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

Region 12
07/15/2025
3:30 PM

TAKE NOTICE that a meeting of the Technical Subcommittee of the San Antonio Regional Flood Planning Group as established by the Texas Water Development Board will be held on Tuesday, July 15th, 2025, at 3:30 PM, in-person at the San Antonio River Authority, located at 100 E. Guenther St and virtually at https://meet.goto.com/918418181.

Agenda:

1. (3:30 PM) Roll Call
2. Public Comments – limit 3 minutes per person
3. Review of Strategy to Identify Future Conditions using TWDB's Future Floodplain Data
4. Discussion on Recommended Goals for Cycle II
5. Public Comments – limit 3 minutes per person
6. Date and Potential Agenda Items for Next Meeting
7. Adjourn

If you wish to provide written comments prior to or after the meeting, please email your comments to khayes@sariverauthority.org or physically mail them to the attention of Kendall Hayes at San Antonio River Authority, 100 E. Guenther St., San Antonio, TX, 78204 and include "Region 12 San Antonio Regional Flood Planning Group Technical Subcommittee Meeting" in the subject line.

Additional information may be obtained from: Kendall Hayes, (210) 302-3641, khayes@sariverauthority.org, San Antonio River Authority, 100 E. Guenther St., San Antonio, TX, 78204.

Region 12 Technical Committee Meeting

July 15, 2025

1

Review - Future Flood Hazard

2

Supporting Materials

- Executive summary on the TWDB Cursory Floodplain Data
- Full report on the TWDB Cursory Floodplain Data
  - Available online and by request
- R12 Cycle 1 Method - Excerpt from the RFP on the methodology used last cycle to develop the Future Flood Hazard Layer.

3

How other regions are doing it:

- R2 – using cursory, scenario 3
- R3 (Dallas) - using a range for future conditions while trying to stick with cursory, scenario 3 (overwriting Scenario 3 with existing where existing is greater)
- R6 (Houston) – a mixture of methods, but not Cursory
- R8 – a mixture of methods, but not Cursory
- R10 (Austin) – using cursory, scenario 3
- R11 – using cursory, scenario 3
- R13 – still deciding
- R15 – using cursory, scenario 3

4

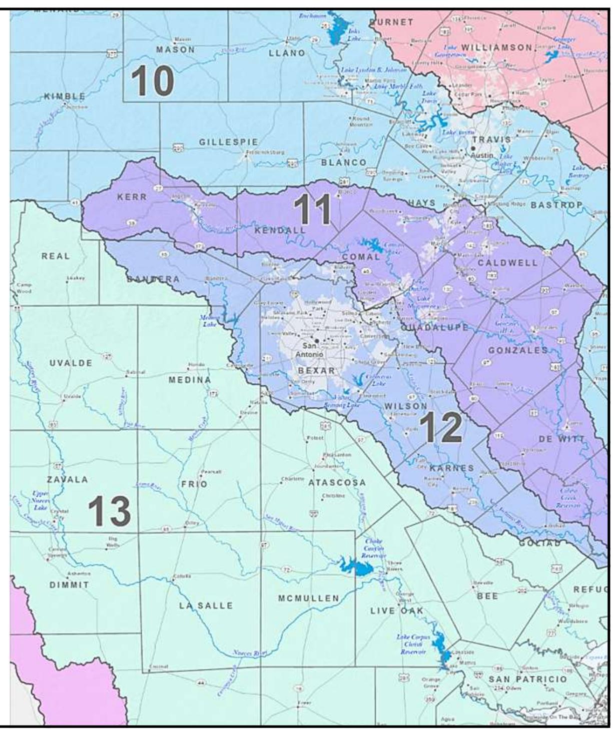
Goals

5

Goals

R10 Comparison

- 28 Goals (10Yr = 14, 30Yr = 14)
- Education and Outreach:
  - Increase the number of public outreach and educational communications and activities conducted by the RFPG to improve awareness of flood hazards and the benefits of flood planning in the Flood Planning Region. Goal = 260 communications over the next two cycles.
- Higher Standards
- Target goal = specific # or vague



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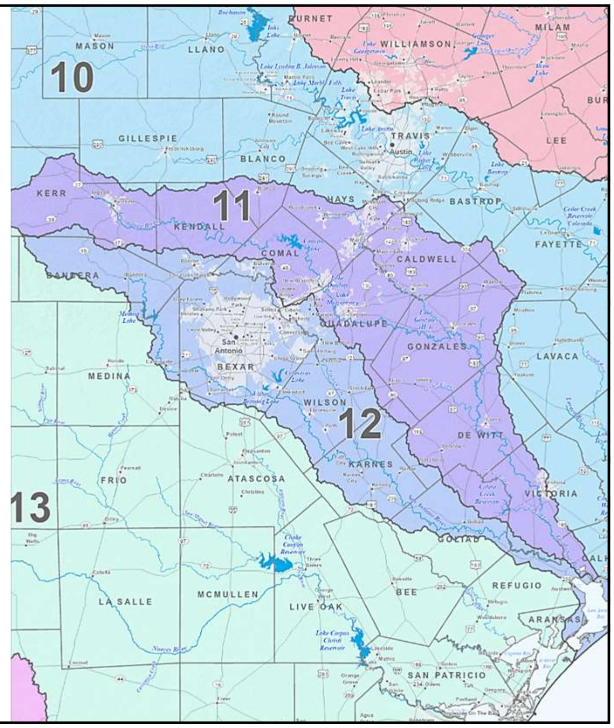
Goals

R11 Comparison

- 12 Goals (10Yr = 6, 30Yr = 6)
- Higher standards & CRS
- Target goal = % change
- Other:
    - LWC signage
    - Maintenance Funding: Increase percentage of communities with dedicated funding sources for operations & maintenance and implementation of storm drainage systems to 35% of communities.

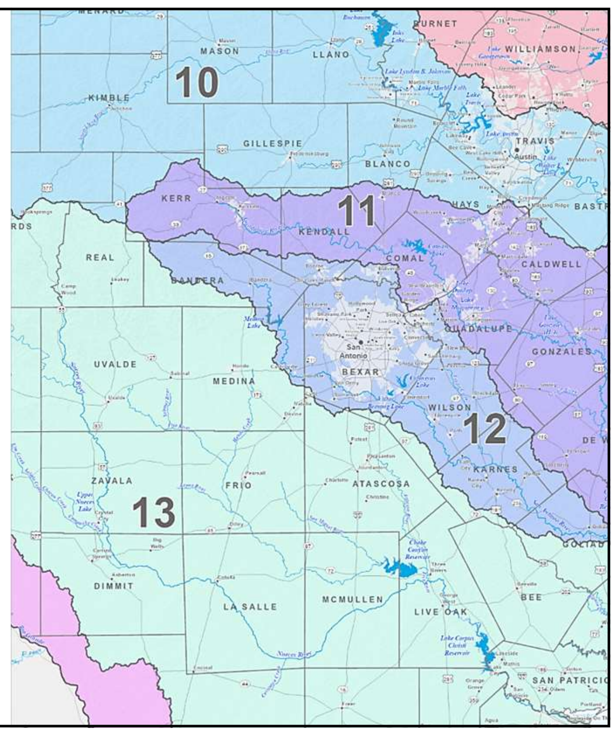


7

Goals

R13 Comparison

- 30 Goals (10yr = 10, 30yr = 10, Other = 10)
- Higher standards
- Target goal = % of region
- Other:
    - High Hazard Dams
    - Maintenance Funding: Increase dedicated funding sources to provide maintenance of drainage and culvert systems (both structural and non- structural solutions) to divert flood flows and identify structural improvements causing flooding issues to remove/rectify.
    - Training Funding

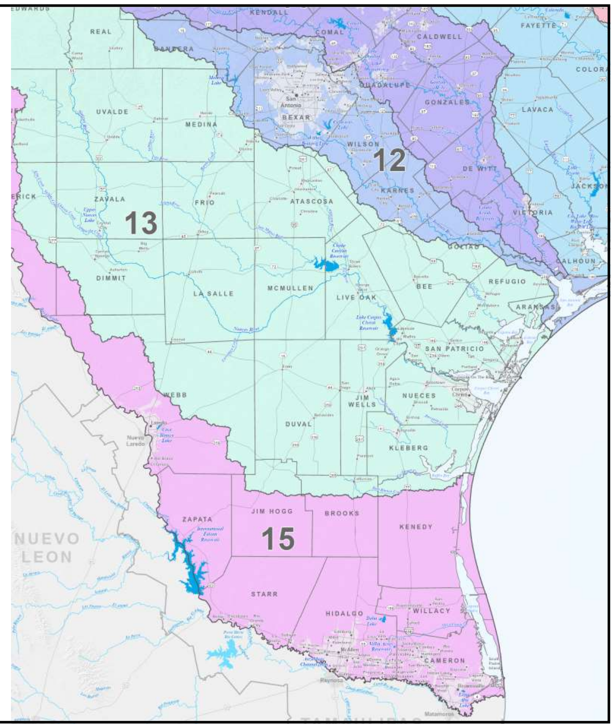


8

Goals

R15 Comparison

- 42 Goals (10Yr = 21, 30Yr = 21)
- Education and Outreach
  - Increase the number of entities and public stakeholders participating in the regional flood planning process by 30% to 40%
- Higher standards & CRS
- Target goal = % of region
- Other:
  - Regional Detention w/ water reuse
  - Evacuation Routes
  - Operational stormwater asset management plan



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Cursory Floodplain Data 2025 - Executive Summary

Introduction

With guidance from the State Climatologist, AECOM, Aqua Strategies (ASI), and Fathom, on behalf of the Texas Water Development Board (TWDB), developed 'approximate' statewide high-resolution flood hazard data for Texas, building on the Phase 1 project from 2021 which provided existing conditions flood mapping for fluvial, pluvial, and coastal flooding for four return periods. This second phase (Phase 2) updates the present-day (existing conditions) flood hazard dataset with up-to-date LiDAR and methodological improvements. Additionally, Phase 2 includes modeling of four Year 2060 future scenarios representing plausible climate futures (incorporating changes in precipitation and sea level rise), changes in land cover, and land subsidence, for five return periods or Annual Exceedance Probabilities (AEPs): 5-year or 20% AEP, 10-year or 10% AEP, 25-year or 4% AEP, 100-year or 1% AEP, 500-year or 0.2% AEP. In Phase 2, five scenarios are included:

Scenario 1. Minimal future climate forcing (17^{th} percentile "change factors" applied) with future subsidence and land use change

Scenario 2. Moderate future climate forcing (50^{th} percentile "change factors" applied) with future subsidence and land use change

Scenario 3. Significant future climate forcing (83^{rd} percentile "change factors" applied) with future subsidence and land use change

Scenario 4. Moderate future climate forcing only (50^{th} percentile "change factors" applied) without future subsidence and land use change

Scenario 5. Present-day (existing Conditions)

The results of this work are expected to support and improve the quality of the required future condition flood risk assessment work of the Regional Flood Planning Groups (RFPGs). These scenarios are being provided in lieu of requiring the RFPGs to choose from one of the prior, simplified future condition flood hazard assessment methodologies that were allowed under the previous flood planning cycle guidelines.

