Chapter 5: Recommendation of Flood Management Evaluations, 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 (FMEs, FMSs, and FMPs) for inclusion in the Regional Flood Plan. While Chapter 4B discusses the technical evaluations of the potential Flood Management Evaluations (FME) and potentially feasible Flood Management Strategies (FMS) and Flood Mitigation Projects (FMPs) identified by the RFPG, Chapter 5 focuses on how the RFPG used this data to make a recommendation for a given flood mitigation action. Generally, this chapter summarizes and documents:

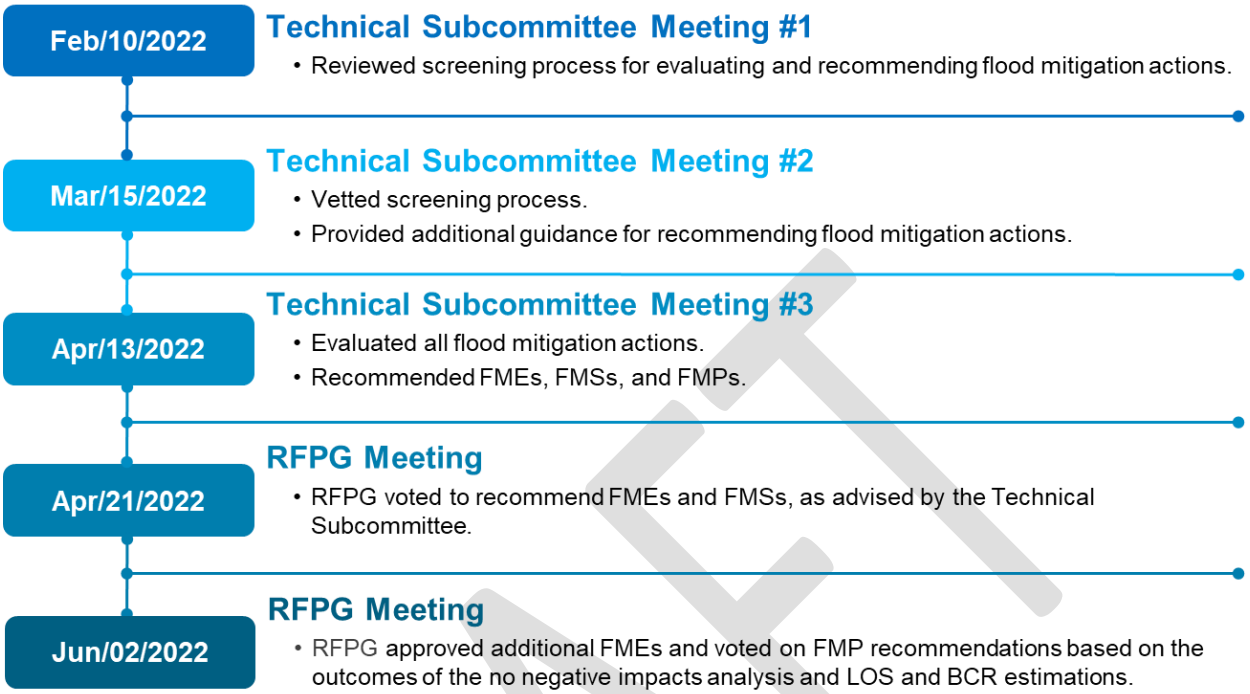
1. The process undertaken by the RFPG to make final recommendations on the given flood mitigation action types
2. The potential FMEs and potentially feasible FMSs and FMPs identified and evaluated under Task 4B and whether these actions are recommended by the RFPG

While there is abundant need across the Region and the State for better, recent, and more widely available data on flood risk, it is evident that not every conceivable flood mitigation action can be recommended in the Regional Flood Plan or included in the State Flood Plan. The RFPG evaluated the identified potential flood mitigation actions and, based on the significant needs in the Region, recommended those that met the TWDB requirements, with the understanding that not all recommendations may be performed in the same planning cycle as they are identified. Finally, all recommendations considered alignment with RFPG-adopted flood mitigation and floodplain management goals.

5.1 RFPG Evaluation and Recommendation Process

The RFPG considered recommendations on flood mitigation actions through a multi-step process. The 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 RFPG for formal approval. **Figure 5.1** provides a timeline and key decisions of the RFPG evaluation and recommendation process. The general methodology included a screening of all potential flood mitigation actions considering TWDB requirements for inclusion in the Regional Flood Plan 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.

Figure 5.1: RFPG Evaluation and Recommendation Process Timeline



The first Technical Subcommittee meeting was held on February 10, 2022. This meeting focused on reviewing the proposed screening process for evaluating and recommending flood mitigation actions. This process is summarized in **Figure 5.2** for FMEs and in **Figure 5.3** for FMPs and FMSs. The process was primarily developed following the TWDB rules and requirements for inclusion in the plan. However, the TWDB left some evaluation criteria to the discretion of the RFPG to implement the screening process. The main discretionary evaluation criteria are the Level of Service (LOS) to be provided by an FMP and the Benefit/Cost Ratio (BCR) for the project. The TWDB recommends that, at a minimum, FMPs should mitigate flood events associated with the 1% annual chance flood (100-year LOS). However, if a 100-year LOS is not feasible, the RFGP can document the reasons for its infeasibility and still recommend an FMP with a lower LOS. Similarly, the TWDB recommends that proposed actions have a benefit-cost ratio (BCR) greater than one, but the RFPG may recommend FMPs with a BCR lower than one with proper justification.

