THE WATER SOURCE

A QUARTERLY PUBLICATION OF THE EDWARDS UNDERGROUND WATER DISTRICT

November 1989

Planning for a Drought

-Michael J. Albach, M.S. Natural Resources
EUWD Senior Environmental Analyst

What is a drought?

Where you live and what you do for a living largely determines your definition of a drought.

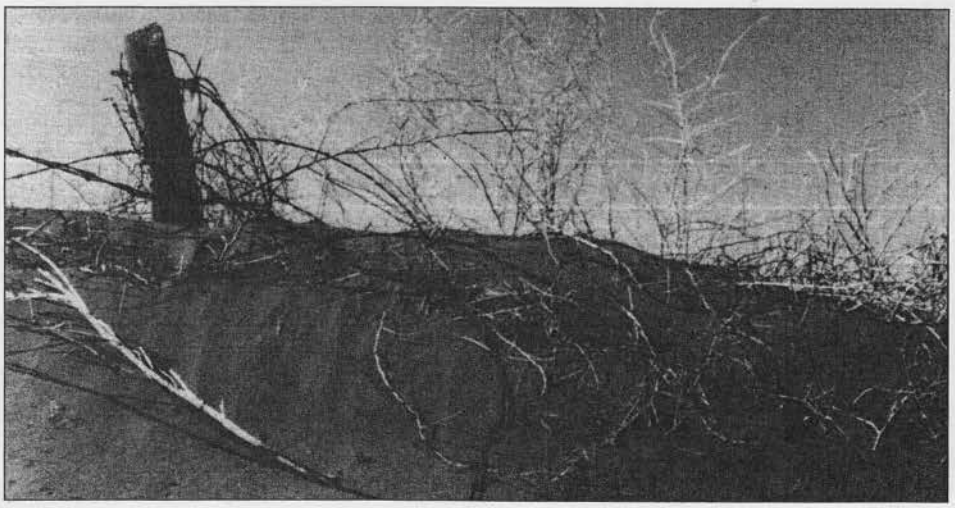
The *dictionary* defines *"drought"* as "a period of dryness especially when prolonged and causing extensive damage to crops or preventing their successful growth". In *Texas Weather* by George W. Bomar (copyright 1983), drought is defined as "a period of abnormally dry weather of sufficient length to cause a serious hydrologic imbalance".

As can be seen in the above definitions, drought is often described *qualitatively* - that is to say, by its effects. Seldom is there a *quantitative* definition of a drought, at least not one based on scientific measurements. One could ask, "How long is the period of dryness that defines a drought?", or "What is the level of water in a reservoir or an aquifer that defines a drought?" More often than not, the definition of a drought depends on an individual's geographic location or economic interest.

For example, the dryland farmer in the Edwards Aquifer region is hard hit economically by a period of insufficient rainfall that lasts only one growing season. On the other hand, the irrigation farmer can endure several years of subnormal rainfall until the water level in the aquifer drops to a level where it is unprofitable to pump the well. Urban dwellers are affected least by the consequences of a short term drought. The increased cost for municipal water suppliers to pump from low aquifer water levels is distributed among thousands of users, the result of which is an imperceptible water bill increase.

There is, however, another qualitative definition of drought in this region - when Comal springs dry up. Unlike San Pedro and San Antonio springs which, at higher land elevations, are dry most of the time, and unlike San Marcos springs which have never gone dry in recorded history, Comal springs in New Braunfels have become symbolic of drought.

Only once in recorded history, during the "super drought" of the 1950's, has Comal springs completely ceased to flow. And only once since then has Comal springflow been seriously threatened - during the "mini-drought" of 1984. Since the 1950's, the population of the Edwards Aquifer region has more than doubled and, likewise, the demand on the aquifer. A consequence of the increasing demand is the acceleration of the hydrologic imbalance. Now, more than ever before, people are a factor in the development of this imbalance.



Drought *continued*

The Plan.

To address the ever increasing demand on the aquifer and the inevitability of another drought, the Edwards Underground Water District has developed a Drought Management Plan (DMP). This plan establishes the framework by which the groundwater of the Edwards Aquifer can be managed during a drought.

The goals of the DMP are:

- to protect human health and safety,
- protect water quality in the Edwards Aquifer,
- share the impacts and hardships caused by a drought,
- minimize disruption of the economy,
- minimize the length of time Comal springs will be dry, and
- prevent San Marcos springs from going dry.

The DMP provides objective standards for determining that drought conditions exist, how long they continue and when a drought has ended. These standards also define increasing stages of drought severity. The hydrologic parameters that define the stages of drought will be monitored by the District. Those parameters are: (1) percent of historic average rainfall; (2) aquifer water levels, and (3) springflow.

The specter of the next "super drought" is ever present in the psyche of South Texas.

A specific combination of the three hydrologic parameters defines a "trigger condition" which, in turn, specifies one of five stages of drought severity. In order of increasing severity, the stages are called Awareness, Watch, Alert, Risk, and Emergency. Correspondingly, there are five sets of demand reduction goals for municipal, industrial, and irrigation water users. Upon declaration of each drought management stage, water users will be expected to reduce the volume of water they use. Reduction goals of 10%, 15%, 25% and 30% have been established for the first four drought management stages. At Stage V, Emergency, the District will determine the specific reduction goals based on measures needed to protect human health and safety and livestock watering.

Municipal water purveyors with more than 35 connections are required to achieve these reductions whereas industrial and irrigation users will be encouraged to meet the reduction goals. The reason for mandatory reductions in the municipal category is that within this category there occurs the greatest amount of discretionary water use, whereas irrigators and industries have fewer opportunities to curtail their water use.

The specter of the next "super drought" is ever present in the psyche of South Texas. With the increasing demand on the Edwards Aquifer caused by a growing population, each successive drought will cause the aquifer water levels to decline more rapidly, remain low for longer periods, and cause greater hardship for aquifer users.

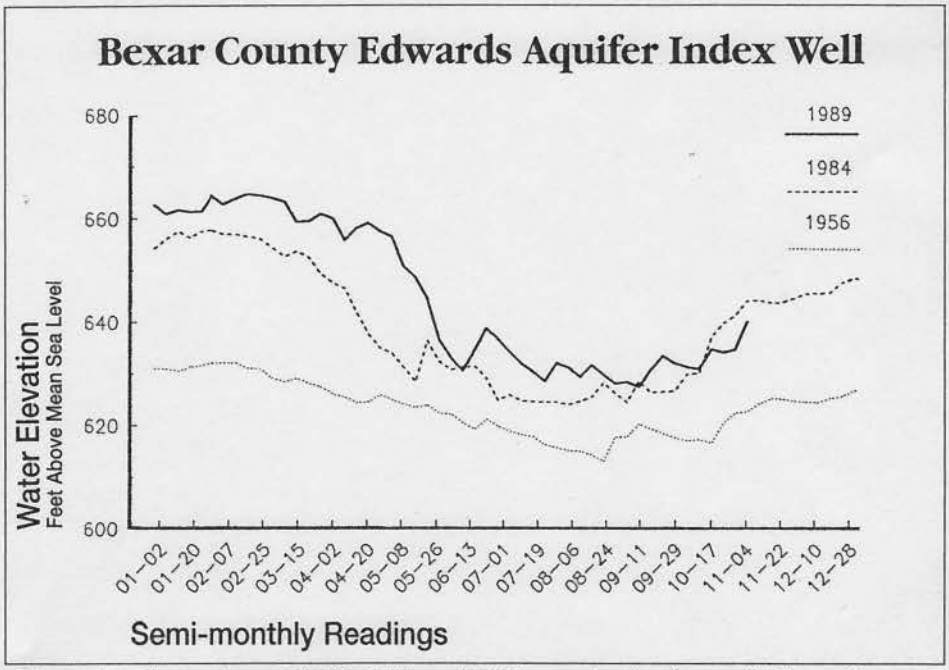


Figure 1:1 Comparison of 1989, 1984, and1956 water levels taken at the Bexar County Edwards Aquifer Index Well

The Edwards Underground Water District, through the Drought Management Plan, is taking positive steps to alleviate the impacts of a drought. It would be nice if we could ignore the potential for a drought but a wise man once said, "The next drought starts after the last rain". When did it rain last? ■

EUWD Seeks Increased Water Quality Protection

-Gayle Kipp, M.S., Environmental Management
EUWD Environmental Analyst

The Edwards Aquifer Recharge and Transition Zones are critical to the Edwards Aquifer in terms of water quality protection. As these areas provide pathways for recharge to enter the aquifer, they also provide avenues for potential contaminants, such as those associated with development activities, to reach the aquifer. Therefore, regulating development activities on these zones is essential to the protection of ground water quality.

The Edwards Rules, as enforced by the Texas Water Commission (TWC), are the means by which the aquifer is at least partially protected from the impact of subdivisions, sewer lines and hydrocarbon storage facilities located on the Recharge and Transition zones. Recently, the TWC held its annual hearing on the Edwards Rules. These hearings provide a vehicle for citizen and agency input regarding the modification of these rules.

Since 1971, the District has been making recommendations to the TWC concerning changes to the Edwards Rules. These recommendations have been consistent with the District's mission to conserve, protect, and recharge the waters of the Edwards Aquifer. The District has repeatedly recommended to the TWC, rules which would increase protection of the Recharge and Transition Zones. Over the years, some of these requests have resulted in stricter regulations; other suggestions are still being offered by the District in the hopes that they will affect the Rules at some time in the future.

At the hearing held on September 28 of this year, EUWD General Manager, Gordon M. Clarke presented the following recommendations on behalf of the District:

- extension of the Transition Zone boundary to include portions of Uvalde County,

- specific methodology for the review of Water Pollution Abatement Plans for regulated developments,

- lift station regulations, and more stringent standards for sewer pipe materials,

- prohibition of municipal landfills on the Recharge Zone,

- prohibition of specific hazardous substances, and of commercial use of some fertilizers and pesticides on the Recharge Zone,

- compliance inspections of underground hydrocarbon storage facilities to augment the stricter regulations already proposed,

- delegation of responsibilities for enforcement of the Edwards Rules to local groundwater districts,

- permitting procedures for hazardous substance transport on the Recharge and Transition Zones, and

- permitting procedures for quarrying operations on the Recharge Zone.

These recommendations were also submitted to the TWC in writing and are now a part of the official hearing record.

Experience has shown that persistent efforts to upgrade the Edwards Rules are necessary for their continued improvement. The District will therefore continue these efforts as a part of its ongoing commitment to safeguarding the water quality of the Edwards Aquifer. ■

News Briefs...

□ "The Edwards Aquifer: A Texas Treasure," a 19 minute video, co-produced by the Witte Museum and the EUWD is now available to the public. Copies may be purchased through the Witte Museum or can be obtained through the District's video tape loan library.

□ The EUWD took an important step this fall in its continuing effort to study and define ground water movement, water quality, and water levels within this region with the installation of two new monitoring wells. The first well, located in Uvalde County, will study the unusual ground water flow patterns in the Knippa area. The second well will be located in northern Bexar County and will study storage trends in the Glen Rose Aquifer.

EUWD Board Chairman, Ken Ikels, presents Lydia Alegria, KSAT-12, with appreciation plaque for the "Kids Can Conserve Too!" poster contest.

□ "Kids Can Conserve Too!" That was the message this summer from the EUWD, KSAT-12, and HEB Food-Drugs. This first annual poster contest targeted children within the District with a water conservation message for six weeks this summer. Youths between the ages of 5 and 18 created colorful posters suggesting ways their families could conserve water. Winning posters were shown nightly on the KSAT-12 6pm newscast. Over 50,000 poster packets were distributed through the 37 HEB stores in Bexar, Comal, and Hays Counties. ■

District Welcomes New Staff

The Edwards Underground Water District is pleased to announce the addition of two staff members.

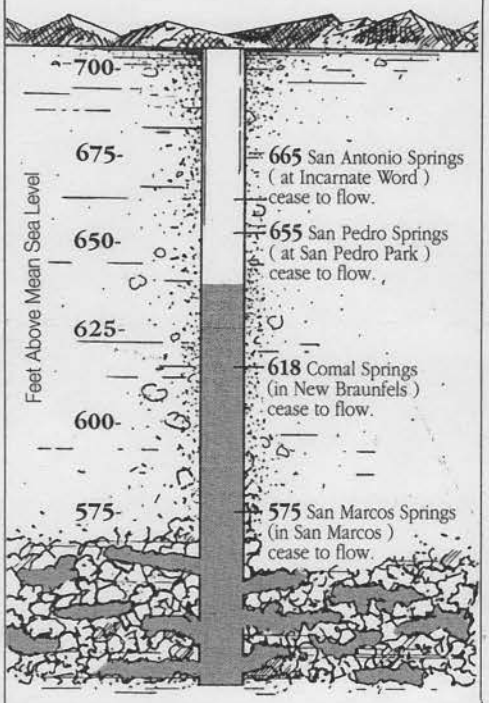
Patricia Rojas joins the District as Personnel Coordinator. Rojas graduated from the University of Texas at San Antonio in December 1987. Prior to joining the District, Rojas was Employment Specialist for nine years, for First Federal Savings and Loan.

Velma M. Reyes has assumed the position of Director of Administration. Reyes holds a Masters degree in Public Affairs from the LBJ School of Public Affairs. Reyes previously held the position of Supervisor of Administrative Services for the City of Austin.

Congratulations are also extended to the following employees who recently celebrated their five year anniversary with the District. Michael J. Albach, Senior Environmental Analyst; John Hoyt, Senior Geologist; and Yolanda Sanchez, Secretary/Receptionist.

The Water Level

This reading reflects the daily high artesian water elevation at the Bexar County Edwards Aquifer Index Well.



Current Status:
On November 8 ,1989 the water elevation was recorded at 640.3 ft AMSL.

THE WATER SOURCE

The Water Source is published quarterly by the Public Information Office of the Edwards Underground Water District, 1615 N. St. Mary's, San Antonio, Texas, 78212. 512/222-2204 or 800/292-1047

Contributors to this issue:
Editor *Kelly G Morris;* Photographer *Gayle K. Kipp;* Feature Articles: *Michael J. Albach* and *Gayle K. Kipp*

EDWARDS UNDERGROUND WATER DISTRICT

1615 N. ST. MARY'S ~ P.O.BOX 15830
SAN ANTONIO TEXAS 78212

ADDRESS CORRECTION REQUESTED

BULK RATE
U.S. POSTAGE
PAID
PERMIT # 771
SAN ANTONIO
TX 78212

THE WATER SOURCE

A QUARTERLY PUBLICATION OF THE EDWARDS UNDERGROUND WATER DISTRICT

March 1990

GROUNDWATER STUDY UNDERWAY IN NEW BRAUNFELS

John R. Hoyt, B.S. Geology
EUWD Senior Geologist

A phenomenon commonly referred to as the "bad-water" line, specifically where freshwater meets salinewater within the Edwards Aquifer, is the focus of a groundwater study currently being conducted by the EUWD in New Braunfels, Texas.

The District has installed four Edwards Aquifer monitoring wells in New Braunfels to characterize and monitor the "bad-water line". The wells are strategically located immediately southwest of Landa Park, on property owned by the City of New Braunfels and the Lower Colorado River Authority, in an area where historical well data suggests the presence of "bad-water".

