2023 REGIONAL FLOOD PLAN

REGION 14

UPPER RIO GRANDE

JANUARY 2023

Prepared for Region 14 Upper Rio Grande Regional Flood Planning Group

2023 REGIONAL FLOOD PLAN
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January 2023

Prepared for:

Region 14 Upper Rio Grande Regional Flood Planning Group

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2023 Regional Flood Plan – Upper Rio Grande (Region 14)

January 2023

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ES. Executive Summary

In response to historic flooding across the State of Texas, the 2019 Texas Legislature passed legislation to form the state's first-ever regional and state flood planning process and provide funding for investments in flood science and mapping efforts to support flood plan development. Through this legislation, a state flood planning framework was created, charging the Texas Water Development Board (TWDB) with creating flood planning regions based on river basins and administering the flood planning process.

In April 2020, the TWDB adopted rules establishing 15 regional flood planning areas across the State of Texas to develop the first planning cycle (2020-2023) Regional Flood Plans (RFPs). Information from these adopted regional plans will then be consolidated into a State Flood Plan (SFP) to be adopted by the TWDB by September 1, 2024. Following this, updated regional and state plans will be developed on a recurring cycle every five years.

The overall goal of the Regional and State Flood Plans is to identify specific flood risks and recommend potential flood solutions to address these risks at the local level, including flood studies, strategies, and projects. The effort is aimed at better managing flood risk overall to reduce loss of life and property from flooding.

ES.1 Introduction and Description of the Upper Rio Grande Flood Planning Region

The Upper Rio Grande Flood Planning Region, designated by the TWDB as "Region 14" and led by the Upper Rio Grande Flood Planning Group (URGFPG), encompasses all or part of 23 West Texas counties as listed below and shown in **Figure ES.1** (partial counties denoted with asterisks):

- Andrews*
- Brewster
- Crane
- Crockett*
- Culberson
- Ector*
- Edwards*
- El Paso
- Hudspeth
- Jeff Davis
- Loving
- Midland*
- Pecos
- Presidio
- Reagan*
- Reeves
- Schleicher*
- Sutton*
- Terrell
- Upton*
- Val Verde*
- Ward
- Winkler

The planning area for Region 14 follows the Upper Rio Grande in West Texas along the US-Mexico border from the City of El Paso to the Amistad Reservoir in Val Verde County as well as the Pecos River from the New Mexico Border to the Rio Grande. This region is the largest of the fifteen state flood planning regions by area, covering more than 43,000 square miles across three river basins – the Upper Rio Grande, the Pecos River, and the Devils River.

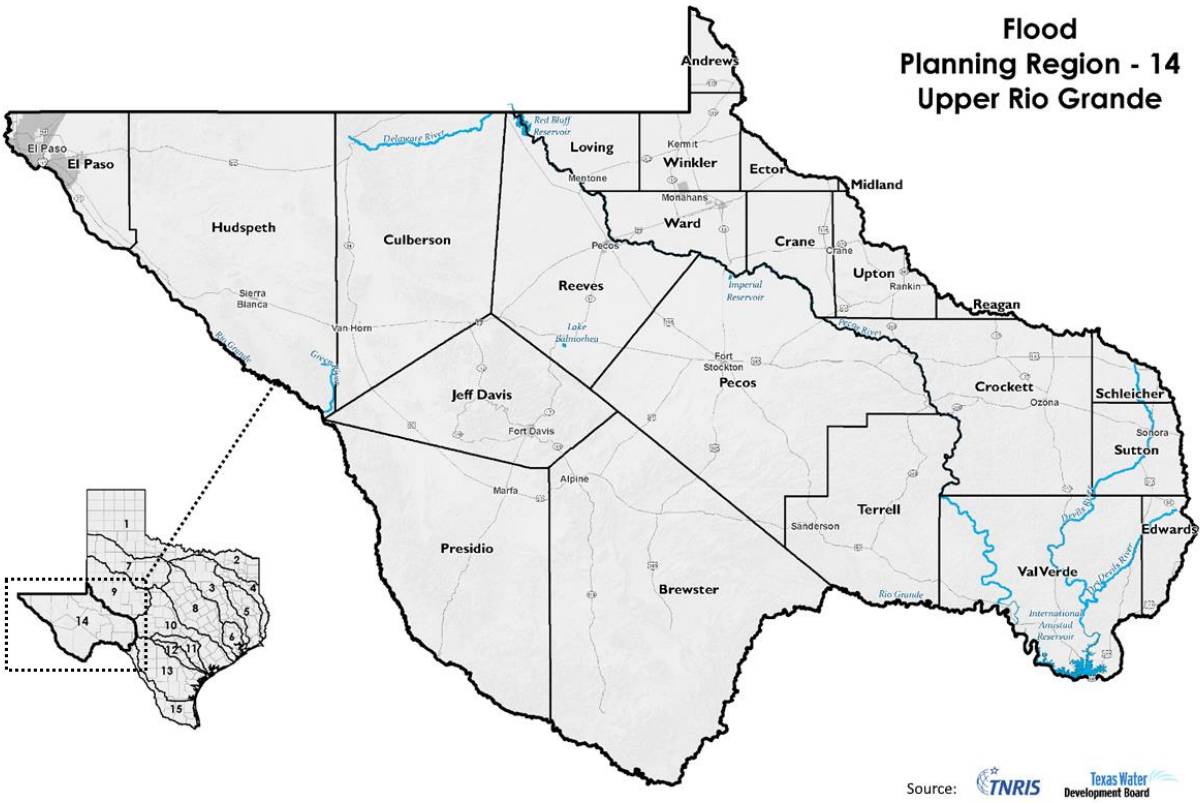

Figure ES.1 Upper Rio Grande Flood Planning Region (Region 14)

ES.1.1 Social and Economic Characteristics

The Far West Texas region is well known for its wide-open expanses and rugged landscapes. Compared to other flood planning regions across the state, Region 14 remains largely rural and less impacted by urban development.[1] The region is approximately 99% rural or undeveloped by land area, including about 2,500 square miles of grassland or pasture (6% of the total area) and 300 square miles of other agricultural property (1% of the total area). Based on population estimates from the 2020 Decennial Census, the total population in the region is estimated at approximately 1.04 million with nearly 90% of the population residing in El Paso County.

