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***845** THE LITTLE FISH THAT ROARED: THE ENDANGERED SPECIES ACT, STATE GROUNDWATER LAW, AND PRIVATE PROPERTY RIGHTS COLLIDE OVER THE TEXAS EDWARDS AQUIFER

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Abstract

The Edwards Aquifer is the sole source of water for San Antonio, Texas. The Aquifer contributes surface water flow in the Guadalupe River through Comal and San Marcos Springs, both of which are home to endangered aquatic species, including the fountain darter. In 1993, a U.S. district court ruled that the Secretary of the Interior allowed takings under the Endangered Species Act (ESA) by not ensuring adequate flows from the Springs. The Texas legislature responded to a court mandated deadline to protect springflow by establishing the Edwards Aquifer Authority (EAA) to regulate groundwater withdrawals. In 1996, as a

severe drought affected the region, the Texas Supreme Court overturned a state trial court ruling that EAA was unconstitutional. During a second ESA suit alleging that groundwater pumpers were causing takes of endangered species, the U.S. district court ordered the implementation of a plan to reduce pumping from the Aquifer. The court's order was later vacated and the litigation continues.

I. Introduction

The Edwards Aquifer region has finally reached the point where the Aquifer is unable to provide for the needs of all those who depend upon it during dry years, from persons directly over the Aquifer, to those persons and endangered species at Comal and San Marcos Springs. Without a fundamental change in the value the region places on freshwater, a major effort to conserve and reuse Aquifer water, and implemented plans to import supplemental supplies of water, the region's quality of life and economic future are imperiled. [FN1]

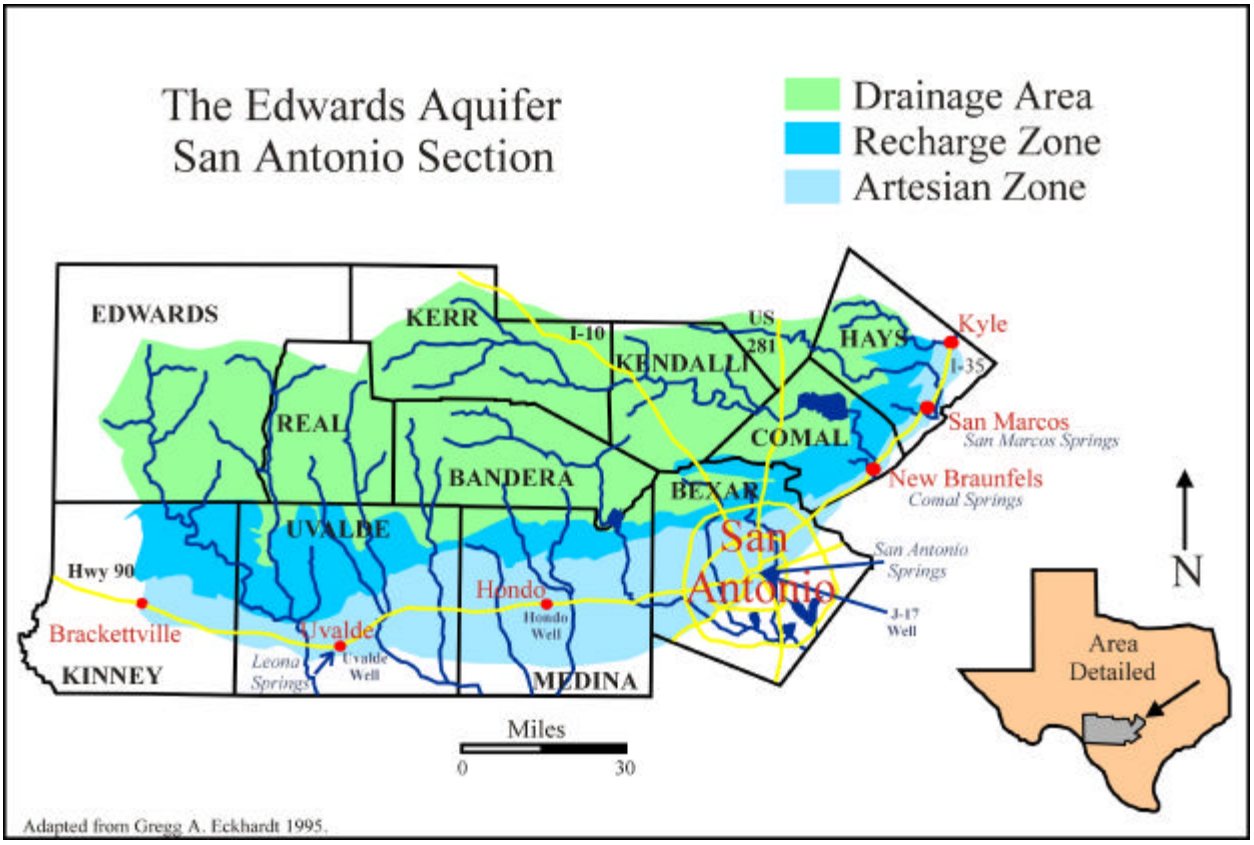
These words at the beginning of the order mandating federal management of the Edwards Aquifer on August 23, 1996 were the result of decades of political and legal stalemate over the sole source of water for San ***846** Antonio -- the Edwards Aquifer (Figure 1). [FN2] Decades of disagreements among local, regional, state, and federal governments, five years of federal litigation, and one year of severe drought preceded the U.S. district court's attempt to protect endangered species dependent upon springflows from the Edwards Aquifer through a court mandated drought management plan.

Management of the Edwards Aquifer has been a controversial and divisive issue for over forty years. Bitter conflicts have erupted between rural and urban interests, and between pumpers and those living downstream of its spring outlets who depend on springflows for their surface water. Some have demanded regulation of groundwater withdrawals, while others have contended that such limitations would violate private

property rights under the Texas Constitution [FN3] and the Fifth Amendment to the U.S. Constitution. [FN4]

The Endangered Species Act (ESA) [FN5] became the instrument that eventually brought state regulation to the Aquifer and the end to unrestricted withdrawals of groundwater. Across the western United States, the ESA implementation is clashing with the overutilization of water resources with increasing frequency. [FN6]

Figure 1. Edwards Aquifer Region



II. Description of the Edwards Aquifer

The Edwards Aquifer (Aquifer) is a complexly faulted karst groundwater formation underlying portions of south-central Texas. It is the sole source of water for

about two million people. [FN7] It supports the economy of San Antonio, the agriculture-based counties west of the city, and the communities in the Guadalupe River Basin all the way to the Texas Gulf Coast. The Aquifer flows generally east from the Texas and Mexico border to San Antonio and then feeds the Guadalupe River through Comal Springs and San Marcos Springs, both of which are home to federally listed, threatened and endangered species. [FN8]

A simple analogy of the complex Aquifer likens it to a bucket with different sized holes from top to bottom that represent the springs. If the bucket is full of water, the water flows from all the holes. As the water level declines, flow from each hole decreases until the lower edge of each ***848** downward hole is reached, and then flow ceases. San Antonio, Comal, and San Marcos Springs are the major holes in the bucket. They are also the sources of rivers of the same name, all of which eventually flow into the Guadalupe River.

The Aquifer is very transmissive and therefore dependent upon the highly-variable annual rainfall for recharge. During droughts, springflow from the Edwards Aquifer can become almost the sole source of flow downstream into the Guadalupe River. Comal Springs and San Marcos Springs are the two largest springs in Texas, as well as the southwest United States. [FN9] Normally, flows from these springs contribute a significant portion of the downstream flow to the Guadalupe River during droughts--81.7% at one point during the summer of 1996. [FN10] In years of below-normal rainfall and low recharge, withdrawals from wells are highest, thereby accelerating water level decline and reducing springflow.

Approximately seventy percent of the recharge to the Aquifer occurs west of San Antonio in Kinney, Medina, and Uvalde Counties. [FN11] Across the Aquifer region, rainfall averages twenty-two to thirty-six inches annually, with twenty-two to twenty-nine inches falling over Kinney, Medina, and Uvalde Counties. [FN12] The average annual recharge to the Aquifer over the period of record from 1934 to 1997 has been 676,000 acre-feet (Table 1). [FN13] During the record withdrawal year of 1989, 542,400 acre-feet were pumped from the Aquifer. [FN14] Record high and low recharge

amounts have been 2,486,000 acre- feet and 43,700 acre-feet. [FN15] In regions where the climate is relatively dry, such as the Edwards Aquifer region, runoff tends to be more variable than in regions that receive more rainfall. [FN16] The large variations in recharge make water supply planning extremely difficult in the Edwards Aquifer region. The challenge is made even greater in the absence of readily available water supply alternatives.

***849** Table 1. Edwards Aquifer Water Facts at a Glance [FN17]

An Acre-Foot	325,851 gallons of water
Average Annual Recharge (1934-1997)	676,000 acre-feet
Average Annual Discharge from All Edwards Aquifer Springs (1934-1997) [FN18]	363,700 acre-feet
Median Annual Recharge, 1934-1997	547,100 acre-feet
Record Lowest Recharge (1956)	43,700 acre-feet
Record Highest Recharge (1992)	2,486,000 acre-feet
Record Withdrawals (1989) [FN19]	542,400 acre-feet

A. History and Present Use of the Aquifer

Humans have relied upon the springs for thousands of years. San Antonio Springs in San Antonio was visited by Cabeza de Vaca in 1535, and eventually supplied water for irrigation through acequias built around Spanish missions. [FN20] San Pedro Springs in San Antonio was established as a public park in 1729 by King Philip V of Spain, making it the second oldest park in the United States. [FN21] The Tehuacana Indians once occupied the Comal Springs area. [FN22] In 1845, German immigrants led by Prince Carl Solms-Braunfels settled in the Comal Springs area, establishing New Braunfels. [FN23] San Marcos Springs had been occupied by Tonkawa Indians for six hundred years before the Spanish arrived. [FN24] San Marcos Springs were also the location of a Spanish

mission from 1755 to 1756. [FN25] Uvalde, Texas was established because of the existence of Leona Springs. [FN26]

***850** Even though the use of artesian wells from the Aquifer dates back to at least the 1880s, the pumping of groundwater began in earnest during the 1950s. [FN27] Today the Edwards Aquifer supplies high quality water to urban, agricultural, industrial, and recreational users. [FN28] The quality and quantity of water supplied throughout most of the history of the region have been so high that San Antonio relied on the Aquifer as its only source of water. San Antonio has not built the infrastructure necessary to deliver or treat surface water needed to supply the city in the event of a prolonged drought or to accommodate future growth. Even though the city is located at the edge of a subhumid region, the cost of water in San Antonio has, until recently, been among the lowest of any major metropolitan area in Texas. [FN29]

One of the fastest-growing uses of Edwards Aquifer water over the last fifty years has been irrigated agriculture. [FN30] Much of the irrigation relies on inefficient irrigation techniques. Because the cost of water to the farmer has been only the cost of the well and the energy to pump water from the Aquifer, few incentives have existed to encourage farmers to adopt more efficient irrigation methods.

There is general agreement that somewhere south of the Edwards Aquifer downdip, a "bad water line" separates the area of usable groundwater from the area where wells produce water of unacceptable quality. The bad water line has not been precisely delineated. There is disagreement among knowledgeable persons as to the risk of this line moving as the result of withdrawing large quantities of water from the Edwards Aquifer during dry years. Research regarding the bad water line has produced conflicting conclusions. Both those who fear the intrusion of bad water into the freshwater zone and those who contend it is not a problem cite as their authority the same U.S. Geological Survey (USGS) publication that describes its existence. [FN31] The possibility of saline water encroachment has been a concern since a drought in the 1950s, when residents reported that some freshwater wells on the southern edge of the Aquifer experienced an intrusion of highly mineralized water. The bad water line exists in close

proximity to both Comal and San Marcos Springs where endangered aquatic species reside.

***851** B. Threatened and Endangered Species

The Edwards Aquifer is considered one of the most diverse aquifer ecosystems in the world. [FN32] Within the Aquifer, species exist that are found nowhere else and about which little is known. Species of unique blind catfish are occasionally pumped out of the Aquifer from great depths. [FN33] The U.S. Fish and Wildlife Service (USFWS) considers the Comal and San Marcos Springs ecosystems to have one of the greatest known diversities of organisms of any aquatic ecosystem in the Southwest. [FN34] This is due in part to the constant nature of the temperature and flow of the Aquifer waters that have created unique ecosystems supporting a high degree of endemism. [FN35] At Comal and San Marcos Springs, one threatened and seven endangered species, which live in the Springs' openings and in the rivers and lakes originating from the Springs, have been listed by USFWS. The San Marcos salamander (Eurycea nana) is listed as threatened. The San Marcos gambusia (Gambusia georgei), Texas wild rice (Zizania texana), fountain darter (Etheostoma fonticola), Texas blind salamander (Typhlomolge rathbuni), Comal Springs riffle beetle (Heterelmis comalensis), Comal Springs dryopid beetle (Stygoparnus comalensis), and Peck's cave amphipod (Stygobromus pecki) are listed as endangered. [FN36] The fountain darter and Comal Springs riffle beetle are the only species listed at both Comal Springs and San Marcos Springs. The USFWS recovery priority for each of the listed species indicates that each faces a high degree of threat and a low potential for recovery, and that each species is in conflict with development projects or other forms of economic activity. [FN37] Critical habitat has been designated only at San Marcos Springs. [FN38]

During dry periods, pumping from the Aquifer increases and flow from the Springs can diminish to critical levels. This alters the aquatic habitat, causing "takes" of species listed under the ESA, and reduces the ***852** flow of surface water downstream.