"Bad-water" in the Aquifer was discovered as early investigators attempted to understand the basic geologic framework of the Balcones Fault Zone Edwards Aquifer system. They noted that the south/southeastern boundary of the system was characterized by a lateral change from fresh to salinewater.

While other physical boundaries of the Aquifer are of a more tangible nature, the "bad-water" line has remained a topic of debate. The debate centers around the position of the "bad-water" line and whether or not significant amounts of salinewater will move into the freshwater zone of the Aquifer and affect water quality.

The New Braunfels study is designed as a continuation of a similar study, conducted in San Antonio in 1985-86, by the U.S. Geological Survey (USGS), the EUWD, the San Antonio City Water Board, and the Texas Water Development Board in which a transect of seven monitoring wells was installed near the Freeman Coliseum, perpendicular to the "bad-water" line in San Antonio. Data from the study has provided the District with valuable insight into the nature of factors controlling the position and potential movement of the "bad-water" line.

During the construction phase of the San Antonio study, two important characteristics of this interface were observed:

- an erratic distribution of fresh and salinewater due to the complexities of a fractured limestone aquifer, and
- the presence of salinewater beneath freshwater areas of the Aquifer.

Currently functioning as long term (50 years) monitoring wells, these wells will observe the position of the "bad-water" line in San Antonio during future periods of Aquifer stress. So far, no positively identified trend of salinewater movement has been observed.

The study currently underway in New Braunfels is a continuation of the effort which began in San Antonio and has two primary objectives. The first objective is to locate and characterize the "bad-water" line in New Braunfels and the second is to provide for long term monitoring of this interface in New Braunfels.

To achieve the first objective of locating and characterizing the interface, one well has been constructed in an area where the Aquifer contains all salinewater; one well has been constructed where the Aquifer contains all freshwater; and two wells have been constructed where the Aquifer contains a mixture of fresh and salinewater.

During construction of the monitoring wells in New Braunfels, rock samples, water quality samples, and aquifer production information were collected from discrete intervals. A series of geophysical well logs were performed on each well and correlated with information collected during well construction.

Now that the drilling and testing phase is over, long term monitoring of the "bad-water" line in New Braunfels will be accomplished by completing the wells into monitoring wells. Upon analysis of data collected during the drilling and testing of each well, intervals most likely to experience changes in water quality will be monitored on a regular basis over the design life of the monitoring well.

The need for long term observation of the "bad-water" line in San Antonio, New Braunfels, and other areas is critical. As fresh-water demands increase and "maximum yield" aquifer management alternatives are considered, the Edwards Underground Water District will continue to strive to provide a more comprehensive understanding of the Edwards Aquifer. ■

RECHARGE:
REPLENISHING THE EDWARDS AQUIFER

Robert W. Bader, B.S. Geology
EUWD Director of Field Operations
Russell Masters, M.S., Environmental Management
EUWD Interim General Manager

When water seeps through the soil, or runs over porous rock, and enters an aquifer, that is *recharge*. The surface area where most of this water enters the ground is called the *recharge zone*. In the Edwards Aquifer Recharge Zone, where the cracks and surface openings are extensive and numerous, the potential for recharge is quite great.

While the amount of water recharged to the Edwards Aquifer varies substantially from year to year, long-term annual average recharge (1934 to 1988) is approximately 635,500 acre feet per year. The lowest recorded recharge was 43,700 acre feet in 1956 and the highest recharge, 2,003,600 acre feet, was recorded in 1987.

Recharge to the Edwards Aquifer can and has been artificially enhanced in past years by the construction of recharge dams. These dams are constructed to hold back floodwaters, over the recharge zone long enough to allow the water to seep down into the Aquifer through the porous Edwards Limestone which is exposed at the land surface.

The recharge dams, built on normally dry streambeds, capture floodwaters that would ordinarily pass by without benefiting the Edwards Aquifer.

In dry years such as 1988-1989, there was no streamflow, and consequently no recharge at any of the District's recharge dam sites. The total long term average recharge, however, from all of these structures, is approximately 5,000 acre feet per year.

In 1974, the Edwards Underground Water District embarked on an ambitious recharge enhancement program, constructing four dams within nine years. The first of the District's recharge structures, constructed at a site on Parker Creek, north of D'Hanis, was originally designated as one of 14 floodwater retarding structures proposed in the 1960's as part of the Seco Creek Watershed Project. Parker Creek dam was completed in 1974 and is the largest of the four structures.

"When water seeps through the soil, or runs over porous rock, and enters an aquifer, that is recharge."

Verde Creek dam, the second of the structures, was completed in 1978, and is located approximately 12 miles north of Hondo. San Geronimo dam, completed in 1979, is approximately 26 miles northwest of San Antonio.

The most unique project is Seco Creek dam and diversion channel. Completed in 1982, Seco Creek Dam is located approximately 20 miles northwest of D'Hanis. The 10 foot wide and 15 foot deep channel extends from the main stream of Seco Creek 685 feet, to a large sinkhole. This

Diversion channel routing water from Seco Creek Dam to large sinkhole capturing excess floodwaters and allowing for rapid recharge to the Edwards Aquifer.

sinkhole is approximately 50 feet in diameter at the ground surface, extending downward 160 feet below land surface into the Edwards limestone. Floodwaters are trapped behind the dam and routed through the channel, into the sinkhole. In 1987 this structure alone recharged about 13,000 acre feet!

For several weeks during May and June of that year, the cave was able to sustain a recharge rate of approximately 235 cubic feet per second (*about 20 acre feet per hour*). The recharge event created a tremendous groundwater mound as water levels in area wells continued to rise for up to four months after the flood.

While the current value of an acre foot of water is assessed at about $45.00, today, the estimated average cost of water artificially recharged by these dams, over a 30 year period, would be less than $15.00 per acre foot.

The District has also participated in the funding of numerous other dams. While these other dams were constructed primarily for flood control by state and local agencies, because of

DISTRICT IMPLEMENTS GIS

Culminating two years of planning, the EUWD has selected a state of the art geographic information system (GIS). A GIS is a computer system designed to allow users to collect, manage, and analyze large volumes of spatially referenced and associated attribute data and is used for solving complex research, planning, and management problems.

Spatial data consist of the various features that are defined by their geographic location and descriptive attributes. These features can have point, line, or areal characteristics that are visually discernible, such as wells, roads, or lakes; or invisible boundaries, such as recharge zone and transition zone boundaries.

With such information, specific to the Edwards Aquifer region, organized and assimilated in one existing database, regional decision makers will be able to develop, analyze and evaluate various aquifer management scenarios.

Some of the planned GIS applications include the analysis of:

- aquifer management scenarios for drought response
- the potential of hydrocarbon and hazardous material contamination
- the cumulative impact of development on ground water quality

The GIS represents a long awaited tool that will enable the District to become the authoritative source of information about the aquifer, making it possible for District staff to provide concise and objective analysis in response to aquifer development, use, and conservation issues. The GIS will further enable the District to fulfill its mandate to conserve, protect, and recharge the Edwards Aquifer. ■

Recharge *continued*

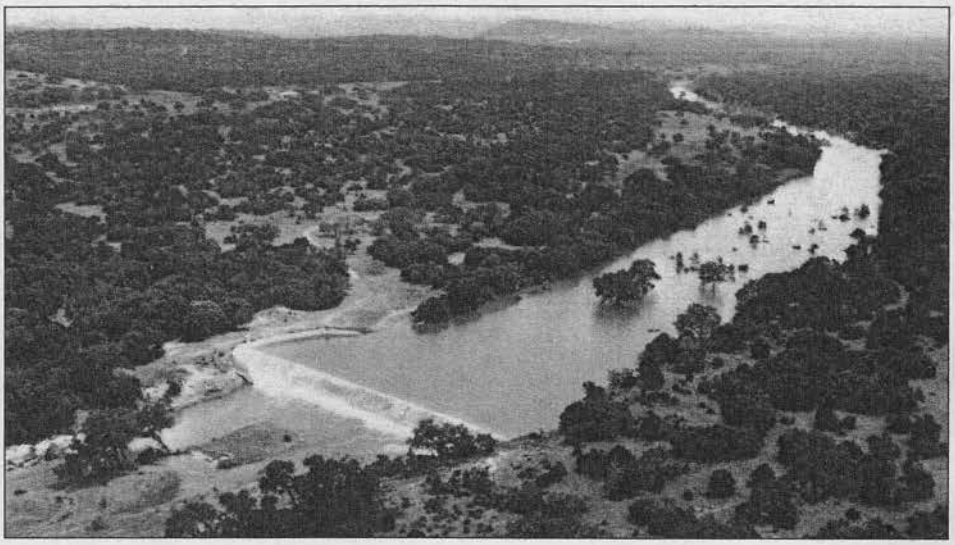
their location, they also serve to enhance natural recharge to the Aquifer. The average recharge resulting from these dams is estimated to be about 13,000 acre feet annually.

"Presently, the District is involved in a two part study that will address any potential for increased recharge across the Edwards Aquifer Recharge Zone."

Presently, the District is involved in a two part study that will address any potential for increased recharge across the Edwards Aquifer Recharge Zone. Part one of the study will be done in cooperation with the Nueces River Authority, the City of Corpus Christi, and the South Texas Water Authority. This study will determine the total water yield in the Nueces Basin and will indicate how much of that yield is still available to be permitted. Part two of the study will determine if any water is available to be permitted in the San Antonio and Guadalupe Basins for recharge purposes.

If this study indicates that there is water available, the District will attempt to obtain permits to divert this water for recharge to the Edwards Aquifer.

This region of South Central Texas is water limited and the Edwards Aquifer is currently the only source of water for over 1.3 million people. The need to maximize other potential sources of water is critical. While recharge is not the ultimate answer to the region's water problems, the Edwards Underground Water District believes that it is an important part of the solution. ■



Verde Creek Recharge Dam following heavy rains in May, 1987.

News Briefs...

☐ The third in a series of leak detection programs, sponsored by the Edwards Underground Water District, was recently completed in San Marcos. Approximately 133 miles of city waterlines were surveyed and some 330 leaks were pinpointed. San Marcos officials estimate that repairs to the system, currently underway, will save the city's system an estimated 8.4 million gallons of water.

☐ In February, a leak detection survey began in New Braunfels. The survey is expected to last for approximately 8 months.

☐ Attention all Xeriscapers! Xeriscape '90, sponsored by the South Central Texas Xeriscape Committee will kick-off Sunday, April 29, 1990. Entry forms can be obtained by calling the Edwards Underground Water District.

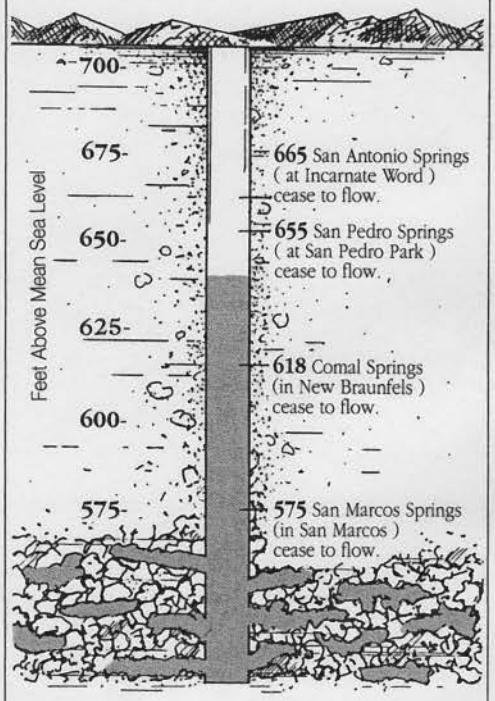
☐ On February 13th, the Edwards Underground Water District Board of Directors approved the Drought Management Plan (DMP) Rules. With the implementation of the state's first regional Drought Management Plan, the District takes a major step toward lessening the impacts that a drought would have on the Edwards Aquifer region.

☐ The District is pleased to make available water conservation kits free of charge. Kits contain one water displacement bag for the toilet, leak detection tablets (also for the toilet), and two shower flow restrictors.

☐ With the hot summer weather approaching fast, the District encourages all of the citizens of the region to conserve water. For more information on how you can conserve water, call the Edwards Underground Water District. ■

The Water Level

This reading reflects the daily high artesian water elevation at the Bexar County Edwards Aquifer Index Well.



Current Status: On March 7, 1990 the water elevation was recorded at 647.4. Average for March is 668.1.

THE WATER SOURCE

The Water Source is published quarterly by the Public Information Office of the Edwards Underground Water District, 1615 N. St. Mary's, San Antonio, Texas, 78212. 512/222-2204 or 800/292-1047

Contributors to this issue:

Editor: *Kelly G. Morris;* Feature Articles: *Russell L. Masters, Robert W. Bader,* and *John R. Hoyt*

EDWARDS UNDERGROUND WATER DISTRICT

1615 N. ST. MARY'S ~ P.O. BOX 15830
SAN ANTONIO TEXAS 78212

BULK RATE
U.S. POSTAGE
PAID
PERMIT # 771
SAN ANTONIO
TX 78212

THE WATER SOURCE

A QUARTERLY PUBLICATION OF THE EDWARDS UNDERGROUND WATER DISTRICT

May 1990

Abandoned Wells: A Serious Hazard

- Randy Williams, B.S. Geology
EUWD Water Resources Technician

What are abandoned wells and why should they concern the people of this region? In Texas, any well which exists in deteriorated condition and has been left unused for more than six continuous months is defined as an abandoned well.

Anyone who relies on the Edwards Aquifer should be concerned about abandoned wells because they are direct paths to our water supply and the widespread distribution of these wells presents a significant threat to water quality. Additionally, property owners and investors should be concerned about the liability for personal injury or environmental damage posed by abandoned wells and should know that they can be held responsible for the cost of plugging, whether or not they were aware of the wells when they assumed ownership.

Abandoned wells are everywhere, in both urban and rural environments. In rural areas, abandoned wells are usually thought of as "old, dry, shallow wells" or "test holes." Surprisingly common in urban areas, abandoned wells are typically found in formerly rural areas which are now urban. The most critical abandoned wells in the urban setting are those located in areas currently undergoing redevelopment. In these areas, the challenge is to "beat the bulldozer". During demolition and excavation, many wells are plowed under by unwitting or unscrupulous owners and, although it is very difficult to locate a well once buried, it can still readily transmit contaminants.

This abandoned irrigation well, located near Braun Station, has been plugged as a result of efforts by the EUWD.

The solution lies in locating and then plugging or capping these wells. Capping a well means to place a temporary cover over a well and is only appropriate for otherwise usuable wells which are being temporarily taken out of service. Abandoned wells, however, according to state law, must be plugged.

Plugging a well requires that it be completely filled with the proper materials from bottom to top and the casing cut off below the ground surface. Typically, an Edwards Aquifer well is plugged by filling the bottom uncased portion (in the Edwards Formation) with gravel, followed by a plug of portland grout to seal the aquifer. Once the grout has cured (24 hours), any water standing on top of the plug is removed and then the well is backfilled with ready mix cement to the surface. The point at which the plug is placed is determined from geophysical logging performed and interpreted by the District as a service to the well owners.

