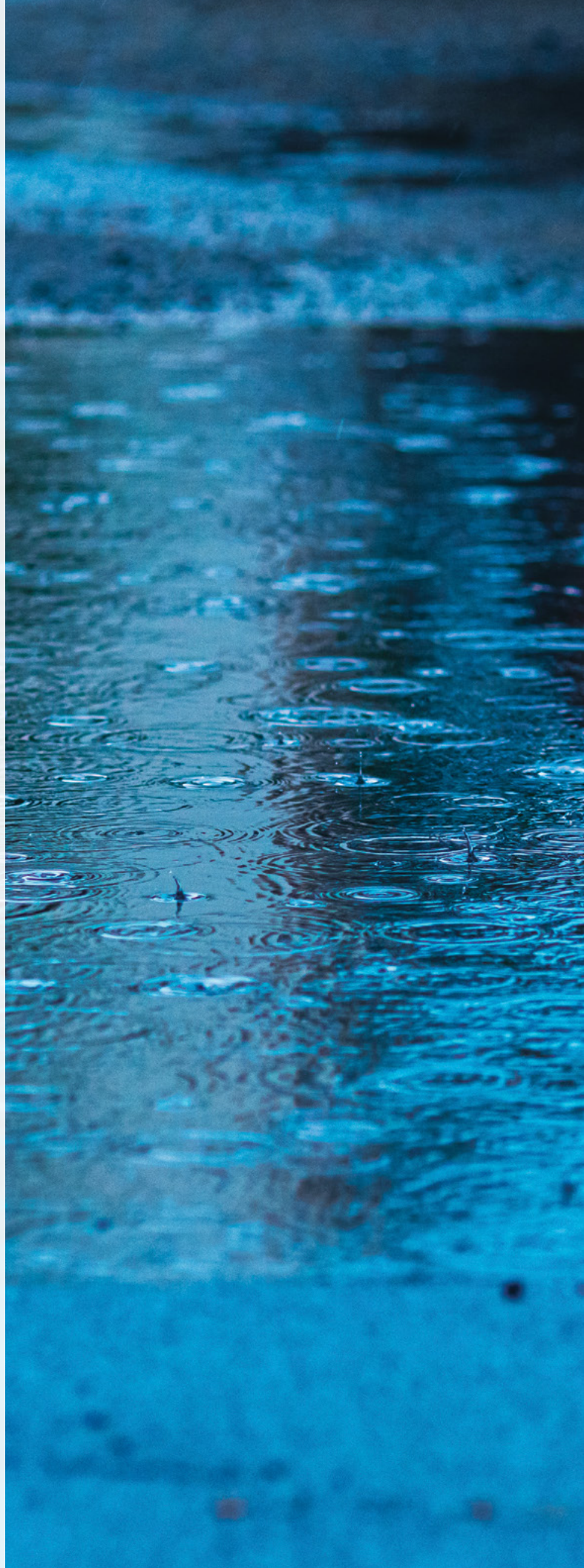


# 5

## Floodplain management practices

- 5.1** Assessment of current floodplain management practices
  - 5.1.1** Entities with flood-related authority
  - 5.1.2** Minimum floodplain management regulations
  - 5.1.3** Higher floodplain management standards
  - 5.1.4** Level of floodplain management practices across Texas
  - 5.1.5** Level of enforcement
  - 5.1.6** Stormwater or drainage fees
  - 5.1.7** Addressing future population growth and development
- 5.2** Regional flood planning group recommendations for floodplain management practices
  - 5.2.1** Summaries by region
- 5.3** TWDB recommendations for floodplain management best practices for Texas communities



## QUICK FACTS

- A total of 1,239 out of 1,473 counties and municipalities in Texas participate in the Federal Emergency Management Agency's National Flood Insurance Program.
- Of those 1,239 entities, more than 500 have floodplain management standards that exceed National Flood Insurance Program minimum standards.
- Approximately 98 percent of Texas' population resides within communities that participate in the National Flood Insurance Program.
- The regional flood planning groups recommended 144 new floodplain management standards for consideration by Texas political subdivisions to help improve community resilience to flooding.

In Texas, floodplain management is a community-led effort by cities, counties, and political subdivisions with flood-related authority to prevent or reduce the risk and impact of flooding. Communities have various levels of floodplain management standards; some do not take an active role in regulating floodplain development, whereas others have robust standards for reducing flood impacts due to development and to keep citizens and property out of harm's way. Many communities in Texas follow rules and policies of the Federal Emergency Management Agency (FEMA), which manages the National Flood Insurance Program where minimum standards for development in and around the floodplain can be found. Cities and counties work with FEMA to create and update Flood Insurance Rate Maps and floodwater surface elevations to define **special flood hazard areas** along rivers, streams, lakes, and coastal areas.

Communities that participate in the National Flood Insurance Program are required to use the Flood Insurance Rate Maps and floodwater surface elevations provided in their floodplain permitting processes. In sparsely populated agricultural and ranch land, local governments may not have the resources to enact, adopt, and enforce specific floodplain management prac-

tices or work with FEMA to develop special flood hazard areas and Flood Insurance Rate Maps.

The state of Texas supports the National Flood Insurance Program through a state coordinating office at the Texas Water Development Board (TWDB). The TWDB serves in a coordinating role cooperating with both FEMA and Texas communities that have adopted ordinances or orders to participate in the National Flood Insurance Program.

Per Texas Administrative Code (TAC) § 361.35, the regional flood planning groups were required to evaluate existing floodplain management practices within each flood planning region and recommend best practices. Floodplain management, as well as land use, infrastructure design, and other practices, play a key role in accomplishing the intents of regional flood planning, specifically in preventing the creation of additional flood risk in the future.

### 5.1 Assessment of current floodplain management practices

Before adopting or recommending floodplain management practices within each flood planning region, the planning groups were required



to first evaluate current floodplain management practices in their regions. To do so, they coordinated with political subdivisions, to the extent possible, to gather information on floodplain management regulations and policies in each region. Using this information, the planning groups made qualitative assessments of floodplain management, land use, infrastructure design, and other practices within and across the region. They provided summaries of key floodplain management practices by identifying entities (cities, counties, and political subdivisions with flood-related authority) with existing floodplain management practices, identifying common and contrasting practices within each region, and acknowledging locations that may lack appropriate floodplain management. Some information presented here differs from that in the respective regional flood plans in cases where the TWDB received conflicting information for entities with jurisdictional boundaries shared by two or more regions and where the TWDB received corrective information from entities during a public comment period. The following sections describe their findings.

### 5.1.1 Entities with flood-related authority

The planning groups were tasked with identifying political subdivisions with flood control authority in their regions. TAC § 361.10(bb) defines political subdivisions as cities, counties, districts, or authorities created under Article III, Section 52, or Article XVI, Section 59, of the Texas Constitution; any other political subdivision of the state; any interstate compact commission to which the state is a party; and any nonprofit water supply corporation created and operating under Chapter 67 of the Texas Water Code. The regional flood planning groups identified the subset of political subdivisions with flood-related authority in their respective regions. The majority are municipal or county governments, both of which exercise authority to set policies to mitigate flood risk. State law also provides for limited-purpose water supply and utility districts (known variously as municipal utility districts, municipal water

districts, fresh water supply districts, special utility districts, and other related names). These districts may be in or adjacent to cities or in a county and may be involved in land reclamation and stormwater drainage management. Water control and improvement districts were also included, as these districts have a more direct relationship to flood management, as outlined in Texas Water Code (TWC) Chapter 51. Although a multitude of these entities have the capability to exercise some degree of flood-related authority, many defer to a larger entity such as a county or municipality for regulatory floodplain management purposes, as larger cities often have unified development codes or floodplain management standards in place.

For political entities to participate in the National Flood Insurance Program, they must adopt a floodplain management ordinance and designate a floodplain administrator who will be responsible for understanding and interpreting local floodplain management regulations and reviewing them for compliance with National Flood Insurance Program standards. TWC § 16.3145 requires each city and county to adopt ordinances or orders necessary to be eligible to participate in the National Flood Insurance Program. In addition, TWC § 16.315 authorizes each political subdivision of the state, not just cities and counties, to take all necessary and reasonable actions that are not less stringent than the requirements and criteria of the National Flood Insurance Program. Some of the rights and responsibilities granted under the authority of TWC § 16.315 include the following:

- Applying for grants and financing to support mitigation activities.
- Guiding the development of future construction away from locations threatened by flood hazards.
- Setting land use standards to constrict the development of land that is exposed to flood damage and minimize damage caused by flood losses.

- Collecting reasonable fees from citizens to cover the cost of administering floodplain management activities.
- Using regional or watershed approaches to improve floodplain management.
- Cooperating with FEMA to assess adequacy of local structural and non-structural mitigation activities.

TWC § 16.314 and § 16.316 charge the TWDB as the state agency to act in a coordinating role for the National Flood Insurance Program for local, state, and federal programs. This coordination includes supporting communities that seek to apply to qualify to participate in the National Flood Insurance Program. It also includes evaluating flood programs, carrying out floodplain studies and mapping programs, and coordinating grant funding.

### 5.1.2 Minimum floodplain management regulations

Minimum standards for floodplain management set a baseline of criteria for ensuring safe development in flood prone areas. Such criteria might include prohibiting construction within certain floodway zones, mandating elevation levels for buildings in flood zones, or requiring the use of flood-resistant construction materials. The regional flood planning groups reported a total of 1,173 entities with flood-related authority with at least minimum floodplain management regulations (Figure 5-1). Minimum floodplain management regulations are a requirement for participation in the National Flood Insurance Program; therefore, the data provided by the planning groups on National Flood Insurance Program participation is used in this plan as a proxy to demonstrate which entities have minimum floodplain management regulations.

