Texas Groundwater Markets and the Edwards Aquifer

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Case Study

Final Report on Political Economy of Water Markets

AMP Insights

ecosystem economics

The ROCKEFELLER FOUNDATION

Texas Groundwater Markets and the Edwards Aquifer

A Case Study for the Political Economy of Water Markets Project

October 2016

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Preface

This paper is one output of a project entitled "The Political Economy of Water Markets." The project was carried out by Ecosystem Economics LLC and AMP Insights LLC. The outputs of the project include a final report and a set of case studies.

The final report comes in three parts:

1. "Healthy" Water Markets: A Conceptual Framework by Bruce Aylward, David Pilz, Megan Dyson and Carl J. Bauer
2. Political Economy of Water Markets in the Western United States by Bruce Aylward, David Pilz and Leslie Sanchez
3. Comparative Analysis of Legal Regimes with Respect to Fostering "Healthy" Water Markets by David Pilz, Megan Dyson, Bruce Aylward, Carl J. Bauer and Amy Hardberger

The eight case studies consist of the following.

1. The Evolving Water Market in Chile's Maipo River Basin by Carl J. Bauer
2. Addressing Overallocation and Water Trade in New South Wales, Australia: Namoi Basin Groundwater by Megan Dyson
3. Evolution of Australian Water Law and the National Water Initiative Framework by Megan Dyson
4. Opportunities for Surface Water Right Marketing in Idaho's Rapidly Urbanizing Treasure Valley by Jeff Fereday
5. Texas Groundwater Markets and the Edwards Aquifer by Amy Hardberger
6. Oregon's Umatilla Basin Aquifer Recharge and Basalt Bank by Martha Pagel
7. Truckee-Carson Surface Water Markets in Northern Nevada by Leslie Sanchez, Bruce Aylward and Don Springmeyer
8. Smart Markets for Groundwater Trading in Western Nebraska: The Twin Platte by Richael Young

The studies and reports can be downloaded from the AMP Insights website at http://www.ampinsights.com/rock-report.

For further information on this work please contact Bruce Aylward at bruce@ampinsights.com.

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Introduction

Texans have a long-standing dependence on groundwater. Its usage has steadily increased throughout the state's history. In the earliest years, farmers required groundwater for their livelihoods. In the 1930s, groundwater was an essential tool in stopping the seemingly endless Dust Bowl in the Texas Panhandle and returning the area from a wasteland to a thriving agricultural economy. The majority of rivers that start in Central Texas, and flow across the state to the bays and estuaries, find their headwaters in groundwater fed springs, without which the state could not provide sufficient surface water for many users. While groundwater has been critical to Texas's past, it may be even more instrumental in its future.

Texas has nine major aquifers and twenty-one minor aquifers.[1] In 2008, groundwater provided nearly sixty percent of the water used throughout the state.[2] This amounted to 9.66 million acre-feet per year.[3] The vast majority, eighty percent, of this water was used for irrigation.[4] Thirty-five percent of municipal demands are met by groundwater, although this percentage may increase in the future, as surface water is increasingly unavailable.[5] State water demands are projected to increase twenty-two percent in the next fifty years.[6] Even with a projected decrease in irrigation demand, the demand for groundwater will continue to increase.

The state's population is predicted to increase eighty-two percent between 2010 and 2060.[7] The vast majority of these citizens will live in urban areas, stressing cities' current water supplies. New water supply plans for municipal areas often include desalination of brackish aquifers or pumping and long-haul transport of groundwater from one region of the state to another. In other areas, where drought and over-allocation have reduced surface water resources, some citizens have starting drilling personal groundwater wells.[8] Unfortunately, in regions where the groundwater is hydrologically connected to nearby surface water sources, withdrawal of the groundwater reduces the available surface water. These realities, viewed in light of climate change predictions for the region, paint a bleak picture and raise questions about how the state's aquifers will survive.

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[1] PETER G. GEORGE ET AL., TEX. WATER DEV. BD. Report 380, AQUIFERS OF TEXAS 3 (2011).
[2] PETER G. GEORGE ET AL., TEX. WATER DEV. BD., STATE WATER PLAN 163 (2012. Report 380, AQUIFERS OF TEXAS 3 (2011).
[3] An acre-foot is equal to 325,851 gallons of water.
[4] PETER G. GEORGE ET AL., TEX. WATER DEV. BD., STATE WATER PLAN 163 (2012. Report 380, AQUIFERS OF TEXAS 3 (2011).
[5] Tex. Water Dev. Bd., *Water Use Survey Historical Summary Estimates By Region In Acre-Feet* (2010), http://www.twdb.state.tx.us/waterplanning/waterusesurvey/estimates/2010/doc/2010state.xlsl; TEX. WATER DEV. BD., STATE WATER PLAN 163 (2012). Municipal uses accounted for fifteen percent of total groundwater withdrawals. TEX. WATER DEV. BD., STATE WATER PLAN 163 (2012).
[6] TEX. WATER DEV. BD., STATE WATER PLAN 3, 129, 136 (2012).
[7] TEX. WATER DEV. BD., STATE WATER PLAN 1 (2012).
[8] Kate Galbraith, *Texas Drought Sparks Water Well Drilling Frenzy*, THE TEX. TRIBUNE, Feb. 17, 2012.

For legal purposes, groundwater is defined by the Texas Water Code as "water percolating below the surface of the earth."[9] This definition can be misleading as underflow of a stream is actually considered surface water and therefore under state control.[10] Implementing regulations of Texas water rights include additional details to the definition. Groundwater is "water under the surface of the ground other than underflow of a stream and underground streams, whatever may be the geologic structure in which it is standing or moving."[11] Once groundwater leaves the ground in the form of springs or other discharges into a surface water body, its legal character changes and it becomes surface water and visa versa.[12] Because surface water and groundwater are regulated separately, there is no liability when one type of use impacts the other. In other words, if permissible groundwater pumping dries up a spring that feeds surface water, there is no liability.[13]

Currently, Texas considers groundwater to be private property often, but not always, associated with the surface estate. While many may object to the wisdom of this classification, it could be argued that this designation might facilitate the ability to purchase and move water from an area of plenty to one with a need. Although the notion of markets is often mentioned, few currently exist in Texas. The purpose of this paper is to evaluate current and potential water markets in the state and explore the possibility of utilizing markets to assist in water planning.

First, the paper reviews and defines groundwater law, which is the underpinning of the any property rights designation in water. Before one can discuss what a landowner can do with their property, the right must first be fully understood. This discussion reviews the legislative and case history leading to groundwater's current management practices. This section also defines Texas's water planning process as an overlay to property law aspect of groundwater management. As part of this analysis, a legal history of the Edwards Aquifer Authority is presented as a special case of groundwater management in Texas.

The paper then evaluates the current state of water markets in various regulatory regimes across the state weighing their strengths and weaknesses. The overarching challenge to water markets in Texas is the lack of groundwater regulation and management particularly if one of the goals of markets is to protect a groundwater resource. While the Edwards Aquifer was seen as an exception to this, recent groundwater case law could threaten this fairly successful market as well.

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[9] TEX. WATER CODE ANN. § 36.001(5) (West 2008).
[10] TEX. WATER CODE ANN. § 11.021(a) (West 2008).
[11] 30 TEX. ADMIN. CODE § 297.1(21) (2012).
[12] *Denis v. Kickapoo Land Co*., 771 S.W.2d 235, 236 (Tex. App.—Austin 1989, writ denied).
[13] The Edwards Aquifer is a special exception to this rule and will be discussed in detail in a later section.

Legal History of Texas Groundwater

Despite data showing groundwater depletion in many Texas aquifers, the majority of landowners remain opposed to increased groundwater regulation seeing it as an invasion of private property rights.[14] To understand this viewpoint, it is important to understand the evolution of groundwater rights in Texas.

The legal road to groundwater in Texas is paved by a series of legal and legislative decisions made somewhat in tandem with, or at least in recognition of, one another. When considered this way—viewing each court and legislative decision as one in a series—the progression in groundwater regulation becomes clearer.

A groundwater law discussion must begin with the Texas Supreme Court's 1904 ruling in *East*.[15] This case established rule of capture, as the law for Texas groundwater. In *East*, the Houston Railroad Company had several lots upon which it built a large groundwater well and attached it to a steam pump. The pump withdrew twenty-five thousand gallons of water each day, which caused East's much smaller, neighboring residential well to go dry. Despite East's injury, the Texas Supreme Court held that Houston Railroad Company's use was reasonable and not actionable. The court explained that the landowner has equal ownership of the soil and the water held therein. The court reached this conclusion for two reasons: first, the court stated that groundwater was too complicated to govern any other way; and second, requiring correlative rights would interfere with economic development. The only exception to this rule appeared to be that groundwater use must be absent evidence of malice or willful waste.

East was a case of first impression for the court and Texas had no laws governing groundwater at the time of its disposition. Without other guidance, the court relied on the experiences of other jurisdictions as well as English common law to reach its conclusion. In particular, the court cited *Acton v. Lundell*, a case that dated back to 1843. Despite its reliance on common law, the court posited that legislation would have guided its decision had the legislature previously created any regulations for groundwater.

