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CHAPTER 4. ASSESSMENT AND IDENTIFICATION OF FLOOD MITIGATION NEEDS

The San Jacinto Regional Flood Planning Group (RFPG) was tasked with assessing and identifying flood mitigation needs in order to evaluate and initiate flood risk reduction solutions for Task 5 recommendations. Chapter 4 aims to translate the flood risk analyses and floodplain management practice evaluations performed in Chapters 2 and 3 into actionable flood risk reduction solutions. This chapter summarizes the effort performed by the RFPG to identify and evaluate Flood Management Evaluations (FMEs), Flood Mitigation Projects (FMPs), and Flood Management Strategies (FMSs) within the region (Task 4A) and perform a prioritized subset of the previously identified FMEs to develop additional potentially feasible FMPs (Task 4C). Task 4B encompassed the interim Technical Memorandum as a deliverable.

Chapter 4.A. Identification and Evaluation of Potential Flood Management Evaluations and Potentially Feasible Flood Management Strategies and Flood Mitigation Projects

This section describes the effort adopted by the San Jacinto RFPG to conduct the identification and evaluation of potential flood risk reduction solutions. Flood risk reduction solutions can be categorized into three classifications, including FMEs, FMSs, and FMPs. An FME is a study of a specific, flood-prone area to assess flood risk and determine potential mitigation projects. In contrast, FMPs and FMSs are proposed projects or plans to reduce flood hazard to life or property. FMPs are flood risk reduction projects with non-zero capital costs or other non-recurring costs. FMSs are flood risk reduction plans that do not classify as an FME or FMP, such as general public awareness initiatives or property acquisition program development.

4.A.1. Process to Identify Potential Flood Management Evaluations (FMEs), Flood Management Strategies (FMSs), and Flood Mitigation Projects (FMPs)

The first step in identifying potential FMEs, FMSs, and FMPs (FMXs) began with conducting research on stakeholder input and publicly available data. The list of potentially feasible FMXs is based on contributions from the RFPG, stakeholder outreach, and from sources such as:

- Previous flood studies
- Master drainage plans
- Capital Improvement Plans (CIPs)
- Hazard Mitigation Plans (HMPs)
- Bond programs
- Community Development Block Grant Mitigation Program (CDBG-MIT) Applications
- Building Resilient Infrastructure and Communities (BRIC) Applications

- Other references as applicable.

The Flood Mitigation Needs Analysis documented in Chapter 3 was used to supplement the actions identified in the public information research. Potential FMEs were added based on the outcome of the evaluation performed in Task 3B. Generally, Task 3B guided the evaluation of potential actions by highlighting:

- The areas with the greatest gaps in flood risk knowledge that should be considered for potential FMEs, and
- The areas of greatest known flood risk and flood mitigation needs that should be considered for implementation of potentially feasible FMSs and FMPs.

Two new tasks this second cycle were also performed to identify FMPs, Tasks 4C and 5B, which are detailed further in Chapter 4.C. and 5. Task 4C was focused on the performance of flood management evaluations by the RFPG to recommend new FMPs. Task 5B was focused on recommending a list of FMEs for small and rural communities to be performed by the TWDB and identify feasible FMPs to recommend before the Draft Regional Flood Plan deliverable.

4.A.2. Evaluation of Potentially Feasible FMEs, FMSs, and FMPs

After conducting the review and intake of FMXs, 150 potential actions were identified from publicly available data and coordination with stakeholders. The breakdown of new actions included 81 FMEs, 49 FMPs, and 20 FMSs. The final total of the first cycle FMXs, per the April 2025 second amendment, was 717 potential FMXs. The breakdown of these FMXs included 529 FMEs, 111 FMPs, and 77 FMSs.

In general, actions identified that were not related to flooding or flood risk were omitted from further consideration in the assessment. For instance, actions that lacked direct flood risk reduction but bore some relation to flooding, storms or hazard preparedness were classified as infeasible. Most examples of actions considered infeasible were those that were solely for maintenance, environmental features, or which would provide no known flood risk reduction benefit. Additionally, if an action was classified as low priority by the source, it was not considered for further evaluation. This allows resources to be focused on the highest priority actions.

The secondary criterion for evaluating the feasibility of an identified FMS or FMP was whether the action had an undefined scope or was lacking in sufficient detail. The level of detail required to be considered feasible was defined by *Technical Guidelines for Regional Flood Planning (Exhibit C)* and **Table 4-1**. Note that during the September 2026 RFPG meeting, the decision was made to remove the Benefit Cost Analysis (BCA) requirement from the FMP category due to it being removed from the Flood Infrastructure Fund submittal requirements. Sponsors were allowed to submit a BCR of zero as a placeholder value for the FMP.