Among the Upper Rio Grande Region's most defining characteristics are the many small towns and unincorporated communities dispersed throughout the region. The region encompasses 61 incorporated and unincorporated communities, all with populations less than 10,000 except for six (El Paso, Socorro, Horizon City, Pecos, Fort Bliss, and San Elizario). In addition, only four of the 23 counties have populations exceeding 10,000, including the Counties of El Paso, Pecos, Reeves, and Ward.

[1] Texas A&M Natural Resources Institute (NRI). *West Texas Landowner Report: Energy and Growth Trends.* December 2019. *https://nri.tamu.edu/media/2786/west-texas-landowner-report-final-20200115.pdf*

As of 2021, the region employs an estimated 590,000 jobs across its 23 counties, with about 91,000 of these jobs added since 2010. In the past decade, jobs in the region have grown at an annual rate of 1.5%, faster than the U.S. average (0.9%) and similar to the Texas average (1.7%). By total employment, the region's top five industries (representing approximately 45% of total jobs) include healthcare, food services, education, oil and gas upstream, and non-food retail.

ES.1.2 Historical Flooding

Flooding in Texas is principally associated with hurricanes, tropical storms, and high intensity storms. Flooding is usually caused by high precipitation volumes, long precipitation duration, and high precipitation intensity. Hurricanes and tropical storms have the potential for each dangerous mode of precipitation as they are large storms fed from warm oceans and can linger over a location.

El Paso County has experienced long duration/low intensity rain events (e.g., 7.95 inches over four days in 2006) and short duration/high intensity rain events (e.g., 3.18 inches over one hour in 2021) which result in various flood hazards and require different mitigation strategies. Both of these storm events had an extremely low Annual Exceedance Probability (AEP) of approximately 0.4% (or the 250-year return period). Both of these storms covered the streets in debris and caused significant damage.

ES.1.3 Agricultural & Natural Resources

More than 30 types of crops are grown in the Upper Rio Grande Region, with the top seven crops most at risk to flooding including grassland/pasture, cotton, alfalfa, pecans, winter wheat, oats, and sorghum. The top five counties for agricultural production include the Counties of Hudspeth (notably Dell City), El Paso, Jeff Davis, Pecos, and Presidio.

Approximately 50 federal- and state-listed threatened and endangered species have been identified in the region, including most notably the western yellow-billed cuckoo, for which the U.S. Fish and Wildlife Services has designated critical habitat along much of the Rio Grande in Brewster County and which may potentially live in many other counties across the region. Other prominent protected species may include the federally endangered southwestern willow flycatcher bird species and the Texas hornshell freshwater mussell.

ES.1.4 Constructed Major Flood Infrastructure

Region 14 includes the following existing stormwater infrastructure: stream crossings; levees; flood protection dams; detention and retention ponds; storm drain systems; stormwater canals; pump stations; and weirs. While statewide and nationwide data sets for dams and levees are available throughout the region, there was generally a lack of digital data for stormwater infrastructure in all Region 14 counties other than El Paso County. The RFP incorporates available digital infrastructure data for constructed flood mitigation features into the "Existing Flood Infrastructure" dataset, summarizing the existing flood infrastructure geodatabase and identifying both constructed and natural features.

ES.2 Flood Risk Analyses

The RFP included an evaluation of flood risks and flood hazard data gaps across the region for existing and future conditions.

Flood risks can be defined in terms of *flood hazards* (i.e., the location, magnitude, and frequency of flooding), *flood exposure* (i.e., who and what might be harmed within the region), and *vulnerabilities* (i.e., areas of exposure including communities and critical facilities which may be particularly susceptible to flood impacts). Flood risk may also be evaluated based on *existing conditions*, accounting for present-day land use and impervious cover, as well as based on *future conditions*, accounting for future land use and impervious cover trends as well as overall climate and precipitation trends.

Existing and future condition flood risk analyses for the 1% annual chance (1% AC) and 0.2% annual chance (0.2% AC) flood events were performed for the Upper Rio Grande region using the best available hydrologic and hydraulic modeling data within the region, including models developed specifically for the RFP.

The results of the flood risk analyses are intended for use by the RFPG to establish priorities in subsequent planning tasks and to identify areas for potential flood solutions. The flood risk maps presented in this RFP do not reflect the effective regulatory floodplains and do not supersede or change federal flood insurance requirements.

Similarly, these regionwide flood risk analyses are intended to establish baseline flood risk levels as currently recognized by the Federal Emergency Management Agency (FEMA) and other best available modeling. As a result, and in accordance with State RFP requirements, any existing levees in the region that do not meet FEMA accreditation are excluded from the baseline flood risk analysis. This consideration is especially applicable to El Paso County, where unaccredited levees are present along the Upper Rio Grande.

In addition to the overview of flood risk analyses process and results described below, *Chapter 2 ("Flood Risk Analyses")* provides additional details regarding potential flood exposure, vulnerabilities, and anticipated loss of function for different types of critical facilities.

ES.2.1 Existing Conditions Analysis

Existing condition flood hazard data sources used for the risk analysis included FEMA National Flood Hazard Layer Preliminary data (for El Paso County only), NFHL Approximate Effective data (for Ector and Val Verde Counties), the First American Flood Data Services (FAFDS) layer (outside of El Paso County), and the Fathom Cursory Floodplain dataset.

