NOTICE OF OPEN MEETING OF THE SAN ANTONIO REGIONAL FLOOD PLANNING GROUP TECHNICAL SUBCOMMITTEE

Region 12 San Antonio RFPG

07/19/2022

10:00 AM

TAKE NOTICE that a meeting of the Technical Subcommittee of the San Antonio Regional Flood Planning Group as established by the Texas Water Development Board will be held on Tuesday, July 19, 2022, at 10:00 AM, in-person at the San Antonio River Authority, located at 201 W. Sheridan St and virtually at https:// meet.goto.com/856326685

Agenda:

1. (10:00 AM) Roll-Call
2. Public comments – limit 3 minutes per person
3. Preview Chapters 5 - 10
4. Public comments – limit 3 minutes per person
5. Date and Potential Agenda Items for Next Meeting
6. Adjourn

If you wish to provide written comments prior to or after the meeting, please email your comments to khayes@sariverauthority.org or physically mail them to the attention of Kendall Hayes at San Antonio River Authority, 201 W. Sheridan, San Antonio, TX, 78204 and include "Region 12 San Antonio Flood Planning Group Meeting" in the subject line of the email.

Additional information may be obtained from: Kendall Hayes, (210) 302-3641, khayes@sariverauthority.org, San Antonio River Authority, 201 W. Sheridan, San Antonio, TX 78204.

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Assessment and Identification of Flood Mitigation Needs

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4 Assessment and Identification of Flood Mitigation Needs

This chapter identifies the greatest flood risk knowledge gaps and known flood risks in the SAFPR. The flood mitigation needs analysis identifies where the greatest flood risk knowledge gaps exist and where known flood risk and flood mitigation needs are located within the SAFPR. This information guides the identification of potentially feasible flood mitigation actions.

4.1 Greatest Flood Risk Knowledge Gaps

The greatest flood risk knowledge gaps for the SAFPR have been identified as areas in the region where:

1. Flood inundation boundaries are either not defined or considered inaccurate
2. Flood studies have not occurred in the recent past and are not on-going or proposed
3. Flood management practices do not exist or are not enforced effectively

4.1.1 Flood Inundation Boundary Gaps

Flood inundation boundaries are used to define the location and magnitude of flooding. Without accurate flood inundation boundaries, the existing flood risk is not well understood, and controlling future risk through floodplain management regulations is difficult. Flood inundation boundaries based on recent detailed hydrologic and hydraulic models are considered accurate. Refer to Chapter 2 – Flood Risk Analysis Figure 2-1, which depicts where there are the largest modeling gaps in the SAFPR. The lower half of the SAFPR does not have accurate flood mapping available and only approximate and/or Fathom data are available.

4.1.2 Flood Studies and On-Going Projects Gaps

Flood studies are used to identify existing and future flood risks and often recommend solutions to reduce those risks. Without a flood study it is difficult to implement actionable steps to reduce flood risk. Flood studies help determine what types of flood projects are needed for an area to reduce their flood impacts. Flood mitigation projects are key to reducing risks in an area. Generally, flood studies and projects have occurred or are occurring for counties throughout the SAFPR. Current major flood studies and projects include the:

- General Land Office Flood Studies
- City Wide Drainage Improvements
- County Wide Drainage Improvements
- TxDOT Crossing Improvements

Refer to Appendix A – Required Maps, Map 2: Proposed or Ongoing Flood Mitigation Projects depicting where these projects are occurring in the SAFPR.

4.1.3 Floodplain Management Practices

Enacting floodplain management practices (regulation and enforcement) is effective in preventing activities that will result in increased flood risk in the future. Examples include requiring a floodplain permit for development activity in the floodplain and/or requiring building finished floor elevations to be one foot above the 1% annual chance storm event elevation. Without floodplain management practices, it is difficult to mitigate future flood risks. Refer to Chapter 3 Floodplain Management Practices and Flood Protection Goals Figure 3-4 depicts where the level of floodplain management practices are unknown or considered “low”. This includes rural areas located near the coast and away from the major population center of San Antonio.

4.2 Greatest Known Flood Risk and Flood Mitigation Needs

The areas of greatest known flood risk and flood mitigation needs in the SAFPR are defined as areas with elevated levels of risk to property and life. The level of risk is defined by identifying the location and magnitude of flooding from the 1% and 0.2% annual chance flood event (flood hazard), who and what may be harmed (flood exposure), and what communities and critical facilities may be vulnerable (flood vulnerability). The details of the flood hazard, exposure, and vulnerability analyses are fully described in Chapter 2 – Flood Risk Analysis.

4.2.1 Flood Hazard

The flood hazard analysis defined the 1% and 0.2% annual chance storm event boundaries for the entirety of the SAFPR’s rivers and associated tributaries with contributing drainage areas greater than one square mile. The existing condition flood hazard is depicted on a sub region level in Appendix A – Required Maps, Map 4: Existing Condition Flood Hazard.

4.2.2 Flood Exposure

The flood exposure analysis indicated roughly 26,633 structures at potential risk of flooding from the 1% and 0.2% annual chance flood event. From this analysis several critical areas for flood exposure appear to be (1) the urban areas around the Cibolo and Medina Rivers due to the density of development and total population in those areas and (2) and the confluence of the San Antonio and Cibolo Rivers due to the magnitude of flood volume on each respective creek and similarity in watershed size. Additionally, flooded roadways and agricultural areas are found throughout the region, and the impacts due to the loss of function in these areas should not be understated. A map produced to illustrate flood exposure in the SAFPR is shown in the Appendix A – Required Maps, Map 6: Existing Condition Flood Exposure.

4.2.3 Flood Vulnerability

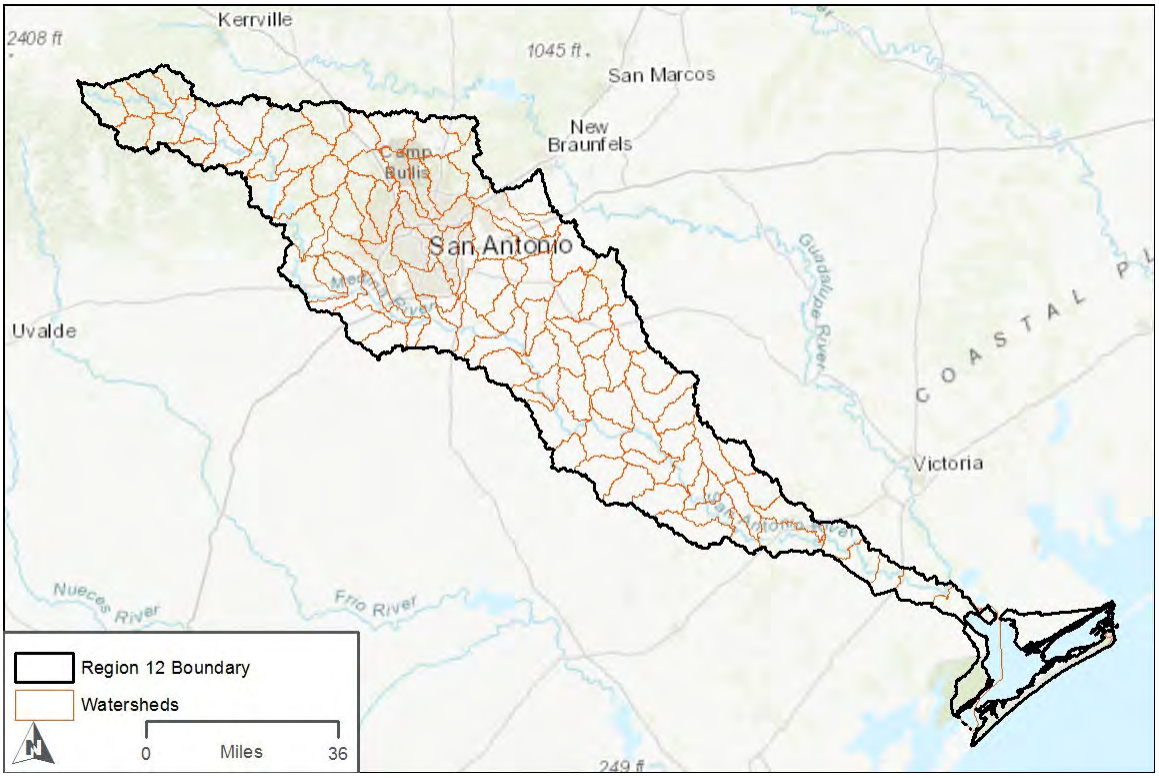
The flood vulnerability analysis identified roughly 220 critical facilities in the 1% and 0.2% annual chance storm event inundation and, in general, mirrored the exposure analysis in terms of critical areas as shown in Appendix A – Required Maps, Map 7: Existing

Condition Flood Vulnerability. The most vulnerable locations are on the outskirts of the City of San Antonio and at confluence of the San Antonio and Cibolo Rivers in Karnes County.

4.2.4 Greatest Known Flood Risk Analysis

An analysis of known flood risk data was performed based on hydrologic unit code (HUC)-12 watershed boundaries. The 180 HUC-12 watersheds in the SAFPR are shown in Figure 4-1.

Figure 4-1. San Antonio Flood Planning Region HUC 12 Watersheds



The flood risk data related to property damage and life loss risk was evaluated for each HUC-12 watershed in the SAFPR, a total of 10 categories were evaluated.

The data points for each of the following categories: Historical Property Damage, Historical Life Loss, Exposure, Vulnerability, Critical Facilities, Low Water Crossings, Dams, and Public Comments, were totaled individually for each HUC-12 watershed. The total length of roadways and area of agricultural land within the floodplain was divided by the area of the respective HUC-12 to establish relative impact density.

Each category was then normalized on a scale of 0-1 for each HUC 12. The normalizations were then summed for each and divided by the total of all categories to establish a per category weighted percent.

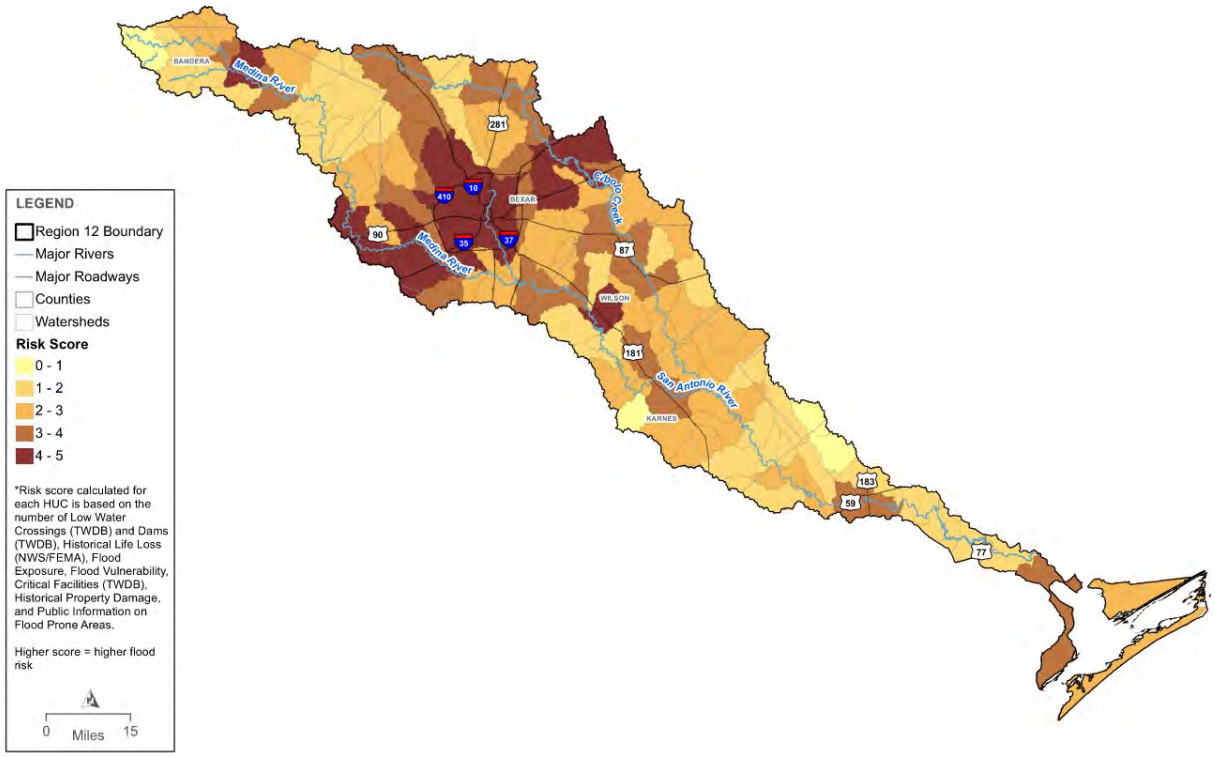
The various flood risk data categories are listed below with descriptions and assigned weighting percentage.

- Historical Property Damage (5.2%) – Property damage data provided by the NWS, FEMA, and local knowledge of flood-prone areas.

- Historical Life Loss (3.5%) – Flood fatality data collected by the NWS since 1996.
- Historical Injuries (0.3%) – Flood injury data collected by the NWS since 1996
- Property Damage – Exposure (17.4%) – Exposure data representing the number of building structures located within the best available 1% and 0.2% annual chance flood inundation boundaries.
- Property Damage – Vulnerability (8.5%) – Vulnerability data representing the number of building structures identified in the 'exposure' layer above within a high vulnerability area (i.e., SVI > 0.75).
- Property Damage – Critical Facilities (8.1%) - Vulnerability data representing critical facilities such as hospitals, schools, fire and police stations, etc., identified in the 'exposure' layer above.
- Low Water Crossings (15.4%) - Data as provided by TNRIS.
- Dams (0.9%) - Data representing potentially hazardous dams that have been identified as either hydraulically inadequate or deficient by the TCEQ.
- Public Comments (5.7%) - Reported flooding problems collected from public comments.
- Roadway Length Divided by HUC12 Area (17.5%) - The length of roadway inundated in each HUC12 watershed divided by the area of the HUC12 watershed.
- Agricultural Area Divided by HUC12 Area (17.5%) - The inundated area used for agriculture in each HUC12 watershed divided by the area of the HUC12 watershed.

These weighted percentage were then applied to each total category occurrence per HUC12 and summed to determine the total HUC12 weighted occurrence. Risk Scores were determined by normalizing the calculated weighted occurrences per HUC12 to a scale of 1 to 5. Flood risk scores for each HUC-12 watershed in the SAFPR are shown in Figure 4-2. No risk is represented by a score of zero and the highest risk is represented by a score of 5. Risk scores of 2 or greater are considered moderate or high risk. The highest risk areas in the SAFPR are centralized in and around Bexar County. This is a combination of where the most structures are located, and highest concentration of population resides.

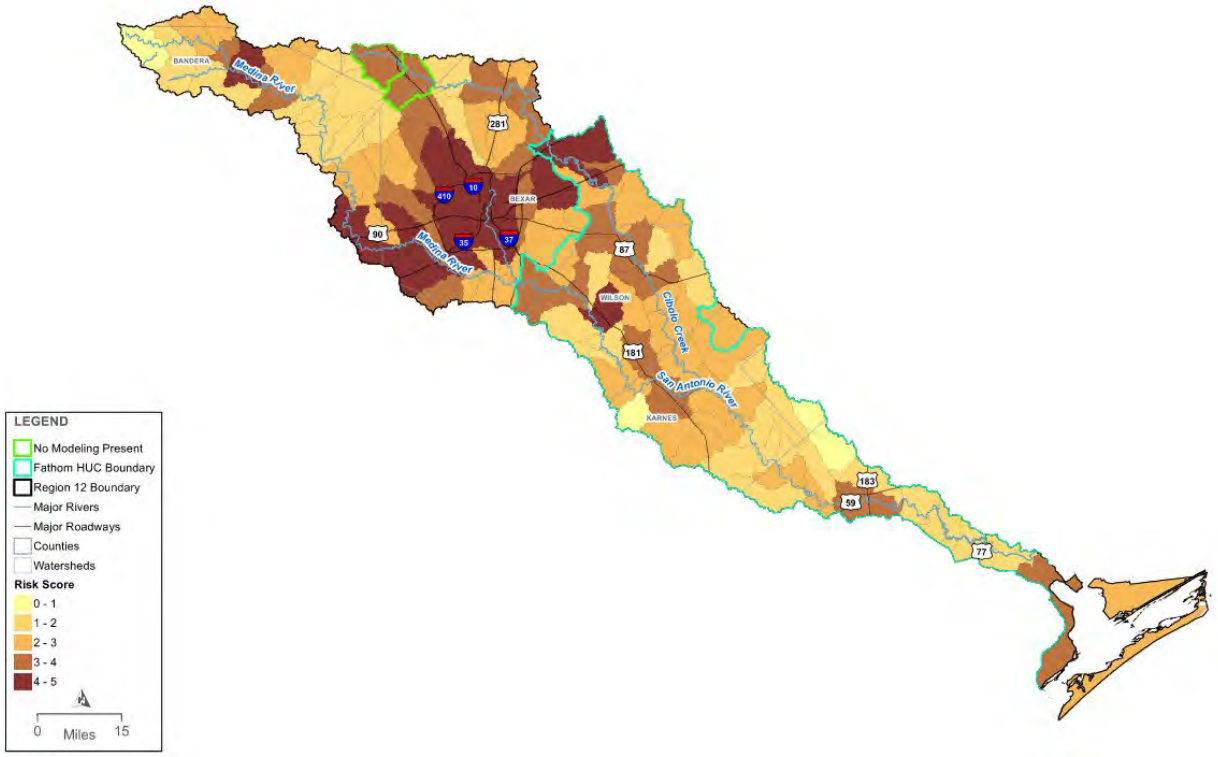
Figure 4-2. Overall Flood Risk per HUC 12 watersheds



4.2.5 Flood Mitigation Needs – Modeling Gaps

Figure 4-3 overlays where flood modeling gaps have been identified with the overall flood risk. There are multiple high flood risk areas identified in the upper and lower basins. There are two tributaries in the City of Boerne surrounding areas that are not mapped, each in a different HUC totaling to two HUCs with some portion not mapped. In the lower basin fathom data was used for the 0.2% annual storm event flood boundaries. A total of 53 HUCs were identified as using fathom data. Investment in detailed hydrologic and hydraulic models should be prioritized in the gap areas with the highest overall flood risk.

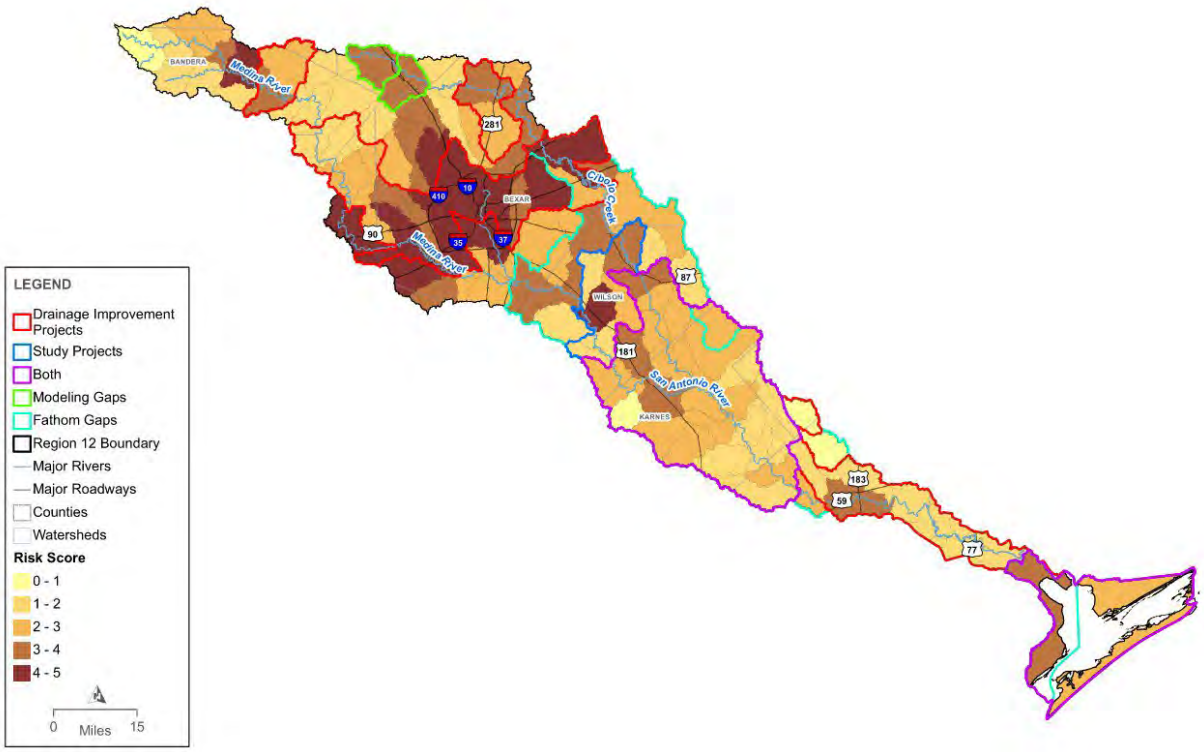
Figure 4-3. Modeling and Mapping Gaps Overlay w/ Overall Flood Risk



4.2.6 Flood Mitigation Needs – Flood Study / Project Gaps

Mapping and modeling gaps make it hard to determine the accurate flood risk for an area, these gaps can be mitigated with studies. High flooding risk areas can be reduced by incorporating flood mitigation projects. Figure 4-4 displays where on-going or proposed flood studies / projects that have been identified overlapping the overall flood risk and the modeling gaps. This map shows that there are many on-going flood mitigation efforts occurring across the SAFPR that could both fill in the gaps and reduce the risk. Investment in flood studies or projects in the remaining gap areas with high flood risk is recommended.

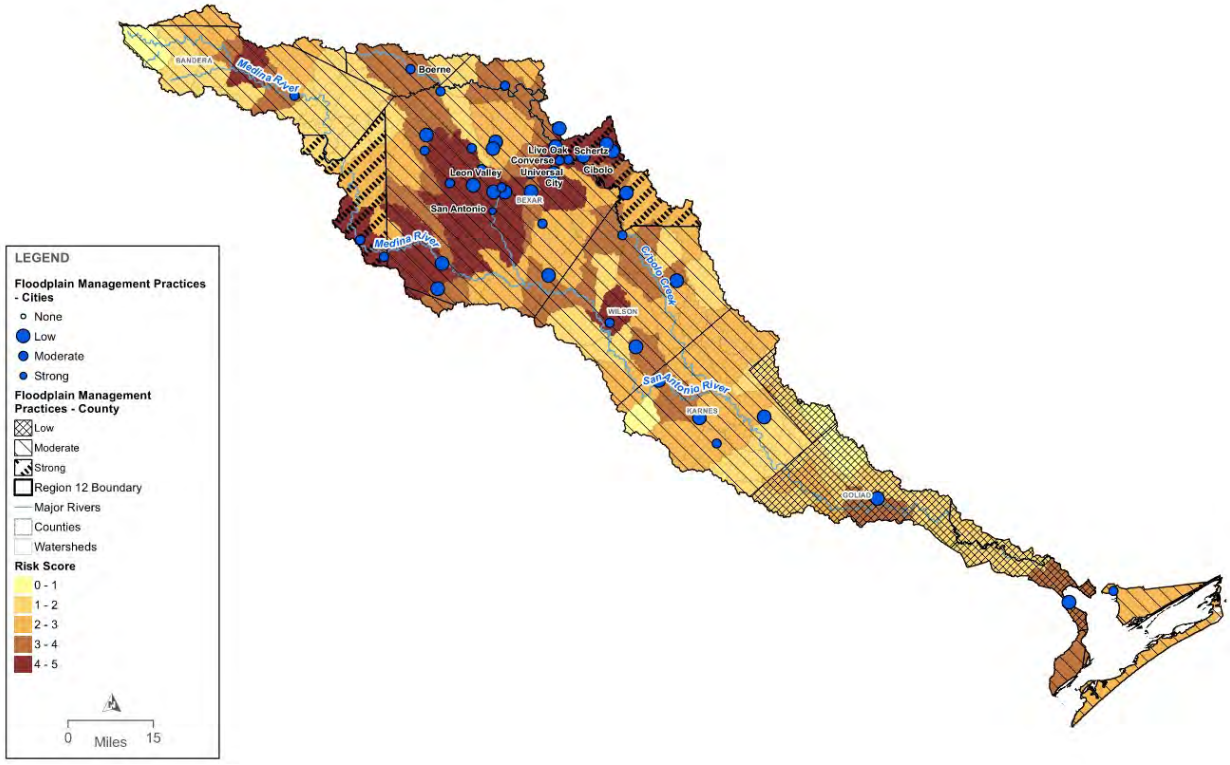
Figure 4-4. Flood Study / Project Gaps Overlay w/ Overall Flood Risk

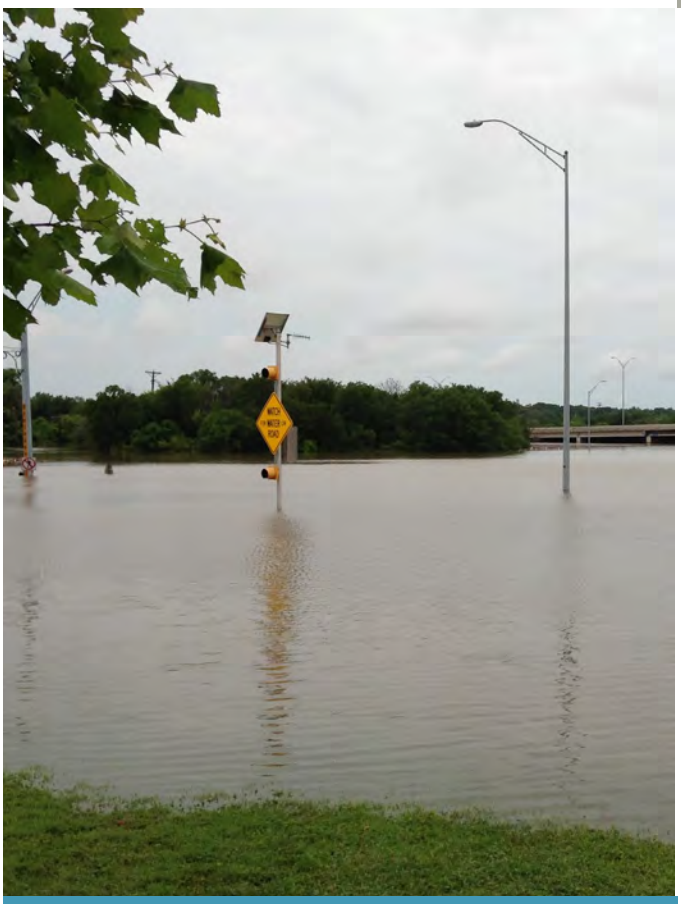


4.2.7 Flood Mitigation Needs– Floodplain Management Gaps

Figure 4-5 overlays where the level of flood management practice is none or low with the overall flood risk. Flood management practices should be enhanced in areas with a high flood risk and no or low levels of floodplain management. Examples would be the enhancement of floodplain management in the lower basin where the levels for both the cities and counties are low to moderate.

