



1 Introduction

The purpose of this plan is to ensure that all of our communities have adequate supplies of water during times of drought.

The availability of water has always influenced patterns of settlement, and communities in Texas originally grew where water was plentiful. But as many of our communities have grown, they have outgrown their water supplies, making it more and more necessary to make efficient use of our local water resources, to work cooperatively with one another on regional solutions to water problems, and to move water around the state when necessary to meet the needs of all our communities. The purpose of this plan is to ensure that all of our communities have adequate supplies of water during times of drought.

The 2012 State Water Plan is Texas' ninth state water plan and the third to be developed through the regional water planning process, initiated by the

Texas Legislature in 1997. When the first state water plan was published in 1961, the population of Texas was less than half the size it is today, with 9.6 million residents. At the time the plan was adopted, only a third of Texans lived in urban areas and 79 percent of the communities in Texas obtained their water supplies from groundwater wells. Now there are over 25 million Texans. Our population has become older, less rural, and more diverse. Communities in the state obtain much more of their water supplies from surface water such as rivers and lakes, but also from new sources such as reuse and desalination. While a lot has changed since the first water plan, much remains the same. All or part of the state is often too wet or too dry, and planning for times of drought is every bit as relevant today as it was then.

The 2012 State Water Plan is based on regional water plans that are updates to the 2006 regional water plans. During this planning cycle, the regional water plans were focused primarily on changed conditions, since new population data from the U.S. Census Bureau was not available to significantly update projections of future water demands. The last state water plan, *Water for Texas—2007*, included population and water demand projections based on newly released 2000 U.S. Census data, and its adoption coincided with the 50th anniversary of TWDB and the commencement of the 80th Texas Legislative session. It also included comprehensive summaries of all of the river basins and aquifers in the state. These summaries are still current and are included by reference in the 2012 State Water Plan.

Since this plan is adopted over 50 years after the first state water plan, a special effort has been made to look back at past plans and to reflect on the evolution of water planning over time. Newer plans have placed greater emphasis on conservation and on innovative strategies that were largely unknown to the planners of the 1950s and 1960s. Plans have included everything from small local projects to importing surplus water from the Mississippi River. But the reality of drought and the needs for water to sustain our cities, rural communities, farms, ranches, businesses, industries, and our environment have remained unchanged.

This plan references numerous studies and reports with multiple findings and recommendations. Reference of these studies and reports does not constitute an endorsement by TWDB of their findings and recommendations.

1.1 A BRIEF HISTORY OF TEXAS WATER PLANNING

Droughts—periods of less than average precipitation over a period of time—have plagued Texas since well before the first Spanish and Anglo settlers began arriving in the 1700s (Dunn, 2011). While some oversight of our state’s water resources began with these first settlers, the modern age of water management began around the mid to late 1800s with the earliest regulations and recordkeeping. The creation of management agencies after the turn of the past century, along with the collection of rainfall and streamflow data, began a new era of water management in the state.

When reviewing the history of weather events, it is easy to see that the major policy changes in the management of Texas’ water resources have largely corresponded to cycles of droughts and floods. Droughts are unique among climate phenomena in that they develop slowly but can ultimately have consequences as economically devastating as hurricanes, tornadoes, and floods (TBWE, 1958).

In each decade of the past century, at least some part of the state has experienced a severe drought. During development of the 2012 State Water Plan, all of Texas was in some form of drought. As of September 2011, 99 percent of the state was experiencing severe, extreme, or exceptional drought conditions. The majority of Texas counties had outdoor burn bans, 902 public water supply systems were imposing voluntary or mandatory restrictions on their customers, and the Texas Commission on Environmental Quality had suspended the use of certain water rights in several of the state’s river basins. As of the fall, the drought of 2011 ranks as the worst one-year drought in Texas’ history.

1.1.1 EARLY HISTORY OF WATER MANAGEMENT IN TEXAS

Formal water supply planning at the state level did not begin in earnest until the 1950s, but the legislature progressively began assigning responsibility for the management and development of the state's water resources to various entities starting in the early 20th century. Partly as a result of a series of devastating droughts and floods, the early 1900s saw a flurry of activity. In 1904, a constitutional amendment was adopted authorizing the first public development of water resources. The legislature authorized the creation of drainage districts in 1905; the Texas Board of Water Engineers in 1913; conservation and reclamation districts (later known as river authorities) in 1917; freshwater supply districts in 1919; and water control and improvement districts in 1925.

The creation of the Texas Board of Water Engineers, a predecessor agency to both the Texas Commission on Environmental Quality and TWDB, played a significant role in the early history of water management in the state. The major duties of the Board of Water Engineers were to approve plans for the organization of irrigation and water supply districts, approve the issuance of bonds by these districts, issue water right permits for storage and diversion of water, and make plans for storage and use of floodwater. Later, the legislature gave the agency the authority to define and designate groundwater aquifers; authorize underground water conservation districts; conduct groundwater and surface water studies; and approve federal projects, including those constructed by the U.S. Army Corps of Engineers.

In 1949, Lyndon Johnson, then a U.S. Senator, wrote a letter to the U.S. Secretary of the Interior requesting that the federal government help guide Texas in achieving "a comprehensive water program that will take into account the needs of the people of my State." Four years later, the U.S. Bureau of Reclamation responded by publishing "Water Supply and the Texas Economy: An Appraisal of the Texas Water Problem" (USBR, 1953). The report divided the state into four planning regions and evaluated existing and projected municipal and industrial water requirements up to the year 2000. The analysis assumed an available water supply under streamflow conditions experienced in 1925, when a short drought affected most of the eastern two-thirds of the state (TBWE, 1959). The appraisal identified "problem areas," presented water supply plans as potential solutions, and made a number of observations on state and federal policy. Most significantly, it recommended that Texas consider forming a permanent water planning and policy agency to represent state interests.

