

Chapter 3: Floodplain Management Practices and Flood Protection Goals

Task 3A – Evaluation and Recommendations on Floodplain Management Practices (361.35)

The Region 3 (Trinity) Regional Flood Planning Group (RFPG) solicited local entity and public input in the development of floodplain management practices and flood protection goals for the Trinity Region. During the Trinity RFPG’s Summer 2021 data collection effort, 90 communities and counties provided feedback on these specific topics, which represents 28 percent of the region. Public input included written and oral comments at planning group meetings in June, August, and September 2021, as well as interactive polling. In addition, the recommended floodplain management practices were posted to www.trinityrfpg.org and an email was sent to the distribution list encouraging interested parties to provide input and feedback by October 27, 2021. The North Central Texas Council of Governments (NCTCOG) also sent a similar email to its distribution list encouraging participation.

The region’s data collection effort included requests for local floodplain ordinances and court orders. The following section of this report focuses on cities and counties as these are the entities with the ability to adopt and enforce floodplain ordinances and court orders. As of September 16, 2021, the Trinity RFPG received 48 floodplain management documents from the data collection effort. Additional research resulted in the identification and collection of five additional ordinances on entity websites. The Texas Water Development Board (TWDB) provided floodplain ordinances, as well as a summary of the Texas Floodplain Management Association’s (TFMA’s) 2018-19 Higher Standards Survey results by those entities who participated.

Extent to which Current Floodplain Management and Land Use Practices Impact Flood Risks

Floodplain management and land use practices were examined by looking at regulations, policies, and trends in the region. The purpose of these management practices is to help with protection of life and property. Floodplain management and land use practices vary from one entity to another. Most communities in the region follow rules and policies of the Federal Emergency Management Agency (FEMA), who manages the National Flood Insurance Program (NFIP) where the minimum standards for development in and around the floodplain can be found.

In 1968, Congress established the NFIP through the National Flood Insurance Act of 1968 to provide federally subsidized flood insurance protection (FEMA, 1968). The program has been updated multiple times since then to strengthen the program, provide fiscal soundness, and better inform the public of flood risk by the publication of insurance rate maps. Title 44 of the Code of Federal Regulations (44 CFR) includes the rules and regulations of the program. Title 44 CFR, Part 60 establishes the minimum criteria that FEMA requires for NFIP participation, which includes identifying special flood hazard areas (SFHA) within the community (CFR, 2011).

The Biggert-Waters Flood Insurance Reform Act of 2012 authorized and funded the national mapping program, as well as rate increases to transition the NFIP into a fiscally sound program (PL 112-141, 2012). The increases in flood insurance rates were intended to move the program to full actuarial rates that reflect the flood risk, as opposed to subsidized rates. In 2019, five federal regulatory agencies issued a joint final rule regarding Biggert-Waters that required regulated lending agencies to accept private flood insurance that meets specific criteria defined in the act (OCC, 2019). Private flood insurance providers offer more coverage options compared to the NFIP, including higher dollar amounts for maximum building coverage, a shorter waiting period for policies to become effective, and competitive rates (National Flood Insurance, 2020). However, private flood insurance is not backed by the federal government, which means the money needed for flood repairs may be at risk when a policy holder files a claim. The private flood insurance option provides competition in the market where consumers can shop around and compare rates. Whereas the NFIP option rate for a particular property remains the same no matter the provider, which eliminates the need to shop around for a better rate.

Cities and counties work with FEMA to create and update Flood Insurance Rate Maps (FIRMs) and the flood water surface elevations to define SFHA along rivers, streams, lakes, and coastal areas. Communities that participate in the NFIP are required to use the FIRMs and flood water surface elevations provided in their floodplain permitting processes. Insurance agents use FIRMs to determine flood risk, which determines the flood insurance policy rate for individual properties.

Cities and counties have the authority to establish their own policies, standards, and practices to manage land use in and around areas of flood risk. NFIP participating communities have the responsibility and authority to restrict development in SFHAs to help protect areas from potential flooding. They can also adopt and enforce higher standards than the FEMA NFIP minimum standards to further reduce flood risk to people and property. FEMA supports and encourages entities to establish higher standards to reduce flood risk to life and property.

Residents and businesses in cities and counties who participate in the NFIP program can purchase NFIP flood insurance to reduce the economic impacts of floods (FEMA Flood Insurance, 2021). Renters may also purchase NFIP “contents only” flood insurance policies to cover the cost of their belongings in the event of flood damage. NFIP participation also makes

the community eligible for disaster assistance following a flood event (FEMA Floodplain Management, 2021).

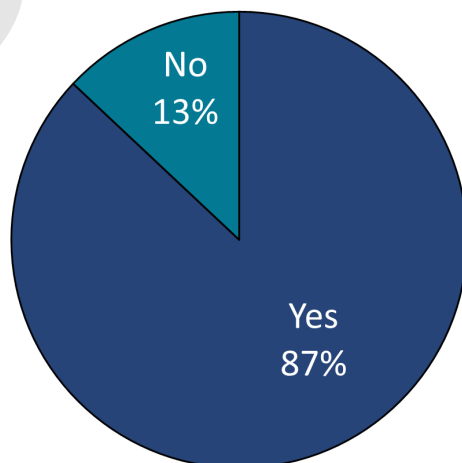
Existing Population and Property

Multiple resources were considered in determining the extent to which current floodplain management and land use practices impact flood risk to existing population and property. Cities and counties can establish floodplain regulation and permitting by ordinance or court order, respectively. Not all entities with flood responsibilities are eligible to participate in the NFIP program. Only cities and counties are eligible to participate in the NFIP program. Therefore, the tables and figures included in this section of the report are limited to cities and counties.

Appendix A includes a list of all cities and counties within the Trinity Region with information regarding their floodplain management programs.

Communities that participate in the NFIP are required to have a floodplain ordinance or court order that meets or exceeds the NFIP minimum standards (FEMA Flood Insurance Rules & Regs, 2021). As of October 2020, 288 cities and counties in the Trinity Region participate in the NFIP and have floodplain ordinances that meet or exceed the NFIP minimum standards (FEMA, 2021). Approximately 87 percent of the communities in the Trinity Region have floodplain ordinances that meet the criteria. All counties within the Trinity Region participate in the NFIP; however, 40 cities within the region do not participate in the NFIP. Of those 40 cities, the Trinity RFPG found five entities who have adopted minimum regulations pursuant to Texas Water Code Section 16.3145 that appear to meet or exceed the NFIP minimum standards. Thus, the Trinity Region has a total of 293 entities (89 percent) with floodplain regulations that meet or exceed the NFIP minimum standards. **Figure 3.1** shows the percentage of entities within the region that participate in the NFIP.

Figure 3.1: Percentage of National Flood Insurance Program Participating Entities in Trinity Region



In support of the NFIP, the 77th Texas Legislature amended Subchapter 1, Chapter 16 of the Texas Water Code with the addition of Section 16.3145 that states, “the governing body of each city and county shall adopt ordinances or orders, as appropriate, necessary for the city or county to be eligible to participate in the NFIP, not later than January 1, 2001.” (TWDB, 2001) TWDB’s Flood Infrastructure Fund (FIF) requires that the area served by the proposed study or project must have and enforce floodplain regulations that meet or exceed the NFIP minimum standards (TWDB FIF, 2021). ***TWDB-Required Map 13*** is located in ***Appendix B***.

Higher Standards

The NFIP establishes minimum standards that a city or county must meet to be eligible to participate in the NFIP. The minimum standards require buildings to be constructed at or above the base flood elevation (BFE), provide for floodproofing as an option for nonresidential buildings, and mandate provisions specific to the elevation and anchoring of manufactured houses (CFR, 1976). The BFE is the anticipated water surface level that has a one percent chance of being equaled or exceeded in any given year (FEMA Glossary, 2021); that is, the 1-percent annual chance event (ACE) water surface elevation. In many cases, minimum standards may be based on maps that were developed with outdated topography, rainfall, and runoff data. Therefore, adopting minimum standards based on these sources may result in protection from flood damages that is less than the NFIP intends.

According to the TWDB Exhibit C guidance document, the term “higher” standard is defined as freeboard, detention requirements, or fill restrictions. FEMA defines freeboard as additional height above the BFE that provides a factor of safety when determining the minimum elevation of the lowest floor (FEMA Glossary, 2021). The TFMA performs a Higher Standards Survey every year of cities and counties to document which entities have adopted higher development standards. According to the TFMA Higher Standards Survey results for 2019-2020, 104 entities within the Trinity Region self-reported as having freeboard one or more feet above the BFE for current and/or fully developed conditions (TFMA, 2020).