In 1999, the Texas Supreme Court had its first modern opportunity to directly confront the question of whether the rule of capture remained the appropriate method of groundwater allocation for Texas. In *Sipriano v. Great Spring Waters of America*, the defendant, Ozarka Natural Spring Water, began pumping nearly 90,000 gallons of groundwater every day for the purpose of bottling and sale.[16] The pumping quickly depleted Sipriano's nearby wells. Among other things, Sipriano asked the court to abandon the rule of capture and replace it with the rule of reasonable use. The court refused to do so. Deferring to its ruling in *East* and the lack of

[14] *See e.g.*, Kate Galbraith, *Texas Farmers Battle Ogallala Pumping Limits*, THE TEX. TRIBUNE, Mar. 18, 2012 (describing farmers' resentment towards the new rules promulgated by High Plains Underground Water Conservation District).
[15] *See Houston & T. C. Ry. Co. v. East*, 81 S.W. 279 (Tex. 1904).
[16] *Sipriano v. Great Spring Waters of Am., Inc.*, 1 S.W.3d 75, 75–76 (Tex. 1999).

subsequent legislation amending or changing the doctrine, the court maintained rule of capture as the law in Texas.

Groundwater Legislation

While Texas courts consistently upheld the rule of capture, the legislature was simultaneously limiting groundwater rights through regulation. This began just six years after the Texas Supreme Court's decision in *East*, when the droughts of 1910 and 1917 motivated the legislature to amend the state constitution to explicitly extend the legislature's obligations to include the duty to protect the state's natural resources. This amendment was not self-enacting but, through its passage, the duty to implement public policy relating to groundwater was placed squarely with the legislature.[17] However, because the amendment passed after *East*, the court had already established a common law regulation. A common law rule of capture evolving contemporaneously with a regulatory structure seeking to regulate groundwater rights created a bifurcated system that continues to create confusion regarding how far the legislature can go in limiting the common law right.

Potential conflicts aside, the legislature took on the responsibility of governing groundwater primarily through Groundwater Conservation Districts (GCDs). A GCD's purpose is "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, consistent with the objectives of Section 59, Article XVI, [of the] Texas Constitution."[18] Texas's legislature first provided for GCDs in 1949 pursuant to the constitutional authority it received through the conservation amendment.[19]

The power of GCDs changed considerably when Texas passed its first historic omnibus water bill in 1997: Senate Bill 1 (SB1).[20] SB 1 marked the first attempt to shift from water development to statewide regional planning.[21] As with most water legislation in Texas, SB 1

[17] TEX. CONST. art. XVI, § 59(a).
[18] TEX. WATER CODE § 36.0015 (West 2008).
[19] *Sipriano v. Great Spring Waters of Am., Inc*., 1 S.W.3d 75, 79 (Tex. 1999).
[20] *See* Act of June 1, 1997, 75th Leg., R.S., ch. 1010, 1997 Tex. Gen. Laws 3610 (codified in various sections of TEX. WATER CODE ANN.). There have been three omnibus water bills: Senate Bills 1, 2, and 3. *See* Act of June 1, 1997, 75th Leg., R.S., ch. 1010, 1997 Tex. Gen. Laws 3610; Act of May 27, 2001, 77th Leg., R.S., ch. 966, 2001 Tex. Gen. Laws 1991; Acts 2007, 80th Leg., R.S., ch. 1430, 2007 Tex. Gen. Laws 5848.
[21] Chris Lehman, *Hung Out to Dry?: Groundwater Conservation Districts and the Continuing Battle to Save Texas's Most Precious Resource*, 35 TEX. TECH L. REV. 101, 107 (2004). State planning as defined by SB 1 included dividing the state into sixteen regional planning groups, separate and apart from the groundwater management areas, for the purposes of forecasting and management of both surface water and groundwater resources for inclusion in the State Water Plan. TEX. WATER DEV. BD., *Water for Texas: Regional Water Planning in Texas*,

came on the heels of a three-year drought.[22] SB 1 had profound consequences on groundwater. Prior to its passage, groundwater management did not exist in many areas of the state except for the few locations where GCDs existed. SB 1 sought to change this and explicitly stated that "[g]roundwater conservation districts . . . are the state's preferred method of groundwater management."[23] GCDs "embody a central premise of this legislation—local control—and represent the idea that those closest to the resource are those most capable of managing it."[24] After SB 1, the number of groundwater districts grew quickly.[25]

In addition to its goal of expanding the regulatory power of individual districts, SB 1 sought to treat the state as a whole and set up a system of regional planning groups, which looked at both surface and groundwater resources.[26] The bill directed these areas to examine water resources, needs, and projections. Each regional planning group was required to consider all of the included GCDs' management plans. Additionally, SB 1 provided for data collection to close data gaps, which had previously made planning difficult, if not impossible. The bill also created Priority Groundwater Management Areas (PGMAs). PGMAs are areas identified as potentially having significant problems within twenty-five years of the bill passing.

SB 1 consolidated the laws governing GCDs into Chapter 36 of the Texas Water Code. This chapter provides for the creation of GCDs, means of governance, powers and duties.[27] In addition to emphasizing the preference for GCDs, the bill increased their statutory authority to manage withdrawals.[28] The bill also provided extensive guidance for the creation of a management plans. Perhaps most importantly, the bill required permits be issued for any newly drilled water wells. Permit applications required users to report their use and submit a statement of purpose when applying for a well permit. Districts were given permission to exempt certain types of wells from obtaining a permit. These included domestic and livestock and as wells used for hydrocarbon production among others. Districts could also issue or deny permits for out-of-basin water transfers. SB 1 increased groundwater management where previously absent, but the bill did not attempt to change the common law regarding statewide groundwater allocation.

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http://www.twdb.texas.gov/publications/shells/RegionalWaterPlanning.pdf. This article focuses solely on the groundwater portion of the planning process.

[22] Martin Hubert & Bob Bullock, *Senate Bill 1, The First Big and Bold Step Toward Meeting Texas's Future Water Needs*, 30 TEX. TECH L. REV. 53, 55 (1999).

[23] Act of June 1, 1997, 75th Leg., R.S., ch. 1010, 1997 Tex. Gen. Laws 3610, 3642– 43 (codified in TEX. WATER CODE ANN. § 36.0015).

[24] Martin Hubert & Bob Bullock, *Senate Bill 1, The First Big and Bold Step Toward Meeting Texas's Future Water Needs*, 30 TEX. TECH L. REV. 53, 66 (1999).

[25] Chris Lehman, *Hung Out to Dry?: Groundwater Conservation Districts and the Continuing Battle to Save Texas's Most Precious Resource*, 35 TEX. TECH L. REV. 101, 104 (2004).

[26] *See* Act of June 1, 1997, 75th Leg., R.S., ch. 1010, § 1.02, 1997 Tex. Gen. Laws 3610, 3611–14 (codified in TEX. WATER CODE ANN. § 16.053).

[27] *See* TEX. WATER CODE ANN. § 36.0001 et. seq. (West 2008).

[28] New GCDs have the regulatory authority to manage new and existing wells, but how rules are applied to wells in existence at the time of GCD formation is entirely dependent on the rules promulgated by the GCD; therefore, there is a lot of variation across the state.

The legislature did not replace the rule of capture, but groundwater legislation limiting its reach continued to evolve. SB 1 was followed by another omnibus water bill in 2001: Senate Bill 2 (SB 2).[29] SB 2 was intended to update and fortify the initiatives commenced in SB 1. "The legislation also reflected a continuation of disputes that arose in the 1999 session about the establishment of single-county groundwater districts and a growing interest in the issue of transporting groundwater outside district boundaries to provide water for thirsty cities."[30] As with many water issues, SB 2 was contentious because it was seen as a potential threat to private property rights and required extensive negotiations to gain passage.

The bill enhanced the regulatory powers of GCDs by expanding their permitting and enforcement powers. Most importantly, the bill provided for increased regulation of well spacing to minimize interference between wells. Districts were also allowed to set production limits based on tract size or production capacity by dictating acre-feet per acre or gallons per minute.

While allowing increased regulations in many ways, SB 2 also did the opposite by prohibiting a district from rejecting a proposed permit specifically for exportation of groundwater out of the district. In exchange, the district received the ability to levy an export fee on that water. The bill also streamlined the process for designation of groundwater management areas (GMAs), which are further described below. Although districts are generally restricted from purchasing groundwater rights, they could do so for conservation purposes if the rights were permanently held in trust.

One existing issue that was compounded after SB 1 was the amount of districts overlaying the same aquifer. This created a potential source of conflict and confusion because each district could create opposing management plans for essentially the same water. SB 2 sought to remedy this by establishing procedures for joint management of the shared aquifer by groundwater districts.

Perhaps foreseeing future conflicts between the established common law created by the courts and the increasing power given to groundwater districts by the legislature, SB 2 attempted to clarify the relationship. The bill amended the statute codifying groundwater ownership and added that ownership rights "may be limited or altered by" district rules.[31] These regulations increased the authority of GCDs and strengthened the state's regional planning process, which led to increased pumping limits in some areas.