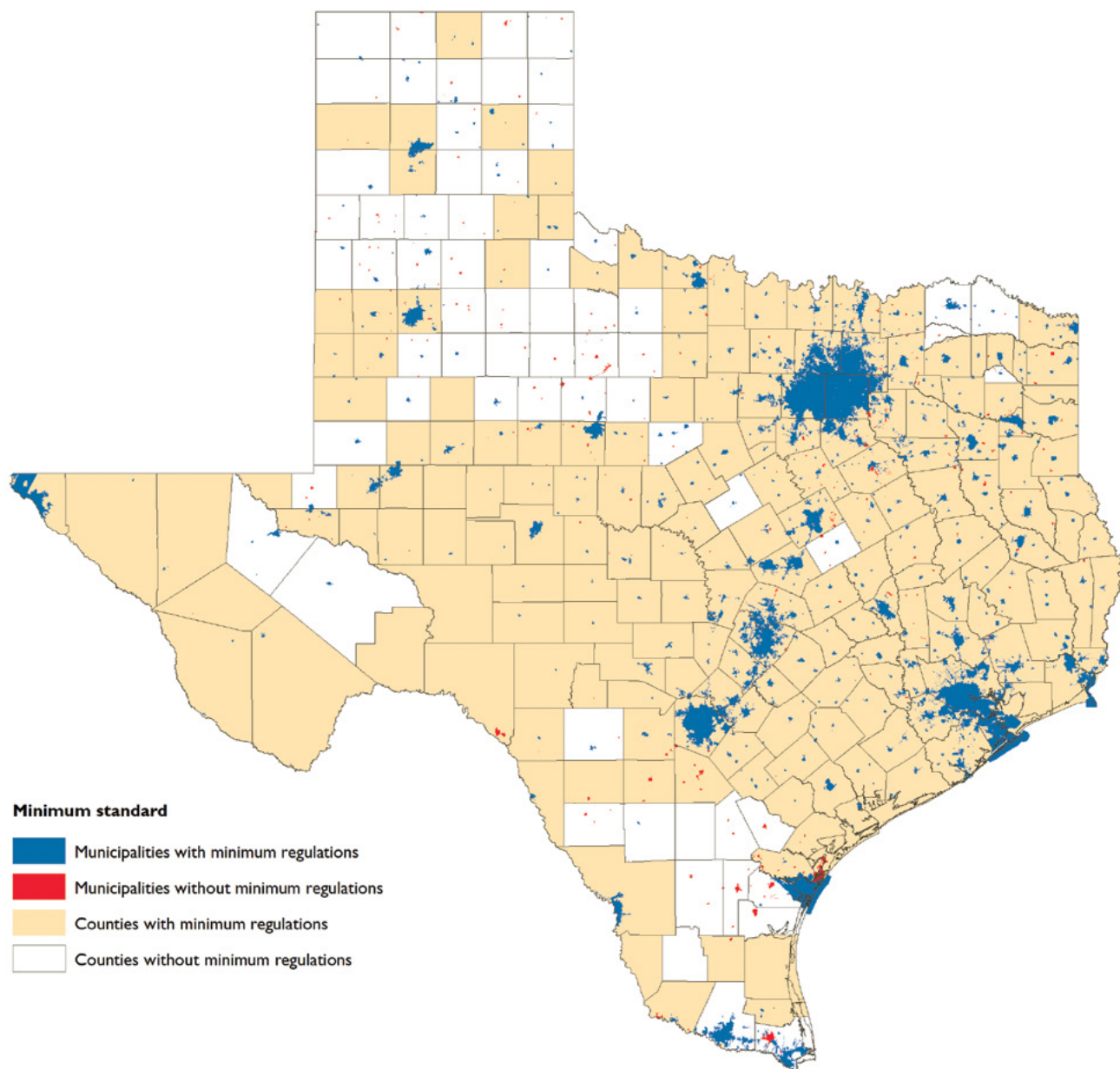
The National Flood Insurance Program was established when Congress passed the National Flood Insurance Act in 1968 to provide federally subsidized flood insurance protection. The National Flood Insurance Program is adminis-

tered by FEMA, which provides subsidies for private flood insurance for property owners in communities that participate in the National Flood Insurance Program. The program has since been updated to strengthen it as well as provide fiscal soundness and inform the public of flood risk through insurance rate maps. The goal of the National Flood Insurance Program is to reduce the exposure to flood risk and protect public safety as well as prevent or minimize damage to property and public infrastructure. Title 44 of the Code of Federal Regulations (CFR) includes the rules and regulations of the program; part 60 within that title establishes minimum criteria that FEMA requires for participation, which includes identifying special flood hazard areas within the participating community. The regional flood planning groups reported a total of 1,239 entities with flood-related authority that participate in the National Flood Insurance Program (Table 5-1 and Figure 5-2).

Participating communities work with FEMA to create and update Flood Insurance Rate Maps and the base flood elevation to define the special flood hazard areas along rivers, streams, lakes, and coastal areas. Flood Insurance Rate Maps and base flood elevations are used by participating communities to establish elevations used in their floodplain permitting process.

When a community joins the National Flood Insurance Program, it must adopt a resolution of intent to participate and cooperate with FEMA. With the ability to establish their own policies, standards, and practices, communities can manage land use in and around areas of flood risk. These risks are mitigated by floodplain management and land use practices enacted through regulations and policies that are adopted by participating communities. Floodplain ordinances, building standards, zoning, and land use policies are three general forms of regulations a community can use to mitigate flood risk.

**Figure 5-1. Locations of entities with and without minimum floodplain management regulations\***

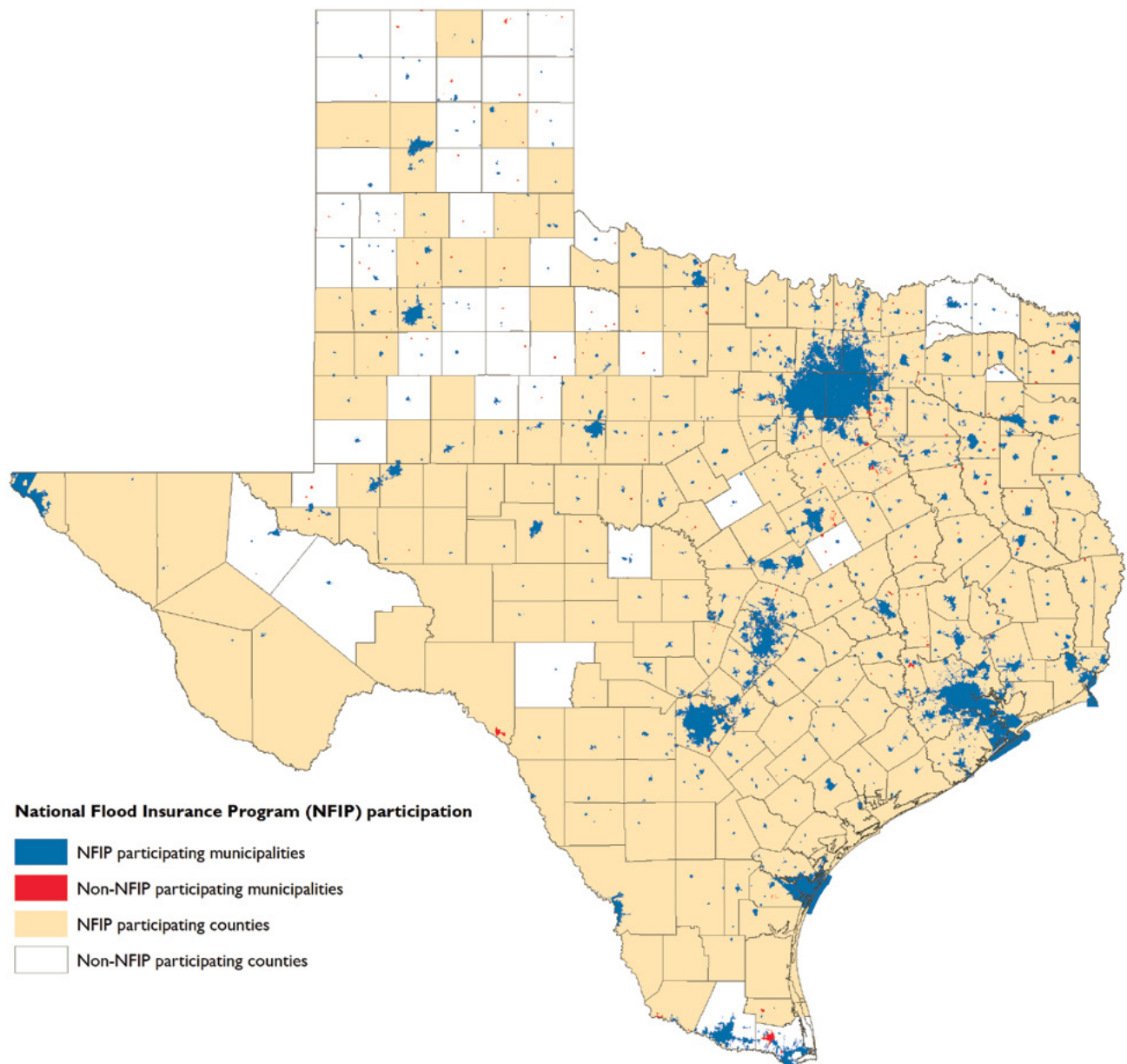


\* This figure contains self-reported information obtained by the regional flood planning groups through outreach surveys to entities throughout the state. Relevant information for some entities may not have been available or reported to the regional flood planning groups.

**Table 5-1. Entities participating in the National Flood Insurance Program\***

Entity type	Yes	No	Total
County	209	45	<b>254</b>
Flood district		18	<b>18</b>
Municipality	1,010	209	<b>1,219</b>
River authority		18	<b>18</b>
Other (includes municipal utility districts, drainage districts, etc.)	20	484	<b>504</b>
<b>Total</b>	<b>1,239</b>	<b>774</b>	<b>2,013</b>

\* This table contains self-reported information obtained by the regional flood planning groups through outreach surveys to entities throughout the state. Blank cells may not signify zero entities; relevant information may not have been available or reported to the regional flood planning groups.

**Figure 5-2. Locations of entities participating in the National Flood Insurance Program\***

\* This figure contains self-reported information obtained by the regional flood planning groups through outreach surveys to entities throughout the state. Relevant information for some entities may not have been available or reported to the regional flood planning groups.

