Chapter 5: Recommended Flood Mitigation Evaluations, Strategies, and Projects

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5. Evaluation and Recommendation of Flood Solutions

This chapter discusses the evaluation and recommendation of Flood Management Evaluations (FMEs), Flood Mitigation Projects (FMPs), and Flood Management Strategies (FMSs) by the Regional Flood Planning Group (RFPG). It describes the general process for evaluating these flood solutions, including the more detailed hydraulic analyses associated with specified FMSs and FMPs. Zoomed in Exhibit Maps are provided for individual flood solutions, and summarized evaluation results tables are presented for recommended flood solutions. The recommended FMEs, FMPs, and FMSs (also referred to as "Flood Solutions") presented in this chapter were discussed and refined with the RFPG throughout the regional flood planning process and were approved by the RFPG in a General RFPG meeting held July 20, 2022.

5.1 Evaluation Process for FMEs, FMPs, and FMSs

As each FME, FMP, or FMS was evaluated throughout the regional flood planning process, relevant issues, changes, and refinements were presented and discussed with the RFPG during General RFPG meetings, meetings for Subcommittee 2 (FMPs), and/or meetings for Subcommittee 3 (FMEs and FMSs). Any feedback provided from the RFPG, stakeholders, or the general public was discussed with the RFPG and/or applicable subcommittee members, and agreed upon changes were incorporated into the evaluations or the scope associated with each flood solution. As FMPs were considered for evaluation, if necessary hydraulic and hydrologic (H&H) modeling was not available, that information was shared with the RFPG, and those projects were evaluated as FMEs rather than FMPs.

Flood Solution evaluations which require additional explanation of methods and assumptions are discussed in this section. These methods and assumptions were applied to estimate specific required flood risk indicators identified in **Appendices 4A, 4C,** and **4E** of *Chapter 4, Identification of Flood Mitigation Needs and Solutions*, respectively. Zoomed-in boundaries of FMEs, FMPs, and FMSs are shown in individual mapbook figures associated with **Exhibit Maps 19, 20,** and **21**, respectively, in **Appendix 5G**. The blue index box label numbers shown in the Index Map of each Exhibit Map in **Appendix 5G** are based upon the last three digits of their respective FME, FMP, and FMS ID numbers, respectively. For example, in **Exhibit Map 21**, Recommended Flood Management Strategies, the index box labeled "24" on the Index Map represents the extent of the zoomed-in mapbook figure for FMS ID: 142000<u>24</u>. The associated mapbook figure is numbered Map 21 of<u>24</u> and shows the zoomed-in boundary for the strategy. Since there are a total of <u>22</u> FMSs recommended in the Regional Flood Plan (RFP), this mapbook figure is Map 21 of <u>22</u>.

Information associated with existing flood risk, scope of work (SOW), cultural resources background (FMPs only), and cost estimates for each FME, FMP, and FMS is provided in narratives included in **Appendices 4B, 4E,** and **4F** of *Chapter 4, Identification of Flood Mitigation Needs and Solutions*, respectively.

5.1.1 Cost Estimates and Potential Funding Sources

Scopes and cost estimates documented in the narratives for typical FMEs include tasks such as Data Collection, Engineering Analysis, Alternatives Development/Selection, Report/ Documentation, and Stakeholder Coordination. Some exceptions include FMEs which involve Supplemental Watershed Plans and Environmental Assessments for the development of alternatives for rehabilitation of dams (FME IDs: 141000012, 141000024, 141000025).

Typical additional costs for FMSs include construction costs or recurring costs, if applicable to the strategy. FMP cost estimates include capital cost breakdowns showing original construction costs estimated from associated SWMPs, converted to September 2020 dollars using the Construction Cost Index, land cost estimates converted to September 2020 dollars using the Consumer Price Index, and the following contingencies:

- 35% Construction Contingency;
- Final Design (20% of Total Construction Cost);
- Permitting (10% of Total Construction Cost); and
- Geotech (15% of Total Construction Costs).