TABLE 4-1: DATA REQUIRED FOR FMX SUBMISSIONS

Data	FME	FMS	FMP
Description	Yes	Yes	Yes

Data	FME	FMS	FMP
Type	Yes	Yes	Yes
Cost	Yes	Yes	Yes
Structures/Population at Risk	Yes	Yes	Yes
Structures to be Removed/Reduced from Risk		Yes	Yes
Historical Injuries/Fatalities/Damages to Property		Yes	Yes
Pre/Post Project Level of Service			Yes
SVI/TX F-SVI			Yes
Negative Impact Determination		Yes	Yes
Water Supply Impacts		Yes	Yes
Nature Based Solutions %			Yes

The third criterion for evaluating the feasibility of an identified action involved considering whether the size of the proposed action was appropriate for inclusion in the RFP. Actions with a contributing drainage area less than or equal to one square mile were generally considered infeasible at this time in accordance with *Exhibit C*. However, a small number of actions were included with a drainage area less than one square mile if they were submitted directly by a sponsor for consideration. Sometimes extreme event overflows, which are not considered in drainage area delineations, can govern flood risk in these smaller areas. Elevated tailwater conditions in receiving streams of large drainage areas can also be an important flood risk factor for smaller areas.

The fourth criterion involved keeping only the actions whose documented funding source is the TWDB or remains unidentified. Therefore, actions with already identified funding sources such as local programs, FEMA, or others, were excluded.

As a part of Task 4A, the San Jacinto RFPG solicited flood risk reduction solutions from entities within the region. After reaching out to the entities within the San Jacinto Region, 14 entities responded as potential sponsors for new FMXs to be submitted for the second cycle of the San Jacinto RFP, shown in **Table 4-2**.

TABLE 4-2: FMX SUBMISSIONS DIRECTLY FROM SPONSORS

Sponsor	FME	FMP	FMS
Brazoria County		1	

Sponsor	FME	FMP	FMS
City of Dickinson	9		
City of Friendswood	15		
City of Galveston		18	
City of Houston		5	
City of Huntsville	7		
City of Jersey Village	1	1	
Coastal Prairie Conservancy		4	
Galveston County Consolidated Drainage District (GCCDD)	4		2
Harris County Flood Control District		11	
Liberty County Water Control & Improvement District 1	1		
Montgomery County Precinct 1	1		
Pine Village PUD		1	
San Jacinto River Authority	1		

4.A.3. Classification of Potential FMEs and Potentially Feasible FMSs and FMPs

Once potential flood risk reduction actions were identified, initial classification was completed to sort actions into an appropriate category. The *Scope of Work* and *Exhibit C* require FMSs and FMPs to be developed at a sufficient level of detail (No Negative Impact, quantitative reporting of estimated benefits, detailed hydrologic and hydraulic modeling, etc.) to be included in the RFP. Generally, FMEs were identified for remaining areas with potential flood risk and exposure that did not have a corresponding flood risk reduction action or for FMSs and FMPs that did not meet inclusion requirements. The classification process shown below in **Figure 4-1** was developed based on the requirements in the *Scope of Work* and *Exhibit C* and was discussed by the Technical Committee and approved by the RFPG at the meeting held in September 2026. As additional data are collected from regional stakeholders and through efforts made possible by the additional funding allocation, classifications may be subject to change.

