A STREETCAR NAMED DESIRED FUTURE CONDITIONS: THE NEW GROUNDWATER AVAILABILITY FOR TEXAS

ROBERT E. MACE
RIMA PETROSSIAN
ROBERT BRADLEY
WILLIAM F.MULLICAN, III
Texas Water Development Board
P.O. Box 13231
Austin, Texas 78711-3231

State Bar of Texas
7TH ANNUAL THE CHANGING FACE OF WATER RIGHTS IN TEXAS
May 18-19, 2006
San Antonio

CHAPTER 3.1

TABLE OF CONTENTS

A STREETCAR NAMED DESIRED FUTURE CONDITIONS: THE NEW GROUNDWATER AVAILABILITY FOR TEXAS

I. INTRODUCTION

Perhaps you didn't notice it, but the ground—or, more accurately, the groundwater policy—shifted beneath your feet on September 1, 2005. On this date, House Bill 1763, passed by the 79th Legislature, became effective. House Bill 1763, as it is reflected in Chapter 36 of the Texas Water Code, offers some profound changes in how groundwater availability is determined in Texas, and groundwater availability—the amount of groundwater available for use—affects where many Texans will be getting their water in the future. Because the population of Texas is expected to double over the next 50 years, groundwater availability—wrapped as it is with groundwater management—will continue to be a topic of heated debate.

In its more important changes, House Bill 1763 (1) regionalizes decisions on groundwater availability, (2) requires regional water planning groups to use groundwater availability numbers from the groundwater conservation districts, and (3) defines a permitting target for groundwater production. These changes affect the rules and plans of groundwater conservation districts, various groundwater projects planned around the state, and the regional and state water plans. It also affects the ability of political subdivisions to get state loans for groundwater projects, even if those projects are in areas with no groundwater conservation districts. The purpose of this paper is to note the most important changes and how they relate to groundwater policy and water planning.[1] In addition, we describe the role of the Texas Water Development Board (TWDB) in the groundwater management area process.

II. GROUNDWATER MANAGEMENT AREAS: FROM NOTHING TO NOW

A groundwater management area is defined as an area suitable for the management of groundwater resources.[2] Although groundwater management areas have recently become important in groundwater management, they have been around more than 50 years.[3] Up until September 2001, the primary purpose of groundwater management areas was the creation of groundwater conservation districts by petition.[4] After September 2001, the primary purpose of groundwater management areas has been joint planning—planning that became required in September 2005.

In 1949, the Legislature authorized a petition process for designating "underground water reservoirs," the predecessor to groundwater management areas, by the Texas Board of Water Engineers[5] and for creating groundwater conservation districts.[6] To create a groundwater conservation district, an underground water reservoir needed to first be delineated. In 1955, the Legislature allowed the Texas Board of Water Engineers to designate underground water reservoirs on its own without an external petition. In 1985, the Legislature changed "underground water reservoirs" to "management areas" and required that the boundaries of a groundwater conservation district be coterminous[7] with a management area, although political boundaries could be considered.[8] The Legislature changed the name again in 1989 from "management areas" to "underground water management areas" and removed the requirement for delineating a management area for legislatively created groundwater conservation

[1] Note that groundwater law in Texas is ever-changing. If a legislation session has occurred since we wrote this paper in March 2006, the statute may have changed.

[2] TWC§35.002(11)

[3] The Legislative history in this and the next paragraph is from TNRCC and TWDB (2001). Appendix A has a summary of legislation related to groundwater management areas, and Appendix B is a quick reference to important parts of statute and administrative rules concerning groundwater management areas.

[4] By 2001, seven of the districts were created by petition. Most (77) were created through legislation.

[5] The Texas Board of Water Engineers is a predecessor agency to the Texas Water Development Board and the Texas Commission on Environmental Quality.

[6] Groundwater conservation districts were referred to as underground water conservation districts at the time (and up to 1995).

[7] Coterminous, a variant of conterminous, means "contained in the same boundaries; coextensive" (Soukhanov, 1992).

[8] The Legislature also introduced the concept of a "critical area process" in 1985, later renamed as the priority groundwater management area process. Priority groundwater management areas are areas delineated by the Texas Commission on Environmental Quality that are experiencing or are expected to experience critical groundwater problems in the next 25 years. The ultimate purpose of priority groundwater management areas is the creation of groundwater conservation districts, either through local initiative or by the Commission. To date, the commission has created five priority groundwater management areas (TCEQ and TWDB, 2005).

districts. Underground water management areas became "groundwater management areas" in 1995.

In 2001, as part of Senate Bill 2, the Legislature moved the responsibility of creating groundwater management areas to the TWDB and directed the TWDB to develop groundwater management areas that covered all of the major and minor aquifers of the state.[9] The statute directed the TWDB to use aquifer boundaries or subdivisions of aquifer boundaries for the groundwater management area boundaries, although other factors, including political boundaries, could be considered. After a stakeholder meeting to discuss different ways to place the boundaries, eight public meetings around the state,[10] and a formal public hearing in Austin, the TWDB adopted boundaries[11] for groundwater management areas that covered the entire state in November 2002 (Figure 1; Appendices C, D, E).[12] TWDB staff used aquifers and other hydrologic boundaries to guide the delineation of groundwater management areas. The boundaries primarily honored the boundaries of the major aquifers of Texas as identified in various TWDB publications. In areas with multiple major aquifers, TWDB staff generally placed a preference on the shallowest aquifer. The TWDB divided several of the major aquifers into multiple groundwater management areas. These divisions were based on hydrogeology and current water-use patterns and coincided with natural features where possible. Where possible, the TWDB aligned boundaries with county and existing groundwater conservation district boundaries.