Extremely low or nonexistent flow from the Springs places the species in "jeopardy" (Tables 2 and 3). [FN39]

***853** The fountain darter at Comal Springs is typically the first species to be affected by declining springflow, and therefore the population of the darter serves as an early warning indicator of stress to the Edwards Aquifer system. A flow rate of 200 cubic feet per second (cfs) at Comal Springs, below which a taking can occur, is the tripwire for ESA litigation. [FN42] When fountain darters are being taken, flows from the Aquifer are diminishing to the Springs as well as to downstream ecosystems and users in the Guadalupe River system. The Guadalupe River also provides freshwater inflows for San Antonio Bay, winter home of the endangered whooping crane (Grus americana).

Table 2. Required Springflows for Threatened and Endangered Species at Comal Springs [FN40]

Species	Status	Conditions	Minimum Flow To Avoid Take	Minimum Flow To Avoid Jeopardy	Minimum Flow To Avoid Habitat Modification
Fountain Darter	Endangered	Current Conditions	200 cfs	150 cfs for short, undefined periods	--
" "	" "	Ramshorn Snail Controlled	150 cfs	60 cfs for short, undefined periods***	--
Comal Springs riffle beetle	Endangered	--	YTBD**	YTBD	--
Comal Springs dryopid beetle	Endangered	--	YTBD	YTBD	--
Peck's cave amphipod	Endangered	--	YTBD	YTBD	--

*cfs = cubic feet per second

**YTBD = yet to be determined

Table 3. Required Springflows for Threatened and Endangered Species at San Marcos Springs [FN41]

Species	Status	Special Conditions	Minimum Flow to Avoid Take	Minimum Flow To Avoid Jeopardy	Minimum Flow To Avoid Habitat Modification
San Marcos Salamander	Threatened (CH)	Current Conditions	60 cfs*	60 cfs	60 cfs
Fountain Darter	Endangered (CH)	Current Conditions	100 cfs	100 cfs	100 cfs
" "	" "	Aquifer Management Plan & Control of Exotics	--	An undefined cfs <100, for short, undefined periods	An undefined cfs <100, for short, undefined periods
San Marcos Gambusia	Endangered (CH)	Current Conditions	100 cfs	100 cfs	100 cfs
" "	" "	Aquifer Management Plan & Control of Exotics	--	An undefined cfs <100, for short, undefined periods	An undefined cfs <100, for short, undefined periods
Texas Blind Salamander	Endangered	Current Conditions	50 cfs	50 cfs	--
Texas Wild-Rice	Endangered (CH)	Current Conditions	100 cfs	100 cfs	100 cfs
" "	" "	Aquifer Management Plan & Control of Exotics	--	An undefined cfs <100, for short, undefined periods	An undefined cfs <100, for short, undefined periods
Comal Springs riffle beetle	Endangered	--	YTBD**	YTBD	--

CH = Critical habitat designated. Critical habitat is the geographical area including, but not limited to, the area occupied by the species, for which special management considerations are required (Endangered Species Act of 1973, Sec. 3(5)(A).

*cfs = cubic feet per second

**YTBD = yet to be determined

Additional water could be pumped from the Edwards Aquifer in low rainfall years with the control of the giant rams-horn snail (Marisa conuarietis). The snail is a large discoidal snail, native to northern South America and southern Central America, that has been a common aquarium snail sold by pet dealers; it is likely that specimens were released into the Comal and San Marcos Rivers by aquarists. [FN43] Areas of Landa Lake, into which Comal Springs flows, supported large masses of aquatic plants until recently. Landa Lake has been severely denuded by the snails, resulting in a loss of cover, refuge, and food supply, making fountain darters more susceptible to predation. The giant rams-horn snail population is likely to ***854** increase during periods of diminished springflow. The snails could indirectly be the biological agent in part responsible for the demise of fountain darters as well as other species.

III. Wading Through Texas Water Law

In water supply planning, the question often asked is not how much water can be supplied from a particular source during periods of average rainfall, but rather how much water can be supplied during droughts. The minimum standard for planning and management purposes is to assume that the worst drought that has occurred in a region since records have been kept, the "drought of record," will occur again in that region. For the Edwards Aquifer, the drought of record is that which began in 1950 and ended in 1957. [FN44] By the end of 1956, about 94% of Texas's 254 counties were classified as disaster areas. [FN45] Comal Springs ceased to flow for 144 days in 1956. [FN46] Another drought, occurring between 1916 and 1919, is considered almost as severe as the drought of record. [FN47]

With the exception of the Gulf Coast Aquifer in the Houston and Galveston areas, and now the Edwards Aquifer, groundwater use in Texas is governed by the "rule of capture," also known as "the law of the biggest pump." The Texas Supreme Court adopted the rule of capture for groundwater law more than ninety years ago. [FN48] The rule provides that a landowner, lessee, or assignee has the right to pump as much water

as desired, ***855** provided the water is not willfully wasted, used maliciously to injure a third party, or pumped negligently. In accordance with this rule, underground water is the exclusive property of the owner of the overlying land. In practice, there is no legal limitation on pumping, so long as the water is not wasted, even if such pumping withdraws water under adjoining land owned by others. There is no cost for the commodity value of the water or its storage or treatment. Texas courts have acknowledged that the rule of capture is, in some respects, "harsh and outmoded" and that the legislature may provide a more sensible rule. [FN49] However, water planning legislation passed by the Texas Legislature in 1997 retained the rule of capture as the framework for regulating groundwater with a few exceptions. [FN50]

Groundwater use is considered a property right by many in Texas. Commentators have described Texas, one of the states most dependent upon groundwater, as a "bad case with regard to wise use" of groundwater because of its piecemeal approach to management that relies on voluntary measures. [FN51] While imposing state regulation of Edwards Aquifer water to protect endangered species has fueled the private property rights movement in Texas, many western states already limit the exercise of water rights associated with property so as not to waste the resource and to assure its beneficial use. Surface water in Texas is governed by the appropriative water rights doctrine common to most western states. [FN52]

Under the rule of capture, gross misallocations of resources can occur. For example, in 1991 Living Waters Artesian Springs Ltd. (the catfish farm), fifteen miles southwest of San Antonio, began using as much as forty million gallons (by some estimates) of Aquifer water a day to raise catfish, and then discharged it directly into the Medina River. [FN53] On an annual basis, this usage equaled approximately 25% of the City of San Antonio's total pumpage. [FN54] However, without regulation of the Aquifer, the catfish farm had the right to pump an unlimited amount of water from the Aquifer, despite complaints from other pumpers who have fought to preserve the rule of capture to protect their own unrestricted use of groundwater. Ironically, the catfish farm, as an

example of the rule of capture taken to the extreme, is one of the catalysts that eventually led to the end of the rule of capture for the Edwards Aquifer.

***856** As water from the Aquifer flows from Comal and San Marcos Springs, its legal character is transformed as it changes from groundwater to surface water in the Guadalupe River Basin east of San Antonio. Permits issued by the State to surface water rights holders downstream on the San Marcos, Blanco, and Guadalupe Rivers are based in part on flows from the Aquifer. According to the Guadalupe-Blanco River Authority, increased pumping in the Edwards Aquifer region depletes the discharge of water at the Springs, interfering with established surface water rights of users in the downstream counties in the Guadalupe River Basin. The different legal systems governing ground and surface water in the Aquifer region have complicated water resource planning and made a solution to periodic shortages elusive.

IV. Sierra Club v. Babbitt

In 1991, the Sierra Club, along with Professor Clark Hubbs (Professor Emeritus of Zoology, University of Texas at Austin), filed a suit in the U.S. District Court in Midland, Texas against the Secretary of the Interior and the USFWS, alleging that the Secretary of the Interior had allowed takings of endangered species by not ensuring water levels in the Edwards Aquifer adequate to sustain the flow of Comal and San Marcos Springs. Originally titled Sierra Club v. Lujan, the Sierra Club, Guadalupe-Blanco River Authority, and other plaintiffs requested that the court enjoin the defendants to restrict pumping from the Edwards Aquifer under certain conditions and to develop and implement recovery plans for certain endangered and threatened species found in the Aquifer and at Comal and San Marcos Springs. [FN55]

A. The Sierra Club and the Guadalupe-Blanco River Authority

On February 1, 1993, Judge Lucius Bunton ruled in favor of the plaintiffs. [FN56] The court required the USFWS to determine the springflow requirements to avoid a taking or jeopardy of the listed species in both Springs. [FN57] The court subsequently set a deadline for the State to prepare a plan that would protect minimum continuous springflows and Aquifer levels: "The next session of the Texas legislature offers the last chance for adoption of an adequate state plan before the 'blunt axes' of Federal intervention have to be dropped." [FN58]

***857** Table 4. Chronology of the Edwards Aquifer Controversy

Date / Time	Event / Condition Period
Prior to Pumping	Comal and San Marcos Springs, the largest springs in the southwest United States, have strong, continuous springflows at all times, even during major droughts.
1900	Pumping increases to approximately 30,000 acre-feet per year.
1950-57	The drought of record. Comal Springs dries up for five months in 1956. Bad water line moves. In 1956 annual recharge is a record low 43,700 acre-feet and pumping reaches 321,000 acre-feet.
1959	56th Legislature creates the Edwards Underground Water District (EUWD) to protect and preserve the Edwards Aquifer.
1967-80	U. S. Fish and Wildlife Service (USFWS) lists five aquatic species at Comal and San Marcos Springs as endangered or threatened.
1972-1984	EUWD builds four small recharge dams over the Edwards Aquifer.
1976	San Antonio City Council rejects purchasing water from Canyon Reservoir.
1980	USFWS designates critical habitat for four of the species at San Marcos Springs.
1980-1990	Pumping averages nearly 500,000 acre-feet per year.

1984	Flow at Comal and San Marcos Springs reaches critical levels during a brief drought.
1985	San Marcos Recovery Plan adopted by USFWS.
January 1989	Uvalde and Medina Counties vote to pull out of the EUWD because of disagreement over pumping limits and establish single-county underground water districts.
June 15, 1989	Guadalupe-Blanco River Authority (GBRA) gives notice of violation under the Endangered Species Act (ESA). GBRA also files suit in State District Court to have the Aquifer declared an underground river owned by the State of Texas.
1989	A long-range regional water plan, adopted by the EUWD and San Antonio after prolonged negotiation, fails enactment by the 71st Legislature. During the summer, the Aquifer drops rapidly in another brief drought. Annual pumping peaks at 542,400 acre-feet.
1989-1990	USFWS warns of the need to respond to excessive pumping and threatens limits.
1990	A professional mediator is appointed by Texas Water Commission (TWC) to attempt to form a consensus about Aquifer regulation among various interests. No consensus emerges.
April 12, 1990	Sierra Club gives ESA notice of violation to USFWS.
Summer 1990	Aquifer levels and springflows plunge. Fortuitous mid-summer rains maintain springflow.
1991	The catfish farm opens southwest of San Antonio, using as much as 40 million gallons of water per day, by some estimates. In October, a suit filed in state district court shuts down the farm pending approval of a wastewater discharge permit.
May 16, 1991	Sierra Club, joined by GBRA and others, files a suit in the U. S. District Court in Midland, Texas. The suit alleges the Secretary of the Interior

	and USFWS failed to protect endangered species dependent on the Aquifer.
November 1991	Texas Attorney General Dan Morales decides it is constitutional for the Texas Natural Resources Conservation Commission (TNRCC), which replaced TWC, to regulate groundwater.
1992	Austin Mayor Bruce Todd attempts to resolve the dispute over Aquifer regulation. Annual recharge is a record high 2,486,000 acre-feet.
February 1992	John Hall, Chairman of TNRCC proposes alternative plan to state regulation.
March 1992	Attorney General Morales reverses his opinion that TNRCC has sufficient authority to regulate the use of groundwater.
April-August 1992	TNRCC adopts emergency rules finding that the Edwards Aquifer is an underground river, subject to state regulation. A state district court invalidates TNRCC's declaration that the Aquifer is an underground river and voids the commission's new rules for the Aquifer.
February 1993	Judge Lucius Bunton finds for the plaintiffs, determining that if pumping from the Aquifer continues unabated, endangered and threatened species will be taken. TNRCC is directed to devise a plan by March 1, 1993 to limit pumping and preserve springflows. The Legislature has until May 31, 1993 to enact a regulatory plan or the plaintiffs can seek regulation by USFWS. USFWS is ordered to determine "take" and "jeopardy" flows for the Springs.
March 1993	TNRCC submits its plan to the court.
May 30, 1993	73rd Legislature enacts Senate Bill 1477 (S. B. 1477), creating the Edwards Aquifer Authority (EAA), to regulate groundwater use, abolishing EUWD.
June 15, 1993	USFWS determines takes and jeopardy flows for Comal and San Marcos Springs.