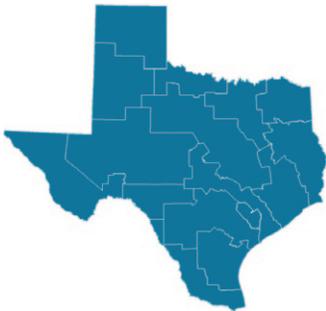
The idea of a dedicated water planning agency came to fruition not long after the state experienced the worst drought in recorded history. For Texas as a whole, the drought began in 1950 and by the end of 1956, all but one of Texas' 254 counties were classified as disaster areas. Ironically, the drought ended in the spring of 1957 with massive rains that resulted in the flooding of every major river and tributary in the state. This drought represents the driest seven-year period in the state's recorded history and is still considered Texas' "drought of record" upon which most water supply planning in the state is based.

The drought of the 1950s was unique in that a majority of Texans felt the impacts of a reduced water supply during some point during the decade. Not only did they feel the impact, but residents were at times called into action to help fix water problems in their communities (see Sidebar: Byers, Texas). Small and large cities alike faced dire situations. By the fall of 1952, Dallas faced a severe water shortage and prohibited all but necessary household use of water. In 1953 alone, 28 municipalities were forced to use emergency sources of water supply, 77 were rationing water, and 8 resorted to hauling in water from neighboring towns or rural wells. The development of additional facilities during the course of the drought reduced the number of communities with shortages during later years of the drought, but still more municipalities were forced to haul in water before it was over (TBWE, 1959). The drought of the 1950s cost the state hundreds of millions of dollars, and was followed by floods that caused damages estimated at \$120 million (TBWE, 1958).

1.1.2 WATER PLANNING ON THE STATE LEVEL (1957 TO 1997)

The legislature responded early in the drought by establishing the Texas Water Resources Committee in 1953 to survey the state's water problems (UT Institute of Internal Affairs, 1955). While dry conditions persisted, the joint committee of both state senators and house members worked to develop a long-range water policy in response to the emergency situations. As a result of some of the committee's recommendations, the Texas Legislature passed a resolution authorizing \$200 million in state bonds to help construct water conservation and supply projects. The legislature created TWDB to administer the funds from the bond sale. Then, during a following special session called by Governor Price Daniel, the legislature passed the Water Planning Act of 1957. The act created the Texas Water Resources Planning Division of the Board of Water Engineers, which was assigned the responsibility of water resources

Byers, Texas



In April 1953, after many months of drought, the town of Byers ran out of water. With the reservoir dry, the mayor declared an emergency and cut off water service to 200 customers and the school system. Word of the emergency spread fast and offers for help quickly poured in from neighboring communities. Most of Byers' 542 residents, along with a detail of men from Sheppard Air Force Base, laid a 2-mile pipeline from a spring on a nearby farm to the town's reservoir. Disaster was averted, but the events in Byers, and in other Texas communities affected by drought, were not soon forgotten (Lewiston Evening Journal, 1953).

Byers is now considered a municipal water user group in the Region B regional water planning area. Thanks to two sources of water supply identified in the 2011 Region B Regional Water Plan—the Wichita Lake system and the Seymour Aquifer—the town is far better positioned today. If the drought of the 1950s were to recur within the next 50 years, Byers would not only be better prepared but would have a surplus of water.

planning on a statewide basis. The voters of Texas subsequently approved a constitutional amendment authorizing TWDB to administer a \$200 million water development fund to help communities develop water supplies.

In June of 1960, Governor Daniel called a meeting in Austin to request that the Board of Water Engineers prepare a planning report with projects to meet the projected municipal and industrial water requirements of the state in 1980. Work quickly began on statewide studies to develop the first state water plan. The first plan—A Plan for Meeting the 1980 Water Requirements of Texas—was published in 1961. The plan described historical and present uses of surface and groundwater by municipalities, industries, and irrigation; summarized the development of reservoirs; estimated the 1980 municipal and industrial requirements of each area of the state; provided a plan for how to meet those requirements by river basin; and discussed how the plan could be implemented.

Later plans were developed by the state and adopted in 1968, 1984, 1990, 1992, and 1997. All of the plans have recognized the growth of the state’s population and the need to develop future water supplies. Earlier plans placed more reliance on the federal government, while later plans developed at the state level increasingly emphasized the importance of conservation and natural resource protection. The 1968 State Water Plan recommended that the federal government continue to fund feasibility studies on the importation of surplus water from the lower Mississippi River. (A later study found that the project was not economically feasible.) The 1984 State Water Plan was the first to address water quality, water conservation and water use efficiency, and environmental water needs in detail.

While previous plans were organized by river basin, the 1990 State Water Plan projected water demands, supplies, and facility needs for eight regions in the state. The 1997 State Water Plan— developed by TWDB through a consensus process with the Texas Parks and Wildlife Department and the Texas Commission on Environmental Quality—divided the state into 16 planning regions.