Each time an abandoned well is plugged another point at which the aquifer could be contaminated is removed. In 1989, the EUWD, as part of its mission to conserve, protect and preserve the Edwards Aquifer, sucessfully coordinated the voluntary plugging of 52 abandoned wells, identifying the location of many more. If you have information on an abandoned well, call the District at 222-2204 or 1-800-292-1047. ■

Making a Case for Good Stewardship - Part I

- Michael J. Albach, M.S. Natural Resources EUWD Division Manager of Planning & Environmental Management

It was forming when the "terrible lizards" (a.k.a. dinosaurs) roamed the earth. At that time a shallow sea covered much of what is now Texas. Coral and plankton grew in profusion in the warm water, leaving their exoskeletons to accumulate on the sea floor. When the sea receded, the dinosaurs left their footprints on *its* exposed, muddy surface. *It* slowly hardened into limestone but not before rainwater eroded and dissolved *it*, making *it* porous and permeable. Then the sea returned and receded, again and again, leaving upon *it* layers of sediment. *It* ... is Edwards limestone and through the millenia rainwater has continued to percolate through the porous rock making it one of the most productive aquifers in the southwest.

Over the ages artesian springs proved the dependability of the Edwards Aquifer as a life sustaining source of water. Prehistoric mammals of the Ice Age, now long extinct, ventured south to escape the rigors of a frozen landscape and search for food and water. The fossil remains of prehistoric horses, elephants and wolves found near "Edwards" springs are testament to the aquifer's overflowing bounty. Evidence of prehistoric man abounds near all of the major springs of the Edwards Aquifer. The artifacts of native Americans, some estimated at 12-13,000 years old, are a tribute to the constancy of this water supply. More than 300 years ago, Europeans intent on colonizing the New World established settlements along the banks of springfed rivers. Today, the 9th largest city in the United States, San Antonio, with a population of nearly 1 million, surrounds the once unfailing San Pedro and San Antonio Springs. The same springs that attracted transient herds of prehistoric mammals and provided sustenance to aboriginal man, the very springs that encouraged settlment of this region in the first place, now are dry.

The advent of well drilling in the late 1800s has had a profound effect on the way in which the human population relates to the Edwards Aquifer. Wells have replaced springs as the source of potable and irrigation water. Through trial and error, well drilling has defined the limits of the aquifer. Human population can settle away from the springs and still rely on the bountiful Edwards Aquifer. Springs no longer are needed. Drilled vertical shafts lined with steel pipes, and outfitted with electric or gas driven pumps have become the new symbols of the aquifer's abundance.

During the first half of this century, demand for water from the aquifer was small -- relative to the population. Likewise, our understanding of and concern for the aquifer was minimal. Springs in San Antonio and the region flowed uninterrupted, creating the illusion of an infinitely bountiful water source. The quality of water from the aquifer was taken for granted since very few people understood how or where pollution could occur. The "recharge zone" was just an esoteric concept belonging to a few government geologists and interested academics.

The "super drought" of the 1950's changed that and put water at the top of the list of community and regional issues. Water levels in the Edwards Aquifer plummeted and for the first time in recorded history, Comal Springs in New Braunfels ceased flowing. Many wells dried up completely. Other wells produced more mineralized water as the drought progressed. For the first time, the aquifer appeared vulnerable; a constant, high quality water was no longer assured. A flurry of activity followed in the wake of the drought which ended in 1957. New and deeper wells were drilled throughout the region. Studies were commissioned by federal, state, and local governments to better define the workings of the aquifer. A conservation district for the Edwards Aquifer was legislated into being. All of these steps were taken in direct response to a temporary, albeit significant, natural crisis.

Much has changed over the past thirty-five years -- the population of the region has more than doubled and, likewise, the demand for water. Many studies have been performed that give us a much clearer understanding of how the Edwards Aquifer works. But one thing remains unchanged -- the Edwards Aquifer is still the only source of high quality water for the region, an area of nearly 5,000 square miles and a current population of 1.3 million.

If our sole dependence on the Edwards Aquifer continues long into the future, then it is imperative to take extraordinary care of such a unique natural resource. How are we doing? Not well! In San Antonio, per capita consumption (total water consumed divided by the population) exceeds 200 gallons per person per day -- an amount incongruous with the semi-arid region in which we live. Although still providing high quality water throughout most of the region, the Edwards Aquifer is subjected to an increasing number of pollution assaults from industrial solvents and gasoline to septic tank effluent and urban runoff. Development of the sensitive recharge zone continues unabated. The latest developments proposed for the recharge zone include a massive theme park, a shopping mall, a dry cleaning facility and the ubiquitous gasoline station. Regulations do exist that specifically pertain to activities on the recharge zone, but at best, these regulations can only mitigate pollution, not prevent it.

This region's unique history and rich culture, in large part, can be attributed to the Edwards Aquifer. Yet, we continue to gamble with our only source of water -- either through action or inaction. Each of us has a stake in the health and future of our aquifer and therefore, each of us has an obligation to be a good steward of our aquifer. Together we must commit to changes in our lifestyles -- changes that will preserve the quality of life, sustain our economy and protect the Edwards Aquifer. The next generation and the prosperity of the region depend on it. ■

EUWD and UTSA Launch New Research Study

The effects of blasting on engineered structures and the potential for groundwater contamination within the Edwards Aquifer Recharge Zone will be the focus of a continuing joint research study between the Edwards Underground Water District and the UTSA Center for Ground-Water Research and Technology.

Blasting for the installation of septic systems, foundations and utility lines, as well as for other excavations, is largely unregulated and yet has played a key role in the developmont of this part of South Texas. In areas such as the Edwards Aquifer Recharge Zone, the risk of damage to buried utilities and underground tanks represents a significant threat to the ground water supply. In addition to the risks to engineered structures, there exists a potential for damage to the natural geology including such recharge features as caves and sinkholes.

Presently, insufficient data exists to accurately characterize the transmission of blast vibrations and/or their effects on engineered structures within the Edwards Aquifer Recharge Zone. Results of this study could provide the information necessary for the development of criteria concerning blasting procedures throughout Texas, and more particularly in the Edwards Group and associated geologic formations.

The primary goals of the study are to:

- determine how vibrations from blasting are transmitted through the Edwards Limestone Formations and
- examine how these vibrations affect sewer lines, underground storage tanks and wells at varying distances from the blast.

Research will focus on measuring the variation of magnitude and characteristics of ground motion with distance from the blast site and the development of equations to predict ground response to blast vibrations. Allowable peak ground velocities for pipes, wells, tanks, and other engineered structures will be determined.

Once the data has been analyzed and the numerical models have been refined and calibrated, practical blasting criteria will be developed for the study areas.

Stone Oak, in their efforts to provide community cooperation and participation, has made available land for this study. ■

Masters Appointed General Manager

On, March 13th, at the regular meeting of the EUWD Board of Directors, Russell L. Masters was appointed General Manager.

Masters served as Assistant General Manager for the District since 1981, holding the post of Interim General Manager twice during that time. He holds a B.S. degree in Biology from Texas Lutheran College and an M.S. degree in Environmental Management from UTSA Before joining the District, Masters served for six years as Chief of the Water Quality Planning Division for the San Antonio River Authority.

As General Manager, such issues as regional management, recharge enhancement, water quality, and the development of an Edwards Aquifer Research Consortium rank high on Masters' list of priorities.

Heading the list of priorities is regional management. "This is a multi-faceted problem which affects many diverse groups, and only those groups working together can come up with a workable solution", Masters says. "I want to get these groups back together in an atmosphere of friendliness, where every group is properly represented."

Also serving on various local and regional committees, Masters was recently appointed as the Vice

Chairman of the Groundwater Panel of the Texas Water Conservation Association. Masters is also a member of the Board of Directors of Lutheran General Hospital and Junior Achievement of South Texas. ■

News Briefs...

☐ Jerome Salas, Lanier High School, has won lst place in the District's first annual Bookcover Design Contest. The theme of the contest was "The Edwards Aquifer: A Texas Treasure". Other winners included Javier Hernandez, Juan Galvan, Javier Garcia, Americo Salazar, and Juan Caldera, all students of Lanier High School; and Grace Morales a student of Providence High School. Special thanks to Lanier High School Art Instructor, Rudy Trevino. Bookcovers bearing the winning design will be provided free of charge by the EUWD to high school and middle school students throughout Bexar, Comal and Hays counties. "Conserve the Edwards Aquifer - It's $H_2$0kay" will remain the theme for elementary school bookcovers.

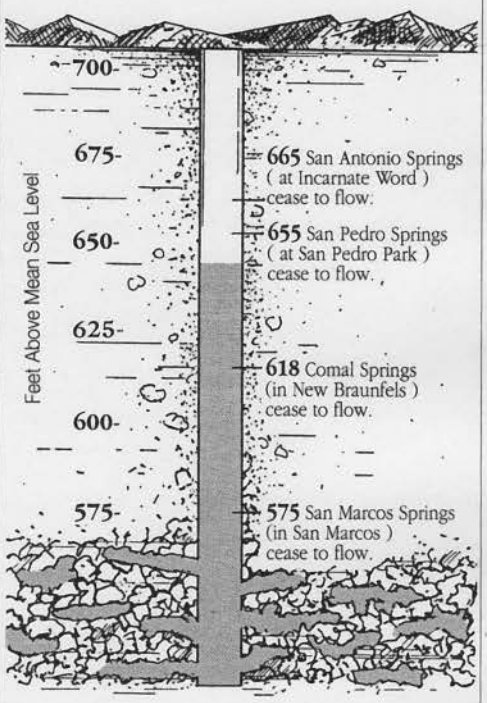
☐ Outdoor commercial and charity car washes have been banned in San Marcos as a water conservation measure by the San Marcos City Council, which has been vigorous in promoting water conservation. The ordinance took effect on May 3rd and carries fines up to $200 per day for violations. A running hose can waste as much as 1,800 gallons of water an hour! The ordinance cites lower than normal water levels, a 20-inch rainfall deficit over the past two years, and concern about drought conditions in the Edwards Aquifer region.

☐ The San Marcos phase of a ground water study designed to further the scientific understanding of the Edwards Aquifer bad water line gets underway in early June. Part I of the study, drilling, testing, and the construction of long-term monitoring wells, is expected to last three months.

☐ Did you know that by installing a toilet tank water displacement bag and shower flow restrictors, an average of 15,000 gallons of water can be conserved annually per household? Call EUWD for your free water conservation kit and start saving water today. ■

The Water Level

This reading reflects the daily high artesian water elevation at the Bexar County Edwards Aquifer Index Well.



Current Status: On May 18, 1990 the water elevation was recorded at 650.8. Average for the month of May is 665.5.

THE WATER SOURCE

The Water Source is published quarterly by the Public Information Office of the Edwards Underground Water District, 1615 N. St. Mary's, San Antonio, Texas, 78212. 512/222-2204 or 800/292-1047

Contributors to this issue:

Editor: *Kelly G. Morris;* Feature Articles: *Randy Williams* and *Michael J. Albach.*

EDWARDS UNDERGROUND WATER DISTRICT

1615 N. ST. MARY'S ~ P.O.BOX 15830
SAN ANTONIO TEXAS 78212

THE WATER SOURCE

A QUARTERLY PUBLICATION OF THE EDWARDS UNDERGROUND WATER DISTRICT

October 1990

Comal Ecosystem Studies Underway

Gayle Kipp, M.S. Environmental Management
EUWD Environmental Analyst

A long range study of the Comal aquatic ecosystem, consisting of the Comal Springs, Comal River, and Landa Lake, is currently underway. Funded in part by the EUWD, the project is being conducted by biologists with the Aquatic Station at Southwest Texas State University at San Marcos.

The Comal aquatic ecosystem is widely known for its biological diversity and uniqueness. It provides an environment for two species listed by the U.S. Fish and Wildlife Service as threatened with or in danger of extinction: the San Marcos salamander and the fountain darter, respectively. Both also occur in the San Marcos aquatic ecosystem but in no other known location.

The San Marcos salamander *(Eurycea nana)* is a member of the lungless salamander family. Unlike most salamanders, the adult does not leave the water to metamorphose into a terrestrial form, but maintains its external gills throughout its life, which it spends almost exclusively in the spring openings. Its diet consists primarily of small crustaceans, insect larvae, and aquatic snails. The fountain darter *(Etheostoma fonticola)* is a small species of darter which is found along vegetated stream-floor habitats and feeds primarily on crustaceans and insect larvae. Other organisms which exist within the Comal aquatic ecosystem have not yet been studied or even identified but may be equally rare.

The Comal aquatic ecosystem presently faces several threats. Declining levels or cessation of springflow, associated with increased pumpage of the aquifer and reduced recharge rates, may drastically affect the habitat and species within it. (Subsequent to the cessation of springflow at Comal Springs in 1956, the previously abundant fountain darter population was apparently eradicated; the present population was reestablished after biologists restocked the Comal River with darters collected from the San Marcos River.) In addition, the Comal aquatic habitat is vulnerable to pollution, flood intensity changes, and habitat alteration associated with urbanization and recreation. The proliferation of the ram's-horn snail, a large, aquatic snail, poses yet another serious threat. Recently introduced (presumably by aquaria enthusiasts) into the Comal River, the snail appears to be responsible for significant reductions in the aquatic vegetation which provides the fountain darter with cover from predators.

In natural systems, populations of organisms survive by adapting, through genetic changes in offspring, to environmental changes over time. Some populations, however, fail to adapt to the rapid changes often associated with human activities, and are eventually eradicated from the habitats in which the changes took place.

The first step in the prevention of this finality at Comal is the collection of information relative to individual organisms and the ecosystem in which they dwell. The Comal aquatic ecosystem investigation is designed to do this. Specific projects include: a survey of the distribution of aquatic plants to determine fountain darter habitat; a species inventory and life history analysis of food items of the darter, the salamander, and their competitors and predators; and field and laboratory experiments to determine the biological impact of the ram's-horn snail.

The study, if successful, will generate new and valuable information about specific habitat requirements and the interrelationships of the inhabitants of the Comal aquatic ecosystem. This information will be vital to development of any future management strategies designed to protect this unique ecosystem. ■

Augmentation: Springs Or Streams?

Michael J. Albach, M.S. Natural Resources
EUWD Division Manager of Planning & Environmental Management

Augmentation, within the context of Edwards Aquifer groundwater management, denotes the substitution of natural artesian flow from Comal and San Marcos springs with flow from pumped wells or surface water storage reservoirs. The theory is that as the water level (potentiometric head) of the Edwards Aquifer declines and springflow is diminished, pumped well water or surface water flows can be directed and discharged at or near the spring openings to supplement or replace natural flows.

Augmentation has been proposed as a means of maintaining in-stream flow requirements (recreation, bay inflows, aquatic biota) and downstream diversion rights (municipal, industrial and irrigation water demands) in the Guadalupe River and its springfed tributaries, the Comal and San Marcos rivers. Opponents to costly alternative water supplies have suggested that springflow augmentation would make available the vast amount of water stored in the aquifer below the elevation of the spring openings. According to the supporters of this concept, augmentation would obviate the need for additional surface water supplies or wastewater reclamation and reuse projects, at least in the near term.