Figure 4-5. Floodplain Management Overlay w/ Overall Flood Risk





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Identification and Evaluation of Potential Flood Management Evaluations and Potentially Feasible Flood Management Strategies and Flood Mitigation Projects

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5 Identification and Evaluation of Potential Flood Management Evaluations and Potentially Feasible Flood Management Strategies and Flood Mitigation Projects

This chapter's objective is to focus on Tasks 4b and 5 as prescribed in the State Flood Plan rules and guidelines. The scope of Task 4b involves the identification and assessment of potential flood management evaluations (FMEs) and potentially feasible flood management strategies (FMSs) and flood mitigation projects (FMPs). The scope of Task 5 involves further evaluation of identified FMEs, FMSs, and FMPs through a final recommended list of such actions to be incorporated into the Region 12 Flood Plan.

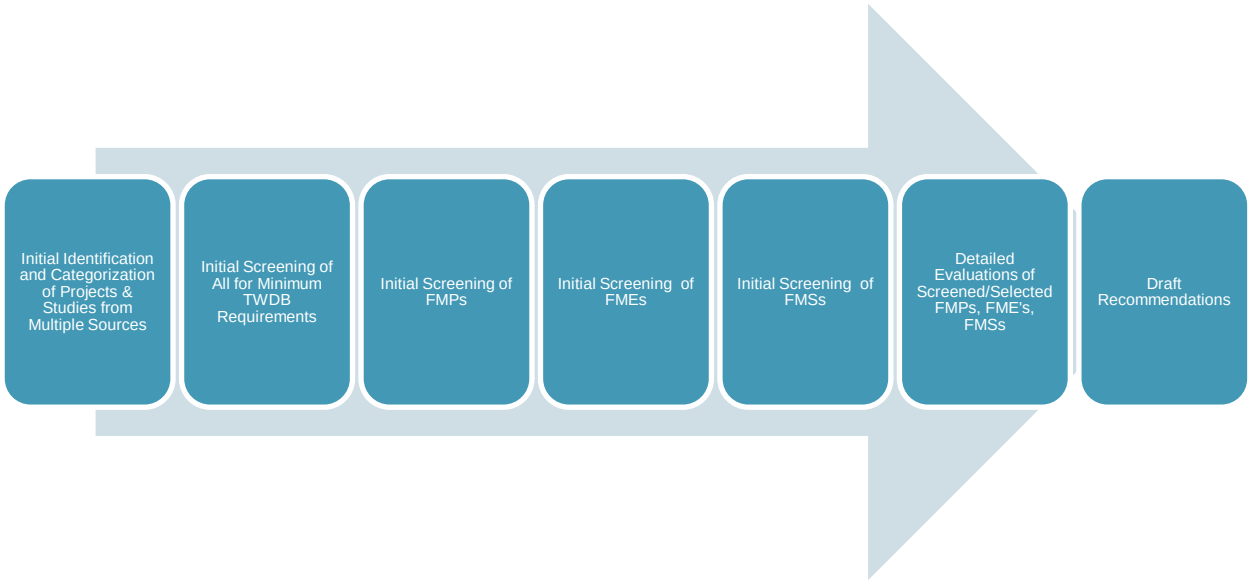
Tasks 4b and 5 build on subsequent Tasks 1 through 4a with the ultimate objective of recommending FMEs, FMSs, and FMPs that:

- Reduce flood risk identified in Task 2 – Existing and Future Conditions Flood Risk Analyses
- Address flood mitigation and floodplain management goals established in Task 3 – Evaluation and Recommendation of Flood Mitigation and Floodplain Management Practices and Goals
- Address flood mitigation needs identified in Task 4a – Flood Mitigation Needs Analysis

The SAFPR adopted a process for screening and evaluation of FMEs, FMSs, and FMPs as summarized in the graphic below based on requirements and guidance within the State Flood Plan rules and guidelines including region-specific interpretations and preferences. The San Antonio RFPG formed a "Task 5" Technical Committee in accordance with SFP rules to oversee the process and eventual recommendations from the Technical Consultant.

The SFP rules and guidelines allow for some region-specific flexibility and interpretation when recommending FMPs, FMEs, and FMSs for the RFP. The San Antonio RFPG's general approach to this flexibility was to be more inclusive as opposed to being more restrictive for this first cycle of the RFP. The following sections summarize the process and draft results of Tasks 4b and 5 for the SAFPR, Figure 5-1 shows the outlined process that will be discussed in this chapter.

Figure 5-1. Identification, Evaluation, and Recommendation Process



5.1 Identification and Evaluation of Potential FME, FMP, and Potentially Feasible FMS

FMEs, FMPs, and FMSs are broadly categorized as “flood risk reduction projects or practices” in the *Technical Guidelines*. Once potential flood risk reduction actions were preliminarily identified, a high-level screening process was used to confirm that potential actions had been sorted into their appropriate categorization.

5.1.1 Process to Identify FME, FMP, and FMS

The goal is to define and evaluate a wide range of potential actions to identify and mitigate flood risk across the SAFPR. These actions have been broadly categorized into the following three distinct types of actions as defined by the State Flood Plan rules and guidelines:

Flood Management Evaluation (FME): a proposed flood study of a specific flood-prone area that is needed to assess flood risk and/or determine whether there are potentially feasible FMSs or FMPs.

Flood Mitigation Project (FMP): a proposed project, either structural or non-structural, that has non-zero capital costs or other non-recurring cost and, when implemented, will reduce flood risk, or mitigate flood hazards to life or property.

Flood Management Strategy (**FMS**): a proposed plan to reduce flood risk or mitigate flood hazards to life or property.

The *Technical Guidelines* also list several potential project types for each subcategory, summarized below in Table 5-1.

Table 1-1. FMP, FME, FMS Project Types

Flood Risk Reduction Project Category	Project Types
Flood Management Evaluation (FME)	• Watershed Planning • H&H Modeling • Flood Mapping Updates • Regional Watershed Studies • Engineering Project Planning • Feasibility Assessments • Floodproofing • Preliminary Engineering (alternative analysis and up to 30% design) • Property or Easement Acquisition • Regulatory Requirements for Reduction of Flood Risk • Studies on Flood Preparedness
Flood Mitigation Project (FMP)	• Structural • Low Water Crossings or Bridge Improvements • Infrastructure (channels, ditches, ponds, stormwater pipes, etc.) • Regional Detention • Regional Channel Improvements • Storm Drain Improvements • Reservoirs • Dam Improvements, Maintenance, and Repair • Flood Walls/Levees • Nature Based Projects – living levees, increasing storage, increasing channel roughness, increasing losses, de-synchronizing peak flows, dune management, river restoration, riparian restoration, run-off pathway management, wetland restoration, low impact development, green infrastructure, playas improvements • Comprehensive Regional Project – includes a combination of projects intended to work together
	Non-Structural • Property or Easement Acquisition • Elevation of Individual Structures • Flood Readiness and Resilience • Flood Early Warning Systems, including stream gauges and monitoring stations • Floodproofing Regulatory Requirements for Reduction of Flood Risk
Flood Management Strategy (FMS)	None specified; at a minimum, regional flood planning groups (RFPGs) should include as FMSs any proposed action that the group would like to identify, evaluate, and recommend that does not qualify as either a FME or FMP.

Identifying potential FMEs and potentially feasible FMPs and FMSs begins with completing the flood mitigation analysis (Chapter 4) to identify the areas with the greatest gaps in flood risk knowledge and the areas of greatest known flood risk. Based on the results of this analysis, several sources of data were used to develop a list of potential flood risk reduction actions that may address the basin's needs. The data includes information compiled under previous tasks:

Existing flood infrastructure, flood mitigation projects currently in progress, and known flood mitigation needs (Task 1);

Existing and future flood risk exposure and vulnerability (Tasks 2A and 2B);

Floodplain management and flood protection goals and strategies developed by the regional flood planning group (RFPG) for the Region (Tasks 3A and 3B); and Stakeholder input.

The initial list of potential actions (FMP, FME, FMS) identified for screening and evaluation were collected from four primary sources:

- Data collected from initial introductory community outreach,
- Other community drainage master plans or capital improvement programs (CIPs), and
- Hazard Mitigation Plans for each community within the region

Table 5-2 below documents the sources from which projects were collected.

Table 5-2. List of Studies Relevant to the RFP

Source	Jurisdiction	Counties	Source Year
Barbara Drive Drainage Study	City of San Antonio	Bexar	2021
Boerne Master Drainage Plan	City of Boerne	Kendall	2021
Castroville Drainage Master Plan	City of Castroville	Medina	2022
Cibolo Creek Watershed Holistic Master Plan	City of Bulverde, City of San Antonio, Wilson County	Bexar, Comal, Wilson, Wilson/ Guadalupe	2018
City of Bulverde Mapping Improvements Cibolo Creek Tributary 19 Drainage Report	City of Bulverde	Comal	2016
City of Bulverde Mapping Improvements Indian Creek Drainage Report	City of Bulverde	Comal	2016
City of Bulverde Mapping Improvements Lewis Creek Watershed Phase 2 Alternative Analysis Drainage Report	City of Bulverde	Comal	2016
City of Fair Oaks Ranch Master Drainage Plan	City of Fair Oaks Ranch	Bexar	2018
Holbrook Road Preliminary Engineering Report	City of San Antonio	Bexar	2021
Holistic Watershed Master Plan Wilson, Karnes, and Goliad Counties	City of Falls City, City of Kenedy	Karnes	2015
Holistic Watershed Master Plan Wilson, Karnes, and Goliad Counties, Flood Issues Volume	Goliad County, Karnes County	Karnes, Goliad	2015
Huebner Creek CAP 205	City of Leon Valley	Bexar	2021

Source	Jurisdiction	Counties	Source Year
Judson and Lookout Project Narrative	City of San Antonio	Bexar	2016
Karnes and Wilson Counties Hazard Mitigation Plan	City of Falls City, City of Floresville, City of Karnes City, City of Kenedy, City of La Vernia, City of Poth, City of Runge, City of Stockdale, Karnes County, La Vernia ISD, Wilson County	Karnes, Wilson	2020
Leon Creek Watershed Master Plan Phase 3	City of San Antonio	Bexar	2011
Medina County HMAP Adopted	City of La Coste	Medina	2020
Medina River Holistic Watershed Master Plan	City of San Antonio, Medina County	Bexar, Medina	2015
Overall Preliminary Drainage Report	La Vernia	Wilson	2022
Project Summary Sheet	City of San Antonio	Bexar	2010-2022
Projects for Flood Risk in Helotes	City of Leon Valley	Bexar	2016
Refugio County Flood Mitigation Projects Outreach Data Collection	Tivoli Community	Refugio	2022-2023
RFPG Committee	SARA, Greater Edwards Aquifer Alliance	All Counties	2022
Salado Creek Watershed Master Plan Report Phase 1	City of San Antonio	Bexar	2011
SARA: Projects for Flood Risk Reduction Helotes	City of Helotes	Bexar	2016
Thames Drainage Channel Improvements	City of San Antonio	Bexar	2016
TWDB Active Projects (Dfund)	Bexar-Medina-Atascosa WCID	Medina	2011
TWDB Active Projects (FIF)	City of Bandera, Karnes County	Karnes, Kendall	2021
Upper San Antonio River Master Plan	City of San Antonio	Bexar	2013-2021
Upper Woodlawn Lake Drainage Study	City of Balcones Heights	Bexar	2014
Wilson County Watershed Master Plan	City of Floresville, City of La Vernia, City of Poth, City of Stockdale, Wilson County, Wilson County/TxDOT	Wilson	2012

Flood Mitigation Projects (FMPs)

One of the primary objectives of the SFP is to identify and fund flood mitigation projects for implementation, therefor, identifying FMPs that meet SFP criteria and requirements

for inclusion into the SFP is priority one. Per the TWDB rules, of the four common phases of emergency management shown below, the regional flood planning process focuses primarily on mitigation projects but may also include preparedness projects.

A flood mitigation project, by TWDB definition, is “a proposed project that has a non-zero capital cost or other non-recurring costs and that when implemented will reduce flood risk and mitigate flood hazards to life or property”. FMPs are further categorized as either structural or non-structural.

Structural FMPs

Structural FMPs are defined as building or modifying infrastructure to change flood characteristics to reduce flood risk. They are infrastructure projects with advanced analysis and 30% - 100% design development including construction plans, specifications, and cost estimates. Structure FMPs include one or a combination of the following project types:

- Culvert/Bridge Improvements
- Channel Improvements
- Flood Detention
- Flood Walls / Levees
- Flood Diversion
- Storm Drain Improvements
- Coastal Protections

Culvert and Bridge Improvements - Typical culvert and bridge improvements address roadway flooding at waterways ranging from large riverine crossings to roadway crossings at smaller creeks and streams. Low water crossings are defined by the TWDB rules as roadway creek crossings that are overtopped by a 50% annual chance storm event (2-year storm). Bridges and culverts that have insufficient area to convey higher flows tend to overtop frequently, preventing the passage of vehicles during high flow times and produce excess backwater that may result in flooding of upstream properties. Bridges and culverts that overtop frequently pose a significant threat to public safety as most flood related deaths occur at these types of crossings. Culvert and bridge improvement FMPs are often part of larger flood risk reduction projects (such as channel widening projects) and not necessarily just single low water crossing projects.

Channel Improvements - Channel improvements generally lower flood levels by improving the hydraulic efficiency of a stream or roadside channel by enlarging, straightening, and/or reducing the channel friction by smoothing the contours and/or lining of the channel banks and removing obstructions. Channel improvements can reduce flood risk to large populations but can require significant modifications to mitigate 1% annual chance floods (100-year foods). Channel improvement projects typically require land acquisition and can be costly and difficult to permit and implement in urbanized areas. Channel improvements can incorporate nature-based natural channel design techniques to help provide ecological function uplift and reduce environmental impacts as well as erosion risk. In urban settings, channel improvements can include recreational, cultural, and educational features providing socio-economic benefits.

Flood Detention – Typical flood detention projects are regional in scale ranging from large flood control reservoirs to smaller regional flood detention ponds and can provide benefit to relatively large populations and or agricultural areas. Regional flood detention facilities require significant storage volume to mitigate 1% annual chance floods (100-year foods) requiring large tracts of land and can be costly and difficult to implement in urban areas. They also require long-term operations and maintenance costs. Flood detention can reduce flood risk and provided additional benefits such as recreation and water supply but can create dam safety risks and environmental impacts.

Floodwalls/Levees – Levees and floodwalls confine out-of-bank flows to areas along rivers and streams to reduce flood risk to properties located in the natural flood plain. The confinement of floodwaters using levees or floodwalls considerably alters the characteristics of flood flows. Reduction of natural valley storage capacity in the floodplain can increase peak discharges for a given flood and increase flood damages downstream of a project. Land must be reserved behind levees or floodwalls for ponding areas, and impounded water must be retained or pumped over the levee. Levees are most applicable where the floodplain is wide and development is located a considerable distance from the channel. Levees can cause catastrophic damage if overtopped by a flood greater than their design flood. Therefore, the design flood for levees is typically the 100-year flood at a minimum, with additional freeboard to reduce risk of overtopping. Levees and floodwall facilities can require significant land acquisition and can be costly and difficult to implement in urban areas. They require closures at road and railroad crossings and interior drainage measures such as stormwater pump stations. They also require long-term operations and maintenance costs typically associated with FEMA certification. Levees and floodwalls can reduce flood risk but can create levee safety risks, environmental impacts, and negative socio-economic impacts.

Flood Diversions - Typical flood diversion projects include diversion channels or diversion conduits (tunnels). Diversion channels intercept flood waters upstream of populated areas and convey them safely above ground to a discharge point downstream of the populated areas. They require significant land acquisition and can be difficult and costly to build in urbanized areas. Diversion tunnels convey flood water underground to reduce flood risk to large, populated areas. They required long-term O&M costs. Flood diversions can reduce flood risk but can cause downstream hydrologic impacts and environmental impacts.

Storm Drain Improvements – Excessive street flow in urbanized areas can cause flooding of residential and commercial structures, safety issues to traffic, damage to pavement, and in some cases life loss. Installing new storm drain systems to collect runoff and convey it underground to a receiving stream is a typical solution for improving street flow and diverting stormwater around problem areas. Storm drain improvements can reduce flood risk to large populations but can require significant sizes of conduit or box sections to mitigate 1% annual chance floods (100-year foods). Storm drain improvement projects typically require other measures to mitigate increases in flood discharges to downstream areas and can be costly and difficult to implement in urbanized areas.

Coastal Protections – Coastal flood protections reduce flood risk to large populations from coastal storm surges and combined riverine and coastal effects. Typical coastal protections include coastal levees, dikes, and seawalls and often include beach erosion

countermeasures such as riprap revetments. Similar to inland levees and floodwall facilities, coastal protections can require significant land acquisition and can be costly and difficult to implement in urban areas. They require closures at road and railroad crossings and interior drainage measures such as stormwater pump stations. They also require long-term operations and maintenance costs typically associated with FEMA certification. Coastal protections can reduce flood risk but can create levee safety risks, environmental impacts, and negative socio-economic impacts.

Nature-based Features – FMPs can include nature-based features as part of flood mitigation solutions where applicable including, but not limited to, stream and coastal restorations, wetlands, natural channel design, other green infrastructure elements, and land preservation. Although nature-based solutions generally do not provide significant flood risk reduction to 1% annual chance flood hazards (100-year floods), they can improve stormwater quality, provide ecological function uplift, and reduce riverine and coastal erosion risk.

Non-Structural FMPs

Non-structural FMPs are flood mitigation projects or actions that change the way people interact with flood risk and move people out of harm's way. These types of projects do not involve modifications to the watershed or flood infrastructure and therefore do not have negative impacts to adjacent areas or environmental impacts. Non-structure FMPs include one or a combination of the following project types:

- Regulatory Improvements
- Floodplain Evacuation (Property Acquisition/"Buyouts")
- Flood Warning
- Floodproofing
- Flood Readiness and Resilience

Regulatory Improvements – Adoption of regulations by local governments provide legal measures to control development in flood prone areas and to prevent the occurrence of future drainage related problems. Regulatory improvements create or improve local regulatory requirements such as floodplain development ordinances and drainage design criteria related to planning, zoning, land development, and building codes. Regulatory improvements include requirements of those proposing new developments or redevelopment to identify flood hazard areas and keep people out of them. This type of non-structural FMP has very low capital cost compared to structural FMPs. Regulation of flood prone land increases the likelihood that such property will be properly used in the best interest of public health, safety, and welfare. However, such regulations offer no relief for existing development.

Floodplain Evacuation – Floodplain evacuation involves acquiring real property at high risk of incurring flood damage and loss of life. Typically referred to as floodplain "buyouts", these can be voluntary or involuntary. One major advantage of this type of FMP is that it eliminates flood risk leaving no residual risk. Buyouts are costly up front, but typically have no long-term O&M costs. Buyouts can provide environmental enhancements by creating open space, riparian restoration, and park land, but can also have negative socio-economic impacts.

Flood Warning – Typical flood warning measures or systems provide means for temporary evacuation of flood hazard areas during floods to reduce flood risk. These types of measures range from simple stream gauges and warning signals to more complex early flood warning systems that can forecast floods and warn large populations to evacuate. Flood warning systems save lives but do not save property. This type of non-structural FMP has low capital costs compared to structural FMPs.

Flood Proofing – Floodproofing generally consists of providing watertight coverings for door and window openings of habitable structures, raising structures in place, raising access roads and escape routes, constructing levees and floodwalls around individual or groups of buildings or critical infrastructure, and waterproofing of walls and mechanical and electrical equipment. Floodproofing is more easily applied to new construction and more applicable where flooding is of short duration, low velocity, infrequent, and of shallow depths. Floodproofing is appropriate for locations where other structural flood mitigation alternatives are not feasible. Floodproofing can mitigate risk from 1% annual chance floods (100-year foods) but does not eliminate all flood risk.

Flood Readiness and Resilience – Typical flood readiness and resilience projects or actions focus on improving flood preparedness and response to save lives and include developing flood response plans, flood or hurricane evacuation plans, and flood or dam emergency action plans. This type of non-structural FMP has low capital costs compared to structural FMPs.

Flood Management Evaluations (FMEs)

A flood management evaluation (FME), by TWDB definition, is “a proposed flood study of a specific, flood-prone area that is needed in order to assess flood risk and/or determine whether there are potentially feasible FMSs or FMPs.” There are 4 general categories of FMEs as described below. An FME may include any or all of these study elements or phases.

Flood hazard modeling and mapping / risk identification studies – These are studies to quantify flood risk in areas where significant flood risk is thought to exist but do not have flood risk data or have insufficient flood risk data. An example of this type of FME is a floodplain modeling and mapping study of a chronic flood prone area with a certain population at risk that has not been studied before.

Flood mitigation alternatives analysis / feasibility studies – These FMEs involve using flood hazard and flood risk data for a known flood problem area to evaluate structural and non-structural flood mitigation alternatives or project types, as the FMP types described above, to provide the most flood risk reduction benefit for the least amount of capital cost. These FMEs include a benefit cost analysis and include evaluations of other factors such as environmental constraints and permitting requirements, land acquisition and utility relocation requirements, constructability and other constraints, and public input and social factors.

Preliminary Engineering studies – Once a flood prone area has been studied and a preferred flood mitigation alternative or set of alternatives have been identified from a feasibility study, a preliminary engineering study of these alternatives would develop at least a 30% level design including initial plans, permitting assessments, and refined capital cost estimates. Potential FMPs that have previously been studied within the

region but do not meet the standards set by the TWDB for FMPs will fall into this category of FME.

Flood Management Strategies (FMSs)

Proposed actions that did not qualify as an FMP or FME were considered as "strategies". The term flood management strategy is not a typical term used in the flood mitigation industry, however, in a few cases, there were community sponsor-specific strategies provided to the San Antonio RFPG that met the TWDB definition. A flood management strategy, by TWDB definition, is "a proposed plan to reduce flood risk or mitigate flood hazards to life or property. A flood management strategy may or may not require associated Flood Mitigation Projects to be implemented". Regional or subregional FMS's generally fell into the following five categories:

- Flood mitigation education and outreach
- Area-wide low water crossing flood mitigation studies and projects
- Identify and fund buyout programs
- Develop regional flood warning measures
- Strengthen flood management regulations

5.1.2 Screening of FMPs, FMEs, and FMSs

TWDB requirements for Task 4B state that each RFPG is to develop and receive public comment on a "…proposed process to be used by the RFPG to identify and select flood management evaluations, flood mitigation strategies, and flood mitigation projects". This process, once adopted by the RFPG, is to be documented and such documentation is to be included in the Technical Memorandum, the Initial Draft Regional Flood Plan, and the adopted Regional Flood Plan.

The following describes the proposed process being considered by the RFPG and on which public comment will be taken, both during the December RFPG meeting and via written comments submitted through the RFPG's website. The process, as described below, was designed to conform with TWDB requirements as expressed in the rules, the scope-of-work for the regional flood planning process, and technical guidelines.

Step 1. Conduct an initial screening of Projects, Evaluations, and Strategies that were received by or developed in conjunction with floodplain management communities/project sponsors:

In this first step, screening is conducted based on minimum TWDB requirements. The screening criteria applied in this step are:

- The evaluation/strategy/project is related to a flood mitigation or floodplain management goal.
- The evaluation /strategy/project meets an emergency need.
- The evaluation /strategy/project addresses a flood problem with drainage area of 1 square mile or greater.

- The evaluation /strategy/project reduces flood risk for the 100-year (1% annual chance) flood.
- Exceptions for level of flood risk reduction or problem area size include instances of flooding of critical facilities, transportation routes, or other factors as determined by the RFPG.

