DRAFT

MANAGEMENT PLAN

June 22, 2017

Board Meeting

30 years 1987-2017

Barton Springs Edwards Aquifer CONSERVATION DISTRICT

Adopted by Board Resolution:

Approved by TWDB:

Barton Springs/Edwards Aquifer Conservation District Management Plan

Board of Directors

Precinct 1 - Mary Stone
Precinct 2 - Blayne Stansberry, President
Precinct 3 - Blake Dorsett, Secretary
Precinct 4 - Dr. Robert D. Larsen
Precinct 5 - Craig Smith, Vice President

General Manager

John T. Dupnik, P.G.

District Office

BSEACD
1124 Regal Row
Austin, Texas 78748
Phone: (512) 282-8441
Website: www.bseacd.org

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1. Introduction

1.1 Purpose of the District Management Plan

With the passage of House Bill 162 by the 51st Texas Legislature in 1949, the landmark legislation commonly referred to as the Underground Water Conservation Act that established the original process for creating and establishing groundwater conservation districts (GCDs) in Texas, the requirement for preparation of management plans that included management goals was first established. House Bill 162, Section 3(c)(B)(8) states that GCDs must "develop comprehensive plans, for the most efficient use of underground waters, and for the control and prevention of waste of such waters; which plans shall specify in such detail as may be possible, the Acts, procedure, performance and avoidances which are or may be necessary for the effectuation of such plans, including specification of engineering operations, and methods of irrigation and to publish such plans and information and bring them to the notice and attention of the owners of land within the district." Thus, even before creation of the first GCD, the need for management plans was established.

Nearly 50 years later, the 75th Texas Legislature in 1997 enacted Senate Bill 1 (SB 1) to establish a new comprehensive statewide water planning process. In particular, SB 1 contained provisions that required GCDs to prepare management plans to identify the water supply resources and water demands that will shape the decisions of each district. GCDs are specifically required to develop and adopt management goals, objectives, and performance standards for prescribed efforts such as, but not limited to, providing the most efficient use of groundwater, controlling and preventing the waste of groundwater, and controlling and preventing subsidence. SB 1 designed the management plans to include management goals for each GCD to manage and conserve the groundwater resources within their boundaries.

In 2001, the Texas Legislature enacted Senate Bill 2 (SB 2) to build on the planning requirements of SB 1 and to further clarify the actions necessary for districts to manage and conserve the groundwater resources of the state of Texas. The Texas Legislature enacted significant changes to the management of groundwater resources in Texas with the passage of House Bill 1763 (HB 1763) in 2005. HB 1763 created a long-term planning process in which GCDs in each Groundwater Management Area (GMA) are required to meet and determine the Desired Future Conditions (DFCs) for the groundwater resources within their boundaries by September 1, 2010. In addition, SB 660 in 2011, amended the Texas Water Code to require that GCDs in a common GMA share and review management plans with the other GCDs in the GMA to facilitate coordinated groundwater management. The Barton Springs/Edwards Aquifer Conservation District's (District) management plan satisfies the requirements of SB 1, SB 2, HB 1763, the statutory requirements of Chapter 36 of the Texas Water Code (TWC), and the administrative requirements of the Texas Water Development Board's (TWDB) rules.

1.2 Time Period of the District Management Plan

The time period for this management plan is five years from the date of approval by the TWDB. Although the District must review and readopt the plan at least once every five years, it is not restricted from doing so more frequently if deemed appropriate by the District. In accordance with the provisions of Chapter 36 of the Texas Water Code, this Management Plan (*Plan*) will be reviewed, updated, and readopted at least once every five years as the District develops site-specific data on local groundwater use and aquifer conditions and as the key management strategies are developed and the overall management approach evolves. Once adopted, this *Plan* will remain in effect until it is replaced by a revised management plan approved by the TWDB.

This *Plan* incorporates relevant regional water management strategies outlined in the current (2016) Regional Water Plans developed by the Lower Colorado Regional Planning Group and the South Central Texas Regional Planning Group, and included in the 2017 State Water Plan. Population and water demand projections cover the 50-year period from 2010 to 2060 and are consistent with those used by the TWDB for this area in statewide water planning.

1.3 Background

Authority and Purpose

The District was created in 1987 by the 70th Texas Legislature, under Senate Bill 988. Its statutory authorities include Chapter 52 (later revised to TWC, Chapter 36), applicable to all GCDs in the state, and the District's enabling legislation, now codified as Chapter 8802, Special District Local Laws Code. The District's legislative mandate is to conserve, protect, and enhance the groundwater resources located within the District boundaries. The District has the power and authority to undertake various studies, assess fees on groundwater pumpage and transport, and to implement structural facilities and non-structural programs to achieve its statutory mandate. The District has rulemaking authority to implement its policies and procedures and to help ensure the management of groundwater resources as directed by the Board. The District is not a taxing authority. Its only sources of income are groundwater production fees, the annual City of Austin water use fee, export fees, administrative fees, and occasional grants from various local, state, and federal programs for special projects.

Jurisdictional Area

Upon creation in 1987, the District's jurisdictional area encompassed approximately 255 square miles including parts of four counties: northwestern Caldwell, northeastern Hays, southeastern Travis Counties, and a small territory in western Bastrop County (In 2011, that small part of Bastrop County was de-annexed from the District and is now in Lost Pines GCD's sole jurisdiction). The jurisdictional area was generally defined to include all the area within the Barton Springs segment of the Edwards Aquifer with an extended area to the east to incorporate the service areas of the Creedmoor-Maha Water Supply Corporation, Goforth Special Utility District, and Monarch Utilities. In this area, designated as the "Exclusive Territory," the District has authority over all groundwater resources.

In 2015, the 84th Texas Legislature (House Bill 3405) expanded the District's jurisdictional area to include the portion of Hays County located within the boundaries of the Edwards Aquifer Authority excluding the overlapping area in the Plum Creek Conservation District (see Figure 1-1). The newly annexed area, designated as "Shared Territory," excludes the Edwards Aquifer and includes all other aquifers, including the underlying Trinity Aquifer. The District's jurisdictional area including the Shared Territory encompasses approximately 420 square miles and includes both urban and rural areas. The District shares boundaries with adjacent GCDs to the west, south, and east including the Hays Trinity GCD, Comal Trinity GCD, Edwards Aquifer Authority, Plum Creek GCD, and Lost Pines GCD respectively (see Figure 1-3). The District participates in joint-regional planning with these and other GCDs in GMAs 9 and 10 which are configured generally to encompass the Trinity and Edwards Aquifers respectively (see Figure 1-1).

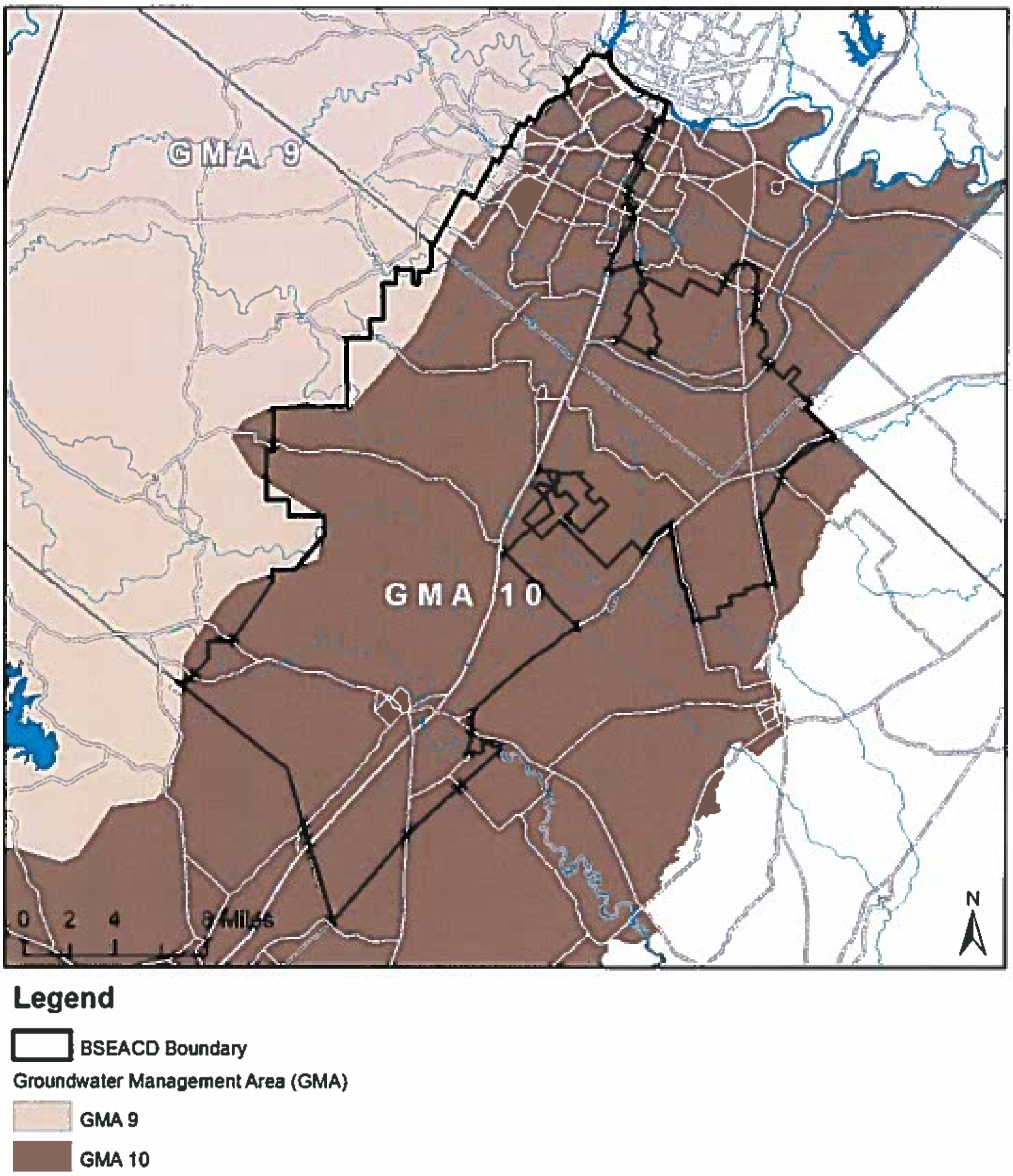


FIGURE 1-1: LOCATION OF THE BARTON SPRINGS/EDWARDS AQUIFER CONSERVATION DISTRICT AND THE GROUNDWATER MANAGEMENT AREAS (GMAS)

This map displays the District's boundaries and the boundaries of the GMAs in which the District actively participates in joint-regional groundwater planning.

Aquifers and Uses

Water from the Barton Springs segment of the Edwards Aquifer serves as the primary water source for public water supply, industrial, and commercial purposes in the District and is a major source of high quality base flow to the Colorado River via discharge through the Barton Springs complex. The Barton Springs complex provides habitat for the Barton Springs salamander (*Eurycea sosorum*) and Austin blind salamanders (*Eurycea waterlooensis*) which are both federally listed Endangered Species under the Endangered Species Act requiring all activities that would or could adversely affect the species to represent optimal conservation efforts. The Trinity Aquifer, underlying the Edwards, is an important primary water resource in some parts of the District and is increasingly being developed in both the Exclusive and Shared Territory. Some wells in the District also produce water from the Taylor and Austin Chalk formations as well as various alluvial deposits along river and stream banks.

The area has a long history of farming, ranching, and rural domestic use of groundwater, but it is increasingly and rapidly being converted to residential use owing to suburban and exurban development from Austin and San Marcos. Groundwater in the area is primarily utilized for domestic and public water supply purposes, with lesser amounts also being utilized for commercial, irrigation, and industrial use. See Figure 1-4 for a breakdown of the types of wells in the District and percent of pumping of all wells by authorized use in 2017 for each classification category.

Governance

A five-member Board of Directors ("Board") governs the District. The Directors are elected on the November general election date in even-numbered years to staggered four-year terms from the five single-member precincts that comprise the District (see Figure 1-5). Each Director represents a precinct of which two (Precincts 4 and 5) are comprised of territory within or surrounded by the City of Austin as required by the District's enabling legislation. The other three precincts (Precincts 1, 2, and 3) represent the remaining area including the Shared Territory.

The Board sets policies and adopts rules and bylaws to operate the District and takes action in accordance with the Rules and Bylaws in executing the District's mission. The general manager reports to and is directed by the Board and is responsible for the overall operations and day-to-day activities of the District including programmatic planning and administration, stakeholder relations and regional planning, staff management and development, and financial administration.

While the area of the District is very small in comparison to other GCDs, its demographics have produced a rather complex set of legislative districts. Each of the State Senators and State Representatives that share constituencies with the District, as shown in Figures 1-6 and 1-7, represents a differing set of legislative priorities, yet each of them has expressed strong support for groundwater management, either on a general or a specific-issue basis.

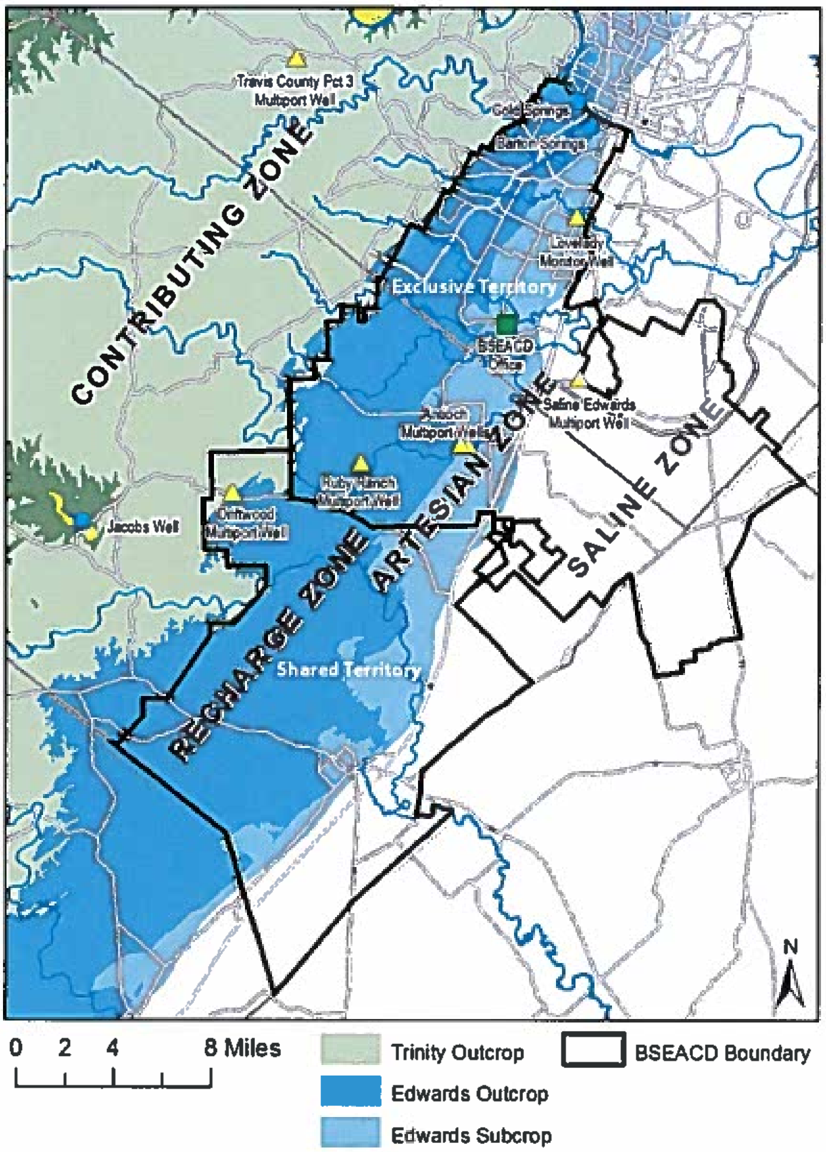


FIGURE 1-2: LOCATION OF THE BARTON SPRINGS/EDWARDS AQUIFER CONSERVATION DISTRICT

This map displays the District's boundaries, major aquifers, hydrogeologic zones, key springs and monitoring wells.

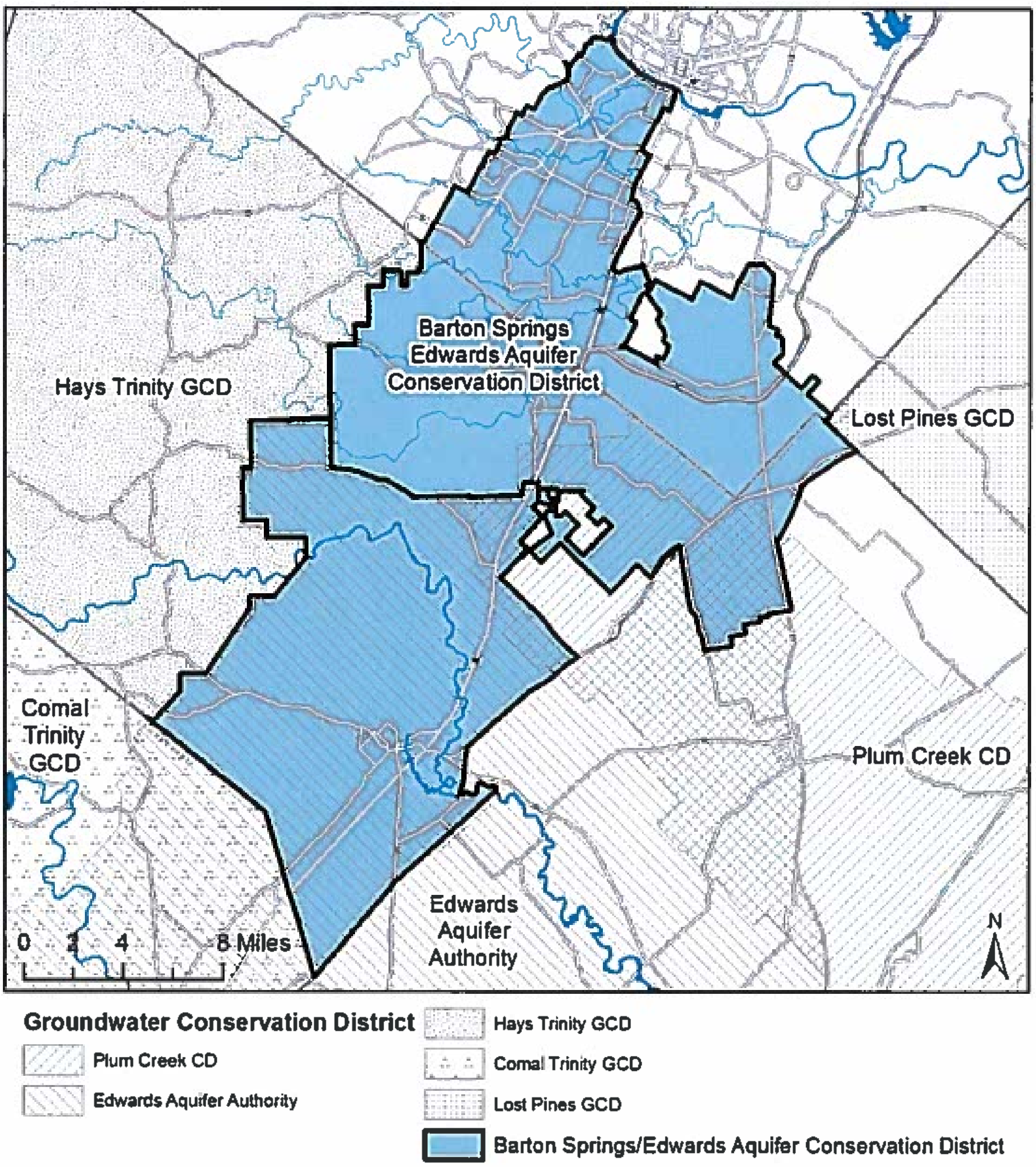


FIGURE 1-3: OTHER GROUNDWATER CONSERVATION DISTRICTS ADJACENT TO THE DISTRICT

This map shows what other groundwater management entities exist in the areas just outside the District.