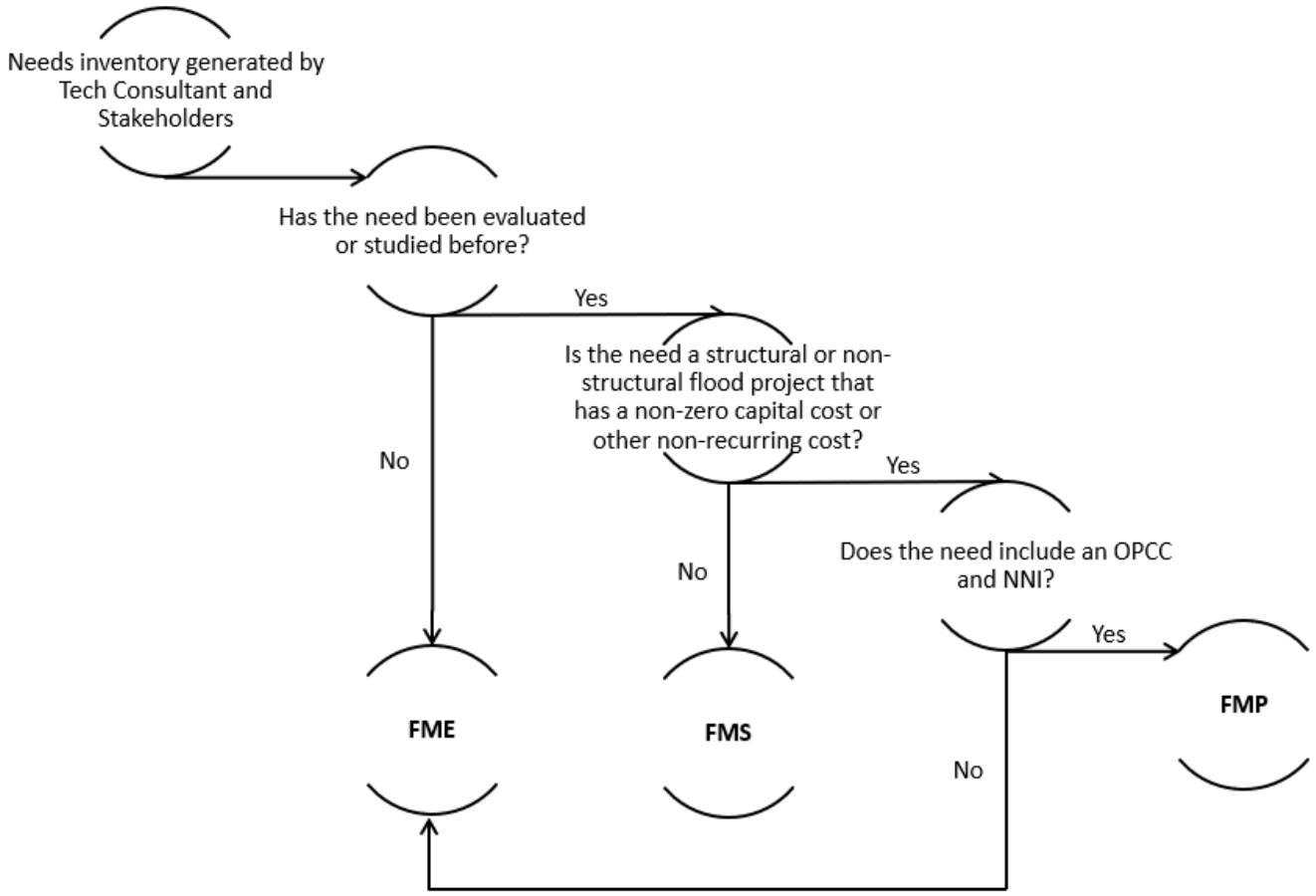


FIGURE 4-1: FLOOD RISK REDUCTION ACTION CLASSIFICATION PROCESS

4.A.4. Identification of FMEs and FMSs

All identified FMEs and FMSs meet the baseline inclusion requirements outlined in *Exhibit C*. However, some actions meeting these requirements were not included in the plan due to the criteria listed below:

- Action does not align with the flood mitigation goal(s) adopted by the San Jacinto region and/or the guidelines and principles set forth by the state.
- Action duplicates the benefits of other included or recommended action(s).
- Action cannot obtain a Memorandum of Understanding or other form of concurrence from entities with oversight, stakeholders, or entities with the potential for adverse impact.
- Public input regarding the action demonstrates a need for further evaluation or consensus building with regional stakeholders.
- Action does not receive a simple majority vote from a quorum of the RFPG members.

4.A.4.a. FME Types

The FME category includes evaluations such as hydrologic and hydraulic (H&H) modeling, flood mapping, feasibility studies, alternative analyses to assess flood risk and define potential FMPs or FMSs. The majority of identified FMEs were based on input from sponsors on future studies or evaluations needed to develop more accurate flood risk information to inform future project identification and prioritization.

Other FMEs were identified based on the findings of Task 3B, which involved a high-level assessment of the San Jacinto region based on multiple risk factors with the goal of identifying areas with the greatest gaps in flood risk information and areas of greatest known flood risk and mitigation needs. 9 FMEs were identified through this effort.

The RFPG identified 610 FMEs for the San Jacinto region which are summarized by type in **Table 4-3**. Identified FMEs are shown on **Map 17** in **Appendix 4-1** and listed in **Table 12** in **Appendix 4-4**.