A joining community must also adopt and submit a floodplain management ordinance or court order that meets or exceeds the minimum National Flood Insurance Program criteria. Minimum standards include the following:

- Adopt and enforce a flood damage prevention ordinance (or court order)
- Require permits for all types of development in floodplains
- Ensure that building sites are reasonably safe from flooding
- Estimate flood elevations for areas that lack FEMA determinations
- Require that new or substantially improved buildings be constructed at or above the base flood elevation
- Require elevation certificates to document compliance
- Require other buildings to be elevated or floodproofed
- Conduct inspections and cite violations
- Minimize variances
- Inform FEMA when updates to flood maps are needed

TWC § 16.3145 requires a city or county to adopt the necessary ordinances or orders for the city or county to be eligible to participate in the National Flood Insurance Program. Based on the data provided by the planning groups, about 1,173 have adopted minimum regulations pursuant to TWC § 16.3145, but 838 entities have not. A floodplain ordinance provides a community with the power to regulate development within the floodplain and the impact new or existing development can have in the floodplain. Building standards are used for construction within or adjacent to the floodplain. This can include the flood proofing of a structure as well as another means of regulating finished floor elevations. The use of zoning and land use policies can be utilized by the community to

regulate the types of land use that are acceptable within and adjacent to the floodplain to promote safety by directly building away from these areas.

### 5.1.3 Higher floodplain management standards

FEMA encourages communities to adopt and enforce higher standards than the National Flood Insurance Program minimum standards to reduce flood risk to life and property. The planning groups reported that 511 communities/entities have higher standards, whereas 792 entities do not (Table 5-2 and Figure 5-3). There are many types of higher floodplain management standards, including the following.

#### Freeboard

FEMA defines **freeboard** as an additional height requirement above the base flood elevation that provides a margin of safety against flood risks, compensating for unknown factors that may affect flood depths (FEMA, 2005). While freeboard reduces the risk of flooding, it also makes the structure eligible for a lower flood insurance rate.

#### Detention and retention

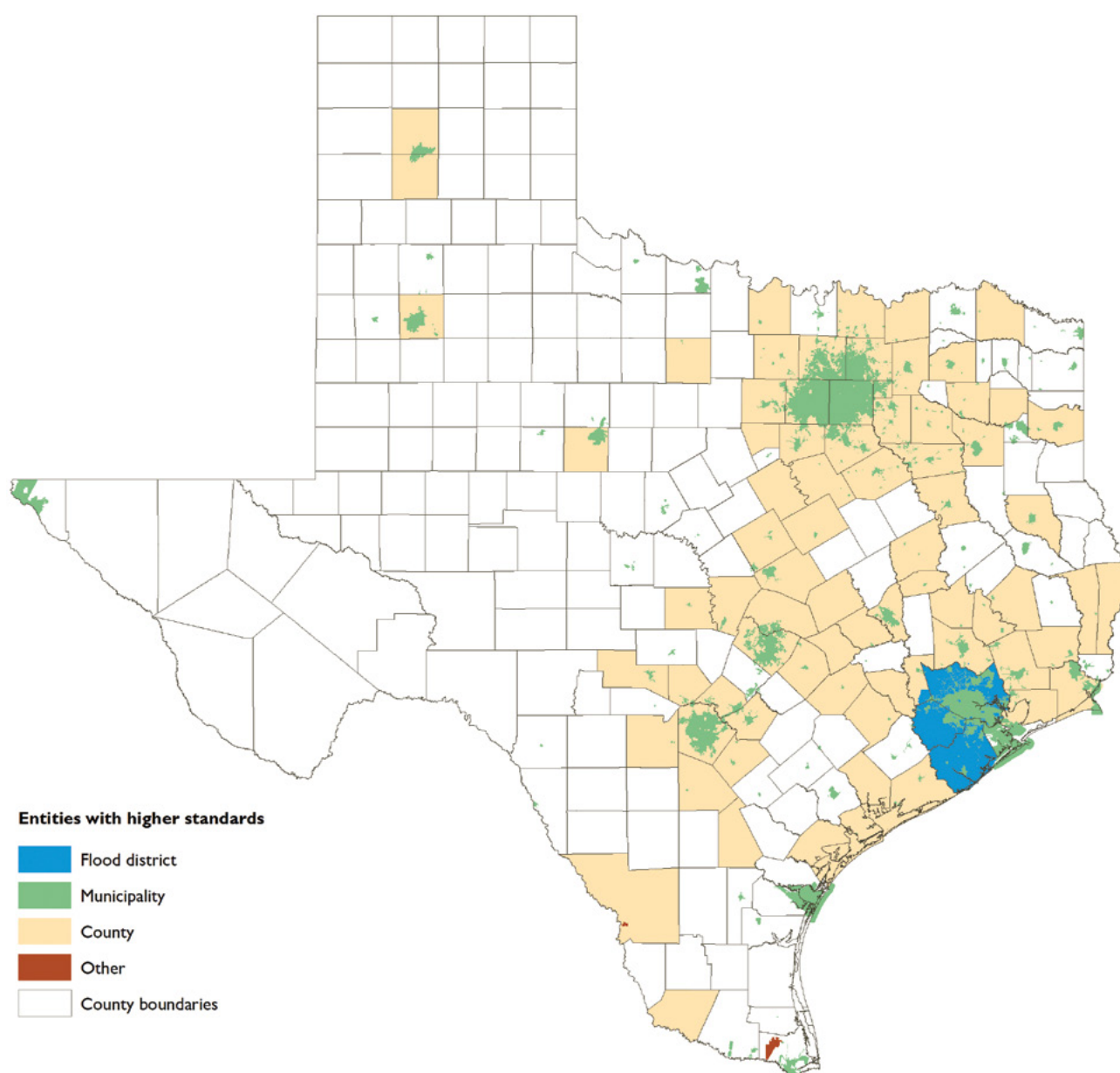
Reducing the impact of increased runoff that results from development in a watershed is known as stormwater management. One way to reduce the impact of stormwater on new development is to require the developer to restrict the rate at which the increased runoff leaves the property. **Stormwater detention** stores and holds the water for release at a restricted rate after the storm subsides. In **stormwater retention**, the runoff of stormwater is held for later use in irrigation or groundwater recharge as well as reducing pollution. Water quality can also improve by utilizing stormwater management, as it reduces erosion and the entry of sediment and pollutants into receiving streams (FEMA, 2005).



**Table 5-2. Entities with higher floodplain management standards\***

Entity type	Yes	No	Unknown	Total
County	80	148	26	<b>254</b>
Flood district	7	11		<b>18</b>
Municipality	422	492	305	<b>1,219</b>
River authority	2	125	377	<b>504</b>
Other (includes municipal utility districts, drainage districts, etc.)		16	2	<b>18</b>
<b>Total</b>	<b>511</b>	<b>792</b>	<b>710</b>	<b>2,013</b>

\* This table contains self-reported information obtained by the regional flood planning groups through outreach surveys to entities throughout the state. For example, blank cells may not signify zero entities; relevant information may not have been available or reported to the regional flood planning groups.

**Figure 5-3. Locations of entities with higher floodplain management standards\***

\* This figure contains self-reported information obtained by the regional flood planning groups through outreach surveys to entities throughout the state. Relevant information for some entities may not have been available or reported to the regional flood planning groups.



## Fill

**Fill** in floodplain or flood hazard areas is referred to as placing of obstructive materials, including sand and soil, to raise the level of the ground to change the flow of water or increase flood elevations. Fill can be used by itself or with other types of foundations to elevate the lowest floor of a building above the base flood elevation. There are restrictions on the use of fill in floodways where fill could cause an increase in flood heights and in coastal zones where fill would act as an obstruction to waves. Many communities that allow the use of fill in the floodplain also require that equal amounts of material be excavated to maintain storage capacity. Ideally, fill placed in the floodplain should not increase water levels on others and must be proven through modeling. A community may require the developer or landowner to obtain a **Conditional Letter of Map Revision** before allowing the project to move forward (FEMA, 2005).

## Community Rating System

FEMA established the Community Rating System in 1990 to encourage, recognize, and reward participating National Flood Insurance Program communities that have adopted floodplain management practices that exceed program minimums. In doing so, communities support the three goals of the Community Rating System:

1. Reduce flood damages to insurable properties
2. Strengthen the insurance aspects of the National Flood Insurance Program
3. Support a comprehensive approach to floodplain management

A community that is part of the Community Rating System receives discounted flood insurance premium rates that are awarded in 5 percent increments from Class 1 to Class 10. For example, a Class 1 community will receive a 45 percent

discount whereas a Class 10 community receives no discount. As of 2023, 69 Texas communities participate in the National Flood Insurance Program Community Rating System.

