Flood Risk Analyses

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Chapter 2: Flood Risk Analyses

A critical foundation for developing a regional flood plan is an accurate and comprehensive assessment of flood risk across the region for both existing (Task 2A) and future conditions (Task 2B). This analysis will help the Lower Brazos Regional Flood Planning Group (LBRFPG) establish priorities for subsequent planning tasks and to effectively focus efforts and resources to those communities that need it most.

The flood risk assessment for both existing and future conditions primarily consists of three components:

1. Flood **hazard** analyses to determine the location, magnitude, and frequency of flooding,
2. Flood **exposure** analyses to identify who and what might be harmed during different flood events; and
3. **Vulnerability** analyses to identify the degree to which communities and critical facilities may be affected by flooding.

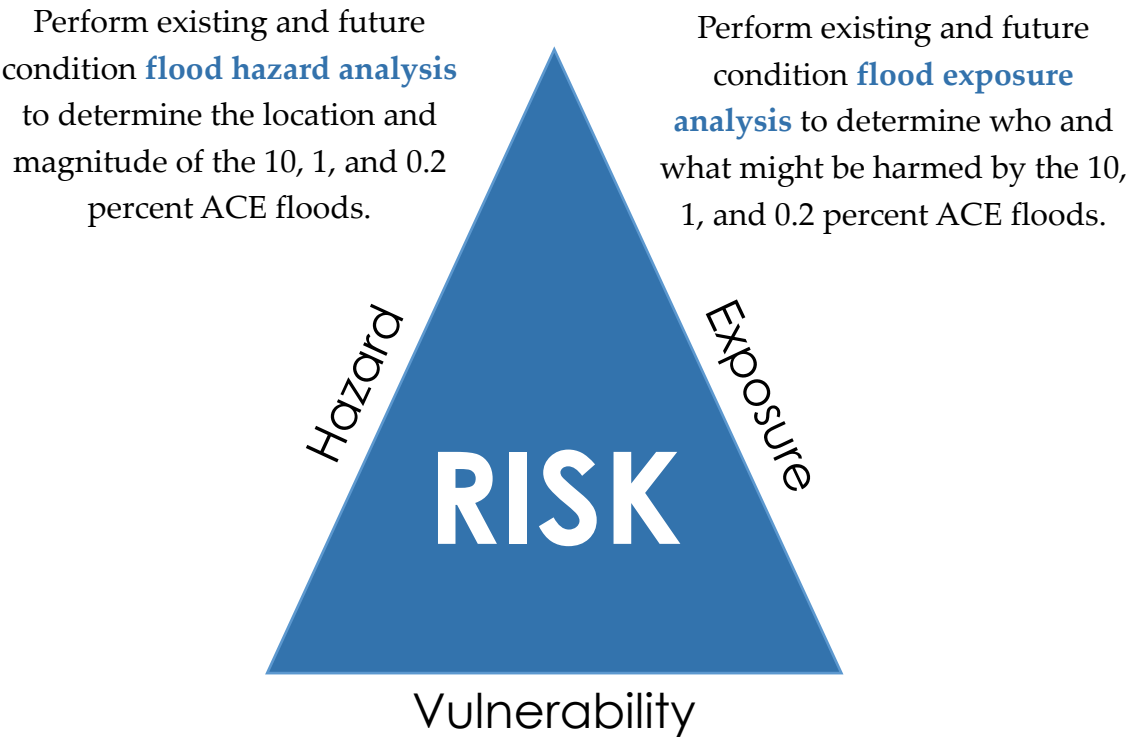


Figure 2.1: Flood Risk Analyses Triangle Framework

2.A Existing Condition Flood Risk Analyses

2.A.1 Existing Condition Flood Hazard Analysis

The purpose of the existing flood risk analyses is to determine the flood hazard in the Lower Brazos Planning Region (Region) to help establish priorities in other tasks in the regional food planning effort. This process contributed toward the general characterization of the Region's current flood risk and, subsequently, identifying locations with high flood risk or gaps in flood risk data.

Sufficiency of Existing Conditions for Planning Purposes

In terms of potential flood hazard analysis, existing conditions refer to the hydrologic and hydraulic conditions present when the available data was created. These conditions include current land use, estimated precipitation data, and constructed drainage-related infrastructure. Existing conditions in relation to the Region do not consider projected changes in rainfall patterns, future land use/population growth, or planned new/improved infrastructure. The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs) Special Flood Hazard Areas (SFHA) are generally based on existing conditions. The FEMA regulatory SFHA boundaries from these maps are part of the data used for the Region's existing conditions flood hazard analysis.

Land Use

Land use is an important factor in determining existing conditions flooding limits. It affects the hydrological processes such as evapotranspiration, interception, and infiltration. As urban development (impervious area) is added to a watershed, the hydrologic response is changed, and surface runoff often increases. As demonstrated in Chapter 1, most urban development occurs in the middle and lower portions of the Region watershed located in Bell, Brazos, Fort Bend, McLennan, and Williamson counties. Land use outside the major population centers within the Region consists primarily of farming and ranching interspersed with forested areas. Ranching occurs throughout the Lower Brazos Basin, while farming is primarily concentrated in the middle and lower portions of the basin. Localized urban development is primarily confined within city boundaries and the extraterritorial jurisdiction. While not as prolific as urban development, cultivated agricultural and grazed land use still quickens the watershed's response time compared to natural forested ground cover increasing existing flood risk. The rate of development and changes in land use since the initial determination of the flooding limits affect the validity of the analysis for planning purposes. For example, the FEMA's SFHA within the Region is based on hydrologic and hydraulic (H&H) analyses performed between the mid-1970s and today. Many older studies may no longer be valid based on land use changes that impact peak flow rates and floodplain inundation limits.

Precipitation

Assessing potential anomalous floods causing precipitation is crucial when planning for existing flood risk conditions. Precipitation, as it relates to flood risk, is commonly analyzed in terms of inches of rainfall that occur within a 24-hour duration. In 1973, the FEMA National Flood Insurance Program (NFIP) set the standard for flood hazard areas based on the 1 percent annual chance exceedance (ACE). All risk assessments for the State Flood Plan will be based on this recurrence interval in addition to the 0.2 percent ACE. A majority of FEMA's SFHA boundaries within the Region were developed using hypothetical rainfall data from the *National Weather Service (NWS), Technical Paper No-40/NWS Hydro-35, 1961/1977*, or *The United States Geological Survey Atlas of Depth-Duration Frequency of Precipitation Annual Maxima for Texas, 2004*. Rainfall data was broken down in terms of duration and recurrence interval. In September 2018, National Oceanic and Atmospheric Administration (NOAA) developed updated hypothetical rainfall in Texas based on historical rainfall data in its Atlas 14 study. The NOAA Atlas 14 study results in significant differences between hypothetical rainfall in the lower portion of the Region's watershed compared to the 1961/1977 and 2004 rainfall data. *Table 2.1* shows the range of rainfall for each data source.

Table 2.1: Lower Brazos Planning Region 1% ACE, 24-hour Precipitation

Lower Brazos Watershed	TP40/Hydro 35 Rainfall (inch)	USGS 2004 Rainfall (inch)	NOAA Atlas 14 Rainfall (inch)
Upper Basin	8.8-10.5	8.5-11.0	8.5-11.0
Middle Basin	10.5-12.0	11.0-12.0	11.0-14.0
Lower Basin	12.0-13.5	12.0-14.0	14.0-18.5

Flood Infrastructure

Drainage-related infrastructure is a key element in determining existing conditions of flood risk. Drainage-related infrastructure includes but is not limited to dams, levees, detention/retention ponds, bridges, culverts, low water crossings, tunnels, urban storm drain networks, breakwaters, bulkheads, and revetments. The Region has nine dams owned and operated by the United States Army Corps of Engineers (USACE). In addition, the Region contains nearly 2,000 minor reservoirs, which control flood waters along the major and minor tributaries. The Brazos River Authority (BRA) owns and operates three reservoirs; however, they are for water supply, not flood control. Many other privately owned and operated dams can also be found in the Region. There are 15 levee districts within the Region, with an estimated 59 levee structures protecting flood-prone populations.

While flood control infrastructure mitigates existing flood risk, some older drainage-related infrastructure contributes to flooding. Bridges, culverts, and storm drain systems that were designed and constructed before major land use changes and higher standards were

implemented, impound flood water, and overtop during major storm events. The result is increased flood risk to both property and life, which is expanded upon in the existing conditions exposure analysis presented below.

Hydrologic and Hydraulic Modeling

Hydrology and hydraulic modeling is necessary in evaluating flood risk and developing effective flood planning strategies. These models estimate how precipitation is translated into runoff, how flood waters flow over land and through creeks and rivers, and what the rustling flood depths and extents are for a given storm event.

Hydrology is the scientific study of the earth's natural water movement with a focus on how rainfall, infiltration, and evaporation affect the amount of water flowing in streams and storm drains. Hydraulics represents the engineering analysis of the flow of water in streams and infrastructure, such as channels, pipes, and other man-made structures.

Applied since the 1970s, H&H modeling uses computer software applications that simulate the flow of rainfall-runoff over the land to predict the rise of creek, river and lake water levels and potential flooding, as well as test ways to reduce flooding without constructing projects. H&H modeling simulates the flow, frequency, depth, and extent of flooding over land. These models inform decisions about selecting and implementing flood reduction and restoration projects. H&H modeling also satisfies regulatory requirements and ensures that natural, agricultural, and social resources are not damaged by flooding induced by modifications to creeks, rivers, and channels.

10% Annual Chance Event

The 10 percent ACE has a one in ten chance of being equaled or exceeded in any given year. The boundary of this event indicates areas that are subject to frequent flooding, often consisting of high velocities that can pose risk to both people and infrastructure. Areas affected by the 10% ACE may be subject to erosion and scouring caused by frequent inundation of fast flowing waters.

1% Annual Chance Event

The 1 percent ACE has a one in a hundred chance of being equaled or exceeded in any given year and an average recurrence interval of 100 years. Also referred to as the SFHA on regulatory FEMA maps, or 100-year flood, this boundary is mapped as a high-risk flood area subject to a 1 percent or greater annual chance of shallow flooding in any given year, where shallow flooding is usually in the form of ponding or sheet flow with average depths between 1 to 3 feet. Along the coast, these high-risk areas are associated with velocity wave action. In the Lower Brazos Planning Region, coastal wave action only affects Brazoria County. The 1 percent ACE flood areas may also be susceptible to erosion, deposition, and mudflow. It is sometimes referred to as

the "Base Flood." It is the national standard used by the NFIP and other Federal agencies to regulate development and require the purchase of flood insurance.

0.2% Annual Chance Event

The 0.2 percent ACE flood has a 0.2 percent chance of occurring in any given year and is also referred to as the 500-year flood. The 0.2 percent ACE flood refers to areas of moderate flood risk that are not considered to be in immediate danger from flooding caused by overflowing rivers; areas in the 1 percent ACE with average depths less than 1 foot or with drainages areas less than 1 square mile. It also refers to areas protected by levees from the 1 percent ACE. The 0.2 percent ACE areas are also referred to as Non-Special Flood Hazard Areas (NSFHA) on regulatory FEMA maps.

Existing Model and Data Availability

Within the Lower Brazos Planning Region's 14 eight-digit Hydrologic Unit Code (HUC)-8 watersheds, hundreds of H&H models were developed for the Region, spanning from the late 1970s to the present.

Regulatory FEMA Floodplain Models and Data

The FEMA FIRMs include flood zones that form the basis of regulatory floodplain management for communities and mandatory flood insurance requirements for structures in the mapped SFHA floodplain. FEMA data consists of two predominant types of studies: detailed studies (Zone AE mapping and 0.2% ACE) that utilize hydrologic and hydraulic methods to identify areas at flood risk and approximate studies (Zone A mapping) that provide an estimate of flood risk extents without the basis of modern hydraulic modeling approaches.

In addition to both the detailed and approximate flood risk datasets, the First American Flood Data Services (FAFDS) data was obtained. This information represents where only paper-based FEMA data was available and digitally converted.

BLE Models

FEMA and the TWDB have also developed Base Level Engineering (BLE) approximate models, which now cover the entirety of the Lower Brazos Planning Region. BLE models are based on regional regression hydrology and the hydraulic models do not have structures (bridges, culverts, etc.); however, they are based on the latest available Light Detection and Ranging (Lidar) terrain data. Within the Region, there is a combination of coverage from 1D and 2D BLE models. 1D BLE provides flood risk data for riverine flood risk only, focusing on the extents of channels, streams, creeks, and rivers. In contrast, 2D BLE assesses riverine flood risk alongside local flood risk in agricultural and urban areas. This data can be leveraged and supplemented with additional detail as needed for community flood risk needs.

GLO Models

Modeling data for the southern portion of the Region was also developed through the General Land Office's (GLO) Central Region River Basin Flood Study. The River Basin Flood Study effort includes the characterization of flood risk for the 49 counties that received a presidential disaster declaration due to the impact of Hurricane Harvey along with evaluation of potential flood risk mitigation projects. Preliminary modeling data for Brazoria and Fort Bend County was made available to the LBRFPG for use in the development of this plan. Modeling approach varied throughout the study area with some models assessing coastal and/or local flood risk alongside riverine flood risk. However, all models were developed based on best available terrain and land use data.

Community Models

Additional H&H models were also collected from various communities throughout the Region. Data output from the various modeling efforts was ultimately incorporated through geographic information system (GIS) mapping into the Lower Brazos Planning Region's existing flood hazard layer (floodplain quilt) as described in *Section 2A.1.c. Map 14* in *Appendix 0* shows the model location in the Region. Many of the models identified for the Lower Brazos Planning Region were created to support the Fort Bend County Master Drainage Plan. This effort created up-to-date 1D/2D models for most of the county. Additional models were sourced from the City of Waco and Williamson County. Both sets of models focused primarily on riverine flood risk within the coverage areas. The cities of Bryan, College Station, Taylor, Stephenville, and Gatesville were also sources for existing conditions modeling. Although referenced for other purposes, many of the models provided by these entities were focused on generating alternatives for flood hotspots, and subsequently were not intended to provide mapping results.

In the first cycle of Regional Flood Planning, the LBRFPG created detailed models of 4 high flood risk HUCs within the region. Data from this effort was not previously incorporated into the floodplain quilt; however, it was considered during this cycle.

Cursory Floodplain Data

The TWDB solicited the creation of the 2025 Cursory Floodplain Data set to be utilized in the Regional Flood Planning process. The data was developed by a research group, Fathom, at the University of Bristol, England. The model is a 2D hydraulic framework developed at a national scale on 30-M Digital Elevation Models (DEMs). The results have been mapped on 10 feet Lidar for Texas to create statewide flood depth rasters for fluvial, pluvial, and coastal mapping for the 10 percent, 1 percent, and 0.2 percent ACE events as well as other frequencies.

Levees and Dams

The LBRFPG also collected data related to areas subject to inundation from reservoirs and levee inundation areas. The Natural Hydrography Dataset indicates lake areas subject to flooding,

while the United States Army Corps of Engineers has a dataset that indicates leveed areas prone to flooding; these publicly available resources were utilized where available.

Best Available Existing Flood Hazard Data

Flooding within the Lower Brazos Planning Region is mostly riverine with coastal influence primarily in Brazoria County to the south, where the area is directly (and frequently) affected by hurricane storms from the Gulf of Mexico. Hurricanes typically fade and downgrade to tropical storms or tropical depressions as they move inland away from the coast. Riverine flooding is mostly from general rainfall and thunderstorm floods. Flash floods are common from these rainfall events, which can occur within a few minutes or hours of excessive rainfall, exposing millions of dollars in valuable public and private property to flood risk. The largest risk from flash flooding is people driving across low water crossings, which has resulted in many fatalities within the Region and across the state. A portion of the Region lies in the flash flood alley of Texas. *Figure 2.2* shows reported and documented flood events by the county as well as the location band of the flash flood alley.

Even though riverine and coastal-based flooding is the dominant types of flooding in the Region, urban flooding data was evaluated for inclusion in the existing floodplain quilt. Urban flooding (off-floodplain, pluvial, or surface flooding) is caused by intense local precipitation running-off impermeable surfaces such as paved streets, sidewalks, and structures that overwhelms local drainage systems and overflows small waterways. Consequently, the water may enter buildings and other properties. This flooding often occurs in locations such as historic downtown areas and residential neighborhoods, which either predate floodplain maps and higher design standards or have land use patterns such as urban sprawl.

Existing flood hazard mapping estimation is based on using current land use and precipitation data to estimate hydrologic condition parameters and discharges. This is then used to simulate water surface elevations to create existing floodplain mapping extents.

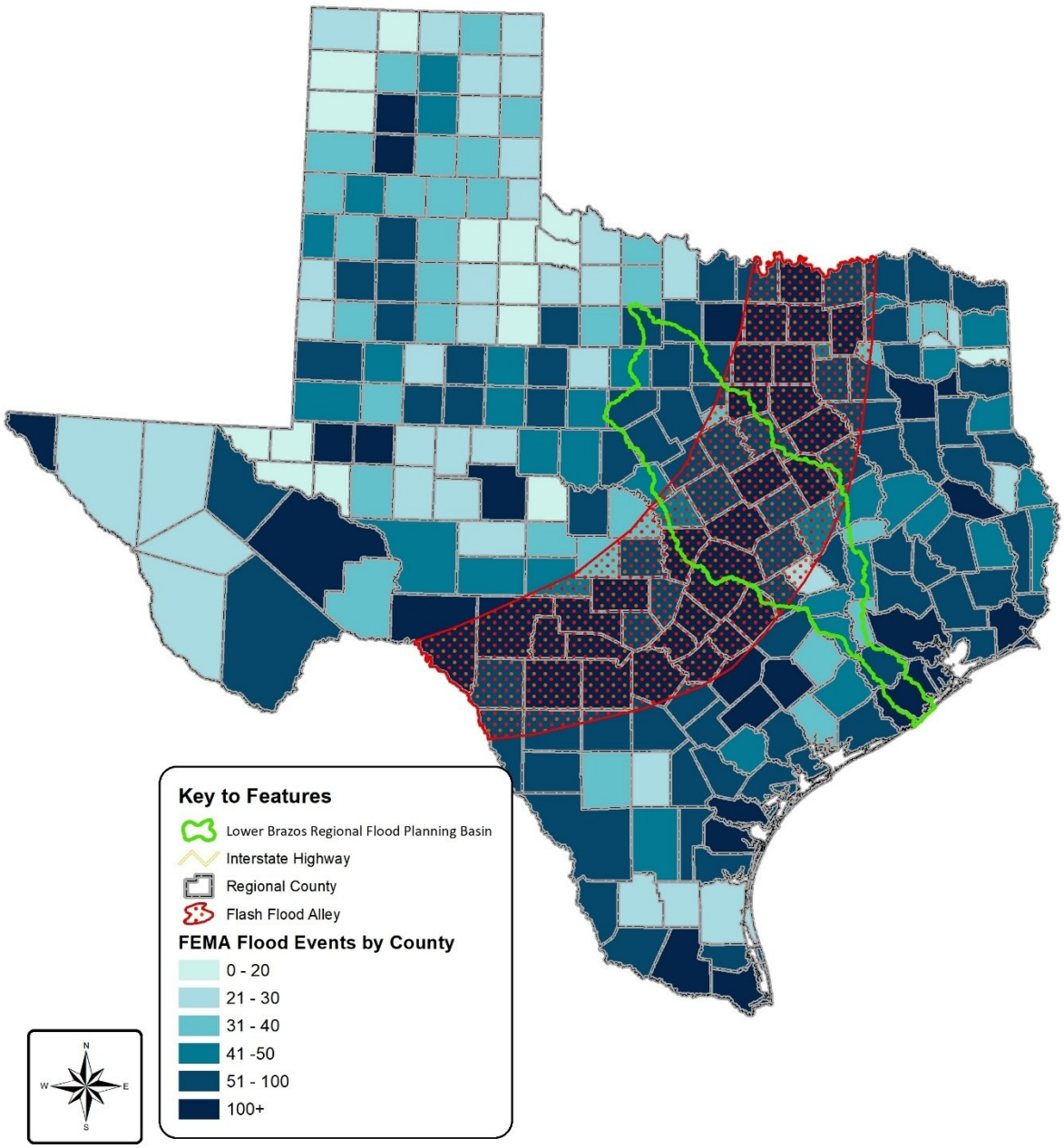


Figure 2.2: Flash Flood Alley

(FEMA/NOAA Storm Data, 1996 – 2019)

The TWDB compiled the most current existing flood hazard mapping data from multiple sources to create a comprehensive, single, coherent, continuous quilt of the best available existing floodplain for the Region. The compiled mapping data was the 10 percent, 1 percent, and 0.2 percent ACE data. The existing floodplain quilt data was then updated with data from FEMA, USACE, United States Geological Survey, and local communities where available.

The primary data sources comprising the existing floodplain data for the Lower Brazos Planning Region are described below:

- Regulatory FEMA Floodplain Data
- Base Level Engineering Data
- TWDB Cursory Floodplain Data
- Local Data Submitted by Entities
- Flood-Prone Areas Related to Reservoirs and Levees

A regional online data collection website was created as an outreach tool to work closely with regional entities (counties, municipalities, state and federal agencies, or political subdivisions with flood-related authorities) to gather local flood-risk information. A web mapping application on the data collection tool enabled entities to document other possible flood-prone areas not previously identified as mapped flood hazard areas; this can be seen in *Figure 2.3.* The webmap was published in October 2025 to receive community input. During this timeframe, several public meetings were conducted throughout the Lower Brazos Planning Region to collect data on areas of historic flooding, roads that are frequently overtopped, and past flood claims hot spots.

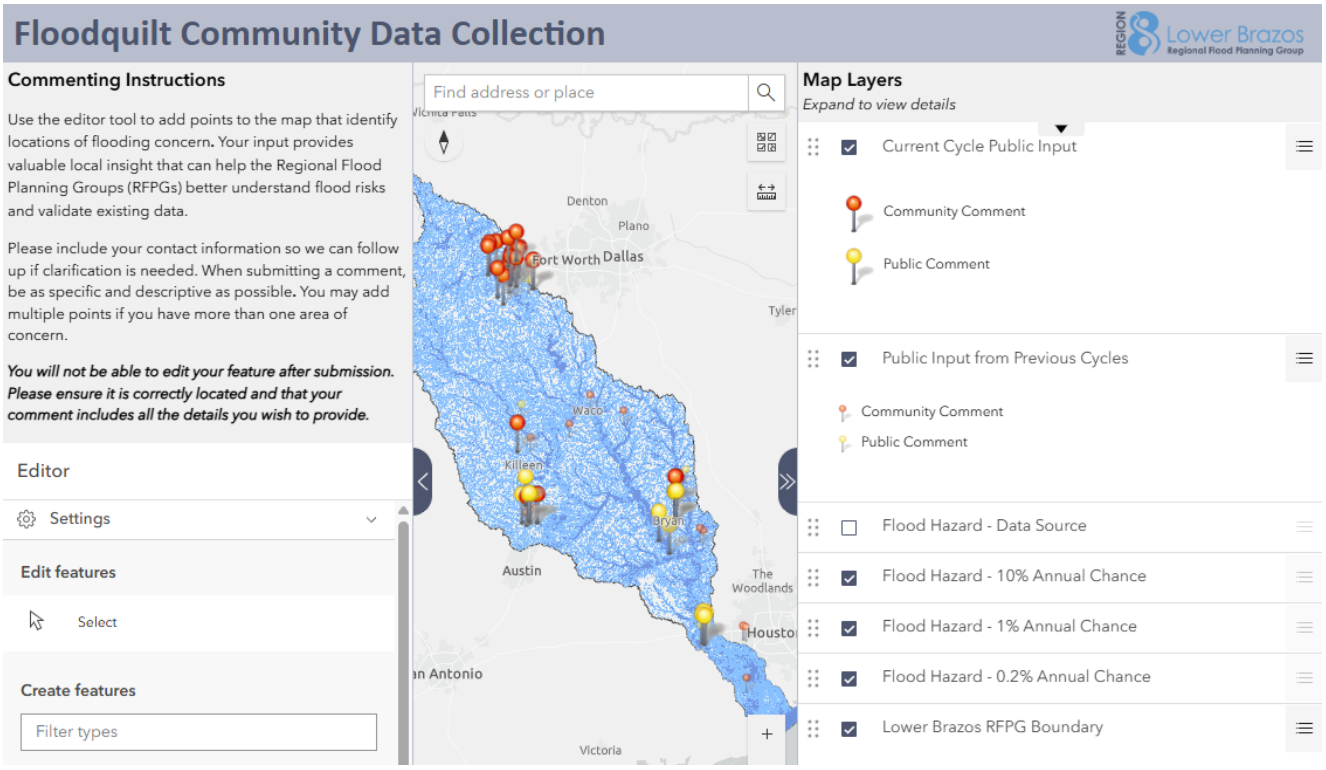


Figure 2.3: Interactive Flood Map

Data submitted to the LBRFPG through the online data collection tool was also added. Cities, counties, entities with flood control responsibilities, and the general public had the opportunity to submit data to the LBRFPG.

The LBRFPG created the existing conditions floodplain quilt using the best available flood hazard data. The various data sources received were prioritized and compiled based on accuracy, quality, and coverage relative to other available datasets. The existing conditions prioritization approach for the development of the floodplain quilt was presented and approved at the Lower Brazos LBRFPG meeting on September 18, 2025, and posted to the Lower Brazos LBRFPG website for public review and comment in October 2025. A summary of the ranking system used by the Lower Brazos LBRFPG is shown in *Table 2.2*. *Appendix 2.1* provides a detailed memorandum that discusses the reasoning for the selected ranking.

Table 2.2: Floodplain Quilt Data Ranking

Ranking	Data Category	Source
1	Detailed FEMA Data (Zone AE and VE)	FEMA
2	Community Models and Maps*	Various Entities
3	Pluvial Fathom for urban areas with populations greater than 5,000	TWDB
4	Base Level Engineering 2D	FEMA / TWDB
5	Maximum of BLE 1D and Fathom	FEMA / TWDB

*Community models and maps were assessed on a case-by-case basis and prioritized through comparison with other available datasets. The modeling and mapping products associated with the General Land Office River Basin Flood Study were considered community models for prioritization purposes.

The compiled existing floodplain quilt data for the Lower Brazos Planning Region is included in the submittal GIS database layer named "ExFldHazard." *Map 4* in *Appendix 0* shows a GIS coverage map of the comprehensive existing flood hazard layer compiled for the Region, showing the 10 percent, 1 percent, and 0.2 percent ACE floodplains.

The total floodplain area for each county and associated percentage distribution within the Region are also displayed in *Table 4* in *Appendix 2.3*.

To ensure there was no confusion on the purpose and content of the floodplain quilt when displayed to the public through the online webmap or in-person meetings, the following disclaimer was used:

"This application is provided for public informational and engagement purposes only. The flood surfaces depicted by these products are the result of hydrologic and hydraulic modeling and are intended to support ongoing planning, risk communication, and data refinement activities."

Additional "Limitations of Use" disclaimers were included to further define appropriate uses of the flood risk data.

Flood Data Gaps

Once the best available comprehensive existing flood data was compiled, data gaps were assessed to identify any remaining areas where flood inundation boundary mapping was missing, lacked modeling or mapping, used outdated modeling or mapping, or had prepared more accurate topographic data since the last map update.

The key factors that were referenced to identify these gaps were:

- counties with no modernized data since the completion of the FEMA Map Modernization initiative
- areas with effective data that is more than 10 years old
- areas where Cursory Floodplain Data was the only available data source
- areas that contain FEMA Approximate studies

The validation status (whether a stream model was new or has updated engineering) was determined, when possible, for the associated H&H models supporting the mapped floodplains using the contributing engineering factors listed earlier. For example, Bell, Brazos, and Fort Bend counties contained FEMA effective detailed studies that were older than 10 years, meaning the effective floodplain information is outdated. Due to this, these counties are being reported as data gaps. Brazoria County, conversely, has new detailed flood risk mapping based on a recent study incorporating Atlas 14 rainfall data and thus was not considered a map gap.

The results of the gap analysis were largely driven by the availability of FEMA detailed studies throughout the region. Counties with approximate FEMA studies or no modernized mapping available were marked as gaps. Additionally, more than 90% of the region was marked as a gap due to FEMA effective studies not containing 10 percent mapping. The 10 percent mapping in the Lower Brazos Region was largely supplemented with BLE data. Areas that had 10 percent mapping from local community sources were not considered gaps.

The gap area data is included in the GIS database in a layer named "Ex_Map_Gaps." *Map 5* in *Appendix 0* shows the identified flood data gaps' locations. Additional detailed data gap maps are shown in the appendices.

While areas were identified within the floodplain quilt as data gaps with outdated information, the compiled existing floodplain quilt still comprised the best available flood hazard datasets for the Lower Brazos Planning Region and was used for the flood risk analysis. Further evaluation of these data gaps for inclusion in Flood Management Evaluations (FMEs) is discussed in Chapter 4.

2.A.2 Existing Condition Flood Exposure Analysis

Flooding is common in the Lower Brazos Planning Region (Shown in *Figure 2.2*). Flooding can become a significant hazard when it inundates the built environment and causes direct damage to buildings, critical facilities, crops, or significant injuries and sometimes death to people. Flooding frequency and intensity have been increasing in recent years, often necessitating state and federal relief, which has risen to record levels. The existing condition flood risk exposure analysis leveraged the compiled existing conditions 10 percent, 1 percent, and 0.2 percent ACE events in the Region to determine existing flooding exposure to buildings, critical facilities, and agriculture. Results from the flood exposure analysis were utilized to estimate the impact on socially vulnerable populations or communities discussed in *Section Existing* Condition Vulnerability Analysis.

Existing Development within the Floodplain

A region-wide inventory of buildings, population, critical facilities, utilities, and agriculture was conducted to assess who and what is at risk. Existing development data leveraged for the Region came from several data sources. The Homeland Infrastructure Foundation Level Data (HIFLD) and data from the TWDB were the sources of critical facilities data. The Texas Department of Transportation (TxDOT) bridge inventory and roadway data were also used. The TWDB provided building data in November 2021 with the associated population and Social Vulnerability Index (SVI) estimates, which were confirmed and updated where additional information was available. In cycle 2, the November 2021 building data was enhanced with Texas Flood Social Vulnerability Index (TX F-SVI) data which allows for better assessment of vulnerabilities to flood risk.

The 2021 TWDB building dataset was built on available Lidar information (2010 to 2021), Microsoft Artificial Intelligence Version 2 data, and 2021 Open Street Map (OSM) buildings. The 2019 LandScan USA dataset from Oak Ridge National Laboratory (ORNL) was utilized to estimate the population per building for both day and night. The 2018 Centers for Disease Control and Prevention (CDC) SVI dataset was applied at the census tract level. The 2025 TX F-SVI was developed by the University of Texas and provided by TWDB.

The 2024 Texas Cropland Data layer was developed by the United States Department of Agriculture (USDA) National Agricultural Statistics Service. The bridge and roadway asset inventory data came from the 2025 TxDOT dataset. Communities and interest groups within the Lower Brazos Planning Region also provided data via the online collection tool.

Results of the detailed analyses of exposure to development within the existing floodplain are presented in *Sections 2A.2c – 2A.4*.

Proposed and Ongoing Flood Mitigation Projects

Throughout the Lower Brazos Planning Region, ongoing projects have already received design and construction funding and are set to be implemented before the completion of the State Flood Plan. These projects were identified through multiple avenues, including the Flood Infrastructure Fund (FIF) tracking website which was one source used to identify project status. Passed by the Legislature and approved by Texas voters through a constitutional amendment, the FIF program provides financial assistance in the form of loans and grants for flood control, flood mitigation, and drainage projects. Similarly, projects recently funded through mechanisms such as the Community Block Development Grant or Hazard Mitigation Grant were identified as ongoing projects.

Additional proposed and ongoing projects were identified through survey responses and research efforts for entities within the Region. A tabular report of the proposed or ongoing projects, set to be complete before the installation of the state flood plan, is provided in *Table 3* in *Appendix 2.2*.

62 proposed or ongoing projects were identified within the region. Of these, 27 were cited to be funded through grant programs including the FIF and CDBG. These grant funded projects total over $200 million worth of flood risk mitigation improvements in the region. The other 35 projects are funded through local mechanisms including bonds, drainage fees, or other funds set aside by entities for drainage improvements. These projects include approximately $175 million worth of flood risk mitigation improvements. *Figure 2.4* shows the types of projects currently underway within the Region.