The assumed construction contingency of 35% is consistent with assumptions applied to both the City of El Paso SWMP and the El Paso County SWMP, the primary sources of most of the FMPs evaluated. The additional cost percentages associated with final design, permitting, and geotechnical costs are also consistent with assumptions applied to new projects developed in the 2021 El Paso County SWMP.

A survey was sent to the identified sponsors of each FME, FMP, and FMS to: 1) request permission to include the entity as a sponsor in the RFP, 2) receive feedback on costs estimated and SOWs, and 3) query potential funding sources of each sponsor and possible match percentages. The results of the funding survey are incorporated in the "Potential Funding Sources and Amount" column of the evaluation tables shown in **Appendices 4A, 4C,** and **4E.** Additional results of the funding survey are summarized and discussed in greater detail in *Chapter 9, Flood Infrastructure Financing Analysis***.**

5.1.2 Model and Mapping Availability

Only FME evaluation tables require indication of whether floodplain mapping or H&H models, which could potentially be utilized for the FME, are already being developed, or if they are anticipated to be available in the near future. It can be seen in the FME evaluation table in **Appendix 4A** that most available or anticipated H&H models or flood mapping are extremely out of date for all FME areas outside of El Paso County. The reported dates do not consider the anticipated Texas Water Development Board (TWDB) and Federal Emergency Management Agency (FEMA) modeling and mapping effort to develop Base Level Engineering data covering all of Region 14 by 2023.

5.1.3 Emergency Need

As discussed in Chapter 4, flood solutions were identified to be an emergency need based on the following criteria:

- Flood solution is associated with emergency flood response activities, e.g., early warning systems; or
- Flood control infrastructure protecting a populated area has been identified as inadequate by authorities responsible for inspecting and regulating stormwater infrastructure, e.g., FMEs involving dam rehabilitation alternatives based on determination of the dam to be "hydraulically inadequate" by the Texas Commission of Environmental Quality (TCEQ) Dam Safety.

Evaluations resulted in emergency needs being identified for eight FMEs (all involve dam rehabilitations for hydraulically inadequate dams per TCEQ or low water crossings), seven FMSs (new stream gages and early warning systems), and one FMP (new stream gage and flood gates).

5.1.4 Evaluation Methodology without Project-Specific Models or Mapping

The evaluation tables in **Appendices 4A, 4C**, and **4E** of Chapter 4 have specific attributes that are common to all three types of flood solutions, and others that are specific to FMEs, FMSs, or FMPs. For example, all FMEs, FMSs, and FMPs include the following analyses:

1. A reference to the specific flood mitigation or floodplain management goal to be addressed;
2. A determination of whether it meets an emergency need;
3. An indication regarding the potential use of federal funds or other sources of funding as a component of the total funding mechanism;
4. A quantitative reporting of the estimated overall cost of the flood solution;
5. A quantitative reporting of the estimated existing 1% annual chance (AC) flood risk affecting the following estimated risk indicators:
    a. Number of structures (all building types, excluding sheds or uninhabitable structures);
    b. Number of residential structures;
    c. Population;
    d. Low water crossings;
    e. Critical facilities;
    f. Number of roads closures occurrences; and
    g. Acres of active farmland and ranchland.

General Methodology for Existing Risk without Project-Specific Data

For FMEs and FMSs without project-specific H&H models or mapping, evaluations of the parameters listed above were typically based on the RFP 1% annual chance flood risk boundaries intersected with enhanced spatial layers for buildings, agricultural land, and other infrastructure, including roadways, low water crossings, and critical facilities. The sources for the development of these spatial layers and the methods used to estimate flood risk region-wide are documented in *Chapter 2, Flood Risk Analyses*.

In some instances, if reliable depth data were available, existing flood risk estimates were based upon a more detailed analysis of estimating maximum depths greater than 0.5 ft associated with the building footprint of each intersecting structure. Only maximum depths greater than 0.5 ft were considered in these analyses to account for potential raised finished floor elevations.