## 5.1.4 Level of floodplain management practices across Texas

The planning groups used a summary of the level of floodplain management practices to identify areas with existing floodplain practices and compare common practices within each region. The following criteria were provided to the planning groups to determine the level of floodplain management practices of communities within their regions:

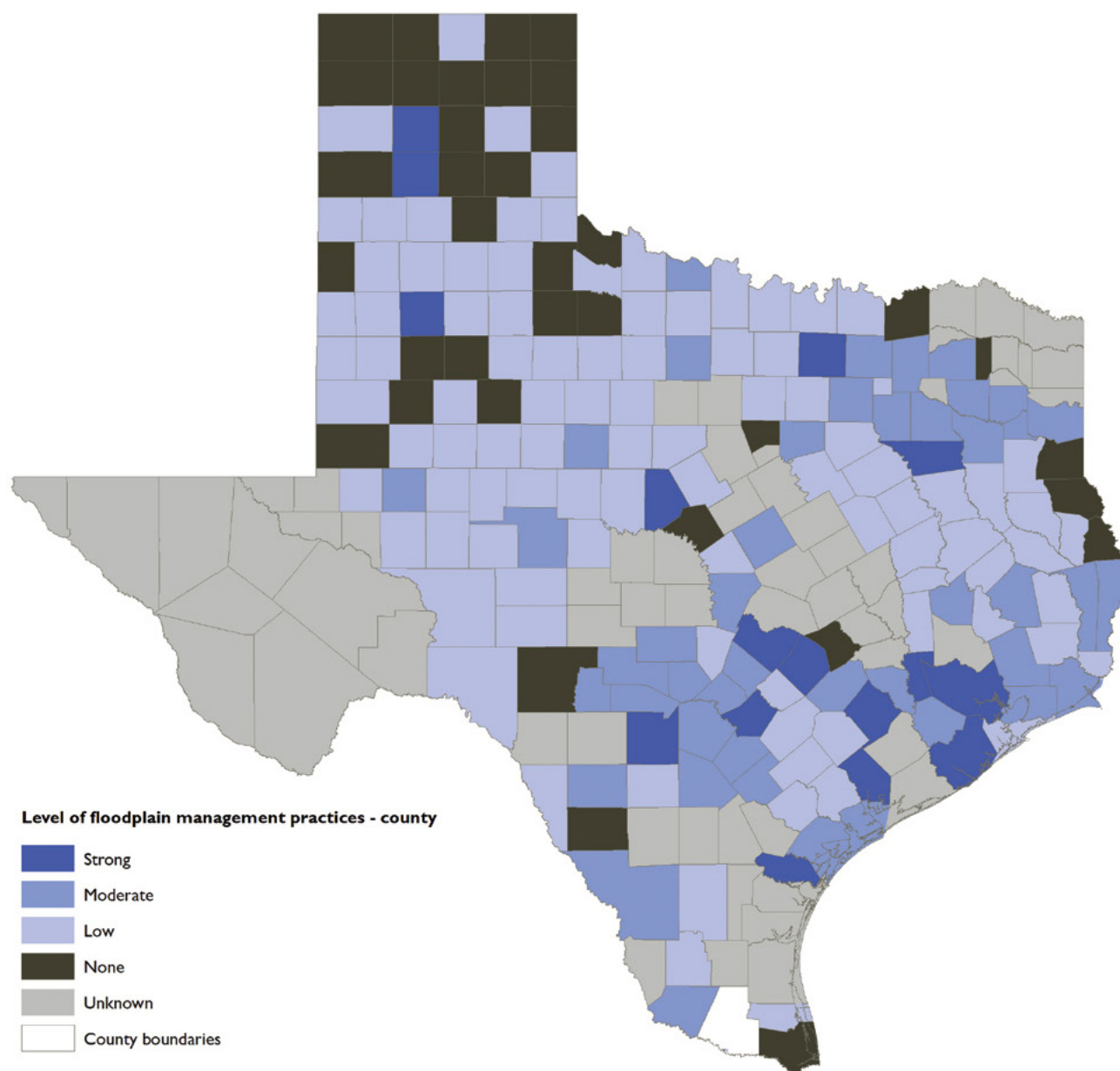
- **None**, meaning no floodplain management practices are in place
- **Low**, meaning that regulations meet the minimum National Flood Insurance Program standards
- **Moderate**, meaning the community has adopted some higher standards, such as freeboard, detention requirements, or fill restrictions
- **Strong**, meaning the community has adopted and enforces significant regulation that exceeds the National Flood Insurance Program standards or the community belongs to the Community Rating System

A total of 521 entities throughout Texas were considered to have a low level of floodplain management practices as their current ordinances or regulations solely met the minimum requirements per the National Flood Insurance Program (Table 5-3, Figure 5-4, and Figure 5-5). While the regional flood planning groups were able to gather a large amount of floodplain management information from entities across the state, there are still several entities whose level of floodplain management practices is unknown.

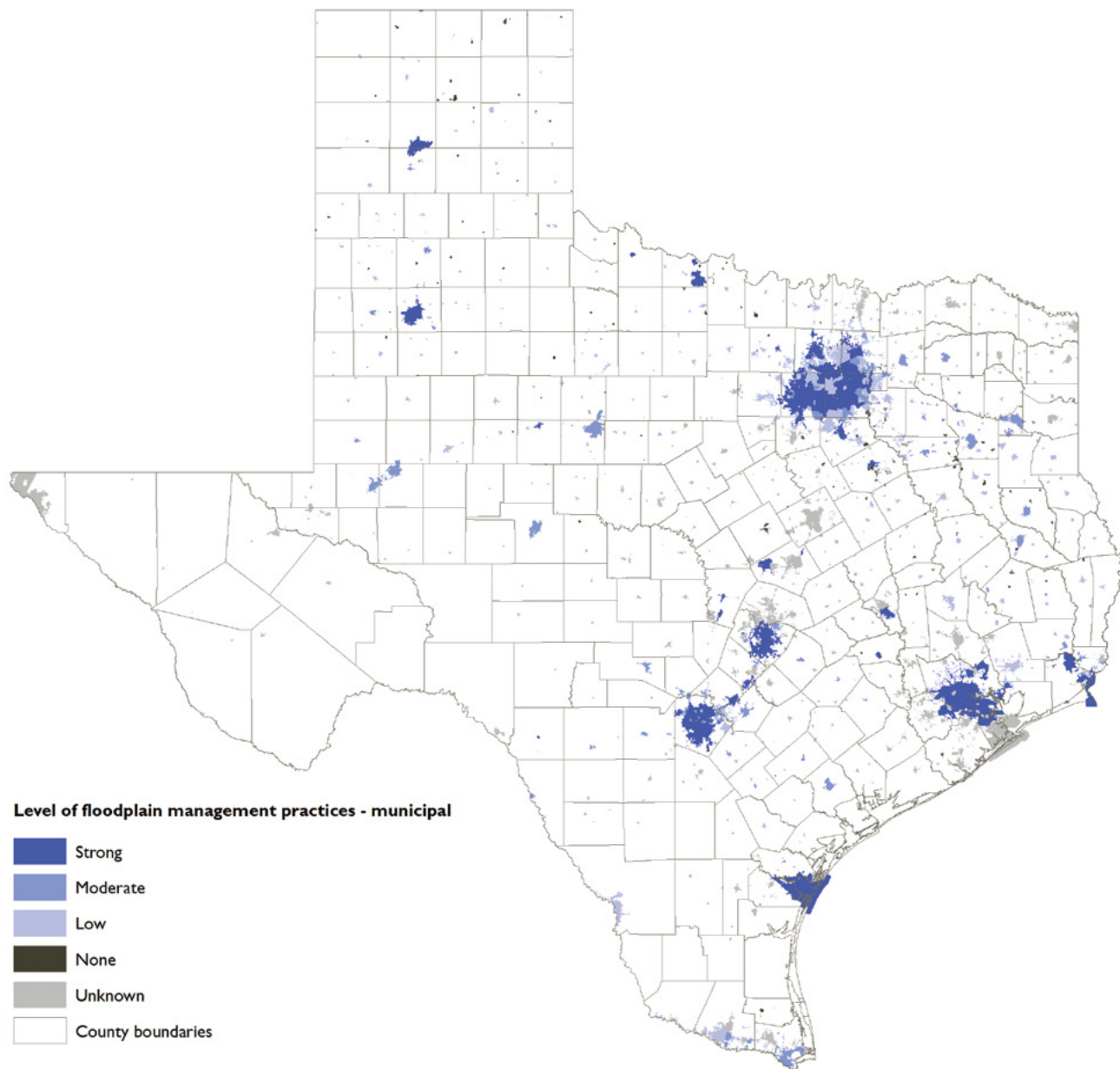
**Table 5-3. Level of floodplain management practices across entity types\***

Entity type	None	Low	Moderate	Strong	Unknown	Total
County	36	97	46	16	59	254
Flood district	5				13	18
Municipality	129	420	117	78	475	1,219
River authority	15				3	18
Other (includes municipal utility districts, drainage districts, etc.)	100	4	1	3	396	504
<b>Total</b>	<b>285</b>	<b>521</b>	<b>164</b>	<b>97</b>	<b>946</b>	<b>2,013</b>

\* This table contains self-reported information obtained by the regional flood planning groups through outreach surveys to entities throughout the state. For example, blank cells may not signify zero entities; relevant information may not have been available or reported to the regional flood planning groups.

**Figure 5-4. Texas counties with different levels of floodplain management practices\***

\* This figure contains self-reported information obtained by the regional flood planning groups through outreach surveys to entities throughout the state. Relevant information for some entities may not have been available or reported to the regional flood planning groups.

**Figure 5-5. Municipalities with different levels of floodplain management practices\***

\* This figure contains self-reported information obtained by the regional flood planning groups through outreach surveys to entities throughout the state. Relevant information for some entities may not have been available or reported to the regional flood planning groups.



44 CFR § 60.3 outlines the minimum requirements for floodplain management criteria for flood prone areas, which are summarized as follows. These are also the minimum requirements for the National Flood Insurance Program and are classified as the “low” level in Table 5-3.

- Require permits for all proposed construction or other development in the community to determine whether such construction or other development is proposed within flood prone areas.
- Review proposed development to assure that all necessary permits have been received from those governmental agencies from which approval is required by federal or state law.
- Review all permit applications to determine whether proposed building sites will be reasonably safe from flooding:
  - If a proposed building site is in a flood prone area, all new construction and substantial improvements shall be designed to adequately prevent flotation or collapse and be constructed with materials resistant to flood damage.
- Review subdivision proposals to determine whether such proposals will be reasonably safe from flooding:
  - If a subdivision proposal is in a flood prone area, any such proposals shall be reviewed to ensure consistency with the need to minimize flood damage within that area.
  - All public utilities and facilities, such as sewer, gas, electrical, and water systems must be located and constructed to minimize or eliminate flood damage.
- Provide adequate drainage to reduce exposure to flood hazards.
- Adopt and enforce a flood damage prevention ordinance.
- Require new or substantially improved homes and manufactured homes to be elevated above the base flood elevation.
- Require elevation certificates to ensure compliance.

- Conduct field inspections, cite violations, resolve non-compliance issues, and consider and manage variances.
- Require new and replacement water supply systems to be designed to minimize or eliminate infiltrations of floodwaters into the system.
- Require new and replacement sanitary sewage systems to be designed to minimize or eliminate infiltrations of floodwaters into the systems and discharges from the systems into floodwaters and onsite waste disposal systems to be located to avoid impairment to them or contamination from them during flood events.

