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Since Hurricane Harvey in 2017, Texas has greatly increased resources for flood planning and mitigation, resulting in significant and much-needed efforts by a wide variety of parties. It has been imperative for agencies and others to coordinate and collaborate during this flood planning process, and many state and federal agencies have successfully engaged to advance flood mitigation efforts that either directly or indirectly relate to this planning effort. This inaugural state flood planning cycle taught many lessons and laid the groundwork for future planning.

10.1 Ongoing flood efforts

In flood management, multiple local, state, and federal entities play important roles in developing and implementing flood mitigation strategies across the state.

10.1.1 Flood mapping, financing, and research efforts

Base level engineering⁵⁶

Passed during the 86th Legislature in 2019, Senate Bill 500⁵⁷ allocated funds to the Texas Water Development Board (TWDB) to develop and update Texas flood risk maps using best available data and technology standards, supporting the creation of the state flood plan. As such, the TWDB's efforts involve improving statewide flood modeling and mapping, conducting flood research activities, and utilizing a combination of available and future condition datasets.

One available dataset is base level engineering, a flood hazard mapping approach that provides credible flood hazard data at various geographic scales, complementing existing Flood Insurance Rate Map data and serving as the primary source for areas without flood mapping information. Base level engineering flood map data is not

inherently a regulatory product but rather an advisory data set, unless local jurisdictions choose to adopt it as a regulatory map or require its use as "best available" data. New efforts were initiated by FEMA in 2023 to begin converting base level engineering products into Flood Insurance Rate Maps. Progress in Texas is shown online.⁵⁸

Community Assistance Program

The Community Assistance Program administered by the TWDB provides floodplain management support to communities. This includes coordinating and providing statewide training and education, consistent outreach through various avenues, and providing on-call technical support. The Community Assistance Program team is partially funded by FEMA's Community Assistance Program – State Support Services Element grant program, which seeks to ensure National Flood Insurance Program flood loss reduction goals are met, build state and community floodplain management capabilities, and leverage state expertise in working with communities. The TWDB's Community Assistance Program also provides disaster recovery support to communities in the days and months following disasters to support substantial damage assessments and floodplain permitting activities, as well as floodplain management expertise and support to statewide flood planning activities and to other state agencies.

FEMA flood assistance grants

The Flood Mitigation Assistance grant program, administered by the TWDB⁵⁹ on behalf of FEMA, offers federal funding to states and communities for cost-effective measures that reduce or eliminate flood risks to structures insured under the National Flood Insurance Program. The program aims to minimize repeated National Flood Insurance Program claims and reduce reliance on federal disaster assistance. It follows an annual application cycle, and eligible cities, counties, and

⁵⁶ www.twdb.texas.gov/flood/science/ble.asp

⁵⁷ capitol.texas.gov/billlookup/text.aspx?LegSess=86R&Bill=SB500

⁵⁸ <https://webapps.usgs.gov/infrm/estbfe/>

⁵⁹ www.twdb.texas.gov/financial/programs/FMA/index.asp

special districts submit applications on behalf of citizens.

Flood Funding Information Clearinghouse⁶⁰

The TWDB collaborates with the Texas General Land Office and Texas Division of Emergency Management to guide communities in identifying the most suitable funding sources for their flood-related projects. The ongoing multi-agency initiative known as the Flood Information Clearinghouse Committee aims to optimize the utilization of public funding resources and help communities determine their preferred funding source.

Flood Infrastructure Fund

The TWDB's Flood Infrastructure Fund program⁶¹ was passed by the legislature and approved by Texas voters through a constitutional amendment in 2019. The program offers financial support through loans and grants for a range of flood studies and mitigation projects. Flood intended use plans outline the structure of each associated funding cycle. Only flood risk reduction solutions (flood management evaluations, flood mitigation projects, and flood management strategies) recommended in the state flood plan will be eligible for funding consideration through the Flood Infrastructure Fund.

Modeling and mapping program⁶²

The TWDB operates a state flood mapping program to provide reliable flood data for informed decision-making at state, regional, and local levels. Following Senate Bill 500 in 2019, the TWDB formed the Flood Science and Community Assistance Division, which includes the Flood Modeling and Flood Mapping departments responsible for delivering statewide base level engineering mapping and providing technical support for other flood-related programs.