The core of Fathom's flood modeling framework is the LISFLOOD-FP 1D - 2D hydrodynamic model, which solves the shallow water equations of flow over representations of rivers and floodplains to produce estimates of floodplain depth and extent. Over the State of Texas, inputs used for this model include:

- A gridded Digital Elevation Model (DEM) for terrain elevations
- Rainfall, flow and sea level boundary conditions derived for the flood type under consideration (fluvial, pluvial, and coastal) using flood frequency analysis
- River hydrography and bathymetry
- River/floodplain friction parameters (Manning's n)

Utilizing the inputs summarized above, LISFLOOD-FP simulates events associated with the five return periods, calculates flood depths and flow per pixel for each timestep of the simulation. Whilst final maps are produced at 3-meter resolution, flood simulations are run at 30-meter resolution since this is more computationally tractable than execution at 3m. The 30m flood maps are then downscaled to 3-meter resolution raster files allowing higher resolution mapping to be achieved. Fathom's computational algorithm is described in Appendix E - Model Simulation Memorandum. Details about the downscaling process can be found in Appendix G - Downscaling Memorandum.

This executive summary provides an overview of the project inputs, processing methodology, results, analysis, and recommendation. Further detailed technical information can be found in the Final Report and supporting Appendices.

Methodology and Result Differences between Phase 1 (2022) and Phase 2 (2025)

Numerous methodological changes have been made to Fathom's flood modeling framework since Phase 1. These changes will be implemented for all five scenarios for Phase 2. The changes include:

1. DEM was updated with the most recently available LiDAR from Texas Geographic Information Office[1], in June 2023, to give a more accurate representation of current terrain elevation. Areas where DEM was updated are shown in Appendix A - LiDAR Reprocessing Memorandum.
2. The least squares optimization approach to calculate channel depths (Neal et al. 2021) was updated for Phase 2 to allow channel slope profiles other than "mild slope" to be represented resulting in more plausible channel depths.
3. The coastal boundary conditions in Phase 2 are generated with a regionalized frequency analysis for storm surge (Collings et al 2024), resulting in a more robust representation of extreme flood quantiles compared to Phase 1, which performs at-site frequency analysis.
4. Spatially varying Manning's roughness was applied in Phase 2, which leads to more realistic overland routing of flood waters while a constant Manning's roughness was used for the entire State in Phase 1. For further details, refer to Appendix C - Land Use Memorandum.
5. The USGS Conterminous United States Land Cover Projections[2] (downloaded July 2023) were used for the land use/urbanization in Phase 2 because this dataset includes urbanization projections for 2060. This replaces the use of the Global Human Settlement Layer, used only to denote degree of urbanization in Phase 1.
6. The anticipated level of service for the urban drainage systems has been updated to better reflect reality in Phase 2. In poorly drained areas the drainage standards applied are the 1-year and 2-year rainfalls for sub-urban and urban areas respectively; in all other areas, the drainage standards applied are the 2-year and 5-year rainfalls for sub-urban and urban areas respectively. This contrasts to the 5-year and 10-year standards applied to suburban and urban area respectively for Phase 1. For further details, refer to Appendix C - Land

[1] TxGIO DataHub

[2] https://www.sciencebase.gov/catalog/item/5b96c2f9e4b0702d0e826f6d

Use Memorandum.

A present-day (existing condition) baseline simulation methodologically consistent with the future scenarios is required for comparison purposes, therefore the present-day scenario was re-simulated with the above changes included. Phase 1 outputs compared to Phase 2 present-day outputs are broadly similar, with some localized changes, in several parts of the State, as a result of updated model processing and input datasets. Where there are changes, the Phase 2 flood extents are generally smaller and more realistic than in Phase 1. Resulting differences between Phase 1 and Phase 2 are shown in Appendix I – Data Review Memorandum.

Future Condition Scenarios

The future scenarios were scoped to estimate future condition flood hazard in year 2060 considering four factors: 1. future precipitation changes, 2. sea level rise, 3. future projected land use and 4. subsidence. Four future conditions scenarios modeled include three with the same future projected land use and subsidence, under three plausible future climate forcing scenarios (minimal, moderate, and significant). A fourth scenario models a moderate future climate forcing (future precipitation and sea level rise), with present-day land use and no subsidence.

Fathom's approach to modeling future hazard is based on the generation of riverine (fluvial) flooding, local (pluvial) flooding and coastal flooding “change factors” from ensembles of global climate models, known as General Circulation Models (GCMs). Riverine (fluvial) flooding, local (pluvial) flooding and coastal flooding are referred to as the three perils in the document.

The climate in 2060 is represented by a 2°C global mean temperature increase relative to the estimated temperature of the 1850-1900 pre-industrial period, after which systematic increases in global CO_2 emissions commenced. This future climate scenario was selected in consultation with the State Climatologist, Dr. John Nielsen-Gammon. Based on the strong relationship between temperature change and precipitation change, the 2°C benchmark is used to select output from an ensemble of General Circulation Models (GCMs) for pluvial modeling and ensembles of GCMs linked to ensembles of hydrological models for fluvial modeling. For simulation of coastal inundation, ensembles of predictions of sea level from the IPCC Sixth Assessment Report (AR6) are used. Comparison of present-day mean indices of precipitation, flow, and sea level to 2060 climate future values are used to generate fluvial (riverine), pluvial (local), and coastal change factors.

Ensembles of change factors grids are produced, and the 17th (lower), 50th (moderate) and 83rd (upper) percentiles are sampled This represents the central 66 percent of possible future outcomes, following the IPCC’s definition of “likely” changes. The 17th, 50th, and 83rd percentile data represent the minor, moderate, and high climate forcing, respectively, in this study. Appendix B - Climate and Sea Level Rise Memorandum presents the spread in the model projections used for the Phase 2 modelling for fluvial, pluvial and coastal boundary conditions. These “change factors” are applied to existing conditions flood peril data boundary conditions generated within Fathom’s flood modeling framework which include:

- Rainfall Intensity-Duration-Curves taken from NOAA Atlas 14 precipitation frequency estimates for **pluvial** rain-on-grid approach

- Peak Flood Flows using a Regional Flood Frequency Analysis (RFFA) approach for **fluvial** perils
- Sea level Regional Frequency Analysis (RFA) for **coastal** perils

Future land use projections are derived from the USGS Conterminous United States Land Cover Projections[1] dataset, which provides a present-day view of land use and a year-2060 view of land use. This dataset is also used to define levels of urban drainage for urban areas, a crucial part of pluvial flooding modelling.

Future land subsidence is generated by linearly extrapolating historical point measurements of terrain elevation (from NOAA and GPS data from Harris-Galveston Subsidence District) to year-2060, and then spatially interpolating these point estimates using the kriging interpolation method. The layer is used to amend the DEM for the scenarios in which land subsidence is modelled. The consideration of subsidence projections is explained in explained in Appendix D – Land Subsidence Memorandum.

Variable Impacts Analysis

To determine which factors are dominant in evolving future flood risk, a series of comparisons between flood inundation maps associated with these scenarios were made. Below is a summary of key findings:

1. Climate forcing is the dominant factor influencing future flooding across Texas for all three perils: fluvial, pluvial and coastal. However, the direction of change of flood hazard (i.e. whether flooding increases or decreases) varies spatially, by peril, and by future climate forcing scenario. Specifically for pluvial flooding, minimal and moderate climate forcings result in reduced or increased flooding depending on location; while for significant climate forcing, inundation is increased for the vast majority of the State.
2. For riverine or fluvial flooding, a strong drying signal occurs when minimal climate forcing is applied, with a mixed signal for moderate climate forcing. A wetting signal is observed everywhere for significant climate forcing. Land use changes lead to a negligible reduction in floodplain inundation, and subsidence has little impact on flooding. Results from the future climate projection approach indicate that there are large areas that are projected to experience negative change factors and therefore decreasing peak flood flows in areas where extreme precipitation is expected to increase. An important finding for fluvial flooding is that, unlike pluvial flooding, large areas are projected to experience smaller extremes, including in some regions where extreme rainfall is expected to intensify. This is because while rainfall depths may be increasing, other hydrologic conditions and processes also impacted by the 2°C global mean temperature change within the climate models that cause more water to be lost (e.g. greater evaporation over the watershed) or attenuate the peaks (e.g. drier antecedent conditions) that result in decreasing change factors to fluvial model boundary conditions (i.e. fluvial flow estimates). These impacts can offset the changes expected by only considering the increase in extreme rainfall. Further detailed discussion of this result and relevant references can be found in the Appendix F - Variable Impacts Memorandum and the references therein.

3. For coastal flood peril under all climate scenarios, future sea level increases under all scenarios, leading to increased coastal flooding. This happens because there is much greater certainty in that global sea levels will rise, based on observed historical trends and a high degree of confidence in the key processes driving it[3]. Historical records show a steady increase in sea levels.
4. Given that changes in subsidence occur very gradually in space, i.e. if a region has subsided by a given amount, there is a good chance a nearby region has subsided by a similar amount. Therefore, it is expected that subsidence has a small impact on pluvial and fluvial perils. However, for coastal simulations, subsidence has a greater impact than land use change, although both will influence flood extent. This is because the lowering of land relative to mean sea level exposes more land to flood waters. These effects will be larger in locations subject to the greatest levels of subsidence.
5. The inclusion of land use change and subsidence leads to localized changes in flood inundation, with some areas increasing and others decreasing as the distribution of flooding is altered by the effects of these factors. Land use is likely more responsible for localized changes in inundation for pluvial and fluvial flooding because land subsidence is relatively constant at a local scale. For fluvial flooding, the roughness coefficient likely contributes the most to local flood variability in future scenarios as a result of land use change.

In addition, a combined hazard analysis was undertaken, in which comparisons were made for overall flooding (fluvial, pluvial, and coastal combined). Taken together, minimal climate forcings result in reduced or increased flooding depending on location; for moderate climate forcing, flooding is generally increased ; while for significant climate forcing, inundation is increased for the majority of the State. Land use has a negligible impact on inundation, whereas subsidence, where applicable, increases inundation. Please refer to Appendix F - Relative Impact of Climate Land Use on Floodplain Extent for more information.

Sources of Uncertainty

Flood models are subject to uncertainty due to the inherent uncertainty in input data sources and model assumptions. The key sources of uncertainty in this project arise from (in random order): the terrain data; channel bathymetry; boundary conditions; urban drainage assumptions; Manning's roughness coefficient; hydraulic model uncertainty; unrepresented structures, such as levees and bridges, which may influence local hydraulics significantly; model configuration; and, for future predictions, the change in future climate. The magnitude of the uncertainty is itself uncertain, but the team has sought to provide best-guess future flood inundation maps based on the assumptions described and the best data available. Please refer to Appendix H- Sources of Uncertainty Memorandum and Appendix I – Data Review Memorandum for more information.

Professional judgment, appropriate caution and disclaimer should be utilized while using this dataset particularly as described in areas discussed below. Below an non-exhaustive list of data limitations:

1. Cursory flood data may not appropriately depict flooding associated with:

[3] https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Chapter09.pdf

- Constructed features that may alter flow patterns (roadways, railroads, urban areas, storm drainage systems, dams, levees, embankments, etc.)
- Natural features that may not be fully represented in the 30-meter model (alluvial fans, sinkholes, small tributaries, waterbodies, areas of immediate topographic change, etc.)
- Border areas along the Texas state boundary

2. Cursory flood depths were developed using a high-level statewide assessment and should be used as approximations of flood risk. Limitations exist above bodies of water where underwater bathymetry might alter flood depths. The raster data in some coastal open water areas exhibits artifacts such as blocks of unreasonably high or low depth.
3. In several areas, the raster data includes visual artifacts such as checkerboard or striping patterns. Most of these artifacts are attributed to limitations of the terrain and land use input data.

Final Products

The Fathom-AECOM-Aqua Strategies team has provided 3-meter resolution gridded flood inundation data for the future scenarios described above, as well as the re-simulation of the existing conditions. These data are provided in both raster and polygon formats, and are organized by climate forcing scenario and return period.