The Trinity RFPG performed a data collection effort in Summer 2021. A question was included regarding the description of the higher standards required by the entity. The BFE is typically shown on FEMA FIRMs and in associated Flood Insurance Studies, and/or models. However, the BFE can be based on localized data developed by the community that may not be incorporated into a FEMA mapping product. The survey response options included in the data collection question were:

- At or above current BFE
- BFE plus one foot (current 1-percent ACE conditions)
- BFE plus one foot (future 1-percent ACE conditions)
- BFE plus two feet (current 1-percent ACE conditions)

- BFE plus two feet (future 1-percent ACE conditions)
- BFE plus three feet (current 1-percent ACE conditions)
- Blank/unknown

In a few instances, the number provided in the survey response differed from the number provided in the TFMA response. In these situations, the Trinity RFPG reviewed the floodplain ordinances to determine the appropriate response. The Trinity RFPG also searched and reviewed online ordinances for missing communities. Otherwise, the information provided in **Table 3.1** relies heavily on self-reported information to provide a summary of the entities with higher standards associated with freeboard at or above the BFE. **Figure 3.2** demonstrates the freeboard requirements for the cities within the region. **Figure 3.3** shows the freeboard requirements for each of the counties in the Trinity Region. The county freeboard requirements are effective in areas outside city boundaries. In some cases, extra territorial jurisdictions (ETJs) may be required to follow the city freeboard requirements depending on the specifics included in the city’s ordinance.

Table 3.1: Summary of Freeboard Requirements for Communities in Trinity Region

Freeboard	Current 1% ACE Conditions	Future 1% ACE Conditions
At or above current BFE	72	4
BFE + 1 foot	25	9
BFE + 1.5 feet	1	1
BFE + 2 feet	164	42
BFE + 3 feet	9	3
Total	271	59

Source: Trinity Region data collection survey results as of September 16, 2021

Of the entities that require freeboard, the majority use the BFE plus two feet for current conditions. Fewer entities have future 1-percent ACE condition information; however, many of those entities require two feet of freeboard above the current BFE.

In addition, the NCTCOG developed and continues to oversee the integrated Stormwater Management (iSWM) program that recognizes cities and counties who achieve water quality protection, streambank protection, and flood mitigation, while meeting construction and post-construction requirements for Texas Commission on Environmental Quality (TCEQ) stormwater permits (NCTCOG iSWM, 2021). (NCTCOG spans a 16-county area that overlaps much of the Trinity Region in the Upper Basin from Parker County on the west side to Hunt County on the east side and from Wise County on the north side to Navarro County on the south side.) Based on the level to which a city or county participates in the program, the entity can apply for and obtain regional recognition for its effort with a bronze, silver, or gold certification.

Figure 3.2: City Freeboard Requirements

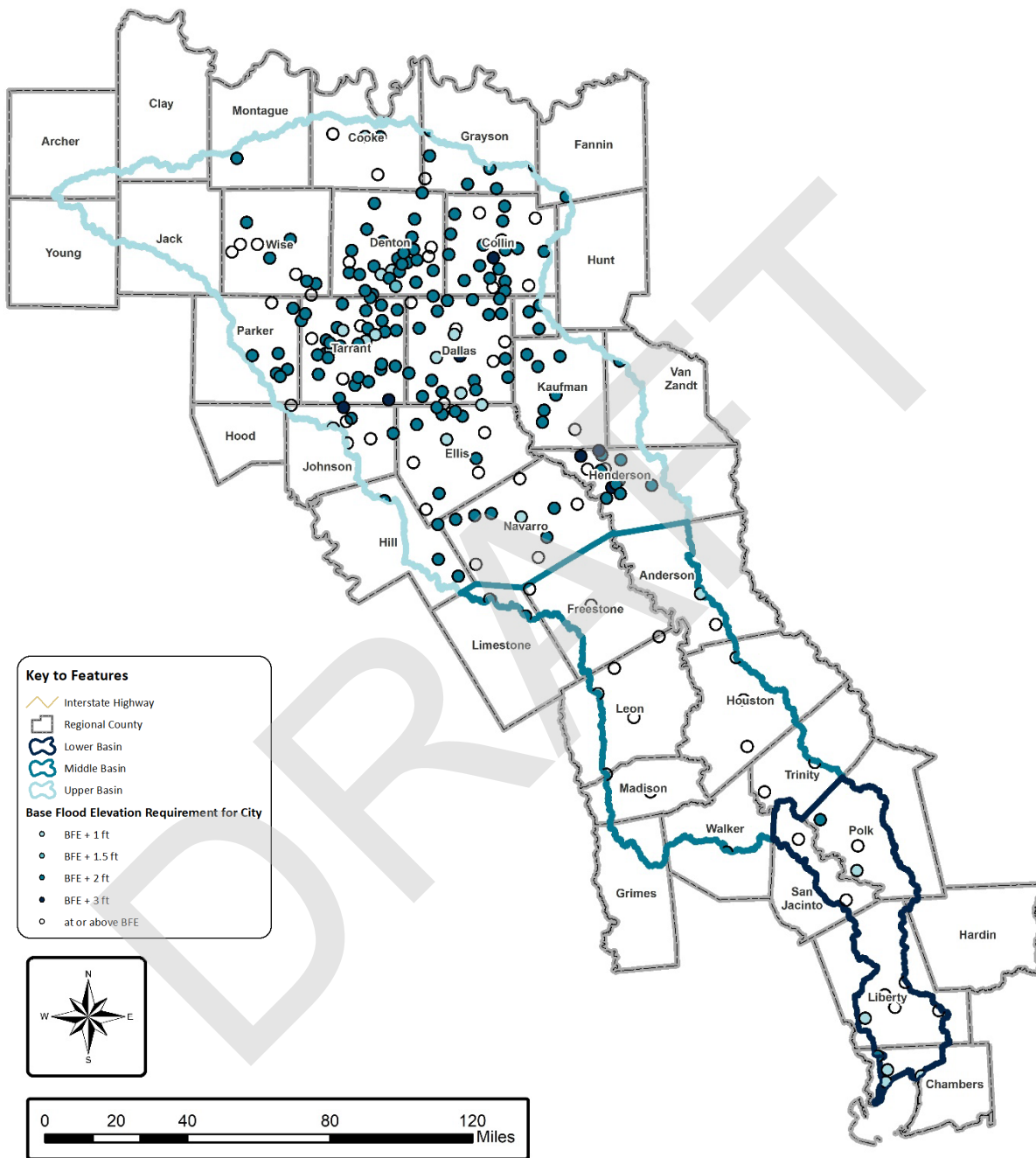
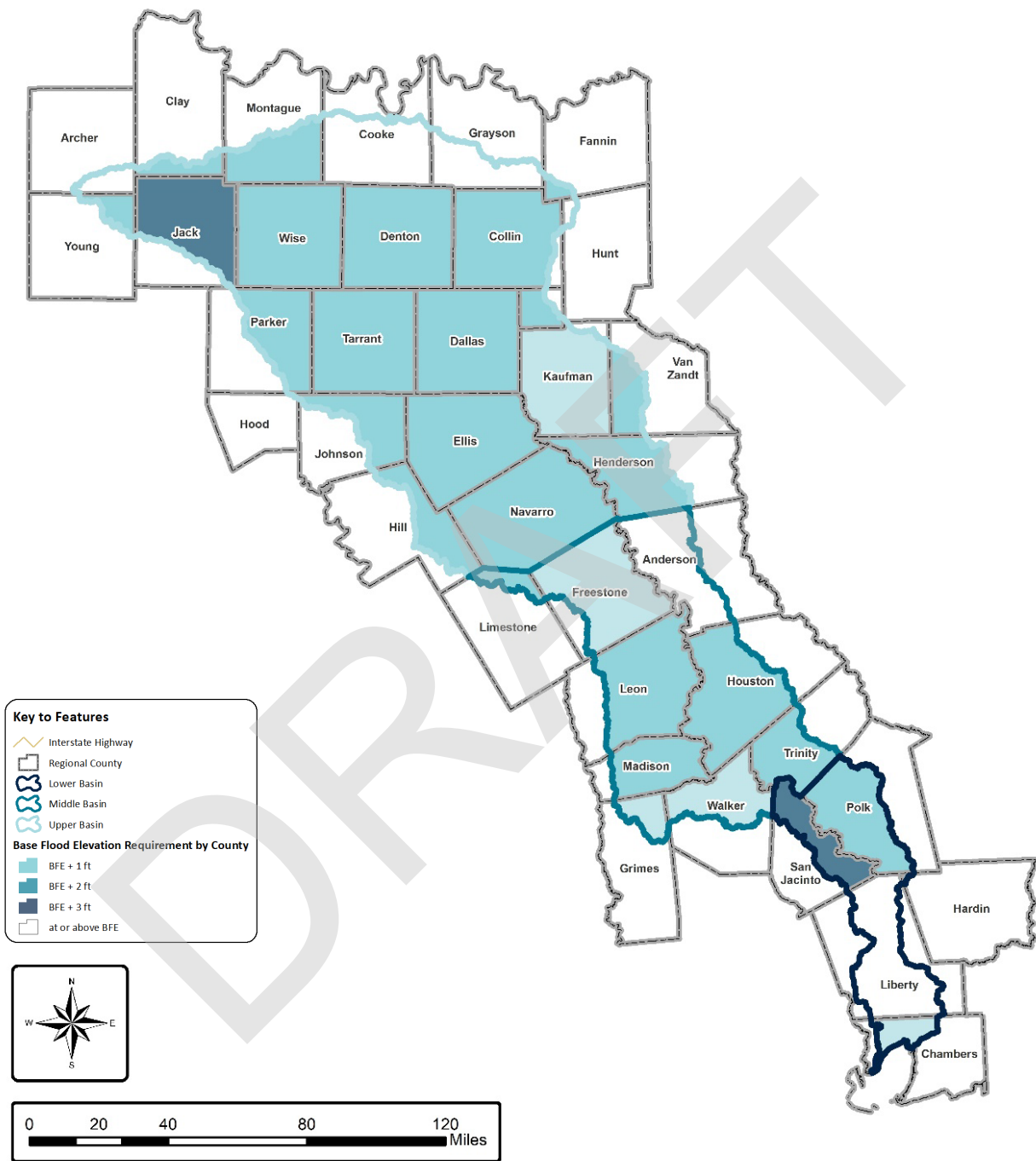