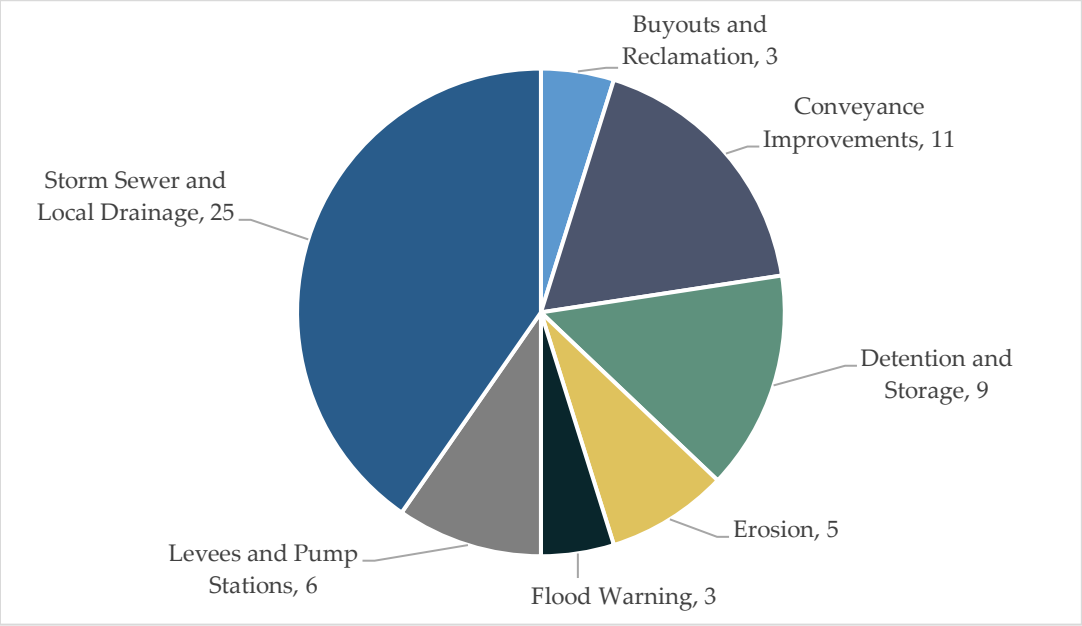


Figure 2.4: Types of Proposed and Ongoing Projects

Flood Exposure Due to Existing Levees or Dams

Flood exposure identifies what is at risk due to extreme flooding. This refers to the people, buildings, businesses, infrastructure systems, and associated functions that could be lost to a flood hazard (*FEMA, 2017*). Exposure also refers to the economic value of assets subject to the flood hazard. This section discusses flood exposure due to levees and dams in the Region.

Levees in the Lower Brazos Planning Region

There are an estimated 59 levees in the USACE National Levee Database (NLD) in the Region. These levees are built parallel to rivers, streams, creeks, and their tributaries as well as lakes and along the coast to protect them from certain levels of flooding. About 66 percent of the levees can be found in the southern portion of the Region in Austin, Brazoria, Fort Bend, and Waller counties. The remaining 34 percent are scattered throughout the Region, with a noticeable gap in the western portion.

Levees can be breached during flood events due to overtopping, toe scour, seepage/piping, and foundation instability. The resulting torrent can quickly inundate a large area behind the failed levee with little or no warning, exposing them to extreme flooding effects and consequences.

Levee accreditation is FEMA's recognition that a levee is reasonably certain to contain the base (1 percent annual chance storm events) regulatory flood. To help communities understand the risk behind levee structures, FEMA applies levee accreditation information on FIRMs to show the locations with reduced risks from the regulatory flood event. Approximately 37 percent of the levees in the Region are accredited. See *Map 2* in *Appendix 0* for the location of deficient levees in the Lower Brazos Planning Region.

On FIRMs, FEMA shows areas mapped behind accredited levees as "Areas with Reduced Risk Due to Levee." When the levee is not accredited, the embankments are categorized as hydraulic significant structures. The area behind the landward side of the levees is not considered to be protected from any flood event and, consequently, exposed to flooding.

USACE leveed-area floodplain data and FEMA's "Areas with Reduced Risk Due to Levee" datasets were incorporated into the existing floodplain quilt dataset for the Lower Brazos Planning Region as "Other Flood-Prone Areas." This data set was primarily added to show potential flood hazards on the landward side of levees.

Levee Exposure Assessment

There are almost 200,000 people who live and work behind the levees in the Region. The exposure summary was estimated by overlaying the leveed areas within the Region's existing floodplain quilt with population data. The exposure analyses assumed that even the accredited levee systems might be subject to internal flooding, ponding, and/or structure failures. Hence,

exposure assessments include structure and population counts behind the accredited levees under flood-prone areas, as shown in the TWDB-required *Table 3* in *Appendix 2.3*.

Fort Bend and Brazoria counties have by far the most exposure with respect to levees.

Dams in the Lower Brazos Planning Region

In the Lower Brazos Planning Region, dams and their associated reservoirs are primarily used for water supply, recreation, navigation, electric generation, irrigation, and flood control. According to the USACE National Inventory of Dams and the Texas Commission on Environmental Quality (TCEQ), there an estimated 1,166 dams in the Region. Most of these are used for flood control, water supply, recreation, and agriculture.

Dams with flood-related capacity keep floodwaters impounded and either release them in controlled amounts downstream to the river below or store and divert water for other uses. Contrary to this, dams used only for water supply, recreational, and agricultural purposes do not have a dedicated flood control pool to retain runoff from flood events and pass-through runoff from flood events. As such, areas lying adjacent to or downstream of dams are exposed to flooding during flood events and potential consequences if a dam breaks or fails.

The dams in the Region are 57 years old on average. Dams that are owned and operated by large entities are regularly maintained. However, dams owned and operated by smaller entities or private landowners may need inspections and/or rehabilitation as funding for such activities is often more costly than the property owners can afford.

While FEMA does not show downstream dam breach inundation extents on maps, such data may be available as non-regulatory products in some flood risk projects. The TCEQ requires dam breach inundation mapping for certain dams.

Dam Flowage Easement

Flowage easements are perpetual rights governing areas delineated around a dam, typically owned by government agencies such as the USACE. The dam flowage easements grant these agencies the right to release water from the reservoir under their operation, even if it floods privately owned land. Additionally, the easements grant them the right to prohibit the construction of, or maintenance of, any improvement(s) for human habitation and to approve any other structures constructed on the included property. The purpose of establishing these lines is to identify and protect personal property that would likely be flood-prone during a flood event. These boundaries, therefore, assist in estimating buildings and population affected in areas subject to dam inundation within the Region. FEMA also shows these flowage easements lie along reservoirs on its FIRMs.

Dam Exposure Assessment

For the Region's dam exposure analysis, dam inundation areas based on flowage easements were overlaid on buildings and population to estimate the associated hazard potential. *Map 2* in *Appendix 0* shows the locations of the dams classified as non-functional or deficient in the Region according to the State Regulatory Dams TCEQ 2021 Reports.

There are approximately 800 people who live around the dams in the that fall within the USACE flowage easement. High dam exposures are prevalent in Eastland and Palo Pinto counties. The State of Texas does not regulate development in high-hazard areas immediately adjacent to or downstream of dams. Many developers purchase properties with small livestock dams classified as low-hazard dams and develop property around lakes and downstream of the dams, creating additional risk. Continued growth in rural areas will result in changes to hazard classification for dams that current residents may not be aware of. Chapter 8 explores recommendations that could help mitigate these issues and reduce flood risk throughout the region.

Existing Conditions Flood Exposure

This section of the Lower Brazos Regional Flood Plan discusses and summarizes the results of the existing condition flood exposure to existing development. The existing conditions flood exposure analysis considered buildings, population, public infrastructure, critical facilities, roadway crossings, and agricultural areas exposed to the compiled existing conditions floodplain quilt. This section excludes flood exposure for levees and dams and only applies to the existing conditions of 10 percent, 1 percent, and 0.2 percent ACE flood mapping extents in the Region's floodplain quilt.

For this planning level analysis, infrastructure was considered to have potential flood risk if it falls within the Lower Brazos flood quilt extents. Many strategies that help prevent flooding of infrastructure in high-risk areas, such as structural elevation or flood proofing, were not accounted for. Although the counts and statistics are indicative of overall trends, flood risk to individual persons and infrastructure would require more detailed analysis.

Buildings, Critical Facilities, Infrastructure, and Agriculture Exposure Totals by County

For this planning cycle, flood exposure analysis estimated the structure count of buildings, critical facilities, roadway crossings, roadway segments, and agriculture areas potentially exposed to existing flooding by overlaying the existing conditions floodplain quilt developed for the Region. *Map 6* in *Appendix 0* shows the total number of buildings, critical facilities, low water crossings, and agriculture areas exposed to the existing floodplain quilt. A summary of this information is displayed in *Table 2.3*. The highest counts by far are in Brazoria and Fort Bend counties due to their proximity to the coast and significant populations. The rest of the Region shows moderate exposure counts.

Table 2.3: Summary of Existing Flood Risk

Flood Risk	Number of Structures	Population	Miles of Roadway	Roadway Crossings	Agricultural Area (sq mi)	Number of Critical Facilities
10 percent ACE	64,080	241,775	3,867	5,598	714	708
1 percent ACE	117,025	610,405	7,501	6,760	1,184	1,866
0.2 percent ACE	268,788	203,876	9,684	7,203	1,391	2,623

Population Totals by County

Population data (day and night) attributed to the associated buildings and critical facilities was used to summarize the county-wide population exposed to the existing conditions floodplain quilt. The higher of the day or night population was used for the exposure population estimated by county; this can be seen in *Table 4* in *Appendix 2.3*.

Similar to structural risk, high population exposures are primarily concentrated in Fort Bend and Brazoria counties. However, there is also significant risk throughout the Waco area in McLennan County. Due to the population count being higher than the day or night numbers, these numbers assume the worst possible scenario where the maximum number of people present are exposed to the existing floodplain quilt.

Regional building data collected for the Region was classified into two main categories: residential and non-residential. As shown in *Figure 2.5*, for the structures at the existing 10 percent, 1 percent, or 0.2 percent ACE flood risk, around 76 percent are residential buildings, while the remaining 24 percent are non-residential. Buildings classified as vacant are structures for which the building type and/or use could not be determined. Agricultural buildings include any structure used to operate a farm or ranch or process and sell their products.

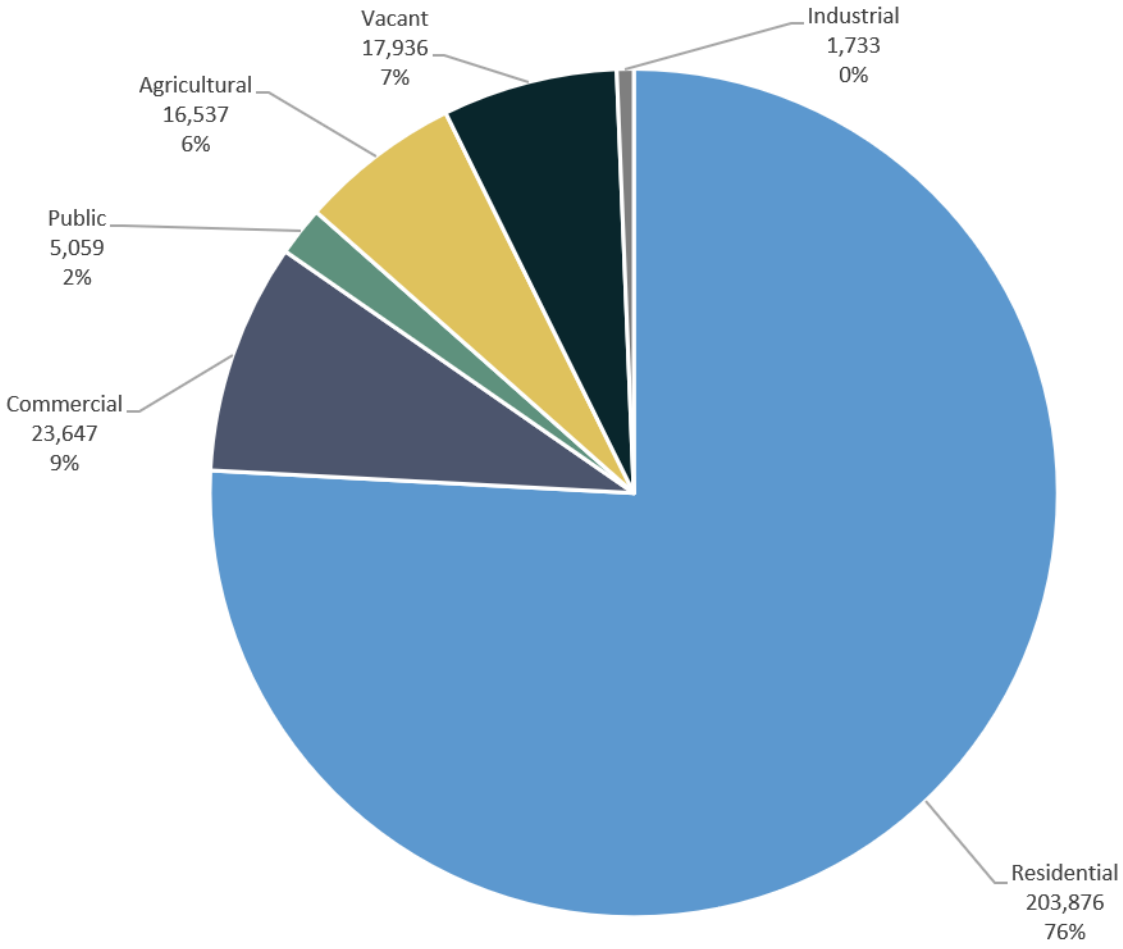


Figure 2.5: Distribution of Structures at Risk of Flooding by Structure Type

Residential Structures

Residential structure data used in the Lower Brazos Planning Region included single-family homes, townhomes, mobile homes, and multi-family residences like apartments and condominiums. Approximately 898,000 residential building footprints were gathered for the Region, and an estimated 30 percent of these buildings were exposed to flooding. *Table 4* in *Appendix 2.3* provides a summary of the estimated number of residential structures exposed to the existing floodplain quilt by county.

Fort Bend and Brazoria counties have the highest number of residential structures in the floodplain by a wide margin; however, Williamson, McLennan, and Bell counties also had significantly more at-risk residential structures than the rest of the counties. Each of the counties contain densely populated cities with numerous residential structures contributing to the higher counts.

Archer, Bastrop, Brown, Callahan, Fayette, and Travis counties show very little residential building exposure because only a very small portion of these counties are within the Region,

most of which are their respective unincorporated areas. Several other largely rural counties also have low numbers of at-risk residential structures.

Non-Residential Structures

Non-Residential inventory data also included agricultural, commercial, industrial, and public buildings. Almost 900,000 non-residential building footprints were gathered for the Region and 20 percent of these buildings are exposed to flooding. The total estimated number of non-residential structures by county exposed to the existing floodplain quilt can be found in *Table 4* in *Appendix 2.3*.

Bell, Fort Bend, McLennan, Parker, and Waller counties each show over 1,000 agricultural structures at flood risk. Over 8,000 commercial structures were identified to have flood risk within Brazoria and Fort Bend counties with Bell, McLennan, and Williamson counties each having over 2,000 commercial structures at risk. Similar to the residential structure analysis, counties with little area within the Region had low numbers of non-residential structures at flood risk while counties with high population densities have significantly higher counts.

To account for population density and region coverage, the percentage of structures at flood risk was also evaluated. Brazoria and Fort Bend counties continued to top the list for the Region due to their proximity to the coast. However, several more rural counties have over one fourth of structures flagged as being at risk from the 0.2% ACE as seen in *Table 2.4*.

Table 2.4: Percent of Structures at 0.2% ACE Risk

County	Structures in Flood Planning Region	Percent of Structures at 0.2% ACE Risk
Archer	61	28%
Brazoria	52,714	70%
Eastland	14,463	31%
Fort Bend	181,866	47%
Hood	32,264	31%
Palo Pinto	22,901	28%
Waller	19,156	27%
Young	11,287	29%

Critical Facilities and Public Infrastructure

A critical facility provides services and functions essential to a community, especially during and after a disaster. Critical infrastructure includes all public or private assets, systems, and functions vital to the security, governance, public health and safety, economy, or morale of the state or the nation (*TWDB, 2021*). Critical facilities data for the Region include fire stations, hospitals, nursing homes, police stations, emergency shelters, schools (Kindergarten through

12th grade), water and wastewater treatment facilities, TCEQ wastewater outfalls, water supply systems (well sites), and superfund sites. Lifeline utility systems data such as petrol storage tanks, power generating plants, as well as natural gas and electric transmission lines were collected for exposure analysis. Critical facilities data were from the TWDB, TCEQ, Railroad Commission of Texas, HIFLD, as well as data from Region communities.

The existing floodplain quilt was overlaid on the data gathered for critical facilities to estimate the flood exposures. *Table 4 in Appendix 2.3* provides the total counts of exposed critical facilities to the existing floodplain quilt in the Region. Nearly 13,500 critical facilities data were identified for the Region and an estimated 20 percent of these facilities are exposed to flooding.

Bell County has the highest number of critical facilities with potential flood risk with over 500 structures identified as falling within the 0.2% ACE flood quilt. Fort Bend and McLennan counties each have over 300 critical facilities with potential flood risk identified. Each of these counties have high concentrations of critical facilities to support their population centers.

Roadway Crossings and Roadway Segments

Transportation line data (roadways and railroads) from TxDOT were used to estimate road and railways crossings at risk of flooding.

There are over 9,600 roadway crossings were identified as being at flood risk in the Lower Brazos Planning Region. *Table 4* in *Appendix 2.3* shows the roadway crossing exposure totals per county as well as the miles of road segment exposed to the existing floodplains. Fort Bend, Williamson, and Brazoria counties have the highest mileage exposures.

Low Water Crossing (LWC) data provided by the communities in the Region and the TWDB was also used to identify road and railway crossings exposed to frequent flooding. 1,183 number of LWCs were identified within the region. The distribution of low water crossings differs from many other metrics. Williamson and Bell counties have the highest number of low water crossings, which are more common in the Hill Country portion of the Lower Brazos Planning Region. *Table 2.5* shows the number of LWCs within each county.

Table 2.5: Low Water Crossings per County

County	Low Water Crossings	County	Low Water Crossings
Archer	0	Hood	34
Austin	6	Jack	0
Bastrop	0	Johnson	20
Bell	249	Lampasas	34
Bosque	19	Lee	46
Brazoria	1	Leon	0
Brazos	75	Limestone	49
Brown	0	Madison	0
Burleson	5	McLennan	57
Burnet	29	Milam	17
Callahan	0	Mills	3
Comanche	20	Palo Pinto	17
Coryell	31	Parker	12
Eastland	9	Robertson	7
Erath	60	Somervell	35
Falls	35	Stephens	0
Fayette	0	Travis	0
Fort Bend	6	Waller	17
Freestone	0	Washington	31
Grimes	14	Williamson	197
Hamilton	27	Young	6
Hill	10		

Agricultural Area

Crops and livestock data used in the Lower Brazos Planning Region was obtained from the 2024 Texas Cropland Data layer developed by the United States Department of Agriculture (USDA) National Agricultural Statistics Service. In the Lower Brazos Basin, the increasing population continues to have a significant influence on the continued loss of working lands, changing ownership sizes, and land values. This occurs particularly within or in surrounding urban centers. Large sections of the southern portion of the basin face similar challenges because of development from the neighboring Houston-Galveston area. (*Texas Land Trends, 2022*).

The 2020 FEMA National Risk Index (NRI) data was leveraged to show the value of crops and livestock exposed to flooding. The FEMA NRI uses data from the 2022 USDA CropScape and the Census of Agriculture to document the value of exposed crops and livestock. The

CropScape data in dollars was used to calculate crop and livestock production value density per county. The county value is divided by the county's total crop and livestock land area to find its dollar value density.

$$AgValueDen_{Co} = \frac{AgValue_{Co}}{AgArea_{Co}}$$

where:

- $AgValueDen_{Co}$ is the crop and livestock value density calculated at the county level (in dollars per square mile)
- $AgValue_{Co}$ is the total crop and livestock production value of the county, as reported in the 2022 Census of Agriculture (in dollars)
- $AgArea_{Co}$ is the total crop and livestock production area of the county (in square miles)

The crop and livestock areas exposed to flooding were determined by overlaying the existing floodplain quilt. Each county's crop and livestock value losses were then calculated as the product of the crop and livestock production value density per county and the associated crop and livestock areas exposed to flooding from the existing conditions floodplain. The value of crop and livestock (production) areas in dollars and exposed area based on the existing floodplain quilt in the Lower Brazos Planning Region are shown in *Table 2.6*. Comanche, McLennan, Milam, Robertson, and Williamson counties have more than $20,000,000 of agricultural land at a 0.2 percent annual chance event flood risk. These counties have high densities of agricultural land, making them susceptible to flooding impacts. Fayette, Madison, and Travis counties had no agricultural exposure in the Region, each of these counties has minimal area within the region. The area of exposed agricultural area per county is provided in *Table 4* in *Appendix 2.3*.

Table 2.6: Value of Agricultural Area at Flood Risk

County	Ag Area at Flood Risk (sq mi)*	Value of Ag Area at Risk	County	Ag Area at Flood Risk (sq mi)*	Value of Ag Area at Risk
Archer	2.5	$322,300	Hood	3.3	$381,700
Austin	19.8	$2,807,400	Jack	5.9	$281,800
Bastrop	0.7	$99,800	Johnson	7.4	$1,085,500
Bell	67.7	$7,862,800	Lampasas	10.8	$510,600
Bosque	22.3	$1,683,100	Lee	6.0	$1,002,200
Brazoria	97.8	$16,747,800	Leon	0.4	$141,300
Brazos	39.2	$11,105,300	Limestone	10.8	$1,443,100
Brown	0.7	$39,600	Madison	0.0	$0
Burleson	63.3	$14,067,800	McLennan	107.1	$26,076,800
Burnet	2.5	$112,500	Milam	114.1	$23,183,200
Callahan	0.9	$27,900	Mills	5.9	$441,900
Comanche	90.5	$26,071,700	Palo Pinto	12.9	$659,000
Coryell	40.5	$3,725,300	Parker	3.5	$449,800
Eastland	43.0	$2,540,600	Robertson	75.8	$22,962,800
Erath	30.5	$13,844,600	Somervell	1.0	$46,700
Falls	128.9	$31,909,500	Stephens	6.2	$95,200
Fayette	0.0	$0	Travis	0.0	$0
Fort Bend	104.4	$13,524,300	Waller	21.1	$6,788,100
Freestone	0.1	$21,100	Washington	14.8	$1,309,500
Grimes	7.5	$795,100	Williamson	132.2	$21,294,700
Hamilton	33.4	$4,172,500	Young	25.6	$1,011,200
Hill	30.0	$4,401,300			

*Representative of agricultural area within 10%, 1%, and 0.2% ACE flood quilt areas.

Expected Loss of Function

Severe flood events can result in a loss of function for a community's infrastructures, impacting the systems supported by the infrastructure. The impacts can include disruptions to life, business, and public services that can be essential to a community during and after a flood event. Infrastructure that becomes inundated during flooding events is often non-functional during the event and through the recovery process.

A spatial analysis was conducted in GIS using the best available data and the existing conditions floodplain quilt to generate qualitative estimates of the expected loss of function for the Region. Metrics were developed to understand the expected loss of function of structures,

transportation, health services, water supply, water treatment, utilities, energy generation, and emergency services during a 1 percent ACE.

Inundated Structures

Residential structure data used in the Region included single-family homes, townhomes, mobile homes, and multi-family residences like apartments and condominiums. Based on the existing flood exposure analysis detailed above, an estimated 128,943 residential buildings are in the 1 percent annual chance storm event floodplain and potentially lose function during and after storm events. An approximate population of 345,000 is estimated to be exposed to the risk of flooding with loss of function of their residences. Loss of function of residential structures can result in content loss and displacement of residents.

Non-Residential inventory data also included over 48,000 buildings that are exposed to flooding. These buildings are subject to a potential loss of function during storm events and the recovery process. Loss of function of non-residential structures can result in content and inventory loss, potential relocation, and loss of short-term shelters. These impacts all contribute to operating losses for businesses.

Transportation

Transportation line data (roadways and railroads) from TxDOT the Existing Flood Hazard Assessment was used to estimate road and railways crossings at risk of flooding. Based on the existing flood exposure analysis presented above, over 7,200 roadway crossings, 9,700 miles of roadway, and 212 miles of railroad are at risk in the Region.

These roadway crossings will likely become impassable and result in a loss of function during significant storm events. The impassable roadways can cause issues for emergency responders and motorists traveling on the roadways. During significant storm events, debris buildup can cause conveyance loss at bridges and exacerbate the risk of road crossings with higher flood waters overtopping the roadways and the potential for debris to overtop the roadway.

Health and Human Services

Health and human services include hospitals, nursing homes, and other services to enhance the health and well-being of the public. Based on the spatial analysis, 252 health and human service facilities are located within the existing 1% ACE floodplain. Potential loss of function can occur during a flood event for these services due to their location within the floodplain. The loss of function of health and human services can result in loss of available beds, displacement of patients, and a potential loss in the quality of care.

Water Supply

Floods can contaminate water supply sources such as wells, springs, and lakes/ponds through polluted runoff laden with sediment, bacteria, animal waste, pesticides, and industrial waste

and chemicals. Drinking water wells have the potential to become contaminated during major flooding events, requiring disinfection and cleanup. The TCEQ's Public Water Supply dataset shows 2161 public water supply wells in the Lower Brazos River Basin, with 473 in the floodplain. Therefore, 22 percent of the public water supply wells in the Region are potentially exposed to flood risk.

Water and Wastewater Treatment

Flooding has the potential to impact water and wastewater treatment facilities and reduce the effectiveness of the facilities. Failure of water and wastewater treatment systems due to flooding may consist of direct losses such as equipment damage and contamination of pipes as well as indirect impacts such as disruption of clean water supply. In the Region there are an estimated 38 water and wastewater facilities located in the 1% ACE flood quilt.

Energy Generation

The potential failure of power generation plants due to flooding can cause direct losses such as equipment damage and indirect impacts to surrounding facilities due to loss of power. Nineteen power plants are located within the floodplain and potentially have a loss of function during a flood event. The power plants are located throughout the Region, with three located in Bosque County, one in Palo Pinto County, and one in Fort Bend County.

Emergency Services

Flood events can disrupt emergency services, causing delays in response times and hindering access to areas such as shelters or locations of emergencies. There are 79 fire stations within the 1% ACE floodplain and that they could experience a loss of function during a flood event. A total of 65 emergency shelters are within the floodplain, which could limit access to the facilities in the event of a flood.

2.A.3 Existing Condition Vulnerability Analysis

Vulnerability is an assessment of the potential negative impact of the flood hazard on communities and a description of the impacts. This task uses the data from the existing flood exposure analysis to determine the vulnerability of exposed structures and populations to flooding. The existing condition vulnerability analysis uses the 2024 Texas Flood Social Vulnerability Index (TX F-SVI) data developed by the University of Texas and TWDB. TX F-SVI is calculated at the census tract level within a specified county using 18 social factors, including poverty, housing, ethnicity, and vehicle access. *Table 2.7* shows a comparison of the variables used for SVI calculations between TX F-SVI and U.S. Centers for Disease Control and Prevention (CDC) SVI used in the first cycle.

Table 2.7: TX F-SVI and CDC SVI Variables Comparison

Variable	TX F-SVI	CDC SVI

Access to Phone/Internet	X	
Age	X	X
Disability	X	X
Environmental Risk Factors	X	
Housing Age	X	
Housing Value	X	X
Income	X	
Language	X	X
Migration	X	
Mobile Homes	X	X
No Vehicle	X	X
Minority	X	X
Poverty	X	X
Renters	X	
Rural-Urban	X	
Employment Type	X	
Single Parent Household	X	X
Unemployment	X	X
Crowding		X
Group Quarters		X
Housing Type		X
No Health Insurance		X
No High School Diploma		X
TOTAL	**18**	**15**

Source: TWDB *(https://www.twdb.texas.gov/flood/research/tx-f-svi-research-2022/index.asp)*

Vulnerabilities of Structures, Agricultural Areas, Bridges, Low Water Crossings, and Critical Facilities

The 2024 TX F-SVI data was overlaid with the Lower Brazos Planning Region's buildings, critical facilities, bridges, low water crossings, and agricultural areas to attribute their associated SVI values. The SVI values for all the buildings, critical facilities, agricultural areas, bridges, and low water crossings exposed to the existing conditions floodplain quilt are summarized by county averages and provided in *Table 4* of *Appendix 2.3*.

A community's SVI score is proportional to a community's risk. Social vulnerability is a consequence enhancing risk component and community risk factor that represents the susceptibility of social groups to the adverse effects of natural hazards like floods, including disproportionate death, injury, loss, or disruption of livelihood (FEMA, 2021). An SVI score and

rating represent the relative level of a community's social vulnerability compared to all other communities, with a higher SVI score resulting in a higher risk index score (FEMA, 2021)

The analysis shows Fort Bend County has the lowest SVI score in the Region but has the second-highest number of critical facilities at flood risk. This is primarily due to the higher median incomes across the county and the significant presence of flood mitigation infrastructure boosting the ability of communities within Fort Bend County to respond during a risk event. However, as indicated by the distribution of critical facilities at flood risk, a low SVI does not mean a community has no flood risk. The TWDB considers a threshold of 0.75 as an indicator for highly vulnerable areas. Only Waller County reaches this threshold in the Region at the county level. *Map 7* in *Appendix 0* shows the county-wide average distribution of SVI with regard to the exposed critical facilities in the Region. Lee, Lampasas, Robertson, Austin, Young, Bell, Eastland, Freestone, Hill and Madison counties all had SVI scores greater than or equal to 0.50.

2.A.4 Summary of Existing Conditions Flood Exposure Analysis and Vulnerability

The existing flood risk, exposure, and vulnerability for the Region are summarized in *Table 2.3*. As the data shows, Brazoria and Fort Bend Counties experience higher exposure than the majority of the Lower Brazos Region due to a combination of dense population and proximity to both coastal and riverine flooding exposure. McLennan County also trends towards high flood exposure, especially centered around the Waco metropolitan. Conversely, several counties such as Archer, Brown, Callahan, and Fayette, have negligible area and flood exposure in the Lower Brazos Region. Much of the Region is rural and does not have large numbers of flood exposed population or infrastructure. However, flooding in these areas could cause significant damage by harming farming and ranching land that much of the region uses to generate revenue.

Appendix 2.3 Table 4 provides the existing flood exposure and vulnerability analysis results per county as outlined in the Technical Guideline for Regional Flood Planning. A geodatabase with applicable layers as well as associated TWDB required maps and figures are provided as digital data.

2.B Future Condition Flood Risk Analyses

The LBRFPGs were tasked with considering the flood risk change over the Lower Brazos Planning Region. Future condition flood risk analyses considered projected increases in flood hazard areas and the additional people and property exposed.

2.B.1 Future Condition Flood Hazard Analysis

The purpose of the future condition flood hazard analysis was to identify future condition flood hazard areas based on projected increases in impervious cover, anticipated change in rainfall patterns, anticipated change in relative sea level and/or land subsidence, anticipated sedimentation in flood control structures, and other factors that may result in increased or altered flood hazards in the future. The *Year 2060 Floodplain Maps for Texas – Final Report* (Cursory Floodplain Report), which documents the methodologies used to develop cursory floodplain data for the 2028 regional flood plans, was relied upon in a variety of ways to develop future conditions flood hazard data. Specific uses of cursory floodplain data are described in further detail in sections below. Flood exposure and vulnerability analyses were also performed based on the future condition flood hazard layer. Future Condition Flood Hazard areas are shown on *Map 8* in *Appendix 0*.

Future Conditions Based on "No Action" Scenario

The future conditions flood risk analysis performed for this plan was based on a 30-year "no-action" scenario. This scenario assumes continued population growth, current regulations, land use and development trends, increased flood risk from sea level rise, and changes in rainfall patterns. Flood mitigation projects recommended in this plan are not incorporated into the future conditions analysis. The analysis is to be used for planning purposes only and is not intended to be used for regulatory purposes.

Population Growth

Population projections were provided by the TWDB at a HUC-12 level through the Flood Planning Data Hub. This dataset uses Water User Group and 2020 Census data to spatially distribute population and growth estimates by watershed for flood planning purposes. Population within the Lower Brazos Planning Region is projected to grow by 59 percent, or about 2,100,000 people, from 2030 to 2060. A summary of growth region-wide is shown in *Table 2.8*.

Table 2.8: Population Projections

Region	2030	2040	2050	2060	Percent Growth
Lower Brazos	3,565,837	4,334,355	5,028,373	5,670,890	59%

Population growth data was used to update regional scale 2D models by accounting for additional impervious cover to create future flood hazard data. Additional details are provided regarding how these models were updated in the *Future Conditions for Areas with Regional Scale 2D Model* Data section.

Anticipated Future Development

The future conditions analysis included distributing projected population growth spatially within the Region. As previously mentioned, the TWDB provided population projections at the HUC-12 watershed level, which leverages Water User Group data used in the State Water Plan. The process of deciding where anticipated development would occur took into consideration regional infrastructure, undeveloped land, natural features, existing flood risk, jurisdictions, and current development trends. The input factors were combined using local knowledge to represent how likely new development could occur throughout the Region.

Future development was distributed within each HUC-12 watershed based on the following factors (in priority order):

- proximity to recent developments
- proximity to existing developments
- proximity to interstates and highways
- proximity to major local thoroughfares
- proximity to planned highways and local thoroughfares
- areas within city limits or extraterritorial jurisdictions (ETJ)

Future development was restricted in the following areas:

- existing wetlands
- existing flood hazard areas
- existing floodways
- existing parks, cemeteries, airports, golf courses
- government-owned land
- existing railroad right of way
- existing road right of way
- existing developments

The 2020 Census informed estimation of future population densities. Values for three density classifications that were used to spatially distribute anticipated development are shown in *Table 2.9*. High population density was assigned to areas within 1 mile of existing urban centers characterized by population densities exceeding 5,000 people per square mile. Medium density was assumed for all areas within 1 mile of existing suburban development characterized by

population densities between 2,000 and 5,000 people per square mile. Lastly, low density was assumed for the remaining area in the Region (rural areas).