While recent flood hazard mapping information is available for El Paso County, Ector County, and Val Verde County, the availability of recent flood hazard data across the rest of the region is much more limited. Two types of existing condition flood hazard data gaps were identified across the region based on data availability and reliability.

The first type of existing condition data gap includes counties which do not have a broad coverage of available FAFDS information or any other available flood hazard data apart from the

Fathom dataset. It also includes counties with limited FAFDS coverage (e.g., for small areas within selected municipalities) that do not have broad countywide coverage of flood hazard data. This first group is made up of five counties with no FAFDS coverage (including the Counties of Andrews, Crane, Loving, Reagan, and Schleicher) and four counties with limited FAFDS coverage (including the Counties of Pecos, Reeves, Upton, and Winkler).

The second type of existing condition data gap includes counties which do have broad coverage of FAFDS information in addition to the Fathom dataset but are in need of updated flood hazard information due to the age of the FAFDS floodplains. This second group is made up of 11 counties, including the Counties of Brewster, Crockett, Culberson, Edwards, Hudspeth, Jeff Davis, Midland, Presidio, Sutton, Terrell, and Ward.

Maps showing the results of the existing condition flood risk and flood hazard data gaps analyses are provided in **Map Exhibits 4-7**, and a summary of the existing condition flood exposure results is provided in **Table ES.1**.

Table ES.1 Existing Flood Exposure Summary

Exposure Type	Number of features		
	1% AC	0.2% AC*	Possible Flood Prone Areas
Floodplain Area (sq. mi.)	9,285	1,755	161
Structures (#)	40,121	14,290	12,393
Population (#)	115,530	47,985	71,036
Critical Facilities (#)	94	41	19
Roadway Segments (mi.)	3,047	548	353
Roadway Stream Crossings (#)	1,377	548	147
Agricultural Areas (sq. mi.)	615	135	39

*0.2% AC flood exposure results are reported separately from the 1% AC results and do not include cumulative flood hazard areas or property impacts from 1% AC flood hazard areas.

ES.2.2 Future Conditions Analysis

Future condition flood hazards were estimated to account for future projections in land use and precipitation over the next 30 years.

According to population projections from the 2021 Regional Water Plan, the Upper Rio Grande Region is projected to grow in population between 2020-2050 by approximately 400,000, which is equivalent to a 38% increase over 30 years with an average annual growth rate of 1.08%. El Paso County is projected to see the highest future population growth compared to other counties in the region with an increase of approximately 370,000 by 2050 or 93% of the region's total growth.

To account for these population growth trends in El Paso County, the El Paso County FEMA Preliminary 2D models were updated based on future condition hydrologic data derived from local population projections. Outside of El Paso County, existing condition 0.2% and 0.1% AC flood hazard areas were utilized as a proxy for future condition 1% and 0.2% AC flood hazard areas, respectively, with changes limited to areas of anticipated future development.

In addition, future precipitation projections influenced by present changes in climate show the potential for increases in the magnitude of extreme precipitation events. In an April 2021 report, the Office of Texas State Climatologist recommended applying a 20% increase to precipitation totals to estimate future rainfall. This adjustment was applied to the El Paso County FEMA Preliminary 2D models for the future condition analysis. Outside of El Paso County, no modifications were made for precipitation in the future condition analysis due to inconclusive precipitation trends shown for a majority of the region east of El Paso County in the Texas State Climatologist report.

Due to the limited availability of future condition flood hazard information across the region (such as detailed future land use data or future conditions flood studies), future flood hazard data gaps were identified for the entire region except for the watersheds of El Paso County and western Hudspeth County. These areas were analyzed as part of the RFP future flood hazard analysis described in Chapter 2.

Maps showing the results of the flood hazard data gaps analysis are provided in **Map Exhibits 5 and 9**, and a summary of the future condition flood exposure results is provided in **Table ES.2**.

Table ES.2 Future Flood Exposure Summary

Exposure Type	Number of features		
	1% AC	0.2% AC	Possible Flood Prone Areas
Floodplain Area (sq. mi.)	9,543	1,807	161
Structures (#)	67,134	35,167	12,393
Population (#)	253,678	110,302	71,036
Critical Facilities (#)	178	56	19
Roadway Segments (mi.)	3,846	1,035	353
Roadway Stream Crossings (#)	1,467	585	147
Agricultural Areas (sq. mi.)	678	149	39

*0.2% AC flood exposure results are reported separately from the 1% AC results and do not include cumulative flood hazard areas or property impacts from 1% AC flood hazard areas.

ES.3 Floodplain Management Practices and Goals

The RFP included an evaluation of floodplain management practices across the region as well as recommendations for floodplain management standards and both short-term (10-year) and long-term (30-year) flood mitigation and floodplain management goals.

ES.3.1 Evaluation of Floodplain Management Practices

In the Upper Rio Grande Region, 75% of all eligible communities participate in the NFIP (40 out of 53), including 78% of counties (18 out of 23 counties representing 31 unincorporated communities) and 73% of incorporated places (22 out of 30). All county and incorporated entities in the region are encouraged to enact ordinances that meet minimum requirements for NFIP Participation and remain active NFIP participants in good standing.

Higher floodplain management standards are recognized through the Texas Floodplain Management Association (TFMA) Higher Standards Survey and the FEMA Community Rating System (CRS). The City of El Paso is presently the only entity in the region with higher standards recognized by the TFMA Higher Standards Survey and an enrollment in the CRS Program (earning an entry-level rating of 9).[2] Applications for CRS participation have also been submitted by El Paso County and City of Sonora and are under review with an expected rating date by the end of 2022.

Communities not participating in the NFIP include seven incorporated places (Barstow, Kermit, Rankin, Thorntonville, Valentine, Wickett, and Wink) and five counties (Andrews, Edwards, Pecos, Reeves, and Winkler). All non-participating communities in the region are located in a Zone A FEMA flood hazard area or are unmapped.