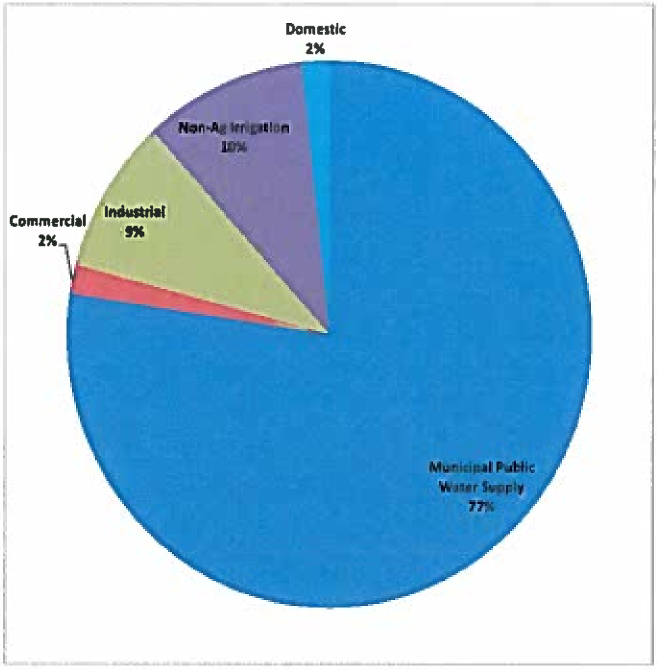


FIGURE 1 -4: TYPES OF GROUNDWATER USE AND THEIR PERCENT OF AUTHORIZED USE FOR PERMITTED WELLS IN THE DISTRICT

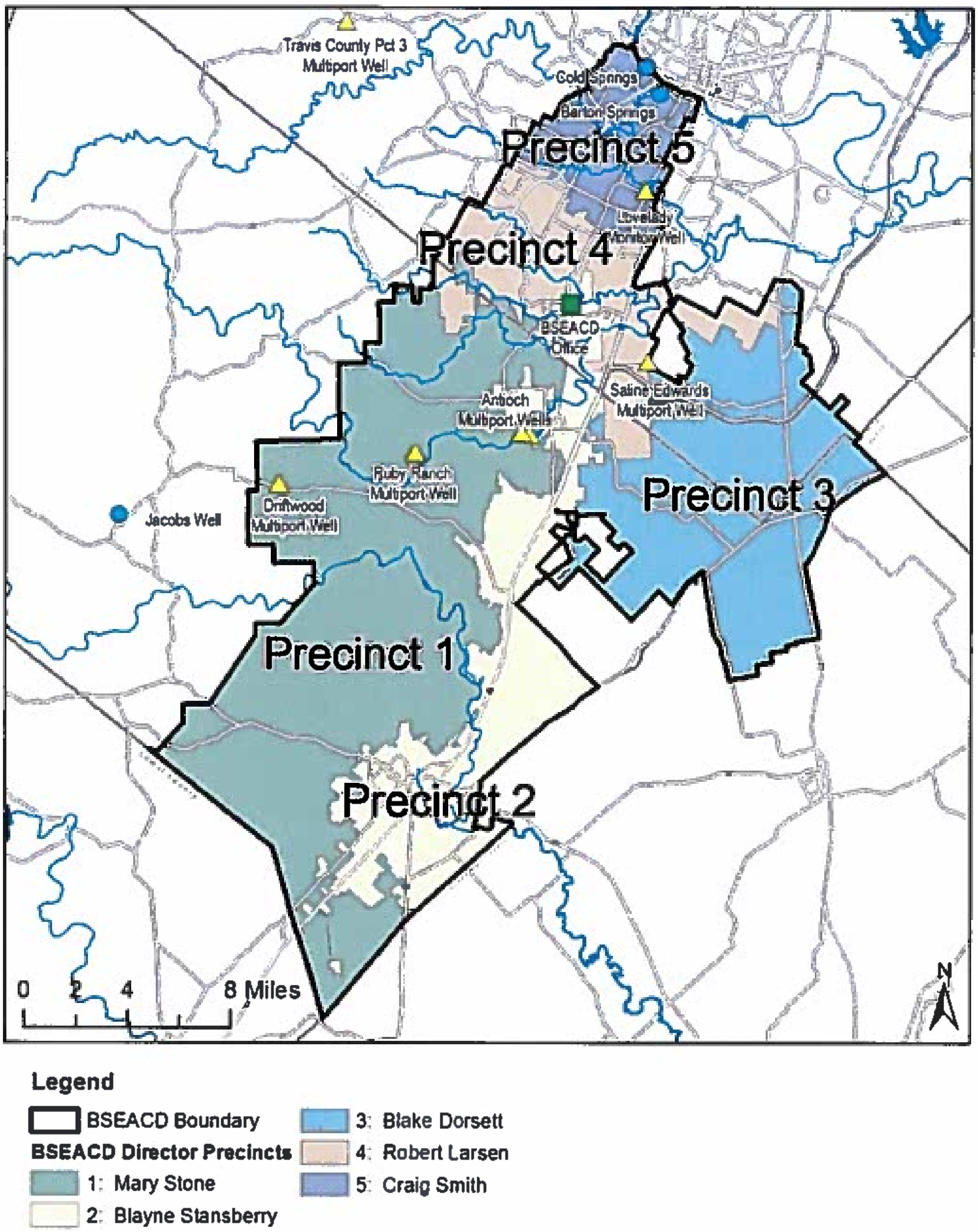


FIGURE 1-5: DIRECTOR PRECINCTS

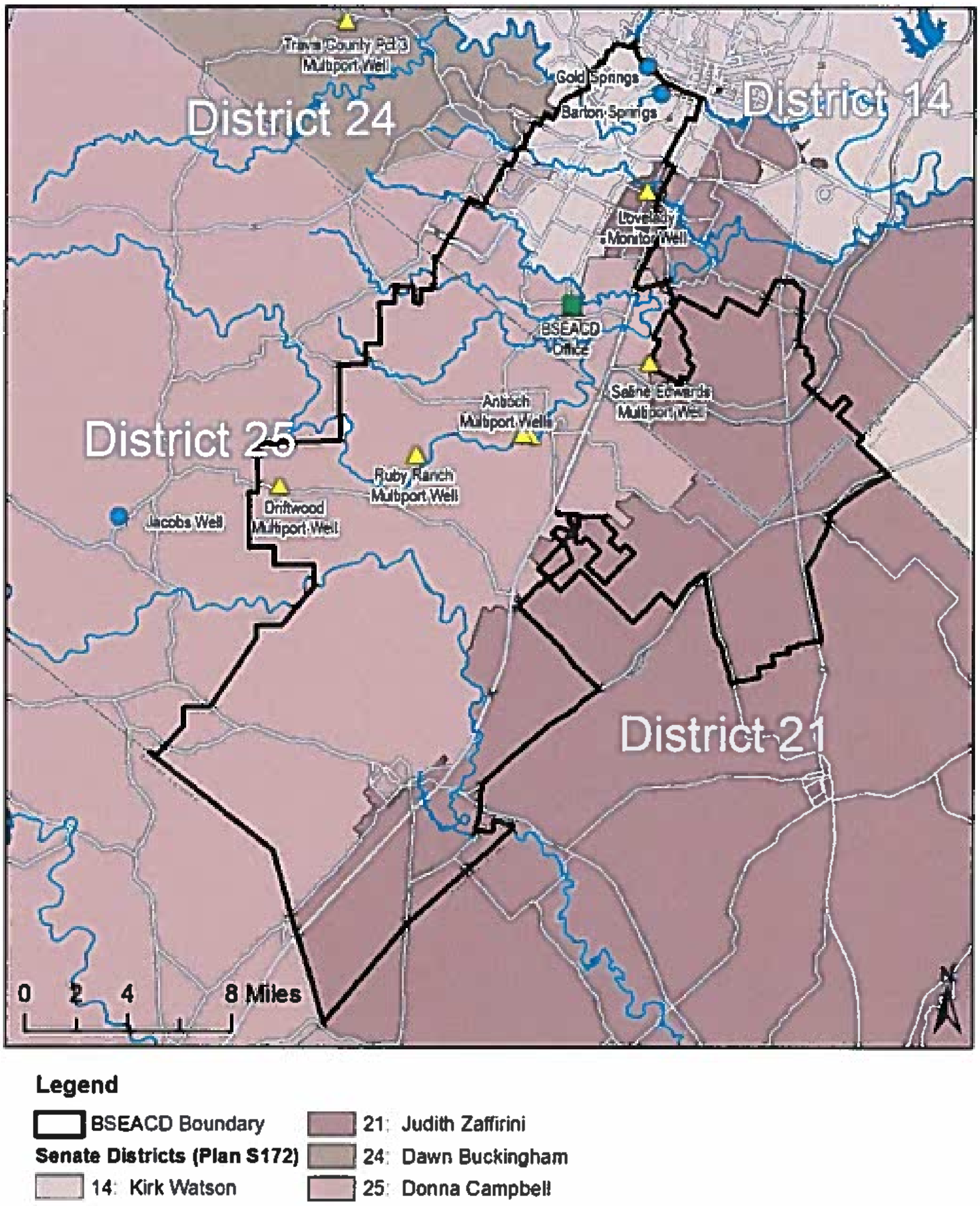


FIGURE 1-6: SENATE DISTRICTS WITHIN OR ADJACENT TO THE DISTRICT'S BOUNDARY

This map displays the boundaries of local Senate Districts in relation to the District's boundary.

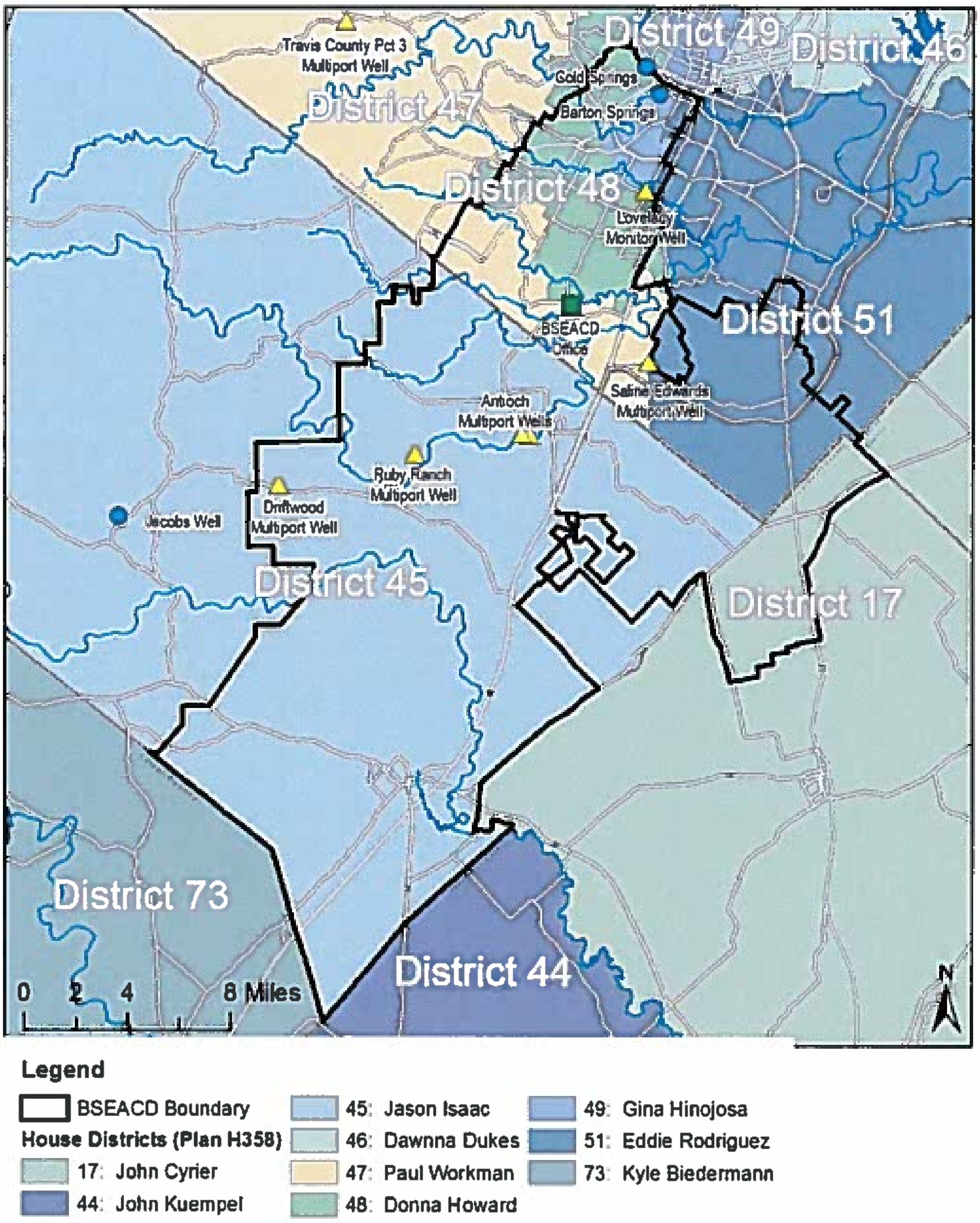


FIGURE 1-7: HOUSE DISTRICTS WITHIN THE DISTRICT'S BOUNDARY

This map displays the boundaries of local House Districts in relation to the District's boundary.

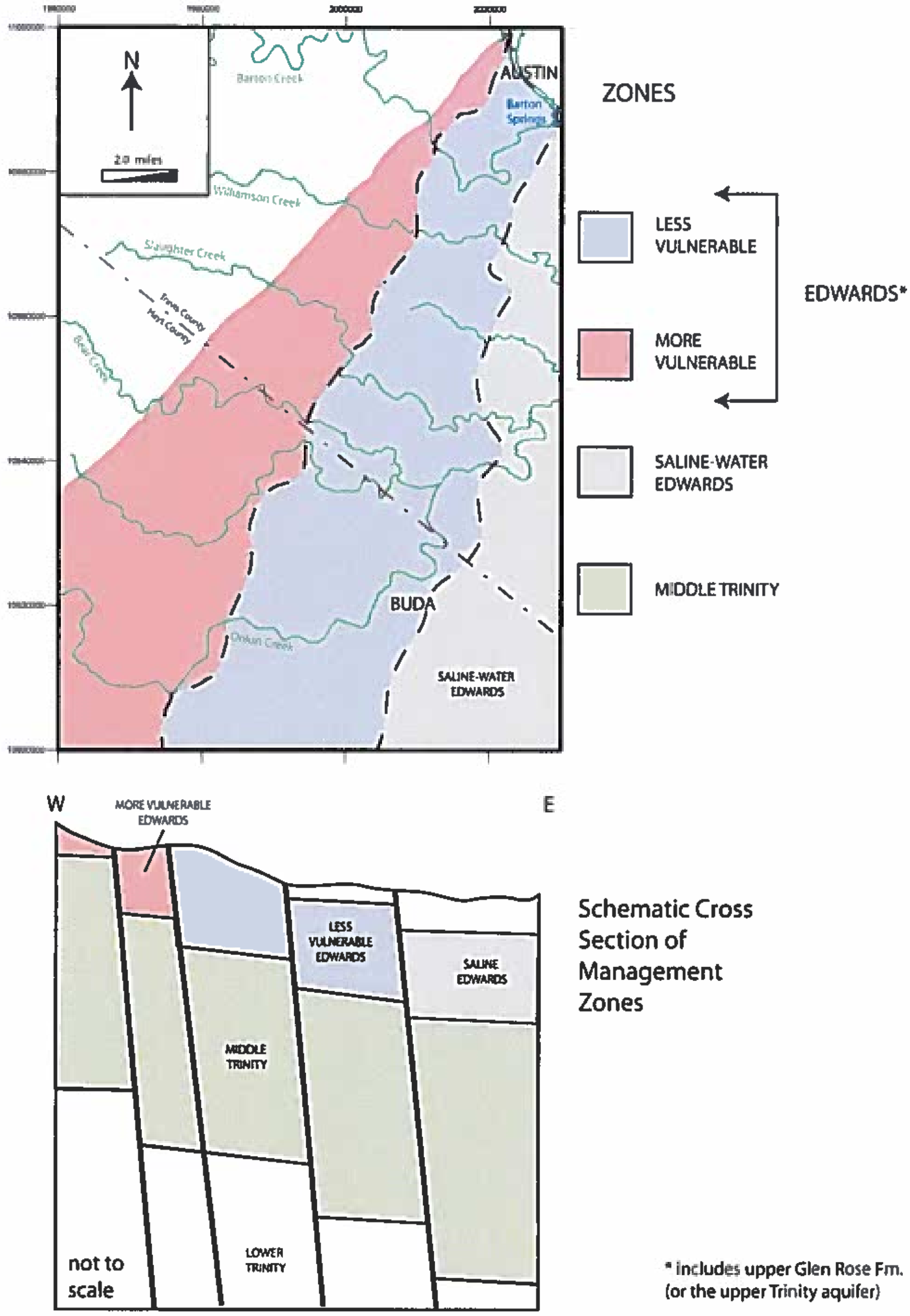


FIGURE 1-8: CONCEPTUAL MANAGEMENT ZONES AND CROSS-SECTION

Portions of the aquifer where the saturated Edwards is thin are considered to be more vulnerable to having wells go dry during periods of extreme drought.

1.4 Mission and Core Values

Strategic planning by the staff and directors of the District has established the following strategic elements that serve as a backdrop and guide for planning and performance:

Mission
"As the responsible authority, the Barton Springs/Edwards Aquifer Conservation District is committed to conserving, protecting, enhancing recharge, and preventing waste of groundwater and to preserving all aquifers within the District."

Vision
"The Barton Springs/Edwards Aquifer Conservation District will excel in its operations and administration so that it is considered the model and standard for other groundwater districts."

Overarching Strategic Purpose
"We will manage the District aquifers to optimize the sustainable uses of groundwater in satisfying community interests."