Senate Bill 2 also required that groundwater conservation districts share their groundwater management plans with each other within a groundwater management area and participate in joint planning, but only if a district in the management area called for it.[13] However, in 2005, the Legislature—via House Bill 1763—*required* joint planning among groundwater conservation districts within groundwater management areas. The presiding officers, or their designees, of groundwater conservation districts are required to meet at least annually to conduct joint planning and to review groundwater management plans and accomplishments in the groundwater management area. A key part of joint planning is determining "desired future conditions," conditions that are used to calculate "managed available groundwater" volumes. These conditions and volumes will be used for regional water plans, groundwater management plans, and permitting.

III. MAJOR CHANGES DUE TO HOUSE BILL 1763

House Bill 1763 produced several major changes related to groundwater policy. Specifically, these major changes include (1) regionalizing decisions on groundwater availability, (2) requiring regional water planning groups to use groundwater availability numbers developed from the groundwater management area process, and (3) requiring a permitting target for groundwater production.

A. Regionalized Decisions on Groundwater Availability

Before House Bill 1763, each groundwater conservation district defined their own groundwater availability[14] which was included in their groundwater management plans (groundwater plans) under the name "total usable amount of groundwater."[15] With the passage of House Bill 1763, districts are now required to work together in each groundwater management

[9] By 2001, the Texas Commission on Environmental Quality and its predecessors had established 19 groundwater reservoirs and groundwater management areas. A map of these delineations is available in TNRCC and TWDB (2001, p. 41). These boundaries were dissolved when the TWDB adopted groundwater management areas that covered the entire state.

[10] TWDB held public meetings concerning the proposed rule on groundwater management area boundaries in several locations throughout the state in September 2002, including the cities of Alpine, Corpus Christi, Fredericksburg, Plainview, San Angelo, Stephenville, Tyler, and Wharton. The Board also held a public hearing in Austin on September 30, 2002.

[11] The TWDB is allowed to change these boundaries if warranted. The process for considering an external request to change a boundary is to submit technical information in support of the boundary change and a document signed by each groundwater conservation district in the affected groundwater management areas in support of the change. TWDB staff will conduct a technical review and submit a recommendation and proposed rule change on the boundary change to the TWDB. Once approved, the rule is posted for public comment, TWDB will hold a public hearing, and, after responding to public comment, the changed boundaries will need to be approved again by the TWDB before becoming final.

[12] 31TAC§356(B)

[13] To our knowledge, a groundwater conservation district had never officially called for joint planning. However, there are several alliances of districts across the state that allowed districts to compare plans and rules.

[14] With the exceptions of (1) the Edwards Aquifer Authority, which has its groundwater availability defined in statute; (2) the subsidence districts, which have their desired future conditions defined in statute; and (3) cases of conflict with the regional water plan, discussed in the next section.

[15] However, some districts interpreted this literally as the total volume of groundwater that could be used if it could be pumped. In other words, the aquifer could be drained.

area to develop "desired future conditions" for their groundwater resources (discussed in more detail later). The districts then deliver these desired future conditions to the TWDB. The TWDB, in turn, provides estimates of "managed available groundwater"—the new term in statute for groundwater availability—to the districts for inclusion in their groundwater plans and to the regional water planning groups for inclusion in their regional water plans.

B. Regions Have to Use Groundwater Management Area Numbers

Before House Bill 1763, regional water planning groups only had to *consider* the information in groundwater plans. Therefore, if a planning group wanted to use a groundwater availability number different from that provided by a groundwater conservation district, they could. In addition, groundwater availability numbers in groundwater plans needed to "…address water supply needs in a manner that [was] not in conflict with the appropriate approved regional water plan…"[16] In other words, if a region had identified a need for the water, the groundwater district had to include that need in its estimates of groundwater availability. With the passage of House Bill 1763, planning groups are now required to use managed available groundwater for their groundwater availability estimates. Because managed available groundwater is defined by the desired future conditions, groundwater conservation districts, working collectively within each groundwater management area, define groundwater availability for the regional water planning process.

This "switch" in who decides groundwater availability for regional water planning will have implications for future regional and state water planning. In its 2006 regional water plan, the South Central Texas Regional Water Planning Group notes that: "Given these new requirements for determining desired future conditions for the relevant aquifers, and that individual groundwater conservation districts management plans shall be consistent with achieving the desired future conditions of the relevant aquifers, the quantity of groundwater available for use by water users located within the respective parts of water planning regions is uncertain, and quite likely will change from the quantities now being used in regional planning. Therefore, water planning for water user groups whose future supplies are from groundwater should carefully consider broadening their strategies both in terms of quantities and sources to take this uncertainty into account." This statement will also apply to many of the other regional water planning areas as well.

C. A Target for Groundwater Production

Before House Bill 1763, it was arguable whether or not groundwater conservation districts—outside of the Edwards Aquifer Authority and the subsidence districts—had the ability to place a cap on groundwater production. With the passage of House Bill 1763, statute now states that "[a] district, to the extent possible, shall issue permits up to the point that the total volume of groundwater permitted equals the managed available groundwater…"[17] Before this time, the majority of districts did not have an overall cap on groundwater production.[18]

IV. DESIRED FUTURE CONDITIONS → MANAGED AVAILABLE GROUNDWATER → PLANS

Desired future conditions are the desired, quantified conditions of groundwater resources (such as water levels, water quality, spring flows, or volumes) at a specified time or times in the future or in perpetuity.[19] In essence, a desired future condition is a management goal that captures the philosophy and policies addressing how an aquifer will be managed. What do you want your aquifer to look like in the future? Some examples of desired future conditions include, but are not limited to: (1) water levels do not decline more than 100 feet in 50 years, (2) water quality is not degraded below 1,000 milligrams per liter of total dissolved solids for 50 years, (3) spring flow is not allowed to fall below 10 cubic feet per second in times during the drought of record for perpetuity, and (4) 50 percent of the water in storage will be available in 100 years.[20]

Groundwater conservation districts are now required to do joint planning within groundwater management areas. The primary goal of joint planning is to define the desired future conditions of their groundwater resources. Districts are required to consider groundwater availability models and other data or information for the management area and uses or conditions of an aquifer within the management area that differ substantially from one geographic area to another.[21] Districts can consider establishing different

[16] TWC§36.1071(3)(4) before September 1, 2005.