ES.3.2 Recommendations for Minimum Standards and Best Practices

The Upper Rio Grande RFPG is required to consider whether to recommend or adopt region-wide minimum floodplain management standards and land use practices. *Recommending* minimum practices by the RFPG encourages entities to adopt similar floodplain management practices within their communities. On the other hand, a*dopting* minimum practices by the RFPG requires potential sponsoring entities to adopt these minimum standards before their flood needs (FMEs, FMSs, and FMPs) may be considered for inclusion in the RFP and be eligible for potential state funding.

During the course of this first planning cycle of the 2023 Region/2024 State Flood Plan, the **Upper Rio Grande RFPG voted to recommend but not adopt** the following minimum standards for the region. <u>In future planning cycles, the RFPG may reconsider whether to adopt these recommendations as minimum standards requirements.</u>

- Participate (and maintain active status) in the National Flood Insurance Program (NFIP)
- Require development permits for all proposed construction to determine whether such construction is proposed within flood-prone areas and will be reasonably safe from flooding (44 CFR § 60.3a[1-4])

[2] CRS Rating classes range from 9 to 1 where CRS Class 1 is the highest possible classification. Most communities enter the program at a CRS Class 9 or Class 8 rating.

- Require new and replacement sanitary sewage and water supply systems within flood prone areas to be designed to minimize or eliminate infiltration of flood waters into the systems (44 CFR § 60.3a[1-5])
- Require additional minimum standards for flood-prone areas associated with designated special flood hazard areas (Zone A and AE) (44 CFR § 60.3b-d)
- Require additional minimum standards associated with mudslide (i.e.mudflow)-prone areas (44 CFR § 60.4)
- Require additional minimum standards associated with flood-related erosion-prone areas (44 CFR § 60.5)

The following general recommendations for best practices were recommended by the RFPG during the first planning cycle. While these general recommendations are strongly encouraged, the RFPG does not anticipate adopting them as minimum standards in future planning cycles at this time.

- Establish local flood outreach and awareness programs (addressing flood risk, resiliency, and mitigation), including providing access to FEMA informational resources
- Coordinate with TxDOT and NWS to use flood warning signs, traffic message boards, and other media (TV, radio, social media) to communicate flood warnings
- Conduct public outreach to identify ongoing flood needs (data gaps, flood management strategies, and flood mitigation projects)
- Develop and maintain local stormwater asset management plans
- Adopt higher-than-NFIP-minimum standards (e.g., higher freeboard) and participate in the TFMA Higher Standards Survey
- Enroll in CRS Program for reduction in flood insurance premiums and flood risk
- Consider and incorporate nature-based practices in flood mitigation projects where possible

ES.3.3 Flood Mitigation and Floodplain Management Goals

The Upper Rio Grande RFPG adopted both Short-Term (10-year) and Long-Term (30-year) flood mitigation and floodplain management goals. These goals help to establish the RFPG's objectives and priorities for the first-cycle flood plan and are presented in **Table ES.3**.

Table ES.3 Flood Mitigation and Floodplain Management Goals

Short Term (10 year)	Long Term (30 year)
Increase NFIP participation or adoption of equivalent standards with 90% of communities meeting qualifying standards	Enroll all current non-participating communities into the NFIP and maintain 100% community enrollment with no suspensions or sanctions
Increase number of communities that have adopted higher-than-NFIP-minimum standards	n/a

Short Term (10 year)	Long Term (30 year)
Increase number of communities enrolled in CRS Program	n/a
Improve CRS rating for the City of El Paso (which has a current CRS Rating of 9)	n/a
Adopt recommended minimum stormwater infrastructure design standards applicable across the region	n/a
Increase flood protection of unaccredited levees in El Paso County watersheds to meet FEMA levee accreditation requirements and update flood mapping to account for any changes in levee accreditation status	Increase flood protection of unaccredited levees in the region outside of El Paso County watersheds to meet FEMA levee accreditation requirements and update flood mapping to account for any changes in levee accreditation status
Increase the number of flood gages (rainfall and/or stream gages) in the region	n/a
Develop and implement region-wide flood warning and emergency response program	n/a
Increase the number of entities that use flood warning signs, traffic message boards, and other media (TV, radio, social media) to communicate flood warnings	n/a
Establish community-led flood outreach and awareness programs (addressing risk, resiliency, and mitigation) in 30% of communities in the region	Establish community-led flood outreach and awareness programs (addressing risk, resiliency, and mitigation) in 90% of communities in the region
Increase entity and public stakeholder participation in the regional flood planning process	n/a
Increase the coverage of flood hazard data across the region by completing studies in 40% of the areas identified as having current gaps in flood mapping in the first cycle Flood Plan	Have complete coverage of flood hazard data across the region by completing studies in 100% of the areas identified as having current gaps in flood mapping in the first cycle Flood Plan and have an ongoing, funded maintenance plan for updates
Remove 10% of the existing structures in El Paso County watersheds from 1% annual chance floodplain in the region (either by remapping or flood risk reduction)	Remove 20% of the existing structures in El Paso County watersheds from 1% annual chance floodplain in the region (either by remapping or flood risk reduction)
Remove 25% of the existing structures outside of El Paso County watersheds from 1% annual chance floodplain in the region (either by remapping or flood risk reduction)	Remove 50% of the existing structures outside of El Paso County watersheds from 1% annual chance floodplain in the region (either by remapping or flood risk reduction)
Remove 40% of the low water crossings from 10% annual chance floodplain in the region (either by remapping or flood risk reduction)	Remove 90% of the low water crossings from 10% annual chance floodplain in the region (either by remapping or flood risk reduction)
Increase the number of entities that utilize regional detention for floodplain management	n/a
Consider and incorporate nature-based practices in flood risk reduction projects	n/a
Establish dual usage regional storage facilities for flood mitigation and water supply	n/a
Increase the number of communities with documented, operational, and fully funded stormwater asset management plans	n/a
Increase number of new funding sources used to pay for implementation of flood management activities and decrease number of communities without a local funding source	n/a

Short Term (10 year)	Long Term (30 year)
Increase the number of entities that have a dedicated drainage fee to help implement future Flood Mitigation Evaluations (FMEs) and Flood Mitigation Projects (FMPs)	n/a

ES.4 Identification of Flood Mitigation Needs and Solutions

Based on the identified flood hazard areas, the RFP included an analysis of flood needs with a consideration of the greatest flood risk areas and greatest flood risk information gaps. Following this and with coordination between the RFPG and stakeholders, potential flood solutions were identified including Flood Management Evaluations (FMEs), Flood Mitigation Projects (FMPs), and Flood Management Strategies (FMSs).