During the second Technical Subcommittee meeting held on March 15, 2022, the technical consultants provided a series of sample evaluations to demonstrate how the screening process would be implemented and requested feedback on the discretionary evaluation criteria. The Technical Subcommittee vetted the process and provided the following additional guidance to determine whether a flood mitigation action may be recommended:

1. The RFPG will not require confirmation from potential Sponsors to support a flood mitigation action as a prerequisite for recommendation (see Section 5.2).

2. All potential actions should be considered for inclusion in the plan unless an entity specifically declines to be listed as a Sponsor and no other appropriate potential sponsor is identified.
3. If a potential flood mitigation action falls within multiple flood planning regions, the RFPG will consider recommending that action for the portion that falls within Region 3 jurisdiction.
4. The RFPG is willing to accept flood mitigation actions with a LOS that is lower than the 100-year flood event. The technical consultants shall determine the estimated LOS for each FMP and the RFPG will make the final determination for its recommendation.
5. The RFPG is willing to accept an FMP with a BCR less than one. The technical consultants shall determine the estimated BCR for each FMP based on readily available data and/or generalized assumptions. The RFPG will make the final determination regarding each FMP recommendation.

The technical consultants applied the screening process based on the technical data developed under Task 4B and the Technical Subcommittee guidance. An initial recommendation for each flood mitigation action was presented to the Technical Subcommittee on April 13, 2022. This working session allowed for multiple adjustments on the flood mitigation action lists, including additions of new FMEs and FMSs, merging multiple FMEs or FMSs into one action, and enhancing project descriptions. All FMEs and FMSs were reviewed and those that met all screening criteria were selected for recommendation. All FMPs were recommended contingent upon confirmation of no negative impacts and a completion of estimated LOS and BCR estimations.

On April 21, 2022, the RFPG voted to recommend FMEs and FMSs, as advised by the Technical Subcommittee. The RFPG approved these FMEs and FMSs with the understanding that they could revisit them at a future meeting if new information warranted additional discussion and possible action.

Finally, on June 2, 2022, the RFPG approved additional FMEs received since the last Technical Subcommittee meeting and voted on FMP recommendations based on the outcomes of the no negative impacts analysis and the LOS and BCR estimations.

All meetings were held in accordance with the requirements of the RFPG bylaws, the Texas Open Meetings Act, the general requirements of the Texas Water Code and the TWDB's flood planning process requirements. Additional details regarding the flood mitigation actions evaluation process and final recommendations are provided in subsequent sections.