Methods for Road Closures without Project-Specific Data

An exception is the "Estimated Number of Road Closures" required data field. Exhibit D of the Data Submittal Guidelines for the RFP states that the "Estimated Number of Road Closures" to be reported in evaluation tables is the "estimated number of road closure occurrences in the past 10 years." Since there is not an accessible database that was identified to retrieve this information for the large number of roadways in all areas affected by FMEs, FMSs, and FMPs, high level assumptions were applied. Where project-specific modeling or mapping data were not available and proposed benefits were not analyzed, the 10% AC risk inundation boundaries from the preliminary FEMA data set in El Paso and from the Fathom data set outside of El Paso were used to estimate the number of road segments intersecting the existing inundation boundaries. Roadway segments are defined as continuous lengths of road between intersections, or on highways, between exits.

Methods for Low Water Crossings without Project-Specific Data

As discussed in *Chapter 2, Flood Risk Analyses*, a low water crossing spatial geodatabase layer was developed for the RFP based upon the TNRIS statewide low water crossing database as well as data sets from existing studies identified in Region 14 during the flood planning process. Low water crossings were assumed to be crossings inundated by flood events more frequent (lower intensity) than the 10% AC flood. This low water crossing data set was utilized to estimate the number of low water crossings intersecting the existing 1% AC flood risk boundary developed for the RFP.

5.1.5 Evaluation Methodology for Project-Specific FMSs and FMPs

For FMSs and FMPs that have project-specific H&H models or mapping data available, those data were utilized to estimate the existing flood risk as well as flood risk reductions associated with the indicators listed in 5-a through 5-g from Section 5.1.4. In addition, the FMS and FMP evaluation tables both include the following information which is not in the FME evaluation table:

1. Number of structures removed from the 0.2% AC flood risk;
2. Cost per structure removed;
3. Nature-based solutions;
4. Negative impacts;
5. Negative impact mitigation; and
6. Water supply benefits.

While the presence of nature-based solutions is only required to be reported as “Yes” or “No” for each FMS, FMPs require a calculated percentage of the total project cost for those components of the project. There were four FMSs identified as having nature-based solutions, and one FMS identified to have a water supply benefit. There were no FMPs identified as having nature-based solutions or water supply benefits.

Methods for Structures at Risk with Project-Specific Data

The methods and assumptions related to flood risks and benefits varied depending on the project type and available modeling/mapping data for each project-specific FMS or FMP. However, in general, when proposed condition hydraulic model outputs or mapping were available, water surface elevations and ground elevations were used to estimate flood risk within El Paso County, and Fathom depth data were used for project-specific FMSs or FMPs located outside of El Paso County. Finished floor elevations were assumed to be 0.5 ft above ground elevations intersecting the footprint of a building. Where depth data were utilized to estimate 1% AC flood risk, raised finished floor elevations were considered by subtracting 0.5 ft from the maximum flood depth intersecting a building footprint. Within El Paso County, finished floor elevations of buildings were estimated by adding 0.5 ft to the average ground elevation within a building footprint.

Ground elevations were estimated from the digital terrain surface utilized in the 2019 Preliminary FEMA hydraulic models developed for El Paso County. The topographic sources of this terrain mosaic vary spatially, but primarily consist of Rio Grande QL2 LiDAR data within El Paso city limits, collected in the Fall of 2014. The different sources of the terrain mosaic are documented in the Hydraulic Report for the Preliminary FEMA study (Study ID 21, from **Appendix Table 1D** of *Chapter 1, Introduction and Description of the Upper Rio Grande Flood Planning Region*). A figure of the topographic data sources from Study ID 21 is shown below for reference.