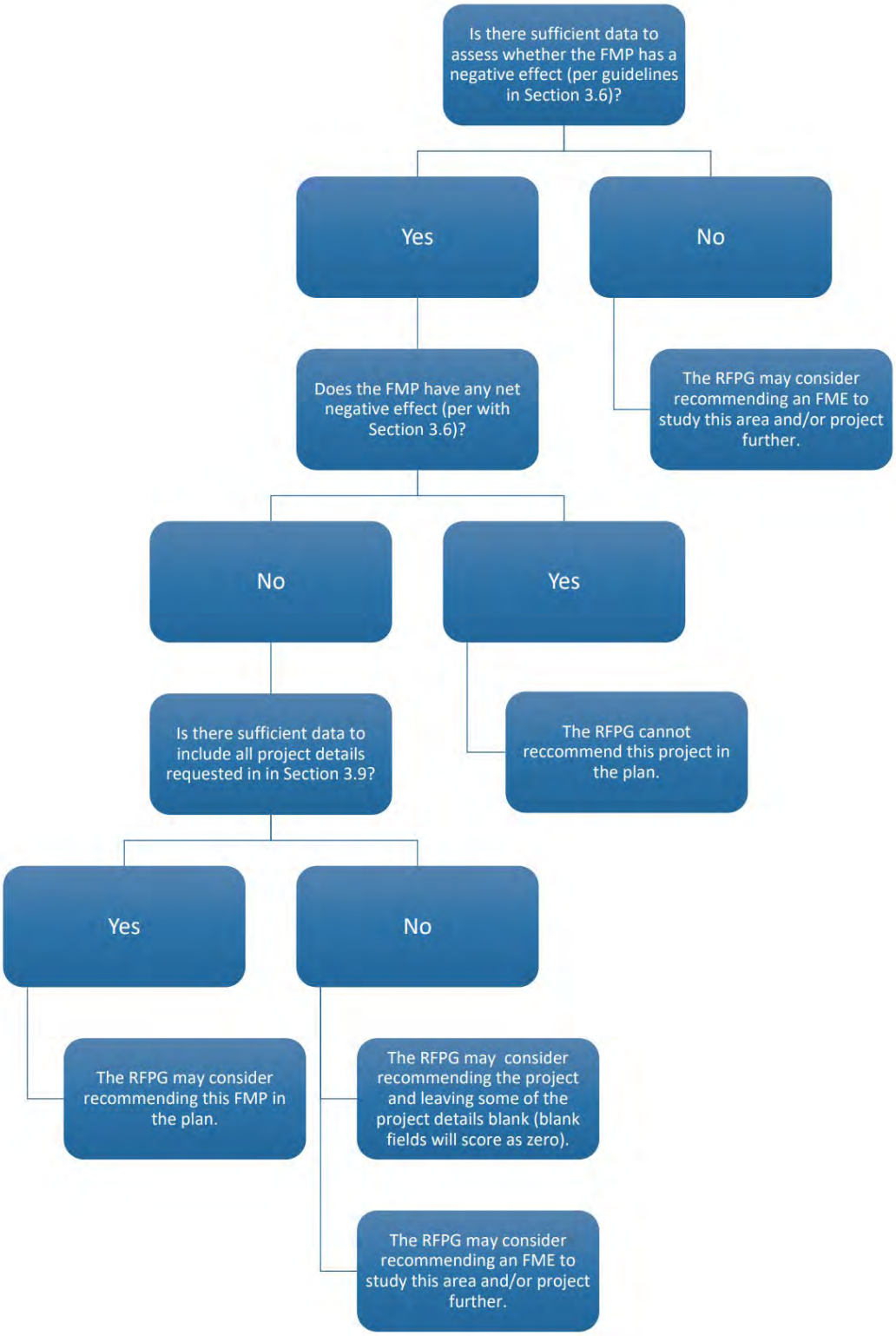
Step 2-1. Screening of Projects (FMPs):

In the second step, potential Flood Mitigation Projects

(FMPs) are subjected to a screening-level evaluation based on the TWDB Technical Guidelines for Regional Flood Planning (April 2021) and specifically Figure 5 FMP flowchart (Attachment A). If a potential FMP does not satisfy the screening criteria in this step, it will then become a potential Flood Management Evaluation. There are three criteria that are applied in this step are: “sufficient data”, “no negative effect”, and “project details”.

- Sufficient data - The data upon which an assessment of no negative effect has been made must be reliable and have minimal uncertainty. H&H modeling, mapping, and basis for mitigation analysis must generally meet Section 3.5 of TWDB technical guidelines.
- No negative effect - The potential Project must not have negative impact on the 100-year (1% annual chance) flood event. It must not raise the flood elevation or increase discharge of the 100-year flood event. Any of the following will disqualify the potential project in this screening step:
    - Potential project increases inundation on homes, commercial buildings, critical facilities, and other structures.
    - Potential project increases inundation beyond existing or proposed ROW or easements.
    - Potential project increases inundation beyond existing drainage infrastructure capacity.
- Project details – Data used to define the potential project must include sufficient project details as described in Section 3.9 of TWDB technical guidelines, including but not limited to the following:
    - Flood severity level metrics
    - Flood risk/damage reduction metrics
    - Estimated capital and O&M costs
    - Benefit/Cost ratios
    - Environmental benefits/impacts
    - Potential for natural flood mitigation components
    - Implementation constraints
    - Water supply benefits

Figure 1-2. FMP Flowchart



Step 2-2: Screening of Evaluations (FMEs):

Flood Management evaluations may fall into one of three general categories:

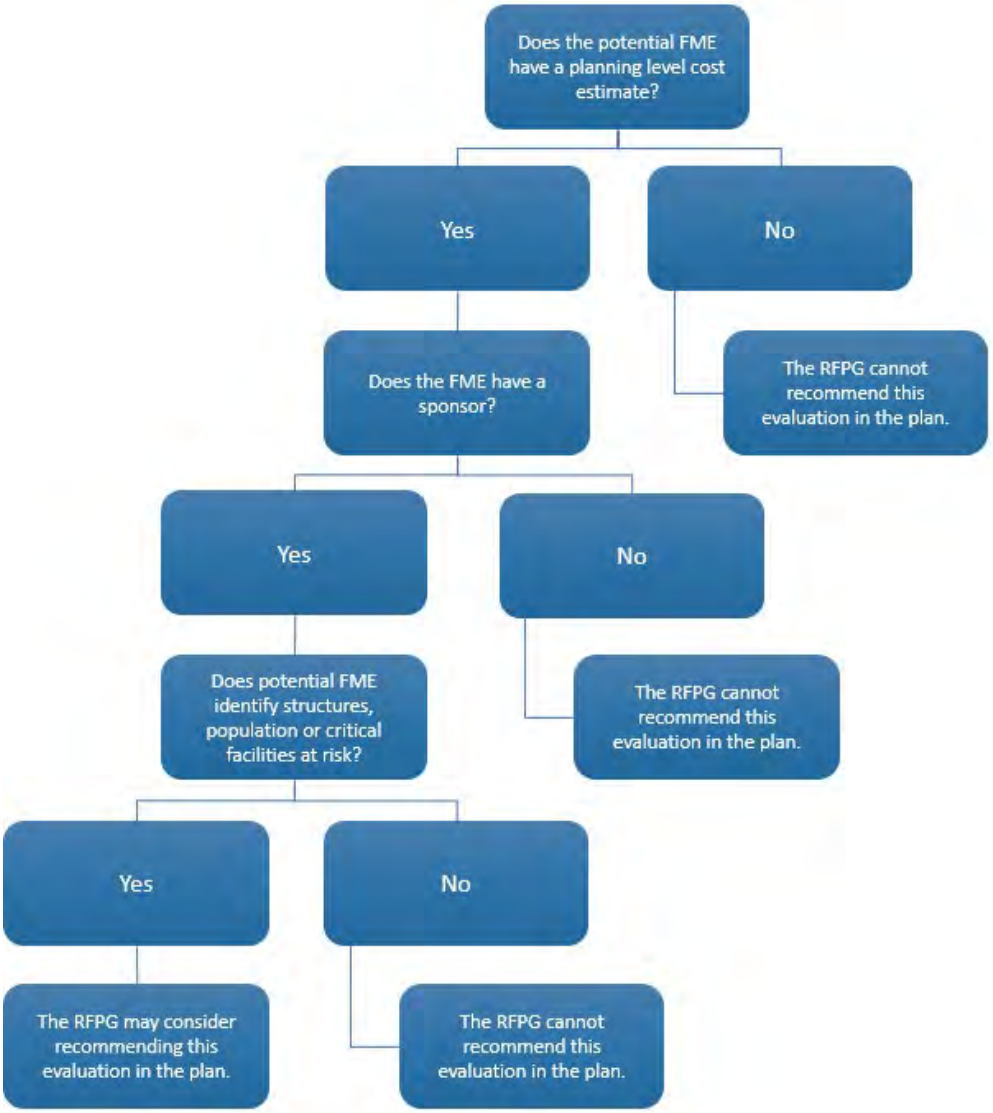
1. Potential projects (FMPs) that did not meet screening criteria Step 2-1.
2. Planned flood studies or flood risk reduction alternatives analyses provided by or developed in conjunction with floodplain management communities/project sponsors.
3. Potential flood studies or flood risk reduction alternatives analysis needs identified by the technical consultant in Task 4A.

In this step potential studies are screened based on the following criteria from TWDB technical guidelines and illustrated in the flowchart in Attachment B:

- Potential evaluation must identify structures, population, and critical facilities at risk within the flood problem area being studied.
- Potential evaluation must identify roadways impacted by flooding within the flood problem area being studied, if applicable.
- Potential evaluation must quantify area of agricultural land at risk within the flood problem area being studied, if applicable.
- Potential evaluation must have willing sponsor(s) identified that are willing to commit resources and some level of potential cost sharing.
- Potential evaluation must have reasonable planning-level cost estimate.

If there is sufficiently detailed H&H analysis and flood mitigation alternatives analysis, then the Evaluation may be considered as Project (FMP) or Strategy (FMS)

Figure 5-1-3. FME Flowchart



Step 2-3. Screening of Strategies (FMSs):

Strategies are proposed plans or actions that reduce flood risk or mitigate flood hazards to life or property. Any proposed action that doesn't meet the criteria to qualify as an evaluation or as a project can potentially be considered as a strategy. Strategies can also be flood studies or flood risk reduction alternatives analysis needs that are identified in Task 4A. In general, RFPG has flexibility with what qualifies as Strategies.

In this step, Strategies are screened based on the following criteria from the TWDB technical guidelines:

- Potential strategies must include a planning-level cost estimate.
- Potential strategies must have an identified sponsor(s) that are willing to commit resources and some level of potential cost sharing.

- Potential strategies must quantify the estimated flood risk being addressed and potential level of flood risk reduction.

Step 3. Sorting of Projects, Evaluations and Strategies by Flood Mitigation and Floodplain Management Goals:

In the third step, the projects, evaluations, and strategies identified will be assigned to one or more of the goals defined in Task 3B.

Step 4. Detailed assessment of selected Projects, Evaluations, and Strategies:

In the fourth step, potential evaluations, strategies, and projects that meet the criteria in the initial screening processes described in Steps 1 and 2 are to be evaluated further for potential feasibility and must meet the following:

- Potential projects are preferred to have an estimated benefit-cost ratio greater than 1.0. If less than 1.0 projects may still be considered with additional justification from the RFPG.
- Potential evaluations, strategies, and projects must have a willing sponsor(s) that has been verified.
- There must be no known insurmountable implementation constraints or hurdles, such as ROW acquisitions, utility conflicts, and/or permitting issues.
- Potential evaluations, strategies, and projects will be evaluated to identify maintenance requirements and their costs.
- Potential strategies and projects must include a description of residual, post-project, and future risks.
- Potential strategies and projects must indicate potential use of federal funds, or other sources of funding, as a component of the total funding mechanism.

Step 5: Final recommendation of Projects, Evaluations, and Strategies:

In this final step recommended studies, strategies, and projects are to be incorporated in the initial draft and final regional flood plan. The regional flood plan must also include:

- Public comments and RFPG response on the recommended FMPs, FMEs and FMSs
- Initial and final adoption

The RFPG conducted a targeted outreach effort to each potential sponsoring community to discuss the initial list of potential actions for potential additions, deletions, or edits to the actions and their attributes, and to verify that they are a willing sponsor. A total of 110 potential sponsors were contacted, approximately 34 responded and met to discuss via online video conferences.

5.1.3 Initial Screening Results

Potentially Feasible FMPs

Potentially feasible FMPs were identified based on responses to survey, reviews of previous studies, and direct coordination with stakeholders. FMPs are required to be developed in a sufficient level of detail to be included in the San Antonio RFP and

recommended for state funding. In most cases, this includes having recent H&H modeling data to assess the impacts of the project and an associated project cost to develop the project's benefit-cost ratio (BCR). The development and use of the technical information to evaluate potentially feasible projects is described in the subsections that follow.

Thanks to multiple completed drainage master plans, the RFPG was able to identify 36 potentially feasible FMPs, mostly within the City of San Antonio and City of Boerne. Additional potentially feasible FMPs may be identified through continued outreach with regional stakeholders under Task 11 and through the execution of identified FMEs, either as FMEs are approved by the San Antonio RFPG to be performed under Task 12, or as other funding sources are acquired by individual stakeholders.

Potentially Feasible FMEs

All potential FMEs that were identified are listed with their supporting technical information in Appendix Table 12. In total, 184 potential FMEs were identified and evaluated. The evaluation of FMEs relied on the compilation of planning level data to gauge alignment with regional strategies and flood planning guidance, the potential flood risk in the area, and the funding need and availability.

Potentially Feasible FMSs

The San Antonio RFPG identified 43 potentially feasible FMSs for the SAFPR, these are listed Appendix Table 11. A variety of FMS types were identified. Some strategies encourage and support communities and municipalities to actively participate within the NFIP. Other FMSs recommend the establishment and implementation of public awareness and educational programs to better inform communities of the risks associated with flood waters. Additional FMSs promote preventive maintenance programs to optimize the efficiency of existing stormwater management infrastructure, recommend the development of a stormwater management manual to encourage best management practices, or the establishment of conservation easement programs.

Because many projects are constrained physically and financially, the San Antonio RFPG decided that they did not want to exclude flood reduction projects based on the level of service or benefit-cost-ratio. Similarly, because many of the known flood mitigation projects were identified by local jurisdictions the drainage areas are sometimes under one-square mile, and the San Antonio RFPG did not want to exclude those from the plan for this first planning cycle. The San Antonio RFPG did express a desire to identify and group small individual projects to create larger FMXs within single jurisdictions where allowable as well as to encourage communities to work together on regional projects. Those efforts are somewhat limited in this first cycle but will be an important aspect of the amended plan due to be submitted in July 2023.

5.2 Task 5 - Recommendation of flood management evaluations and flood management strategies and associated flood mitigation projects

The objective of Task 5 is for RFPGs to use the information developed under Task 4 to recommend flood mitigation actions for inclusion in the Regional Flood Plan. While there was a lot of overlap in the performance of Tasks 4B and 5 (task 5 is a continuation of 4B), Task 4B focused on the steps of technical evaluations and screening of the potential FMEs and potentially feasible FMSs and FMPs and Task 5 focuses on how the RFPG used this data to determine whether to recommend flood mitigation actions. Since Task 5 builds off the evaluations from Task 4B much of the detailed evaluation and screening results have only been included in the Task 5 section to act as basis for recommendations. This section summarizes and documents:

1. The process undertaken to make final recommendations on flood mitigation actions
2. The potential FMEs and potentially feasible FMSs and FMPs identified and evaluated under Task 4B and whether these actions are recommended by the RFPG
3. The entities that will benefit from the recommended flood mitigation actions

While there is a significant need across the region to improve flood risk awareness and to develop and implement actions to reduce existing and future flood risk, not every flood mitigation action can be recommended in the San Antonio RFP or included in the State Flood Plan. The San Antonio RFPG opted to take an inclusive approach to the evaluation and recommendation process. If an evaluation, strategy, or project met the TWDB requirements and was aligned with the SAFPR flood mitigation and floodplain management goals the planning group choose to show deference to the local communities/sponsors and leaned towards including in the regional plan.

Figure 5-4. FMP and FMS Final Screening and Recommendation Process

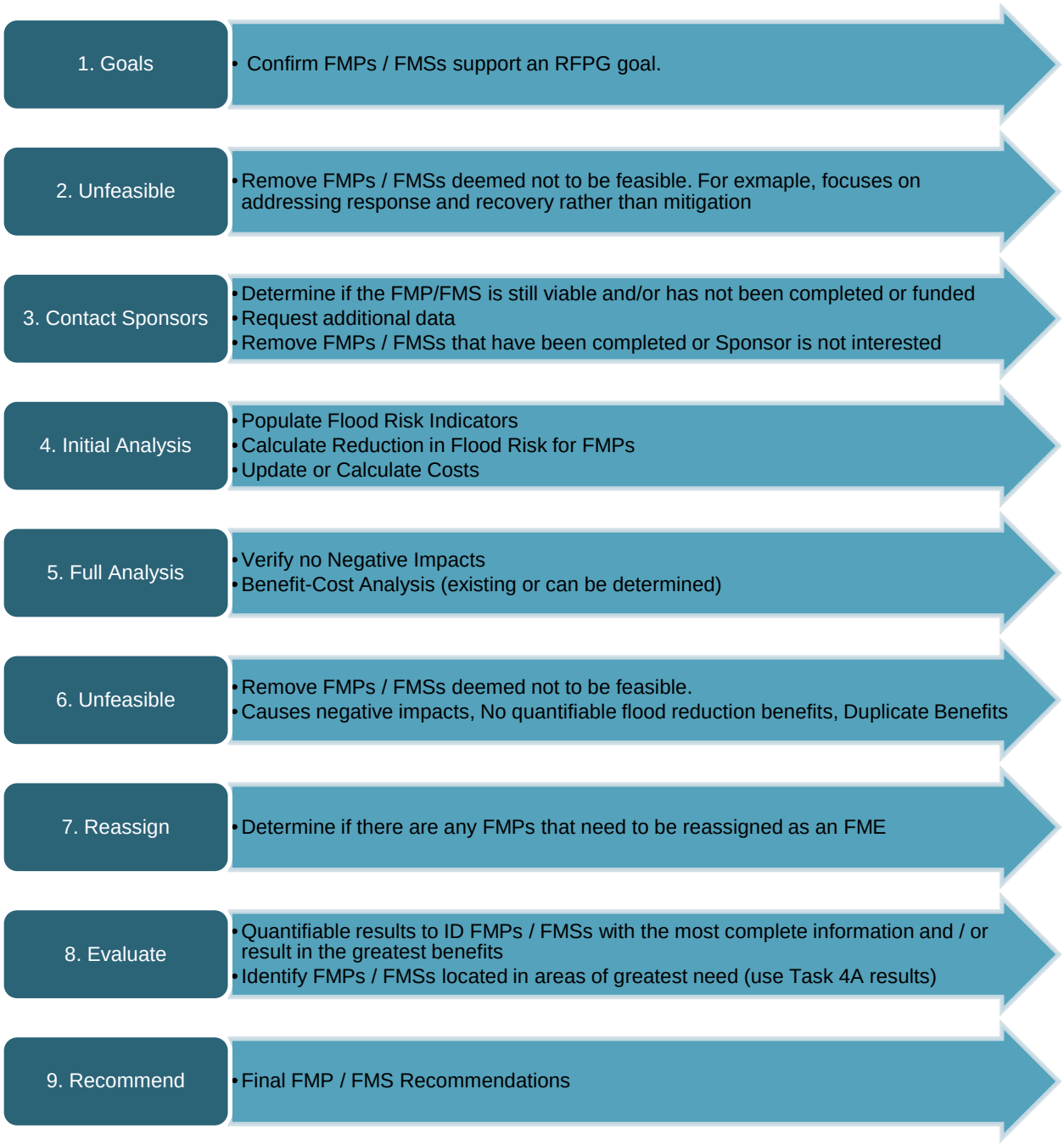
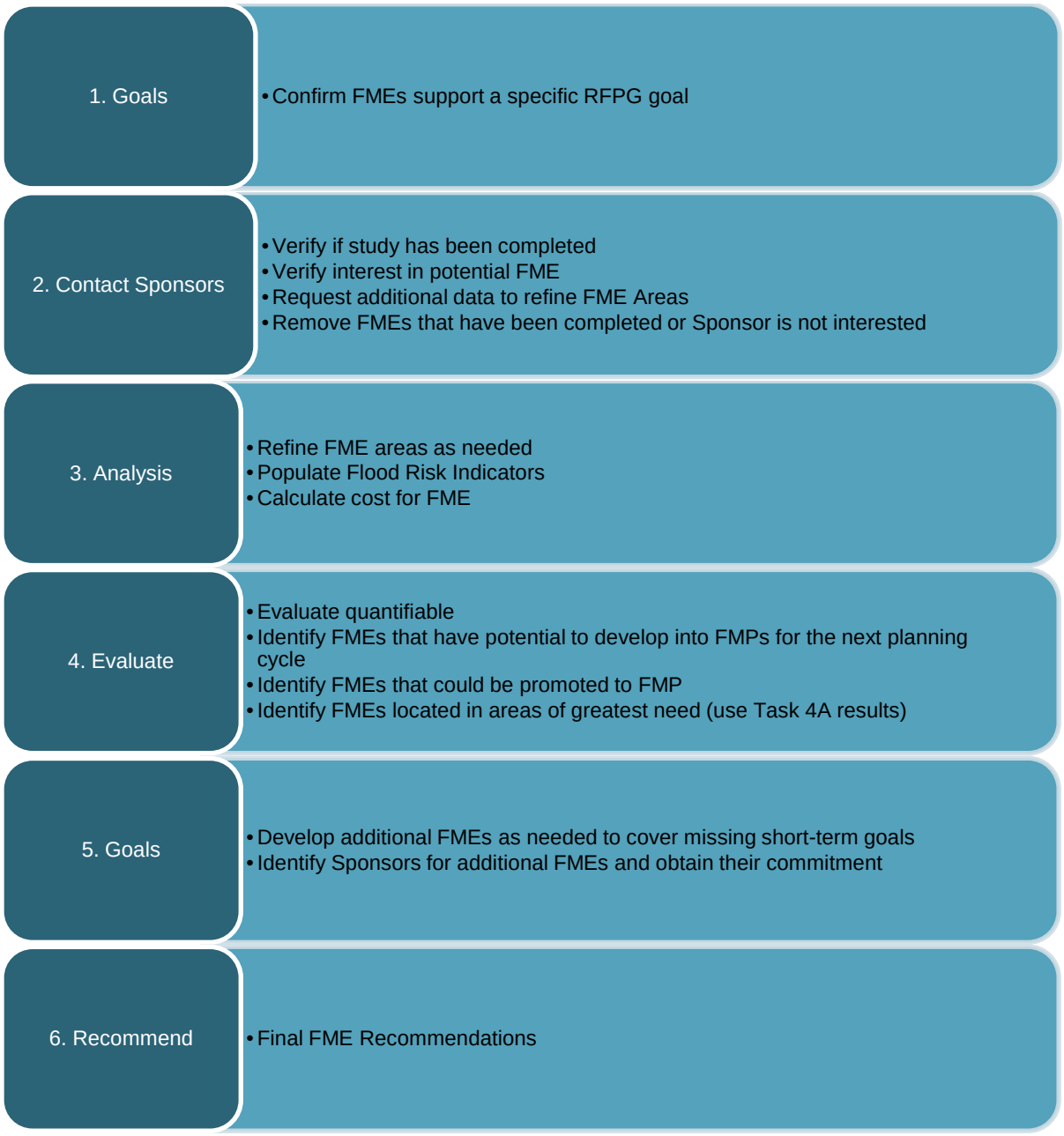


Figure 5-5. FME Final Screening and Recommendation Process



5.2.1 Detailed Evaluation Requirements Per Rules and Guidelines

The San Antonio RFPG considered recommendations of flood mitigation actions through a multi-step process. The methodology included a screening of all potential flood mitigation actions considering TWDB requirements for inclusion in the San Antonio Regional Flood Plan. The reasons for not recommending a particular flood mitigation action were clearly documented as part of the screening, evaluation, and recommendation process.

The screening process for evaluating and recommending flood mitigation actions is summarized in Figure 5-4 for FMPs and FMSs and in Figure 5-5 for FMEs. These processes were developed following the TWDB rules and requirements that left some

evaluation criteria at the discretion of the RFPG. The discretionary evaluation criteria are the:

- Level of Service (LOS) to be provided, if a 100-yr LOS is not feasible the RFGP can recommend an FMP with a lower LOS.
- Benefit/Cost Ratio (BCR) for the project, TWDB recommends that proposed actions have a BCR greater than one, but the RFPG may recommend FMPs with a BCR lower than one with proper justification.
- Drainage Area (DA), TWDB recommends actions with a DA greater than one-square mile to encourage regional actions and cooperation, but the RFPG may recommend FMPs with a smaller DA and justification.

FMX Costs and Benefit-Cost-Ratio for FMPs

FME Planning Level Cost Estimates

Planning level cost estimates are based on Sponsor provided information and verification/validation of those costs in accordance with the *Technical Guidelines*. The process to produce cost estimates where none exist for each FME type is summarized below. Cost estimates presented are for planning purposes only and are not supported by detailed scopes of work or workhour estimates. *Local sponsors will develop detailed scopes of work and associated cost estimates prior to submitting future funding applications through TWDB or other sources.*

Regional or Watershed Planning – Floodplain Modeling and Mapping. A unit cost per square mile was developed to generate estimates based on the size of the study area. Based on previous FEMA FIF projects, Regional or Watershed Planning Studies costs are estimated to be $2,500/sq. mile.

Watershed Planning – Drainage Master Plans. Depending on the size of the desired drainage master plan a unit cost per square mile was used for the estimates. After a comparative analysis of previously completed City Wide and County Wide Studies the unit costs were separated into three categories to capture the appropriate funds necessary to accomplish each. The following Table 5-3 shows the estimated ranges.

Table 5-3. Drainage Master Plan Cost Estimate Ranges

Area (sq. miles)	Cost Estimate (per sq. mile)
0-10	$40,000
10-25	$30,000
>25	$20,000

Engineering Project Planning – These studies consider two components: the evaluation of a proposed project to determine feasibility, and an initial engineering assessment / preliminary engineering. Analyzed from pasts projects a range of estimated costs was estimated based on size, the following is the criteria set for FMEs falling in this category.

Table 5-4. Preliminary Engineering /Site Cost Estimate Ranges

Size	Cost Estimate (per sq. mile)
Small	$50,000
Medium	$100,000
Large/Bridge	$150,000

Estimated Capital Cost of FMPs and FMSs

Cost estimates for each FMP and FMS were taken from associated engineering reports and were adjusted as needed. These costs were escalated using construction cost indices to account for inflation and other changes to the construction market and to include applicable non-recurring and recurring project costs as listed on Table 22 of the *Technical Guidance*. The cost estimates listed in Table X and Table X are expressed in September 2020 dollars (see Appendix).

Benefit-cost Ratios for FMPs

Benefit-Cost Analysis (BCA) is the method by which the future benefits of a hazard mitigation project are determined and compared to its costs. The result is a Benefit-Cost Ratio (BCR), which is calculated by dividing the project's total benefits, quantified as a dollar amount, by its total costs. The BCR is a numerical expression of the relative "cost-effectiveness" of a project. A project is generally considered to be cost effective when the BCR is 1.0 or greater, indicating the benefits of a prospective hazard mitigation project are sufficient to justify the costs (Federal Emergency Management Agency, 2009). However, a BCR greater than 1.0 is not a requirement for inclusion in the Regional Flood Plan. The RFPG can recommend a project with a lower BCR with appropriate justification.

When a BCR had been previously calculated in an engineering report or study that was used to create an FMP, the previously calculated BCR value was utilized for the FMP analysis. For any FMP that did not already have a calculated BCR value, the TWDB BCA Input Spreadsheet was utilized in conjunction with the FEMA BCA Toolkit 6.0 to generate BCR values.