Figure 5.2: FME Screening Process

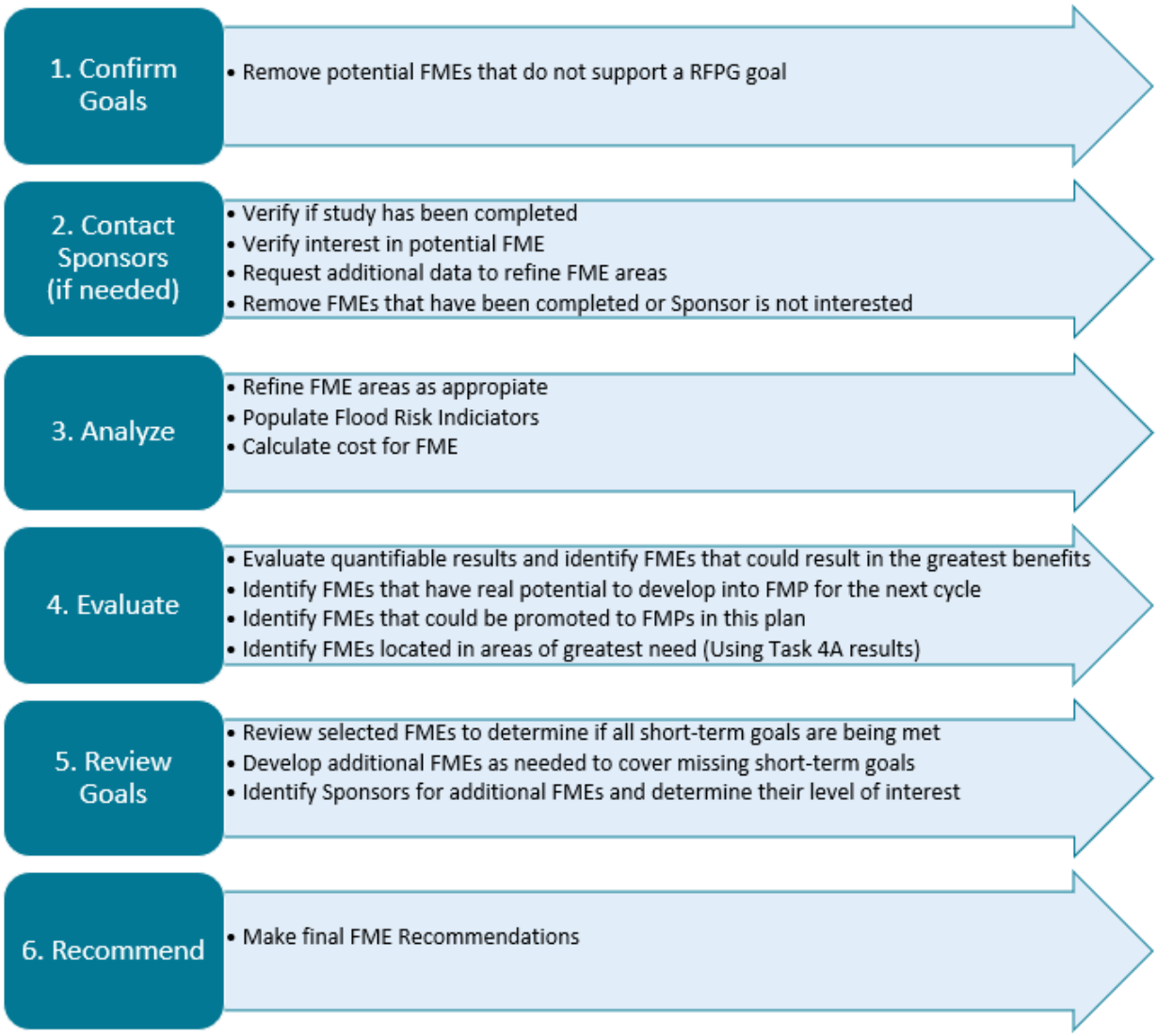
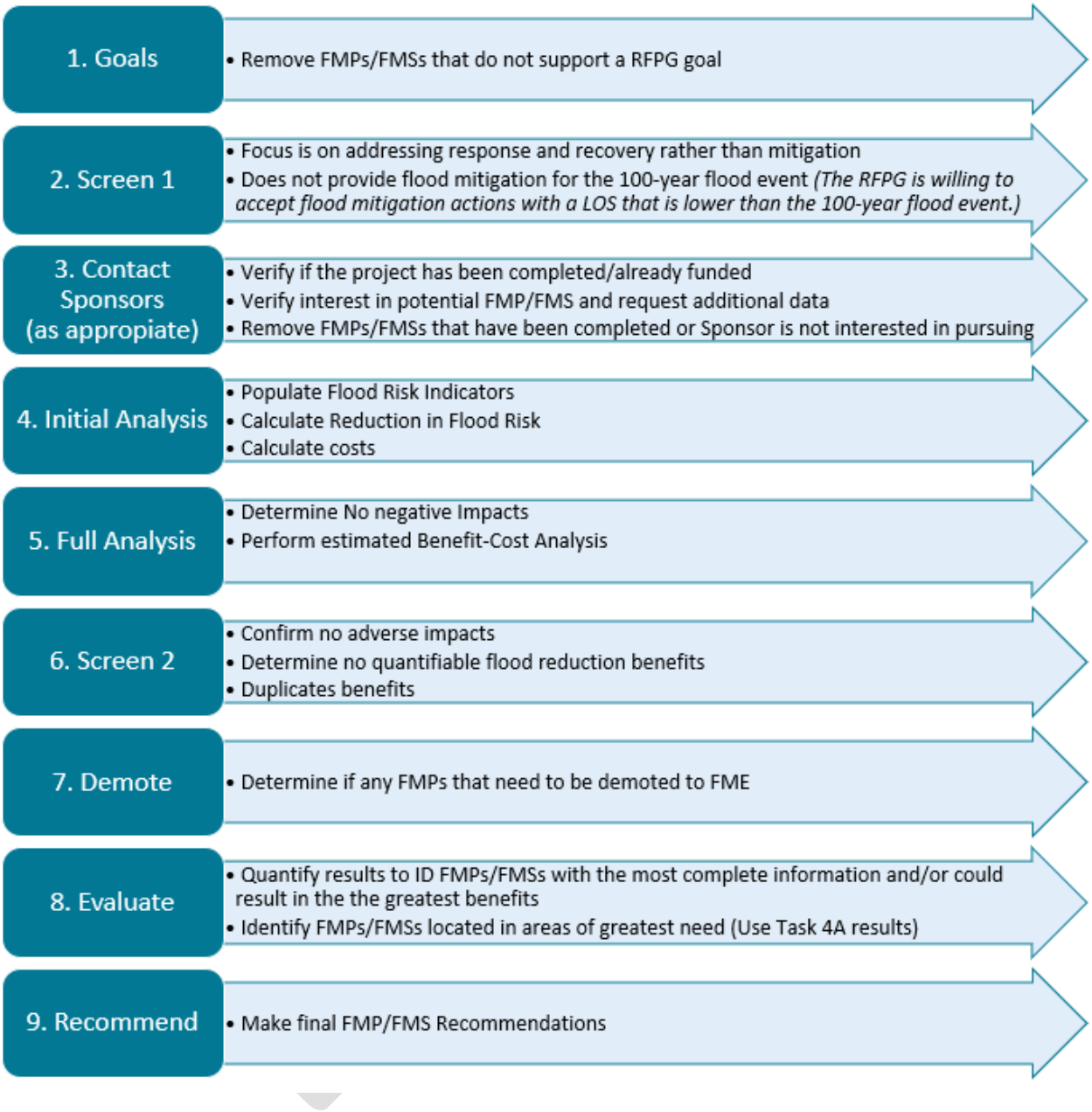


