

THE WATERS OF THE EDWARDS AQUIFER, SOUTH CENTRAL TEXAS:
PERCEPTION AND POLICY

by

JONATHAN PLUMMER

A THESIS

Presented to the Environmental Studies Program
and the Graduate School of the University of Oregon
in partial fulfillment of the requirements
for the degree of
Master of Science

June 2000

"The Waters of the Edwards Aquifer, South Central Texas: Perception and Policy," a thesis prepared by Jonathan Plummer in partial fulfillment of the requirements for the Master of Science Degree in the Environmental Studies Program. This thesis has been approved and accepted by:



Dr. Shaul Cohen, Chair of the ~~Examining~~ Committee

May 30, 2000
Date

Committee in Charge: Dr. Shaul Cohen, Chair
 Dr. Matthew Dennis

Accepted by:



Dean of the Graduate School

An Abstract of the Thesis of

Jonathan Plummer for the degree of Master of Science

in the Environmental Studies Program to be taken June 2000

Title: THE WATERS OF THE EDWARDS AQUIFER, SOUTH CENTRAL TEXAS:
PERCEPTION AND POLICY

Approved: _____


Dr. ~~Shaul~~ Cohen

As the sole-source aquifer for the region, the Edwards Aquifer of South Central Texas provides for the various needs of some two million area residents, primarily within the city of San Antonio. Following a 1991 Sierra Club lawsuit which mandated the protection of eight species at aquifer-fed springs, use and management of the Edwards have become dramatically more complicated. Beginning with an applied chronological progression of Worster's hydraulic thesis, the histories of the Edwards-fed San Antonio River and the San Marcos Springs reveal perceptions that have resulted in the current, so-called "water crisis." Additional exegesis of contemporary management policies, attitudes toward development, and proposed alternative water supplies provides further insight. Ultimately, this evidence reveals fundamental problems of Edwards management—namely, that this crisis proves not so much one of water quantity or quality, but one more rooted in wrongful, mistaken perceptions that have led to the misuse of the region's water source.

CURRICULUM VITAE

NAME OF AUTHOR: Jonathan Plummer

PLACE OF BIRTH: Houston, Texas

DATE OF BIRTH: July 27, 1974

GRADUATE AND UNDERGRADUATE SCHOOL ATTENDED:

University of Oregon
University of Montana
Trinity University

DEGREES AWARDED:

Master of Science in Environmental Studies, 2000, University of Oregon
Bachelor of Arts in English Literature, 1996, University of Montana

AREAS OF SPECIAL INTEREST:

Water Resource Management
Social Perceptions of Resource Management

PROFESSIONAL EXPERIENCE:

Intern, Edwards Aquifer Authority, San Antonio, Texas, 1999

Graduate Teaching Fellow, Environmental Studies Program, University of Oregon, Eugene, 1998 – 2000

GRANTS:

Graduate School, University of Oregon, 1999
Environmental Studies Program, 1999

ACKNOWLEDGMENTS

My gratitude and sincere appreciation for committee members Professor Shaul Cohen and Professor Matt Dennis, their invaluable comments, and aide in preparation. My thanks, also, to Ann Heppermann for research assistance.

TABLE OF CONTENTS

Chapter	Page
I. INTRODU CTION	1
II. APPLICATIONS OF WORSTER'S HYDRAULIC THESIS	9
The Local Subsistence Mode	9
Local Subsistence: San Marcos Springs	12
Local Subsistence: San Antonio River	14
The Agrarian State Mode	16
Agrarian State: San Marcos Springs	17
Agrarian State: San Antonio River	19
The Capitalist State Mode	28
Capitalist State: San Marcos Springs	29
Capitalist State: San Antonio River	35
III. CONTEMPORARY HYDRAULIC REFLECTIONS	43
Political History of the Edwards Aquifer	46
Recharge Zone, Ho!	48
Applewhite Reservoir	49
IV. RECHARGE ZONE PLANNING.....	56
V. RECENT GOVERNANCE AND POLICY	66
VI. ANALYSIS AND CONCLUSIONS	77
APPENDIX	
A. EXCERPTS FROM THE SAN ANTONIO <i>EXPRESS-NEWS</i> "WATER CRISIS" CHAT ROOM	82
B. REPRESENTATIONS OF REAL ESTATE DEVELOPMENT	84

	Page
C. CITY AND STATE RECHARGE ZONE LAND USE REGULATIONS	86
D. SAWS'S 1999 CRITICAL PERIOD STAGE WATER USE RESTRICTIONS	88
BIBLIOGRAPHY	91

LIST OF FIGURES

Figure	Page
1. Edwards Aquifer Region	3
2. Fountain Darter	5
3. Texas Widemouth Blindcat	5
4. Mission Espada Acequia	20
5. Mission Espada Dam	20
6. Rodgers' Spring Lake Park Hotel, 1929	29
7. San Marcos Springs, South Bank Shop Facades	30
8. San Marcos Springs, Submarine Theater	31
9. Spring Lake, Fountain and Boat	32
10. Spring Lake Hotel	34
11. Hugman's Signature along the San Antonio River Walk	37
12. River Extension, Convention Center	39
13. River Extension, Hyatt Regency	40
14. River Headwaters, Hyatt Regency	40
15. River Walk Visitor Map	42
16. Purple Pipe: Recycled Water Program Infrastructure	70

CHAPTER I

INTRODUCTION

Yes, as every one knows, meditation and water are wedded for ever.

Herman Melville, *Moby-Dick*

The history of any land begins with nature, and all histories must end with nature.¹

J. Frank Dobie, 1943

People [in the U.S. West] have been organized and induced to run, as the water in the canal does, in a straight line toward maximum yield, maximum profit. This American West can be best described as a modern hydraulic society, which is to say, a social order based on the intensive, large-scale manipulation of water and its products in an arid setting.... The hydraulic society of the West ... is increasingly a coercive, monolithic and hierarchical system, ruled by a power elite based on the ownership of capital and expertise. Its face is reflected in every mile of the irrigation canal.²

Donald Worster

¹ Dary, David A. *The Buffalo Book: The Full Saga of the American Animal*. Athens: Swallow Press/Ohio University Press, 1989. 4.

² Worster, Donald. *Rivers of Empire: Water, Aridity, and the Growth of the American West*. New York: Oxford University Press, 1985. 6-7.

As the sole-source aquifer for the region,³ the Edwards Aquifer of South Central Texas, provides for the various needs of some two million area residents, primarily within the city of San Antonio. Named after the Edwards karst limestone that comprises it—itsself renamed from Caprina limestone in 1898 by geologists Hill and Vaughn⁴—the aquifer's nomenclature, along with that of the Plateau and area county, stems from Virginian Hayden Edwards whose 1825 application to the government of Mexico allowed for the settlement of himself and 800 would-be Texians within the region.⁵ The aquifer region covers some 8,000 square miles—4,400 square miles of which encompasses the recharge and contributing zones,⁶ the remainder falling within the aquifer's artesian zone,⁷ running 140 miles laterally with a north/south width ranging between ten and 40 miles (see Fig. 1). Containing an estimated 25 to 55 million acre

³ The sole source designation was originally derived from the Safe Water Drinking Act in order to identify groundwater systems that are a region's major or only drinking water supply. Such designation, ostensibly, is to reduce risk posed to these aquifers by any federally funded project (Jensen, Ric. Great Plains Agricultural Council, Texas Water Resources Institute. "Groundwater in the Great Plains: GPAC Report 141." Texas A&M University: 1991, 11.) In 1977, the Edwards became the first aquifer identified by the EPA as sole-source.³ (Illgner, Rick. "The Edwards Aquifer: Political Prisoner." Association of American Geographers. Atlanta: April, 1993. 1.1.)

⁴ *University of Texas Bulletin*, No. 3232. "The Geology of Texas—Mesozoic Systems." 338.

⁵ *Texas Mohair Weekly*. May 2, 1958.

⁶ Illgner. 1.1. The recharge zone refers to the area where water is likely to percolate to the aquifer through recharge features, such as caves or fissures, or through the fractured, porous limestone. The contributing zone—also known, though not officially, as the drainage area—refers to the basin, or watershed, of the aquifer, where waters from these areas will flow to the recharge and artesian zones.

⁷ The artesian zone overlays the area where water is confined under sufficient pressure so that the water will rise in a well casing above the confining layer over the aquifer.

feet⁸ of notably clean, clear water, the Edwards formation makes the aquifer one of the most permeable and productive limestone aquifers in the U.S.⁹

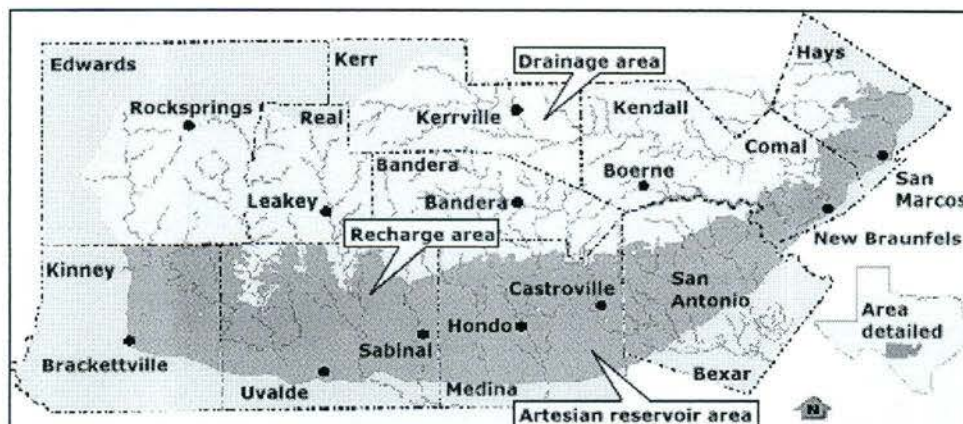


Figure 1. Edwards Aquifer Region.

As a highly rechargeable karst limestone aquifer, the Edwards's drainage basin is delineated between recharge and contributing zones.^{10 11} Despite its highly transmissive ability to recharge, the Edwards depends on the region's variable rainfall to maintain levels sufficient for continued flow from the several thousand area wells and handful of

⁸ An acre foot of water—325,851 gallons—is defined as the amount of water that would cover an acre to the depth of one foot.

⁹ Edwards Aquifer Authority. "Edwards Aquifer Hydrogeologic Report for 1997." Report 98-02. October 1998: 1.0.

¹⁰ The recharge zone is defined as the "area of the aquifer outcrop where caves, sinkholes, faults, fractures, or other permeable features create potential for recharge" (Edwards Aquifer Authority, Aquifer Science Team. "The Edwards Aquifer Authority Recharge Protection Issues." July 7, 1999). The contributing zone (previously known as the drainage area) is the watershed of the recharge.

¹¹ As a glance at any map of the aquifer region will show, state SB 1477, which originally defined and delineated the three zones, was not immune to political maneuvering. The recharge zone noticeably stops along the southern boundary of Edwards and Real Counties, defying a more accurate hydrogeological interpretation of the region.

aquifer-fed springs. With median annual recharge at 676,000 acre feet¹² and record withdrawal at 542,400 acre feet,¹³ the area's water usage maintains, at present, a precarious balance. Recent and projected increases in regional population, particularly within San Antonio, however, would combine with a protracted drought to create a water mining situation.

Following a 1991 Sierra Club lawsuit whose result mandated the protection of eight species at Edwards-fed springs, such drawdown on the aquifer, as with the perennially low summer levels, has within the past decade become dramatically more complicated. The suit, *Sierra Club, et al. v. Manuel Lujan, Jr., et al.*,¹⁴ forced the state and federal listing of various aquatic plant and animal species which rely on minimum spring flows to maintain the integrity of their habitat as threatened and endangered.¹⁵ As one of the

¹² Estimated median recharge for years of record 1934 to 1997 (Votteler, Todd H. "The Little Fish that Roared: The Endangered Species Act, State Groundwater Law, and Private Property Rights Collide over the Texas Edwards Aquifer." *Environmental Law*. Winter 1998: 849).

¹³ Estimated withdrawal for years of record 1934 to 1997 (Votteler, 849). Such estimations, it should be mentioned, have very low degrees of confidence due to the various difficulties of measuring groundwater flow.

¹⁴ Also often referred to as *Sierra Club, et al. v. Bruce Babbitt, et al.*, reflecting the change in 1993 of the Department of Interior's administration.

¹⁵ U.S. Fish and Wildlife, as of September 7, 1999, listed the following aquifer-dependent species as endangered: Comal Springs riffle beetle (*Heterelmis comalensis*), Comal Springs dryopid beetle (*Stygoparnus comalensis*), Fountain Darter (*Etheostoma fonticola*) (with critical habitat), Peck's cave amphipod (*Stygobromus pecki*), San Marcos gambusia (*Gambusia georgei*) (with critical habitat, though likely already extinct), Texas wild-rice (*Zizania texana*) (with critical habitat), Texas blind salamander (*Typhlomolge rathbuni*). The San Marcos salamander (*Eurycea nana*) (with critical habitat) is federally listed as threatened.

Texas Parks and Wildlife additionally lists the Widemouth Blindcat (*Satan eurystomus*) and Toothless Blindcat (*Trogloglanis pattersoni*) as threatened (Edwards Underground Water District. "Threatened and Endangered Plant and Animal Species of the Edwards Aquifer." Undated pamphlet).

Given the varied scales of threatened, endangered, and possibly extinct, and of federal and state involvement, there has been considerable public and academic confusion as to the names, numbers, and

most diverse aquifer systems in the world, the Edwards is home to rare and unique species found nowhere else and this endemism lies at the root of the listings¹⁶ (see Figures 2¹⁷ and 3¹⁸ for examples).

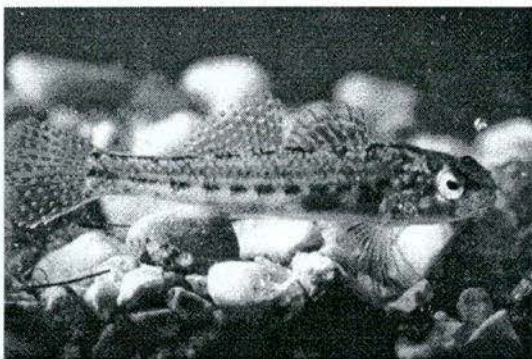


Figure 2. Fountain darter (*Etheostoma fonticola*)

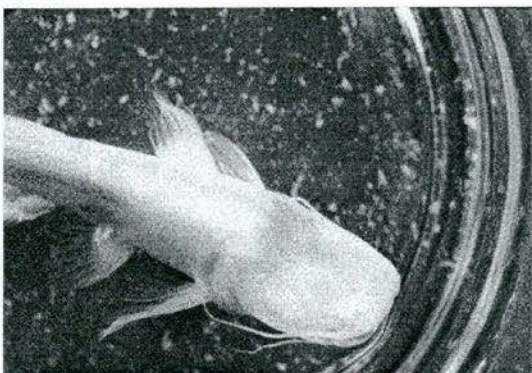


Figure 3. Texas widemouth blindcat (*Satan eurystomus*)

predicaments of these species. Such a lack of consensus on such basic information that so directly affects aquifer policy is, here, unfortunately common.

¹⁶ Votteler, 845-879.

¹⁷ Edwards Aquifer Research and Data Center. <http://eardc.swt.edu/EndangeredSpecies.html>. April 24, 2000.

¹⁸ Ibid.

This recent upheaval in perceptions and policy of the region's water source belies a long, complicated history of human relations and manipulations of the aquifer, its springs, and rivers. As the impetus for some estimated 12,000 years of human settlement, the areas surrounding Edwards-fed springs are thought to be some of the longest continuously-inhabited places in North America. From these inauspicious beginnings of use by nomadic Native tribes, and the wells and engineered acequias of the region's missions, the present loomings of potentially insufficient water quantity and quality have developed, steadily, following the population and consumption increases of the past century. With these waters acting as a cipher and context by which to understand this human history and, perhaps more importantly, contemporary implications of water manipulation, a clearer understanding arises of possible reactions to current and impending water troubles.

There exists a particular, if shifting, geography of cities, water, and power. At the intersection of these, where cities spring from the water that fuels their habitation and economy, the interaction of development and various water sources illustrates the ways in which power manifests itself, can move and mutate, and will, faithfully, benefit some at the expense of others. By examining the history of San Antonio, its river, its aquifer, and the interplay of these in terms of development, a clearer portrait of contemporary regional perceptions and policies appear.

Donald Worster's more nuanced interpretation of Karl Wittfogel's hydraulic society thesis, as described in his *Rivers of Empire*,¹⁹ provides a ready theoretical framework by which to analyze the region's development of and relations to its water resources from

the beginning of the area's first settlement to its more recent manipulations and strains. Following the hydraulic thesis, these human relations to water also reflect a set of shifting power relations. As simply the basis for the city's establishment and development, the manipulation and distribution of water reflects the manipulation and distribution of power within culture. In the local subsistence, agrarian state, and capitalist state modes of Worster's hydraulic thesis, there flows to varying degrees a progression of power and authority uphill, creating a social hierarchy where power accumulates near the top. As historical developments have introduced and required newer and larger methods of water manipulation to satisfy increased demands and populations, heightened agglomerations of power, as Worster illustrates, have reliably followed. And it is behind these hierarchies and concomitant demands of power inequity where the ecological ramifications of water and cultural manipulation are obscured.