September 1993	S. B. 1477 takes effect, but implementation is delayed while the U.S. Department of Justice (USDOJ) decides whether the abolition of the EUWD elected board violates the Voting Rights Act.
November 19, 1993	USDOJ rules that S. B. 1477 does not meet the requirements of the Voting Rights Act because it would abolish an elected board (the EUWD).
February 25, 1994	Judge Bunton appoints a Court Monitor to gather data for the court.
June 6, 1994	Judge Bunton orders the Monitor to prepare a plan to limit pumping by August 1, 1994, and also orders USFWS to publish a proposed recovery plan for the species by August 1, 1994.
August 1, 1994	Emergency Withdrawal Reduction Plan for the Edwards Aquifer is delivered to the court.
August 13, 1994	San Antonio voters decide in a referendum not to complete the Applewhite Reservoir.
September 25, 1994	Judge Bunton orders the formation of a panel, chaired by the Court Monitor, to draft a regional water management plan / habitat conservation plan to obtain an ESA Section 10(A) permit.
March 31, 1995	Revised Emergency Withdrawal Reduction Plan for the Edwards Aquifer filed with court.
April 19, 1995	The Letter of Intent is executed to assure the transport of 15,000 acre-feet of Guadalupe River water to the military bases in San Antonio.
April 28, 1995	Sierra Club files an ESA suit in Judge Bunton's court against USDA, alleging that USDA is allowing agricultural activities to harm species.
May 31, 1995	Governor George Bush approves changes to S. B. 1477 adopted by the 74th Legislature to give EAA an elected board to satisfy the concerns of USDOJ.

June 23, 1995	Draft Habitat Conservation Plan for the Edwards Aquifer (Balcones Fault Zone-San Antonio Region) is distributed for comments.
August 23, 1995	A group led by the Medina and Uvalde County Underground Water Conservation Districts challenge to the constitutionality of S. B. 1477 (EAA) in state district court.
October 18, 1995	Monitor's activities are stayed by the Fifth Circuit Court of Appeals.
October 27, 1995	The state district court rules that S. B. 1477 is unconstitutional.
February 14, 1996	USFWS finishes the recovery plan, bringing the Sierra Club's suit against DOI to an end.
1996	Drought returns to the region. Comal and San Marcos Springs rapidly drop to levels below jeopardy.
June 10, 1996	Sierra Club files a second ESA suit in Judge Bunton's court. The suit alleges that pumpers are causing takes of fountain darters as springflow declines.
June 28, 1996	Undivided Texas Supreme Court reverses state district court, and finds that S. B. 1477 is constitutional.
July 2, 1996	Judge Bunton orders USDA to develop species conservation plan.
July 31, 1996	EAA board votes for a second time not to declare a water emergency.
August 1, 1996	Judge Bunton appoints the author as Special Master. The Special Master is ordered to develop a new water conservation plan within ten days.
August 23, 1996	After a public comment period, the 1996 Emergency Withdrawal Reduction Plan for the Edwards Aquifer is revised and adopted by the court. Judge Bunton declares a water emergency and issues an order setting a date for the plan's activation.
September 11,	Judge Bunton's August 23, 1996 order is stayed by the Fifth Circuit

1996	Court of Appeals.
October 23, 1996	The Fifth Circuit grants USDA's motion for a stay pending appeal.
April 30, 1997	The Fifth Circuit vacates Judge Bunton's August 23, 1996 order, finding that the Court should have abstained from acting on a matter that the EAA could potentially handle.
December 18, 1997	USFWS lists Comal Springs riffle beetle, Comal Springs dryopid beetle, and Peck's cave amphipod as endangered.
1998	After significant rains in 1997, drought returns to the region. Comal Springs drops to a level below take.
August 5, 1998	A State District Court issues a temporary injunction on behalf of the catfish farm, enjoining EAA from implementing or enforcing its rules that pertain to the filing and processing of permit applications.
August 14, 1998	Sierra Club notifies EAA and USFWS of intent to sue for violations of the ESA.
September 11, 1998	A second state district court enjoins EAA from enforcing its rules for issuing permits.
September 14, 1998	Environmental Defense Fund notifies EAA of intent to sue for violations of the ESA.
September 24, 1998	Ruling on an appeal of Judge Bunton's order, the Fifth Circuit finds that the ESA requires the USDA to develop programs to conserve endangered species.
December 17, 1998	Travis County court invalidates EAA permit rules and drought management plan.

***859** Judge Bunton ruled that if the Texas Legislature did not adopt a management plan to limit withdrawals from the Aquifer by the end of that legislative session, the plaintiffs could return to the court and seek additional ***860** relief. The Sierra Club

indicated that if it had to return to court, it would seek regulation of the Aquifer by the USFWS, placing the Aquifer under federal judicial control.

B. Senate Bill 1477, The Edwards Aquifer Authority Enabling Statute

Senate Bill 1477 [FN59] was adopted by the Legislature on May 30, 1993, one day before the deadline for federal action established by Judge Bunton. The bill, passed pursuant to the Conservation Amendment in the Texas Constitution, [FN60] established a conservation and reclamation district, the Edwards Aquifer Authority (EAA), to regulate groundwater withdrawals and manage the Aquifer. [FN61]

When Senate Bill 1477 is fully implemented, EAA must enforce pumping limits of 450,000 acre-feet before December 31, 2007, and 400,000 acre-feet thereafter, unless drought conditions require more severe restrictions. [FN62] By December 31, 2012, "[EAA] . . . shall ensure that . . . the continuous minimum springflows of the Comal Springs and the San Marcos Springs are maintained to protect endangered and threatened species to the extent required by federal law." [FN63] Computer simulations by the Texas Water Development Board show that in a repeat of the drought of record, the requirement to ensure the continuous minimum springflows could reduce withdrawals to 165,000 acre- feet, unless water use restrictions are triggered at the onset of low springflow conditions. [FN64] With historical withdrawals reaching 542,400 acre-feet in 1989, water from the Aquifer will have to be supplemented by other sources, or conservation measures will have to be adopted, if projected water demands are to be met.

1. Challenges to Senate Bill 1477

In 1993, a challenge under the Voting Rights Act of 1965 [FN65] by the U.S. Department of Justice (USDOJ) to the governing board prevented EAA's activation. [FN66] Under section 5 of the Voting Rights Act, in certain states with a past history of discrimination against minority voters, any change affecting voters or elections must be submitted to USDOJ for preclearance. [FN67] The Mexican American Legal Defense and

Education Fund (MALDEF) opposed preclearance of Senate Bill 1477. On November 19, 1993, USDOJ's Civil Rights Division agreed with MALDEF and objected to ***861** the new law "insofar as it replaces the previously elected governing body [of the Edwards Underground Water District] with an appointed board [for EAA]." [FN68] USDOJ was concerned that Hispanic voters in the former Edwards Underground Water District (EUWD) would not have the same opportunity to be represented on the appointed EAA board.

2. Interim Measures and Temporary Resolutions

With EAA in limbo, the Sierra Club returned to the district court and requested that a monitor be appointed in the case. In February 1994 Judge Bunton appointed Joe G. Moore, Jr. as the court monitor (Monitor) to "gather, summarize, and evaluate information necessary to allow the court to take appropriate action to prevent violations of the Endangered Species Act (ESA)." [FN69]

In the summer of 1994, flow at Comal Springs decreased so much that the Sierra Club requested that the court direct the Monitor to prepare an emergency plan to reduce pumping from the Aquifer. On July 3, 1994, the court ordered the Monitor to prepare the plan by August 1 and allowed him to employ the author of this Article to assist with preparation of the plan. [FN70] The plan was to function as a drought management plan and as a document to educate the public about Aquifer management issues at the center of the litigation. [FN71] The Emergency Withdrawal Reduction Plan (EWRP) for the Edwards Aquifer was researched and developed in thirty days. It provided for staged reductions of pumping for municipal, industrial, and agricultural uses of groundwater for the Aquifer. The EWRP, like each of the succeeding plans developed for the court, was intended to maintain flow at Comal Springs above the 150 cubic feet per second (cfs) jeopardy level for fountain darters, using measures that were based on the current hydrologic conditions and regulatory authorities. However, with the end of heavy summer pumping from the Aquifer and fall rains, the need for the court to implement the EWRP was averted.

Also in August 1994, during a special referendum, the citizens of San Antonio voted not to complete the nearby Applewhite Reservoir under construction on the Medina River southwest of the city. [FN72] This project was one in a series of supplemental water supplies rejected by San Antonio, including the City Council's rejection of the purchase of water from ***862** nearby Canyon Lake on the Guadalupe River in 1976. Because no supplemental water source was available to reduce San Antonio's reliance upon the Aquifer, the Monitor suggested that the city and other pumpers apply for an ESA section 10(a) Incidental Take Permit (ITP). [FN73] An ITP would allow the inadvertent taking of federally listed species during an otherwise legal activity. Development of a habitat conservation plan (HCP) is required for an ITP. The Edwards Aquifer HCP would double as a water conservation and supply plan for the region. The HCP was to be used to secure a twenty-year permit authorizing incidental takes by those entities and individuals who participated. Permit holders were expected to implement the HCP/water conservation and supply plan. For holders of the ITP, the take level at Comal Springs would drop from 200 cfs to 150 cfs and the jeopardy springflows could fall from 150 to 60 cfs for short durations, with adequate control of the giant rams-horn snail. [FN74] The difference between these jeopardy flows is 90 cfs, which has been estimated to allow additional pumping of approximately 65,000 acre-feet annually in dry years for those who rely on withdrawals from the Edwards Aquifer.

The Monitor recommended to Judge Bunton that a panel convene to review and discuss the available water supply and conservation options that could preserve the endangered species. [FN75] The panel would consist of the Monitor as chair and a professional staff member representing each of the nine major water organizations from the Edwards Aquifer region. [FN76] The Judge responded with an order creating the Incidental Take Permit Panel (Panel). [FN77]

A total of eleven Panel meetings were held over the next four months in several cities across the Edwards Aquifer and Guadalupe River region. At each meeting, Panel members and the public received presentations on methods to conserve Aquifer water and alternatives for securing new supplies for the region. Presenters at these meetings

were from state and federal agencies, water purveyors, major water users, elected governing bodies, academic institutions, and engineering firms. Information collected during Panel meetings became the basis for the draft HCP. In addition ***863** to presentations made at Panel meetings, the Monitor met individually with representatives of various industries and government agencies, academic researchers, and persons knowledgeable in water conservation and supply. These meetings included discussions of hydrologic models, tours of experimental land treatments that enhance groundwater recharge, and various water conservation technologies. The accumulated information was evaluated, and appropriate alternatives and practices were incorporated into the draft HCP.

In June 1995 a 330-page draft of the HCP was released. The primary themes of the HCP were the conservation and reuse of existing water supplies, and the introduction of 250,000 to 350,000 acre-feet of additional water supplies to the region to substitute for withdrawals from the Aquifer. [FN78] A sufficient number of alternatives were proposed in the HCP to protect the endangered species and assure downstream minimum flows in the Guadalupe River during droughts.

In March 1995 the Revised Emergency Withdrawal Reduction Plan (REWRP) for the Edwards Aquifer was produced for the court in anticipation of decreased springflow later in the year. [FN79] The REWRP incorporated information on water conservation collected during Panel meetings. As an alternative, Judge Bunton directed attorneys representing various interests in the litigation to meet and develop recommendations for maintaining springflow above the 150 cfs jeopardy level at Comal Springs. The result was a plan referred to as the Lawyer's Panel Plan, announced in June 1995; this plan was later accepted and approved by the court. [FN80] However, as in 1994, the end of heavy summer pumping, and fall rains, averted the need for the court to implement the Lawyer's Panel Plan.