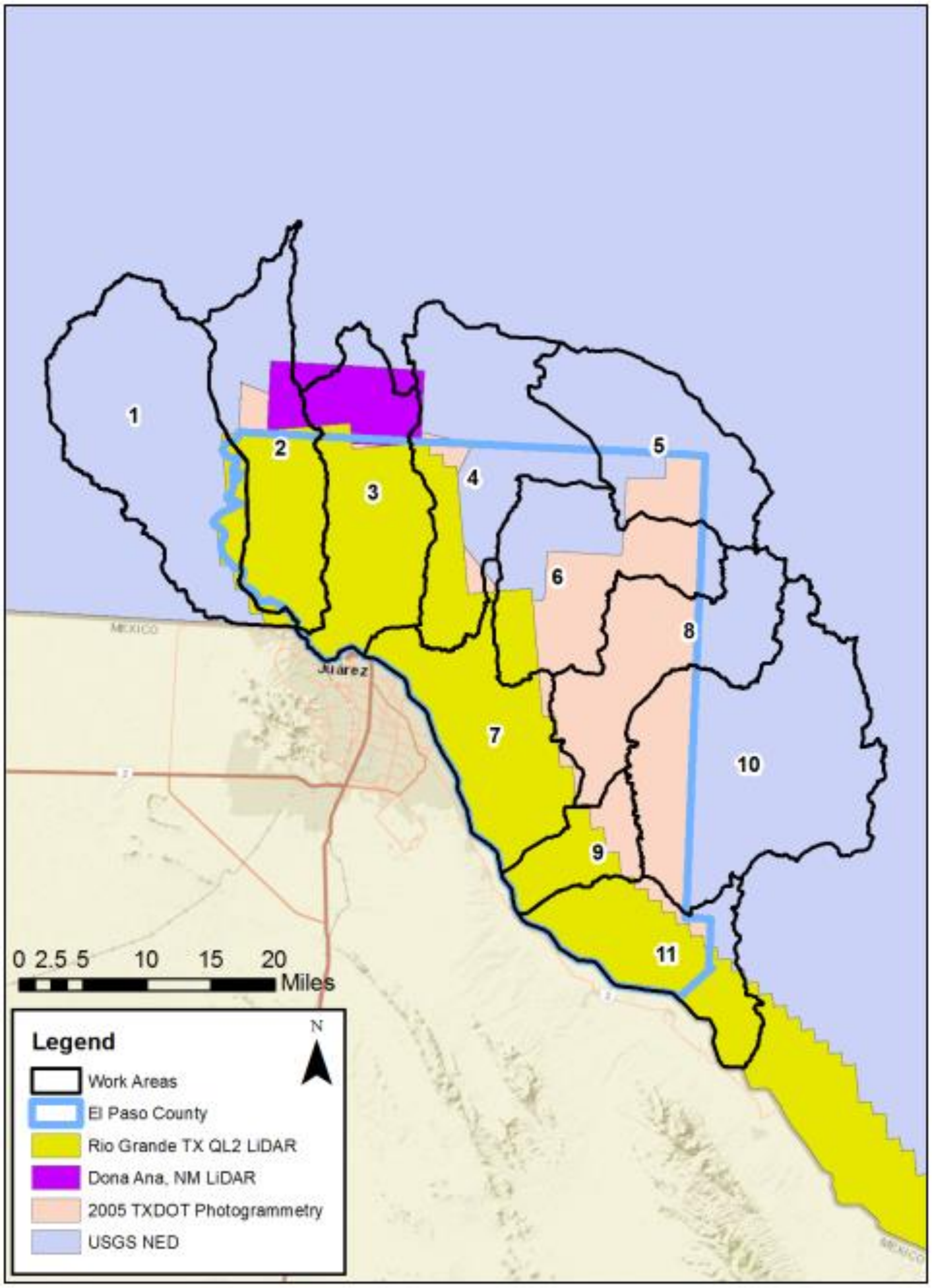

Figure 5.1 Sources of Preliminary FEMA Hydraulic Modeling Terrain (from Study ID 21)

Methods for Structures Removed from 0.2% AC Flood with Project-Specific Data

While all FMPs specified as having 1% AC post-project level-of-service in **Appendix Table 4C** were capable of containing the 1% AC flood based on hydrologic modeling of the upstream watershed, the exact configurations of outfall pipes and auxiliary spillways of detention structures was not modeled at this planning level; so there is uncertainty as to the downstream discharge associated with the 0.2% AC flood event. To be conservative, FMPs and FMSs associated with roadway drainage, storm drain, or channel improvement infrastructure projects were assumed not to have any structures removed from the 0.2% AC flood risk.