A total of 164 entities were considered to have a moderate degree of floodplain management practices as they exceeded the minimum requirements of the National Flood Insurance Program. These included higher standards such as detention requirements, compensatory fill requirements in the 1 percent (100-year) annual chance regulatory floodplain, and requirements that minimum finished floor elevations of new habitable structures exceed the base flood elevation.

The flood planning groups identified a total of 97 entities as having a strong degree of floodplain management practices. Factors for this determination included entities that currently regulate to the effective 0.2 percent (500-year) annual chance floodplain or had adopted Atlas 14 rainfall data, which is the latest available data and depicts increased rainfall in many areas of Texas resulting in larger floodplains. The implemented regulations for these entities include requiring compensatory floodplain fill mitigation for fill placed within the effective 0.2 percent (500-year) annual chance floodplain, as well as requiring the finished floor elevations of new habitable structures to be built above the 0.2 percent (500-year) annual chance floodplain elevation.

**Table 5-4. Level of enforcement\***

Entity type	None	Low	Moderate	High	Unknown	Total
County	56	43	45	22	88	<b>254</b>
Flood district	5				13	<b>18</b>
Municipality	340	62	118	91	608	<b>1,219</b>
River authority	14				4	<b>18</b>
Other (includes municipal utility districts, drainage districts, etc.)	94	5	4	4	397	<b>504</b>
<b>Total</b>	<b>509</b>	<b>110</b>	<b>167</b>	<b>117</b>	<b>1,110</b>	<b>2,013</b>

\* This table contains self-reported information obtained by the regional flood planning groups through outreach surveys to entities throughout the state. Blank cells may not signify zero entities; relevant information may not have been available or reported to the regional flood planning groups.

### 5.1.5 Level of enforcement

Through outreach, the regional flood planning groups identified the level of enforcement of floodplain regulations by entities with flood-related authority. While some flood planning regions collected this data from self-reported surveys, other regions reported enforcement based on level of National Flood Insurance Program participation. The following criteria were provided to the planning groups to determine the level of enforcement for their regions:

- **None**, meaning the entity does not enforce floodplain management regulations
- **Low**, meaning the entity provides permitting of development in the floodplain but may not perform inspections or issue fines or violations
- **Moderate**, meaning the entity enforces much of the ordinance, performs limited inspections, and is limited in issuing fines and violations
- **High**, meaning the entity actively enforces all adopted requirements, performs multiple inspections throughout the construction process, issues fines for violations as appropriate, and enforces substantial damage and improvement policies

The planning groups reported 177 entities with a high level of enforcement, 167 entities with a moderate level of enforcement, and 110 with what was considered a low level of enforcement. The level of enforcement for 1,110 entities was reported as unknown (Table 5-4, Figure 5-6, and Figure 5-7). The regional flood planning groups

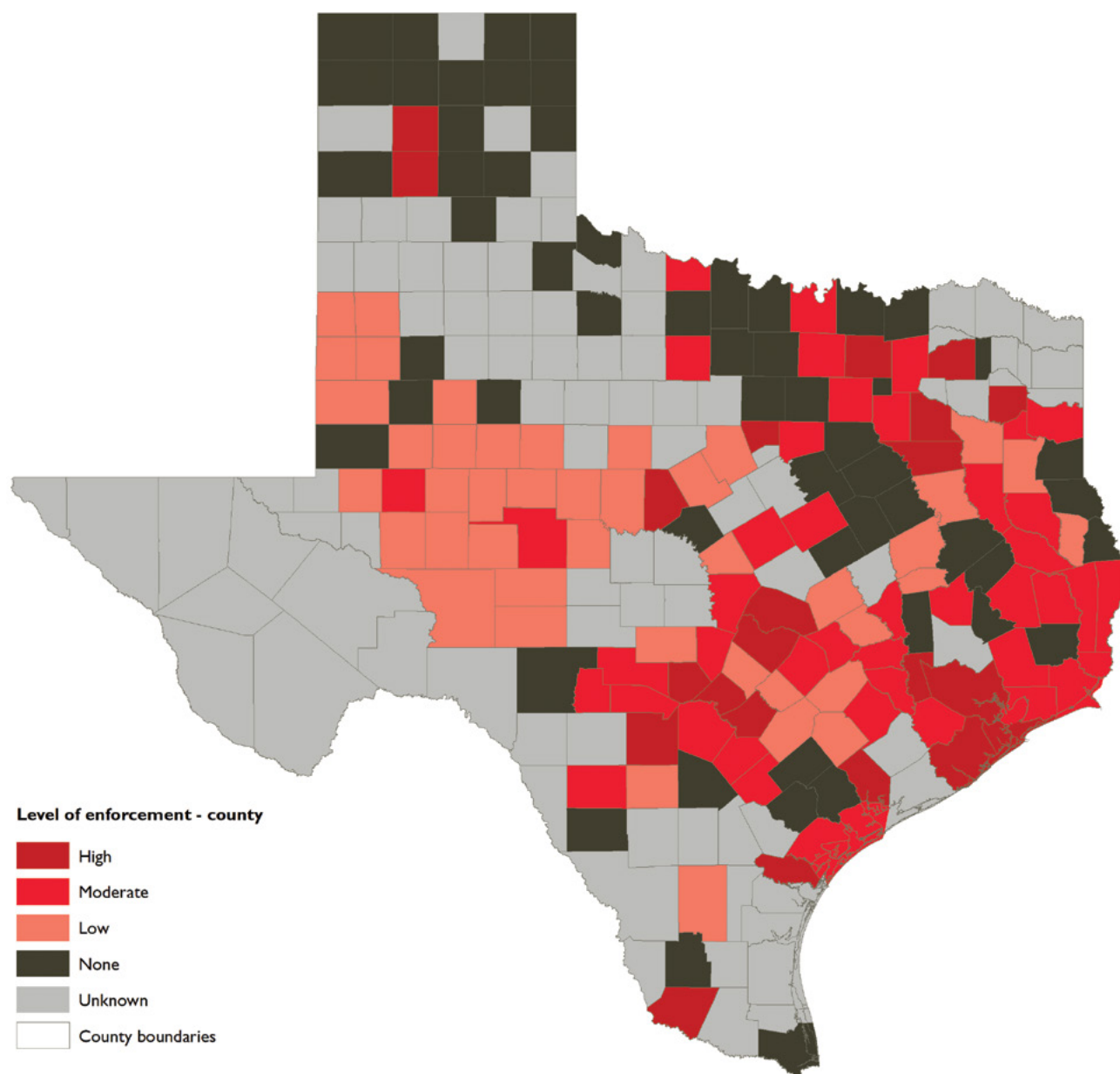
noted that many communities may have been reluctant to share this information, fearing its potential impact on flood insurance.

### 5.1.6 Stormwater or drainage fees

Texas Local Government Code, Chapter 552, provides municipalities with the authority to establish stormwater utilities and assess stormwater utility fees, also referred to as drainage utility fees or drainage fees. Chapter 552, Municipal Utilities, also includes discussion of water, sewer, gas, and electric utility systems. Drainage utilities are typically the only municipal utility systems that do not have a dedicated charge or fee associated with use or benefit of the utility. Similarly, many municipalities do not have staff or services dedicated exclusively to support their drainage utility and instead commonly embed those services within public works or transportation departments.

Drainage utility assets are typically made up of open channels (ditches, creeks, rivers), closed conduits (storm sewers, culverts), ponds (dry or wet detention ponds, lakes), and levees/dams. These facilities are often bounded by drainage easements, road rights-of-way, or other forms of property ownership. As many of these assets relate to roadway systems, they are often maintained in tandem with the roadways. Notable exceptions are the larger drainage systems such as creeks, rivers, levees, and dams. Drainage utility fees are intended to provide a stable and dedicated funding mechanism to help maintain or improve these drainage utility assets. Improved

Figure 5-6. Level of enforcement by county\*



\* This figure contains self-reported information obtained by the regional flood planning groups through outreach surveys to entities throughout the state. Relevant information for some entities may not have been available or reported to the regional flood planning groups.

or newly built drainage utility assets can provide additional flood mitigation opportunities.