As GCDs attempted to create permitting rules, where once there were none, questions arose about how to decide who should receive a permit, particularly in areas where landowners had been using water for years. The conflict between permitting based on historic use and

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[29] Act of May 27, 2001, 77th Leg., R.S., ch. 966, 2001 Tex. Gen. Laws 1991.

[30] Ken Kramer, Senate Bill 2—Omnibus Water Legislation, http://texas.sierraclub.org/texaslegislature/EIS/sb2.html.

Act of May 27, 2001, 77th Leg., R.S., ch. 966, § 2.31 Gen. Laws 1991, 2009 (amending TEX. WATER CODE ANN. § 36.002).

questions of property rights reached the Texas Supreme Court in *Guitar Holding Co. v. Hudspeth County Underground Water Conservation District*.[32] The Hudspeth County Underground Water Conservation District No. 1,[33] established in the 1950s, adopted a new management plan in an attempt to sustain the Bone Springs–Victorio Peak Aquifer at historically optimal levels through regulation of groundwater withdrawals.[34]

Their plan included a permitting program "recogniz[ing] three types of permits: 1) validation permits, 2) operating permits, and 3) transfer permits."[35] Existing wells that produced water during a defined historic period were entitled to a validation permit. If a well, such as a new well, was not eligible for a validation permit, a landowner could apply for an operating permit. Transfer permits were required for anyone wishing to transfer water out of the district. To be eligible for a transfer permit, a landowner must first receive a validation or operating permit. The system relied on historic use to quantify the permissible amount of water permitted. A user was obligated to show usage during the requisite time period in the past. This type of permit, here called a validation permit by the district, is often referred to as a historic use permit.

Irrigating landowners were entitled to a validation permit of four acre-feet of water per acre irrigated subject to a district reduction to three acre-feet based on the aquifer's elevation at the well location. Non-irrigating owners were entitled to a validation permit equal to "the maximum amount of water beneficially used in any one year during the [historic] period."[36] With this system, the district permitted based on past types of use without consideration of the landowner's intent as to future use. Therefore, an irrigator could gain a permit based on historic irrigation even if her future intent was sale and transport of the water out of the district. In fact, this case was triggered because the City of El Paso wanted to purchase groundwater to transport for municipal use.

Unfortunately, this system pitted different types of users against one another because the ability to obtain and then transfer water was predicated on past use. This system disadvantaged owners who used limited quantities of water during the historic period and rewarded people who did not. For transfer permits, there was also a higher standard for those applying for completely new permits as compared to those holding validation permits. Guitar Holding Company, a large landowner, only irrigated a small portion of land during the historic period and was therefore

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[32] *Guitar Holding Co. v. Hudspeth Cnty. Underground Water Conservation Dist.*, 263 S.W.3d 910, 915–16 (Tex. 2008).

[33] This groundwater district is located in far West Texas, less than 100 miles east of El Paso. This area is extremely dry with very little precipitation to provide surface watering or recharge opportunities. Despite annual rainfall of only eight to ten inches, this region had a historic agricultural economy made possible by groundwater irrigation.

[34] In 2000, prior to these new rules, the state auditor questioned whether the district was successfully managing the aquifer.

[35] Operating permits, although authorized had limited value because they could not be used unless water rose above pre-irrigation levels.

[36] *Guitar Holding Co. v. Hudspeth Cnty. Underground Water Conservation Dist.*, 263 S.W.3d 910, 914 (Tex. 2008).

eligible for fewer water permits than a group of permitted irrigators. Guitar Holding Company brought suit challenging the validity of the permitting requirements.

The Texas Supreme Court ruled that the protection of historic use authorized by Chapter 36 was only for the exact use and location for which it had been used. If either of those changed, the permit holder had to be treated like any other new applicant. Since no one had ever transferred water out of the basin, all transfers should be treated as new uses and not attached to prior use validation permits. Ultimately, it was the perceived unfairness in the loss of this income through lost transfer earnings that may have driven the decision.

The ruling in *Guitar* greatly affects the market transfers of historic use permits. Generally, the ability to have water for sale and transfer is a potential economic boon for the rights holder; however, any value advantage a historic permit rights holder has is essentially stripped if it is transferred to be used in a different location or for a different purpose. Therefore, it is easier and equally valuable for a potential buyer to simply buy some surface estate and apply for their own water permit for use outside the area.

Texas Groundwater Planning Process

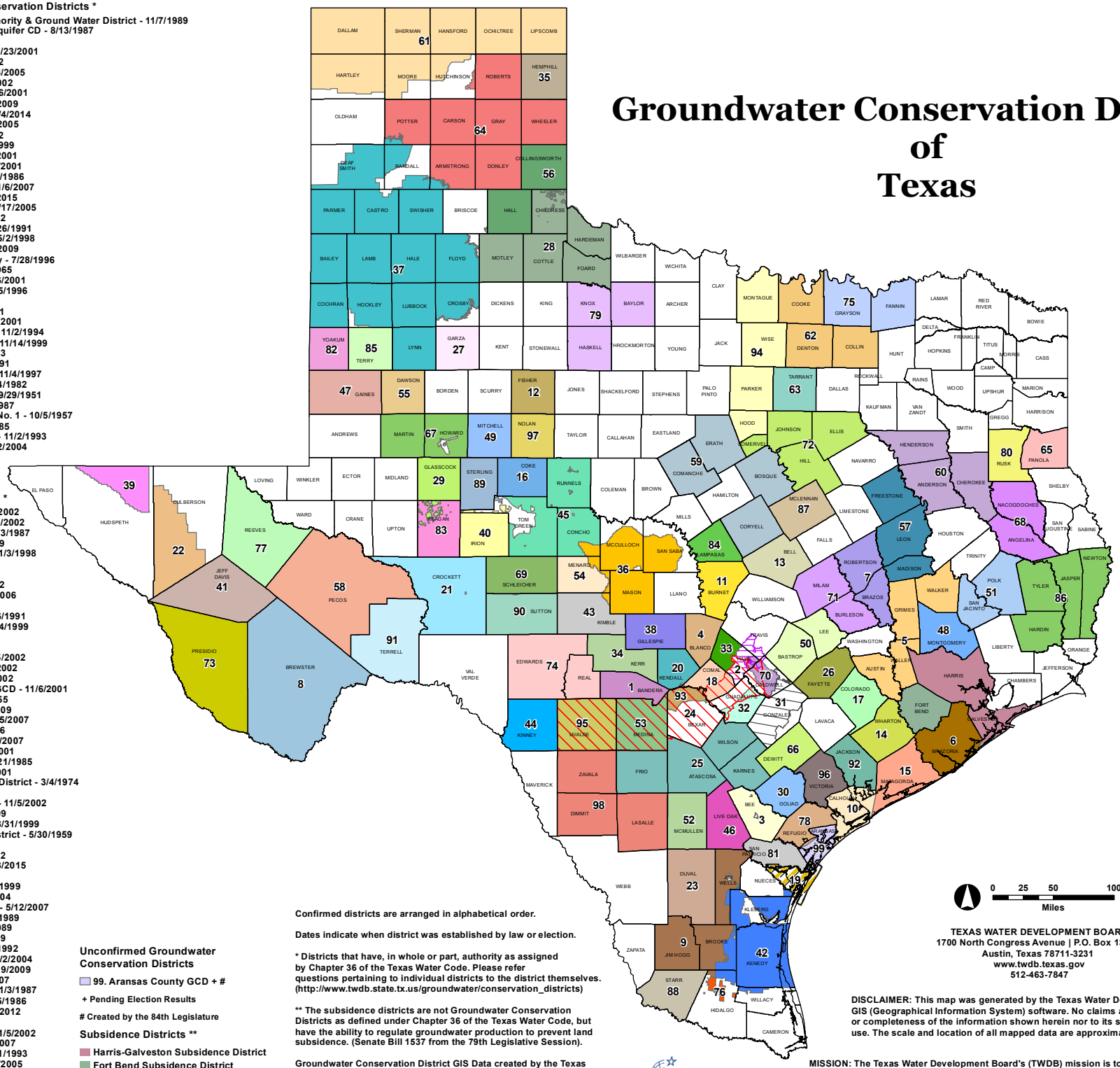
The number of districts grew quickly after the passage of SB 1.[37] Currently, there are ninety-seven confirmed districts and three additional districts pending. Almost ninety percent of groundwater produced in Texas comes from counties with such a district, but much of Texas' land area is not covered by a GCD (these are the GCDs that are not colored in on the map on the next page).[38]

Even with the proliferation of GCDs after SB1 and their increased permitting authority imparted by SB 2, there was little immediate conflict between regulators and users regarding a perceived invasion of property rights. This tension began to increase when the regional planning process brought harbingers of greater regulation, which could affect an unfettered property right in water. This regulatory process combined with a steady increase in demand created the perfect storm between owners and regulators.