⁶⁰ www.texasfloodclearinghouse.org/

⁶¹ www.twdb.texas.gov/financial/programs/FIF/index.asp

⁶² www.twdb.texas.gov/flood/science/programs.asp

At the federal level, the TWDB serves as the state Cooperating Technical Partner for FEMA's Cooperating Technical Partners program. This program promotes local involvement in developing and updating Flood Insurance Rate Maps and associated geospatial data. The TWDB also supports FEMA's Risk Mapping, Assessment, and Planning program.

10.1.2 Other coordination, studies, and efforts

Army Corps of Engineers

The U.S. Army Corps of Engineers collaborates extensively with local, state, and federal entities in Texas through its Albuquerque, New Mexico; Fort Worth; Galveston; and Tulsa, Oklahoma, districts, including on vital missions such as flood risk management and emergency operations. The U.S. Army Corps of Engineers oversees 32 multi-purpose dams and was integral during major flood events like Hurricane Harvey by producing real-time flood maps and managing significant levee systems, including the historic Fort Worth and Dallas floodways.

Simultaneously, the U.S. Army Corps of Engineers is developing coastal flood resilience initiatives and refining flood resiliency tools. A prime example of its collaborative efforts is the partnership with entities like the Texas General Land Office and the U.S. Geological Survey on the Texas Integrated Flooding Framework Project.

National Weather Service

The National Weather Service, a component of the National Oceanic and Atmospheric Administration, provides vital weather, water, and climate data, forecasts, and impact-based decision support services to safeguard life and property and bolster the national economy. The National Weather Service operates through a vast infrastructure comprising nine national centers and 122 field offices that offer broad weather, water, and climate insights. The organization encompasses the National Water Center and 13 River Forecast Centers that execute hydrologic

forecasting and development, including approximately 3,600 forecasts nationwide. This forecasting aids local National Weather Service meteorologists in issuing flood alerts and providing support for decision-makers such as emergency managers and first responders. For these reasons, the National Weather Service is persistently enhancing its offerings, notably real-time flood inundation mapping for improved flood forecast communication and a commitment to advance water research through the Cooperative Institute for Research to Operations in Hydrology, supporting the National Oceanic and Atmospheric Administration's vision for a weather-ready nation.

Texas Department of Agriculture

The Texas Department of Agriculture plays a supportive role in flood risk reduction. Staff actively participate as non-voting members in all 15 flood planning groups, ensuring alignment with broader agricultural concerns. The Texas Department of Agriculture is affiliated with various committees and councils, such as the Texas Water Conservation Advisory Committee and the Galveston Bay Council, which indirectly address flood matters. In emergency scenarios, the Texas Department of Agriculture collaborates with Texas AgriLife on water contamination issues and joins forces with the Texas Animal Health Commission during livestock-related flood crises. One ongoing initiative involves partnering with the Texas Agricultural Council and the U.S. Department of Agriculture to implement best practices addressing water-related challenges, including floods.

Texas Commission on Environmental Quality

The Texas Commission on Environmental Quality Dam Safety Program oversees private and public dams, focusing on those with high or significant hazard potential. The agency inspects these dams and offers safety recommendations to owners. Twice per year, the Texas Commission on Environmental Quality shares a list of dams, detailing their condition and Emergency Action Plan status, with local emergency management and councils of government officials. Further-

more, the agency requires that dam operators with gated spillways must notify local emergency operation centers when releasing floodwaters, ensuring downstream communities are informed and can alert the public to potential flood risks. TWDB staff coordinated with the Texas Commission on Environmental Quality regarding a state flood plan legislative recommendation. Agency staff also participate in each of the 15 regional flood planning groups as non-voting members.