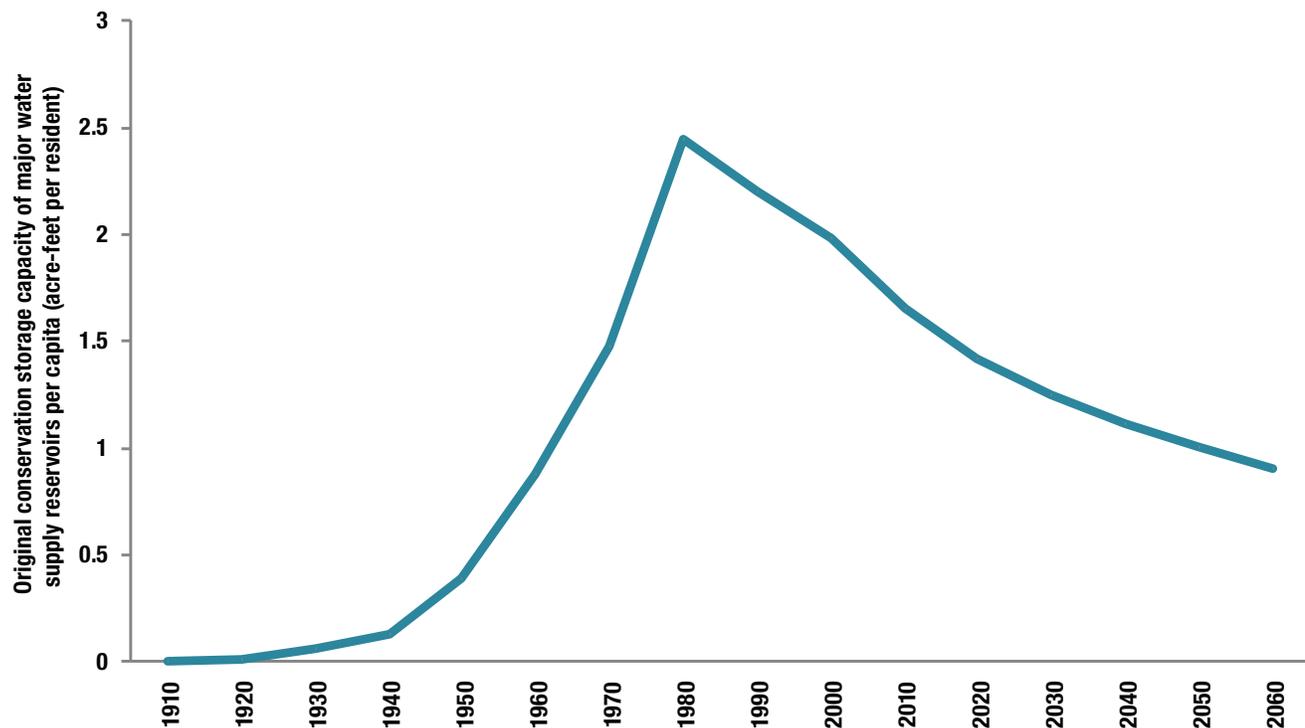
RESERVOIR DEVELOPMENT IN TEXAS

Texas has 15 major river basins and 8 coastal basins along with 9 major and 21 minor groundwater aquifers, but water supplies vary widely from year to year and place to place. Because of the unpredictability of rainfall and streamflows in the state, communities have historically relied on reservoirs to supply water during times of drought, capturing a portion of normal flow as well as floodwaters. Prevention of flooding and conservation of water for use during droughts, together with an efficient distribution system, have always been important goals in water resources planning (TBWE, 1958).

When the Texas Board of Water Engineers was originally created in 1913, the state had only 8 major reservoirs—those with a total conservation storage capacity of 5,000 acre-feet or greater (TBWE, 1959). Of these eight reservoirs, three were for municipal water supply, four were for irrigation, and one was for the generation of hydroelectric power. Lake Travis, constructed between 1937 and 1941, was the first multipurpose reservoir to provide water storage for municipal, irrigation, and mining uses; recreation; hydroelectric power generation; and flood control.

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FIGURE 1.1. RESERVOIR STORAGE PER CAPITA OVER TIME.



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During the mid 20th century, the federal government constructed a number of major reservoirs primarily for flood control but also with water supply storage. In many instances these reservoirs have prevented flood losses far exceeding the cost of their construction. (Amistad Dam on the Rio Grande retained a 1954 flood shortly after it was completed, preventing catastrophic flooding in the Lower Rio Grande Valley (TBWE, 1958).) In 1950, the state had 53 major water supply reservoirs; by 1980, the state had 179; and today, Texas has 188 major water supply reservoirs, with only a handful in some stage of planning or implementation.

Reservoir construction has slowly declined since the 1980s. While fewer reservoirs are recommended now than in early state water plans, they still play

an important role in meeting needs for water during a drought. The 2012 State Water Plan recommends 26 reservoirs that would provide 1.5 million acre-feet of water during a repeat of drought of record conditions in 2060. In the absence of these reservoirs, other water management strategies would simply not be enough to meet the needs of Texans during a severe drought.

As shown in Figure 1.1, reservoir storage per person in the state has declined from a peak of 2.4 acre-feet of conservation storage per person in 1980 to 1.7 acre-feet of conservation storage per person today. If no additional reservoirs are constructed in the next 50 years, the amount of reservoir storage would decline to less than 1 acre-foot per person by 2060, the lowest amount since immediately following the 1950s drought of record.

1.1.3 THE ADVENT OF REGIONAL WATER PLANNING

The same circumstances that led to the beginning of state water planning served as the impetus for one of the most significant changes in how Texas conducts water planning. In the mid 1990s, Texas suffered an intense 10-month drought. Reservoirs and aquifer levels declined sharply and farmers suffered widespread crop failure, with estimated economic losses in billions of dollars. Some cities had to ration water for several months and others ran out of water entirely.

The drought of 1996 was relatively short-lived, but it lasted long enough to remind Texans of the importance of water planning. When the legislature met in 1997, Lieutenant Governor Bob Bullock declared that the primary issue for the 75th Texas Legislature would be water. After lengthy debate and numerous amendments, Senate Bill 1 was passed to improve the development and management of the water resources in the state. Among other provisions relating to water supplies, financial assistance, water data collection and dissemination, and other water management issues, the bill established the regional water planning process: a new framework that directed that water planning be conducted from the ground up.

1.2 THE REGIONAL WATER PLANNING PROCESS TODAY

Senate Bill 1 outlined an entirely new process where local and regional stakeholders were tasked with developing consensus-based regional plans for how to meet water needs during times of drought. TWDB would then develop a comprehensive state water plan—based on the regional water plans—every five years. One of the most important aspects of the legislation specified that TWDB could provide financial assistance for water supply projects only if the needs to be addressed by the project were addressed

in a manner that is consistent with the regional water plans and the state water plan. This same provision also applied to the granting of water right permits by the Texas Commission on Environmental Quality.