In order to assess the utility of this concept, several basic questions must be answered. For example, who sets, and what is, the minimum acceptable spring/stream discharge rate? If just one-half of the long term average flow rate of Comal and San Marcos springs is considered acceptable, that would amount to four and a half times the annual well discharge in Comal and Hays counties combined (165,053 acre-feet per year). If, however, the acceptable flow rate is the least amount necessary to sustain the rare endemic plants and animals inhabiting the springs, then another very basic and infinitely more complex question must be answered: can man-made "springs" support the sensitive and intricate ecosystem that sustains the endangered plants and animals living in or near Comal and San Marcos springs? Another important consideration is whether the U.S. Fish and Wildlife Service, the federal agency responsible for listing and protecting endangered animal and plant species, will accept springflow augmentation as a means of preserving the species and their habitat.

In the forthcoming months, the Edwards Underground Water District will initiate a study designed to address these complex and controversial questions. The study promises to attract more than a little interest. ■

22,705 Find Homes

22,705 water conservation kits that is. The Edwards Underground Water District has placed 22,705 free water conservation kits with homeowners and tenants in the five counties that use the Edwards Aquifer. Taking credit for finding the new homes is the District's 1990 water conservation campaign--"Learn to be Water Tight."

One of the District's goals for this campaign was to distribute at least 25,000 water conservation kits. "I feel confident we will reach and even surpass our goal since we have distributed so many in such a short period of time", said Russell Masters, the District's General Manager.

On September 8th, the District sponsored "Water Tight Weekend." Various retailers and malls throughout San Antonio and surrounding counties served as distribution points where people could pick up a free water conservation kit. Participating in the region-wide effort were Westlakes® Mercado Mall; all four Builders Square locations; McCoy's in San Marcos and New Braunfels and all five locations in San Antonio; all seven Wolfe's Nurseries; Grimm's Nursery; Henne Hardware in New Braunfels; and Lowe's in San Marcos. Each of these locations will continue to distribute the free water conservation kits as long as supplies last. Kits can also be obtained by calling 64-TIGHT.

The District kicked off the campaign at the end of July and it will run through the end of October. The fully bilingual campaign consists of an english and spanish slogan and visual identities, two television commercials, two radio commercials, three outdoor boards, six print ads and new water conservation brochures— all aimed at getting homeowners to order and use the water conservation kits

By ordering a water conservation kit, people make a conscious decision to start conserving water. The kits are free, easy to use, and have a tremendous potential to save water. (Each kit, when installed, can save up to 20,000 gallons of water per year).

The Edwards Underground Water District, under the leadership of the Board of Directors, continues its mission to conserve, preserve and protect the Edwards Aquifer for present and future generations. ■

Drought Response: From Process To Project

Philip Farrington, M.S. Community & Regional Planning
EUWD Water Resources Planner I

As Edwards Aquifer elevations cascaded at a rate of nearly one foot per day from mid-May through June, many wondered why the Edwards Underground Water District did not implement its Drought Management Plan.

As record precipitation in July dripped with irony and area communities scrambled to comply with the District's Emergency Action Plan, many wondered why an alternate plan was implemented.

The answers to these musings lie in the differences between process and project, between proactive planning and reactive response.

The Drought Management Plan (DMP) and the Emergency Action Plan (EAP) must each be viewed independently to understand the history behind the plans and their respective impacts.

The DMP was born of a 1987 legislative amendment to the EUWD's enabling act which authorized the District to develop, implement, and enforce a plan managing water in the Edwards and associated limestone formations within the District during drought periods.

Approved by the EUWD Board of Directors in late 1989, the DMP is a long-term plan; it develops an infrastructure for drought contingency planning by defining parameters for the existence and severity of a drought, and by correlating effective responses to the drought stage declared. Implementation of the plan is contingent upon several "trigger" conditions: rainfall as a percentage of historic precipitation, aquifer elevations, springflow, and water quality.

If water levels were the only criteria, then Stage I of the DMP could have been declared as early as June 3, but spring rains precluded a drought declaration. In fact, combined rainfall for San Antonio and Uvalde for the twelve months ending in May, measured 97.5% of historic precipitation. There is no consensus on what constitutes a drought, but with average rainfall, the District could not implement the drought plan despite rapidly declining aquifer elevations.

The decline of water levels correlated to diminished discharge from Comal Springs, imperiling the habitat of several endangered aquatic species. This development prompted threats of lawsuits against all aquifer users under the auspices of the Endangered Species Act. U.S. Fish & Wildlife officials notified stakeholders region-wide that emergency actions must be taken to preserve springflow and avert federal intervention.

These stakeholders, representatives of local government and special interests, met several times at the behest of Commissioner John Birdwell of the Texas Water Commission to respond to the impending crisis. Unable to reach an agreement on a long-term solution to the twin problems of increased pumpage and diminished springflow, the officials endorsed an emergency plan, drafted by the TWC, as a short-term means of addressing the intervention issue and protecting Comal springflow.

Basically an extraction of the aquifer elevation trigger conditions and demand reduction measures from the EUWD drought plan, the Commission Plan modified some measures, contained only four stages rather than the five stages in the DMP, and was designed to cover the entire aquifer region - even the counties not under EUWD jurisdiction.

On July 11, 1990, the EUWD Board of Directors adopted Resolution and Order No.07-90-121 which implemented the Commission Plan under the name "Emergency Action Plan" (EAP). The EAP took effect upon adoption and will expire on December 31, 1990.

The plan requires all domestic, industrial, and agricultural aquifer users and all suppliers and water purveyors under the District's purview to conform with the EAP and its associated conservation measures. These measures, like those in the DMP, codify efficient water use (e.g., prohibiting lawn sprinkling during the hottest hours of the day). But whereas the DMP demand reduction measures and rules were developed after the District conducted public hearings, some aquifer users believe certain use restrictions contained in the emergency plan are sufficiently different from those in the DMP to be inequitable and that they were developed by the TWC without sufficient public input.

Since the objective is to reduce consumption during an emergency period, the District attempted to mitigate some of these inequities. The EAP allowed municipalities within the District to either adopt the EAP or develop their own emergency plans, as long as they were substantially equivalent to the EAP.

The true efficacy of the emergency plan and its restrictions may never be known since record July rainfall in the region raised aquifer elevations by more than 20 feet.

Although the EAP confused and confounded aquifer users struggling to fathom the Drought Management Plan, its imposition underscores the fact that it is more often increased demand, and not drought, which creates regional water emergencies.

The District is currently reviewing the DMP for possible revisions to certain demand reduction measures, rainfall trigger conditions, and to the Rules for Drought Management. Modifications aside, the DMP will continue to be an integral part of the District's drought response and planning process. Droughts are, after all, random episodes but predictable in their eventuality. ■

News Briefs...

☐ In the summer of 1989, the UTSA and the EUWD launched a two-year study to research the effects of blasting on buried pipes, tanks and wells. Three of six tasks aimed at acquiring background information, equipment, and field data have been completed. Remaining tasks include continued field data collection, data analysis, and presentation of the results. Resulting from the study will be blasting criteria applicable to the Edwards Aquifer region.

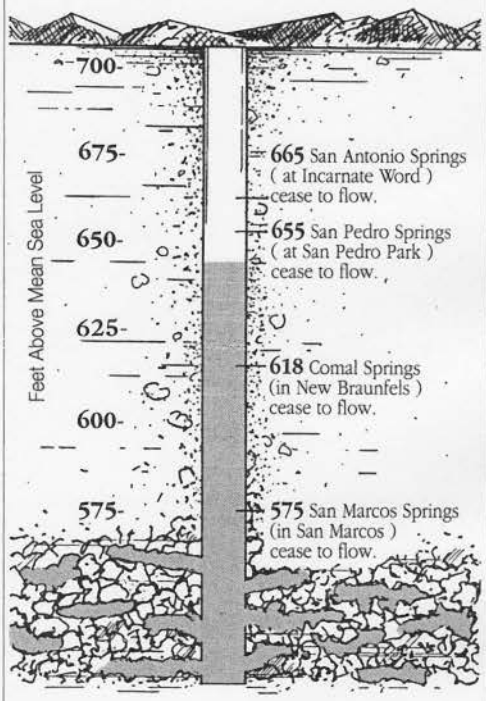
☐ In February of this year, the Edwards Underground Water District and New Braunfels Utilities (NBU), began an extensive leak survey of the NBU water distribution system. By mid-summer, approximately 70 miles of NBU'S 415 mile distribution system had been surveyed, discovering 244 leaks and repairing 78 leaks. Total estimated water savings from repairing just those leaks is estimated at 37 million gallons per month. The survey will continue through the end of 1990.

☐ The drilling, testing and monitor well construction phase of the District's "bad-water" line monitoring project was completed in mid-August. The project included the installation of three wells near Comal Springs in New Braunfels and two wells near San Marcos Springs in San Marcos. Water quality samples, rock cutting samples, geophysical logs and hydrologic data collected during the first phase of the project will be tabulated, analyzed and put into report format over the next several months. The objective of the project is to characterize and monitor the interface between saline water and fresh water in the Edwards Aquifer.

☐ Resulting from this year's water conservation campaign, the District has entered into an agreement with the San Antonio Apartment Association (SAAA) to provide association members with free water conservation kits. The SAAA represents an estimated 87,000 units throughout San Antonio. ■

The Water Level

This reading reflects the daily high artesian water elevation at the Bexar County Edwards Aquifer Index Well.



Current Status: On September 25, 1990 the water elevation was recorded at 646.9. Average for September is 658.4.

THE WATER SOURCE

The Water Source is published quarterly by the Public Information Office of the Edwards Underground Water District, 1615 N. St. Mary's, San Antonio, Texas, 78212. 512/222-2204 or 800/292-1047

Contributors to this issue:

Editor: *Kelly G. Morris;* Feature Articles: *Gayle Kipp, Michael J. Albach,* and *Philip Farrington*

EDWARDS UNDERGROUND WATER DISTRICT

1615 N. ST. MARY'S ~ P.O.BOX 15830
SAN ANTONIO TEXAS 78212

THE WATER SOURCE

A QUARTERLY PUBLICATION OF THE EDWARDS UNDERGROUND WATER DISTRICT

February 1991

District Hosts Plumbing Efficiency Seminar

Philip Farrington, M.S. Community & Regional Planning
EUWD Water Resources Planner I.

On October 30, nearly 100 South Texas officials converged in San Antonio to hear a panel of nationally regarded experts describe state-of-the-art plumbing technologies that can substantially reduce indoor water consumption.

The "End-Use Water Efficiency Seminar," a half-day forum hosted by the Edwards Underground Water District, focused on the performance of Ultra Low-Flow (ULF) toilet, showerhead, and faucet fixtures and the potential benefits from legislation mandating their installation.

Targeting policymakers, seminar attendees included area mayors, city council members, managers, planners, and public works directors, as well as representatives from chambers of commerce and the building and plumbing industries.

State Senator Cyndi Taylor Krier, co-chair of the Special Committee on the Edwards Aquifer, gave the keynote address. In her opening remarks she said, "If technological advances allow these appliances to perform their tasks with a smaller volume of water, then it becomes practical for us to encourage such efficiency."

From Georgia to Washington, and from Boston to Austin, that same kind of encouragement has prompted plumbing code revisions and ordinances requiring the installation of ULF plumbing fixtures, usually in new construction.

Currently eight states and more than two dozen cities, counties, and regional entities have adopted ULF legislation. Also, the proposed "National Plumbing Products Efficiency Act", introduced in Congress each of the last two terms, would establish uniform national standards for plumbing fixtures, require new appliances to display water use labels, and mandate ULF fixture installation in all new construction.

"Now is the time to act," urged the seminar's first speaker, Amy Vickers. A water resources consultant and the principal author of both the national bill and similar legislation for Massachusetts, Vickers is familiar with technical and political issues surrounding water efficiency improvements. "Public opinion increasingly supports environmental legislation, particularly in the water area," she said.

"The public," she said, "wants quality, not quantity of water use in their plumbing fixtures," noting that most people are oblivious to the volume of water their appliances consume.

The potential benefits of water efficiency are evident when ULFs are compared to standard plumbing fixtures. Regionally, indoor water usage hovers at 100 gallons per person per day and some two-thirds of that usage occurs in the bathroom. Most toilets sold since 1980 consume 3.5 gallons per flush (gpf), but many older 5 to 7 gallon models are still in use. Design improvements within the last decade, however, spawned highly efficient water closets which use only 1.6 gallons per flush, some even less. Likewise, conventional showerheads and faucets typically have flow rates of 5-8 gallons per minute (gpm) and 5 gpm, respectively, but competitively priced ULF fixtures are available which use only 2.5 gpm.

By installing a ULF toilet rather than one consuming 3.5 gpf, the average three-person household can save more than 8,000 gallons of water annually. If that same household had a 5 gallon toilet tank, retrofitting with a 1.6 gpf model would save approximately 20,000 gallons per year. Municipal water consumers using ULF fixtures also can save as much as $50 annually on their water and sewer bills, and another $20 from using less hot water in the shower.

In addition to consumers, cities can also benefit from ULF installations in a number of ways. Reduction in the volume of flows through water and sewage treatment facilities can improve facility efficiency since capacity limits are not stretched, allowing peak demands to be more easily met.

Seminar *(continued)*

Reducing water demand lessens the need for oversized distribution piping to new developments. This, in turn, helps avert or delay expensive capital facility expansions, reduces additions to bonded indebtedness for taxing jurisdictions, and eases the burden placed upon taxpayers. As suppliers realize reduced energy costs for pumping and distributing water, these cost savings can be passed onto utility consumers.

Demand-side management energy programs can serve as a model for analagous improvements in managing water demands. Sen. Krier told attendees, "The political, economic, and environmental crises of the 1970's prompted efficiency improvements, some legislatively mandated, in a range of energy-intensive applications. The payoffs have been substantial. Since 1979, energy efficiency has produced seven times as much energy as from all net increases in energy supply. Taking similar steps in improving the efficiency of water-intensive applications can likewise have a profound and positive impact."

Environmental benefits to the Edwards Aquifer region will be one such impact as reduced municipal pumpage prolongs natural springflows and helps preserve the high quality of aquifer water.

The economic benefits of ULF technologies will ripple throughout the state as the market for water-efficient plumbing fixtures expands. Of the 2.5 million ULF toilets that were projected to be sold nationally in 1990, one-third will be manufactured in Texas.

There are now 20 manufacturers of ULF toilets nationally, and while they represent just under 25% of all toilet sales nationally, the production of 1.6 gallon toilets has boomed within the last five years. ULF toilet production tripled from 1987 to 1988, according to a Plumbing Manufacturers Institute survey. Production of the 1.6 gallon models increased tenfold from 1988 to 1989.

Although these efficient appliances have proven their mettle in a host of settings (single and multi-family residential, hotels and schools, new and existing development), there remain those who are wary of changes to established plumbing codes. But a survey of seminar attendees revealed that while one-third of the respondents had a less than positive opinion about ULF fixtures prior to the seminar, 100% of those surveyed left the seminar with a positive attitude toward the technologies discussed.

Most of this wariness is due to unfounded rumors of poor ULF performance. Numerous independent scientific tests and case studies in cities across the country attest that the performance of ULF fixtures is at least on par with that of fixtures using more than twice the volume of water.