The Board has also established the following tenets as the core values of the District that guide all of our internal and external interactions and operations:

- We operate on the basis of the highest integrity.
- We are committed to protection of the aquifers and to prudent stewardship of the groundwater resources of the District.
- We provide exceptional service that is consistently and equitably applied and is responsive to the needs of the public, interest groups, and other governmental agencies.
- We recognize that we are a public trust and operate on a sound legal basis and under a financially responsible philosophy.
- We encourage our employees to succeed by doing what they do best, both individually and as a team, in a supportive working environment.
- We value and work to ensure transparency of our operations and openness in our dealings with various stakeholder groups.
- We strive to communicate useful information on groundwater management when and where needed by the public.

These values have been translated into the following operational guidelines for all District staff:

- **Integrity** - We maintain and exhibit the highest integrity in all of our dealings, both internally and externally.

- **Quality** - We offer high-quality services that meet or exceed our Board's expectations in providing support to their decision-making.
- **Continuous Improvement** - We continuously look for innovative approaches and processes that improve the services we provide.
- **Teamwork** - We build trust in our fellow workers and their roles, cultivate a harmonious and productive relationship among co-workers, and utilize the diversity of knowledge and perspective that reside in all of us to develop workable responses as shared solutions.
- **Problem-solving** - We solve problems at the most immediate level first, while ensuring that problems are pursued to solution and that unresolved issues are elevated to successively higher levels.
- **Decision-making** - In all decisions, we consider impacts on protection of the aquifer, on all users and other stewards of its resources, on District employees and Board members, and on other public and private entities.
- **Working Environment** - We promote a safe, healthy work environment and foster a sense of care about our fellow workers' physical, mental, and emotional well-being.
- **Staff Development** - We take advantage of those opportunities in which employees can grow professionally and/or personally, while allowing the District to apply new knowledge, skills, and expertise in accomplishing its mission.
- **Relationship-building** - We build and maintain effective, bilateral relationships and communication with the regulated community, the scientific community, the public at-large and its special interest groups, and other state, federal, and local regulators.
- **Community Outreach** - We communicate regularly and effectively with stakeholders and the public, to educate and disseminate information about groundwater use, conservation, protection, and resource value.
- **Value Proposition** - As individual staff members, we provide the District with an honest day's work each working day and receive in return a competitive, fair compensation and benefits package and valued, challenging work assignments.

Through its continuing strategic and management planning process, the District Board has established the following as overall Critical Success Factors (CSFs) for the District that underpin the District's management objectives in this *Plan*:

- **Scientific CSF** - Providing sound science to support policy and tactical decisions made by the District that affect water supply users and endangered species habitat;
- **Business Administrative CSF** - Being highly efficient, accurate, and fair in administering transactional activities related to all District programs;
- **Regulatory CSF** - Developing and instituting an equitable and consistently administered regulatory program that is required to serve our mission;
- **Political CSF** - Being a respected, effective part of the state and local political landscape for water resource management and its stakeholder communities;
- **Educational CSF** - Serving our permittees, stakeholders, and the public at large as a readily accessible 'source of first resort' for reliable information about local water, groundwater, aquifer science, water use and conservation; and
- **Sustaining CSF** - Providing the programmatic and resource basis for innovative, cost-effective solutions to maintain and augment the sustainable quantity of water in the District and to protect the quality of District waters required for various existing uses.

1.5 Management of Groundwater Resources in the District

Background. Since 1904, the legal framework applied to groundwater resources in Texas has been the common law "Rule of Capture." Although the Rule of Capture remains in effect today, GCDs such as the Barton Springs/ Edwards Aquifer Conservation District, have been established across the state and authorized to modify how the Rule of Capture is to be applied within their boundaries, as part of a comprehensive, approved groundwater management plan.

In 1997, the Texas Legislature codified the commitment to GCDs in Chapter 36, Section 36.0015 of the Texas Water Code, by designating GCDs as the preferred method of groundwater management. This section of Chapter 36 also establishes that GCDs will manage groundwater resources in order to protect property rights, balance the conservation and development of groundwater to meet the needs of this state, and use the best available science through rules developed, adopted, and promulgated in accordance with the Chapter. As the overarching statute governing GCDs, Chapter 36 gives specific directives to GCDs and the statutory authority to carry out such directives. It provides the so-called "tool box" that enables GCDs to promulgate the appropriate rules needed to protect and manage the groundwater resources within their boundaries given consideration to the conditions and factors unique to each GCD.

In addition to Chapter 36 authority, the District has the powers expressly granted by Chapter 8802 of the Special District Local Laws Code, ("the District Enabling Legislation"). Applied together, these statutes provide the District with the authority to serve the statutory purpose to provide for the conservation, preservation, protection, recharging, and prevention of waste of groundwater, and of groundwater reservoirs or their subdivisions, and to control subsidence caused by withdrawal of water from those groundwater reservoirs or their subdivisions. This section provides an overview of the District's application of the authority provided to manage the groundwater resources within the District and the fundamental management concepts and strategies that embody the District's regulatory and permitting program.

Key Milestones in Regulatory Program

1987-2004: Historical Production Permits
2004: Sustainable Yield Study
2004: Conditional Production Permits
2007: Extreme Drought Withdrawal Limitation (EDWL)
2009: Ecological Flow Reserve
2009: Management Zones
2010: DFC Determination
2014: Habitat Conservation Plan
2015: HB 3405
2016: Unreasonable Impacts

Evolution of the District's Regulatory Program.

Since its creation in 1987, the District has applied the statutory authority and sound science to manage its groundwater resources. The District established a precedent for developing the governing polices and rules through an initial data-driven evaluation of the science to characterize the District's aquifers followed by a thorough vetting by affected stakeholders and the public. This process has served to inform the Board's direction and policy decisions resulting in the current regulatory program that has evolved to address challenges unique to the District. This evolution has been marked by key milestones producing management strategies that are now integrated within the current regulatory approach. A chronological summary of the milestones and associated management strategies is provided as follows.

Historical Production Permits (1987-2004). After creation of the District in 1987, the initial focus was on issuing permits that addressed historical and existing nonexempt use from the freshwater Edwards Aquifer and collecting data on aquifer conditions. The production permits issued allowed existing well owners, primarily utilities providing public water supply, with existing investments in wells and infrastructure to continue groundwater production to support their existing uses and water demands. The establishment of a monitor well network provided data on aquifer conditions that would later prove to be integral to establishing policies and rules to accomplish the groundwater management objectives for the Edwards Aquifer. Withdrawals from existing wells that were nonexempt and registered with the District as of September 9, 2004, were designated with Historical-use Status and authorized under permits designated as Historical Production Permits. These permits authorize firm-yield production from the freshwater Edwards Aquifer even during extreme drought conditions.

Sustainable Yield Study (2004). In 2004, the District completed the sustainable yield study to evaluate potential impacts to groundwater availability and spring flows from various rates of groundwater pumping during 1950s drought-of-record (DOR) conditions. To guide the study, the Board defined sustainable yield as:

> *The amount of water that can be pumped for beneficial use from the aquifer under drought-of-record conditions after considering adequate water levels in water-supply wells and degradation of water quality that could result from low water levels and low spring discharge.*

The study concluded that the District had already reached the sustainable yield limits for the Edwards Aquifer with findings indicating that without curtailments in the then-current rate of permitted pumping (~10 cfs), during the recurrence of DOR conditions, Barton Springs would cease to flow and as many as 19% of all Edwards Aquifer wells in the District would be negatively impacted (Hunt and Smith, 2004). These findings effectively unified two core management objectives: 1) preservation of spring flows as habitat for endangered species, and 2) preservation of aquifer levels and groundwater supplies for existing users, by confirming that both objectives would be compromised without active management during extreme drought conditions.

Conditional Permits (2004). In response to the findings of the sustainable yield study, the District modified its Rules effective on September 9, 2004, to limit firm-yield groundwater production from the freshwater Edwards Aquifer. This date marks the endpoint for issuance of firm-yield Historical Production Permits and the beginning of interruptible Conditional Production Permits requiring up to complete cessation of pumping during extreme drought. This Board-adopted policy served to respond to the findings of the sustainable yield study that indicated the limited amount of firm-yield availability during extreme drought, while also allowing for increased or additional groundwater production during no-drought conditions.

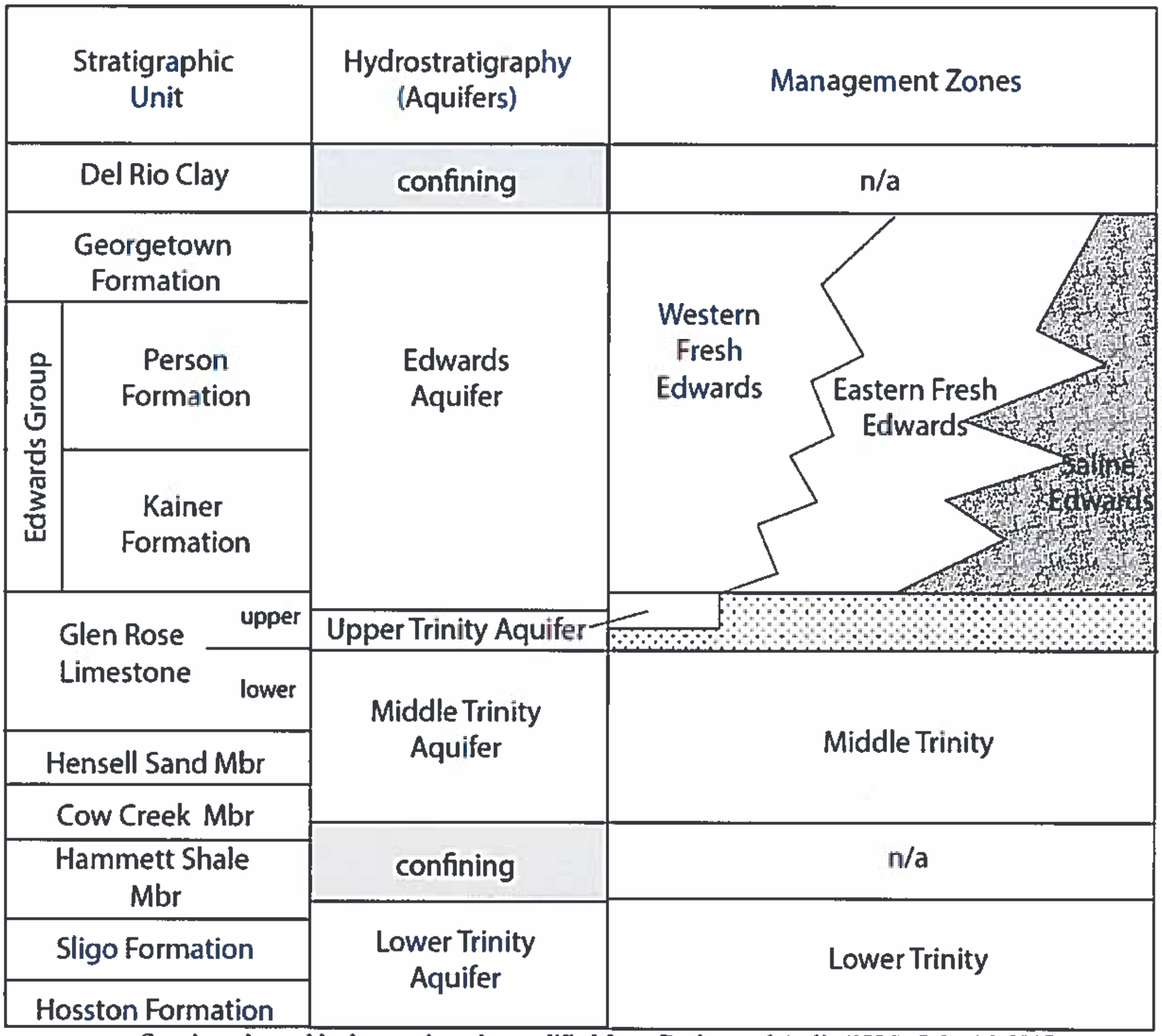
Extreme Drought Withdrawal Limitation (2007) and Ecological Flow Reserve (2009). The District experienced a severe drought in 2006 that reinforced the need to further refine the regulatory program to manage the district aquifers pursuant to the sustainable yield polices adopted in 2004. In response, the District initiated a stakeholder driven effort to solicit input and conducted two rounds of rulemaking

(January and April, 2007) to adopt rules that would further develop the drought management rules, the conditional permitting program, and establish the Extreme Drought Withdrawal Limitation (EDWL) as a cap on firm-yield groundwater production from the freshwater Edwards Aquifer. The EDWL was set at 8.5 cfs to represent the total amount of aggregate authorized (after curtailments) and exempt groundwater production at that point in time and the maximum amount ever to be authorized going forward. The EDWL was the predecessor to the DFCs adopted in the joint-regional planning process in 2010 and served as the turning point in which the District would commit to further decrease aggregate extreme drought groundwater production.

In 2009, the EDWL was bolstered with the establishment of the Conservation Permit and the Ecological Flow Reserve. The Conservation Permit is a protected, accumulative permit held only by the District to serve as a holding vehicle for all firm-yield permitted production that was previously authorized and since retired and is now permanently dedicated in the Ecological Flow Reserve. Retired permitted production dedicated to the Ecological Flow Reserve may not be re-permitted for firm-yield production during extreme drought and is an integral component of the District's Habitat Conservation Plan (HCP).

Management Zones (2009). With implementation of Conditional Permitting in 2004 and the establishment of the EDWL in 2007, firm-yield availability from the freshwater Edwards Aquifer was effectively fully appropriated. This permitting cap created an impetus to recognize a distinction from the other non-freshwater Edwards aquifers in the District that had additional availability that could continue to be permitted on a firm-yield basis, even during extreme drought. The District recognized the benefit of creating Management Zones that allow for separate permitting and production rules unique to each aquifer and its subdivisions or geographic area. The initial Management Zones (MZs) were created by rule in 2009 and now include the following MZs (see Figure 1-8):

- Western Freshwater Edwards MZ
- Eastern Freshwater Edwards MZ
- Saline Edwards MZ
- Upper Trinity MZ
- Middle Trinity MZ
- Lower Trinity MZ
- Austin Chalk MZ (minor)
- Alluvial MZ (minor)



Stratigraphy and hydrostratigraphy modified from Barker and Ardis (1996). July, 16, 2015

FIGURE 1-9 CORRELATION CHART SHOWING STRATIGRAPHIC UNITS, AQUIFERS, AND MAJOR MANAGEMENT ZONES

Desired Future Conditions and Modeled Available Groundwater (2010). The evolution of the District's permitting and drought management program described above set the stage for setting aquifer-based management goals known as DFCs through the joint-regional groundwater planning process put in place with the passage of HB 1763 in 2005 (see Section 1.1, Purpose of the District Management Plan). The DFCs are established by the GCDs within GMAs to collectively determine the quantifiable aquifer condition that will be maintained over a 50-year planning period and to encourage coordinated management of shared aquifers. The maximum amount of groundwater production allowed to preserve that DFC is known as the Modeled Available Groundwater (MAG) estimate and is determined by the TWDB and provided to each DFC to be considered as a factor in permitting decisions (see Section 2.2, Managed Available Groundwater based on DFC). The District has territory and participates in joint planning in both GMA 9 and GMA 10 (see Figure 1-1).

As part of the DFC decision-making in the first round groundwater planning that culminated in 2010, the Board considered studies concerning dissolved oxygen (DO) concentrations and salamander mortality conducted in support of the District's HCP (see below, Habitat Conservation Plan), which suggested that Barton Springs flow needed to be higher during extreme drought than what could be achieved under the then-current permitting and drought management program and the established EDWL. This result informed the District's recommendation to GMA 10 for the northern segment of the GMA (primarily the District's territory) to adopt an extreme drought DFC for the freshwater Edwards Aquifer to preserve a minimum spring flow rate at Barton Springs of 6.5 cfs during a recurrence of DOR conditions. The corresponding MAG allowing only 5.2 cfs of total aggregate annual pumping was substantially lower than the EDWL of 8.5 cfs established in 2007 and the aggregate production (after curtailments) of the then-current regulatory program (2010) of 6.7 cfs.

The DFCs set ambitious goal for maintaining minimum spring flows and water well supplies during DOR. The DFCs coupled with preparation of the District's HCP beginning in 2004 prompted an expanded focus on conservation and demand management, including exploring the feasibility of alternative water supplies that could be used to substitute for production under Edwards Aquifer historical production permits. In 2012, the District initiated a stakeholder driven effort to develop a plan and implement measures to close the 1.5 cfs gap through adoption of more aggressive drought rules and encouraging the permanent retirement of historical Edwards Aquifer permits to be dedicated to the Ecological Flow Reserve. To date, the gap has been reduced to 0.3 cfs (see Figure 2-1).

DFCs in GMA 9 and 10 were also adopted for the other aquifers including the Saline Edwards Aquifer (GMA 10) and the Trinity Aquifer (GMA 9 and 10) reflecting the District's expanded focus and elevated priority to manage all of aquifers in the District (see Section 2.2, Managed Available Groundwater based on DFC).

Habitat Conservation Plan (2004-2014). The sustainable yield study in 2004 also indicated that groundwater withdrawals from the freshwater Edwards Aquifer in the District would be accompanied by a rapid, one-for-one volumetric reduction in springflows at Barton Springs during a DOR recurrence. The impact of such reduced springflow on the endangered species of salamanders that use Barton Springs as their sole habitat was then unknown. Although the legal obligations were uncertain, the District opted to commit to managing the Edwards Aquifer groundwater production to avoid or minimize its impact on the endangered species to the greatest extent practicable and on an enduring basis. (Similar conclusions were being drawn at the same time by the federal courts and ultimately the Texas Legislature for the southern segment of the Edwards Aquifer and its own suite of endangered species.) To accomplish this goal, there was a need for a better understanding of the consequences of regulatory program options on the endangered species at Barton Springs.

Consequently, the District began the process of developing a HCP under the federal Endangered Species Act, in anticipation of applying for an Incidental Take Permit from the U.S. Fish & Wildlife Service. As part of the HCP development process, the District initiated several biological and hydrogeological science-based studies to determine how such protection of the salamanders could be most efficaciously achieved while protecting the rights of groundwater owners. These studies received substantial funding from federal matching grants, administered by the Texas Parks and Wildlife Department, as well as substantial financial and in-kind participation by the District. The supporting studies included: a) a first-of-its-kind laboratory and ecological modeling study of the effects of reduced DO concentrations and increased salinity on the Barton Springs salamander, conducted by the University of Texas Department of Integrated Biology (Poteet and Woods, 2007; Woods et al., 2010); b) development of a more rigorous and meaningful drought trigger methodology to support a new, more stringent drought management program that featured the imposition of a junior-senior permitting scheme (described above); and c) a preliminary integrated HCP and Environmental Impact Statement (EIS) document.