Following passage of the legislation in 1997, TWDB initiated regional water planning with administrative rules to guide the process. TWDB designated 16 regional water planning areas (Figure 2.1), taking into consideration river basin and aquifer delineations, water utility development patterns, socioeconomic characteristics, existing regional water planning areas, state political subdivision boundaries, public comments, and other factors. TWDB is required to review and update the planning area boundaries at least once every five years, but no changes have been made to date.

Each regional water planning area has its own planning group responsible for developing a regional water plan every five years. Regional water planning groups are required to have at least 11 interests represented, including the public, counties, municipalities, industries, agriculture, environment, small businesses, electric-generating utilities, river authorities, water districts, and water utilities. Planning groups must have at least one representative from each interest, and can designate representatives for other interests that are important to the planning area. Planning groups also have non-voting members from federal, state, and local agencies and have members that serve as liaisons with planning groups in adjacent areas. (Legislation passed during the 82nd Legislative Session now requires that groundwater conservation districts in each groundwater management area located in the regional water planning area to appoint one representative to serve on the regional water planning group.) Each planning group approves

bylaws to govern its methods of conducting business and designates a political subdivision of the state.

The regional water planning process consists of 10 tasks:

- **Describing the regional water planning area:** Descriptions include information on major water providers, current water use, sources of groundwater and surface water, agricultural and natural resources, the regional economy, summaries of local water plans, and other information.
- **Quantifying current and projected population and water demand over a 50-year planning horizon:** Planning groups review projections provided by TWDB and propose revisions resulting from changed conditions or new information. TWDB consults with the Texas Department of Agriculture, Texas Commission on Environmental Quality, and Texas Parks and Wildlife Department before formally approving requests for revisions.
- **Evaluating and quantifying current water supplies:** Planning groups determine the water supplies that would be physically and legally available from existing sources during a repeat of the drought of record or worse. To estimate the existing water supplies, the planning groups use the state's surface water and groundwater availability models, when available.
- **Identifying surpluses and needs:** Planning groups compare existing water supplies with current and projected water demands to identify when and where additional water supplies are needed for each identified water user group and wholesale water provider.
- **Evaluating and recommending water management strategies to meet the needs:** Planning groups must address the needs of all water users, if feasible. If existing supplies do not meet future demand, they recommend specific water management strategies to meet water supply needs, such as conservation of existing water supplies, new reservoir and groundwater development, conveyance facilities to move available or newly developed water supplies to areas of need, water reuse, and others.
- **Evaluating impacts of water management strategies on water quality:** Planning groups describe how implementing recommended and alternative water management strategies could affect water quality in Texas.
- **Describing how the plan is consistent with long-term protection of the state's water, agricultural, and natural resources:** Planning groups estimate the environmental impacts of water management strategies. They identify specific resources important to their planning areas and describe how these resources are protected through the regional water planning process.
- **Recommending regulatory, administrative, and legislative changes:** Along with general policy and statutory recommendations, planning groups make recommendations for designating unique reservoir sites and stream segments of unique ecological value. The legislature is responsible for making the official designations of these sites.
- **Describing how sponsors of water management strategies will finance projects:** Planning groups survey water providers on how they propose to pay for water infrastructure projects in the plan and identify needs for state financing.
- **Adopting the plan:** All meetings are held in accordance with the Texas Open Meetings Act. Planning groups hold public meetings when planning their work and hold hearings before adopting their regional water plans. Members

adopt plans by vote in accordance with each group's respective bylaws.

After planning groups adopt their regional water plans, they are sent to TWDB for approval. As required by statute, TWDB then begins development of the state water plan. The state water plan incorporates information from the regional water plans, but it is more than just the sum of the regional plans. The state water plan serves as a guide to state water policy; it also explains planning methodology, presents data for the state as a whole, identifies statewide trends, and provides recommendations to the state legislature. Prior to adoption of the final state water plan, TWDB releases a draft for public comment, publishes its intent to adopt the state water plan in the Texas Register, notifies the regional water planning groups, and holds a public hearing in Austin.

The 2012 State Water Plan is the third plan developed through the regional water planning process. In response to issues identified in the 2007 State Water Plan, the legislature made several policy changes that impacted water planning. The 79th Texas Legislature passed Senate Bill 3, which created a process to address environmental flows and designated unique reservoir sites and sites of unique ecological value. The legislature also provided appropriations to allow \$1.2 billion of funding to implement water management strategies recommended in the 2006 regional water plans and the 2007 State Water Plan. Priority was given to entities with the earliest recommended implementation date in the state and regional water plans and that have already demonstrated significant water conservation savings or would achieve significant water conservation by implementing a proposed project. Later chapters of this plan discuss these issues in detail.

1.3 STATE AND FEDERAL WATER SUPPLY INSTITUTIONS

While TWDB is the state's primary water planning agency, a number of state and federal agencies in Texas have responsibility for the management of water resources and participate in the regional planning process directly and indirectly. Texas Parks and Wildlife Department, the Texas Commission on Environmental Quality, and the Texas Department of Agriculture all have non-voting representation on each planning group. They actively participate in the development of population projections and are given the opportunity to comment on the state water plan early in its development and are consulted in the development and amendment of rules governing the planning process. The water-related responsibilities of these agencies, along with other state and federal entities that indirectly participate in the regional water planning process, are described in the following sections.

1.3.1 STATE ENTITIES

TWDB, as created in 1957, is the state's primary water supply planning and financing agency. TWDB supports the development of the 16 regional water plans and is responsible for developing the state water plan every five years. The agency provides financial assistance to local governments for water supply and wastewater treatment projects, flood protection planning and flood control projects, agricultural water conservation projects, and groundwater district creation expenses. TWDB collects data and conducts studies of the fresh water needs of the state's bays and estuaries and is responsible for all aspects of groundwater studies. The agency also maintains the Texas Natural Resources Information System, the clearinghouse for geographic data in the state. TWDB provides technical support to the environmental flows process and is a member

of the Texas Water Conservation Advisory Council, providing administrative support to the council.