TABLE 4-3: FME TYPES AND GENERAL DESCRIPTION

FME Sub-Type	Description	Total FMEs Identified
Watershed Planning - Flood Mapping Updates	An assessment of a watershed with the intent to develop better flood risk information which can include both regulatory and non-regulatory flood risk mapping.	195
Watershed Planning - Regional Watershed Studies		
Watershed Planning - Hydrologic and Hydraulic Modeling		
Engineering Project Planning - Feasibility Assessment	Develop flood mitigation project alternatives for a discrete high flood risk area, estimate construction costs for alternatives, and determine flood reduction benefit for alternatives. Evaluation may require creation of H&H modeling.	411
Engineering Project Planning - Preliminary Engineering	Further evaluate an identified potential FMP to refine and validate constructions costs and flood reduction benefits. Evaluation may require the creation or updating of H&H modeling.	
Studies on Flood Preparedness	Analysis to determine community risk and enhance preparedness in event of infrastructure failure or severe flooding event.	1
Other	Other flood management evaluations that do not fit into one of the above categories.	3
	Total	**610**

4.A.4.b. FMEs Selected for Evaluation

A subset of the FMEs identified above in **Table 4-3** was selected for further evaluation under Task 4C of this planning cycle. The goal of these evaluations was to study flood risk solutions and to develop the data required by *Exhibit C* for potential recommendation of additional FMPs in Task 5A.

Recognizing that not all identified FMEs could be evaluated, the RFPG developed a prioritization process for targeted selection. Details and outcomes of the FME evaluations are included in **Chapter 4.C**.

4.A.4.c. FMS Types

The FMS category includes a wide range of flood mitigation and floodplain management efforts that do not classify as projects or evaluations. Identified strategies included flood awareness, public education, flood warning system improvements, property acquisition, regulatory guidance, and hardening/maintenance of infrastructure. The majority of FMSs include public education and outreach as well as property acquisition and structural elevation. The RFPG identified 97 FMSs for the San Jacinto region, which are summarized by type in **Table 4-4**. Potential FMSs are shown on **Map 19**, **Appendix 4-3** and summarized in **Table 14**, **Appendix 4-6**.

TABLE 4-4: FMS TYPES AND GENERAL DESCRIPTION

FMS Type	Description	Total FMSs Identified
Education and Outreach	Programs or initiatives that aim to educate the public on the hazards and risks of flooding.	17
Flood Measurement and Warning	Installation of or improvements to rain or stream gauges to monitor water levels and have real-time feedback during flood events.	9
Infrastructure Projects	Critical maintenance and improvements to existing drainage systems throughout a community.	10
Property Acquisition and Structural Elevation	Buyouts or elevation of structures with high flood risk or historical flooding impact as well as land preservation and restoration programs.	26
Regulatory and Guidance	Updates or creation of new ordinances, development codes, design standards, or other floodplain management regulations to minimize future flood risk or reduce current flood risk.	22
Other	Other flood management strategies that do not fit into the one of the above categories.	13
	Total	**97**

4.A.5. Identification of FMPs

The FMP category includes types of flood risk mitigation projects designed to address specific known flood risk needs. An FMP is a proposed project, either structural or non-structural, that has non-zero capital costs or other non-recurring costs and, when implemented, will reduce flood risk and mitigate flood hazards to life or property. To be considered a potentially feasible FMP, a project had to fulfill the

requirements specified by the Technical Guidelines. The key requirements for FMP classification are summarized below:

1. Estimated Construction Cost in September 2025 Dollars,
2. Hydrologic and Hydraulic Models,
3. Pre and Post Project Floodplain Extents, and
4. No Negative Impact Certification.

4.A.5.a. FMEs Recategorized to FMPs as part of Task 4C

As previously mentioned in Section 4.A.4.b, the RFPG prioritized a selection of FMEs for further evaluation to recategorize them as FMPs in the Flood Plan. As part of Task 4C, 9 FMEs were evaluated to develop necessary data to fulfill FMP status, described further in **Chapter 4.C**.

4.A.5.b. No Negative Impact (NNI)

All FMPs had to demonstrate that implementation will not negatively affect a neighboring area, based on data from H&H models.

Requirements for No Negative Impact determination were provided by *Exhibit C* and are summarized below:

1. A proposed project cannot increase flood risk to residential and commercial buildings and structures;
2. Stormwater does not increase inundation in areas beyond the public right-of-way, project property, or easement;
3. Stormwater does not increase inundation of storm drainage networks, channels, and roadways beyond design capacity;
4. Maximum increase of 1D water surface elevations (WSEs) must round to 0.0 feet (< 0.05ft) measured along the hydraulic cross-section;
5. Maximum increase of 2D WSEs must round to 0.3 feet (< 0.35ft) measured at each computational cell;
6. Maximum increase in hydrologic peak discharge must be < 0.5 percent measured at computational nodes (sub-basins, junctions, reaches, reservoirs, etc.). This discharge restriction does not apply to a 2D overland analysis.