ES.4.1 Flood Mitigation Needs Analysis

Flood mitigation needs were identified based on both a quantitative comparison of the Task 2 exposure results at the county and subcounty level as well as a qualitative evaluation by the RFPG and stakeholders.

The quantitative analysis considered areas of greatest potential flood exposure based on at risk structures, population, roadways, critical facilities, agricultural area, and social vulnerability. It also included an evaluation of the greatest gaps in flood risk information and the areas with the greatest flood risk.

The qualitative analysis was conducted over several stakeholder workshop meetings and considered historic flooding events, flood prone areas, existing flood mapping and modeling availability, emergency needs, and other factors.

A summary of flood mitigation needs and at risk communities by county are shown in **Table ES.4**.

Table ES.4 Summary of Flood Mitigation Needs by County

County	Greatest Flood Risk Data Gap (Limited or No FEMA Flood Mapping Information)	Greatest Flood Risk Data Gap (Old FEMA Flood Mapping Information	Greatest Flood Risk	Top At Risk Communities by Estimated Number of Structures in Floodplain
Andrews	✓	-	-	-
Brewster	-	✓	✓	Alpine city
Crane	✓	-	-	Crane city
Crockett	-	✓	✓	Ozona CDP
Culberson	-	✓	✓	Van Horn town
Ector	-	-	-	-
Edwards	-	-	-	-
El Paso	-	-	✓	El Paso city, Socorro city, Fort Bliss CDP, Canutillo CDP, San Elizario city, Homestead

County	Greatest Flood Risk Data Gap (Limited or No FEMA Flood Mapping Information)	Greatest Flood Risk Data Gap (Old FEMA Flood Mapping Information	Greatest Flood Risk	Top At Risk Communities by Estimated Number of Structures in Floodplain
				Meadows North CDP, Clint town, Fabens CDP, Prado Verde CDP
Hudspeth	-	✓	✓	Dell City city
Jeff Davis	-	✓	✓	Fort Davis CDP
Loving	-	-	-	-
Midland	-	-	-	-
Pecos	✓	-	✓	Imperial CDP, Fort Stockton city
Presidio	-	✓	✓	Presidio city, Marfa city
Reagan	-	-	-	-
Reeves	✓	-	✓	Pecos city, Balmorhea city, Lindsay CDP, Toyah town
Schleicher	-	-	-	-
Sutton	-	✓	✓	Sonora city
Terrell	-	✓	-	Sanderson CDP
Upton	✓	-	-	McCamey city
Val Verde	-	-	-	-
Ward	-	✓	✓	Southwest Sandhill CDP, Monahans city, Thorntonville town, Barstow city
Winkler	✓	-	✓	Kermit city

ES.4.2 Process for Identifying Flood Mitigation Solutions

The primary objective of the Upper Rio Grande Regional Flood Plan (RFP) is to identify specific flood risks within the region and identify, evaluate, and recommend potential solutions to mitigate and manage these risks in alignment with the region's short-term and long-term goals. These solutions may include FMEs, FMSs, and FMPs, as defined below:

- Flood Management Evaluation – a proposed flood study of a specific, flood-prone area that is needed to assess flood risk and/or determine whether there are potentially feasible FMSs or FMPs;
- Flood Mitigation Project – 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, mitigating flood hazards to life or property; and
- Flood Management Strategy – a proposed plan to reduce flood risk or mitigate flood hazards to life or property.

FMSs and FMPs that were identified to be potentially feasible through the processes described Chapter 4 were selected for further evaluation as part of Task 4B to determine whether they have sufficient H&H modeling data to be analyzed for project impacts and benefits.

ES.4.3 Identification of Flood Management Evaluations (FMEs), Flood Mitigation Projects (FMPs), and Flood Management Strategies (FMSs)

Due to the large portion of Region 14 which has limited or no available flood risk mapping or modeling available, a significant part of the process of identifying potential FMEs and potentially feasible FMSs and FMPs involved extensive stakeholder coordination. Through the coordination conducted in workshops, public meetings, and phone interviews, the RFPG identified and evaluated 22 potential FMEs, 14 potentially feasible FMPs, and 22 potentially feasible FMSs.

FMEs identified generally fell into the categories of project planning, storm water master plans (SWMPs) which also includes development of flood risk mapping, dam safety/emergency need, riverine risk related to sediment or levees, irrigation and stormwater interaction, and preparedness.

Most of the FMPs identified were detention/retention storage basins or related to transportation/mobility from the City of El Paso SWMP (2021) or the El Paso County SWMP (2021), which were both recently updated. The lack of modeled and evaluated stormwater projects meeting the minimum criteria for FMPs in the region is likely related to the lack of available or updated flood risk models and mapping. Due to the large number of projects in the City SWMP (96 projects) and in the County (69 projects), heavy coordination was involved with the City, County, and RFPG in selecting and prioritizing which projects would be evaluated within the limited schedule available for the RFP.