Texas Division of Emergency Management

The Texas Division of Emergency Management is responsible for maintaining and updating the State Hazard Mitigation Plan. The State Hazard Mitigation Plan enables the state to identify natural hazards, identify actions and activities to reduce losses from those hazards, and establish a coordinated process to implement the plan using a wide range of resources. The State Hazard Mitigation Plan serves as the foundation for all other plans and planning processes in the state to integrate resilience and long-term risk reduction, as well as guides decision-makers to reduce the effects of natural hazards as resources are committed. The Texas Division of Emergency Management routinely works closely with the TWDB to synchronize projects and funding across the multiple grant sources available for mitigation activities. The Texas Division of Emergency Management also supports jurisdictions during the creation of their local hazard mitigation plans, including serving as the liaison between jurisdictions and FEMA and providing grant funding for local plan creation. Agency staff also participate in each of the 15 regional flood planning groups as non-voting members.

TexasFlood.org

After what became known as the 2015 Memorial Day Flood in South and Central Texas, authorities identified a need for accessible flood preparation resources for the public. Many available tools were tailored for experts, but information specifically geared to the public was scattered across multiple platforms with inconsistent messaging.

TEXAS FLOOD

Home About Flood Basics Emergency Preparation Recovery Science & Tools Library Search

SCIENCE & TOOLS LIBRARY

Near Real-Time Maps

Near real-time maps provide information from sensors like weather conditions, water levels or road conditions. This collection of maps includes weather sensors (rainfall, soil moisture and wind conditions), river gages, lake levels, road conditions and flooding scenarios. These maps are designed to help you assess current conditions across the state.

TxGIO Flood Viewer

The Texas Geographic Information Office (TxGIO) Flood Viewer displays lake levels, river heights, and other real-time weather conditions across Texas. You can subscribe and set up notifications that will alert you when water is rising in a river near your house or property.

TWDB TexMesonet

The Texas Water Development Board TexMesonet displays real-time and seasonal data from weather stations across the state including precipitation, soil moisture, and other measurements.

Flood Decision Support Toolbox

Drive Texas

TxGIO DataHub

The Texas Geographic Information Office (TxGIO) is a unique state agency that provides high quality historic and current geospatial data products, education and training, while advancing the GIS Community through collaboration, expertise, cost-sharing initiatives and exceptional customer service.

Texas Integrated Flooding Framework (TIFF)

The Texas Integrated Flooding Framework (TIFF) project was established in 2020 to create an integrated framework to equip local, regional, and state entities with vital compound flood risk information and essential planning tools to support comprehensive regional flood planning and mitigation in the coastal zone.

- About TIFF
- TIFF Components
- TIFF Structure
- Accomplishments to Date
- Reports
- Recommendations
- Collaborations/Relationships
- Upcoming Events

Flood GIS Resources

Texasflood.org offers essential flood risk and emergency preparation information and tools

To address this, the TWDB launched TexasFlood.org, initially a consolidated webpage on the TWDB site. Recognizing the need for more comprehensive resources, a standalone TexasFlood.org website was released in August 2021 in collaboration with other Texas agencies. The site now offers essential flood risk and emergency preparation information in a user-friendly format to serve Texans in their flood awareness and preparation endeavors.

Texas General Land Office

The Texas General Land Office's Community Development and Revitalization Division initiated the Combined River Basin Flood Studies in response to recent extreme weather events and their devastating flooding impacts. The Combined River Basin Flood Studies is a one-time planning effort divided into four regions covering counties affected by Hurricane Harvey and flooding in the Lower Rio Grande Valley. It aims to evaluate flood risks, empower Texans with flood risk information, develop cost-effective mitigation strategies, determine funding sources for future projects, and engage stakeholders. The strategic framework includes stakeholder engagement, data collection, risk analysis, alternatives analysis,

and funding/technical assistance, with a focus on collecting accurate data to inform modeling and funding efforts. The data produced will support Texas' regional and state flood planning efforts and inform the Texas Disaster Information System for disaster recovery and mitigation planning at the community level. General Land Office staff also participate in each of the 15 regional flood planning groups as non-voting members.

Texas Integrated Flooding Framework Planning Project

The Texas Integrated Flooding Framework Planning Project,⁶³ funded by the Texas General Land Office, is a collaborative effort led by the TWDB, U.S. Army Corps of Engineers, and U.S. Geological Survey. The project aims to develop guidelines and processes for implementing an integrated framework to model, visualize, and plan for the risk of compound flooding in coastal regions. By enhancing data collection, modeling capabilities, and coordination among agencies, the Texas Integrated Flooding Framework will enable more effective planning and long-term resilience strate-

⁶³ www.texasflood.org/tools-library/tiff/index.html

gies to mitigate the impacts of coastal flooding in Texas (USGS, n.d. a).