Willing Sponsors for FMXs

Initial efforts to contact potential sponsors consisted of sending surveys to communities. These surveys included actions associated identified for each community, giving the community an opportunity to identify any that are no longer relevant or that they are actively pursuing. These surveys were followed up with calls to inform communities of the survey and its purpose. To supplement this outreach effort the Technical Consultant Team leveraged existing relationships to contact communities to increase community participation and to gather additional input.

While these efforts furthered the goal of receiving community feedback on what actions they wanted to pursue, not all communities were able to be reached, and accordingly,

the San Antonio RFPG decided that an affirmative willingness to sponsor a given action would not be a prerequisite for inclusion in the plan. Therefore, all potential actions were considered for inclusion in the plan unless an entity had specifically declined to be listed as a sponsor and no other appropriate potential sponsor was identified. This approach was adopted because:

1. It provides a conservative estimate of the flood mitigation need in the region.
2. Inclusion in the plan does not obligate an entity to sponsorship an action, it simply allows an entity to be eligible for funding if they have the interest and capacity to pursue an action.

It is important to note that all sponsors associated with recommended actions were subsequently sent a survey to identify potential funding sources for the actions listed in the plan. This effort is detailed in Chapter 9.

Residual, Post-Project, and Future-Risks of FMPs

It is expected that the implementation of recommended FMPs will reduce current and future levels of flood risk in the region. While it is not possible to protect against all potential flood risks, the evaluation of FMPs should consider their associated residual, post-project and future risks including the risk of potential catastrophic failure and the potential for future increases to these risks due to lack of maintenance. In general, residual and future risks for FMPs could be characterized as follows:

1. Flood events may exceed the level of service for which infrastructure is designed.
2. Potential failure or overtopping of dams and levees.
3. Lack of routine maintenance to maintain, repair or replace its design capacity.
4. Policy changes that adversely impact budgets, prior plans, assets, and design or floodplain management standards.
5. Human behavior is unpredictable, and people may choose to ignore flood warning systems or cross over flooded roadways for a variety of reasons

Known Insurmountable Constraints

Potential project implementation issues include conflicts pertaining to rights-of-way, permitting, acquisitions, utility or transportation relocations, amongst other issues that might be encountered before an FMP is able to be fully implemented. Such issues are an inherent part of flood mitigation projects, so they do not exclude actions from being considered for the plan.

Because a right-of-way is a public use on private land, it can create issues when securing access to projects for construction and maintenance. The acquisition of right-of-way or other property and utility relocation located near or on property impacted by a project requires close coordination between government agencies, private entities, and landowners. Coordination and early engagement with the appropriate entities is key to facilitating projects.

Most FMPs will require a variety of permits from local to state and federal depending on the scale. Because permitting can be a lengthy process, the goal is to identify permitting

needs during the project development phase and initiating the permitting process as early as practicable during final design. This will minimize significant design changes and delays in project implementation.

The terms “buyout” and “acquisition” are often utilized interchangeably, but in the context of flood protection, both refer generally to the purchase of private property by the government for public use. In the case of flood acquisitions, the process most often involves the purchase of property in a floodplain to reduce repetitive flood damage. Voluntary buyout programs are a specific subset of property acquisitions in which private land is purchased, existing structures demolished, and the land is returned to an undeveloped state in perpetuity. Voluntary property acquisition is not a simple process and requires agreement by the property owner and local jurisdiction. If state or federal funding is involved, the process could also include other governmental agencies and program requirements. The process can also be financially burdensome and lengthy.

Utility relocations may include water and wastewater lines, existing storm drain systems, telecommunication, power lines, and similar infrastructure. The local government and franchise utility owners are usually responsible for utility relocations; however, developers may also assume responsibility for utility relocations depending on the project. Utility relocation includes removing and reinstalling the utility, including necessary temporary utilities; acquiring necessary right-of-way; and taking any necessary safety and protective measures. Utility relocations can take significant lead time to accomplish and can be a significant portion of the total project implementation cost.

5.2.2 Recommendations Evaluation Summary of Screening Results

Overview Process

Tech Committee Formation

The San Antonio RFPG created a Technical Subcommittee tasked with establishing a selection methodology, implementing the evaluation and selection process, and reporting their findings and recommendations back to the San Antonio RFPG for formal approval. The methodology included a screening of all potential flood mitigation actions based on the general process described is Section 5.1.1 (above) and any other additional considerations established by the Technical Subcommittee. The reasons for not recommending a particular flood mitigation action were clearly documented as part of the evaluation and recommendation process.

In December, 2021 the Technical Committee meeting members reviewed, discussed, and approved the process and timeline for reviewing FMEs, FMSs, and FMPs and making recommendations to the full San Antonio RFPG. The Technical Committee met over a series of meetings in 2022 to further discuss recommendations.

(list meetings dates)

Tech Committee Review and Approval of Draft FMX Recommendations

Initial meetings of the Technical Committee focused on completion of the initial screening process to identify potentially feasible evaluations, projects, and strategies. This included

the discussion of how the actions were being categorized, limitations of the available data, and confirmation of how the discretionary evaluation criteria was applied to each applicable action.

In May, 2022 the Technical Committee reviewed the initial batch of potential actions for recommending. That “pilot” batch included three FMSs, FMPs, and FMEs. The FMSs and FMEs were voted on and recommended to the forwarded to the full San Antonio RFPG for consideration and pending minor changes to the decision documents templates. During this meeting the technical committee established a process for reviewing, discussing, and a making their recommendations. In short, the committee agreed that future batches would be reviewed prior to the meeting at which they were to be considered and the actions would be brought forward in groups, or batches, for consideration in a manner like a consent agenda. This format allowed each committee member to provide comments on, or to discuss any of the individual actions, and allowed the committee to make recommendations to the San Antonio RFPG for each batch. At the May, 2022 Technical Committee meeting the group reviewed and forwarded recommendations for approval to the full San Antonio RFPG for 184 individual FMEs, 38 FMPs, and 43 FMSs.

RFPG Review and Approval of Draft FMX Recommendations

At the May, 2022 Technical Committee meeting the group reviewed and forwarded recommendations for approval

Flood mitigation Projects (FMPs)

Initial Evaluation: The scope of work for each FMP was evaluated to ensure that it would support at least one of the regional floodplain management and flood mitigation goals established in Chapter 3. The goals associated with each FMP are included in Appendix. Based on a review of supporting information, it was determined that the primary purpose for each FMP is mitigation (rather than a response or recovery project) and they do not have any anticipated impacts to water supply or water availability allocations as established in the most recent adopted State Water Plan.

No Negative Impacts Determination: Each identified FMP must demonstrate that there would be no negative impacts on a neighboring area due to its implementation. No negative impact means that a project will not increase flood risk of surrounding properties. Using best available data, the increase in flood risk must be measured by the 1% annual chance event water surface elevation and peak discharge. It is recommended that no rise in water surface elevation or discharge should be permissible (without acquiring the effected land or obtaining permission from the effect parties), and that the analysis extent must be sufficient to prove proposed project conditions are equal to or less than the existing conditions.

For the purposes of flood planning effort, a determination of no negative impact can be established if a project does not increase inundation of infrastructure such as residential and commercial buildings and structures. Additionally, the following requirements, per TWDB Technical Guidelines, should be met to establish no negative impact, as applicable:

Does not increase inundation in areas beyond the public right-of-way, project property, or easement

Does not increase inundation of storm drainage networks, channels, and roadways beyond design capacity

Maximum increase of 1D Water Surface Elevation must round to 0.0 feet (<0.05 ft) measured along the hydraulic cross-section

Maximum increase of 2D Water Surface Elevations must round to 0.3 feet (<0.35 ft) measured at each computation cell

Maximum increase in hydrologic peak discharge must be <0.5 percent measured at computation nodes (sub-basins, junctions, reaches, reservoirs, etc.). This discharge restriction does not apply to a 2D overland analysis.

If negative impacts are identified, mitigation measures may be utilized to alleviate such impacts. Projects with design level mitigation measures already identified may be included in the Regional Flood Plan and could be finalized at a later stage to conform to the "No Negative Impact" requirements prior to funding or execution of a project.

Furthermore, the RFPG has flexibility to consider and accept additional "negative impact" for requirements 1 through 5 based on engineer's professional judgment and analysis given any affected stakeholders are informed and accept the impacts. This should be well-documented and consistent across the entire region. However, flexibility regarding negative impact remains subject to TWDB review.

A comparative assessment of pre- and post-project conditions for the 1% annual chance event (100-yr flood) was performed for each potentially feasible FMP based on their reported hydrologic and hydraulic model results. Study results for floodplain boundary extents, resulting water surface elevations, and peak discharge values were reviewed to verify potential FMPs conform to the no negative impacts requirements. The same studies were used to identify reported flood risk reduction.

A general description of the scope of work and a summary of the expected impacts of the proposed improvements for each potentially feasible FMP is provided in summary Table 5-4 below.

Level of Service (LOS) Evaluation and BCR: All the recommended FMPs provide some level of flood reduction benefits which are included based on the available information. When a BCR had been previously calculated in an engineering report or study that was used to create an FMP, the previously calculated BCR value was utilized for the FMP analysis. For any FMP that did not already have a calculated BCR value, the TWDB BCA Input Spreadsheet was utilized in conjunction with the FEMA BCA Toolkit 6.0 to generate BCR values.

The RFPG considered the below projects and determined that recommending these FMPs is consistent with the overarching goal of the Regional Flood Plan "to protect against the loss of life and property".

Figure 5-6. Geographical Distribution of Recommended FMSs

Table 5-4. FMPs recommended by the RFPG

Table Head	Table Head	Table Head
Table Cell	Table Cell	Table Cell
Table Cell	Table Cell	Table Cell
Table Cell	Table Cell	Table Cell

Source: Table Source/Note
[a] Table Footnote

Flood Management Evaluation (FMEs)

In considering potential FMEs for recommendation, the RFPG sought to determine which FMEs would be most likely to result in identification of potentially feasible FMSs and FMPs in future planning cycles. Recommended FMEs were also required to demonstrate alignment with at least one regional floodplain management and flood mitigation goal developed under Task 3. Finally, each recommended FME should identify and investigate at least one solution to mitigate the 1% annual chance flood. It is the intent that all FMEs with a hydrologic and hydraulic modeling component will evaluate multiple storm events, including the 1% annual chance flood. The potential solutions and level of service that will be identified are unknown; however, it is expected that analyses will evaluate potential negative impacts and potential flood risk reduction for the 1% annual chance flood to help inform recommended alternatives and to define potentially feasible FMPs under this planning framework. Based on these TWDB requirements, the RFPG identified two main reasons for recommending FMEs.

The first subset of recommended FMEs would result in increased flood risk modeling and mapping coverage across the region as they are implemented. These types of FMEs have two major implications for the identification of potentially feasible FMSs and FMPs. First, a current and comprehensive understanding of flood risk across the basin is necessary to identify high-risk areas for evaluation and development of flood risk reduction alternatives. Secondly, FMPs, and in some cases, FMSs, require a demonstrated potential reduction in flood risk to be recommended in the Regional Flood Plan. For this metric to be assessed, hydrologic and hydraulic modeling must be available to compare existing and post-project flood risk.

The second subset of recommended FMEs were project planning type FMEs. These FMEs are generally studies or preliminary designs to address a specific, known flood need. These actions include low water crossing improvements, storm drain or channel projects, city or countywide studies, and evaluations of possible buyouts or elevation. While in many cases a specific location is known, the actions currently lack some or all the detailed technical data necessary for evaluation and recommendation as an FMP. An example would be an existing study that identifies potential drainage construction projects but does not provide a full negative impacts analysis. Completing these components as part of an FME will result in a potentially feasible FMP for consideration during future flood planning efforts.

Sponsor input was a major driver for choosing not to recommend FMEs. FMEs that were indicated by the sponsor as being in progress, completed, or lacking interest to pursue were not recommended. Additionally, some FMEs located near one another were

combined into a single FME for recommendation, a process the RFPG plans to continue as it develops the amended plan (due July 2023).

Description and Summary of Recommended FMEs

A total of XXX potential FMEs were identified and evaluated by the RFPG. Of these, all were recommended, representing a combined total of $XXX,XXX,XXX of flood management evaluation need across the region. The number and types of studies recommended by the RFPG are summarized in Table 5-5. The full list of FMEs and supporting technical data is included as XXXXX. A map and table of recommended FMEs is presented in Appendix X and X, respectively. Overall, the recommended FMEs represent over X square miles of contributing drainage area and provide comprehensive coverage of the Flood Planning Region.

Figure 5-7. Geographical Distribution of Recommended FMEs

Table 5-5. FMEs recommended by the RFPG

Table Head	Table Head	Table Head
Table Cell	Table Cell	Table Cell
Table Cell	Table Cell	Table Cell
Table Cell	Table Cell	Table Cell
Source: Table Source/Note [a]Table Footnote		

Flood Management Strategy (FMSs)

The approach for recommending FMSs adheres to similar requirements as the FMP process except, due to the flexibility and varying nature of RFPG's potential utilization of FMSs, some of these requirements may not be applicable to certain types of FMSs. In general, the RFPG must be able to demonstrate that each recommended FMS meets the following TWDB requirements as applicable:

1. The primary purpose is mitigation (response and recovery projects are not eligible for inclusion in the Regional Flood Plan).
2. Supports at least one regional floodplain management and flood mitigation goal.
3. Implementation of the FMS results in:
    a. Quantifiable flood risk reduction benefits
    b. No negative impacts to adjacent or downstream properties (a No Negative Impact certification is required)
    c. No negative impacts to an entities water supply
    d. No overallocation of a water source based on the water availability allocations in the most recently adopted State Water Plan.

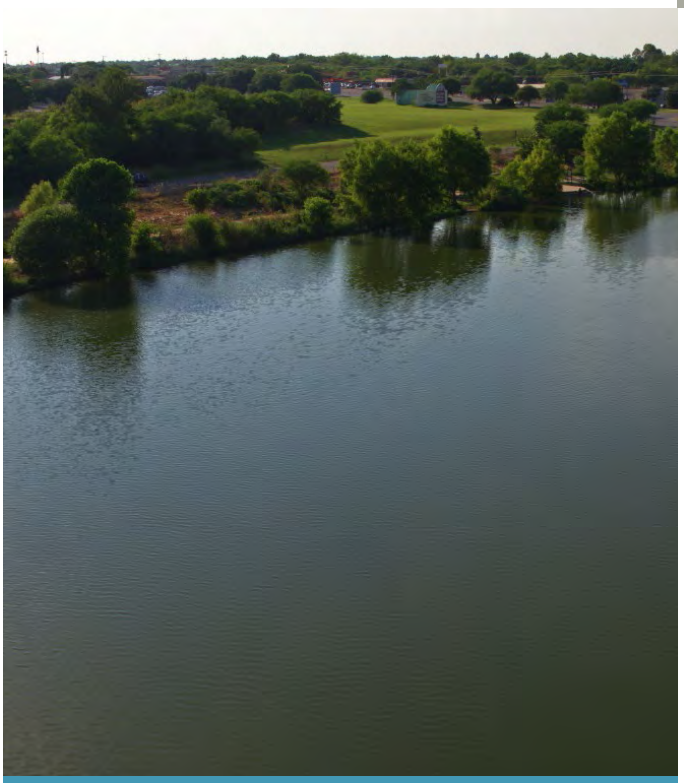
In addition, the TWDB recommends that, at a minimum, FMSs should mitigate flood events associated with the 1% annual chance flood (100-yr LOS) and must demonstrate that there would be no negative flood impacts on a neighboring area due to its implementation. There were no structural FMSs identified for this region, and therefore flood mitigation and no adverse impacts from flooding or to the water supply are anticipated. The number and types of studies recommended by the RFPG are summarized in Table 5-6.

Figure 5-8. Geographical Distribution of Recommended FMSs

Table 5-6. FMSs recommended by the RFPG

Table Head	Table Head	Table Head
Table Cell	Table Cell	Table Cell
Table Cell	Table Cell	Table Cell
Table Cell	Table Cell	Table Cell

Source: Table Source/Note
[a]Table Footnote



6

Impact and Contribution of the Regional Flood Plan

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2023 Regional Flood Plan – Flood Planning Region 12 –San Antonio
Flood Risk Analysis

1 Impact and Contribution of the San Antonio Regional Flood Plan

The objective of this task is to assess and summarize the impacts and contributions, in the aggregate, associated with implementation of this San Antonio RFP. In previous chapters, existing flood hazard and exposure conditions were assessed based on the 1.0% and 0.2% annual chance flood events. In addition, an inventory of existing infrastructure and natural features was compiled for use as a baseline. Flood risk reduction or mitigation needs were identified leading to adoption by the San Antonio RFPG of recommendations, presented in the previous chapter, of flood management evaluations and strategies, and flood mitigation projects. This chapter aims to compare those identified risks with the potential estimated positive and negative benefits of implementing the San Antonio RFP. Additionally, in the second part of this chapter potential contributions to and impacts on water supply development and the State Water Plan are assessed.

1.1 Impacts of San Antonio Regional Flood Plan

Implementation of the San Antonio RFP can be expected to provide numerous benefits to the areas served by local Sponsors and will not negatively impact neighboring areas within or outside of the SAFPR. More specifically, the implementation of recommended Flood Mitigation Projects are expected to reduce the number and/or spatial extent of areas with high flood hazard and exposure. For example, implementation of recommended FMPs are expected to remove an estimated XXX at-risk structures from flood prone areas. Note however that the benefits will vary greatly across the SAFPR due to the highly variable and local nature of most flood hazard areas, as well as with the types of studies, strategies, and projects that are implemented. Further discussion of the potential benefits of implementing this Plan is provided below.

1.1.1 Floodplain Management and Modeling

Information was compiled during the baseline development of the San Antonio RFP. As part of the compilation, data gaps were identified within the SAFPR. The information and data gaps were found in areas of low to high flood risks that lack floodplain management practices, adequate enforcement of floodplain standards and regulations, detailed hydrologic and hydraulic models, and flood inundation mapping. Combined, these areas cover approximately XXX square miles or xx% of SAFPR and include an estimated population of XXX. The lack of information hinders the ability of local entities to effectively manage activities in floodplains, adequately assess flood risks and exposure, evaluate potentially feasible flood risk reduction strategies and solutions, and select a preferred option(s) for implementation. Overall, this likely results in population and property exposed unnecessarily to flood risk. As reported in Chapter 5, XXX FMEs are recommended and when implemented will close data and information gaps and set in

motion the process of developing and implementing flood risk reduction solutions to ultimately reduce exposure to flood hazards. (Insert number) (X) recommended FMEs are specifically focused on watershed modeling and mapping, and XX include modeling and mapping to identify flood risk, flood mitigation alternatives analysis and feasibility studies, and preliminary engineering studies among others. There is a total of XX FMEs identified within the Plan. The FMEs will reduce the areas and population not covered by flood risk evaluations by approximately XX miles and approximately XX, respectively.

1.1.2 Reduction in Flood Impacted Areas

Existing and future flood hazard areas were identified and quantified for both 1.0 % and 0.2% annual chance flood events. The tables below show the flood impacted areas in square miles for both existing and future scenarios based on both annual chance flood events and the reduction of impacted areas. A series of FMEs, FMSs, and FMPs were identified to ultimately reduce impacts during flood events. By implementing the Plan, areas previously impacted will be reduced by approximately XXXX percent or a reduction in approximately XXX square miles.

Table 6-1. Reduction in Existing Flood Impacted Areas (Table to be completed with Chapter 2 data and Guidance Tables 13 and 14)

Annual Chance Event	Area in Floodplain (Sq. Mi.)	Reduction due to the Plan (Sq.Mi.)	Change in Area (Sq. Mi.)	Change in Area
1.0%	XX	XX	X	XX%
0.2%	XX	XX	X	XX%
Total	XX	XX	X	XX%

Table 6-2. Reductions in Future Flood Impacted Areas (Table to be completed with Chapter 2 data and Guidance Tables 13 and 14)

Annual Chance Event	Area in Floodplain (Sq. Mi.)	Future Area in Floodplain (Sq. Mi.)	Change in Area (Sq. Mi.)	Change in Area
1.0%	XX	XX	X	XX%
0.2%	XX	XX	X	XX%
Total	XX	XX	X	XX%

1.2 Benefits to Population and Structures at Risk

With the number of square miles affected by flooding being reduced with the implementation of this Plan, the ultimate beneficiaries are populations residing in those areas as well as public and private assets (e.g., structures, roads, utilities). Since the area of land being impacted will be reduced, the subsequent population benefitting from the Plan within the SAFPR is estimated to be XXX. The socioeconomic benefits to the population will vary based upon location. Additional descriptions of those benefits will be provided in section X.X. The estimated population removed from the floodplain is shown

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in the following table. While the number of potentially avoidable injuries and deaths associated with implementation of this plan is not quantifiable, the expected benefits can be substantial. The benefits will be generated by changing flood characteristics to reduce flood risk to structures, roads, and property (structural flood mitigation projects) and changing the way people interact with flood risk (non-structural flood mitigation projects and strategies) through regulatory improvements, educating people about flood risks, implementing flood early warning and evacuation measures.

Table 6-3. Population Removed from the Floodplain (Table to be completed with Guidance Tables 13 and 14)

Annual Chance Risk Flood	Existing Population Impacted	Estimated Population Impacted after Implementation	Decrease in Population Impacted
1.0%	XXX	XXX	XX%
0.2%	XXX	XXX	XX%
Totals	XXX	XXX	XX%

Implementing the San Antonio RFP provides additional benefit to the removal of existing structures located within flood hazard areas. Removing structures from flood danger benefits communities who rely on those structures for residences, work, industry, and critical facilities. These include structures that are inundated for short periods to those for extended periods along the flatter topographical areas within the SAFPR. Table 6-4 shows the estimated reduction in the number of structures that will be removed by implementing the Plan.

Table 6-4. Structures Removed from the Floodplain (Table to be completed with Guidance Tables 13 and 14)

Annual Chance Risk Flood	Existing Structures Impacted	Estimated Structures Impacted after Implementation	Decrease in Structures Impacted
1.0%	XXX	XXX	XX%
0.2%	XXX	XXX	XX%
Totals	XXX	XXX	XX%

Critical facilities identified generally as municipal utilities and buildings, hospitals and care facilities, and schools are of special importance that will benefit from the Plan. The following table shows the estimated number of critical facilities that are currently impacted and those which will be removed from the floodplain with Plan implementation.

Table 6-5. Critical Facilities Removed from the Floodplain (Table to be completed with Guidance Tables 13 and 14)

Annual Chance Risk Flood	Existing Critical Facilities Impacted	Estimated Critical Facilities Impacted after Implementation	Decrease in Critical Facilities Impacted
1.0%	XXX	XXX	XX%
0.2%	XXX	XXX	XX%
Totals	XXX	XXX	XX%

1.3 Low Water Crossings and Impacted Roadways

Implementing FMSs and FMPs across the SAFPR will have a considerable impact on the number of existing low water crossings. As projects are implemented over time the number of low water crossings will be reduced saving life and property. The estimated number of low water crossings being removed due to implementing the San Antonio RFP is shown in Table 6-6.

Table 6-6. Low Water Crossings Removed (Table to be completed with Guidance Tables 13 and 14)

Annual Chance Risk Flood	Existing Low Water Crossings	Low Water Crossings Removed after Implementation	Decrease in Low Water Crossings
1.0%	XXX	XXX	XX%
0.2%	XXX	XXX	XX%
Totals	XXX	XXX	XX%

In addition to the number low water crossing being removed, flooded roadways also benefit from the Plan being implemented. Roadways that are often closed due to flooding pose risks to life, property, and transportation in general. Information in tables 6-7 and 6-8 show the benefit to transportation infrastructure by reducing the amount of time a roadway is closed or removing it from flooding altogether.

Table 6-7. Reduction in Roadway Closures (Table to be completed with Guidance Tables 13 and 14)

Annual Chance Risk Flood	Existing Road Closures	Reduction Roadway Closures after Implementation	Decrease in Roadway Closures
1.0%	XXX	XXX	XX%
0.2%	XXX	XXX	XX%
Totals	XXX	XXX	XX%

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Table 6-8. Removal of Roads from Flood Risks (Table to be completed with Guidance Tables 13 and 14)

Annual Chance Risk Flood	Existing Roads in Floodplain (Mi.)	Roadways Removed from Floodplain after Implementation	Decrease in Roads in Flood plain
1.0%	XXX	XXX	XX%
0.2%	XXX	XXX	XX%
Totals	XXX	XXX	XX%

1.4 Socioeconomic and Recreational Impacts

1.4.1 Socioeconomic

Implementing the San Antonio RFP, as shown in the previous sections, provides a benefit to the SAFPR. As part of this effort, socioeconomic impacts were taken into consideration to evenly distribute flood risk reduction benefits among all groups across the SAFPR as much as practical. The SAFPR has a diverse population with wide ranging economic levels requiring extra attention to improve conditions for everyone. Disadvantaged socioeconomic populations have limited access to resources hindering response and recovery from flood events. Processes in developing the appropriate FMSs, FMPs, and FMEs included reducing impacts to flood events and improving the lives of all socioeconomic groups ensuring the most disadvantaged were well represented. This can be shown in the locations of FMSs, FMPs, and FMEs identified throughout the SAFPR.

1.4.2 Recreation Impacts

There can be many opportunities to benefit recreation through the implementation of the Plan. Many parks located along water fronts are designed to be flooded periodically with infrastructure minimally impacted. Floodplains and wetlands can support recreation and tourism. Although not specifically identified in this Plan, as FMSs and FMPs are implemented removing structures from floodplains and existing floodplains removed, new opportunities become available for local sponsors. These areas are often utilized in cities throughout the state for hiking and biking trails. The San Antonio RFPG will encourage secondary benefits such as recreational opportunities. While the Plan will provide opportunities, it will not negatively impact existing recreation activities located throughout the SAFPR.

1.5 Overall Impacts

Implementing the San Antonio RFP provides numerous benefits associated to the primary purposes of FMSs, FMPs, and FMEs. The benefits, although not readily quantifiable, will protect the health and safety of the SAFPR. This is done by reducing

flooding frequency and severity, advanced flood warning systems, removing roads from flooding, and providing officials the tools to properly manage flood prone areas.