The criteria listed above do not have any regulatory implications at a local, state, or federal level due to the approximate nature of flood planning.

For potential FMPs provided by stakeholders, signed and sealed reports were checked for certified statements that the associated project would not cause negative impacts upstream, downstream, or within the project area in events up to and including the 1% ACE, as well as for compliance with the NNI criteria set by the Technical Guidelines.

For FME evaluations performed in this cycle as part of Task 4C, NNI was assessed using the criteria above. Any FME that could not conform to the NNI criteria was not included in the plan.

Non-structural FMPs were determined to have no negative impact on neighboring areas by default. These projects do not propose physical changes to the floodplain and resulting flood hazard areas, which eliminates the potential for increases in 1% ACE discharges or WSEs.

In the San Jacinto region, non-structural FMPs focused on increasing public awareness work to mitigate flood risk by enabling individuals to make well-informed decisions during flood events. Additionally, non-structural FMPs, aimed at improving regulations and permit requirements, can strengthen resilience before disaster strikes. These types of projects can reduce flood risk over time by ensuring that all new construction and significant remodels are built according to modern best practices including ensuring no negative impacts.

4.A.5.c. Benefit-Cost Ratio for FMPs

A BCA quantifies the future benefits of a hazard mitigation project and compares them 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 RFP and it is recognized that industry-standard BCR methods mainly measure benefits to physical property often not adequately accounting for social and environmental benefits.

Requiring a BCR of greater than 1.0 can result in higher-property-value communities receiving a disproportionate share of mitigation infrastructure. Therefore, the RFPG can decide to recommend a project with a lower BCR and to compete for funding based on a set of other criteria to be established by the TWDB. For potential FMPs provided by stakeholders, the BCR previously calculated in an engineering report or study was utilized for the FMP assessment.

During the September 2026 RFPG meeting, the RFPG removed the BCA requirement for FMPs to align with updated Flood Infrastructure Fund submittal requirements. Sponsors were permitted to enter a BCR of zero as a placeholder for their FMPs.

4.A.5.d. FMP Types

For the San Jacinto region, 160 projects were identified by the RFPG and are summarized in **Table 4-5** based on the FMP type. These projects included regional detention facilities, channel improvement projects, coastal protection systems, and non-structural flood preparedness enhancements. Potential FMPs are shown on **Map 18**, **Appendix 4-2,** and summarized in **Table 13**, **Appendix 4-5**.

TABLE 4-5: FMP TYPES AND GENERAL DESCRIPTION

FMP Type		Description	Total FMPs Identified
Structural	Regional Detention	Detention ponds intended to mitigate flooding by reducing peak flow rates for multiple sites or large regions.	28
	Regional Channel Improvements	Channel improvements intended to mitigate flooding by lowering the water surface elevation for multiple sites or large regions.	12
	Coastal Protections	Projects intended to prevent coastal erosion and mitigate coastal storm surge risk such as flood gates, sea wall improvements, and ecosystem restoration.	2
	Infrastructure Improvements	Improvements to flood mitigation infrastructure including storm drain improvements and detention ponds intended to mitigate flooding in individual neighborhoods.	52
	Comprehensive Regional Improvements	A combination of individual flood risk reduction projects intended to work together to mitigate flood risk.	38
Non-Structural	Flood Preparedness	Projects intended to mitigate flood risk through improved flood management regulations and ordinances.	21
	Property Acquisition	Purchase of flood-prone or repetitive loss properties to permanently remove structures from risk of flooding.	5
	Property Elevation	Elevation of flood-prone or repetitive loss properties to permanently remove structures from risk of flooding.	1
	Other	Other flood mitigation projects that do not fit into one of the above categories.	1
		Total	**160**

4.A.6. Estimated Benefits of FMPs, FMSs, and FMEs

Benefits for FMPs, FMSs, and FMEs include quantifiable flood risk reduction; outreach to the communities regarding flood risk; and additional identification of flood risk within the region. These benefits directly correspond to accomplishing the regional flood planning goals outlined in **Chapter 3**. Examples of goals include expanding the understanding of flood risk in the San Jacinto region, Goal ID 06-20-0000000010, incorporating nature-based practices, Goal ID 06-20-0000000013, and reducing the number of structures subject to inundation during the 1% ACE storm, Goal ID 06-20-0000000015. Where feasible, benefits were tabulated using geospatial data provided by project sponsors and TWDB.