During the litigation, the Base Closure and Realignment Commission (BRAC) was considering the fate of the five military bases in San Antonio. The water supply for these bases required attention because the local bases had previously received adverse ratings

by the BRAC for their sole reliance on the Edwards Aquifer. The threat of formal consultation under ***864** section 7 of the ESA was hanging over four of the five San Antonio bases and could have influenced the decision to keep the bases open. [FN81]

Early in April 1995 the Monitor met with the principals of five water purveyors to discuss a Letter of Intent to be executed by these parties to assure the transport of 15,000 acre-feet of Guadalupe River water to the military bases in San Antonio. During the discussion of bringing water to the military bases, the surface water needs of cities along Interstate Highway 35 (I-35) were also considered. The Monitor facilitated discussions with the parties individually and as a group.

An agreement was reached, and arrangements were made so that a public announcement and a signed document could be released simultaneously by the governing boards of Guadalupe-Blanco River Authority, San Antonio River Authority, Canyon Regional Water Authority, Bexar Metropolitan Water District, and San Antonio Water System on April 19, the day before a visit of BRAC representatives to San Antonio. A copy was delivered to the San Antonio military bases for use during the BRAC meeting on April 20. As a result, it was hoped the water supply for the bases would no longer be a factor in the BRAC's deliberations to consider closing the bases in San Antonio. [FN82]

In October 1995 the work of the Monitor was stayed by the U.S. Fifth Circuit Court of Appeals apparently over concerns that the U.S. district court was preparing to take control of the Aquifer upon a ruling by a state district court that EAA was unconstitutional. This left no entity in place with the acknowledged authority to regulate withdrawals from the Aquifer. Sierra Club v. Babbitt was eventually resolved in February 1996, after USFWS published a recovery plan for the threatened and endangered species at Comal and San Marcos Springs, and the appellate court concluded that all action required by Judge Bunton's 1993 amended judgment had been fulfilled. [FN83] Despite the ruling from the appellate court, the litigation ***865** resulted in the end of the rule of capture for the Edwards Aquifer and the creation of a state entity specifically designed to regulate pumping. [FN84]

C. Sierra Club v. Glickman

Pumping from the Edwards Aquifer for agricultural irrigation averaged 127,000 acre-feet per year from 1982 to 1996. [FN85] In 1992, TWC estimated that conservation efforts in the Edwards Aquifer area could reduce pumping by irrigated agriculture by 40,000 to 52,000 acre-feet per year. [FN86] In response, the Sierra Club filed a second complaint in the U.S. District Court in Midland, Texas on April 28, 1995, this time against Secretary Dan Glickman and the U.S. Department of Agriculture (USDA). Sierra Club v. Glickman contained three counts. [FN87] Count I alleged the violation of the Agricultural and Water Policy Coordination Act, provisions establishing the USDA Council on Environmental Quality, and the Bankhead-Jones Farm Tenant Act. [FN88] The Sierra Club charged that these Acts required USDA to prevent adverse environmental impacts rising from agricultural ***866** activities. [FN89] Count II alleged USDA violated both ESA section 7(a)(1) and section 7(a)(2) by failing to consult with USFWS and by failing to develop programs to conserve the listed species at Comal and San Marcos Springs. [FN90] Count III alleged that USDA further violated ESA section 7(a)(2) by subsidizing irrigation dependent on Edwards Aquifer water without formally consulting with USFWS or insuring that its actions would not cause jeopardy to the listed species. [FN91] On July 2, 1996, Judge Lucius Bunton ruled in favor of the Sierra Club. On September 19, 1996, the court entered a judgment finding that USDA had failed to consult with USFWS. [FN92] USDA was ordered to develop and implement a program to protect water quality and to preserve natural resources and protect fish and wildlife through land conservation and utilization. [FN93] The judgment was appealed and a stay was granted by the U.S. Fifth Circuit Court of Appeals on October 23, 1996. [FN94]

V. Litigation in the State District Court

After the Voting Rights Act defects of Senate Bill 1477 were corrected during the 1995 Legislative session, board members of EAA were scheduled to be sworn into office on August 28, 1995. However, on August 23, 1995, a group led by the Medina and Uvalde

County Underground Water Conservation Districts filed suit against the board members (who had yet to be sworn in). [FN95] The suit was filed in the state trial court in Medina County, a county where the primary use of Aquifer water is irrigation. A temporary restraining order was granted by Judge Mickey Pennington to prevent the EAA board members from taking office, and once again to extend the life of the old EUWD. A trial was held beginning on October 11, 1995. The defendants, EAA board members, were barred from implementing Senate Bill 1477; however, they were permitted to organize for the purpose of defending the legislation in court. The court eventually held that Senate Bill 1477 was unconstitutional, with the exception of the provision validating the creation of the Uvalde County Underground Water Conservation District, one of the plaintiffs. [FN96]

Because a water supply emergency for the Edwards Aquifer appeared imminent in 1996, the Texas Attorney General's Office obtained an expedited ***867** appeal of the state trial court ruling to the Texas Supreme Court, bypassing the court of appeals. The brief filed by the Medina County Underground Water Conservation District and several others, argued that the regulation of groundwater was a violation of private property rights and that Senate Bill 1477 must be declared unconstitutional because no other water regulation entity quite like EAA currently existed in Texas. [FN97]

The State, in its brief for the Texas Supreme Court, recognized the Aquifer as a common property resource and compared unregulated withdrawals from the Aquifer to a tragedy of the commons in the making, a concept first enunciated by Garrett Hardin:

> Underground water in Texas is private property, although of an unusual kind, because despite being "absolutely owned in place" by the surface owner, it is subject to the rule of capture allowing others to take it. The Edwards Aquifer Act affects that property much as a local zoning ordinance containing a grandfather clause affects surface land. Historical users of Aquifer water, who range from cities to manufacturing companies to farmers irrigating maize, will have the broadest rights of continued use. It is only fair and reasonable (and constitutional) for

historical non-users-persons whose only "use" during the 21 years from 1972-93 has been to leave "their" water in the ground, available for withdrawal by others--to be limited in their future uses. No owner's use is entirely barred.

The Edwards Aquifer Act is as at least as constitutionally sound as city zoning ordinances and as the time--honored Texas systems for controlling oil and gas well drilling and production rates—far--reaching regulatory regimes which have marked effects on private property yet have withstood attacks from several directions.

Plaintiff-appellees and the district court slighted these analogies and over-extended the property concepts shaping underground water law. Their approaches, which would recognize a constitutional right in each surface owner to drill as many wells as he or she wants and pump nonwastefully from them as much water as he or she wants, suffer from a false naivete overlooking the commonalty of the Edwards Aquifer and its vulnerability to the collective effects of individual actions.

When a shared, limited resource is involved, some kind of use control is needed.

> Picture a pasture open to all. . . . [E]ach herdsman will try to keep as many cattle as possible on the commons. . . . [M]ore or less consciously, he asks, "What is the utility to me of adding one more animal to my herd? . . ." [T]he rational herdsman concludes that the only sensible course is for him to add another animal . . . . And another and another . . . . [T]his is the conclusion reached by each and every herdsman sharing a commons. . . . Each man is locked into a system that compels him to increase his herd without limit . . . . Freedom in a commons brings ruin to all.
>
> ***868** [T]his article's proposed solution is a regime of mutual coercion mutually agreed upon--in other words, some form of institutional control . . . . [FN98]

The State successfully argued that the power to create entities to regulate groundwater is an established fact in Texas law, resulting in a unanimous decision by the Texas Supreme Court on June 28, 1996 that Senate Bill 1477 was indeed constitutional. [FN99]

Another case in state court concerning the Edwards Aquifer provides a historical footnote. In 1989, litigation brought by the Guadalupe-Blanco River Authority sought to designate the Edwards Aquifer as an underground river. Under Texas water law an underground river must have certain characteristics defined in case law. [FN100] On April 15, 1992, in a surprise move, the Texas Water Commission (TWC, predecessor agency to the Texas Natural Resources Conservation Committee) seized upon the Guadalupe Blanco River Authority's idea and moved to designate the Aquifer as an underground river, allowing TWC to take control of the Aquifer on an emergency basis. [FN101] The designation would have allowed TWC to ignore the rule of capture for the Edwards Aquifer, and regulate withdrawals in a system parallel to that used for surface lakes, rivers, and streams. TWC's action was later overturned by a state district court in December 1992. [FN102]

VI. Round Two in the Battle to Protect the Aquifer

In the latter half of 1995 and most of 1996, much of Texas and the Aquifer region suffered the effects of a severe drought. Recharge to the Aquifer in each year since 1992 had been below average. In June 1996 the Texas Supreme Court ruled that the statute creating EAA (Senate Bill 1477) was constitutional. The EAA board, facing their first elections in November, was divided about taking the controversial emergency action that would reduce pumping from the Aquifer while running for reelection.

***869** A. Sierra Club v. San Antonio

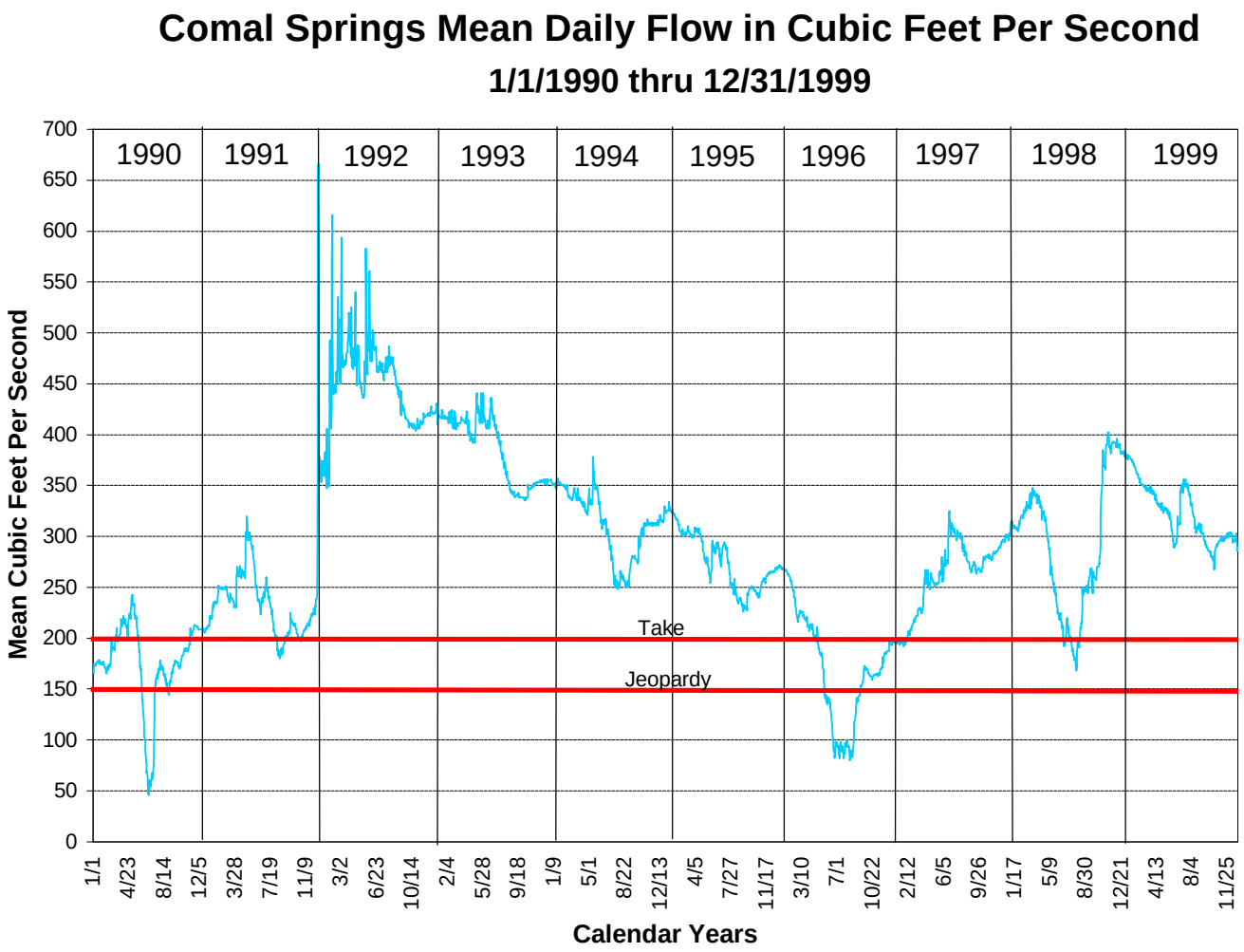
Flow from both Comal and San Marcos Springs reached the jeopardy levels in May 1996. In June, the director of the USFWS office in Austin, Texas, stated before the San

Antonio City Council that USFWS would take no action against pumpers to reduce pumping from the Aquifer. [FN103] Later that month, the Sierra Club filed a class action suit under section 9 of the ESA in Judge Bunton's court alleging that pumpers from the Aquifer were causing takes of endangered species. Sierra Club v. San Antonio [FN104] sought to include everyone pumping from the Aquifer, as many as one thousand individuals, organizations, and corporations, into representative defendant classes to manage the litigation.