Figure 5.3: FMP and FMS Screening Process



5.2 Sponsor Outreach

A supplemental effort to contact potential Sponsors was conducted to obtain clarification on flood mitigation actions where there was significant uncertainty regarding their location and/or scope of work. Feedback from potential Sponsors was requested via email. These outreach e-mails included a one-page summary of the potential flood mitigation action with a map showing its approximate location, allowing the potential sponsors to view the potential actions for their entity. In addition, potential Sponsors were encouraged to provide any other flood mitigation action of their interest for the RFPG to consider for inclusion in the Regional Flood Plan. Several conference call meetings were held following this outreach effort, which resulted in multiple positive outcomes for the flood planning process. Potential Sponsors were able to fill in data gaps, identify actions that were already completed or had allocated funding, add new actions for consideration, and confirm interest in including the identified potential actions in the Regional Flood Plan.

Due to schedule limitations, this outreach effort was targeted to the potential flood mitigation actions with the greatest data gaps. However, flood mitigation actions must be included in the Regional Flood Plan to be eligible for future state funding from the Texas Water Development Board. Given this constraint, the RFPG decided that an affirmative willingness to sponsor a given action would not be a prerequisite for inclusion in the plan. As a result, all potential actions were considered for inclusion 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 needs in the region.
2. It does not obligate an entity to sponsorship; it simply allows an entity to be eligible for funding if interest in and capacity to sponsor an action becomes evident before the next regional flood plan is adopted.

It is important to note that all sponsors associated with recommended actions subsequently received a survey to communicate that they were identified as a sponsor and were asked to provide information for potential funding sources for the actions listed in the plan. This effort is detailed in Chapter 9.

5.3 Flood Management Evaluations (FMEs)

5.3.1 Summary of Approach in Recommending FMEs

The RFPG evaluated the identified potential FMEs and, based on the significant needs in the Region, recommended all FMEs that met the TWDB requirements, with the understanding that not all FMEs may be performed during the same planning cycle as they are identified. Recommended FMEs were also required to demonstrate alignment with at least one regional floodplain management and flood mitigation goal developed in Chapter 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 an H&H modeling component will evaluate multiple storm events, including the 1% annual chance flood. The exact solutions identified through performing these FMEs cannot be defined at this time. However, it is anticipated that an impact analysis will be performed for all alternatives and project benefits will be

tabulated for the 1% annual chance flood to inform any recommended alternatives and to define potentially feasible FMPs under this planning framework. Based on these TWDB requirements, the RFPG identified and recommended two main types of FMEs:

1. Recommended FMEs include those that 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. Second, FMPs, and in some cases, FMSs, require a demonstrated potential reduction in flood risk to be recommended in the Regional Flood Plan. In order for this metric to be assessed, H&H modeling must be available to compare existing and post-project floodplain boundaries to determine the flood risk reduction potential of a given project.

2. Recommended FMEs classified as project planning type were also included. These FMEs are generally studies or preliminary designs to address a specific, known flood need. However, these flood mitigation actions currently lack some or all of 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 impacts analysis. Completing these components as part of an FME will result in a potentially feasible FMP for consideration during future flood planning efforts.

The primary reason for not recommending an FME was based on Sponsor input. An FME was not recommended if a sponsor indicated that the proposed study is currently in progress, has been competed already, or was no longer a priority they intended to pursue. In some cases, multiple FMEs were combined into a single FME for recommendation due to the proximity of the study areas.