The regional planning process as it stands today evolved through a series of legislative efforts, each subsequently responding to deficiencies or challenges that arose. A GMA is defined as an area suitable for the management of groundwater resources.[39] SB2 directed the TWDB to create GMAs using aquifer boundaries or subdivisions. This is very different than the construct of most GCDs, which usually follow political boundaries such as county borders.[40] The purpose

[37] Chris Lehman, *Hung Out to Dry?: Groundwater Conservation Districts and the Continuing Battle to Save Texas's Most Precious Resource*, 35 TEX. TECH L. REV. 101, 104 (2004).
[38] Groundwater, 45 Tex. Prac., Environmental Law § 14.2 (2d ed.).
[39] TEX. WATER CODE ANN. § 35.002(11) (West 2008).
[40] *See* TEX. WATER DEV. BD., Groundwater Conservation Districts, http://www.twdb.state.tx.us/mapping/doc/maps/gcd_only_8x11.pdf.

Groundwater Conservation Districts of Texas



Confirmed Groundwater Conservation Districts *

1. Bandera County River Authority & Ground Water District - 11/7/1989
2. Barton Springs/Edwards Aquifer CD - 8/13/1987
3. Bee GCD - 1/20/2001
4. Blanco-Pedernales GCD - 1/23/2001
5. Bluebonnet GCD - 11/5/2002
6. Brazoria County GCD - 11/8/2005
7. Brazos Valley GCD - 11/5/2002
8. Brewster County GCD - 11/6/2001
9. Brush Country GCD - 11/3/2009
10. Calhoun County GCD - 11/4/2014
11. Central Texas GCD - 9/24/2005
12. Clear Fork GCD - 11/5/2002
13. Clearwater UWCD - 8/21/1999
14. Coastal Bend GCD - 11/6/2001
15. Coastal Plains GCD - 11/6/2001
16. Coke County UWCD - 11/4/1986
17. Colorado County GCD - 11/6/2007
18. Comal Trinity GCD - 6/17/2015
19. Corpus Christi ASRCD - 6/17/2005
20. Cow Creek GCD - 11/5/2002
21. Crockett County GCD - 1/26/1991
22. Culberson County GCD - 5/2/1998
23. Duval County GCD - 7/25/2009
24. Edwards Aquifer Authority - 7/28/1996
25. Evergreen UWCD - 8/30/1965
26. Fayette County GCD - 11/6/2001
27. Garza County UWCD - 11/5/1996
28. Gateway GCD - 5/3/2003
29. Glasscock GCD - 8/22/1981
30. Goliad County GCD - 11/6/2001
31. Gonzales County UWCD - 11/2/1994
32. Guadalupe County GCD - 11/14/1999
33. Hays Trinity GCD - 5/3/2003
34. Headwaters GCD - 11/5/1991
35. Hemphill County UWCD - 11/4/1997
36. Hickory UWCD No. 1 - 8/14/1982
37. High Plains UWCD No.1 - 9/29/1951
38. Hill Country UWCD - 8/8/1987
39. Hudspeth County UWCD No. 1 - 10/5/1957
40. Irion County WCD - 8/2/1985
41. Jeff Davis County UWCD - 11/2/1993
42. Kenedy County GCD - 11/2/2004

Confirmed Groundwater Conservation Districts (Cont.) *

43. Kimble County GCD - 5/3/2002
44. Kinney County GCD - 1/12/2002
45. Lipan-Kickapoo WCD - 11/3/1987
46. Live Oak UWCD - 11/7/1989
47. Llano Estacado UWCD - 11/3/1998
48. Lone Star GCD - 11/6/2001
49. Lone Wolf GCD - 2/2/2002
50. Lost Pines GCD - 11/5/2002
51. Lower Trinity GCD - 11/7/2006
52. McMullen GCD - 11/6/2001
53. Medina County GCD - 8/26/1991
54. Menard County UWD - 8/14/1999
55. Mesa UWCD - 1/20/1990
56. Mesquite GCD - 11/4/1986
57. Mid-East Texas GCD - 11/5/2002
58. Middle Pecos GCD - 11/5/2002
59. Middle Trinity GCD - 5/4/2002
60. Neches & Trinity Valleys GCD - 11/6/2001
61. North Plains GCD - 1/2/1955
62. North Texas GCD - 12/1/2009
63. Northern Trinity GCD - 5/15/2007
64. Panhandle GCD - 1/21/1956
65. Panola County GCD - 11/6/2007
66. Pecan Valley GCD - 11/6/2001
67. Permian Basin UWCD - 9/21/1985
68. Pineywoods GCD - 11/6/2001
69. Plateau UWC and Supply District - 3/4/1974
70. Plum Creek CD - 5/1/1993
71. Post Oak Savannah GCD - 11/5/2002
72. Prairielands GCD - 9/1/2009
73. Presidio County UWCD - 8/31/1999
74. Real-Edwards C and R District - 5/30/1959
75. Red River GCD - 9/1/2009
76. Red Sands GCD - 11/5/2002
77. Reeves County GCD - 11/3/2015
78. Refugio GCD - 11/6/2001
79. Rolling Plains GCD - 1/26/1999
80. Rusk County GCD - 6/5/2004
81. San Patricio County GCD - 5/12/2007
82. Sandy Land UWCD - 11/7/1989
83. Santa Rita UWCD - 8/19/1989
84. Saratoga UWCD - 11/7/1989
85. South Plains UWCD - 2/8/1992
86. Southeast Texas GCD - 11/2/2004
87. Southern Trinity GCD - 6/19/2009
88. Starr County GCD - 1/6/2007
89. Sterling County UWCD - 11/3/1987
90. Sutton County UWCD - 4/5/1986
91. Terrell County GCD - 11/6/2012
92. Texana GCD - 11/6/2001
93. Trinity Glen Rose GCD - 11/5/2002
94. Upper Trinity GCD - 11/6/2007
95. Uvalde County UWCD - 9/1/1993
96. Victoria County GCD - 8/5/2005
97. Wes-Tex GCD - 11/5/2002
98. Wintergarden GCD - 1/17/1998

Unconfirmed Groundwater Conservation Districts

99. Aransas County GCD + #

\+ Pending Election Results

\# Created by the 84th Legislature

Subsidence Districts **

- Harris-Galveston Subsidence District
- Fort Bend Subsidence District
- County Boundaries

Confirmed districts are arranged in alphabetical order.

Dates indicate when district was established by law or election.

* Districts that have, in whole or part, authority as assigned by Chapter 36 of the Texas Water Code. Please refer questions pertaining to individual districts to the district themselves. (http://www.twdb.state.tx.us/groundwater/conservation_districts)

** The subsidence districts are not Groundwater Conservation Districts as defined under Chapter 36 of the Texas Water Code, but have the ability to regulate groundwater production to prevent land subsidence. (Senate Bill 1537 from the 79th Legislative Session).

Groundwater Conservation District GIS Data created by the Texas Commission on Environmental Quality. For more information, please contact TCEQ at 512-239-1000 or wras@tceq.texas.gov.

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Miles

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MISSION: The Texas Water Development Board's (TWDB) mission is to provide leadership, planning, financial assistance, information, and education for the conservation and responsible development of water for Texas.

Texas Water Development Board

of a GMA was to create administrative boundaries. Planning within a GMA is done by the individual GCDs.

There are currently sixteen GMAs in Texas (see map on next page with GMAs, GCDs and Texas Aquifers). Within the GMAs are varying numbers of GCDs. SB 2 commenced the process of linking a GCD's planning with all other GCDs within the GMA. Recognizing the potential for conflict among GCDs regarding the appropriate management of groundwater, the bill directed GCDs within the same GMA to share their groundwater management plans with each other.

Policymakers have also attempted to link regional and district planning with the statewide plan. For example, SB 2 added additional consideration requirements in the regional water plans including impacts of the plan on unique river or stream segments on water quality. Also, the TWDB would approve regional water plans only if the plan included water conservation practices and drought management measures and was consistent with the long-term protection of the state's water, agricultural, and natural resources embodied in the guidance principles for the state plan.

GCDs and GMAs are required to coordinate.[41] This joint planning is intended to generate desired future conditions (DFCs) for an entire management area.[42] A DFC is a way to determine what the region wants the resource to look like in the future. Once a DFC was established, the TWDB prepared final models to translate that goal into a quantity of water, or modeled available groundwater (MAG), that could be extracted annually and over a fifty year period and still meet the DFC.

Districts can use MAGs to structure pumping limits and other regulatory measures to be implemented to ensure that the DFC is met.[43] Planning was meant to maintain the bottom-up procedures created by past legislatures while also creating a big picture for Texas groundwater sustainability. This would then link into the larger State Water Plan, which looks at supply and demand of all water needs across the state and assess potential shortfalls. The plan is completed every five years and projects out over a fifty-year planning horizon.

The continued development of the regional planning process and the apparent authorization of pumping caps to meet MAGs allowed districts to control withdrawals in a way that created legal conflicts between limitations on pumping and the common law rule of capture.