[17] TWC§36.1132

[18] However, many districts have correlative pumping limits such as a certain amount of pumping per acre of land.

[19] After 31TAC§356.2(8)

[20] Note that we have used 50 years or longer in our examples. Since desired future conditions will be used to calculate groundwater availability that will ultimately go into the regional water plans, desired future conditions should ideally be at least 50 years, the planning horizon for regional water planning.

[21] TWC§36.108(d)

desired future conditions for each aquifer, subdivision of an aquifer, or geologic strata and each geographic area overlying an aquifer within a groundwater management area.[22] A subdivision of an aquifer could include "sub-aquifers" such as the Chicot, Evangeline, and Jasper aquifers of the Gulf Coast aquifer or different segments of an aquifer such as the San Antonio, Barton Springs, and northern segments of the Edwards (Balcones Fault Zone) aquifer. Geologic strata often coincide with aquifers and sub-aquifers. The meaning of "geographic area" is not clear and could include a number of surficial factors.[23] The desired future conditions statements must be adopted by a two-thirds vote of at least two thirds of the districts located in whole or in part in the groundwater management area.[24]

In its rules, the TWDB requires that desired future conditions have to be physically possible, individually and collectively, if different desired future conditions are stated for different geographic areas overlying an aquifer or subdivision of an aquifer within the groundwater management area.[25] Because the TWDB provides values of managed available groundwater, we need to be able to make the calculations. First, the desired future conditions have to be physically possible. For example, a desired future condition limiting water-level declines to 100 feet in an unconfined (water table) aquifer with only 50 feet of water would be physically impossible. Second, if there are multiple desired future conditions in the same aquifer in a groundwater management area, they need to be compatible. For example, it would be difficult to estimate managed available groundwater if one area with a desired future condition of maintaining spring flow was right next to another area with a desired future condition to drain the aquifer. This TWDB requirement, however, does not apply across groundwater management areas in the same aquifer.[26]

After the groundwater conservation districts have developed their plans, they are required to submit their desired future conditions statements to the Executive Administrator of the TWDB.[27] The TWDB then provides each district and regional water planning group in the groundwater management area with the values of managed available groundwater based on the desired future conditions.

Districts are required to report the managed available groundwater in their groundwater plans and to ensure that their groundwater plans contain goals and objectives consistent with achieving the desired future conditions.[28] Regional water planning groups are required to use the managed available groundwater numbers in their regional water plans.[29]

V. CHALLENGING DESIRED FUTURE CONDITIONS

There are a several ways for someone to protest the desired future conditions or the implementation of the desired future conditions, one through the TWDB and two through the Texas Commission on Environmental Quality.

A person with a legally defined interest in groundwater in the management area,[30] a district in or adjacent to the groundwater management area, or a regional water planning group in the groundwater management area may file a petition with the TWDB appealing the approval of desired future conditions.[31] The petition has to include evidence that the districts did not establish *reasonable* desired future conditions. Once the petition is filed, the following occurs:[32]

- the TWDB will review the petition and any evidence relevant to the petition;
- the TWDB will hold at least one public hearing at central location in the groundwater management area;
- if the TWDB finds that a revision is needed, the TWDB will submit a report to the districts that includes a list of findings and recommended revisions to the desired future conditions;

[22] TWC§36.1089(d)(1)&(2)

[23] Soukhanov (1992) defines "geographic" as (1) of or relating to geography or (2) concerning the topography of a region. The relevant definition for "geography" is: the physical characteristics, especially the surface features, of an area.

[24] TWC§36.108(d–1). There is also a requirement that <u>all</u> districts provide public notice of the meeting.

[25] 31TAC§356.2(8)

[26] However, there is a process where a district next to a groundwater management area can petition that the area's desired future condition is not reasonable (addressed in the next section).

[27] TWC§36.108(o)

[28] TWC§36108(d–2)

[29] TWC§16.053(e)(3)(A)

[30] 31TAC§356.2(18) of the TWDB's rules states that a "person with a legal interest in groundwater" includes, but is not limited to, a person who owns land or groundwater rights in the district, has a legal interest in a well in the district, or has authorization from or an application pending with the district to produce groundwater.

[31] TWC§36.108(l)

[32] TWC§36.10(m)&(n)

- the districts will prepare a revised plan in accordance with the TWDB's recommendations;
- the districts will hold at least one public hearing at a central location in the groundwater management area;
- the districts shall then revise the desired future conditions considering all comments, including those by the TWDB and the public; and
- the districts will resubmit the revised desired future conditions to the TWDB for review.[33]

A district or person with a legally defined interest in groundwater in the management area may file a petition with the Texas Commission on Environmental Quality requesting an inquiry if the joint planning process in the groundwater management area failed to result in reasonable desired future conditions of the aquifers.[34] Once the petition is filed, the following occurs:[35]

- the commission reviews the petition within 90 days and either (1) dismisses the petition if the evidence does not support the allegations or (2) selects a review panel;
- the commission assembles a review panel that consists of a chairman, four other members, and a non-voting member to serve as a recording secretary;
- within 120 days of appointment, the review panel will review the petition and any evidence relevant to the petition and, in a public meeting, consider and adopt a report to the commission with recommended action (The commission may direct the review panel to hold public hearings in the groundwater management area. The review panel may attempt to negotiate a settlement or resolve the dispute.); and
- the commission will then take action on the report within 45 days.

A district or person with a legally defined interest in the groundwater in the management area may also file a petition with the Texas Commission on Environmental Quality alleging that a district has not adopted rules that are designed to achieve the desired future conditions or that a district is not enforcing compliance with their district rules.[36] This process is the same as the one described above with the exception that if the rules adopted by the district are not designed to achieve the desired future conditions, the commission may issue an order. This order could (1) require the district to take or not take certain actions, (2) dissolve the board and call for the election of a new board, (3) place the district in receivership, (4) dissolve the district, and (5) give recommendations to the legislature on how to achieve comprehensive management in the district.