The delivered datasets exhibit the following features:

- Flood depths and extents represent maximum depths from all perils (i.e. coastal, fluvial, and pluvial).
- Flood depths of less than 15cm over land have been removed.
- The units of depth are reported in decimal feet.
- Polygons have been simplified with a 5ft simplification tolerance.

Recommended Scenario for Use by RFPGs

It is recommended that RFPGs use Scenario 3: Significant future climate forcing (83rd percentile climate "change factors" applied) with future subsidence and land use change. This scenario represents the upper percentile of possible flood inundation across Texas, allowing robust planning of worst-case flood scenarios. Scenarios 1 and 2 (17^{th} percentile and 50^{th} climate "change factor" percentiles, respectively) may also be considered. However, it should be noted that under these two scenarios, several parts of the State are projected to exhibit reduced flooding. While Scenario 3 is recommended, RFPGs may use their judgement to select the scenario that fits their region best and provide the reasoning for doing so.

Since the future condition flood hazard assessment is for guiding long term floodplain management and flood risk reduction efforts in Texas, in areas where future floodplain is projected to shrink or decrease, the RFPGs are required to utilize the flood hazard area that is at least equal to the existing flood hazard for the same area.

2.2.3 Resilience of Communities Located within a Flood-Prone Area

The average SVI of features within floodplains or flood-prone areas per county is provided in Table 3 Existing Condition Flood Risk Summary Table in Appendix A. Locations of high SVI areas located within floodplains or flood-prone areas are shown in Figure 2-4. Vulnerable areas include:

1. Most vulnerable areas: Calhoun, Atascosa, and Refugio Counties
2. Other vulnerable areas: San Antonio, Floresville, and Von Ormy

2.3 Future Condition Flood Risk Analysis

In addition to quantifying the current flood risk, it is helpful to consider the change in flood risk over the course of the planning horizon to help communities plan ahead for new or increased risks. With this concept in mind, a future condition flood risk analysis was performed for the SAFPR.

The future condition flood risk analysis included two components: projected increases in flood hazard, and additional exposure/vulnerability. The first step was to define a future flood hazard area boundary to identify areas of existing development that, while not currently at risk of flooding during the 1 or 0.2 percent annual chance storm events, may be at risk of flooding during these events in the future. The second step was to identify areas that face an increase in future flood risk due to new development or redevelopment that may occur in these areas. The methods employed to evaluate future risk and the results of the analysis are explored in the following sections.

2.3.1 Future Condition Flood Hazard Analysis

History has demonstrated that flood hazards tend to increase over time in populated areas due to projected increases in impervious cover, anticipated sedimentation in flood control structures, and other factors that result in increased or altered flood hazards. As a result, the future condition flood hazard area was defined based on an expected increase in flooding extents and magnitude across the region.

The TWDB has provided several methods to determine the future flood hazard layer. The first step of this task is to identify areas within the region where future condition H&H model results and maps already exist. Currently within the SAFPR, detailed FEMA studies include a future 1 percent flood risk area. However, they were developed using future land use shapefiles created by Bexar County and the CoSA. This process differs from the method proposed by the TWDB and does not consider climatic changes. Therefore, one of the following four methods must be used to identify the future flood risk across the region:

1. Increase water surface elevation based on projected percent population increase (as a proxy for land development)
3. Use the existing 0.2 percent annual chance floodplain as a proxy for the future 1 percent annual chance storm event
4. Use a combination of Methods 1 and 2 or an RFPG-proposed method
5. Request TWDB for a Desktop Analysis

Flood Planning Region (FPR) 12 employed Methods 2 and 3, described further in this section.

2.3.1.1 Future Conditions Based on "No Action" Scenario

It must be noted that these estimated changes in flood hazard extents are meant to represent the "30-year, no action" scenario for the purpose of evaluating the potential magnitude for future flood risk. This information will in no way be used for floodplain mapping for regulatory purposes, such as local (municipal) floodplain management and development regulation, or in any way by FEMA or the NFIP. This is simply a planning level analysis for the purpose of supporting the regional flood planning process.

2.3.1.2 Methods for Developing the Future Flood Hazard Layer

Future flood conditions represent projected conditions 30 years into the future, or year 2050, and can be influenced by several factors, such as:

- Precipitation climate change
- Rising sea levels
- Population growth and associated development increases (impervious cover)
- Natural stream migration changes to existing waterways
- Implementation of constructed drainage infrastructure

The existing 0.2 percent flood risk areas were used as a proxy for the future 1 percent flood risk areas in areas where future 1 percent flood risk areas did not exist, per Method 2 in TWDB's guidance. Method 3, a San Antonio RFPG method, was used to calculate the 0.2 percent future storm event risk area, given as a buffer value. For the 0.2 percent annual chance future conditions floodplain, HDR used the 2018 *San Antonio River Basin Future Precipitation Study,* developed by SARA, which estimates the 0.2 percent annual chance storm event rainfall total will increase 3.8 inches in 20 years and 5.1 inches in 40 years.

As part of separate effort with SARA, HDR used the precipitation study information along with draft hydrology models for the major watersheds currently being developed by SARA as part of a county-wide floodplain remapping effort within the SAFPR to estimate peak discharges. This analysis showed the average increase in the 0.2 percent annual chance storm event peak flows throughout the basin were between 30 and 40 percent for the 20- and 40-year future projections, respectively. From this data, HDR estimated a 35 percent increase in 0.2 percent annual chance storm event peak flows for a 30-year future event. With this estimated flow increase, HDR evaluated the horizontal increase in 0.2 percent annual chance floodplain top-widths using selected HEC-RAS models in various locations throughout the watershed. Below is a more detailed explanation of how the future flood hazard conditions were calculated.

HYDRAULIC MODEL UPDATES

The system hydraulic models were updated by increasing the 0.2 percent annual peak flows by 35 percent, as established above. However, due to variations in model versions, boundary conditions, and level of detail, some specific modifications were made to execute the hydraulic models.

All selected stream effective hydraulic models, except Salado Creek and Upper San Antonio River, downloaded from SARA's D2MR, were provided in their original HEC-RAS format (versions 3.1.2 and 4.0). At the time of this analysis, SARA provided draft hydraulic models for the Salado Creek and Upper San Antonio River systems developed as part of SARA county-wide floodplain remapping effort, which were provided in HEC-RAS (version 5.0.7). For the purpose of this exercise, all models were executed in HEC-RAS (version 4.1 or later), which allow for Defined Results Tables with "Left and Right Station" results, as needed for the top-width assessment. A comparison between the HEC-RAS results (versions 3.1.2/4.0 versus 4.1) existing 0.2 percent annual chance storm event showed less than 0.01 percent difference in peak Water Surface Elevation Level (WSEL); therefore, the version change posed no impact to hydraulic results.

Hydraulic models with boundary conditions defined as known WSEL were left unchanged for this analysis based on a sensitivity analysis performed on Ojo De Aqua at the Lower San Antonio River confluence in Karnes County. The Ojo De Aqua hydraulic model was simulated assuming an unchanged known WSEL boundary condition and updated boundary condition based on future 0.2 percent annual chance peak flows along the Lower San Antonio River to evaluate potential changes due to boundary condition assumptions. Based on the results, less than a 0.01 percent change in WSEL occurred on the first two to three cross sections. Therefore, it was determined leaving the boundary conditions as is had no effect on the comparison objective of this exercise.

Due to the type of available study, some models only had the 1 percent annual chance storm event present and not the 0.2 percent annual chance storm event needed for the assessment. Seguin Branch LOMR was one of the models that did not have the 0.2 percent annual chance storm event, so this flow was pulled from the HEC-HMS hydrology model downloaded from SARA D2MR. However, it is presumed that this HEC-HMS model is not the same model that was used to establish the HEC-RAS models 1 percent annual chance storm event peak flows. The HEC-HMS 1 percent annual chance storm event peak flows were within 4 percent of the HEC-RAS peak flows (8,541 versus 8,860 cubic feet per second), so the 0.2 percent annual chance storm event peak flow data from the HEC-HMS was used to determine the top-width difference. Following the completion of this process, where 0.2 percent results were lacking, it was determined a more efficient method would be needed to complete the exercise within the project time constraints. In comparing surrounding hydraulic models with both 1 and 0.2 percent annual chance storm event peak flows, a conversion multiplier was established to determine the existing 0.2 percent annual chance peak flow from the 1 percent annual chance peak flows when not available. A summary of the hydraulic models, 1 to 0.2 percent annual chance multipliers, and reasoning are included in Table 2-2.

Hydraulic models were run with the above considerations and modifications, and the existing and future 0.2 percent annual chance storm event peak WSEL results were compared.

Table 2-2. HEC-RAS Models Using Multipliers

RAS Model	0.2% Flows Increase Criteria	Reason
Cibolo Wilson Co	43%	• US: Lower Cibolo HEC-RAS average 43% • DS: SAR Lower Karnes average 43%
Cibolo Karnes Co	43%	
Ecleto	66%	
Manahuilla	67%	

RAS Model	0.2% Flows Increase Criteria	Reason
Cabeza	68%	• Smaller reaches like Marcelinas and Seguin are higher average than larger reaches; Cibolo and SAR • Ecleto similar geo-location to Marcelinas • SAR Lower Goliad higher average than US SAR Lower Karnes; therefore, assume Manahuilla and Cabeza increase from Ecleto to DS

Notes: DS = Downstream; SAR = San Antonio River; US = Upstream

HYDRAULIC MODEL ASSESSMENT

As explained above, some variations occurred in the hydraulic model updates, but the same assessment of the peak WSEL was implemented for all modeled streams.

Existing and future 0.2 percent annual chance storm event results were compared based on top-width and WSEL differences. Averages for both were calculated for each modeled stream. To develop a refined average, outlier data was not considered to avoid skewing results. Outlier data consisted of top-width differences greater than 500 feet, WSEL differences greater than 5 feet, and any result where the WSEL was not contained within the cross section.

Each hydraulic model was categorized based on urbanization levels, location within the region, and general land slope to develop geospatial watershed relationships. Some of the longer reaches with varying categories were split for this assessment. Urbanization levels were defined as “Urban” if most of the reach passed through cities, or “Rural” if the reach was primarily passing through undeveloped/agriculture land. Location was divided by “Upper,” north of San Antonio and North San Antonio; “Mid,” mid San Antonio to edge of Bexar County; “Lower,” Wilson and Karnes Counties; and “Coastal,” DeWitt and Goliad Counties. Slopes were generalized into ranges less than 0.1, 0.1 to 0.2, 0.2 to 0.5, and greater than 0.5 percent. Averages from each of the categories can be found in Table 2-3.

The average increases in top-width would be applied to the existing 0.2 percent flood risk area as a horizontal buffer to develop the future 0.2 percent flood risk area.

Table 2-3. Assessment Categories and Results for the Existing and Future 0.2 Percent Annual Chance Comparison

Assessment Category	Category Type	Total Top-Width Difference (feet)	One Side Top-Width Difference (feet)	WSEL Difference (feet)
Urbanization	Urban	119	59	2
	Rural	152	76	2
Location	Upper	118	59	2
	Mid	156	78	2
	Lower	140	70	2
	Coastal	154	77	2
Slope	$x \geq 0.005$	90	45	2
	$0.002 \leq x < 0.005$	148	74	2
	$0.001 \leq x < 0.002$	147	74	2
	$x < 0.001$	169	85	3
Medina	—	67	33	4
Average	—	**139**	**70**	**2**

RESULTS

Using the results developed from the top-width exercise, buffer criteria were established based on stream spatial location within the region to develop the future 0.2 percent flood risk area. Final criteria areas were refined to the following boundaries:

- Upper: North of North Loop 1604 from Culebra Road to Interstate 35
- Mid: South of North Loop 1604 to south of Karnes County
- Coastal: South of Karnes County to the Gulf of Mexico
- Medina: Includes reaches and tributaries not evaluated in the assessment

Based on initial results of Medina tributaries evaluated in the top-width assessment, result differences were noted to be significantly lower than top-width results and higher than WSEL differences compared to all other reaches. This can be attributed to the steep terrain and channel bank slopes.