Texas Parks and Wildlife Department

The Texas Parks and Wildlife Department plays a collaborative role in regional flood planning. Staff from the Wildlife, Inland Fisheries, and Coastal Fisheries divisions participate as non-voting members on each regional flood planning group and advise on potential impacts to wildlife and fish to ensure that the needs of these species are considered.

Additionally, the Texas Parks and Wildlife Department encourages voluntary conservation through programs like the Landowner Incentive Program and the Watershed Conservation Team. The agency also has regulatory responsibilities, necessitating coordination or permitting for flood projects that could impact public waters, aquatic life, or involve nuisance plant management. Key regulatory programs include the Kills and Spills Team; the Marl, Sand, Gravel, Shell Permit Program; and the Ecological and Environmental Planning Program, which reviews and advises on a range of flood-related projects.

Texas State Soil and Water Conservation Board

The Texas State Soil and Water Conservation Board⁶⁴ oversees a robust flood mitigation program aimed at managing floodwaters through the construction of more than 2,000 floodwater-retarding structures or dams in Texas. These earthen dams, built with the assistance of the U.S. Department of Agriculture's Natural Resources Conservation Service, reduce floodwater velocity and protect lives and property. With an increasing need for maintenance and rehabilitation due to aging infrastructure and rapid urbanization, the Texas State Soil and Water Conservation Board administers grants to soil and water conservation districts and other local sponsors (local units of government) for operation, maintenance, and

structural repairs to ensure the safety and effectiveness of these vital flood mitigation structures. Agency staff also participate in each of the 15 regional flood planning groups as non-voting members.

United States Geological Survey

The U.S. Geological Survey developed the Flood Decision Support Toolbox⁶⁵ in collaboration with the federal Interagency Flood Risk Management team, consisting of the U.S. Geological Survey, FEMA, U.S. Army Corps of Engineers, and National Weather Service. The toolbox is a comprehensive resource that utilizes digital geospatial flood inundation mapping to assist in making informed decisions regarding flood risk management. It encompasses various tools and functionalities aimed at enhancing flood preparedness, communication, warning systems, response strategies, and mitigation efforts, enabling officials to assess and prioritize flood-related actions (USGS, n.d. b).

10.2 Challenges

During the inaugural cycle of regional flood planning, several challenges emerged that highlighted opportunities for focus and growth in subsequent planning cycles. The most prominent identified challenges include the following:

- Uncertainties surrounding predicting future flood risks
- Engaging rural areas and evaluating their flood risk
- Difficulty integrating nature-based solutions into flood risk reduction solutions
- Obtaining information regarding the condition of major flood infrastructure
- Challenges associated with computing benefit-cost ratios
- Limited community/public engagement and participation

⁶⁴ www.tsswcb.texas.gov/programs/flood-control-program

⁶⁵ www.webapps.usgs.gov/infrm/fdst/?region=tx

Feedback from the planning groups was instrumental in our understanding of the first planning cycle and, together with the TWDB's own experiences and observations, informed preparations for the second planning cycle, as described in this section. The Texas Legislature's charge to develop the first state flood plan within three years was an immense challenge. Embracing the lessons learned, the TWDB recognizes that each challenge presents an opportunity for growth, innovation, and improvement in the evolution of Texas' flood planning process.

10.2.1 Uncertainty associated with future flood risk

To help guide development of their flood plans, it was important that the regional planning groups also look ahead to consider future flood risks. Accordingly (see Chapter 4), the regional flood planning groups were required to perform flood risk analyses looking 30 years into the future, which included three components:

1. Determining the location, magnitude, and frequency of flooding
2. Identifying who and what might be harmed within the region
3. Identifying vulnerabilities of communities and critical facilities

Forecasting future flood risk under any circumstances is difficult due to variables like weather patterns, topography (e.g., subsidence), sea level rise, land use changes, and human activities. Flood data primarily relies on historical records and assumptions about future scenarios, potentially not accounting for a shifting climate. Accurate flood risk predictions depend on models using these assumptions under varied conditions. However, uncertainty prevails, as assumptions may not always align with actual future events, like extreme weather or demographic shifts, affecting the precision of flood risk forecasts (Meresa and others, 2021).