Table 2.9: Approximate Future Population Densities

Population Density	People per Acre
High	12
Medium	5
Low	3

Future development was distributed within each HUC-12 watershed, beginning with the most desirable areas as determined by the factors listed above until all anticipated population was assigned. Areas anticipated to be developed were divided into individual parcels based on population densities determined at the 2020 Census. A single residential structure was created at the center of each parcel for inclusion in the future conditions flood risk exposure analysis.

Figure 2.6 illustrates the outcome of the process, which includes the zones identified as potential future development and the predicted layout of residential structures. The shaded area follows typical development patterns. Undeveloped land near the major thoroughfares and pockets of vacant land within the city has developed, and additional land on the edge of the existing urban area has also been developed. The shaded areas were then divided into potential future structures based on the population associated with the development. These potential future structures were included in the future conditions flood exposure analysis, which is discussed in greater detail in section *2.B.2*.

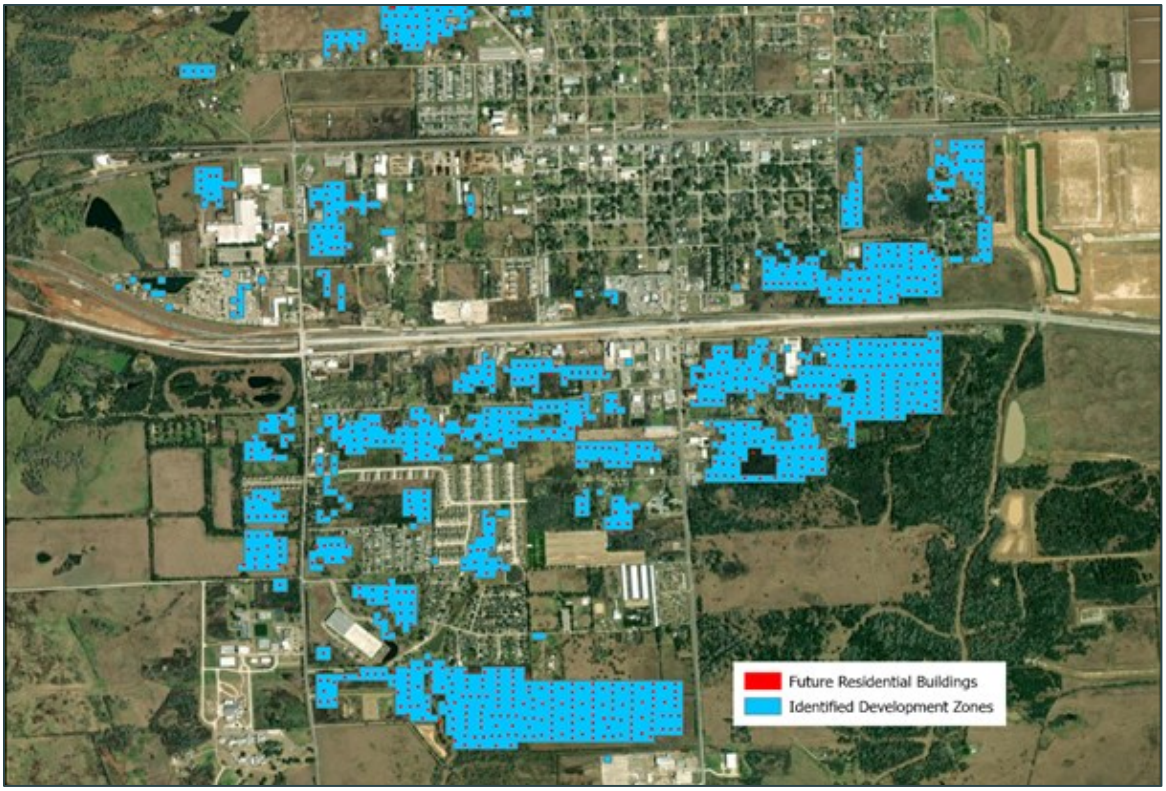


Figure 2.6: Sample Area of Anticipated Future Development

Sea Level Rise

Sea Level Rise (SLR) is an on-going phenomenon in which the relative ocean elevation increases and encroaches on coastal areas. The Cursory Floodplain Report was referenced to estimate the impact of SLR on future condition flood hazard extents. The study team that developed the cursory floodplain data evaluated a present-day scenario and a year 2060 scenario that reflects a 2-degree Celsius global mean temperature increase relative to the pre-industrial period. These scenarios were evaluated to calculate change factors (CFs) quantifying differences from existing to future conditions for pluvial (rainfall), fluvial (discharge), and coastal (elevation) model boundary conditions. Assumptions related to future climate conditions were coordinated with State Climatologist, Dr. John Nielsen-Gammon. More details regarding the methodology for determining CFs can be found in the *Year 2060 Floodplain Maps for Texas – Final Report* (Cursory Floodplain Report).

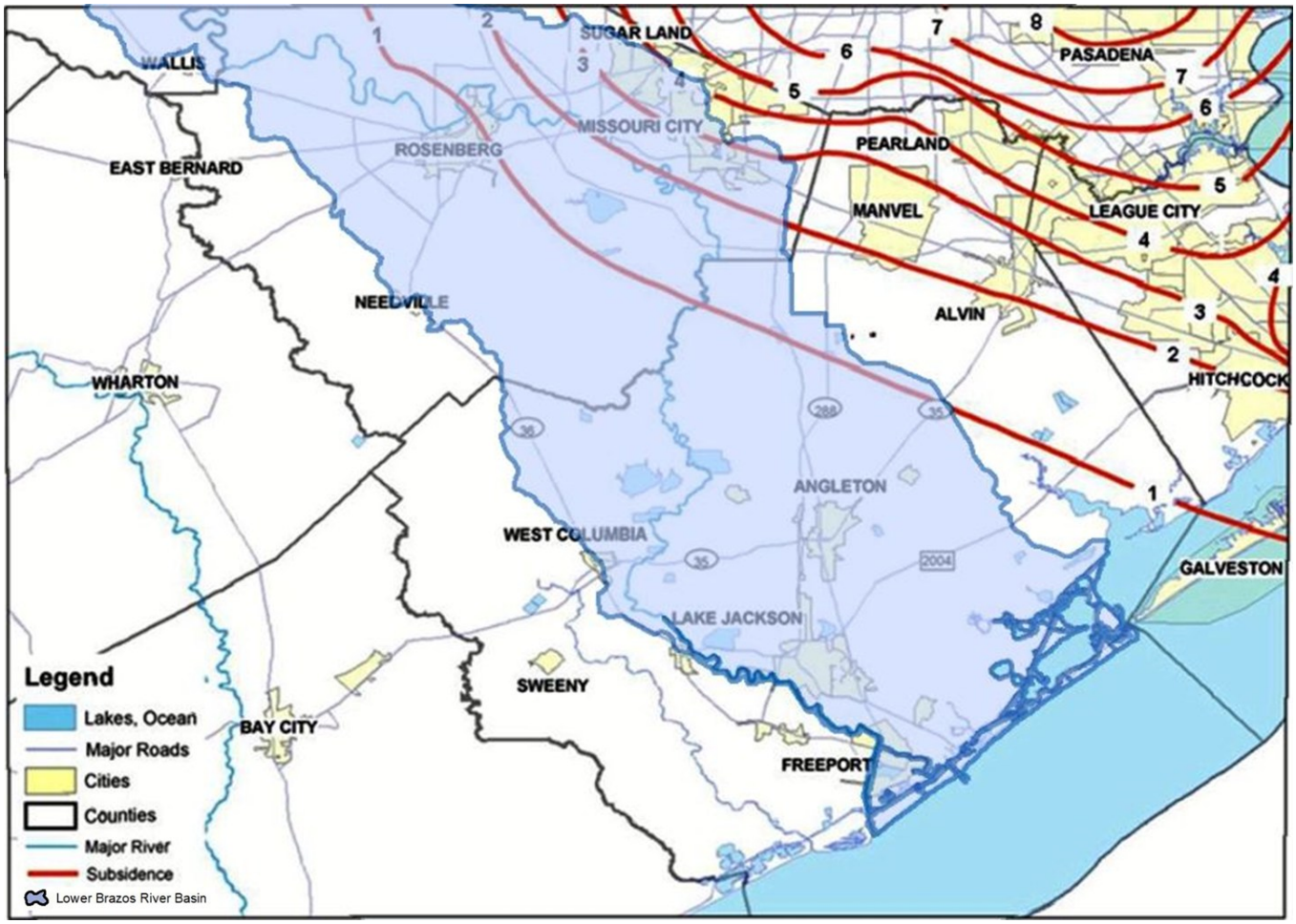
The Texas General Land Office River Basin Flood Study (GLO RBFS) Dry Bayou Austin Lower Oyster (DBALO) 2D HEC-RAS model was used as best available data to develop existing and future conditions flood hazard data for the downstream-most-portion of the Lower Brazos Planning Region. This hydraulic model includes a surge-dominated scenario to model coastal flooding, which was modified to reflect future conditions. The Cursory Floodplain Report documents findings that SLR is expected to contribute substantially more to coastal flooding

than other factors, including atmospheric changes, that could result in increased severity of storm surge. Therefore, all future changes to coastal flooding were assumed to be due to SLR under this analysis. Since storm surge is already accounted for in the DBALO model, a vertical increase in water surface elevation of **0.67 meters**, or **2.20 feet**, was added to existing conditions stage hydrograph boundary conditions to account for SLR in future conditions. This vertical increase represents the 83rd percentile (Cursory Scenario 3) of possible future outcomes with respect to SLR based on global ensemble models, as documented in the Cursory Floodplain Report. Additional details about modeling in support of developing the future conditions flood hazard layer are provided under the *Future Condition Flood Hazard Mapping Development* section.

Subsidence

Subsidence is the gradual lowering of the ground elevation that can result from changing groundwater levels or increases in sediment loadings. GPS stations are currently monitoring subsidence within the Region near the Gulf Coast, operated by the Harris-Galveston Subsidence District, Fort Bend Subsidence District, University of Houston, Lone Star Groundwater Conservation District, Brazoria County Groundwater Conservation District, Texas Department of Transportation, and other local entities. Land subsidence can occur due to aquifer compaction, drainage of organic soils, underground mining, natural compaction, sinkholes, and thawing permafrost.

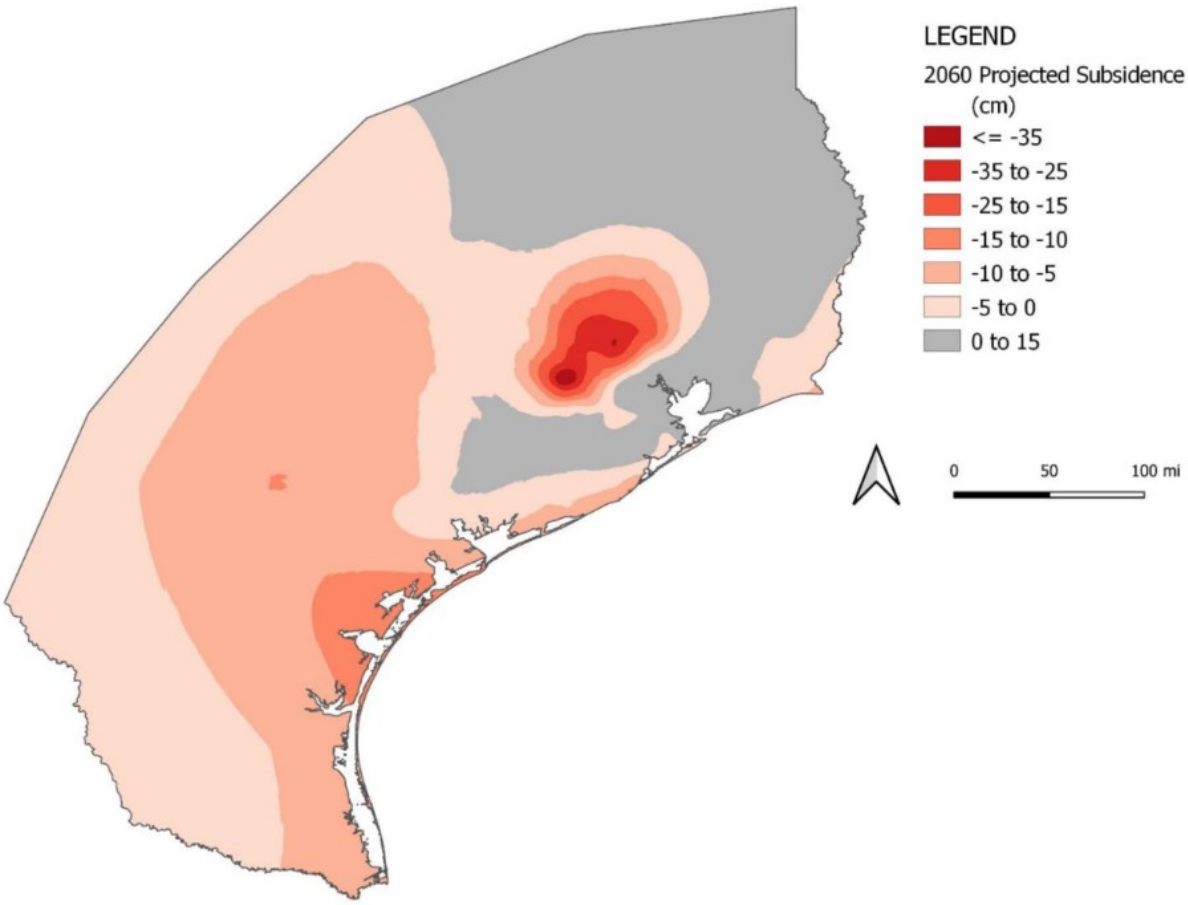
Actual land subsidence varies spatially. While the areas near the Gulf Coast have shown to experience subsidence at higher rates, areas further inland tend to show little to no subsidence and do not consider it a concern. The Southern Trinity Groundwater Conservation District, located in the middle portion of the Region, states that subsidence is unlikely to occur in the district, and the aquifers have little potential for compaction and subsidence due to groundwater withdrawals. Looking toward the coastal areas of the Region, historical subsidence has been observed from 1906-2000, with areas in the Lower Brazos Planning Region experiencing subsidence from 1 to 5 feet as shown in *Figure 2.7*.



(Northern Gulf Coast Groundwater Availability Model developed by U.S. Geological Survey and 2002 RWPG Pumping Estimates by Regional Water Planning Groups and the TWDB)

Figure 2.7: Actual Subsidence in Feet: 1906-2000 (Geodetic Survey Contour Interpretations)

The Cursory Floodplain Report was referenced as best available data for projecting future subsidence since the analysis leverages current subsidence rates based on both NOAA and Houston-Galveston Subsidence District (HGSD) data, and specifically projects to the year 2060. Future subsidence estimates documented in the Cursory Floodplain Report show further lowering of land within the Lower Brazos Planning Region by 2060 (*Figure 2.8*) and range from 0 to 35 cm (1.15 feet). While the area within the Region impacted by subsidence is localized to the coastal areas, long-term monitoring and management of groundwater resources are recommended for future planning to control and prevent further land subsidence.



(Year 2060 Floodplain Maps for Texas – Final Report, TWDB, 2025)

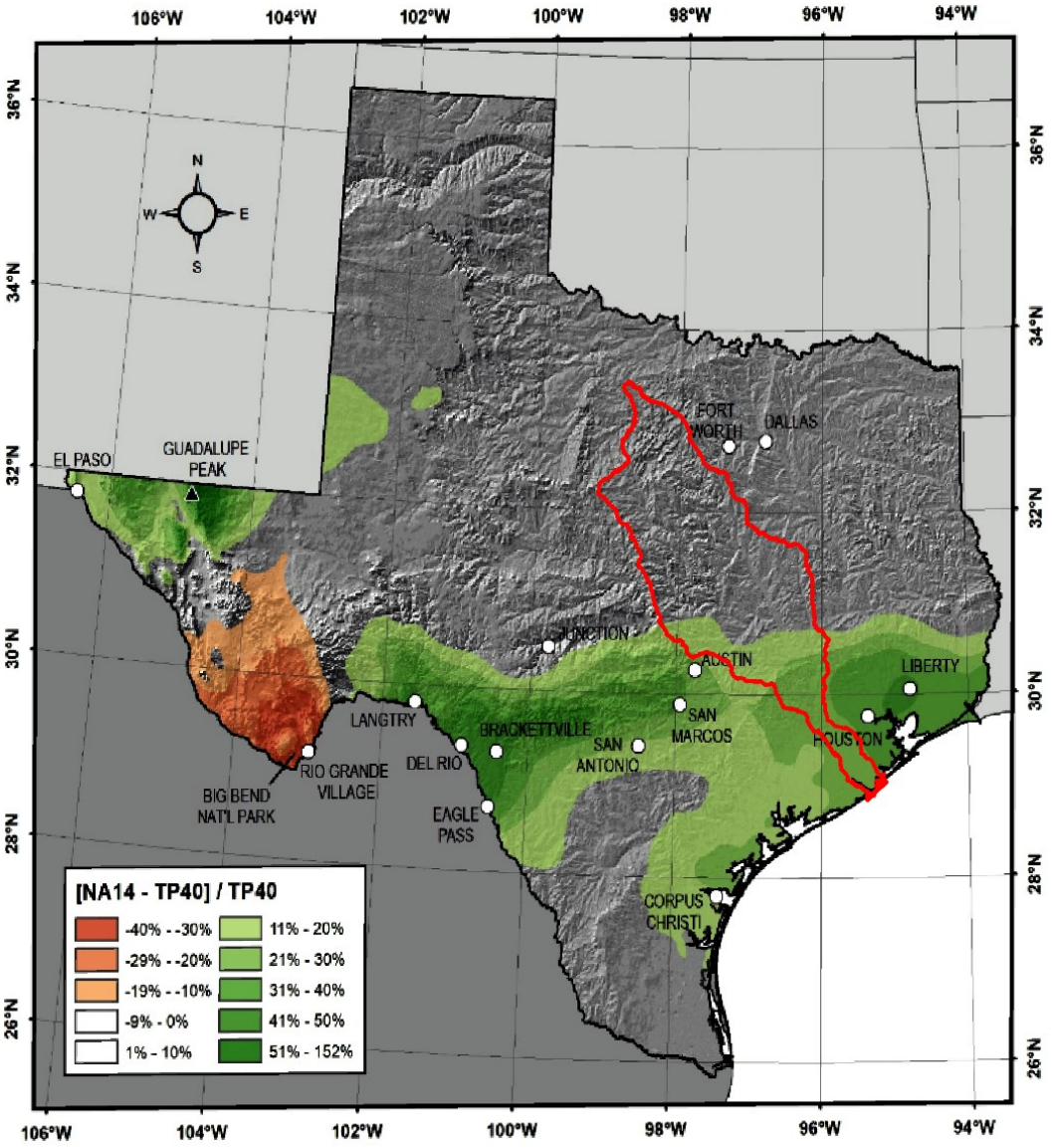
Figure 2.8: Projected Subsidence: 2022-2060

The Cursory Floodplain Report states that the impact of subsidence on pluvial and fluvial flood mapping is minimal due to changes in subsidence occurring "very gradually in space," meaning that flood elevations are likely to vary similarly to ground elevations. While subsidence would be expected to impact coastal flooding due to increases in the difference between ground levels and mean sea level, the figure above shows projected subsidence values that range from 0 to 10 cm, or 0.33 feet, at the coast. As previously mentioned, estimated sea level rise of 2.20 feet relative to existing conditions is accounted for in future conditions modeling and mapping, which has a far greater impact on coastal flood mapping than projected subsidence values, which are estimated to be about 0.16 feet on average for areas in the Region affected by coastal flooding. For these reasons, subsidence was not directly accounted for in future conditions modeling and hazard mapping.

Anticipated Changes in Rainfall Patterns and Floodplains

Changing rainfall patterns in the basin are anticipated to increase flood risk. Two major rainfall atlases have been completed in the Lower Brazos Planning Region. Technical Paper Number 40

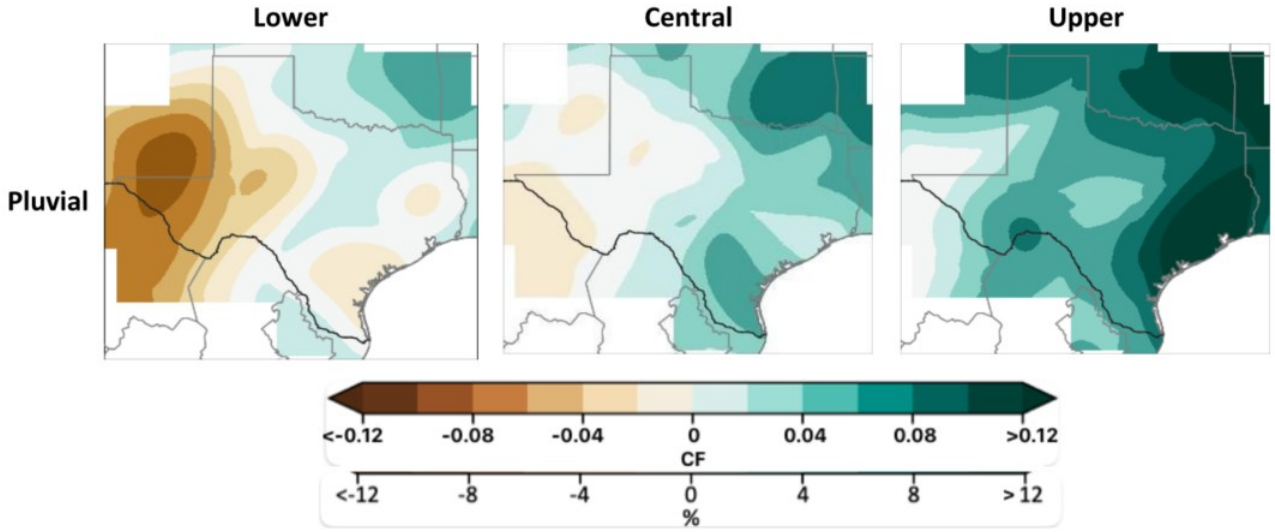
(TP-40) was released in 1962 and NOAA Atlas 14 Update to TP-40 was released in 2018. In the 50 years between both publications, the lower end of the basin experienced increases between 20 – 40 percent in rainfall associated with a 1 percent annual chance storm event. *Figure 2.9* shows the statewide historical change in rainfall.



(NOAA Atlas 14 Updates to Texas TP-40 Rainfall Frequency Values, 2018)

Figure 2.9: Change in 24-hour 1 Percent ACE Rainfall Between AN14 and TP-40

The Cursory Floodplain Report was referenced to determine how precipitation is anticipated to change from existing conditions to future conditions. As previously mentioned, the analysis described in this report developed pluvial CFs by evaluating global ensemble model outputs for a present-day scenario and a year 2060 scenario that reflects a 2-degree Celsius global mean temperature increase relative to the pre-industrial period. The resulting CFs for the 17th (Lower), 50th (Central), 50th, and 83rd (Upper) percentile of ensemble model results are shown in *Figure 2.10* below.



(Year 2060 Floodplain Maps for Texas – Final Report, TWDB, 2025)

Figure 2.10: Change Factors (CF) for Existing Cursory Precipitation Boundary Conditions

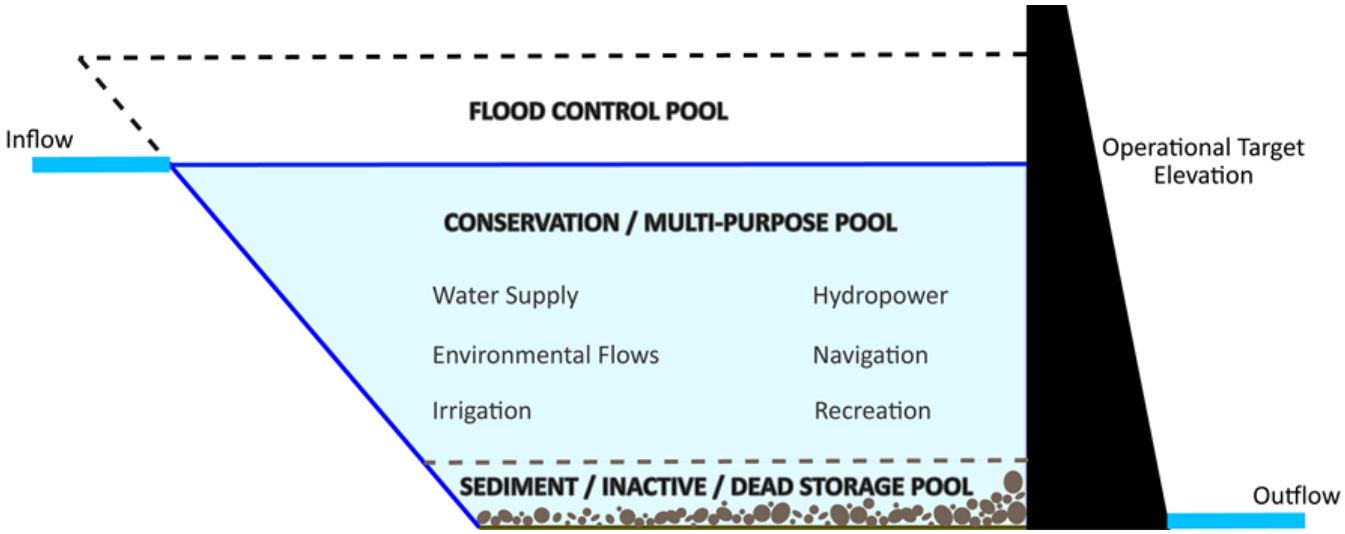
Pluvial multipliers representing the 83rd percentile CFs (Cursory Scenario 3) were referenced across the basin to modify existing modeling and mapping data to develop future conditions flood hazard mapping. Pluvial multipliers ranged from 1.14 near the coast to 1.06 in the northern and western-most portions of the Lower Brazos Planning Region. Multipliers representing the 50th percentile CFs (Cursory Scenario 4) were used where no other data was available to develop future conditions flood hazard mapping. Additional details are provided describing how future rainfall assumptions were used to develop future conditions flood hazard mapping in the sections *Future Conditions for Areas with 1D BLE Data* and *Future Conditions for Areas with Regional Scale 2D Model* Data.

Sedimentation and Major Geomorphic Changes

Erosion, sedimentation, and significant planform changes are major issues in the Lower Brazos Planning Region. Geomorphic changes affect losses in property access, roads, agriculture, and residential structures. Erosion also threatens the integrity of levees systems which protect billions of dollars from flood risk. Further analysis and planning efforts outside the Regional Flood Plan are needed to better understand and address these concerns.

Anticipated Impacts of Sedimentation in Flood Control Structures

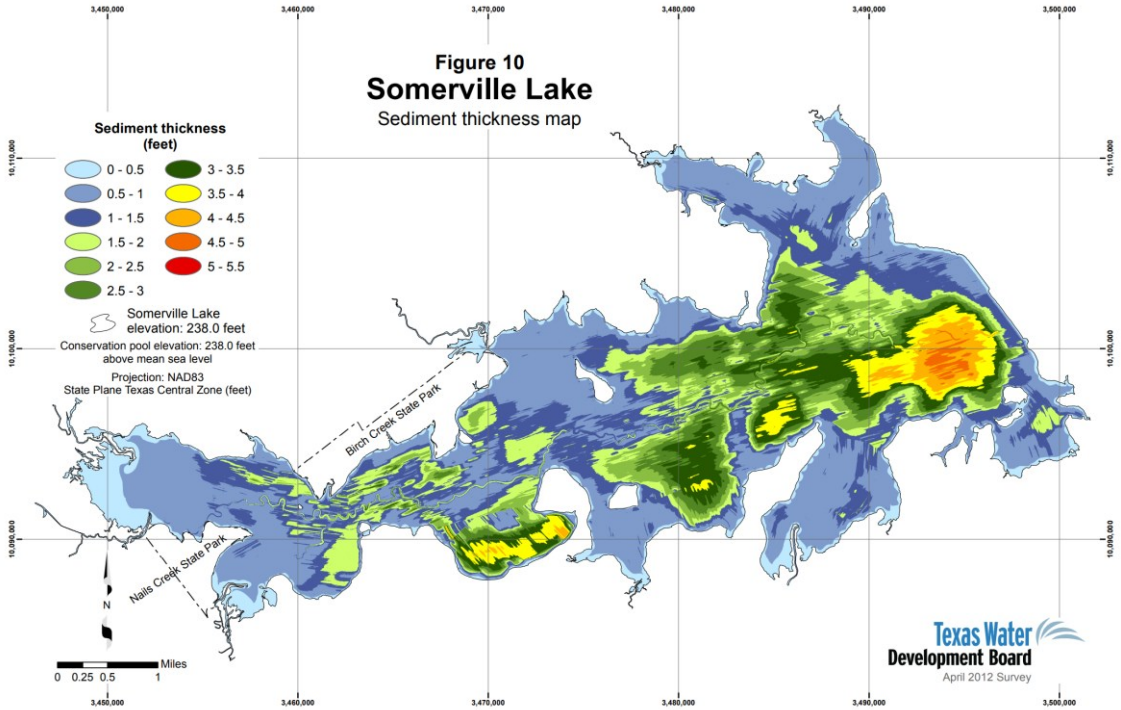
In the Region, the most prominent flood control structures at a regional scale are levees, dams, and their associated reservoirs. In general, reservoirs are the facilities that are most susceptible to the impacts of sediment deposition over time within this watershed. *Figure 2.11* shows a section of a typical multipurpose reservoir.



(https://nicholasinstitute.duke.edu/reservoir-reallocation)

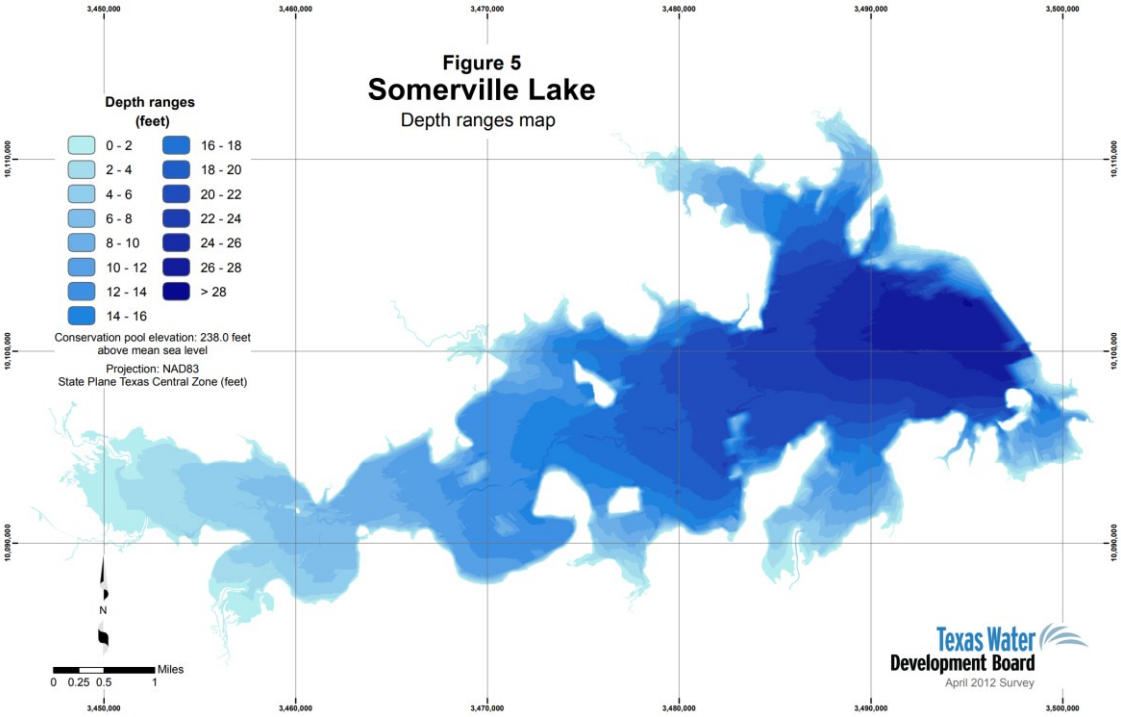
Figure 2.11: Section of a Typical Multipurpose Reservoir

Sedimentation within reservoirs would primarily impact, the conservation pool. In most cases the conservation pool characterizes the volume of water available for water supply; however, in some cases it can also be used for hydropower generation. The regional water plans evaluate the consequences of sedimentation impacting the ability of reservoirs to maintain a steady water supply. The TWDB has performed numerous bathymetric surveys of lakes, which are used to track the progress of sedimentation. *Figure 2.12* shows a map of sediment thickness in Somerville Lake, and *Figure 2.13* shows the water depths below the conservation pool; these maps show that the majority of the sediment has accumulated on the east end (near the dam) where the conservation pool is the deepest, and the shoreline shows the minimal accumulation of sediment. This is consistent with the concept illustrated in *Figure 2.11.* In large reservoirs, it is unlikely for sedimentation to impact the flood control pool (if available) significantly, as the majority of the sediment load will deposit below the conservation pool.