The State Parks Board, originally created in 1923, was later merged with other state entities and renamed the **Texas Parks and Wildlife Department**. Today, the agency has primary responsibility for conserving, protecting, and enhancing the state's fish and wildlife resources. It maintains a system of public lands, including state parks, historic sites, fish hatcheries, and wildlife management areas; regulates and enforces commercial and recreational fishing, hunting, boating, and nongame laws; and monitors, conserves, and enhances aquatic and wildlife habitat. Texas Parks and Wildlife Department reviews and makes recommendations to minimize or avoid impacts on fish and wildlife resources resulting from water projects. The agency works with regional and state water planning stakeholders and regulatory agencies to protect and enhance water quality and to ensure adequate environmental flows for rivers, bays, and estuaries. It also provides technical support to the environmental flows process and is a member of the Texas Water Conservation Advisory Council.

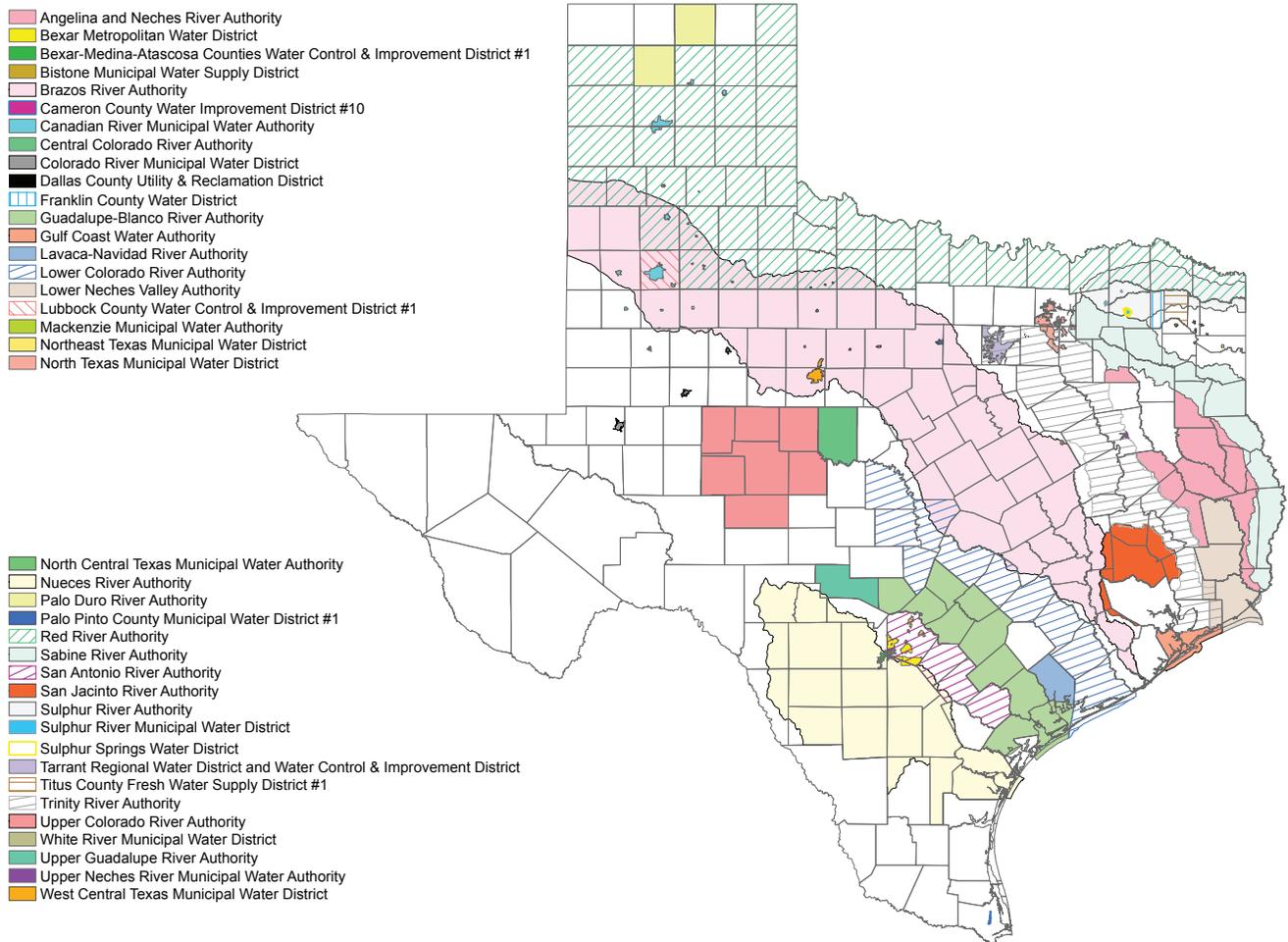
In 1992, to make natural resource protection more efficient, the legislature consolidated several programs into one large environmental agency now known as the **Texas Commission on Environmental Quality**. The Texas Commission on Environmental Quality is the environmental regulatory agency for the state, focusing on water quality and quantity through various state and federal programs. The agency issues permits for the treatment and discharge of industrial and domestic wastewater and storm water; reviews plans and specifications for public water systems; and conducts assessments of surface water and groundwater quality. The Texas Commission on Environmental Quality regulates retail water and

sewer utilities, reviews rate increases by investor-owned water and wastewater utilities, and administers a portion of the Nonpoint Source Management Program. In addition, it administers the surface water rights permitting program and a dam safety program; delineates and designates Priority Groundwater Management Areas; creates some groundwater conservation districts; and enforces the requirements of groundwater management planning. The agency also regulates public drinking water systems and is the primary agency for enforcing the federal Safe Drinking Water Act. The Texas Commission on Environmental Quality provides support to the environmental flows process and adopts rules for environmental flow standards. The Texas Commission on Environmental Quality is a member of the Texas Water Conservation Advisory Council.