Potentially feasible strategy types vary between regulatory and guidance strategies, infrastructure projects, flood measurement and warning, and education and outreach. In general, FMSs do not typically fit into the FME or FMP categories for a variety of reasons. Below are a list of criteria that led to the decision to list a flood reduction action as an FMS rather than an FME or FMP:

- Studies, projects, and/or program development involving complex coordination between multiple entities (local, state, federal, or international);
- Associated with other FMEs, FMSs, or FMPs requiring a specified sequence of actions as part of a larger plan;
- Involve multiple projects with varying statuses of design/construction; and
- Include recurring costs

ES.5 Evaluation and Recommendation of Flood Solutions

The recommended FMEs, FMPs, and FMSs (also referred to as “Flood Solutions”) 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.

ES.5.1 Evaluation & Recommendation Process for FMEs, FMSs, and FMPs

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.

ES.5.2 Summary of Evaluation Process for FMEs and FMSs without Project Specific Data

For FMEs and FMSs without project-specific H&H models or mapping, evaluations of the required parameters 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

ES.5.3 Methods for Evaluation of FMSs and FMPs 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.

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, 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, which were provided in Chapter 5 appendices.

Each project-specific FMS and 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 for each project area. Chapter 5 appendices also document the Benefit Cost Analysis (BCA) and the process used to estimate that each FMP or Project-specific FMS will have no negative impact on neighboring areas.

ES.5.4 Summary of Recommendation Process

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, FMSs, and FMPs 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.

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.

ES.6 Impacts and Contribution of Regional Flood Plan

Chapter 6 summarizes the overall impacts of the Regional Flood Plan (RFP), considering the potential for both positive and negative outcomes related to flood risk and multiple other considerations. Other resources which are not directly related to flood planning, but which can be strongly influenced by flood-related actions include water supply, the environment, agriculture, recreation, water quality, and navigation.

ES.6.1 Impacts of Regional Flood Plan

The methods applied to estimate potential increases in future conditions flood risk are documented in *Chapter 2 (“Flood Risk Analyses”)*. The anticipated increased flood risk was modeled and mapped in the RFP based on the following:

- Best available flood risk modeling and mapping data;
- Future precipitation projections based on recent studies (for El Paso County watersheds only);
- Future land use planning documents (for El Paso County watersheds only); and
- Population projections throughout the region

Based on these methods, a future 1% annual chance and 0.2% annual chance floodplain was developed for Region 14 and compared to the existing conditions inundation areas for corresponding flood frequency boundaries. The extent of increased 1% annual chance risk inundation area from existing to future conditions is **242** square miles (sq. mi.). The extent of increased 0.2% annual chance risk inundation area from existing to future conditions (separate from the 1% annual chance risk inundation area) is **181** sq. mi. These anticipated increases in flood risk are estimated to be reduced if the FMEs, FMSs, and FMPs recommended in the RFP are performed.

As noted in *Chapter 4*, there are 20 out of the 23 counties within Region 14 that are in need of flood risk identification or in need of updated flood risk mapping. The exceptions are El Paso, Ector, and Val Verde Counties, which have recent flood risk mapping. Out of these 20 counties which need current floodplain mapping, there are 39 cities or Census Designated Places (CDPs) within Region 14, which have a combined jurisdictional area of 175 sq. mi. To address this need, there are 9 FMEs recommended for cities with outdated or no floodplain mapping. These 9 cities have a combined total jurisdictional area of **110 sq. mi**. These cities were selected for SWMP FMEs based on an assessment of cities within the region with the greatest number of structures at risk of 1% annual chance flooding.

As noted in *Chapter 2*, there are approximately 40,121 structures at risk of 1% annual chance flooding in the region with a total population of 115,530. There are an additional 14,290 structures within the 0.2% annual chance flood risk inundation area (separate from the 1% annual chance risk inundation area) with a population of 47,985. The recommended FMPs and project-specific FMSs analyzed for flood risk benefits are estimated to remove **11,964** structures from the 1% annual chance flood risk boundary with a combined population of approximately **31,233**. The recommended FMPs are estimated to remove **936** structures from the 0.2% annual chance flood risk boundary with an approximate population of **2,400**. Furthermore, the recommended FMPs and FMS are estimated to remove **41** low water crossings from the 1% annual chance flood risk boundary.

ES.6.2 Contributions to and Impacts on Water Supply Development and the State Water Plan

There are no recommended FMPs that would measurably contribute to water supply. However, there is one recommended FMS which is estimated to contribute to water supply (FMS ID: 142000002). In the RFP, this FMS is named, “Irrigation and Recharge Application of Captured Rainwater Runoff at Alpine.” It is also recommended in the 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.”

The Water User Group identified for this strategy in the Region E Water Plan is the City of Alpine. The State Water Plan identified the City of Alpine as the Sponsor of the recommended strategy. Based on the information provided by the project planners and the Far West Texas Water Plan (TWDB, 2021) for Region E, this strategy is expected to directly increases water supply volume available during droughts of record for the City of Alpine.

The RFPG is also required to list recommended FMSs or FMPs that, if implemented, would negatively impact and/or measurably reduce:

- Water availability volumes that are the basis for the most recently adopted SWP; and
- Water supply volumes if implemented.

Based on the evaluations of recommended FMSs and FMPs previously discussed in *Chapter 5*, no measurable negative impacts are anticipated on water supply, water availability, or projects in the State Water Plan.

ES.7 Flood Response Information and Activities

The RFP includes a summary of flood emergency management activities across the Upper Rio Grande Region to address the preparedness, response, and recovery phases of flood emergencies. Information was gathered based on agency coordination, survey responses, and hazard mitigation planning documents.

Flood emergency preparedness activities include the development of emergency management and action plans, hazard mitigation plans, and the building of flood early warning and alert systems, flood gages, or automatic low water crossings. Several Emergency Action Plans (EAPs) have been developed for dams throughout the region including the City of El Paso High Hazard Dams EAP (2008), the Red Bluff Dam EAP (2021), and the Elephant Butte & Caballo Dams EAP (2018). In addition, Hazard Mitigation Plans (HMPs) have been developed for the Counties of Brewster, Ector, El Paso, Hudspeth, Jeff Davis, and Presidio. These HMPs, while primarily mitigation-focused, encourage interregional coordination with key flood planning stakeholders and assist with flood preparedness by reducing emergency response demands during a flood.