(Volumetric and Sedimentation Survey of Somerville Lake, TWDB, 2014)

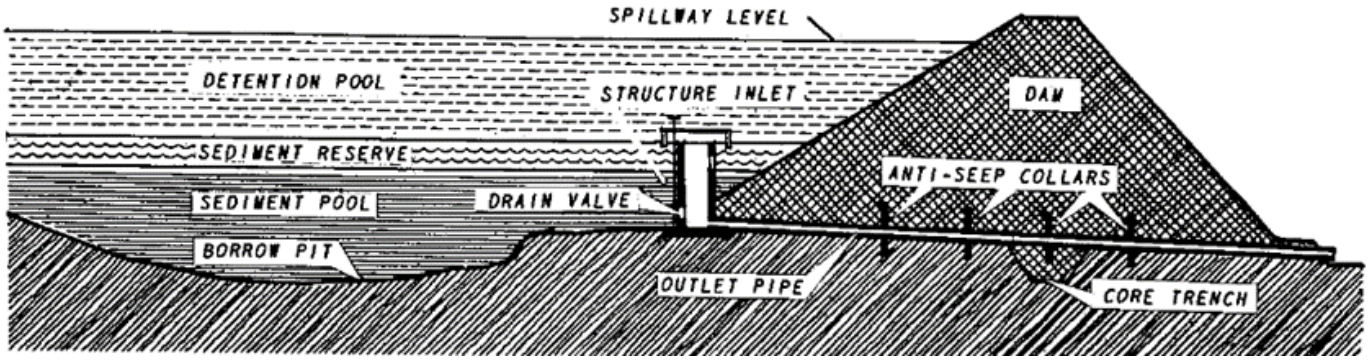
Figure 2.12: Sediment Thickness Map for Somerville Lake



(Volumetric and Sedimentation Survey of Somerville Lake, TWDB, 2014)

Figure 2.13: Depth Ranges Map for Somerville Lake

In the case of NRCS floodwater retarding structures, sedimentation may be considered to have an adverse impact on the structure's flood control performance only when the sediment pool capacity has been depleted and sediment accumulates in the detention pool. *Figure 2.14* shows a section of a typical NRCS flood retarding structure. Periodic maintenance to remove accumulated sediment is recommended to maintain the capacity of the detention pool. Since sediment deposition is not anticipated to have a significant impact on performance of dams and reservoirs in the basin, updates were not made to future conditions modeling and mapping to account for potential loss of flood control storage.



(Big Sandy Creek Watershed Work Plan, Soil Conservation Service, 1955)

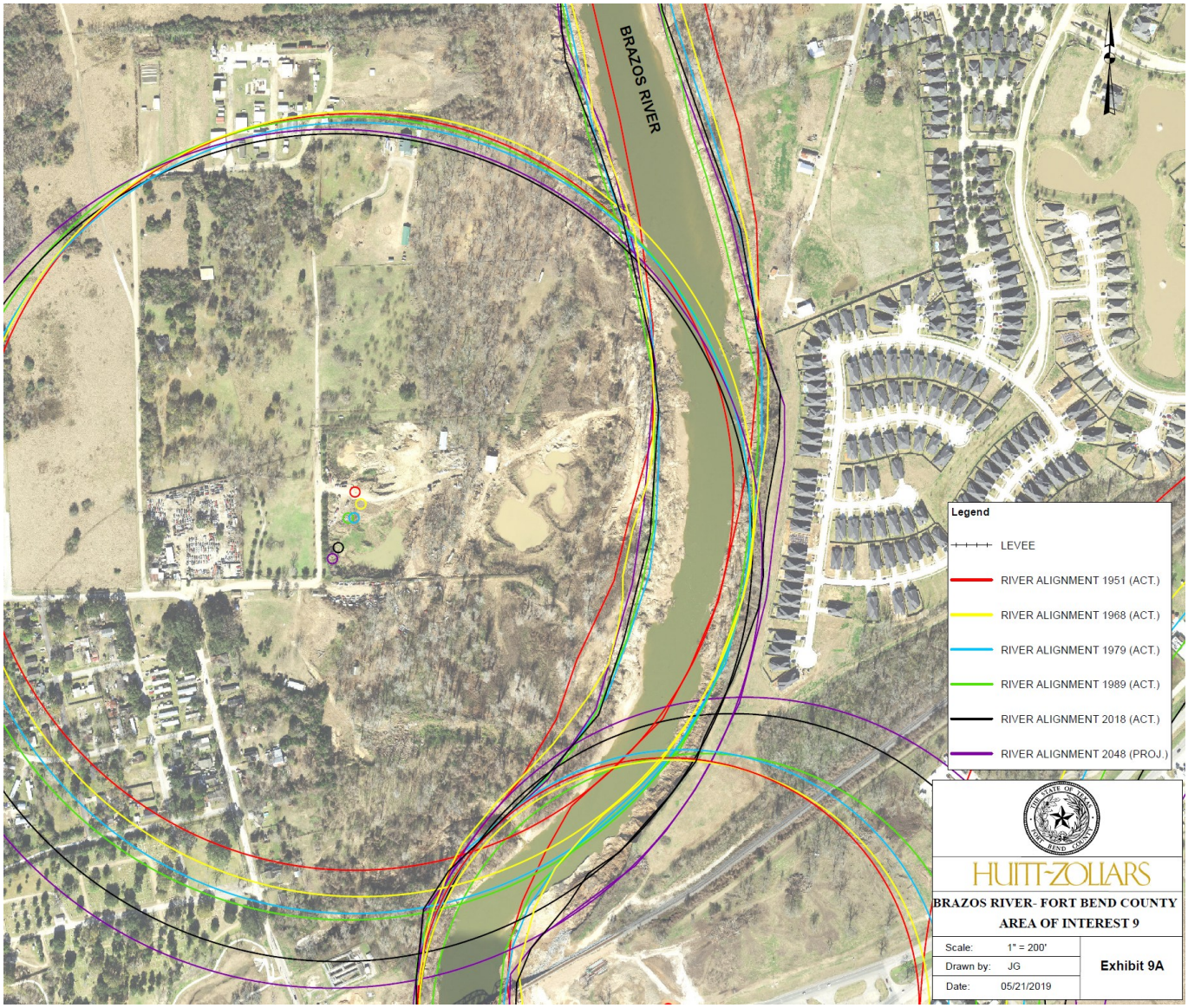
Figure 2.14: Section of a Typical NRCS Floodwater Retarding Structure

Effects of Geomorphic Changes on Flood Risks

The Brazos River has a long history of geomorphic changes. For example, Oyster Creek in Fort Bend and Brazoria Counties was formed due to major geomorphic changes to the course of the Brazos River over thousands of years. In May 2019, Fort Bend County completed the Brazos River Erosion Study, which focused on a geomorphologic analysis at 24 locations on the Brazos River to project the meander migration of the river over the next 30 years. The locations evaluated pose a greater risk to existing infrastructure and population; developing measures to mitigate geomorphic changes would require further evaluation. Compromise of existing levee systems due to erosion along the Brazos River could increase flood risk in those locations.

Figure 2.15 shows the projected meander migration at one of the locations of interest. Areas outside Fort Bend County would benefit from similar assessments to identify locations that pose a risk to existing infrastructure and population. The 2020 Brazos River Flood Risk Management Study completed by the USACE-ERDC analyzed the available methodology for addressing geomorphic changes in the region. The recommended bank stabilization methodologies included direct and indirect approaches. Indirect measures such as permeable or impermeable dikes are common in straight river reaches. Direct bank stabilization methods, including rip-rap blanks or stone toe protection, are common recommendations for the Brazos River, according to

the USACE-ERDC. Further analysis is needed to better understand the impact that future geomorphic changes could have on flood risks.



(Brazos River Erosion Study, Huitt-Zollars, Fort Bend County Drainage District, 2019)

Figure 2.15: Projected Meander Migration at Example Location of Interest

Available Future Condition Hydrologic & Hydraulic Models

No future condition H&H models or floodplain mapping were available in the Lower Brazos Planning Region for use in Task 2B. As a result, the LBRFPG had to modify existing conditions data to create future condition flood hazard information; the process for doing so is discussed the *Future Condition Flood Hazard Mapping Development* section.

Future Condition Flood Hazard Mapping Development

As previously discussed, the TWDB provided cursory future condition flood hazard data for the LBRFPGs to use during the 2028 regional flood planning cycle. This data includes floodplain mapping for 4 future conditions scenarios, which are summarized below in *Table 2.10*.

Table 2.10: Cursory Data Future Conditions Scenarios

Scenario	Adjustment			
	Land Use	Subsidence	Rainfall	Sea Level Rise
1	Considered	Considered	Low	Low
2	Considered	Considered	Moderate	Moderate
3	Considered	Considered	Significant	Significant
4	Existing	Existing	Moderate	Moderate

In accordance with the technical guidelines, the LBRFPG submitted a memorandum to the TWDB on June 6, 2026, to obtain approval of methodologies for developing future condition flood hazard data, which is summarized in subsequent sections. The proposed methodology was accepted by the TWDB on July 15, 2026.

Future Conditions for Areas with 1D BLE Data

For areas with available water surface elevation (WSE) results from 1D BLE models, a vertical buffer was applied to add expected increases in flood levels to the 10%, 1%, and 0.2% annual chance WSE rasters. Expected increases in flood levels were estimated by calculating the difference between Cursory flood depths in Scenario 3 (significant climate forcing) and Scenario 5 (existing conditions). Once the vertical buffer was applied to existing 1D BLE WSEs to estimate future conditions 1D BLE WSEs, the updated raster was mapped against lidar terrain data. This process is illustrated in *Figure 2.16*.

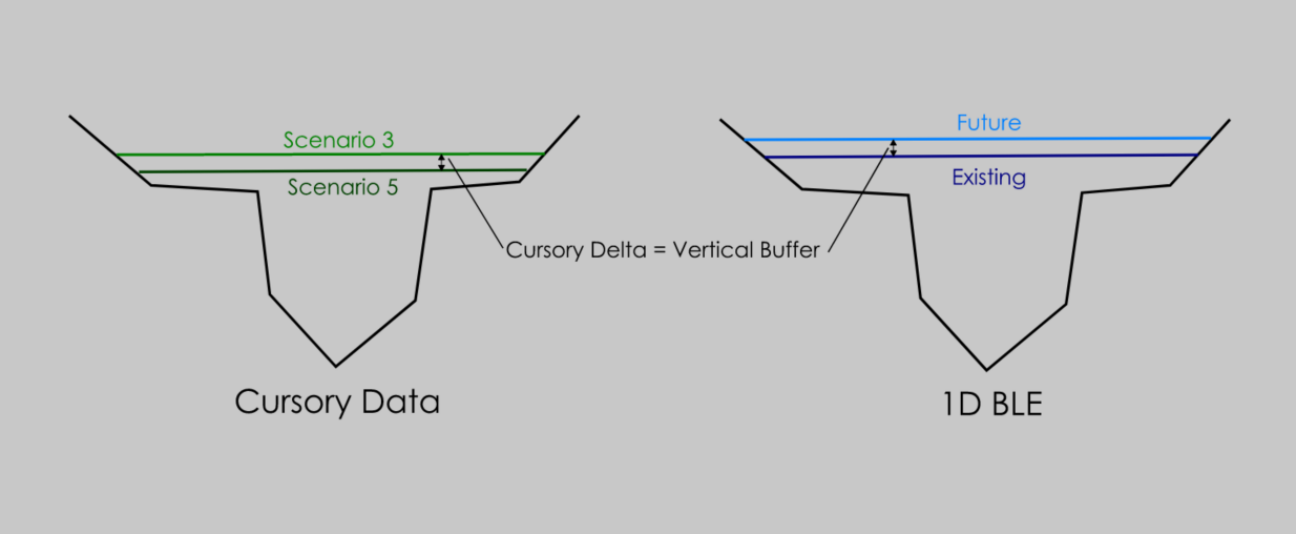


Figure 2.16: Future Conditions Flood Hazard Data Developed from 1D BLE Models

Areas with 1D BLE mapping data do not have substantial coverage of pluvial flood risk data. Therefore, pluvial Scenario 4 Cursory data was included as a supplemental data source to fill these gaps. A detailed review of the Cursory data revealed that a significant driver of future increases in flooding reflected by Scenario 3 was changes in roughness in the hydraulic modeling. Therefore, since the technical consultant team did not have confidence that significant roughness changes would have an outsized impact on future flooding conditions, the LBRFPG decided to use Scenario 4 Cursory data instead of Scenario 3. This process of buffering 1D BLE models and supplementing the results with pluvial Scenario 4 Cursory data was implemented in all watersheds with available 1D BLE data, which are shown in *Figure 2.17*.

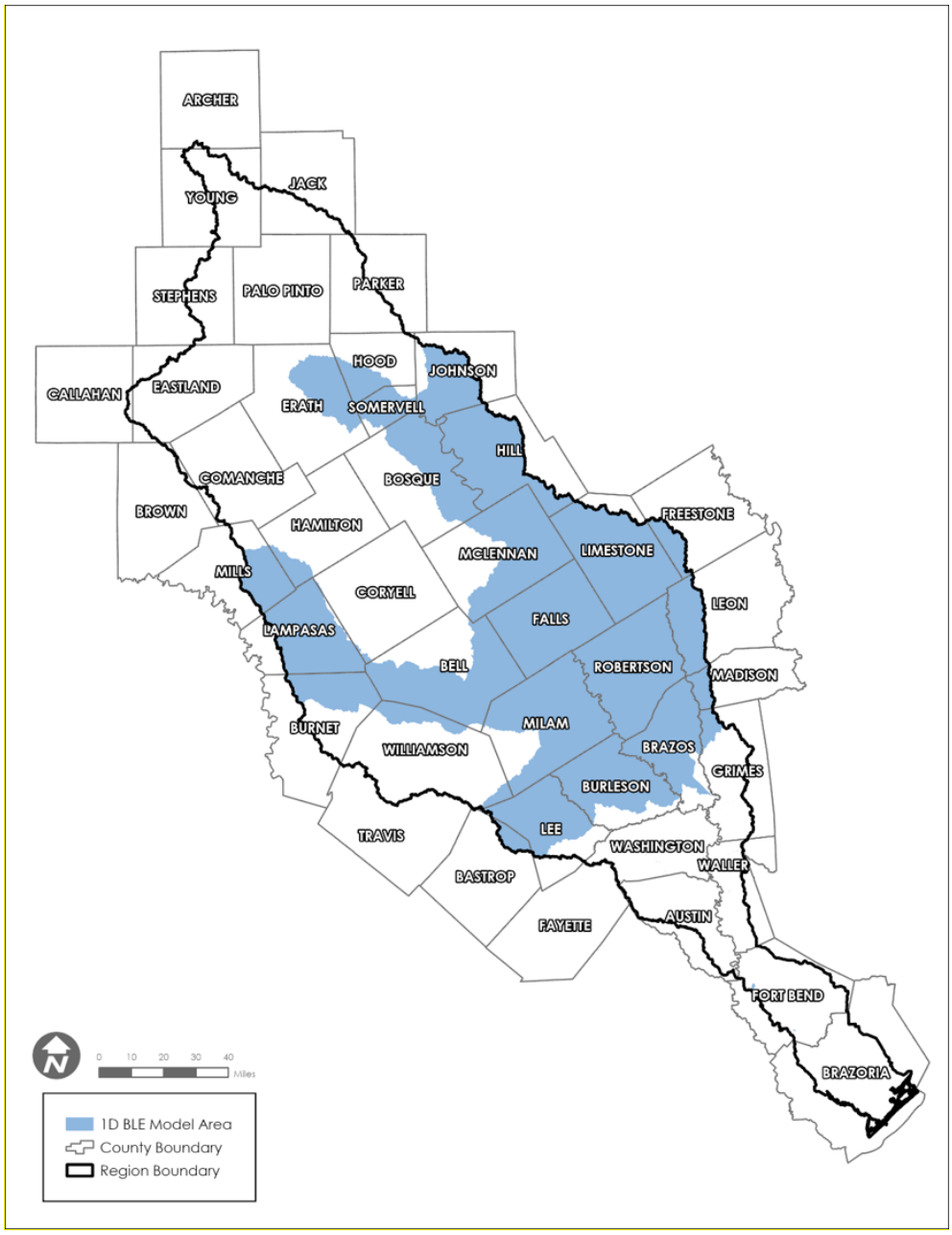


Figure 2.17: Area of 1D BLE Data Updates for Future Conditions Mapping

Future Conditions for Areas with Regional Scale 2D Model Data

Where regional scale 2D model data was available, the LBRFPG recomputed models with updated precipitation and impervious cover assumptions to create future conditions flood mapping data. Models updated and recomputed in this analysis include 2D BLE models and GLO RBFS models, which are shown in *Figure 2.18* below.

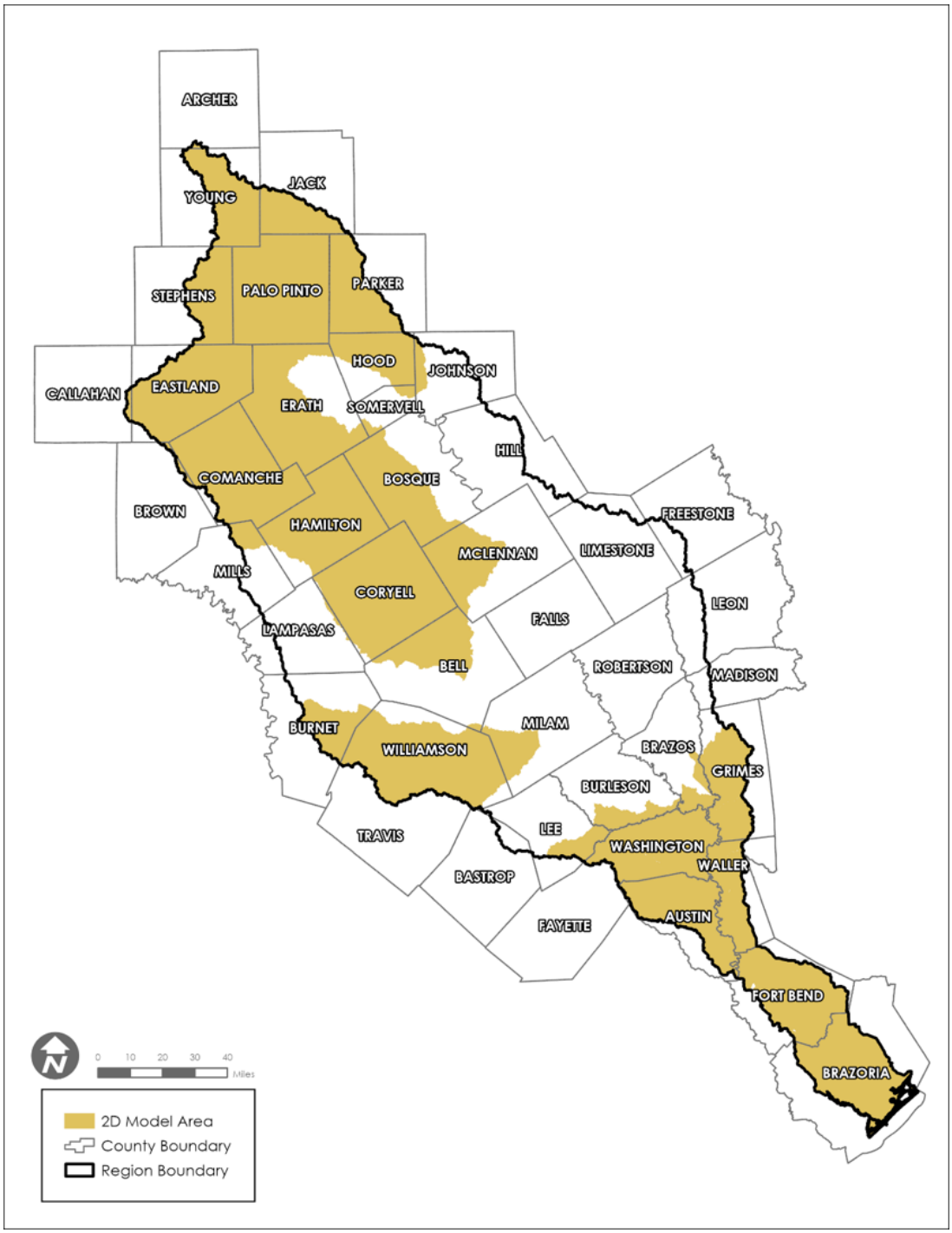


Figure 2.18: Area of 2D Model Updates for Future Conditions Mapping

Adjustments to impervious cover for model areas were determined by assuming impervious cover per capita rates would remain constant from existing to future conditions as reflected in the equation below:

$$\frac{Existing\ Percent\ Impervious\ Cover}{Existing\ Population} = \frac{Year\ 2060\ Percent\ Impervious\ Cover}{Year\ 2060\ Population}$$

For each model area, existing percent impervious cover values were determined by aggregating 2019 NLCD impervious cover data within each HUC-12 with centroids falling within the model perimeter. 2020 and 2060 projected populations were also totaled by summing HUC-12 populations with centroids falling within the model perimeter. Year 2060 percent impervious cover was then calculated using the equation above.

To determine the anticipated increase in rainfall, Cursory pluvial CFs, which represent the proportion of future rainfall depth to existing rainfall depth, were obtained for Scenario 3, which reflects significant climate forcing as documented in the Cursory Floodplain Report. These values were used as multipliers for precipitation hyetographs. As previously mentioned, these multipliers ranged from 1.14 near the coast to 1.06 in the northern and westernmost portions of the Lower Brazos Planning Region.

Once projected changes in rainfall and impervious cover data were determined, combined multipliers were calculated that accounted for both factors. The multipliers were then applied to rainfall hyetographs in 2D Rain-on-mesh (ROM) models, and flow hydrographs in 2D models with subbasin inflow boundary conditions. Multipliers varied by frequency event, accounting for the fact that as rainfall depth increases for the same temporal distribution, the percentage of rainfall that becomes runoff increases. Resulting multipliers for the 1% annual chance event ranged from 1.07 in the northern and western-most areas of the region that are not anticipated to experience significant development, to 1.36 in portions of the San Gabriel River watershed. It is important to note that external inflows representing substantial upstream contributing drainage area were not updated, which is consistent with the findings in the Cursory Floodplain Report that flood risk due to larger rivers is not anticipated to increase in the future.

2D BLE mapping was used as the sole mapping information for future conditions outside of urban areas defined referencing city limits with populations exceeding 5,000. Within these areas, Cursory Scenario 4 pluvial data was used to define future condition flood hazard extents since the Cursory data accounts for sub-surface drainage infrastructure, while 2D BLE data does not. Where inflow hydrograph-based GLO RBFS models were updated, Cursory Scenario 4 pluvial data was used to fill gaps in areas not covered by GLO RBFS mapping.

Map 8 in *Appendix 0* shows future condition flood hazard areas across the Region resulting from the process described above, and *Map 9* shows the changes in flood hazard data from existing to

future conditions. It is important to note that this mapping data was developed for conceptual planning purposes and is not intended to be regulatory.

Flood Data Gaps

Key factors referenced to identify map gaps in existing conditions are described in *Section 2.A.2*. As previously discussed, the results of the gap analysis were largely driven by review of FEMA data throughout the region, resulting in more than 90% of the region being reported as data gaps. In existing conditions, areas were not identified as gaps primarily due to availability of recent detailed FEMA study data published within the last 10 years. In future conditions, areas previously identified in existing conditions as having recent detailed FEMA study data are considered to have outdated information. Other data gap types remain unchanged from existing conditions. As a result, in future conditions, the entire region was assumed to be a data gap, assuming that all available flood risk data remains unchanged from existing conditions. The future conditions flood data gaps discussed above are shown in *Map 9* in *Appendix 0*.

2.B.2 Future Condition Flood Exposure Analysis

Future Conditions Flood Exposure

The flood exposure analysis for future conditions followed the same methodology as existing conditions as outlined in *Section 2.A.2*. However, residential structures created based on projected future development and population projections were incorporated into the exposure analysis, and future conditions flood hazard areas were utilized. Existing buildings, roadway crossings, and agricultural areas were maintained in the future conditions analysis. The summary of future flood exposure by county can be found in *Table 5* in *Appendix 2.5* and *Map 11* in *Appendix 0.* The increase in future conditions exposure compared with existing conditions exposure is summarized in *Table 2.11.*

Table 2.11: Summary of Increased Exposure in 1% ACE Flood Hazard Area

Feature	Existing Conditions	Future Conditions	Increase
Population	610,405	783,806	173,401
Total Structures	177,025	231,633	54,608
Residential Structures	128,943	172,771	43,828
Non-Residential Structures	48,082	58,862	10,780
Critical Facilities	1,866	2,412	546
Roadway Segments (miles)	7,501	8,961	1,460
Agricultural Area (sq. mi)	1,184	1,295	111

The Existing Floodplain Management Practices layer was used to identify areas that regulate to higher standards, where flood frequencies for anticipated future residential buildings were considered "unknown" if structures intersected with the future conditions flood hazard layer. The exposure analysis was performed in this way to account for development that would likely be subject to freeboard requirements. While the future flood risk of structures in these areas would be potentially lower than what is reflected in the future conditions flood hazard layer, flood risk cannot be ruled out completely based on the changing nature of flood hazard extents over time and potential impacts of development on flood conditions. In jurisdictions not regulating to higher standards, the flood frequency for all buildings was determined based on the highest flooding frequency the building intersects in the future conditions flood hazard layer, which is the same methodology used for the existing conditions exposure analysis. Accounting for development regulations in this way resulted in about 1,800 anticipated future buildings being identified as at risk of flooding of a known frequency (10%, 1% or 0.2% ACE), while about 142,600 anticipated future buildings were considered to have "unknown" future flood risk.

Buildings, Critical Facilities, Infrastructure, and Agriculture Exposure Totals by County

The future conditions flood exposure analysis included existing and anticipated future development and estimated the number of buildings, critical facilities, low water crossings, roadway segments, and agriculture areas potentially exposed to anticipated future flooding by overlaying the future conditions flood hazard areas developed for the Region. *Table 5* in *Appendix 2.5* shows the total number of buildings, critical facilities, and agriculture areas exposed to the future flood hazard areas, summarized at the county level. The most significant structural exposure in the Lower Brazos Planning Region is found in Bell, Brazoria, Fort Bend, McLennan, and Williamson counties. Within each of these counties, over 10,000 structures intersect the future conditions 1% ACE flood hazard extents.

Population Totals by County

Population data for the future conditions flood risk exposure analysis accounted for population growth and existing population data. The population associated with existing structures was not altered for the future exposure analysis. As discussed previously, the population of new structures was determined using population projections and population density. Populations exposed to the 1% ACE flood event are shown for the most impacted counties in *Table 2.12*.

Table 2.12: Counties with the Highest Population Exposure within the 1% ACE Flood Hazard Area

County	Existing Conditions Population	Future Conditions Population	Increase
Fort Bend	135,595	172,141	36,546
Williamson	119,758	164,902	45,144
McLennan	75,072	87,220	12,148
Brazoria	65,386	95,124	29,738
Bell	55,139	62,597	7,458

Populations exposed to flooding follow a similar pattern to structures, as the two metrics are highly correlated. Populations exposed to flooding are also highest in Bell, Brazoria, Fort Bend, McLennan, and Williamson counties. The potential future population includes both the existing population and projected population. However, as previously mentioned, the increase in population at risk of flooding from existing to future conditions can primarily be attributed to expansion of flood hazard areas, since the vast majority of population growth was classified as being subject to unknown flood risk due to most high-growth areas regulating development.

The Region is expected to grow by about 59% from 2030 to 2060 to approximately 5,700,000 people. Approximately 780,000 people are anticipated to be located within the future 1 percent ACE flood hazard area, and 1,060,000 within the future 0.2 percent ACE flood hazard area, or 14 percent, and 19 percent of the total population within the region, respectively. About 710,000 people are anticipated to be located in areas of unknown flood risk, which reflects new development in future flood hazard areas within jurisdictions regulating to higher standards.

Residential Properties

A total of 232,000 structures are exposed to flooding region-wide within the 1 percent ACE. The overwhelming majority of the structures exposed are residential, totaling 173,000. Similar to the population exposed to flooding, the counties with the largest number of residential structures exposed to future flood risk include Bell, Brazoria, Fort Bend, McLennan, and Williamson counties, which is shown relative to existing conditions in *Table 2.13*. The complete list of residential properties exposed by county is included in *Table 5* in *Appendix 2.5*. Potential future residential structures include existing and approximate future residential structures. However, the increase in structures at risk of flooding during the 1% ACE from existing to future conditions can primarily be attributed to expansion of flood hazard areas. As previously discussed, the vast majority of anticipated future structures intersecting flood hazard areas were classified as being subject to unknown flood risk due to most high-growth areas regulating development.

Table 2.13: Counties with the Highest Residential Structural Exposure within the 1% ACE

Flood hazard Area

County	Existing Conditions Structures	Future Conditions Structures	Increase
Fort Bend	46,359	58,275	11,916
Brazoria	27,441	38,332	10,891
Williamson	20,589	34,312	13,723
McLennan	12,370	15,004	2,634
Bell	10,050	12,599	2,549

Non-Residential Properties

Non-residential structure inventory data included agricultural, commercial, industrial, public, and vacant buildings. Buildings classified as vacant are structures for which the building type and/or use could not be determined. No additional non-residential structures were included in the analysis due to the uncertainty of where or how many structures may be constructed in the future. The exposure of existing, non-residential structures is anticipated to increase by 22 percent in future conditions during the 1% ACE. Of the structures exposed to the 1% ACE future flood hazard area, 75 percent are residential buildings, while the remaining 25 percent are non-residential.

Critical Facilities and Public Infrastructure

Critical facilities and public infrastructure were analyzed with the future flood hazard areas to determine the future flood risk exposure of these features. No additional features were added to the dataset compiled in the existing conditions flood exposure analysis previously described. The future condition scenario assumes that all new critical facilities are constructed outside of future flood hazard areas, and no exiting critical facilities are retrofitted to decrease the flood risk exposure. An additional 667 critical facilities were identified in the future condition flood exposure analysis, including all frequency events, that were not previously identified in existing conditions. *Table 2.14* summarizes the change in structural flood exposure for critical facilities in future conditions compared to existing conditions for the top five counties with the highest exposure metrics. Notably, Coryell County is included in this list over Brazoria County. A summary of all critical facilities in flood-prone areas in *Table 5* in *Appendix 2.5.*

Table 2.14: Counties with the Highest Critical Facilities Exposure within the 1% ACE Flood Hazard Area

County	Existing Conditions Critical Facilities	Future Conditions Critical Facilities	Increase
Bell	378	473	95
McLennan	289	375	86
Coryell	212	248	36
Brazoria	178	239	61
Fort Bend	171	248	77

Roadway Crossings and Roadway Segments

The future flood risk exposure analysis for roadways used only the existing roadway data available from TxDOT. Without considering additional future roads, the future flood risk exposure resulted in a 19 percent increase in miles of roadways inundated by the 1% ACE. Similar to the existing condition exposure analysis, bridge deck height was not considered in the future condition exposure analysis. Larger flood hazard areas resulted in a significant increase in inundated roadway miles. A summary of all roadway crossings and roadway segments in flood-prone areas is included in *Table 5* in *Appendix 2.5.*

Agricultural Area

The agricultural area in the Lower Brazos Planning Region was also evaluated to determine future flood exposure. The same land determined in the existing exposure analysis as agricultural was used in the future flood risk exposure analysis. Without altering the agricultural land dataset, the future flood risk exposure resulted in a 9 percent increase and 6 percent increase in agricultural land inundated by the 1% ACE and 0.2% ACE, respectively. The changes in inundation of agricultural land from existing to future conditions are lower than other exposure metrics, which is likely due to lands that flood more frequently being more suited to agricultural use than residential, commercial, or industrial use.

Potential Flood Mitigation Projects

The existing conditions flood hazard areas were developed using all data made available to the Lower Brazos LBRFPG. Of the proposed and ongoing projects identified in Task 1, no pre-project or post-project models were provided for inclusion in the existing and future conditions analyses. Therefore, the benefits of proposed and ongoing projects are not reflected in the future conditions flood hazard layer.