A series of changes in both federal and state laws and regulations, changes in federal personnel providing guidance and oversight, and changes in the drought management program in response to severe droughts in 2006, 2008-2009, and 2011 lengthened the timeline for completing the HCP. But over the decade during which the HCP was developed, the HCP conservation measures that avoided, minimized, and mitigated effects and impacts of groundwater production on the endangered species ultimately became integrally intertwined with the District's groundwater management scheme and its regulatory program. Currently, the goals, objectives, strategies, and performance standards in this *Plan* (see Section 3.3, Goals and Strategies) are aligned in all material respects with the goals and conservation measures in the 2014 Draft HCP, and therefore link the HCP program with the District's authorized regulatory, science, educational, and other programs during the term of this *Plan*.

HB 3405 – Unreasonable Impacts (2015 - 2016). In 2015, HB 3405 was passed by the Legislature to extend the jurisdiction of the District, providing authority over all non-Edwards aquifers in the annexed area of the "Shared Territory" within Hays County and to affirm District authority over all aquifers in the "Exclusive Territory" which described the jurisdictional area of the District prior to annexation (see Figure 1-2). HB 3405 also codified a temporary permitting process to allow existing nonexempt well owners to transition into a regular permit. The initial "Temporary Production Permits" were to be issued to existing nonexempt well owners for production not to exceed the "maximum production capacity" and converted to regular permits for the same amount contingent on an evaluation and determination of whether that amount would cause either 1) a failure to achieve the applicable adopted DFCs for the aquifer, or 2) an unreasonable impact on existing wells. These factors triggered two rounds of rulemaking in July 2015 and April 2016 to implement the provision of HB 3405 to first, establish the procedure for processing Temporary Production Permits and second, further define the second factor involving the evaluation of unreasonable impacts.

The second round of rulemaking would incorporate the concept of avoidance of unreasonable impacts into an updated sustainable yield definition and expand the evaluation of unreasonable impacts from beyond HB 3405 permits to be applied as a principal consideration in all future permit decisions. This consideration of the potential for unreasonable impacts is dependent principally on the analysis of site-specific aquifer testing using numerical models and the best available analytical tools and avoidance measures as permit conditions if the evaluation of the proposed production amount confirms potential for such impacts. The following statement was adopted by the Board to memorialize this key management strategy as policy:

> *"The District seeks to manage total groundwater production on a long-term basis while avoiding the occurrence of unreasonable impacts. The preferred approach to achieve this objective is through an evaluation of the potential for unreasonable impacts using the best available science to anticipate such impacts, monitoring and data collection to measure the actual impacts on the aquifer(s) over time once pumping commences, and prescribed response measures to be triggered by defined aquifer conditions and implemented to avoid unreasonable impacts. Mitigation, if agreed to by the applicant, shall be reserved and implemented only after all reasonable preemptive avoidance measures have been exhausted and shall serve as a contingency for the occurrence of unreasonable impacts that are unanticipated and unavoidable through reasonable measures."*

The policy statement affirms the District's preferred approach to consideration of localized impacts in permitting decisions and establishes the preference for avoidance of such impacts reserving any mitigation only for unavoidable or unanticipated impacts. Expansion of the District's territory and confirmation of authority of the Trinity Aquifer and other aquifers in both the previous area and the new Shared Territory would also effectively shift the District's prior emphasis on the Edwards Aquifer as the primary management focus to also include the Trinity Aquifer and other aquifers as aquifers of equal priority.

Synopsis of District's Current Regulatory Approach.
Since its creation in 1987, the District has honored the established precedent of developing policy and management strategies on the basis of statutory compliance, sound science, and stakeholder input. The evolution of the District's policies and strategies chronicled above has produced a regulatory program that is fair, innovative, and customized to objectively address the challenges and management objectives unique to the District. The District's management approach evolved from an initial focus on permitting for historical use from 1987 until the completion of the sustainable yield study in 2004. On the basis of that study, the District began preparation for management under an HCP to protect the endangered salamanders at Barton Springs. To this end, the District implemented rules and policies to:

- cap firm-yield production from the freshwater Edwards Aquifer;
- allow future production from the freshwater Edwards Aquifer only on an interruptible basis through Conditional Production Permits;
- create an Ecological Flow Reserve under the District-held Conservation Permit to support minimum spring flow rates during Extreme Drought;
- create and promulgate rules for Management Zones to allow production from other aquifers to serve as alternative supplies to the freshwater Edwards Aquifer;
- invest in exploring the feasibility of alternative water supply strategies (e.g. aquifer storage and recovery, brackish groundwater desalination);
- adopt ambitious DFCs to preserve minimum spring flows through the joint-regional groundwater planning process, and
- implement an aggressive drought management program to preserve minimum spring flow rates and groundwater supplies.

After the passage of HB 3405 in 2015, the District's attention then shifted to include the management of the Trinity Aquifer and other non-Edwards aquifers in the Shared Territory, and the development of a permitting program with a refined interest in managing to avoid unreasonable impacts and an updated definition of sustainable yield. Sustainable yield is now defined as:

> *The amount of groundwater available for beneficial uses from an aquifer under a recurrence of drought of record conditions, or worse, without causing unreasonable impacts.*

The integration of these strategies collectively produced a program formed on the basis of demand-based permitting integrated with an evaluation of the potential for localized and regional unreasonable impacts and an active drought management program to abate groundwater depletion during District-declared drought. The current permitting and drought management programs are further described below.

Permitting. The current permitting program in place and supported by this *Plan* applies a three-part evaluation to: a) affirm beneficial use in accordance with demand-based permitting standards and the Reasonable Use Doctrine, and b) evaluate the full range of potential impacts for each production permit request. The three-part permit evaluation involves (see Figure 1-10):

1) **Reasonable Non-speculative Demand.** District rules require that all production permit applications indicate the proposed use type of the well and the intended use and the volume of annual production. The requested volume and use are evaluated to affirm that it is for beneficial use and for an annual volume that is non-speculative and commensurate with reasonable demand to avoid over-permitting and discourage waste. The evaluation involves calculation of annual demand based on accepted standards, planning estimates, and regional trends and assurances that there are actual plans and intent to use the water for beneficial purposes within the near term.

2) **Local-scale Evaluations.** Production permit applications for large-scale groundwater production are also evaluated to assess the potential for localized impacts attributed to the proposed demand-based production volume. The District evaluation is performed on the basis of the results of aquifer testing and a hydrogeological report conducted in accordance with District's guidelines and submitted to support the application. Staff evaluates the results of the test and the report through application of the best available science to predict drawdowns (analytical or numerical models) and the potential for unreasonable impacts to existing wells.

3) **Aquifer-scale Evaluations.** Finally, each production permit application is evaluated to assess the potential for impacts to the applicable DFCs and other more long-term conditions defined as unreasonable impacts. This involves a broader evaluation of the cumulative impacts of the aggregate pumping on a regional scale and beyond the term of a permit. Such evaluations require more complex tools, modeling, and ongoing aquifer monitoring and data collection to assess actual and predicted impacts to the DFC and other indicators. The MAG is also a factor considered in this evaluation.

The extent of the evaluation scales with the magnitude of the requested production volume, with the more comprehensive evaluations reserved for the more complex, larger-scale projects with greater potential to cause unreasonable impacts. Each component of the evaluation is considered individually and collectively to determine the General Manager's action or recommendation to the Board to either 1) deny the permit, 2) approve the permit, or 3) approve with special conditions if necessary to avoid unreasonable impacts.

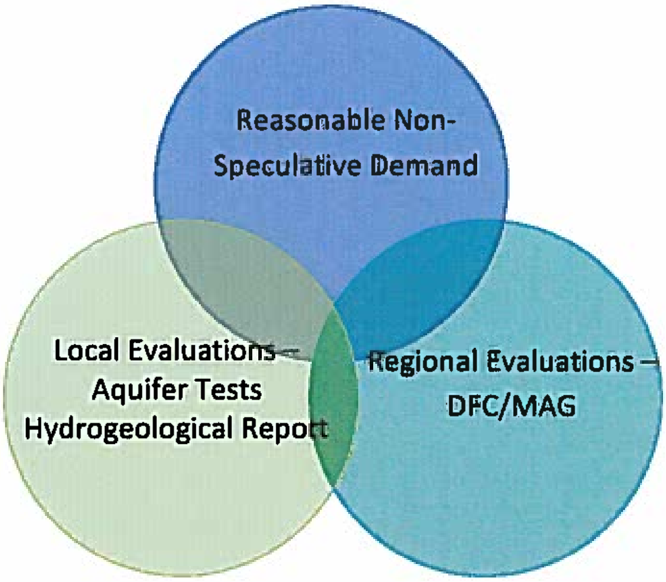


FIGURE 1-10: THREE-PART PERMIT EVALUATION

Drought Management. One of the principal responsibilities central to the District's mission is to manage groundwater production during drought conditions when the aquifers are most stressed. After District creation in 1987 and until 2004, the District put into place its initial permitting program and drought management program with a network of drought indicator wells and curtailments linked to percentiles of monthly flow at Barton Springs. With a burgeoning regional population and increasing demand on the District's aquifers coupled with the findings of the sustained yield study, the District recognized a need to improve the drought management program. Significant droughts in 2006, 2008–09, and 2011 provided further impetus for a series of amendments that implemented a more effective science-based drought trigger methodology and expanded permit-based drought rules and enforcement protocol. The amendments produced milestones in the District's regulatory approach (e.g., conditional permitting, the EDWL, the Ecological Flow Reserve, management zones, as described above) that were the product of numerous scientific studies conducted by the District's hydrogeologists, vetted through technical consultants and advisors, reviewed and commented on by stakeholders and the public, and approved by the Board.

The current drought management program in place and supported by this *Plan* is implemented through User Drought Contingency Plans (UDCPs) that are an integral component required of each Production Permit. Drought declarations involve continuous evaluation of the aquifer conditions measured at the drought indicators for the Edwards Aquifer that also serve as surrogates indicative of regional drought conditions for all District aquifers. When the designated aquifer conditions are met, permittees are required to implement the prescribed measures of the UDCPs requiring mandatory curtailments of permitted groundwater production based on permit type and aquifer management zones.

Curtailments are implemented on a monthly basis during District-declared drought, and increase with drought severity with maximum curtailments reserved for an Emergency Response Period (see Table 1-1). The curtailments are derived on the basis of a pumping profile representing the average monthly distribution of the demand-based annual permit volume for each groundwater use type, and are calculated as a percentage reduction off of the monthly baseline amount. Authorized permit volumes based on reasonable non-speculative demand, monthly reporting of actual groundwater production by permittees, and active enforcement of monthly curtailments are integral to effective drought management in order to ensure the more immediate and consistent relief in actual pumping pressure needed to sustain spring flows and existing water supplies during District-declared drought until the drought conditions recede and the aquifers recover.

Summary and Future Policy Considerations. Collectively, this *Plan* and the supporting rules and policies are protective of historical use based on when production exceeds scientifically defined sustainable yield, rooted in the doctrine of Reasonable Use, and serve the District's intended purpose pursuant to §36.015 of the Texas Water Code. All strategies are integrated and integral to achieving the DFCs in compliance with state law and the measures of the District's HCP in compliance with the prospective Incidental Take Permit (ITP) in compliance with federal law.

As demonstrated above, the regulatory program must be adaptable and able to evolve as the science of the aquifers evolve and, inevitably, as the laws governing GCDs change. As such, the current regulatory program as supported by this *Plan* may also require updates and changes in the interim prior to subsequent plan updates. Therefore, the current policies and rules shall not be considered static and shall evolve as necessary, provided that such changes are not fundamentally inconsistent with the goals and objectives of this *Plan* and/or the HCP.

Table 1-1: Mandatory Drought Curtailments.

Curtailments established for different well permit types, aquifers, and drought conditions. (Curtailment expressed as percentage of authorized monthly groundwater production in designated drought stage. For example, freshwater Edwards Aquifer historical permittees would be required to curtail their authorized monthly withdrawal by 30% during Stage III Critical Drought.)

Drought Curtailment Chart

Aquifer	Edwards Aquifer						Trinity Aquifer			
Management Zone	Eastern/Western Freshwater					Saline	Lower	Middle	Upper	Outcrop
Permit Type	Historical	Conditional Class A	Conditional Class B	Conditional Class C	Conditional Class D	Hist.	Hist.	Hist.	Hist.	Hist.
Drought Stages										
No Drought	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Water Conservation (Voluntary)	10%	10%	10%	10%	10%	0%	10%	10%	10%	10%
Stage II Alarm	20%	20%	50%	100%	100%	0%	20%	20%	20%	20%
Stage III Critical	30%	30%	75%	100%	100%	0%	30%	30%	30%	30%
Stage IV Exceptional	40%	50%[1]	100%	100%	100%	0%	30%	30%	30%	30%
Emergency Response Period	50%[3]	>50%[2]	100%	100%	100%	0%	30%	30%	30%	30%

Percentages indicate the curtailed volumes required during specific stages of drought.

1 Only applicable to LPPs and existing unpermitted nonexempts after A to B reclassification triggered by Exceptional Stage declaration

2 Curtailment > 50% subject to Board discretion

3 ERP (50%) curtailments become effective October 11, 2015. ERP curtailments to be measured as rolling 90-day average after first three months of declared ERP.

1.6 TWDB Checklist Reference Table

Texas Water Development Board

Groundwater Conservation District Management Plan Checklist, effective December 6, 2012

District name: ☐ **Official review** ☐ **Prereview**

Reviewing staff:

Date plan received:

Date plan reviewed:

A management plan shall contain, unless explained as not applicable, the following elements, 31 TAC §356.52(a):

	Citation of rule	Citation of statute	Present in plan and administratively complete	Source of data	Evidence that best available data was used	Notes
Is a paper hard copy of the plan available?	31 TAC §356.53(a)(1)					
Is an electronic copy of the plan available?	31 TAC §356.53(a)(2)					
1. Is an estimate of the modeled available groundwater in the District based on the desired future condition established under Section 36.108 included?	31 TAC §356.52(a)(5)(A)	TWC §36.1071(e)(3)(A)				p.
2. Is an estimate of the <u>amount of groundwater being used</u> within the District on an annual basis for at least the <u>most recent five years</u> included?	31 TAC §356.52(a)(5)(B); §356.10(2)	TWC §36.1071(e)(3)(B)				p.
For sections 3-5 below, each district must use the groundwater availability modeling information provided by the TWDB in conjunction with available site-specific information provided by the district when developing the required estimates, 31 TAC §356.52(c):						
3. Is an estimate of the annual <u>amount of recharge</u>, <u>from precipitation</u>, if any, to the groundwater resources within the District included?	31 TAC §356.52(a)(5)(C)	TWC §36.1071(e)(3)(C)				p.
4. For each aquifer in the district, is an estimate of the annual volume of <u>water that discharges from the aquifer</u> to springs and any surface water bodies, including lakes, streams and rivers, included?	31 TAC §356.52(a)(5)(D)	TWC §36.1071(e)(3)(D)				p.
5. Is an estimate of the annual volume of flow	31 TAC §356.52(a)(5)(E)	TWC §36.1071(e)(3)(E)				
a) <u>into the District</u> within each aquifer,						p.
b) <u>out of the District</u> within each aquifer,						p.
c) and <u>between aquifers</u> in the District,						p.
if a groundwater availability model is available, included?						
6. Is an estimate of the <u>projected surface water supply</u> within the District according to the most recently adopted state water plan included?	31 TAC §356.52(a)(5)(F)	TWC §36.1071(e)(3)(F)				p.
7. Is an estimate of the <u>projected total demand for water</u> within the District according to the most recently adopted state water plan included?	31 TAC §356.52(a)(5)(G)	TWC §36.1071(e)(3)(G)				p.
8. Did the District consider and include the <u>water supply needs</u> from the adopted state water plan?		TWC §36.1071(e)(4)				p.
9. Did the District consider and include the <u>water management strategies</u> from the adopted state water plan?		TWC §36.1071(e)(4)				p.
10. Did the district include details of how it will manage groundwater supplies in the district	31 TAC §356.52(a)(4)					p.
11. Are the actions, procedures, performance, and avoidance necessary to effectuate the management plan, including <u>specifications</u> and <u>proposed rules</u>, all specified in as much detail as possible, included in the plan?		TWC §36.1071(e)(2)				p.
12. Was <u>evidence</u> that the plan was adopted, <u>after notice and hearing</u>, included? Evidence includes the posted agenda, meeting minutes, and copies of the notice printed in the newspaper(s) and/or copies of certified receipts from the county courthouse(s).	31 TAC §356.53(a)(3)	TWC §36.1071(a)				p.
13. Was <u>evidence</u> that, following notice and hearing, the District coordinated in the development of its management plan with regional surface water management entities?	31 TAC §356.51	TWC §36.1071(a)				p.
14. Has any available <u>site-specific information</u> been provided by the district to the executive administrator for review and comment before being used in the management plan when developing the <u>estimates required in subsections 31 TAC §356.52(a)(5)(C), (D), and (E)</u>?	31 TAC §356.52(c)	TWC §36.1071(h)				p.

Mark an affirmative response with YES
Mark a negative response with NO
Mark a non-applicable checklist item with N/A

Management goals required to be addressed unless declared not applicable	Management goal (time-based and quantifiable) 31 TAC §356.51	Methodology for tracking progress 31TAC §356.52(a)(4)	Management objective(s) (specific and time-based statements of future outcomes) 31 TAC §356.52 (a)(2)	Performance standard(s) (measures used to evaluate the effectiveness of district activities) 31 TAC §356.52 (a)(3)	Notes
Providing the most efficient use of groundwater 31 TAC 356.52(a)(1)(A); TWC §36.1071(a)(1)	15)	16)	17)	18)	p.
Controlling and preventing waste of groundwater 31 TAC 356.52(a)(1)(B); TWC §36.1071(a)(2)	19)	20)	21)	22)	p.
Controlling and preventing subsidence 31 TAC 356.52(a)(1)(C); TWC §36.1071(a)(3)	23)	24)	25)	26)	p.
Addressing conjunctive surface water management issues 31 TAC 356.52(a)(1)(D); TWC §36.1071(a)(4)	27)	28)	29)	30)	p.
Addressing natural resource issues that impact the use and availability of groundwater and which are impacted by the use of groundwater 31 TAC 356.52(a)(1)(E); TWC §36.1071(a)(5)	31)	32)	33)	34)	p.
Addressing drought conditions 31 TAC 356.52(a)(1)(F); TWC §36.1071(a)(6)	35)	36)	37)	38)	p.
Addressing	39)	40)	41)	42)	
a) conservation,	39a)	40a)	41a)	42a)	p.
b) recharge enhancement,	39b)	40b)	41b)	42b)	p.
c) rainwater harvesting,	39c)	40c)	41c)	42c)	p.
d) precipitation enhancement, and	39d)	40d)	41d)	42d)	p.
e) brush control	39e)	40e)	41e)	42e)	p.
where appropriate and cost effective 31 TAC 356.52(a)(1)(G); TWC §36.1071(a)(7)					
Addressing the desired future conditions established under TWC §36.108. 31 TAC 356.52(a)(1)(H); TWC §36.1071(a)(8)	43)	44)	45)	46)	p.
Does the plan identify the performance standards and management objectives for effecting the plan? 31 TAC §356.52(a)(2)&(3); TWC §36.1071(e)(1)			47)	48)	

Mark required elements that are present in the plan with YES
Mark any required elements that are missing from the plan with NO
Mark plan elements that have been indicated as not applicable to the district with N/A

2. Planning Data and Required Information

2.1 Hydrological Estimates

Total Estimated Recoverable Storage (TERS), per TWDB

Texas Water Code (TWC), §36.108(d) states that, before voting on the proposed desired future conditions (DFCs) for a relevant aquifer within a groundwater management area, the GCDs shall consider the Total Estimated Recoverable Storage (TERS) as provided by the Executive Administrator of the Texas Water Development Board (TWDB) along with other factors listed in §36.108(d). The TERS defined in 31 Texas Administrative Code §356.10 is the estimated amount of groundwater within an aquifer that accounts for recovery scenarios that range between 25 percent and 75 percent of the porosity-adjusted aquifer volume.