Figure 3.3: Trinity Region Freeboard Requirements by County

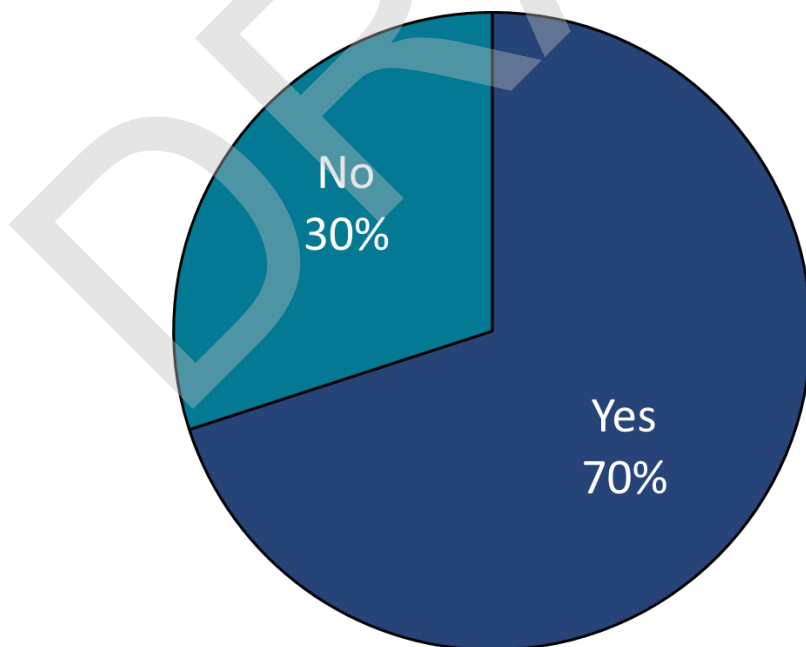


NCTCOG maintains an inventory of the iSWM participants and the elements of the iSWM program that each entity includes. The iSWM program includes detention structure discharge criteria, flood mitigation/downstream assessments, and/or finished floor elevations that are relevant to the TWDB’s definition of higher standards for this regional flood plan. The NCTCOG information was considered in determining the number of entities within the region with higher standards as defined by the TWDB.

In 2017, NCTCOG hosted two Countywide Watershed Management roundtable discussions and presentations (NCTCOG Countywide Watershed Standards, 2017). NCTCOG also performed a survey of the 16 counties within their area. The discussion and input resulted in the development of a document that specifies 13 regionally recommended standards for new development within county-regulated areas. The document includes a sample resolution that counties can use to enact their authority to regulate development within the floodplains. Some higher standards include requiring freeboard for fully developed conditions, maintaining valley storage, protecting against erosive velocities, and matching pre-development site runoff.

In all, 231 of the 328 cities and counties require some form of higher standards. **Figure 3.4** demonstrates that more than two-thirds of the region’s entities require some form of higher standards, whether it be elevation requirements, detention requirements, and/or fill restrictions.

Figure 3.4: Percentage of Entities that Require Higher Standards



Source: Trinity Region data collection survey results as of September 16, 2021 and additional Trinity RFPG research

Within the NFIP, FEMA manages the Community Rating System (CRS) program. The CRS program is a voluntary program in which cities and counties can participate (FEMA CRS, 2021), (FEMA CRS Manual, 2021). The more flood risk reduction activities in which an entity participates, the more points it earns. The points translate to a CRS score that ultimately provides residents and businesses within the jurisdiction the opportunity to receive a discount on flood insurance premiums. The flood insurance savings encourages residents and businesses to purchase flood insurance to protect buildings and contents.

Twenty entities within the region participate in the CRS program (FEMA, 2021). These communities have a CRS class ranging between five and 10 and represent a 25 percent to 0 percent savings on flood insurance premiums, respectively. Per TWDB Technical Guidance, these communities qualify as having “Strong” floodplain management standards. The list of CRS participating entities is provided in **Table 3.2**.

Table 3.2: Trinity Region Cities and Counties Participating in Community Rating System Program

Entity	CRS Class	% Discount for Structures within SFHA	% Discount for Structures Located Outside the SFHA
Arlington, City of	6	20	10
Benbrook, City of	7	15	5
Burleson, City of	9	5	5
Carrollton, City of	6	20	10
Coppell, City of	8	10	5
Dallas, City of	5	25	10
Denton, City of	8	10	5
Denton County	10	0	0
Duncanville, City of	8	10	5
Flower Mound, City of	8	10	5
Fort Worth, City of	8	10	5
Garland, City of	7	15	5
Grand Prairie, City of	5	25	10
Haltom City, City of	8	10	5
Hurst, City of	8	10	5
Lewisville, City of	9	5	5
North Richland Hills, City of	7	15	5
Plano, City of	8	10	5
Richardson, City of	8	10	5
Richland Hills, City of	8	10	5

Source: FEMA CIS Report as of October 1, 2020

Part of the Summer 2021 data collection effort included a question that asked survey participants to select the description that best represented their impression of their enforcement of their floodplain regulations.

TWDB Exhibit C Guidance document described enforcement activities as the following:

- High – actively enforces the entire ordinance, performs many inspections throughout construction process, issues fines, violations, and Section 1316s where appropriate, and enforces substantial damage and substantial improvement
- Moderate – enforces much of the ordinance, performs limited inspections, and is limited in issuance of fines and violations
- Low – provides permitting of development in the floodplain, may not perform inspections, and may not issue fines or violations
- None – does not enforce floodplain management regulations

Approximately 56 percent of the participants who responded to this question described their level of enforcement as being moderate or high activity. The remaining participants have a low, none, or unknown activity with regards to enforcing the floodplain regulations. These entities have a significant opportunity to improve the effectiveness of their ordinance or court order by increasing the enforcement of their existing floodplain ordinances. **Table 3.3** summarizes the survey participant responses.