2.B.3 Future Condition Vulnerability Analysis

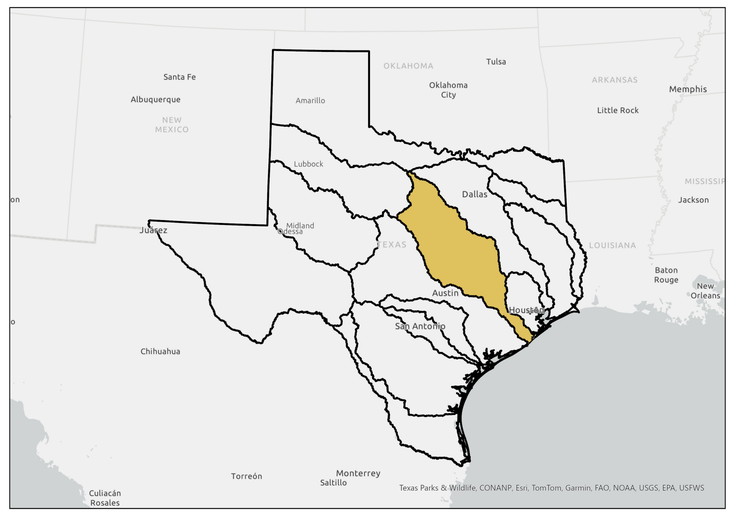
After identifying areas of future risk and the anticipated people and property exposed to that risk, the vulnerability of those affected people was studied. Vulnerability in future conditions

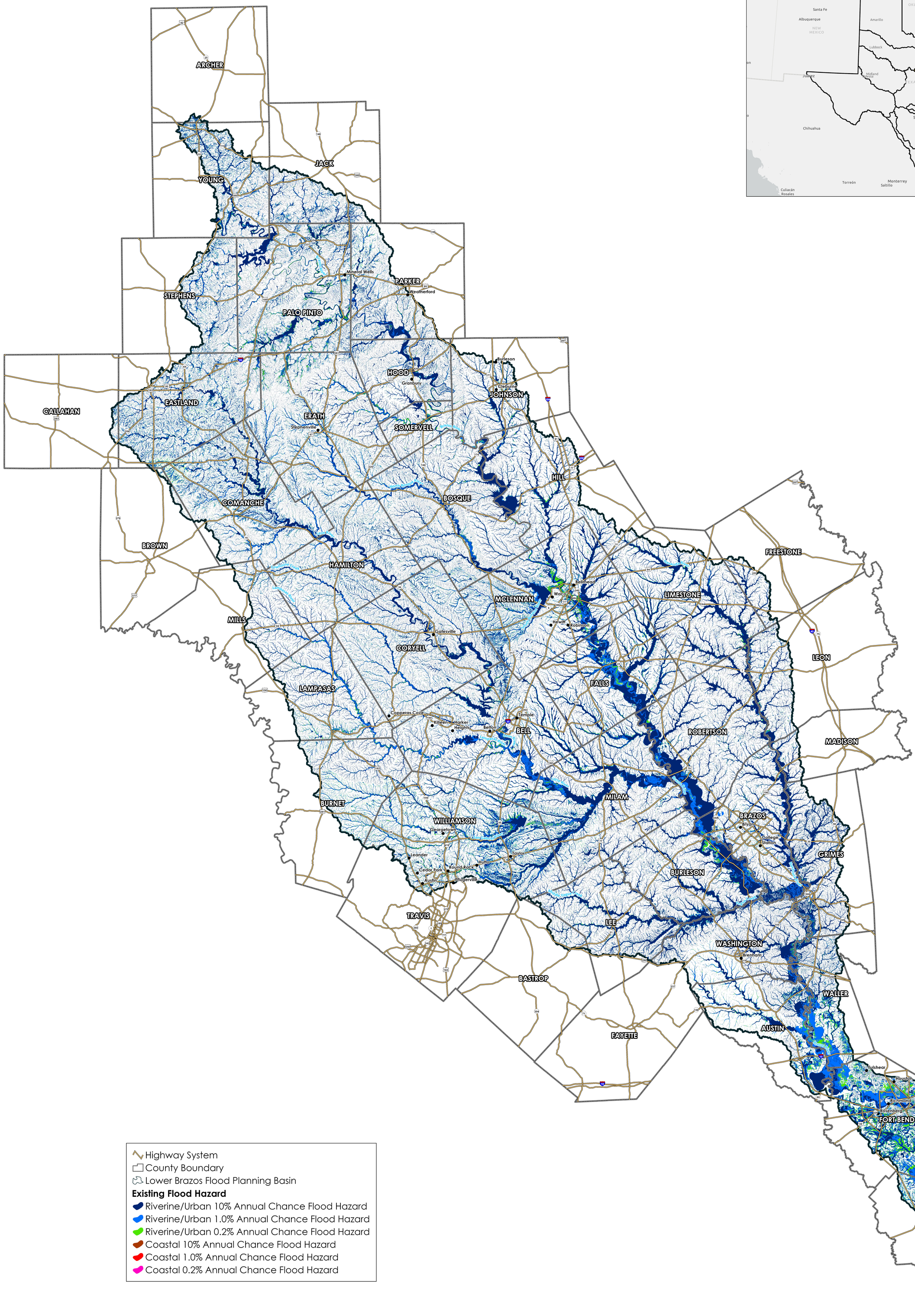
was assessed using the same methodology as the existing condition vulnerability analysis discussed in *Section 2.A.3*. All new residential structures developed to account for the projected population were assigned the existing TX F-SVI value of the census tract. The vulnerability analysis results are summarized by county in *Table 5* of *Appendix 2.5*. This information is also shown in *Map 12* of *Appendix 0*, which also includes the locations of critical facilities, buildings, and low water crossings identified in the future conditions flood exposure analysis in areas where TX F-SVI values exceed 0.75. Considering areas at risk of flooding in future conditions, Bell, Eastland, Jack, and Robertson counties have the highest county-wide average TX F-SVI values in the Region.

2.B.4 Summary of Future Conditions Flood Exposure Analysis and Vulnerability

The future flood exposure analysis anticipates that 20% more structures and 18% more people are potentially impacted by flooding in future conditions than in existing conditions during events up to and including the 0.2% ACE. The analysis predicts that Bell, Brazoria, Fort Bend, McLennan, and Williamson counties will be the highest exposure counties by structure count in the region by 2060. Considering counties where more than 10,000 structures are expected to be located within the 0.2% ACE flood hazard area, Williamson experiences the highest increase in exposure to structures from existing to future conditions, as structure counts increase by 43% if trends in flood risk and development continue. There is approximately a 6% increase in agricultural areas inundated by the 0.2% flood hazard area. Considering counties with above average impacted agricultural land values in the region, Brazoria and Williamson counties experience the highest increase in impacted agricultural land during the 0.2% ACE from existing to future conditions, with changes exceeding 10%. The future flood risk, exposure, and vulnerability analyses for the Lower Brazos Planning Region are summarized in *Table 5* of *Appendix 2.5*. The table provides the results per county of the future flood exposure and vulnerability analyses as outlined in the Technical Guidelines for Regional Flood Planning.

Appendix 0: Maps





- Highway System
- County Boundary
- Lower Brazos Flood Planning Basin

Existing Flood Hazard

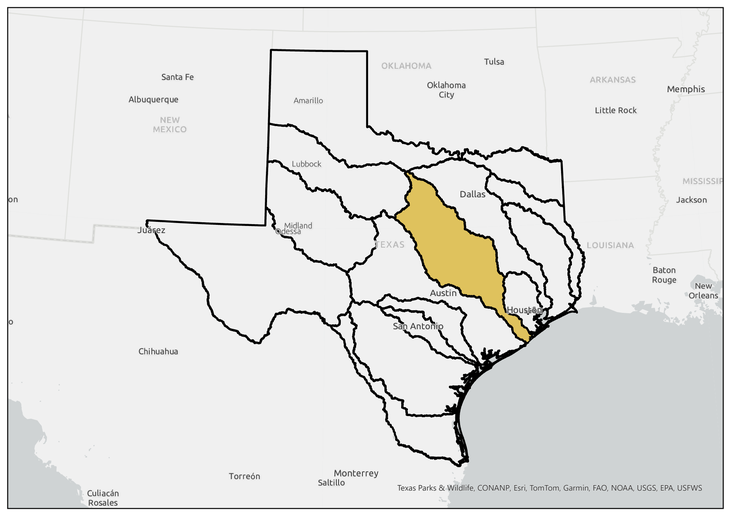
- Riverine/Urban 10% Annual Chance Flood Hazard
- Riverine/Urban 1.0% Annual Chance Flood Hazard
- Riverine/Urban 0.2% Annual Chance Flood Hazard
- Coastal 10% Annual Chance Flood Hazard
- Coastal 1.0% Annual Chance Flood Hazard
- Coastal 0.2% Annual Chance Flood Hazard

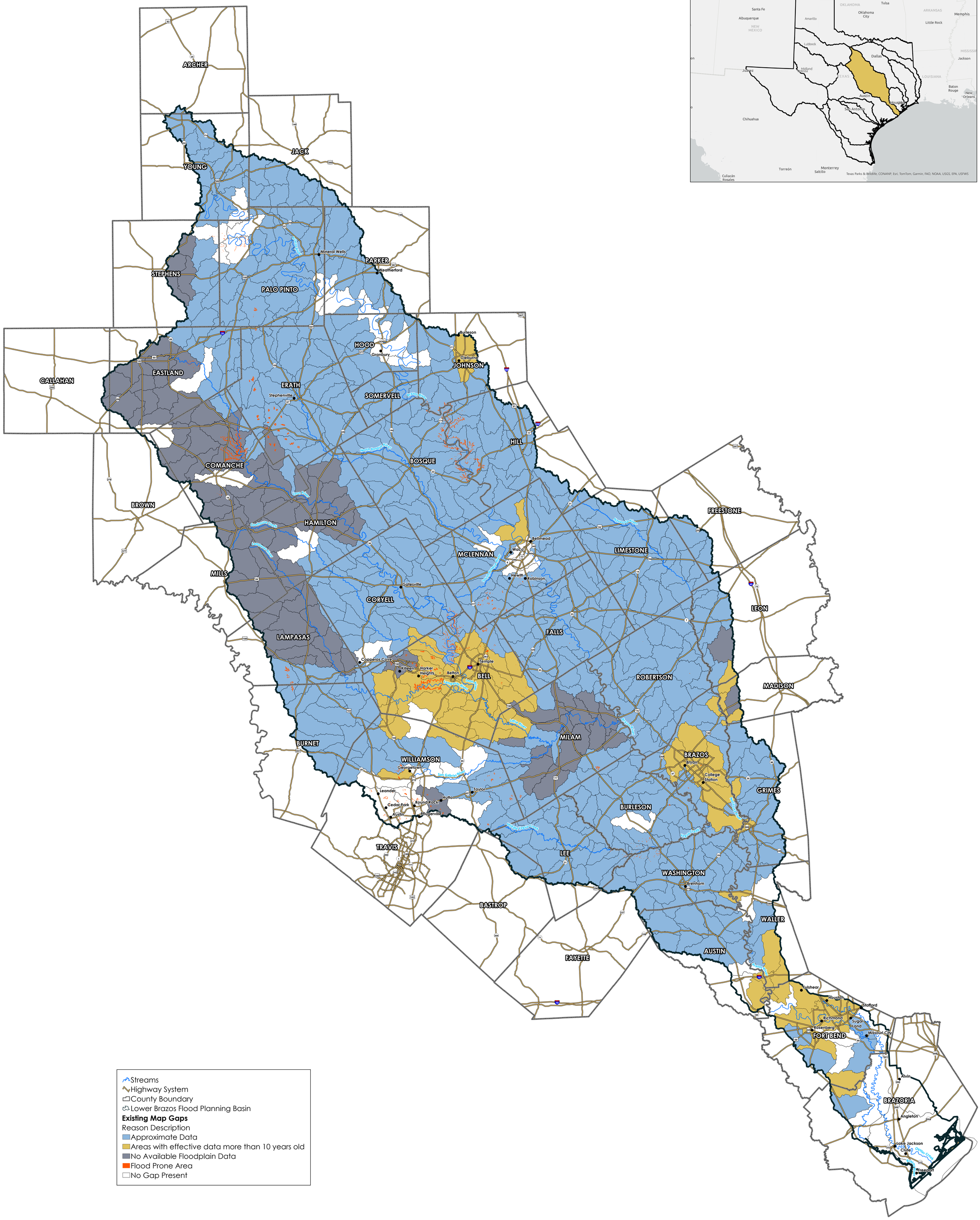
REGION 8 Lower Brazos Regional Flood Planning Group

MAP 4: Existing Condition Flood Hazard

0 5 10 15 20 Miles

November 14, 2025



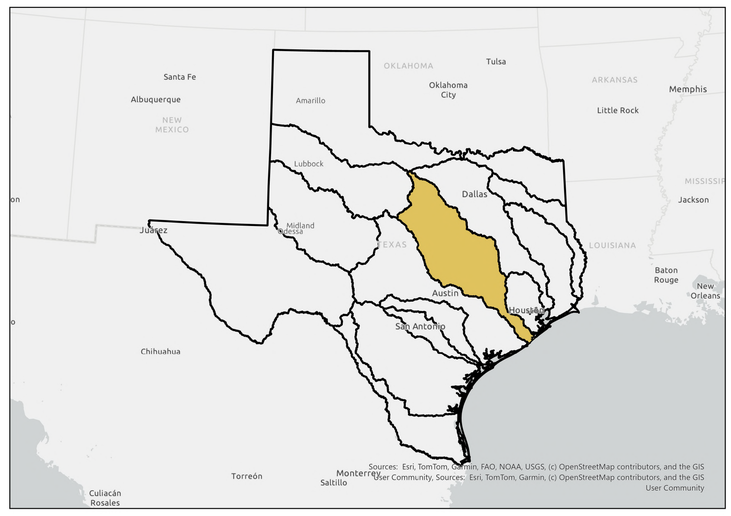


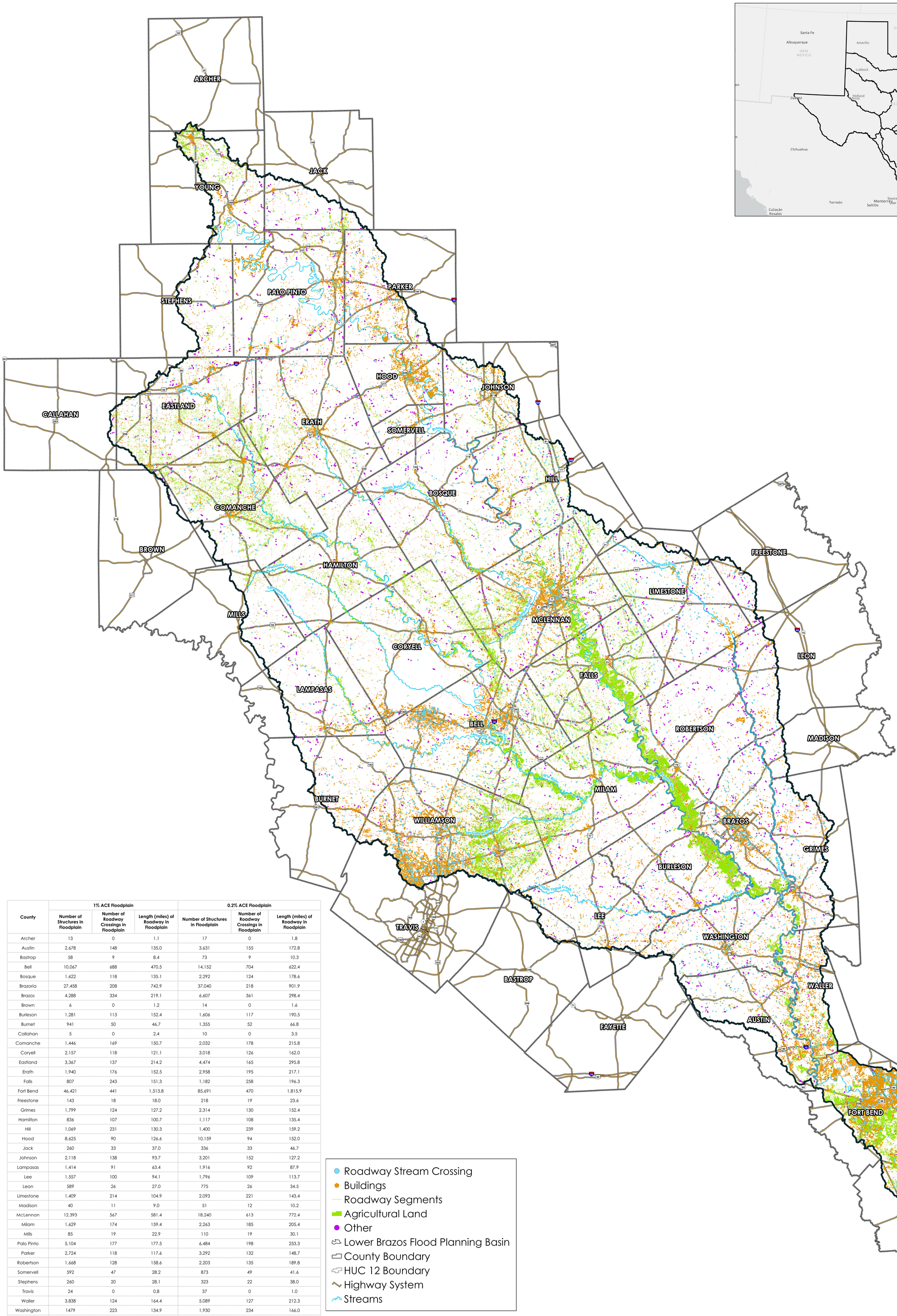
REGION 8 Lower Brazos Regional Flood Planning Group

MAP 5: Existing Map Gaps

0 5 10 15 20 Miles

December 1, 2025





County	1% ACE Floodplain			0.2% ACE Floodplain		
	Number of Structures in Floodplain	Number of Roadway Crossings in Floodplain	Length (miles) of Roadway in Floodplain	Number of Structures in Floodplain	Number of Roadway Crossings in Floodplain	Length (miles) of Roadway in Floodplain
Archer	13	0	1.1	17	0	1.8
Austin	2,678	148	135.0	3,631	155	172.8
Bastrop	58	9	8.4	73	9	10.3
Bell	10,067	688	470.5	14,152	704	622.4
Bosque	1,622	118	135.1	2,292	124	178.6
Brazoria	27,458	208	742.9	37,040	218	901.9
Brazos	4,288	334	219.1	6,607	361	298.4
Brown	6	0	1.2	14	0	1.6
Burleson	1,281	113	152.4	1,606	117	190.5
Burnet	941	50	46.7	1,355	52	66.8
Callahan	5	0	2.4	10	0	3.5
Comanche	1,446	169	150.7	2,032	178	215.8
Coryell	2,157	118	121.1	3,018	126	162.0
Eastland	3,367	137	214.2	4,474	165	295.8
Erath	1,940	176	152.5	2,958	195	217.1
Falls	807	243	151.3	1,182	258	196.3
Fort Bend	46,421	441	1,513.8	85,691	470	1,815.9
Freestone	143	18	18.0	218	19	23.6
Grimes	1,799	124	127.2	2,314	130	152.4
Hamilton	836	107	100.7	1,117	108	135.4
Hill	1,069	231	130.3	1,400	239	159.2
Hood	8,625	90	126.6	10,159	94	152.0
Jack	260	33	37.0	336	33	46.7
Johnson	2,118	138	93.7	3,201	152	127.2
Lampasas	1,414	91	63.4	1,916	92	87.9
Lee	1,557	100	94.1	1,796	109	113.7
Leon	589	26	27.0	775	26	34.5
Limestone	1,409	214	104.9	2,093	221	143.4
Madison	40	11	9.0	51	12	10.2
McLennan	12,393	567	581.4	18,240	613	772.4
Milam	1,629	174	159.4	2,263	185	205.4
Mills	85	19	22.9	110	19	30.1
Palo Pinto	5,104	177	177.5	6,484	198	253.3
Parker	2,724	118	117.6	3,292	132	148.7
Robertson	1,668	128	158.6	2,203	135	189.8
Somervell	592	47	28.2	873	49	41.6
Stephens	260	20	28.1	323	22	38.0
Travis	24	0	0.8	37	0	1.0
Waller	3,838	124	164.4	5,089	127	212.3
Washington	1479	223	134.9	1,930	234	166.0
Williamson	20,624	971	669.2	33,503	1,062	951.2
Young	2,456	47	107.3	3,265	50	135.7
Total	**177,290**	**6,750**	**7,500.7**	**269,140**	**7,193**	**9,683.5**

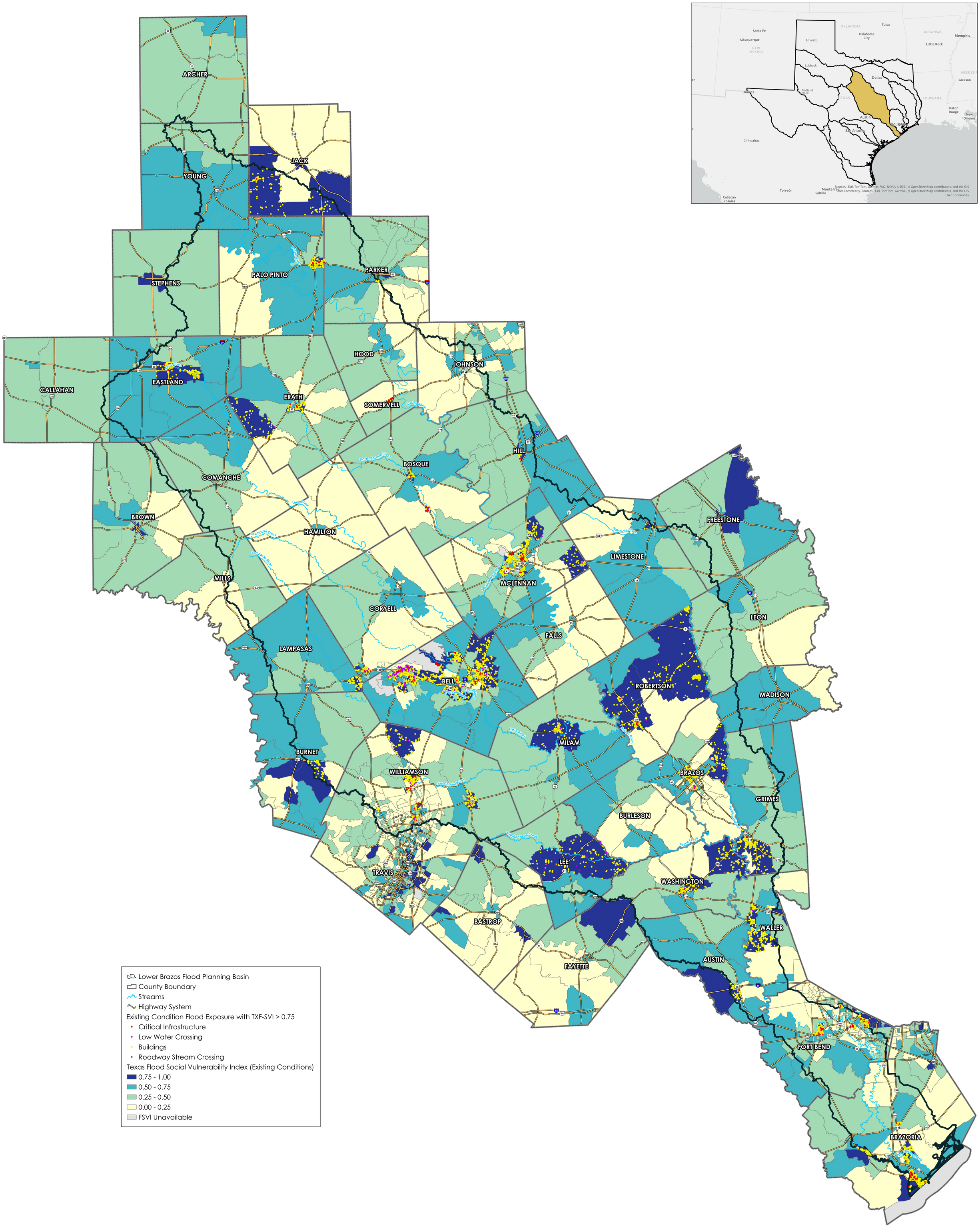
- Roadway Stream Crossing
- Buildings
- Roadway Segments
- Agricultural Land
- Other
- Lower Brazos Flood Planning Basin
- County Boundary
- HUC 12 Boundary
- Highway System
- Streams

REGION 8 Lower Brazos Regional Flood Planning Group

MAP 6: Existing Condition Flood Exposure

0 5 10 15 20 Miles

November 17, 2025

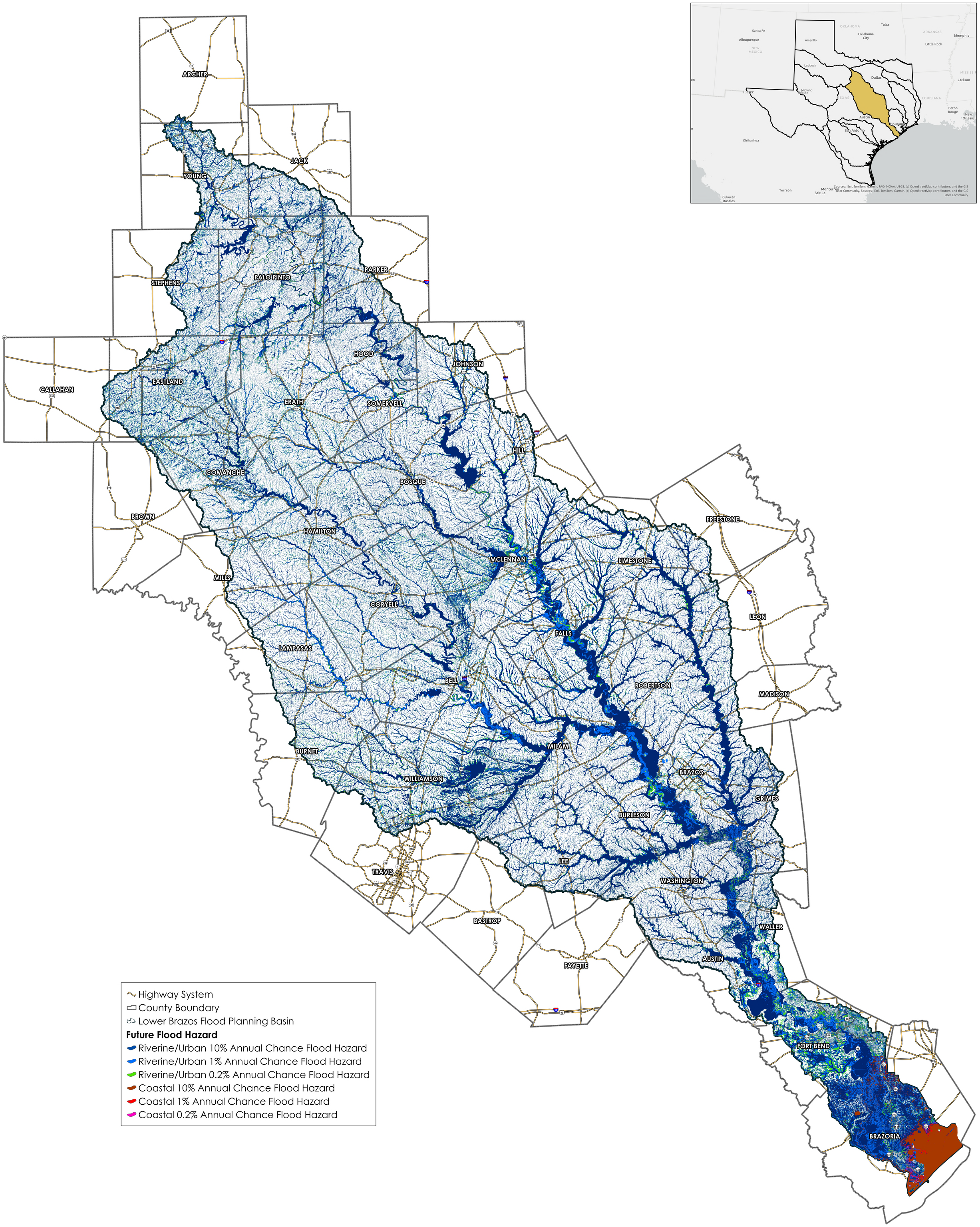


REGION 8 Lower Brazos Regional Flood Planning Group

MAP 7: Existing Condition Vulnerability Including Critical Infrastructure

0 5 10 15 20 Miles

November 17, 2025



- Highway System
- County Boundary
- Lower Brazos Flood Planning Basin

Future Flood Hazard

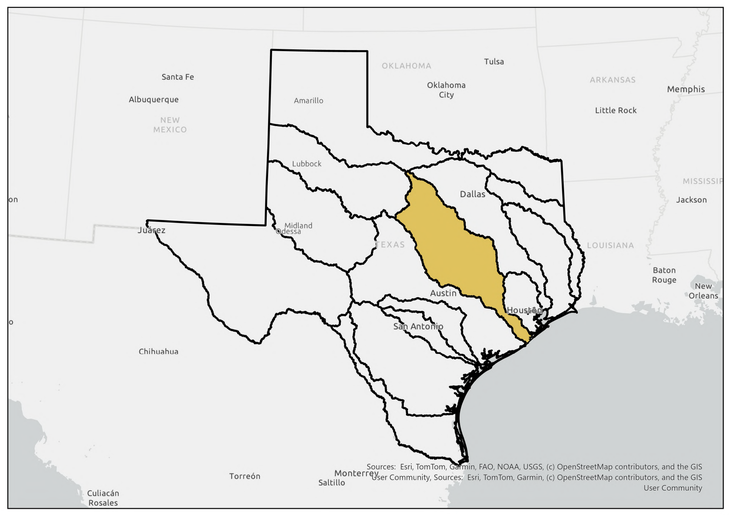
- Riverine/Urban 10% Annual Chance Flood Hazard
- Riverine/Urban 1% Annual Chance Flood Hazard
- Riverine/Urban 0.2% Annual Chance Flood Hazard
- Coastal 10% Annual Chance Flood Hazard
- Coastal 1% Annual Chance Flood Hazard
- Coastal 0.2% Annual Chance Flood Hazard

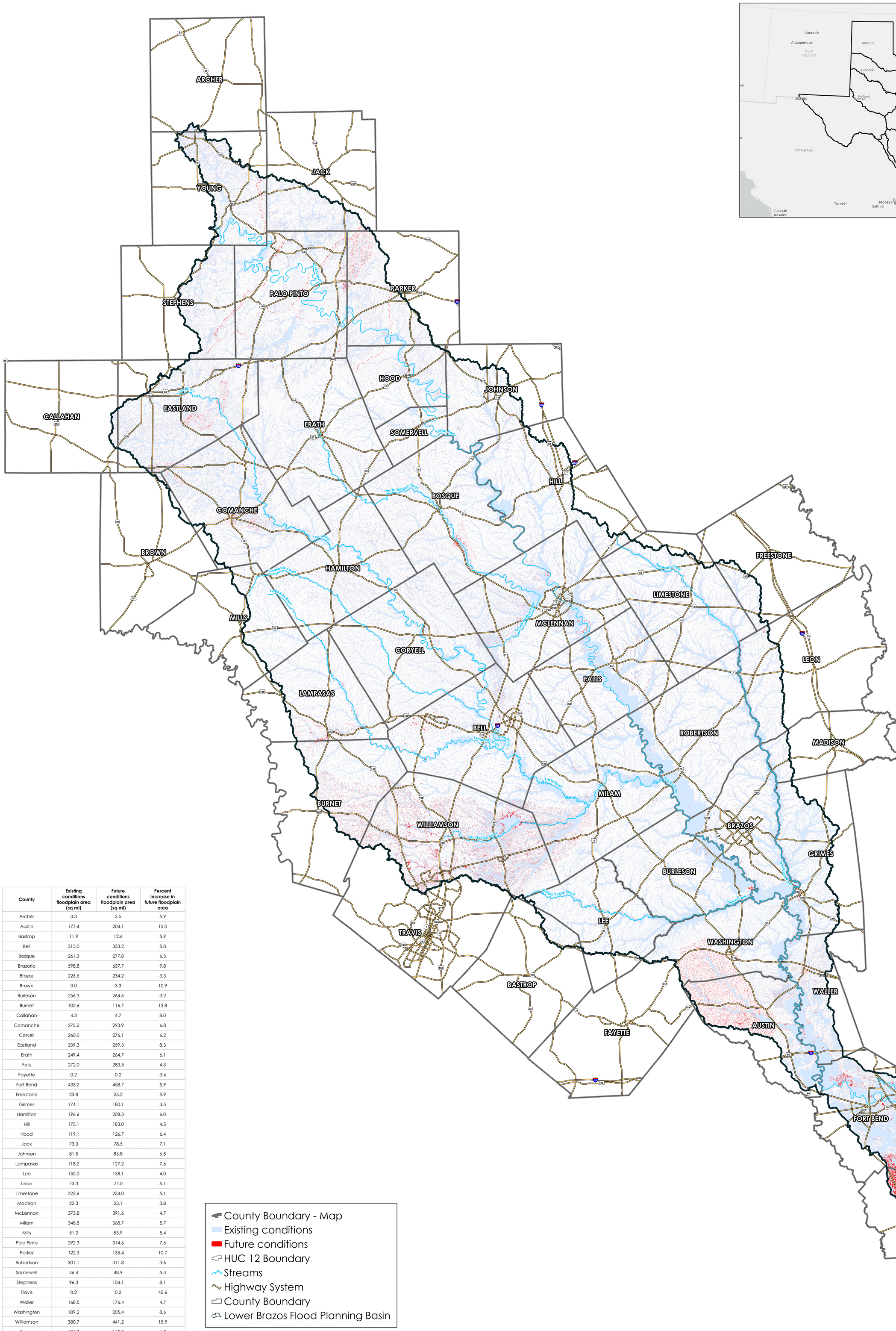
REGION 8 Lower Brazos Regional Flood Planning Group