Regarding ULF toilets, for example, Wendy Corpening, a water efficiency expert and seminar speaker, said, "In many cases these new toilets work better because they are designed with a higher velocity flush and are not dependent on a large amount of water in the bowl to achieve the proper evacuation of waste."

One concern expressed by attendees involved the ability of ULF toilets to adequately transport waste. Corpening dispelled such fears, saying there exists no credible evidence that ULF toilets have problems with drainline carry. "In fact," she said, " in a study done in Phoenix, Arizona the homeowners reported that the low consumption toilets actually clogged less than the 3.5 gallon types."

"There are more than 8 million low consumption toilets installed throughout the world in a variety of situations and there is no evidence that they have caused any more problems than conventional fixture types," said Corpening.

This sentiment was echoed by another speaker, Larry Farwell, water conservation coordinator for the Goleta Water District in California. Severe drought, limitations to surface water additions, and diminishing groundwater supplies prompted Goleta to be the first community, in 1983, to adopt an ordinance requiring ULF fixtures in new construction. The Goleta Water District later established aggressive water conservation programs fostering the retrofit of older fixtures through distribution of free showerheads and rebates for ULF toilet installations.

"We are unaware of any problems with either the lateral or main sewer lines during the six years of ULF use in the Goleta area," said Farwell. This observation came after the retrofit of nearly 30% of all toilets in the Goleta Water District's service area, in addition to those commodes installed in new development.

While ULF fixtures may cost slightly more than their highly consumptive peers, their cost has dropped as code revisions and ordinances requiring more water-efficient appliances has expanded the market for ULF products. Corpening stated that retail prices for ULF toilets are currently as low as $80 per unit. A 1990 *Consumer Reports* study of ULF showerheads showed that "price was no guide to the quality of the showerheads. Six of the highest-rated fixed-position heads cost $10 or less."

Support for legislation mandating efficiency improvements in water consumptive appliances is mounting. This concept has been endorsed by groups as diverse as the American Water Works Association and the Consumer Federation of America, the National Rural Water Association and the California Municipal Utilities Association, the National Wildlife Federation and the Texas Water Development Board.

The EUWD presented the "End-Use Water Efficiency Seminar" to both inform and motive regional policy makers. The manifold benefits of water efficient fixtures are available for both governments and the governed, and the District hopes to capitalize on the energy created by bringing together decision makers and an idea whose time has come. ■

EUWD Building Expansion Project Underway

Velma R. Danielson, Master of Public Affairs
EUWD Division Manager of Administration

Construction is presently underway on the Edwards Underground Water District's office expansion project--a project designed to add approximately 8,000 square feet of office, meeting, and storage space to the current six-year old building, and to renovate the existing 4,200 square foot office facility.

In 1984, the EUWD permanently relocated its offices from rented space in the Tower Life Building to the current location at 1615 N. St. Mary's Street, San Antonio, Texas. At that time, the District employed seven staff members and was primarily involved in water quality monitoring, recharge enhancement, and limited water conservation programs.

In 1991, the situation is markedly different. Ongoing technical programs include an abandoned well closing program, data collection activities, water quality investigations, leak detection surveys, recharge enhancement projects and implementation of the state's first region-wide Drought Management Plan. Additionally, the District conducts public information and education programs throughout the region aimed at fostering a water conservation ethic.

As the scope and degree of the District's programs have increased, so too has its personnel, and consequently, its office needs. The District currently employs a professional staff of twenty-seven permanent full-time employees and three temporary part-time personnel.

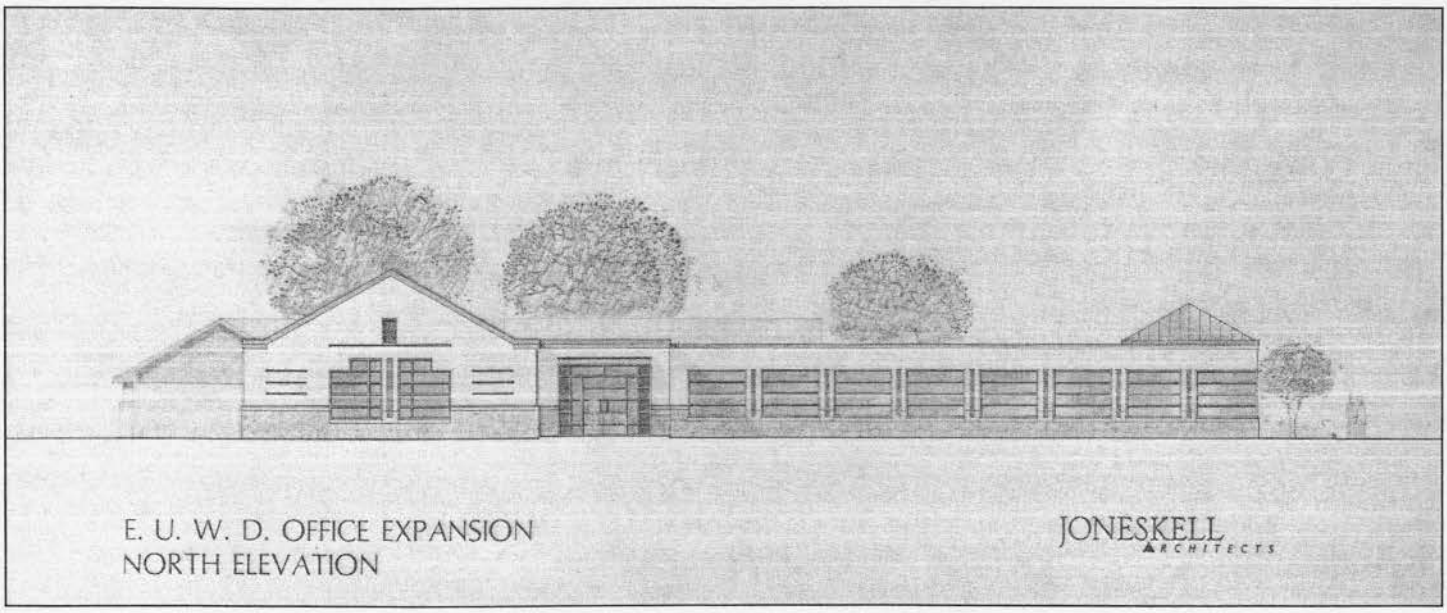
The actual construction of the project will be conducted in two phases. Phase I will consist of construction of the 8,000 square foot addition to the building, while Phase II will consist of the renovation portion of the project. District staff anticipate construction activities for both phases to be completed in September 1991.

Plans for the building expansion project began to take shape in January 1990 when the District contracted with San Antonio based Jones and Kell Architects, Inc. for design of the project. With the space planning and design phase completed, the District is now under contract with Stoddard Construction Company for general construction contractor services.

The Board of Directors' Building Committee has worked with District staff throughout the project. Members of the Building Committee are: Mr. Jack Ohlrich (Comal County), Committee Chair; Mrs. Lynda Billa Burke (Bexar County); Mr. Robert C. Hasslocher (Bexar County); Ms. Jerri W. Martin (Hays County); and Mr. Jesse Zuniga (Bexar County).

Once completed, the District's expanded office building will provide staff with adequate space to meet present and future office needs, additional file and storage space, an employee break room, an expanded reference materials library, a larger Board/multi-purpose room, and increased parking.

Also included in the plans is the use of ultra-low flow water fixtures and xeriscape planting materials throughout the project. The total projected cost of the project is approximately $726,000.00. ■



Phase I and Phase II of the expansion project are expected to be completed in September 1991.

News Briefs...

☐ The District recently participated in a study to determine the potential for increasing artificial recharge in the Nueces River Basin. According to the study, conducted by HDR Engineering, Inc., recharge to the Edwards Aquifer in the Nueces River Basin could be increased by an average of 62,600 acre feet of water per year, without affecting downstream water rights. This can be accomplished by constructing certain recharge structures. Phase II to determine the costs of the recharge structures is expected to be underway by spring '91.

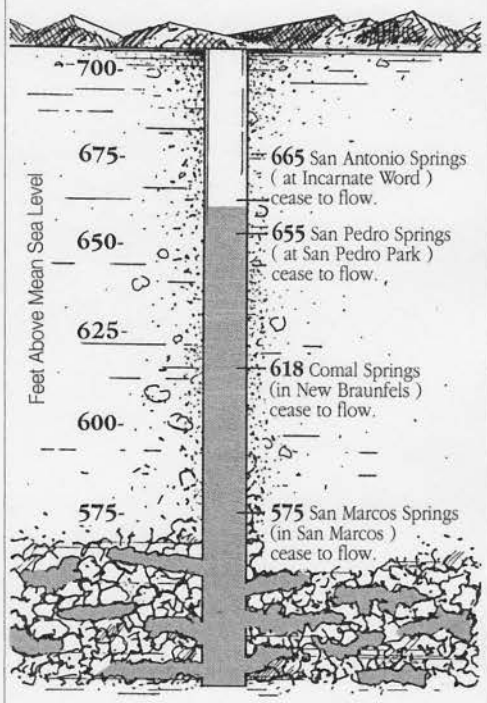
☐ The District is presently conducting a study which may provide information regarding the effects that emissions resulting from burning hazardous wastes may have on surrounding soils--and potentially the Edwards Aquifer. The study is prompted by concerns over the proposed, New Braunfels-based, LaFarge-Systech plant. District environmental staff coordinated with the Texas Air Control Board to collect and analyze soil samples near Midlothian, Texas, a city south of Dallas, where similar hazardous waste burning cement kilns have been in operation for a number of years. Results of the soil samples are expected within approximately one month.

☐ In 1989, the District launched an intensive abandoned well closing program. Since that time, field staff have identified approximately 150 abandoned or flowing wells and effected the closing of 80 of these wells. These efforts can result in a tremendous water savings and an immeasurable level of water quality protection. If you know of any abandoned or flowing well, call the District at 222-2204 or 1(800) 292-1047.

☐ As a follow-up to the October seminar, a Plumbing Efficiency Task Force is presently being formed. Comprised largely of representatives of municipalities and the plumbing industry, the Task Force will create model ordinances that would effect water efficiency improvements in plumbing fixture standards. ■

The Water Level

This reading reflects the daily high artesian water elevation at the Bexar County Edwards Aquifer Index Well.



Current Status: On February 6, 1991 the water elevation was recorded at 660.7. Average for February is 668.0.

THE WATER SOURCE

The Water Source is published quarterly by the Public Information Office of the Edwards Underground Water District, 1615 N. St. Mary's, San Antonio, Texas, 78212. 512/222-2204 or 800/292-1047

Contributors to this issue:

Editor: *Kelly G. Morris;* Feature Articles: *Philip Farrington* and *Velma R. Danielson*

EDWARDS UNDERGROUND WATER DISTRICT

1615 N. ST. MARY'S ~ P.O.BOX 15830
SAN ANTONIO TEXAS 78212

THE WATER SOURCE

A QUARTERLY PUBLICATION OF THE EDWARDS UNDERGROUND WATER DISTRICT

May 1991

Converting To Xeriscape

Calvin R. Finch, M.S., Agriculture
County Extension Agent-Horticulture

Xeriscape is a concept of creative landscaping that combines beauty, water conservation and low maintenance. We present seven principles as the basis of Xeriscape: good planning, soil preparation, appropriate turf areas, adapted plant material, extensive mulching, efficient watering and effective maintenance.

The principles of Xeriscape are relatively easy to implement if you have a new landscape. They appear more difficult to achieve when you have a traditional landscape in place and want to convert it. Prepare a three year dream plan as if your yard were a new landscape. Then adjust the dream plan to reflect limitations of budget and ability to do the work.

Xeriscape plants do well in native soils, but adding organic material to areas where old plants are taken up and new planting will be placed improves performance. The addition of organic material improves water holding capabilities and water penetration.

Turf areas are very attractive but they require intensive maintenance and large quantities of water. It is recommended that turf be limited to family activity areas and as a view enhancer. A key component of the conversion effort involves replacing turf with ground covers, hardscape, and shrubs. Address this imposing task through the use of non-selective contact herbicide, such as glyphosate, and then planting directly into the dead turf.

Once almost all turf, this yard has been converted to Xeriscape (photo courtesy of Terry Lewis, Landscape Architect).

Nearly every plant that survives the South Texas summer and winter qualifies as a Xeriscape plant if it is used appropriately. Plant lists are available from the Edwards Underground Water District and the Texas Agricultural Extension Service. Consider the readily available and colorful selections of hollies, crepe myrtle, lantana, firebush, iris and daylilies. Arrange plants of like water requirements together and shape your turf and ornamental plantings to allow efficient watering.

The easiest part of converting a traditional landscape to Xeriscape is to begin to use mulch. Adding three to four inches of pine bark, compost, leaves, shredded pruning or other materials over the drip line reduces water needs of individual shrubs and trees by as much as 50%. In addition to conserving water, the activity of mulch lowers soil temperatures, stimulates beneficial microorganisms, reduces iron chlorosis, and improves soil structure. In San Antonio, free mulch is available from the City by calling the Solid Waste Department.

Even more effective than mulches in achieving direct water savings is to improve watering tactics. Learn how to recognize water need and how much water to apply to develop a deep root system. Many more plants die from overwatering than from drought stress. Simple temporary drip irrigation systems can be constructed for the one to two year period required to establish Xeriscape plantings. Most irrigation companies can now help you convert your existing sprinkler system to a more efficient system at a reasonable cost.

Effective planning, mulches and the other Xeriscape principles reduce landscape maintenance requirements considerably. Some weeding and pruning is still required, however. Appropriately pruned plants use less water than rangy, oversized specimens and weeds always waste water.

A Xeriscape Conversion Bulletin is available from the Texas Agricultural Extension Office at 228-0417. ■

Edwards Aquifer Preservation Program
–Preserving Our Future

Michael Albach, M.S. Natural Resources
EUWD Division Manager of Planning & Environmental Management

That land is a community is the basic concept of ecology, but that land is to be loved and respected is an extension of ethics.
— Aldo Leopold

Land, like air and water, is indispensable to life and, thus, has social value. Land is a natural process. Some land areas exhibit natural processes that are of direct benefit to man and, thus, have social value. The recognition of these social values, inherent in natural processes, must precede prescription for the utilization of these land areas. No land area better exemplifies nature as process, nature as a value to man, than the recharge zone of the Edwards Aquifer.

A creek in northern Bexar county which recharges the aquifer.

From the earliest times the natural environment has influenced the location and form of human settlement. The land and its features present opportunities and constraints for various human activities. It is important to understand the natural characteristics of the land, the processes that shape it, its resource potential, and the consequences of its use.

Urbanization is a characteristic of our time. It has brought with it a host of new or aggravated problems that often make new or greater demands on our natural resources and physical environment. The issue of how to best accommodate development and growth while conserving our natural resource base, insuring public health and safety, and minimizing degradation of our natural environment, is difficult and complex. The land itself is a resource that must be used, or conserved, wisely. The needs of our growing population require that we conscientiously plan for the use of land to protect its resource value by giving explicit consideration to natural processes in land-use decisions.