By July, flow at both Springs was well below the jeopardy levels, and the possibility of the total cessation of flows at Comal Springs loomed (Figure 2). The trickle of water flowing from both the Comal and San Marcos Springs comprised approximately 81.7% of the remaining flow in the Guadalupe River at Victoria, Texas. [FN105] After a vote by the EAA board declined on July 31, 1996 to declare a water use emergency, Judge Bunton appointed the author of this Article as Special Master on August 1, and directed him to produce a draft of a regional plan to reduce pumping from the Aquifer within ten days. [FN106] A draft plan was developed within the deadline, released for public comment, then quickly revised and adopted by Judge Bunton as the 1996 Emergency Withdrawal Reduction Plan for the Edwards Aquifer (1996 EWRP). [FN107] The 1996 EWRP contained a schedule of staged reductions of municipal pumping of discretionary water use from the Aquifer to be triggered by declining flows from Comal Springs. [FN108] The plan was designed to allow individual municipalities as much flexibility as possible to achieve the required reductions mandated by the court. [FN109]

With none of the federal, state, or local government agencies acting to significantly reduce pumping from the Aquifer, Judge Bunton issued an ***870** order on August 23, 1996, setting a deadline of October 1, 1996 for the activation of the 1996 EWRP and directing the Special Master to monitor the 1996 EWRP's implementation as well as perform other additional duties. [FN110]

Figure 2.


Comal Springs Mean Daily Flow in Cubic Feet Per Second
1/1/1990 thru 12/31/1999
Mean Cubic Feet Per Second
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
Take
Jeopardy
1/1
4/23
8/14
12/5
3/28
7/19
11/9
3/2
6/23
10/14
2/4
5/28
9/18
1/9
5/1
8/22
12/13
4/5
7/27
11/17
3/10
7/1
10/22
2/12
6/5
9/26
1/17
5/9
8/30
12/21
4/13
8/4
11/25
Calendar Years

B. Current Status of the Litigation

On August 23, 1996, the day the 1996 EWRP was adopted by the court, the rain began to fall, providing temporary relief for the Springs from the drought. In September, Judge Bunton's August 23, 1996 order was stayed by the U.S. Fifth Circuit Court of Appeals until a hearing was held on December 4, 1996. [FN111]

At the beginning of 1997 EAA implemented a program to reduce pumping for agricultural irrigation called the Irrigation Suspension Program. [FN112] The program was designed to raise the level of the Aquifer, increase springflow, and provide municipalities with relief during droughts by paying farmers not to irrigate in critical years. In 1997, thirty-seven individuals with 9669 acres of irrigated land were enrolled for a median per-acre cost of $240. [FN113] While the potential existed to reduce irrigation pumping by 23,206 acre-feet, the drought was ended by heavy late-winter and spring rains. [FN114]

On April 30, 1997, after the crisis had passed, the Fifth Circuit vacated Judge Bunton's August 23, 1996 order, finding that the court should have abstained from acting on a matter that could be handled by EAA. [FN115] A three judge panel of the Fifth Circuit, in a 2-1 vote ruled:

> Because we hold that the Sierra Club did not establish a substantial likelihood of success on the merits, in light of the abstention doctrine enunciated in Burford v. Sun Oil Co. [319 U.S. 315 (1943)], we vacate the injunction. . . .
>
> San Antonio and other defendants moved to dismiss this suit on Burford abstention grounds. The Sierra Club moved for a preliminary injunction. After a one-day evidentiary hearing, the court denied the motion to dismiss and entered the preliminary injunction now on appeal. . . .
>
> We state no bar against the Sierra Club, either in pursuing the merits or in ultimate efforts to protect the water and darters if the State of Texas fails to do so. [FN116]

The Sierra Club appealed the decision to the U.S. Supreme Court, which denied certiorari. [FN117] Fortunately, in 1997 heavy rainfall temporarily ***872** quenched the region's thirst, providing Central Texas with a reprieve before the onset of the next cycle of drought.

The region did not have to wait long. The next cycle began in 1998. This time USFWS warned pumpers that the agency was prepared to file civil lawsuits or bring criminal charges against pumpers to protect species in danger of dying from diminished springflow (Figure 2). [FN118] In response to the drought, EAA implemented its plan, the Critical Period Management Plan, which restricted certain uses of water. EAA also turned to less traditional means to combat the drought, seeking a permit from the State for a $500,000 cloud-seeding program to increase precipitation in selected areas. [FN119] Although flow at Comal Springs fell below the take level, USFWS did not file suit or bring criminal charges against pumpers or EAA. [FN120] Fortunately, rainfall in August from tropical storms Charlie and Francis recharged the Aquifer and diminished the elevated rates of pumping, raising springflow at Comal Springs significantly above the take level. Prior to the welcome relief, the mean flow at Comal Springs was below the take level of 200 cfs for a total of thirty-eight days. As in 1996, once again a crisis at the Springs was averted by an unusually wet August, with rainfall over the recharge zone far in excess of normal for what is typically one of the driest and hottest months. [FN121]

However, rainfall did not bring an end to developments related to EAA and the ESA. On August 5, 1998 a state district court in Travis County issued a temporary injunction against EAA, enjoining EAA from implementing or enforcing its rules that relate to the filing and processing of permit applications. [FN122] The injunction resulted from a suit filed by Living Waters Artesian Springs Ltd., over concerns that rules adopted by EAA would treat some users of Edwards Aquifer water arbitrarily when allocating pumping rights. [FN123] EAA had already notified permit applicants on April 29, 1998 that it was proposing to approve permits for withdrawals from ***873** the Aquifer totaling approximately 484,600 acre-feet after receiving applications for 852,800 acre- feet. [FN124] EAA was to begin enforcing the new 484,600 pumping cap beginning January 1, 2000.

[FN125] A second ruling on September 11, 1998, this time by 38th State District Court Judge Mickey Pennington, also enjoined EAA from enforcing its rules and found that the Act creating EAA violated the Texas Private Real Property Rights Preservation Act by failing to conduct a takings impact assessment as required by the Act. [FN126] On August 14, 1998, the Sierra Club notified EAA and USFWS of its intent to sue over violations of the ESA resulting from the "failure" of those entities to limit pumping from the Aquifer as required by Senate Bill 1477 and to enforce the recovery plan. [FN127] EAA and USFWS are not defendants in Sierra Club v. San Antonio, but could be added to the suit or be the subject of a new suit. As a response to the threat of renewed ESA litigation, State Representative John Shields, whose district includes portions of San Antonio, filed suit against the Secretary of the Department of the Interior, Bruce Babbitt, the director of USFWS, Jamie Rappaport Clark, and the Sierra Club. [FN128] Among other charges, Representative Shields alleges that the ESA has taken the private property rights of pumpers from the Aquifer, and that the ESA does not apply to the species listed at Comal and San Marcos Springs because they are "wholly intrastate species" residing completely within the boundaries of Texas. [FN129] On September 14, 1998, the Environmental Defense Fund notified EAA of its intent to sue over violations of the ESA as a result of EAA allowing pumping from the Aquifer "in quantities great enough so as to reduce springflows at Comal and San Marcos Springs to the point that listed species are harmed and harassed." [FN130] On September 24, 1998, a three judge panel of the U.S. Fifth Circuit Court of Appeals ruled on an appeal of Sierra Club v. Glickman. Among the Court of Appeals findings was the determination that the ESA requires federal agencies not only to avoid actions that jeopardize listed species, but also that federal agencies are required to consult with USFWS ***874** and develop programs to conserve endangered species consistent with the agency's real authority over species-related issues. [FN131] The State District Court for Travis County voided EAA's rules for granting permits as well as the Critical Period Management Plan. [FN132] This development seems likely to delay the date that permits will begin to be enforced far beyond the January 1, 2000 target. As of January 1999, the annual legal limit on pumping was 792,000 acre- feet (the

maximum pumpers withdrew in any one year between 1972 and 1993). [FN133] This is some 250,000 acre-feet above the record year of pumping in 1989 (Table 1). In addition, no regional drought management plan was in place.

Finally, the rush of activity that characterized the latter half of 1998 was capped on December 30, when the San Antonio Water System (SAWS) board of trustees gave preliminary approval for the purchase of a large amount of groundwater from the Aluminum Company of America (Alcoa). As much as 90,000 acre-feet, or about 50% of SAWS's current pumping from the Edwards Aquifer, could be transferred annually from an Alcoa lignite operation northeast of Austin in the Simsboro Aquifer that is part of the larger Carrizo-Wilcox Aquifer. [FN134] The water could be piped to either San Antonio or the recharge zone, or it could be traded in exchange for allowing SAWS to receive additional commitments of water from the Guadalupe River. A pipeline could potentially be adapted to serve as a conveyance facility for future transfers of additional ground and surface water from the east to San Antonio.

VII. Private Property Rights Versus Free Market Property Rights

Interests opposed to the end of unrestricted pumping from the Edwards Aquifer claim that their individual private property rights have become endangered. Some have contended that the regulation of Edwards Aquifer groundwater through the ESA is a taking of private property rights. [FN135] However, it is the regulation and allocation of Edwards Aquifer ***875** water that has actually created property rights. Until permits to withdraw specific amounts of water are issued by EAA, property rights, from a free-market perspective, do not exist in the Edwards Aquifer groundwater. This is because the fundamental characteristics of property rights are absent. In neoclassical economic theory a "property right" refers to a bundle of entitlements defining the owner's rights, privileges, and limitations for use of a resource. These property rights can be vested either with individuals, corporations, or the government. An efficient property rights system has the following characteristics: 1) universality-all resources are privately

owned, and all entitlements completely specified; 2) exclusivity-all benefits and costs accrued as a result of owning and using the resources should accrue to the owner, and only to the owner, either directly or indirectly by sale to others; 3) transferability-all property rights should be transferable from one owner to another in a voluntary exchange; 4) enforceability-property rights should be secure from involuntary seizure or encroachment by others. [FN136]

In the Edwards Aquifer, none of these characteristics have been present under the rule of capture. There was no universality because entitlements could not be specified under a system where a pumper's use of water was vulnerable to extraction by a neighbor. Exclusivity did not exist. During periods when pumping was not needed, well owners did not have the option of leasing or selling the water to which they had access. Similarly, transferability did not exist. Even if a well owner was paid not to pump water, nothing prevented another landowner from drilling a new well into the Aquifer to begin pumping. Thus a transfer would be rendered meaningless because the purchaser was not protected from excessive pumping by other users. Finally, there could be no enforceability of a property right for all of the reasons stated above. There was no effective way to prevent one pumper from encroaching on another individual's property right.

An owner with a well-defined property right (one that has the four characteristics mentioned above) has a strong incentive to use that resource efficiently, because a decline in the value of that resource represents a financial loss. When well-defined property rights are exchanged, as in a market economy, this exchange facilitates efficiency. Because the seller has the right to prevent the consumer from consuming the product without paying for it, the consumer must pay to receive the product. Given a market price, the consumer will decide how much to purchase by choosing the amount that maximizes individual net benefit.

As stated earlier, the State of Texas believes the Aquifer is an example of a common property resource. Common property resources are those not exclusively controlled by a single agent or source. Prior to regulation, land ownership was the sole

legal requirement for participation in the common property system that characterized the Edwards Aquifer. If access ***876** to these resources is not controlled by a single agent or source, the resources will be exploited on a first-come, first-served basis.

Typically, the neoclassical economic approach to solving the problem of overexploitation of common property resources has been to define and enforce property rights through institutional intervention. [FN137] The government institution protects property rights and manages the resource under goals that promote the public interest. Under a pure rule of capture system for water, property rights--in the economic sense--are an illusion. Existing users are not protected against installation of a well on an adjacent plot of land or against withdrawal of water from that well at a rate great enough to lower the water table below the well intakes of surrounding landowners. Indeed, it was this type of unrestricted extraction that ended the rule of capture for oil and gas in Texas, resulting in pooling of underground oil and gas resources. Since the advent of EAA, some of the most vocal opponents of government intervention have become ardent supporters of regulation because such an approach may eventually provide certainty through the creation of firm water rights. [FN138]

VIII. Keep Praying for Rain

A. A Precarious Situation

The Texas Water Development Board (TWDB) has created a computer model of how the Aquifer responds under various scenarios of recharge and pumping. [FN139] For better or for worse, this model has dominated certain aspects of the debate over management of the Edwards Aquifer. Tables 1 and 5 demonstrate that recharge to the Edwards Aquifer is highly variable. Table 5 also indicates that since the drought of record in the 1950s, the Edwards Aquifer region has generally experienced a wet cycle with relatively high recharge. In 1994, the TWDB model indicated that if the drought of record were to occur again, pumping from the Aquifer should be restricted to approximately 225,000 acre-feet per year or less in order to prevent violations of the most critical aspects

of the Endangered Species Act (Table 6). [FN140] It is difficult to imagine how the region could cut its pumping during a repeat of the drought of record by more than half to meet the 225,000 acre-feet per year limit. All interested parties can hope that the results produced by the State's model are too conservative and more water can be pumped from the Aquifer during the most severe droughts.