Review information on final list of FMSs and FMPs to determine additional impacts.

None of the FMSs, FMEs, and FMPs specifically address water supply issues and are not expected to have an impact on water supply. The following section focuses on water supply.

1.6 Contributions To and Impacts on Water Supply Development and the State Water Plan

Plans must include a regionwide assessment of the potential contributions and impacts that implementation of Plans can be expected to have on water supplies and the State Water Plan. As part of this analysis, each FMS and FMP was reviewed to determine whether there are potential impacts to existing water supplies or the availability of water supplies. Impacts include potential contributions to, as well as reductions in water supply and availability. These impacts as determined would be placed in one of the following categories:

1. Involves direct impacts to available water supply yield during a drought-of-record, which requires both availability and directly connecting supply to specific water user group(s)
2. Direct benefits (i.e., increases) water availability
3. Indirectly benefits water availability
4. Or has no anticipated impact on water supply

A coordinated effort with representatives from multiple regional water planning groups occurred to identify water management strategies that could be impacted. Those regional water planning groups include Region J (Plateau), Region L (South Central Texas), and Region N (Coastal Bend). The results of those analyses and discussions are provided in the following tables.

It was determined that there were no anticipated impacts from the recommended FMSs and FMPs on water supply, water availability, or projects in the State Water Plan based on no anticipated measurable impact.

Place map of SAFPR and Regional Water Plan boundaries

The table below includes all FMS and FMPs that were identified to measurably contribute to water supply/availability or have no impact at all.

Table 6-9. FMS/FMP Contributions to Water Supply

Name	FMS/FMP	Volume (AF)	Water Supply	Direct Water Availability	Indirect Water Availability	No Impact

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Comments – Review all new flood reduction structures for quantifiable impacts to surface water rights permits, structures located over aquifer recharge zones for increased recharge, changes in reservoir operations impacting water supply storage (decrease in conservation pool to accommodate additional flood protections), these are just a few examples for both tables

The table below includes all FMS and FMPs that were identified to negatively impact or measurably reduce water supply/availability.

Table 6-10. FMS/FMP Negatively Impacting Water Supply

Name	FMS/FMP	Volume (AF)	Water Supply	Direct Water Availability	Indirect Water Availability	No Impact

Insert a paragraph providing a summary of the reductions in the Region's water supply. Highlight the number of structures and volume of water supply reduction.

7

Flood Response Information and Activities

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7 Flood Response Information and Activities

[31 TAC §361.42]

7.1 Flood response and recovery activities in the San Antonio Flood Planning Region(SAFPR)

This chapter summarizes the flood response preparations using demographic, historical, projected, and statistical data from the previous chapters and further research. The TWDB specifically stated that the San Antonio RFPG "shall not perform analyses or other activities related to planning for disaster response or recovery activities." The focus of this chapter is summarizing the information obtained and providing general recommendations regarding flood response activities.

7.1.1 Types of Flooding in the SAFPR

To better understand how to respond, floods are generally categorized into 5 types: flash floods, coastal floods, urban floods, river floods and pluvial floods.

Flash Floods are floods caused by heavy rainfall over a short period. The flood water can occur quickly and be very powerful, making it extremely dangerous.

Pluvial Floods happen when there is flooding independent from an overflowing body of water due to extreme rain fall. The most common example of this is when an urban drainage system is overwhelmed and the excess water floods into the streets and onto adjacent property.

Riverine Floods occur when excess rainfall causes an overtopping of the riverbank. This overtopping then spills the water onto nearby land.

Urban Flooding is caused by excess runoff water in developed areas where the water does not have anywhere else to go. Urban flooding can be considered a type of pluvial flooding.

Coastal Floods occur when a coastal process such as waves, tide, storm surge or heavy rainfall from coastal storms create a flood where the sea meets land.

The SAFPR is prone to each type with frequency depending on which part of the region it occurs. The region is separated into 4 subregions: *Upper*- north of Loop 1604 from Culebra Road to I-35; *Mid*- south of North loop 1604 to south of Karnes County; *Coastal*- from south Karnes County to the sea; and *Medina*- the Medina River and its tributaries.

Geography, climate and urbanization merge to create significant flood issues for a band of counties in North-Central, Central, and South-Central Texas. This is one of the most flash-flood prone regions in North America and is often referred to as "Flash Flood Alley."[1] The counties that are most affected by this phenomenon are shown in Figure 7-

[1] SARA. The River Basin Report Card Highlights. March 18, 2022. New to San Antonio? Welcome to Flash Flood Alley | San Antonio River Authority (sariverauthority.org)

1, with green representing the boundaries of the SAFPR. The primary feature impacting flooding in the SAFPR is the Balcones Escarpment, a geological fault zone that traps warm weather masses moving in from the coast, resulting in heavy rainfall events, that runoff quickly downhill due to terrain, increasing impervious surfaces, shallow soils and narrow river channels. The result is deep, fast, erosive flood waters with destructive forces that have the potential to penetrate communities downstream. Increased development and impervious surfaces can exacerbate these issues, leading to water running over the banks of rivers and overwhelming drainage systems in urban and non-urban areas.

Figure 7-1. Flood Plain Alley in Texas

Source: San Antonio River Authority(SARA) (sariverauthority.org)

When storms fall over the City of San Antonio area, the runoff flows into the river system and arrives in Wilson, Karnes or Goliad counties several days later, providing advance notice of impending flooding. When such flood events occur, it is imperative that plans are in place to combat the effects of the flooding.

7.1.2 The Nature and Types of Flood Responses

Emergency Management is defined by four phases:

- **Flood Mitigation:** The implementation of actions, including both structural and non-structural solutions, to reduce flood risk to protect against the loss of life and property.
- **Flood Preparedness:** Actions, aside from mitigation, that are taken before flood events to prepare for flood response activities.
- **Flood Response:** Actions taken during and immediately following a flood event.
- **Flood Recovery:** Actions taken after a flood event involving repairs or other actions necessary to return to pre-event conditions.

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

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

Flood Mitigation is the primary focus of the SAFPR planning process and efforts to identify and recommend Flood Management Evaluations (FMEs), Flood Management Strategies (FMSs), and Flood Mitigation Projects (FMPs) by the San Antonio RFPG. The plan may also include FMEs, FMSs and FMPs related to Flood Preparedness.

Examples of mitigation actions include planning and zoning, floodplain protection, property acquisition and relocation, and public outreach. Examples of preparedness actions include installing disaster warning systems, purchasing radio communications equipment, and conducting emergency response training.

Mitigation actions from Hazard Mitigation Action Plans (HMAP) can include the following efforts:

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

7.1.3 Relevant Entities in the Region

The purpose of flood risk management is to help prevent or reduce flood risk by using structural and/or non-structural means. Responsibility for flood risk management is shared between federal, state, and local government agencies; private-sector stakeholders; and the general public. The political subdivisions in the SAFPR with flood-related authority are listed in Table 7-1, Table 7-2, and Table 7-3.

Table 7-1. Counties with flood-related authority in the SAFPR

Kerr	Bexar	Goliad	Atascosa
Bandera	Guadalupe	Victoria	Calhoun
Kendall	Wilson	Refugio	De Witt
Comal	Karnes	Aransas	Medina

Table 7-2. Cities with flood-related authority in the SAFPR

Boerne	Converse	Bandera	Seadrift
San Antonio	Goliad	Fair Oaks Ranch	Nordheim
New Braunfels	Cibolo	Grey Forest	Balcones Heights
Floresville	Schertz	Garden Ridge	Santa Clara
Karnes City	Timberwood Park	La Vernia	Stockdale
Charlottee	Lytle	Alamo Heights	Kirby
Christine	Pleasanton	Converse	Leon Valley
Jourdanton	Poteet	Helotes	Live Oak
St. Hedwig	Somerset	Terrell Hills	Universal City
Von Ormy	Windcerst	Bulverde	Seguin
Falls City	Kenedy	Runge	Ingram

Castroville	Devine	Hondo	Natalia

Table 7-3. Other entities with flood-related authority in the SAFPR

Alamo Area Council of Governments	Cibolo Creek Municipal Authority MUD	Port O'Connor MUD
Golden Crescent Regional planning commission	San Antonio MUD 1	Aransas County MUD 1
Coastal Bend Council of Governments	Flying L PUD	Lone Oak Farm MUD
San Antonio River Authority	Guadalupe County MUD 3	Comal County WID 3
Guadalupe-Blanco River Authority	Johnson Ranch MUD	Meyer Ranch MUD
Upper Guadalupe River Authority	Kendall County MUD 1	Rebecca Creek MUD
Nueces River Authority	J-O Ranch MUD	Port O'Connor MUD
Calhoun County MUD 1	Quail Creek MUD	Refugio County WCID #1
Bexar-Medina-Atascosa Counties WCID 1	Bandera County River Authority	

Various stakeholders can play a role in flood preparation and response, including. agriculture, cities, counties, councils of government, districts (e.g., MUDs, FWSDs, etc.), and state and federal agencies. Following are the various contributing entities and partners with a description of their role related to flooding. These include entities listed above, as well as other types of entities not previously mentioned.

Ag Extension agents are employed by land-grant universities and serve the citizens of Texas as experts or teachers on the topic of agriculture. Every county in Texas has an Ag Extension office. Ag Extension agents can provide valuable information about preparing for and recovering from flood events specific to agricultural entities. The SAFPR contains a significant amount of agricultural land, particularly in Wilson, Bexar, Guadalupe, and Medina Counties. This type of land use has a substantial footprint, making working closely with ag extension agents crucial to prevent losses.

Cities and **municipalities** generally take responsibility for parks and recreation services, police and fire departments, housing services, emergency medical services, municipal courts, transportation services (including public transportation), and public works (streets, sewers, snow removal, signage, and so forth), in addition to serving frequently as flood plain managers. There are 49 municipalities within the SAFPR.

The major responsibilities of the 12 SAFPR **county governments** include providing public safety and justice, holding elections at every level of government, maintaining Texans' most important records; building and maintaining roads, bridges, and in some cases, county airports; providing emergency management services; providing health and safety services; collecting property taxes for the county and sometimes for other taxing entities; issuing vehicle registration and transfers; and registering voters. Counties have substantial unincorporated land under their jurisdiction that is outside the land use regulations of local cities. Many counties have floodplain management authority.

The three SAFPR **COGs** are voluntary associations that represent member local governments, mainly cities and counties, that seek to provide cooperative planning, coordination, and technical assistance on cross-jurisdictional issues of mutual concern. COGs can serve as regional resources for flood data, flood planning, and flood management.

The mission of the **TWDB** is to lead the state's efforts in ensuring a secure water future for Texas and its citizens. The TWDB provides water and flood planning, data collection and dissemination, financial assistance, and technical assistance services to the citizens of Texas.

A **flood control district** is a special purpose district created by the Texas Legislature and governed by County Commissioners Courts. It is a government agency established to provide control of rivers, streams, their tributaries, and related structures within a certain boundary, to reduce the effects of flooding. There are multiple flood control districts within the SAFPR.

Dams and levees are owned and operated by individuals, private and public organizations, and the government. The responsibility for maintaining a safe dam rests with the owner. A dam failure resulting in an uncontrolled release of water can have a devastating effect on persons and property downstream. To ensure the safety of the people and infrastructure downstream from a dam, the owners must create an Emergency Action Plan (EAP) and submitted it for approval to TCEQ. In the SAFPR there are about 269 dams and an estimated 1,865,900 acres at potential risk from potential inundation of at least 1 foot in depth.[2] Dam owners should play a critical role in the flood planning process to ensure collaborative and cohesive flood planning.

The **National Weather Service's (NWS)** mission is to provide weather, water and climate data, forecasts, warnings, and impact-based decision support services for the protection of life and property and enhancement of the national economy. NWS provides flash flood indicators through watches, warnings, and emergency notices.

Flash Flood WATCH is issued when conditions look favorable for flash flooding. A watch usually encompasses several counties. This is the time the public should start thinking about their plan of action and where they would go if water begins to rise.

Flash Flood WARNING is issued when dangerous flash flooding is happening or will happen soon. A warning usually focuses on a smaller, more specific area. A warning can be issued due to excessive heavy rain or a dam/levee failure. This is when the public must act quickly as flash floods are an imminent threat to them and their family. They may only have seconds to move to higher ground.

Flash Flood EMERGENCY is issued for the exceedingly rare situations when extremely heavy rain is leading to a severe threat to human life and catastrophic damage from a flash flood is happening or will happen soon. Typically, emergency officials are reporting life threatening water rises resulting in water rescues/evacuations.

Daily river forecasts are issued by **River Forecast Centers (RFCs)** of the NWS using hydrologic models based on rainfall, soil characteristics, precipitation forecasts, and

[2] Alamo Area Council of Governments. Regional Mitigation Action Plan Update. April 23, 2012.

several other variables. Some RFCs, especially those in mountainous regions, also provide seasonal snowpack and peak flow forecasts. A wide variety of users rely on these forecasts, including those in agriculture, hydroelectric dam operation, and water supply resources. The forecasts can provide essential information on the river levels and conditions.

The **National Oceanic and Atmospheric Administration (NOAA)** is a scientific and regulatory agency within the U.S. Department of Commerce that forecasts weather, monitors oceanic and atmospheric conditions, charts the seas, conducts deep sea exploration, and manages fishing and protection of marine mammals and endangered species in the U.S. exclusive economic zone. NOAA provides historical data that can help communities determine their future probability of flood events and is key in the planning and mitigation process. The NWS is an agency within NOAA.

River authorities or districts in Texas are public agencies established by the state legislature and given authority to develop and manage the waters of the state. SAFPR has four river authorities within its region that each have the power to conserve, store, control, preserve, use, and distribute the waters of a designated geographic region for the benefit of the public.

After multiple flooding events in the late 1990s and early 2000s that resulted in $1 billion in damage, government leaders united to come up with improved flood control, stormwater management and water quality strategies for the region. The **Bexar Regional Watershed Management (BRWN) partnership** was formed between Bexar County Commissioners, San Antonio City Council, and the San Antonio River Authority. BRWN works to prevent the impact that heavy rain and flooding has on Bexar County by coordinating planning and capital improvement programs. Technology is used to aid in analyzing flood and stormwater data to enhance flood warning, water quality, land use planning. This collaboration makes it easier to apply for grants as a region.

The **Texas Division of Emergency Management (TDEM)**, a division of the Texas Department of Public Safety (DPS), is charged with coordinating state and local responses to natural disasters and other emergencies in Texas. TDEM is intended to ensure the state and its local governments respond to and recover from emergencies and disasters and implement plans and programs to help prevent or lessen the impact of emergencies and disasters. There are six TDEM regions in Texas, and in those regions, there are assistant chiefs and district coordinators who serve as TDEM's field response personnel stationed throughout the state (Figure 71). They have a dual role as they carry out emergency preparedness activities and coordinate emergency response operations. In their preparedness role, they assist local officials in carrying out emergency planning, training, and exercises, and developing emergency teams and facilities. They also teach a wide variety of emergency management training courses. In their response role, they deploy to incident sites to assess damages, identify urgent needs, advise local officials regarding state assistance, and coordinate deployment of state emergency resources to assist local emergency responders. The SAFPR falls within **TDEM Region 6**.

The **Texas Department of Transportation (TxDOT)** generally is associated with the construction and maintenance of the state's immense state highway system; however, the agency is also responsible for overseeing aviation, rail, and public transportation

systems in the state. TxDOT can provide real-time road closure and low water crossing information in the response and recovery phases of a flood event. Users can access these data through TxDOT's Drive Texas website: https://drivetexas.org.

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

The **General Land Office (GLO)** is the oldest state agency in Texas. The GLO manages state lands, operates the Alamo, helps Texans recovering from natural disasters, helps fund Texas public education through the Permanent School Fund, provides benefits to Texas Veterans, and manages the vast Texas coast. (GLO), through the Community Development and Revitalization division aids communities in rebuilding, restoring critical infrastructure, and mitigating future damage through resilient community planning. The GLO administers both Community Development Block Grant Disaster Recovery (CDBG-DR) and Mitigation (CDBG-MIT) funds from the U.S. Department of Housing and Urban Development (HUD) on behalf of the state of Texas.

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

The **U.S. Army Corps of Engineers (USACE)** is an important part of the nation's military. The agency is responsible for a wide range of efforts in the United States including addressing safety issues related to waterways, dams, and canals but also environmental protection, emergency relief, and hydroelectric power. USACE is composed of several divisions with the SAFPR located in the Southwest Division and in the Galveston and the Fort Worth Districts.

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

USACE responds to disasters each year by deploying hundreds of trained personnel and providing resources nationwide. USACE works under the direction of FEMA as a member of the federal team to support State and local governments in responding to major disasters.

The **Federal Emergency Management Agency (FEMA)** is an agency of the U.S. Department of Homeland Security (DHS). While on-the-ground support of disaster recovery efforts is a major part of FEMA's charter, the agency provides state and local governments with experts in specialized fields and funding for rebuilding efforts and relief funds for infrastructure by directing individuals to access low-interest loans in conjunction with the Small Business Administration. FEMA also manages technical efforts for flood plain mapping for communities in the FNIP. In addition to this, FEMA provides funds for training of response personnel throughout the United States and its territories as part of the agency's preparedness effort.

7.1.4 Emergency Information

Flood Warning Systems

There are various means by which data can be collected and disseminated in a flood event. These include gauges to measure the current flood risk and communication systems to alert the public.

Two types of gauges used are rain gages and stream gages. A rain gauge is a meteorological instrument to measure rainfall in a given amount of time. It collects water falling on it and records the change over time in the rainfall depth. Stream gauging is a technique used to measure the discharge, or the volume of water moving through a channel per unit time, of a stream. The height of water in the stream channel, known as a stage or gauge height, can be used to determine the discharge in a stream. Within the SAFPR, there are 56 U.S. Geological Survey (USGS) stream gages that are jointly funded under a cooperative program between the USGS and local cooperators such as river authorities, cities, and the TWDB.

Rain and stream gages are useful for a variety of flood warning systems that cities, counties and region employ to keep citizens informed. San Antonio River Authority's program FloodWorks is a real time operations software that takes in a weather radar system known as NexRAD, and gauge rainfall, estimates flows, runs InfoWorks collection systems (CS), storm drainage (SD), and river systems (RS) models, maps the maximum flood inundation, and produces short-term stream forecasts at 142 locations around the region. The recently expanded warning system now includes all of Bexar county. InfoWorks RS dynamic hydraulic models have been streamlined for 182 miles of channels to reliably produce alerts and flood inundation maps every 15 minutes. Critical information about depth, flow velocity and whether creeks are continuing to rise or have peaked is transmitted to the City's Swift Water Rescue Teams while on the way to a rescue so they can enhance their situational planning.[3]

The San Antonio River Authority performs flood risk studies and uses the results to map flood risk and provide this information to property owners and local governments for planning mitigation action through watershed master planning, and to improve their flood warning systems. As part of their flood warning, the city also developed a public

[3] Beitel et al. SARA's Bexar County Flood Warning System. May 14, 2015. World Environmental and Water Resources Congress 2015. Austin. https://doi.org/10.1061/9780784479162.152

education and flood preparedness program called San Antonio Flood Emergency or SAFE. The goals of this program are; educate the public on flood awareness, preparedness and safety, develop multi-media approach to public education training, and work with first responders, the national weather service, school districts, businesses, media, neighborhood and apartment organizations to reach a wide range of individuals.

In collaboration with the USGS, Bandera County River Authority and Ground Water District (BCRAGD) developed a tool set in 2018 that provides a flood warning system for Bandera County. The tool consists of streamflow-gage monitoring network, a Hydrologic Engineering Center River Analysis System (HEC-RAS) that creates a well calibrated hydraulic model of the Medina River. It has the ability to generate flood inundation maps in the USGS FIMI website and a Decision Support System (DSS). The hydraulic model of Medina River at and near Bandera was created using high resolution digital elevation data, aerial photographs, field surveys on structure and channel cross sections, and the stage-discharge rating curve that was established at the Bandera Station. This information was used to develop 29 flood-inundation maps showing potential inundation areas and depths for stages ranging from 10-38 feet.[4] The river is continuously measured at all gages every 15 minutes and transmitted every hour to a satellite. This information is publicly accessible through the USGS Flood Inundation Mapping (FIM) Program.

Across the region, several jurisdictions have shown an interest in installing more flood warning and readiness systems (gauges, gates, low water crossing barriers, etc.) that provide localized data. The SAFPR is a site where Hill Country rocky terrain and Gulf Coastal Plan converge. These topographic changes cause intense, localized floods. The current system of rain and stream gages is not able to convey data on a granular level to better inform downstream entities so they can act accordingly to protect the loss of life.

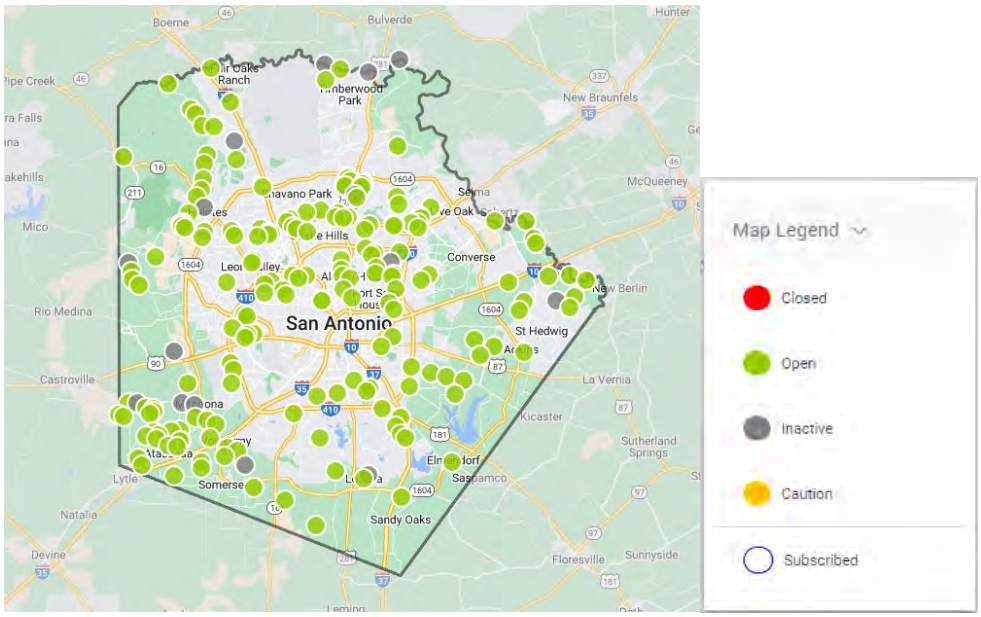
Alert Systems

In addition to the National Weather Service, local news stations or radio stations are vital components in relaying real time information to residents of inclement weather and flooding. They can also alert residents to low water crossing closings, dam or levee breaches, and other potential dangers. They can also issue flood watches, warnings, and emergency notifications. Various entities in the SAFPR maintain websites to provide the public with real time information about flooded streets and places to avoid.

Bexar County has implemented a new system known as High Water Alert Life Saving Technology (HALT) to warn drivers about too much water over the road, creating unsafe conditions. A sensor detects rising water depth, initiating flashing lights or a combination of gates and lights once a certain depth is reached. The county has installed more than 150 HALT systems in the community, monitoring road conditions 24 hours a day, 7 days a week. In addition to lights and gates, the county has set up an interactive website (BEXARflood.org) with information and a map displaying the status of all the County's low water crossings at any given time. Each dot on the map indicates a location of a

[4] Engel F., Namjeong C. Flood warning toolset for the Medina River in Bandera County, Texas. 2019. USGS Numbered Series 2019-3043. 10.3133/fs20193043

Bexar County HALT sensor. The sensors detect rising water and send real time information to this website: green means the road safe, yellow means the water is rising and red means the road is closed.



Image, Source: BEXARflood.org

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

A reverse 911 system allows an agency to pull up a map on a computer, define an area and send off a recorded phone message to each business or residence in that area. It can provide data to residents of flood dangers in their area. AlertSA is a program that residents can sign up for to receive alerts about disasters to their home phone, business and/or cell phone. The system is also ADA compliant with options for those that are Deaf and/or Blind to receive alerts tailored to their needs. Bexar, Comal and Guadalupe counties are all included in the geographical scope. Many counties in the SAFPR have county organized alert systems that residents can sign up for on county websites.

School emergency alert systems allow schools to communicate quickly with staff, students, first responders, and others so that they can take appropriate action in the event of an emergency. Various versions of this tool are used in schools throughout the region from daycares to K-12 grade, as well as universities.

Local Emergency Operations

The four phases of emergency management, mitigation, preparedness, response and recovery are used as guides for action. Community outreach, proper training of staff, crafting agreements with other municipalities and acquiring proper equipment are completed during the mitigation and preparedness phase. Response activities include

warning, emergency medical services, law enforcement operations, evacuation, shelter and mass care, emergency public information, and search and rescue. Short term recovery focuses on restoring vital services and addressing public needs. Long-term recovery comprises of applying for funds to upgrade and/or fixed damage infrastructure and homes, debris removal, restoration of utilities, mental health services and supporting businesses that were affected.

The City of San Antonio outlines emergency operations in their recently updated Basic Plan.[5] The city's emergency management program is comprehensive and integrated with resources from government, organized volunteer groups and businesses. COSA employs the Incident Command System to manage emergencies. The major organizational activities include managing the incident, operations, planning, logistics and finance/administration. During major emergencies and disasters, the Emergency Operations Center is activated along with the Incident Command System and responsibilities of informing the public, controlling the scene of the event, making informed decisions about whether to evacuate the public or shelter in-place, implementing traffic controls and requesting assistance if local capacity is overwhelmed, are delegated to various staff. Leadership includes the Mayor, City manager, and Emergency Management Coordinator, which is usually a Judge or Emergency Manager. These individuals are endowed with the authority to provide guidance and direction for the COSA emergency management programs. A county Judge or Mayor has the authority to order evacuation of population from a threatened area. Cities are required to request assistance from the county before requesting assistance from the state. The Disaster District Committee Chairperson located at the Dept of Public Safety District Office in San Antonio makes the request. If a Presidential declaration is made, federal agencies such as FEMA may be employed to the scene.