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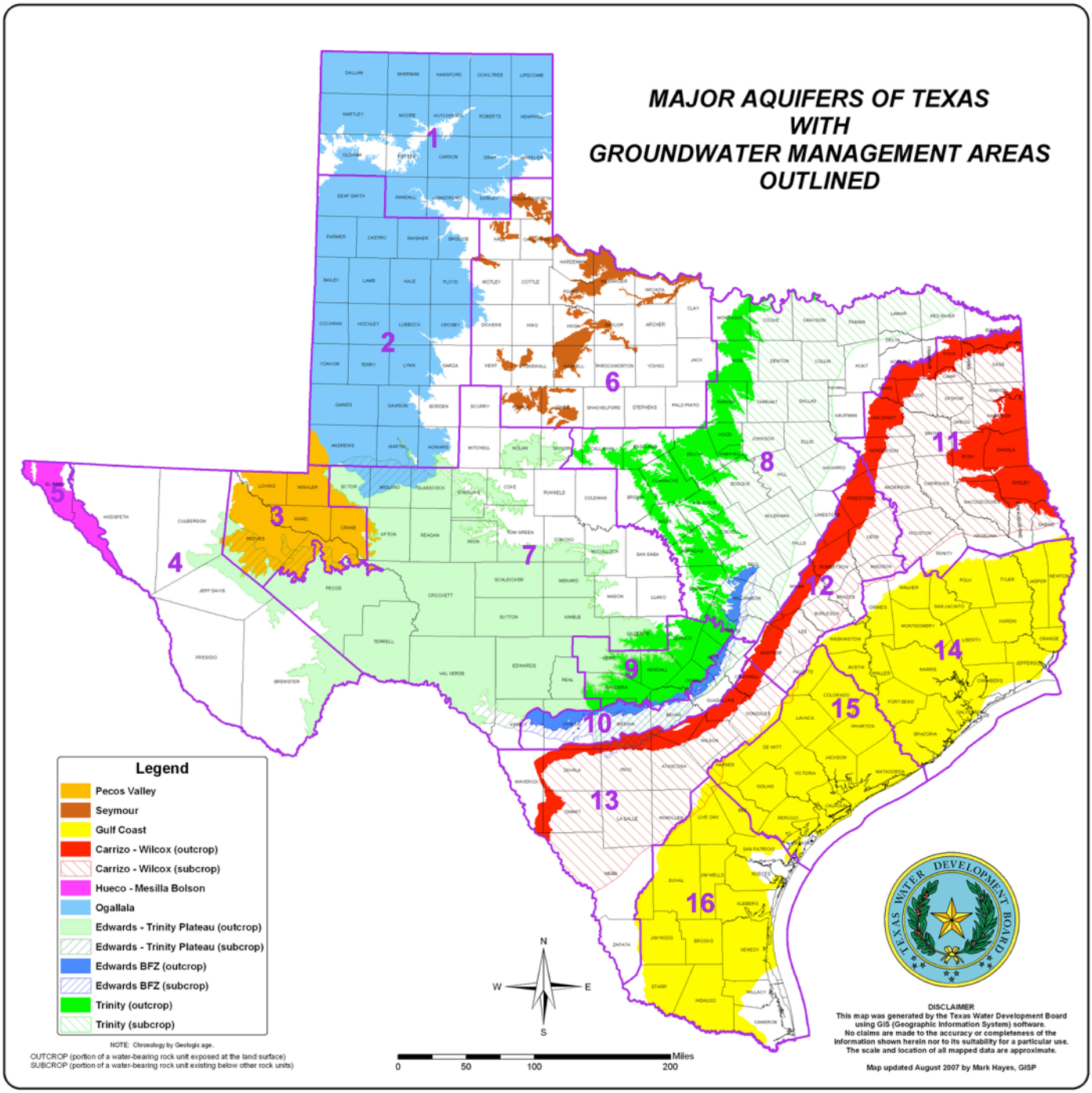
[41] Act of May 30, 2005, 79th Leg., R.S. ch. 970, § 8, 2005 Tex. Gen. Laws 3247, 3254-56 (amending TEX. WATER CODE ANN. § 36.108(c)).

[42] Robert E. Mace et al., *A Streetcar Named Desired Future Conditions: The New Groundwater Availability for Texas (Revised)* 2 Changing Face of Water Rights in Texas State Bar of Texas CLE (2008).

[43] Robert E. Mace et al., *A Streetcar Named Desired Future Conditions: The New Groundwater Availability for Texas (Revised)* 2 Changing Face of Water Rights in Texas State Bar of Texas CLE (2008).


MAJOR AQUIFERS OF TEXAS
WITH
GROUNDWATER MANAGEMENT AREAS
OUTLINED
1
2
3
4
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6
7
8
9
10
11
12
13
14
15
16
Legend
Pecos Valley
Seymour
Gulf Coast
Carrizo - Wilcox (outcrop)
Carrizo - Wilcox (subcrop)
Hueco - Mesilla Bolson
Ogallala
Edwards - Trinity Plateau (outcrop)
Edwards - Trinity Plateau (subcrop)
Edwards BFZ (outcrop)
Edwards BFZ (subcrop)
Trinity (outcrop)
Trinity (subcrop)
NOTE: Chronology by Geologic age.
OUTCROP (portion of a water-bearing rock unit exposed at the land surface)
SUBCROP (portion of a water-bearing rock unit existing below other rock units)
N
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TEXAS WATER DEVELOPMENT BOARD
DISCLAIMER
This map was generated by the Texas Water Development Board using GIS (Geographic Information System) software.
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The scale and location of all mapped data are approximate.
Map updated August 2007 by Mark Hayes, GISP

While this friction was new to most GCDs, special districts were already managing these conflicts.

The Edwards Aquifer: A Special Case

While districts grappled with the ever-changing planning process and how and whether to implement a cap on pumping, the Edwards Aquifer Authority (EAA) was already very familiar with this concept. The EAA is a legislatively created special district formed in response to a federal court ruling on an Endangered Species Act (ESA) claim brought by the Sierra Club.[44] The court ruled that because excessive pumping of the Edwards Aquifer was threatening several endangered species, the state was obligated to create a firm-pumping cap in this region long before it was a statewide discussion.

The Edwards Aquifer is a karst aquifer located in Central Texas covering approximately 3,600 square miles (see map on the next page).[45] The majority of water enters the aquifer primarily along surface streams in an area referred to as the "recharge zone."[46] The aquifer discharges naturally into several springs including Comal and San Marcos Springs. These springs are headwater tributaries for the Guadalupe River, which flows from Central Texas to the Gulf of Mexico. Water is withdrawn from the aquifer primarily through groundwater wells.[47] Many interests are dependent on the aquifer, but the largest user is the City of San Antonio, which depends on the aquifer as its primary water source.[48]

Several endangered species are also dependent on the flow of these headwater springs for their own survival. Among them are the Texas Blind Salamander and the Fountain Darter. These and others threatened species were at the heart of the Sierra Club lawsuit.[49] During the 1950s' drought of record, Comal Springs completely dried up. This would not have happened without the additional depletion created by pumping. Although San Marcos Springs did not totally dry up during the same time period, its flow was considerably diminished due to pumping.

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[44] *See* Act of June 11, 1993, 73d Leg., R.S., ch. 626, § 1.01, 1993 Tex. Gen. Laws 2350, 2350.

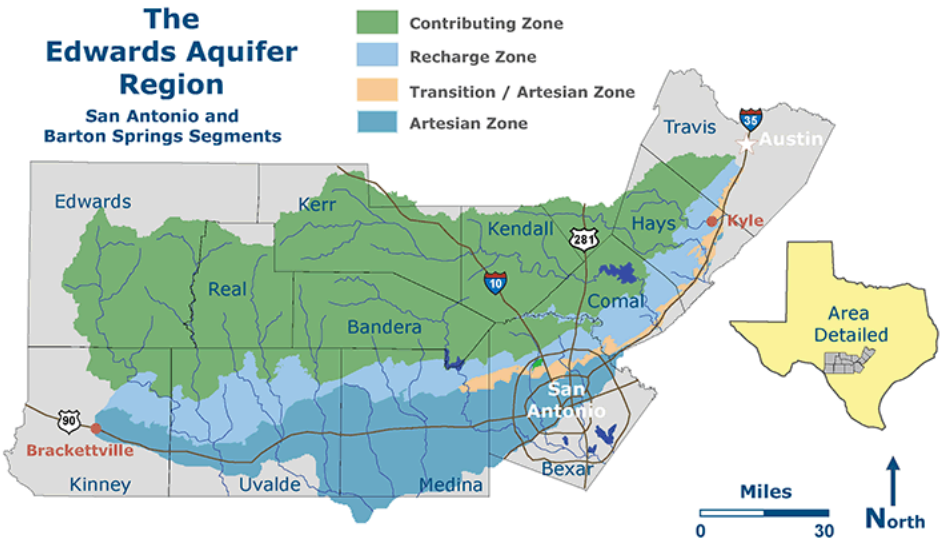
[45] Karst is a geologic landscape created by the dissolution of soluble rocks including limestone, dolomite and gypsum characterized by sinkholes, caves, and underground drainage systems.