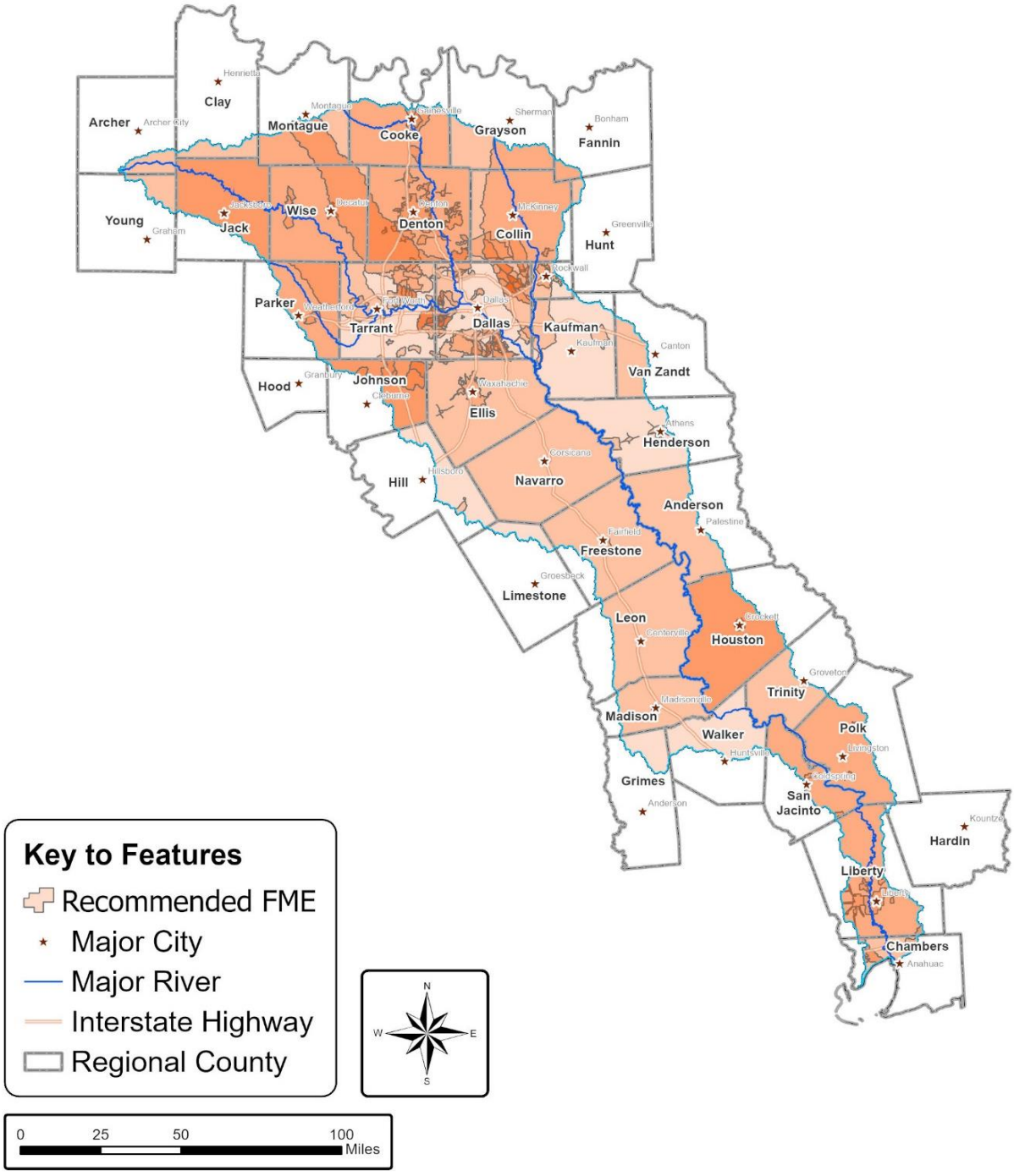
5.3.2 Description and Summary of Recommended FMEs

A total of 356 potential FMEs were identified and evaluated by the RFPG. Of these projects, 342 were recommended, representing a combined total of approximately $146 million dollars of flood management evaluation needs across the region. The number and types of projects recommended by the RFPG are summarized in **Table 5.1**. The full list of FMEs and supporting technical data is included as **Table 15** in **Appendix 5.1**. A map of recommended FMEs is presented as **Figure 5.4**. Color gradations in **Figure 5.4** reflect the number of FMEs that overlap for the same area, the darker the color, the greater the number of FMEs. A one-page report summary for each recommended FME is included in **Appendix 5.2**. Overall, the recommended FMEs represent over 90,600 square miles of contributing drainage area and provide extensive coverage of the Flood Planning Region.

Table 5.1: Summary of Recommended FMEs

FME Type	FME Description	# of Potential FMEs Identified	# of FMEs Recommended	Total Cost of Recommended FMEs
Preparedness	Studies on Flood Preparedness	5	5	$3,150,000
Project Planning	Previously Identified Drainage Projects and Flood Studies	238	228	$60,937,000
Watershed Planning	Flood Mapping Updates, Drainage Master Plans, H&H Modeling, Dam & Levee Failure	112	108	$79,879,000
Other	Dam Studies	1	1	$2,000,000
	Total	**356**	**342**	**$145,966,000**

Figure 5.4: Map of Recommended FMEs (TWDB Map 20)



5.4 Flood Mitigation Projects (FMPs)

5.4.1 Summary of Approach in Recommending FMPs

For consideration as an FMP, a project must be defined in a sufficient level of detail to meet the technical requirements of the regional flood planning project *Scope of Work* and the associated *Technical Guidelines* developed by the TWDB. In summary, the RFPG must be able to demonstrate that each recommended FMP meets the following TWDB requirements:

1. Supports at least one regional floodplain management and flood mitigation goal.
2. The primary purpose is mitigation (response and recovery projects are not eligible for inclusion in the Regional Flood Plan).
3. The FMP is a discrete project (not an entire capital program or drainage master plan).
4. Implementation of the FMP 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 entity's 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, FMPs should mitigate flood events associated with the 1% annual chance flood (100-year LOS). However, if a 100-year LOS is not feasible, the RFGP can document the reasons for its infeasibility and may recommend an FMP with a lower LOS.