Before the passage of House Bill 1763, there were opportunities for conflict between groundwater availability in a groundwater plan and a regional water plan. The passage of House Bill 1763 removed this language from statute and addressed the issue of inconsistent plans since the groundwater management area process will result in consistent groundwater availability numbers between groundwater plans and regional water plans. House Bill 1763 also put into place a process by which a conflict is resolved between a groundwater conservation district and a regional water planning group.[37] Because statute no longer defines what a conflict is or can be, the TWDB established rules defining a conflict—a situation where the managed available groundwater identified in a groundwater plan or the adopted state water plan is not the managed available groundwater based on the desired future conditions set by the groundwater conservation districts in the groundwater management area.

VI. PLANNING FOR THE "WHITE AREAS"

The TWDB's groundwater conservation district map is a colorful patchwork in which each of the 89 groundwater conservation districts is assigned a different color (Figure 2). Areas without districts are without color, what we refer to around the office as the "white areas." An interesting provision of House Bill 1763 is that groundwater conservation districts are not only deciding desired future conditions for the aquifers in their districts, but also for the aquifers *outside* of their districts. For some groundwater management areas—such as areas 10 and 12—this should not be much of a challenge because most of the areas have groundwater conservation districts. For other groundwater management areas—such as areas 3 and 8—this could be more of a challenge because most of the areas do not have groundwater conservation districts.[38]

[33] Statute does not describe what this review entails.

[34] TWC§36.108(f). This section also requires that the petition provide certain evidence, although none of it relates to the reasonableness of the desired future conditions.

[35] TWC§36.108(g), (h), (i), (j), and (k)

[36] TWC§36.108(f)

[37] TWC§36.1072(g)

[38] In the case of area 5, there are no groundwater conservation districts.

The desired future conditions that groundwater conservation districts develop for the groundwater management areas will also be used to develop managed available groundwater values for the "white areas." These values will be used by the regional water planning groups and could affect state funding for water projects outside of the districts, even though the rule of capture applies. The reason for this is because the regions are required to use the numbers from the districts. Therefore, although the rule of capture means there are no limits on pumping, there is a limit for water planning purposes. If a project is not in the regional water plan, then the project cannot receive state funding. However, if a municipality can find alternative funding, they can still build the project, regardless of what the groundwater districts and regional water plan say (This only applies to the white areas: a municipality within a district will need to abide by the districts rules).

In addition, any new districts will be created under the existing desired future conditions statements and managed available groundwater numbers, at least until the next time desired future conditions are reconsidered.

Because of the importance of the desired future conditions in the "white areas," districts should strongly consider involving stakeholders in these areas as part of the process, even though this is not required by law. Districts in several groundwater management areas have already addressed this. Area 13 has invited county judges in those counties without districts to participate as non-voting members. Area 14 is including the subsidence districts[39] in the joint planning process. Area 8 is considering how to include the involvement of the many counties and cities (including Dallas and Fort Worth) without districts in their management area. Additional stakeholder involvement up front may minimize petitions against the desired future conditions later.

VII. TIMING IS EVERYTHING

Statute requires that groundwater conservation districts in groundwater management areas submit their desired future conditions to the TWDB by September 1, 2010. However, for managed available groundwater numbers to be used in the next round of regional and state water planning (2007–2012), desired future conditions statements will need to be submitted much earlier, probably in late 2007 or early 2008.[40] Time is needed for TWDB staff to estimate or review managed available groundwater numbers and for regional water planning groups to incorporate the new managed available groundwater amounts into their planning documents.[41] At some point during the regional water planning process, if managed available groundwater numbers are not available, regional water planning groups have to use their own numbers to meet their statutory deadlines. By the fourth round of regional water planning (2012–2017), managed available groundwater based on the districts' desired future conditions should be available for use in all regional water plans. Once districts establish their desired future conditions, they may update them at any time.[42]

VIII. TWDB SUPPORT

The water code lists the TWDB's involvement as providing values of managed available groundwater and participating in the petition process when someone wants to protest a desired future condition. Our interpretation of "provide" is that the TWDB will make the calculations or review and approve the work of the districts or consultants to the districts for managed available groundwater and then deliver the information to the districts and regional water planning groups.

Although statute does not require the TWDB's involvement until we receive the desired future conditions statements, we recommended last year that districts in the groundwater management areas include us early in the groundwater management area process. One reason for this is to coordinate our technical assistance and to ensure, as much as possible, a smooth path to managed available groundwater. Another reason is that the TWDB can also be a resource recording and reporting on what districts in each groundwater management area are doing and can be a clearinghouse on information concerning joint planning in groundwater management areas.

Statute requires districts to consider groundwater availability models when deciding on desired future conditions. TWDB staff can provide technical assistance on the groundwater availability models to help districts decide which desired future conditions to use. We recommend an iterative process for coming to consensus on desired future conditions, similar to the process described for consensus yield in Mace and

---

[39] The Legislature removed the subsidence districts from Chapter 36 in 2005, thus they are technically not part of the joint planning process in groundwater management areas.

[40] By statute, adopted regional water plans are due to the TWDB by January 5, 2011. By this time, initially prepared plans have already been submitted to the TWDB, and the planning groups have held meetings to take public comment.

[41] Groundwater availability numbers are needed before regions can evaluate and consider different water management strategies.

[42] The statute does not provide for changes to be made more frequently than every five years from the date of the first change; however, there is also no prohibition against more frequent changes.

others (2001). With an iterative process, the districts would investigate various desired future conditions or several permutations of a desired future condition before settling on a final condition. Because of limited staff and no additional funding,[43] we encourage districts to submit model run requests as soon as possible. Our new priority list gives greater weight to model requests to evaluate desired future conditions (Appendix F).