Table II A-1a TERS estimates for the BSEACD within the northern subdivision of GMA 10 (Bradley, 2016):

Aquifer	Total Storage (acre-feet)	25% of Total Storage (acre-feet)	75% of Total Storage (acre-feet)
Edwards	130,000	32,500	97,500
Trinity*	1,200,000	300,000	900,000
Saline Edwards	690,000	172, 500	517,000

***Calculation does not include increased area in Hays County since HB 3405.**

Table II A-1b TERS estimates within GMA 9 for the BSEACD (Jones and Bradley, (2013):

Aquifer	Total Storage (acre-feet)	25% of Total Storage (acre-feet)	75% of Total Storage (acre-feet)
Edwards	15,000	3,750	11,250
Trinity	2,200	550	1,650

2.2 Managed Available Groundwater Based on DFC (Per TWDB)

This *Plan* has been prepared to include the various DFCs adopted by the Board for aquifers in the District that are coincident with GMA 9 and the northern subdivision of GMA 10 (see Figure 1-1) and were determined to be "relevant" for the purposes of regional planning. These DFCs were established in accordance with the provisions of TWC 36.108 related to the joint-regional groundwater planning process required by. The DFCs are as follows:

- Edwards Balcones Fault Zone (Freshwater) DFC dated August 24, 2010
    - Springflow of Barton Springs during average recharge conditions shall be no less than 49.7 cubic feet per second (cfs) averaged of an 84-month (seven-year) period; and
    - During extreme drought conditions, including those as severe as a recurrence of the 1950s drought of record, springflow of Barton Springs shall be no less than 6.5 cubic feet per second (cfs), averaged on a monthly basis.

- Saline Edwards Aquifer DFC adopted XXXX

- No more than 75 feet of regional average potentiometric surface drawdown due to pumping when compared to pre-development conditions.

- Trinity Aquifer DFC adopted August 23, 2010 (for the entire GMA 10)

- Average regional well drawdown not exceeding 25 feet during average recharge conditions (including exempt and non-exempt use); within Hays-Trinity Groundwater Conservation District: no drawdown; within Uvalde County: 20 feet; not relevant in Trinity-Glen Rose GCD (TWDB, 2015).

- Trinity Aquifer DFC adopted April 28, 2016 for GMA 9
  - Trinity Aquifer [Upper, Middle, and Lower undifferentiated] - Allow for an increase in average drawdown of approximately 30 feet through 2060 (throughout GMA 9) consistent with "Scenario 6" in TWDB GAM Task 10- 005.

The TWDB has determined the amount of modeled available groundwater (MAG) that is available from the relevant aquifers being managed by the District and that preserve the DFCs. The MAGs for GMA 9 and the northern subdivision of GMA 10 are shown in Table 2-1.

Table 2-1: Summary of MAGs

AQUIFER	MAG (acre-ft/yr)	MAG (cfs)	TWDB GAM Report Citation
Edwards (Freshwater) Average Conditions Drought Conditions	 11,528 3,756	 16 5.2	 Hutchison and Oliver, December 7, 2011
Edwards (Saline)	523	0.72	Bradley, 2011
Trinity Aquifer (GMA-10)	1,288	1.78	Thorkildsen and Backhouse, 2011
Trinity Aquifer (GMA-9)	22		Jones, 2017

Prior to the MAG determination by TWDB for extreme drought conditions in the freshwater Edwards, the District relied on a modeling and water balance approach described in a study of the sustainable yield of the Barton Springs aquifer completed in 2004, and accepted by TWDB (Smith and Hunt, 2004). The results of that study and other numerical modeling efforts support an approximate one-to-one relationship between springflow and pumping under low-flow conditions (Hunt et al., 2011). These studies have informed the determination of the drought MAG. The lowest measured daily value of springflow is 9.6 cfs, during the drought of record (DOR); the lowest monthly value is 11 cfs. Withdrawals of 10 cfs would produce a springflow of 1 cfs, and so forth. Any withdrawals more than 11 cfs would further increase impacts to wells as the aquifer is de-watered, and would increase the duration of no-flow conditions at Barton Springs. These levels of withdrawals have been determined by the District Board to lead to unsustainable conditions.

This *Plan* has been prepared to be consistent with the proposed measures in the District's HCP submitted to the U.S. Fish and Wildlife Service (Service) pursuant to the pending Incidental Take Permit

(ITP) application by the District. The internal Service review of the application is near complete, however, that permit and a supporting Final HCP have not yet been finalized and approved. While considered unlikely at this time, the Service could require the Draft HCP to be modified before the ITP may be approved. The requirements of the Draft HCP have been used to establish the freshwater Edwards Aquifer DFCs in the District and in turn the MAG. The District employs a groundwater management regulatory program that is designed to limit total authorized groundwater production from the freshwater Edwards Aquifer to no more than about 5.2 cfs during a recurrence of the DOR to comply with the DFC expression, including 4.7 cfs of permitted non-exempt production by permittees. This limitation is the MAG for the freshwater Edwards Aquifer drought DFC and is consistent with the management objectives of the HCP (See Section 1.5, Management of groundwater resources in the District).

The current regulatory program maximizes the amount of springflow during the worst part of a drought similar to the DOR. However, if exempt pumpage stays the same as now, aggregate authorized pumping needs to be further reduced by approximately 0.3 cfs to equal the extreme drought MAG. This gap amount was reduced from 1.5 cfs in 2010 and ongoing efforts are on pace to eliminate the gap completely. Alternatively, the DFC (and the MAG) could be restated in a subsequent round of joint planning, but that would require an amendment to the ITP and approved HCP. Figure 2-1 is a graphic that depicts the relationship of the DFC, MAGs, and the permitting structure for the freshwater Edwards Aquifer.

Prehistoric climatic data indicate that there may be future droughts that will be worse than the 1950s' DOR. Climate change associated with increased levels of greenhouse gases in the atmosphere may cause future droughts to be more severe than droughts that have occurred during the historic period (IPCC 2007, Nielsen-Gammon, 2008). The District has already begun to review data relating to such conditions and may consider policies in the future that would address the need and options for regulatory responses to more intense droughts. Such responses could include additional curtailments of nonexempt pumpage, but that circumstance is considered highly unlikely during the term of the *Plan* or even the HCP.

No sustainable yield assessments for the Trinity Aquifer and Edwards (Saline) aquifers have been conducted prior to this *Plan*. Initial assessments and evaluations of the Trinity and Edwards (Saline) aquifer were conducted as part of the DFC and MAG process. An assessment of the suitability of the saline Edwards Aquifer for desalinization and for Aquifer Storage and Recovery (ASR) are presently underway (TWDB grant #?). In addition, revisions to the conceptual model of the Trinity Aquifer in GMA-9 and GMA 10 is also underway and could lead to revision to the Hill Country GAM numerical model (TWDB grant #?). As more information becomes available, revisions to the DFC expressions and new aquifer assessments are expected.

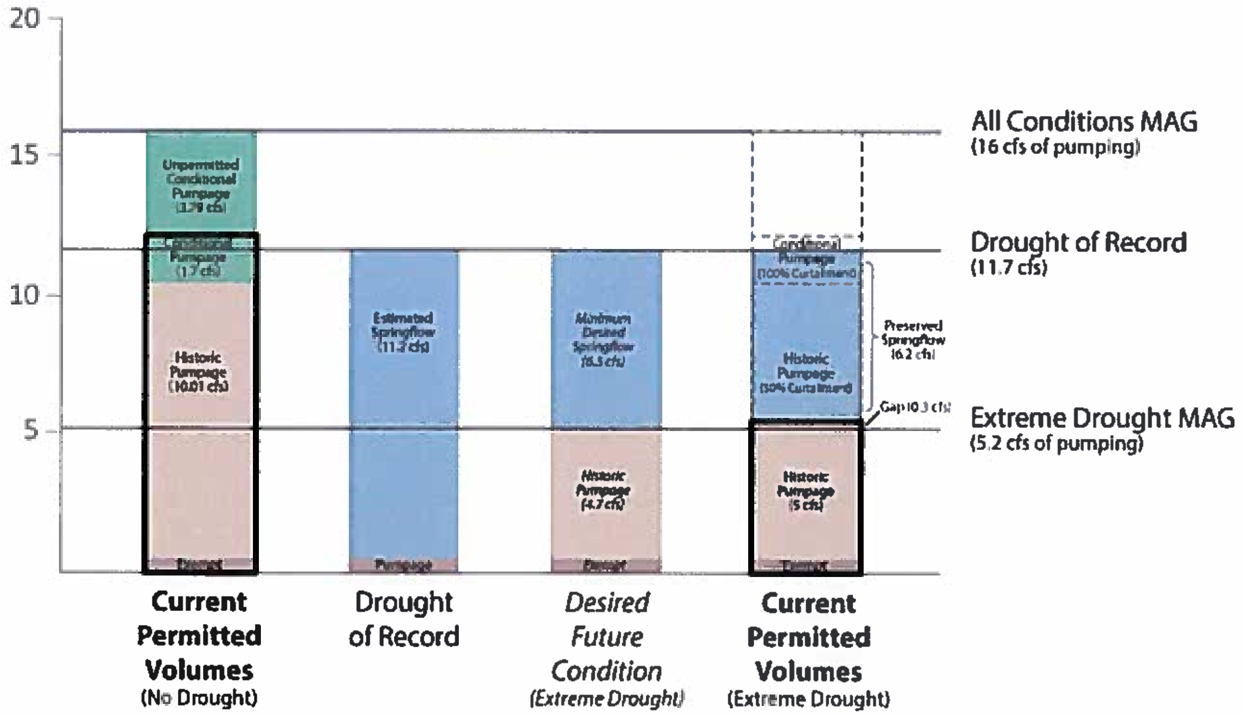


FIGURE 2-1: CONCEPTUAL DIAGRAM OF THE DISTRICT'S MODELED AVAILABLE GROUNDWATER AND THE EQUIVALENT EXTREME DROUGHT WITHDRAWAL LIMITATION FORMULATION FOR THE FRESHWATER EDWARDS AQUIFER

This conceptual diagram shows the components and their restrictions associated with the Extreme Drought Withdrawal Limitation (EDWL) as incorporated in the District's drought management policy.

2.3 Annual Groundwater Use, by aquifer

Groundwater use within the District is comprised primarily of pumpage and use from the freshwater Edwards Aquifers with a much smaller but increasing component of overall pumpage coming from the Trinity Aquifers. An incidental amount of groundwater is derived from the Taylor and Austin Groups and more geologically recent alluvial deposits. Given the current management scheme of conditional permitting and the drought restrictions and curtailment requirements associated with new interruptible pumpage authorizations for the freshwater Edwards Aquifer, it is likely that future groundwater production will trend more towards pumpage from the saline Edwards Aquifer and the Middle and Lower Trinity Aquifers.

The data presented below are a compilation of District monthly meter readings reported by District permittees and are therefore, a more accurate representation of actual in-District groundwater use than was provided by the TWDB in Appendix II. The following tables present the reported use data organized by major aquifer and water use type (using the District's water use type designations) in Table 2-2(a), and by county and management zone in Table 2-2 (b). These data include neither Exempt Use, which is primarily from the Edwards Aquifer and is estimated to be about 118,000,000 gallons (362 AF) annually, nor Limited Production Permits (LPPs) under the District's LPP general permit, which is also primarily from the Edwards Aquifer and is estimated to be about 18,000,000 gallons (55.2 AF) annually.

Table 2-2: Actual Pumpage from Permitted Wells for Last Five Years (in gallons and acre-feet)

(a) By Major Aquifer and Type of Use:

Fiscal Year	PWS	Commercial	Irrigation	Industrial	Total
Edwards Aquifer					
2012	1,342,690,771	6,190,339	99,695,520	196,314,335	**1,644,890,965**
	4,121	19	306	602	**5,048**
2013	1,223,357,684	5,070,988	92,631,818	184,074,250	**1,505,134,740**
	3,754	16	284	565	**4,619**
2014	1,235,581,969	4,573,050	114,352,609	155,014,481	**1,509,522,109**
	3,792	14	351	476	**4,633**
2015	1,115,109,732	3,841,806	100,079,109	145,017,167	**1,364,047,814**
	3,422	12	307	445	**4,186**
2016	1,198,026,790	3,915,430	94,238,904	122,301,561	**1,418,482,685**
	3,677	12	289	375	**4,353**
Trinity Aquifer					
2012	41,162,382	0	12,896,000	0	**54,058,382**
	126	0	40	0	**166**
2013	38,298,032	0	10,326,900	0	**48,624,932**
	118	0	32	0	**149**
2014	36,825,616	0	23,586,300	0	**60,411,916**
	113	0	72	0	**185**
2015	32,429,684	0	19,284,604	625,500	**52,339,788**
	100	0	59	2	**161**
2016	58,926,382	2,001,141	68,725,505	2,267,200	**131,920,228**
	181	6	211	7	**405**
Alluvial/Austin Chalk Aquifer					
2016	0	0	290,260	0	**290,260**
	0	0	1	0	**1**

(b) By County and District Management Zone

Fiscal Year	Edwards Aquifer		Trinity Aquifers			Other Aquifers	
	Freshwater Zones	Saline Zone	Upper Trinity	Middle Trinity	Lower Trinity	Alluvial/Austin Chalk	Totals
Hays County							
2012	1,252,248,026	0	0	41,162,382	0	0	**1,293,410,408**
	3,843	0	0	126	0	0	**3,969**
2013	1,162,223,574	0	0	38,298,032	0	0	**1,200,521,606**
	3,567	0	0	118	0	0	**3,684**
2014	1,150,739,221	0	0	36,825,616	0	0	**1,187,564,837**
	3,531	0	0	113	0	0	**3,645**
2015	1,022,534,700	0	0	33,055,184	0	0	**1,055,589,884**
	3,138	0	0	101	0	0	**3,239**
2016	1,079,232,302	0	21,918	63,137,395	0	290,260	**1,142,681,875**
	3,312	0	0.1	194	0	1	**3,507**
Travis County							
2012	392,642,939	0	0	0	12,896,000	0	**405,538,939**
	1,205	0	0	0	40	0	**1,245**
2013	342,911,166	0	0	0	10,326,900	0	**353,238,066**
	1,052	0	0	0	32	0	**1,084**
2014	358,782,888	0	0	15,358,500	8,227,800	0	**382,369,188**
	1,101	0	0	47	25	0	**1,173**
2015	341,513,114	0	0	12,622,504	6,662,100	0	**360,797,718**
	1,048	0	0	39	20	0	**1,107**
2016	339,250,383	0	0	61,981,315	6,779,600	0	**408,011,298**
	1,041	0	0	190	21	0	**1,252**

2.4 Annual Recharge from Precipitation, by aquifer

Edwards Aquifer

For the Barton Springs segment of the Edwards Aquifer, the long-term mean surface recharge should approximately equal the mean natural (i.e., with no well withdrawals) spring discharge, or about 53 cubic feet per second (cfs) at Barton Springs (Slade et al., 1986). The distribution and volume of this recharge have been modeled by many scientists. The report by Scanlon et al. (2001) documents the official TWDB GAM for the Barton Springs segment. A recent draft report by TWDB, GAM Run 08-37 (June 20, 2008), included as Appendix III, summarizes the estimated amount of recharge from precipitation, the amount of spring discharge, and the amount of flow into and out of the District for steady-state conditions in 1989. Annual recharge from precipitation for the modeling was 42,858 acre-ft (59.2 cfs).

The majority (as much as 85 percent) of recharge to the aquifer is derived from streams originating on the contributing zone, located up gradient to the west of the recharge zone. Water flowing onto the recharge zone sinks into numerous caves, sinkholes, and fractures along its six major, ephemeral streams and the perennial Blanco River. The remaining recharge (15 percent) occurs in the upland areas of the recharge zone (Slade et al., 1986). Site-scale measurements suggested a larger portion of recharge occurs in the uplands (Hauwert, 2009; Hauwert, 2011). Recent water balance studies indicate that stream recharge contributed 56-67% of recharge with upland, and other small sources, contributing the remaining 33-44% (Hauwert, 2016). Studies have shown that recharge is highly variable in space and time, and a large amount can be focused within discrete features (Smith et al., 2001). For example, Onion Creek is the largest contributor of recharge (32-34 percent) with maximum recharge rates up to 160 cfs (Slade et al., 1986; Hauwert, 2016). Antioch Cave is located within Onion Creek and is the largest-capacity recharge feature with an average recharge of 46 cfs and a maximum of 95 cfs during one 100-day study (Fieseler, 1998). Recent work at Antioch Cave has also documented greater than 100 cfs of recharge entering the aquifer through the entrance to Antioch Cave (Smith et al., 2011). Dye tracing studies have shown that some of this water flows directly and very rapidly to Barton Springs with an unknown percentage contributing to storage.

Groundwater divides delineate the boundaries of aquifer systems and influence not only the local aquifer hydrodynamics, but also the groundwater budget (recharge). The groundwater divide separating the San Antonio and Barton Springs segments of the Edwards Aquifer has historically been drawn along topographic or surface water divides between the Blanco River and Onion Creek in the recharge zone, and along potentiometric highs in the confined zone between the cities of Kyle and Buda in Hays County. Recent studies reveal that during wet conditions, the groundwater divide is located generally along Onion Creek in the recharge zone, extending easterly along a potentiometric ridge between the cities of Kyle and Buda toward the saline zone boundary (Hunt et al. 2006). During dry conditions the hydrologic divide moves south and is located along the Blanco River in the recharge zone, extending southeasterly to San Marcos Springs (Johnson et al., 2011). Thus, the groundwater divide is a hydrodynamic feature dependent upon the hydrologic conditions (wet versus dry) and the resulting hydraulic heads between Onion Creek and the Blanco River. Recent studies also reveal than under extreme drought conditions, some groundwater may bypass San Marcos Springs and flow toward Barton Springs (Land et al., 2011), and the Blanco River is the only source of active surface water recharge during drought conditions (Smith et al., 2012).