MAP 8 : Future Condition Flood Hazard

0 5 10 15 20 Miles

December 4, 2025





County	Existing conditions floodplain area (sq mi)	Future conditions floodplain area (sq mi)	Percent increase in future floodplain area
Archer	3.3	3.5	5.9
Austin	177.4	204.1	15.0
Bastrop	11.9	12.6	5.9
Bell	315.0	333.2	5.8
Bosque	261.3	277.8	6.3
Brazoria	598.8	657.7	9.8
Brazos	226.6	234.2	3.3
Brown	3.0	3.3	10.9
Burleson	256.3	264.6	3.2
Burnet	102.6	116.7	13.8
Callahan	4.3	4.7	8.0
Comanche	275.2	293.9	6.8
Coryell	260.0	276.1	6.2
Eastland	239.3	259.3	8.3
Erath	249.4	264.7	6.1
Falls	272.0	283.5	4.3
Fayette	0.2	0.2	3.4
Fort Bend	433.2	458.7	5.9
Freestone	23.8	25.2	5.9
Grimes	174.1	180.1	3.5
Hamilton	196.6	208.3	6.0
Hill	175.1	183.0	4.5
Hood	119.1	126.7	6.4
Jack	73.3	78.5	7.1
Johnson	81.5	86.8	6.5
Lampasas	118.2	127.2	7.6
Lee	152.0	158.1	4.0
Leon	73.3	77.0	5.1
Limestone	222.6	234.0	5.1
Madison	22.3	23.1	3.8
McLennan	373.8	391.6	4.7
Milam	348.8	368.7	5.7
Mills	51.2	53.9	5.4
Palo Pinto	292.3	314.6	7.6
Parker	122.3	135.4	10.7
Robertson	301.1	311.8	3.6
Somervell	46.4	48.9	5.3
Stephens	96.3	104.1	8.1
Travis	0.2	0.2	45.6
Waller	168.5	176.4	4.7
Washington	189.2	205.4	8.6
Williamson	380.7	441.2	15.9
Young	136.7	145.9	6.7
Total	**7629.0**	**8154.6**	**6.9**

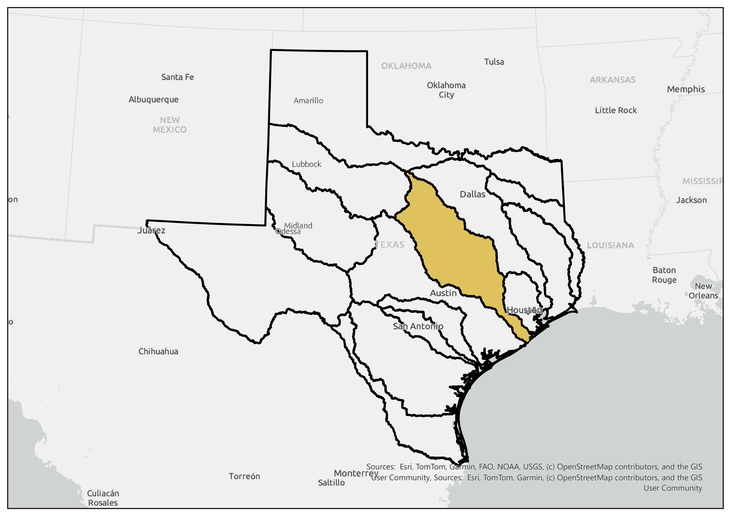
- County Boundary - Map
- Existing conditions
- Future conditions
- HUC 12 Boundary
- Streams
- Highway System
- County Boundary
- Lower Brazos Flood Planning Basin

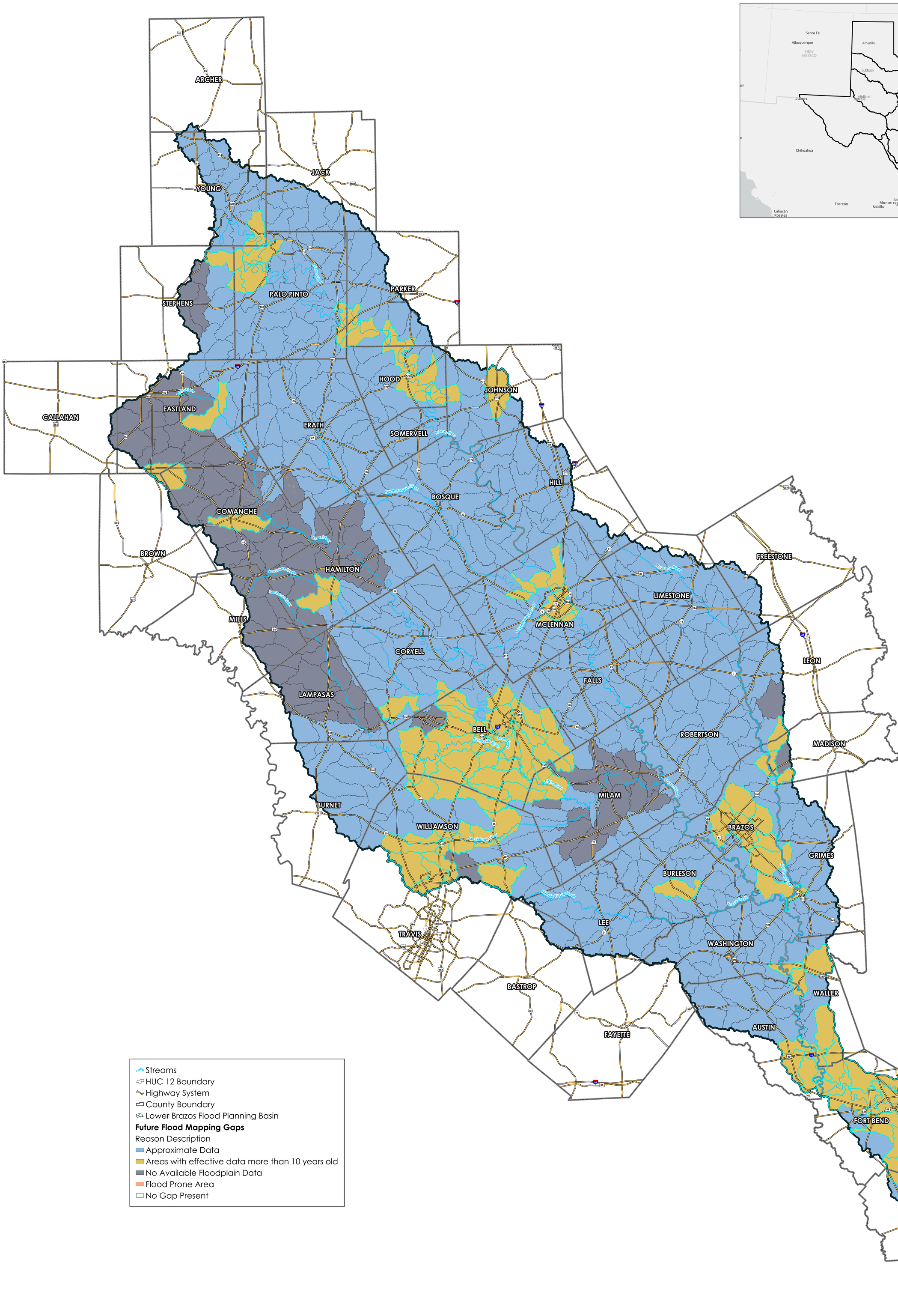
REGION 8 Lower Brazos Regional Flood Planning Group

MAP 9:Extent of Increase of Flood Hazard Compared to Existing Conditions

0 5 10 15 20 Miles

December 4, 2025





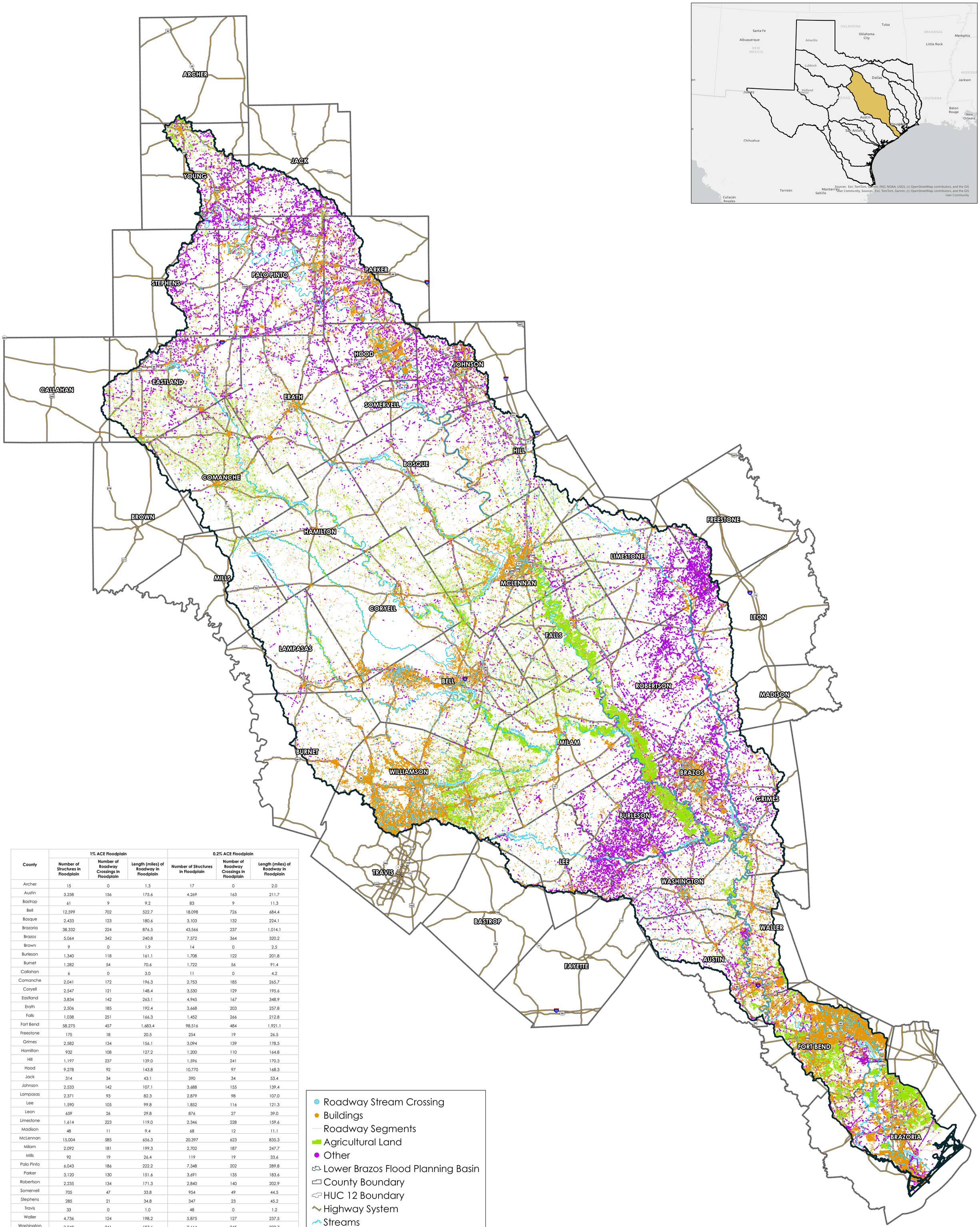
REGION 8 Lower Brazos Regional Flood Planning Group

MAP 10: Future Condition Flood Hazard Gaps in Inundation Boundary Mapping and Identify Known Flood Prone Areas

0 5 10 15 20 Miles

N

December 3, 2025



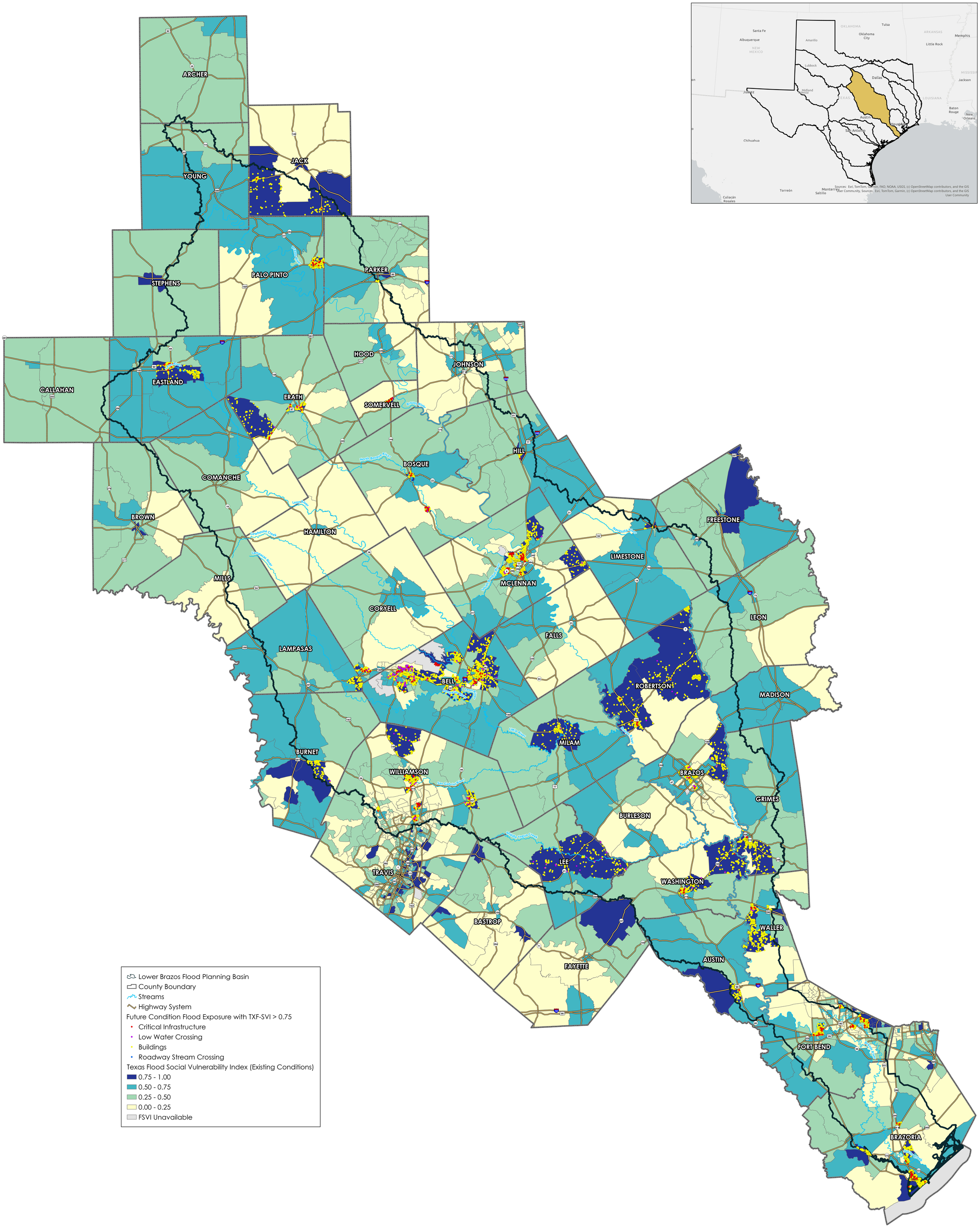
County	1% ACE Floodplain			0.2% ACE Floodplain		
	Number of Structures in Floodplain	Number of Roadway Crossings in Floodplain	Length (miles) of Roadway in Floodplain	Number of Structures in Floodplain	Number of Roadway Crossings in Floodplain	Length (miles) of Roadway in Floodplain
Archer	15	0	1.3	17	0	2.0
Austin	3,258	156	175.6	4,269	163	211.7
Bastrop	61	9	9.2	83	9	11.3
Bell	12,599	702	522.7	18,098	726	684.4
Bosque	2,433	123	180.6	3,103	132	224.1
Brazoria	38,332	224	876.5	43,566	237	1,014.1
Brazos	5,064	342	240.8	7,572	364	320.2
Brown	9	0	1.9	14	0	2.5
Burleson	1,340	118	161.1	1,708	122	201.8
Burnet	1,282	54	70.6	1,722	56	91.4
Callahan	6	0	3.0	11	0	4.2
Comanche	2,041	172	196.3	2,753	185	265.7
Coryell	2,547	121	148.4	3,530	129	195.6
Eastland	3,834	142	263.1	4,945	167	348.9
Erath	2,506	185	192.4	3,668	203	257.8
Falls	1,038	251	166.3	1,452	266	212.8
Fort Bend	58,275	457	1,683.4	98,516	484	1,921.1
Freestone	175	18	20.5	254	19	26.5
Grimes	2,582	134	156.1	3,094	139	178.5
Hamilton	932	108	127.2	1,200	110	164.8
Hill	1,197	237	139.0	1,596	241	170.3
Hood	9,278	92	143.8	10,770	97	168.3
Jack	314	34	43.1	390	34	53.4
Johnson	2,533	142	107.1	3,688	155	139.4
Lampasas	2,371	93	82.3	2,879	98	107.0
Lee	1,590	105	99.8	1,852	116	121.3
Leon	659	26	29.8	876	27	39.0
Limestone	1,614	223	119.0	2,346	228	159.6
Madison	48	11	9.4	68	12	11.1
McLennan	15,004	585	656.3	20,397	623	835.3
Milam	2,092	181	199.3	2,702	187	247.7
Mills	92	19	26.4	119	19	33.6
Palo Pinto	6,043	186	222.2	7,348	202	289.8
Parker	3,120	130	151.6	3,691	135	183.6
Robertson	2,235	134	171.3	2,840	140	202.9
Somervell	705	47	33.8	954	49	44.5
Stephens	285	21	34.8	347	23	45.2
Travis	33	0	1.0	48	0	1.2
Waller	4,736	124	198.2	5,875	127	237.5
Washington	2,248	241	187.6	2,664	245	223.7
Williamson	34,312	1,068	954.6	47,897	1,130	1,225.0
Young	2,795	47	122.0	3,552	50	151.5
Total	**231,633**	**7,062**	**8,929.5**	**322,474**	**7,449**	**11,030.5**

REGION 8 Lower Brazos Regional Flood Planning Group

MAP 11: Future Condition Flood Exposure

0 5 10 15 20 Miles

December 9, 2025



Lower Brazos Flood Planning Basin
County Boundary
Streams
Highway System
Future Condition Flood Exposure with TXF-SVI > 0.75
- Critical Infrastructure
- Low Water Crossing
- Buildings
- Roadway Stream Crossing

Texas Flood Social Vulnerability Index (Existing Conditions)
- 0.75 - 1.00
- 0.50 - 0.75
- 0.25 - 0.50
- 0.00 - 0.25
- FSVI Unavailable

REGION 8 Lower Brazos Regional Flood Planning Group

MAP 12: Future Condition Vulnerability Including Critical Infrastructure

0 5 10 15 20 Miles

December 9, 2025

Appendix 2.1: Task 2A Approach Memornadum

Region 8 – Task 2A Revised Approach Memorandum

To:	Bryan McMath, Executive Administrator Tressa Olson, Assistant Director, Flood Planning	**Date:**	11/21/2025
From:	Region 8 Technical Consultant Team	**AVO:**	54860
Email:	rLondeen@halff.com jBlohm@halff.com		
Subject:	Task 2A – Revised Approach Memorandum for Existing Conditions Flood Hazard Layer Prioritization		

PROPOSED APPROACH

On behalf of the Lower Brazos Regional Flood Planning Group (LBRFPG), the technical consultant team has summarized the methodology for determining the prioritization of available existing conditions datasets for the existing conditions flood hazard layer.

A proposed approach memorandum was supplied to the Texas Water Development Board (TWDB) on September 19, 2025, based on the prioritization developed by the LBRFPG at its regular meeting on September 18, 2025. The TWDB reviewed the proposed approach and provided feedback on October 17, 2025 that they could not accept the removal of the Detailed FEMA data (Zone AE & VE). The following revised approach memorandum details the RFPG's revised approach that utilizes Detailed FEMA data as the highest priority according to the TWDB's dictation.

The prioritization of available datasets is as follows:

1. Detailed FEMA Data (Zone AE and VE)
2. Community Models / Maps*
3. Pluvial Fathom for urban areas with populations greater than 5,000
4. Base Level Engineering (BLE) 2D
5. Maximum of BLE 1D and Fathom

*Community models and maps were assessed on a case-by-case basis and prioritized through comparison with other available datasets. The modeling and mapping products associated with the General Land Office River Basin Flood study are considered community models.

The revised prioritization varies from the recommended TWDB prioritization in two ways: the de-prioritization and removal of approximate FEMA data (Zone A) and the prioritization of Fathom over BLE data in select areas. Justification for the change in approach is provided below.

JUSTIFICATION OF APPROACH

Removal of Approximate FEMA Data (Zone A)

Since the Lower Brazos Flood Planning Region (Region) has complete BLE coverage, and BLE has a higher accuracy than FEMA approximate Zone A, all Zone A areas were removed from consideration.

Consideration of Detailed FEMA Data (Zone AE)

In the recommended TWDB prioritization, Detailed FEMA data (AE & VE) is ranked above BLE. Our review of the Region indicates that many FEMA mapping products are based on models that use old rainfall statistics, terrain data, and land use information, as well as older modeling technology. In comparison, all BLE 2D models within the Region were developed within the past five years and incorporate Atlas 14 rainfall statistics, along with updated land use and terrain datasets that reflect more recent changes and development projects.

The team did consider the fact that Detailed FEMA models for larger rivers are typically based on more accurate riverine hydrology over traditional hydrological methods. However, a comparison between the BLE 2D and Detailed FEMA extents for major rivers throughout the Region showed minimal differences in flood extents between the two datasets. Upon review of the BLE 2D reports, it was found that large rivers were calibrated to FEMA data which we believe contributed to the similarity between the datasets, as seen in **Figure 1**.

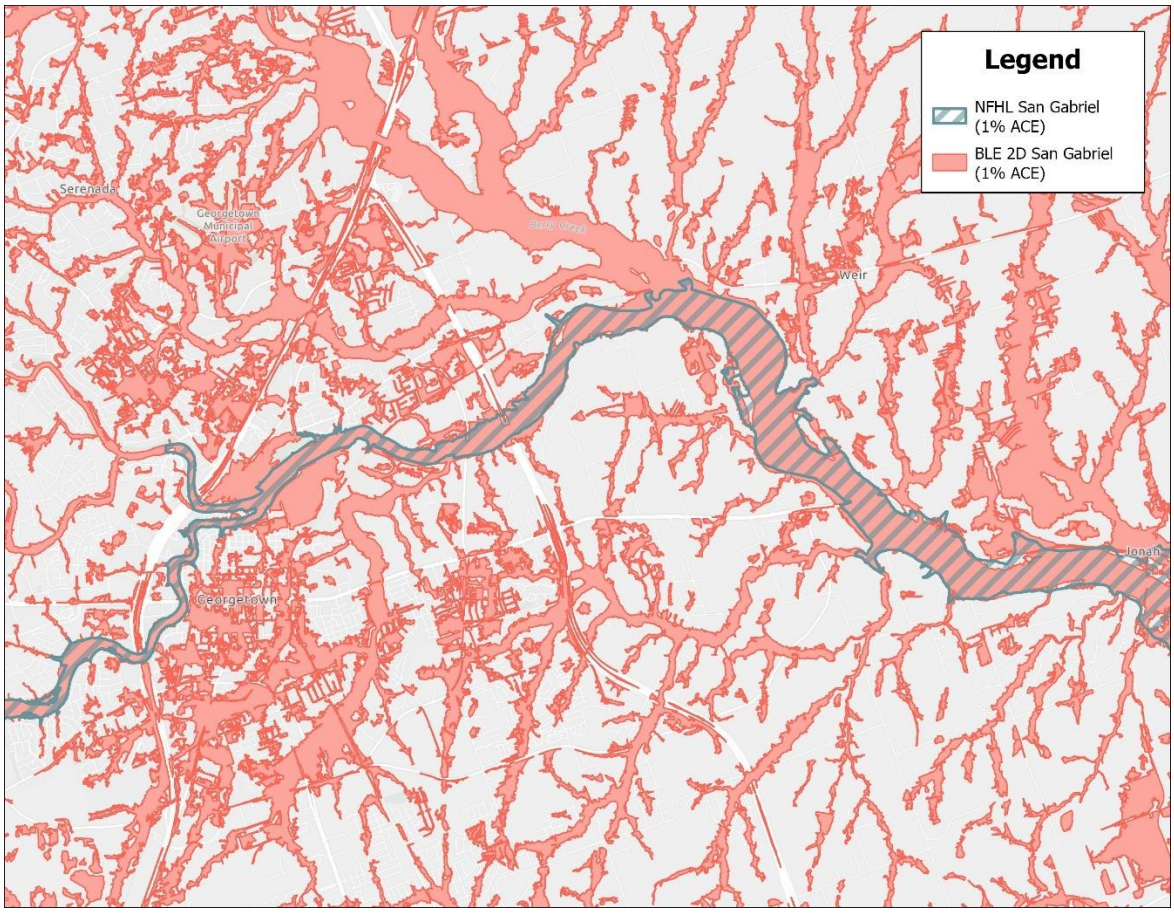


Figure 1: NFHL vs BLE 2D - San Gabriel River

Based on this review of the Detailed FEMA data, the LBRFPG voted to prioritize BLE over FEMA and effectively remove FEMA representation from the flood quilt. However, upon the TWDB's review of the proposed prioritization, they indicated this change would not be accepted. The TWDB stipulated that regulatory data extents must be shown throughout the flood quilt. To account for this, the revised approach includes Detailed FEMA data as the top prioritization, superseding all other datasets throughout the flood quilt extents.

BLE and Fathom

In the recommended TWDB prioritization, BLE is ranked higher than Fathom data in all circumstances. However, the LBRFPG has requested that Fathom be prioritized higher in two circumstances: in HUC-8s where BLE 1D is the only other available dataset, and for pluvial flooding in urban areas with a population greater than 5,000 people.

BLE 1D and Fathom

Initial work on the flood quilt processing indicated that weaving together BLE 1D fluvial data and Fathom pluvial data for all three storm events was not manageable. Attempting to tie the datasets together at each dataset intersection resulted in portions of the BLE 1D being removed at each tie-in location. Due to the high number of tie-ins, the removal of BLE 1D was extensive and resulted in the HUC-8s being almost entirely characterized by Fathom data instead of BLE.

Rather than setting coverage limits for each dataset, the revised approach uses either Fathom or BLE 1D—whichever is greater—for any area within the affected HUC-8s. This approach ensures that BLE 1D data is utilized in regions where it provides a more detailed and conservative estimate of riverine flood risk while also capturing pluvial flood risk provided by Fathom, especially in those locations where Fathom and BLE datasets intersect.

BLE 2D and Fathom in Urban Areas

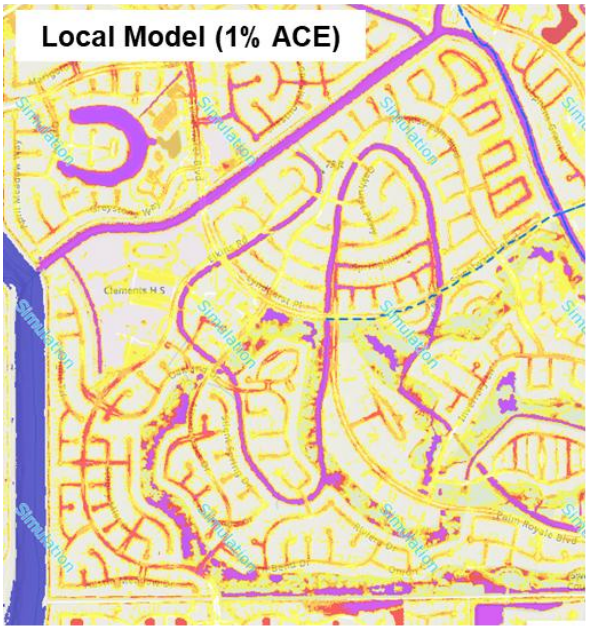
BLE 2D is also ranked higher than Fathom data in the recommended TWDB prioritization. A review of the characterization of pluvial flood risk in cities indicated that BLE 2D is likely overestimating flood depths in these areas. The technical team completed a detailed comparison of BLE 2D and Fathom data for cities throughout the region. In all locations, BLE 2D showed higher flood depths and wider inundation extents for pluvial flood risk that Fathom, as shown in **Figure 2**.

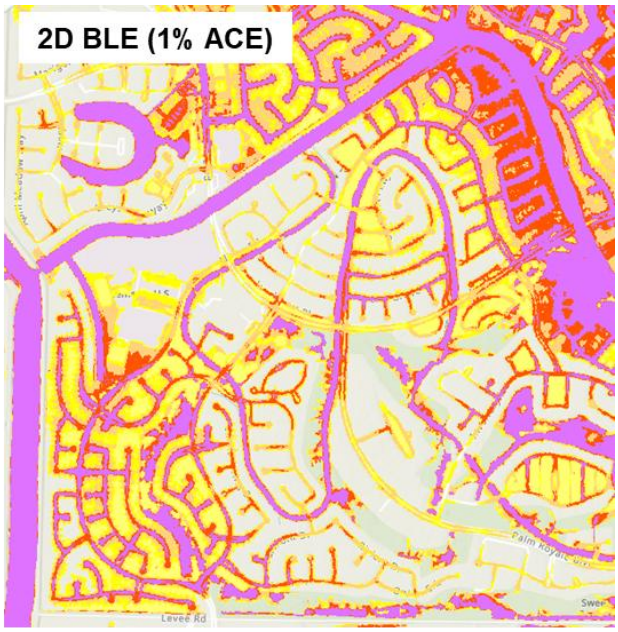
Figure 2: BLE 2D vs Fathom - City of Hutto

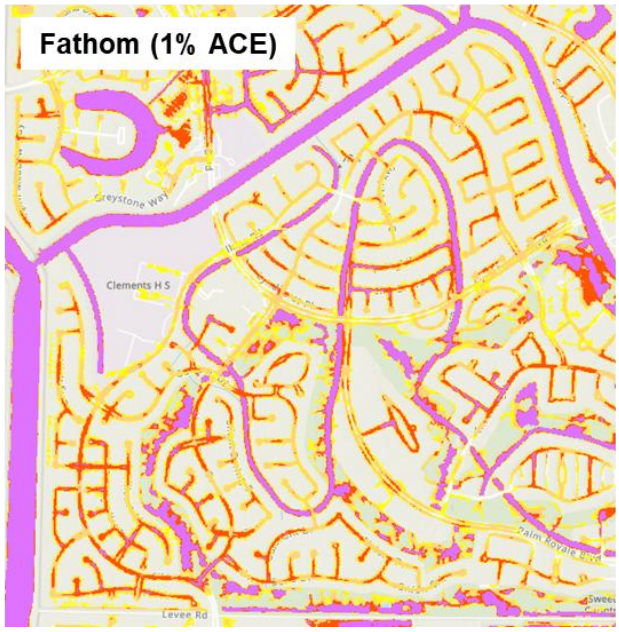
BLE 2D does not account for storm sewer systems which are typically sized for the 50% or 20% annual chance event (ACE). The rainfall associated with the 50% and 20% ACE accounts for 30-50% of the 1% ACE rainfall within the Lower Brazos region. The presence of urban drainage infrastructure means this portion of the 1% ACE rainfall is not contributing to flood risk in urban areas since it is effectively being conveyed underground. By not accounting for this, BLE 2D likely overestimates flooding extents.

In contrast, Fathom approximates the effect of urban drainage infrastructure by removing the 50% ACE rainfall hyetograph from the 10%, 1%, and 0.2% ACE applied rainfall. This provides a better representation of the ponding that would be seen within these urban areas during a storm event.

To support this conclusion, a comparison of Fathom, BLE 2D, and local modeling was completed where data was available. Particularly, the technical team made comparisons to publicly available 1% ACE inundation data for the City of Sugar Land that includes detailed modeling of storm sewer infrastructure, as shown in **Figure 3**. Fathom data was found to closely resemble the detailed modeling results within this location, while BLE 2D overestimated flood depths by over 2 feet in some locations.