Besides attending meetings, coordinating technical assistance, and running models, the TWDB is in the process of developing guidance documents and considering a proposal to train districts in public participation and conflict resolution. We also maintain a list of frequently asked questions on our Web page: http://www.twdb.state.tx.us/GwRD/GCD/faqmain.htm

IX. SUMMARY

Groundwater management areas have been around for more than 50 years. However, they have assumed greater importance with the passage of House Bill 1763 in 2005, a bill that resulted in several fundamental changes in how groundwater availability is determined and used in Texas. The more important changes include (1) regionalizing decisions on groundwater availability, (2) requiring regional water planning groups to use groundwater availability numbers developed from the groundwater management area process, and (3) requiring a permitting target for groundwater production. This new process involves (1) groundwater conservation districts developing desired future conditions for the groundwater resources in the groundwater management areas, (2) the TWDB providing values of managed available groundwater based on the desired future conditions to the districts and regional water planning groups, and (3) the districts and the planning groups including the values of managed available groundwater in their plans. There are also processes in place to challenge desired future conditions and the implementation of desired future conditions.

The desired future conditions that districts develop for their management area apply not only to their districts, but also to the areas outside of their districts. For managed available groundwater values to be included in the next round of regional water planning, districts may have to decide on their desired future conditions before the end of 2007 or the beginning of 2008. The TWDB is providing technical assistance to the districts in support of joint planning in the groundwater management areas as much as possible. Because of the anticipated backlog of groundwater availability model run requests, we encourage districts to submit their requests for model runs as soon as possible.

In Tennessee Williams' play, "A Streetcar Named Desire," Blanche DuBois rides a New Orleans' streetcar on her way from bankruptcy and loneliness to more heartbreak. In Texas, a streetcar named Desired Future Conditions will hopefully carry us to a more desirable destination: managed available groundwater. Working together, we should be able to get there.

X. ACKNOWLEDGMENTS

We are grateful for the reviews and comments of Merry Klonower in the preparation of this paper. Our paper has also benefited from discussions and guidance from Wendy Braniff, Carolyn Brittin, Ron Fieseler, and Ron Pigott. We are also grateful to Luanna Buckner for providing the quote on groundwater management areas in the South Central Texas Regional Water Plan.

XI. REFERENCES

Mace, R. E., Mullican, W. F., III, and Way, T. (S.-C.), 2001, Estimating groundwater availability in Texas: *in* the proceedings of the 1st annual Texas Rural Water Association and Texas Water Conservation Association Water Law Seminar: Water Allocation in Texas: The Legal Issues." Austin, Texas, January 25–26, 2001. Section 1, 16 p.

Soukhanov, A. H., editor, 1992, The American heritage dictionary of the English language, third edition: Houghton Mifflin Company, Boston, Massachusetts, 2140 p.

TCEQ and TWDB, 2005, Priority groundwater management areas and groundwater conservation districts—Report to the 79th Texas Legislature: Texas Commission on Environmental Quality, SFR-053/04, 62 p.+appendix.

TNRCC and TWDB, 2001, Priority groundwater management areas and groundwater conservation districts—Report to the 79th Texas Legislature: Texas Natural Resource Conservation Commission, SFR-053/01, 98 p.+appendix.

[43] TWDB submitted a fiscal note to House Bill 1763 that would have resulting in hiring three geologists and a lawyer to implement the bill. However, because the bill came up late in the session, no money was appropriated.