Updated construction cost estimates and estimates of project benefits must also be available to define a benefit-cost ratio (BCR) for each recommended FMP. The TWDB recommends that proposed projects have a BCR greater than one, but the RFPG may recommend FMPs with a BCR lower than one with proper justification.

All potentially feasible FMPs that had the necessary data and detailed H&H modeling results available to populate these technical requirements were considered for recommendation by the RFPG. Pertinent details about the FMP evaluation are provided in the following section.

5.4.2 FMP Evaluation

Initial Evaluation

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 goal(s) associated with each FMP are included in **Table 16** in **Appendix 5.1**. Based on a review of the supporting studies and hydrologic and hydraulic models, the Region determined that the primary purpose for each FMP is mitigation (rather than a response or recovery project), is a discrete project, and does not have any anticipated

impacts to water supply or water availability allocations as established in the most recently adopted State Water Plan.

No Negative Impacts Determination

Each identified FMP must demonstrate that no negative impacts on a neighboring area would result from 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 is measured by the 1% annual chance event water surface elevation and peak discharge. According to TWDB *Technical Guidelines* it is recommended that no rise in water surface elevation or discharge should be permissible, and that the analysis extent must be sufficient to prove proposed project conditions are equal to or less than the existing conditions. These conditions were evaluated for each potentially feasible FMP based on currently available regional planning level data. However, the local sponsor will be ultimately responsible for proving the final project design has no negative flood impact prior to initiating construction.

For the purposes of flood planning effort, a determination of no negative impact can be established if stormwater 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:

1. Stormwater does not increase inundation in areas beyond the public right-of-way, project property, or easement
2. Stormwater does not increase inundation of storm drainage networks, channels, and roadways beyond design capacity
3. Maximum increase of 1D Water Surface Elevation must round to 0.0 feet (<0.05 ft) measured along the hydraulic cross-section
4. Maximum increase of 2D Water Surface Elevations must round to 0.3 feet (<0.35 ft) measured at each computation cell
5. 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-year flood) was performed for each potentially feasible FMP based on their associated hydrologic and

hydraulic models. The floodplain boundary extents, resulting water surface elevations, and peak discharge values were compared at pertinent locations to determine if the FMP conforms to the no negative impacts requirements. This comparative assessment was performed for the entire zone of influence of the FMP.

A general description of the scope of work and a summary of the expected benefits and impacts of the proposed improvements for each potentially feasible FMP is provided in **Appendix 5.3**. This appendix also provides a summary of the comparative assessment of hydrologic and hydraulic parameters and the final determination of no negative impacts for each FMP. Based on this evaluation, it was determined that seven (7) potentially feasible FMPs conform to the no negative impact requirements (see **Table 5.2**). However, six (6) FMPs that do not strictly comply with these requirements were still considered by the RFPG as not having adverse impacts due to various justified conditions and based on engineer's professional judgment. These particular cases are explained as appropriate in the project descriptions included in **Appendix 5.3** and are identified in **Table 5.2**. The remaining 26 potential FMPs did not have sufficient data available to perform the no negative impacts assessment at the time of this draft report. These FMPs may still be considered for recommendation as part of the Draft RFP when data becomes available.

Table 5.2: No Negative Impact Determination for Potentially Feasible FMPs

FMP ID	FMP Name	Meets All TWDB No Negative Impacts Requirements*	Identified Negative Impact	No Negative Impacts based on Engineering Judgement+
033000007	Spring Meadows Estates Detention Pond Design	Y	-	✓
033000008	West Irving Creek Phases 2, 3, and 4	N	Increases WSE Increases Peak Discharge	✓
033000016	Arlington VC(A)-1 Drainage and Erosion Improvements	N	Increases WSE Increases Peak Discharge	✓
033000030	Lancaster/Foch Area Mitigation (Trail Drive)	N	Increases Peak Discharge	✓
033000031	Linwood Park Flood Mitigation (Western Arlington Heights)	N	Increases WSE	✓
033000033	Sunnyvale Urban Flooding Reduction Improvements – Area 1	N	Increases Peak Discharge	✓
033000036	Sunnyvale Urban Flooding Reduction Improvements - Area 2	N	Increases Peak Discharge	✓

**TWDB Technical Guidance - Exhibit C Section 3.6.A*

+Additional details regarding nature of impacts and reasoning for accepting impacts based on engineering judgment is included in individual project descriptions (See Appendix 5.3)

Benefit Cost Analysis

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 end 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 decide to 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. BCR calculations are included in **Table 16** in **Appendix 5.1**).

5.4.3 Description and Summary of Recommended FMPs

Due to the level of detail required for consideration as an FMP, only seven (7) out of 33 potentially feasible FMPs were determined to have enough details available for evaluation and potential recommendation for inclusion in the Regional Flood Plan. Based on the FMP evaluation described in Section 5.4.2, the RFPG has determined that seven (7) FMPs comply with all the TWDB requirements and recommended them for inclusion in the Regional Flood Plan. The remaining 26 potential FMPs may still be considered for recommendation as part of the Draft RFP when data becomes available.