***877** B. Moving Toward a Solution

No one knows when a repeat of the drought of record will begin. TWDB estimates that a similar drought occurs on average once in every fifty to eighty years. [FN141] The State may even be in the beginning stages of a similar cycle of drought today; no one can be certain. If steps are taken very early in a drought to reduce pumping, reductions could be less during the most critical summer months. However, if Comal and San Marcos Springs are to continue flowing on a permanent basis, measures are required that include the following: conservation of Edwards Aquifer water to the maximum extent possible; control of the giant rams-horn snail; adoption of a regional drought management plan that will preserve springflow in a repeat of the drought of record; expansion of the irrigation suspension program that pays farmers not to irrigate in years when diminished springflows are likely at the Springs; development and refinement of techniques for anticipating years in which low springflow will be encountered to activate drought management plans, the irrigation suspension program, and to take other measures as far in advance as practical; [FN142] development of an efficient market for trading Edwards Aquifer water rights; development of significant amounts of additional surface and groundwater supplies; and development of a regional habitat conservation plan to obtain an ESA section 10(a) incidental take permit.

Table 5. Total Recharge to the Edwards Aquifer by Decade [FN143]

Decade	Recharge in millions of acre-feet
1940 – 1949	4.7
1950 – 1959	4.7
1960 – 1969	5.6
1970 – 1979	8.9
1980 – 1989	7.6
1990 through 1998	9.2

***878** Table 6. Edwards Aquifer Pumping Limitations and Potential Deficits

1. Total amount of Aquifer withdrawals applied for [FN144]	852,800 acre-feet
2. Total withdrawals authorized before 2008 [FN145]	450,000 acre-feet
3. Total withdrawals authorized after 2008 [FN146]	400,000 acre-feet
4. Total withdrawals authorized after 2012 [FN147]	The amount that will prevent jeopardy at the Springs (# 6 or #7)
5. Amount of withdrawals the EAA proposed to authorize [FN148]	484,600 acre-feet
6. Total withdrawals the Texas Water Development Board (TWDB) model estimates can be pumped during a repeat of the drought of record while preventing jeopardy to the Springs [FN149]	165,000 acre-feet [FN150]
7. Total withdrawals the TWDB model estimates can be pumped during a repeat of the drought of record while preventing jeopardy to the Springs (assumes control of the giant ramshorn snail) [FN151]	225,000 acre-feet
8. Given the pumping in row #5, the amount of additional water that would be needed during a repeat of the drought of record to avoid jeopardy (# 5 minus # 6)	319,600 acre-feet
9. Given the pumping in row #5, the amount of additional water that would be needed during a repeat of the drought of record to avoid jeopardy, with control of the giant ramshorn snail (# 5 minus # 8)	259,600 acre-feet

IX. The End of the Commons in the Edwards Aquifer?

Once the process of allocating Edwards Aquifer water began, those who were likely to receive permits for Aquifer water, including some of the agricultural interests that fought hardest to preserve the rule of capture, responded to San Antonio's inquiries about leasing water. [FN152] The protracted litigation over the Aquifer has only delayed the transfer of water to San Antonio, but those who resisted may ultimately reap higher prices for ***879** their water because the droughts of 1996 and 1998 have placed water supply at the top of the agendas for regional governments, business leaders, and agriculture.

The inability to regulate the Edwards Aquifer through local government placed the initiative to limit pumping from the Aquifer in the State's hands. When the State was unable to regulate the Aquifer, the federal government became the focus for managing withdrawals because of the effect of diminished springflow upon federally listed endangered species. When USFWS did not develop and implement a recovery plan for the endangered species, the authority for limiting withdrawals became the U.S. district court. With encouragement from the court, the State passed a statute designed to create a market for groundwater through a regional regulatory body. Despite numerous opportunities to do so at earlier dates, the court did not move to reduce pumping from the Aquifer until flow at Comal and San Marcos Springs declined significantly below the level at which jeopardy begins for the fountain darter. While sometimes accused of a "federal power grab," the district court consistently exercised restraint until the duty to enforce federal law was overwhelming. By refusing to accept some restrictions on pumping through local governments, those who dreaded the loss of control over their ability to pump from the Aquifer brought on the very result they professed to fear most--federal intervention. Even then, the court gave the state legislature opportunities to protect the species without imposing federal control.

As 1999 begins, the question on the public's mind no longer seems to be whether pumping from the Aquifer should be limited. Rather, the question is how big a piece of the aquatic pie will each pumper get. Implementation of Senate Bill 1477 continues to be hobbled by litigation in state courts while the next drought of record looms somewhere over the horizon. Meanwhile, the opportunity remains for the region to take its fate into its own hands, ending the commons in the Edwards Aquifer and avoiding the tragedy.

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FN1. Sierra Club v. San Antonio, No. MO-96-CA-097, slip op. at 1 (W.D. Tex. Aug. 23, 1996) (order mandating federal management of the Aquifer).

FN2. San Antonio is the third largest metropolitan area in Texas and the only major city in the United States that obtains its entire water supply from a single aquifer. Tex. Water Dev. Bd., Texas Water Facts 19 (1991).

FN3. Tex. Const. art. I, s 17.

FN4. U.S. Const. amend. V.

FN5. Endangered Species Act of 1973 (ESA), 16 U.S.C. s 1544 (1994).

FN6. For a discussion of the extent of the conflict between the ESA and western water resources, see generally Michael R. Moore et al., Water Allocation in the American West:

Endangered Fish Versus Irrigated Agriculture, 36 Nat. Resources J. 319 (1996) (arguing that the number of ESA-listed species in a county is positively correlated with the level of agriculture reliant on surface water in the county.)

FN7. David W. Watkins, Jr. & Daene C. McKinney, Screening Water Supply Options for the Edwards Aquifer Region in Central Texas, 125 J. Water Resources Plan. & Mgmt. 14, 14 (1999).

FN8. See Sierra Club v. San Antonio, No. MO-96-CA-097, slip op. at 1 (W.D. Tex. Aug. 23, 1996).

FN9. Gunnar Brune, Springs of Texas 10 (1981); Watkins & McKinney, supra note 7, at 14.

FN10. Memorandum from the Guadalupe-Blanco River Authority to Board of Director [sic] of the Edwards Aquifer Authority (July 25, 1996) (on file with author) [hereinafter Guadalupe-Blanco River Authority] (input concerning emergency rules to be adopted by the EAA).

FN11. U.S. Dep't of the Interior, U.S. Geological Survey, Recharge to and Discharge from the Edwards Aquifer in the San Antonio Area, Texas, 1997 2 (1998) [hereinafter U.S. Geological Survey].

FN12. Rick Illgner, The Edwards Aquifer: Political Prisoner, Edwards Underground Water District 1.2 (Apr. 1993) (unpublished manuscript presented at 89th Annual Meeting of the Association of American Geographers) (on file with author).

FN13. U.S. Geological Survey, supra note 11, at 4. An acre-foot equals 325,851 gallons of water. See Ronald A. Kaiser, Handbook of Texas Water Law: Problems and Needs 43 (1987).

FN14. U.S. Geological Survey, supra note 11, at 4.

FN15. Id.

FN16. Luna B. Leopold, A View of the River 96 (1994).

FN17. U.S. Geological Survey, supra note 11, at 4.

FN18. Discharge from Comal and San Marcos Springs accounted for 85% of the total spring discharge from the Edwards Aquifer during 1997. U.S. Geological Survey, supra note 11, at 4.

FN19. A footnote to the U.S. Geological Survey's 1998 report on recharge and discharge to the Edwards Aquifer notes that beginning in 1997 the total for estimated withdrawals is incomplete, lacking an estimate for irrigation withdrawals in Bexar, Medina, and Uvalde Counties, one of the major uses of Aquifer water. As a result, the continuous record of estimates of total withdrawals from the Aquifer (reported by the USGS from 1934 through 1996) has been interrupted. U.S. Geological Survey, supra note 11, at 4.

FN20. Gunnar Brune, Tex. Water Dev. Bd., Major and Historical Springs of Texas, Report 189, 33 (Mar. 1975). An acequia is a community irrigation ditch for domestic use and crop irrigation. Kaiser, supra note 13, at 43.

FN21. Ralph Haurwitz, Springs Under Strain, Austin Am.-Statesman, Nov. 20, 1997, at A1.

FN22. Brune, supra note 9, at 38.

FN23. Id. The Fredericksburg area, not the Comal Springs area, was the original target for settlement by the German colonists. Misunderstandings over land deals between the Prince and his agents prevented the colony from being established at its intended location. Comal Springs was to serve as a way station to the area targeted for settlement. The colonists eventually established New Braunfels at Comal Springs in part because Comal Springs provided a source of water to power mills. Telephone Interview with Laura A. Wimberley, Ph.D. candidate, Texas A&M University (Feb. 9, 1998).

FN24. Wimberley, supra note 23.

FN25. Id.

FN26. Id.

FN27. Laura A. Wimberley, Reluctant Conservationists, Water Scarcity and Regional Interdependence: Central Texans and the 'Great Drought' 1 (Mar. 28, 1997) (unpublished manuscript presented at the Southwest Social Science Association Annual Meeting, New Orleans, LA) (on file with author).

FN28. The water in the River Walk, a central feature of the City, is supplied from the San Antonio River. Primarily because of groundwater pumping, the San Antonio River, which once was spring-fed, would be dry within the city limits if not for well water pumped into it from the Edwards Aquifer, wastewater discharges, and storm water runoff. Tex. Water Dev. Bd., supra note 2, at 19.

FN29. San Antonio Water Sys., Conservation Rates and Related Adjustments 48-49 (Mar. 1994).

FN30. Tex. Water Dev. Bd., Surveys of Irrigation in Tex. 1958, 1964, 1969, 1974, 1979, 1984, 1989, & 1994, Report 347, 29, 37 (Jan. 1996).

FN31. Robert Perez, U.S. Geological Survey, Potential for Updip Movement of Saline Water in the Edwards Aquifer, San Antonio, Texas, Report 86-4032 (1986).

FN32. Glenn Longley, The Edwards Aquifer: Earth's Most Diverse Groundwater Ecosystem?, 11 Int'l J. Speleology 123, 123 (1981). See also Illgner, supra note 12, at 1.4.

FN33. The widemouth blindcat has been brought forth from wells almost 610 meters deep. Glenn Longley & Henry Karnei, Jr., S.W. Tex. St. U., Status of Satan Eurystomus Hubbs and Bailey, the Widemouth Blindcat 6 (1978).

FN34. San Marcos/Comal Recovery Team, U.S. Fish & Wildlife Serv., San Marcos and Comal Springs and Associated Aquatic Ecosystems (Revised) Recovery Plan 6 (1996) [hereinafter Revised Recovery Plan].

FN35. Id. Endemism refers to the existence of a species or race native to a particular place and found only there. Edward O. Wilson, The Diversity of Life 397 (1992).

FN36. Endangered and Threatened Wildlife and Plants; Listing of the San Marcos Salamander as Endangered, and the Listing of Critical Habitat for Texas Wild Rice, San Marcos Salamander, San Marcos Gambusia and Fountain Darter, 45 Fed. Reg. 47,355 (July 14, 1980) (to be codified at 50 C.F.R. pt. 17) [[[hereinafter Endangered and Threatened Wildlife and Plants]; Revised Recovery Plan, supra note 34, at 6. The San Marcos gambusia is probably extinct. Historically, gambusia populations have been sparse. No individuals, however, were collected during sampling in at least 15 attempts between 1984 and 1995. Id. at 28 tbl.3.

FN37. Revised Recovery Plan, supra note 34, at 27.

FN38. Endangered and Threatened Wildlife and Plants, 45 Fed. Reg. 47,355 (July 14, 1980).

FN39. "Take" means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." Endangered Species Act of 1973, 16 U.S.C. s 1532(19) (1994). A "take" is an event that may pertain to as few as one individual of the species. The term "jeopardy" refers to a situation where the survival of the entire species is in peril.

FN40. U.S. Fish & Wildlife Serv., April 15 and June 15 letters filed with Judge Lucius D. Bunton (W.D. Tex. 1993); Final Rule to List Three Aquatic Invertebrates in Comal and Hays Counties, Tx, as Endangered, 62 Fed. Reg. 66,295 (Dec. 18, 1997).