For regional flood groups that lacked detailed flood risk information for existing conditions, their efforts to forecast *future* flood risk were especially challenging, despite several alternative approaches that were offered for their use.

To improve the overall quality of future condition flood risk analyses, ensure more consistent statewide consideration of future flood risk, and reduce the effort and cost required to do so, the TWDB funded a project to develop and provide regional flood planning groups with a comprehensive statewide future condition flood hazard dataset for the year 2060. This dataset will consider probable land use changes, future climate, sea level rise, and land subsidence. Like the existing flood risk data provided to the planning groups by the TWDB during the first planning cycle, the future condition flood risk data will include complete, but approximate, flood risk coverage for Texas developed from nationwide 2-D hydrodynamic modeling. Although this data will be considered approximate, it will be available to the flood planning groups for their use during the second cycle of regional flood planning and the 2029 regional flood plans.

10.2.2 Small, remote, and rural communities

The definition of "smaller communities" utilized by the planning groups included factors like low population, rural jurisdictions, socioeconomic disadvantages, or areas of persistent poverty. Each planning group used the definition it considered most appropriate for its region yet still identified several significant challenges in striving to involve small, remote, and rural communities in the flood planning process.

First, these communities often face barriers to engaging in basic floodplain management and flood risk mitigation. Due to limited funding, a lack of revenue streams, and stiff competition for state and federal support, many started the planning cycle with less flood risk information. Secondly, the planning groups grappled with accurately

identifying flood risk and mitigation strategies for these communities due to outdated or absent models, data gaps, and limited local resources. Finally, there was relatively low engagement in the regional flood planning process, which was not entirely surprising due to their limited resources, and this required significant outreach efforts by the flood planning groups.

The planning groups were challenged with finding current flood risk information like hazard mapping or flood modeling for smaller, remote areas within their regions. Across many rural areas, the planning groups identified large gaps in current flood data, which made identifying or describing flood risk difficult in the regional plans. Even with the flood data quilt provided by the TWDB, many regions had to extrapolate their flood risk based on limited data and models that inaccurately reflect their risks.

Many communities in smaller, resource limited, or rural areas do not have any dedicated or regular funding sources for stormwater infrastructure or floodplain management activities. For example, more sparsely populated regions or those where the majority population has a household income below the state median often face an uphill battle to identify their needs and obtain resources to do so. There may also be limited knowledge of funding sources and/or a lack of expertise or resources to apply for available state and federal funding programs. Unlike other infrastructure types, flood projects typically do not generate revenue, making flood mitigation even more difficult for these resource-limited communities. Even communities able to apply for state and federal funding do so in an extremely competitive environment.

As a result, and even within the new regional flood planning process, many planning groups considered the detailed requirements difficult for smaller, rural communities to elevate a flood management study to a flood mitigation project or constructable infrastructure.

Accordingly, 14 of the 15 flood planning groups recommended some form of directed assistance towards smaller communities for floodplain management (see Chapter 2 policy recommendations). Engaging and supporting rural entities will likely require a sustained and resourced effort to assist these communities in addressing their unique flood risks.

10.2.3 Integrating nature-based solutions

Nature-based solutions are included in 14 of the 15 regional flood plans. Nature-based solutions are sustainable planning, design, environmental management, and engineering practices that weave natural features or processes into the built environment to promote adaptation and resilience (FEMA, 2021). Some examples of nature-based solutions with flood risk reduction benefits include floodplain preservation, dual-use stormwater parks such as detention areas used for sports fields or recreation areas, interconnected systems of natural areas and open space, rainfall capture, and coastal solutions such as living shorelines, wetland restoration, etc. These solutions not only help to reduce the risk of flooding but may also provide other co-benefits, like improving water quality, enhancing biodiversity, reducing heat island effects, offering aesthetic value, and providing recreational opportunities for communities.