The **Texas Department of Agriculture**, established by the Texas Legislature in 1907, is headed by the Texas Commissioner of Agriculture. The agency supports protection of agricultural crops and livestock from harmful pests and diseases; facilitates trade and market development of agricultural commodities; provides financial assistance to farmers and ranchers; and administers consumer protection, economic development, and healthy living programs, and is a member of the Texas Water Conservation Advisory Council.

Created in 1939, the **Texas State Soil and Water Conservation Board** administers Texas' soil and water conservation law and coordinates conservation and nonpoint source pollution abatement programs. The agency also administers water quality and water supply enhancement programs and is a member of the Texas Water Conservation Advisory Council.

FIGURE 1.2. RIVER AUTHORITIES AND SPECIAL LAW DISTRICTS IN TEXAS.

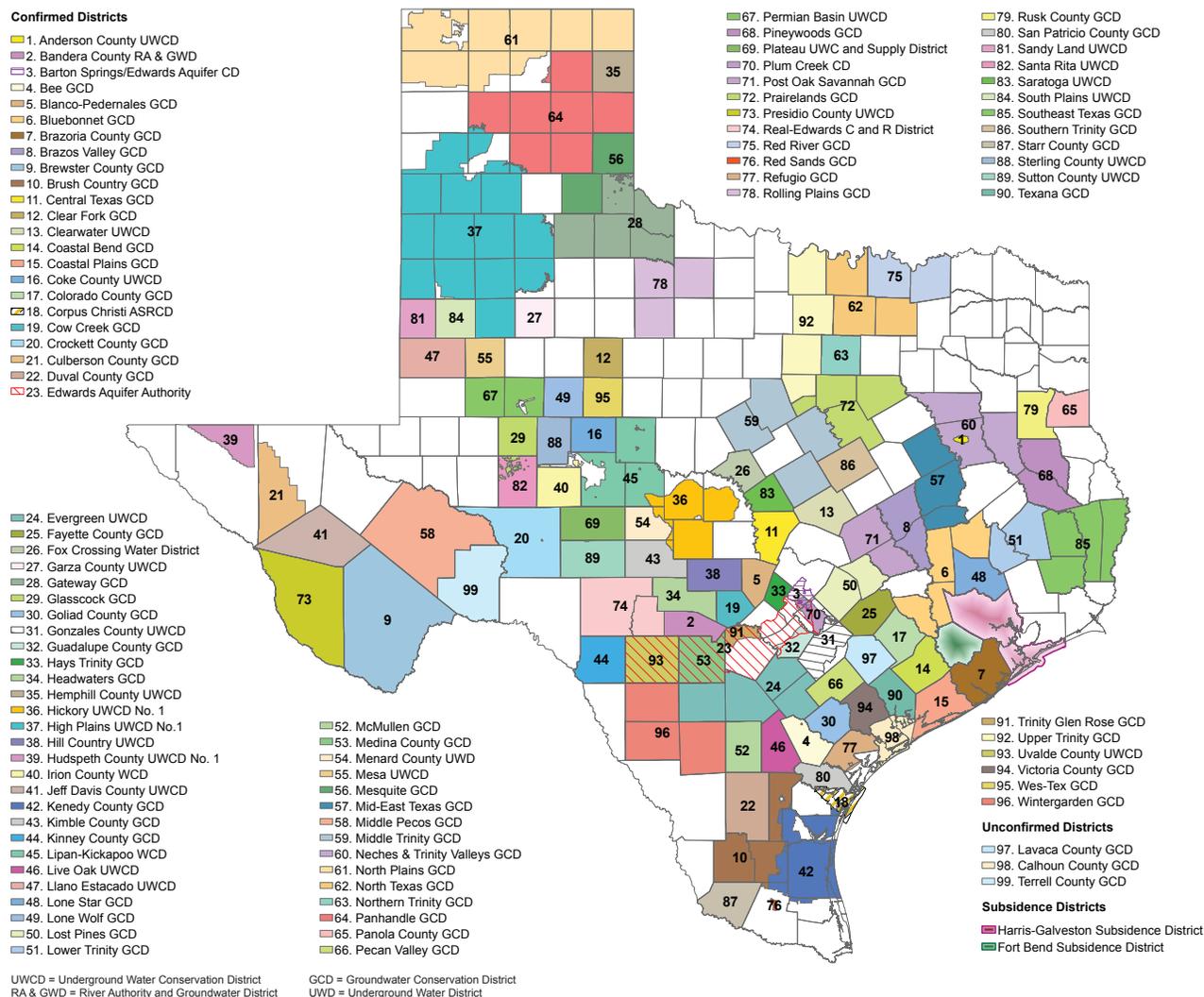


First authorized by the legislature in 1917, river authorities could be created and assigned the conservation and reclamation of the state’s natural resources, including the development and management of water. They generally operate on utility revenues generated from supplying energy, water, wastewater, and other community services. The 17 river authorities in Texas, along with similar special law districts authorized by the legislature, are shown in Figure 1.2.

The formation of **groundwater conservation districts** was first authorized by the legislature in 1949 to manage and protect groundwater at the local level.

Groundwater conservation districts are governed by a local board of directors, which develops a management plan for the district with technical support from TWDB, the Texas Commission on Environmental Quality, and other state agencies. Because most groundwater conservation districts are based on county lines and do not manage an entire aquifer, one aquifer may be managed by several groundwater districts. Each district must plan with the other districts within their common groundwater management areas to determine the desired future conditions of the aquifers within the groundwater management areas. As of 2011, 96 groundwater

FIGURE 1.3. GROUNDWATER CONSERVATION DISTRICTS IN TEXAS.



conservation districts have been established in Texas covering all or part of 173 counties (Figure 1.3).

Other entities at the regional and local levels of government construct, operate, and maintain water supply and wastewater infrastructure. These include municipalities; water supply, irrigation, and municipal utility districts; flood and drainage districts; subsidence districts; and non-profit water supply and sewer service corporations.