Beginning with an applied progression of the hydraulic thesis—from local subsistence to agrarian state to capitalist state modes—the histories and manipulations of the Edwards Aquifer-fed San Antonio River and the San Marcos Springs reveal the human perceptions that have resulted in the current, so-called 'water crisis.' These histories are followed by a synopsis of the Edwards's hydrogeologic functions, detailing the issues of use, demand, and their effects on the aquifer's hydrology. With these basics laid out, the politics of the Edwards's management—from the establishment of the Edwards Underground Water District in 1959 to the Applewhite Reservoir controversies to most recent management strategies and developments—are explained and examined. The following chapter, addressing city and state planning strategies for the aquifer's

¹⁹ Worster.

recharge zone, reveal the tepid attitudes and approaches toward resource management that have failed to alleviate present and potential threats to water quantity and quality. Inextricably and richly intertwined with recharge zone development and planning, the socioeconomic and racial politics of San Antonio are scrutinized, implicating a race- and class-based development push towards the recharge zone that threatens the aquifer's integrity. A further chapter follows, providing an exegesis of the various governing agencies at municipal and state levels and their respective attempts to control the Edwards, including examples and critiques of several plans to provide alternative water supplies. Ultimately, these evidences and examples reveal some fundamental problems of Edwards resource management—namely, that this crisis proves not so much one of water quantity or even quality, as is commonly argued, as it is one, more deeply rooted, of wrongful, misguided perceptions that have led to the misuse and abuse of nothing less important than the region's sole source of water.

CHAPTER II

APPLICATIONS OF WORSTER'S HYDRAULIC THESIS

The Local Subsistence Mode

Worster identifies the local subsistence mode as “the simplest type of irrigation society [where] water control relies on temporary structures and small-scale permanent works that interfere only minimally with the natural flow of streams.”²⁰ Water and the food that it produces flows “directly into the mouths of those who have diverted it from nature—who have dug ditches with their own hands, thrown up their own brush or rock dams, and watched the vital liquid soak into the earth around their plants.”²¹ The importance to Worster’s thesis of this sort of small-scale production is that these sources of water, as much as they are a part of a human society, are not the rivers of empire. That is, these loose manipulations of water preclude the tight manipulation of people and the accumulation of power. The small-scale society and its incumbent limited need for water

²⁰ Worster, 31.

²¹ Ibid.

and water projects neither requires nor facilitates the sorts of water distribution that directly leads to hierarchical structures of power.

For historical examples, Worster points to the early indigenous cultures of the U.S. Southwest. From the Paiute of Owens Valley, California, to the Zuni and Hopi of the Four Corners region, water and its control rested in a diffused system of power with decisions as to use and manipulation lying with, at its most conglomerated point in Pueblo cultures, the flattened hierarchies of family groups or clans.²² The important lesson here lies in the illustration that water control follows pre-ordained systems of social power and not the other way around. Manipulation of water represents relatively egalitarian decision-making processes for the good of a given community, not a means by which a relative few would assume decision-making control and considerable power over the basic functions of irrigation and agriculture.

Such decentralization of water control and commensurate power results in large part from the simple geographical dispersion of these particular cultures. Just as the physical accumulation of water encourages the physical accumulation of the people who need that water (which, in turn facilitates the domination of these people by a few), the lack of such accumulation of water precludes, conversely, dense populations and this associated domination. Alternately, the ability to move water via large-scale manipulation of canal or ditch, as was not uncommon in the prehistoric Southwest, allowed for this dispersal of populations. Such was the case with, for example, Los Muertos, a Hohokam settlement in the Salt River Valley. Located some six miles from the Salt River itself, an elaborate

²² Ibid. 32-3.

canal system helped establish the area as one of the thriving population center of the fourteenth century. Later augmented by reservoirs and at least three ditches, this manipulation allowed an intensification and concentration of irrigation waters, followed by people, and, arguably, power.²³ An example such as this illustrates the various scales (historical, geographic, social, and those of water manipulation) through which Worster's thesis of the local subsistence mode should be approached. His somewhat soft-gloved analysis of elaborate Hohokam canal systems is, perhaps, somewhat idealistic in the assumption that there was only limited social control that followed large-scale water distribution. Worster dismisses the Hohokam as merely a lesson of the "political and environmental consequences of bigness."²⁴ He is not, that is to say, as careful or detailed as he could be in delineating these differences in prehistoric Southwest cultures, their approaches to water manipulations, and their approaches to social hierarchy and control.

Applying Worster's framework to two important and visible sources of Edwards water, the San Marcos Springs and the San Antonio River, illustrates the long progression along the scale of the hydraulic society.

²³Haury, Emil W. *Prehistory of the American Southwest*. Tucson: University of Arizona Press, 1994. 429.

²⁴Worster, 35.

Local Subsistence: San Marcos Springs

This collection of some 200 aquifer-fed springs, the second-most productive in the state, lie some two miles northeast of San Marcos. The springs have held a variety of names, reflecting their long, complicated human history. Tonkawas, the first identified settlers of the area, labeled the springs Canocanayesatetlo, meaning “warm water,” despite the constant temperature of 72 degrees. After the development of a resort hotel directly over the springs in 1921, vacillation between San Marcos and Saint Mark’s reflect the cultural inclinations of the springs visitors and the resort’s proprietors.²⁵ When the springs evolved into a more full-fledged theme and amusement park in the 1960s, they assumed the flashier title of Aquarena Springs, reflecting the tourist-oriented spectacle that included a submergible “submarine” theater for a showcase of the park’s swimming pig and dancing mermaids. Most recently, since their purchase by the adjacent Southwest Texas State University, the springs have been known as the Aquarena Center—maintaining the ties to the popular park while attempting to reflect the educational goals of their new owners. These names, like all names, reflect the human interpretations and manipulations of the springs, providing benchmarks by which to identify such evolution.

With archaeological evidence dating human habitation of the area around the springs back some eight to 12,000 years BP, the San Marcos Springs, along with several other Edwards-fed springs, represent one of the longest continually inhabited places in North

²⁵ Brune, Gunnar. *Springs of Texas, Volume I*. Fort Worth: Branch-Smith, Inc., 1981. 223.

America.²⁶ Tonkawa Indians,²⁷ as evidenced by a corncob found in the region, were farming—and perhaps irrigating—at least some 800 years BP.²⁸ Likely the first European contact with the springs came in 1709 with members of Spanish Espinosa-Olivares-Aguirre expedition. The gushing springs provided for grapes, nuts, fish, deer, bear, mountain lion, turkey, wolves, and a few bison, increasing the site's habitability. Period journals reveal natives as willing to trade—nuts for tobacco and brown sugar, in one instance. The San Xavier Missions were established near the springs in 1755, only to move one year later to Comal Springs to facilitate irrigation. The springs likewise proved an important stop on the Camino Real (“Kings Highway”) that led from Nacogdoches south into Mexico²⁹ and, years later, from 1867 to 1895, on the Chisolm cattle trail.³⁰

²⁶ Owens.

²⁷ While relatively little exists that would describe the Tonkawa culture, the tribe is thought to have been largely nomadic, with the San Marcos region acting as some of their most southernmost range. Tonkawa is derived from the Waco name for the tribe, Tonkaweya, meaning “they all stay together” (Jones, William K. “Notes on the History and Material Culture of the Tonkawa Indians.” *Smithsonian Contributions to Anthropology* Vol 2 No 5. Smithsonian Press. Washington: 1969. 65.) Referring to themselves as Títscan Wátitch, “the most human people,” their neighbors noted their cannibalism in names that translated to “man-eating men” or “maneaters.” While such activity was common to tribes in the region, the Tonkawa were noted for their casual approach to eating the flesh of enemies, making little ceremony of it. Such behavior led, in 1760, to the priests of the San Antonio Mission adding to their catechism, “Have you eaten human flesh?” (Ibid, 69).

²⁸ Brune, 220.

²⁹ Brune, 224.

³⁰ Eckhardt, 1998.

Local Subsistence: San Antonio River

Applying Worster's local subsistence mode proves a useful analytical tool when examining early development of the San Antonio River. The river once flowed entirely from San Antonio and San Pedro Springs, some hundred or so Edwards Aquifer-fed springs. George W. Bonnell describes how, in 1840, the river flowed prior to large-scale manipulation:

The San Antonio River is formed by about one hundred large springs in a beautiful valley four miles above the city. Many of these springs would singly form a river; and when they unite in San Antonio, they form a bold and rapid stream of two hundred feet in width, and about four feet deep over the shoals.³¹

Such a portrait provides an idea of the river's strong and abundant flow prior to large-scale manipulation and, yet, still after the effects of small-scale—local subsistence mode—manipulation via the acequia water system that began over 100 years prior.

Many of the migrants to San Antonio of the early 1700s came originally from Spain via long-term and typically very unsuccessful agricultural settlements in the Canary Islands. The various failures of the settlements, resulting from poor cropland, a series of devastating hurricanes, and a famine from 1721-23, correlates chronologically with the departure of two hundred residents from the Canary Islands and the arrival of 15 families, including 56 men, women, and children, at the Spanish Presidio of San Antonio de

³¹ Eckhardt, Gregg A. "The Edwards Aquifer Home Page." <http://www.edwardsaquifer.net/>. November 2, 1998.

Bejar³² on March 9, 1731.³³ Of these fifteen families, seven came from islands (Gran Canaria, Tenerife, and La Palma) that had, however unsuccessfully, employed irrigation in their farming practices. Their arrival marked the beginning of the construction, which lasted throughout the eighteenth century, of the elaborate acequia and dam irrigation system, itself based, it has been extrapolated, on the canal systems of Valencia, Spain,³⁴ that still enjoy some use today.³⁵ Working with the missionaries, the islander immigrants helped construct raised canals for the missions Concepcion, San Juan, San Jose San Francisco de Espada, and San Antonio de Valero, providing water solely (until secularization of the missions in 1794) for the native converts living on Church grounds.³⁶

³² The Presidio itself had been established at this site in 1718 due primarily to its plentiful water sources, including the San Antonio River and the San Pedro Springs (Glick, Thomas F. *The Old World Background of The Irrigation System of San Antonio, Texas*. Southwestern Studies, Monograph No. 35. El Paso: The University of Texas at El Paso, 1972. 29). A gauge placed on the river directly below the San Antonio Springs in 1907 measured a flow of 27 million gallons per day. While a considerable amount, it is still substantially less, due to well drilling and pumping, than what would have been available in the eighteenth century (Glick, 62).

³³ Glick, 27.

³⁴ Ibid.

³⁵ Worster, 36.

³⁶ Glick, 29.

The Agrarian State Mode

Worster's conception of the agrarian state mode, as a model of water manipulation more developed and organized than the local subsistence mode, posits a central authority controlling or dominating a given water supply much to the disadvantage of those who rely on the water. Rather than "insular" and "autonomous" communities of local subsistence using nearby water to grow food that would typically remain within the area, strings of settlements with larger and larger irrigation projects develop. By Worster's account, such agglomeration of communities usually occurred much to the advantage of a single, larger settlement and of a few people within that settlement. The smaller communities, reliant upon the large-scale projects provided by this larger, centralized settlement, were required to offer tribute in forms of labor, crops, or monetary payment. The progression to the agrarian state thus reflects the installation of a much more vertical hierarchy of power and control.

Agrarian State: San Marcos Springs

Given Worster's sliding interpretations of this three modes of hydraulic manipulation, application proves an inexact science. In the case of the San Marcos Springs, there exists, at best, only a short period that embodies the qualities of the agrarian state. Following some 12,000 years of local subsistence habitation at the site, arguably only a short foray into the agrarian state model precludes, as addressed below, a full, disconcerting embrace of capital manipulation.

Beginning in 1835, Mexican land grants of the type Hayden Edwards had received ten years prior allowed for some initial settlement from the U.S. to the immediate area. A settler's description of the springs from 1846 follows:

2 miles north of St. Marks we crossed the Blanco, a mountain torrent of purest water, narrow and deep, there is the finest spring or springs (for they are not less than 50 in a distance of 200 yds.), I ever beheld. These springs gush from the foot of a high cliff and boil up as from a well in the middle of the channel. One of these, the first you see in going up the stream, is near the center, the channel is here 40 yds. wide, the water 15 or 20 feet deep, yet so strong is the ebullition of the spring, that the water is thrown two or three feet above the surface of the stream.³⁷

Following this time of initial settlement, the springs powered gins, a variety of mills (corn, saw, and grist), as well as an ice factory.³⁸ In 1854, German settlers built a dam

³⁷ Brune, 224.

³⁸ Ibid.

some 300 yards below the spring flow, simultaneously inundating the gurgling springs, submerging 12,000 years worth of Native American archaeological artifacts, and creating Spring Lake.³⁹

³⁹ Eckhardt 1998.

Agrarian State: San Antonio River

While, as mentioned, Worster's conceptual progression of modes of water manipulation move along something of a sliding scale—he presents no immutable delineations between the modes—there appear, when applying the hydraulic society to the development of the San Antonio River, several representative points of departure from the local subsistence to the agrarian state. As there exist only characteristics of the various modes and no hard and sharp demarcations between them, such variable representations can arguably emerge when applying the thesis to real world events.

The first possible shift in the context of the San Antonio River comes in water conflicts between townspeople (including the Canary Islanders) and the five missions that controlled the acequia system. Dating back to 1731, such complaints appear, however, to have little to do with water and more to do, perhaps, with other underlying tensions—that is, the townspeople complained to the Presidio viceroy and Spanish governor about the inequitable distribution of water when, in fact, there was abundant water for all.⁴⁰ It was, it seems, the process of distribution, when settlers and Natives of the missions had to take turns which often lasted days at a time in order to have access to the river and canal systems, that sat well with neither side (see figures 3 and 4 for extant remnants of the system). Legal emphasis was placed on proportionate distribution—the underlying question seemed based on whether existing water would be divided in half between the missions and settlers or in six ways between the five missions and the townspeople.

⁴⁰ Glick, 33.

Endemic to this history, however, is a wide lack of primary sources, apart from scattered official letters and minutes from some meetings, that might shine a brighter light on the details and bases of the conflict.⁴¹



Figure 4. Remnants of the Mission Espada acequia (photo by author).



Figure 5. Remnants of the Mission Espada Dam (photo by author).

⁴¹ Glick, 36-8.

From what records that do exist, however, there seemed few problematic conflicts regarding the use of water. Still very much a frontier settlement, there was considerable pressure to remain in the good graces of the society of which members of the community were largely dependent. Even during dry spells (there were no recorded droughts in this era), it was in the water user's long-term interest to let fields go dry rather than risk the social consequences of stealing communal water. And with the secularization of the missions in 1794, control of the acequia water was relinquished to the Presidio government, ending the conflict over proportionate division. As such, Worster's indictment of the agrarian state's incremental agglomeration of water and power seems somewhat far-fetched in this context. Beginning in the 1750s, rules governing water established official, rather than social, control that were minimally constraining and leaned toward maximized benefit for the community. For instance: "Clothes shall not be laundered in the acequia of the town. The woman or person found washing shall be dispossessed of the clothes being laundered in the said acequia."⁴² Likewise, heavy fines and penalties, such as relinquishing water rights for a full year, for "befouling" the water or shirking communal acequia maintenance reinforced the already strong social obligations to and respect for the area's water.⁴³

As ample water existed to slake the community's requirements, it proves, as said, difficult to read much of Worster into water policy of the time. While hardly an equitable, egalitarian, or particularly democratic culture, San Antonio of the eighteenth

⁴² Glick, 45.

⁴³ Ibid.

century reflects, perhaps, something of that ideal which Worster envisions—a small-scale community living within the means of a localized water source, respecting the water as the basis for their tenuous arid existence.

Moving further along Worster's scale of water control and power, a second possible example of the agrarian state mode—one, admittedly, which quickly blurs the distinctions between the agrarian and capitalist state modes—is reflected in the attempted development of a short downtown section of the San Antonio River into the commercial and residential area of the River Walk nearly 200 years after the city's first water conflicts.

By the 1920s, San Antonio had so grown⁴⁴ that its river stretched some six miles long across downtown. Until this point, however, development in the city allowed the river to retain its natural bends, designing around what was already there, so that within this six-mile stretch the river slowly meandered nearly 13 miles. With burgeoning development, city planners had been eyeing these bends with the hopes of straightening the river to make valuable room for in-fill growth and, in the name of public safety, to allow for the waters of the flood-prone river to pass more swiftly through town. It was, in fact, the flood in spring of 1921 that finally pressed the city to action. The debris that caught in the winding bends slowed the swollen river even further, ultimately raising the waters some 12 feet above their banks, devastating the still-nascent central business district, and killing 50 people. Not willing to allow a river to stop the progress of a flourishing city,

⁴⁴ The introduction of the railroad to the city in 1877 ended its long isolation and marked the beginning of a period of sustained growth (Fisher, Lewis F. *Saving San Antonio: The Precarious Preservation of a Heritage*. Lubbock: Texas Tech University Press, 1996).

planners were quick to push their vision of a flattened, faster river onto city politicians and developers.⁴⁵

It is at this point—between when a city builds around and accommodates a river, and when a city decides to build, manipulate, and dominate that river to its exacting specifications—that Worster's agrarian mode reveals itself. Long after the local subsistence mode of this section of the river had past, during a time when the slow-moving river represented little more than heightened property values along its banks, San Antonio was rapidly embracing a role as a capitalist city. By channeling the river into a straighter flow and lining the banks with concrete, the city was protecting its new-found interests. By ensuring that flood damage, not to mention loss of life, was a thing of the past via a re-engineered river, the city ensured that development would continue and population would further increase. The planned manipulation of the river was, following a simple logic of capital development, infrastructure as an investment in the city's future economic well-being.

The plans, eventually gaining widespread momentum by late 1927, included straightening several particular bends. In the case of the large horseshoe River Bend that meandered nearly half a mile through downtown, plans included eliminating this section with a cutoff channel, paving over what had been the Bend, and selling the newly-made property developers in an effort offset construction costs. Estimations at the value of this "reclaimed" land—294,000 square feet of it—ranged from \$2 to 14 million.⁴⁶ Following

⁴⁵ Fisher, 181-2.

⁴⁶ Fisher, 189-190.