Trinity Aquifer
The Trinity Aquifer, exposed in the Hill Country region (west of the District), receives recharge from rainfall on the outcrop, losing streams, and perhaps lakes during high levels (Mace et al., 2000). Mace et al. (2001) estimated recharge for the Upper and Middle Trinity Aquifers is equal to 4 to 6 percent of mean annual rainfall. Some of the Trinity units are recharged by vertical leakage from overlying strata (Ashworth, 1983). There are karst features, faults, and fractures throughout the Hill Country and such features provide discrete recharge to the Trinity Aquifer. Recent studies characterize the Hill Country landscape as having streams that are hydrologically linked to the aquifer (groundwater) systems (Hunt et al., 2016; Hunt et al., 2017). Aquifers provide spring flows that sustain the streams, and the streams, in turn, recharge the downstream aquifers.

In the Balcones Fault Zone (BFZ), the amount of recharge to the Trinity Aquifer is generally unknown. The Trinity is composed of the Upper, Middle, and Lower Trinity Aquifers. Within the BFZ, recent studies have indicated that portions of the Upper Trinity Aquifer (Upper Glen Rose) are hydrologically connected to the Edwards Aquifer, while the lower portion of the Upper Trinity behaves as an aquitard between the Edwards and Middle Trinity Aquifers (Wong et al., 2014; Hunt et al., 2016). Primary sources of recharge to the Middle Trinity Aquifer include lateral flow from the Hill Country Trinity Aquifer (Hunt et al., 2015). Significant vertical leakage from the Edwards Aquifer (stratigraphically above the Middle Trinity) is not supported by recent studies in the District. These studies indicate that the Middle Trinity is hydrologically separate from the overlying Edwards Aquifer. Geochemical and head data suggest that the Edwards and Middle Trinity Aquifers can be managed independently because of the behavior of the Upper Trinity as an aquitard (Smith and Hunt, 2010; Kromann et al., 2011; Wong et al., 2014).

2.5 Annual Discharges to Springs and Surface-water Bodies, by aquifer

Both the Edwards and Trinity Aquifers of Central Texas have recently been characterized as tributary in nature, meaning that they provide flows to surface-water bodies, and they are not isolated from other aquifers (Anaya et al., 2016). The saline Edwards could be considered a non-tributary aquifer as it does not provide flows to surface-water bodies and appears to be largely isolated from other aquifers.

Edwards Aquifer
The largest natural discharge point of the Barton Springs aquifer is Barton Springs, the fourth largest spring in Texas, and consists of four major outlets: Main, Eliza, Old Mill, and Upper. Main Spring is the largest and discharges directly into Barton Springs Pool. Springflow at Barton Springs is determined and reported by the U.S. Geological Survey (USGS). Discharge reported for Barton Springs is based on a rating-curve correlation between water levels in the Barton Well (State Well Number 5842903) and physical flow measurements from Main, Eliza, and Old Mill. Flow from Upper Barton Springs, which is located about 400 feet upstream of the pool, is not included in the reported discharge, and bypasses the pool. Upper Barton Springs is characterized as an "overflow" spring and only flows when discharge at Barton Springs exceeds about 40 cfs (Hauwert et al., 2004).

Barton Springs has a long period of continuous discharge data, beginning in 1917. Monthly mean data are available from 1917 to 1978 (Slade et al., 1986), and daily mean discharge data are available thereafter. The long-term average springflow at Barton Springs is 53 cfs based on data from 1917 to 1995 and is a widely reported value (Slade et al., 1986; Scanlon et al., 2001; Hauwert et al., 2004). Indeed a recent state-wide studies cite average values of 61 cfs and median values of 58 cfs for Barton

Springs (Anaya et al., 2016). The maximum and minimum measured discharges are 166 and 9.6 cfs, respectively. The lowest measured spring discharge value occurred on March 26, 1956 during the 1950s drought (Slade et al., 1986). Low flow periods are defined as discharge below 35 cfs, moderate flow conditions occur between 35 to 70 cfs, and high flow conditions correspond to flows greater than 70 cfs (Hauwert et al., 2004). Mahler et al. (2006) define low flow as below 40 cfs. A peak in the daily average flow occurs in June, following the average peak rainfall in May.

Barton Springs flow is typical of a spring in a karst system with dynamic responses to recharge events and integrating a combined conduit, fracture, and matrix flow from the system. Springflow recessions and discharge rates are in large part determined by pre-existing conditions, the magnitude of recharge, and location of recharge. Massei et al. (2007) identify several source water types contributing to the conductivity measured in Barton Springs. Sources include matrix, surface water, saline-water zone, and other unidentified sources. Their relative contribution is dependent upon aquifer response to climatic and hydrologic conditions. Generally speaking; however, base springflow during periods of drought is sustained by the discharge of the matrix flow system into the conduit system (White, 1988; Mahler et al., 2006).

The Barton Springs segment of the Edwards Aquifer contains other smaller springs. Cold Springs discharges directly into the Colorado River and is partially submerged by Lady Bird Lake. There are very few discharge data for Cold Springs, but it is estimated to be about 5 percent of Barton Springs discharge (Scanlon et al., 2001). A small spring named Rollingwood Spring, near Cold Springs, discharges into the Colorado River at a rate of about 0.02 to 0.06 cfs. Backdoor Spring is a small, perched spring located on Barton Creek and has discharge of about 0.02 cfs. Bee Spring is a small, perched spring and seep horizon discharging along Bee Creek and into Lake Austin and discharges about 0.2 to 0.6 cfs (Hauwert et al., 2004).

The report by TWDB on GAM Run 08-37 (Appendix III) states that discharge from springs (Barton and Cold) was 39,723 acre-ft/year (54.9 cfs) under steady-state conditions in 1989. The amount of water withdrawn from wells was 3,135 acre-ft (4.3 cfs).

Saline Edwards Aquifer

The saline portion of the Edwards BFZ Aquifer is confined above by younger Cretaceous-age formations of the Taylor Group. The saline portion of the aquifer, therefore, does not receive direct recharge from precipitation, nor does it discharge to springs.

Trinity Aquifer

Most of the streams and rivers in the Central Texas Hill Country were historically characterized as net-gaining for the Hill Country Trinity Aquifer region (Ashworth, 1983; Jones et al., 2009). Recent state-wide studies indicate a net gain of average annual flows to surface water from the Trinity Aquifer for Hays and Travis Counties of 57 and 51 cfs, respectively (Anaya et al., 2016). However, recent local studies have documented that surface and groundwater interactions in the Central Texas Hill Country are very complex. Streams and rivers have both losing and gaining reaches (Hunt et al., 2017; Hunt et al., 2017). Losing stream reaches within the Hill Country provide recharge to the Trinity Aquifer. Discharge (gains) into the Hill Country streams and rivers is the source of baseflows that ultimately recharge to the Edwards Aquifer. There are many small springs and seeps throughout the Hill Country that issue from the Upper and Middle Trinity Aquifers. Two of the larger springs in the study area are Jacob's Well, near Wimberley, and Pleasant Valley Spring near Fischer Store. Both springs are critical to the baseflows of the Blanco River that provide recharge to the Edwards Aquifer.

Potentiometric maps of the Hill Country indicate lateral flow in the Upper and Middle Trinity Aquifers toward the Colorado River in northwestern Hays and western Travis Counties (Mace et al., 2000; Wierman et al., 2010). As described above, most of the lateral flow in the Middle Trinity Aquifer stays within the Middle Trinity Aquifer as it enters the BFZ and does not discharge as springflow or to surface water bodies in the District (Hunt et al., 2015). Some of the flow within the upper-most portion of the Upper Trinity may flow laterally and vertically into the Edwards Aquifer, and ultimately contribute to wells and Barton Springs.

No major springs are known to flow from the Trinity Aquifer within the District, since only an incidental amount of the Trinity crops out in the District.

2.6 Annual Inter-formational Inflows and Outflows

Both the Edwards and Trinity Aquifers of Central Texas have recently been characterized as tributary in nature, meaning that they provide flows to surface-water bodies, and they are not isolated from other aquifers (Anaya et al., 2016). The saline Edwards could be considered a non-tributary aquifer as it does not provide flows to surface-water bodies and appears to be largely isolated from other aquifers.

Edwards Aquifer

The amount of cross-formational inflow (sub-surface recharge) occurring through adjacent aquifers into the Barton Springs aquifer is unknown, although it is thought to be relatively small on the basis of water-budget analysis for surface recharge and discharge (Slade et al., 1985; Hauwert, 2016). However, recent studies by the District and others have shown the potential for some amount of cross-formational flow both to and from the Barton Springs aquifer. Some sources of cross-formational flow are discussed below and include the saline-water zone, San Antonio segment, the Trinity Aquifer, and urban recharge.

Leakage from the saline-water zone into the freshwater zone is probably minimal, although leakage appears to influence water quality at Barton Springs during low-flow conditions (Senger and Kreitler, 1984; Slade et al., 1986). Recent studies indicate that the fresh-saline zone interface may be relatively stable over time (Lambert et al., 2010; Brakefield et al., 2015). On the basis of a geochemical evaluation, Hauwert et al. (2004) state that the saline-water zone contribution could be as high as 3% for Old Mill Springs and 0.5% for Main and Eliza Springs under low-flow conditions of 17cfs at Barton Springs. These estimates were independently recalculated and corroborated by Johns (2006) and are similar to the results of Garner and Mahler (2005). Under normal flow conditions contribution from the saline-water zone would be smaller. Massei et al. (2007) noted that specific conductance of Barton Springs increased 20% under the 2000 drought condition, probably from saline-water zone contribution.

Subsurface flow into the Barton Springs aquifer from the adjacent San Antonio segment located to the south is limited when compared with surface recharge (Slade et al., 1985). Hauwert et al. (2004) indicated that flow across the southern boundary is probably insignificant under normal conditions. As discussed previously, recent studies (Smith et al., 2012) have documented that the southern boundary of the Barton Springs aquifer is hydrodynamic in nature and fluctuates between Onion Creek and the Blanco River. Accordingly, groundwater from the recharge zone of the San Antonio segment is flowing into the Barton Springs segment of the Edwards Aquifer during drought conditions (Johnson et al., 2011). Water recharged along the Blanco River can flow to both San Marcos and Barton Springs. Under extreme drought conditions, the Blanco River would be the only active surface water body providing recharge in the area. Lastly, it was estimated that up to 5 cfs of groundwater flow could bypass (underflow) San Marcos Springs and flows toward Barton Springs (Land et al., 2011).

Changes in land use influence the inflows of aquifers systems. Recent studies have shown that urbanization may increase recharge to the Edwards Aquifer (Sharp, 2010; Sharp et al., 2009). Sources of the increase in recharge include leaking infrastructure such as pressurized potable water lines, wastewater from both collector lines and septic tank drainfields, and stormwater in infiltration basins. Recharge is increased from the return flows of irrigation practices (e.g. lawn watering), and the increase in pervious cover decreases evapotranspiration (Sharp, 2010; Sharp et al., 2009; Passarello, 2011).

Saline Edwards Aquifer

As the saline Edwards (Balcones Fault Zone) Aquifer is not in direct communication with the land surface, any flows into and out of the aquifer must occur as lateral flows from the fresh portion of the aquifer to the east or as vertical flows from overlying or underlying formations. Based on information from a recent USGS study and observations of District technical staff, the saline-freshwater interface is relatively stable (Brakefield et al., 2015). That is, the movement of groundwater into the saline portion of the aquifer from the freshwater portion of the aquifer is small.

The amount of cross-formational inflow (subsurface recharge) occurring through adjacent aquifers into the Barton Springs segment of the Edwards (BFZ) Aquifer is unknown, although it is thought to be relatively small on the basis of water-budget analyses for surface recharge and discharge (Slade et al., 1985; Hauwert, 2016).

Trinity Aquifer

Flow (or leakage) from the Trinity Aquifer into the Barton Springs aquifer is thought to be relatively insignificant when compared with surface recharge (Slade et al., 1985; Hauwert, 2016). However, leakage from the Trinity Aquifer may nevertheless locally impact water quality and influence water levels (Senger and Kreitler, 1984; Slade et al., 1986). Estimates by Hauwert et al., 2004, based on water chemistry at Barton Springs, suggest that a small contribution of flow to the springs is from the Trinity Aquifer. As discussed previously, recent studies utilizing multiport monitoring wells have provided a lot of information about hydrologic communication between the Edwards and Upper and Middle Trinity aquifers. Results of those studies indicate that the top 100 ft of the Upper Trinity appear to be in direct hydrologic communication with the overlying Edwards. However, the remaining 350 feet of the Upper Trinity units behave effectively as an aquitard and represent a confining unit between the Edwards and the Middle Trinity. These studies indicate that the Middle Trinity is hydrologically separate from the overlying Edwards Aquifer (Smith and Hunt, 2010; Kromann et al., 2011; Wong et al., 2014)).

Previously it was presumed that the flow was from the Trinity into the Edwards Aquifer. A groundwater model of the (Hill Country) Trinity Aquifer includes lateral groundwater leakage into the BFZ in order for the model to simulate observed hydrogeologic conditions in the Hill Country Trinity. Steady-state modeling indicates that as much as 8,000 acre-feet/year discharge into the Edwards (BFZ) in Travis and Hays Counties (Mace et al., 2000). However, recent data and studies suggest that the flow within the Middle Trinity units is laterally continuous (e.g. stays within the Middle Trinity) from the Hill Country into the BFZ (Smith and Hunt, 2010; Hunt et al., 2015).

Very little information is available on the Lower Trinity Aquifer and the hydrologic relationship with the overlying Middle Trinity Aquifer in the District. The Hammett Shale is a very good aquitard, perhaps even an aquiclude in the District, and may inhibit flows into, or out of, the lower Trinity (Wierman et al., 2010).

2.7 State Water Plan Projections

As shown in Figure 2-2, the District lies rather evenly between Central Texas Water Planning Region (Region L) and Lower Colorado Water Planning Region (Region K). While the majority of the District lies within Region L, most of the groundwater production is within Region K. The prevailing water strategies applicable to the area of the District in the two regions are similar.

This section of the *Plan* utilizes information provided by the TWDB in the report titled *Estimated Historical Water Use and 2017 State Water Plan Datasets: BSEACD*. The report provides county-level data that are applicable to the District and is included in this *Plan* as Appendix III.

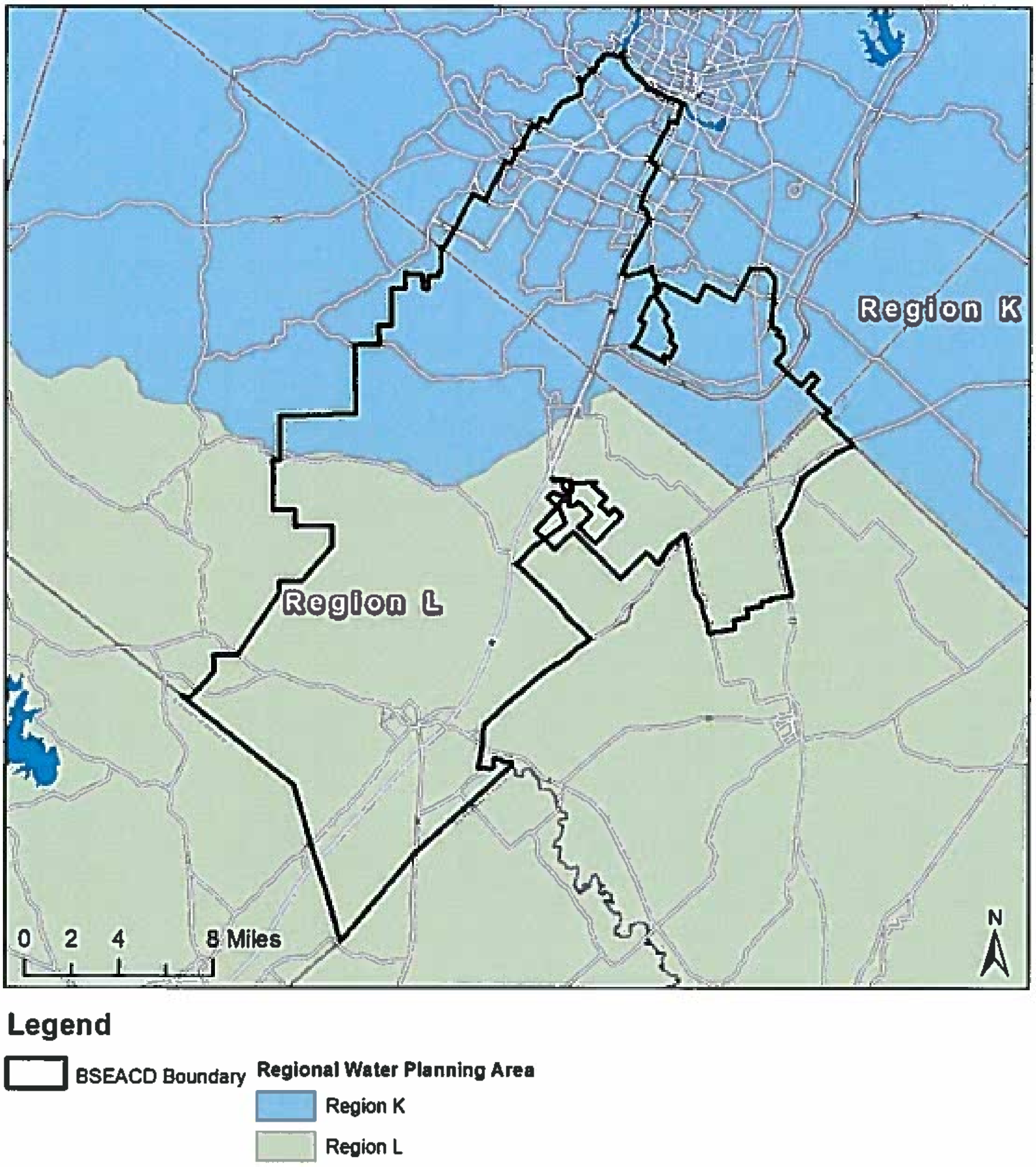


FIGURE 2-2: REGIONAL WATER PLANNING AREAS WITHIN THE DISTRICT'S BOUNDARY
This map displays the District's boundaries in relation to the Region L and Region K boundaries.

2.8 Surface Water Supply in District

The surface water supply in the District is provided primarily by run-of-river diversions and especially by reservoirs in the Colorado River basin. The part of the District in Hays County and Caldwell County is supplied by the Guadalupe-Blanco River system, especially water from main-stem reservoirs like Canyon Lake. Most of this Guadalupe-Blanco water is conveyed to some users in the District by the Hays County Pipeline.

Projected water supply data have been extracted from the 2017 State Water Plan (SWP) database and provided by the TWDB at the county level (Appendix II). The projections are estimated using an apportioning multiplier derived from the ratio of the land area of District in the county relative to the entire county area. The apportioning multiplier was used for all water user groups (WUGs) except for public water supplies (i.e. municipalities, water supply corporations, and utility districts). The derivation of these apportioning multipliers is shown in Table 2-3.