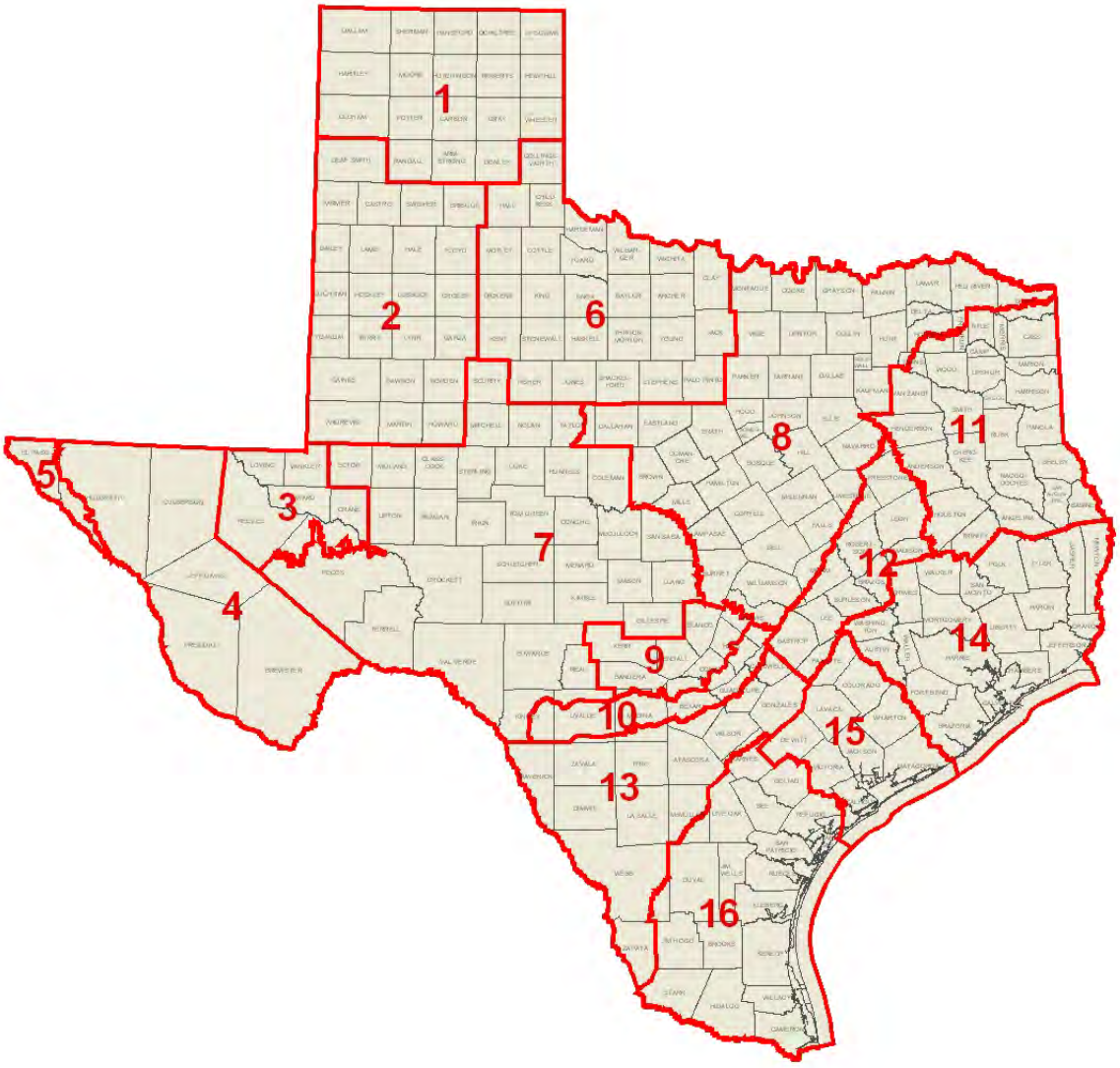

Figure 1: Groundwater management areas.

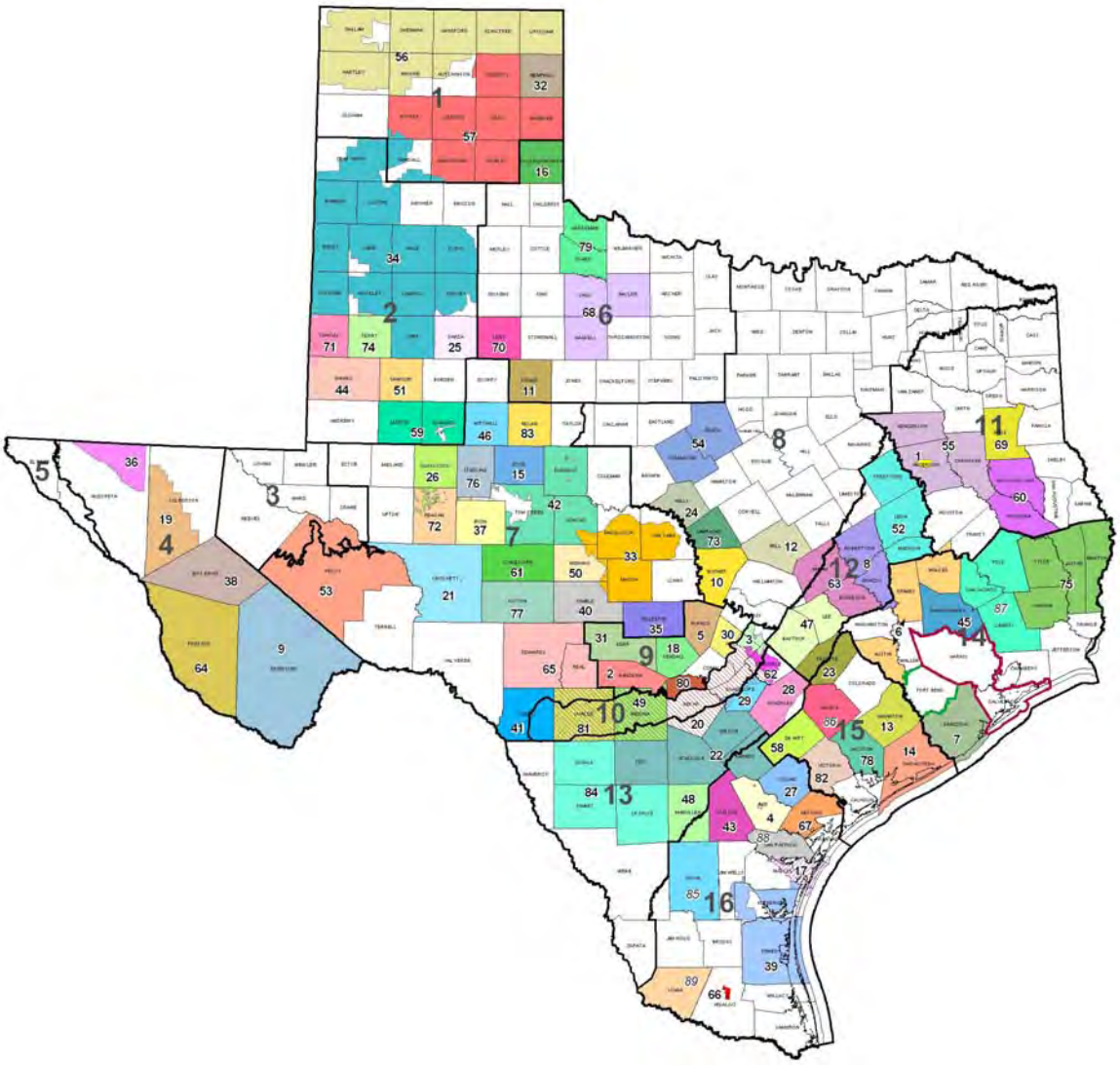

Figure 2: Groundwater conservation districts.