Worster's thesis nicely, that manipulation of water and power are richly intertwined, the *San Antonio Express*⁴⁷ in February of 1928, published that "rumors of a well-defined movement headed by at least three real estate promoters," with obvious self-interest at stake, were working behind political scenes to ensure that the proposed construction went through.⁴⁸ The immediately ensuing public outcry and political fallout quickly put an end to the plan and, importantly, made room for "several women's clubs," the San Antonio Conservation Society (SACS) in particular, advocating for the "preservation of the river."⁴⁹ More accurately, SACS advocated not the San Antonio River's preservation, but the retaining of the "natural" beauty of this one-half mile River Bend.

The plan, in the wake of the scandal, was revised. While the proposed cutoff channel would remain for purposes of flood spillway, so would, for the sake of historical preservation, the River Bend. SACS, encouraged by their first tastes of political influence, organized themselves into a strong faction, eventually wielding considerable influence with the mayor and city council. Comprised almost entirely of white, well-heeled wives with prominent names such as Edwards and Maverick,⁵⁰ SACS organized in February, 1924, in order to preserve the Market House, one of the city's few examples of

⁴⁷ A predecessor of the *Express-News*.

⁴⁸ Fisher, 189.

⁴⁹ Ibid.

⁵⁰ The Edwards family was, as mentioned, one of the first to settle the region, while the Mavericks have a long, multi-generational history in San Antonio and national politics.

classic Greek Revival architecture, in the face of a proposed street widening.⁵¹ Picking up the mantle of historic preservation, SACS, in the wake of the original cutoff channel proposal, set their sights on the River Bend.

Comprised of educated women who were, typically, unfamiliar with the role of traditional power-broker, SACS often resorted to unconventional methods of political persuasion. In their first attempt to make the city's political scene, for instance, the women put on a puppet show for the City Council to illustrate the general importance of historic preservation. Complete with rhyming quatrains, "The Goose That Laid the Golden Eggs" portrayed a scene of Mr. San Antonio attempting, in the name of progress and short-term profit, to kill the Goose, embodying the city's historical sites and their long-term value. Enter Mrs. San Antonio, the preservation-minded wife, to save the Goose. After arguing the Goose's relative merits, they struggle for the knife, finally agreeing to settle the matter before the City Council. Mrs. San Antonio, arguing before the Council (replicas of the very Council that was the show's audience), waxes over the value of the Goose and, more importantly, her five golden eggs, helpfully labeled Heart of Texas, Missions, History, Tourists, and Beauty. One by one, the eggs and their use to the city were extolled by Mrs. San Antonio who finally concludes, "Ah spare this goose for future use / The voice of culture begs, / Your reward will come, for this precious goose / Will lay *more golden eggs*."⁵²

⁵¹ While the Market House was eventually razed for the street-widening project, a small SACS victory can be seen in the City Council's guilt which resulted in the replication of the House's façade in the San Pedro Playhouse soon after (Fisher, 8).

⁵² Fisher, 7.

Continuing their non-traditional campaign of influence several weeks later, SACS convinced the city's mayor, flood engineer, and city commissioner to take with them a two-hour rowboat tour of the downtown section of the river.⁵³ In this personal, direct approach, the women were attempting to show the city's powers-that-be an alternate vision of development—that destruction of the remaining cottonwoods and alder was not necessary for the advancement of business interests and might, in fact, be detrimental to the long-range economic future of the city.

As rich as these scenarios are with insights to gendered perceptions of landscape and the socio-political relations in early twentieth century South Texas, the most important outcome of the puppet show and rowboat tour, perhaps, is that the traditional power-brokers of the city who control and direct development were faced, likely for the first time, with an alternative to pro-development business interests. Not that SACS was necessarily against business—their focus on the golden eggs of the missions, beauty, and tourists worked well to convince the council that such preservation reflected merely a long-term investment that would eventually pay off higher returns. In terms of Worster, it seems as this point tempting to revise the hydraulic thesis, inserting a “bored, capitalist housewife mode.” Barring that, this point of historical and social development certainly blurs the already fuzzy lines between what has been defined as the agrarian and capitalist state modes. The backgrounds of the composite SACS member, as, typically, the white, gentile wife of a white, gentile, rich powerbroker betrays their complicity with capitalistic interests. Arguably, however, these women could be seen as so rich and so excluded from the business interests of their husbands as to have little interest in the matters of

⁵³ Ibid, 183-5.

maximizing profit and dominating humans and landscapes—characteristics that embody the capitalist state mode. Examining SACS as members of an exclusive subculture of Texas socialites, it proves difficult if not impossible to track their truer motivations which would allow their classification in the hydraulic schema. This seems, however, in the face of it, splitting ideological hairs. The lesson, possibly, is that members of SACS stood in the way of their more capitalistic male counterparts, preserving the history, unique characteristics, and, more importantly, the remnants of the river's natural features and ecology—much, in the end, to the benefit of San Antonio. What followed—the pro-development and –capital attrition of their hard-won gains—leaves little doubt as to Worsterian classification and analysis.

The Capitalist State Mode

As carrying the most venom that Worster has to offer, the capitalist state mode is, likewise, the most well-defined mode of his hydraulic theory. The hydraulic society of capitalism's last 100 years demonstrates "once more how the domination of nature can lead to the domination of some people over others."⁵⁴ Unlike its predecessors, however, the capitalist state, having traveled so far in time, culture, and economy, sees little value other than pecuniary within its waters. "Water in the capitalist state has no intrinsic value, no integrity that must be respected.... It has now become a commodity that is bought and sold and used to make other commodities that can be bought and sold and carried to the marketplace. It is, in other words, purely and abstractly a commercial instrument."⁵⁵ Arguably untenable ideas aside—such as the appreciation of "intrinsic value" of nature within this particular American cultural moment—Worster's illustration of human separation from water, the most basic requirement for life, reflects a lamentably unsustainable human-ecology relationship. A society, as he envisions, lacking a perception of respect for water and its simple importance, and confounded within a culture of commodification, dramatically enhances the potential for environmental catastrophe. Applying this lens of the capitalist state mode to the River Bend—soon in this narrative to become the River Walk—the relations and perceptions of the city to its particularly valuable water resources aid in locating, eventually, the roots of San Antonio's "water crisis."

⁵⁴ Worster, 50.

Capitalist State: San Marcos Springs

Following the short period of itinerant use as a watering hole by cowboys of the Chisolm Trail and of travelers along the Camino Real, the San Marcos Springs rapidly embraced the capitalist state mode. Namely, in this century, the springs (in the form of the dammed Spring Lake) became a popular tourist attraction, with a two-story hotel built above the northeast edge in 1921. The banks of the lake were formed with concrete and a diving board, next to the hotel, was added, creating something of a swimming pool from the headwaters (see figure 5).

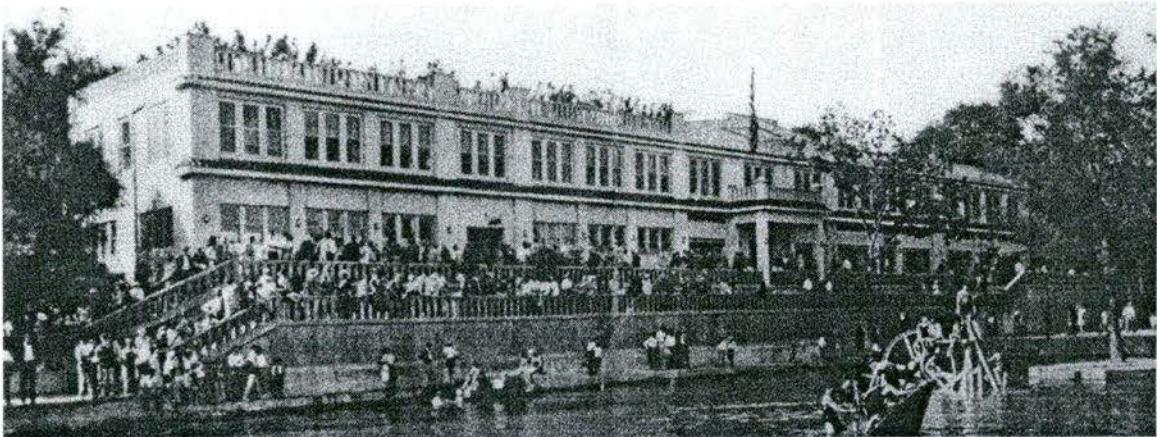


Figure 6. Rogers' Spring Lake Park Hotel, 1929 (postcard).

The 1960s brought the era of Aquarena Springs, building up many of the theme park structures that currently stand, including a more generic swimming pool, a gondola ride, a spinning needle ride, glass-bottom boat tours, bicycle-riding and tic-tac-

⁵⁵ Ibid, 52.

toe playing chickens, and, most notably, the submersible “submarine” theater where patrons could watch an underwater show involving a model volcano, “dancing” mermaids, and one of several Ralph the swimming pigs. While, of these, only the boat tours still operate, other remaining attractions include replicated and authentic historic homes and buildings from the region, a cave-themed stage, a façade in the style of Old-Tyme Shoppes, and a gift shop that all contribute to the unsettling, non-sequitur feeling of the springs (see figures 6, 7, 8, and 9 for contemporary views of the springs’ development). Said to be the saddest place in Texas, one writer made the claim that, “seated in this theater at the mouth of the spring, how can one help but wonder if there is any most unlikely corner of the biosphere humans will not invade and desecrate to their own whims.”⁵⁶



Figure 7. San Marcos Springs, South Bank Shop Facades (photo by author).

⁵⁶ Weniger, Del. *The Explorer's Texas: The Lands and Waters*. Eakin Press: Austin. 1984. 109.

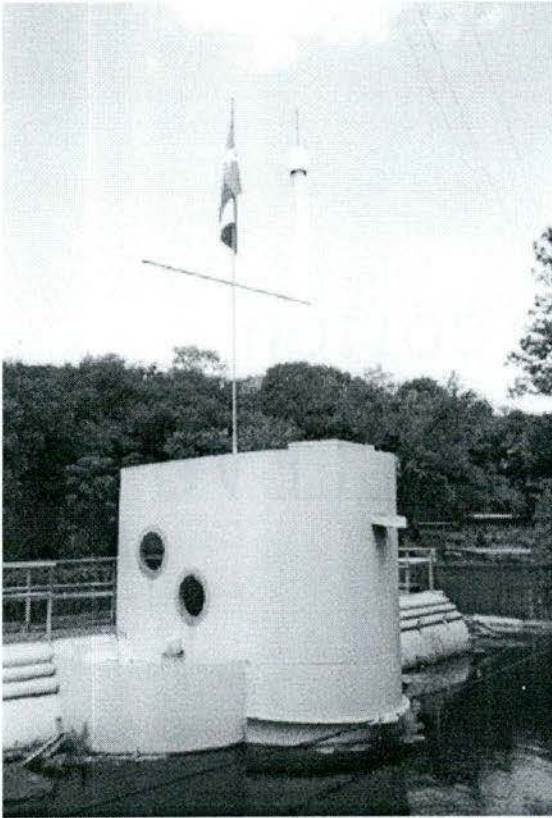


Figure 8. San Marcos Springs, Submarine Theater (photo by author).

In 1991, the adjacent Southwest Texas State University purchased the rundown, economically-failing Aquarena Springs and in February 1996, the Board of Regents of the university voted to put an end to the theme-park attractions in order that the springs might be opened to other “educational and general uses,” renaming the springs as Aquarena Center. As mentioned, only the glass-bottom boat tours still run, providing visitors, largely local school children, a closer view of the submerged springs. An exhibit dedicated to the endangered species of the springs has been installed and the underwater stage where pigs and mermaids once swam now exists as a training course for underwater divers intent on studying the spring’s species without disturbing their habitat. Plans to



Figure 9. Spring Lake, Fountain and Boat (photo by author).

remove many of the nearby structures, asphalt parking lots, much of the landscaping, and concrete banking are under consideration. Restoring the historical, native wetlands nearby are also a priority, along with a boardwalk leading to observation and interpretive areas. Earnest efforts to remove the non-native species include a floating mower and organized hand picking of hyacinth, elephant ears, and hydrilla that have taken over much of the area.⁵⁷

More recently, the most pressing and perhaps most interesting aspect of the plans to reconfigure and restore the springs and surrounding area include the question of Spring Dam. After withstanding the weight of Spring Lake for nearly 150 years, the dam was severely undercut during the remarkable flooding of the region in October of 1998,⁵⁸

⁵⁷ Owens, Murray. Personal interview. March 26, 1999.

⁵⁸ The flooding, following some 22 inches of rainfall between October 17 and 19, exceeded in some places the estimated 500 year flood plain (McCollough, Chuck. "Flood at top of '98 list." (San Antonio *Express-News* 30 December 1998: 1H.) In the months following the flooding, the city of San Antonio reasserted its long tradition of dubious flood control and remediation practices. The waters had left in their wake

when waters overtopped the dam by six to eight feet and scoured away bank-stabilizing vegetation. Engineers from the Texas Natural Resource Conservation Commission's Dam Safety Program pronounced the dam as on the brink of failure. Such a failure, while ostensibly returning the springs to historic, "natural" conditions, would likely prove disastrous for the endangered species that rely on the spring. Downstream Texas wild rice could potentially be scoured out of existence by such a dramatic event while increased spring flows, resulting from the removal of the lake's downward pressure on the springs themselves, could conceivably harm the species that rely on the diminished flow as habitat. Even plans to decommission the dam in a more traditional manner prove suspect in terms of maintaining habitat viability. Removing the dam would remove the lake, thereby constituting a taking under the Endangered Species Act (ESA) by eliminating listed species habitat. Efforts to increase the lake's size and concomitant habitat by rebuilding a larger dam would create greater downward pressure on the springs, diminishing flow and, likewise, habitat for spring-dwelling species. Such a predicament speaks closely to contemporary thought on human/nature interaction, particularly within a context of the ESA. Though they have been proposed, plans to

substantial damage and debris within the riparian regions of area rivers, particularly along Salado Creek which runs through the eastern portion of the city. In their efforts to remove downed trees, garbage, and even dead horses, the city's Public Works Department scoured clean the riparian vegetation, apart from healthy and vertical trees, along with much of the topsoil. The director of the department argued that the work was needed to remedy the "total devastation" wrought by the floodwaters and that the area in question should recuperate naturally. When the city arborist complained that the action would not only increase pollution and siltation of the creek, but would actually increase future flood intensity, the Public Works director avowed that further remediation work would be done "environmentally sensitive [sic]." (Dorsett, Amy. "Creek cleanup raises concern: Damage to vegetation claimed." *San Antonio Express-News* 3 February 1999: 1H.)

remove the dam and drain the lake to return the springs to their previous gurgling state are considered by the university “highly unlikely.”⁵⁹

The lessons of San Marcos Springs developments offer vital clues in an effort to understand the region’s relationship to and perceptions of its water and its aquifer.⁶⁰ When such resources have existed historically only in terms of their human use-value—their ability to be transformed from ‘natural’ ecosystems into useful and, more obviously, profitable human endeavors as a measure of their worth—their conservation or preservation are inevitably complicated by these hotly contested issues of urban and rural development. With this context, dissension over the uses and management of the aquifer seems, despite the complications, somewhat more understandable.



Figure 10. Spring Lake Hotel (photo by author).

⁵⁹ Eckhardt, 1998.

⁶⁰ Additional examples of usage that present water as commodified resource removed from natural systems include the city’s three water theme parks, Schlitterbahn, Splashtown, and Sea World of Texas.

Capitalist State: San Antonio River

As part of their “beautification” campaign to preserve the River Bend from destruction and development, the women of the Conservation Society brought in a young architect, Robert H. H. Hugman, to incorporate into the city’s plans of flood control along the river a bit of “beauty.” A native San Antonian and one-time high school art student of SACS’s co-founder, Hugman had studied architecture at the University of Texas and had worked for several years in New Orleans, a city often compared to San Antonio for its historic preservation heritage.⁶¹ Aligning with the philosophy of SACS, he wrote in an early appraisal of the possibilities for the River Bend and cutoff channel:

The river is sometimes looked upon with disfavor, as taking too much room in its vagabondish winding through the valuable downtown area. This, I believe, is an entirely wrong slant on the situation. To me, the river is one of nature’s greatest gifts to San Antonio and should be appreciated and developed as such.⁶²

In a later presentation to City Council entitled “The Shops of Aragon and Romula,” Hugman outlined his vision of an appreciative development—a commercial and residential river park, housing “cobblestone walks and small shops, footbridges, apartments, and cafes similar to the narrow, winding streets of the old cities of Spain.”⁶³ He writes:

⁶¹ Fisher, 192.

⁶² Ibid., 192-3.

⁶³ City of San Antonio, a.

Wedged in behind the pretentious business houses on Houston, Soledad, Commerce and St. Mary's, why not a quaint old cobblestoned street rambling lazily along the river? On this little street of my imagination, the shops would be built of old stone and brick of very simple architecture, creating maximum charm at minimum expense. They ... would be called "The Shops of Aragon" Upon leaving Aragon with its shadowed charm, we come to a foot-bridge which crosses the new channel in one graceful span, bringing us to Romula, ... no more than an interesting flagstone walk along the river bank with shops similar to those of Aragon.... Beginning at the new [cutoff] channel, Romula would follow the river's meanderings around the horseshoe bend [River Bend] to the Plaza Hotel, presenting an opportunity for unlimited development of beauty and interest.⁶⁴

Further selling his vision:

Think what a wealth of advertising material the city would have in the Shops of Aragon and Romula, lending themselves, as they would, to the most colorful descriptions.⁶⁵

Buried in Hugman's language of the sales pitch, one hears a sugary version of a capitalist development that would dominate what little nature that was left of the river. In an ecological sense, the river as a river was likely doomed at this point. With its staunchest defenders willing, in the face of political opposition and the drive to develop, to sacrifice the more natural features of the river for a beautification project that would line its banks with concrete, the River Bend ceased its function as a river and became an environmental fetish—something "natural" that fomented capitalist accumulation and

⁶⁴ Fisher, 193-4.