Bexar County uses a very similar plan structure as COSA. The county employs the six components of NIMS, a standardized framework that guides the county in all phases of emergency management. This includes effectively integrating resources from different agencies into a temporary emergency organization at an incident site referred to as the Incidence Command System. Just as with COSA, the county will activate the Emergency Operations Center for major emergencies and disasters. Division of responsibilities is established and delegated. The site[s] of the emergency or disaster is assessed and managed, warnings are put out to the surrounding residents, the decision of whether or not to order an evacuation is decided and traffic control is arranged. If local capacity is overwhelmed, request for state aid is made by either the County Judge or Mayor of the cities, to the Disaster District 17 committee (DDC) chairperson, located in the City of San Antonio.

[5] City of San Antonio. Basic Plan. Updated September 7, 2021. BasicPlan.pdf (saoemprepare.com)

Hurricane tracking and Evacuation

NOAA Hurricane Center (NHC) is a component of the National Centers for Environmental prediction located at Florida International University. The NHC issues watches, warnings forecasts and analyses of hazardous tropical weather. The NHC is composed of several units with the goal of understanding tropical storms so they can better inform governments and residents of risk. The San Antonio River Basin has multiple counties within the coastal zone that are at risk of damaging effects from a tropical storm, strong winds and storm surge. Few hurricanes have reached as far inland as Bexar County to cause devastating flooding conditions for residents.

Evacuation routes designated to provide the safest and most timely evacuation of the coastal areas are established by Texas Department of Transportation. During an evacuation, two options may be utilized to help speed up the process, contraflow and evaculanes. Contraflow reverses some or all inbound lanes into outbound lanes on a designated roadway. Evaculanes allows drives to use the should of the road as a transportation lane. Maps of evacuation routes are available on the TXDOT website as well as city and county websites. The northern region of the river basin is typically the location where hurricane refuges go to escape an incoming tropical storm.

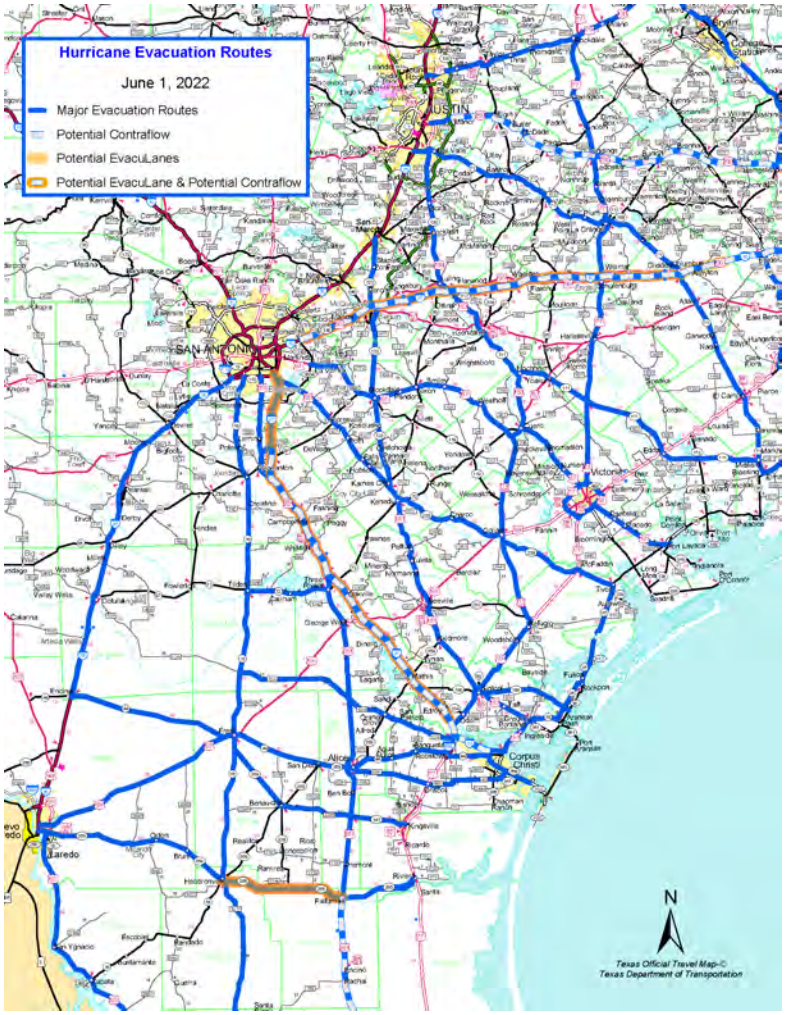


Image Source: Texas Department of Transportation. corpus.pdf (txdot.gov)

7.1.5 Plans to be Considered

State and Regional Plans

The State Hazard Mitigation Plan is an assessment developed by the Texas Department of Emergency Management[6]. It is an effective instrument to reduce losses by reducing the impact of disasters upon people and property. Although mitigation efforts cannot completely eliminate impacts of disastrous events, the plan endeavors to reduce the impacts of hazardous events to the greatest extent possible. The plan evaluates, profiles and ranks natural and human-caused hazards affecting Texas as determined by frequency of event, economic impact, deaths, and injuries. The plan assesses hazard risk, reviews current state and local hazard mitigation and climate adaption capabilities and develops strategies and identifies state agency (and other entities) potential actions to address needs.

The Regional Emergency Preparedness Program[7] is one of the largest and most effective programs of its kind nationwide. Bringing together urban, suburban, and rural jurisdictions, the program utilizes the guidance of the Homeland Security Exercise and Evaluation Program to facilitate information sharing, training collaboration, and cooperation between jurisdictions in a politically neutral and supportive environment. The Regional Preparedness Program accomplishes this through networking, standardizing policy and procedures, and coordinating efforts with stakeholders. Increased participation in the Regional Emergency Preparedness Program is beneficial for the safety of the region.

Local Plans

To examine the state of its flood preparedness, the San Antonio RFPG obtained emergency management plans, hazard mitigation plans, and other regional and local flood planning studies from county and local jurisdictions.

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

The SAFPR has several plans and regulations in place that provide the framework that describes a community's capabilities in implementing mitigation and preparedness actions. These include HMAPs, emergency action plans (EAP), emergency management plans (EMP), floodplain management plans, and watershed master plans. Table 7-4 summarizes existing HMAPs and EMPs adopted in the SAFPR. Figure 7-2 illustrates counties with Flood Hazard Mitigation Plans, and Table 7-5 lists floodplain management plans and drainage master plans developed by communities in the SAFPR.

[6] https://www.tdem.texas.gov/mitigation/hazard-mitigation-section

[7] Regional Emergency Preparedness Program: Member Services (nctcog.org)

Table 7-4. Hazard Mitigation Action and/or Emergency Management Plans adopted in the SAFPR

Jurisdiction	Adoption Date	Status
Aransas County HMAP	2019	Needs Update
Alamo Area COG	2005, updated 2012	Needs Update
Victoria County HMAP	2022	Just Updated
Refugio County HMAP	2021	Just Updated
DeWitt HMAP	2016	Needs Update
Calhoun County HMAP	2020	Just Updated
Karnes County & Wilson County Multi-Jurisdictional HMAP	2020	Just Updated
Guadalupe County	2020	Just Updated
Comal County HMAP	2018	Needs Update 2023
Bexar County EMP	2009	Needs Update
Kendall County HMAP	2017	Needs Update
Kerr County EMP	2015	Needs Update
Medina County HMAP	2020	Just Updated

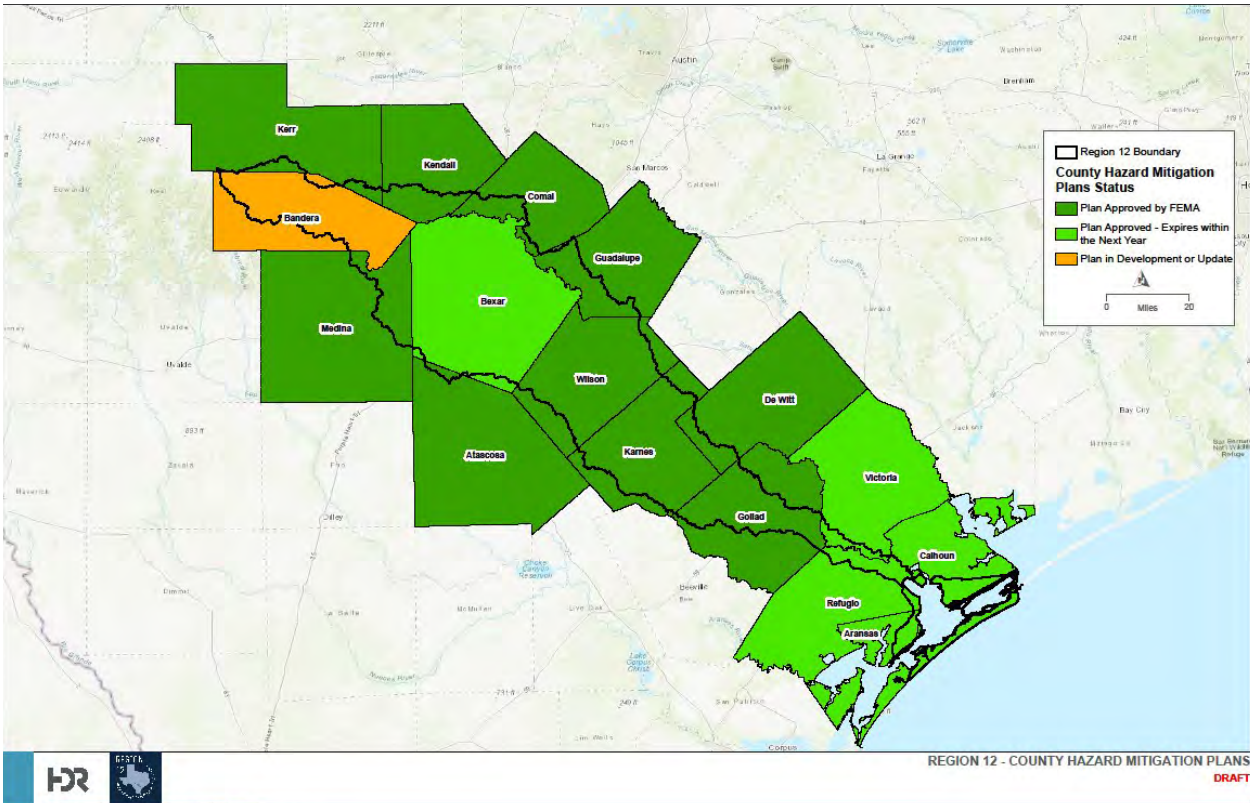


Figure 7-2. County Hazard Mitigation Action Plans in the SAFPR

Table 7-5. Floodplain management and drainage master plans by communities in the SAFPR

Jurisdiction	Plan Type	Year
City of Boerne	Drainage Master Plan	2021
Aransas County	Multi-Jurisdictional Floodplain Management Plan	2017
Bandera County	River Authority and Groundwater District Flood Plan	2019
San Antonio	Local Drainage Master Plan	2016

The San Antonio River Authority has worked with partner agencies to complete Watershed Master Plans since 2009 for watersheds in the San Antonio River Basin. The master plans have two primary objectives:

1. Identify needs and opportunities related to flood risk, water quality issues, low impact development, stream restoration, nature-based park planning, mitigation banking, and conservation easements.
2. Develop and assess proposed projects to address the identified needs and preserve identified opportunities.

Table 7-6. Watershed master plans developed by SARA and participating local entities

Watershed	Status
Upper San Antonio River	Revised November 2013
Leon Creek	Completed January 2011
Salado Creek	Completed December 2011
Medina River	Completed November 2015
Lower San Antonio River	Completed September 2015
Cibolo Creek	Revised July 2018

Hazard mitigation planning reduces loss of life and property by implementing strategies to minimize the impact of disasters. It begins with state, tribal, and local governments identifying natural disaster risks and vulnerabilities that are common in their area. Table 7-7 illustrates how the Alamo Area Council of Governments assessed risk by hazard type in their HMAP. After identifying risks, plans often locate and assess the level of risk that critical infrastructure and social systems have regarding a certain hazard. They develop long-term strategies for protecting people and property from similar events. Having an up-to-date HMAP is key in assessing risk and in developing mitigation actions. Systems are interconnected and it is also important to incorporate hazard mitigation information into other jurisdictional plans such as master and comprehensive plans.

Table 7-7. Qualitative risk assessment terminology used in the Alamo Area Council of Governments HMAP

Definitions of Risk Assessment Impact Terminology for Qualitative Risk Assessment			
Term	**Potential Impact to People (Life Safety/Livelihood)**	**Potential Impact to Buildings/Critical Facilities**	**Potential Impact to Infrastructure**
Low	Some injuries possible but unlikely	Cosmetic damages to structures Loss of Function for less than 1 day	Some roads/bridges temporarily blocked Temporary power loss
Moderate	Injuries expected, some deaths possible	Some structural damages Loss of function for 1-2 days	Road/bridges closures Power and utility loss
High	Several deaths expected	Some structures irreparably damaged Loss of function for 3-5 days	Long-term road/bridge closures Long-term power and utility loss

The purpose of EAPs is to facilitate and organize employer and employee actions during workplace emergencies. They are an essential element in emergency management for critical facilities. In the private sector, an EAP is a document required by Occupational Safety and Health Administration (OSHA) standards.

As part of the Dam Safety Program, owners of significant-hazard and high-hazard dams are required to submit an EAP to the TCEQ Dam Safety Program. Dam EAPs document responsibilities during flood response and identifies the flood inundation area. A high hazard classification indicates that if the dam were to fail, there would be large consequences (such as loss of life), not that the dam is in a condition that is more likely to fail. As shown in Table 7-8 below, there are numerous dams located in the SAFPR that introduce risk for a significant number of properties and critical infrastructure.

Table 7-8. Counties with dams in the SAFPR

Number of Dams by County in the San Antonio FPR			
Atascosa	19	Wilson	14
Bandera	32	Kendall	15
Bexar	58	De Witt	16
Comal	12	Goliad	6
Guadalupe	16	Aransas	0
Karnes	19	Calhoun	8
Kerr	18	Victoria	4
Medina	28	Refugio	4

Watershed master plans encourage all sectors of the community to work together to create a flood hazard resilient community. A watershed master plan addresses existing flooding, erosion, and water quality problems and can be useful in preparing for future challenges. Watershed master plans provide recommendations, help educate the public

and influence decision makers regarding land use changes, investment in capital projects, and modifications to development regulations within a watershed.

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

8

Administrative, Regulatory, and Legislative Recommendations

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8 Administrative, Regulatory and Legislative Recommendations

[31 TAC §361.43]

Part of the San Antonio RFP effort includes proposing changes to administrative practices and existing statutes in order to make floodplain management and flood mitigation planning and implementation throughout the State of Texas more efficient or logical. As set forth in the TWDB rules and guidelines for regional flood planning, the regional flood planning groups (RFPG) may adopt recommendations on policy issues related to floodplain management and flood mitigation planning and implementation. Specifically, the RFPGs may adopt:

- Legislative recommendations considered necessary to facilitate floodplain management and flood mitigation planning and implementation.
- Other regulatory or administrative recommendations considered necessary to facilitate floodplain management and flood mitigation planning and implementation.
- Any other recommendations that the San Antonio RFPG believes are needed and desirable to achieve its regional flood mitigation and floodplain management goals.
- Recommendations regarding potential, new revenue-raising opportunities, including potential new municipal drainage utilities or regional flood authorities, that could fund the development, operation, and maintenance of floodplain management or flood mitigation activities in the region.
- Legislative, regulatory, and administrative recommendations adopted by the San Antonio RFPG are detailed in this chapter.

8.1 Regulatory and Administrative Recommendations

The San Antonio RFPG has also developed recommendations of an administrative or regulatory nature, concerning existing procedures, state entities, or state/regional regulations. Alterations to these procedures could also be proposed to the TWDB for consideration.

Recommendations in Table 8-1 are suggested changes to existing standards, state-controlled entities, or procedures.

Table 8-1. Regulatory and Administrative Recommendations

ID	Recommendation	Rationale for Recommendation
8.1.2	Review and revise as necessary all state infrastructure entities' (i.e., Texas Department of Transportation [TxDOT]) standards and practices for legislative and regulatory compliance with stormwater best practices.	State entities should be aware of the drainage and stormwater standards in the areas where they are active. State entities should be required to comply with local regulations when local regulations are higher than state minimum criteria or entity specific criteria.

ID	Recommendation	Rationale for Recommendation
8.1.3	TxDOT should employ roadway design criteria to require all new and reconstructed state roadways to be designed and constructed, to the extent practicable, at elevations at or above the 1.0% annual chance event water surface elevation. TxDOT should also consider future conditions, such as urbanization and changing rainfall, in its roadway design criteria for drainage and flood risk reduction.	TxDOT is not a participant in the NFIP and does not, in all cases, design roadways in a manner consistent with minimum NFIP requirements. It is recognized that, by their nature, it is often not feasible or practicable to design and construct roadways to provide a level of flood protection equivalent to or greater than the 1% annual chance storm (100-year) event. However, concerning policy and practice, TxDOT should strive to meet this standard.
8.1.4	Develop resources for and educate local and regional officials regarding the respective entities' ability/authorization to establish and enforce higher development standards.	Local and regional officials are often unaware of their authority to establish and enforce stormwater regulations (Texas Local Government Code Title 7, Subtitle B; Texas Water Code Chapter 16, Section 16.315). Flooding and drainage components of local and regional officials' training is often inadequate for their level of responsibility.
8.1.5	Provide measures to allow and encourage jurisdictions to work together towards regional flood mitigation solutions.	Flooding does not recognize jurisdictional boundaries. Allowing and encouraging entities to work together towards common flood mitigation goals would be beneficial to all involved. This should also include state agencies.
8.1.6	Develop a publicly available, statewide database and tracking system to document flood-related fatalities and injuries.	In order to more accurately address the health, safety, and welfare of the public, high flood-risk areas should be tracked and reported. Doing so would increase awareness of the area, both so the public could be aware of the risks, and elected officials and decision-makers could institute solutions to reduce the risk in those areas.
8.1.7	Revise the scoring criteria for funding associated with stormwater and flood-related projects that benefit agricultural activities.	The traditional benefit-cost analysis tools prevent agricultural projects from competing with municipal benefit-cost ratios.
8.1.8	Provide financial or technical assistance to smaller/rural jurisdictions.	The former Office of Rural Affairs/Texas Department of Rural Affairs was intended to assist and work with rural entities. However, the department was disbanded. Actions such as maintaining a department specifically for smaller/rural entities, incentivizing consultants to pursue work for smaller or rural entities or adjusting benefit-cost ratios to rank small/rural entities equally are all ideas towards accomplishing this goal.
8.1.9	Address the concern of "takings" with regards to floodplain development regulations, comprehensive plans, land use regulations and zoning ordinances.	Jurisdictions should be allowed to regulate development in a responsible manner that reduces future flood risk exposure without the fear of legal action by property owners. Develop documentation that states the landowner has been made aware of current flood risk on a property.
8.1.10	Develop a process for SAFPR goal tracking.	A process is needed to document the progress of the short/long term region goals. This process could be similar to the MS4 program and include interim milestones to track progress.

ID	Recommendation	Rationale for Recommendation
8.1.11	Encourage dedicated funding provided to TxDOT for upgrading critical Low-water crossings on TxDOT facilities that are identified as critical in the regional flood plan.	Low-water crossing can be expensive and complicated projects. A dedicated funding source for TxDOT to upgrade critical crossings, provides a mechanism for rural counties and/or small cities to implement these projects without having to apply for a grant and add staff or hire consultants.
8.1.12	Provide financial assistance to increase the amount of stream gauges and flood warning systems in the region.	An increase in stream gauges and flood warning systems throughout the region will reduce flood risk.
8.1.13	Task a state agency with developing a regionally coordinated warning and emergency response program.	Timely warning flood threats and impending danger will aid in the reduction of additional flood risk and flood related deaths. River authorities could serve as the state level agency to implement these efforts.
8.1.14	Encourage each entity to adopt a dedicated funding mechanism for floodplain management purposes.	A dedicated funding mechanism will allow entities to study, plan for and construction flood mitigation programs and projects.

8.2 Legislative Recommendations

The San Antonio RFPG, sponsors, and technical consultants have interacted with a wide variety of entities during the flood planning efforts. There are trends and occurrences throughout a large portion of the state. Some of these trends and occurrences are positive and should be encouraged while others may be detrimental to the floodplain and stormwater management of the entities within the region, and/or state. During the flood planning process, the San Antonio RFPG, technical consultants, entities and members of the public have provided input on the function and usefulness of existing legislature related to floodplain and stormwater management.

Table 8-2 presents recommendations related to flood planning, flood risk mitigation, and funding adopted by the San Antonio RFPG that will require legislative action.

Table 8-2. Legislative Recommendations

ID	Recommendation	Rationale for Recommendation
8.2.1	Direct state funding to counties to maintain drainage and stormwater infrastructure in unincorporated areas.	Counties have floodplain and drainage related responsibilities in Texas without a consistent way to fund projects.
8.2.2	Develop state-wide strategies to aid in acquiring federal funds.	Projects for entities in Texas do not compete well for some federal funding programs. For example, FEMA's Building Resilient Infrastructure and Communities (BRIC) Grant program provides entities with additional points when there are statewide building codes.
8.2.3	Provide funding and/or technical assistance to develop regulatory floodplain maps.	Several entities who have outdated maps or no mapping at all are not able to fund the projects necessary to update or create accurate depictions of flood risk.

ID	Recommendation	Rationale for Recommendation
8.2.4	Provide funding and/or technical assistance to update drainage criteria and development standards.	Up-to-date drainage criteria and development standards at the county level improve resiliency and prevent additional flood risk. However, many entities do not have the funding to update criteria and standards.
8.2.5	Provide funding and/or technical assistance to update or perform flood planning and/or master drainage planning studies.	Many communities and entities do not have up-to-date studies or plans that are reflective of growth or updated rainfall data.
8.2.6	Expand eligibility for and use of funding for stormwater and flood mitigation solutions (local, state, federal, public/private partnerships, etc.)	Flood mitigation studies/projects do not generate revenue, which makes them more challenging to fund at the local level. Funding sources could utilize different financial/economic benefit metrics for projects that do not generate revenue.
8.2.7	Provide additional grant funding to enable the continued function of regional flood planning groups during the time between planning cycles.	In the time between planning cycles, not only could the San Antonio RFPG continue adding FMEs, FMSs, and FMPs to the regional flood plan, but they could also implement San Antonio RFPG-sponsored flood management activities and outreach, and stay informed on regional flood-related events.
8.2.8	Extend Local Government Code, Title 13, Subtitle A, Chapter 552 to allow counties the opportunity to establish and collect drainage utilities/fees in unincorporated areas.	Counties have floodplain- and drainage-related responsibilities in Texas but do not have the ability to establish and collect stormwater utility fees. This limits their ability to fund stormwater or drainage projects, despite having the responsibility to do so.
8.2.9	Grant counties additional authority to plan land use to steer development away from unincorporated flood prone areas.	Guiding development away from flood prone unincorporated areas by counties will aid in prevention of additional flood risk and reduce future costs to state, county, and local governments.
8.2.10	Establish and fund a state program to assist counties and cities with the assessment and prioritization of low-water crossings. Funding should also be provided on a cost-sharing basis for implementation of structural and/or non-structural flood risk reduction measures at high-risk low-water crossings.	Many low-water crossings experience frequent flooding but may have relatively minor flood risk in terms of public safety and/or the integrity of the roadway. Others, however, are at high-risk and experience flood depths and velocities that do pose a significant risk. The cost to mitigate flood risk at high-risk low-water crossings with structural solutions (e.g., bridges) is typically cost-prohibitive. Flood risk at low-water crossings should be systematically and fully evaluated to prioritize those crossings in need of mitigation, either through structural measures or non-structural (e.g., closures, reverse 911 notifications, etc.) measures.
8.2.11	Develop statewide minimum standards for stormwater management practices.	Stormwater management practices can vary greatly across the state. Statewide minimum standards will aid in the prevention of additional flood risk.

8.3 Flood Planning Recommendations

The San Antonio RFPG has identified several improvements to streamline the planning process and make it more effective. Recommendations in Table 8-3 should be considered to improve the regional flood planning process for future planning cycles.

Table 8-3. Regional Flood Planning Process Recommendations

ID	Recommendation	Rationale for Recommendation
8.3.1	Update the scope of work, guidance documents, rules, checklists, etc., based on the adjustments and lessons learned made to these planning documents during the first cycle of planning.	During the first cycle of regional flood planning, multiple amendments and additions to the TWDB documents and the TWDB's interpretation of its documents occurred. Moving forward, the TWDB documents provided at the onset of each new planning cycle should reflect what is ultimately required of the San Antonio RFPG.
8.3.2	Develop a fact sheet and/or other publicity measures to encourage entities to participate in the SAFPR effort.	Many entities were unaware of the regional and state flood planning efforts despite the San Antonio RFPG's outreach efforts.
8.3.3	Host "lessons learned" discussions with TWDB staff, San Antonio RFPG members, sponsors and technical consultants following the submittal of the final regional plans.	Opening dialogue among these participants to discuss proposed improvements to the regional flood planning process will streamline and improve future regional flood planning efforts.
8.3.4	Develop a process to efficiently amend approved regional flood plans to incorporate additional recommended FMEs, FMSs, and FMPs, and to allow the San Antonio RFPG to advance the recommended FMEs to FMPs.	Amending the San Antonio RFP is anticipated to be an intensive process. Amendments to move FMEs to FMPs and incorporate new flood management solutions should have a quick turn-around time to efficiently include them in the adopted Plan.
8.3.5	Reduce the amount of information required to escalate potentially feasible FMEs to FMPs. Align required information to be similar to what is required for design/construction funding.	Some of the data currently requested for FMPs is more detailed than traditional planning level data. Therefore, certain FMPs had to be submitted as FMEs or FMSs despite having sufficient data to produce a project. The RFPs should focus on meeting the minimum requirement to produce funding, rather than spending time and money more appropriately spent during a project's design phase.
8.3.6	Revise the criteria for the "No Adverse Impact" certification required for FMPs.	The current criteria give thresholds for increases in flow, water surface elevation, and inundation extents. Though useful, the current criteria do not allow for consideration of projects that exceed these thresholds but address the impact during final design or downstream accommodations.
8.3.7	Streamline the data collection requirements, specifically those identified in Task 1. Focus on collecting the data that was most useful to the regional flood plan development.	This first round of regional flood planning revealed that very few local entities collect and maintain data and information prescribed by TWDB for use in the planning process. This is particularly the case with data available in a digital geospatial format. Also, some required data (e.g., drainage infrastructure) is of questionable value in the planning process and is generally unavailable. As noted in the previous recommendation, most problems associated with drainage infrastructure do not present significant flood risk and are best characterized as nuisance flooding.
8.3.8	Provide statewide data and a methodology to determine infrastructure functionality and deficiencies in the next cycle of the flood planning process. Consider the lack of readily available local data when developing the methodology.	Most entities do not have information regarding the functionality and deficiency of their infrastructure. Some fields required by the TWDB-required tables in the San Antonio RFP are based on data that are not available to entities without extensive field work. A statewide database with this information would be useful to all entities.