4.A.6.a. FMPs

Estimated benefits for FMPs were geospatially determined using provided hydrologic and hydraulic models or obtained from resultant model output or tabular summaries contained within source documentation. The existing and proposed condition floodplains for the 1% and 0.2% ACE floodplains were used to estimate the associated flood risk reduction for the project based on the following metrics:

- Reduction in floodplain area
- Reduction in structures flood risk
- Reduction in residential structures flood risk
- Reduction in residential population flood risk
- Reduction in critical facilities flood risk
- Reduction in Medical, EMS, Police, Fire, and School critical facilities flood risk
- Reduction in flooded low water crossings
- Reduction in acres of agricultural areas
- Reduction in length of road overtopped and road closures

Estimates in reduction in fatalities or injuries upon project completion were not evaluated due to limited documentation for these metrics. However, these values could be reviewed further and provided in future planning cycles.

4.A.6.b. FMSs

FMSs provide widespread benefit to the associated area by updating floodplain management regulations to increase community resilience, informing the public regarding flood risk reduction challenges and a holistic vision for solutions, and implementing regional infrastructure improvements. These benefits, while impactful, are often not quantified with supporting files like modeling due to the high-level nature of the strategies. Therefore, quantitative evaluation of the flood risk and flood risk reduction uniformly for all FMSs was not feasible and was instead performed just for FMPs.

4.A.6.c. FMEs

The FMEs provide a roadmap for further defining and implementing future projects and strategies that will lead to flood risk reduction throughout the region. FMEs range from high-level regional planning studies to detailed benefit cost analyses on specific projects. Benefits of completing the recommended FMEs include the development of more accurate flood risk maps for areas with limited or outdated information, the evaluation of flood risk reduction alternatives, and determination of additional information required to transition FMEs to FMPs.

4.A.7. Estimated Costs of FMPs, FMSs, and FMEs

Costs for FMPs, FMSs, and FMEs provide the RFPG guidance for implementation of the associated project, strategy or evaluation. The baseline value used for cost estimates is September 2025 dollars.

4.A.7.a. FMPs

Cost estimates for FMPs provided by stakeholders were obtained from the associated engineering report or plan documentation for the project. Costs were adjusted to account for inflation and other changes in price of labor and commodities that had taken place since the publication date of the information. FMP costs were converted to September 2025 dollars to provide a consistent baseline for comparison.

Recurring costs were also calculated for FMPs to account for monetary and maintenance costs associated with the project. Debt service is related to the cost required to pay for the interest expense of any potential loan. This may be required for projects locally funded that would require loans or interests. For most of the construction projects, operations and maintenance will be required to keep the project functioning as designed such as inspection, mowing, and clearing. The yearly operations and maintenance were assumed to be 1.0% of the total construction budget. This was based on an analysis of a sample project that determined that 1.0% was a conservative estimate for the FMPs.

4.A.7.b. FMSs

Most of the identified FMS cost estimates were obtained from the available Hazard Mitigation Plan for the entity. Strategies without associated costs were estimated based on professional experience on similar work.

4.A.7.c. FMEs

FME costs were obtained from available documentation or were calculated based on anticipated effort of the evaluation. Following TWDB guidance, the cost estimates included the following major components:

- Associated non-engineering studies, planning studies
- Engineering/technical/feasibility studies
- Surveying, geotechnical, testing

FME costs were determined based on key parameters including FME sub-type, study area size, and estimated project construction cost. If the associated documentation did not include study costs, FME cost was estimated based on the following approach:

- For Watershed Planning and Flood Preparedness FMEs, a cost-to-study area relationship was developed based on previous project experience completing similar types of projects. This relationship was used to estimate the potential study cost based on the area delineated for the study including the contributing watershed.
- Costs for Preliminary Engineering FMEs were estimated based on the scope and type of project being evaluated. These evaluations have been identified in previous modeling but require additional vetting through a preliminary engineering report. The study cost was estimated as a percentage of the project construction cost provided in supporting documentation. As with typical engineering costs, the percentage of the cost decreased as the overall project cost increased.

- Preliminary engineering evaluations that did not have an associated construction cost within source material were classified as Feasibility Assessments. Feasibility Assessment FME costs were estimated based on the study area using the cost-to-study area developed for the watershed planning studies.

The estimated costs associated with each FME depend on broad, high-level assumptions. The FME costs estimated as part of this plan are for high-level planning purposes only and should be evaluated further prior to implementation.