APPENDIX A

Legislative History Concerning Groundwater Management Areas

Legislative act	Legislature	Major provisions or changes
House Bill 162	51st, 1949	• Authorized petition process for designating underground water reservoirs and creating underground water conservation districts. • Amended in 1955 to authorize Texas Board of Water Engineers to designate underground water reservoirs on its own motion.
House Bill 2	69th, 1985	• Changed underground water reservoirs to management areas.
Senate Bill 1212	71st, 1989	• Changed management areas to underground water management areas. • Repealed underground water management area delineation requirements for legislatively-created districts. • Required groundwater conservation districts to develop comprehensive management plans (groundwater plans).
House Bill 2294	74th, 1995	• Replaced references to underground water management areas and underground water reservoirs with groundwater management areas and groundwater reservoirs, respectively.
Senate Bill 1	74th, 1997	• Required certain content in groundwater management plans. • Created the regional water planning process. • Groundwater plans needed to address water supply needs not in conflict with the appropriate regional water plan.
Senate Bill 2	77th, 2001	• Authorized the Texas Water Development Board to designate groundwater management areas that would include all major and minor aquifers of the state. • Required groundwater conservation districts to share groundwater plans with other districts in the groundwater management area. • Allowed a groundwater conservation district to call for joint planning among districts in a groundwater management area. • Removed the requirement for a groundwater management area or a priority groundwater management area to exist to create a groundwater conservation district by petition.
House Bill 1763	79th, 2005	• Required groundwater conservation districts in groundwater management areas to meet at least once every year and to define the desired future conditions of the groundwater resources within the groundwater management area. • Based on the desired future conditions, the Texas Water Development Board delivers managed available groundwater values to groundwater conservation districts and regional water planning groups for inclusion in their plans.

Information through 1997 is after TNRCC and TWDB (2001).

APPENDIX B

Quick Reference Sheet to Groundwater Statute and Rules Related to Groundwater Management Areas

Texas Water Code

TWC§16.053(e)(3)(a)	Requirement for regional water planning groups to use managed available groundwater.
TWC§35.007	Identifying, designating, and delineating priority groundwater management areas.
TWC§36.002	Ownership of groundwater.
TWC§35.004	Designation of groundwater management areas.
TWC§36.1071	Groundwater management plan.
TWC§36.1072	Texas Water Development Board review and approval of management plan.
TWC§36.108	Joint planning in groundwater management area.
TWC§36.1132	Permits based on managed available groundwater.

Texas Administrative Code

TAC§356.02	Definitions
TAC§356.10	Possible conflicts of a groundwater management plan with the state water plan.
TAC§356.11	Appealing approval of the desired future conditions of the groundwater resources.
TAC§356.23	Designation of groundwater management areas.

APPENDIX C

Listing of Groundwater Conservation Districts in each Groundwater Management Area

Groundwater Management Area 1

Hemphill County Underground Water Conservation District
High Plains Underground Water Conservation District No. 1
North Plains Groundwater Conservation District
Panhandle Groundwater Conservation District

Groundwater Management Area 2

Garza County Underground and Fresh Water Conservation District
High Plains Underground Water Conservation District No. 1
Llano Estacado Underground Water Conservation District
Mesa Underground Water Conservation District
Permian Basin Underground Water Conservation District
Sandy Land Underground Water Conservation District
South Plains Underground Water Conservation District

Groundwater Management Area 3

Middle Pecos Groundwater Conservation District

Groundwater Management Area 4

Brewster County Groundwater Conservation District
Culberson County Groundwater Conservation District
Hudspeth County Underground Water Conservation District No. 1
Jeff Davis County Underground Water Conservation District
Presidio County Underground Water Conservation District

Groundwater Management Area 5

None

Groundwater Management Area 6

Clear Fork Groundwater Conservation District
Collingsworth County Underground Water Conservation District
Rolling Plains Groundwater Conservation District
Salt Fork Underground Water Conservation District
Tri-County Groundwater Conservation District

Groundwater Management Area 7

Coke County Underground Water Conservation District
Edwards Aquifer Authority
Emerald Underground Water Conservation District
Glasscock Groundwater Conservation District
Hickory Underground Water Conservation District No. 1
Hill Country Underground Water Conservation District
Irion County Water Conservation District
Kimble County Groundwater Conservation District
Kinney County Groundwater Conservation District
Lipan-Kickapoo Water Conservation District
Lone Wolf Groundwater Conservation District
Menard County Underground Water District

Groundwater Management Area 7 (continued)

Middle Pecos Groundwater Conservation District
Plateau Underground Water Conservation and Supply District
Real-Edwards Conservation and Reclamation District
Santa Rita Underground Water Conservation District
Sterling County Underground Water Conservation District
Sutton County Underground Water Conservation District
Uvalde County Underground Water Conservation District
Wes-Tex Groundwater Conservation District

Groundwater Management Area 8

Central Texas Groundwater Conservation District
Clearwater Underground Water Conservation District
Fox Crossing Water District
Middle Trinity Groundwater Conservation District
Post Oak Savannah Groundwater Conservation District
Saratoga Underground Water Conservation District

Groundwater Management Area 9

Bandera County River Authority and Ground Water District
Barton Springs/Edwards Aquifer Conservation District
Blanco-Pedernales Groundwater Conservation District
Cow Creek Groundwater Conservation District
Edwards Aquifer Authority
Hays Trinity Groundwater Conservation District
Headwaters Groundwater Conservation District
Medina County Groundwater Conservation District
Trinity-Glen Rose Groundwater Conservation District

Groundwater Management Area 10

Barton Springs/Edwards Aquifer Conservation District
Edwards Aquifer Authority
Guadalupe County Groundwater Conservation District
Hays Trinity Groundwater Conservation District
Kinney County Groundwater Conservation District
Medina County Groundwater Conservation District
Plum Creek Conservation District
Uvalde County Underground Water Conservation District

Groundwater Management Area 11

Anderson County Underground Water Conservation District
Bluebonnet Groundwater Conservation District
Mid-East Texas Groundwater Conservation District
Neches & Trinity Valleys Groundwater Conservation District
Pineywoods Groundwater Conservation District
Rusk County Groundwater Conservation District

Groundwater Management Area 12

Brazos Valley Groundwater Conservation District
Fayette County Groundwater Conservation District
Lost Pines Groundwater Conservation District
McMullen Groundwater Conservation District
Post Oak Savannah Groundwater Conservation District