FN41. U.S. Fish and Wildlife Service, April 15 and June 15 letters filed with Judge Lucius D. Bunton (W.D. Tex. 1993); Final Rule to List Three Aquatic Invertebrates in Comal and Hays Counties, 62 Fed. Reg. 66,295 (Dec. 18, 1997).

FN42. United States Geological Survey data beginning in 1927 indicates that the mean daily flow of Comal Springs had not fallen below 200 cubic feet per second (cfs) prior to June 30, 1951. As pumping from the Aquifer has risen since the end of the drought of record in 1957, Comal Springs has frequently fallen below critical levels. Over the period 1958-1998, Comal Springs has been below the 200 cfs take level for the fountain darter in 41% of the years, and below the 150 cfs jeopardy level for the fountain darter in 20% of the years. Calculations based on data from USGS Station 08169000, New Braunfels, Comal County, Texas.

FN43. T.L. Arsuffi et al., Ecology of the Exotic Giant Rams-Horn Snail, Marisa Conuarietis, Other Biological Characteristics, and a Species/Ecological Review of the Literature of the Comal River Ecosystem of South Central Texas, Final Report for the Edwards Underground Water District and City of New Braunsfels 10-11 (1992).

FN44. There are many ways to define drought, including hydrological drought, which is the effect of precipitation shortfalls on water supplies. Donald A. Wilhite, A Methodology for Drought Preparedness, 13 Nat. Hazards 232-33 (1996). Estimates of the duration of the drought of record for the Edwards Aquifer have varied between 1948-1957. USGS estimates of annual recharge are available beginning in 1934. The average estimated annual recharge for the period 1934- 1997 has been 676,000 acre-feet. The average estimated annual recharge for the period 1942-1956 was 317,713 acre-feet, is less than half of the 1934-1997 average. Recharge was below average for the entire period from 1942-1956, never exceeding 560,900 acre-feet in any year. Calculations based on U.S. Geological Survey, supra note 11, at 2.

FN45. 2 Tex. Dep't of Water Resources, Water for Texas: Technical Appendix II- 1 (1984).

FN46. Joe G. Moore, Jr., Emergency Withdrawal Reduction Plan for the Edwards Aquifer 8 (Aug. 1, 1994) (unpublished manuscript, on file with the U.S. District Court, Western District of Texas, Midland-Odessa Division, Judge Lucius Bunton). The original population of fountain darters was extirpated from the Comal Springs ecosystem when the Springs ceased to flow. Fountain darters from San Marcos Springs were reintroduced into Comal Springs in 1975 and 1976. Arsuffi, supra note 43, at 4. There is no record that San Marcos Springs has ever ceased to flow. Three points have been cited to support this conclusion: no known record exists indicating flow has ever ceased, the development of great biological diversity and unique endemic plants and animals is indicative of consistent flow, and the archeological record of continuous human habitation goes back at least as early as 9200 B.C. Glenn Longley, S.W. Tex. St. U., San Marcos River

Management Plan, Report Phase II 1 (1991) (prepared for the Texas Parks and Wildlife Department and U.S. Fish and Wildlife Service).

FN47. 2 Tex. Dep't of Water Resources, supra note 45, at II-1.

FN48. The rule of capture for groundwater law in Texas was established in Houston & T.C. Ry. Co. v. East, 98 Tex. 146, 81 S.W. 279 (Tex. 1904). See Friendswood Dev. Co. v. Smith-Southwest Indus., 576 S.W.2d 21, 25-26 (Tex. 1978). The Texas Supreme Court is currently considering whether to revise the rule of capture. Nicole Foy, 'Rule of capture' law for water facing test (visited Mar. 3, 1999) <http://www.expressnews.com/pantheon/index/aquifer.shtml>.

FN49. Friendswood Dev. Co., 576 S.W.2d at 28.

FN50. S. 1, 75th Leg., Regular Sess. (Tex. 1997).

FN51. G.A. Tobin et al., Water Resources, in Geography in America 127, 128 (Gary L. Gaile & Cort J. Wilmot eds., 1989).

FN52. Appropriative water rights is the western doctrine which holds that water is held for the benefit of all the people subject to a permitted right to use, and those "first in time" are "first in right" to take or divert water from a watercourse and apply it to a beneficial use. Kaiser, supra note 13, at 43.

FN53. House Research Org., Tex. House of Representatives, Regulating the Edwards Aquifer: A Status Report, No. 73-8, at 19 (1994).

FN54. Illgner, supra note 12, at 4.3. When the cap is removed from the well a forty foot gusher of water explodes from the earth. Michael Parfit, Sharing the Wealth of Water,

National Geographic Special Issue: Water, Nov. 1993, at 32. A second well at the catfish farm could be the largest artesian well in the country. Illgner, supra note 12, at 4.3.

FN55. Sierra Club v. Lujan, No. MO-91-CA-69, 1993 WL 151353, at *1 (W.D. Tex. Feb. 1, 1993).

FN56. Id.

FN57. Id.

FN58. Sierra Club v. Babbitt, No. MO-91-CA-069, slip op. at 69 (W.D. Tex. May 26, 1993) (amended findings of fact and conclusions of law) (emphasis in original).

FN59. S. 1477, 73d Leg., Reg. Sess. (Tex. 1993).

FN60. Tex. Const. art. XVI, s 59.

FN61. As a result of Senate Bill 1477 the Edwards Aquifer Authority (EAA) replaced the Edwards Underground Water District that had limited jurisdiction and lacked the clear authority to regulate withdrawals from the Aquifer.

FN62. Edwards Aquifer Authority Enabling Statute, ch. 626, 1993 Tex. Gen. Laws 2355, as amended by ch. 621, 1995 Tex. Gen. Laws s1.14(a)(6), (b), (c), (h).

FN63. Id. s1.14(h).

FN64. Moore, supra note 46, at 3. Withdrawals of 225,000 acre-feet could occur with control of the giant rams-horn snail.

FN65. Voting Rights Act of 1965, 42 U.S.C. s 1973 (1994).

FN66. House Research Org., supra note 53, at 2.

FN67. 42 U.S.C. s 1973 (1994).

FN68. House Research Org., supra note 53, at 2.

FN69. Sierra Club v. Babbitt, No. MO-91-CA-069, slip op. at 1-2 (W.D. Tex. Feb. 25, 1994) (order appointing Joe G. Moore, Jr. as monitor). For more information on the role of monitors and masters in environmental litigation see Todd H. Votteler & Joe G. Moore, Jr., The Use of Masters in Environmental Litigation, Nat. Resources & Env't, Fall 1997 at 126.

FN70. Sierra Club v. Babbitt, No. MO-91-CA-069, slip op. at 7-8 (W.D. Tex. Jun. 3, 1994) (order on motion for additional relief).

FN71. The EWRP did not apply to small sections of Atascosa, Caldwell, Guadalupe, and Kinney Counties that are above the Aquifer.

FN72. The nucleus of the citizen's organization that coordinated the campaign to defeat the Applewhite Reservoir project had originally formed to successfully prevent fluoride from being added to San Antonio's drinking water. By the time Sierra Club v. San Antonio, No. MO-96-CA-097, slip op. (W.D. Tex. Aug. 16, 1996, was filed, San Antonio had elected a dentist and oral surgeon as mayor.

FN73. 16 U.S.C. s 1539(a)(1)(B) (1994).

FN74. Letter from Charles R. Shockey, U.S. Dep't of Justice, Env't and Nat. Resources Div., to U.S. District Court for the Western District of Texas, Notice of Filing of

Springflow Determinations Regarding Survival and Recovery and Critical Habitat of Endangered and Threatened Species 5 (June 15, 1993). The Recovery Plan omitted the 60 cfs quantity as the minimum flow for fountain darters under certain conditions. Revised Recovery Plan, supra note 34, at 17.

FN75. The Incidental Take Permit Panel was not the first attempt to find a compromise among the parties contending over the control of Edwards Aquifer water. Numerous attempts had been made to resolve the disputes that sparked this litigation. These efforts included a legislative effort in 1989, a mediation sponsored by the Texas Water Development Board (TWDB) in 1991, involvement of the chairman of the Texas Water Commission and the mayor of Austin in 1992, and recent attempts by the USFWS in 1996.

FN76. Two of the panel members were representatives of the cities of New Braunfels and San Marcos, where Comal and San Marcos Springs are located.

FN77. Sierra Club v. Babbitt, No. MO-91-CA-069, slip op. at 3-4 (W.D. Tex. Sept. 30, 1994) (order directing the monitor to create a panel).

FN78. Joe G. Moore, Jr. & Todd H. Votteler, Draft Habitat Conservation Plan for the Edwards Aquifer (Balcones Fault Zone-San Antonio Region) 4 (1995) (unpublished manuscript on file with the U.S. District Court for the Western District of Texas Midland-Odessa Division, Judge Lucius Bunton). The 250,000 to 350,000 acre-feet figure is a conservative estimate that does not include the construction of any new reservoirs. Since the drought of 1996 the estimated amount of available water has declined. The 50,000 acre-feet from the Lower Colorado River is now less likely to be available due to the passage of Texas Senate Bill 1 in 1997, which places additional restrictions upon future interbasin transfers, and with the purchase of some 100,000 acre-feet of available water rights by the Lower Colorado River Authority from the Garwood Irrigation District in 1998.

FN79. Joe G. Moore, Jr. & Todd H. Votteler, Revised Emergency Withdrawal Reduction Plan for the Edwards Aquifer (March 31, 1995) (unpublished manuscript on file with the U.S. District Court for the Western District of Texas Midland- Odessa Division, Judge Lucius Bunton).

FN80. Sierra Club v. Babbitt, No. MO-91-CA-069, slip op. at 3-4 (W.D. Tex. Jun. 14, 1995) (order on Summer 1995 emergency withdrawal reductions).

FN81. Section 7(a)(2) of the Endangered Species Act requires that each Federal agency consult with the USFWS to insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any threatened or endangered species or result in the adverse modification of habitat of such species. Endangered Species Act of 1973, 16 U.S.C. s 1536(a)(2) (1988). Consultation can be formal or informal. Informal consultation includes any and all communications between agencies prior to the initiation of formal consultation. Formal consultation is required when a federal action "may adversely affect" a listed species or critical habitat.

FN82. Kelly Air Force Base was added eventually to the base closure list for other reasons.

FN83. The recovery plan acknowledges that the key issue to survival of the listed species is the conservation of the aquatic ecosystems at Comal and San Marcos Springs, as well as the Aquifer itself. Revised Recovery Plan, supra note 34, at 51. One of the measures described in the recovery plan is the establishment of "refugium" for endangered species. Soon after the Recovery Plan was released in 1996 the National Biological Service attempted to close the San Marcos National Fish Hatchery, which served as a primary refugium. The Sierra Club filed suit in the U.S. District Court for the Western District of Texas to keep the hatchery open, and Judge Bunton ruled in their favor. Sierra Club v.

Bruce Babbitt & Nat'l Biological Serv., No. MO-96-CA-19 slip op. (W.D. Tex. Apr. 4, 1997) (order).

FN84. With the addition of Kelly Air Force Base to the base closure list, and its use for private purposes the U.S. Air Force (USAF) initiated a section 7(a) consultation before transfer of the base to the Greater Kelly Development Corporation (GKDC) organized by an ordinance of the City of San Antonio. In the USFWS biological opinion concerning the proposed plan to dispose and redevelop Kelly Air Force Base, the USFWS described the terms and conditions to exempt the USAF and the GKDC from section 9 of the ESA. A sample of the terms and conditions include: To be exempt from the prohibitions of section 9 of the ESA the USAF and GKDC are responsible for compliance with the following terms and conditions, which implement the reasonable and prudent measures described above... 4. Contribute $200,000 to a Conservation Fund administered by National Fish and Wildlife Foundation (or other foundation mutually acceptable to the USAF and the Service). Contributions will be used to fund such things as mentioned in item 2 of the Reasonable and Prudent Measures and that are consistent with the Recovery Plan for these species. Some examples of such projects may include but are not limited to exotic and predator species control, control structure repair / modification, fountain darter parasite research, vegetation restoration, and entering historic stand localities of wild rice into a geographic information system. In an effort to enhance the capability to accomplish the highest priority needs and for adaptive management to address unforeseen circumstances, or the development of new information which may dictate new priorities, the funding priorities will be decided by the Service. The USAF will make the contribution no later than twelve (12) months after receiving notification from the Service that the fund manager is in place and a list of projects being considered for funding. Biological Opinion Letter from U.S. Fish and Wildlife Serv. to Director, SA- ALC / ECM, Kelly Air Force Base, Texas 35 (June 26, 1997). The total conservation fund consists of two menus of mitigation items totaling $23,195,000. U.S. Fish and Wildlife Service, Conservation Fund 1 (undated and unpublished manuscript on file with author).