Table 2-3: Areal Distribution of District by County.

For County:	Total Acres in County	Acres in District	Percent in Co.	Apportioning Multiplier
Travis	656,348	74,311	27%	11.5%
Hays	433,248	184,513	67%	15.4%
Caldwell	350,498	16,777	6%	4.5%
Totals	**1,440,094**	**275,601**	**100%**	**100%**

The total annual projected surface water supply in the counties of the District is estimated to be **286,052** acre-feet in 2030 (2030 is the closest decadal estimate to 2027, the final year of this *Plan*). These supplies refer to the firm-yield supplies from surface water sources during a recurrence of the DOR. Water user groups (WUGs) that are located out of the District boundaries have been excluded. For comparison purposes, the projected surface water supplies from the three primary counties comprising the District are provided in the following table by decade in acre-feet.

	2020	**2030**	**2040**	**2050**	**2060**	**2070**
Travis	272,646	265,710	250,110	239,028	227,489	214,541
Hays	20,326	20,297	20,286	20,290	20,299	20,302
Caldwell	45	45	45	45	45	45
Total	**293,017**	**286,052**	**270,441**	**259,363**	**247,833**	**234,888**

2.9 Total Demand for Water in District

For estimating total water demand, the District has used data extracted from the SWP and provided by the TWDB (Appendix II). As with projected surface water supply data, county-level water demand data have been apportioned for certain WUGs using the apportioning multipliers described in Table 2-3. WUGs outside of the District boundaries have been excluded The TWDB provides demand estimates by decade as well as by county. The decadal estimates for 2030 are used to approximate demand for the year 2027, the final year of this *Plan*. On these bases, the total annual demand by county for water arising from the District is shown below:

From Travis County in the District: 196,566 acre-feet
From Hays County in the District: 30,442 acre-feet
From Caldwell County in the District: 414 acre-feet

TOTAL DEMAND IN DISTRICT: 227,422 acre-feet in 2027

The water demands arising from the County in the prevailing SWP are provided in the following table by decade in acre-feet.

	2020	2030	2040	2050	2060	2070
Travis	168,907	196,566	225,590	246,926	264,954	286,354
Hays	23,943	30,442	36,755	42,478	49,796	58,347
Caldwell	367	414	460	512	567	619
Total	**193,217**	**227,422**	**262,805**	**289,916**	**315,317**	**345,320**

2.10 Water Supply Needs and Planning Strategies

For estimating projected water supply needs, the District has used data extracted from the SWP and provided by the TWDB (Appendix III). The TWDB provides water supply needs estimates by decade as well as by county. The decadal estimates for 2030 are used to approximate demand for the year 2027, the final year of this *Plan*. WUGs outside of the District boundaries have been excluded. A summary of the projected water supply needs is provided in the following table by decade in acre-feet.

	2020	2030	2040	2050	2060	2070
Travis	123,634	86,071	41,961	5,628	-29,768	-70,062
Hays	15,910	8,235	-1,955	-10,740	-24,537	-40,410
Caldwell	1,329	1,266	1,192	1,107	1,008	897
Total	**140,873**	**95,572**	**41,198**	**-4,005**	**-53,297**	**-109,575**

The above projections show that for the SWP planning period (2020-2070), there is a progressively increasing water supply deficit, going from a surplus of 140,873 acre/feet in 2020 to a deficit of 109,575 acre/feet in 2070. These water supply needs in the District arise primarily from and are dominated by the burgeoning growth on the southern fringe of the Austin metropolitan area and I-35 corridor from San Marcos to Austin (Figure 2-3), as well as increasing production and decreasing availability from the major aquifers and the gradual reduction of surface water supplies, as reservoir capacity decreases with time. Accordingly, it is projected that there will be unmet needs in the District, especially under DOR conditions and in the out-years.

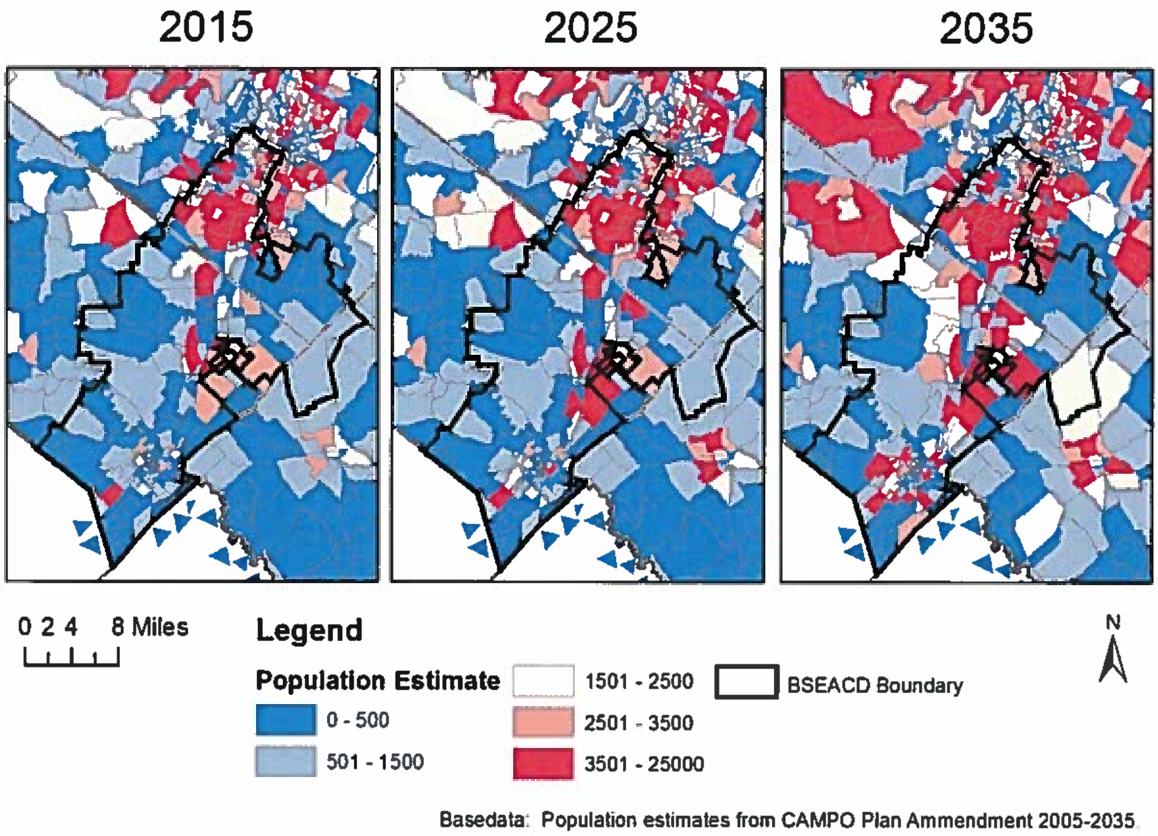


FIGURE 2-3: POPULATION GROWTH PREDICTIONS 2015-2035
Population density mapping based on population estimates from the Capitol Area Metropolitan Planning Organization.

2.11 Water Management Strategies

The strategies to address the supply needs described above are identified in Appendix II. These data -- organized by decade, county, and WUG -- are extracted from the 2012 SWP and have been provided to the District by the TWDB. Key management strategies relevant to WUGs in the District and adjoining areas include:

- (Municipal Water) Conservation
- Drought Management
- Use of/Transfer from Available or Re-allocated Surface Water Supplies
- Purchase of Surface Water from Wholesale Water Providers (WWP)
- Purchase of Carrizo-Wilcox Aquifer Water, via Hays-Caldwell Public Utility Agency
- Development of Saline Zone of Edwards-BFZ Aquifer
- Expansion of Current Groundwater Supplies - Trinity Aquifer
- Direct Reuse
- Indirect Potable Reuse
- Edwards/Middle Trinity Aquifer Storage and Recovery (ASR)

- Saline Edwards ASR
- Rainwater Harvesting

All of the strategies listed above will be beneficial to the District in reducing demand and providing more supplies and more equitable distribution of water supplies.

2.12 Synthesis of Regional Water Supply and Demand for District Planning

The strategies for addressing water supply and demand in the District's jurisdiction identified by the regional water planning groups in the SWP are supported by the District and demonstrate the importance of local factors in determining what is available and feasible in any one area. It is under these conditions that local management of the water resources, such as is provided by local GCDs, is of paramount importance in being a vehicle for making those things happen. Effective communication among local jurisdictions and among local, regional, and state levels of government will be required to meet the water challenges in the future.

In accordance with the District's mission, the SWP strategies supported by the District will serve to facilitate conserving, preserving, and protecting its aquifers, notably the freshwater Edwards Aquifer that is already at its sustainable yield, fully appropriated, and at MAG-level production. Such efforts are necessary to allow the aquifer to continue to serve as a reliable, high-quality water supply for its existing users. Accordingly, many of the WUGs in the current SWP continue to rely on production from the freshwater Edwards Aquifer for existing needs but none have a strategy that involves increased use for future needs.

While the freshwater Edwards Aquifer is fully appropriated, demand and production from the Trinity Aquifer and other aquifers in the District is increasing and will continue to be managed to ensure long-term reliability and availability. This District intends to continue to closely coordinate and to actively participate in regional water supply planning to support the District's mission and objectives identified in this *Plan*.

3. Management Goals, Objectives, and Performance Standards

3.1 Actions, Procedures, Performance and Avoidance for Management Plan Implementation

The provisions of this *Plan* will be implemented by the District and will be used by the District as a guide for determining the direction or priority for all District activities. All operations of the District, all agreements entered into by the District, all District policies and programs, and any additional planning efforts in which the District may participate will be consistent with the provisions of this *Plan*. The District will encourage cooperation and coordination with relevant entities in the implementation of this *Plan*. All operations and activities of the District will be performed in a manner that best encourages and fosters cooperation with state, regional, and local water entities.

The District will utilize this *Plan* as a guide for the on-going establishment and evaluation of District's programmatic activities. The District will adopt rules necessary to support the District's mission including rules related to the permitting of wells, the production and transport of groundwater and drought management. The rules and policies established by the District shall be consistent with the provisions of this *Plan* and shall be adopted on the basis of the best available science, public and stakeholder input, and recommendations of competent professionals.. Further, the rules shall comply with TWC Chapter 36 and the District's enabling legislation. All rules will be adhered to and enforced in a manner that is fair and objective. A copy of the Rules can be found on the District's website here: http://bseacd.org/about-us/governing-documents/.

3.2 Methodology for Tracking District Progress in Achieving Management Goals

In order to achieve the goals, management objectives, and performance standards adopted in this *Plan*, the District shall continually work to develop, maintain, review, and update rules, policies, and procedures for the various programs and activities contained in the *Plan*. As a means to monitor performance, the General Manager will provide direction on activities throughout the year and routinely meet with staff to track interim progress on the various goals, management objectives, and performance standards adopted in this *Plan*.

On an annual basis, the General Manager will prepare an annual report documenting progress made towards implementation of the management plan and achievement of the goals and objectives. The General Manager will present the annual report to the Board to assist the Board's evaluation of the progress made, and to consider approval. Once approved by the Board, a copy of the annual report will remain on file at the District's office for members of the public to access as well as made available on the website and then submitted to the relevant entities pursuant to District Rules and Bylaws.

3.3 Goals and Strategies

The Texas Water Development Board (TWDB) has specified eight overarching management goals to be addressed in the groundwater management planning performed by all GCDs in Texas. These goals are prescribed in accordance with Texas Water Code (TWC), Chapter 36.1071, and provide the framework for specific objectives and performance standards defined by each individual GCD. Each of the established TWDB goals are identified and characterized in this *Plan* by the relevant objectives and performance standards as defined by the District to serve its mission. The strategies embodied in this *Plan* are integrated and integral to: 1) achieving the DFCs in compliance with state law and 2) the measures of the District's HCP in compliance with the prospective Incidental Take Permit (ITP) and federal law (See Section 1.5, Management of Groundwater Resources in the District).

This *Plan* establishes the District's scope of activities, and in concert with legal statutes and enabling authority, will:

- Serve as a planning tool for the District in its management and operations;
- Provide general information about the District and its groundwater resources;
- Provide technical information concerning groundwater resources, water supply, and demand;
- Establish management objectives and performance standards relative to each of the prescribed goals;
- Serve as a resource to help guide the District's development of additional technical information on local groundwater resources, use, and demand; and
- Support the District's development of its regulatory program.

The Board sets policies embodied in this *Plan*, adopts rules and bylaws, and takes action in accordance with the Rules and Bylaws to implement this *Plan* and execute the District's mission. The general manager reports to and is directed by the Board and is responsible for the overall operations and day-to-day activities of the District.

Goal 1 - Providing the Most Efficient Use of Groundwater

Goal 2 - Controlling and Preventing Waste of Groundwater

Goal 3 - Addressing Conjunctive Surface Water Management Issues

Goal 4 - Addressing Natural Resource Issues which Impact the Use and Availability of Groundwater, and which are Impacted by the Use of Groundwater

Goal 5 - Addressing Drought Conditions

Goal 6 - Addressing Conservation and Rainwater Harvesting where Appropriate and Cost Effective

Goal 7 - Addressing Recharge Enhancement where Appropriate and Cost Effective

Goal 8 - Addressing the Desired Future Conditions of the Groundwater Resources

TWDB Goals determined not applicable to the District - Controlling and Preventing Subsidence.

This category of management goal is not considered applicable to the District because the formations making up the aquifers of use are consolidated with little potential for subsidence within the District as a result of groundwater usage. Mace et al., (1994) studies the potential for subsidence resulting from the significant historical level declines observed in the northern Trinity Aquifer in central Texas. They concluded that even in the confined portions of the aquifer, where the largest declines have occurred, the subsidence expected would be only a small amount that would take a very long time to manifest itself.

4. Coordination with Other Water Management Entitles

4.1 Coordination with Regional Surface Water Management Entities

The District has actively contributed to and participated in the development of the Lower Colorado Regional Water Plan (Region K). While most of the Edwards aquifer production within the District occurs within the planning area of Region K, some large Edwards aquifer production is permitted within the planning area of South Central Texas Regional Water Plan (Region L). Additionally, the District expanded its jurisdictional area over the Trinity Aquifer in 2015 to include central and eastern Hays County which extended the District further into the Region L. As such, the District is also engaged and actively participates in the development of the Region L plan. Figure II-2 is a map that shows the spatial relationship of the District with these two Regional Water Planning Groups. For regional water planning purposes in both Region K and L, groundwater availability from the District's relevant aquifers is determined by the TWDB-calculated MAG estimates for the District's adopted DFCs. These estimates are shown in Table II-1.

Letters evidencing District coordination with the Regional Planning Groups on this Plan are in Appendix I. The District intends to continue to participate actively in the regional water planning activities through voting membership representing GMA 10 on Region K and by attending meetings and providing information to Region L during the term of this *Plan*.

Other Resource Management Agencies

While not strictly a water management entity, the U.S. Fish and Wildlife Service (USFWS) has applied for and anticipates issuance of a federal Endangered Species Act Section 10(a) permit to the District during the term of this *Plan*. This permit authorizes the specific groundwater management planning and associated measures used by the District to protect the endangered species that use the natural outflows of the Edwards Aquifer at Barton Springs as key habitat. Changes in the groundwater management measures used by the District must not only be consistent with the prevailing *Plan* but also potentially must be authorized by USFWS via a change to the Section 10(a) permit.

4.2 Coordination with Regional Surface Water Management Entities

The District participates in and contributes to the joint regional planning being conducted by Groundwater Management Areas (GMAs) 9 and 10, as authorized and required by Texas Water Code §36.108. Figure IV-1 is a map that shows the spatial relationship of the District with these two GMAs. The purpose of this recurring joint planning is to develop and revise, as necessary, feasible Desired Future Conditions (DFCs) for all relevant aquifers being managed by the groundwater conservation districts (GCDs) in the GMA; these represent consensus views of what characteristics are intended that the aquifers should have during and/or at the end of the 50-year planning term. TWDB uses groundwater availability models or the best available analytical tools to convert those DFCs to estimates of the modeled available groundwater (MAG), which comprise the approved volumetric basis for regional water planning, and constitute one of the important considerations in groundwater permitting and related regulatory programs for the GCDs.

GMA 9 focuses on the Trinity Aquifer, especially in the Hill Country Priority Groundwater Management Area (PGMA), but includes other minor aquifers in the GMA. GMA 10 focuses on the Edwards Aquifer, but includes other major and minor aquifers within its geographic boundaries. For the District, the Trinity Aquifers in both GMAs and the Edwards Aquifers, both its freshwater and saline-water zones, in GMA 10 are of regulatory interest and are therefore included in the joint planning.

The joint planning process has now produced the initial set of DFCs that are applicable to and relevant for the District, and the TWDB has estimated the corresponding MAGs for the District that now form key considerations in its permitting programs. The current DFCs for the District's relevant aquifers are further described in Section II.A. The associated MAGs applicable to the District and the initial planned approach to monitoring the DFCs to demonstrate compliance are shown in Table II-1. This *Plan* has regulatory, educational, and scientific programs that are consistent with achieving and/or maintaining these DFCs during the term of the *Plan*.

APPENDICES

I. Supporting Documentation:
   A. Resolution Adopting the Management Plan
   B. Evidence that the Management Plan was Adopted after Notice and Hearing
   C. Evidence that the District Coordinated Development of the Management Plan with other Regional Entities (Planning Groups, GMAs, Surface Water Entities, Groundwater Entities)

II. Estimated Historical Water Use and State Water Plan Datasets

III. GAM Run

DRAFT Management Plan Objectives and Performance Standards DRAFT

For Board Discussion Only

Include intro paragraph about annual report serving as the primary tracking method for measuring performance and progress towards achieving the District's goals and objectives.