ID	Recommendation	Rationale for Recommendation
8.3.9	Review and revise the geodatabase submittal attributes and elements.	Normalizing the geodatabase with relationships would allow for cross-referencing of data elements and attributes. More domains for attributes need to be developed.
8.3.10	Use the FEMA Social Vulnerability Index (SVI) when available instead of the Centers for Disease Control and Prevention (CDC) SVI in future planning cycles.	FEMA's SVI is considered to be more relevant to flood resiliency and risk than the CDC's SVI.
8.3.11	Use consistent hydrologic unit code (HUC) reporting requirements throughout the TWDB-required tables.	The RFPG Guidance requires HUC-8 in some tables, HUC-10 in other tables, and HUC-12 in other tables. Some tables require multiple HUCs to be provided. The RFPG recommends that the TWDB require HUC-8 in all TWDB-required tables for consistency and to correspond to FEMA's base level watershed planning granularity.
8.3.12	Improve upon the flood risk identification and exposure process with regards to building footprints and population at risk by including first-floor elevations of structures.	While the building footprints are helpful, without the first-floor elevations of each structure, it is difficult to determine the actual flood risk to each structure. If a structure is sufficiently elevated above the base flood elevation, for example, the footprint still shows the structure in the floodplain and the corresponding population is considered "at risk" even though the structure meets NFIP standards, This likely overestimates the population at risk.
8.3.13	Clarify the distinction between flood mitigation and flood infrastructure and what is more commonly considered drainage infrastructure.	Many local entities, for example, municipal utility districts, have drainage responsibilities, particularly with respect to the development of land within their jurisdictions and the maintenance of drainage infrastructure, such as storm drain systems. These entities may or may not also develop what might be considered flood risk reduction infrastructure. Also, most local drainage problems and deficiencies in local drainage infrastructure are very localized and sometimes cause what can be characterized as "nuisance" flooding rather than posing significant risk and exposure to people and property. In future planning cycles, it would be helpful to delineate this distinction as best as possible. For example, the TWDB guidance regarding flood exposure and vulnerability could be refined to better emphasize identifying and mitigating significant risks to public safety, property, and public infrastructure.
8.3.14	Develop guidance and a standardized evaluation criteria for the benefits of nature-based solutions.	Including multi-benefit improvements for nature-based solutions criteria for entities in the SAFPR will allow a full life-cycle analysis and holistic cost-benefit comparisons between alternatives.

ID	Recommendation	Rationale for Recommendation
8.3.15	Define the phrase “flood-related authorities or entities,” to clarify what local and regional governmental entities are included, and which are not.	The phrase is used in the TWDB planning documents multiple times and is a central part of Tasks 1 and 10. The TWDB originally provided the San Antonio RFPG with a list of entities that were thought to have flood-related responsibilities. During the outreach efforts, many of those entities communicated they did not have flood responsibilities and did not believe they should be included in the regional flood planning effort. Clarification is requested regarding the intent of this phrase. Note however, that some political subdivisions of the state such as water control and improvement districts or municipal utility districts, do have authority to develop and maintain drainage and other related infrastructure, such as stormwater conveyance systems and detention facilities, but not all exercise that authority.

8.4 Summary of Recommendations

The administrative, regulatory, legislative, and flood planning recommendations have been selected and proposed by the San Antonio RFPG to make floodplain management and flood mitigation planning and implementation throughout Texas more efficient and logical. From a legislative perspective, funding is one of the greatest challenges. Providing more state legislature backed funding will allow entities to minimize additional flood risks and protect life and property. The administrative recommendations have been proposed to aid entities in their floodplain and stormwater management practices. Many communities are hesitant to enact higher standards over the concern that future legislative acts will limit their ability to regulate. For future flood planning, recommendations were made to improve future SAFPR efforts. Clarifying and editing current requirements will improve the overall flood planning process and reduce future costs to taxpayers. These recommendations will aid in fulfilling the SAFPR goals discussed in Chapter 3.

9

Flood Infrastructure Financing Analysis

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1 Flood Infrastructure Financing Analysis

[31 TAC §361.44]

The TWDB requires that each RFPG assess and report on how sponsors propose to finance recommended FMEs, FMSs, and FMPs**. A primary aim of this survey effort is to understand the funding needs of local sponsors and propose what role the state should have in financing the recommended FMEs, FMSs, and FMPs.**

Chapter 9 is an analysis of the funding for flood related issues in the SAFPR. Communities in the region were surveyed to determine the needs, costs, and proposed methods of funding to address current flood related issues. Section 9.1 presents an overview of common sources of funding for flood mitigation, planning, projects, and other flood management efforts. The methodology, results of the financing survey, and comments regarding the state's role in financing are presented in Section 9.2 through Section 9.4.

1.1 Sources of Funding for Flood Management Activities

Communities across the state utilize a variety of funding sources for their flood management efforts, including local, state, and federal sources. This section discusses some of the most common avenues of generating local funding and various state and federal financial assistance programs available to communities. **Table 9-1** summarizes the local, state, and federal sources discussed in this chapter, and characterizes each by the following three key parameters: first, which state and federal agencies are involved, if applicable; second, whether they offer grants, loans, or both; and third, whether they are classified as regularly occurring opportunities or are only available after a disaster.

Table 9-1: Common Sources of Flood Funding in Texas

Source	Federal Agency	State Agency	Program Name	Grant (G)	Loan (L)	Post-Disaster (D)
Federal	FEMA	TWDB	**Flood Mitigation Assistance (FMA)**	G	-	-
	FEMA	TDEM	**Building Resilient Infrastructure and Communities (BRIC)**	G	-	-
	FEMA	TCEQ	**Rehabilitation of High Hazard Potential Dam Grant Program (HHPD)**	G	-	-
	FEMA	*TBD*	**Safeguarding Tomorrow through Ongoing Risk Mitigation (STORM)**	-	L	-
	FEMA	TDEM	**Hazard Mitigation Grant Program (HMGP)**	G	-	D
	FEMA	TDEM	**Public Assistance (PA)**	G	-	D

Source	Federal Agency	State Agency	Program Name	Grant (G)	Loan (L)	Post-Disaster (D)
	HUD	GLO	**Community Development Block Grant – Mitigation (CDBG-MIT)**	G	-	D
	HUD	GLO	**Community Development Block Grant Disaster Recovery Funds (CDBG-DR)**	G	-	D
	HUD	TDA	**Community Development Block Grant (TxCDBG) Program for Rural Texas**	G	-	-
	USACE		**Partnerships with USACE, funded through Continuing Authorities Program (CAP), Water Resources Development Acts (WRDA), or other legislative vehicles***	-	-	-
	EPA	TWDB	**Clean Water State Revolving Fund (CWSRF)**	G**	L	-
State		TWDB	**Flood Infrastructure Fund (FIF)**	G	L	-
		TWDB	**Texas Water Development Fund (Dfund)**	-	L	-
		TSSWCB	**Structural Dam Repair Grant Program**	G	-	-
		TSSWCB	**Operation and Maintenance (O&M) Grant Program**	G	-	-
		TSSWCB	**Flood Control Dam Infrastructure Projects - Supplemental Funding**	G	-	-
Local			**General fund**	-	-	-
			Bonds	-	-	-
			Stormwater or drainage utility fee	-	-	-
			Special-purpose district taxes and fees	-	-	-

*Opportunities to partner with USACE are not considered grant or loan opportunities, but shared participation projects where USACE performs planning work and shares in the cost of construction.
**The CWSRF program offers principal forgiveness, which is similar to grant funding.

A combination of increased local capabilities and increased funding amounts and opportunities from the state and federal government will be required to meet the flood risk study and mitigation needs identified through this planning process. State funding particularly will be needed to provide access to funding for small, rural communities, incentivizing high-priority projects and project types, and improving access to and leveraging federal funding sources.

1.1.1 Local Funding

Overall, larger urban communities typically bear a greater percentage of the burden for funding flood and stormwater-related activities in their jurisdictions than the smaller, more

resource-limited communities who are often unable to generate a significant amount of funding for these activities.

This section primarily focuses on the funding mechanisms available to municipalities and counties, as a large majority of the FME, FMS, and FMP sponsors are these types of entities. Special purpose districts are briefly discussed as there may be opportunities to create more of these types of districts in the region.

A community's general fund revenue (for cities[1] or counties[2]) stems from sales, property, and other taxes and is typically the primary fund used by a government entity to support most departments and services such as police, fire, parks, trash collection, and local government administration. Due to the high demands on the general fund for many local needs, there is often not a significant amount available for funding flood projects.

Many entities may be able to receive funding from the various programs listed in Table 9.1. But each entity and each program must be closely evaluated to determine applicability, available financing, and ability to collect revenue to support debt and infrastructure.

As noted in the Texas Flood Information Clearinghouse information included in the TWDB "Community Official Flood Resource Guide, Volume 1: February 2022", some of the entity types include:

> City, council of government, county, drainage district, groundwater conservation district, hospital district ,irrigation district, levee Improvement district, local government corporation, municipal management district, municipal utility district, navigation district, private entities, regional district, school district, oil conservation district, special law district, state agency, stormwater control district, tribal organizations, water control and improvement district, water improvement district, and non-profit water supply corporation

Dedicated fees such as stormwater or drainage fees are an increasingly popular tool for local flood-related funding, primarily in more urban areas. Municipalities can establish a stormwater utility (sometimes called a drainage utility), which is a legal mechanism used to generate revenue to finance a city's cost to provide and manage stormwater services. To provide these services, municipalities assess fees from users of the stormwater utility system. Impact fees can be collected from developers to cover a portion of the expense to expand storm water systems necessitated by new development.

Another source for local funding to support flood management efforts includes special districts. A special district is a political subdivision established to provide a single public service (such as water supply, drainage, or sanitation) within a specific geographic area. Examples of these special districts include Water Control and Improvement Districts (WCID), Municipal Utility Districts (MUD), Drainage Districts (DD), and Flood Control Districts (FCD). Each of the different types of districts are governed by different state laws, which specify the authorities and process for creation of a district. Districts can be created by various entities, including the Texas Legislature, the TCEQ, county commissioners' courts, and city councils. Depending on the type of district, a district may

[1] https://comptroller.texas.gov/transparency/local/cities.php

[2] https://comptroller.texas.gov/transparency/local/counties.php

have the ability to raise revenue through taxes, fees, or issuing bonds to fund flood and drainage-related improvements within the district's area.

Lastly, municipalities and counties have the option to issue debt[3] through general obligation bonds, revenue bonds, or certificates of obligation[4], which are typically paid back using any of the previously mentioned local revenue raising mechanisms.

The communities in the SAFPR are impacted by flooding issues and have been proactively addressing many of these issues to the best of their funding ability. Flood studies and projects have been typically funded by individual communities as they apply for the available funding through the various state and federal programs (See 9.1.1 below) and through their own financial resources via fees, taxes, and bonds. These efforts are intended to address local flooding issues in a smaller scale typically for smaller communities and in a larger scale typically for larger communities.

For example, smaller communities such as Castroville, La Vernia and Floresville have been diligently funding projects with their own funds and with as much state and federal funding that can be obtained. The City of San Antonio's Proposition B in May of 2022 was passed to apply $169,873,000 in bonds toward flood control and drainage projects. This was preceded in the City's 2017-2022 Bond Program by an investment that was approximately equal to that amount for flood control and drainage projects. In 2007 Bexar County embarked on a 10-year $500M Flood Control Program that constructed over 50 flood mitigation projects to alleviate some of the area's most pressing flood concerns. Wilson and Karnes Counties received a FEMA Hazard Mitigation Multi-Jurisdictional Assistance grant for planning to reduce long-term risk from natural hazards and disasters. Participants included Falls City, Karnes City, Kenedy, Runge, Floresville, La Vernia, Poth, Stockdale, various school districts, SARA, water districts, and local stakeholders. And, as a final example, SARA has provided funding for studies through grants and its own general fund investments for flood issues throughout the San Antonio River Basin, such as the 2019 U.S. Department of Homeland Security's FEMA Cooperative Technical Partnership (CTP) Program Cooperative Agreement grant for $1,365,400 for flood prevention, mitigation, and protection through mapping updates throughout the basin. Also, SARA was cited by the TWDB in its, "Community Official Flood Resource Guide, Volume 1: February 2022", as an example of best practice for flood outreach and education.

These examples show some of the ways that the communities in the SAFPR have proactively and cooperatively pursued solutions to their flooding needs. The basin should be viewed as a leader and be applauded for its efforts. The survey discussed in this chapter shows that much more funding is needed in the basin, and clearly much more will be needed in the future as Texas and the SAFPR grow.

Overall, local governments have various options for raising revenue to support local flood-related efforts; however, each avenue presents its own unique challenges and considerations. It is important to note that municipalities have more authority to establish various revenue raising options in comparison to counties. Of the communities that do

[3] https://www.county.org/TAC/media/TACMedia/Legal/Legal%20Publications%20Documents/2017_Public_Finance_Final.pdf

[4] https://comptroller.texas.gov/economy/fiscal-notes/2017/january/co.php

have access to local funding, the amount available is generally much lower than the total need, leading local communities to seek out state and federal financial assistance programs.

1.1.2 State Funding

Today, communities have a broader range of state funding sources and programs available due to new grant and loan programs that didn't exist as recently as five years ago. It is important to note that state financial assistance programs discussed herein are not directly available to homeowners and the general public. Local governments apply on behalf of their communities to receive and implement funding for flood projects in their jurisdiction.

The TWDB's Flood Infrastructure Fund (FIF)[5] is a new funding program passed by the Texas Legislature and approved by Texas voters through a constitutional amendment in 2019. The program provides financial assistance in the form of low or no interest loans and grants (cost match varies) to eligible political subdivisions for flood control, flood mitigation, and drainage projects. FIF rules allow for a wide range of flood projects, including structural and nonstructural projects, planning studies, and preparedness efforts such as flood early warning systems. After the first State Flood Plan is adopted, only projects included in the most recently adopted state plan will be eligible for funding from the FIF. FMEs, FMSs, and FMPs recommended in this regional flood plan will be included in the overall state flood plan and will thus be eligible for this funding source.

The TWDB also manages the Texas Water Development Fund (Dfund)[6] program, which is a state-funded streamlined loan program that provides financing for several types of infrastructure projects to eligible political subdivisions. This program enables the TWDB to fund projects with multiple eligible components (water supply, wastewater, or flood control) in one loan at low market rates. Financial assistance for flood control may include structural and nonstructural projects, planning efforts, and flood warning systems. The TWDB Clean Water State Revolving Fund (CWSRF)[7] program can also be used to fund flood improvements which may be related to wastewater infrastructure, which is the focus of the program.

The Texas State Soil & Water (TSSWCB)[8] has three state-funded programs specifically for flood control dams: the Operation and Maintenance (O&M) Grant Program; the Flood Control Dam Infrastructure Projects - Supplemental Funding Program; and the Structural Repair Grant Program. The O&M Grant Program is a grant program for local soil and water conservation districts (SWCD) and certain co-sponsors of flood control dams. This program reimburses SWCDs 90 percent of the cost of an eligible operation and maintenance activity as defined by the program rules; the remaining 10 percent must be paid with non-state funding. The Flood Control Dam Infrastructure Projects - Supplemental Funding program was newly created and funded in 2019 by the Texas Legislature. Grants are provided to local sponsors of flood control dams, including

[5] http://www.twdb.texas.gov/financial/programs/FIF/index.asp

[6] http://www.twdb.texas.gov/financial/programs/TWDF/index.asp

[7] https://www.twdb.texas.gov/financial/programs/CWSRF/index.asp

[8] https://www.tsswcb.texas.gov/index.php/programs/flood-control-program

SWCDs, to fund the repair and rehabilitation of the flood control structures, to ensure dams meet safety criteria to adequately protect lives downstream. The Structural Repair Grant Program provides state grant funds to provide 95 percent of the cost of allowable repair activities on dams constructed by the NRCS, including match funding for federal projects through the Dam Rehabilitation Program and the Emergency Watershed Protection (EWP) Program of the Texas section of the NRCS.

1.1.3 Federal Funding

The federal government plays an important, sometimes critical role, particularly in the financing of large-scale flood mitigation projects and studies that would otherwise be beyond the capabilities of the state and local governments. Commonly utilized funding programs administered by seven different federal agencies are discussed in this section. The funding for these programs originates from the federal government but for many of the programs, a state agency partner plays a key role in the management of the program. Each funding program has its own unique eligible applicants, eligible project types, requirements, and application and award timelines. A few examples of eligibility requirements for some of the federal grant programs are: requiring recipients of funding to participate in the National Flood Insurance Program (NFIP), requiring recipients to have an approved Hazard Mitigation Plan, or requiring a project to have a benefit cost ratio of 1.0 or greater. More information regarding each program and their unique eligibility requirements and award processes can be found at the links in this section.

Federal Emergency Management Agency (FEMA)

Common FEMA-administered federal flood-related funding programs include Flood Mitigation Assistance (FMA), Building Resilient Infrastructure and Communities (BRIC), Safeguarding Tomorrow through Ongoing Risk Mitigation (STORM), Rehabilitation of High Hazard Potential Dam (HHPD) Grant Program, Hazard Mitigation Grant Program (HMGP), the Public Assistance (PA) program, and the Cooperating Technical Partners (CTP) Program.

Flood Mitigation Assistance[9] (FMA) is a nationally competitive annual grant program that provides funding to states, local communities, federally recognized tribes, and territories. FMA is administered in Texas by the TWDB[10]. Funds can be used for projects that reduce or eliminate the risk of repetitive flood damage to buildings insured by the NFIP. Funding is typically a 75 percent federal grant with a 25 percent local match. Projects mitigating repetitive loss and severe repetitive loss properties may be funded through a 90 percent federal grant and 100 percent federal grant, respectively. FEMA's FMA program now includes a disaster initiative called Swift Current. The program was released as a pilot initiative in 2022 and explored ways to make flood mitigation assistance more readily available during disaster recovery. Similar to traditional FMA, the program mitigates repetitive losses and substantially damaged buildings insured under the NFIP.

[9] https://www.fema.gov/grants/mitigation/floods

[10] https://www.twdb.texas.gov/flood/grant/fma.asp

The Building Resilient Infrastructure and Communities (BRIC)[11] is a new nationally competitive non-disaster annual grant program implemented in 2020. The program supports states, local communities, tribes, and territories as they undertake hazard mitigation projects, reducing the risks they face from disasters and natural hazards. BRIC is administered in Texas by the TDEM[12]. Funding is typically a 75 percent federal grant with a 25 percent local match. Small, impoverished communities may be funded through grants ranging from 90 percent to 100 percent. Texas communities are at a disadvantage competing for these funds because points are awarded to communities for state-wide building codes which are not adopted in Texas.

Safeguarding Tomorrow through Ongoing Risk Mitigation (STORM)[13] is a new revolving loan program enacted through federal legislation in 2021 to provide needed and sustainable funding for hazard mitigation projects. The program is designed to provide capitalization grants to states to establish revolving loan funds for projects to reduce risks from disaster, natural hazards, and other related environmental harm. At the time of the publication of this plan, the program does not yet appear to be operational and has not yet been implemented in Texas.

FEMA's Rehabilitation of High Hazard Potential Dam (HHPD)[14] Grant Program, administered in Texas by the TCEQ, provides technical, planning, design, and construction assistance in the form of grants for rehabilitation of eligible high hazard potential dams. The cost share requirement is typically no less than 35 percent state or local share.

Under the Hazard Mitigation Grant Program (HMGP)[15], FEMA provides funding to state, local, tribal, and territorial governments so they can rebuild from a recent disaster in a way that reduces, or mitigates, future disaster losses in their communities. The program is administered in Texas by TDEM[16]. Funding is typically a 75 percent federal grant with a 25 percent local match. While the program is associated with Presidential Disaster Declarations, the HMGP is not a disaster relief program for individual disaster victims or a recovery program that funds repairs to public property damaged during a disaster. The key purpose of HMGP is to ensure that the opportunity to take critical mitigation measures to reduce the risk of loss of life and property from future disasters is not lost during the reconstruction process following a disaster.

FEMA's Public Assistance (PA)[17] program provides supplemental grants to state, tribal, territorial, and local governments, and certain types of private non-profits following a declared disaster so communities can quickly respond to and recover from major

[11] https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities

[12] https://www.tdem.texas.gov/bric

[13] https://www.congress.gov/bill/116th-congress/senate-bill/3418/all-info

[14] https://www.fema.gov/emergency-managers/risk-management/dam-safety/rehabilitation-high-hazard-potential-dams

[15] https://www.fema.gov/emergency-managers/risk-management/dam-safety/rehabilitation-high-hazard-potential-dams

[16] https://www.tdem.texas.gov/mitigation

[17] https://www.fema.gov/assistance/public

disasters or emergencies through actions such as debris removal, life-saving emergency protective measures, and restoring public infrastructure. Funding cost share levels are determined for each disaster and are typically not less than 75 percent federal grant (25 percent local match) and typically not more than 90 percent federal grant (10 percent local match). In Texas, FEMA PA is administered by TDEM. In some situations, FEMA may fund mitigation measures as part of the repair of damaged infrastructure. Generally, mitigation measures are eligible if they directly reduce future hazard impacts on damaged infrastructure and are cost-effective. Funding is limited to eligible damaged facilities located within PA-declared counties.

The Cooperating Technical Partners (CTP)[18] program is an effort launched by FEMA in 1999 to increase local involvement in developing and updating FIRMs, FIS reports, and associated geospatial data in support of FEMA's Risk Mapping, Assessment and Planning (Risk MAP) Program. To participate in the program, interested NFIP-participating communities, state or regional agencies, universities, territories, tribes, or nonprofits must complete training and execute a partnership agreement. Working with the FEMA regions, a program participant can develop business plans and apply for grants to perform eligible activities.

Housing and Urban Development (HUD)

HUD administers the following three federal funding programs: Community Development Block Grant – Disaster Recovery (CDBG-DR), Community Development Block Grant – Mitigation (CDBG-MIT), and Community Development Block Grant (TxCDBG) for rural Texas.

Following a major disaster, Congress may appropriate funds to HUD under the Community Development Block Grant – Disaster Recovery (CDBG-DR)[19] program when there are significant unmet needs for long-term recovery. Appropriations for CDBG-DR are frequently very large, and the program provides 100 percent grants in most cases. The CDBG-DR is administered in Texas by the Texas General Land Office (GLO)[20]. The special appropriation provides funds to the most impacted and distressed areas for disaster relief, long term-recovery, restoration of infrastructure, housing, and economic revitalization.

The Community Development Block Grant – Mitigation (CDBG-MIT)[21] is administered in Texas by the GLO. Eligible grantees can use CDBG Mitigation (CDBG-MIT) assistance in areas impacted by recent disasters to carry out strategic and high-impact activities to mitigate disaster risks with typically 100% grants. The primary feature differentiating CDBG-MIT from CDBG-DR is that unlike CDBG-DR which funds recovery from a recent disaster to retore damaged services, systems, and infrastructure, CDBG-MIT funds are intended to support mitigation efforts to rebuild in a way which will lessen the impact of future disasters.

[18] https://www.fema.gov/flood-maps/cooperating-technical-partners

[19] https://www.hudexchange.info/programs/cdbg-dr/

[20] https://recovery.texas.gov/disasters/index.html

[21] https://www.hudexchange.info/programs/cdbg-mit/overview/

The Community Development Block Grant (CDBG)[22] program provides annual grants on a formula basis to small, rural cities and to counties to develop viable communities by providing decent housing and suitable living environments, and expanding economic opportunities principally for persons of low- to moderate-income. Funds can be used for public facilities such as water and wastewater infrastructure, street and drainage improvements, and housing. In Texas, the CDBG program is administered by the Texas Department of Agriculture (TDA)[23].

U.S. Army Corps of Engineers (USACE)

The USACE[24] works with non-Federal partners (states, tribes, counties, or local governments) throughout the country to investigate water resources and related land problems and opportunities and, if warranted, develop civil works projects that would otherwise be beyond the sole capability of the non-Federal partner(s). Partnerships are typically initiated or requested by the local community to their local USACE District office. Before any project or study can begin, USACE determines whether there is an existing authority under which the project could be considered, such as the US Army Corps of Engineers Continuing Authorities Program (CAP)[25], or whether Congress must establish study or project authority and appropriate specific funding for the activity. New study or project authorizations are typically provided through periodic Water Resource Development Acts (WRDA) or via another legislative vehicle. Congress will not provide project authority until a completed study results in a recommendation to Congress of a water resources project, conveyed via a Report of the Chief of Engineers (Chief's Report) or Report of the Director of Civil Works (Director's Report). Opportunities to partner with USACE are not considered grant or loan opportunities, but shared participation projects where USACE performs planning work and shares in the cost of construction. USACE also has technical assistance opportunities, including Floodplain Management Services and the Planning Assistance to States program, available to local communities.

U.S. Environmental Protection Agency (EPA)

The Clean Water State Revolving Fund (CWSRF)[26] provides financial assistance in the form of loans with subsidized interest rates and opportunities for partial principal forgiveness for planning, acquisition, design, and construction of wastewater, reuse, and stormwater mitigation infrastructure projects. Projects can be structural or non-structural. Low Impact Development (LID) projects are also eligible. The CWSRF is administered in Texas by the TWDB.