Table 3.3: Survey Participant Level of Enforcement of Floodplain Regulations

Level of Enforcement	Number of Responses	Percent
High Activity	24	26%
Moderate Activity	28	30%
Low Activity	14	15%
None	11	13%
I do not know	15	16%
Total	92	100%

Source: Trinity Region data collection survey results as of September 16, 2021

The TWDB guidance defines the existing floodplain management practices as

- **Strong:** significant regulation that exceed NFIP standards with enforcement, or community belongs to the CRS
- **Moderate:** some higher standards, such as freeboard, detention requirements or fill restrictions
- **Low:** regulations meet the minimum NFIP standards
- **None:** no floodplain management practices in place

The Trinity Region rated each community and county using these definitions. Entities participating in the CRS program received a “Strong” classification for floodplain management practices. Entities that have higher standards but responded to the survey as having low levels of enforcement were typically categorized as having “Moderate” floodplain management practices unless the entity participated in the CRS program which automatically results in a “Strong” classification. For those entities who reported that they require construction to be at or above BFE, the floodplain management practice was typically classified as “Low”. If an entity had some form of higher standards as determined from other resources but did not respond to the survey or responded with “I do not know” with regards to enforcement, the floodplain management practices were categorized as “Low” unless the level of enforcement or elevation above base flood warranted a different classification. In some instances, an entity responded that its level of enforcement was “None” even though it has adopted some form of higher standards. In these situations, the floodplain management practices were ranked as “None”. **Table 3.4** summarizes the results of the floodplain management practices. **TWDB-Required Table 6** is included in **Appendix A** and provides details considered for each community and county in determining the appropriate description of overall floodplain management practices.

Table 3.4: Floodplain Management Practices for All Communities and Counties in the Trinity Region

Description	Number of Communities and Counties	Percent
Strong	35	11%
Moderate	23	7%
Low	228	69%
None	42	13%
Total	328	100%

Source: Trinity Region data collection survey results as of September 16, 2021

Local Government Code, Title 13, Subtitle A, Chapter 552 authorizes cities to establish stormwater utilities and assess stormwater utility fees, also referred to as drainage utility fees. Only cities have the authority to establish and assess stormwater utility fees. Western Kentucky 2020 data was used as the primary source for identifying cities with stormwater utilities (Western Kentucky, 2020). The Summer 2021 data collection effort included two questions regarding stormwater utilities. The responses to these questions were considered more accurate and were confirmed when the Western Kentucky data differed from the survey responses. In all, only 62 (or 22 percent) of the 288 cities within the region have established stormwater utilities.

One of the questions in the Trinity Region data collection effort in Summer 2021 asked about sources of revenue and specific stormwater utility rates, if applicable. Seventeen cities responded that they have stormwater utilities and provided their rates as of July 2021. The provided rates ranged from \$1.66 to \$13.59 per equivalent residential unit (ERU). One community responded that it has established a stormwater utility but was in the process of developing the rate.

Future Population and Property

Existing floodplain ordinances and court orders with higher standards may continue to protect future population and property as long as they are enforced. Future floodplain maps and models are anticipated to be updated with higher resolution data, best available data, and advanced modeling techniques in the years to come. The combination of applying higher standards and best available data should translate into life and property savings in the future.

Areas without flood maps and models or with outdated maps and models are at greater danger of increased flood risk in terms of future population and property development within the floodplain. Entities need comprehensive and updated maps to direct development away from flood-prone areas. Local floodplain regulations with higher standards need to be adopted and enforced to better reduce the flood risk to future population and property.

The Trinity Region encourages those cities and counties without floodplain ordinances or court orders to develop, adopt, implement, and enforce floodplain regulations that at least meet the NFIP minimum standard.

Some cities and counties have already developed watershed studies that include existing and future flood conditions. Sometimes the future flood conditions represent a future time period, often 30 years. In other cases, the future flood conditions are based on fully developed land conditions. Entities who currently apply future flood conditions as part of their design criteria essentially apply a factor of safety to better protect today's developments from future flood risks.

In the Upper Basin area of the Trinity Region, communities along the West Fork and Elm Fork of the Trinity River participate in the NCTCOG's Corridor Development Certificate program (NCTCOG CDC, 2021). The Corridor Development Certificate program is a regional approach to maintain flood capacity within the Trinity River. The Corridor Development Certificate flood model includes current conditions and future (year 2055) conditions flood discharges that must be considered for evaluating proposed projects within the Trinity River corridor.

The three primary criteria (NCTCOG Corridor Development Certificate Criteria Manual, 2021) of the Corridor Development Certificate program that proposed new development in the corridor must meet are:

- Water surface elevations do not increase for the 1-percent ACE flood elevation and no significant increase for the standard project flood elevation
- Valley storage must be maintained in the 1-percent ACE floodplain with a maximum loss of five percent in the standard project floodplain
- Channel and floodplain velocities cannot be increased

According to the United States Army Corps of Engineers (USACE), the Standard Project Flood (SPF) is the flood that may be anticipated from the most severe combination of meteorological and hydrologic conditions that are reasonably characteristic of the region (USACE Engineering Manual, 1965). The SPF flood discharges are typically 40 to 60 percent of the probable maximum flood for the basin. USACE defines the probable maximum flood as the flood resulting from the most extreme combination of meteorological and hydrological conditions that are reasonably possible for the area (USACE, 1970). The SPF represents the “standard” degree of flood control project should be designed to protect life and property.

When a project is proposed within the Corridor Development Certificate area, the applicant submits a Corridor Development Certificate Permit to the appropriate county or city. Once the floodplain administrator determines that the proposed project generally meets the Corridor Development Certificate requirements, as well as its local requirements, the floodplain administrator forwards the application to the Corridor Development Certificate reviewers, including state and federal agencies. The USACE performs detailed model analyses to confirm the proposed project meets the Corridor Development Certificate requirements. Other Corridor Development Certificate participants can review the application and supporting documentation and ask questions or raise any concerns they might have. Once the model is deemed acceptable and all concerns have been addressed to the city or county’s satisfaction, the county or city may issue the Corridor Development Certificate permit.

NCTCOG is actively working with additional jurisdictions to expand the Corridor Development Certificate program to other branches of the Trinity River, as well as the main stem of the Trinity River located downstream of where the flood model currently ends (just south of I-20 and east of Hutchins, TX). The future conditions considered in the model and the expansion of the program to other areas will provide valuable flood risk information for existing and future property, people, and infrastructure.

Future Flood Hazard Exposure

Future flood hazard exposure is assessed in **Chapter 2** of this report. This section of the report focuses on the potential impact that floodplain management and land use practices may have

in the future. Cities and counties that have and enforce floodplain regulations reduce the future flood hazard impact. As of September 16, 2021, the Trinity RFPG data collection effort revealed 34 entities have these regulations, but have a low, no, or unknown activity with regards to enforcement. The Trinity RFPG supports and encourages entities' abilities to enforce their regulations. The TWDB developed a sample Flood Damage Prevention Ordinance that communities can use as a starting point in developing their own floodplain ordinances. (TWDB NFIP, 2021)

Cities and counties that implement future land use plans consider areas of anticipated population growth and development within their communities. However, the existing and future floodplains are not necessarily a component in developing the future land use plan. (Land use planning is addressed in **Chapter 1** of this report in more detail.) Incorporating the existing and future floodplains will provide cities and counties with additional direction as to where population and development should be directed to avoid flood risk to people and property.

It is challenging to define future floodplains with complete certainty. However, one should anticipate that the future floodplains will be different from existing floodplains in some areas within the region. Maps and models are regularly being updated with new topography, survey, precipitation, runoff, and other data as development occurs in and around floodplains and the watershed. One should anticipate that the BFEs will increase in the future due to a number of conditions that are presented in **Chapter 2**. Cities and counties that require future conditions in the evaluation and modeling of proposed projects and seek to minimize the allowable increases in water surface elevations, will reduce future flood hazard to new and existing developments.

One factor of safety that can be implemented today to reduce future flood hazard exposure is freeboard. Freeboard is the term used for the additional height provided above the BFE as discussed previously. Even if the BFE changes in the future, freeboard can result in allowing the structure to remain above the future flood water surface if higher as is often the case.

The Trinity RFPG supports the use of freeboard in local floodplain ordinances and court orders. Ideally, the Trinity RFPG recommends cities and counties to adopt and enforce a minimum freeboard requirement of one foot above the BFE based on future 1-percent ACE conditions, where possible.

Another higher standard that can be implemented today that will limit future flood hazard exposure is maintaining valley storage, which is also referred to as prohibiting fill without equivalent, compensatory excavation. Maintaining valley storage aids in maintaining "no rise" in water surface elevations. Reducing a river or streams valley storage tends to increase downstream flooding. Currently, a property within the floodplain holds a certain volume of water during a flood event. After the proposed project is completed, the property must still hold the same volume of floodwater. The shape may be different, but the volume remains the

same. Maintaining valley storage allows a property owner to move dirt around on the property, while still containing the volume of floodwaters prior to the earthwork activity. If the existing soil is not suitable for construction, then soil can be replaced with appropriate soils. Typically, this is a one-to-one match meaning that for every amount of dirt brought into the floodplain, an equal amount of dirt is removed. Some communities, however, may have differing requirements on the amount of material removed and replaced.