4.A.8. Additional Considerations for FMPs, FMEs, and FMSs

4.A.8.a. Emergency Need

The term "emergency need" was defined by the TWDB during the June 2025 Technical Conference Call, which was an update from the first cycle. The TWDB requested emergency need be defined by RPFG's using the following guidance:

- Medical, EMS, fire, police, and/or schools located in the flood hazard area,
- Imminent anticipated failure of infrastructure to alleviate immediate threat to life and property from flooding, or
- Single access to 20 or more residences

FMXs submitted to the RFPG were reviewed based on the listed criteria and details were included in the emergency description fields to elaborate on the categorization.

4.A.8.b. Funding Sources

There is a wide range of funding mechanisms available for the identified FMPs, FMSs, and FMEs including local, state, and federal sources. Different sources can be used for the individual projects based on grant and funding requirements and matched to stretch the available local funding for projects.

Local – Municipalities can establish a stormwater utility which can be used to generate revenue to provide for and maintain stormwater services. Stormwater utilities are typically used to fund local maintenance projects making this funding source suitable for FMPs, FMSs, and FMEs. Local communities also can issue bonds for developing and implementing flood related projects.

State – The TWDB provides financial assistance for a variety of flood related projects, evaluations, and studies including through the Flood Infrastructure Fund (FIF) and Clean Water State Revolving Fund (CWSRF). Historically, regional solutions have been given priority for the FIF. CWSRF is mostly oriented toward mitigation activities. Since both programs appropriate funding from planning level activities to construction, they are suitable mechanisms for FMEs, FMSs, and FMPs.

Federal – The FEMA Flood Mitigation Assistance (FMA) appropriates funds to applications from applicants with FEMA-approved HMAPs to support activities that mitigate severe repetitive loss. Additionally, the CDBG-MIT grant was created in 2018 to fund activities to reduce future losses in areas affected by qualifying disasters. Lastly, the FEMA BRIC program provides funding to applicants with

FEMA-approved HMPs for a broad range of activities. Since all these programs prioritize flood hazard reduction, each could be used for the identified FMPs, FMSs, and FMEs.

Further details on funding opportunities and the anticipated funding sources for the recommended actions are included in **Chapter 9**.

4.A.8.c. Residual Risk

While it is not possible to protect against all potential flood risks, the evaluation of FMPs considered 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. For more details regarding an approach for considering residual risks and TWDB's proposed scoring guidelines, please see the Technical Guidelines for RFP.

Flood risk is often reduced by the construction of flood mitigation structures but, as a result, may also be 'transformed' into a different type of risk, for example, in the form of risk from structural failure of that mitigation infrastructure, such as in the case of dams or levees.

Residual risks by nature have a low probability of occurrence. However, keeping them low requires continuing maintenance of FMPs and effective emergency services for preparedness, response, and recovery as a holistic approach.

In order to determine the residual risk of the FMPs, each project description was reviewed to determine what type of project it is, for instance, a detention/retention basin, channel or capacity improvements, public outreach, structural, codes/ordinances revision, etc. Residual risks were determined for each category. For example, several types of projects require maintenance/upkeep, and others do not reduce the risk of flooding for every storm event. Residual risks are listed for each FMP in **Appendix 4-5**.

4.A.8.d. Contributions to Water Supply

A review of all feasible FMPs and FMSs found that none would provide any contributions to water supply. For an action to be considered to have contribution to water supply, it must be measurable. While some FMPs and FMSs are likely to provide indirect water supply benefits through environmental features such as wet bottom detention, none of these actions would be measurable.

4.A.8.e. Other Benefits

Projects may have an additional benefit aside from flood mitigation. These other benefits include public uplift, public education, low impact development features, and environmental benefits. Each FMP and FMS was analyzed to determine if any other benefit was captured and could be included as a benefit.

Public uplift refers to the uplift of the amenities that many people of the public may use in their daily lives. For example, if a project includes the reconstruction of a bridge or sidewalk, then it would be placed into this category since there is improvement to something that is available and usable to the public. More examples would be improving a driveway from having to relocate a certain utility or the creation of a park that is also used as a detention basin. These kinds of improvements not only benefit by mitigating the flood risk but also bring an additional benefit of uplifting the community amenities.

Certain projects do not necessarily have a structural benefit to mitigate flood risk. These projects may pertain to the education of the public regarding flooding to mitigate their flood risk. These things include informing the public on what actions to take during a flood, places to avoid, and projects that are in the Study and Design stages. These measures are taken to ensure that in the event of a flood, the public has the information to guide them to safety.