The RFPG recommendations also considered the Level of Service (LOS) and Benefit/Cost Ratio (BCR) of each FMP as discretionary evaluation criteria. Some FMPs do not provide a 100-year LOS and/or their BCR is less than one.

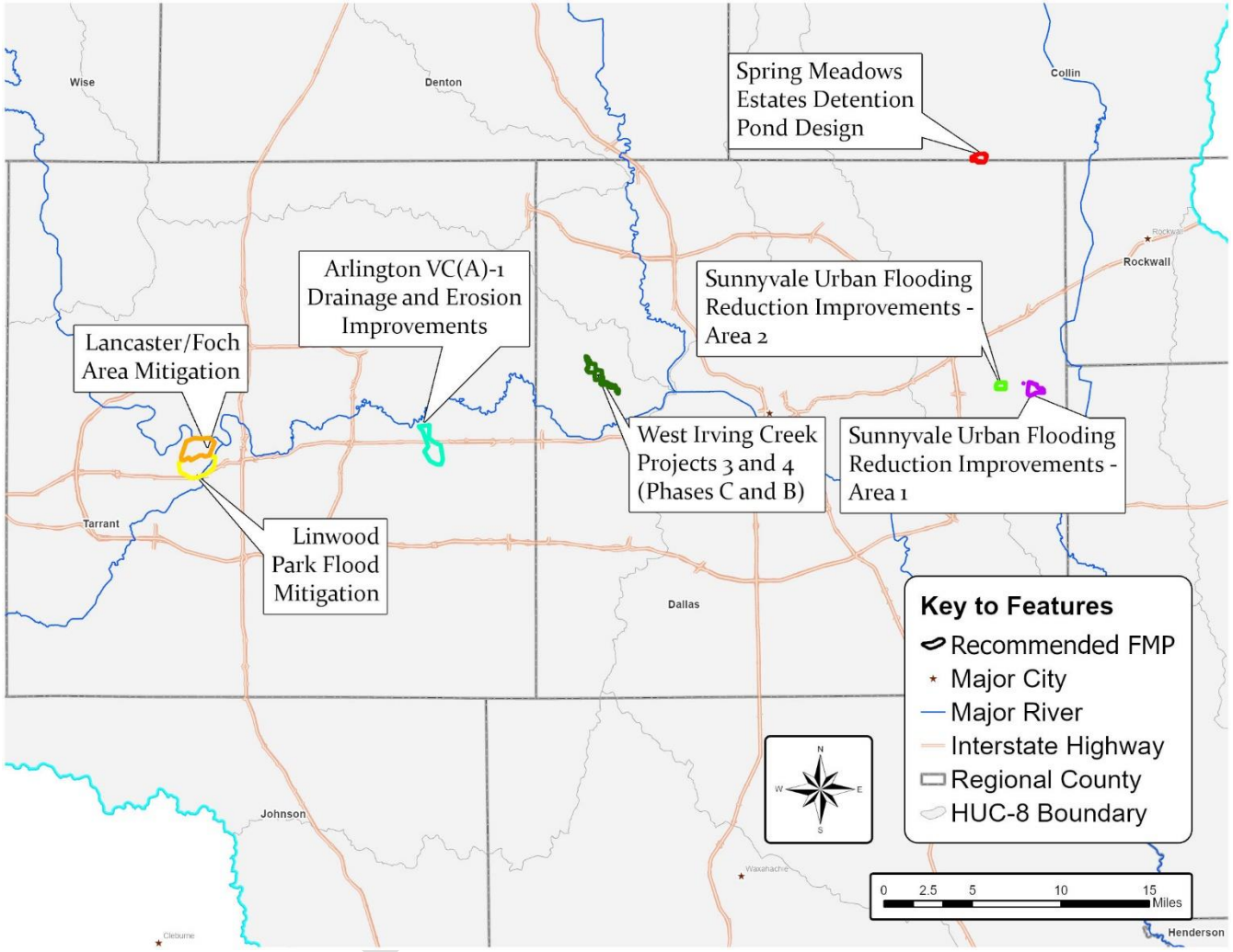
- Physical, environmental, or other constraints may impact the ability of a recommended FMP regarding the LOS to which it can provide. The RFPG considered these results and determined that recommending these FMPs would still be consistent with the overarching goal of the Regional Flood Plan, which is "*to protect against the loss of life and property*", even if that protection can only be provided against smaller magnitude storm events.
- The costs and benefits of the FMPs are developed at a high level or regional scale. A Sponsor will need to refine the BCR according to the funding program BCA requirements if and when the Sponsor decides to pursue funding to move forward with the implementation of an FMP. Every funding program has its own BCA tool that is required for its specific funding application. Therefore, the RFPG considered potential non-quantifiable secondary benefits, such as improving water quality, expanding recreational opportunities, and improvements in community livability, as a justification for recommending FMPs with BCRs less than 1.