Therefore, a separate buffer criterion was established for the Medina watershed.

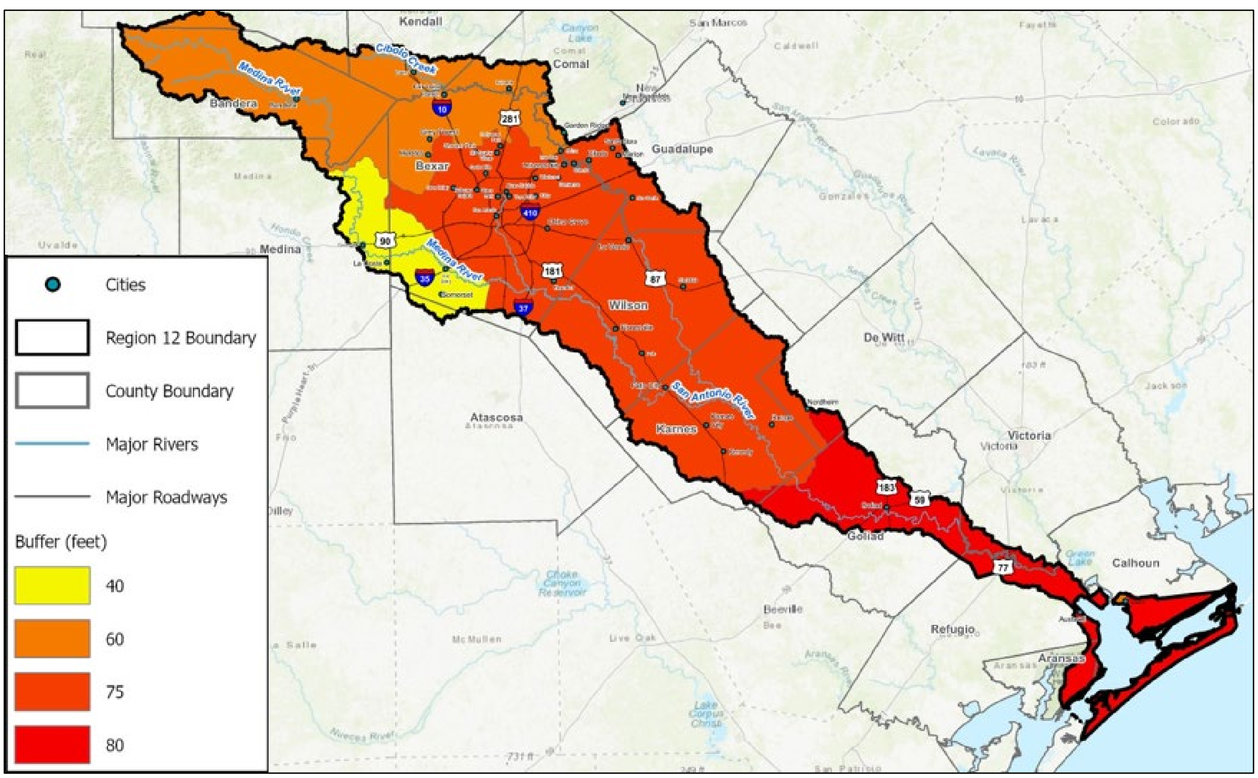
The final criteria set is in Table 2-4 and Figure 2-5. The buffer is the top-width increase that should be applied to each side of the existing 0.2 percent annual chance storm event floodplain to develop the future 0.2 percent annual chance storm event floodplain.

Table 2-4. Final Criteria for the 0.2 Percent Future Floodplain Buffer

Criteria	Type	Buffer[a] (feet)
Location	Medina	40
	Upper	60
	Mid	75
	Coastal	80

[a] Buffer is applied to each side of the floodplain.

Figure 2-5. Final Criteria for the 0.2 Percent Future Floodplain Buffer



2.3.1.3 Coastal Future Conditions

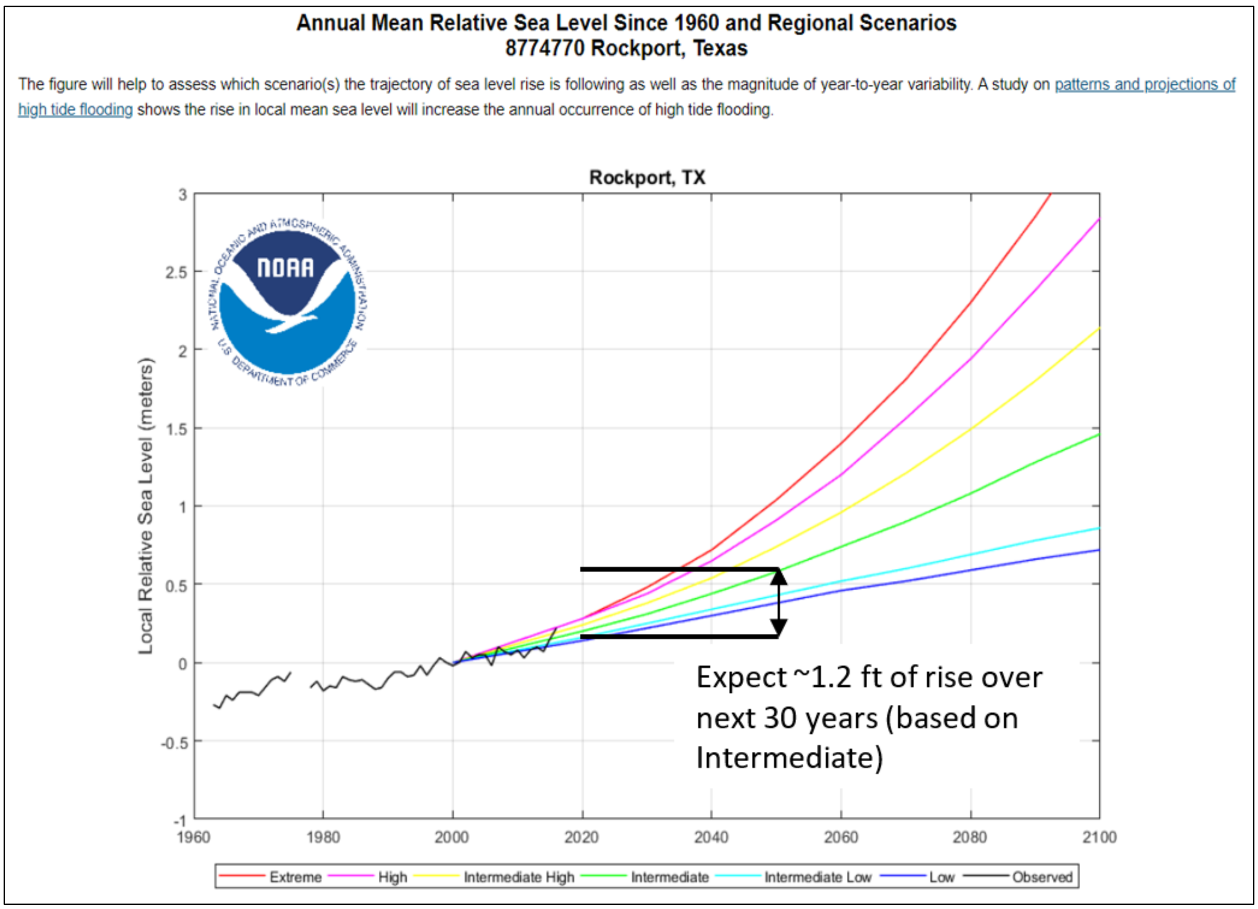
Relative sea level rise (SLR) is also considered a significant factor in the future condition flood risk along the coastline. For this study, relative sea level change is estimated on best available existing data. The following data sources are currently available and were reviewed for this task:

- National Research Council (NRC) (1987) *Responding to Changes in Sea Level: Engineering Implications*: The NRC study developed SLR/sea level change scenarios. This study was leveraged by the USACE and NOAA and is the main resource for all present-day estimates.
- NOAA (2017) *Global and Regional Sea Level Rise Scenarios for the United States* (TR NOS CO-OPS 083): NOAA has developed a tool to calculate the approximate SLR computed from the most recent Intergovernmental Panel on Climate Change and modified NRC projections. NOAA computed five scenarios, including “high,” “intermediate-high,” “intermediate,” “intermediate-low,” and “low.” These SLR scenarios are presented in Figure 2-6. Table 2-5 provides a comparison of NOAA and USACE sea level rise scenarios. This data can be extrapolated from graphs and applied to a digital terrain model.
- NOAA (2022) *Sea Level Rise Technical Report*: NOAA developed an update to the 2017 report and data.
- USACE (2013) *Incorporating Sea Level Change in Civil Works Programs* (ER 1100-2-8162): This source provides design guidelines for incorporating the direct and indirect physical effects of projected future sea level change across the project life cycle in managing, planning, engineering, designing, constructing, operating, and maintaining USACE projects and systems of projects.
- USACE Sea-Level Change Curve Calculator (Version 2021.12): The USACE developed a tool to calculate the approximate SLR for three scenarios including “high,” “intermediate,” and “low.”
- General Land Office (GLO) (2021) *Coastal Texas Protection and Restoration Feasibility Study Final Report* (short title: Coastal Texas Study): This study uses the NOAA 2017 data and prepared inundation mapping for entire Texas coast. The inundation mapping is based on various scenarios, including: 100- and 500-year storm events modeled and future conditions with no mitigation (i.e., a “no action”) scenarios available for years 2035 and 2085.

Table 2-5. Comparison of NOAA and USACE Sea Level Rise Scenarios

NOAA Scenarios	USACE Scenarios	Description
Low	Low	Linear historic SLR
Intermediate-Low	Intermediate	NRC Curve I – Moderate Greenhouse Gas Emission
Intermediate	—	NRC Curve I – High Greenhouse Gas Emission
Intermediate-High	High	NRC Curve III – Moderate Glacier Melt
High	—	NRC Curve III – High Glacier Melt

Figure 2-6. Annual Mean Relative Sea Level Scenarios – Rockport, Texas



Source: NOAA 2017

NOAA's *Global and Regional Sea Level Rise Scenarios for the United States* (2017 with 2022 update) provides the most relevant technical data related to SLR. When considering the various scenarios of SLR, the "intermediate-low" scenario has a high likelihood of occurrence based on predicted outcomes and includes scientifically reasonable considerations for increased greenhouse gas emissions, ocean thermal expansion, and land-based subsidence/uplift. However, the "intermediate" scenario is the most typical scenario selected for design. It includes considerations for past observed sea level trends and global effects due to moderate increases in greenhouse gas emissions. Table 2-6 compares the NOAA and USACE data to understand what the expected SLR is for the San Antonio region at the 30-year projected time frame.

Table 2-6. Water Surface Elevation Increase (feet) Projected from 2020 to 2050

NOAA Scenarios	USACE Scenarios	USACE 2013[a]	NOAA 2017[b]	NOAA 2022[b]	Description
Intermediate-Low	Intermediate	0.7	0.9	1.0	NRC Curve I
Intermediate	—	—	1.2	1.1	—
Intermediate-High	High	1.5	1.6	1.3	NRC Curve II

[a] https://cwbi-app.sec.usace.army.mil/rccslc/slcc_calc.html
[b] https://coast.noaa.gov/sir/

GLO's 2021 Coastal Texas Study used the NOAA 2017 data to prepare inundation mapping for the entire Texas coast for several different scenarios and various projections into the future (Figure 2-7). None of the modeled scenarios precisely match the 30-year projection required by the San Antonio RFP. However, the Year 2035 "low" and Year 2085 "intermediate" scenarios result in a SLR of approximately 2 feet.