It is a long established fact that human occupation modifies the natural processes, and that the value of these processes often determines the degree of intolerance. Some lands possess an intrinsic suitability for certain land uses. Multiple uses may be tolerated if the intrinsic values are not compromised. But some lands are intrinsically suitable for conservation, and nothing else. It is with due consideration of these precepts that the Edwards Underground Water District introduces the Edwards Aquifer Preservation Program (EAPP).

The goal of the EAPP is to preserve and protect those sensitive geologic features and geographic areas within the Edwards Aquifer Recharge Zone for the enhancement of recharge to and the preservation of water quality in the Edwards Aquifer. These features include caves, sinkholes, fault and fracture zones, streambeds and watersheds.

Specific objectives of the EAPP are:

- to identify and inventory physical features and geographic areas which provide substantial amounts of recharge.
- to identify and inventory physical features and geographic areas which are vulnerable to the deleterious effects of development on water quality.
- to apply one or more methods of land acquisition and protection to identified properties.
- to properly manage or effect the management of properties identified and selected so as to preserve the integrity of water quality and the volume of water recharged on said properties.
- to cooperate with property owners, citizens, other governments, and interested organizations in meeting the goals of this program.
- to implement this program for the benefit of all users of the Edwards Aquifer.

Similar to a land trust, the intent of the EAPP is to acquire hydrologically sensitive land areas and to maintain these land areas in an undisturbed, natural condition. Proposed methods of

Preservation Program *(continued)*

acquisition include "fee-simple," either through purchasing or accepting donations of available properties, and the use of conservation easements. Once acquired, these properties would be maintained in perpetuity for the benefit of the aquifer and all of its users.

The first step in implementing the EAPP is the identification and ranking of sensitive land areas. Much of the groundwork for identifying sensitive land areas has been accomplished through various geologic studies. Several methods of ranking available properties will be employed that take into account sensitivity, vulnerability, and availability. Use of a ranking system will help to ensure maximum benefit from lands acquired and optimal use of District funds. The criteria used in ranking properties reinforces the program goals and provides a rational process for prioritizing sensitive land areas. Further, the use of specific criteria in assessing properties enhances opportunities for landowners to realize tax advantages in donating properties for this important program.

Once land is acquired or set aside through conservation easements, perpetual management becomes the most crucial element of the program. Since the stated goal of the program is to maintain or enhance the quantity and preserve the quality of water recharging the Edwards Aquifer, few, if any uses for these sensitive land areas are compatible with this goal. Management then implies regular inspection and upkeep of the properties. Measures to limit or discourage access and to hinder undesirable uses will be developed and employed in a site-specific manner. To carry out this responsibility, the District hopes to work with various conservation organizations and volunteer groups.

The land area comprising the recharge zone of the Edwards Aquifer is at risk of being voraciously consumed, especially in the counties of Bexar, Comal, and Hays. The value of this land as a natural process is equally at risk. The Edwards Aquifer Preservation Program aims to reserve these natural process lands thereby capturing their value for the benefit of all. ■

Water Efficient Plumbing Catching On

California has it. Arizona does too. Even Maryland has it. These states each have at least seven communities that have adopted water efficient plumbing legislation. Until February of this year, only one city in Texas (Austin) had adopted an ordinance requiring water efficient plumbing fixtures in new construction. On February 12, the San Antonio suburb of Castle Hills took the lead and passed the region's first ordinance requiring that new construction and remodeling have water efficient plumbing fixtures installed.

Castle Hills City Manager, David Seyfarth, feels this is an idea whose time has come. "We're getting lots of calls. There is a lot of interest in this, especially from other cities." He continued, "And I've received no complaints from residents. Hopefully other suburbs and larger municipalities will follow."

Seyfarth had heard of the benefits of water efficient plumbing, but after he attended a seminar in October sponsored by the Edwards Underground Water District (see February issue of "The Water Source"), he was sold. The District followed up the seminar by forming a task force which met in March. Planners, plumbing industry representatives and city officials (New Braunfels, Converse, San Marcos, Universal City, San Antonio and Hollywood Park) all attended. The task force drafted a model ordinance from which cities can craft their own legislation. Michael Albach, Division Manager of Planning and Environmental Management, states that the Edwards Underground Water District is, "convinced that efficiency standards should be adopted in every community in the region."

Universal City adopted an ordinance in April which was modeled from the task force's draft. The cities of San Marcos and San Antonio are expected to follow. In addition, three bills setting efficiency standards for plumbing fixtures are pending in the state legislature.

Tony Rivas, Director of Public Works for Universal City, learned of water efficient plumbing at the District's seminar. He then volunteered to be a part of the task force. Rivas used the model as a guideline when presenting the ordinance to his city manager, Gene Thorpe. Universal City is the second most populous city in the San Antonio metropolitan area. Rivas feels that by adopting the ordinance, Universal City will help conserve water and protect the aquifer. "The populace is aware of the need to conserve water as a way of life, and they accept that." After researching and weighing the benefits, William Johnson, Director of Maintenance for Air Force Villages, has installed water efficient fixtures in their new retirement center. "For the savings in water we will receive, it was worth the extra costs."

The Edwards Aquifer region is semi-arid. Low volume fixtures will prolong our limited water supplies through the efficient use of water. Albach summarized the District's position. "The Edwards Underground Water District supports water use efficiency in plumbing fixtures and in all aspects of water use. Good sense tells us that we must use existing water supplies wisely and in the most efficient manner possible." ■

News Briefs...

☐ The Edwards Underground Water District has just completed a comprehensive leak detection survey in the city of New Braunfels. This is the fourth survey that the District has finished, and the most successful to date.

With the cooperation of New Braunfels Utilities, the District was able to locate over 400 leaks, resulting in a savings of over 1.6 million gallons of water per day. Repairing the leaks helps protect the aquifer, and may also postpone the need for water system upgrades and help prevent potentially dangerous road conditions.

The next leak detection survey will be conducted at Randolph Air Force Base. The District initiated this region-wide program in 1989.

☐ A recent computer analysis of the Nueces River Basin reveals that additional surface water is available for increasing artificial recharge to the Edwards Aquifer. The study was conducted by HDR Engineering for the Texas Water Development Board, the Nueces River Authority, the City of Corpus Christi, the South Texas Water Authority and the EUWD.

A computer model provided the first comprehensive analysis of stream flows and water rights in the Nueces Basin. Emphasis was placed on determining the historical natural recharge to the Edwards Aquifer and the amount of streamflow available for artificial recharge.

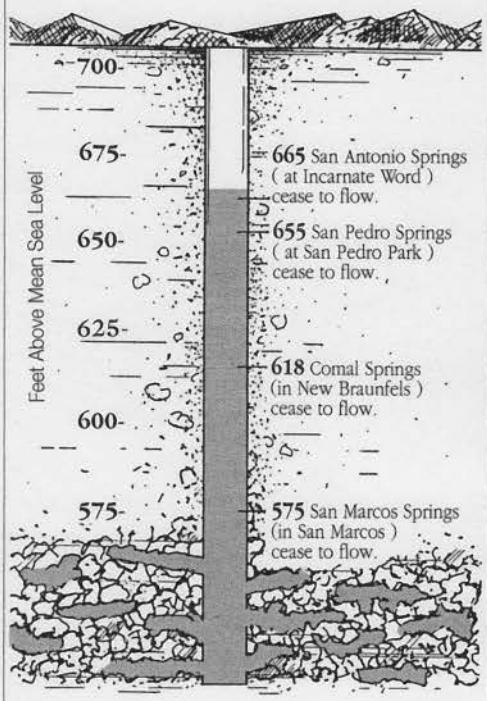
Structures built on the recharge zone, and designed to capture and quickly transmit water into the Edwards Aquifer through natural or artificial openings, could recharge up to 62,500 acre feet per year with affecting downstream water rights. The second phase of the study currently underway will analyze structural, financial, environmental, and political implications of potential recharge structures on the Nueces Basin.

Gregory Rothe, PE
Consulting Project Manager

☐ You can help us prevent waste by passing this *Water Source* on to a friend, recycling it when you are through, and by letting us know if you would rather not receive it. Please take a moment to complete the enclosed card so we can update our mailing list. ■

The Water Level

This reading reflects the daily high artesian water elevation at the Bexar County Edwards Aquifer Index Well.



Current Status: On May 13, 1991 the water elevation was recorded at 667.8. Average for May is 665.3.

THE WATER SOURCE

The Water Source is published quarterly by the Public Information Office of the Edwards Underground Water District, 1615 N. St. Mary's, San Antonio, Texas, 78212. 512/222-2204 or 800/292-1047
Contributors to this issue:
Editor: *Carolyn Eagle;* Feature Articles: *Michael J. Albach and Guest Columnist, Calvin Finch, Texas Agricultural Extension Service*

EDWARDS UNDERGROUND WATER DISTRICT

1615 N. ST. MARY'S ~ P.O.BOX 15830
SAN ANTONIO TEXAS 78212

ADDRESS CORRECTION REQUESTED

BULK RATE
U.S. POSTAGE
PAID
PERMIT # 771
SAN ANTONIO
TX 78212

THE WATER SOURCE

A QUARTERLY PUBLICATION OF THE EDWARDS UNDERGROUND WATER DISTRICT

August 1991

Is There A Tiger In Our Tank?

Underground Storage Tanks Threaten the Aquifer with Contamination

Melissa M. Lopez,
EUWD Environmental Protection Technician

In the 1970's a popular ad campaign for gasoline promised the power of a tiger in every automobile tank. The tiger of the '90's isn't in your car engine. It's buried underground. And the bad news is, the beast may be getting loose.

Underground storage tanks containing hydrocarbon fuels pose the greatest single threat of hydrocarbon contamination to the Edwards Aquifer. Not only because of their subsurface location, but primarily due to sheer abundance. The Texas Water Commission lists 176 known locations, containing an average of two to three tanks, on the Edwards recharge and transition zones of the San Antonio area alone.

At the beginning of 1991, the EUWD implemented a monitoring program of all aboveground and underground hydrocarbon storage facilities on the recharge and transition zones of the Edwards Aquifer. The project was established to compile location and technical information concerning the equipment, storage capacities, and types of fuels contained at these facilities. This information is currently being collected and integrated into the District's Geographic Information System (GIS) database. By coordinating this data with water well and significant recharge feature information, the District will be better equipped to predict how the aquifer might be impacted by a hydrocarbon or hazardous waste leak or spill. This information can also be applied to detect contamination sources, providing support for effective remediation.

By far, the service station industry constitutes the single largest utilizer of underground storage tanks (UST's) containing hydrocarbon fuels. Although conveniently out of the way, the drawback to UST's is that you cannot see if there is a problem with leakage.

Most of the tanks in the San Antonio area were installed in the late 1970's and mid 1980's. Tanks manufactured during this time were typically constructed of steel, single walled, and coated with paint or epoxy to prevent corrosion. If a tank is overfilled or excess fuel is emptied from a delivery hose around the tank opening, the gasoline will flow around the outside of the tank wall and collect at the bottom of the tank. Over time, the protective coating dissolves, exposing the tank wall to corrosive soils.

As grim as this may sound, the tank is not usually the culprit in underground system leaks. Most contamination is not due to catastrophic tank failure, but can be attributed to slowly leaking pipes. Structurally weaker, because of joints and thinner construction materials, 80% of all leakage can be attributed to piping failures.

In an effort to protect the Edwards Aquifer, the Texas Water Commission (TWC) imposed further regulations, in addition to the existing state rules, for hydrocarbon storage facilities located on the Edwards recharge and transition zones. These supplemental restrictions, known as the Edwards Rules, apply not only to hydrocarbon storage facilities, but also address development over the recharge zone.

(continued)

The drawback to underground storage tanks is that you cannot see if there is a problem with leakage.

Slowing the Flow

Program Focuses on Artesian Wells

Randy Williams, B.S. Geology
EUWD Geologist

Conserving the flow and eliminating the waste of fresh Edwards Aquifer water is as important as developing additional sources. Leak detection surveys of municipal supply systems, passage of uniform ordinances requiring the use of water efficient plumbing fixtures, recharge projects, and public education programs which promote water conservation are all a part of the District's comprehensive water management strategy.

An effort which aims to protect both the quantity and quality of water in the aquifer is the District's well closing program. Responding to its legislated mandate to protect and preserve the Edwards Aquifer, the District launched an intensive well closing program in 1989. To date, the District has effected the voluntary closing of 96 open or flowing wells throughout the region.

Because of their abundance in formerly undeveloped areas, the first phase of the program concentrated on identifying and closing non-flowing wells. During the development boom of the early to mid-eighties, which occurred predominantly on the recharge zone, numerous abandoned wells were discovered. The District focused on locating and plugging them to protect the aquifer from the immediate threat of contamination.

But times have changed. Since development has slowed considerably, the abandoned well closing program is now concentrating on artesian wells to protect the aquifer through conservation.

The Edwards region is noted for the prevalence of flowing artesian wells. When the water level of the aquifer is greater than the land surface elevation of an individual wellhead, pressure will cause the well to flow naturally. The resulting artesian flow is a valuable resource if the well is in use. However, if the well is abandoned or is flowing uncontrollably, it can represent a terrible waste.

The most recent example of a voluntary well closing occurred in June of this year. An open artesian well, flowing at a rate of 550 gallons a minute, was identified by the District near the Union stockyards. The owner, Southern Pacific Transportation Company, was unaware of the well's existence. After being contacted, the company voluntarily closed the well.

In all cases, the District aims to obtain voluntary closing of these wells but retains its statutory authority to initiate action to plug them. In Texas, any well which exists in deteriorated condition and has been left unused for more than six continuous months is defined as an abandoned well. If you have information on any abandoned well, flowing or dry, call the Edwards Underground Water District at 222-2204 or 1-800-292-1047. ■

Tiger *(continued)*

Hydrocarbon storage facilities on the recharge and transition zones are reviewed on an individual basis by the TWC. Based on a geological assessment, the TWC stipulates very specific equipment and construction requirements for each site. Standard equipment for these facilities includes double-walled tanks and piping, electronic monitoring of the entire system, tank overfill prevention devices, and catchment basins for containment of delivery spills.

In addition to compiling the location and technical data, the District has been able to provide the TWC with valuable information concerning violations of the Edwards Rules and other regulations. Currently, TWC investigators have the responsibility of patrolling an immense area, while most of their time is consumed responding to reported abuses. By notifying both the responsible party and the TWC of violations, the District has encouraged many of the owners to come into compliance without having to call upon the TWC for enforcement action. When an owner refuses to comply, the violation is brought to the TWC's attention.

Although the majority of UST's in the metropolitan area are operated by corporate service station chains, they are not usually found to be in violation of state regulations. Large corporations are fully versed in their legal obligations, and are only too familiar with the prohibitive costs of remediation.

The most prevalent source of violations has been found in the small business sector. Most small business owners are not only unfamiliar with the state leak detection requirements for UST's, but are unaware of the less expensive monitoring alternatives available to them which satisfy the regulatory requirements. By providing regulatory information to these individuals, the District has been able to assist them in complying with state laws.