Teams	General Mgmt. (9 objectives)	Administration (3 objectives)	Education & Outreach (5 objectives)	Aquifer Science (8 objectives)	Reg. Compliance (8 objectives)

GOAL 1 - Providing the Most Efficient Use of Groundwater – 31TAC356.52(a)(1)(A)/TWC §36.1071(a)(1)
[HCP Measures – Providing Most Efficient Use of Groundwater]

MP Obj No.	Management Plan Objectives	Performance Standards	HCP ID No.	2013 MP Standard*
1-1	Provide and maintain on an ongoing basis a sound statutory, regulatory, financial, and policy framework for continued District operations and programmatic needs.	A. Develop, implement, and revise as necessary, the District Management Plan in accordance with state law and requirements. Each year, the Board will evaluate progress towards satisfying the District goals. A summary of the Board evaluation and any updates or revisions to the management plan will be provided in the annual report. B. Review and modify District Rules as warranted to provide and maintain a sound statutory basis for continued District operations and to ensure consistency with both District authority and programmatic needs. A summary of any rule amendments adopted in the previous fiscal year will be included in the annual report.	1-1	PS 1-1, PS 1-2, PS 2-1
1-2	Monitor aggregated use of various types of water wells in the District, as feasible and appropriate, to assess overall groundwater use and trends on a continuing basis.	Monitor annual withdrawals from all nonexempt wells through required monthly or annual meter reports to ensure that groundwater is used as efficiently as possible for beneficial use. A summary of the volume of aggregate groundwater withdrawals permitted and actually produced from permitted wells for each Management Zone and permit type will be provided in the annual report.	1-2	PS 2-3, PS 2-4, PS 3-1, PS 6-1, PS 6-2
1-3	Evaluate quantitatively at least every five years the amount of groundwater withdrawn by exempt wells in the District to ensure an accurate accounting of total withdrawals in a water budget that includes both regulated and non-regulated withdrawals, so that appropriate groundwater management actions are taken.	A. Provide an estimate of groundwater withdrawn by exempt wells in the District using TDLR and TWDB databases and District well records and update the estimate every five years with the District's management plan updates. B. In the interim years between management plan updates, the most current estimates of exempt well withdrawals will be included in a summary of the volume of aggregate groundwater withdrawals permitted and actually produced from permitted wells for each Management Zone and permit type that will be provided in the annual report.	1-3	PS 4-2
1-4	Develop and maintain programs that inform and educate citizens of all ages about groundwater and springflow-related matters, which affect both water supplies and salamander ecology.	A. Publicize District drought trigger status (Barton Springs 10-day average discharge and Lovelady Monitor Well water level) in monthly eNews bulletins and continuously on the District website. B. Provide summaries of associated outreach and education programs, events, workshops, and meetings in the monthly team activity reports in the publicly-available Board backup. C. A summary of outreach activities and estimated reach will be provided in the annual report.	1-4	PS 3-3, PS 4-4
1-5	Ensure responsible and effective management of District finances such that the District has the near-term and long-term financial means to support its mission.	A. Receive a clean financial audit each year. A copy of the auditor's report will be included in the annual report. B. Timely develop and approve fiscal-year budgets and amendments. The dates for public hearings and Board approval of the budget and any amendments will be provided in the annual report.	N/A	PS 1-3
1-6	Provide efficient administrative support and infrastructure, such that District operations are executed reliably and accurately, meet staff and local stakeholder needs, and conform to District policies and with federal and state requirements.	A. Maintain, retain, and control all District records in accordance with the Texas State Library and Archives Commission-approved District Records Retention Schedule to allow for safekeeping and efficient retrieval of any and all records, and annually audit records for effective management of use, maintenance, retention, preservation and disposal of the records' life cycle as required by the Local Government Code. A summary of records requests received under the PIA, any training provided to staff or directors, or any claims of violation of the Public Information Act will be provided in the annual report. B. Develop, post, and distribute District Board agendas, meeting materials, and backup documentation in a timely and required manner; post select documents on the District website, and maintain official records, files, and minutes of Board meetings appropriately. A summary of training provided to staff or directors or any claims of violation of the Open Meetings Act will be provided in the annual report.	N/A	PS 1-4
1-7	Manage and coordinate electoral process for Board members.	Ensure elections process is conducted and documented in accordance with applicable requirements and timelines. Elections documents will be maintained on file and a summary of elections-related dates and activities will be provided in the annual report for years when elections occur.	N/A	PS 1-5

MP Obj No.	Management Plan Objectives	Performance Standards	HCP ID No.	2013 MP Standard*
	GOAL 2 - Controlling and Preventing Waste of Groundwater – 31TAC 356.52(a)(1)(B)/TWC §36.1071(a)(2)) [HCP Measures – Controlling and Preventing Waste of Groundwater]			
2-1	Require all newly drilled exempt and nonexempt wells, and all plugged wells to be registered and to comply with applicable District Rules, including Well Construction Standards.	A summary of the number and type of applications processed and approved for authorizations, permits, and permit amendments including approved use types and commensurate permit volumes for production permits and amendments will be provided in the annual report.	2-1	PS 2-2, PS 2-3 (Existing wells)
2-2	Ensure permitted wells and well systems are operated as intended by requiring reporting of periodic meter readings, making periodic inspections of wells, and reviewing pumpage compliance at regular intervals that are meaningful with respect to the existing aquifer conditions.	A. Inspect all new wells for compliance with the Rules, and Well Construction Standards, and provide a summary of the number and type of inspections or investigations in the annual report. B. Provide a summary of the volume of aggregate groundwater withdrawals permitted and actually produced from permitted wells for each Management Zone and permit type in the annual report.	2-2	PS 2-3, PS 2-4, PS 3-1
2-3	Provide leadership and technical assistance to government entities, organizations, and individuals affected by groundwater-utilizing land use activities, including support of or opposition to legislative initiatives or projects that are inconsistent with this objective.	A. In even-numbered fiscal years, provide a summary of interim legislative activity and related District efforts in the annual report. In odd-numbered fiscal years, provide a legislative debrief to the Board on bills of interest to the District and provide a summary in the annual report. B. Provide a summary of District activity related to other land use activities affecting groundwater in the annual report.	M-5	PS 1-6, PS 4-3
2-4	Ensure all firm-yield production permits are evaluated with consideration given to the Reasonable Use doctrine and demand-based permitting standards including verification of beneficial use that is commensurate with reasonable non-speculative demand.	A summary of the number and type of applications processed and approved for authorizations, permits, and permit amendments including approved use types and commensurate permit volumes for production permits and amendments will be provided in the annual report.	N/A	
	GOAL 3 - Addressing Conjunctive Surface Water Management Issues – 31TAC 356.52(a)(1)(D)/TWC §36.1071(a)(4) [HCP Measures – Addressing Conjunctive Surface Water Management Issues]			
MP Obj No.	**Management Plan Objectives**	**Performance Standards**	**HCP ID No.**	**2013 MP Standard***
3-1	Assess the physical and institutional availability of existing regional surface water and alternative groundwater supplies and the feasibility of those sources as viable supplemental or substitute supplies for District groundwater users.	Identify available alternative water resources and supplies that may facilitate source substitution and reduce demand on the Edwards Aquifer, and evaluate feasibility by considering: 1. available/proposed infrastructure, 2. financial factors, 3. logistical/engineering factors, and 4. potential secondary impacts (development density/intensity or recharge water quality). A summary of District activity related to this objective will be provided in the annual report.	3-1	PS 5-1
3-2	Encourage and assist District permittees to diversify their water supplies by assessing the feasibility of alternative water supplies and fostering arrangements with currently available alternative water suppliers.	Identify available alternative water resources and supplies that may facilitate source substitution and reduce demand on the Edwards Aquifer, and evaluate feasibility by considering: 1. available/proposed infrastructure, 2. financial factors, 3. logistical/engineering factors, and 4. potential secondary impacts (development density/intensity or recharge water quality). A summary of District activity related to this objective will be provided in the annual report.	3-2	PS 5-1
3-3	Demonstrate the importance of the relationship between surface water and groundwater, and the need for implementing prudent conjunctive use through educational programs with permittees and public outreach programs.	A. Provide summaries of associated outreach and education programs, events, workshops, and meetings in the monthly team activity reports in the publicly-available Board backup. B. Summarize outreach activities and estimate reach in the annual report.	3-3	PS 4-4, PS 5-4
3-4	Actively participate in the regional water planning process to provide input into policies, planning elements, and activities that affect the aquifers managed by the District.	Regularly attend regional water planning group meetings and annually report on meetings attended.	N/A	
	GOAL 4 - Addressing Natural Resource Issues which Impact the Use and Availability of Groundwater, and which are Impacted by the Use of Groundwater – 31TAC 356.52 (a)(1)(E)/TWC §36.1071(a)(5) [HCP Measures – Addressing Natural Resource Management Issues]			

MP Obj No.	Management Plan Objectives	Performance Standards	HCP ID No.	2013 MP Standard*
4-1	Assess ambient conditions in District aquifers on a recurring basis by: 1. sampling and collecting groundwater data from selected wells and springs monthly; 2. conducting scientific investigations as indicated by new data and models to better determine groundwater availability for the District aquifers; 3. conducting studies as warranted to help increase understanding of the aquifers and, to the extent feasible, detect possible threats to water quality and evaluate their consequences.	A. Review water-level and water-quality data that are maintained by the District and/or TWDB, or other agencies, on a regular basis. B. Improve existing analytical or numerical models or work with other organizations on analytical or numerical models that can be applied to the aquifers in the District. C. A review of the data mentioned above will be assessed for significant changes and reported in the annual report.	4-1.a	PS 6-1
4-3	Implement separate management zones and, as warranted, different management strategies to address more effectively the groundwater management needs for the various aquifers in the District.	A. Increase the understanding of District aquifers by assessing aquifer conditions, logging wells, and collecting water quality data. A summary of the number of water quality samples performed will be provided in the annual report. B. A summary of the volume of aggregate groundwater withdrawals permitted and actually produced from permitted wells for each Management Zone and permit type will be provided in the annual report.	4-3	PS 2-1, PS 5-1
4-4	Actively participate in the joint planning processes for the relevant aquifers in the District to establish and refine Desired Future Conditions (DFCs) that protect the aquifers and the Covered Species of the District HCP.	Attend at least 75% of the GMA meetings and annually report on meetings attended, GMA decisions on DFCs, and other relevant GMA business.	4-4	PS 4-2
4-5	Review all production permit applications requesting groundwater production greater than 2,000,000 gallons/year for potential to cause unreasonable impacts as defined by District rules.	To evaluate the potential for unreasonable impacts, staff will: 1. Perform a technical evaluation of the application, aquifer test, and hydrogeological report; 2. Use best available science and analytical tools to estimate amount of drawdown from pumping and influence on other water resources; and 3. Recommend proposed permit conditions to the Board for avoiding unreasonable impacts if warranted. A list of permit applications that are determined to have potential for unreasonable impacts will be provided in the annual report.	N/A	
4-6	Implement the measures of the District Habitat Conservation Plan (HCP) and Incidental Take Permit (ITP) from the U.S. Fish & Wildlife Service (USFWS) for the covered species and covered activity to support the biological goals and objectives of the HCP.	Prior to ITP permit issuance, a progress report summarizing activities related to the USFWS review of the ITP application will be provided in the annual report. Upon ITP issuance, the HCP annual report documenting the District's activities and compliance with ITP permit requirements will be incorporated into the annual report by reference.	N/A	
	GOAL 5 - Addressing Drought Conditions – 31TAC 356.52 (a)(1)(F)/TWC §36.1071(a)(6) (HCP Measures – Addressing Drought Conditions)			
MP Obj No.	Management Plan Objectives	Performance Standards	HCP ID No.	2013 MP Standard*
5-1	Adopt and keep updated a science-based drought trigger methodology, and frequently monitor drought stages on the basis of actual aquifer conditions, and declare drought conditions as determined by analyzing data from the District's defined drought triggers and from existing and such other new drought-declaration factors, especially the prevailing DO concentration trends at the spring outlets, as warranted.	A. During periods of District-declared drought, prepare a drought chart at least monthly to report the stage of drought and the conditions that indicate that stage of drought. During periods of non-drought, prepare the drought charts at least once every three months. C. A summary of the drought indicator conditions and any declared drought stages and duration will be provided in the annual report.		PS 3-2

5-2	Implement a drought management program that step-wise curtails freshwater Edwards Aquifer use to at least 50% by volume of 2014 authorized aggregate monthly use during Extreme Drought, and that designs/uses other programs that provide an incentive for additional curtailments where possible. For all other aquifers, implement a drought management program that requires mandatory monthly pumpage curtailments during District-declared drought stages.	During District-declared drought, enforce compliance with drought management rules to achieve overall monthly pumpage curtailments within 10% of the aggregate curtailment goal of the prevailing drought stage. A monthly drought compliance report for all individual permittees will be provided to the Board during District-declared drought, and a summary will be included in the annual report.	5-2	PS 3-1, PS 4-2, PS 5-1
5-3	Inform and educate permittees and other well owners about the significance of declared drought stages and the severity of drought, and encourage practices and behaviors that reduce water use by a stage-appropriate amount.	A. During District-declared drought, publicize declared drought stages and associated demand reduction targets in monthly eNews bulletins and continuously on the District website. B. A summary of drought and water conservation related newsletter articles, press releases, and drought updates sent to Press, Permittees, Well Owners and eNews subscribers will be provided in the annual report.	5-3	PS 3-1, PS 3-3, PS 4-4, PS 5-4
5-4	Assist and, where feasible, incentivize individual freshwater Edwards Aquifer historic-production permittees in developing drought planning strategies to comply with drought rules, including: 1. pumping curtailments by drought stage to at least 50% of the 2014 authorized use during Extreme Drought, 2. "right-sizing" authorized use over the long term to reconcile actual water demands and permitted levels, and 3. as necessary and with appropriate conditions, the source substitution with alternative supplies.	A. Require an updated UCP/UDCP from Permittees within one year of each five-year Management Plan Adoption. B. Provide a summary of any activity related to permit right sizing or source substitution with alternative supplies that may reduce demand on the freshwater Edwards Aquifer in the annual report.		PS 3-1, PS 5-1
5-5	Implement a Conservation Permit that is held by the District and accumulates and preserves withdrawals from the freshwater Edwards Aquifer that were previously authorized with historic-use status and that is retired or otherwise additionally curtailed during severe drought, for use as ecological flow at Barton Springs during Extreme Drought and thereby increase springflow for a given set of hydrologic conditions.	A summary of the volume of aggregate groundwater withdrawals permitted and actually produced from permitted wells for each Management Zone and permit type including the volume reserved in the freshwater Edwards Conservation Permit for ecological flows will be provided in the annual report.	5-5	Objective 3, PS 4-5
	GOAL 6 - Addressing Conservation and Rainwater Harvesting where Appropriate and Cost Effective – 31TAC 356.52 (a)(1)(G)/TWC §36.1071(a)(7) [HCP Measures - 6.2.1.6 Addressing Demand Reduction through Conservation]			
MP Obj No.	Management Plan Objectives	Performance Standards	HCP ID No.	2013 MP Standard*
6-1	Develop and maintain programs that inform, educate, and support District permittees in their efforts to educate their end-user customers about water conservation and its benefits, and about drought-period temporary demand reduction measures.	A. A summary of efforts to assist permittees in developing drought and conservation messaging strategies will be provided in annual report. B. Publicize declared drought stages and associated demand reduction targets monthly in eNews bulletins and continuously on the District website.	6-1	PS 3-3, PS 5-4
6-2	Encourage use of conservation-oriented rate structures by water utility permittees to discourage egregious water demand by individual end-users during declared drought.	On an annual basis, the District will provide an informational resource or reference document to all Public Water Supply permittees to serve as resources related to conservation best management strategies and conservation-oriented rate structures.	6-2	PS 3-1
6-3	Develop and maintain programs that educate and inform District groundwater users and constituents of all ages about water conservation practices and resources.	Summarize water conservation related newsletter articles, press releases, and events in the annual report.	6-3	PS 5-4
	GOAL 7 - Addressing Recharge Enhancement where Appropriate and Cost Effective – 31TAC 356.52 (a)(1)(G)/TWC §36.1071(a)(7) [HCP Measures - 6.2.1.7 Addressing Supply through Structural Enhancement]			
MP Obj No.	Management Plan Objectives	Performance Standards	HCP ID No.	2013 MP Standard*

7-1	Improve recharge to the freshwater Edwards Aquifer by conducting studies and, as feasible and allowed by law, physically altering (cleaning, enlarging, protecting, diverting surface water to) discrete recharge features that will lead to an increase in recharge and water in storage beyond what otherwise would exist naturally.	Maintaining the functionality of the Antioch system will be the principal method for enhancing recharge to the freshwater Edwards Aquifer. Additional activities may be excavating sinkholes and caves within the District. A summary of all recharge improvement activities will be provided in the annual report.	7-1	PS 5-2
7-2	Conduct technical investigations and, as feasible, assist water-supply providers in implementing engineered enhancements to regional supply strategies, including desalination, aquifer storage and recovery, and effluent reclamation and re-use, to increase the options for water-supply substitution and reduce dependence on the Aquifer.	Assess progress toward enhancing regional water supplies in the annual report.	7-2	PS 5-1, 5-3,
	GOAL 8 - Addressing the Desired Future Conditions of the Groundwater Resources – 31TAC (a)(1)(H)/TWC §36.1071(a)(8) [HCP Measures - 6.2.1.8 Quantitatively Addressing Established Desired Future Conditions]			
MP Obj No.	**Management Plan Objectives**	**Performance Standards**	**HCP ID No.**	**2013 MP Standard***
8-1	**Freshwater Edwards Aquifer All-Conditions DFC:** Adopt rules that restrict, to the greatest extent practicable, the total amount of groundwater authorized to be withdrawn annually from the Aquifer to an amount that will not substantially accelerate the onset of drought conditions in the Aquifer; this is established as a running seven-year average springflow at Barton Springs of no less than 49.7 cfs during average recharge conditions.	A. A summary of the volume of aggregate groundwater withdrawals permitted and actually produced from permitted wells for each Management Zone and permit type will be provided in the annual report. B. Upon ITP issuance, the HCP annual report documenting the District's activities and compliance with ITP permit requirements will be incorporated into the annual report by reference. C. Upon ITP issuance, compile a summary of aquifer data including: 1) the frequency and duration of District-declared drought, 2) levels of the Aquifer as measured by springflow and indicator wells (including temporal and spatial variations), and 3) total annual and daily discharge from Barton Springs will be provided in the annual report.	8-1	PS 4-5
8-2	**Freshwater Edwards Aquifer Extreme Drought DFC:** Adopt rules that restrict, to the greatest extent practicable and as legally possible, the total amount of groundwater withdrawn monthly from the Aquifer during Extreme Drought conditions in order to minimize take and avoid jeopardy of the Covered Species as a result of the Covered Activities, as established by the best science available. This is established as a limitation on actual withdrawals from the Aquifer to a total of no more than 5.2 cfs on an average annual (curtailed) basis during Extreme Drought, which will produce a minimum springflow of not less than 6.5 cfs during a recurrence of the drought of record (DOR).	A. A summary of the volume of aggregate groundwater withdrawals permitted and actually produced from permitted wells for each Management Zone and permit type will be provided in the annual report. B. Upon ITP issuance, the HCP annual report documenting the District's activities and compliance with ITP permit requirements will be incorporated into the annual report by reference. C. Upon ITP issuance, compile a summary of aquifer data including: 1) the frequency and duration of District-declared drought, 2) levels of the Aquifer as measured by springflow and indicator wells (including temporal and spatial variations), and 3) total annual and daily discharge from Barton Springs will be provided in the annual report.	8-2	Objective 3, PS 4-2, PS 4-5
8-3	Implement appropriate rules and measures to ensure compliance with District-adopted DFCs for each relevant aquifer or aquifer subdivision in the District.	Develop and implement a cost-effective method for evaluating and demonstrating compliance with the DFCs of the relevant aquifers in the District, in collaboration with other GCDs in the GMAs. Prior to method implementation, provide a summary of activities related to method development in the annual report. Once developed, provide a summary of data for each District-adopted DFC for each relevant aquifer indicating aquifer conditions relative to the DFC and provide in the annual report.	N/A	