[46] Edwards Aquifer Authority, *Hydrogeology of the Edwards Aquifer*, http://www.edwardsaquifer.org/index.php/science_and_research/hydrogeology/.

[47] *Sierra Club v. Lujan*, MO-91-CA-069, 1993 WL 151353, at *3 (W.D. Tex. Feb. 1, 1993).

[48] Darcy Alan Frownfelter, *Edwards Aquifer Authority*, *in* GROUNDWATER LAW AND REGULATION IN ESSENTIALS OF TEXAS WATER RESOURCES 334 (Mary K Sahs ed. 2009).

[49] *Sierra Club v. Lujan*, MO-91-CA-069, 1993 WL 151353, at *9 (W.D. Tex. Feb. 1, 1993).



Source: Edwards Aquifer Authority

Data presented at the Edwards trial showed that, but for human withdrawals, the springs' natural discharge would be stable. Evidence showed that continued pumping would result in extended no-flow periods for the springs in drought conditions. These dry periods would threaten the survival of the species that live there. Despite these known connections between the aquifers and the springs, neither the state nor the GCDs had established pumping limits at the time of the litigation. Sierra Club brought a lawsuit against the Department of the Interior and Fish and Wildlife Service, one of the federal agencies tasked with species protection under the ESA, to compel the Fish and Wildlife Service to take action based on its statutory obligation to complete a recovery plan.

The judge agreed that the federal government failed to implement the recovery plans and did not identify the spring flow requirements for the survival of the species. As a result, the judge ordered Fish and Wildlife Service to determine the minimum springflow for each of the springs needed to protect listed species. Judge Bunton directed the Texas legislature to provide the appropriate management of the aquifer in such a way that the spring flow would be maintained to protect the species. This mandate paved the way for the Edwards Aquifer Authority Act (EAAA) enrolled by the Texas Legislature just four months after the *Sierra Club* judgment was rendered. The EAA is required to manage the aquifer in such a way that flow is protected. While authorized by the same constitutional amendment as other districts, this GCD has additional authority and regulations that others did not.

The biggest difference between the EAA and other districts was the establishment of a firm total pumping limit on the Edwards Aquifer. This cap was derived from scientific data that determined minimal aquifer levels necessary for species protection. The current pumping cap is 572,000 acre-feet per year, which is the sum of all regular permits and all permits under application by January 1, 2005. Texas state law mandates an exemption from permitting requirements for livestock or domestic wells across the state. The EAAA provided a similar exemption for wells producing 25,000 gallons of water a day or less for domestic or livestock

use, but requires that all such wells be registered with the Authority. Wells serving a residential subdivision do not qualify for the exemption. Other permitting exemptions include federal facilities and limited production wells.

The legislation also created a rubric for how permits were to be allocated. Permits were primarily issued to those who could show they used Edwards water in a beneficial way without waste during one calendar year of the historic period from June 1, 1972, through May 31, 1993. Users who could show they used water for three or more years of the historic period were entitled to the average amount used annually. If an irrigator utilized unmetered Edwards water, a permit would be issued for two acre-feet a year per acre irrigated during one year of the historic period, assuming all other permit requirements were met. Historic permit applications had to be received by March 1, 1994. Fifty percent of an irrigation permit is considered a base permit that is limited for use on the land on which it was historically used and cannot be used on property not defined in the permit.

Permit preference was given to existing historic users. New users could only be granted a permit after all historic permits had issued if any water was remaining. No permits could be issued beyond the cap amount. Other than the stated exceptions, it is illegal to pump water from the Edwards Aquifer without an EAA permit. All permits are subject to temporary reduction as part of the EAA's critical period management plan when aquifer levels drop below predetermined levels. Edwards Aquifer water cannot be used outside the district.

Although capture had been maintained in Texas for over one hundred years, the addition of regulations and increased demand for water created many questions about the property interest capture created.[50] One of the issues that persisted was determining when ownership actually began. Did rule of capture only give a landowner the right to use with ownership commencing at the moment of capture or did a landowner have an ownership interest in the water prior to production? The answer to this question became critical in defining regulatory opportunities and constitutional limitations.[51] Although a few cases danced around the issue, the Texas Supreme Court took the issue up directly in *Edwards Aquifer Authority v. Day*.[52] On February 24, 2012, the Texas Supreme Court ruled that landowners have a vested ownership right in groundwater below their land even before it is captured.

In 1994, R. Burrel Day and Joel McDaniel (Day) purchased acreage within the EAA's jurisdiction. Their intent was to grow oats and peanuts as well as graze cattle on the land. Although there was not a working well on the land, there was a lake used for irrigation that was filled by an intermittent creek, overland flow, and some artesian groundwater flow. Day applied for a permit to allow 700 acre-feet of water a year based on evidentiary statements that 300 acres were irrigated during the historic period as well 50 acre-feet for recreational use in the lake.

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[50] Russell Johnson, *Groundwater Law and Regulation, in* ESSENTIALS OF TEXAS WATER RESOURCES 111 (Mary K. Sahs ed. 2009).
[51] See Marvin W. Jones & Andrew Little, *The Ownership of Groundwater in Texas: A Contrived Battle for State Control of Groundwater*, 61 BAYLOR L. REV. 578, 579–80, 592 (2009).
[52] *See Edwards Aquifer Auth. v. Day*, 369 S.W.3d 814 (Tex. 2012).

In 1997, Day received information from the EAA that there was a preliminary finding that he was entitled to 600 acre-feet of water based on the irrigation of the 300 acres. In 1999, after receiving approval from the EAA to change the diversion location, Day drilled a new well, even though the EAA had not yet officially ruled on his permit. In November 2000, the EAA denied the application because it was determined that well "withdrawals . . . were not placed to a beneficial use."[53]

After an administrative appeal, it was found that only seven acres were irrigated using exclusively well water. The administrative law judge determined that water from the lake, which included some overland flow from the artesian well, was surface water and not under EAA authority. Based on the testimony, the administrative law judge determined that the maximum beneficial use of groundwater to earn a permit was fourteen acre-feet calculated from the seven acres that used groundwater directly from the well for irrigation. The EAA agreed and issued a permit in that amount.

Day appealed this finding in trial court, which ultimately worked its way up to the State Supreme Court. The issue that garnered the most attention was whether Day had a constitutionally protected interest in the groundwater in place. The court held that he did. Despite the court's acknowledgement that rule of capture could exist without ownership in place, it held that, in Texas, the two are one and the same. However, the case was remanded to determine the specific issue of whether a taking had occurred in this case. That issue was settled out of court for an undisclosed amount.

The decision in the *Day* case does establish that the right to capture is not without limits. In its opinion, the court continued to recognize the role of districts and the constitutional amendment that allowed for their creation.[54] The opinion also reiterated the regulations that dictate a district's authority to regulate wells.[55] However, excessive regulation would require takings compensation. The court did not provide additional details on what would be considered excessive.

While the *Day* case was pending at the Texas Supreme Court, the 2011 legislative session commenced. As the state awaited a ruling, there were growing concerns on both sides regarding the possible outcome. With Senate Bill (SB) 322, the legislature attempted to settle the question pending before the court in advance of the ruling by amending the Texas Water Code groundwater ownership section.[56] The pertinent part of the final bill read: "the legislature recognizes that the landowner owns the groundwater below the surface of the landowner's land as real property."[57] This interest does not provide an owner the right to capture a specific amount of groundwater below the surface of that landowner's land. It also stated that an owner's

[53] *Edwards Aquifer Auth. v. Day*, 369 S.W.3d 814, 820–21 (Tex. 2012).
[54] *Edwards Aquifer Auth. v. Day*, 369 S.W.3d 814, 833–43 (Tex. 2012).
[55] *Edwards Aquifer Auth. v. Day*, 369 S.W.3d 814, 833–43 (Tex. 2012).
[56] Senate Comm. on Natural Resources, Bill Analysis, Tex. S.B. 332, 82d Leg., R.S. (2011).
[57] TEX. WATER CODE ANN. § 36.002(a) (West 2008).

ability to drill and pump water does not "affect the ability of a district to regulate groundwater production as authorized . . . under Chapter 36.[58] The newly amended statute also recognized the ability of districts to limit drilling based on well spacing or tract size as adopted by the district.

Finally, the bill specified that districts are not required to adopt a rule that "allocate[s] a proportionate share of available groundwater for production from the aquifer based on the number of acres owned by the landowner."[59] Districts are instructed to consider ownership and rights during their creation and enforcement of rules. The bill also contained a special provision for the EAA and other special districts, stating that the "ownership" of groundwater as described in the first part of the bill "does not affect the ability [of the EAA] to regulate" as authorized by the legislature.[60]

Another ownership case that was moving through the courts when the *Day* decision was issued is *Bragg v. Edwards Aquifer Authority*.[61] The Braggs requested groundwater permits from the EAA for two pecan farms, totaling about 625 acre-feet per year. The EAA denied one permit because there had been no pumping within the statutory historical use period. For the other property, the EAA limited the permit to 120 acre-feet per year, based on the two acre-feet per year standard provided in its rules. The Braggs brought a takings claim based on an unconstitutional infringement on their property right to groundwater.