In addition to these planning documents, El Paso currently utilizes a flood early warning system based on early warnings provided by a dedicated meteorologist with coordination between EPWater, EPCWID1, and the operators of Caballo Dam in New Mexico. *Chapter 5 ("Evaluation and Recommendation of Flood Solutions")* of this RFP includes six recommended FMPs to develop or improve flood early warning systems for the City/County of El Paso and the Cities of Pecos, Alpine, Presidio, Fort Stockton, and Marfa. A general FMS is also recommended for the entire region to prioritize, fund, and develop new flood gages (rainfall and/or stream gages) to support flood warning system improvements. Lastly, an FMP is recommended to install automatic low water crossing gates along Alamito Creek in Marfa, including the installation of a monitoring and early detection gage.

In response to flooding emergencies, several communities in the region reported using a public alert or alarm system to broadcast alarms via an outdoor siren or send notifications via text messaging, website, or social media. Cities and counties coordinate with the Texas Department of Transportation (TxDOT) on road closures and traffic message boards. Emergency managers rely on publicly available information from the National Oceanic and Atmospheric Administration (NOAA), the National Weather Service (NWS), and the United States Geologic Survey (USGS). The Bureau of Reclamation El Paso Field Division (EPFD) works with offices and divisions from New Mexico to regulate releases from the Elephant Butte and Caballo Dams to minimize flows during a flood event.

Flood recovery activities most often include debris removal from culvert entrances and bridges by cities, counties, and TxDOT. Due to the region's arid landscape, sedimentation from arroyos is a common issue after floods, especially in El Paso where arroyos from the Franklin Mountains frequently deposit sediment impacting downstream culverts, roadways, agricultural land, and irrigation system infrastructure. In the event of significant flood damages, flood damage assessment and recovery efforts are supported with assistance and resources by FEMA Region VI and the Texas Division of Emergency Management (TDEM) Region 4.

ES.8 Administrative, Regulatory, and Legislative Recommendations

The Upper Rio Grande engaged with stakeholders within the region to develop administrative, regulatory, and legislative recommendations for consider by the Texas Legislature, TWDB, TCEQ, other water planning regions, and all stakeholders and participants in Texas' regional and state flood planning efforts. Prior to these engagements, individual interviews were conducted with comparative entities outside the region to solicit feedback for consideration by the RFPG. Four RFPG subcommittee meetings were held to develop recommendations for floodplain management and flood mitigation implementation. From these discussions, a list of region-specific needs was developed along with recommendations to address these needs. Recommendations are organized by stakeholders (i.e., for the El Paso County area and the flood planning area outside of El Paso County) as well as by type (i.e., legislative, regulatory/administrative, fundraising, and other recommendations). Recommendations from the legislative and regulatory/administrative categories are presented below in **Table ES.5** through **Table ES.8**, while details pertaining to the fundraising recommendations and other recommendations are provided in *Chapter 8 ("Administrative, Regulatory, and Legislative Recommendations").*

Table ES.5 Legislative Recommendations (El Paso County Area Stakeholders)

Need to address	Recommendation
Burden on sponsors for levee certification is excessive	Communicate with the federal government about lessening the burden for levee certification
Counties perceive lack of ability to regulate drainage outside of FEMA floodplains	Counties to consider adoption of drainage requirements beyond areas that are in flood zone (e.g., within County Road ROWs outside floodplains)

Need to address	Recommendation
Revolving state funds are not self-sustaining	Create specific revolving state funds to provide matching to federal dollars for FMPs

Table ES.6 Regulatory/Administrative Recommendations (El Paso County Area Stakeholders)

Need to address	Recommendation
Identified potential design standard improvements	Develop recommendations for inlets, curb cuts, on-site storage, sediment controls at inlets, discharges into irrigation drains, 2D modeling (include freeboard requirements)
Erosion in natural channels	Develop recommendations for design guidelines for erosion mitigation in arroyos
Issues with outfalls into Rio Grande	Develop guidelines for design of outfalls
EPCWID1 is concerned with the risk of loss of Clean Water Act exemptions associated with stormwater accumulated in irrigation drains	Recommend that USACE develop clear guidance relevant to situation in El Paso County to ensure exemption is retained
There are uncertainties in El Paso County associated with the capture of stormwater with the potential for reuse	Investigate permitting issues and develop clear guidance to ensure compliance and optimize opportunities for capture/blend
Improve coordination with other jurisdictions to facilitate floodplain management (TxDOT, IBWC, TPW, RRC, TCEQ, Private Entities)	Coordinate regional protocols to facilitate floodplain management involving multiple jurisdictions. (e.g., create consensus requiring no adverse impact)
Codify use of most restrictive standard where conflicts exist	Revise local standards to codify this requirement and address adverse impact
Drainage component is not part of certificate of compliance (In Ector County there is no review of any building or development permit, no component for flood mitigation)	Counties should have the option to be empowered to enforce drainage requirements within the requirements for a certificate of compliance
ATV-induced erosion on state lands	Review existing regulatory/ admin controls and effectiveness. Recommend changes
Improve coordination with other jurisdictions to facilitate (TxDOT, IBWC, TPW, RRC, TCEQ, Private Entities)	Coordinate regional protocols to facilitate flood mitigation planning involving multiple jurisdictions.
Improve coordination with other jurisdictions to facilitate (TxDOT, IBWC, TPW, RRC, TCEQ, Private Entities)	Coordinate regional protocols to facilitate flood mitigation implementation involving multiple jurisdictions.
Coordinate with State Historic Preservation Office to develop acceptable mitigation practices for the El Paso region	Develop county-wide procedures for accelerating compliance, reducing delays in projects due to interaction with the historic preservation office.
Shortfalls with use of existing El Paso area MOUs with State Historic Preservation Office	Negotiate with the State Historic Preservation Office to address shortfalls