Detention and retention ponds are often required to mitigate the impacts that impervious surfaces and more efficient drainage infrastructure have on the runoff from a developed property. The standard engineering design requirement in the Upper Basin area, within the NCTCOG area (NCTCOG ISWM Site Development Manual, 2006), is to manage runoff so that it discharges from the developed property at the existing rate that it leaves the property in its natural state. Incorporating this requirement mitigates increased runoff in the future, which in turn, can reduce future flood hazard exposure for adjacent properties. However, detention does not mitigate the increases in runoff volume associated with development activity that cumulatively can increase flood risk for properties downstream. This design criteria could be applied in other areas of the Trinity Region.

Consideration of Recommendation or Adoption of Minimum Floodplain Management and Land Use Practices

The Trinity RFPG is required to consider the possibility of recommending or adopting consistent minimum floodplain management standards and land use practices for the entire region. Recommended practices encourage entities with flood control responsibilities to establish minimum floodplain management standards over the next several years, whereas the adoption of minimum standards requires entities to have adopted the minimum standards before their flood management evaluations (FMEs), flood management strategies (FMSs), and flood mitigation projects (FMPs) could be considered for potential inclusion in the regional flood plan.

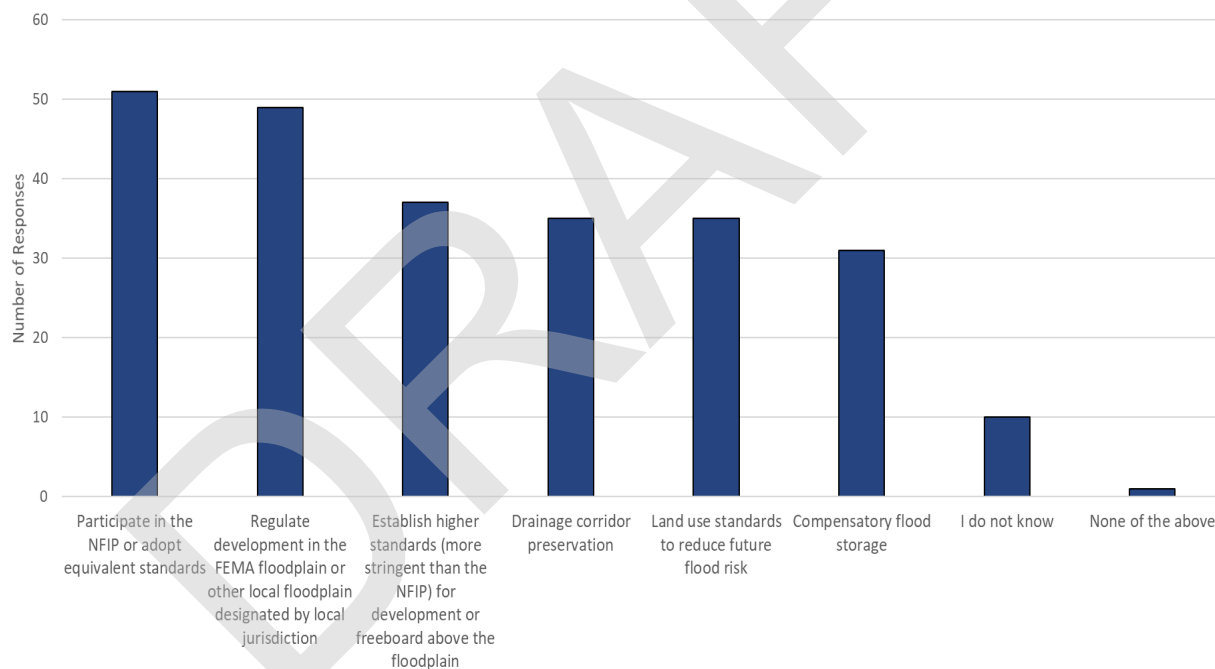
Several questions were included in the data collection effort in Summer 2021 regarding region-wide minimum floodplain management standards. Survey participants were asked if they thought the Trinity RFPG should recommend consistent minimum standards across the region. As of September 16, 2021, 95 entities responded to this question. **Table 3.5** summarizes participant responses regarding the question of recommending region-wide minimum floodplain management practices. **Figure 3.5** shows the survey responses in support of specific management practices for potential consideration by the Trinity RFPG. (Participants were able to select multiple responses.)

Table 3.5: Survey Responses for Potentially Recommending Consistent Minimum Floodplain Management Standards

Description	Number of Responses	Percent
Yes	58	61%
No	12	13%
I don't know	25	26%
Total	95	100%

Source: Trinity Region data collection survey results as of September 16, 2021

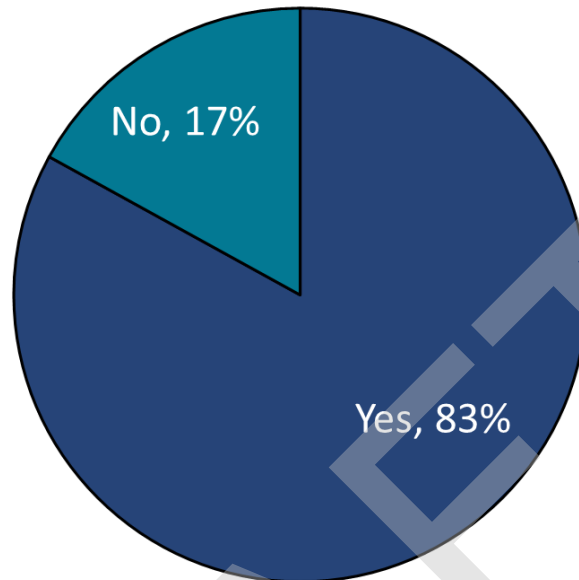
Figure 3.5: Survey Responses in Support of Potential Recommended Minimum Floodplain Management Standards



Source: Trinity Region data collection survey results as of September 16, 2021

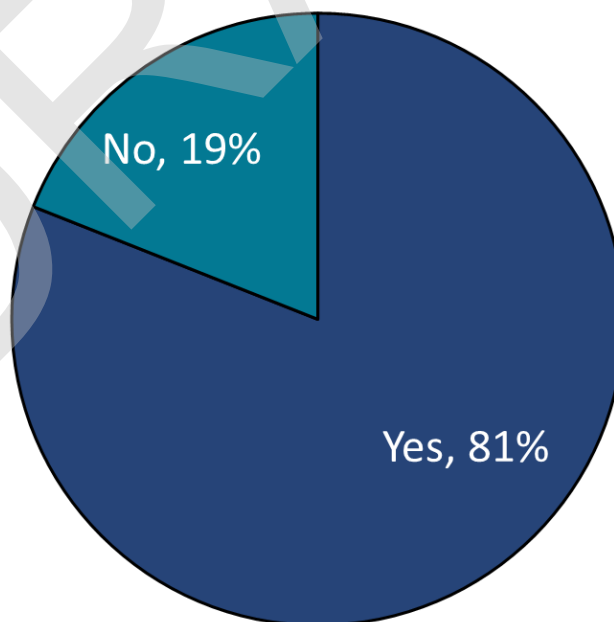
The idea of recommending consistent minimum floodplain management standards for the Trinity Region is supported by 61 percent of the survey participants. The survey participants showed significant support for entities to participate in the NFIP or adopt equivalent standards. Survey participants also expressed significant interest in local entities regulating development in the FEMA floodplain or other local floodplain designated by the local jurisdiction. **Figure 3.6** and **Figure 3.7** show the percent support of these two potential recommended minimum standards as of September 16, 2021.

Figure 3.6: Survey Participants in Support of Recommending All Entities Participate in the National Flood Insurance Program or Adopting Equivalent Standards



Source: Trinity Region data collection survey results as of September 16, 2021

Figure 3.7: Survey Participants in Support of Recommending the Regulation of Development in the Federal Emergency Management Agency Floodplain or Other Local Floodplain



Source: Trinity Region data collection survey results as of September 16, 2021

The Summer 2021 data collection also asked survey participants their opinion on whether the Trinity RFPG should adopt consistent minimum standards across the entire region. The survey question went on to clarify that such a requirement would only allow the Trinity RFPG to consider including flood mitigation solutions for those entities who currently meet the adopted/required minimum standards. Ninety-five entities responded to the question but most respondents were less committed to the idea of requiring consistent minimum standards for a flood mitigation solution to be included in the regional flood plan. **Table 3.6** summarizes the participant responses, and **Figure 3.8** shows the number of survey participants supporting specific standards.