Several planning groups noted challenges to recommending more flood risk reduction solutions that incorporated nature-based components. These included the following:

- Inadequate incentives and funding for land conservation easements, property acquisitions, and buyout programs
- The need for expert guidance on designing and implementing projects that incorporate nature-based solutions
- The need for guidance on inclusion of land preservation/conservation projects

To assist communities and the regional flood planning groups during the second cycle of flood planning, the TWDB is implementing a flood priority research project (expected to be completed April 2025) to consolidate guidance on the use of nature-based flood mitigation solutions into a single, statewide manual for Texas. With the manual, the TWDB aims to make it easier to address flood risk through nature-based solutions or to employ nature-based solutions in combination with traditional flood mitigation infrastructure. More focused, practical guidance that considers the efficacy of nature-based solutions within the various geographic regions of Texas is needed to support regional and statewide flood planning efforts and to help Texas communities better understand and utilize these approaches.

The project will examine and describe the efficacy and cost effectiveness of various nature-based solutions for different regions in Texas. The focus of this research is to identify the range of nature-based solutions best suited for floods of varying magnitudes; the types of associated flood mitigation benefits, including additional co-benefits within social, ecologic, and economic categories; and the various methods by which these benefits may be described and quantified.

10.2.4 Assessing existing major flood infrastructure

Regional flood planning groups were required to evaluate the condition and adequacy of flood mitigation infrastructure for their regions. They did so by inventorying the existing major flood infrastructure within each planning region and assessing, as best as they could, the functionality and condition of the identified infrastructure. This requirement is intended to assist the planning groups in making informed decisions regarding where investment may be needed to address existing deficiencies, enhance functionality, and ensure that Texas' prior investments in infrastructure perform as designed to protect against the risk and impact of flooding. The first cycle of regional flood planning produced a robust cata-

log of existing flood infrastructure—both natural and constructed—across the state. However, it became apparent that assessing the condition and functionality of existing infrastructure was a difficult task for the regional flood planning groups to perform.

One of the primary limiting factors was that the planning groups and their technical consultants had to rely on available data from local entities regarding their existing infrastructure conditions. The flood planning groups do not have the resources to identify and assess individual flood infrastructure components in the field and, therefore, must rely on infrastructure owners in the region. Depending on each entity's resources, level of expertise, and engagement in the process, many did not or could not provide useful information to the planning groups regarding the functionality of their infrastructure.

To assist local entities and the planning groups in future flood planning cycles, the TWDB funded a flood priority project to develop planning-level infrastructure condition assessment methods for local entities to use and provide to the planning groups. This includes a toolkit for assessing the condition of flood infrastructure at a regional planning level for future planning cycles. Once the toolkit is developed, it is expected that regional flood planning groups and local entities will be better able to assess the condition and functionality of major flood infrastructure and build upon the initial inventory developed during the first planning cycle.

10.2.5 Benefit-cost analysis

Benefit-cost analysis is a method that determines the future risk reduction benefits of a hazard mitigation project and compares those benefits to its costs. By comparing the benefits and costs, the benefit-cost analysis process helps decision-makers determine if the project is economically viable and whether the benefits are worth the costs. Projects with a benefit-cost ratio of 1.0 or greater are generally considered cost



The City of Nassau Bay, Texas, received Flood Mitigation Assistance grant funding to acquire repetitive loss structures and elevate homes

effective because the benefits are expected to outweigh the cost.

The process of conducting a benefit-cost analysis typically involves identifying and measuring the benefits and costs associated with the project. Benefits include factors like reducing the likelihood of damage or loss of life, while costs include the financial expenses needed to implement the project and provide long-term maintenance (FEMA 2023).

During the first cycle of regional flood planning, several of the flood planning groups encountered significant challenges with integrating the benefit-cost analysis into their flood mitigation project evaluations. Anticipating this potential issue, the TWDB had already funded and guided the development of a user-friendly benefit-cost analysis tool in the form of a spreadsheet that works in conjunction with the FEMA Benefit-Cost Analysis Toolkit.⁶⁶ This tool was completed in time for the first cycle and shared with the planning groups and their technical consultants to meet the associated planning requirements.