However, for FMPs involving detention/retention structures, maximum storage capacities associated with original construction costs were compared to total inflow volumes of the 0.2% AC flood to estimate potential downstream discharges for that event. Diversions were set up in each applicable FMP proposed condition hydrologic models to divert all upstream runoff from the 0.2% AC event into a sink until the total inflow volume reached the capacity of each detention/retention structure. All excess runoff beyond the reported capacity of each structure was discharged downstream. The resulting discharge hydrograph was applied to the corresponding post-project 2D hydraulic model immediately downstream of each proposed structure.

Pre- and post- project water surface elevations were compared at downstream structures at risk to measure reductions in 0.2% AC flood risk. This approach assumed no outflow through a principal or auxiliary spillway. This is a conservative assumption, since outflow from principal and/or auxiliary spillways would likely limit the releases from the 0.2% AC flood.

Methods for Road Closures with Project-Specific Data

In locations where pre- and post-project modeling and mapping data were available for the 1% AC event, roadway closures were estimated based on a scaling factor applied to the 1% AC flood depths on inundated roadways. The scaling ratio was obtained by dividing the 1% AC, 24-hour duration rainfall depth by the 10% AC 24-hour rainfall depth. If the reduced maximum depth on each road segment after applying the scaling factor was less than 0.5 ft, a road closure was assumed for that road segment.

Methods for Low Water Crossings with Project-Specific Data

In locations where pre- and post-project modeling and mapping data are available for the 1% AC event, the number of low water crossings at risk in pre-project and post-project conditions was based upon whether the low water crossing point layer, described in *Chapter 2*, intersected the pre- and post-project 1% AC floodplains.

Methods for Evaluating Water Supply Benefits and Impacts

To report an FMP or FMS as having a water supply benefit, it must be included as a recommended strategy in the most recently adopted State Water Plan with all relevant evaluations relating to Identification and Evaluation of Potentially Feasible Water Management Strategies and Water Management Strategy Projects (as required under §357.34[e]). In addition, FMSs or FMPs that contribute to water supply may not result in an overallocation of a water source based on the water availability allocations in the most recently adopted State Water Plan. Only one potentially feasible FMS meets these criteria (FMS ID: 142000002, Irrigation and Recharge Application of Captured Rainwater Runoff at Alpine). This FMS is recommended in the most recently adopted State Water Plan (TWDB, 2022) as well as in the current Far West Texas Water Plan (TWDB, 2021) for Region E, where it is identified as Strategy E-2, “Irrigation and Recharge Application of Captured Rainwater Runoff.” Details related to the water supply benefits of this strategy and its evaluation methods are provided in *Chapter 6, Impacts and Contribution of Regional Flood Plan.*

While FMS ID: 142000002 is the only water supply project evaluated in the RFP, two other recommended water supply projects from the most recently adopted State Water Plan and Region E Water Plan were identified as having flood benefits in the initial data collection phase of the RFP. These strategies are:

- Strategy E-14, EPW - Hueco Bolson Artificial Recharge; and
- Strategy E-18, El Paso County - EPCWID1 - Regulating Riverside Reservoir.

Based on the FMP selection and prioritization process for identifying potentially feasible FMPs, described in *Chapter 4, Identification of Flood Mitigation Needs and Solutions*, the above strategies were presented to the RFPG and included in the FMP scoring/ranking process. Due to limited budget and time available for FMP and FMS evaluations, and because other potentially feasible FMPs were anticipated to have more significant expected flood benefits, the RFPG chose not to evaluate these two strategies.