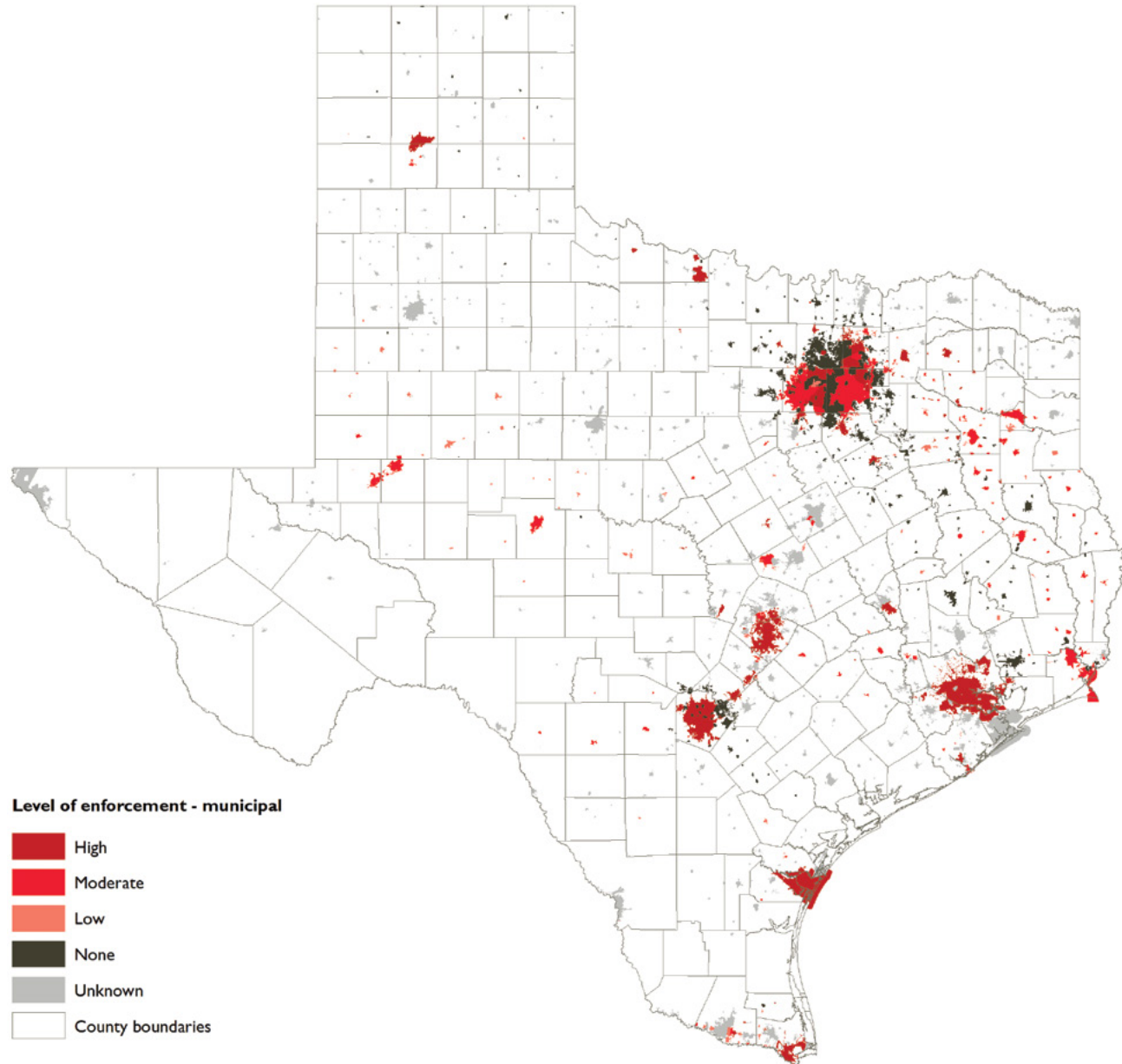
Only municipalities can charge drainage fees, although there are certain districts, like drainage or levee districts, that also have fee mechanisms associated with maintaining their assets. At least one city, Longview, collects a sales tax instead of a drainage fee to fund drainage projects and maintenance. In general, counties do not have

statutory authority to charge drainage fees in Texas.<sup>31</sup>

Drainage fees are not currently tracked by a state or federal agency; therefore, it is difficult to get an accurate assessment of the number of actual municipalities with drainage fees in Texas.

<sup>31</sup> Texas Attorney General Opinion GA-0366 (2005), [www.texasattorneygeneral.gov/opinions/greg-abbott/ga-0366](http://www.texasattorneygeneral.gov/opinions/greg-abbott/ga-0366)



**Figure 5-7. Level of enforcement by municipality\***

*\* This figure contains self-reported information obtained by the regional flood planning groups through outreach surveys to entities throughout the state. Relevant information for some entities may not have been available or reported to the regional flood planning groups.*

Six of the 15 regional flood plans identified 87 municipalities with drainage utility fees (Table 5-5 and Figure 5-8). Of these, approximately 70 percent (63) were identified within Region 3 Trinity, or more specifically, within the Dallas-Fort Worth metro area.

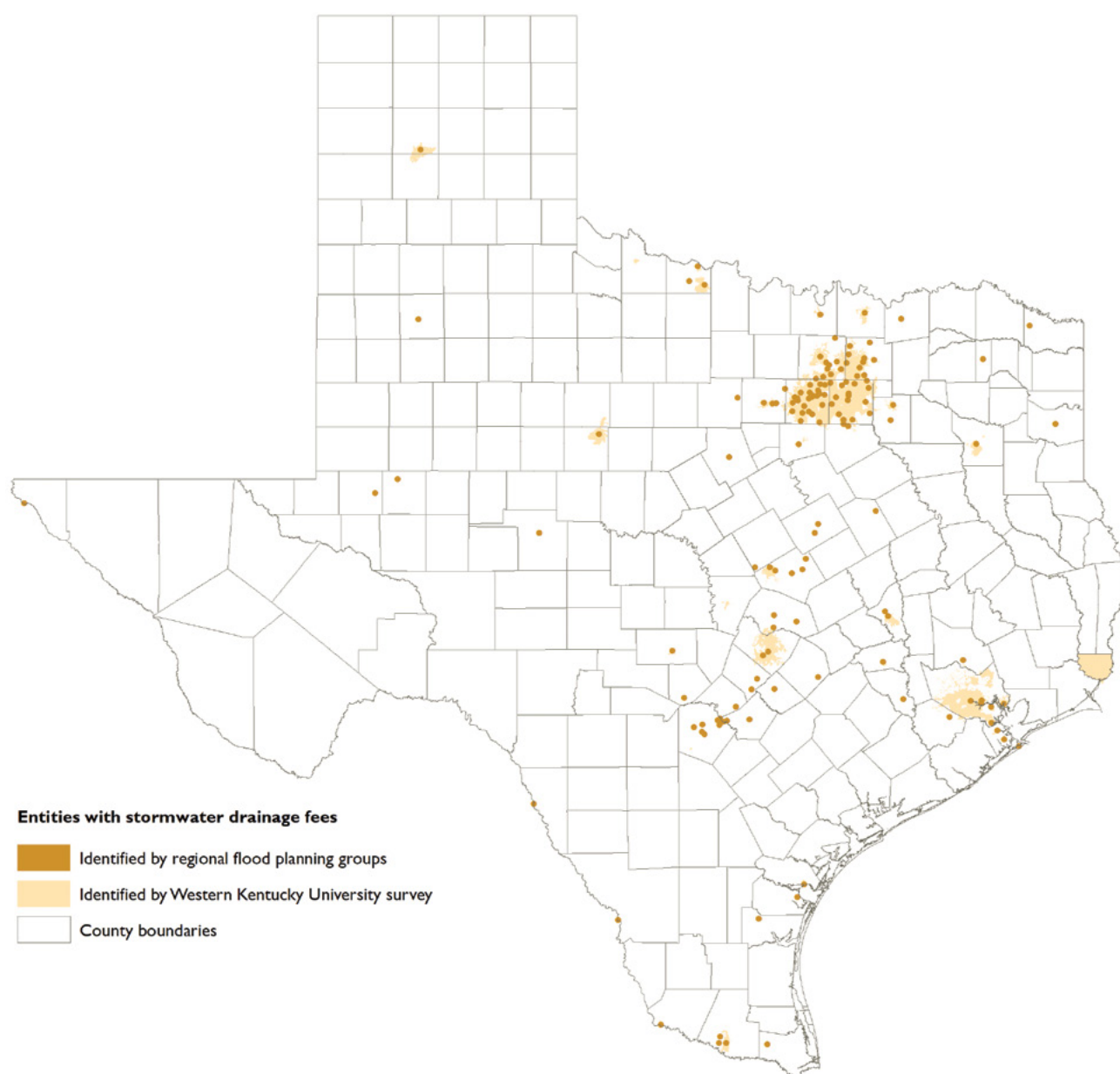
It is possible that there are additional communities in Texas with drainage fees that are not cap-

tured in the data reported by the regional flood planning groups. For example, a 2023 Western Kentucky University study identified 145 communities in Texas with drainage fees, also with a significant majority located in the Dallas-Fort Worth area (Campbell and Davis, 2023). The total count of Texas communities with drainage fees reported in the regional flood plans (displayed in

**Table 5-5. Texas entities with drainage fees\***

Entity type	Yes	No	Unknown	Total
County		174	80	<b>254</b>
Flood district		14	4	<b>18</b>
Municipality	87	625	507	<b>1,219</b>
River authority		66	438	<b>504</b>
Other (includes municipal utility districts, drainage districts, etc.)		8	10	<b>18</b>
<b>Total</b>	<b>87</b>	<b>887</b>	<b>1,039</b>	<b>2,013</b>

\* This table contains self-reported information obtained by the regional flood planning groups through outreach surveys to entities throughout the state. Blank cells may not signify zero entities; relevant information may not have been available or reported to the regional flood planning groups.

**Figure 5-8. Entities in Texas with stormwater drainage fees\***

\* This figure contains self-reported information obtained by the regional flood planning groups through outreach surveys to entities throughout the state. Relevant information for some entities may not have been available or reported to the regional flood planning groups.

Figure 5-8) varies slightly from the Texas portion of the Western Kentucky University information.

Drainage fees are typically based on some assessment of a property's relative impact to the drainage system. Like water or electric metering, municipalities attempt to estimate usage of the drainage system when assessing fees. Common approaches to estimate usage include an assessment of impervious cover, use of an equivalent residential unit to normalize structure sizes, or a tiered system. Some municipalities simply collect a flat fee. Regardless, drainage fees are an option for municipalities to provide a stable and consistent revenue source to maintain and improve their drainage assets, which can result in reducing flood risk within their communities.

### 5.1.7 Addressing future population growth and development

In the face of population growth and changing land use patterns in Texas, the future of floodplains and flood risk are uncertain. Due to increasing impervious cover, rising sea level, and other factors, the future base flood elevations will likely increase at many locations, thereby expanding the horizontal extent of floodplains. Moreover, variability in floodplain management practices across the state introduces an escalating level of flood risk as the population continues to expand. While some of the current floodplain ordinances and standards may prove effective in safeguarding future populations and properties, their successful implementation is crucial. Entities that currently use future flood conditions as part of their design criteria provide a safety factor that reduces future flood hazard exposure for new and existing developments, whereas areas lacking comprehensive or up-to-date flood risk information, including floodplain maps and models, or areas with inadequate implementation of floodplain management standards, are particularly vulnerable to heightened flood risks.