[22] https://www.hud.gov/program_offices/comm_planning/cdbg

[23] https://texasagriculture.gov/GrantsServices/RuralEconomicDevelopment/RuralCommunityDevelopmentBlockGrant(CDBG)/About.aspx

[24] https://planning.erdc.dren.mil/toolbox/library/IWRServer/2019-R-02.pdf

[25] https://www.swd.usace.army.mil/About/Directorates-Offices/Programs-Directorate/Planning-Division/CAP/

[26] http://www.twdb.texas.gov/financial/programs/CWSRF/index.asp

U.S. Department of Agriculture (USDA)

The USDA's NRCS provides technical and financial assistance to local government agencies through the following programs: Emergency Watershed Protection Program, Watershed Protection and Flood Prevention Program, Watershed Surveys and Planning, and Watershed Rehabilitation. The Emergency Watershed Protection (EWP)[27] program, a federal emergency recovery program, helps local communities recover after a natural disaster by offering technical and financial assistance to relieve imminent threats to life and property caused by floods and other natural disasters that impair a watershed. The Watershed Protection and Flood Prevention Program[28] helps federal, state, local and tribal governments protect and restore watersheds; to prevent erosion, floodwater, and sediment damage; to further the conservation development, use and disposal of water; and to further the conservation and proper use of land in authorized watersheds. The focus of the Watershed Surveys and Planning[29] program is funding watershed plans, river basin surveys and studies, flood hazard analyses, and floodplain management assistance aimed at identifying solutions that use land treatment and nonstructural measures to solve resource problems. Lastly, the Watershed Rehabilitation Program[30] helps project sponsors rehabilitate aging dams that are reaching the end of their design lives. This rehabilitation addresses critical public health and safety concerns. The USDA also offers various Water and Environmental grant and loan funding programs[31], which can be used for water and waste facilities, including stormwater facilities, in rural communities.

Special Appropriations

On occasion and when the need is large enough, Congress may appropriate funds for special circumstances such natural disasters or pandemics such as COVID-19. A few examples of recent special appropriations from the federal government that can be used to fund flood-related activities are discussed in this section.

In 2021, the American Rescue Plan Act (ARPA) provided for a substantial infusion of resources to eligible state, local, territorial, and tribal governments to support their response to and recovery from the COVID-19 pandemic. Coronavirus State and Local Fiscal Recovery Funds (SLFRF), a part of ARPA, delivers $350 billion directly to state, local, and tribal governments across the country. Communities have significant flexibility to meet local needs within the eligible use categories, one of which includes improving stormwater facilities and infrastructure. Eligible entities may request their allocation of Coronavirus State and Local Fiscal Recovery Funds directly from the U.S. Department of Treasury.

Although not a direct appropriation to local governments like ARPA, the 2021 Infrastructure Investment and Jobs Act (IIJA), also called the Bipartisan Infrastructure

[27] https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/ewpp/

[28] https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/wfpo/

[29] https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/wsp/

[30] https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/wr/

[31] https://www.rd.usda.gov/programs-services/water-environmental-programs

Law (BIL), authorizes over $1 trillion for infrastructure spending across the U.S. and provides for a significant infusion of resources over the next several years into existing federal financial assistance programs, including several of the flood funding programs discussed in this Chapter, as well as creating new programs.

1.2 Barriers to Funding

Local communities encounter barriers to accessing or seeking funding for flood management activities, including lack of knowledge of funding sources, lack of expertise and staff time to apply for funding, and limited local funds available for local match requirements. The available funding programs operate independently, each with its own requirements, schedules, and financial offers. This alone constitutes a barrier to funding.

As opposed to some other types of infrastructure, flood projects do not typically generate revenue and many communities do not have steady revenue streams to fund flood projects, as discussed in Section 9.1.1. Consequently, communities struggle to generate funds for local match requirements or loan repayment. Complex or burdensome application or program requirements as well as prolonged timelines also act as barriers to accessing state and federal financial assistance programs. Of those communities able to overcome these barriers, apply for funding, and generate local resources for match requirements, the high demand for state and federal funding, particularly for grant opportunities, means that need outstrips supply, leaving many local communities without the resources they need to address flood risks.

1.3 Flood Infrastructure Financing Survey

The San Antonio RFPG surveyed sponsors of the recommended FMEs, FMSs, and FMPs that have capital costs in the form of a mailed survey or other means of collecting the required information. The primary aim of this survey effort was to understand the funding needs of local sponsors and then propose what role the state should have in financing the recommended FMEs, FMSs, and FMPs**.** For the SAFPR, a first round of targeted outreach via in person meetings, phone calls and emails to sponsors was used to gather preliminary information on funding needs for recommended FMEs, FMSs, and FMPs. If the entity did not meet to discuss the project, a survey was sent to gather information.

To gather specific results related to financing, follow-up calls were made to sponsors to ask specifically:

- How much funding is needed for the listed FMEs, FMSs, and FMPs?
- How much of this funding by percentage will be sought as grant and how much will be sought as a loan?
- Have you ever received a designation from a state or local funding program that recognized some or all of your community as having fewer financial resources (such as “low to mod” from the CDBG program or “Disadvantaged” from the TWDB)?
- How will the loan portion of any proposed funding package be supported (fees, and/or taxes)?

In general, Sponsors that were smaller and/or considered to have fewer financial resources were noted as needing a 75 percent or greater grant. Conversely, sponsors that were larger and/or considered to have more financial resources were noted as needing a 50 percent or smaller grant.

1.4 Summary of Survey Results and Funding Needs

A total of XXX sponsors of recommended FMEs, FMSs, and FMPs with capital costs were identified and contacted, and XXX responded. This represents a response rate of X percent. **Appendix 9.1** presents the results of the survey for each FME, FMS, and FMP in TWDB-required Table 19. At total of XXX percent of the sponsors that responded were individually contacted and polled as part of the survey for the financial analysis.

Overall, a total of $ XXX is needed to implement the recommended FMEs, FMSs, and FMPs in the 2023 San Antonio RFP. From the total cost, it is projected that $ XXX in state and federal grant funding is needed. It is also projected that $XXX will be needed in loans.

The basic three sources of funding included federal and state grants, federal and state loans with favorable loan terms, and local financing through private sources of funds and bond issues. As noted in Section 9.1.1, smaller communities are often resource-limited and unable to generate funding for flood-related projects and activities. Discussions with stakeholders during outreach efforts, confirmed that many communities, particularly smaller and more rural communities, do not have local funding available for flood management activities and larger communities that did report having local funding indicated relatively little local funding available in relation to overall need.

Since most federal funding programs are dependent upon availability or upon project selection in a nationally competitive grant program, it is difficult to estimate how much federal funding may be available to implement these studies, strategies, and projects. It is conservatively estimated that as much as the full amount may be needed from state sources. This number does not represent the amount of funding needed to mitigate all risks in the region and solve flooding problems in their totality. This number simply represents the funding needs for the specific, identified studies, strategies, and projects in this cycle of regional flood planning. Future cycles of regional flood planning will continue to identify more projects and studies needed to further flood mitigation efforts in the San Antonio River Basin.

1.5 Proposed Role for the State in Funding Needs

As noted in Section 9.1.1, the state currently provides some of the existing funding programs that sponsors are using to finance FMEs, FMSs, and FMPs. This is a critical source of funding to communities given the limited local financial resources. The large demand for funding and limited local resources, however, necessitate a critical look at the available federal and state funding programs. What improvements need to be made to the programs? How can an increase in funding be provided? How can grant funding be increased? How can favorable loan terms and conditions be used? What new funding mechanisms should be developed? This paragraph will comment briefly on the potential role of the state as it relates to these questions.

The following state agencies provide funding for flood needs:

- Texas Water Development Board (TWDB)
- Texas Department of Emergency Management (TDEM)
- General Land Office (GLO)
- Texas Department of Agriculture (TDA)
- Texas State Soil and Water Conservation Board (TSSWCB)
- Texas Commission on Environmental Quality (TCEQ)

The sources of funding for these programs are eclectic. The state agencies receive some state money for these programs, but they also receive federal funds from agencies which include FEMA, HUD, EPA, USDA, NRCS, USACE, and federal special appropriations. Each of these state and federal programs come with individual program requirements and specific funding terms, limits, and applicability. In addition, there is a large list of entities which may be able to access funding for flood related purposes. The San Antonio RFPG offers the suggestions regarding funding for flood-related projects. These suggestions are closely related to several of the administrative, regulatory, and legislative recommendations described in Chapter 8.

Suggestion #1:

The State Should Simplify Access to its Funding Programs

Items to consider would be to develop a common application for all state funding programs, consolidate state funding programs, reduce programmatic requirements, and accept studies and reports already performed to meet federal program requirements (particularly applicable to the use of state funding programs that are not solely targeted for flood needs such as CWSRF, Dfund, and TxCDBG, for example).

Suggestion #2

The State Should Increase Grant Funding and Establish Favorable Loan Terms for any Loan Share in its Funding Programs

The survey demonstrated a need for an increase in grant funding. In addition, favorable loan terms can be equated as a means of providing a subsidy to borrowers.

Items to consider related to grants would be to increase the total amount of grant money provided by the state, increase the grant portion that is offered by the state in the funding packages, limit restrictions on the use of grant funding and allow the RFPG to establish criteria for its own basin.

Items to consider related to loans would be to provide principal forgiveness, defer principal and interest in the debt/service schedule, offer longer loan terms, reduce required debt coverage ratios where possible, accept inferior lien positions to enable coordination with other funding programs, offer guaranteed subsidized low interest rates that are not tied to the market.

Suggestion #3

The State Should allow the RFPG to Establish Funding Priorities in its Basin

RFPGs should be allowed to identify priority FMEs, FMSs, and FMPs in its basin. This would enable the implementation of the grassroots, “bottom-up” planning that was established for the statewide flood planning process.

Items to consider would be to allow RFPGs to develop funding studies and projects, guide the development of cooperative agreements in the basin, facilitate basin-wide efforts, equip the region to develop funding packages between the available funding programs, apply for federal funding, and apply funding to special financial needs in the region.

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Public Participation and Adoption of Plan

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10 Public Participation and Adoption of Plan

[31 TAC §361.30-32]

10.1 Introduction

The San Antonio RFPG encouraged public participation through public meetings and online tools throughout the flood planning process and completed all activities necessary to complete and submit the draft and final San Antonio RFP and to obtain TWDB approval of the Plan.

The San Antonio RFP satisfies the requirements of each of the 39 guidance principles identified in 31 TAC §362.3, as shown in Table 101.The San Antonio RFPG also certifies that the Plan will not negatively affect a neighboring area.

Table 10-1. Title 31 TAC §362.3 Guidance Principles and the Means by which each Requirement is Met in the SARFP

Guidance Principle	Means by which Requirement is Met in Regional Flood Plan (RFP)
(1) shall be a guide to state, regional, and local flood risk management policy;	The RFP is a guide with management goals in Chapter 3, management strategies in Chapter 5, and management and policy recommendations in Chapter 8.
(2) shall be based on the best available science, data, models, and flood risk mapping;	Best available information from a quality, coverage, and contemporary perspective were used in RFP, for example in Chapter 2 analyses.
(3) shall focus on identifying both current and future flood risks, including hazard, exposure, vulnerability and residual risks; selecting achievable flood mitigation goals, as determined by each RFPG for their region; and incorporating strategies and projects to reduce the identified risks accordingly;	The RFP examines current and future flood risk in Chapter 2, mitigation goals in Chapter 3, and strategies in Chapter 5. Maps show the areas of flood risks.
(4) shall, at a minimum, evaluate flood hazard exposure to life and property associated with 0.2 percent annual chance flood event (the 500-year flood) and, in these efforts, shall not be limited to consideration of historic flood events;	Flood hazard exposure is evaluated and presented in Chapter 2. Maps show the areas of flood risks associated with different percent annual chance flood event.
(5) shall, when possible and at a minimum, evaluate flood risk to life and property associated with 1.0 percent annual chance flood event (the 100-year flood) and address, through recommended strategies and projects, the flood mitigation goals of the RFPG (per item 2 above) to address flood events associated with a 1.0 percent annual chance flood event (the 100-year flood); and, in these efforts, shall not be limited to consideration of historic flood events;	Flood risks are evaluated and presented in Chapter 2, with recommended strategies and projects provided in Chapter 7 and Chapter 8.
(6) shall consider the extent to which current floodplain management, land use regulations, and economic development practices increase future flood risks to life and property and consider recommending adoption of floodplain management, land use regulations, and economic development practices to reduce future flood risk;	Floodplain management practices throughout the SAFPR are mostly low and could be expanded as described in Chapter 3. Increased recognition of floodplains and flood risk is needed for most of the SAFPR.

Guidance Principle	Means by which Requirement is Met in Regional Flood Plan (RFP)
(7) shall consider future development within the SAFPR and its potential to impact the benefits of flood management strategies (and associated projects) recommended in the plan;	Future development is considered in Chapter 2 and Chapter 3.
(8) shall consider various types of flooding risks that pose a threat to life and property, including, but not limited to, riverine flooding, urban flooding, engineered structure failures, slow rise flooding, ponding, flash flooding, and coastal flooding, including relative sea level change and storm surge;	Various types of flooding risks that pose a threat to life and property, including but not limited to, riverine flooding, pluvial flooding, coastal flooding and playa flooding, which are considered in Chapter 2.
(9) shall focus primarily on flood management strategies and projects with a contributing drainage area greater than or equal to 1.0 (one) square miles except in instances of flooding of critical facilities or transportation routes or for other reasons, including levels of risk or project size, determined by the RFPG;	Chapter 4 and Chapter 5 focus on flood management strategies and projects.
(10) shall consider the potential upstream and downstream effects, including environmental, of potential flood management strategies (and associated projects) on neighboring areas. In recommending strategies, RFPGs shall ensure that no neighboring area is negatively affected by the regional flood plan;	Consideration of neighboring area is described in Chapter 4 and Chapter 5. Strategies and projects are assessed to confirm negative impacts to surrounding areas would not occur.
(11) shall include an assessment of existing, major flood mitigation infrastructure and will recommend both new strategies and projects that will further reduce risk, beyond what existing flood strategies and projects were designed to provide, and make recommendations regarding required expenditures to address deferred maintenance on or repairs to existing flood infrastructure;	Infrastructure is evaluated in Chapter 4 and Chapter 5. The strategies and projects include many related to infrastructure. Chapter 9 examines the financing aspects.
(12) shall include the estimate of costs and benefits at a level of detail sufficient for RFPGs and sponsors of flood mitigation projects to understand project benefits and, when applicable, compare the relative benefits and costs, including environmental and social benefits and costs, between feasible options;	Costs drive most decision making and are discussed in most chapters, although Chapter 4, Chapter 5, and Chapter 9 present the most information on costs.
(13) shall provide for the orderly preparation for and response to flood conditions to protect against the loss of life and property and reduce injuries and other flood-related human suffering;	Preparation and response are described in Chapter 7.
(14) shall provide for an achievable reduction in flood risk at a reasonable cost to protect against the loss of life and property from flooding;	Like costs and benefits in Chapter 4 and Chapter 5, reasonable costs to achievable reduction in flood risk is considered.
(15) shall be supported by state agencies, including the TWDB, General Land Office, Texas Commission on Environmental Quality, Texas State Soil and Water Conservation Board, Texas Parks and Wildlife Department, and the Texas Department of Agriculture, working cooperatively to avoid duplication of effort and to make the best and most efficient use of state and federal resources;	Agency representation is addressed in Chapter 10, Public Participation.

Guidance Principle	Means by which Requirement is Met in Regional Flood Plan (RFP)
(16) shall include recommended strategies and projects that minimize residual flood risk and provide effective and economical management of flood risk to people, properties, and communities, and associated environmental benefits;	Chapter 5 includes recommended strategies and projects.
(17) shall include strategies and projects that provide for a balance of structural and nonstructural flood mitigation measures, including projects that use nature-based features, that lead to long-term mitigation of flood risk;	Chapter 4 and Chapter 5 include strategies and projects that are labeled as other, which includes nature-based solutions. A variety of strategies and projects are included but balance could be improved in future planning.
(18) shall contribute to water supply development where possible;	Contributions and impacts to water supply development are assessed in Chapter 6.
(19) shall also follow all regional and state water planning guidance principles (31 TAC 358.3) in instances where recommended flood projects also include a water supply component;	Contributions and impacts to water supply development are assessed in Chapter 6.
(20) shall be based on decision-making that is open to, understandable for, and accountable to the public with full dissemination of planning results except for those matters made confidential by law;	The RFP is based on the requirements of the TAC and the associated TWDB technical guidance documents.
(21) shall be based on established terms of participation that shall be equitable and shall not unduly hinder participation;	The RFP is based on the requirements of the TAC and the associated TWDB technical guidance documents. Chapter 10 directly addressed public participation.
(22) shall include flood management strategies and projects recommended by the RFPGs that are based upon identification, analysis, and comparison of all flood management strategies the RFPGs determine to be potentially feasible to meet flood mitigation and floodplain management goals;	The RFPGs worked directly with the technical consultant in the development of the RFP as described in Chapter 1.
(23) shall consider land-use and floodplain management policies and approaches that support short- and long-term flood mitigation and floodplain management goals;	Land-use and floodplain management policies and approaches that support short- and long-term flood mitigation and floodplain management goals are addressed in Chapter 3
(24) shall consider natural systems and beneficial functions of floodplains, including flood peak attenuation and ecosystem services;	Chapter 3 includes natured-based goals like attenuation and ecosystem services within the category of environmental stewardship.
(25) shall be consistent with the National Flood Insurance Program (NFIP) and shall not undermine participation in nor the incentives or benefits associated with the NFIP;	This is a primary aspect of the goals and purpose of the RFP as stated in Chapter 1. The RFP is consistent with the NFIP.
(26) shall emphasize the fundamental importance of floodplain management policies that reduce flood risk;	Policies that reduce flood risk are a fundamental importance of the RFP and is specifically emphasize in Chapter 2.
(27) shall encourage flood mitigation design approaches that work with, rather than against, natural patterns and conditions of floodplains;	Chapter 3 includes natured-based goals to work with natural patterns and conditions within the category of environmental stewardship.
(28) shall not cause long-term impairment to the designated water quality as shown in the state water quality management plan as a result of a recommended flood management strategy or project;	The conclusion of Chapter 6 states there are no anticipated impacts to the State Water Quality Management Plan.

Guidance Principle	Means by which Requirement is Met in Regional Flood Plan (RFP)
(29) shall be based on identifying common needs, issues, and challenges; achieving efficiencies; fostering cooperative planning with local, state, and federal partners; and resolving conflicts in a fair, equitable, and efficient manner;	These are part of the process for identifying the FME, FMS, and FMP lists as described in Chapter 5.
(30) shall include recommended strategies and projects that are described in sufficient detail to allow a state agency making a financial or regulatory decision to determine if a proposed action before the state agency is consistent with an approved regional flood plan;	Chapter 5 includes recommended strategies and projects.
(31) shall include ongoing flood projects that are in the planning stage, have been permitted, or are under construction;	Chapter 1 includes discussion about proposed and ongoing flood mitigation projects.
(32) shall include legislative recommendations that are considered necessary and desirable to facilitate flood management planning and implementation to protect life and property;	Legislative recommendations along with rationale are provided in Chapter 8.
(33) shall be based on coordination of flood management planning, strategies, and mitigation projects with local, regional, state, and federal agencies projects and goals;	These are part of the process for identifying the FME, FMS, and FMP lists with the UCRFPG providing the coordination as described in Chapter 5.
(34) shall be in accordance with all existing water rights laws, including but not limited to, Texas statutes and rules, federal statutes and rules, interstate compacts, and international treaties;	The conclusion of Chapter 6 states there are no anticipated impacts to water rights.
(35) shall consider protection of vulnerable populations;	Flood risks to vulnerable populations are evaluated in Chapter 2 using the social vulnerability index. Vulnerability was then carried forward to the process for identifying FME, FMS, and FMP lists in Chapter 5.
(36) shall consider benefits of flood management strategies to water quality, fish and wildlife, ecosystem function, and recreation, as appropriate;	Chapter 4 recognizes the consideration of these additional benefits alongside the needs analysis results for developing strategies and projects.
(37) shall minimize adverse environmental impacts and be in accordance with adopted environmental flow standards;	Chapter 6 addresses minimizing adverse environmental impacts and meeting adopted environmental flow standards in the recommendations.
(38) shall consider how long-term maintenance and operation of flood strategies will be conducted and funded; and	Chapter 9 includes the consideration of conducting and funding O&M.
(39) shall consider multi-use opportunities such as green space, parks, water quality, or recreation, portions of which could be funded, constructed, and or maintained by additional, third-party project participants.	Chapter 4 recognizes the consideration of these additional opportunities alongside the needs analysis results for developing strategies and projects.

10.2 Public Participation

Stakeholder outreach and public participation are an important part of any planning process. Public participation has aided every aspect of the San Antonio RFP development – from the identification of flood risks and management and mitigation project needs to the formation of legislative and policy recommendations specific to the SAFPR.

The San Antonio RFPG provided opportunity for the public to participate in the regional flood planning process and met all requirements under the Texas Open Meetings Act and Public Information Act in accordance with 31 TAC Chapters 357.12, 357.21, and 357.50(f) during development of the *Draft* 2023 *San Antonio Regional Flood Plan*. San Antonio RFPG meeting agendas and other meeting materials were posted on the SAFPR website (https://www.region12texas.org/) prior to each meeting. The public was invited to speak during public comment periods during each meeting.

Non-voting members of the San Antonio RFPG included representatives from the following state agencies: Texas Parks and Wildlife Department, Texas Division of Emergency Management, Texas Department of Agriculture, Texas State Soil and Water Conservation Board, General Land Office, Texas Water Development Board, and Texas Commission on Environmental Quality. The representatives provided input to the San Antonio RFPG and worked cooperatively to avoid duplication of effort and to make the best and most efficient use of state and federal resources.

The San Antonio RFPG held a “pre-planning” meeting on April 20, 2021, to obtain input on development of the RFP, determine flood mitigation and floodplain management goals, and develop the process for identifying potential flood management evaluations (FMEs), and potentially feasible flood management strategies (FMSs) and flood management projects (FMPs). In compliance with the TWDB Regional Flood Planning Rules [31 TAC Section 361.21(h)(2)], written comments from the public were accepted for a period of 14 days prior to and 14 days after the pre-planning meeting. Public comments were also accepted at the January 4, 2022, meeting and the March 3, 2022, meeting where the San Antonio RFPG considered approval of the Technical Memorandum, which was an interim deliverable requirement.

10.3 San Antonio RFPG Communications

10.3.1 Regional Website and Email Address

To communicate the activities of the San Antonio RFPG and receive input from the public and stakeholders, the San Antonio RFPG created a website for the public to access: https://www.region12texas.org/members/. The website has been used to convey the following information.

- General SAFPR information;
- Contact information for members of the San Antonio RFPG;

- Notifications of upcoming San Antonio RFPG meetings, including a virtual meeting option using GoToMeeting software;
- Meeting archives containing past meeting agendas, supporting documentation, and meeting minutes;
- A link to a community survey to poll the level of community support for the goal statements of the San Antonio RFPG;
- Links to additional flood planning resources, including the TNRIS Flood Planning Regions Map Collection;
- Phone number and address to submit public comments for a particular agenda item and/or submit questions to the San Antonio RFPG; and
- A link to an interactive map, which citizens used to confirm the benefitted area of proposed projects as well as indicate areas with flooding issues.

10.3.2 ArcGIS StoryMap

An ArcGIS StoryMap was created to help the citizens of the SAFPR visually understand the purpose of the San Antonio RFP and the work being completed by the technical consultants. As of March 2022, the StoryMap was located at the following link:

https://hdr.maps.arcgis.com/apps/MapSeries/index.html?appid=4bf56a7abed44fe9b07a450d1f95404b

10.4 Coordination with Other Planning Regions

Coordination with other planning regions was accomplished primarily through the technical consultants, who coordinated data and shared information that were then reported to the planning groups. Coordination was accomplished with adjacent RFPGs, including Regions 10,11 and 13. Other coordination was accomplished through the participation of San Antonio RFPG members and liaisons with adjacent planning groups.

10.5 San Antonio Regional Flood Planning Meetings

The San Antonio RFPG and the Outreach Committee of the planning group conducted public meetings on the following dates in accordance with TWDB requirements and the approved bylaws. The meetings were held to identify areas of additional flood risk and to identify potential FMXs to mitigate risk in flood prone areas. The purpose of the outreach committee was to facilitate public involvement in the planning process.

Planning Group Meetings

July 25, 2022
June 27, 2022
May 26, 2022
April 7, 2022
March 3, 2022
January 4, 2022
December 16, 2021
November 16, 2021
September 21, 2021
August 17, 2021
June 15, 2021
May 14, 2021
April 20, 2021
February 9, 2021
December 1, 2020
November 2, 2020

Outreach Committee Meetings

July 14, 2022
June 22, 2022
May 19, 2022
April 22, 2022
March 25, 2022
January 14, 2022
November 3, 2021
October 26, 2021
October 13, 2021

10.6 Public Hearing and Responses to Public Comments on the Draft Plan

The San Antonio RFPG approved the *Draft 2023 San Antonio Regional Flood Plan* for submittal to the TWDB on July 25, 2022. The *Draft 2023 San Antonio Regional Flood Plan* will be submitted to the TWDB by August 1, 2022. The public hearing to receive comments on the *Draft 2023 San Antonio Regional Flood Plan* will be held in September 2022, providing sufficient time to accept public comments according to statute to meet the January 10, 2023, deadline for submission of the adopted Final 2023 San Antonio RFP. Hard copies of the *Draft 2023 San Antonio Regional Flood Plan* will be provided as required and the Plan will be posted on the SAFPR website for public review and comment. The comments received on the *Draft 2023 San Antonio Regional Flood Plan* with responses will be included as an appendix in the *Final 2023 San Antonio Regional Flood Plan*.

10.7 Plan Adoption

The *Draft 2023 San Antonio Regional Flood Plan* was developed and adopted in accordance with 31 TAC §361.50 and §361.60–.61. The San Antonio RFPG will approve and adopt the *Final 2023 San Antonio Regional Flood Plan* in late 2022 and will direct the San Antonio River Authority and the Technical Consultant Team to submit the *Final 2023 San Antonio Regional Flood Plan* to the TWDB on or before the January 10, 2023, deadline.