Methods for Evaluating Negative Impacts with Project-Specific Data

FMSs and FMPs are required to demonstrate that they will not negatively affect a neighboring area. While this criterion did not require analyses to demonstrate for non-structural FMPs or FMSs such as FMP ID: 143000007 (stream gage and flood gates in Marfa) or FMP ID: 143000009 (Hudspeth County floodplain ordinance), the documentation of engineering analyses and/or assumptions is required for FMSs or FMPs involving proposed flood control infrastructure.

The methods for demonstrating no negative impact varied for each FMS or FMP involving flood infrastructure projects. To document the methods and assumptions associated with the negative impact analysis, it is necessary to explain the source and type of H&H models used in the flood risk analysis for existing and proposed conditions. This level of explanation is provided for project-specific FMSs in **Appendix 5A**, and for project-specific FMPs in **Appendix 5B**. These appendices provide an overview of modeling methods and assumptions for specific FMSs and FMPs, respectively, as well as documentation explaining why none of the proposed FMSs or FMPs are anticipated to have a negative impact on neighboring areas. In addition, **Appendix Table 5D** ("Flood Mitigation Projects Recommended by RFPG") includes a column entitled, "How No Negative Impact was Determined," which specifies the method and/or models used to assess pre-project vs. post-project conditions to confirm that no negative impacts are anticipated on neighboring areas to FMPs.

Since no negative impacts are anticipated, there are no negative impact mitigations recommended to address potential negative impacts of FMSs or FMPs. **Appendix 5H** includes a table of building IDs which were analyzed for FMPs which have project-specific models and floodplain mapping for existing and proposed conditions. These tables demonstrate no negative impacts of depths at buildings for the proposed 1% annual chance event relative to existing conditions. In addition, the spatial data (GIS building polygons) associated with the data table in **Appendix 5H** is provided in the "FPR14_Supplemental" geodatabase for the Region 14 RFP, named "Appendix_5H_FMP_Flooded_Structures.gdb"

H&H Modeling and Mapping Methods for FMSs

Evaluations of all potential FMEs and most potentially feasible FMSs were performed at a reconnaissance or screening-level, unsupported by associated detailed H&H analyses. The exceptions were the following three FMSs, which had specified hydrologic, hydraulic, and/or mapping information available that could be used to estimate proposed FMS benefits:

- FMS ID: 142000001, FEMA Levee Accreditation for All Rio Grande Levees at El Paso (see **Exhibit Map 21.01**);
- FMS ID: 142000004, Coordination with Ft. Bliss for FMP Permitting and Maintenance Access (see **Exhibit Map 21.04**); and
- FMS ID: 142000008, Develop Certification Package for Cibolo Creek Channel and Levee (see **Exhibit Map 21.08**).

Individual mapbook figures displaying zoomed-in project locations and existing downstream flood risk areas are provided as part of **Exhibit Map 21** (see specified mapbook figure numbers listed above for each FMS). In addition, **Exhibit Map 22** shows a region-wide map of H&H model coverage extents, with coverage areas displayed according to Model IDs. Each Model ID coverage area also has an individual mapbook figure (44 total).

Each of these three FMSs were analyzed to estimate potential flood benefits as well as demonstrate no negative impacts on neighboring areas. Methods and assumptions related to these evaluations are discussed for each FMS in the **Appendix 5A**, along with documentation of the process used to estimate that each project-specific FMS noted above will have no negative impact on neighboring areas. The remaining FMSs are not estimated to have a direct effect on 1% AC flooding; therefore, no flood benefits or impacts are anticipated or reported.

H&H Modeling and Mapping Methods for FMPs

Appendix 5B explains sources of H&H models, mapping, and other information utilized to estimate pre-project and post-project benefits for specific FMPs evaluated in the RFP. Each project-specific FMP was analyzed to estimate potential flood benefits as well as demonstrate no negative impacts on neighboring areas. Individual mapbook figures displaying zoomed-in project locations and existing downstream flood risk areas are provided as part of **Exhibit Map 20** (with specified mapbook figure numbers corresponding to the last three digits of each FMP ID). In addition, **Exhibit Map 22** shows a region-wide index map of H&H model coverage extents, with coverage areas displayed according to Model IDs. Each Model ID coverage area also has an individual mapbook figure (44 total). **Appendix 5B** also documents the Benefit Cost Analysis (BCA) and the process used to estimate that each FMP will have no negative impact on neighboring areas.