Low Impact Development (LID) is a stormwater and land-use management strategy that provides features with a low impact on the environment. The LID strategies and techniques are used to manage stormwater in a sustainable and cost-effective manner.

A project may have an additional benefit such as an environmental benefit. An environmental benefit can include actions that help to restore the natural environment. This includes habitat restoration, preservation of ecosystems and wildlife, natural environment improvements, and creation of green spaces. For a project to have an environmental benefit, it should have aspects of the project that improve or restore the natural environment.

Chapter 4.B. Technical Memorandum

The first deliverable for the 2028 Regional Flood Plan, delivered to the TWDB on January 7, 2026, is the interim Technical Memorandum intended to demonstrate progress towards compiling the necessary technical information and analyses needed to develop the RFP and meet contract requirements. As an interim deliverable fully covered by Chapters 1 through 4 of this Plan, the memorandum is not included as an appendix item. The document was found administratively complete on January 9, 2026 by the TWDB and informal comments received have been incorporated into the Plan.

Chapter 4.C. Performance of Flood Management Evaluations

As previously mentioned in Section 4.A.4.b, the RFGP approved a prioritized selection of FMEs for futher evaluation to recategorize them as FMPs in the Flood Plan on November 13, 2025. As part of Task 4C, nine FMEs were evaluated to develop necessary data to fulfill FMP status, as shown in **Table 4-6**. Generally, H&H modeling was performed to assess No Negative Impact status and developed benefit cost analyses. However, in some instances the FMEs selected for evaluation in Task 4C only required a BCA or an assessment of No Negative Impact. **Appendix 4-7, Table 15** summarizes the FMEs performed, while documentation for these analyses with individual engineering reports developed for each FME evaluated is provided in **Appendix 4-8**.

TABLE 4-6: FMES RECATEGORIZED TO FMPS

Project Name	FME ID	New FMP ID
League City – Stormwater Drainage Improvement- Interurban & Newport ditch	06-51-0000000097	06-52-0000000564
Stormwater Drainage Improvement- Nottingham ditch	06-51-0000000115	06-52-0000000565
Downtown Cleveland Drainage Line Installation	06-51-0000000153	06-52-0000000573
D-133 Sharpstown	06-51-0000000484	06-52-0000000567
Green Acres Neighborhood Drainage Improvement Study	06-51-0000000500	06-52-0000000571

Project Name	FME ID	New FMP ID
Texas Avenue-Magnolia-MedicalCenterBlvd-Hwy3 Drainage Improvement Study	06-51-0000000554	06-52-0000000572
HCMUD 365 Cole Crossing Stormwater Detention and Water Quality Improvement Project	06-51-0000000555	06-52-0000000586
City of Manvel Chocolate Bayou Drainage Improvements	06-51-0000000695	06-52-0000000563
HCMUD 365 Cole Crossing South Jarvis Rd Detention Study	06-51-0000000696	06-52-0000000587

4.C.1. Prioritization and Performance of FMEs

The prioritization of FMEs to be elevated to FMPs under Task 4C utilized the previously developed approach under Task 12 of the first cycle of the San Jacinto RFP and refined this cycle with the Technical Committee. The approach scored FMEs based on the following attributes and ultimately prioritized studies based on sponsor interest and equitable distribution of funds across the region:

- Level of effort is less than $300k
- Model and data availability
- Known flood risk
- Number of entities benefited
- Critical facilities, structures, and population at risk
- Priority within subwatershed (HUC10)
- Social vulnerability index
- Length of inundated roadway

Hydrologic and hydraulic modeling for the FME evaluations was performed in alignment with general mapping and modeling guidelines in *Exhibit C*. The goal of the modeling effort was two-fold: to evaluate potential flood risk reduction solutions and assess compliance with the NNI criteria set forth by TWDB. Cost estimates were developed using September 2025 prices for the flood risk reduction action identified by the modeling for each FME evaluation. FME evaluations utilized the TWDB BCA Input Tool for consistency across all studies. Benefits centered on quantification of flood risk reduction benefits to structures. However, social benefits (such as recreation) and environmental benefits (such as Nature Based Solutions) were also included where applicable. Project implementation issues include different conflicts such as right-of-way, permitting, acquisitions, relocations, utility or transportation conflicts, environmental concerns, and other issues that could arise before an FMP can be fully constructed. These implementation issues are critical to identifying, documenting, and managing the feasibility of the projects while allowing for sufficient planning to manage these potential issues.