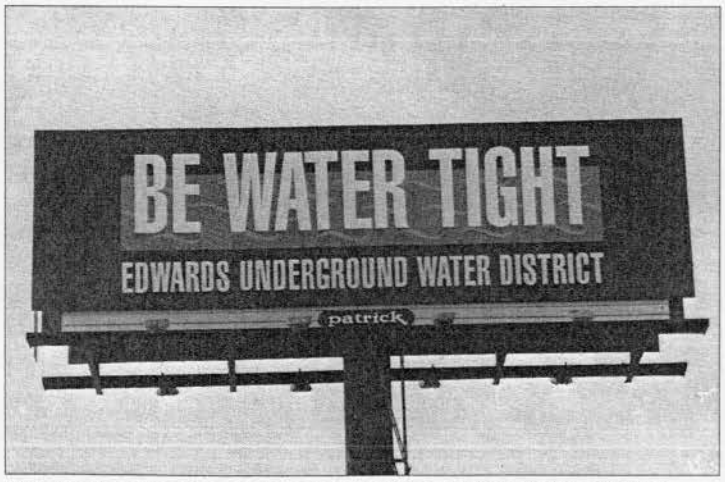
Through this program, the District will also develop another valuable information resource. Sources of hydrocarbon contamination are difficult to pinpoint in a vast aquifer. Having access to location and technical information on hydrocarbon storage sites increases the District's effectiveness in detecting sources of contamination and its impact on the Edwards Aquifer. By providing information to UST owners, the District has been able to assist them in making their systems safer, thereby protecting themselves from devastating remediation costs and ultimately helping to safeguard our precious and irreplaceable aquifer for future generations. ■

Nothing Grows Without Water

"Till taught by pain,
Men really know not
What good water's worth."
—Byron

Did you know that only six-tenths of a percent of the earth's water supply is groundwater? San Antonio is the largest city in the nation relying solely on groundwater. In the last 50 years, our metro area population has increased five times, and water use has more than tripled. Cities in five other counties also depend on this same source of water. We will always depend on fresh water for survival, and so we must preserve, conserve and protect the Edwards Aquifer.

The Edwards Underground Water District views water conservation as an additional source of water. It is estimated that common-sense conservation efforts can result in as much as a 10-15% reduction in water use region-wide.



Billboards promoting water conservation will be visible in Bexar, Comal, Hays, Medina and Uvalde counties through September.

Hot weather and declining water levels make a powerful combination to focus the public's attention on this issue each summer. Targeting homeowners, adult consumers and children, the goal of the District's seasonally-intensive water conservation campaign is to convince people to conserve as a way of life, not as a response to weather. The theme for a second year is "Be Water Tight."

Components of the campaign can be seen dotting the highways and byways of Bexar, Comal, Hays, Medina, and Uvalde counties. They include billboards, bus benches, and street banners.

H.E.B. and KSAT-TV have joined the EUWD for a third year in sponsoring "Kids Can Conserve Too!", a region-wide coloring contest. Children are asked to express through a drawing why water is important to them. Another co-promotion with Diamond Shamrock and KMOL-TV was aimed at adults. The month-long program, entitled "Water Facts," complimented KMOL's commitment of giving viewers "straight facts, straight to you." Each week night viewers were educated on the aquifer, its history, and the importance of conservation.

If you're a Saturday shopper, you may have seen displays of material during the District's second annual "Water Tight Weekend." Conservation information was distributed at eight locations throughout the region.

Additional components of the campaign, which continues through September, all focus on delivering a consistent message through the media, promoting Xeriscape, and pursuing exposure for the slogan at every opportunity. Will it make a difference?

In 1990, a benchmark survey on attitudes toward water conservation was conducted for the District by the University of Texas at San Antonio and Anderson Advertising. According to the survey, nearly 100% of the respondents considered conservation somewhat or very important. When asked if people should conserve voluntarily, an overwhelming number of respondents (97.1%) said "yes" as compared to two percent who disagreed. Respondents were asked when people should conserve. A large majority (82.9%) reported a need for people to conserve year-round, with 15.1% of them suggesting conservation during the summer or periods of high use. More importantly, we found there was a belief that individuals can make a difference (94%)!

The Edwards Underground Water District believes that a well informed public who understands the importance of water conservation will be better prepared for, and more responsive to, meeting the challenges which face the region. Reinforcement of that message will remind them that conserving water is a necessary way of life in South Texas.

BE WATER TIGHT: CONSERVE!

If you would like more information on the campaign, or conservation tips, contact the District at 222-2204 or 1-800-292-1047. ■

The Edwards Underground Water District was presented the 1991 Project Planning Award for its Edwards Aquifer Preservation Program *(see May 1991 Water Source)*. The award is given by the San Antonio chapter of the American Planning Association.

Look for "The Edwards Aquifer: A Texas Treasure" at H.E.B. Video Central stores in San Antonio. Two copies of the twenty minute video will be available at each of H.E.B.'s 13 locations.

News Briefs...

Buying Texas Time

A milestone for Texas in the area of water conservation occurred during the final hours of the 72nd legislative session. Senate Bill 587, establishing water efficient plumbing standards, was passed by the legislature and signed by Governor Ann Richards. Representative Ron Lewis' (D-Mauriceville) and Senator Carlos Truan's (D-Corpus Christi) bill sets new plumbing standards that prohibit the sale of certain inefficient plumbing fixtures after January 1, 1992.

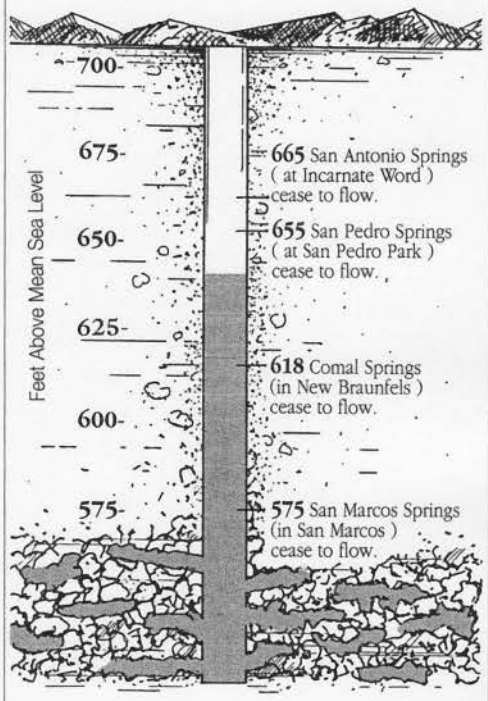
This new law will eventually save more water than is currently being used by Dallas, Houston, San Antonio, Austin and El Paso combined. Senator Truan feels that the law will buy Texas time. "If you follow the national news, you know that California is experiencing a horrible drought. Their water problems are partly due to nature, and partly of their own making. California, for years, over-developed its water resources without imposing reasonable constraints of water use. This has created the situation the state is in today."

Senator Truan continued, "Texas is in a position where we can take a hard look at what our water resources really are, and what constraints we may have in the future as a result of a drought and other changing conditions. We can plan today through such measures as water conservation. SB 587 is one step towards recognizing we live in a land with limited water, which will be adequate for our needs if we use it wisely."

When the program is in full swing, an annual savings of between 20 and 40% of water used indoors will be realized, resulting in statewide savings of almost a billion gallons a day. Estimated monetary savings to Texas utility customers is expected to be almost $25 billion over the next 50 years. ■

The Water Level

This reading reflects the daily high artesian water elevation at the Bexar County Edwards Aquifer Index Well.



Current Status: On July 30, 1991 the water elevation was recorded at 641.1. Average for July is 660.4.

THE WATER SOURCE

The Water Source is published quarterly by the Public Information Office of the Edwards Underground Water District, 1615 N. St. Mary's, San Antonio, Texas, 78212. 512/222-2204 or 800/292-1047

Contributors to this issue:

Editor: *Carolyn Eagle;* Feature Articles: *Melissa M. Lopez* and *Randy Williams*

EDWARDS UNDERGROUND WATER DISTRICT

1615 N. ST. MARY'S ~ P.O.BOX 15830
SAN ANTONIO TEXAS 78212

Forward and Address Correction

THE WATER SOURCE

A QUARTERLY PUBLICATION OF THE EDWARDS UNDERGROUND WATER DISTRICT

October, 1991

A Fistful of Dynamite

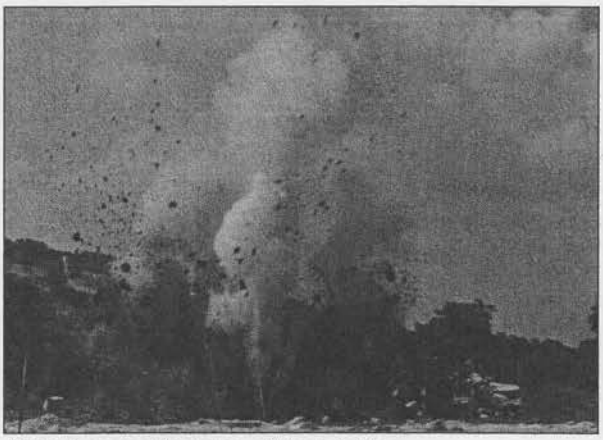
Diane Poteet, B.S. Geology
EUWD Geologist

In the movies, the hero always yells, "Duck!" when he sets off explosives. But a fistful of dynamite can disturb more than rocks above ground. It can also affect things below the ground.

In south central Texas, the limestone rocks which comprise the Edwards Aquifer, and crop out on the surface in the recharge zone, are used in construction materials for roads, buildings and houses. As further testament to their strength, these rocks are the primary ingredient in cement made at local plants. With this in mind, it is easy to understand why explosives must be used when building on or in these rocks. But blasting causes vibrations which can cause structural damage to underground storage tanks, sewer systems and pipelines. The Edwards Underground Water District is concerned with the potential to contaminate our underground water supply when blasting takes place near any of these engineered structures.

Damage potential is particularly acute on the Edwards Aquifer recharge zone and the adjacent drainage area because little or no soil cover exists. Blasting is unregulated in the counties over the Edwards Aquifer, so there is no control over the size and placement of charges.

The Edwards Underground Water District, in conjunction with the University of Texas at San Antonio's Center for Groundwater Research and Technology, recently completed a two year investigation which examined the blasting effects on engineered structures. The study was designed to develop criteria which could be used in implementing regulations. Professor Geoff Blaney, an engineer and research scientist with the Center, was the principal researcher for the study.



Explosives go off at one of the test sites.

Five sites with different types of engineered structures were used in the study. At Mud Creek in Stone Oak, data was collected without blasting to test the seismic equipment and rock characteristics. Then it was collected during blasting for the construction of Highway 211 in rural Bexar county. Next, data was collected at a City of San Antonio monitoring well near where highway construction for FM 1604 was taking place. The final stage of data collection occurred at two San Antonio River Authority dam sites. The base for a dam was being blasted near an existing sewer line at one location. At the other blasting site, two underground storage tanks and a sewer line were installed especially for the study.

All the engineered structures were subjected to blast loadings of varying duration and intensity. The vibrations were analyzed using state-of-the-art seismic and computer equipment. Both the structures and the surrounding ground area were equipped with velocity sensors called geophones. The data was retrieved on a PC-based system which enabled it to be reviewed on site, assuring accurate data collection. The information was then taken back to the university and analyzed further.

The results of the study are currently being reviewed and will be made available in November. By developing recommendations of blasting standards, and their application in this region, the EUWD and UTSA will contribute to reducing the possibility of unexpected contamination of the aquifer. ■

Water Conservation Pays

Water Tight In Business and Industry

Businesses are often perceived as water wasters. In an area where 1.4 million people rely on the same source of water, a conservation campaign can show a commitment to being environmentally responsible. Implementing a conservation program also makes good business sense, especially when considering potential cost reductions. These include savings in the actual cost of water, the energy used to heat water, and in wastewater treatment.

In San Antonio, non-residential water users account for almost 7% of the City Water Board's accounts. This is equivalent to approximately 28% of the city's water consumption, or 14 billion gallons per year.

Four factors play an important role in developing a successful water conservation campaign:

1. Commitment of top management to support the program.
2. A complete understanding of your water system.
3. A plan committed to paper.
4. Active employee participation.

Pearl Brewery, located in San Antonio, implemented a water conservation program in 1987. While motivated by an increase in industrial sewer charges, Pearl has gone beyond just saving money.

The brewery has two artesian wells located on its property. The larger well flows at a rate of 1400 gallons per minute (gpm), and the smaller well at 1000 gpm. In 1987, Pearl was utilizing both wells, using between 1.4 and 1.6 million gallons of water per day. Today, the brewery averages less than 500,000 gallons per day, and it uses only the small well for production, which has remained constant. The larger well's valve is closed.

According to officials at Pearl Brewery, the commitment to reducing its water and sewer usage has paid off. Ed Mueller, Plant Manager, estimates savings of approximately $26,000 a month in sewer costs alone. The monthly wastewater outfall was reduced from 27 million gallons to nine million.

The beer brewing industry is water-intensive. Pearl's conservation plan began with a top-down approach, retrofitting equipment which used the largest volume of water. The piping and pump configuration of the pasteurizer was changed, reducing usage from 112 gpm to zero. Changing a condenser on the de-alcoholizing unit to a closed system cost $26,000. Mueller estimates it paid for itself in eight months due to water and wastewater savings. In other stages of the brewing process, well water which once went down the sewer is now being stored and reused. The pumpage volume has gone from 153,090,250 gallons in 1987 to 96,000,000 in 1989.

Pearl has taken other steps to reduce water waste. The brewery purchased a water meter to measure use and discharge. The utility engineer checks for leaks twice a month. Trucks and company cars are no longer washed on a regular basis. When needed, they are taken to a car wash which recycles water. The 1100 Springs waterfall was disconnected, and spring-loaded valves were installed in the lavoratories.

None of this would have been possible without employee participation and support. From the janitor to the plant manager, employees are encouraged to practice water conservation. Twice a year, supervisors meet on the topic and citations are issued if anyone is caught wasting water. Mueller estimates that the water efficient equipment paid for itself in 15 months. And, he adds, only with the help of the employees.

The following is a list of suggestions which can help you reduce water consumption in your facility.

STEP ONE: Start at the top

Like any successful business plan, top management's commitment and support, both ideologically and financially, is critical to effective implementation. Therefore, step one in launching a company-wide conservation program has to start at the top. The CEO and management staff must get behind the plan from the beginning before employees will lend their time and effort to saving water for the company.

STEP TWO: Understand your water system

Inside

- Locate and identify each water meter and record numbers.
- Separate sewage costs from water costs.
- Determine annual energy cost of heating water.
- Leak detection—locate broken pipes, leaks, faulty hoses, etc.
- Install water efficient plumbing fixtures (low volume flush toilets, low-flow shower heads, faucet aerators, and appliances such as dishwashers, clothes washers and icemakers).
- For tank type toilets with 3.5 or greater flush, install toilet dams or low-flow flapper valves to decrease consumption per flush.
- When retrofitting or installing new air conditioning, use water and energy-efficient equipment.
- Use recycling systems for cooling towers. Increase the cycles of concentration as much as possible.
- Determine where water can be conserved in the production process, and its potential paybacks.

Outside

- Automate landscape water systems for early morning or late evening. Utilize drip irrigation systems where applicable.
- Water only as frequently as NECESSARY.
- Landscape with drought-tolerant plants (xeriscape). If possible, eliminate narrow landscape strips.

STEP THREE: Put it on paper

Commit your plan to paper, making it specific to your facility. Include:

- a company policy statement,
- goals—set reduction goals which are measurable, specific and achievable,
- action steps,
- who is responsible for plan implementation.