DEPTH (ft)
- 0 – 1
- 1 – 2
- 2 – 3
- 3 +

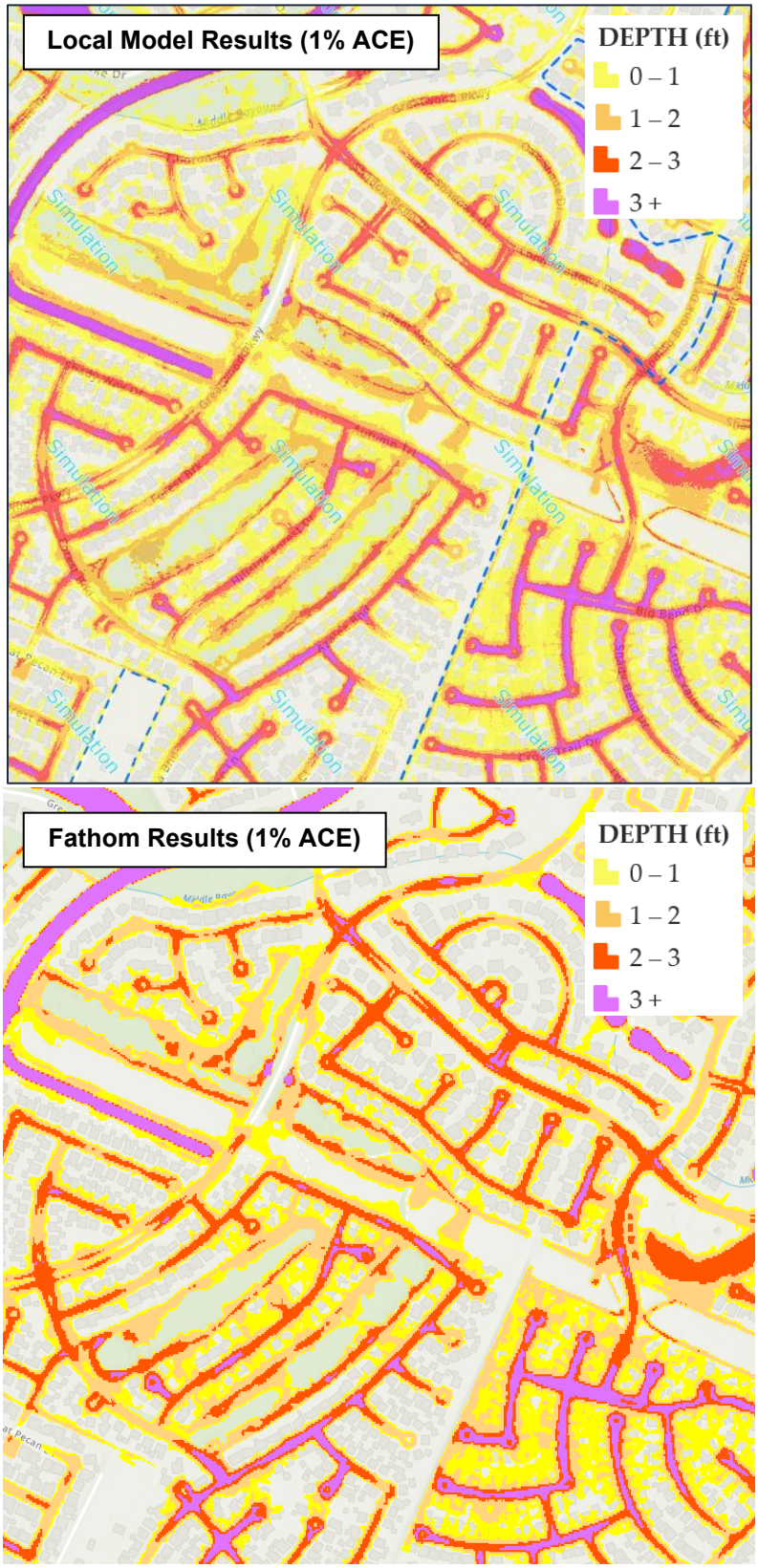


Figure 3: Comparison of Model Results in Sugar Land

Finally, portions of the Region do not have 2D BLE and pluvial Fathom is the only flood risk dataset available for some cities. Using pluvial Fathom for all urban areas ensures that flood risk in urban areas is quantified consistently across the region.

Pluvial Fathom will be applied in urban areas with populations over 5,000, while BLE 2D characterization will continue to assess pluvial and fluvial flood risks in rural areas. This update impacts about 30 cities in the Lower Brazos region. The 5,000-population threshold aligns with cities of approximately one square mile which is consistent with the threshold required for an FMX to be included in the plan.

CONCLUSION

The revised prioritization approach developed by the LBRFPG is the result of research and analyses completed by the technical consultant team, as well as revisions made upon the TWDB's review of the proposed approach. Although it may not offer the most accurate representation of flood risk, the group strived to use the available data in a way that most accurately reflects flood risk consistently across the region. The proposed approach ensures the Lower Brazos flood quilt provides a comprehensive and cohesive analysis of flood risk extents within the region.

Appendix 2.2: Table 3 – Summary of Proposed and Ongoing Flood Mitigation Projects

Table 3 - Summary of Proposed or Ongoing Flood Mitigation Projects

Existing Project ID	RFPG No.	RFPG Name	Project Name	Description	Cycle 1 FMP or FMS ID	County	Watersheds	Project Status	Project Cost	Dedicated Funding for Construction	Source of Funding	Expected Year of Completion	Anticipated Benefit
08-06-0000000001	8	Lower Brazos	B-FEWS Scalable Flood Early Warning System	Addition of flood sensors at 20 flood prone roadway locations across the City of Bryan.	N/A	Brazos	08-02-0000000648, 08-02-0000000649	Ongoing	$450,000	Yes	Flood Infrastructure Fund	2023	Increased public awareness of flood risk and current conditions.
08-06-0000000002	8	Lower Brazos	Pump Station Upgrade and Replacement	Improvements to Fort Bend LID #14 pump station to add electric gates, a flood warning system, and increase capacity.	N/A	Fort Bend	08-02-0000000650	Ongoing	$3,000,000	Yes	Flood Infrastructure Fund	2026	Increased pump capactiy and performane in flood events to protect residents.
08-06-0000000003	8	Lower Brazos	Barron's Branch Buyouts	Buyout of several flood-prone structures in the City of Waco.	N/A	McLennan	08-02-0000000653	Proposed	$3,130,880	Yes	Flood Infrastructure Fund	Unknown	Removal of flood-prone structures.
08-06-0000000004	8	Lower Brazos	Main Channel Widening along Sienna Point	Expansion of channel to increase flow capacity.	N/A	Fort Bend	08-02-0000000651	Ongoing	$4,500,000	Yes	Flood Infrastructure Fund	Unknown	Increased flow capactiy in flood events to better contain flood waters.
08-06-0000000005	8	Lower Brazos	Channel 1 Widening (Scanlan Road to Main Channel)	Expansion of channel to increase flow capacity in Sienna LID.	N/A	Fort Bend	08-02-0000000651	Ongoing	$2,300,000	Yes	Flood Infrastructure Fund	Unknown	Increased flow capactiy in flood events to better contain flood waters.
08-06-0000000006	8	Lower Brazos	Channel 4 Widening	Phase 5 of channel expansion to increase flow capacity in Sienna LID.	N/A	Fort Bend	08-02-0000000650, 08-02-0000000651	Ongoing	$3,055,500	Yes	Flood Infrastructure Fund	Unknown	Increased flow capactiy in flood events to better contain flood waters.
08-06-0000000007	8	Lower Brazos	ATALS 14 Southern Colony Culvert	Improvements to a culvert located in the Southern Colony Neighborhood to reflect updated hydrology.	N/A	Fort Bend	08-02-0000000651	Proposed	$1,400,000	Yes	Flood Infrastructure Fund	Unknown	Increased culvert capacity to lessen restriction along flow path and increase conveyance.
08-06-0000000008	8	Lower Brazos	ATLAS 14 Channel 3-4b Pipeline Culvert Replacement	Improvements to drainage infrastructure along two channels in the Sienna LID to reflect updated hydrology.	N/A	Fort Bend	08-02-0000000650	Proposed	$750,000	Yes	Flood Infrastructure Fund	Unknown	Increased storm infrastructure capacity to lessen restriction along flow path and increase conveyance.
08-06-0000000009	8	Lower Brazos	Brazos River Erosion Project	Limit the erosion of the portion of the Brazos that runs through Sienna LID.	N/A	Fort Bend	08-02-0000000650	Proposed	$15,000,000	Yes	Flood Infrastructure Fund	Unknown	Stabilization of Brazos River to ensure capacity is maintained.
08-06-0000000010	8	Lower Brazos	Expand Working Area & Improve Access to Pump Station	Improve working around Sienna LID South pump stations to ensure emergency access.	N/A	Fort Bend	08-02-0000000650, 08-02-0000000651	Proposed	$2,600,000	Yes	Flood Infrastructure Fund	Unknown	Increased accessibility to pump station during flood events to better operate.

Table 3 - Summary of Proposed or Ongoing Flood Mitigation Projects

Existing Project ID	RFPG No.	RFPG Name	Project Name	Description	Cycle 1 FMP or FMS ID	County	Watersheds	Project Status	Project Cost	Dedicated Funding for Construction	Source of Funding	Expected Year of Completion	Anticipated Benefit
08-06-0000000011	8	Lower Brazos	400,500 GPM Pump Station at Outfall No 2	Improvements to Sienna South pump station to increase capacity.	N/A	Fort Bend	08-02-0000000650	Proposed	$15,600,000	Yes	Flood Infrastructure Fund	Unknown	Increased pump capactiy and performane in flood events to protect residents.
08-06-0000000012	8	Lower Brazos	Structural Hardening of Brazos River Levee	Improvements to Brazos River Levee in Sienna LID to ensure it does not fail during flood events.	N/A	Fort Bend	08-02-0000000650, 08-02-0000000651	Proposed	$5,000,000	Yes	Flood Infrastructure Fund	Unknown	Improvements to levee to maintain service level.
08-06-0000000013	8	Lower Brazos	Channel 1 Detention Facility	Expansion of Sienna LID detention facility.	N/A	Fort Bend	08-02-0000000650, 08-02-0000000651	Proposed	$9,400,000	Yes	Flood Infrastructure Fund	Unknown	Expansion of detention to increase capacity and provide increased flood relief.
08-06-0000000014	8	Lower Brazos	FM 359 Regional Levee	Improvements to levee in Fort Bend County MUD #140 along FM 359.	N/A	Fort Bend	08-02-0000000650	Ongoing	$22,000,000	Yes	Flood Infrastructure Fund	Unknown	Improvements to levee to maintain service level.
08-06-0000000015	8	Lower Brazos	Flat Creek Automatic Gate System Project	Installation of automated gate system to warn public of flood events along Flat Creek in Hewitt.	N/A	McLennan	08-02-0000000653	Proposed	$231,700	Yes	Flood Infrastructure Fund	Unknown	Increased public awareness of flood risk and current conditions.
08-06-0000000016	8	Lower Brazos	Flood Diversion Canal	Creation of canal in Weston Lakes to divert flood waters to detention lakes.	N/A	Fort Bend	08-02-0000000650	Proposed	$900,000	Yes	Flood Infrastructure Fund	Unknown	Increased collection of water and diversion to detention lakes to lessen overland flow.
08-06-0000000017	8	Lower Brazos	Flat Bank Cutoff Structure	Installation of flood structure to prevent the backup of flood waters in Flat Bank Creek.	N/A	Fort Bend	08-02-0000000650	Proposed	$21,000,000	Yes	Flood Infrastructure Fund	Unknown	Increased storm infrastructure capacity to lessen restriction along flow path and increase conveyance.
08-06-0000000018	8	Lower Brazos	600 Acre-Foot Regional Detention Facility	Addition of a large detention facility to increase the flood storage in Sienna LID.	N/A	Fort Bend	08-02-0000000650, 08-02-0000000651	Proposed	$8,000,000	Yes	Flood Infrastructure Fund	Unknown	Creation of detention to increase capacity and provide increased flood relief.
08-06-0000000019	8	Lower Brazos	Woods Acreage Estates Pump Station	Additional pump station to serve South Sienna LID.	N/A	Fort Bend	08-02-0000000650, 08-02-0000000651	Proposed	$2,100,000	Yes	Flood Infrastructure Fund	Unknown	Increased pump capactiy and performane in flood events to protect residents.
08-06-0000000020	8	Lower Brazos	Covington W & Imperial Woods Drainage	Improvements to stormwater network throughout neighborhood.	N/A	Fort Bend	08-02-0000000651	Ongoing	$4,100,000	Yes	General Obligations Bond & Flood Infrastructure Fund	2025	Improvements to storm infrastructure to lessen flooding in neighborhood.

Table 3 - Summary of Proposed or Ongoing Flood Mitigation Projects

Existing Project ID	RFPG No.	RFPG Name	Project Name	Description	Cycle 1 FMP or FMS ID	County	Watersheds	Project Status	Project Cost	Dedicated Funding for Construction	Source of Funding	Expected Year of Completion	Anticipated Benefit
08-06-0000000021	8	Lower Brazos	Avalon/Brazos Landing/ Commonwealth Draiage Improvements Phase 1	Improvements to stormwater network and regrading of streets throughout neighborhood.	N/A	Fort Bend	08-02-0000000650	Proposed	$7,300,000	Yes	General Obligations Bond	2026	Improvements to storm infrastructure to lessen flooding in neighborhood.
08-06-0000000022	8	Lower Brazos	Austin Park and Chimneystone Drainage Improvements	Design and construction of a new channel from south of SH 6 to Acacia.	N/A	Fort Bend	08-02-0000000650, 08-02-0000000651	Ongoing	$16,500,000	Yes	General Obligations Bond & Flood Infrastructure Fund	2026	Creation of channel to collect flood waters and decrease overland flow.
08-06-0000000023	8	Lower Brazos	Angleton Warning System	Improvements to City-wide siren system to ensure critical facilities are within system range.	N/A	Brazoria	08-02-0000000651	Proposed	$13,000,000	Yes	Community Block Development Grant & Hazard Mitigation Grant Program	Unknown	Increased public awareness of flood risk and current conditions.
08-06-0000000024	8	Lower Brazos	Big Sandy Creek Lake Line Lowering	Increase capacity of the lake in Brenham to allow more flow from Big Sandy Creek.	N/A	Washington	08-02-0000000648, 08-02-0000000650	Proposed	$281,278	No	Flood Infrastructure Fund	Unknown	Expansion of detention to increase capacity and provide increased flood relief.
08-06-0000000025	8	Lower Brazos	Plummers Creek Tributary Storm Sewer Improvements	Replacement of piping and culverts throughout The City of Mexia where residential structures have been flooded.	N/A	Limestone	08-02-0000000649	Ongoing	$1,700,000	Yes	Flood Infrastructure Fund	2025	Reduce the local flood risk by increasing the capacity of a retention basin and stormwater system.
08-06-0000000026	8	Lower Brazos	Ditch One Regional Detention Drainage Improvements	Nature based improvements to the main channela and detention pond in the City of Cameron.	N/A	Milam	08-02-0000000656	Proposed	$1,260,000	Yes	Flood Infrastructure Fund	2024	Expansion of detention to increase capacity and provide increased flood relief.
08-06-0000000027	8	Lower Brazos	City of Taylor Drainage Mitigation Project	Several infrastructure improvements to reduce flooding throughout the City.	N/A	Williamson	08-02-0000000659	Ongoing	$5,898,040	Yes	Flood Infrastructure Fund	Unknown	Improvements to storm infrastructure to lessen flooding in City.
08-06-0000000028	8	Lower Brazos	Dam 101	Construction of new dam along Lake Creek	N/A	Travis, Williamson	08-02-0000000659	Ongoing	$30,000,000	Yes	Bonds/Other	2025	Provide flood relief along the lake and for 5 miles downstream.
08-06-0000000029	8	Lower Brazos	Briar & Burton Creek Slope Stabilization Project	Addition of concrete lining to the banks of Briar Creek	N/A	Brazos	08-02-0000000649	Proposed	$306,933	No	Capital Reserve Fund	2028	Stabilization of the banks of Briar and Burton Creek, preventing future flooding.

Table 3 - Summary of Proposed or Ongoing Flood Mitigation Projects

Existing Project ID	RFPG No.	RFPG Name	Project Name	Description	Cycle 1 FMP or FMS ID	County	Watersheds	Project Status	Project Cost	Dedicated Funding for Construction	Source of Funding	Expected Year of Completion	Anticipated Benefit
08-06-0000000030	8	Lower Brazos	Bristol St & Esther Blvd Drainage Improvements	Replacement of and additions to existing stormwater systems.	N/A	Brazos	08-02-0000000649	Proposed	$7,264,130	Yes	Drainage Fee	2026	Increase capture capacity of storm infrastucture and reduce flooding in neighborhood.
08-06-0000000031	8	Lower Brazos	Hillside Oaks & Old Oaks Drainage Improvements	Improvements to and addition of storm sewer systems and recontruction of local streets.	N/A	Brazos	08-02-0000000649	Ongoing	$3,285,790	Yes	Drainage Fee	2025	Improve surface drainage and decrease lot flooding throughout the neighborhood.
08-06-0000000032	8	Lower Brazos	Avalon/Brazos Landing/ Commonwealth Draiage Improvements Phase 1	Improvements to stormwater network and regrading of streets throughout neighborhood.	N/A	Fort Bend	08-02-0000000650	Proposed	$7,300,000	Yes	General Obligations Bond	2026	Improvements to storm infrastructure to lessen flooding in neighborhood.
08-06-0000000033	8	Lower Brazos	Avalon/Brazos Landing/ Commonwealth Drainage Improvement Phase I - Lake Control Structure Modifications	Improvements to weir and outfall structure of the neighborhood lake.	N/A	Fort Bend	08-02-0000000650	Ongoing	$1,100,000	Yes	General Obligations Bond	2025	Improve functionality of local lake detention.
08-06-0000000034	8	Lower Brazos	Chatham at McAllister Drainage Modifications	Enlargement of the main storm sewer line.	N/A	Fort Bend	08-02-0000000650, 08-02-0000000651	Proposed	$5,350,000	No	General Obligation Bond	2029	Prevent flooding in nearby neighborhoods by increasing the capacity and performance of the storm sewer.
08-06-0000000035	8	Lower Brazos	SH 6 at Brooks St Drainage Modifications	Enlargement of the main storm sewer line.	N/A	Fort Bend	08-02-0000000650, 08-02-0000000651	Proposed	$5,825,000	No	General Obligations Bond	2029	Reduce ponding depths and duration after rain events along the roadway.
08-06-0000000036	8	Lower Brazos	Sugar Lakes Inlet Replacement	Replacement storm water drainage inlets around the neighborhood.	N/A	Fort Bend	08-02-0000000651	Ongoing	$1,050,000	Yes	General Obligation Bond	2026	Reduce flooding within the neighborhood by increasing the capacity of the storm sewer.

Table 3 - Summary of Proposed or Ongoing Flood Mitigation Projects

Existing Project ID	RFPG No.	RFPG Name	Project Name	Description	Cycle 1 FMP or FMS ID	County	Watersheds	Project Status	Project Cost	Dedicated Funding for Construction	Source of Funding	Expected Year of Completion	Anticipated Benefit
08-06-0000000037	8	Lower Brazos	Oyster Creek Diversion Channel	Creation of a wet detention pond and diversion channel from Oyster Creek to Bullhead Bayou, additional drainage improvements to the bayou, and blockage for a ditch near the airport.	N/A	Fort Bend	08-02-0000000650, 08-02-0000000651	Ongoing	$27,500,000	Yes	Capital Obligation Bond	2027	Protect several local crucial facilities, like anairport and prison, from flooding and remove them from the 100-year floodplain.
08-06-0000000038	8	Lower Brazos	Austin Parkway West Drainage Modifications	Replacement of the drainage system from Ditch C-1.	N/A	Fort Bend	08-02-0000000650, 08-02-0000000651	Proposed	$8,175,000	Yes	General Obligation Bond	2028	Improve the capacity of the storm sewer system to reduce the duration and depth of ponding.
08-06-0000000039	8	Lower Brazos	Hillstone Drainage Modifications	Enlargement of the main storm sewer line.	N/A	Fort Bend	08-02-0000000650	Proposed	$8,000,000	Yes	General Obligation Bond	2027	Reduce flooding in the neighborhood by increasing the capacity of and movement of stormwater in drainage channels.
08-06-0000000040	8	Lower Brazos	Windmill Drainage Modifications	Enlargement of the main storm sewer line.	N/A	Fort Bend	08-02-0000000650, 08-02-0000000651	Proposed	$6,050,000	Yes	General Obligation Bond	Unknown	Reduce flooding in the neighborhood by increasing the capacity of and movement of stormwater in drainage channels.
08-06-0000000041	8	Lower Brazos	Public Safety Head Quarters Drainage Improvements	Expansion of the underground drainage pipes below the Public Safety Headquarters to reduce ponding and flooding.	N/A	Fort Bend	08-02-0000000651	Proposed	$500,000	Yes	General Obligations Bond	2026	Reducing ponding around the building, which can improve emergency response during major rain events.
08-06-0000000042	8	Lower Brazos	North East Oyster Creek (NEOC) Detention Improvements	Expansion of existing dentention facility.	N/A	Fort Bend	08-02-0000000651	Proposed	$3,000,000	Yes	General Obligations Bond	2026	Increase in detention capacity to lessen flooding.
08-06-0000000043	8	Lower Brazos	La Quinta Golf Course Drainage Improvements	Improvements to the stormwater systems along the La Quinta Golf Course.	N/A	Fort Bend	08-02-0000000651	Ongoing	$3,000,000	Yes	General Obligations Bond	2025	Reduce the flooding experienced by local residential areas during major rain events through improvements to the drainage system.

Table 3 - Summary of Proposed or Ongoing Flood Mitigation Projects

Existing Project ID	RFPG No.	RFPG Name	Project Name	Description	Cycle 1 FMP or FMS ID	County	Watersheds	Project Status	Project Cost	Dedicated Funding for Construction	Source of Funding	Expected Year of Completion	Anticipated Benefit
08-06-0000000044	8	Lower Brazos	Kitty Hollow Dam Rehabilitation	Restoration and rehabilitation to the earthen Kitty Hollow Dam.	N/A	Fort Bend	08-02-0000000650, 08-02-0000000651	Proposed	$2,000,000	Yes	Local	Unknown	Improvements to the dam help control stormwater and reduces flooding.
08-06-0000000045	8	Lower Brazos	Long Point Creek Drainage Improvements	Improvements to stormwater drainage along Long Point Creek.	N/A	Fort Bend	08-02-0000000651	Ongoing	$3,400,000	Yes	Local	2026	Reduce standing water and flooding issues caused by the creek.
08-06-0000000046	8	Lower Brazos	Channel Improvements and Flood Mitigation Projects	Improvements and additions to storm sewers, regional detention, slope paving, channels, and culvert crossings across Rosenberg	N/A	Fort Bend	08-02-0000000650	Proposed	$47,586,000	Yes	Community Development Block Grant	Unknown	Reduce floodplain area, flooding in roadways, and water surface elevations along flooding sources.
08-06-0000000047	8	Lower Brazos	Drainage Improvements at Milliff and Redmond	Creation of storm sewer inlets and other improvements to the storm sewer system.	N/A	Brazos	08-02-0000000649	Ongoing	$2,556,500	Yes	Drainage Utility Fund	2025	Reduce flooding in the neighborhood by increasing the capacity of the stormwater system.
08-06-0000000048	8	Lower Brazos	Round Rock West Area 3	Replacement of old stormwater systems and addition of new systems because of ongoing flooding issues.	N/A	Travis, Williamson	08-02-0000000659	Ongoing	$2,400,000	Yes	Local	2025	Prevent flooding caused by inadequate stormwater infrastructure.
08-06-0000000049	8	Lower Brazos	Round Rock West Area 5	Replacement of old stormwater systems and addition of new systems because of ongoing flooding issues.	N/A	Travis, Williamson	08-02-0000000659	Ongoing	$2,750,000	Yes	Local	2025	Prevent flooding caused by inadequate stormwater infrastructure.
08-06-0000000050	8	Lower Brazos	South Creek Channel Improvements	Improvements to fix channel erosion and meandering.	N/A	Williamson	08-02-0000000659	Ongoing	$350,000	Yes	Local	Unknown	Improvements to the channel prevent flooding to local structures and infrastructure that is threatened by the channel erosion.
08-06-0000000051	8	Lower Brazos	Meadows Area 2 & 4	Replacement of old stormwater systems and addition of new systems because of ongoing flooding issues.	N/A	Williamson	08-02-0000000659	Ongoing	$7,600,000	Yes	Local	Unknown	Prevent flooding caused by inadequate stormwater infrastructure.

Table 3 - Summary of Proposed or Ongoing Flood Mitigation Projects

Existing Project ID	RFPG No.	RFPG Name	Project Name	Description	Cycle 1 FMP or FMS ID	County	Watersheds	Project Status	Project Cost	Dedicated Funding for Construction	Source of Funding	Expected Year of Completion	Anticipated Benefit
08-06-0000000052	8	Lower Brazos	Bell District Floodplain Reclamation	Grading of floodplains so the land can be used for development.	N/A	Williamson	08-02-0000000659	Proposed	$400,000	Yes	Stormwater General Fund	Unknown	Reclaim floodplains for future development in the area can reduce flooding.
08-06-0000000053	8	Lower Brazos	Georgetown Curb and Gutter	Replacement and repaire of old curbs and gutters and addition of new ones where no curb or stormwater gutter exists	N/A	Williamson	08-02-0000000659	Ongoing	$4,800,000	Yes	Bond	2025	Improve drainage across the old town area of Georgetown by preventing sheet flow from overtopping curbs.
08-06-0000000054	8	Lower Brazos	Waco Airport Drainage Improvements	Widening and improvements to storm sewer system.	N/A	McLennan	08-02-0000000652, 08-02-0000000653, 08-02-0000000654	Proposed	$3,700,000	Yes	Local	Unknown	Improve drainage around the Waco Airport.
08-06-0000000055	8	Lower Brazos	Friars Creek Regional Detention Pond	Creation of a detention pond along Friars Creek.	N/A	Bell	08-02-0000000655, 08-02-0000000656, 08-02-0000000657	Proposed	$0	No	Unkown	Unknown	Creation of a dentention pond to alleviate flood and increase stormwater capacity.
08-06-0000000056	8	Lower Brazos	Iverness Rd Drainage Improvement	Improvements to preexisting stormwater drainage in the neighbhorhood.	N/A	Bell	08-02-0000000655	Proposed	$0	No	Unkown	Unknown	Improvements to the drainage system were made to account for 100 year storm events and to prevent flooding in the neighborhood.
08-06-0000000057	8	Lower Brazos	Village Way Drainage Improvement	Improvements to the drainage near the intersection.	N/A	Bell	08-02-0000000655, 08-02-0000000656	Ongoing	$0	No	Unkown	Unknown	Improvements to better drainage reduce flooding in the intersection.
08-06-0000000058	8	Lower Brazos	Westgate Addition	Removal of inudated structures and addition of culverts under nearby railroad tracks.	N/A	Bell	08-02-0000000655	Proposed	$0	No	Unkown	Unknown	Improvements the drainage system to prevent flooding in the nearby neighborhood in response to the 100 year floodplain.
08-06-0000000059	8	Lower Brazos	Stonetree Drive Drainage Improvements	Redirection of runoff to nearby pond through a pipe.	N/A	Bell	08-02-0000000655, 08-02-0000000657	Ongoing	$100,000	Yes	Local	Unknown	Prevent ponding along the roadway and fix the low spot in the golf club parking lot.
08-06-0000000060	8	Lower Brazos	Greenforest Circle Major CIP	Addition of storm drain and inlets along and near Greenforest Circle.	N/A	Bell	08-02-0000000655, 08-02-0000000657	Ongoing	$623,642	Yes	Drainage Bond	Unknown	Prevent flooding of roadways and nearby homes after storm events.

Table 3 - Summary of Proposed or Ongoing Flood Mitigation Projects

Existing Project ID	RFPG No.	RFPG Name	Project Name	Description	Cycle 1 FMP or FMS ID	County	Watersheds	Project Status	Project Cost	Dedicated Funding for Construction	Source of Funding	Expected Year of Completion	Anticipated Benefit
08-06-0000000061	8	Lower Brazos	Bermuda Ditch Wall Repair	Repair the concrete channel and retaining wall along Bermuda Ditch.	N/A	Bell	08-02-0000000655	Ongoing	$150,000	Yes	Local	Unknown	Prevent the collapse of the retaining wall and reinfornce the drainage ditch to protect nearby residents.
08-06-0000000062	8	Lower Brazos	Wolf Ditch Drainage Improvements	Addition of drainage infrastructure, including inlets and piping, along Wolf Ditch.	N/A	Bell	08-02-0000000655	Ongoing	$490,000	Yes	Local	Unknown	Prevent reoccuring flooding into roads and homes.

** Currently under construction, being implemented; and or with dedicated construction funding*

Appendix 2.3: Table 4 – Summary of Existing Conditions Flood Risk

Table 4 - Summary of Existing Conditions Flood Risk

General			10% Annual Chance Flood Risk							
Num	County	Area in Flood Planning Region (sqmi)	Area (sqmi)	Number of Structures[A]	Residential Structures	Population	Roadway Stream Crossings (#)	Roadways Segments (miles)	Agricultural Areas (sqmi)	Critical Facilities (#)
1	Archer	5.9	1.7	7	0	5	0	0.2	1.2	0
2	Austin	511.2	100.7	718	401	562	132	52.5	9.9	0
3	Bastrop	59.0	8.5	43	21	55	9	5.4	0.4	0
4	Bell	1,086.8	191.0	3,567	2,003	19,568	516	194.2	32.9	98
5	Bosque	1,002.4	175.6	906	475	1,842	103	78.6	12.9	17
6	Brazoria	668.6	250.9	6,280	4,432	17,769	167	240.9	19.4	35
7	Brazos	590.4	162.9	1,218	911	4,212	248	72.7	28.1	7
8	Brown	19.2	1.3	1	1	0	0	0.6	0.3	0
9	Burleson	677.8	191.5	730	414	1,076	100	82.8	43.3	3
10	Burnet	484.5	50.7	357	257	473	44	20.5	0.7	1
11	Callahan	16.3	2.0	1	0	0	0	1.0	0.4	0
12	Comanche	922.9	144.1	583	342	1,189	144	61.2	45.7	5
13	Coryell	1,056.7	159.5	877	557	9,440	102	61.1	24.2	94
14	Eastland	772.9	118.5	1,699	970	4,578	114	104.6	19.2	29
15	Erath	1,087.4	124.7	667	329	2,637	142	64.6	12.8	13
16	Falls	773.8	180.7	346	144	566	219	79.2	74.8	3
17	Fayette	1.0	0.1	0	0	0	0	0.0	0.0	0
18	Fort Bend	610.7	180.9	12,108	10,254	40,590	358	1,017.3	31.4	46
19	Freestone	103.7	17.6	56	23	39	14	10.3	0.1	0
20	Grimes	457.0	135.3	927	443	2,963	113	79.5	5.6	13
21	Hamilton	836.2	120.5	406	138	1,151	99	51.0	18.9	6
22	Hill	664.1	130.8	542	269	755	217	86.0	17.6	2
23	Hood	437.7	80.7	6,024	5,042	16,586	80	84.8	1.5	26
24	Jack	261.0	44.8	147	53	443	31	21.7	3.4	1
25	Johnson	373.3	53.5	753	484	1,294	114	43.0	3.7	8
26	Lampasas	561.7	65.7	594	302	2,387	83	34.5	2.8	5
27	Lee	531.8	116.8	1,167	681	2,561	92	70.0	4.4	5
28	Leon	270.0	55.6	354	0	251	20	16.9	0.2	0
29	Limestone	836.8	166.1	712	398	700	200	55.4	6.0	3
30	Madison	69.8	18.1	20	13	13	11	6.7	0.0	0
31	McLennan	1,060.9	223.9	4,552	2,841	31,990	457	285.9	55.1	138
32	Milam	1,021.5	242.7	760	379	770	153	85.8	73.8	5
33	Mills	289.8	33.1	55	17	98	17	13.5	2.3	1
34	Palo Pinto	985.5	181.9	2,983	1,688	3,776	150	90.8	7.4	21
35	Parker	430.8	76.8	1,710	876	3,767	104	64.1	2.0	7
36	Robertson	865.4	232.7	637	323	1,397	113	94.3	59.9	3
37	Somervell	191.6	30.3	230	111	1,471	42	13.6	0.3	3
38	Stephens	358.4	53.4	170	0	63	15	14.2	3.0	0
39	Travis	1.9	0.1	10	5	15	0	0.4	0.0	0
40	Waller	323.9	71.8	1,281	605	3,309	97	54.4	6.2	19
41	Washington	620.2	140.2	778	353	1,764	191	86.0	11.6	12
42	Williamson	1,133.1	191.6	8,038	6,395	56,702	749	306.9	58.5	69
43	Young	408.8	79.8	1,066	662	2,948	38	59.8	11.5	10
TOTAL		**23,442.4**	**4,608.9**	**64,080**	**43,612**	**241,775**	**5,598**	**3,866.9**	**713.6**	**708**

[A] *Structures include Residential Bldg, Commercial Bldg, Agricultural Bldg, Industrial Bldg, Public Bldg, and Vacant or Unknown Bldg*