FN85. Keith Keplinger et al., Tex. Water Resources Inst., the 1997 Irrigation Suspension Program for the Edwards Aquifer: Evaluation and Alternatives, Report TR-178 6 (1998). Irrigation pumping reached 203,000 acre-feet in 1985. Moore & Votteler, supra note 79, at 20.

FN86. Tex. Water Comm'n, Avoiding Disaster: An Interim Suspension Program for the Edwards Aquifer 8 (1992).

FN87. Sierra Club v. Glickman, No. MO-95-CA-091, slip op. (W.D. Tex. Apr. 28, 1995).

FN88. Id. at 12-13.

FN89. Id.

FN90. Id. at 13-14.

FN91. Id. at 15-20.

FN92. Glickman, No. MO-95-CA-091, slip op. at 1 (W.D. Tex. Sept. 19, 1996) (judgment).

FN93. Id. at 2.

FN94. Sierra Club v. Glickman, No. 96-50677, No. 96-50778, slip op. at 5 (5th Cir. Sept. 24, 1998).

FN95. The Medina and Uvalde County Underground Water Conservation Districts were created after Medina and Uvalde County withdrew from the Edwards Underground Water District in 1989 over a disagreement concerning Aquifer pumping limits. House

Research Org., supra note 53, at 37. The original members were named in the statute correcting the Voting Rights Act deficiencies.

FN96. Barshop v. Medina County Underground Water Conservation Dist., 925 S.W.2d 618, 623 (Tex. 1996).

FN97. Brief for Appellees at 5-6, Barshop v. Medina County Underground Water Conservation Dist., 925 S.W.2d 618 (Tex. 1996) (No. 95-0881).

FN98. Brief for Appellant at 8-9, Barshop v. Medina County Underground Water Conservation Dist., 925 S.W.2d 618 (Tex. 1996) (No. 95-0881) (quoting Garrett Hardin, The Tragedy of the Commons, 162 Sci. 1243, 1244 (1968)).

FN99. Barshop, 925 S.W.2d at 626.

FN100. "The high standard of proof required to establish underground streams limits the utility of the use of the subsurface stream doctrine to coordinate ground and surface water rights; findings of subsurface streams are likely to be comparatively rare." A. Dan Tarlock, Law of Water Rights and Resources 3-27 (1993). This litigation is still pending. See Brief of Regional Amicus Parties Urging Expedited Decision and Retention of Jurisdiction at 24, Barshop v. Medina County Underground Water Conservation District, No. 98-0881 (Tex. filed March 15, 1996) (discussing In re the Adjudication of Rights to Water in the Edwards Aquifer, No. 89-0381 (D. Tex. Hayes County filed 1989)).

FN101. Patrick Crimmins, Aquifer is Ruled a River, San Antonio up a Creek: Commission Takes Control of Water Supply, San Antonio Light, Apr. 16, 1992, at A1.

FN102. McFadden v. Texas Water Comm'n, No. 92-05214, slip op. at 2 (D.C. of Travis County, Tex. 1992).

FN103. Jerry Needham, Wildlife Agency Doesn't Plan Suits, San Antonio Express- News, June 7, 1996, at 1C.

FN104. Sierra Club v. San Antonio, No. MO-96-CA-097, slip op. at 1 (W.D. Tex. Aug. 16, 1996).

FN105. Guadalupe-Blanco River Authority, supra note 10, at Exhibit 2.

FN106. Sierra Club, No. MO-96-CA-097, slip op. at 1 (order).

FN107. Todd H. Votteler, 1996 Emergency Withdrawal Reduction Plan for the Edwards Aquifer 1 (Aug. 23, 1996) (unpublished manuscript, on file with the U.S. District Court, Western District of Texas, Midland-Odessa Division, Judge Lucius Bunton). The full text of the Plan was published by the San Antonio Express-News. Judge Bunton's Decision: The Order, San Antonio Express-News, Aug. 26, 1996, at 9A.

FN108. A statement filed with the court from the San Antonio Fire Chief in opposition to the 1996 Emergency Withdrawal Reduction Plan (EWRP) indicated that restrictions on landscape watering could lead to an increase in fires in the city. During this time Corpus Christi, Texas, 143 miles south of San Antonio, had already implemented more severe restrictions on landscape watering than were proposed in the 1996 EWRP.

FN109. While unpopular in San Antonio, the 1996 EWRP received resolutions of support from entities in the Guadalupe River Basin, including the Guadalupe- Blanco River Authority, the City of Seguin, the Board of Trustees of the New Braunfels Utilities, the Luling Area Chamber of Commerce, and the Comal and Hays County Board Members of EAA.

FN110. Judge Bunton's order states: "It would appear from the failure to act by federal, state, and local agencies, that the question posed in Genesis 4:9 has been 'No' when it should be 'Yes' (emphasis in original). In Genesis 4:9, Cain asks God, '... am I my brother's keeper?'" Sierra Club, No. MO-96-CA-097, slip op. at 4 (order).

FN111. Sierra Club v. San Antonio, 112 F.3d 789, 792 n.7 (5th Cir. 1997), reh'g denied, 118 F.3d 1580 (5th Cir. 1997), and cert. denied, 118 U.S. 879 (1998).

FN112. Keplinger et al., supra note 85, at 4.

FN113. Id. at 10.

FN114. Id. at 12.

FN115. Sierra Club, 112 F.3d at 791.

FN116. Id. at 791-92, 797.

FN117. Sierra Club v. San Antonio, 118 U.S. 879 (1998).

FN118. Jerry Needham, Suits Ready if Drought Kills Wildlife, San Antonio Express-News, June 25, 1998, at 1A.

FN119. Jerry Needham, Board Pushes Cloud Seeding, San Antonio Express-News, July 28, 1998, at 1B.

FN120. The EAA is charged by Senate Bill 1477 with protecting endangered species: "Authorizations to withdraw water from the aquifer and all authorizations and rights to make a withdrawal under this Act shall be limited in accordance with this section to...

protect species that are designated as threatened or endangered under applicable federal or state law." Edwards Aquifer Authority Enabling Statute, ch. 626, 1993 Tex. Gen. Laws 2355, as amended by Edwards Aquifer Authority Enabling Statute, ch. 621, 1995 Tex. Gen. Laws, s1.14(a)(6).

FN121. Heavy rainfall in August was followed by tragic flooding in October over the eastern counties of the Aquifer. The floods increased the sustained flow of the Springs to levels not experienced since 1993 (see Figure 2).

FN122. Living Waters Artesian Springs, Ltd. v. Edwards Aquifer Auth., No. 98-02644, slip op. at 1 (D.C. of Travis County, Tex. Aug. 5, 1998) (order granting temporary injunction).

FN123. Living Waters applied for 47,043 acre-feet annually and received a proposed permit for 6934 acre-feet. Jerry Needham, Water Officials Say Area Is in Catfish Farmer's Net, San Antonio Express-News, Aug. 7, 1998, at 3B [[[hereinafter Water Officials]. By the time the injunction was in place, EAA was still tallying the hundreds of challenges to the proposed permits it had received from pumpers. Jerry Needham, Edwards Aquifer Authority Flooded with Permit Protests, San Antonio Express-News, Aug. 8, 1998, at 5B.

FN124. Jerry Needham, Water Users Will Pay Higher Price: Panel Releases Proposed Quotas for Jan. 1, 2000, San Antonio Express-News, Apr. 29, 1998, at 6A. Pumping limitations have attracted the interest of the U.S. Filter Corporation, which owns water rights in other states. Rick Casey, Billionaire Bass Clan Stakes Out Area Water, San Antonio Express-News, Nov. 2, 1997, at 2A.

FN125. Water Officials, supra note 123.

FN126. Jerry Needham, 2nd Judge Suspends EAA Pumping Rules, San Antonio Express-News, Sept. 16, 1998, at 3B. Bragg v. Edwards Aquifer Auth., No. 98-07-

14535CV, slip op. (Tex. Sept. 11, 1998) (no written order issued yet). Judge Pennington ruled in 1995 that Senate Bill 1477 was unconstitutional, but was later overruled by the Texas Supreme Court.

FN127. Letter from Mary E. Kelly, Henry, Lowerre, Johnson, Hess & Frederick Attorneys at Law, to Michael Beldon, Chairman of Edwards Aquifer Authority (Aug. 14, 1998) (on file with author) (notice to recipient of violation of the Federal Endangered Species Act and intent to sue).

FN128. Shields v. Babbitt, No. SA-98-CA-0774, slip op. at 1 (W.D. Tex. Aug. 28, 1998).

FN129. Id. at 6.

FN130. Letter from Melinda E. Taylor, Senior Attorney, Environmental Defense Fund, to Michael Beldon, Chairman of Edwards Aquifer Authority (Sept. 14, 1998) (on file with author) (notifying recipient of violations of the Federal Endangered Species Act and intent to sue).

FN131. Sierra Club v. Glickman, No. 96-50677, No. 96-50778, slip op. at 10 (5th Cir., Sept. 24, 1998).

FN132. Living Waters Artesian Springs v. Edwards Aquifer Auth., No. 98- 02644, slip op. (D.C. Travis County, TX Dec. 17, 1998).

FN133. Jerry Needham, District Judge Strikes Down EAA Statutes, San Antonio Express-News, Jan. 5, 1999, at 8A.

FN134. Jerry Needham, City Poised to Nail down Major New Water Source, San Antonio Express-News, Dec. 28, 1998, at 8A; Jerry Needham, SAWS OKs Water Pacts, San Antonio Express-News, Dec. 31, 1998, at 1A.

FN135. For example: In 1989, in Sierra Club v. Babbitt, the ESA was used as a weapon to take property rights, in this instance Water [sic], from private landowners.... We have invested thousands of dollars of our membership dues in an attempt to protect a sacred property right in Texas known as a 'rule of capture.' To this day, there has been no satisfactory resolution to this lawsuit. However, under the threat of federal intervention, the State legislature has taken individual's property rights by restricting their right to pump water from beneath their own land. Bob Stallman, Endangered Species Task Force, Statement at House Resources Field Hearing in Boerne, Texas 1 (Mar. 20, 1995).

FN136. Tom Teitenberg, Environmental and Natural Resources Economics 41 (4th ed. 1996).

FN137. Tobin, supra note 51, at 127.

FN138. Ralph K.M. Haurwitz, Maurice Rimkus: Coming Around on Water Reform, Austin Am.-Statesman, Dec. 28, 1997, at A15.

FN139. See Tex. Water Dev. Bd., Model Refinement and Applications for the Edwards (Balcones Fault Zone) Aquifer in San Antonio Region, Texas, Report 340 (1992).

FN140. House Research Org., supra note 53, at 10.

FN141. Tex. Water Dev. Bd., Water for Texas 2-36 (1997). Stahle and Cleaveland have estimated that extreme prolonged droughts, similar to the drought of record, occur about every 90 years in Texas, while there is a 50% risk of extreme June drought in south Texas every 10 years. They found that prolonged droughts are either proceeded or followed by

extended wet periods (see Table 5). They also found that the risk for below average June moisture increases to 65% in south Texas in the summer following a June drought. David W. Stahle & Malcolm K. Cleaveland, Texas Drought History Reconstructed and Analyzed from 1698 to 1980, 1 J. Climate 59, 66, 72 (1988).

FN142. See Moore & Votteler, supra note 79, at 26-28.

FN143. Calculations based on U.S. Geological Survey, supra note 11, at 2. Despite two serious droughts in 1996 and 1998, the 1990s will likely surpass the 1970s as the decade with the highest total recharge.

FN144. Water Officials, supra note 123, at 6A.

FN145. Edwards Aquifer Authority Enabling Act, ch. 626, s 1.14 (b), 1993 Tex. Gen. Laws 2350, 2360.

FN146. Id. s 1.14(c).

FN147. Id. s 1.14(h).

FN148. Water Officials, supra note 123, at 6A. As noted earlier the rules adopted by EAA to allocate Edwards water have been thrown out by State District Courts in Medina and Travis Counties. Therefore, this number is almost certain to change, but it is used here to calculate potential shortfalls for the purpose of demonstration.

FN149. House Research Org., supra note 53, at 10. The TWDB modeled springflows under hypothetical pumping scenarios.

FN150. Id. Even with pumping restricted to 165,000 ac-ft/yr, the TWDB model shows that during a repeat of the drought of record Comal Springs would temporarily dip below the 150 cfs jeopardy level for fountain darters. If drought management plans are implemented in the early stages of the drought, more water might be able to be pumped while avoiding the jeopardy level.

FN151. Id. Control of the giant rams-horn snail lowers the jeopardy level for fountain darters at Comal Springs from 150 to 60 cfs for short periods of time (see Table 2).

FN152. Telephone Interview with Juanita Carabajal, San Antonio Water System, (Oct. 8, 1998). Many of the 188 respondents offered to lease water for around $100 per acre-foot per year.

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