Table 3.6: Survey Responses for Potentially Adopting (Requiring) Consistent Minimum Floodplain Management Standards

Description	Number of Responses	Percent
Yes	47	49%
No	13	14%
I don't know	35	37%
Total	95	100%

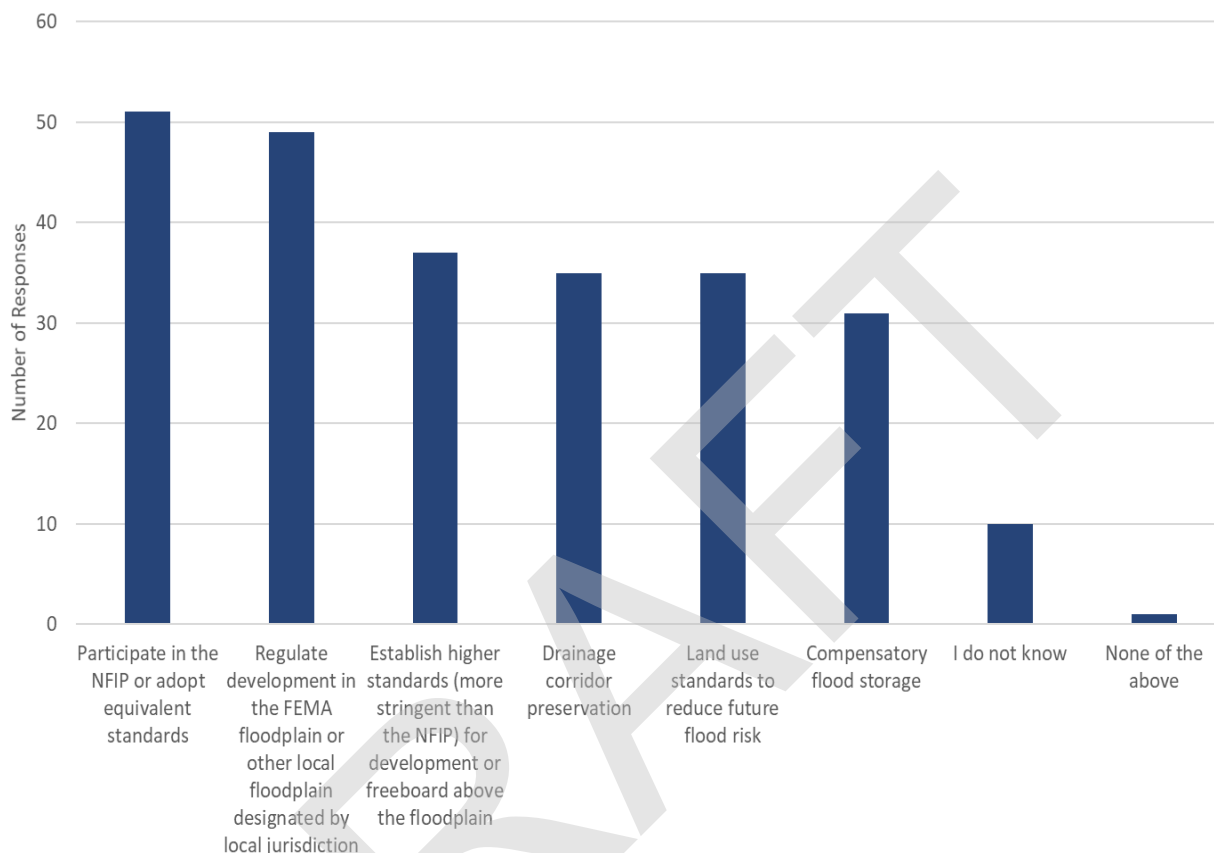
Source: Trinity Region data collection survey results as of September 16, 2021

In contrast, less than half of the survey participants supported the concept of requiring consistent minimum floodplain management standards. Those potential required region-wide minimum standards that received the most support included the same top two potential standards in the consideration for recommended standards. However, more participants responded with “I do not know” or did not respond.

The Trinity RFPG considered all the information gathered and analyzed in this chapter. The Trinity RFPG held a public meeting on September 23, 2021 to consider the question of recommending or adopting (requiring) minimum standards for this plan. The Trinity RFPG approved the following recommended region-wide floodplain management standards for this plan:

- Participate in the NFIP or adopt equivalent standards
- Regulate development in the FEMA floodplain or other local floodplain designated by local jurisdiction
- Establish higher standards (more stringent than the NFIP) for development or freeboard above the floodplain
- Support drainage corridor preservation
- Utilize land use standards to reduce future flood risk
- Consider compensatory flood storage

Figure 3.8: Survey Responses for Potential Adopted (Required) Minimum Floodplain Management Standards



Source: Trinity Region data collection survey results as of September 16, 2021

The recommended standards were summarized in a memorandum, posted to the Trinity RFG website, and distributed by email to the list of interested parties informing them of the decision and soliciting feedback by October 27, 2021. A copy of the memo and the email notification are included in **Appendix C**.

As in other chapters of this report, the TWDB requires a detailed table of existing floodplain management practices with the region. The **TWDB-Required Table 6** has been populated for all cities and counties within the Trinity Region and is included in **Appendix A**.

Task 3B – Flood Mitigation and Floodplain Management Goals (361.36)

A critical component of the inaugural State Flood Plan process is the development of flood mitigation and floodplain management goals. As such, the Trinity RFPG spent a significant amount of time and resources exploring values and measurable goals that the region should aspire to reach.

As set out in the Guidance Principles in 31 TAC §362.3, the overarching intent of the region’s goals must be “to protect against the loss of life and property.” This is further defined to:

1. Identify and reduce the risk and impact to life and property that already exists
2. Avoid increasing or creating new flood risk by addressing future development within the areas known to have existing or future flood risk

The goals, when implemented, must demonstrate progress towards the fundamental goal set forth by the state. This section summarizes the results of the Trinity RFPG efforts and the initial flood mitigation and floodplain management goals for the Trinity Region.

Flood Mitigation and Floodplain Management Goal Categories

The Trinity RFPG selected seven overarching goal categories. These categories are further defined to clarify the general focus and resulting benefits of each specific, measurable goal and to create a one-to-one connection with the FMS types as outlined in TWDB Data Submittal Guidelines. The selected specific goals guide the development of the FMSs, FMEs, and FMPs for the Trinity Region. They build upon TWDB regional flood planning guidance and provide a comprehensive framework for future strategy development focused on reducing flood risk to people and property, while not negatively affecting neighboring areas. The seven overarching goal categories include:

1. Improving flood warning and public safety
2. Improving flood analyses
3. Reducing property damage and loss
4. Preserving the floodplain
5. Improving flood infrastructure
6. Expanding flood education and outreach
7. Expanding funding

The seven categories are further discussed in detail later in this chapter.

To determine the overarching goals and the specific and attainable goals, the Trinity RFPG provided multiple opportunities for discussion and public input:

- **June 24, 2021 Trinity RFPG Meeting:** Discussed legislative and TWDB Guidance and conducted interactive goal setting exercise to determine the Trinity RFPG’s overarching goals and values.
- **August 19, 2021 Trinity RFPG Meeting:** Presented a refined list of potential specific goals for discussion based upon feedback received during the June meeting using interactive polling. Established the Goals Subcommittee to narrow the list of potential goals for consideration in this plan.
- **August 31, 2021 Trinity RFPG Subcommittee Meeting:** Refined the overarching and specific goals and set measurable indicators.
- **September 23, 2021 Trinity RFPG Meeting:** Considered and approved the draft goals as refined by the Goals Subcommittee and added a seventh overarching goal with specific goals. Requested the consultants distribute the draft goals to the list of interested parties and request input for an additional 30 days. The goals were distributed on September 27 with a request for comments to be submitted by October 27.
- **November 18, 2021 Trinity RFPG Meeting:** Reported results of outreach activity related to goals. Feedback from those who responded was that the goals were appropriate for the region.
- **December 12, 2021 Trinity RFPG Meeting:** Discussed and revised the language of several specific goal statements, added a few new specific goal statements with measurable indicators appropriate to the region, and moved one goal statement related to funding eligibility to Chapter 8. The RFPG approved the goals.

Appendix D includes documents showing the Trinity RFPG’s progression of refining the goals for the Trinity Region.