Table 4 - Summary of Existing Conditions Flood Risk

General			1% Annual Chance Flood Risk							
Num	County	Area in Flood Planning Region (sqmi)	Area in Floodplain (sqmi)	Number of Structures[A]	Residential Structures	Population	Roadway Stream Crossings (#)	Roadways Segments (miles)	Agricultural Areas (sqmi)	Critical Facilities (#)
1	Archer	5.9	1.1	6	0	17	0	0.8	0.9	0
2	Austin	511.2	54.5	1,959	1,209	2,750	16	82.5	7.1	7
3	Bastrop	59.0	1.9	15	8	12	0	3.1	0.2	0
4	Bell	1,086.8	81.9	6,483	4,211	35,571	172	276.3	23.9	280
5	Bosque	1,002.4	54.9	703	345	1,522	15	56.5	6.5	6
6	Brazoria	668.6	286.1	21,161	16,342	47,617	41	502.0	62.9	143
7	Brazos	590.4	47.8	3,064	2,338	21,904	89	146.4	9.8	50
8	Brown	19.2	0.8	5	3	2	0	0.6	0.2	0
9	Burleson	677.8	44.1	550	302	843	13	69.6	15.2	5
10	Burnet	484.5	31.7	583	399	803	6	26.3	1.3	2
11	Callahan	16.3	1.5	4	0	2	0	1.4	0.3	0
12	Comanche	922.9	83.7	863	523	951	25	89.5	29.6	6
13	Coryell	1,056.7	64.3	1,276	863	7,656	16	60.0	10.5	118
14	Eastland	772.9	76.5	1,656	1,022	2,678	23	109.6	15.0	19
15	Erath	1,087.4	78.5	1,260	758	4,014	34	87.9	11.5	21
16	Falls	773.8	64.2	461	234	606	24	72.2	39.5	8
17	Fayette	1.0	0.0	0	0	0	0	0.0	0.0	0
18	Fort Bend	610.7	170.5	34,251	30,139	95,005	83	496.5	45.8	125
19	Freestone	103.7	3.8	87	35	66	4	7.7	0.0	0
20	Grimes	457.0	24.6	871	518	2,154	11	47.7	1.3	7
21	Hamilton	836.2	49.0	424	245	813	8	49.7	9.5	6
22	Hill	664.1	26.9	527	300	1,104	14	44.2	7.4	7
23	Hood	437.7	24.7	2,594	2,058	5,515	17	41.8	1.2	10
24	Jack	261.0	19.1	112	45	117	2	15.3	1.7	0
25	Johnson	373.3	17.1	1,361	1,007	6,630	24	50.8	2.2	10
26	Lampasas	561.7	34.9	820	411	1,828	8	28.9	6.3	5
27	Lee	531.8	21.2	386	212	502	8	24.2	1.0	4
28	Leon	270.0	10.8	232	0	210	6	10.1	0.1	3
29	Limestone	836.8	33.8	696	421	1,442	14	49.5	2.7	3
30	Madison	69.8	2.7	20	17	11	0	2.3	0.0	0
31	McLennan	1,060.9	93.5	7,818	5,579	43,082	110	295.6	32.6	151
32	Milam	1,021.5	73.5	867	585	1,327	21	73.6	30.2	5
33	Mills	289.8	11.7	30	10	9	2	9.4	2.3	0
34	Palo Pinto	985.5	63.4	2,113	1,138	4,385	27	86.7	3.2	19
35	Parker	430.8	29.1	1,012	389	1,486	14	53.5	1.0	8
36	Robertson	865.4	49.4	1,023	605	2,083	15	64.3	14.9	6
37	Somervell	191.6	8.5	360	193	1,239	5	14.6	0.3	11
38	Stephens	358.4	27.8	90	0	44	5	13.9	2.1	0
39	Travis	1.9	0.0	14	9	92	0	0.4	0.0	1
40	Waller	323.9	71.5	2,555	1,343	3,980	27	110.0	10.9	12
41	Washington	620.2	32.1	701	339	2,036	32	48.8	2.4	9
42	Williamson	1,133.1	116.8	12,551	10,223	63,056	222	362.3	48.3	82
43	Young	408.8	36.4	1,381	953	3,466	9	47.5	8.8	9
TOTAL		**23,442.4**	**2,026.1**	**112,945**	**85,331**	**368,630**	**1,162**	**3,633.8**	**470.5**	**1,158**

[A] *Structures include Residential Bldg, Commercial Bldg, Agricultural Bldg, Industrial Bldg, Public Bldg, and Vacant or Unknown Bldg*

Table 4 - Summary of Existing Conditions Flood Risk

General			0.2% Annual Chance Flood Risk							
Num	County	Area in Flood Planning Region (sqmi)	Area (sqmi)	Number of Structures[A]	Residential Structures	Population	Roadway Stream Crossings (#)	Roadways Segments (miles)	Agricultural Areas (sqmi)	Critical Facilities (#)
1	Archer	5.9	0.6	4	0	0	0	0.7	0.4	0
2	Austin	511.2	22.2	953	616	1,687	7	37.8	2.8	3
3	Bastrop	59.0	1.5	15	10	10	0	1.8	0.1	0
4	Bell	1,086.8	39.3	4,077	2,768	14,991	16	151.9	10.9	176
5	Bosque	1,002.4	30.5	670	396	1,152	6	43.5	2.9	4
6	Brazoria	668.6	61.8	9,573	7,694	23,738	10	159.0	15.5	45
7	Brazos	590.4	16.0	2,314	1,852	20,088	27	79.3	1.3	27
8	Brown	19.2	0.9	8	3	5	0	0.4	0.2	0
9	Burleson	677.8	20.6	325	175	351	4	38.1	4.8	0
10	Burnet	484.5	20.1	414	274	615	2	20.1	0.5	2
11	Callahan	16.3	0.8	5	0	3	0	1.1	0.2	0
12	Comanche	922.9	45.8	586	358	956	9	65.1	15.2	5
13	Coryell	1,056.7	36.1	860	622	3,713	8	40.9	5.8	56
14	Eastland	772.9	44.3	1,104	658	1,371	28	81.6	8.8	15
15	Erath	1,087.4	44.9	1,018	629	3,800	19	64.6	6.2	13
16	Falls	773.8	27.1	372	187	1,921	15	45.0	14.6	24
17	Fayette	1.0	0.0	0	0	0	0	0.0	0.0	0
18	Fort Bend	610.7	81.8	39,257	36,604	111,290	29	302.0	27.2	181
19	Freestone	103.7	2.4	75	37	134	1	5.6	0.0	1
20	Grimes	457.0	14.2	515	292	623	6	25.1	0.6	0
21	Hamilton	836.2	27.1	281	151	383	1	34.7	5.0	0
22	Hill	664.1	16.8	331	209	415	8	28.9	5.0	5
23	Hood	437.7	13.7	1,532	1,252	3,048	4	25.4	0.6	6
24	Jack	261.0	9.5	76	17	70	0	9.8	0.8	0
25	Johnson	373.3	10.9	1,080	814	5,181	14	33.5	1.5	7
26	Lampasas	561.7	17.4	500	214	842	1	24.5	1.7	4
27	Lee	531.8	14.0	239	131	257	9	19.6	0.6	0
28	Leon	270.0	6.9	186	0	143	0	7.5	0.1	1
29	Limestone	836.8	22.7	684	482	573	7	38.4	2.1	3
30	Madison	69.8	1.5	11	6	5	1	1.3	0.0	0
31	McLennan	1,060.9	54.3	5,833	4,289	24,194	46	191.0	19.4	92
32	Milam	1,021.5	32.6	634	425	928	11	46.0	10.1	2
33	Mills	289.8	6.4	25	9	6	0	7.2	1.3	0
34	Palo Pinto	985.5	46.9	1,380	765	1,641	21	75.8	2.3	1
35	Parker	430.8	16.4	568	213	815	14	31.1	0.5	2
36	Robertson	865.4	19.0	535	328	767	7	31.2	1.0	3
37	Somervell	191.6	7.6	280	152	664	2	13.4	0.4	5
38	Stephens	358.4	15.1	63	0	28	2	9.9	1.1	0
39	Travis	1.9	0.1	13	5	888	0	0.2	0.0	0
40	Waller	323.9	25.2	1,251	711	2,079	3	47.9	4.0	8
41	Washington	620.2	16.9	451	231	1,108	11	31.2	0.8	4
42	Williamson	1,133.1	71.9	12,856	10,832	50,305	91	282.0	25.4	54
43	Young	408.8	20.6	809	522	1,460	3	28.5	5.3	8
TOTAL		**23,442.4**	**984.2**	**91,763**	**74,933**	**282,248**	**443**	**2,182.8**	**207.1**	**757**

[A] *Structures include Residential Bldg, Commercial Bldg, Agricultural Bldg, Industrial Bldg, Public Bldg, and Vacant or Unknown Bldg*

Table 4 - Summary of Existing Conditions Flood Risk

General			Possible Flood Prone Areas								Vulnerability	
Num	County	Area in Flood Planning Region (sqmi)	Area (sqmi)	Number of Structures[A]	Residential Structures	Population	Roadway Stream Crossings (#)	Roadways Segments (miles)	Agricultural Areas (sqmi)	Critical Facilities (#)	Average CDC SVI of features in flood hazard areas	Average TX F-SVI of features in flood hazard areas
1	Archer	5.9	0.0	0	0	0	0	0.0	0.0	0	0.39	0.44
2	Austin	511.2	0.0	0	0	0	0	0.0	0.0	0	0.48	0.42
3	Bastrop	59.0	0.0	0	0	0	0	0.0	0.0	0	0.30	0.24
4	Bell	1,086.8	2.8	62	41	122	1	5.9	0.1	2	0.52	0.67
5	Bosque	1,002.4	0.3	71	53	81	0	2.2	0.0	1	0.48	0.46
6	Brazoria	668.6	0.0	0	0	0	0	0.0	0.0	0	0.49	0.51
7	Brazos	590.4	0.0	35	30	1,121	0	0.4	0.0	0	0.41	0.44
8	Brown	19.2	0.0	0	0	0	0	0.0	0.0	0	0.29	0.38
9	Burleson	677.8	0.1	35	32	50	0	0.7	0.0	0	0.47	0.37
10	Burnet	484.5	0.0	0	0	0	0	0.0	0.0	0	0.35	0.32
11	Callahan	16.3	0.0	0	0	0	0	0.0	0.0	0	0.52	0.47
12	Comanche	922.9	1.6	28	13	17	0	4.4	0.3	0	0.52	0.44
13	Coryell	1,056.7	0.0	1	0	1	0	0.0	0.0	0	0.47	0.47
14	Eastland	772.9	0.0	15	13	30	0	0.1	0.0	0	0.61	0.68
15	Erath	1,087.4	1.4	9	2	8	0	0.5	0.1	0	0.47	0.46
16	Falls	773.8	0.0	0	0	0	0	0.0	0.0	0	0.57	0.38
17	Fayette	1.0	0.0	0	0	0	0	0.0	0.0	0	0.25	0.77
18	Fort Bend	610.7	0.0	0	0	0	0	0.0	0.0	0	0.29	0.33
19	Freestone	103.7	0.0	0	0	0	0	0.0	0.0	0	0.49	0.49
20	Grimes	457.0	0.0	0	0	0	0	0.0	0.0	0	0.57	0.60
21	Hamilton	836.2	0.0	0	0	0	0	0.0	0.0	0	0.52	0.33
22	Hill	664.1	0.4	66	53	105	0	1.1	0.0	0	0.46	0.49
23	Hood	437.7	0.0	0	0	0	0	0.0	0.0	0	0.36	0.46
24	Jack	261.0	0.0	0	0	0	0	0.0	0.0	0	0.48	0.80
25	Johnson	373.3	0.0	4	1	1	0	0.2	0.0	0	0.53	0.36
26	Lampasas	561.7	0.2	0	0	0	0	0.0	0.0	0	0.51	0.62
27	Lee	531.8	0.0	0	0	0	0	0.0	0.0	0	0.57	0.45
28	Leon	270.0	0.0	0	0	0	0	0.0	0.0	0	0.38	0.36
29	Limestone	836.8	0.0	0	0	0	0	0.0	0.0	0	0.44	0.49
30	Madison	69.8	0.0	0	0	0	0	0.0	0.0	0	0.43	0.56
31	McLennan	1,060.9	0.2	20	17	71	0	0.6	0.0	0	0.55	0.57
32	Milam	1,021.5	0.0	2	2	1	0	0.0	0.0	0	0.50	0.48
33	Mills	289.8	0.0	0	0	0	0	0.0	0.0	0	0.37	0.32
34	Palo Pinto	985.5	0.0	7	3	9	0	0.1	0.0	0	0.42	0.58
35	Parker	430.8	0.0	3	3	4	0	0.0	0.0	0	0.37	0.44
36	Robertson	865.4	0.0	0	0	0	0	0.0	0.0	0	0.57	0.79
37	Somervell	191.6	0.0	0	0	0	0	0.0	0.0	0	0.47	0.41
38	Stephens	358.4	0.0	0	0	0	0	0.0	0.0	0	0.25	0.28
39	Travis	1.9	0.0	0	0	0	0	0.0	0.0	0	0.28	0.21
40	Waller	323.9	0.0	0	0	0	0	0.0	0.0	0	0.66	0.54
41	Washington	620.2	0.0	0	0	0	0	0.0	0.0	0	0.39	0.56
42	Williamson	1,133.1	0.5	130	114	560	0	1.3	0.0	0	0.27	0.30
43	Young	408.8	0.0	1	0	0	0	0.0	0.0	0	0.45	0.57
TOTAL		**23,442.4**	**7.8**	**489**	**377**	**2,181**	**1**	**17.5**	**0.5**	**3**		

[A] Structures include Residential Bldg, Commercial Bldg, Agricultural Bldg, Industrial Bldg, Public Bldg, and Vacant or Unknown Bldg

Appendix 2.4: Task 2B Approach Memorandum

MEMORANDUM

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TO: Mr. Bryan McMath, Executive Administrator

CC: Tressa Olsen, Assistant Director, Flood Planning

FROM: Region 8 Technical Consultants Team

SUBJECT: Task 2B - Future Flood Hazard Area Approach

DATE: 6/27/2025

On behalf of the Lower Brazos RFPG, the consultant team is requesting the TWDB to evaluate for approval the methodology proposed in this document for determining the location and extent of future flood hazard areas as a part of Task 2B. Generally, the region can be classified into two categories for the purposes of describing the Lower Brazos RFPG's proposed approach: areas covered by regional 2D hydraulic models, including GLO RBFS and BLE products, and 1D BLE models. The proposed approach for these areas is summarized as follows:

Areas Covered by 2D BLE and/or GLO RBFS models:

- Prioritization ranking:
    1. GLO (future)
    2. 2D BLE (future)
    3. Pluvial Fathom Scenario 4
- Modification technique of existing data to develop future conditions:
    - Recompute models with updated precipitation and land cover assumptions
    - TWDB Water User Group data to be used to identify areas of new 2060 urbanization and resulting updates to impervious cover assumptions
    - Fathom study significant climate forcing scenario used to update rainfall boundary conditions

Areas Covered by 1D BLE:

- Delineate the following areas based on review of data:
    - Pluvial Fathom Scenario 4
    - Greater extent of Pluvial Fathom Scenario 4 + 1D BLE (future)
- Modification technique of existing data to develop future conditions:
    - Calculate typical increase from Combined Fathom Scenario 5 to Combined Fathom Scenario 3
    - Apply this increase in flood depth to 1D BLE water surface elevation raster data using vertical buffer process implemented in cycle 1

Justification of approach:

Exhibit C specifies that the RFPGs may choose to utilize other more detailed or accurate future condition flood hazard information for their region, if available. Based on our review of the fathom model results and report, we believe that 2D BLE models and 2D GLO models produce results that more accurately reflect flooding consequences at a localized level than Fathom results. Therefore, we plan to modify

model boundary conditions and land cover assumptions as necessary to identify future conditions flood risk. In order to modify model boundary conditions, we will use Fathom input data recently provided by the TWDB to determine necessary increases to rainfall depths, and use Water User Group data to predict development patterns. This "future development" process was used for the future condition exposure analysis in the first planning cycle. In this cycle, the RFPG will also use this process to determine anticipated increases in impervious cover throughout the watershed.

Furthermore, 1D BLE models for larger flooding sources, including main channels draining HUC12-sized areas and greater, tend to produce more conservative results than Fathom data. These 1D BLE studies have clear report documentation at a HUC-8 level to justify and explain the modeling approach. Therefore, we believe that there are areas where it is appropriate to leverage vertically buffered 1D BLE data and supplement with Pluvial fathom data.

Lastly, during our review of fathom data, we noted that Fathom Scenario 3 shows inconsistent increases relative to Fathom Scenario 5 (existing) due to hydraulic model roughness changes, which is explained in further detail in the attached document *20250506_Future_Fathom_Comments.docx* that Scott Hubley previously provided. Because of this, for areas where we are using future fathom data, we plan to use Fathom Scenario 4, which includes moderate climate forcing and no land cover or roughness changes.

Appendix 2.5: Table 5 – Summary of Future Conditions Flood Risk

Table 5 - Summary of Future Conditions Flood Risk

General			10% Annual Chance Flood Risk							
Num	County	Area in Flood Planning Region (sqmi)	Area (sqmi)	Number of Structures[A]	Residential Structures	Population	Roadway Stream Crossings (#)	Roadways Segments (miles)	Agricultural Areas (acres)	Critical Facilities (#)
1	Archer	5.9	1.9	7	0	5	0	0.5	1.4	0
2	Austin	511.2	148.9	1,574	908	2,683	142	107.9	13.4	4
3	Bastrop	59.0	9.1	47	24	56	9	5.2	0.5	0
4	Bell	1,086.8	210.4	4,826	2,852	26,119	546	235.0	37.6	145
5	Bosque	1,002.4	198.0	1,681	976	4,528	114	103.6	16.1	24
6	Brazoria	668.6	488.5	18,823	13,948	48,061	199	439.7	80.7	108
7	Brazos	590.4	169.4	1,575	1,202	6,805	259	85.1	28.3	10
8	Brown	19.2	1.7	3	1	1	0	1.3	0.3	0
9	Burleson	677.8	198.0	780	441	1,110	105	92.6	43.8	3
10	Burnet	484.5	72.1	837	606	1,194	50	37.1	1.2	5
11	Callahan	16.3	2.3	2	0	0	0	1.6	0.5	0
12	Comanche	922.9	168.0	1,026	559	2,958	147	98.8	53.5	13
13	Coryell	1,056.7	179.0	1,130	741	10,292	106	75.0	26.5	120
14	Eastland	772.9	141.8	2,167	1,263	5,151	116	137.5	23.6	38
15	Erath	1,087.4	144.7	922	495	3,327	147	89.9	14.9	16
16	Falls	773.8	188.5	466	226	817	226	86.2	77.7	6
17	Fayette	1.0	0.1	0	0	0	0	0.0	0.0	0
18	Fort Bend	610.7	254.7	18,805	15,817	58,842	397	1,232.7	47.7	76
19	Freestone	103.7	18.6	74	31	44	14	10.5	0.1	0
20	Grimes	457.0	142.5	1,760	998	6,092	126	89.6	5.7	19
21	Hamilton	836.2	134.7	486	184	1,266	102	63.1	20.8	7
22	Hill	664.1	135.9	609	309	810	222	84.5	18.7	2
23	Hood	437.7	88.9	6,607	5,497	17,738	85	91.1	1.7	29
24	Jack	261.0	51.3	182	76	467	33	21.4	3.9	2
25	Johnson	373.3	57.0	872	571	1,925	120	48.2	4.0	9
26	Lampasas	561.7	77.5	1,181	699	3,492	84	40.9	3.5	6
27	Lee	531.8	121.4	1,192	691	2,562	96	58.2	4.5	5
28	Leon	270.0	58.1	383	0	266	20	16.9	0.2	0
29	Limestone	836.8	173.3	787	435	818	202	61.1	6.4	3
30	Madison	69.8	18.7	23	15	13	11	5.8	0.0	0
31	McLennan	1,060.9	240.5	5,508	3,481	40,442	471	336.2	59.7	184
32	Milam	1,021.5	268.0	1,217	717	1,498	165	118.1	81.3	8
33	Mills	289.8	35.6	61	20	100	18	14.5	2.6	1
34	Palo Pinto	985.5	210.4	3,649	2,093	4,868	158	112.9	8.5	26
35	Parker	430.8	94.1	2,238	1,083	4,169	110	93.6	2.5	13
36	Robertson	865.4	240.2	923	578	1,839	115	97.7	60.1	4
37	Somervell	191.6	32.2	271	144	1,926	42	14.7	0.3	4
38	Stephens	358.4	62.6	196	1	76	15	17.4	3.5	0
39	Travis	1.9	0.1	29	16	586	0	0.5	0.0	0
40	Waller	323.9	104.9	2,291	1,145	5,407	111	96.2	9.5	33
41	Washington	620.2	162.2	1,591	766	7,749	230	113.6	12.4	30
42	Williamson	1,133.1	297.6	17,799	14,456	85,891	896	521.5	98.3	107
43	Young	408.8	89.7	1,305	820	3,352	38	67.6	13.3	13
TOTAL		**23,442.4**	**5,493.2**	**105,905**	**74,885**	**365,345**	**6,047**	**5,025.9**	**889.5**	**1,073**

[A] *Structures include Residential Bldg, Commercial Bldg, Agricultural Bldg, Industrial Bldg, Public Bldg, and Vacant or Unknown Bldg*

Table 5 - Summary of Future Conditions Flood Risk

General			1% Annual Chance Flood Risk							
Num	County	Area in Flood Planning Region (sqmi)	Area in Floodplain (sqmi)	Number of Structures[A]	Residential Structures	Population	Roadway Stream Crossings (#)	Roadways Segments (miles)	Agricultural Areas (acres)	Critical Facilities (#)
1	Archer	5.9	1.1	8	0	17	0	0.9	0.8	0
2	Austin	511.2	36.4	1,684	1,033	2,731	14	74.1	4.6	9
3	Bastrop	59.0	2.1	14	7	18	0	2.6	0.2	0
4	Bell	1,086.8	81.3	7,773	5,374	36,478	156	291.7	24.0	328
5	Bosque	1,002.4	49.7	752	424	1,417	9	58.2	4.7	6
6	Brazoria	668.6	146.2	19,509	15,378	47,063	25	521.4	26.6	131
7	Brazos	590.4	48.2	3,489	2,697	24,805	86	152.6	9.7	63
8	Brown	19.2	0.9	6	4	2	0	0.7	0.2	0
9	Burleson	677.8	45.0	560	309	894	13	75.3	15.8	5
10	Burnet	484.5	25.9	445	273	566	4	23.2	1.1	1
11	Callahan	16.3	1.5	4	0	2	0	1.3	0.3	0
12	Comanche	922.9	80.2	1,015	648	1,411	25	90.3	28.0	7
13	Coryell	1,056.7	60.4	1,417	986	7,708	15	62.3	10.1	128
14	Eastland	772.9	74.2	1,667	1,024	2,669	26	113.9	14.7	20
15	Erath	1,087.4	76.7	1,584	1,045	6,284	38	93.3	11.0	22
16	Falls	773.8	67.1	572	307	1,531	25	78.2	41.0	15
17	Fayette	1.0	0.0	0	0	0	0	0.0	0.0	0
18	Fort Bend	610.7	135.4	39,470	35,416	113,299	60	567.9	38.6	172
19	Freestone	103.7	4.1	101	44	102	4	8.4	0.0	0
20	Grimes	457.0	23.9	822	522	2,203	8	43.5	1.3	4
21	Hamilton	836.2	46.1	446	255	815	6	51.2	9.0	7
22	Hill	664.1	29.0	588	342	1,196	15	46.7	8.1	9
23	Hood	437.7	24.6	2,671	2,140	5,679	14	43.8	1.2	12
24	Jack	261.0	18.0	132	46	131	1	13.2	1.6	0
25	Johnson	373.3	18.7	1,661	1,234	7,944	22	57.3	2.4	11
26	Lampasas	561.7	34.4	1,190	623	2,733	9	37.0	6.5	13
27	Lee	531.8	21.7	398	219	508	9	24.5	1.0	4
28	Leon	270.0	11.6	276	0	243	6	10.8	0.1	3
29	Limestone	836.8	36.9	827	528	1,469	21	61.4	3.0	3
30	Madison	69.8	2.8	25	22	17	0	2.2	0.0	0
31	McLennan	1,060.9	99.6	9,496	6,948	46,778	114	360.2	35.0	191
32	Milam	1,021.5	69.5	875	578	1,313	16	79.2	28.5	3
33	Mills	289.8	11.8	31	11	8	1	10.1	2.4	0
34	Palo Pinto	985.5	64.0	2,394	1,328	4,582	28	101.7	3.2	18
35	Parker	430.8	26.8	882	324	3,785	20	47.9	0.9	8
36	Robertson	865.4	51.8	1,312	844	2,272	19	66.2	14.9	8
37	Somervell	191.6	10.6	434	231	1,017	5	18.4	0.4	10
38	Stephens	358.4	26.7	89	0	46	6	12.4	2.0	0
39	Travis	1.9	0.0	4	4	18	0	0.5	0.0	0
40	Waller	323.9	51.7	2,445	1,309	3,738	13	106.5	8.8	12
41	Washington	620.2	26.8	657	328	2,175	11	58.6	2.1	7
42	Williamson	1,133.1	84.6	16,513	14,043	79,011	172	418.4	32.5	101
43	Young	408.8	35.8	1,490	1,038	3,783	9	46.8	8.8	8
TOTAL		**23,442.4**	**1,763.7**	**125,728**	**97,886**	**418,461**	**1,025**	**3,934.8**	**405.6**	**1,339**

[A] *Structures include Residential Bldg, Commercial Bldg, Agricultural Bldg, Industrial Bldg, Public Bldg, and Vacant or Unknown Bldg*

Table 5 - Summary of Future Conditions Flood Risk

General			0.2% Annual Chance Flood Risk							
Num	County	Area in Flood Planning Region (sqmi)	Area (sqmi)	Number of Structures[A]	Residential Structures	Population	Roadway Stream Crossings (#)	Roadways Segments (miles)	Agricultural Areas (acres)	Critical Facilities (#)
1	Archer	5.9	0.5	2	0	0	0	0.8	0.4	0
2	Austin	511.2	18.7	1,011	632	2,483	7	40.0	2.5	3
3	Bastrop	59.0	1.4	22	16	22	0	2.0	0.1	0
4	Bell	1,086.8	38.8	5,499	3,903	19,829	24	170.9	10.3	306
5	Bosque	1,002.4	29.8	670	391	895	9	46.8	2.8	6
6	Brazoria	668.6	23.0	5,234	4,024	13,095	13	145.2	3.1	34
7	Brazos	590.4	16.5	2,508	2,007	23,650	22	83.2	1.3	46
8	Brown	19.2	0.7	5	2	4	0	0.7	0.1	0
9	Burleson	677.8	21.4	368	211	469	4	43.0	4.6	1
10	Burnet	484.5	18.7	440	304	483	2	20.6	0.4	0
11	Callahan	16.3	0.8	5	0	3	0	1.2	0.2	0
12	Comanche	922.9	44.3	712	470	783	13	74.5	14.4	5
13	Coryell	1,056.7	36.6	983	705	4,607	8	50.5	5.9	71
14	Eastland	772.9	43.2	1,111	651	1,547	25	93.2	8.3	12
15	Erath	1,087.4	42.0	1,162	751	4,062	18	68.0	6.0	14
16	Falls	773.8	27.9	414	218	1,140	15	48.9	14.9	14
17	Fayette	1.0	0.0	0	0	0	0	0.0	0.0	0
18	Fort Bend	610.7	68.6	40,241	37,807	113,852	27	263.0	22.1	143
19	Freestone	103.7	2.5	79	47	138	1	6.0	0.0	1
20	Grimes	457.0	13.7	512	307	675	5	29.0	0.5	0
21	Hamilton	836.2	27.5	268	146	347	2	43.6	5.1	1
22	Hill	664.1	17.8	399	249	976	4	33.3	5.3	6
23	Hood	437.7	13.2	1,492	1,197	2,755	5	29.9	0.5	9
24	Jack	261.0	9.3	76	28	74	0	10.3	0.7	0
25	Johnson	373.3	11.2	1,155	851	4,414	13	37.2	1.6	8
26	Lampasas	561.7	15.1	508	285	1,011	5	25.7	1.2	2
27	Lee	531.8	15.0	262	144	283	11	22.5	0.7	0
28	Leon	270.0	7.3	217	0	145	1	10.3	0.1	1
29	Limestone	836.8	23.7	732	488	623	5	41.7	2.2	3
30	Madison	69.8	1.6	20	6	15	1	1.8	0.0	0
31	McLennan	1,060.9	51.3	5,393	3,926	25,342	38	184.4	18.3	98
32	Milam	1,021.5	31.1	610	412	849	6	50.9	8.9	2
33	Mills	289.8	6.5	27	9	6	0	7.3	1.3	0
34	Palo Pinto	985.5	40.1	1,305	733	1,775	16	75.9	1.8	4
35	Parker	430.8	14.5	571	205	717	5	32.3	0.5	2
36	Robertson	865.4	19.8	605	392	983	6	33.4	0.9	3
37	Somervell	191.6	6.1	249	141	547	2	10.3	0.3	6
38	Stephens	358.4	14.8	62	1	33	2	10.7	1.1	1
39	Travis	1.9	0.1	15	5	1,161	0	0.2	0.0	1
40	Waller	323.9	19.8	1,139	657	2,040	3	42.6	3.3	12
41	Washington	620.2	16.5	416	219	1,444	4	40.5	0.7	5
42	Williamson	1,133.1	58.9	13,585	11,590	39,099	62	295.4	20.5	50
43	Young	408.8	20.4	757	499	1,005	3	32.1	5.2	8
TOTAL		**23,442.4**	**891.0**	**90,841**	**74,629**	**273,381**	**387**	**2,259.6**	**178.1**	**878**

[A] *Structures include Residential Bldg, Commercial Bldg, Agricultural Bldg, Industrial Bldg, Public Bldg, and Vacant or Unknown Bldg*

Table 5 - Summary of Future Conditions Flood Risk

General			Possible Flood Prone Areas								Vulnerability	
Num	County	Area in Flood Planning Region (sqmi)	Area (sqmi)	Number of Structures[A]	Residential Structures	Population	Roadway Stream Crossings (#)	Roadways Segments (miles)	Agricultural Areas (acres)	Critical Facilities (#)	Average CDC SVI of features in flood hazard areas	Average TX F-SVI of features in flood hazard areas
1	Archer	5.9	0.0	0	0	0	0	0.0	0.0	0	0.40	0.44
2	Austin	511.2	0.0	685	685	2,055	0	0.0	0.0	0	0.48	0.42
3	Bastrop	59.0	0.0	101	101	303	0	0.0	0.0	0	0.31	0.25
4	Bell	1,086.8	2.7	6,926	6,907	39,366	1	6.0	0.1	2	0.52	0.67
5	Bosque	1,002.4	0.3	300	283	768	0	2.0	0.0	1	0.51	0.52
6	Brazoria	668.6	0.0	1,947	1,947	6,069	0	0.0	0.0	0	0.49	0.51
7	Brazos	590.4	0.0	6,246	6,242	32,350	0	0.4	0.0	1	0.41	0.44
8	Brown	19.2	0.0	0	0	0	0	0.0	0.0	0	0.29	0.38
9	Burleson	677.8	0.1	90	87	215	0	0.7	0.0	0	0.48	0.38
10	Burnet	484.5	0.0	2,220	2,220	6,657	0	0.0	0.0	0	0.35	0.32
11	Callahan	16.3	0.0	0	0	0	0	0.0	0.0	0	0.52	0.47
12	Comanche	922.9	1.4	26	13	17	0	3.9	0.2	0	0.58	0.44
13	Coryell	1,056.7	0.0	959	958	4,631	0	0.0	0.0	0	0.48	0.50
14	Eastland	772.9	0.0	26	25	66	0	0.1	0.0	0	0.61	0.68
15	Erath	1,087.4	1.3	753	746	3,728	0	0.4	0.1	0	0.49	0.49
16	Falls	773.8	0.0	0	0	0	0	0.0	0.0	0	0.63	0.44
17	Fayette	1.0	0.0	0	0	0	0	0.0	0.0	0	0.00	0.00
18	Fort Bend	610.7	0.0	37,517	37,517	212,890	0	0.0	0.0	0	0.29	0.33
19	Freestone	103.7	0.0	0	0	0	0	0.0	0.0	0	0.50	0.53
20	Grimes	457.0	0.0	195	195	585	0	0.0	0.0	0	0.64	0.63
21	Hamilton	836.2	0.0	0	0	0	0	0.0	0.0	0	0.54	0.37
22	Hill	664.1	0.4	244	235	655	0	1.1	0.0	0	0.46	0.49
23	Hood	437.7	0.0	5,001	5,001	15,003	0	0.0	0.0	0	0.35	0.46
24	Jack	261.0	0.0	0	0	0	0	0.0	0.0	0	0.48	0.81
25	Johnson	373.3	0.0	1,070	1,068	4,726	0	0.2	0.0	0	0.54	0.37
26	Lampasas	561.7	0.2	80	80	400	0	0.0	0.0	0	0.52	0.63
27	Lee	531.8	0.0	60	60	180	0	0.0	0.0	0	0.59	0.42
28	Leon	270.0	0.0	1	1	3	0	0.0	0.0	0	0.39	0.36
29	Limestone	836.8	0.0	0	0	0	0	0.0	0.0	0	0.44	0.50
30	Madison	69.8	0.0	2	2	6	0	0.0	0.0	0	0.43	0.57
31	McLennan	1,060.9	0.1	4,913	4,912	22,869	0	0.2	0.0	0	0.55	0.57
32	Milam	1,021.5	0.0	6,100	6,100	18,300	0	0.0	0.0	0	0.49	0.49
33	Mills	289.8	0.0	0	0	0	0	0.0	0.0	0	0.37	0.33
34	Palo Pinto	985.5	0.0	4	1	5	0	0.3	0.0	0	0.43	0.59
35	Parker	430.8	0.0	3,713	3,713	14,621	0	0.0	0.0	0	0.36	0.45
36	Robertson	865.4	0.0	0	0	0	0	0.0	0.0	0	0.58	0.82
37	Somervell	191.6	0.0	8	8	24	0	0.0	0.0	0	0.48	0.42
38	Stephens	358.4	0.0	0	0	0	0	0.0	0.0	0	0.25	0.28
39	Travis	1.9	0.0	12	12	144	0	0.0	0.0	0	0.23	0.19
40	Waller	323.9	0.0	3,022	3,022	10,326	0	0.0	0.0	0	0.65	0.55
41	Washington	620.2	0.0	22	22	66	0	0.0	0.0	0	0.45	0.62
42	Williamson	1,133.1	0.2	60,631	60,626	312,008	0	0.6	0.0	0	0.26	0.29
43	Young	408.8	0.0	16	15	45	0	0.0	0.0	0	0.46	0.57
TOTAL		**23,442.4**	**6.7**	**142,890**	**142,804**	**709,081**	**1**	**16.0**	**0.4**	**4**		

[A] *Structures include Residential Bldg, Commercial Bldg, Agricultural Bldg, Industrial Bldg, Public Bldg, and Vacant or Unknown Bldg*