5.1.6 Evaluations Applicable to FMPs Only

For applicable FMPs involving infrastructure projects, evaluation data fields unique to just FMPs include the following estimates:

- Reductions in injuries or fatalities (if available);
- Pre- and Post- Project Levels of Service;
- Social Vulnerability Index; and
- Benefit Cost Ratio (BCR).

This section describes methods associated with evaluating each of the risk indicators above.

Methods for Reductions in Injuries or Fatalities

Since this is the first cycle of the RFP, these attributes were not required. However, one of the potentially feasible FMPs evaluated affects public safety at a low water crossing where a flood-related death occurred in Marfa in 2021. The low water crossings and flood gage project in Marfa (FMP ID: 143000007) includes installing a stream gage upstream of Marfa to aid in providing early warning. It also includes installing road closure gates at four low water crossings in Marfa. The flood-related death occurred on June 27-28, 2021, at one of the low water crossings considered in the FMP. The location where a driver was swept away in his vehicle is the low water crossing of Alamito Creek near the intersection of Neville Street and Dallas Street. For this reason, FMP ID: 143000007 is anticipated to have one reduction in fatalities due to the FMP.

Pre- and Post- Project Levels of Service

Each potentially feasible FMP involving flood protection infrastructure was evaluated using H&H modeling and mapping, as described in **Appendix 5B**. The information available to estimate pre-project levels of service depended on the flood events modeled previously in the original studies where projects were initially conceived. In most cases, only 1% AC flood events were previously modeled for pre-project conditions, and those conditions involved flood damages to property. Therefore, in most cases, the minimum event known to cause flood damages is the 1% annual chance storm, and the pre-project level of service is reported as “<1% annual chance”. If previous studies documented the pre-project levels of services for higher frequency events than the 1% annual chance, and provided the associated models for those evaluations, a pre-project level of service is identified in **Appendix 4C** according to the highest frequency (lowest intensity) flood event known to incur damages on public property.

Since the 1% and 0.2% AC events were modeled for all proposed FMPs associated with stormwater detention/retention structures, the post-project level of service could be documented for each of those projects. All projects which were reported to be designed for the 1% annual chance event in previous studies were documented as providing a 1% annual chance level of service. This required engineering judgment in some cases where a detention structure is proposed to include a principal spillway outfall, which would allow outflow during an event. Since the exact principal spillway elevations and configurations were not provided, the previously reported capacity for the detention/retention structure was compared to the total inflow volume for 1% annual chance event with no outflow assumed. In cases where the total inflow exceeded the structure’s reported capacity with no outflow, engineering judgment was applied to estimate whether the proposed principal spillway described in the previous study would allow for sufficient discharge from the structure, such that the 1% annual chance capacity would not be exceeded in a flood event.

Estimating the level of service for the 0.2% annual chance required different assumptions, since the elevation and dimensions of an auxiliary spillway outfall can have a significant effect on water surface elevations and outflows of a detention/retention structures. Since the precise outflow configurations were not reported or modeled in previous studies for all projects, only the FMPs with model results showing they could contain the entire 0.2% AC flood with no outflow were reported to have a 0.2% AC post-project level of service.

Social Vulnerability Index

The buildings layer used to estimate number of structures at risk for the 1% AC event was attributed with data from the Social Vulnerability Index (SVI) and day/night population data documented in *Chapter 2* to report the corresponding SVI and population at risk data for each flood solution, respectively.

Benefit Cost Ratio

Consistent with TWDB guidelines, benefits associated with FMPs considered in the evaluation process are based upon pre-project and post-project water surface elevations relative to estimated finished floor elevations, assumed to be raised 0.5 ft above existing ground. The existing ground elevation for each building was estimated by calculating the average ground level within each building footprint, based upon the same topographic data used to estimate water surface elevations. Annual structural benefits were estimated for the 1% and 0.2% AC events by comparing the depth of water above each finished floor elevation to the residential and commercial building depth-structure damage curves and depth-content damage curves provided in the FEMA BCA toolkit 6.0 by TWDB.