Goals

The seven overarching goal categories are detailed below and include specific goal statements that are achievable, measurable, and time specific. Per TWDB requirements and guidelines, the goals selected by the Trinity RFPG must be specific and achievable and include the information listed below:

- Description of the goal
- Term of the goal set at 10 years (short-term) and 30 years (long-term)
- Extent or geographic area to which the goal applies
- Residual risk that remains after the goal is met
- Measurement method that will be used to quantify goal attainment
- Association with the overarching goal categories

The following specific goals associated with each overarching goal were reviewed and approved by the Trinity RFPG on September 23, 2021 during the Trinity RFPG meeting.

Goal Category 1. Improving Flood Warning and Public Safety

Goal category 1 intends to improve the dissemination of information regarding early flood recognition and danger, emergency response procedures, and post-flood recovery actions to protect the public. **Table 3.7** includes two detailed goals to accomplish this goal category that also align with the TWDB’s fundamental goal of protecting against the loss of life by keeping the public informed, prepared, and aware of flood risk.

Table 3.7: Goal Category 1. Improving Flood Warning and Public Safety Specific Goal Statements

Goals	Specific Goal Statements	Baseline	Short Term (2033)	Long Term (2053)
A	Increase the number of entities with flood warning programs that can detect flood threats and provide timely warning of impending flood danger.	Number of entities with flood warning programs	Establish a baseline measurement	Increase by 10 from 2033
B	Improve safety at low water crossings (LWCs) by adding warning systems/signage or improving LWCs in high-risk areas	Number of warning systems/signs installed at LWCs	100 total	300 total

Communicating flood risk and appropriate flood response to the public often involves multiple entities and departments within those entities. Flood warnings may be issued via television, radio, websites, electronic message boards, roadway signage, and other measures. Flood warning programs could include a variety of measures, such as rain gauges, stream gauges, stage gauges, emergency action plans, and others. Potential LWC safety measures might include Turn Around Don’t Drown signs, barricades, flashing lights, and automated gates to name a few. Advanced technology can be used to report readings from rain and stream gauge equipment to the entity’s website to inform the public of real-time flood risks during and following storm events.

Goal Category 2. Improving Flood Analyses

Goal category 2 intends to increase the number and extent of regional flood planning studies (FMEs) and analyses. By accomplishing this, the studies will be used to identify flood risk and better prepare communities for implementing FMPs. **Table 3.8** provides details on the three specific goal statements that support this goal category, as well as the TWDB’s fundamental goal of protecting against the loss of life and property by utilizing the best available data when performing flood analyses.

Table 3.8: Goal Category 2. Improving Flood Analyses Specific Goal Statements

Goals	Specific Goal Statements	Baseline	Short Term (2033)	Long Term (2053)
A	Increase the availability of flood hazard data that uses the best available land use and precipitation data to reduce gaps in floodplain mapping.	Flood hazard data gaps identified in Regional Flood Plan	25% gap reduction	95% gap reduction
B	Increase the number of entities that conduct detailed studies of localized/urban flooding impacts within the flood planning region.	Number of entities that conduct detailed, local studies	Establish a baseline measurement	30%
C	Increase the number of entities that utilize latest and most appropriate precipitation and land use data as a basis for design criteria and flood prevention regulations.	Number of entities that are utilizing latest, most appropriate data	Establish a baseline measurement	30%

Goal Category 3. Reducing Property Damage and Loss

Increase the number and extent of protective regulatory measures and programs to limit future risk and reduce flood damage in the flood planning region. **Table 3.9** includes five specific goal statements that aim to protect property and people and align with the TWDB’s fundamental goal of protecting against the loss of life and property by reducing current flood risk and providing more flood risk awareness to the public.

Table 3.9: Goal Category 3. Reducing Property Damage and Loss Specific Goal Statements

Goals	Specific Goal Statements	Baseline	Short Term (2033)	Long Term (2053)
A	Increase the number of entities that have floodplain standards that meet or exceed the NFIP-minimum standards.	Number of entities with NFIP minimum standards	5 new cities/towns	25 additional cities/towns
B	Reduce the number of structures within the 1% floodplain (i.e. through structural projects, property buyouts, acquisitions, elevations, and/or relocations).	96,575 structures identified within 1% floodplain in Regional Flood Plan	5%	10%
C	Reduce the vulnerability of agriculture, ranching and forestry to flood-related losses.	Number of projects reducing flood risk to agricultural, ranching, and forestry lands within 1% floodplain.	2	8
D	Reduce the number of critical facilities within the 1% floodplain	929 critical facilities identified in 1% floodplain in Regional Flood Plan.	5%	10%
E	When relocation and/or elevation adjustment is not possible, increase the number of non-residential facilities that implement floodproofing	Non-residential facilities with floodproofing in 1% floodplain	5	25

Goal Category 4. Floodplain Preservation

Maintain the natural and beneficial functions of floodplains by preservation and conservation programs. In other words, allow floodplains to reduce flood risk by slowing runoff and storing floodwaters as intended (FEMA Benefits of Natural Floodplains, 2021). **Table 3.10** provides information on three goal statements that directly supports the TWDB’s fundamental goal of protecting against the loss of life and property by reducing current and future flood risk in low-lying areas.

Table 3.10: Goal Category 4. Floodplain Preservation Specific Goal Statements

Goals	Specific Goal Statements	Baseline	Short Term (2033)	Long Term (2053)
A	Increase the acreage of publicly protected natural areas for flood and ecosystem purposes to reduce future impacts of flooding.	Number of projects that protect natural areas	2	8
B	Increase the number of entities that include the 1% ACE floodplain on Future Land Use plans and other planning documents	Number of entities with future land use zoning regulations that incorporates floodplain	Increase by 20	Increase by 50
C	Avoid new exposure to flood hazards by adopting comprehensive plans or subdivision regulations that direct development away from the floodplain.	Entities with plans/regulations including floodplain preservation tactics	Establish a baseline measurement	10%

Publicly protected natural areas may include dedicated or deed-restricted parks, wetlands, preservations, forests, and other similar areas.

Future land use plans or comprehensive plans provide a guide for communities in determining where and what types of future development will occur in accordance with the community’s long-range goals (Gary D. Taylor, 2019). These plans consider existing physical factors, such as topography, infrastructure, and development. Topography should include rivers and creeks and their associated floodplains.

Cities and counties have the authority to establish subdivision regulations that govern the platting process of property, including the identification and designation of floodplains (LGC, 2017) and (LGC, 2021). Subdivision rules can apply to Extraterritorial Jurisdictions (ETJs) if designated in the city ordinance.

Goal Category 5. Flood Infrastructure Improvement

Reduce flood risk and mitigate flood hazards to life and property through the maintenance and rehabilitation of existing infrastructure and implementation of new flood infrastructure projects. Four specific goal statements are included in **Table 3.11**, all of which directly support the TWDB’s fundamental goal of protecting against the loss of life and property by reducing current flood risk.

Table 3.11: Goal Category 5. Flood Infrastructure Improvement Specific Goal Statements

Goals	Specific Goal Statements	Baseline	Short Term (2033)	Long Term (2053)
A	Increase the number of nature-based practices as part of flood risk reduction projects.	Stormwater or drainage projects that incorporate nature-based solutions	Establish a baseline measurement	30%
B	Improve flood infrastructure and maintain streams and drainage channels to reduce flood risk to agricultural lands.	Stormwater or drainage projects that reduce risk to agricultural lands	Establish a baseline measurement	10%
C	Improve urban drainage infrastructure to minimize flood risk.	Mileage of drainage infrastructure	50 miles	500 miles
D	Perform regular inspections and maintain existing dams, levees, and other flood mitigation structures.	Number of regular inspections	Establish a baseline measurement	10%

Nature-based practices often involve geomorphic assessments to understand the specific site conditions and to select the most appropriate flood infrastructure improvement, including stream restoration or erosion solution. Geomorphic studies also aide in identifying the locations for needed improvements. **Chapter 2** includes a discussion of geomorphology. Nature-based solutions may include strategically placed plantings, wood/logs, stakes, geotextile

fabric, boulders, or other materials (USDA, 2021). In some cases, a combination of traditional engineered solutions can be used with certain nature-based components.

Goal Category 6. Expanding Flood Education and Outreach

Increase the amount of flood education and outreach opportunities to improve awareness of flood hazards and promote future participation throughout the flood planning region. Flood education and outreach is critical to protecting people and property. The goal category aligns with TWDB’s fundamental goal of reducing loss of life and property by helping people understand and avoid flood risk. **Table 3.12** includes three specific goal statements to meet the goal category.