A summary of the recommended FMPs for inclusion in the Regional Flood Plan is presented in **Table 5.3**. These projects are primarily located within the Upper Basin area, and they represent a combined total construction cost of nearly $176 million. Supporting technical data for each FMP, including their flood risk reduction benefits, is included as **Table 16** in **Appendix 5.1**. A map of project areas for the recommended FMPs is provided as **Figure 5.5**. A one-page report summary for each recommended FMP is included in **Appendix 5.2**. Additionally, **Appendix 5.4** provides a detailed breakdown of the estimated planning level costs for each FMP following the TWDB *Technical Guidelines*.

Table 5.3: Summary of Recommended FMPs

FMP ID	FMP Name	FMP Type	Cost
033000007	Spring Meadows Estates Detention Pond Design	Regional Detention	$1,868,000
033000008	West Irving Creek Phases 2, 3, and 4	Infrastructure (channels, ditches, ponds, pipes, etc.)	$98,746,000
033000016	Arlington VC(A)-1 Drainage and Erosion Improvements	Infrastructure (channels, ditches, ponds, pipes, etc.)	$2,601,000
033000030	Lancaster/Foch Area Mitigation	Storm Drain Improvements	$11,771,000
033000031	Linwood Park Flood Mitigation (University Drive)	Storm Drain Improvements	$50,523,000
033000033	Sunnyvale Urban Flooding Reduction Improvements - Area 1	Infrastructure (channels, ditches, ponds, pipes, etc.)	$4,560,000
033000036	Sunnyvale Urban Flooding Reduction Improvements - Area 2	Infrastructure (channels, ditches, ponds, pipes, etc.)	$5,701,000
		Total	**$175,770,000**

Figure 5.5: Map of Recommended FMPs (TWDB Map 21)



5.5 Flood Management Strategies (FMSs)

5.5.1 Summary of Approach in Recommending FMSs

The approach for recommending FMSs adheres to similar requirements as the FMP process. However, 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. Supports at least one regional floodplain management and flood mitigation goal.
2. The primary purpose is mitigation. (Response and recovery projects are not eligible for inclusion in the Regional Flood Plan).
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-year LOS). However, if a 100-year LOS is not feasible, the RFGP may document the reasons for its infeasibility and still recommend an FMS with a lower LOS.

Although each potentially feasible FMS 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 no adverse impacts from flooding or to the water supply are anticipated.

In addition to the above requirements, some FMSs were not recommended if they were redundant with another recommended FMS or if their purpose was primarily related to stormwater quality. In some cases, multiple FMSs were combined into a single FMS for recommendation. These merged FMSs included the development of county-wide educational programs and updates to land use planning and zoning regulations.

5.5.2 Description and Summary of Recommended FMSs

A wide variety of FMS types were identified and evaluated for Region 3. A total of 143 potentially feasible FMSs were considered by the RFPG and 136 were recommended for inclusion in the Regional Flood Plan. Generally, these FMSs recommend city-wide and county-wide strategies and initiatives that represent a combined total cost of approximately $747 million. Some projects did not meet FMP requirements and therefore were listed individually as FMEs or collectively as city-wide FMSs to capture the anticipated construction costs. These FMSs support several of the regional floodplain management and flood mitigation goals established in Chapter 3.

The number and types of projects recommended by the RFPG are summarized in **Table 5.4**. The full list of FMSs and supporting technical data, including their flood risk reduction benefits as applicable, is included in **Table 17** in **Appendix 5.1**. A map of recommended FMSs is presented as **Figure 5.6**. Color gradations in **Figure 5.6** reflect the number of FMSs that overlap for the same area, the darker the color, the greater the number of FMSs. A one-page report summary for each recommended FMS is included in **Appendix 5.2**.

Table 5.4: Summary of Recommended FMSs

FMS Type	FMS Description	# of Potential FMSs Identified	# of FMSs Recommended	Total Cost of Recommended FMSs
Education and Outreach	Turn Around, Don't Drown Campaigns; NFIP Education; Flood Education; Dam Safety Education; Floodplain Regulatory Awareness	22	19	$975,000
Flood Measurement and Warning	Flood Warning Systems; Rain/Stream Gauges and Weather Stations; Low Water Crossings	20	20	$5,300,000
Infrastructure Projects	Hazardous Roadway Overtopping Mitigation Program; Citywide Drainage Improvements; Flood-Proofing facilities	5	5	$430,000,00
Other	Debris Clearing Maintenance; Channel Maintenance and Erosion Control; Dam Inspections; Levee Inspections; City Parks; Green Infrastructure; Open Space Programs	13	12	$8,525,000
Property Acquisition and Structural Elevation	Acquire High Risk and Repetitive Loss Properties; Acquire and Preserve Open Spaces; Flood-Proofing Facilities	28	28	$295,500,000
Regulatory and Guidance	City Floodplain Ordinance Creation/Updates; Zoning Regulations; Land Use Programs; Open Space Regulations	55	52	$6,600,000
	Total	**143**	**136**	**$746,900,000**

Figure 5.6: Map of Recommended FMSs (no TWDB Map #)