⁶⁵ Ibid., 194.

exchange. As little more than a tourist attraction, Hugman's vision, as that of the project's lead architect, the River Walk would set the tone for San Antonio's economic future (see figure 10).

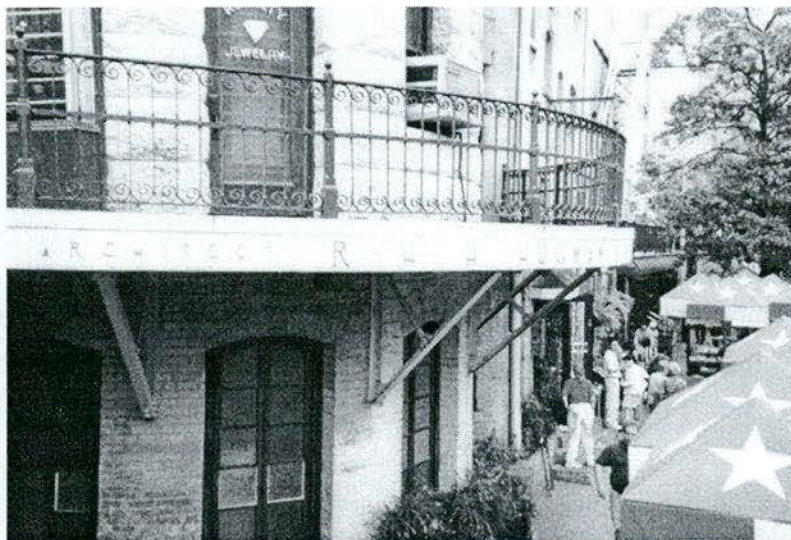


Figure 11. Hugman's Signature along the San Antonio River Walk (photo by author).

Thirty years after the River Walk's construction—much aided as a Works Progress Association project by federal money—the city made its attempt to vault onto the world's stage. Agreeing to host HemisFair '68, facilitated by Rep. Henry B. Gonzalez,⁶⁶ San Antonio would celebrate both the 250th anniversary of the city's founding and "The Confluence of Civilizations in the Americas."⁶⁷ Apart from the status gained from

⁶⁶ San Antonio's repeated attempts to host a Republican presidential convention, in an effort to attract tourist dollars and national attention, have been stymied by the fact that such a convention would necessarily be held in the Hemisphere Convention Center that bears the name of the legendary Democratic representative, noted for his attempts to impeach every sitting Republican president from Richard Nixon to George Bush.

⁶⁷ Fisher, 297.

hosting a world's fair, San Antonio hoped to tap into federal dollars to build itself up. Selecting a site just south of downtown, HemisFair and city planners infused federal Urban Renewal funds into a dilapidated, historic section of town with the intention, among others, of drawing attention and investment to the River Walk.⁶⁸ In the years since its construction, the River Walk was a far cry from the mythic shops of Aragon and Romula. It was, in fact, nearly as discarded as a zone of discard could be—in a city where the Air Force represented the largest single industry, the River Walk, now such a dilapidated and dangerous place, was off-limits to military personnel. Placing the HemisFair so close to the area, it was hoped, would infuse capital development above and beyond the two restaurants that occupied the riverfront strip. Planners were so keen to involve the River Walk, what they could not do to locate HemisFair plaza near enough to the river, they compensated by, simply, extending the river, leading an offshoot from the original River Bend to a dead end between the new Convention Center and Theater for the Performing Arts⁶⁹ (see figure 11).

The fair, in the end, was something of an immediate disappointment. Opening seven days after the assassination of Martin Luther King and five days after Texan Lyndon Johnson announced, in the face of escalating war and protests, that he would not seek reelection, national press attention was diverted from the event. Attendance, at 6.4 million, was 800,000 short of projections and the fair lost \$6 million. However, the city whose skyline had not significantly changed since the Depression gained the Tower of

⁶⁸ Ibid.

⁶⁹ Ibid., 300.



Figure 12. River Extension, Convention Center (photo by author).

the Americas (modeled after Seattle's Space Needle⁷⁰), HemisFair Arena (seating 10,500 and crucial in later attracting the San Antonio Spurs), the Theater for the Performing Arts (seating 2,600), the Henry B. Gonzalez Convention Center, and the Hilton Palacio del Rio Hotel—all the ingredients necessary to gradually turn San Antonio into booming tourist town.⁷¹

The city today attracts seven million visitors annually, pumping \$3 billion into the economy. According to a *Conde Nast Traveler*⁷² survey, San Antonio is the ninth most popular destination in the world, sandwiched between Paris and Venice, and, domestically, follows only San Francisco and Santa Fe.⁷³ In 1987, the arm of the River Bend that had been extended for HemisFair was extended further, accommodating the

⁷⁰ Itself built for that city's World Fair.

⁷¹ Fisher, 314.

⁷² The magazine for the successful capitalist tourist.

⁷³ Fisher, ix.

new Rivercenter shopping mall. The Marriott Rivercenter Hotel became the city's new tallest building at 42 stories and 1,000 rooms.⁷⁴ Around the same time, the Hyatt Regency built a portion of the river flowing through its lobby—contemporary explorers can follow a neo-Aztec acequia to the headwaters flowing from a fountain south of Alamo Street, across from Alamo Plaza (see figures 12 and 13). The apotheosis of tourism would not be complete, however, without a Hard Rock Café and Planet Hollywood, both built in the early 1990s, adjacent to the river.

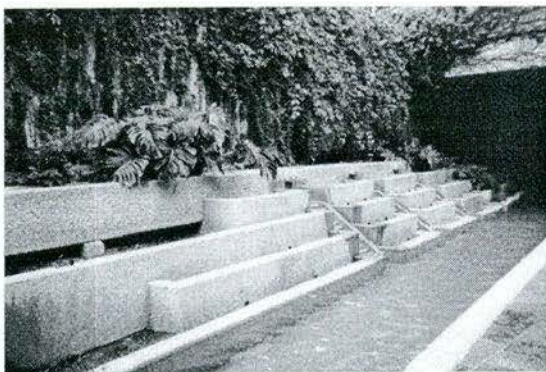


Figure 13. River Extension: Hyatt Regency (photo by author).

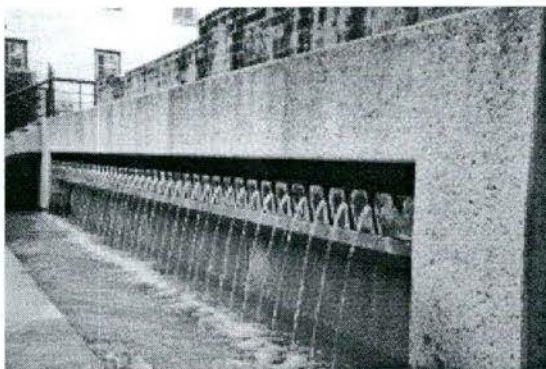


Figure 14. River Headwaters: Hyatt Regency (photo by author).

⁷⁴ Ibid., 492.

More recent manipulations of the river in the name of flood control, beyond the original cutoff channel, include the river tunnel, completed in December 1997 following \$111 million and ten years worth of construction. The three-mile long tunnel runs some 150 feet beneath the central business district, including the River Walk itself, engineering excess flood waters away from the valuable tourist and commercial areas.⁷⁵

This sort of emphasis on tourism and the WalMartization of a city that has spent much of its history attempting to preserve its unique character and features is not so lamentable, in and of itself, as its reflection of Worster's capitalist state model. That is, the River Walk has been so manipulated for the sake of attracting tourist dollars (see figure 14), the economy now revolves around a tourist industry that, for those without power, means at best low-wage employment. The city, with hopes of expanding its tourism- and convention-based economy offers to multi-national hotel chains property tax breaks totaling tens of millions of dollars—all with the hopes of pouring more money into the local economy. Touting new jobs, the city claims the tax breaks are worth the expenditure, not mentioning that the few hundred jobs created for each new hotel earn roughly five to six dollars an hour. The powers-that-be broker development, on and around the River Walk, which promulgates low-wage work and perpetuates economic inequity.

⁷⁵ Eckhardt. <http://www.edwardsaquifer.net/sariver.html>. May 22, 2000.

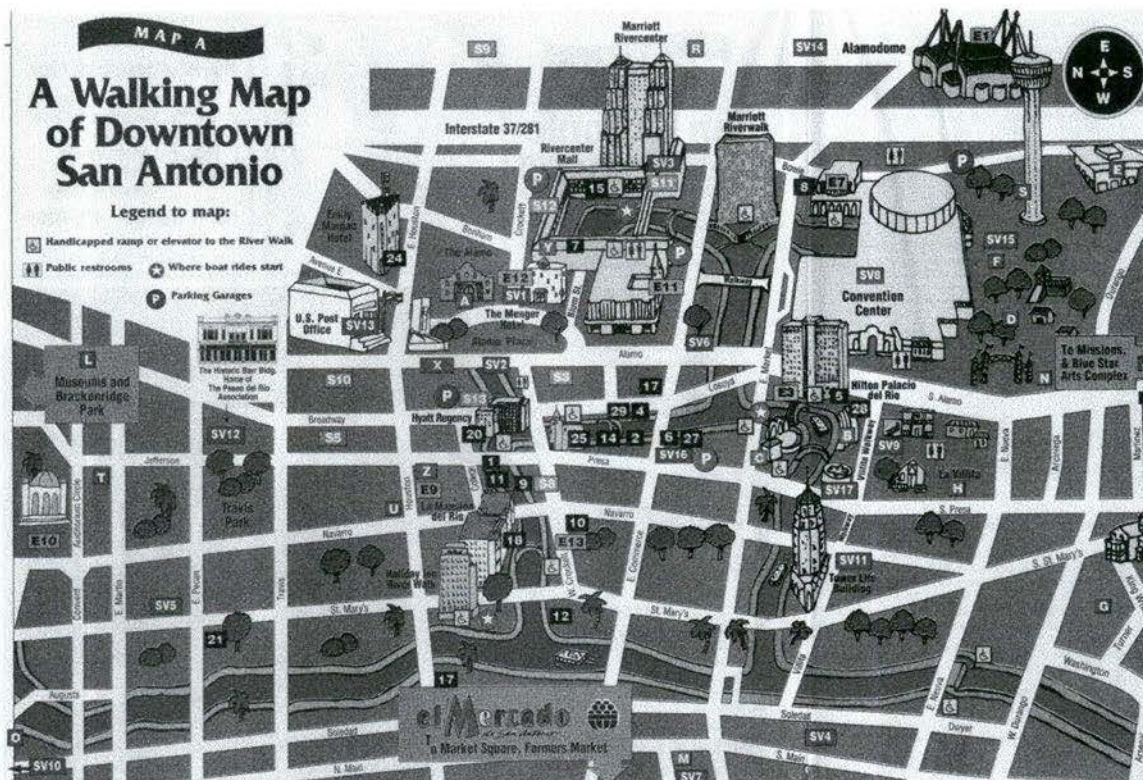


Figure 15. River Walk Visitor Map.⁷⁶

The example of the River Walk has been used, simply, to reflect far larger ecological problems. As a distillation of regional perceptions of water, helpfully clarified by the lens of Worster's hydraulic thesis, the progression of the river's manipulation through time, culture, and place has, hopefully, brought us to a point where more pressing matters—particularly the recent water shortages presented by the region's aquifer—can be addressed.

⁷⁶ Paseo Del Rio Association. *Rio: The Official Magazine of the River Walk*. August 1999: 14-5.

CHAPTER III

CONTEMPORARY HYDRAULIC REFLECTIONS

The Edwards Aquifer of South Central Texas, as the sole-source aquifer for much of seven counties, has become, in the face of mushrooming population, perhaps the most contentious resource issue in the region. In an area not generally known for its environmental awareness, the recent and escalating fights over the contents of the aquifer have certainly forced many residents to reexamine their views of water as a commodified resource, and have colluded with other development and growth issues to create a social and political minefield. Combined with burgeoning population and increased water demand; bureaucratic, multi-agency control; an uninformed, disinterested, relatively powerless citizenry; development issues tinged by race and class; and a real potential of salinating Edwards due to over-pumping, such dissention over water usage and management will not likely in the near future find a tenable resolution to the satisfaction of the many and various interests fighting for water. Examining these contemporary and historical conflicts over the aquifer present an opportunity to unpack the various cultural

meanings that the region's inhabitants place upon the Edwards water which, extrapolated, reveal common perceptions of resource and environmental issues in a region wholly unused to living within and recognizing the real constraints of a physical system.

While water disputes are a historical given in both the rural and urban West, the Edwards troubles began only in earnest with the previously-mentioned, relatively recent federal listing of several endangered species at two aquifer-fed springs. While the aquifer is, by all accounts, enormous—estimates of its capacity range from 25 to 55 million acre feet—a relatively high water level must be maintained in order to keep spring flows at a rate scientists say will preserve the integrity of the endangered species' habitat.⁷⁷ That, in turn, limits the amount that can be pumped for surface use. Unfortunately, these limits come at a time when the region is experiencing an incredible growth spurt. San Antonio, recently named the eighth largest city in the U.S. with well over one-and-a-half million people, is expected to double its population within the next 50 years.⁷⁸ Such strain on resources works only to exacerbate the difficulties of the recently imposed limits.

The politics of the issue, however, are not so cut and dry as simply the attempts to preserve a handful of species. Texas water politics, as the recent example of the Applewhite Reservoir will illustrate, appear sometimes as a comedy of errors, with too many bumbling players attempting to steal the limelight. Likewise, the conflict over the aquifer has become additionally muddled by numerous sources providing an abundance of information, most of it politically-charged, much of it incomplete, and some of it

⁷⁷ Eckhardt, 1998.

⁷⁸ San Antonio Water System. <http://www.saws.org>. November 12, 1998.

contradictory in very basic ways. Confronting this barrage of information, it is easy to overlook many of the gaps where important, primarily scientific information simply isn't available. Given this sort of media representation, most San Antonians are generally ignorant or ambivalent regarding the Edwards issues (see Appendix A for a loosely representative selection of attitudes and opinions).⁷⁹ Those who are not possess a common thread of distrust of the agencies that control water policy and a very surprising lack of acknowledgement of the endangered species at the problem's root. And for those few who do recognize that these species are the reason for city-imposed water restrictions, many are very unhappy that their lawns were sacrificed for the sake of a blind, translucent salamander.⁸⁰

⁷⁹ To the vast majority of San Antonio, the talk about the aquifer has been only so much white noise—a complicated issue that has yet to affect them in any real way. While the city imposes graded water restrictions during the hot and dry months in an attempt to keep the aquifer levels up, there exists a general lack of compliance throughout the city and a historical unwillingness to enforce the regulations.

⁸⁰ The San Antonio *Express-News* runs annually a listing of the "ten thirstiest homes" in the city to, ostensibly, illustrate the importance of limiting water use while tending also to shame those on the list into conserving. The winner of 1998, however, was the same as in 1997. The two-time champion, who lives alone and only stays at the property some four times a month, used an average 305,932 gallons per month on his 1.12 acre lot landscaped primarily with St. Augustine grass (a species originally imported from tropical central Africa). Likewise, four other homeowners on the list requested and were granted anonymity from the water service. Number eight on 1998's list invited the reporter to stroll around the lush grounds of her home, apparently in an attempt to show the benefits of such high water use (*Express News*, June 14, 1998).

Political History of the Edwards Aquifer

The importance in examining, in this historical context, the recent politics that surround the aquifer and its springs lies not so much in the details as in the recognition that management and perception of the water issues represents something egregiously bureaucratic and misguided. The many details that follow, delineating the various laws, politics, and controlling authorities that have and do control the aquifer, work to illustrate this point.

Use of aquifer water was, until recently, based on and controlled by “English rule” of free capture, which allowed property owners to pump any water under their land so long as it was “not wasted.”⁸¹ ⁸² Increasing population, however, brought further demands on the water source for agriculture, municipal, and recreational use.⁸³ But not until a severe drought struck the area between 1947 and 1956 (a period during which the Comal Springs ran dry) did residents find need to place the watershed under government scrutiny and control. Thus, in 1959 (some twelve years after the start of the drought), the Texas legislature established the Edwards Underground Water District, allowing it the authority “to conserve, preserve, protect and increase the recharge of and prevent the

⁸¹ Donahue, John M. “Water Wars in South Texas: Managing the Edwards Aquifer.” Donahue, John M. and Johnston, Barbara Rose, Ed. *Water, Culture, and Power: Local Struggles in a Global Context*. Washington, D.C.: Island Press, 1998. 191.

⁸² There is presently a lawsuit pending, filed by a San Antonio catfish farmer, that, if successful, would reinstate the rule of free capture (*Express-News*, November 19, 1998).

⁸³ While 47% of the Edwards discharge is represented by springflow, municipal and irrigation purposes account for 30% and 21% respectively (Eckhardt, 1998).

pollution of the underground water.”⁸⁴ The District, however, possessed no authority to restrict the rights of property owners in regards to pumping water from beneath their land.

Following the passage of the federal Water Quality Act of 1965, the Texas legislature in 1967 created the Texas Water Quality Board headed by an appointee of the governor’s choosing. The partisan board in its early years sided with rural interests, retaining the English rule (for the time being) and disallowing any pumping limits as desired by urban constituents in the name of conservation.⁸⁵

⁸⁴ Donahue, 192.

⁸⁵ Ibid.

Recharge Zone, Ho!