Table 3.12: Goal Category 6. Expanding Flood Education and Outreach Specific Goal Statements

Goals	Specific Goal Statements	Baseline	Short Term (2033)	Long Term (2053)
A	Increase the number of participating entities in the regional flood planning process.	Entities participating in the regional flood plan	35% ¹	90% ¹
B	Increase the number of local entities that host annual public outreach and education activities to improve awareness of flood hazards, benefits of flood planning, and procedures associated with emergency response associated with flooding.	Number of entities that host public, flood-related outreach	Establish a baseline measurement	50 total
C	Increase the number of entities that work cooperatively as part of an overall floodplain management program.	Number of entities participating in overall floodplain management programs	5 total	25 total

¹ Percentage shown is the percent of total entity participation.

Public education and outreach may incorporate a variety of methods from publishing newsletter articles to hosting booths at in-person events. Communities that participate in FEMA’s CRS program typically have significant public outreach elements in their stormwater

programs as they receive credit for doing so. The CRS program is described in **Task 3A** of this plan. Topics that might be covered in public education programs could include the following:

- Risks associated with driving through floodwaters
- Understanding/reading floodplain maps
- Being aware of the risks associated with living near rivers, creeks, and dams
- Being aware that the flood risks can be located in low-lying areas and away from streams
- Offering amenities with flood risk projects
- Understanding need and advantages of having dedicated funding

One of the key messages that is often misunderstood by the public is that anyone who lives in a community or county that participates in the NFIP can purchase FEMA flood insurance. Flood insurance is available to residential owners and renters, as well as commercial buildings. Flood insurance is required by mortgage companies if a house is located within the 1-percent ACE floodplain. Houses outside the floodplain are also eligible for flood insurance and at a lower rate because the risk of flooding is lower.

Goal Category 7. Expand Funding

Funding, or lack thereof, is a constant struggle for communities. Most communities have more stormwater needs and flood-related issues to address than they have funding to do so. Goal 7 directly supports the fundamental goal of reducing loss of life and property by expanding funding options for implementing FMEs, FMSs, and FMPs. **Table 3.13** provides a detailed goal statement aimed at expanding funding for stormwater and flood-related needs.

Table 3.13: Goal Category 7. Expand Funding Specific Goal Statements

Goals	Specific Goal Statements	Baseline	Short Term (2033)	Long Term (2053)
A	Increase the number of entities with dedicated stormwater funding mechanisms.	Number of entities with stormwater funding mechanisms	10%	30%

In addition to traditional state and federal funding opportunities that could potentially be expanded, local communities have the authority to establish and collect stormwater utility fees (also known as drainage utility fees) to support stormwater-related needs within the community (LGC, 2009). Stormwater utilities generate dependable revenue that can be used as local matching funds for state and federal grants to broaden the reach of such programs.

Benefits and Residual Risk after Goals are Met

The selected goal statements were developed in a manner to set the stage for specific actions that can be quantified and measured in future regional and state flood planning cycles. Future data collection efforts or implementation of FMEs, FMSs, and/or FMPs may be used to establish baseline data. The established baselines will be used for future measurements to determine progress towards achieving the goals. Implementation efforts will also demonstrate progress towards the overall purpose and intent of the regional flood planning process and will result in various benefits to individuals, communities, and the region as a whole.

Beyond protecting against the loss of life and property, the goals offer several benefits, including protecting infrastructure, water supply, the environment, and sustainability. The types of benefits to be realized with implementation of the Trinity Regional Flood Plan were explained previously and presented in **Table 3.14**.

If the goals are fully achieved, then the residual risk should be minimal. However, residual risks should be anticipated for each of the overarching goal categories. Overall, the goal categories fall into one or more of the following residual risks:

- Storm events exceeding the design capacity of the infrastructure
- Time and budget limitations
- Human behavior
- Funding limitations for maintenance
- Policy and regulation changes

Goal Category 1: Flood warning and public safety residual risk depends on public response to flood warnings. Drivers may choose to ignore flood warning signs or barricaded roads for a variety of reasons. Despite an entity's best effort, risk will remain at LWCs.

Goal Category 2: Reducing residual risk associated with improving flood analyses involves technology that is always changing and improving. Due to the change and updates to terrain, land use, precipitation, and other data, the risk associated with the floodplains may change over time. While a new development may be constructed outside the 1-percent ACE floodplain, future improvements in technology and other data may change the floodplain boundary resulting in some structures being located within the floodplain.

Goal Category 3: Reducing the residual risk to property damage and loss depends on the local community's floodplain management policies and political leaders. Getting every community within the Trinity Region to adopt and enforce NFIP minimum standards, let alone higher standards, may prove to be challenging. The lack of local enforcement of floodplain regulations also creates risk.

Table 3.14: Flood Planning Goals and Benefits

Types of Benefits	Overarching Goal Categories						
	Goal 1: Flood Warning and Public Safety	Goal 2: Improving Flood Analyses	Goal 3: Reducing Property Damage and Loss	Goal 4: Floodplain Preservation	Goal 5: Flood Infrastructure Improvement	Goal 6: Flood Education and Outreach	Goal 7: Funding
Protect against the loss of life	●	●	◐	◐	●	◐	●
Protect against the loss of property	◐	●	●	◐	●	◐	●
Protect infrastructure	●	●	●		●		●
Protect the environment	◐	◐	●	●			●
Protect water supply			◐	●	◐		●
Sustain the economy	●	◐	●		◐		●
Design for co-benefits*			◐	●	●		●
Increase public awareness	●	●				●	●
Build community support	●	●				●	◐

- Benefit
- ◐ Potential Benefit

* Single project with multiple benefits, i.e. improves floodplain protection and water supply, increases recreation opportunities, habitat preservation, etc.

Goal Category 4: Floodplain preservation allows floodplains to serve their natural and intended purpose to mitigate floods. Residual risk depends on people stepping back and allowing space for flooding to remain in natural areas.

Goal Category 5: Flood infrastructure improvements can only be expected to perform based on the design capacity. In other words, if any storm that exceeds the design capacity was to occur, the infrastructure will still be at risk. Most community stormwater collection systems are not designed to collect the 1-percent ACE due to cost constraints. Even if the system was designed for that storm, a larger storm would still overwhelm the system. Likewise, storm intensities can overwhelm stormwater collection systems resulting in flooded roadways, bridges, culverts, and other damages. Also, routine maintenance of infrastructure is required to maintain the design capacity. Maintenance is sometimes overlooked due to budget, staff, and time constraints.

Goal Category 6: Flood education and outreach primarily provide benefits when implemented. The primary risks associated with public education and outreach are misunderstandings and lack of attention. Misunderstandings happen when the public becomes confused about the message, possibly due to its length or complex nature.

Goal Category 7: Funding residual risk includes lack of funding for design and construction of FMPs that result in delayed or shelved projects leaving the area(s) at risk. Lack of funding for maintenance may result in unanticipated infrastructure failure that costs much more to repair than to maintain. Local entities have more stormwater and flood-related needs than they have the funding to resolve.

Consideration of Minimum Recommended Flood Protection Goal

The Trinity RFPG is tasked with identifying specific and achievable flood protection goals that address risks to life and property. **Table 3.14** includes the Trinity RFPG's selected overarching goals and the goals' relation to the TWDB's fundamental goal with a benefit or co-benefit to protect life and property. The selected goals are more fully described in earlier in this section.

Goals Applicable to HUC-8 Watersheds

The Trinity RFPG discussed whether to apply goals differentially across the Upper, Middle, and Lower regions of the Trinity River Watershed, given their differences in flood risk. The group also considered if any of the goals should be applied to specific HUC-8 areas. The Trinity RFPG determined that the goals are universal in nature and each selected goal applies to each entity within the entire flood planning region. Therefore, no regional or HUC-8 watershed distinctions are recommended.

Short-Term Goals (10 years) and Long-Term Goals (30-years)

The selected goals guide the preparation of recommendations for FMSs, FMEs, and FMPs in this plan. They build upon TWDB’s regional flood planning guidance and provide a comprehensive framework for future strategy development focused on reducing flood risk to people and property, while not negatively affecting neighboring areas.

Table 3.7 through **Table 3.13** include the short-term and long-term measurements towards accomplishing the specific goal statements. As this is the first regional flood plan prepared for the Trinity Region, the short-term goal for several of these statements will be to establish a baseline from which to measure future successes. The measurements of other goals are stated in these tables. The **TWDB-Required Table 11** is included in **Appendix A** and contains similar details as the above referenced tables.

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