Figure 2-7. Coastal Texas Study Relative Sea Level Change Projections

Coastal Texas Protection and Restoration Feasibility Study Final Report — 1. Introduction

Year	Pier 21 (Region 1) Low	Pier 21 (Region 1) Intermediate	Pier 21 (Region 1) High	Rockport (Regions 2 and 3) Low	Rockport (Regions 2 and 3) Intermediate	Rockport (Regions 2 and 3) High	Port Isabel (Region 4) Low	Port Isabel (Region 4) Intermediate	Port Isabel (Region 4) High
2017	0	0	0	0	0	0	0	0	0
2035	0.4	0.5	0.8	0.3	0.4	0.8	0.2	0.3	0.7
2085	1.4	2.1	4.4	1.2	1.9	4.1	0.8	1.5	3.8
2135	2.5	4.2	9.8	2.0	3.8	9.4	1.4	3.2	8.8

***Table 1.1:** Relative Sea Level Change Projections (feet)*

This 1- to 2-foot SLR matches closely with the future rise in riverine WSELs (as seen in Section 2.3.1 Future Condition Flood Hazard Analysis); therefore, the buffers shown in Table 2-4 of 80 feet on each side (or total of 160 feet) were used in the future mapping limits development.

2.3.1.4 Identified Future Flood Hazard Areas

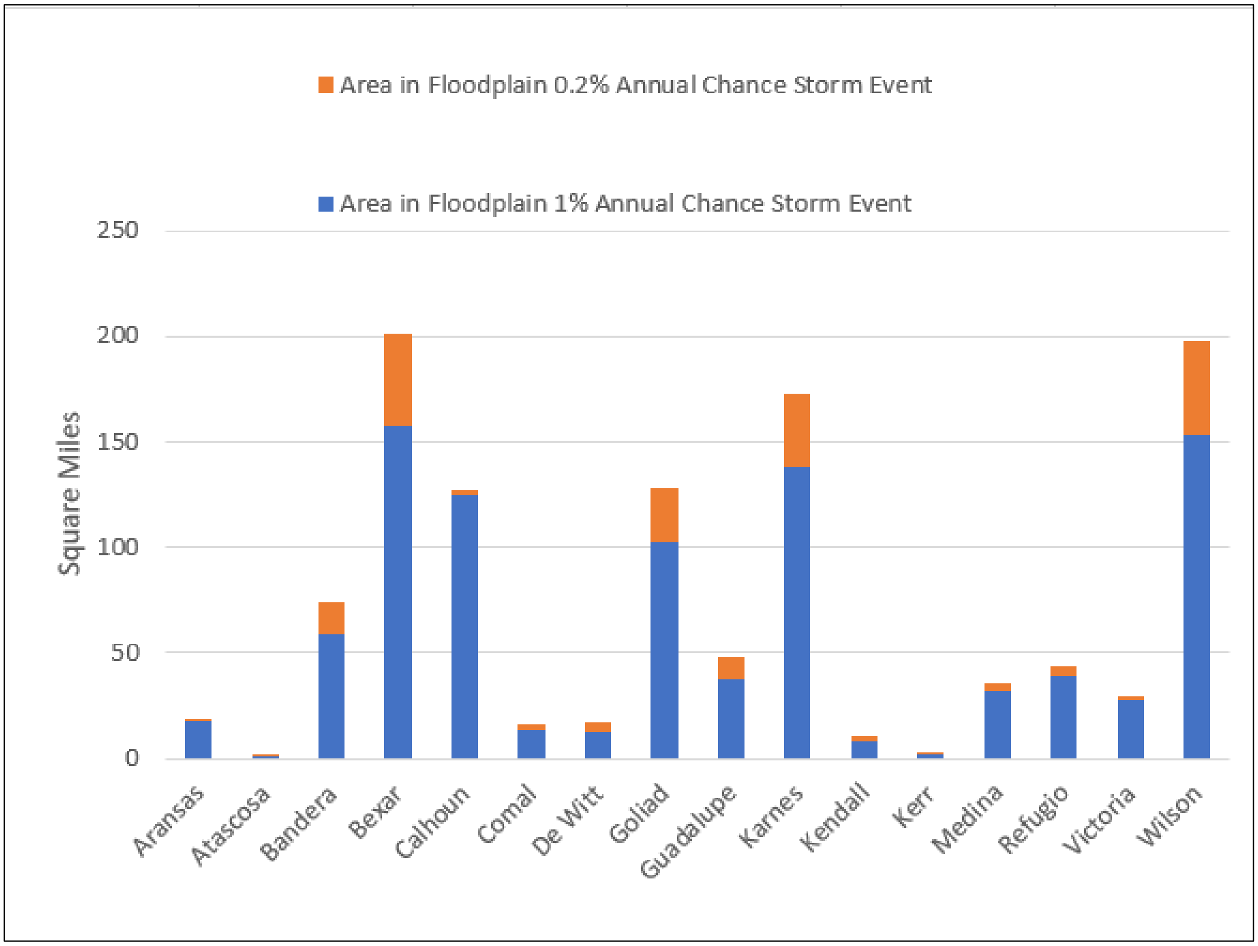
Using the method described previously, the maps for the future 1 and 0.2 percent flood risk areas were developed in GIS. A comparison of the existing and future flood risk area is presented in Table 2-7. An additional 200 square miles of flood risk area is added to the floodplain with estimated future conditions, or an increase of 22 percent.

Table 2-7. Existing and Future Flood Hazard Comparison

Flood Hazard Area	Total Existing Area (square miles)	Total Future Area (square miles)	Area Change (square miles)	Area Change (%)
1%	800.2	925.57	125.37	16
0.2%	124.34	199.32	74.98	60
Total	**925.54**	**1124.89**	**200.35**	**22**

The total future condition flood risk area is summarized by county in Figure 2-8. As with existing conditions, Bexar, Calhoun, Goliad, Bandera, Wilson, and Karnes are the counties with significantly high total area in both the 1 and 0.2 percent annual chance storm events. The future area in square miles inundated under future conditions is represented in Figure 2-8. Due to the methodology selected, most of the increase in floodplain is from more urbanized counties. Of the counties located in SAFPR, the flood hazard area increased the most in Wilson, Bexar, and Karnes Counties.

Figure 2-8. Future Area Located within Floodplain



2.3.1.5 Future Conditions Data Gaps

FPR 12 used detailed study floodplains and the buffer to develop the future modeling extents; not all existing detailed mapping within the SAFPR has detailed future conditions. As a result, large portions of FPR 12 are considered to be a data gap under future conditions.

2.3.2 Future Condition Flood Exposure Analysis

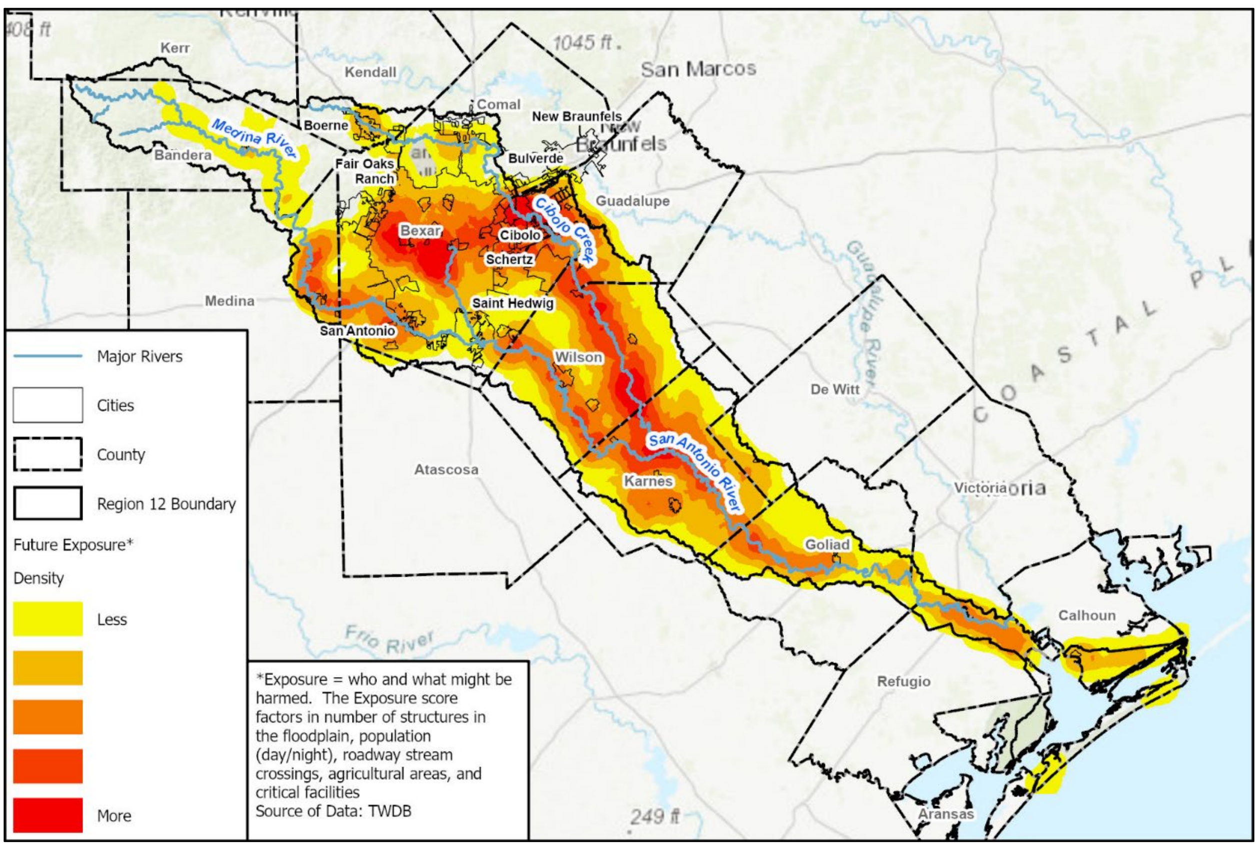
The same flood exposure analysis procedure was followed to quantify exposure under future conditions. This exposure was only quantified for existing development as it compared to the future condition flood hazard area. It is difficult to quantify exposure of future development due to the inherent uncertainty in the exact location of development and changes in population.

However, an effort was made to evaluate areas of future development and provide qualitative information regarding potential exposure in these areas.

2.3.2.1 Future Flood Exposure Summary

The following sections describe the results of the future flood exposure analysis through the same series of maps that is presented for existing flood exposure. The Cities of San Antonio, Boerne, Bandera, and Karnes continue to have a high concentration of flood exposure within the SAFPR. The urban areas around the San Antonio River, Medina River, and Cibolo Creek have the highest concentration of flood exposure within the SAFPR due to the density of development and total population in these areas. However, other portions of the SAFPR see a greater density of flood exposure as compared to existing conditions. A heat map illustrating the future conditions flood exposure within the SAFPR is shown in Figure 2-9.

Figure 2-9. Future Condition Exposure Heat Map



RESIDENTIAL PROPERTIES

Table 2-8 summarizes residential property exposure by county. Those counties with the largest increase in number of residential structures affected are the most urbanized counties within the SAFPR (Bexar, Wilson, Guadalupe, and Bandera). The total number of residential structures that are exposed to future floodplains greatly increases from 19,211 to close to 42,838 structures.