The issue of aquifer protection was eventually and inevitably brought to a head by a series of proposed development projects in the early 1970s. It was these projects which, likewise, brought into play the divisive racial and class politics of the city in the name of aquifer protection. The fact that San Antonio is the largest Hispanic-majority city and, likewise, one of the poorest cities in the U.S. is not lost on many citizens, particularly the plurality of poorer Mexican Americans. When the wealthy, generally white citizens of the North Side of the city want to develop, they have expanded further north. Rather than associate with and reinvest in the typically working class Latino/Latina neighborhoods of the West and South Sides and in the typically working class black neighborhoods on the East Side, they have pushed ever north, covering the sizeable recharge zone of the aquifer with suburbs, shopping strips, and ranchettes. This implicit economic and environmental racism, however, did (and does) not go unnoticed. From two particular development projects of the early 1970s (a shopping mall that would have been the largest in the Southwest, and Ranch Town, a suburb large enough for 88,000 people) sprang several activist citizens groups who managed, through local or federal intervention, to slow the continued recharge zone development.^{86 87}

⁸⁶ Donahue, 192.

⁸⁷ See "Recharge Zone Planning," pg 46, for more contemporary approaches and reactions to recharge zone development; see Appendix B for examples of developers' North Side bias.

Applewhite Reservoir

In 1979, Henry Cisneros, the popular first Latino mayor of San Antonio, proposed the development of a large surface reservoir, called Applewhite,⁸⁸ to serve the city's growing municipal needs.⁸⁹ With approval from City Council, appropriate permits were received and environmental impact statements completed.⁹⁰ The San Antonio Water System (SAWS) purchased 2,334 acres north of town for \$17.87 million and awarded construction contracts totaling \$37.5 million.⁹¹ All told, capital costs including a treatment center and distribution system would total \$180 million.⁹² Opposition to the reservoir did not fully develop until nearly a decade later, when recharge zone preservationists teamed with landowners whose property was soon to be seized for construction of Applewhite. The preservationists felt the reservoir would constitute only an excuse to allow more building over the recharge zone while various landowner (and taxpayer) advocates saw Applewhite as a conspiracy between city officials and developers to build an expensive, ill-planned project at citizens' expense.⁹³

⁸⁸ Somewhat appropriately, the name parallels the proposed Applecore Reservoir of Robert Townes's *Chinatown*—a film detailing Los Angeles's duplicitous water manipulation and speculation that, likewise, suits the hydraulic thesis nicely.

⁸⁹ It was pro-development Cisneros who pushed, also, the construction of the perennially empty Alamo Dome. The stadium was built over an old industrial zone and now sits atop several thousand cubic feet of so-called, toxic "Dome dirt."

⁹⁰ Donahue, 193-4.

⁹¹ San Antonio *Express-News* 8 June 1998.

⁹² Donahue, 194.

⁹³ Ibid.

Meanwhile, the Guadalupe-Blanco River Authority (GBRA)—a smaller player representing the economic interests of the Comal and San Marcos Springs—threatened duplicitously to file a lawsuit under the ESA to keep the springs flowing. Hiding behind the ESA and capitalizing on the precarious situation of the various endangered species, the GBRA was much more genuinely interested in maintaining their tourist attractions.⁹⁴

Likewise, Water Now!, a political action committee formed in 1991, contended that, since the aquifer held somewhere between 22-55 million acre feet, it was senseless to spend millions of dollars on a reservoir that held only 48,000 acre feet.⁹⁵ Given that the 2,300 acre Applewhite, due to the limestone bedrock, would range in depth from 4 to 15 feet—essentially a giant swimming pool evaporating in the hot Texas sun—Water Now!'s argument did have some validity. A better alternative, they argued, was to build large dams at the base of recharge zone that could potentially funnel runoff into the aquifer.⁹⁶

Such varied dissension and confusion led City Council to call a citywide referendum on the issue. In 1991, voters struck down by a margin of two percent plans to build Applewhite, effectively eating the costs already incurred and leaving themselves without a water plan. Two weeks after the referendum, the frustrated Lone Star chapter of the Sierra Club filed suit in federal court, arguing that the US Fish and Wildlife Service was violating the ESA in having no plan and taking no action to protect the species at Comal and San Marcos Springs.⁹⁷

⁹⁴ Ibid., 196.

⁹⁵ Ibid., 195.

⁹⁶ Ibid.

⁹⁷ Ibid.

To circumvent any federal intervention in the aquifer matter that the Sierra Club suit might bring, the Texas Attorney General ruled that state law dictated that the Texas Water Commission (TWC) controlled the state's rivers. Soon after, the TWC conveniently declared that the Edwards Aquifer was actually an underground river, thus renaming it the Edwards Underground River, and took overriding control. They advocated a plan of paying farmers not to irrigate during dry spells and for reviving the issue of Applewhite.⁹⁸

The Texas and Southwestern Cattle Raisers Association, which controlled millions of acres of land and pumping rights, responded to the TWC action by successfully filing suit against the state arguing that the commission's power grab had overturned 150 years' worth of water law without legislative process or compensation.⁹⁹

Two years after it was filed, the Sierra Club won its suit against the state, mandating that the legislature implement a workable water plan to protect the various endangered species. Failure to do so would result in federal intervention by the USFWS. The legislature soon found itself swamped by interest groups possessing authoritative scientific data regarding aquifer pumping that, not surprisingly, supported their various needs and agendas.¹⁰⁰

One result of the legislative attempt to reconcile the water demands was the replacement of the elected Edwards Underground Water District, the original aquifer

⁹⁸ Eckhardt, 1998.

⁹⁹ Donahue, 196.

¹⁰⁰ Ibid., 196-7.

water authority, with the appointed Edwards Aquifer Authority (EAA) to have a broad control over the Aquifer issues. Suit was filed, however, by the Mexican American Legal Defense and Educational Fund by way of the Department of Justice, arguing successfully that the replacement of an elected board by an appointed board was a violation of the Voting Rights Act.¹⁰¹

Back to square one, as it were, with the threat of federal intervention looming, the city appointed in 1993 a twenty-six-member citizens committee—the 2050 Water Committee—to examine present and future city water needs. Notably absent from the Committee were any recharge zone preservationists and anti-Applewhite activists. As a result, Applewhite returned from the dead, more expensive and built-up than ever. The new Applewhite, however, would serve only to hold water to discharge downstream via a canal for petrochemical users and to exchange with aquifer water during times of drought. Aquifer water would be removed from the Guadalupe River in two different areas and piped to San Antonio. The total cost now proposed was \$300 million.¹⁰²

Critics were quick to point out that, apart from the faults of the original Applewhite plan that remained (and which often were exacerbated) in the updated version, this second go around still did not guarantee protection of the Comal and San Marcos Springs, ostensibly the legally-mandated primary concern of the Committee. Critics also noted that the reservoir proponents were assuming that pumping rights to the Guadalupe, belonging to the Colorado River Authority, would be sold to the city. Likewise, several

¹⁰¹ Ibid., 198.

¹⁰² Ibid., 199.

more reasonable and less costly alternatives were proposed, including the pumped augmentation of the two springs—a process already used at a spring in another part of the city for recreational purposes. Regardless of widespread opposition, yet another referendum was hastily called. Fighting a \$700,000 pro-Applewhite media campaign, opponents (including the Catholic Church, a powerful social and political force in the city) argued that the reservoir would not resolve the legal and environmental issues that were the issue at hand, did not protect the recharge zone from pollution and development, and was far too expensive an undertaking. The second referendum in three years was again voted down, this time by a margin of ten percent.¹⁰³

Present alternatives to Applewhite include building a series of four dams in the Guadalupe River basin 80 miles from San Antonio (flooding 186,000 acres of ranch and agriculture land), or pumping water from lakes and rivers in the Colorado River basin north of Austin. The city already pumps some treated water from Canyon Lake some 60 miles from the city.¹⁰⁴ Likewise, the city has begun purchasing agricultural land outside city limits for the sake of obtaining pumping rights (at a going price of \$500 per acre foot). In a recent buy, the city paid \$600,000 for several hundred acres. But, as state law dictates, the city is entitled to only half of the water rights of any land it purchases solely for water—in this case, 320 annual acre feet to help supplement the 550,000 acre feet pumped from the aquifer each year. (Near this same time, however, the city charged a developer some \$600,000 to build a subdivision over the recharge zone.)

¹⁰³ Ibid., 200.

¹⁰⁴ San Antonio *Express-News* 5 June 1998.

The latest attempt by the Texas State Legislature to deal with the issues came in a 1997 comprehensive water planning law that created 16 regional groups around the state charged to develop plans to meet future water needs by Sept 1, 2000.¹⁰⁵ The law, Senate Bill 1, requires that the city limit its pumping in order to keep the Comal and San Marcos Springs flowing and the various species alive.¹⁰⁶ In an attempt to comply with this state mandate, SAWS unveiled its 2050 Water Plan on October 20, 1998. Amidst much talk of a “citizen-driven” proposal, the city council approved on November 5, 1998, the multi-faceted SAWS water-usage plan (entitled “Securing Our Water Future Together”) in anticipation of a doubling of the city’s population by the year 2050. Rather than make the historical mistakes, many examples of which are listed above, of focusing on simply one or two tacks in addressing a solution, the new SAWS plan calls for a series of 17 remediation, policy, and development approaches. Included are plans to search for new water sources, both surface and underground; study ways to optimize aquifer production; increase enforcement of water quality policies; recycle water; and acknowledge that the city needs to work with and abide by state water-planning agencies.¹⁰⁷

While this does indeed appear as a promising improvement over past blunders, the 2050 plan does possess its own disturbing qualities. Like many of its preceding proposed solutions, this SAWS plan makes no mention of endangered species. While the need to protect the species is perhaps implicit in the plan, it certainly does not aid SAWS’s stated

¹⁰⁵ San Antonio *Express-News* 31 May 1998.

¹⁰⁶ Donahue, John M. Personal correspondence b. November 13, 1998.

¹⁰⁷ San Antonio Water System. www.saws.org. November 12, 1998.

attempt to inform the public of their motivations. And despite the talk of citizen involvement, which included input from 62 citizen and electronic town hall meetings, there hardly seems a knowledgeable citizen base or a city-wide interest and consensus on the issues (again, refer to Appendix A).

Most recently, the pumping limits imposed by the EAA in an effort to preclude federal intervention¹⁰⁸ were deemed illegally adopted and subsequently nullified. On December 3, 1998, a state district judge ruled that the EAA failed to follow the Texas Administrative Procedure Act when proposed its most recent rationing plan in January 1998. According to TAPA, such limits cannot be enforced without “reasonable justification” which the EAA supposedly did not provide. Whether this ruled lack of justification includes protection of the endangered species is unclear. In the interim, the judge ruled that all aquifer users are allowed to pump as much water as they ever did in a single year between 1972 and 1993. Why these years in particular were selected and what effects this ruling will have on the aquifer and the species is, again, unclear.¹⁰⁹ As the EAA’s management responsibility has been to regulate pumping levels to preclude federal intervention in the preservation of the endangered species (as ruled in the Sierra Club lawsuit mentioned above),¹¹⁰ this latest state ruling may well bring the USFWS into the aquifer management picture.¹¹¹

¹⁰⁸ Boggess, John. Personal correspondence. San Antonio Water System. November 16, 1998..

¹⁰⁹ Greenwire. “*10: Edwards Aquifer: Judge Says H2O Limits Illegally Adopted.” December 4, 1998.

¹¹⁰ Boggess, 1998.

¹¹¹ The recent federal intervention in Oregon’s Coho salmon preservation plan—in spite of the state’s “Kitzhaber Plan”—may indicate a shift towards more active federal involvement in such issues.

CHAPTER IV

RECHARGE ZONE PLANNING

The city of San Antonio, whose municipal needs constitute the greatest single-user of the aquifer, possesses an obvious need to protect the viability—both in terms of quantity and quality—of the water supply. Regulation of development within the recharge zone, however, proves an unfortunately complicated affair—unfortunate for those assorted government agencies who must enforce the various regulations, for those developers and residents who must attempt to comply with the many rules, and for those one-and-a-half million people who currently rely on the aquifer's water.¹¹²

Two of the more important and germane regulations include San Antonio City Ordinance #81491, amending City Code Chapter 34, Article VI (of the Unified Development Code), and 30 Texas Administrative Code (TAC) Chapter 213 (along with

¹¹² Nine additional species of invertebrates located in caves over the recharge zone have recently been proposed for listing. The five spiders, three beetles, a harvestman are considered potentially threatened due to habitat loss and contamination (resulting from increased urbanization of the region) and the presence of invasive red fire ant species (Needham, Jerry. "9 local species may be termed endangered." *San Antonio Express-News* 31 December 1998: 1B; Federal Register, Vol. 63, No. 250. 30 December 1998: 71855).

Chapters 317, 321, 330, 331, 335 and associated subsections) of the Texas Natural Resource Conservation Commission (TNRCC).

City Ordinance #81491 (the Ordinance, henceforth), approved January 12, 1995 by the San Antonio City Council, outlines the City's regulatory actions in regards to land use within the recharge zone. The Ordinance, ratified on January 12, 1995, results from recommendations of a city Water Quality Task Force assembled the previous year and had the effect of amending Chapters 34 and 35 of the City Code—chapters addressing the city's water supply—to create more stringent regulations regarding protection of the aquifer and the recharge zone.¹¹³

The Ordinance, as previously stated, mandates administration of its rules by the SAWS, the primary, though not only, water purveyor in the city.¹¹⁴ As the city's Planning Department possessed neither the hydrogeological expertise nor the budget to acquire it, the private SAWS created its Watershed Protection and Management Department to assume such a regulatory and enforcement role.¹¹⁵ Thus, the costs for the city's attempts to protect the aquifer's integrity are passed along directly to SAWS's customers, allowing something of a free ride for those whose water is supplied either by other purveyors or private wells.¹¹⁶

¹¹³ The updated version of the code chapters can be accessed at www.municode.com/.

¹¹⁴ City of San Antonio. Ordinance 81491. §34-901.

¹¹⁵ San Antonio Water System. www.saws.org/yoursaws/BACKGROUND.HTM. August 24, 1999.

¹¹⁶ The issue of economic fairness is one of particular concern in San Antonio, given its concentrated levels of poverty. As it is, there have been, however undocumented, cases of severe dehydration by citizens deliberately not using water for drinking or bathing in an effort to keep water bills low (Patterson, Kirk and Carol. Personal interview. September 4, 1999).

Given this charge from the city, SAWS administers all development over the recharge zone.¹¹⁷ They dispense, after an application process, a letter of certification for each development project valid for three years.¹¹⁸ Each application for a letter requires the submission of a Water Pollution Abatement Plan (WPAP), detailing how developers intend to apply the city's rules to a given project. In addition to protection of the recharge zone proper, SAWS administers similar rules over the Floodplain Preservation Area (defined as the 100-year floodplain), the Floodplain Buffer Zone, the Drainage Area (including all watersheds larger than 300 acres extending into the Extraterritorial Jurisdiction), and significant recharge features (e.g., caves exposed during construction excavation).¹¹⁹

Beyond the series of regulations affecting floodplain protection, drainage areas, and other hydrological features, the Ordinance addresses the issue of impervious cover. Allowing only 15% gross impervious cover for all new construction over the recharge zone (as opposed to up to 65% impervious cover for commercial developments within the remainder of the city's limits), the Ordinance works to minimize the impacts of development on the amount of precipitation that can percolate to the aquifer, not

¹¹⁷ Despite their relative impotence in matters over the recharge zone, the San Antonio Planning Commission still must approve all development projects within city limits. Though possessing the ability to stem the sprawl that threatens the quality and quantity of aquifer water, the commission has proven reticent to do so, even in the face of neighborhood protests, increased traffic congestion, loss of urban forests, stormwater and flooding concerns, conflicting municipal jurisdictions, and increased threats to potentially endangered species (see Miller, Anne. "Neighbors protest development plan: Then Planning Commission approves it." *San Antonio Express-News*. 1 September 1999: 1H).

¹¹⁸ City of San Antonio. Ordinance 81491: 1995. §34-910, 911.

¹¹⁹ *Ibid.* §34-912, 913, 914.

necessarily through larger recharge features.¹²⁰ Likewise, depending on the automobile traffic existing or anticipated over the recharge zone, the Ordinance requires the installation of hazardous material traps (HMTs)—drainage basins using sand and gravel to filter stormwater—along busier roadways.¹²¹ Other stormwater regulations include capture and isolation of the first half inch of precipitation runoff around both commercial and multi-family residential projects, again to minimize pollutants percolating into the aquifer.

The other major, related document—TNRCC's Chapter 213—represents the state's attempt at land use regulation over the aquifer and, similar to the Ordinance, calls for the non-degradation of groundwater quality "consistent with §26.401 of the [Texas] Water Code."¹²² This stated goal, however, is qualified by calls for protection of "existing industries, and the maintenance and enhancement of the long-term economic health of the state."¹²³

Associated chapters of TNRCC's rules provide a delineation of acceptable and prohibited activities in both residential and commercial zones over the Edwards Aquifer. Further dividing the surface demarcations, the TNRCC has recently added, effective June 1, 1999, a Transition Zone (in addition to the artesian and recharge zones). TNRCC defines the new zone as "that area where geologic formations crop out in proximity to [the] south and southeast of the recharge zone and where faults,

¹²⁰ Ibid. §34-926, 930, 935.

¹²¹ Ibid. §34-960.

¹²² TNRCC. Texas Administrative Code: Chapter 213. §213.1

¹²³ Ibid.

fractures, and other geologic features present a possible avenue for recharge of surface water to the Edwards Aquifer.”¹²⁴ This new definition has the net effect of allowing for somewhat more relaxed land use regulations than the recharge zone, while still applying more stringent rules than would otherwise be necessary. For instance, while waste disposal wells and land disposal of toxic or hazardous wastes are prohibited in both the recharge and transition zones, new feedlots and sewage holding tanks are prohibited only within the recharge zone.¹²⁵

As with the Ordinance, new construction requires the submission of a Water Pollution Abatement Plan (WPAP) for TNRCC review and approval. As a “comprehensive set of plans and information detailing provisions to protect the water quality in the Edwards Aquifer,” the WPAP acts as something akin to the federal Environmental Impact Statements. Submissions are required to account for drainage, stormwater controls, stormwater discharges, surface water and wetlands impact, and amounts and types of impervious cover that would prevent recharge.¹²⁶

Though these recent regulations provide initial steps in mandating water quality protection, San Antonio is a large and fast-growing city. The eighth largest city in the U.S., it suffers, as many other cities, the typical growing pains of increasing air pollution and traffic as well as infrastructure costs. And while water supply proves an

¹²⁴ Ibid. §213.3.34

¹²⁵ Texas Natural Resource Conservation Commission, Field Operations. “Complying with the Edwards Aquifer Rules: Administrative Guidance.” June 1999.