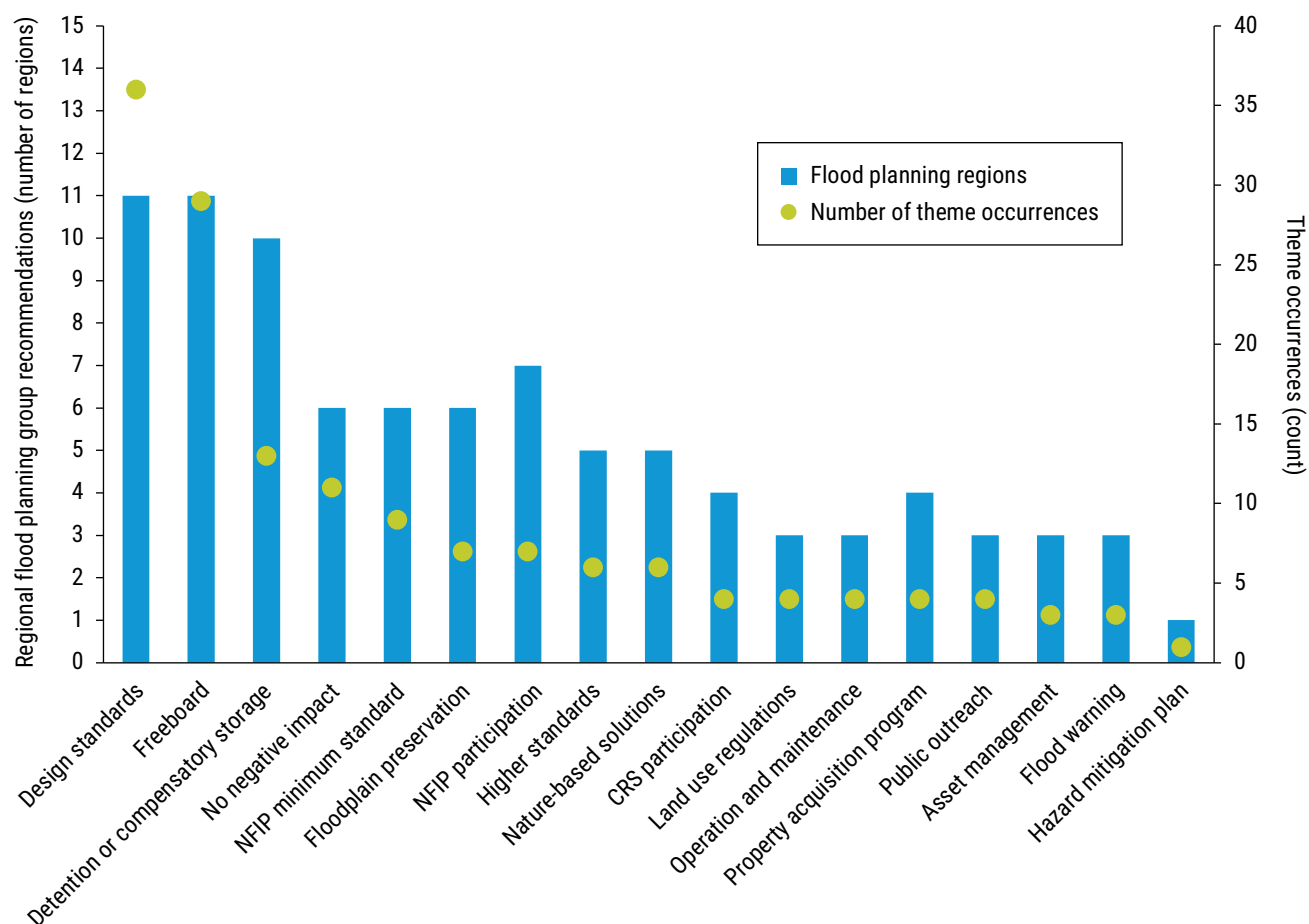
Anticipated increases in future base flood elevations and the subsequent expansion of floodplains necessitate proactive measures. By adopting comprehensive measures and incorporating floodplain considerations into community planning, Texas can effectively address the potential risks associated with future flood hazards.

## 5.2 Regional flood planning group recommendations for floodplain management practices

In addition to evaluating existing floodplain management practices within their regions, the planning groups were required to make general recommendations and/or adopt specific minimum floodplain management standards to achieve more consistent approaches across the region(s). Each regional flood plan was required to clearly state whether the standards are recommendations for consideration by local entities or planning group-adopted, region-specific minimum standards required to be adopted by local entities. If the latter, the standards must be adopted prior to the planning group including in its regional flood plan any flood management evaluations, flood mitigation projects, or flood management strategies sponsored by or that will otherwise be implemented by such entities.

All 15 of the flood planning regions concluded that standards produced as part of the flood planning effort should be classified as recommendations for general consideration by entities and communities within the flood planning region. Although standards for adoption are not proposed for any of the first cycle regional flood plans, it is conceivable that some planning groups may eventually adopt standards during future cycles of regional flood planning.



**Figure 5-9. Floodplain management recommendations by flood planning region**

CRS = Community Rating System

NFIP = National Flood Insurance Program

A total of 144 floodplain management standards were recommended by the planning groups for consideration by local entities (Figure 5-9). The major themes of these recommendations include the following:

- Asset management
- Participation in the Community Rating System
- Design standards
- Detention or compensatory storage
- Flood warning
- Floodplain preservation
- Freeboard
- Hazard mitigation plan
- Higher standards
- Land use regulations
- Mapping
- Nature-based solutions

- National Flood Insurance Program minimum standards
- No negative impact
- Operations and maintenance
- Property acquisition
- Public outreach

### 5.2.1 Summaries by region

Some regions made regionwide recommendations for floodplain management practices while some divided their region into multiple groups for specific recommendations for consideration by local entities. Brief summaries of recommendations for each of the 15 regional flood planning groups are provided in the proceeding sections. Complete lists of all recommendations are avail-

able in each planning group's 2023 regional flood plan, available on the TWDB website.<sup>32</sup>

### **Region 1 Canadian-Upper Red**

Region 1 Canadian-Upper Red recommended four key minimum standards to help the region maintain the natural flood attenuation benefits provided by the playas and promote naturally occurring processes within playas. These recommendations covered the following themes: No negative impact, freeboard, design standards, detention or compensatory storage, operation and maintenance, and floodplain preservation.

### **Region 2 Lower Red-Sulphur-Cypress**

The Lower Red-Sulfur-Cypress planning group recommended minimum standards that can be grouped into four themes for the region: freeboard, design standards, detention or compensatory storage, and no negative impact. The Neches planning group chose to recommend minimum standards for the region.

### **Region 3 Trinity**

The Trinity planning group approved six recommended region-wide floodplain management standards: National Flood Insurance Program minimum standard, National Flood Insurance Program participation, higher standards, floodplain preservation, land use regulations, and detention or compensatory storage.

### **Region 4 Sabine**

The Sabine planning group recommended region-wide floodplain management standards aimed at implementing basic floodplain management practices across the watershed. These recommendations include asset management, design standards, no negative impact, detention or compensatory storage, freeboard, and nature-based solutions.

### **Region 5 Neches**

The Neches planning group recommended minimum standards for the region that can be summarized into National Flood Insurance Program minimum standards, property acquisition, operation and maintenance, public outreach, design standards, hazard mitigation plan, flood warning, no negative impact, detention or compensatory storage, freeboard, and nature-based solutions.

### **Region 6 San Jacinto**

Because there is already widespread community participation in the National Flood Insurance Program, the San Jacinto planning group focused its floodplain management recommendations on higher standards. These recommendations fell under eight major themes: National Flood Insurance Program minimum standards, National Flood Insurance Program participation, participation in the Community Rating System, no negative impact, freeboard, design standards, detention or compensatory storage, and floodplain preservation.

### **Region 7 Upper Brazos**

The Upper Brazos planning group recommended practices to encourage entities with flood control responsibilities to establish minimum floodplain management standards to reduce or eliminate potential flooding risk. These recommendations included freeboard, design standards, detention or compensatory storage, and property acquisition.

### **Region 8 Lower Brazos**

The Lower Brazos planning group chose to recommend floodplain management standards by zone, or subregion, to better tailor recommendations to diverse areas throughout the region with varying flood risk. Each zone differs from the next in terms of natural hydrography, topography, climatological effects, and demographics throughout the river basin. The recommended zone-level standards include design standards, no negative impact, flood warning, public outreach, property

<sup>32</sup> [www.twdb.texas.gov/flood/planning/plans/2023a/index.asp](http://www.twdb.texas.gov/flood/planning/plans/2023a/index.asp)

acquisition, operation and maintenance, floodplain preservation, detention or compensatory storage, and National Flood Insurance Program participation.

### **Region 9 Upper Colorado**

While the Upper Colorado region has approximately 74 percent National Flood Insurance Program participation, 86 percent of the region either lacks effective floodplain data or has outdated detailed studies. To address the main flooding concerns for the watershed, the Upper Colorado planning group provided four recommendations that fall under two main themes: design standards and freeboard.

### **Region 10 Lower Colorado-Lavaca**

The Lower Colorado-Lavaca region has nearly 100 percent National Flood Insurance Program participation. Because of this, the planning group chose to focus its floodplain management recommendations on those that exceeded current regional practices. These recommendations include National Flood Insurance Program participation, higher standards, freeboard, detention or compensatory storage, National Flood Insurance Program minimum standards, and land use regulations.

### **Region 11 Guadalupe**

The Guadalupe planning group's recommendations generally focused on the adoption of higher standards and participation in the Community Rating System. Overall, the planning group's recommendations fall under these themes in priority order: nature-based solutions, floodplain preservation, land use regulations, detention or compensatory storage, design standards, higher standards, freeboard, National Flood Insurance Program minimum standards, National Flood Insurance Program participation, and participation in the Community Rating System.

### **Region 12 San Antonio**

The San Antonio planning group decided to encourage floodplain management and land

use practices in addition to adopting higher standards.

### **Region 13 Nueces**

The Nueces planning group's floodplain management recommendations for local entities with flood-related authority fell under the following themes: freeboard, participation in the Community Rating System, higher standards, nature-based solutions, floodplain preservation, and asset management.

### **Region 14 Upper Rio Grande**

The Upper Rio Grande planning group recommendations fell under public outreach, flood warning, asset management, higher standards, participation in the Community Rating System, nature-based solutions, design standards, National Flood Insurance Program participation, and National Flood Insurance Program minimum standards.

### **Region 15 Lower Rio Grande**

The Lower Rio Grande planning group opted to recommend floodplain management standards that include design standards, property acquisition, and freeboard.