⁶⁶ www.fema.gov/grants/tools/benefit-cost-analysis#toolkit

The complexity and limits of the analysis remained particularly pronounced for non-structural projects, where the benefits were more difficult to quantify than structural projects. For example, some groups found that traditional benefit-cost analyses often fell short in adequately scoring certain projects and that the existing criteria failed to adequately recognize the full scope of benefits from stormwater and flood-related solutions.

A general sentiment emerged that there was a need to revise and broaden the benefit-cost analysis criteria to better capture benefits from certain types of flood mitigation solutions. Some planning groups and local entities perceived the benefit-cost analysis requirement as a stumbling block, hindering them from recommending potentially beneficial flood mitigation projects.

Planning groups were encouraged to recommend projects with a benefit-cost analysis of 1.0 or greater, because a benefit-cost ratio greater than 1.0 is frequently a requirement for state and federal financial assistance. However, the TWDB permitted the planning groups to recommend flood risk reduction solutions with benefit-cost

ratios less than 1.0 in their regional flood plans if additional justification was provided.

In its ongoing efforts to improve the quality of benefit-cost analyses for flood risk mitigation solutions, the TWDB contracted with a consultant to develop benefit-cost analysis guidance⁶⁷ that identifies easier and scalable approaches to benefit-cost analysis and an expanded range of damage/benefit tables to support communities and professionals. This includes detailed benefit-cost analyses for specific, identified projects seeking financial assistance as well as broader benefit-cost analyses for general planning purposes. This guidance document will be available in 2024.

10.2.6 Public outreach and participation

Many flood planning groups reported low response rates to their community outreach efforts regarding information about current floodplain management practices, existing infrastructure, existing flood hazard, and a flood mitigation financing survey. The lack of engagement and limited participation in the regional flood planning process may be attributed to several causes:

- This was the first cycle of an entirely new state flood planning effort.
- The regional flood plans were developed within a short timeframe and mostly during a global pandemic.
- While the regional flood planning groups held more than 550 public meetings (all with opportunities for public comment and input), most were necessarily virtual, which likely discouraged some potential participants.

During the first flood planning cycle, much of Texas experienced drought conditions ranging in severity from abnormally dry to exceptional drought.⁶⁸ Flooding was likely not top of mind

for many Texans during this period. For those reasons, it is not surprising that it was difficult to deploy robust outreach and engagement to all Texas communities, especially those in more rural or remote areas. In addition, many smaller, remote, or rural communities may have a limited role in floodplain management in their areas, often due to lack of resources, so participation in regional flood planning was not made a priority.

In response to these factors, stakeholder surveys, and information contained in the regional flood plans, there appears to be a desire for a comprehensive guide on stakeholder outreach and engagement as well as a need for more concentrated effort on the behalf of all participants, including the TWDB, to expand awareness about flood planning and increase stakeholder engagement at all levels.

Aside from providing greater grant funding and a longer timeframe to complete the next regional plans, the TWDB is considering several options to further assist and support the regional flood planning groups in their efforts to increase participation in the flood planning process. One idea is to facilitate or support an online workshop where planning group sponsors, chairs, and technical consultants can share their best practices and lessons learned.

10.3 Looking ahead

The first cycle of regional and state flood planning laid a solid foundation for future flood planning efforts. The TWDB will continue to value stakeholder input and work hard to provide strong support and innovative resources to the regional flood planning groups. The TWDB intends to ensure that future flood planning efforts deploy state funds efficiently and that planning groups successfully and meaningfully mitigate existing and future flood risk in the state.

⁶⁷ www.twdb.texas.gov/flood/research/benefit-cost-analysis-guidance/index.asp

⁶⁸ www.drought.gov/states/texas

10.3.1 Identifying and recommending flood risk reduction solutions

During the first cycle of regional flood planning, the TWDB and the regional flood planning groups faced an expedited timeframe, during which the planning groups were expected to identify, evaluate, and recommend flood risk reduction solutions in their 2023 regional flood plans. A flood project can only receive funding through the Flood Infrastructure Fund if it's recommended in the state flood plan. Many stakeholders expressed the desire to have a greater opportunity to develop projects for recommendation in the regional plans, which will become part of the state flood plan. In response, the TWDB extended and expanded the grant contracts by providing the planning groups with an additional \$10 million in funding and six extra months to amend their initial plans with more projects. Allowing the planning groups to amend their initial regional flood plans resulted in roughly tripling the number of projects for inclusion in the state flood plan. In total, the planning groups added 763 flood management evaluations, 410 flood mitigation projects, and 51 flood management strategies.