¹²⁶ Edwards Aquifer Authority, Aquifer Science Team. “The Edwards Aquifer Authority Recharge Protection Issues, Phase 2.” Presentation to the EAA Board of Directors. July 28, 1999.

extremely contentious issue in this city that lies on the northern edge of the Chihuahuan Desert ecosystem, the security of water quality has, with the northward growth of the city, recently begun butting heads with development and development interests.

The issue of aquifer protection was eventually and inevitably brought to a head by a series of proposed development projects in the early 1970s.¹²⁷ It was these projects which, likewise, brought into play the divisive racial and class politics of the city in the name of aquifer protection. The fact that San Antonio is the largest Hispanic-majority city and, likewise, the second poorest large city in the U.S.¹²⁸ is not lost on many citizens, particularly the plurality of poorer Mexican Americans.¹²⁹ When the wealthier, generally white citizens of the North Side of the city want to develop, they have typically expanded further north, encroaching on the recharge zone. This northward development has occurred for a variety of often-interlinked reasons.

Geologically, the recharge zone is typified by a series of faults—the Balcones Faults—a region signified by rolling hills and thick oak tree flora. The landscape, thus, proves more charismatic than the lowlands to the south and often cooler in temperature,

¹²⁷ Donahue, John M. "Water wars in South Texas: Managing the Edwards Aquifer." *Water, Culture, and Power: Local Struggles in a Global Context*. John M. Donahue and Barbara Rose Johnston, eds. Washington, D.C.: Island Press, 1998.

¹²⁸ Tobar, Hector. "Political, economic gulf separate Alamo City." *San Antonio Express-News* 12 September 1999: 1G.

¹²⁹ From two particular development projects of the early 1970s (a shopping mall that would have been the largest in the Southwest, and Ranch Town, a suburb large enough for 88,000 people) sprang several activist citizens groups who managed, through local or federal intervention, to slow the continued recharge zone development. (Donahue, John M. "Water wars in South Texas: Managing the Edwards Aquifer." *Water, Culture, and Power: Local Struggles in a Global Context*. John M. Donahue and Barbara Rose Johnston, eds. Washington, D.C.: Island Press, 1998. 192.)

given the area's forest cover.¹³⁰ Economically, these geographic features have led to higher property values which, in turn, have led to better-funded school districts. For families moving to the city, the relatively good and safe schools on the northwest, north, and northeast sides provide attractive incentives to locate in these areas (or, more accurately, the poorer schools within the remaining sides of town typically discourage families from moving in). Likewise, growth generators built within the past thirty years have all worked to encourage the northward spread of the city. Large projects such as the University of Texas at San Antonio campus (UTSA), the University of Texas Health Science Center (UTHSC), as well as two shopping malls have all been located and developed in areas that were, at the time, farm and ranchland far north of the city proper. Rumored to be the result of land speculation by developers, such projects as UTSA and UTHSC, ostensibly intended for the good of the city (vis-à-vis education and health care), were located far from the people they could have helped most—the historically underserved west, south, and east sides of the city.¹³¹ The result of such development has been the increased desirability of the north sides of town, with housing subdivisions (to varying degrees of exclusivity) and strip malls soon following. A casual examination of the Real Estate section of a Sunday *San Antonio Express-News* reveals an unmistakable bias in new development toward the northeast, north central, and northwest side of the city. Developer advertisements, in their maps to provide potential buyers some spatial context of the properties, rarely descend below

¹³⁰ Valdavia, Enrique. Personal interview. March 1999. Valdavia is an environmental and social justice lawyer working in San Antonio.

¹³¹ Veni, George. Phone interview. September 9, 1999.

the I-10/Hwy 90 interchange that runs laterally through the city, dividing its loops (410 and 1604) in halves. The unspoken yet plainly clear ramifications of the advertisements indicate that the other, largely Latino and African-American and typically poorer parts of town do not exist in the eyes of developers—rather, the market exists only in the charismatic, whiter landscape over the recharge zone.

While understanding the urban and ecological history relating to aquifer issues provides a useful context with which to understand the city's Ordinance and the state's Administrative Code rulings, the effectiveness of the recent legislation must be judged in light of the real results of their application. Using the example of a recent gasoline spill as a cipher, the limitations of the city and state restrictions impacting the recharge zone and, ostensibly, protecting water quality become fairly apparent.

On July 11, 1999, a motorist leaving an adjacent Dairy Queen backed into a standard gasoline pump at a Texaco station located along US 281, several miles into the recharge zone. Though only a few gallons spilled from the pump itself, an unnoticed rupture in the line connecting the pump to the underground storage tank leaked an estimated 800 to 900 gallons of gasoline. The following day, a residence across the highway reported a strong gasoline odor from their water well. In the following week, six more wells were reported contaminated. While the gasoline had spilled into the Glen Rose section of the Trinity Aquifer—a series of limestone formations that lay above those of the Edwards Aquifer—there was considerable fear from authorities and local residents alike that the pollution was slowly moving in the direction of nearby Cibolo Creek, whose bed contains several recharge features leading more directly into the Edwards. News of the spill, surprisingly,

was not reported to the public until July 22, a full 11 days after the original accident, by which time a costly cleanup process of pumping, carbon filtering, purification, and re-injection was already well underway.¹³²

In response to the spill, the elected board of directors of the EAA requested that the TNRCC, who has ultimate enforcement jurisdiction over aquifer issues, place a 180-day moratorium on construction of underground storage tanks within the recharge zone. The Authority had hoped such a grace period would allow time to better plan both land use regulations and responses to such inevitable spills. TNRCC rejected the request, acknowledging that “there is no regulatory fix for this scenario short of a complete prohibition of new and existing USTs across the entire recharge zone of the Edwards Aquifer”.¹³³ Such an admission appears to confirm that TNRCC recognizes the potential threat of USTs to the area’s water supply, yet remains unwilling to take the necessary enforcement steps to slow their growth in numbers, much less to remove them. Given the size of the Edwards and its recharge area—extending far beyond the reaches of San Antonio’s jurisdiction—long-term protection of the sole-source aquifer and the one-and-a-half million residents who depend upon it requires the more aggressive and assertive intervention on the part of the TNRCC. To allow continued

¹³² Newspaper accounts of the spill and its ecological and political aftermaths can be found in the following articles: Bush, Rudolph. “800-gallon gas spill may pollute aquifer.” *San Antonio Express-News* 22 July 1999: www.mysa.com; Bush, Rudolf. “Gas spill fouls third Trinity Aquifer well.” *San Antonio Express-News* 3 August 1999: www.mysa.com; Needham, Jerry. “Board looks to protect aquifer.” *San Antonio Express-News* 10 August 1999: www.mysa.com; Needham, Jerry. “Aquifer board rebuffed on halt to gas stations.” *San Antonio Express-News* 13 August 1999: www.mysa.com.

¹³³ Needham, Jerry. “Aquifer board rebuffed on halt to gas stations.” *San Antonio Express-News* 13 August 1999. www.mysa.com.

development of the region as TNRCC has runs the certain risk of inevitable, catastrophic contamination of the Edwards.

CHAPTER V

RECENT GOVERNANCE AND POLICY

The obscene is sometimes defined as that which is out of joint with nature. It is not the worst definition, and by its measure, America is an obscene nation.

Norman Mailer¹³⁴

Ain't nothing bring you down like your hometown.

Steve Earle¹³⁵

The city of San Antonio has, in recent years, done considerable work in solidifying its role as a capitalist state water manipulator, meeting population growth prognostications with ever-larger projects intended to remediate concomitant water shortages. Facing the state-mandated aquifer pumping limits, from 450,000 at present to 400,000 af/yr by 2008,

¹³⁴ "A Note on Comparative Pornography." *Advertisements for Myself*. Glasgow: Flamingo, 380.

¹³⁵ Singer/songwriter Earle was born in Schertz, Texas—a city now indistinguishable from the spill-over sprawl of San Antonio.

state and local authorities, notably the EAA and the SAWS, have taken a decidedly active approach to water planning.

The nascent EAA,¹³⁶ as a state agency byproduct of 1993's SB 1477—itsself a result of the 1991 Sierra Club lawsuit against the Department of the Interior—replaced the Edwards Underground Water District¹³⁷ in an effort to stem federal involvement in the region's water issues, namely in terms of protection of endangered and threatened species related to the Edwards.

Another outcome from the 1991 Sierra Club lawsuit was the 1992 transformation of the City Water Board into SAWS. As the primary controlling authority of the city's municipal water supply, SAWS has, for a private water purveyor, taken a surprisingly active role in regional water planning. From publishing predictions of population growth to searching for new water resources, SAWS has proven a highly visible policy player, making significant strides to inform and interest a previously uniformed and disinterested public.

SAWS, despite being one of several privately held water purveyors in the city, has found itself, given recent events and circumstances, at the forefront of regional policy-making and planning efforts. As the nascent EAA currently possesses neither the budget, staff, nor, likely, the legal right to take to effect much regional policy, and as the city, likewise, lacks the willingness and budget to fund water policy efforts, SAWS stands as the major policy player. Publishing "Securing Our Water Future Together" in July 1998,

¹³⁶ As an intern, I worked for the EAA from June to September 1999.

¹³⁷ The EUWD was a representative board enacted by the state legislature following the region-wide drought in the fifties.

SAWS laid out its planning roles and goals through 2050, emphasizing, as the title implies, the collaborative nature of the process that, so claimed, would evolve with the contributions from an elaborate public participation process. Given, however, the inherent complexity of the issues at hand—based as they are on complicated water laws and controlled by multiple layers of bureaucratic authority—and the historical ambivalence, with some notable exceptions, of the citizenry, SAWS seems here to talk through their hands.

Despite SAWS's firm language of cooperation and planning—including gratuitous uses of “we” and “our,” “guiding principles,” and “management strategies”—the words, when placed in context, amount to little more than the contemporary bureaucratic clichés that they are. There is no mention in these plans of the simple, obvious fact that San Antonio follows Detroit as the second-poorest major metropolitan city in the nation,¹³⁸ and that the downplayed rate-hikes would present a major financial burden for many of the city's residents.¹³⁹ The guiding principles, which speak of protecting water quality, belie the relative impotence of the handful of restrictions that could possibly enact such protection.

Facing a state-imposed shortfall in coming years, as overall pumping from the Edwards is restricted from 450,000 to 400,000 af/yr and SAWS's share is cut from

¹³⁸ Tobar.

¹³⁹ To their credit, SAWS implemented in 1999 an additional, fifth rate tier for higher end water users. Following nearly a doubling of rates for high-volume users in 1994 that did little to diminish use, the System added the fifth tier, affecting those customers pumping more than 25,435 gallons a month and increasing that block's rate from 32 to 48 cents for summer, residential usage (Needham, Jerry. “Large-use water rate fires debate.” *San Antonio Express-News* 7 February 1999: 1A; Needham, Jerry. “Crowd badgers trustees over plan to raise water rates.” *San Antonio Express-News* 25 February 1999: 1A).

roughly 175,000 to exactly 148,074 af/yr, the purveyor has begun actively pursuing other water sources to supplement that 25,000 af.¹⁴⁰ With the recent allocation of water rights based upon historical use, SAWS entered the market, looking to either buy or lease rights, mostly from rural landowners. Additionally, when property owner's were unwilling to divest water rights from their land, SAWS has purchased the property outright.¹⁴¹ To this end, SAWS has gone so far as direct mail solicitations targeting most of the aquifer's known 693 pumpers.¹⁴² Results priced leased rights at around \$75 af/yr and purchased rights at \$500 af.¹⁴³ Other recent purchases have been made in the name of water quality preservation, buying up properties which contain significant, vulnerable recharge features.¹⁴⁴

Another tack SAWS has taken to compensate for diminished pumping includes the recent "recycled" water program. Begun in 1996, construction began of two pipelines—colored bright purple to distinguish its contents from Edwards water¹⁴⁵—running 80

¹⁴⁰ BexarMet, another, smaller purveyor to the city, has recently begun piping water from Medina Reservoir, roughly 40 miles east-northeast of San Antonio.

¹⁴¹ Needham, Jerry. "SAWS buys farm for aquifer pumping rights." *San Antonio Express-News* 20 May 1998: 3B.

¹⁴² Needham, Jerry. "SAWS courting pumpers." *San Antonio Express-News*. 22 August 1998: 2B.

¹⁴³ Needham, Jerry. "SAWS buys more water interests." *San Antonio Express-News* 2 September 1998: 8B.

¹⁴⁴ Examples include the Government Canyon Recreation Area, now open only to low-impact recreation. A recent purchase of 663 acres of the Davis Ranch in northwestern Bexar County for some \$2 million, or roughly \$1,880 per acre, proved an attempt to stem the rapid suburbanization of the scenic oak and cedar landscape of this Hill Country area. The land, in this instance, was purchased with monies from SAWS, the Kronkosky Charitable Foundation, the EAA, and the Texas Nature Conservancy (Needham, Jerry. "SAWS buys site to guard aquifer." *San Antonio Express-News*. 15 December 1998).

¹⁴⁵ Despite the potable quality of the recycled water (see "Potable vs. Recycled Water Comparison." SAWS: 24 August 1998), San Antonio residents—perhaps spoiled by high quality Edwards water and

miles north from the Leon Creek and Salado Creek Water Recycling Centers on the city's far south side¹⁴⁶ (see figure 14). At a cost of an estimated \$122 million, the project will ultimately provide 35,000 af/yr, typically to area golf courses, universities, and military bases.¹⁴⁷

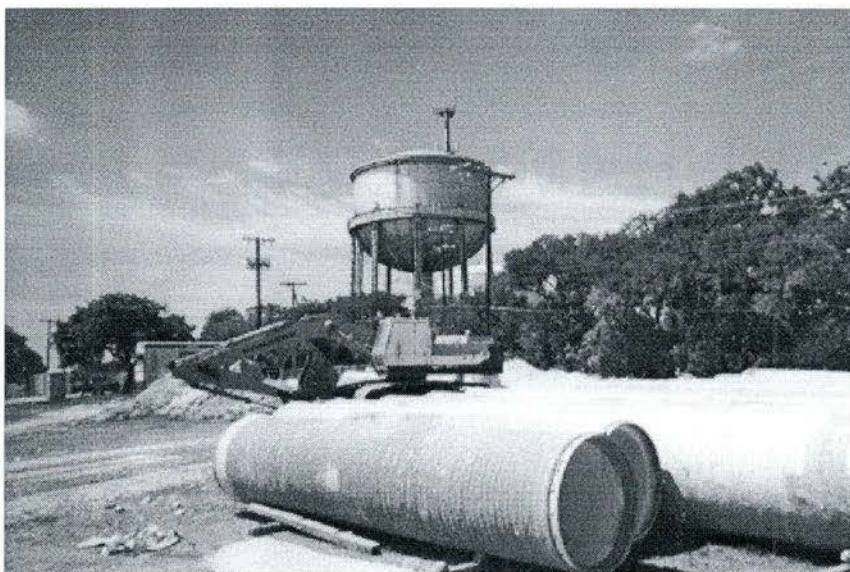


Figure 16. Purple Pipe: Recycled Water Program Infrastructure (photo by author).

Perhaps the most obvious and troublesome outcome of SAWS's planning has resulted in a recent deal with the Aluminum Company of America (Alcoa) that would exchange city-owned coal mining rights for a portion of water rights from Alcoa's adjacent lignite

turned off by the appellations of "recycled" or "gray" water—prove adamant in their opposition of using it for anything other than irrigation. This is the same citizenry, it should be noted, who voted down some years prior a proposal that would have fluoridated the city's water supply amid health concerns—a la *Dr. Strangelove's* Gen. Jack E. Ripper.

¹⁴⁶ Spicer, Emily. "SAWS seeks pipeline contracts." *San Antonio Express-News* 14 October 1998: 1H.

¹⁴⁷ Needham, Jerry. "7 major customers sign up for SAWS recycled water." *San Antonio Express-News* 18 November 1998: 3B.

mining operation.¹⁴⁸ The prospect of a private water purveyor arranging for the trade of city-owned mining rights for water proves disturbing enough, even if this water were not, as it is, 120 miles from those who would ultimately use it. Despite considerable protest during the public comment period, SAWS has continued to push the plan which, at present, offers five options—all of which require the piping of water from a distant hydrologic basin at estimated costs from between \$649 and \$840 af/yr. The most cost efficient of these options involves piping Alcoa water, at 75,000 af/yr, to an east Bexar County treatment plant. The most expensive involves piping the water from the Alcoa site to the Colorado River, where it would be pumped from a downstream site to an eastern Bexar County treatment plant. The most auspicious of these plans includes piping Alcoa water to the recharge zone, east of Medina Lake, where it would be stored to augment aquifer levels and spring flows.¹⁴⁹

Opponents of the plan argue that the interbasin transfer represents both an unnecessarily built-up and expensive option, while placing unsustainable demands on Alcoa's water source, the Simsboro Aquifer. As a slowly recharging sand aquifer, the Simsboro, SAWS's studies show, would suffer considerable drawdown, potentially drying up area springs and wetlands which, themselves are habitat for endangered

¹⁴⁸ City Public Service, San Antonio's municipally-owned power company purchased the land some 20 years ago with intentions—now abandoned—of building a coal-fired plant near the low-grade deposit (Needham, Jerry. "Residents critical of SAWS' plan with Alcoa." *San Antonio Express-News*. 9 March 1999: 2B).