NON-RESIDENTIAL PROPERTIES

Table 2-8 summarizes non-residential property exposure by county. While the total number of non-residential properties contained in the future flood hazard area did not increase as dramatically as residential properties, urbanized counties still saw an increase. Bexar, Wilson, Guadalupe, and Bandera Counties, which saw high residential building increases, are also represented in some of the highest increases of non-residential properties within the same areas. The total non-residential property exposed to future 1 and 0.2 percent annual chance storm events is 12,669 structures.

PUBLIC INFRASTRUCTURE

A total of 670 buildings are marked as public infrastructure within the future flood hazard, 246 more than within the existing flood hazard. Within this group, 293 buildings are critical facilities and discussed further below. Most of these buildings are located within municipalities, with a large portion found within San Antonio.

Major Industrial and Power Generation Facilities

A total of 167 buildings within the future flood hazard are marked as industrial, 80 more than within the existing mapped flood hazard. Of those marked as Industrial facilities, none are classified as critical facilities. Within the future flood hazard area, 35 facilities are associated with power generation.

Critical Facilities

A total of 419 critical facilities are within the future flood hazard area, 185 more than within the existing flood hazard.

Table 2-8 shows a count for the critical facilities, and Figure 2-10 shows the location of these facilities. The two most common types of facilities within the flood hazard area are schools and DOD facilities.

Roadway Crossings

The number of roadway stream crossings within the future flood hazard area are greatest where more urbanization exists, such as Bexar, Bandera, Wilson, and Karnes Counties (Table 2-8). The number of crossings within the future 1 and 0.2 percent annual chance storm event flood hazard area is 2,096, putting more than 452 more roadway crossings within the future flood zones. As mentioned previously, this increase in stream crossings per county is associated with a greater extent of urban area becoming exposed under the future flooding scenario.

Agricultural Areas

Table 2-8 shows the relative number of agricultural areas inundated by flooding under future conditions by county. The amount and value of agricultural areas impacted by flooding increased by 11.8 percent in the future flood hazard condition to 110 square miles and almost $5 billion, respectively. Of the counties located primarily in SAFPR, the counties with the largest increase are Bexar, Wilson, Karnes, and Medina. These areas saw larger increases in overall floodplain size, so this increase is expected for the area.

Roadway Segments

Similar to the roadway crossings, Bexar, Bandera, Wilson, and Karnes Counties have the most miles of roadway within the future hazard area. This can be attributed to an increase in urbanized flooding within the future flood scenario. All the counties in SAFPR have roadways that would be inundated in the future by the 1 and 0.2 percent annual chance storm events. A total of 1,572 miles of roadway are exposed to flood risk in future assessments.

POTENTIAL FLOOD MITIGATION PROJECTS

The future condition flood exposure analysis also required the consideration of impacts from flood mitigation projects in progress with dedicated construction funding that are scheduled for completion prior to the adoption of the next SFP. A total of 46 proposed and ongoing projects have been identified within the SAFPR that meet this criterion.

Major cities within the SAFPR have CIPs and stormwater fees, which may lead to the implementation of additional local stormwater projects. However, these projects do not have specific allocations, so they were not considered in the development of the future flood hazard layer since their construction is not guaranteed. Additionally, these projects will have a minor impact on the floodplain and will not result in major impacts on regional flood risk.

Table 2-8. Summary of Structures within the Future Flood Hazard Areas

County	Area in Flood-plain (square miles)	Number of Structures in Flood-plain	Residential Structures in Flood-plain	Pop. (day-time)	Pop. (night-time)	Pop.	Roadway Crossings (#)	Roadway Segments (miles)	Agricult-ural Areas (square miles)	Critical Facilities (#)
1% Annual Chance Storm Event										
Aransas	17.791	0	0	0	0	0	0	13.069	0.033	0
Atascosa	0.962	57	51	32	95	95	1	2.205	0.045	0
Bandera	58.648	1601	855	1339	1664	1664	83	81.746	1.284	7
Bexar	157.539	13608	10203	59842	36667	59842	1026	397.758	11.849	108
Calhoun	124.950	1553	1156	670	963	963	4	33.078	1.787	4
Comal	13.000	649	507	1482	749	1482	28	19.661	0.600	34
De Witt	12.484	47	14	6	17	17	17	8.388	0.560	0
Goliad	102.239	287	95	158	334	334	58	38.410	13.794	0
Guadalupe	37.577	3809	3123	16208	11218	16208	91	85.629	5.640	45
Karnes	138.381	563	255	318	594	594	107	86.113	25.871	0
Kendall	7.798	961	606	4322	2357	4322	32	17.109	0.093	10
Kerr	1.615	34	10	6	23	23	4	1.292	0.039	0
Medina	31.692	1229	852	2004	1654	2004	59	41.284	9.241	8
Refugio	39.090	179	69	109	188	188	15	12.255	3.156	1
Victoria	27.580	37	14	10	21	21	8	5.658	1.906	1

County	Area in Flood-plain (square miles)	Number of Structures in Flood-plain	Residential Structures in Flood-plain	Pop. (day-time)	Pop. (night-time)	Pop.	Roadway Crossings (#)	Roadway Segments (miles)	Agricult-ural Areas (square miles)	Critical Facilities (#)
Wilson	153.218	2042	1401	1819	2622	2622	110	123.846	21.987	16
Total	**924.57**	**26656**	**19211**	**88325**	**59166**	**90379**	**1643**	**967.50**	**97.89**	**234**
0.2% Annual Chance Storm Event										
Aransas	1.059	0	0	0	0	0	0	2.897	0.003	0
Atascosa	0.232	22	19	9	30	30	0	0.472	0.012	0
Bandera	15.181	1095	631	938	1363	1363	7	22.146	0.098	5
Bexar	43.917	22277	19061	94501	74892	94501	360	237.517	2.056	151
Calhoun	2.335	121	104	11	49	49	2	8.941	0.111	0
Comal	2.660	441	382	980	797	980	6	9.525	0.055	1
De Witt	4.341	44	12	5	18	18	2	9.799	0.242	0
Goliad	25.613	263	114	434	400	434	6	40.699	1.106	3
Guadalupe	10.807	1483	1251	4468	4033	4468	7	37.138	1.644	10
Karnes	34.492	471	204	408	416	416	21	80.011	3.441	0
Kendall	3.025	536	391	1612	1868	1868	11	6.922	0.016	3
Kerr	0.899	47	19	5	19	19	0	0.832	0.008	0
Medina	3.988	285	171	288	413	413	4	7.419	0.522	1
Refugio	4.722	78	27	234	130	234	3	20.397	0.722	3
Victoria	1.968	22	12	6	25	25	1	4.586	0.119	0

County	Area in Flood-plain (square miles)	Number of Structures in Flood-plain	Residential Structures in Flood-plain	Pop. (day-time)	Pop. (night-time)	Pop.	Roadway Crossings (#)	Roadway Segments (miles)	Agricult-ural Areas (square miles)	Critical Facilities (#)
Wilson	44.082	1666	1229	1941	2478	2478	23	115.094	2.928	8
Total	**199.32**	**28851**	**23627**	**105840**	**86931**	**107296**	**453**	**604.40**	**13.08**	**185**
Combined 1 and 0.2% Flood Risk Total	**1123.88**	**55507**	**42838**	**194165**	**146097**	**197675**	**2096**	**1571.90**	**110.97**	**419**

Region 12

Table 11. Regional Flood Plan Flood Mitigation and Floodplain Management Goals

Goal ID	RFPG No.	RFPG Name	Goal	Term of Goal	Overarching Goal(s)	% Complete	Notes
12000001	12	San Antonio	**Track and document** existing public outreach and education activities that improve awareness of flood hazards and benefits of flood planning, including nature based solutions, in the region and ensure there are at least 6 additional occurrences per year.	Short Term (10 year)	Education and Outreach		Who is in charge of tracking this?
12000002	12	San Antonio	**Increase to 12 per year** and maintain and increase public outreach and education activities to improve awareness of flood hazards and benefits of flood planning including nature based solutions in the region.	Long Term (30 year)	Education and Outreach		
12000003	12	San Antonio	**Increase** the proficiency of stakeholders and floodplain managers across the region through training from Region 12 entities, TFMA, ASFPM and FEMA and provide certificates of completion. Improve **50%** of FPM knowledge of nature based solutions, floodplain preservation, and cost/benefit of traditional structural solutions.	Short Term (10 year)	Education and Outreach		How do we track this and who is in charge of completing this?
12000004	12	San Antonio	**Increase** the proficiency of stakeholders and floodplain managers across the region through training from Region 12 entities, TFMA, ASFPM and FEMA and provide certificates of completion. Improve **100%** of FPM knowledge of nature based solutions, floodplain preservation, and cost/benefit of traditional structural solutions.	Long Term (30 year)	Education and Outreach		
12000005	12	San Antonio	**Support the development** of a regionally coordinated warning and emergency response program that can detect the flood threat and provide timely warning of impending flood danger to reduce flood deaths and high water rescues across the region.	Short Term (10 year)	Flood Warning and Readiness		SARA to provide update on Flood Warning for the Region
12000006	12	San Antonio	**Expand the development** of a regionally coordinated warning and emergency response program that can detect the flood threat and provide timely warning of impending flood danger to reduce flood deaths and high water rescues across the region.	Long Term (30 year)	Flood Warning and Readiness		
12000007	12	San Antonio	Increase the number of flood gauges (rainfall, stream, reservoir, etc.) in the region to provide localized information to emergency responders, and storage and accessibility of data to agencies by **25% of existing or at minimum 10.**	Short Term (10 year)	Flood Warning and Readiness		Guages are an FME supported by SARA.

Table 11. Regional Flood Plan Flood Mitigation and Floodplain Management Goals

Goal ID	RFPG No.	RFPG Name	Goal	Term of Goal	Overarching Goal(s)	% Complete	Notes
12000008	12	San Antonio	Increase the number of flood gauges (rainfall, stream, reservoir, etc.) in the region to provide localized information to emergency responders, and storage and accessibility of data to agencies by **50% of existing.**	Long Term (30 year)	Flood Warning and Readiness		How do we make the data more accessible?
12000009	12	San Antonio	**Increase** the number of entities that communicate real time flood warnings to the public. Leverage mobile phone navigation apps to provide real time rerouting for the public.	Short Term (10 year)	Flood Warning and Readiness		
12000010	12	San Antonio	**Increase** the number of entities that communicate real time flood warnings to the public. Leverage mobile phone navigation apps to provide real time rerouting for the public.	Long Term (30 year)	Flood Warning and Readiness		Same Goal. Should we modify or just make this a 10 year goal.
12000011	12	San Antonio	**Establish a baseline and increase** the number of NFIP communities which utilize Atlas 14 (Volume 11) or best available data from NOAA revised rainfall data as part of revisions to design criteria and flood prevention regulations **by 50% percent**. (region specific)	Short Term (10 year)	Flood Studies and Analysis		We can collect the data, but how do we increase the number of communities using?
12000012	12	San Antonio	**Increase** the number of NFIP communities which utilize/adopt Atlas 14 (Volume 11) or best available data from NOAA revised rainfall data as part of revisions to design criteria and flood prevention regulations **by 100%**. (region specific)	Long Term (30 year)	Flood Studies and Analysis		
12000013	12	San Antonio	**Decrease** the number of Zone X by **30% and increase** the number of entities that conduct detailed studies to update their local flood risk by **25%.**	Short Term (10 year)	Flood Studies and Analysis		Are these numbers reasonable? R10 - (10Yr) Increase number from 49 with an additional 26. R15 - gaps - (10Yr) 30% to 40%, (30Yr) over 70%
12000014	12	San Antonio	**Increase** the number of entities that conduct detailed studies to update their local flood risk to **100%.**	Long Term (30 year)	Flood Studies and Analysis		R10 - (30Yr) Increase from 75 with an additional 40.
12000015	12	San Antonio	**Decrease** the average age of FEMA Flood Insurance Rate Maps (NFHL/FIRMs/FIS) **to less than 10 years**.	Short Term (10 year)	Flood Studies and Analysis		We can collect this information with assistance from SARA.