Table ES.7 Legislative Recommendations (Flood Planning Area Outside of El Paso County)

Need to address	Recommendation
New federal requirements addressing historic preservation	Develop a set of regional comments on new requirements to be provided to the federal agency
Counties perceive lack of ability to regulate drainage outside of FEMA floodplains	Counties to consider adoption of drainage requirements beyond areas that are in flood zone (e.g., within County Road ROWs outside floodplains)

Table ES.8 Regulatory/Administrative Recommendations (Flood Planning Area Outside of El Paso County)

Need to address	Recommendation
Unregulated/ minimally regulated development in Hudspeth County	Develop program to regulate drainage from development in Hudspeth County and similar counties that elect to participate
No technical personnel on staff nor funds to develop drainage criteria/standards	Provide regional coordination for technical assistance and/or funding to update drainage criteria and development standards
Improve coordination with other jurisdictions to facilitate floodplain management (TxDOT, IBWC, TPW, RRC, TCEQ, Private Entities)	Coordinate regional protocols to facilitate floodplain management involving multiple jurisdictions. (e.g., create consensus requiring no adverse impact)
Codify use of most restrictive standard where conflicts exist	Revise local standards to codify this requirement and address adverse impact
Drainage component is not part of certificate of compliance (In Ector County there is no review of any building or development permit, no component for flood mitigation)	Counties should have the option to be empowered to enforce drainage requirements within the requirements for a certificate of compliance
Improve flood mitigation planning coordination with other jurisdictions to facilitate (TxDOT, IBWC, TPW, RRC, TCEQ, Private Entities)	Coordinate regional protocols to facilitate flood mitigation planning involving multiple jurisdictions.
Improve flood mitigation implementation coordination with other jurisdictions to facilitate (TxDOT, IBWC, TPW, RRC, TCEQ, Private Entities)	Coordinate regional protocols to facilitate flood mitigation implementation involving multiple jurisdictions.
Coordinate with State Historic Preservation Office to develop acceptable mitigation practices for the Upper Rio Grande Flood Planning region outside of El Paso County	Develop regional procedures for accelerating compliance, reducing delays in projects due to interaction with the historic preservation office.

ES.9 Flood Infrastructure Financing Analysis

The Region 14 RFPG has recommended a total of 58 flood mitigation actions to address flood risk across the planning region. Combined, these flood mitigation actions are anticipated to cost $160.3 million to implement. Given the challenges of funding flood management activities, local sponsors will likely be required to use a combination of funding sources to implement flood mitigation actions, including local, state, and federal sources. This chapter discusses some of the most common avenues of generating local funding and overviews various state and federal financial assistance programs available to communities for flood management.

TWDB requires that each RFPG assess and report on how local sponsors propose to finance recommended FMEs, FMSs, and FMPs. To determine the capabilities of the local sponsors to finance the projects, the RFPG conducted a survey for local sponsors to determine the funding needs of local sponsors and propose what role the state should have in financing the recommended FMEs, FMSs, and FMPs.

While the overall response rate appears low, there is significant interest and continued participation demonstrated by major regional stakeholders. The communities that responded to

the survey are listed as sponsors for a combined 46 of the 58 flood mitigation actions (79%) accounting for $156.5 million (97.6%) of the total implementation cost needed. As a result, even with a low overall response rate, the information received provides a representative picture of total funding needs across the basin.

Of the 11 entities that responded to the survey, the likely sources of funding indicated to implement flood management activities included general or dedicated revenues, bonds, tax notes, or utility fees. Just under half (5 of 11) of the respondents had not applied for grant funding in the past five years (one respondent left this blank). Of the remaining six respondents that had applied for grant funding, three had been successful in receiving a grant and loan, one had been unsuccessful, one had received an invitation for a full application but decided not to pursue the project, and one application was still under further review.

ES.10 Public Participation and Plan Adoption

The Upper Rio Grande RFPG held 16 formal Planning Group meetings between November 2020 and July 2022 to discuss relevant RFP topics, conduct pre-planning and administrative activities, receive updates from the technical consultant, and vote on specific measures. All meetings were posted and held in accordance with the Texas Open Meetings Act (OMA) with recordings and meeting minutes posted online on the RFPG website (www.urgfpg.org) following the meetings.

In addition to the regular RFPG and committee meetings, several public open house meetings were held throughout the region to facilitate engagement with the public and other flood planning stakeholders including two in El Paso (October 27, 2021, and June 8, 2022), one in Pecos (February 9, 2022), and one in Presidio (February 10, 2022).

From September to October 2021, the RFPG conducted a stakeholder survey to obtain flood-related information from the public and other flood planning stakeholders. As part of the survey, an interactive web map was also developed to collect feedback from the public regarding flood prone areas, critical infrastructure or resources, existing infrastructure, and existing or proposed flood mitigation projects.

Following the submittal of the Draft RFP to the TWDB, a Public Hearing was held in El Paso on September 14, 2022, to receive public comments. Printed copies of the Draft RFP were located in three publicly accessible locations in the region including the cities of El Paso, Pecos, and Presidio. The Draft RFP was also posted to the RFPG website for public review, and public comments were accepted electronically during the public review and comment period. The Final RFP was adopted by the RFPG on December 15, 2022, and submitted to the TWDB along with supporting materials on January 10, 2023.

The state and regional flood planning process is guided by 39 principles adopted in Title 31 Texas Administrative Code (TAC) §362.3. This RFP conforms with each of these flood planning guidance principles, including the requirement that the plan will not negatively affect any neighboring areas.