Groundwater Management Area 13

Edwards Aquifer Authority
Evergreen Underground Water Conservation District
Gonzales County Underground Water Conservation District
Guadalupe County Groundwater Conservation District
Medina County Groundwater Conservation District
Plum Creek Conservation District
Uvalde County Underground Water Conservation District
Wintergarden Groundwater Conservation District

Groundwater Management Area 14

Bluebonnet Groundwater Conservation District
Brazoria County Groundwater Conservation District
Brazos Valley Groundwater Conservation District
Lone Star Groundwater Conservation District
Southeast Texas Groundwater Conservation District

Groundwater Management Area 15

Coastal Bend Groundwater Conservation District
Coastal Plains Groundwater Conservation District
Fayette County Groundwater Conservation District
Lavaca County Groundwater Conservation District
Pecan Valley Groundwater Conservation District
Texana Groundwater Conservation District
Victoria County Groundwater Conservation District

Groundwater Management Area 16

Bee Groundwater Conservation District
Duval County Groundwater Conservation District
Evergreen Underground Water Conservation District
Goliad County Groundwater Conservation District
Kenedy County Groundwater Conservation District
Live Oak Underground Water Conservation District
McMullen Groundwater Conservation District
Red Sands Groundwater Conservation District
Refugio Groundwater Conservation District
San Patricio County Groundwater Conservation District
Starr County Groundwater Conservation District

APPENDIX D

Listing of Groundwater Conservation Districts in Multiple Groundwater Management Areas

In four groundwater management areas

Edwards Aquifer Authority

In three groundwater management areas

Medina County Groundwater Conservation District
Uvalde County Underground Water Conservation District

In two groundwater management areas

Barton Springs/Edwards Aquifer Conservation District
Bluebonnet Groundwater Conservation District
Brazos Valley Groundwater Conservation District
Evergreen Underground Water Conservation District
Fayette County Groundwater Conservation District
Guadalupe County Groundwater Conservation District
Hays Trinity Groundwater Conservation District
High Plains Underground Water Conservation District No. 1
Kinney County Groundwater Conservation District
McMullen Groundwater Conservation District
Middle Pecos Groundwater Conservation District
Plum Creek Conservation District
Post Oak Savannah Groundwater Conservation District

APPENDIX E

Listing of Major and Minor Aquifers in each Groundwater Management Area

Groundwater Management Area 1
- Ogallala
- Seymour
- Dockum
- Rita Blanca
- Blaine

Groundwater Management Area 2
- Dockum
- Edwards-Trinity (High Plains)
- Ogallala
- Cenozoic Pecos Alluvium
- Edwards-Trinity (Plateau)
- Seymour

Groundwater Management Area 2
- Ogallala
- Cenozoic Pecos Alluvium
- Edwards-Trinity (Plateau)
- Dockum
- Capitan Reef Complex
- Rustler

Groundwater Management Area 4
- Hueco-Mesilla Bolson
- Edwards-Trinity (Plateau)
- Cenozoic Pecos Alluvium
- West Texas Bolsons
- Rustler
- Marathon
- Igneous
- Capitan Reef Complex
- Bone Spring-Victorio Peak

Groundwater Management Area 5
- Hueco-Mesilla Bolson

Groundwater Management Area 6
- Trinity
- Seymour
- Ogallala
- Dockum
- Blaine

Groundwater Management Area 7
- Cenozoic Pecos Alluvium
- Edwards-Trinity Plateau
- Edwards (Balcones Fault Zone)
- Ogallala
- Seymour
- Trinity
- Capitan Reef Complex
- Dockum
- Ellenburger-San Saba
- Hickory
- Lipan
- Marble Falls
- Rustler

Groundwater Management Area 8
- Edwards (Balcones Fault Zone)
- Edwards-Trinity (Plateau)
- Trinity
- Brazos River Alluvium
- Ellenburger-San Saba
- Hickory
- Marble Falls
- Nacatoch
- Woobine
- Blossom

Groundwater Management Area 9
- Edwards (Balcones Fault Zone)
- Edwards-Trinity (Plateau)
- Trinity
- Ellenburger-San Saba
- Hickory
- Marble Falls

Groundwater Management Area 10
- Edwards (Balcones Fault Zone)
- Trinity
- Edwards-Trinity (Plateau)

Groundwater Management Area 11
- Carrizo-Wilcox
- Nacatoch
- Queen City
- Sparta
- Yegua-Jackson

Groundwater Management Area 12
- Carrizo-Wilcox
- Trinity
- Brazos River Alluvium
- Queen City
- Sparta
- Yegua-Jackson

Groundwater Management Area 13
- Carrizo-Wilcox
- Queen City
- Sparta
- Yegua-Jackson

Groundwater Management Area 14
- Gulf Coast
- Carrizo-Wilcox
- Brazos River Alluvium
- Queen City
- Sparta
- Yegua-Jackson

Groundwater Management Area 15
- Gulf Coast
- Carrizo-Wilcox
- Queen City
- Sparta
- Yegua-Jackson

Groundwater Management Area 16
- Gulf Coast
- Carrizo-Wilcox
- Yegua-Jackson

APPENDIX F

Priority List for Making Model Runs with the Groundwater Availability Models

The following list represents which model run requests will receive the highest priority.

(1) Model runs to estimate managed available groundwater based on a final desired future conditions statement.
(2) Model runs to provide required information for groundwater management plans.
(3) Model runs to provide required information for regional water plans.
(4) Model runs to estimate managed available groundwater based on a draft desired future conditions
(5) Any other request from a groundwater conservation district or regional water planning group.

TWDB staff is currently developing required information from the models for groundwater management plans for all of the groundwater conservation districts. This will allow more time to run models on draft desired future conditions. We do not anticipate many requests from regional water planning groups until later in the next round of the regional water planning process.