Benefit Cost Analysis (BCA) methodology was adopted from the El Paso County SWMP 2021 methods with updates applied for the purposes of the RFP, including the use of the FEMA BCA toolkit 6.0 depth-damage and depth-content curves. Each detention/retention basin project expected to have significant undeveloped flow contributing to it was assumed to have annual operation and maintenance (O&M) costs of $10,000 associated with sediment clearing.

The sum of the annual structural and agricultural benefits was divided by the annualized project cost with a discount rate of 2.75% and a planning horizon of 50 years to obtain the BCR for each project. Flooded roadways were not directly evaluated for benefits associated with the BCR, so it is anticipated that the projects will have higher BCRs than presented in the FMP evaluation table (**Appendix 4C**). A summary of the estimated BCR calculations for each of the FMP which reported any 1% AC benefits is provided in **Appendix 5B**.

5.2 Recommendation Process for FMEs, FMSs, and FMPs

The process for recommending FMEs, FMSs, and FMPs includes coordination with the RFPG throughout the regional flood planning process. As new information became available or as evaluations were completed, evaluation results were shared with the RFPG during periodic

General RFPG Meetings. The following General RFPG Meetings included votes by the RFPG on Recommended FMEs, FMPs, and/or FMSs:

- General RFPG Meeting held April 21, 2022;
- General RFPG Meeting held May 25, 2022; and
- General RFPG Meeting held July 20, 2022.

Each of the Recommended FMEs, FMPs, and FMSs are included in **Appendices 5C**, **5D**, and **5E**, respectively. The general reason for recommendation for each FME, FMS, and FMP is that the evaluated Flood Solutions were in alignment with RFPG and stakeholder goals. All of the flood solutions which were fully evaluated, and which are presented **Appendices 4A, 4C**, and **4E** were also recommended by the RFPG. Two projects from the El Paso County SWMP (CAN1 and FAB1) were initially identified to be evaluated as FMP for the RFP, but the evaluations were not completed because likely alternative funding sources were identified for each project. There were no potential FMEs or potentially feasible FMSs or FMPs that were evaluated and found to be infeasible by the RFPG.

Even projects with a lower BCR than expected were recommended by the RFPG, as it was recognized that including the flood solution in the RFP would be a minimum requirement to allow the sponsors to apply for funding for the study, strategy, or project in the future. At the time when sponsors apply for funding, there may have been additional studies performed which can demonstrate higher benefits and a higher benefit cost ratio, which they can submit at that time for consideration. This is the RFPG's understanding based upon communication with TWDB. For example, future grant applications for the same FMPs included in this RFP may include modified designs to alternatives, an increased number of frequency storms analyzed, and/or listing additional benefits that may become associated with each FMP, depending on the evolution of each project.

In addition, each recommended FMP was evaluated based upon scoring criteria required for potential impacts and benefits from the FMP to flood risk, life and safety, the environment, agriculture, recreational resources, navigation, water quality, erosion, sedimentation, and implementation/permitting. This information is presented in **Table 5F** of **Appendix 5F**, "Data Entry Table for TWDB Scoring of Flood Mitigation Projects". The table was filled out according to specific criteria and instructions included in the Technical Guidelines provided by TWDB. Notes applicable to specific scores are also included in the table.

Appendix 5A
Hydrologic and Hydraulic Analysis of Project Specific FMSs

Appendix 5B
Evaluation Methodology for FMPs

Appendix 5C
FMEs Recommended by the RFPG

Appendix 5D
FMPs Recommended by the RFPG

Appendix 5E
FMSs Recommended by the RFPG

Appendix 5F
Data Entry Scoring Summary Table for FMPs

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Appendix 5H
Hydraulic Model Depth Results and Buildings Analyzed