¹⁴⁹ HDR Engineering, Inc. "Preliminary Feasibility of Options to Deliver ALCOA/CPS Groundwater to Bexar County." January 2000: x.

species.¹⁵⁰ Local residents are, likewise, concerned about effects on personal and municipal wells¹⁵¹—such sustained drawdown would eventually run area wells dry. These potential ramifications are plainly the pitfalls of large-scale water manipulation which Worster predicts.

In a state that possesses, at most, one perennial lake not made by humans,¹⁵² there exists now nearly as much surface water as Minnesota—the land of 10,000 lakes.¹⁵³ And, in an era when there is considerable, rational talk in both government and scientific communities of decommissioning dams and their reservoirs, Texas water planning focuses heavily on these intensive manipulations of water resources that, elsewhere, have been deemed ecologically destructive and major impediments to the survival of aquatic species. In the most recent state water plan, *Water for Texas*, the Texas Water Development Board argues, as their name implies, for at least seven major new reservoirs in the eastern half of the state, including the Cibolo Creek Reservoir southeast of San Antonio.¹⁵⁴

¹⁵⁰ Needham, Jerry. "Residents critical of SAWS' plan with Alcoa." *San Antonio Express-News*. 9 March 1999: 2B.

¹⁵¹ Needham, Jerry. "SAWS forum to study Alcoa proposal." *San Antonio Express-News*. 5 March 1999: www.mysa.com. The article quotes a local resident as "terrified" of the ramifications of the potential deal—brokered as it is between government agencies and a multinational corporation.

¹⁵² Thought to have been formed by either an earthquake or a logjam along the Red River some 200 years ago, there exists, however, some uncertainty as to the "naturalness" of Caddo Lake. Likewise, while the largest lake in the U.S. South, half of the 26,800 acre lake falls in Louisiana, denying Texas its own entire, natural lake (<http://www.caddolake.com/history.htm>). Additional seasonal playa lakes are located in West Texas.

¹⁵³ McKinney, Larry. "They Call Me Dr. Doom." *Texas Parks and Wildlife Magazine*. January 1999: 34.

¹⁵⁴ Texas Water Development Board. *Existing Major Water Supply Reservoir and Recommended Projects*. Map. Austin: TWDB, 1997.

Mitchell Reservoir, or Mitchell Lake as it is more commonly referred to, once was the repository for San Antonio's raw sewage. After decades of severe pollution, eutrophication, and human neglect, paralleling the phenomena of Rocky Mountain Flats Arsenal outside Denver¹⁵⁵, the reservoir has become in recent years an important bird sanctuary and is currently being developed as an "eco-resource" and bird-watching destination.¹⁵⁶ The 600-acre reservoir, along with 700 surrounding acres, is owned by SAWS and subject to \$57.1 million in proposed construction that would transform the site into a visitor center, complete with hiking trails, constructed wetlands, and a parking lot.¹⁵⁷

SAWS has, in effect, co-opted the popular language of consensus-based planning to justify their cost intensive and ecologically destructive methods of providing water for an area whose population has, simply, outgrown the water resources of its hydrologic basin. Such a betrayal of the sincere efforts of consensus planning to reinject democracy into the process proves, however, less disconcerting than the end results of their water manipulation. The interbasin water transfers—stealing from Peter to pay Paul, as John Graves has notably put it—that SAWS and other state agencies see as the solution to the region's supply problems simply exacerbate the problem by facilitating population

¹⁵⁵ see Worster, Donald. "The Nation's Most Ironic Nature Park." *Uncommon Ground: Rethinking the Human Place in Nature*. W.W. Norton & Company. New York: 1995.

¹⁵⁶ San Antonio Water System. http://www.saws.org/yoursaws/mitchell/Content/Facts/Fact_Frm.htm. March 30, 2000.

¹⁵⁷ Needham, Jerry. "SAWS gets briefing on plans for lake: Vote due on wildlife habitat, park, center." *San Antonio Express-News* 4 April 2000: www.mysa.com.

growth while offering only short-term solutions to concomitant, increased water demands.

As early as 1890, John Wesley Powell, the prescient observer of water and the arid US West, publicly addressed the important relationship between watershed and political boundaries. The acting head of the USGS from 1881 to 1893 (an auspicious time in the planning and shaping of the west), Powell concluded, in numerous writings and testimonies before Congress, that for its relative scarcity water would constitute the defining resource of the new west.¹⁵⁸

Recognizing the dubious nature of irrigated societies, particularly their anti-democratic tendencies within their advanced stages, Powell, despite his own inclinations toward technocratic boosterism, was wary of an irrigated west on the scale many of his contemporaries were envisioning. His proposal to avoid such an outcome appears, in retrospect, remarkably simple: divide the arid west—delineated as land west of the hundredth meridian, east of Sacramento Valley, and north to the Columbia—into two or three hundred “hydrographic basins” following watershed boundaries.¹⁵⁹ Hydrographic basins, rather than typical organizational units of counties or townships, would exclude the possibility of interbasin water transfers. Such basin-scale planning would thereby inhibit both the notion that more water can be had to facilitate increased growth in a given area and the concomitant human/ecological domination that follows such manipulation.

¹⁵⁸ Worster, 135.

¹⁵⁹ Worster, 138.

The results of Edwards-related political and legislative machinations, particularly the contrivance of state SB 1477, reveals the ways in which politics rather than hydrological or ecological concerns shape the policies that determine such planning. The bill, among other actions, delineates the hydrologic boundaries of the Edwards region, defining in great detail which lands fall within the artesian, recharge, and contributing zones. Problems arose, in particular, with the definition of the recharge zone—likely the most important area in terms of maintaining both the high quality and continued, if somewhat unreliable, quantity of aquifer water. In the western portion of the region, both Edwards and Real counties contain considerable areas of drainage and recharge coverage, though neither overlay the artesian zone. In concrete terms, this simply means that the two counties receive no water from the Edwards, yet, as they are hydrologically and geographically related to the aquifer, fall within the jurisdiction of the agencies which dictate pumping and land use regulations as germane to aquifer protection. Simply put, Edwards and Real counties have nothing to gain from aquifer regulation and a substantial amount to lose, if and when stringent land use regulations are imposed in the name of aquifer protection. Understanding this, one must assume, the counties intervened in the writing of SB 1477, removing any delineated recharge zone from within their jurisdiction. Such political maneuvering proves particularly disturbing in this instance as a largely disproportionate percentage of aquifer recharge occurs within the western third of the region, including Edwards and Real counties. Should regulations be imposed—and they would likely be imposed on the more important recharge zone than before or in conjunction with the contributing zone—lands within these counties would be exempt,

removing the teeth from any such legislation and continuing the threat of diminished water quality and quantity for the entire Edwards region.

More recent attempts at watershed-based planning have, likewise, proven politicized to the point of ineffectiveness. Drawn almost entirely following county boundaries, the 12 regional water planning groups established by the legislature in 1999 ignore too much matters of watershed boundaries, available water supply, and projected water demand, while covering areas so large as to severely limit public participation in the planning process.

CHAPTER VI

ANALYSIS AND CONCLUSIONS

The rosy preindustrial time is past when the humanism of a man like Thoreau (*was* it humanism?) could still theorize in terms of natural harmony. Humanism has to speak in the terms of extant human beings. The terms of today's human beings are air conditioners and suburbs and water impoundments overlaying whole countrysides, and the hell with nature except maybe in a cross-sectional park here and there. In our time quietness and sun and leaves and bird song and all the multitudinous lore of the natural world have to come second or third, because whether we wanted to be born there or not, we were all born into the prickly machine-humming place that man has hung for himself above that natural world.¹⁶⁰

John Graves

We are in a transition period like no other in our history as we move from a time when Texas defined Texans, to a time when Texans will define Texas.¹⁶¹

Larry McKinney

¹⁶⁰ *Goodbye to a River*, Houston: Gulf Publishing Company. 1959. 159.

¹⁶¹ "A Trickle Down to Wildlife." *Texas Parks and Wildlife Magazine*. January 1999.

It seems, perhaps, reasonable enough at this point to wonder why this need be such a convoluted and contentious issue. In the relatively straightforward (i.e., federally-mandated) effort to save several endangered species, politics of race and class have collided with simple economic wants and needs. The typically affluent whites of the north side of the city are expanding and developing, not back into the poorer regions of the city, but to the more charismatic landscape of the Hill Country (i.e., the recharge zone). More directly, though, a city that has never before faced resource limits is now fumbling policy in light of such confines. The city and state bureaucrats had, until the recent introduction of the SAWS 2050 plan, placed human municipal water needs before those of the species—a violation, it would seem, of federal law.

As an apology for citizen disinterest in the uses and management of the Edwards Aquifer, it seems important to note that, unlike the Pacific Northwest or the U.S. West in general, resource issues are not at the forefront of regional political or media issues.¹⁶² While central Texans in general may consume and develop as much, if not more, than other Americans, they are not geographically bound by, for example, forests or mineral deposits. They do not, therefore, witness such expansive results of resource extraction. They see no expanding ski resorts or slag heaps. They see no clearcuts; only, perhaps, a few scattered strip coal mines. Likewise, there are no salmon to miss, and Mexican wolves are well beyond the immediate reach of history. On the contrary, such regional symbols of resource extraction—oil wells and derricks, for instance—represent,

¹⁶² As a resident of San Antonio for a total of some four years, I speak here as one complicit in and, thus, familiar with this sort of city-wide ignorance and apathy. Despite my relatively strong environmental leanings while I lived in the city, it has only during my times spent away, particularly in the more resource-

still, economic prosperity with minimal impact on the landscape. The stench and pollution of refineries is largely confined mostly to the “Golden Triangle” of southeast Texas where the economic benefits make it worth residents’ while. Physically, as such, the Edwards Aquifer is much like an oil well—underground and out of sight, providing for seemingly unlimited and unquestioned wants and basic needs, with minimally perceived economic or environmental costs.

Such disinterest cannot simply be blamed on citizens without implicating media outlets. The San Antonio *Express-News*, the major source of printed news for the region, for instance, consistently prints editorials and letters to the editor that work to obfuscate the issues surrounding the aquifer without running consistent, accurate reportorial or editorial comments regarding the aquifer and its management (or most any environmental issue, for that matter). When the editorial staff of the *Express-News*, it can be presumed by experience, possess no sure-footed knowledge or opinion regarding the aquifer, then the paper will readily fall victim to the political whims and uninformed opinions of the moment. While they print daily readings on the relative levels of the aquifer, the *Express-News* never bothered, as long as I have been reading, to mention that these levels were set in relation to federally mandated limits that could reasonably be expected to ensure the survival of several endangered species. Such absence works only to exacerbate the problems of ignorance, confusion, and indifference.

However, an interested citizenry—which San Antonians, to their discredit, generally are not—has the capacity to become informed and to demand helpful participation by and

minded West, have I become better informed and more concerned regarding the aquifer’s management and, in turn, the social perceptions concerned with the Edwards.

information from media outlets. As the severity of the aquifer problems escalate, a workable solution will require dissemination of basic information to radically alter perceptions of the current ecological and political situation. In a city that still reels from the historical influence of race and class inequality, preoccupation with such basic justice issues typically reinforces traditional, egregiously anthropocentric values and concerns. Without an informed citizenry, those in the region who have traditionally controlled the use of the aquifer in a less than democratic manner will continue and likely strengthen this sort of political and municipal control. With an informed citizenry, the greater the likelihood that the current power disparities between issues of race, class, and development will not determine the future aquifer policy.

In a context of Worster's hydraulic thesis, however, it seems important to note that such misconceptions and overt apathy, while distinct in this instance, are not particularly unique. When Worster states that efforts to manipulate and dominate resources—not water only—eventually effect the manipulation and domination of people, this proves only a broadly-scaled critique of economy, culture, and governance—hegemonic structures unlikely to find agreeable remedy or resolution to a degree argued for here. The many parallels between the management and perception of the Edwards Aquifer and other resources in the U.S. illuminate simply the urgent need for reconnoitered methods of using and perceiving these resources—namely, that increasing human reliance on and consumption of basic resources must refer to the admittedly fuzzy notion of ecological sustainability; that population growth and consumption growth cannot continue unabated without the consequences of restrictions and impeding governance. Ignoring this

“prickly machine-humming place” that we have hung for ourselves above the natural world—the place we abide, either willfully or reluctantly—demands restrictive consequence.

Not until managing agencies and, more importantly, the region's population as a whole recognize the particular limits of this particular ecosystem will the priorities of development, species preservation, and respect for water resources be realigned. The region's present ecologically myopic stance on the aquifer reflects a genuine split of a culture living apart from the natural systems upon which it depends, reifying in the city's mind this sort of backhanded treatment of nothing less important than its sole source of water.

APPENDIX A

EXCERPTS FROM THE SAN ANTONIO *EXPRESS-NEWS*

"WATER CRISIS" CHAT ROOM

Unedited selections from the now-defunct "Water Crisis Chat Room" on the web site of the San Antonio *Express-News*, dated as marked.

Fri Sep 18 09:54:13 CDT 1998
JAMES PEZZARO from SAN ANTONIO

THERE IS NO WATER CRISIS. THE IDEA IS USED TO KEEP INDUSTRIAL BUSINESS OUT OF THE AREA. SAN ANTONIO LEADERS WANT TO KEEP THE MINIMUM WAGE "KING". THE TOURISM/CONVENTION BUSINESS MAKE THE BUCKS AND THE WORKER NEVER GETS AHEAD.

Wed Sep 16 02:57:47 CDT 1998
Karlos BlackAdder from SA

How about if the city PUTS SOME TEETH in their restrictions!!! The dumbest act are the [apartment complexes], and business [sic] that waste water like crazy, yet the public is expected to "do their share"??? I lived at Austin Pointe apts & would see water wasted day after day. I would report these people, and ALL THE CITY would do, is tell them not to do it again. Next day.....same old, same old. THAT'S STUPID !!!!!!!

Mon Aug 31 12:35:22 CDT 1998
Waterworld Wally from Northlands

I love SA. As a former resident, 2 things are needed: 1. A resevoir [sic] to hold the storm water runoff. 2. Yes, the water needs to be fluoridated. It works and don't listen to the old farts who talk about fluoride aggravating arthritis. It's all phooeey [sic]. Let's make the dentists a little less busy. Go Spurs!

Sat Aug 15 22:32:25 CDT 1998
John M Mokry from San Antonio

Has anyone considered the REAL reason that we have water rationing? Could it be because of the Sierra Club, "Defenders of the Universe", threatening to sue if we pump

over a certain amount of water out of the Aquifer? They must have our city officials running scared.

Sat Aug 1 10:39:56 CDT 1998
John from San Antonio

There is no water crisis!! The crisis is a manufactured 'crisis mentality' to gain control of water for money. The would be 'crisis mentality' is supported by the media because they like nothing better than a 'crisis' to fan the flames of fear and fanatic over-reaction. Greed inspired the crisis; greed feeds the crisis. Where's the money going ? Not just the wasteful purchase of an empty brewery, but where's the MONEY really going?? A real investigative reporter should be able to track it. Someone too brave to be bought or fear for his life could expose the source of the greed and crade! [sic] of the crisis. Come on, guys 'n gals. Where's your fanatical search for the Truth ??

Thu Jul 2 01:11:08 CDT 1998
Dan Flanders from Shearer Hills

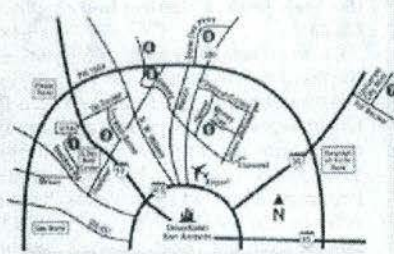
Perhaps the most immediate priority would be to know exactly what considerations are driving the water crisis. Just why is the 650' level in the test well the controlling measurment [sic] to invoke restrictions? Is it just an arbitrary level based on the Comal spring flow, and if so, was that chosen in an attempt to placate the Sierra Club? Or is it based upon some theoritical [sic] level representing estimated capacity of the aquifer? If some knowledgeable and unbiased presentation were made perhaps some of us could understand the gravity of the situation. As it is the whole controversy seems to be about whose ox is being gored when restrictions are invoked. I would like to think that the whole concern was for the ability of the aquifer to support projected populations and not whether the Sierra Club and their bedfellows are able to impose their demands upon the rest of the citizenry.

APPENDIX B

REAL ESTATE REPRESENTATIONS OF CITY DEVELOPMENT

Representative advertising selections from the Sunday Real Estate section of the San Antonio *Express-News* (12 September 1999). The maps provided by developers all represent their North Side bias, to the point of ignoring the existence of other parts of town.

See hundreds of plans at our website...
www.DavidWeekleyHomes.com



1. Hart Ranch
From the \$130's
(210)690-1752
2. Shavano Heights
From the \$230's
(210)479-6286
3. The Village at Inwood
From the \$150's
(210)495-8815
4. Rogers Ranch
\$200's to \$260's
(210)492-1557
5. The Springs at Stone Oak
From the \$150's
(210)495-8815
6. The Parke at Heritage Oaks
\$130's to \$190's
(210)490-8940
7. Olympia Hills
From the \$162's
(210)566-6217

imagination makes the difference
David Weekley Homes

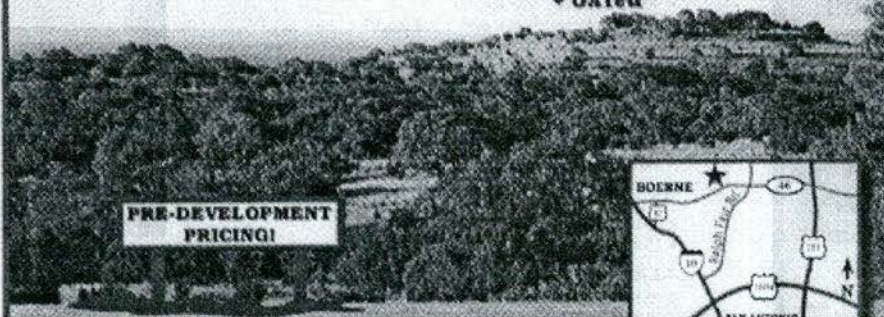
BUILD on Your Lot!
 (210)479-0491

Prices and communities subject to change without notice. Models open daily: Mon-Sat 10 am - 7 pm, Sun 11 am - 6 pm.