1.3.2 FEDERAL AGENCIES

Federal civil works projects played a major role in the early development of the state's water resources (TBWE, 1958). Texas historically relied heavily on federal funds to finance water development projects, with local commitments used to repay a portion of the costs. Federal agencies such as the Soil Conservation Service, the U.S. Bureau of Reclamation, and the U.S. Army Corps of Engineers constructed a number of surface water reservoirs in Texas. These reservoirs were built for the primary purpose of flood control, but provide a large portion of the state's current water

supply. The pace of federal spending on reservoir construction has declined considerably since the 1950s and 1960s, and current federal policy recognizes a declining federal interest in the long-term management of water supplies.

Several federal agencies are responsible for the management of the nation's water resources. The U.S. Army Corps of Engineers investigates, develops, and maintains the nation's water and related environmental resources. Historically, the **U.S. Army Corps of Engineers** has been responsible for flood protection, dam safety, and the planning and construction of water projects, including reservoirs. Pursuant to the Clean Water Act and the Rivers and Harbors Act, the Corps operates a program that regulates construction and other work in the nation's waterways.

Within the U.S. Department of the Interior, the **U.S. Geological Survey** conducts natural resources studies and collects water-related data, and the **U.S. Bureau of Reclamation** conducts water resource planning studies and manages water resources primarily in the western United States. The **U.S. Fish and Wildlife Service**, also part of the Department of the Interior, protects fish and wildlife resources through various programs and carries out provisions of the Endangered Species Act.

The **Natural Resources Conservation Service**, part of the U.S. Department of Agriculture and successor to the Soil Conservation Service, implements soil conservation programs and works at the local level through conservation planning and assistance programs. The **U.S. Environmental Protection Agency** regulates and funds federal water quality, solid waste, drinking water, and other programs pursuant to the Clean Water Act, the Safe Drinking

Water Act, and other federal laws and regulations. The **International Boundary and Water Commission** manages the waters of the Rio Grande between the United States and Mexico.

1.4 THE MANAGEMENT OF WATER IN TEXAS

Unlike scientists who recognize that all water is interconnected, Texas law divides water into several classes for the purpose of regulation. Different rules govern each class, determining who is entitled to use the water, in what amount, and for what purpose. Texas' complicated system arose from Spanish and English common law, the laws of other western states, and state and federal case law and legislation.

To understand how regional water planning groups plan for water needs during a drought, it is helpful to have some understanding of how water is managed in the state. Each regional water plan must be consistent with all laws, rules, and regulations applicable to water use in the planning area. The following sections briefly describe how the state manages surface and groundwater, water quality, drinking water, and interstate waters, all important considerations when planning for drought.

1.4.1 SURFACE WATER

In Texas, all surface water is held in trust by the state, which grants permission to use the water to different groups and individuals. Texas recognizes two basic doctrines of surface water rights: the riparian doctrine and the prior appropriation doctrine. Under the riparian doctrine, landowners whose property is adjacent to a river or stream have the right to make reasonable use of the water. The riparian doctrine was introduced in Texas over 200 years ago with the first Spanish settlers. In 1840, the state adopted the common law of England, which included a somewhat

different version of the riparian doctrine (Templer, 2011). The state later began to recognize the need for a prior appropriation system, which had developed in response to the scarcity of water in the western United States (BLM, 2011). The prior appropriation system, first adopted by Texas in 1895, has evolved into the modern system used today. Landowners who live on many of the water bodies in the state are allowed to divert and use water for domestic and livestock purposes (not to exceed 200 acre-feet per year), but these are some of the last riparian rights still in place.

In 1913, the legislature extended the prior appropriation system to the entire state. It also established the Texas Board of Water Engineers, the agency that had original jurisdiction over all applications for appropriated water. Because different laws governed the use of surface waters at different times in Texas history, claims to water rights often conflicted with one another. As a result of these historic conflicts, in 1967 the state began to resolve claims for water rights. A “certificate of adjudication” was issued for each approved claim, limiting riparian and other unrecorded rights to a specific quantity of water. The certificate also assigned a priority date to each claim, with some dates going back to the time of the first Spanish settlements (TCEQ, 2009).

The adjudication of surface water rights gave the state the potential for more efficient management of surface waters (Templer, 2011). With only a few exceptions, water users today need a permit in the form of an appropriated water right from the Texas Commission on Environmental Quality. The prior appropriations system recognizes the “doctrine of priority,” which gives superior rights to those who first used the water, often known as “first in time, first in right.” In most of the state, water rights are prioritized only by the date assigned to them and not by the purpose for which

the water will be used. Only water stored in Falcon and Amistad reservoirs in the middle and lower Rio Grande river basin is prioritized by the purpose of its use, with municipal and industrial rights having priority over irrigation rights during times of drought.

When issuing a new water right, the Texas Commission on Environmental Quality assigns a priority date, specifies the volume of water that can be used each year, and may allow users to divert or impound the water. Water rights do not guarantee that water will be available, but they are considered property interests that may be bought, sold, or leased. The agency also grants term permits and temporary permits, which do not have priority dates and are not considered property rights. The water rights system works hand in hand with the regional water planning process: the agency may not issue a new water right unless it addresses a water supply need in a manner that is consistent with the regional water plans and the state water plan.

Texas relies on the honor system in most parts of the state to protect water rights during times of drought. But in three areas, the Texas Commission on Environmental Quality has appointed a “watermaster” to oversee and continuously monitor streamflows, reservoir levels, and water use. There are two watermasters in Texas: the Rio Grande Watermaster, who among other things, coordinates releases from the Amistad and Falcon reservoir system, and the South Texas Watermaster, who serves the Nueces, San Antonio, Guadalupe, and Lavaca river and coastal basins, and who also serves as the Concho Watermaster, who serves the Concho River and its tributaries in the Colorado River Basin.