Using the partial economic impacts test set out by *Penn Central Transportation Company v. New York City*, the Medina County district court held that the Braggs were entitled to compensation of $630,000 for the lost value of their water rights.[62] The Fourth Court of Appeals disagreed with the valuation methodology arguing that the valuation be based on a comparison of the land values with water right and those without rights. The Texas Supreme Court refused to hear the case, which was then remanded solely on the valuation issue. On remand, a jury in Medina County District Court awarded the Bragg family $2.55 million in takings compensation plus interest totaling more than $4 million. This number was based on the estimated value of the land with full water rights and land valuation with water actually permitted by the EAA. The *Bragg* decision was the first in the state to recognize property owners can pursue regulatory takings claims after the denial of a groundwater permit, but many questions still remain about the ability of GCDs, and specifically the EAA, to regulate groundwater use.

Many question where this recent legal history places the EAA and its efforts to protect the aquifer from over pumping. Currently, no new permits are available based on the legislative

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[58] TEX. WATER CODE ANN. § 36.002(d)(2) (West 2008).
[59] TEX. WATER CODE ANN. § 36.002(d)(3) (West 2008).
[60] TEX. WATER CODE ANN. § 36.002(e)(1) (West 2008).
[61] *Bragg v. Edwards Aquifer Auth.*, Cause No. 06-11-18170-CV, 38th Dist. Court, Medina County, TX (May 7, 2010); *Bragg v. Edwards Aquifer Auth.,* 342 F. App'x 43, 45 (5th Cir. 2009).
[62] *Bragg v. Edwards Aquifer Auth.*, Cause No. 06-11-18170-CV, 38th Dist. Court, Medina County, TX (May 7, 2010).

pumping cap. The continuing legal concern is how many applicants are similarly situated as the Bragg or Day families - landowners who applied to water permits but were denied based on their inability to show pumping during the historic period defined by the EAAA. If there are a lot of them, the takings penalties could be substantial thus threatening the financial viability of the EAA and impact the Edwards marketplace. Outside the Edwards, it is equally unclear what the *Day* decision means for GCDs wishing to promulgate new regulations and ensure compliance with the groundwater planning process. It is clear that landowners have a property right, but it is equally clear that GCDs have a right to regulate that groundwater. What is unclear is when that regulation goes too far. This boundary can only be answered in time by court rulings on individual takings claims brought by landowners.

The Texas Groundwater Market

Any discussions about groundwater markets in Texas must be divided into three categories: 1) water governed by the Edwards Aquifer Authority; 2) water regulated by other GCDs; and 3) water under land located outside of a district. Due to varying regulatory structures, the potential for markets in each category varies.

A primary issue that arises when discussing sale and transport of groundwater is the physical impediments associated with moving water from a seller to a buyer. Texas is geographically large and annual precipitation rates range from less than fourteen inches of rainfall per year to above fifty-four inches ranging from west to east. This means that areas of plenty and areas of need can be vastly far apart. Population corridors are essentially located near two interstate highways that quadrisect the state.

A statewide market is only a possibility if water can be moved great distances. Currently, no infrastructure exists for such a project. Even an evaluation of regional water sales requires extensive construction budgets. For example, the city of San Antonio completed a contract to transport 50,000 acre-feet of groundwater annually from a nearby aquifer. At a total cost of 3.4 billion dollars, much of the projected expense is dedicated to the acquisition of water rights, permits and right-of-way easements. The cost of constructing the 142 mile pipeline is estimated to be $885 million.

Additionally, there is not a centralized marketplace where buyers and sellers can come together and make these transactions. Currently, the purchasing or leasing of water rights is a private contract transaction with no recorded data of price. This scenario leads to missed transaction opportunities when buyers are not matched with sellers. Also, because these transfers are private, there is not consistent pricing to reflect valuation.

Finally, long-term protection of the water resource is difficult due to the existing regulatory regime. As will be discussed later, right of capture can put the long-term sustainability of the aquifer at risk and devalue existing water rights. Also, the lack of legal recognition of the connectivity between surface water and groundwater creates many unintended consequences including depletion of surface water by over-pumping of groundwater and visa versa.

Despite these impediments, several large groundwater transactions have taken place around the state. Most commonly, the buyer is a city looking to diversify water sources. One example can be found in the Texas panhandle where T. Boone Pickens purchased the groundwater right associated with 211,000 acres of land for $130 million. The water rights have been estimated to yield up to four trillion gallons of water (12,276 acre-feet). He then sold those rights to the Canadian River Municipal Water Authority to be used by Amarillo and Lubbock citizens, who overly the same aquifer. Unfortunately, this water comes from the Ogallala aquifer, which is considered a fossil aquifer making this project unsustainable over the long term. Pickens hoped to find a buyer further away such as San Antonio or Dallas, but the price was too high. Most recently, there is the San Antonio project discussed above.

1) Edwards Water Market

The Edwards water market has been the most successful Texas groundwater market to date for several reasons. First and foremost, the aquifer is managed closely by a regulatory agency and there is a limited amount of water permits available. Although initial permits were essentially free, over time the value has increased because no new permits will be issued while demand for the water continues to increase. Unlike in other GCDs, where it is often easier to purchase land and apply for a new permit, all the Edwards permits have already been issued. Second, there are much fewer impediments to transfers in the Edwards meaning fewer opportunities for a transfer application to be denied – particularly for a change in withdrawal location. In practice, permits will only be denied if the water is not present due to a previous transfer of the same water or other title inconsistencies.

Generally, a transfer permit is easier within the Edwards than in other regulated aquifers because of the aquifer's characteristics. Water moves very quickly through the aquifer and recharges more like a lake than a subsurface aquifer. Because of its confined nature, the aquifer has a very consistent drawdown across its expanse, meaning that one neighbor cannot pump another dry by drawing down the aquifer regionally. Instead the aquifer can be managed as a whole. This provides more opportunities to use water throughout the aquifer.

When the EAA first formed, water could be transferred on paper between users located on opposite sides of the aquifer shifting the point of withdrawal without an issue. A few years ago, a limitation was added because of concerns about large water transfers from west to the east that might negatively impact spring flow. This is referred to as the Cibolo Creek Prohibition.[63] This rule puts additional obligations on water transfers from west of Cibolo Creek to a user on the east side to show that the spring flow will not be impacted. Interestingly, this rule has created a market within the market. Water east of the creek is twice the price (up to $10,000 an acre-foot) because the purchaser takes free of the limitation. There is no issue with water being moved from east to the west.

[63] Cibolo Creek is roughly located between Bexar County to the west of the creek and Hays and Comal Counties on the east. These eastern counties house Comal and San Marcos Springs.

One major limitation of the Edwards market is the prohibition on exportation of water for use outside the aquifer. That being said, because of San Antonio and other nearby municipalities, the population within the EAA jurisdiction is considerable. An additional weakness in this market is the various types of exempt wells, which are not metered. These include domestic or irrigation wells, federal facilities and limited production wells. While not requiring a permit application, the owners of limited production wells are required to meter and report. Domestic and livestock wells, which can pump up to 25,000 gallons a day, do need to be registered and cannot have a pump capable of exceeding the daily amount. Otherwise, they are not regulated. Despite these exemptions, water permit values in the Edwards have increased consistently since the formation of the EAA. Original permits were issued for free or requiring only a small filing agree. Now they can sell for transfer at $5,000 to 10,000 per acre-foott depending on location and type of permit.

An additional limit on transfer is applied to irrigation water. The majority of Edwards permits were issued based on historic use. Many of these were for irrigation purposes. While most permit types can be freely transferred, only a portion of these permits can. As mentioned above, fifty percent of an irrigation permit is considered a base permit that is limited for use on the land on which it was historically used. The other fifty percent is considered unrestricted and can be transferred throughout the Edwards Aquifer for any desired use. This limits makes half of all irrigation permits unavailable for market transfers outside of being included in a sale of the surface estate.

Unlike in other GCDs there is more of a marketplace in the Edwards. While the EAA does not manage or track sales, they do provide a location on their website for willing sellers to list their permits. Transactions from this website are usually short-term leases for small amounts of water. Purchasers using the website generally wish to acquire that water for use in a drought year, particularly when their permits are reduced by drought management obligations prescribed in the EAAA. Large water purchases, to the extent that they occur, are accomplished using a similar mechanism as other GCDs. A buyer simply contacts permit holders based on the quantity needed and propose a sale. All transactions are completed through private conveyance using a warranty deed. Although the EAA does not track pricing, they do ask for voluntary reporting, with mixed success. EAA officials estimate the current price is $5,000 per acre-foot.

The newest challenges to this market are the rulings in the *Day* and *Bragg* cases. Because both of those cases named the EAA as the defendant, the agency is in the cross hairs of the regulatory uncertainty that these cases created. Further, they are not liable for a $4 million judgment despite the fact that the permitting scheme they were implementing was actually created by the Texas legislature. Because the EAAA is statutory, the agency is obligated to continue permitting the same way.