The second cycle of regional and state flood planning will provide the planning groups with the benefit of a longer planning period in which they will build on the information gathered during the first cycle. The next cycle will also benefit greatly from the updated agency rules and technical guidance that the TWDB has since developed based on lessons learned. We look forward to seeing more flood risk evaluations and recommended flood mitigation solutions in the next set of regional flood plans.

10.3.2 Additional assistance for smaller and rural communities

The first cycle of regional and state flood planning made clear the inherent challenges in involving small, remote, and rural communities in the regional flood planning process. For example, some smaller communities experienced difficulties in procuring the appropriate or sufficient

flood risk information required for planning groups to recommend flood mitigation projects on the communities' behalf that would also meet statutory requirements. As a result, the planning groups reported a significant need for many flood management evaluations to assess flood risks and, in turn, identify potential projects to mitigate that risk.

To address the unique challenges faced by small and rural communities, the TWDB has introduced and is expecting to implement two initiatives during the second planning cycle. The first is additional planning group grant funding (made available through 2023 appropriations from the Texas Legislature) to enhance the scope of work to perform additional flood management evaluations. Second, the TWDB obtained additional funding and agency staff capacity from the 88th Texas Legislature to create a new flood management evaluation initiative. The TWDB will perform a limited number of flood risk studies, *as identified and selected by the regional flood planning groups*, and provide the results, including potential flood mitigation project information, to the respective regions and communities for their consideration. Both initiatives are designed to help the planning groups identify and recommend new flood risk reduction solutions for smaller and rural entities.

Due to the large number of studies identified, the regional flood planning groups will select which evaluations to pursue with study oversight from the TWDB to maximize the volume of studies that can be performed with the limited funding while ensuring technically credible results.

10.3.3 Flood planning and floodplain management awareness

The next cycle of regional flood planning promises to be more comprehensive and robust for several key reasons. First, it is anticipated that general awareness of the flood planning process is growing across Texas thanks to the first cycle of flood planning and the ongoing Flood Infra-

structure Fund program. As the program progresses, the TWDB hopes to continue reaching all communities across the state, including the most remote and underserved areas. Widespread understanding, knowledge, and engagement will help ensure that more communities, particularly in small, remote, and rural regions, will actively participate in developing flood risk reduction solutions for their own areas.

The important linkage between state flood funding and participation in the regional planning process is becoming clearer to stakeholders. As the second intended use plan of the Flood Infrastructure Fund is released in 2024, Texas communities will better understand that to qualify for flood evaluation and project funding opportunities through the Flood Infrastructure Fund, their projects must be recommended in both the regional and state flood plans. This direct tie between funding and planning participation will likely act as a strong incentive to motivate communities to be proactive in both their local and regional flood planning efforts. Implementing flood mitigation solutions on the ground is the best way to draw in participation to the regional planning process, which is already reflected in stakeholders' growing interest.

Lastly, although none of the regional flood planning groups mandated communities to adopt specific floodplain management standards to be able to incorporate their flood risk reduction solutions in the regional flood plans, communities will have greater awareness of and access to floodplain discussions, management best practices, and associated recommendations for their region. With a deeper understanding and, hopefully, involvement in the planning process and access to floodplain management for their region, the expectation is that communities will establish effective floodplain management systems to reduce existing flood risks and avoid increasing future flood risk.

10.3.4 A guide to state and local flood control policies

As the state's guide to state and local flood control, the policy and floodplain management recommendations contained in this 2024 State Flood Plan will likely lead to discussions, new initiatives, and potentially direct funding for important flood mitigation activities. The TWDB is committed to exploring and implementing any of the Chapter 2 recommendations or any other state flood initiatives that the Texas Legislature prioritizes.

References

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A flood gage at a low water crossing in Cedar Park, Texas