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## **5.3 TWDB recommendations for floodplain management best practices for Texas communities**

There are a wide variety of means by which state agencies and local communities can implement floodplain management practices that may result in reduced flood risk. The TWDB developed several recommendations based on a combination of regional flood planning group recommendations as well as recommendations based on TWDB staff experience working directly with Texas communities. Some recommendations indicate potential actions by the TWDB or other regional,



state, and federal entities, while other recommendations indicate actions by local communities. Each recommended action is preceded by a designation to whom it is most applicable. All recommendations are optional and subject to available funding and official adoption by a given agency or community. Regional flood planning groups that supported recommendations in their regional flood plans are included at the end of each recommendation, as applicable.

TWDB recommendations are divided into five broad categories:

### 1. Floodplain management

- a. [Communities] Communities are encouraged to develop, designate, and enforce floodplain management standards as recommended in Chapter 2 floodplain management recommendation A.
- b. [Communities and TWDB] Encourage National Flood Insurance Program participation and adoption of minimum floodplain management practices for all Texas communities. Consistent statewide adoption for minimum floodplain management standards helps ensure all Texas communities are on a level playing field and minimizes the risk of development within one community affecting flood risk in another community. This could be achieved through the following strategy:
  - i. [Communities] Utilize base level engineering models and maps to improve local permitting processes and ensure development is in line with current flood risk assessments. Since many current FEMA regulatory maps are out of date, base level engineering is often considered the best available flood hazard data for some areas *[Recommended by Regions 4, 5, 10, 11, 15]*.
  - c. [Communities and TWDB] Encourage use of higher floodplain management standards for communities who already have minimum or National Flood Insurance Program standards in place. The National Flood Insurance Program minimum standards only consider existing conditions (not future development) and do not account for uncertainty or variability of existing flood hazard estimates. In addition to reducing risk, adopting higher standards can provide discounts on flood insurance costs at each property if the community participates in the Community Rating System program. This could be achieved through the following strategies:
    - i. [TWDB] Develop template ordinances with specific, State-recommended higher standards. Centralizing sets of recommended standards would help ensure consistency and uniformity across regions, which can be helpful for streamlining regulatory processes. Templates may also help communities more easily adopt and implement standards, reducing the burden on local resources *[Recommended by Regions 1, 4, 5, 6, 7, 11, 13]*.
    - ii. [TWDB] Encourage regional, state, and federal agencies to provide incentives for community adoption and consistent adherence to higher standard *[Recommended by Regions 6, 11]*.
    - iii. [TWDB] Encourage and facilitate community adoption of consistent building codes. The United States does not have a national building code, nor does Texas have a state building code. International building codes are often developed and updated in response to lessons learned from recent natural disasters, like flooding, as well as advancements in technology. Adopting the latest codes can help communities ensure their infrastructure is equipped to handle potential flood risks *[Recommended by Regions 6, 13]*.

- d. [Communities, TWDB, and other state agencies]<sup>33</sup> Develop and incentivize State-recommended higher standards for floodplain management, such as through the following:
  - i. [TWDB] Provide clear guidance for how communities may formally adopt base level engineering or other new flood modeling and mapping products to ensure access to the most accurate flood risk data available. Connect varying uncertainty in flood risk with varying freeboard recommendations to further refine local strategies and make communities more resilient to flood vulnerabilities *[Recommended by Regions 2, 3, 8, 9, 12, 13]*.
  - ii. [Communities and other state agencies] Treat all coastal FEMA flood hazard zones (**Zone V and Zone VE**) as areas potentially subject to high velocity wave action so buildings are more resilient and better able to resist the damaging force of waves.
  - iii. [TWDB] Develop statewide guidance on accounting for flood velocities in riverine areas. Local adoption of this guidance would help standardize how communities assess and mitigate flood risks to protect areas from the dynamic and erosive force of high velocity flows. One example approach to assess severity of high velocity flows would be to consider the combination of flood depth times flood velocity.
  - iv. [TWDB] Improve guidance on how to assess flood impacts in approximate **Zone A** areas or other special flood hazard areas without base flood elevations. Develop guidance on how to determine best available data. Through this enhanced guidance, communities can better achieve a more accurate and comprehensive understanding of flood risks, allowing for more informed decision-making.
- v. [Communities] Improve community floodplain management and development permitting for RV parks in the floodplain. RV parks often lack permanent infrastructure, making them particularly vulnerable to flood events. Enhancing floodplain management in these areas can help ensure protective measures are in place and that development occurs in safer areas to reduce the risk to life and property.
- vi. [Communities] Adopt cumulative substantial damage regulations for communities. Tracking and addressing property damages over time can help communities recognize structures that are repeatedly at risk and may require proactive interventions and incentivize safety and sustainability over expensive short-term fixes.
- vii. [Communities and other state agencies] Implement regulations that require an additional 2 to 3 feet of freeboard above the base flood elevation (known flood height) where properties are identified as both substantially damaged and either repetitive loss or severe repetitive loss. Substantially damaged and repetitive loss properties have a demonstrated history of vulnerability to flooding. Requiring additional elevation reduces future risk to lives and property while reducing the financial burden of high insurance premiums on the property owner and community resources.
- e. [TWDB] Develop consistent statewide drainage and floodplain-related design and construction standards that are not otherwise covered with National Flood Insurance Program floodplain management regulations. Develop templates for local community

<sup>33</sup> Other state agencies may include but are not limited to Texas Division of Emergency Management, Texas General Land Office, Texas Department of Transportation, Texas Commission on Environmental Quality, and Texas State Soil and Water Conservation Board

adoption into ordinances or drainage criteria manuals. Align these efforts with existing components in place from the Texas Department of Transportation and other state agencies *[Recommended by Regions 1, 2, 3, 4, 6, 7, 8, 9, 11, 12, 14]*.

- f. [TWDB and other state agencies] Consider explicitly adopting National Flood Insurance Program regulations for State-owned properties. Further, consider adopting higher standards for State-owned properties. Many State-owned properties serve vital public functions that should be safeguarded to ensure continuity of essential services. Adopting minimum and/or higher standards for these properties sets an example for local communities while improving infrastructure resiliency, demonstrating good fiscal responsibility, and potentially reducing the burden on taxpayers to fund recovery efforts. FEMA is evaluating the few states that currently have not adopted National Flood Insurance Program regulations for State-owned properties and is considering imposing restrictions or penalties (such as loss of disaster grant funding opportunities).
- g. [TWDB and other state agencies] Enhance coordination among state agencies for floodplain management. Improve education for state agencies that perform a variety of permitting functions, such as the Texas Parks and Wildlife Department for park properties, the Texas Department of Licensing and Regulation for mobile home installations, and the Railroad Commission of Texas for propane tank installations. Coordination ensures a streamlined and consistent approach to floodplain management while reducing overlaps and gaps in responsibilities *[Recommended by Regions 13, 14]*.

## 2. Nature-based solutions

- a. [TWDB] Provide guidance on how communities can better maintain adequate flood flow conveyance capacities using nature-based techniques. Water needs space to flow.

Leaving adequate space for water to flow can prevent it from creating its own space and causing flood risk to life and property. Adequate space can also better maintain the ecological health of creek and river systems.

- b. [TWDB, communities, and other state agencies] Seek ways to provide additional incentives to nature-based solutions, such as open space preservation or reduced use of impervious cover approaches for development or drainage projects. Examples include improved Flood Infrastructure Fund prioritization or set-aside funding for nature-based solution projects *[Recommended by Regions 5, 13]*.

## 3. Asset management

- a. [TWDB] Generate and maintain a statewide inventory and assessment of major flood infrastructure. This is a large effort that will require dedicated resources and funding at the local level.<sup>34</sup>
- b. [TWDB] Provide guidance on how to best manage drainage and floodplain assets to help all communities, regardless of their location or resources, benefit from consistent approaches to asset management. Providing clear, standardized guidance may also allow the State to direct resources more efficiently *[Recommended by Regions 3, 14]*.

## 4. Education and outreach

- a. [Communities, TWDB, and other state agencies] Seek to improve awareness and ways to mitigate risk at low water crossings. Examples include improved mapping of locations, improved flood warning, and increased or prioritized grant funding. Low water crossings remain one of the leading causes of flood-related fatalities in the state. By enhancing awareness, residents and travelers can make better informed

<sup>34</sup> May require additional resources to implement, including through the TWDB

decisions, reducing the risk of incidents [Recommended by Regions 7, 9, 10, 11].

- b. [Communities, TWDB, and other state agencies] Improve public flood education, outreach and coordinated messaging between federal, state, regional, and local agencies. Increase targeted marketing campaigns through avenues like social media, print media, TV media, and billboard media. Public information campaigns can help Texans better understand flood risk and prepare for future flood events [Recommended by Regions 8, 11, 13, 14].
- c. [Communities, TWDB, and other state agencies] Improve training and professional development activities for floodplain practitioners like floodplain administrators, as well as floodplain-related professions such as planning, development, real estate, and insurance. Floodplain management approaches are continually evolving with advances in technology, research, and best practices. Improved training can help incorporate those changes into existing activities [Recommended by Region 13].
- d. [Communities, TWDB, and other state agencies] Increase regional and statewide activities related to flood warning. Support the National Weather Service's release of new flood inundation mapping products. Improve guidance and outreach related to developing flood warning systems and flood sensors. Flood warning systems enhance preparedness and response time in emergencies, potentially saving lives and reducing property damage. Bolstering flood warning activities can also help communities gather and analyze data more comprehensively, helping to refine prediction models [Recommended by Regions 11, 12, 14].

## 5. State flood planning

- a. [TWDB and other state agencies] Maintain coordination between Texas Division of Emergency Management's state hazard mitigation planning and the TWDB's state flood



Palo Duro Canyon State Park; photo courtesy of Texas Parks and Wildlife Department

planning processes. Seek to incorporate state flood planning into other statewide planning processes such as Texas Department of Transportation planning, Texas Parks and Wildlife Department planning, and Texas Facilities Commission planning. Integrating planning processes can ensure a more cohesive and comprehensive approach to addressing flood risk in the state while helping to eliminate overlaps and gaps in planning efforts.

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