Currently, the *Bragg* case is the only takings data point the state has so more cases are required before regulatory limitations are fully understood. These cases take time and may have a chilling effect on market transfers in the Edwards and in other groundwater districts until that information is clear.

2) GCD Water Market

Although not as ideal as the Edwards, markets within other GCDs have promise. As the regional planning process continues and GCDs are required to permit groundwater to meet their DFCs there is a possibility of an Edwards-like market forming. Ideally, the MAG information provided by TWDB would create enough information to create a cap on pumping and allow the market to work as it has in the Edwards. Unfortunately, many GCDs are permitting in a way that is not sustainable. For now this limits market activity and keeps prices low.

Perhaps the biggest threat to the development of markets in these areas is the lack of consistent regulation to ensure aquifer sustainability. In most Texas aquifers, other than the Edwards, multiple GCDs manage the same aquifer. Although the regional planning process aims to require districts to coordinate their management by identifying the aquifer DFC, the reality is that each district has the legal authority to permit as they see fit. While one GCD attempts to limit the allocation of permits to protect the aquifer and increase the value of permits, a neighboring GCD may have a much less stringent regulation system.

Permitting rules are promulgated by a publically elected board of directors, who often have no scientific expertise and are vulnerable to political influence. Another weakness of buying water from within a GCD is the risk of someone accessing the same aquifer water from a neighboring area free from regulation. In that case, even the best run GCD can be undermined by unfettered pumping in nearby areas. Even within the districts or groups of districts that are more stringent, most do not require metering or reporting of water use by permit holders, which limits their ability to really manage the aquifer. Finally, the same issue presented above concerning exempt wells is present in all GCDs.[64] This cumulative lack of data suppresses the value of existing permits because there is no guarantee there will be yield over the life of the permit.

Current permitting rules can create obstacles to market efficacy. As dictated by law, permits are limited to user, location and purpose. Because a permit can also be limited based on well spacing or surface ownership, a project developer will have to acquire water, by lease or purchase, from several landowners to have enough water for the full project. Another issue is obtaining a permit for the lifetime of the water project. Many permits are for terms as short as one year. This impedes the ability to sell water to a buyer requiring a firm yield for many decades.

As mentioned above, the lack of an organized or central marketplace is another substantial impediment to market transfers. Currently, within GCDs if someone wishes to purchases an existing permit, the only way to locate a potential seller is to request a list of permit holders from the GCD and contact each directly with the request. If a seller is located and a deal

[64] Wells that qualify as exempt under Chapter 36 are domestic and livestock wells and wells used for drilling and exploration of oil and gas. The latter exemption has been increasing important recently when hydraulic fracturing increased throughout the state. A normal fracking operation can require 4-6 million gallons per well without regulation by a GCD.

is made, the GCD does not track the price of the transfer. Therefore, there is no known value for permits in any given location. In fact, the only "approval" mechanism that a GCD may have, depending on their regulations, is within the permit transfer application.

When a permit transfers ownership, the GCD may require the new owner to apply for a transfer with any and all proposed changes to the existing permit including owner's name, place of withdrawal and location of use. This provides some limited authority for the GCD to deny the transfer permit, but their criteria for review and denial are very limited by Chapter 36, which provides only general permitting guidelines such as aquifer protection and ensuring beneficial use of water.[65] Recently, a GCD denied a permit transfer because of concerns that moving the point of use outside the aquifer boundaries would negatively impact recharge. This type of permit transfer does also require public notice and can trigger a contested case hearing if there is public opposition.

The *Guitar* ruling also impacts any potential water market within a GCD. By stripping a historic permit of its uniqueness when transferred, sales, except for use on the original tract, are dissuaded. This rule along with other transfer limitations that may exist in a GCD create a situation where a buyer might be better off just purchasing tracts within the district and applying for new permits. This type of arrangement recently occurred in El Paso, Texas when the city purchased ranch property 100 miles away to gain groundwater rights. The city is considering similar purchases from even further away.

Adding to the regulatory challenge are the recent verdicts in the *Day* & *Bragg*. The determination that groundwater ownership is held in place creates questions about when regulation becomes a compensatory taking under the 5th Amendment. The subsequent monetary judgment in *Bragg* only underlines the risk of overregulating to the point of a payment amounts many GCDs cannot afford. GCDs are now trapped between aquifer management and property rights in a way they have not been before with very little legal guidance to determine the permissive regulatory limits. Due to all the above-discussed impediments and the relative ease with which someone can purchase land for the purpose of receiving a new permit, there currently is not an active water market within GCDs.

To increase the amount of water transfers possible within GCDs, several things must happen. First, a marketplace must be established where buyers and sellers can locate one another and pricing is both tracked and made public. Second, there are several regulatory changes needed to protect permit owners by protecting their purchase. Individual GCDs need to do a better job with data collection and aquifer management, including registration and metering of domestic and livestock wells.

On a state level, GCDs need more guidance about how to review permit transfers. This would provide more authority to deny them when the aquifer will be harmed, thus protecting existing interests while still providing for a market to take shape. Also, repealing the rule exempting all water wells associated with drilling and exploration, or at the very least requiring

[65] TEX. WATER CODE ANN. § 36.101 (West 2008).

metering and reporting, would greatly assist many GCDs in their water management efforts. Texas prefers a local approach for groundwater, which is why GCDs have been empowered; therefore, any regulatory changes need to focus on this bottom-up concept. There is little to no political will for a top-down statewide regulatory approach to groundwater management.

3) Rule of Capture Market

Unlike the previous two scenarios, in these areas, there is no regulation to manage pumping. Groundwater underneath land located outside a GCD is governed by the Absolute Ownership doctrine defined in the *Day* case. In these areas, it is truly the law of the biggest pump and there is no liability if one owner drains a neighbor's water. In these areas, buying and selling usually takes two forms. A surface estate holder can separate the water rights from the surface estate and sell them to a buyer who intends to move and sell the water to third party. Second, a water marketer can actually purchase a small surface estate, which still includes the groundwater, and install her own pump to use the water locally or for export.

While a market is possible under these conditions, it has its weaknesses. First, the incentive in right of capture areas is to pump first and pump more in order to beat the competition and maximize the return on investment. In these locations, because there is nothing in place to protect the aquifer, it lead to detrimental mining as pumping outpaces recharge. Second, as there is no accountability between users, there is also no consideration of the environment. This is particularly damaging in areas where surface resources are reliant on groundwater source waters. While this market might be lucrative, it may also be short-lived because of the lack of incentives for sustainable pumping.

There is also limited demand for water within the unregulated market because any landowner desiring water can easily install their own well and pump what they need. The most likely scenario in these areas is a buyer from an area within a regulated district who needs a large quantity of water. Of course, this is a high-risk purchase because of the upfront capital to build the transportation infrastructure for water that may not be there in the future due to a lack of regulation. If the purchaser is a local governmental entity like a municipality, there are likely legal issues with the long-term debt associated with the project as the Texas Constitution limits this possibility except in certain circumstances.

Pricing water can also be difficult in an unregulated market because there is no known cap or quantity of supply. When water is plentiful, it follows that the price will be low. Price may not match value until the water source is depleted, which encourages destruction of the resource. The fact that there are no protections of the source may be a disincentive for a purchaser because there is no guarantee the water will be present over the long term.

Little can be done under the current legal system to alleviate these issues. The property rights established in *Day* cannot be abridged by the legislature without takings compensation obligations. Any legal modifications would have to be done in a way that does not infringe the current right. In addition to the legal limitations, there is also little political will to alter this rule.

Although many water experts and environmental advocates[66] hold grave concerns about the right of capture, Texas is generally a very strong property rights state and powerful lobbying groups like the Texas Farm Bureau view absolute ownership as gospel.

One consideration is to add a correlative rights doctrine, which would recognize that each person has a fair share right to capture the water under his or her land. Another alternative is to borrow the concept of pooling and unitization from oil and gas to at least compensate those owners being drained by a neighboring property. The addition of the latter might actually inhibit a market because someone pumping may need to pay others from their proceeds. Finally, landowners can agree to a limiting protocol that creates a pumping cap in order to maintain the valuation of the each individual's rights.

The current situation in Texas provides many lessons about potential groundwater markets. First, some legal regulation is necessary if one of the market goals is protection of the aquifer or water resource. Without a management protocol, a market can exist, but it will only survive until the resource is depleted, which significantly reduces the long term value of a water right. Regulation might include a pumping cap for current permit value to increase. When supply is limited as demand increases, like the Edwards situation, increased valuation encourages a market. Another lesson from the Edwards is that market conditions must be tied to aquifer conditions. Because of its unique geology, location of withdrawal in the Edwards is far less of an issue than most other aquifers. Other aquifers would need additional protocols to evaluate potential hydrologic impacts of a transfer. Comparative market evaluation across Texas ultimately demonstrates a range of best and worst practices as well as physical challenges presented when water must be moved long distances. Although water markets are often discussed as a solution to water inequity across the state, it is clear that much needs to be done before that is a viable possibility.

[66] It is worth noting, that there are very few statewide environment-centric water policy advocates/organizations in the state and those that do exist have limited resources.