Table 11. Regional Flood Plan Flood Mitigation and Floodplain Management Goals

Goal ID	RFPG No.	RFPG Name	Goal	Term of Goal	Overarching Goal(s)	% Complete	Notes
12000016	12	San Antonio	**Establish a baseline** number of existing studies and process for analyzing watersheds to identify existing Natural Flood Mitigation Features (NFMF) such as headwaters, buffers, and conservation easements.	Short Term (10 year)	Flood Studies and Analysis		
12000021	12	San Antonio	**Increase** the number of entities above the established baseline that have adopted a holistic watershed approach using existing Natural Flood Mitigation Features (NFMF) such as headwaters, buffers, and conservation easements for flood risk reduction as a basis for comprehensive subdivision regulations.	Short Term (30 year)	Flood Studies and Analysis		
12000017	12	San Antonio	**Increase** the number of participating Community Rating System (CRS) entities in the FPR **by 5**.	Short Term (10 year)	Flood Prevention		Are these number reasonable? R10 - NFIP (10Yr) 100%, (30Yr) Maintain R10 Higher Standards - (10Yr) Increase to 60, (30Yr) increase to 80 R11 - (10Yr) 50% of all high growth communities. (30Yr) 75%. R15 - (10Yr) 30-40%, (30Yr) over 50%
12000018	12	San Antonio	**Increase** the number of participating entities within Community Rating System (CRS) in the FPR **by 100% or improve their rating**.	Long Term (30 year)	Flood Prevention		
12000019	12	San Antonio	Increase the number of entities which regulate to the 1% annual chance future conditions floodplains as part of new development and redevelopment by **10%**.	Short Term (10 year)	Flood Prevention		Are these numbers reasonable? How do we increase these numbers? R10 1% in future landuse plan - (10Yr) baseline, (30Yr) increase baseline R11 EX 1% - (10Yr) 20%., (30Yr) 50%
12000020	12	San Antonio	Increase the number of entities which regulate to the 1% annual chance future conditions floodplains as part of new development and redevelopment by **50%**.	Long Term (30 year)	Flood Prevention		

Table 11. Regional Flood Plan Flood Mitigation and Floodplain Management Goals

Goal ID	RFPG No.	RFPG Name	Goal	Term of Goal	Overarching Goal(s)	% Complete	Notes
12000022	12	San Antonio	**Establish a baseline and increase** the number of acres of publicly protected open space by **10 %** as part of land conservation and acquisitions to reduce future impacts of flooding.	Short Term (10 year)	Non-Structural Flood Infrastructure Projects		Get with conservancy to get the baseline - how do we increase this? R10 - (10Yr) increase 15%, (30Yr) additional 25% R13 - (10Yr) Identify and protect 25%, (30Yr) protect 50%
12000023	12	San Antonio	**Increase** the number of restored acres of publicly protected open space land in the region.	Long Term (30 year)	Non-Structural Flood Infrastructure Projects		
12000024	12	San Antonio	**Reduce** the number of NFIP repetitive-loss properties in the FPR by **25%.**	Short Term (10 year)	Non-Structural Flood Infrastructure Projects		These numbers do not seem reasonable. R15 - (10Yr) property buyouts $10 million. (30Yr) property buyouts by $20 million to $50 million.
12000025	12	San Antonio	**Reduce** the number of NFIP repetitive-loss properties in the FPR by **75%.**	Long Term (30 year)	Non-Structural Flood Infrastructure Projects		
12000026	12	San Antonio	**Reduce** the number of existing (2022) residential properties in the future 1% annual chance floodplain **by 10%**.	Short Term (10 year)	Structural and Non-structural Flood Infrastructure Projects		These numbers do not seem reasonable. Other regions compare it to the existing. R10 - (10Yr) reduce by 1000, (30Yr) " by 1,500 R11 - reduce by 10% and 20%, R13 - reduce for 60% and 100% of basin.
12000027	12	San Antonio	**Reduce** the number of existing (2022) residential properties in the future 1% annual chance floodplain **by 50%**.	Long Term (30 year)	Structural and Non-structural Flood Infrastructure Projects		

Table 11. Regional Flood Plan Flood Mitigation and Floodplain Management Goals

Goal ID	RFPG No.	RFPG Name	Goal	Term of Goal	Overarching Goal(s)	% Complete	Notes
12000028	12	San Antonio	**Reduce** the number of vulnerable critical facilities located within the existing and future 1% annual chance (100-year) floodplain **by 50%**.	Short Term (10 year)	Structural Flood Infrastructure Projects		The number of Critical facilities EX = 203, FUT = 234. This could be a potential FME for the entire region.
12000029	12	San Antonio	**Reduce** the number of vulnerable critical facilities located within the existing and future 1% annual chance (100-year) floodplain **by 100%**.	Long Term (30 year)	Structural Flood Infrastructure Projects		
12000030	12	San Antonio	**Identify** the eligible **top 50** vulnerable roadway segments and low water crossings located within the existing and future 1% annual chance (100-year) floodplain.	Short Term (10 year)	Structural Flood Infrastructure Projects		Suggest making this an FME for the entire region.
12000031	12	San Antonio	**Eliminate** or mitigate the eligible **top 50** vulnerable roadway segments and low water crossings located within the existing and future 1% annual chance (100-year) floodplain.	Long Term (30 year)	Structural Flood Infrastructure Projects		Suggest making this a more reasonable number? R10 - (10Yr) establish baseline. (30Yr) increase baseline. R13 - (10Yr) address 30% of high-risk. (30Yr) 80%.
12000032	12	San Antonio	**Increase** the number of structural projects **by 10%** that include a NBS or Green Infrastructure (GI) component.	Short Term (10 year)	Structural Flood Infrastructure Projects		How do we track this? Is this a reasonable number? R11 - (10Yr) project exceed 1acre required NBS, increase by 30%. (30Yr) 100%. R15 - (10Yr) increase 20% - 30%. (30Yr) greater than 50%.
12000033	12	San Antonio	**Increase** the number of structural projects **by 50%** that include a NBS or Green Infrastructure (GI) component.	Long Term (30 year)	Structural Flood Infrastructure Projects		

Goal Comparison

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Goal ID	RFPG No.	RFPG Name	Goal	Term of Goal	Overarching Goal(s)	Goal ID	RFPG Number	RFPG Name	Goal	Term of Goal (Short Term, Long Term)	Overarching Goal
12000001	12	San Antonio	**Track and document** existing public outreach and education activities that improve awareness of flood hazards and benefits of flood planning, including nature based solutions, in the region and ensure there are at least **6 additional occurrences per year**.	Short Term (10 year)	Education and Outreach	10000001	10	Lower Colorado-Lavaca	**Increase** the number of **public outreach and educational communications and activities conducted by the RFPG** to improve awareness of flood hazards and the benefits of flood planning in the Flood Planning Region. **Goal = 260 communications over the next two cycles**	Short Term (10-year)	Education and Outreach
12000002	12	San Antonio	**Increase to 12 per year and maintain** and increase public outreach and education activities to improve awareness of flood hazards and benefits of flood planning including nature based solutions in the region.	Long Term (30 year)	Education and Outreach	10000002	10	Lower Colorado-Lavaca	**Increase** the number of **public outreach and educational communications and activities conducted by the RFPG** to improve awareness of flood hazards and the benefits of flood planning in the Flood Planning Region. **Maintain short-term goal.**	Long Term (30-year)	Education and Outreach
12000003	12	San Antonio	**Increase** the proficiency of stakeholders and floodplain managers across the region through training from Region 12 entities, TFMA, ASFPM and FEMA and provide certificates of completion. **Improve 50%** of FPM knowledge of nature based solutions, floodplain preservation, and cost/benefit of traditional structural solutions.	Short Term (10 year)	Education and Outreach						
12000004	12	San Antonio	**Increase** the proficiency of stakeholders and floodplain managers across the region through training from Region 12 entities, TFMA, ASFPM and FEMA and provide certificates of completion. **Improve 100%** of FPM knowledge of nature based solutions, floodplain preservation, and cost/benefit of traditional structural solutions.	Long Term (30 year)	Education and Outreach						
12000005	12	San Antonio	**Support** the development of a regionally coordinated warning and emergency response program that can detect the flood threat and provide timely warning of impending flood danger to reduce flood deaths and high water rescues across the region.	Short Term (10 year)	Flood Warning and Readiness						
12000006	12	San Antonio	**Expand** the development of a regionally coordinated warning and emergency response program that can detect the flood threat and provide timely warning of impending flood danger to reduce flood deaths and high water rescues across the region.	Long Term (30 year)	Flood Warning and Readiness						
12000007	12	San Antonio	**Increase the number of flood gauges** (rainfall, stream, reservoir, etc.) in the region to provide localized information to emergency responders, and storage and accessibility of data to agencies **by 25% of existing or at minimum 10.**	Short Term (10 year)	Flood Warning and Readiness						
12000008	12	San Antonio	**Increase the number of flood gauges (**rainfall, stream, reservoir, etc.) in the region to provide localized information to emergency responders, and storage and accessibility of data to agencies **by 50% of existing.**	Long Term (30 year)	Flood Warning and Readiness						
12000009	12	San Antonio	**Increase** the number of entities that **communicate real time flood warnings to the public.** Leverage mobile phone navigation apps to **provide real time rerouting for the public.**	Short Term (10 year)	Flood Warning and Readiness	10000003	10	Lower Colorado-Lavaca	**Increase** the number of cities and counties which utilize real-time data from regional or local flood monitoring systems (e.g., LCRA Hydromet, City of Austin Early Warning System) **to enhance flood warning, readiness, and other preparedness activities. Establish a baseline** through a survey of flood monitoring system users.	Short Term (10-year)	Flood Warning and Readiness
12000010	12	San Antonio	**Increase** the number of entities that **communicate real time flood warnings to the public.** Leverage mobile phone navigation apps to **provide real time rerouting for the public.**	Long Term (30 year)	Flood Warning and Readiness	10000004	10	Lower Colorado-Lavaca	**Increase** the number of cities and counties which utilize real-time data from regional or local flood monitoring systems (e.g., LCRA Hydromet, City of Austin Early Warning System) to **enhance flood warning, readiness, and other preparedness activities**. **Increase from baseline.**	Long Term (30-year)	Flood Warning and Readiness
12000011	12	San Antonio	**Establish a baseline and increase** the number of NFIP communities which **utilize Atlas 14** (Volume 11) or best available data from NOAA revised rainfall data as part of revisions to design criteria and flood prevention regulations **by 50% percent.** (region specific)	Short Term (10 year)	Flood Studies and Analysis	10000005	10	Lower Colorado-Lavaca	**Increase** the number of cities and counties that have updated watershed models and floodplain maps to reflect current data (e.g., **Atlas 14 revised rainfall data**). **Increase number from 7 with an additional 60**.	Short Term (10-year)	Flood Studies and Analysis