In general, Texas has very little water remaining for appropriation to new users. In some river basins, water is over appropriated, meaning that the rights

already in place amount to more water than is typically available during drought. This lack of “new” surface water makes the work of water planners all the more important. Now more than ever, regional water plans must make efficient use of the water that is available during times of drought.

1.4.2 GROUNDWATER

Groundwater in the state is managed in an entirely different fashion than surface water. Historically, Texas has followed the English common law rule that landowners have the right to capture or remove all of the water that can be captured from beneath their land. This “rule of capture” doctrine was adopted by the Texas Supreme Court in its 1904 decision *Houston & T.C. Railway Co. v. East*. In part, the rule was adopted because the science of quantifying and tracking the movement of groundwater was so poorly developed at the time that it would be practically impossible to administer any set of legal rules to govern its use. The *East* case and later court rulings established that landowners, with few exceptions, may pump as much water as they choose without liability. Today, Texas is the only western state that continues to follow the rule of capture.

In an attempt to balance landowner interests with limited groundwater resources, in 1949 the legislature authorized the creation of groundwater conservation districts for local management of groundwater. While the science of groundwater is much better developed (TWDB has groundwater availability models for all of the major aquifers and most of the minor aquifers in the state that are used to support local site-specific modeling), its use is still governed by the rule of capture, unless under the authority of a groundwater conservation district. Senate Bill 1 in 1997 reaffirmed state policy that groundwater conservation districts

are the state’s preferred method of groundwater management.

Since the original legislation creating groundwater districts in 1949, the legislature has made several changes to the way groundwater is managed in the state while still providing for local management. Most significantly, legislation in 2005 required groundwater conservation districts to meet regularly and to define the “desired future conditions” of the groundwater resources within designated groundwater management areas. Based on these desired future conditions, TWDB delivers modeled available groundwater values to groundwater conservation districts and regional water planning groups for inclusion in their plans.

Groundwater districts can be created by four possible methods: action of the Texas Legislature, petition by property owners, initiation by the Texas Commission on Environmental Quality, or addition of territory to an existing district. Districts may regulate both the location and production of wells, with certain voluntary and mandatory exemptions. They are also required to adopt management plans that include goals that provide for the most efficient use of groundwater. The goals must also address drought, other natural resources issues, and adopted desired future conditions. The management plan must include estimates of modeled available groundwater based on desired future conditions and must address water supply needs and water management strategies in the state water plan.

Several state agencies are involved in implementing the groundwater management plan requirements, including TWDB, the Texas Commission on Environmental Quality, and others. Along

with determining values for modeled available groundwater based on desired future conditions of the aquifer, TWDB provides technical and financial support to districts, reviews and administratively approves management plans, performs groundwater availability and water-use studies, and is responsible for the delineation and designation of groundwater management areas.

The Texas Commission on Environmental Quality provides technical assistance to districts and is responsible for enforcing the adoption, approval, and implementation of management plans. The agency also evaluates designated priority groundwater management areas, areas that are experiencing or are expected to experience critical groundwater problems within 50 years, including shortages of surface water or groundwater, land subsidence resulting from groundwater withdrawal, and contamination of groundwater supplies.

1.4.3 SURFACE WATER QUALITY

The Texas Commission on Environmental Quality is charged with managing the quality of the state's surface water resources. Guided by the federal Clean Water Act and state regulations, the agency classifies water bodies and sets water quality standards for managing surface water quality. Water quality standards consist of two parts: 1) the purposes for which surface water will be used (aquatic life, contact recreation, water supply, or fish consumption) and 2) criteria that will be used to determine if the use is being supported. Water quality data are gathered regularly to monitor the condition of the state's surface waters and to determine if standards are being met. Through the Texas Clean Rivers Program, the Texas Commission on Environmental Quality works in partnership with state, regional, and federal entities to coordinate water quality monitoring, assessment, and stakeholder

participation to improve the quality of surface water within each river basin.

Every two years, Texas submits a report to the U.S. Environmental Protection Agency that lists the status of all the waters in the state and identifies those that do not meet water quality standards. When water bodies do not meet standards, the Texas Commission on Environmental Quality may develop a restoration plan, evaluate the appropriateness of the standard, or collect more data and information. For water bodies with significant impairments, the agency must develop a scientific allocation called a "total maximum daily load" to determine the maximum amount of a pollutant that a water body can receive from all sources, including point and nonpoint sources, and still maintain water quality standards set for its use.

1.4.4 DRINKING WATER

The Texas Commission on Environmental Quality is also responsible for protecting the quality and safety of drinking water through primary and secondary standards. In accordance with the federal Safe Drinking Water Act and state regulations, primary drinking water standards protect public health by limiting the levels of certain contaminants; secondary drinking water quality standards address taste, color, and odor. Public drinking water systems must comply with certain construction and operational standards and they must continually monitor water quality and file regular reports with the Texas Commission on Environmental Quality.

The Texas Commission on Environmental Quality is also responsible for licensing operators that supervise a public water system's production, treatment, and distribution facilities. The agency also issues certificates of convenience and necessity, which delineate the service area of a water or sewer utility and authorizes

the utility the exclusive right to provide service to that area. A utility that holds a certificate of convenience and necessity must provide continuous and adequate service to every customer who requests service in that area.

1.4.5 INTERSTATE WATERS

Texas is a member of five interstate river compacts with neighboring states for the management of the Rio Grande, Pecos, Canadian, Sabine, and Red rivers. The compacts, as ratified by the legislature of each participating state and the U.S. Congress, represent agreements that establish how water should be allocated. Each compact is administered by a commission of state representatives and, in some cases, a representative of the federal government appointed by the president. Compact commissioners protect the states' rights under the compacts, oversee water deliveries from one state to another, and work to prevent and resolve any disputes over water. The compact commissions are authorized to plan for river operations, monitor activities affecting water quantity and quality, and engage in water accounting and rulemaking. To administer the five compacts in Texas, the Texas Commission on Environmental Quality provides administrative and technical support to each commission and maintains databases of river flows, diversions, and other information.

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