**Created By Nature
 Sculpted By Time...**

- ♦ 3-5 Acre Homesites
- ♦ Spectacular Views
- ♦ Miles of Nature Trails
- ♦ Boerne Schools
- ♦ Gated

PRE-DEVELOPMENT PRICING!




COVENEY RANCH
...at home with Nature

7 Miles East of Boerne
 20 Minutes from San Antonio
 650 E. Hwy 46 • Boerne, TX 78006
 Toll Free 1-877-COVENEY
 www.coveneyranch.com

CLOSEOUT SALE - SECTION II-B

Final Homesites Just Released - All New Inventory!



Beautifully wooded
1/2 to 1 acre country homesites
overlooking
Canyon Springs Golf Course.
From \$49,900

- Beautiful tall oaks
- Gated entrance
- Underground Utility
- NO city taxes
- Quality restrictions

Private 35 acre homeowner's park with greenbelts

- Spectacular views
- Curbed Streets
- Central water/sewer
- Premier 281N location
- Choose your own builder

5 minutes from San Antonio Drive Out Today!

Closeout Incentives
Sat & Sun 9/11 & 9/12

SPECIAL REDUCTIONS!
on the following premier homesites:

#21 Breathtaking Hill Country View!
~~Was \$76,500~~, **NOW \$73,900**

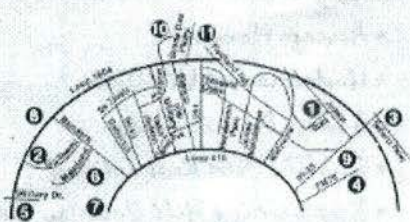
#33 Huge Live Oaks on Cul-de-sac!
~~Was \$78,400~~, **NOW \$75,900**

#43 Covered w/ 1 Huge Oak!
~~Was \$54,900~~, **NOW \$52,900**

OTHERS AT COMPARABLE SAVINGS!



Call Metro 830-980-2324, ext. 6228
A development of Southland Properties



Continental

Welcome Home

A D-R-HORTON Company

<http://www.continentalhomes.com>



APPENDIX C

CITY AND STATE RECHARGE ZONE LAND USE REGULATIONS

Regulated activities over the Edwards Aquifer and related regions, adapted from City Ordinance #81491 and 30 TAC Chapter 213:

Recharge Zone:

- Construction of buildings, utility stations, utility lines, roads, highways, or railroads
- Clearing, excavation, or other site disturbance
- Installation of 500 gallon aboveground or underground storage tank facilities (for hazardous substances)
- Any other activities that may pose a potential for contaminating the Edwards Aquifer and hydrologically connected surface streams

Regulated activity does not include:

- Clearing of vegetation without soil disturbance
- Agricultural activities, except feedlots/concentrated animal feeding operations
- Activities associated with the exploration, development, and production of oil, gas, or geothermal resources under the jurisdiction of the Railroad Commission of Texas
- Routine maintenance
- Construction of single-family residences on lots that are larger than five acres, where no more than one single-family residence is located on each lot

Prohibited activities:

- Waste disposal wells
- New feedlot/concentrated animal feeding operations
- Land disposal of Class I wastes
- Use of a sewage holding tank as part of an organized sewage collection system
- New municipal solid waste landfill facilities
- New wastewater discharges that would create additional pollutant loading

Transition Zone:

- Because the transition zone has faults, fractures and other geologic features which can act as possible avenues for movement of surface or near-surface contaminants into the Edwards Aquifer, the area is considered sensitive for certain activities. Regulated activities are limited to the installation and maintenance of 500 gallon underground and aboveground storage tanks for petroleum hydrocarbons

Prohibited activities

- Waste disposal wells
- Land disposal of Class I wastes
- New municipal solid waste landfill facilities

Contributing Zone:

Activities disturbing five or more acres or are part of a common plan that disturbs five or more acres are regulated (this is the same threshold as the EPA General Permit for Stormwater Discharges from Construction Activities). Activities of concern are any construction or post-construction activity occurring on the contributing zone of the Edwards Aquifer that has the potential for contributing pollution to surface streams that enter the Edwards Aquifer recharge zone is regulated.

- Construction or installation of buildings; utility stations; utility lines; underground and aboveground storage tank systems; roads; highways; or railroads
- Clearing, excavation, or other site disturbance
- Any other activities that pose a potential for contaminating stormwater runoff

Regulated activity does not include:

- Clearing of vegetation without soil disturbance
- Agricultural activities, except feedlots/concentrated animal feeding operations
- Activities associated with the exploration, development, and production of oil or gas or geothermal resources under the jurisdiction of the Railroad Commission of Texas
- Routine maintenance
- Construction of single-family residences on lots that are larger than five acres, where no more than one single-family residence is located on each lot

APPENDIX D

SAWS'S CRITICAL PERIOD STAGE RESTRICTIONS

SAWS, adhering to their policy-making mandates, administers critical period water use restrictions. Listed below are the various "stage" restrictions, based upon regular measurements taken at city well J-17, that begin when levels fall below 650'. While the restrictions prove an effective way to involve and inform citizens as to the precarious nature of their water supply, enforcement of the rules has been unfortunately lax.

STAGE I

650'

Mandatory restrictions

Waste is prohibited *

Landscape watering with an irrigation system or sprinkler permitted only between the hours of 8:00 p.m. and 10 a.m. *

Charity car washes permitted at commercial car washes that use recycled water or are certified as a conservation car wash *

Washing impervious cover such as parking lot, driveway street or side walk prohibited

Restaurants may serve water only upon request

Pools must be covered at least 25% when not in use

Vehicle washing at home permitted only during designated days and times

Golf courses - 10% reduction in replacement of daily evapotranspiration (ET) rate or 1.8 times the base usage irrigation between hours of 8:00 p.m. and 10 a.m.

STAGE 2

642'

All restrictions from STAGE I

Aesthetic fountains prohibited, unless water is recirculated or recycled

Landscaping watering with an irrigation system or sprinkler permitted 2 days/week

Residential Odd Sunday & Thursday
 Residential Even Saturday & Tuesday
 Commercial Monday & Friday

Watering with a hand-held hose or drip irrigation permitted only after 8:00 p.m. and before 10 a.m.

Golf courses - 20% reduction in replacement of daily evapotranspiration (ET) rate or 1.6 times the base usage irrigation between hours of 8:00 p.m. and 10 a.m. only.

Landscape watering for new landscapes permitted until plants are established

Public Playing fields-watering permitted only between midnight 9:00 am to extent necessary to protect health and safety, unless conservation plan approved by EAA

Filling and replenishing of swimming pools to maintenance level permitted, draining onto pervious surface only

Citizens are encouraged to wash their cars no more than twice / month

STAGE 3

636'

All restrictions from Stage I and II

Landscape watering with an irrigation system permitted only one day/week. Based on last digit of street address, the following schedule applies:

0,1 – Monday
 2,3 – Tuesday
 4,5 – Wednesday
 6,7 – Thursday
 8,9 – Friday

Watering with a hand-held hose, soaker hose or drip irrigation permitted only after 8:00 p.m. and before 10:00 a.m.

Golf courses – 30% reduction in replacement of daily evapotranspiration (ET) rate or 20% reduction in replacement of daily ET rate if an ISP participant; or 1.4 times the base usage, irrigation between hours of 8:00 p.m. and 10:00 a.m. only.

Installation of new landscapes permitted only if not more than 50% is drought tolerant turf and if proper horticultural practices are used. Variances may be granted.

Athletic fields-watering permitted only between midnight and 9:00 a.m. for health and safety reasons, unless conservation plan approved by EAA.

STAGE 4

632'

All restrictions from Stage I and II

Landscape watering with an irrigation system or sprinkler permitted on one day/week on same schedule as Stage III during the hours of 3:00 a.m. – 7:00 a.m. and 8:00 p.m. – 11:00 p.m.

Watering with a hand-held hose, soaker hose or drip irrigation is permitted to maintain trees, shrubs and other ornamental plants between 3:00 a.m. and 7:00 a.m.

Filling all new and existing swimming pools is prohibited; unless at least 30% of water is obtained from source other than Edwards Aquifer.

Draining permitted onto pervious surface and only if necessary to repair leaks or remove excess water in order to have water level to maintenance level.

Golf courses – 30% reduction in replacement of ET rate or 20% reduction if a participant in ISP or not more than 1.4 times base usage. 40% reduction of ET rate or not more than 1.4 times base usage if not participant irrigation between 8:00 p.m. and 10:00 a.m. only.

Additional reductions may be imposed by the City Council if conditions warranted.

Installation of non-drought turf is prohibited.

Public playing fields-watering permitted only between midnight and 9:00 a.m. to extent necessary to protect health and safety, unless conservation plan approved by EAA.

BIBLIOGRAPHY

- Boggess, John. Personal correspondence. San Antonio Water System. 16 November 1998.
- Brumley, Bradley. "Why Local Swimmers will be Saying Dam!" *The Southwest File*. Vol. 10, Issue 2. July 1999: 8.
- Brune, Gunnar. *Springs of Texas, Volume I*. Fort Worth: Branch-Smith, Inc., 1981.
- Bush, Rudolph. "800-gallon gas spill may pollute aquifer." *San Antonio Express-News* 22 July 1999: www.mysa.com.
- _____. "Gas spill fouls third Trinity Aquifer well." *San Antonio Express-News* 3 August 1999: www.mysa.com.
- City of San Antonio. "The San Antonio River: A Brief Look at its Colorful History." <http://www.ci.sat.tx.us/pio/rivrwalk.htm>. 6 December 1998.
- City of San Antonio. Ordinance 81491: 1995.
- Donahue, John M. Personal correspondence b. 13 November 1998.
- _____. "Water Wars in South Texas: Managing the Edwards Aquifer." Donahue, John M. and Johnston, Barbara Rose, Ed. *Water, Culture, and Power: Local Struggles in a Global Context*. Washington, D.C.: Island Press, 1998.
- Dorsett, Amy. "Creek cleanup raises concern: Damage to vegetation claimed." *San Antonio Express-News* 3 February 1999: 1H.

- Eckhardt, Gregg A. "The Edwards Aquifer Home Page." <http://www.edwardsaquifer.net/>. 2 November 1998.
- _____. "The Edwards Aquifer Homepage: The San Antonio River." <http://www.edwardsaquifer.net/sariver.html>. 22 May 2000.
- Edwards Aquifer Authority. "Edwards Aquifer Hydrogeologic Report for 1997." Report 98-02. October 1998.
- Edwards Aquifer Authority, Aquifer Science Team. "The Edwards Aquifer Authority Recharge Protection Issues, Phase 2." Presentation to the EAA Board of Directors. 28 July 1999.
- Edwards Aquifer Research and Development Center (EARDC). "Edwards Aquifer Information Page." <http://www.eardc.swt.edu/edwards/index.html>. 3 November 1998.
- Federal Register, Vol. 63, No. 250. 30 December 1998: 71855.
- Fisher, Lewis F. *Saving San Antonio: The Precarious Preservation of a Heritage*. Lubbock: Texas Tech University Press, 1996.
- Glick, Thomas F. *The Old World Background of The Irrigation System of San Antonio, Texas*. Southwestern Studies, Monograph No. 35. El Paso: The University of Texas at El Paso, 1972.
- Graves, John. "You Ain't Seen Nothing Yet." *The Water Hustlers*. Comp. Robert H. Boyle, John Graves, T.H. Watkins. San Francisco: Sierra Club Books. 1971.
- _____. *Goodbye to a River*. Houston: Gulf Publishing Company. 1959.
- Greenberg, Mike. "Seeing ahead with eyes on the past." *San Antonio Express-News*. 24 March 1999: 1B
- Greenwire. "*10: Edwards Aquifer: Judge Says H2O Limits Illegally Adopted." 4 December 1998.
- Haury, Emil W. *Prehistory of the American Southwest*. Tucson: University of Arizona Press, 1994.
- HDR Engineering, Inc. "Preliminary Feasibility of Options to Deliver ALCOA/CPS Groundwater to Bexar County." www.saws.org. January 2000.

- Illgner, Rick. "The Edwards Aquifer: Political Prisoner." Association of American Geographers. Atlanta: April, 1993.
- Jensen, Ric. Great Plains Agricultural Council, Texas Water Resources Institute. "Groundwater in the Great Plains: GPAC Report 141." Texas A&M University: 1991.
- Jones, William K. "Notes on the History and Material Culture of the Tonkawa Indians." *Smithsonian Contributions to Anthropology*, Vol. 2, No. 5. Smithsonian Press. Washington: 1969.
- Lyman, Rick. "What's Doing in San Antonio." *New York Times*. 29 November 1998.
- Mailer, Norman. "A Note on Comparative Pornography." *Advertisements for Myself*. Glasgow: Flamingo, 380.
- McCollough, Chuck. "Flood at top of '98 list." *San Antonio Express-News*. 30 December 1998: 1H.
- McKinney, Larry. "A Trickle Down to Wildlife." *Texas Parks and Wildlife Magazine*. January 1999: 34.
- Miller, Anne. "Neighbors protest development plan: Then Planning Commission approves it." *San Antonio Express-News*. 1 September 1999: 1H.
- Needham, Jerry. "9 local species may be termed endangered." *San Antonio Express-News* 31 December 1998: 1B.
- _____. "SAWS buys farm for aquifer pumping rights." *San Antonio Express-News* 20 May 1998: 3B.
- _____. "SAWS courting pumpers." *San Antonio Express-News*. 22 August 1998: 2B.
- _____. "SAWS buys more water interests." *San Antonio Express-News* 2 September 1998: 8B.
- _____. "7 major customers sign up for SAWS recycled water." *San Antonio Express-News* 18 November 1998: 3B.
- _____. "SAWS buys site to guard aquifer." *San Antonio Express-News*. 15 December 1998.
- _____. "Residents critical of SAWS' plan with Alcoa." *San Antonio Express-News*. 9 March 1999: 2B.

- ____. "SAWS gets briefing on plans for lake: Vote due on wildlife habitat, park, center." San Antonio *Express-News* 4 April 2000: www.mysa.com.
- ____. "Large-use water rate fires debate." San Antonio *Express-News* 7 February 1999: 1A.
- ____. "Crowd badgers trustees over plan to raise water rates." San Antonio *Express-News* 25 February 1999: 1A.
- ____. "Board looks to protect aquifer." San Antonio *Express-News* 10 August 1999: www.mysa.com.
- ____. "Aquifer board rebuffed on halt to gas stations." San Antonio *Express-News* 13 August 1999. www.mysa.com.
- Owens, Murray. Personal interview. 26 March 1999.
- Patterson, Kirk and Carol. Personal interview. 4 September 1999.
- San Antonio Water System. www.saws.org. 12 November 1998.
- ____. *Securing Our Water Future Together*. 12 February 1999.
- ____. www.saws.org/yoursaws/mitchell/Content/Facts/Fact_Frm.htm. 30 March 2000.
- ____. www.saws.org/yoursaws/BACKGROUND.HTM. 24 August 1999.
- Spicer, Emily. "SAWS seeks pipeline contracts." San Antonio *Express-News* 14 October 1998: 1H.
- Texas Mohair Weekly*. 2 May 1958.
- Texas Natural Resource Conservation Commission. Texas Administrative Code: Chapter 213.
- Texas Natural Resource Conservation Commission, Field Operations. "Complying with the Edwards Aquifer Rules: Administrative Guidance." June 1999.
- Texas Water Development Board. *Water for Texas: A Consensus-Based Update to the State Water Plan*. Document No. GP-6-2. Austin: TWDB, 1997.
- ____. *Existing Major Water Supply Reservoir and Recommended Projects*. Map. Austin: TWDB, 1997.

Tobar, Hector. "Divided We Stand: Political, economic gulf separate Alamo City." San Antonio *Express-News* 12 September 1999: 1G.

University of Texas Bulletin. No. 3232. "The Geology of Texas—Mesozoic Systems."

Valdavia, Enrique. Personal interview. March 1999.

Veni, George. Phone interview. 9 September 1999.

Votteler, Todd H. "The Little Fish that Roared: The Endangered Species Act, State Groundwater Law, and Private Property Rights Collide over the Texas Edwards Aquifer." *Environmental Law*. Winter 1998: 845-879.

Weniger, Del. *The Explorer's Texas: The Lands and Waters*. Eakin Press: Austin. 1984.

Worster, Donald. *Rivers of Empire: Water, Aridity, and the Growth of the American West*. New York: Oxford University Press, 1985.

Other Resources Used

Donahue, John M. Personal correspondence a. 5 November 1998.

Edwards Aquifer: A Texas Treasure. Videocassette. San Antonio Museum Association, 1989. 19 minutes.

Edwards Aquifer Authority. "Homepage." <http://www.e-aquifer.com/>. 2 November 1998.

Inside the Edwards Aquifer. Videocassette. Edwards Underground Water District. Zimmerman and Associates, Inc., 1992. 30 minutes.

River of Innocence: The Story of the San Marcos River. Videocassette. Ron Coley. 1983. 55 minutes.

Scitovsky, Tibor. Summary of "The Psychology and Economics of Motivation." Goodwin, Neva R., et al., ed. *The Consumer Society*. Island Press: Washington, D.C. 1995.

USGS. "United States Geological Survey in Texas." <http://txwww.cr.usgs.gov/>. 2 November 1998.