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Goal ID	RFPG No.	RFPG Name	Goal	Term of Goal	Overarching Goal(s)
12000012	12	San Antonio	**Increase** the number of NFIP communities which utilize/adopt **Atlas 14** (Volume 11) or best available data from NOAA revised rainfall data as part of revisions to design criteria and flood prevention regulations **by 100%.** (region specific)	Long Term (30 year)	Flood Studies and Analysis
12000013	12	San Antonio	**Decrease** the number of **Zone X by 30%** and **increase** the number of **entities** that conduct **detailed studies** to **update their local flood risk by 25%.**	Short Term (10 year)	Flood Studies and Analysis
12000014	12	San Antonio	**Increase** the number of entities that **conduct detailed studies** to **update their local flood risk to 100%.**	Long Term (30 year)	Flood Studies and Analysis
12000015	12	San Antonio	**Decrease** the average **age** of FEMA Flood Insurance Rate Maps (NFHL/FIRMs/FIS) **to less than 10 years.**	Short Term (10 year)	Flood Studies and Analysis
12000016	12	San Antonio	**Establish a baseline** number of existing studies and process for analyzing **watersheds to identify existing Natural Flood Mitigation Features (NFMF)** such as headwaters, buffers, and conservation easements.	Short Term (10 year)	Flood Studies and Analysis
12000021	12	San Antonio	**Increase** the number of entities above the established baseline **that have adopted a holistic watershed approach using existing Natural Flood Mitigation Features, (NFMF) s**uch as headwaters, buffers, and conservation easements, for flood risk reduction as a basis for comprehensive subdivision regulations.	Short Term (10 year)	Flood Prevention
12000017	12	San Antonio	**Increase** the number of **participating Community Rating System (CRS) entities in the FPR by 5**.	Short Term (10 year)	Flood Prevention
12000018	12	San Antonio	**Increase** the number of participating entities within **Community Rating System (CRS) in the FPR by 100% or improve their rating.**	Long Term (30 year)	Flood Prevention

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Goal ID	RFPG Number	RFPG Name	Goal	Term of Goal (Short Term, Long Term)	Overarching Goal
10000006	10	Lower Colorado-Lavaca	**Increase** the number of cities and counties that have updated watershed models and floodplain maps to reflect current data (e.g., **Atlas 14 revised rainfall data**). **Increase number from 67 with an additional 40.**	Long Term (30-year)	Flood Studies and Analysis
10000007	10	Lower Colorado-Lavaca	**Increase** the number of cities and counties that **have evaluated priority flood risk areas and risk reduction measures** (e.g., alternatives analysis and preliminary engineering). **Increase number from 49 with an additional 26.**	Short Term (10-year)	Flood Studies and Analysis
10000008	10	Lower Colorado-Lavaca	**Increase** the number of cities and counties that have evaluated priority flood risk areas and risk reduction measures (e.g., alternatives analysis and preliminary engineering). **Increase number from 75 with an additional 40.**	Long Term (30-year)	Flood Studies and Analysis
10000009	10	Lower Colorado-Lavaca	**Increase** the number of counties **with digital flood insurance rate maps** (DFIRMs) **that reflect current conditions**. **Increase number from 19 with an additional 5**.	Short Term (10-year)	Flood Studies and Analysis
10000010	10	Lower Colorado-Lavaca	**Increase** the number of counties **with digital flood insurance rate maps** (DFIRMs) **that reflect current conditions**. **Increase number from 24 with an additional 10.**	Long Term (30-year)	Flood Studies and Analysis
10000017	10	Lower Colorado-Lavaca	**Increase** the number of cities and counties **which provide alternate compliance options that allow or incentivize nature- based solutions** to reduce future flood risk. **Establish a baseline.**	Short Term (10-year)	Flood Prevention
10000018	10	Lower Colorado-Lavaca	**Increase** the number of cities and counties **which provide alternate compliance options that allow or incentivize nature- based** solutions to reduce future flood risk. **Increase baseline.**	Long Term (30-year)	Flood Prevention
10000011	10	Lower Colorado-Lavaca	**Increase** the number of cities and counties **participating in the National Flood Insurance Program** (NFIP). **Obtain 100% NFIP participation.**	Short Term (10-year)	Flood Prevention
10000012	10	Lower Colorado-Lavaca	**Increase** the number of cities and counties **participating in the National Flood Insurance Program** (NFIP). **Maintain 100% NFIP participation.**	Long Term (30-year)	Flood Prevention
10000013	10	Lower Colorado-Lavaca	**Increase** the number of cities and counties that **have adopted higher standards over and above NFIP minimum standards**, including regulating to one or more feet above the Base Flood Elevation (BFE) for existing 1% annual chance event (100-year) conditions. **Increase number from 40 with an additional 20.**	Short Term (10-year)	Flood Prevention
10000014	10	Lower Colorado-Lavaca	**Increase** the number of cities and counties that **have adopted higher standards over and above NFIP minimum standards**, including regulating to one or more feet above the Base Flood Elevation (BFE) for existing 1% annual chance event (100-year) conditions. **Increase number from 60 with an additional 20.**	Long Term (30-year)	Flood Prevention
10000015	10	Lower Colorado-Lavaca	**Increase** the number of cities and counties that have adopted regulations to reduce the risk from localized flooding. **Establish a baseline.**	Short Term (10-year)	Flood Prevention

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Goal ID	RFPG No.	RFPG Name	Goal	Term of Goal	Overarching Goal(s)
12000019	12	San Antonio	**Increase** the number of entities which regulate to the 1% annual chance **future conditions floodplains** as part of new development and redevelopment **by 10%.**	Short Term (10 year)	Flood Prevention
12000020	12	San Antonio	**Increase** the number of entities which regulate to the 1% annual chance **future conditions floodplains** as part of new development and redevelopment **by 50%.**	Long Term (30 year)	Flood Prevention
12000022	12	San Antonio	**Establish a baseline and increase** the **number of acres of publicly protected open space by 10** % as part of land conservation and acquisitions to reduce future impacts of flooding.	Short Term (10 year)	Non-Structural Flood Infrastructure Projects
12000023	12	San Antonio	**Increase** the number of restored **acres of publicly protected open space** land in the region.	Long Term (30 year)	Non-Structural Flood Infrastructure Projects
12000024	12	San Antonio	**Reduce** the number of NFIP repetitive-loss properties in the FPR by **25%.**	Short Term (10 year)	Non-Structural Flood Infrastructure Projects
12000025	12	San Antonio	**Reduce** the number of NFIP repetitive-loss properties in the FPR by **75%.**	Long Term (30 year)	Non-Structural Flood Infrastructure Projects
12000026	12	San Antonio	**Reduce** the number of existing (2022) **residential properties** in the future 1% annual chance floodplain by **10%.**	Short Term (10 year)	Structural and Non-structural Flood Infrastructure Projects
12000027	12	San Antonio	**Reduce** the number of existing (2022) **residential properties** in the future 1% annual chance floodplain by **50**%.	Long Term (30 year)	Structural and Non-structural Flood Infrastructure Projects
12000028	12	San Antonio	**Reduce** the number of **vulnerable critical facilities** located within the existing and future 1% annual chance (100-year) floodplain by **50%.**	Short Term (10 year)	Structural Flood Infrastructure Projects

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Goal ID	RFPG Number	RFPG Name	Goal	Term of Goal (Short Term, Long Term)	Overarching Goal
10000016	10	Lower Colorado-Lavaca	**Increase** the number of cities and counties that have adopted regulations to reduce the risk from localized flooding. **Increase baseline.**	Long Term (30-year)	Flood Prevention
10000019	10	Lower Colorado-Lavaca	**Increase** the number of cities and counties in the flood planning region considering the 1% annual chance (100-year) floodplain on the entity's **future land use plans and development regulations**. **Establish a baseline**.	Short Term (10-year)	Flood Prevention
10000020	10	Lower Colorado-Lavaca	**Increase** the number of cities and counties in the flood planning region considering the 1% annual chance (100-year) floodplain on the entity's **future land use plans and development regulations. Increase baseline.**	Long Term (30-year)	Flood Prevention
10000023	10	Lower Colorado-Lavaca	**Increase** the **acreage of publicly protected open space in perpetuity** to reduce future impacts of flooding through property buyouts, land conservation easements, acquisitions, or other comparable means. **Increase 133,000 acres by 15%.**	Short Term (10-year)	Non-Structural Flood Infrastructure Projects
10000024	10	Lower Colorado-Lavaca	**Increase** the **acreage of publicly protected open space in perpetuity** to reduce future impacts of flooding through property buyouts, land conservation easements, acquisitions, or other comparable means. Increase **by additional 25%.**	Long Term (30-year)	Non-Structural Flood Infrastructure Projects
10000021	10	Lower Colorado-Lavaca	**Reduce** the number of **structures** at risk of flooding through property/easement acquisitions, relocations, flood-proofing, and/or elevation. **Reduce 68,000 structures in 1% ACE by 1,000 structures.**	Short Term (10-year)	Non-Structural Flood Infrastructure Projects
10000022	10	Lower Colorado-Lavaca	**Reduce** the number of **structures** at risk of flooding through property/easement acquisitions, relocations, flood-proofing, and/or elevation. **Reduce 67,000 structures in 1% ACE by 1,500 structures.**	Long Term (30-year)	Non-Structural Flood Infrastructure Projects
10000025	10	Lower Colorado-Lavaca	**Reduce** the number of **structures and critical facilities** at risk of flooding by implementing structural flood mitigation projects. **Reduce by 1,000 structures and 3 critical facilities.**	Short Term (10-year)	Structural Flood Infrastructure Projects

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Goal ID	RFPG No.	RFPG Name	Goal	Term of Goal	Overarching Goal(s)
12000029	12	San Antonio	**Reduce** the number of **vulnerable critical facilitie**s located within the existing and future 1% annual chance (100-year) floodplain by 100%.	Long Term (30 year)	Structural Flood Infrastructure Projects
12000030	12	San Antonio	**Identify** the **eligible top 50 vulnerable roadway** segments and low water crossings located within the existing and future 1% annual chance (100-year) floodplain.	Short Term (10 year)	Structural Flood Infrastructure Projects
12000031	12	San Antonio	**Eliminate or mitigate** the eligible **top 50 vulnerable roadway** segments and low water crossings located within the existing and future 1% annual chance (100-year) floodplain.	Long Term (30 year)	Structural Flood Infrastructure Projects
12000032	12	San Antonio	**Increase** the number of structural **projects** by **10%** that **include a NBS or Green Infrastructure (GI) component.**	Short Term (10 year)	Structural Flood Infrastructure Projects
12000033	12	San Antonio	**Increase** the number of structural **projects** by **50%** that **include a NBS or Green Infrastructure (GI) component**.	Long Term (30 year)	Structural Flood Infrastructure Projects

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Goal ID	RFPG Number	RFPG Name	Goal	Term of Goal (Short Term, Long Term)	Overarching Goal
10000026	10	Lower Colorado-Lavaca	**Reduce** the number of **structures and critical facilities** at risk of flooding by implementing structural flood mitigation projects. **Reduce by additional 1,500 structures and 5 critical facilities.**	Long Term (30-year)	Structural Flood Infrastructure Projects
10000027	10	Lower Colorado-Lavaca	**Increase** the number of entities that mitigate flood risk at **vulnerable roadways or waterways** (e.g., low-water crossings, irrigation canals). **Establish a baseline.**	Short Term (10-year)	Structural Flood Infrastructure Projects
10000028	10	Lower Colorado-Lavaca	**Increase** the number of entities that mitigate flood risk at **vulnerable roadways or waterways** (e.g., low-water crossings, irrigation canals). **Increase baseline.**	Long Term (30-year)	Structural Flood Infrastructure Projects