STEP FOUR: Employee participation and awareness

Without the willing participation of employees, the first three steps of plan development will be unworkable.

- Stimulate employees interest in water conservation with posters, newsletter articles and training programs.
- Solicit and reward employee ideas that contribute to water savings.
- Hold meetings with all employees, especially those in heavy water using areas, and discuss the conservation methods that are being implemented.
- Post reminders near all water sources, such as sinks and drinking fountains.
- Take advantage of audio-visual programs and use outside speakers for employee meetings.
- Establish a system for employees to notify the proper parties about leaks, dripping faucets, broken sprinklers or other occurrences of water waste.

These are just a few suggestions to help save water in your facility. Each facility is different, and you will need a customized plan that will work for your situation. If you need assistance with additional conservation questions,call the Edwards Underground Water District at (512) 222-2204 or 1-800-292-1047. ■

Putting It Together

Groundwater Protection Forum: Policy and Practice

Danielle Milam, League of Women Voters Co-project Manager

Groundwater protection has become the focus of national attention as the costs of contamination clean-up hit the headlines and skyrocket Superfund budgets into the millions. Effective groundwater protection requires a coordinated attack at the national, state and local level. The attack must engage the active cooperation of the private sector and public interest community, as well as the management capabilities of the various levels of government. Many activities can lead to the deterioration of groundwater quality. However, with an understanding of groundwater management, citizens are a step ahead in protecting this priceless resource.

Edwards Underground Water District / League of Women Voters Groundwater Protection Forum Saturday, November 23, 1991 Embassy Suites Northwest 9:00am to 3:30pm

The San Antonio Area and San Marcos Area League of Women Voters, in cooperation with the Edwards Underground Water District and the U.S. Environmental Protection Agency, will launch a citizen's education campaign to promote awareness of contamination threats to groundwater supplies, and of existing programs and regulations which aim to prevent groundwater contamination. A forum will be held November 23 at the Embassy Suites Northwest, featuring speakers from municipal, regional, state and federal agencies responsible for groundwater protection. Texas Water Commission Chairman, John Hall, will be the luncheon guest speaker. He will discuss the purposes and proposed organization of the new Texas Natural Resource Conservation Commission.

The diversity of land uses in the Edwards Aquifer region means we face contamination threats from a number of sources. These include leakage from underground pipelines, storage tanks and improperly lined landfills; septic tanks; fertilizer and pesticide infiltration; animal feedlots; abandoned wells; stormwater runoff; and accidental spills of hazardous materials.

Because we are solely dependent on groundwater in this region, the League of Women Voters sees the next step of public education as clarifying who and what protects groundwater. The goal of the forum will be to hear from the agencies and to provide an opportunity for the public to ask questions, putting together a comprehensive picture of how groundwater is being protected for future generations.

The forum is free of charge. For reservations or further information, contact project managers Danielle Milam at (512) 828-3960 or Kaylene Ray at (512) 396-7190. ■

News Briefs...

☐ On September 10, 1991, seventy-nine years after it was drilled, the open and flowing artesian well known as J-21 was plugged. Located on Salado Creek, the well had been flowing up to a rate of 3500 gallons per minute.

Before deciding to plug the well, an assessment was conducted to determine whether it could be re-cased and re-valved. A video camera was lowered down the well, revealing it would have to be closed due to the deteriorated condition of the casing. Approximately 31,500 gallons of cement, four times the usual amount, was eventually needed to stop the flow.

The Edwards Underground Water District is the only governmental body mandated by the legislature to preserve, conserve and protect the Edwards Aquifer. Eliminating the waste of groundwater by closing the flowing well is one way the District is fulfilling its mission.

(continued)

News Briefs... *(continued)*

☐ The sixth annual Groundwater Protection Seminar, hosted by the Texas Water Commission, was held in San Antonio this year. Complementing the seminar was a day-long field trip sponsored by the EUWD. The District's Field Operations division conducted the tour which began on the recharge zone and finished at Comal Springs.

Participants saw the Seco Creek sinkhole, diversion channel and recharge dam; Olmos Basin Pump Station; the Bexar County Index Well at Fort Sam Houston; J-21; a bad water line well and Comal Springs. Lectures were also provided by the District, the Seco Creek Water Quality Demonstration Project and the City Water Board.

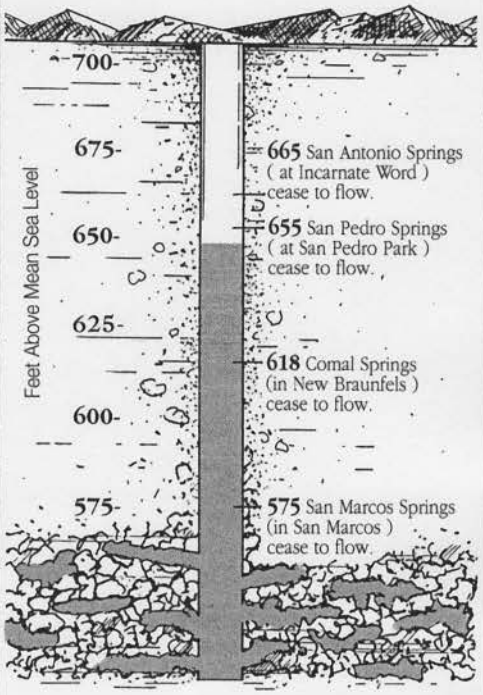
The trip was filled to capacity and generated many positive comments. The EUWD hopes to offer more field trips in the future as part of its emphasis on educating the public on the Edwards Aquifer.

☐ The EUWD's Division of Information and Education has developed a teacher's guide to complement the video, "Edwards Aquifer: A Texas Treasure." The packet includes a secondary teacher's guide, a copy of the video, a transparency, and a map of the aquifer system. It was sent to every public middle school in the five county region, as well as to a limited number of private schools. The activities included in the guide provide an excellent opportunity for discussion, cooperative learning, and evaluation. They were designed to use in conjunction with the 1989 video.

A technical version, "Inside the Edwards Aquifer," will be available in November, and there are plans to develop a variation for the elementary school level. If you would like a brochure which lists all of the District's information and education materials, call (512) 222-2204 or 1 (800) 292-1047. ■

The Water Level

This reading reflects the daily high artesian water elevation at the Bexar County Edwards Aquifer Index Well.



Current Status: On October 18, 1991 the water elevation was recorded at 647. Average for October is 661.5.

THE WATER SOURCE

The Water Source is published quarterly by the Public Information Office of the Edwards Underground Water District, 1615 N. St. Mary's, San Antonio, Texas, 78212. 512/222-2204 or 800/292-1047

Contributors to this issue:

Editor: *Carolyn Eagle*; Feature Articles: *Diane Poteet*, and Guest Columnist: *Danielle Milam*

EDWARDS UNDERGROUND WATER DISTRICT

1615 N. ST. MARY'S ~ P.O.BOX 15830
SAN ANTONIO TEXAS 78212

THE WATER SOURCE

A QUARTERLY PUBLICATION OF THE EDWARDS UNDERGROUND WATER DISTRICT

May 1992

Urban BMPs Can Preserve Water Quality

Philip Farrington,
M.S., Community & Regional Planning
EUWD Water Resource Planner II

Editors Note: May 3-9, 1992 has been designated as National Drinking Water Week. The American Water Works Association has organized a coalition of non-profit groups and government agencies to conduct a national water awareness campaign. Locally, the Edwards Underground Water District, City Water Board and League of Women Voters will join water-related organizations around the country and ask our community to get on the "Blue Thumb" bandwagon and "give drinking water a hand." Citizens around the region can show their "Blue Thumb" when they take action to protect their source of water, conserve and get involved in community decisions that affect water quality.

Often forgotten amid water supply arguments in the region is the fact that San Antonio is the world's largest city without a treatment plant for its drinking water. This circumstance can be viewed both as a blessing and a curse: as a blessing because, even untreated, water from the Edwards Aquifer surpasses all federal drinking water standards; as a curse if we take our natural estate for granted and foul the superior quality of water provided us by the Edwards. By using Best Management Practices (BMPs), however, each of us can be good stewards of this precious resource. BMPs can be defined as one or a combination of practices which help reduce or prevent groundwater pollution at the source.

Some pollution can be captured and treated in structural controls such as retention and filtration ponds, but these facilities are costly, difficult to maintain, and their ability to filter some pollutants from runoff is questionable. A far more cost-effective solution is to keep storm-water runoff and recharging waters free from potential aquifer contaminants by using sound BMPs. Given that water from our sole source aquifer arrives at the tap with only a modicum of chlorine as treatment, it is crucial that the BMPs for the following potential pollutants be adhered to by all who live, work, play, or travel through the recharge and transition zones.

Fertilizers, Pesticides, and Herbicides

Everyone appreciates the aesthetic appeal of a lush green lawn, but many products applied as lawn treatments contain toxic chemicals which can easily attach to disturbed soil sediments and be carried to recharging waters with storm-water runoff, thereby contaminating the groundwater. Furthermore, homeowners tend to apply far more fertilizer than is warranted; it is estimated that 30% of nitrogen applied to lawns is washed away or percolates beyond the root zone. Far more chemicals are applied to the land in the course of agricultural production, but one study suggests that homeowners use up to eight times more pesticides *per acre* than do farmers. Best Management Practices, therefore, include:

- Reducing application rates for fertilizers, pesticides, or herbicides. Never use more than directed on the label.
- Using organic substitutes whenever possible.
- Using slow-release fertilizers and pesticides if chemicals are used.
- *Never* disposing pesticides, fertilizers, herbicides, or their containers by merely dumping on the ground. Always dispose in a conscientious and safe manner (see product instructions).
- Converting your lawn to a xeriscape. Limiting turfgrasses to functional areas reduces the need for fertilization. Also, native and non-native xeriscape plants require less water, maintenance, fertilizers and pesticides, and produce a natural, beautiful landscape.
- Timing, as well as distribution of fertilizers, is important. Applications should correspond with grass requirements rather than homeowner convenience. Soil and grass type, shade conditions and other environmental factors should be considered in determining fertilizer requirements.

(continued)

Water Wisdom

Being good stewards of the Edwards Aquifer

Reverend John Moder, S.M., Ph.D.
President, St. Mary's University

Editors Note: This essay is adapted from a speech Fr. Moder delivered at the premier of the District's new technical film, "Inside the Edwards Aquifer." His message on stewardship is worth sharing with all those who rely upon the Edwards Aquifer.

Religious traditions around the world have seen water as so essential to human life that it becomes a symbol of the divine. The Rgyeda, the most ancient text of Hinduism, contains a hymn to the goddess Waters. The twenty-five hundred year old Chinese I Ching contains a symbol for the Abysmal or Water. Water is linked with "repetition of danger" and the following advice is given:

> ...a man is in the same pass as the water in a ravine, and, like the water, he can escape if he behaves correctly... Water sets the example... It flows on and on, and merely fills up all the places through which it flows; it does not shrink from any dangerous spot nor from any plunge and nothing can make it lose its own essential nature... Thus likewise, if one is sincere when confronted with difficulties, the heart can penetrate the meaning of the situation. And once we have gained inner mastery of a problem, it will come about naturally that the action we take will succeed. (Book I, Hexagram 29, K'an)

The Judeo-Christian tradition is probably more familiar to us. The Hebrew scriptures begin the creation story with the spirit of God hovering over the waters (Gen. 1:2), and the Christian scriptures conclude the book of Revelation with an invitation to the thirsty to come to the waters (22:17). Water effects both destruction for God's enemies and salvation for God's friends in the story of the Flood and the exodus through the Red Sea, and the same theme is carried forward in the New Testament accounts of baptism.

For religious people, water is life and death, power, cleansing and purification, refreshment and coolness.

Our situation is different from the ancients' in two important ways. For them, water seemed an inexhaustible resource, whereas, because of pressures from both our population and our technology, we are acutely aware of the limitations on our water resources. Second, while in the ancient world, water was a mysterious power beyond human control, our technical and social mastery gives humankind the crucial decision-making power over our water.

These two dramatic shifts impose the critical responsibility of intelligent stewardship on our generation. It is absolutely vital that we do make decisions about our water resources. Our water issues will not be resolved by themselves, but must be attended to consciously and deliberately.

Because these are complex technical and social questions, we need the best expert information available. We need to research and learn from the research, both about the hydrology of the aquifer and about the human needs that it serves. This information must not remain only in the hands of the experts, but everyone must be well-informed, even technically, in order to participate responsibly in the public decision-making process.

Perhaps most important is the need for fairness—a fairness to the past, to history and accepted practice, where these are relevant. There must be a fairness to the diverse needs of diverse groups of users: we must seek to be fair to all involved. And we must be fair to the future, so that generations to come will have the life-giving waters we enjoy.

Clearly, this whole process will involve a lot of listening to the experts, to the users, to the public, to other decision-makers. The responsibilities of our time call us to be better listeners than we have been in the past. We will need to listen not only to the words and the positions, but to the real needs and values at stake.

Finally, decision-makers will need to make a continuing series of courageous decisions. The standard for these decisions ought to be the common good, a deeper value often neglected in our pursuit of sometimes genuine and sometimes spurious "rights."

Let me conclude with one more piece of water wisdom from the East—the eighth poem in the Tao Te Ching:

> The highest good is like water.
> Water gives life to the ten thousand things and does not strive.
> It flows in places men reject and so is like the Way.
> In dwelling, be close to the land.
> In meditation, go deep in the heart.
> In dealing with others, be gentle and kind.
> In speech, be true.
> In ruling, be just.
> In business, be competent.
> In action, watch the timing.
> No fight: No blame. ■

Editors Note:

As this edition of The Water Source goes to print, major issues are affecting the status of the Edwards Aquifer. As the water situation becomes clearer, the Edwards Underground Water District will discuss the changes and their effects in future editions of our newsletter.

Water Quality *(continued)*

• Consider IPM, Integrated Pest Management, in maintaining your lawn. IPM emphasizes the importance of planting adaptive turf types, following prescribed cultural practices, monitoring weed and pest populations, targeting pesticide applications, and using biological controls such as beneficial insects to manage lawn and garden areas. For more details on IPM, contact your local horticultural extension agent.

Household Hazardous Wastes

There are a variety of everyday products which can negatively impact groundwater if improperly disposed or stored. Although beneficial in their applications, these products can be classified as household hazardous wastes due to the toxic or volatile chemicals they contain. Examples of household hazardous wastes include: solvents, pool acids, paint products, and automotive products.

BMPs call for the proper handling, use, storage, and disposal of suspected household hazardous wastes. Other BMPs include:

• Using products only as directed on labels.

• Keeping products in their original containers with labels kept legible for proper subsequent use and storage.

• Storing products in a cool, dry place away from the elements, and inspecting them regularly to ensure containers are not leaking.

• Properly maintaining motor vehicles helps keep motor oils, grease, shavings from brake linings, etc. from being deposited on roadways and available for subsequent runoff.

• Never disposing waste products -- particularly used motor oils, antifreeze, brake and transmission fluids, and car batteries -- by dumping or pouring on the ground, or into a storm sewer. One quart of motor oil can contaminate 250,000 gallons of water. Extreme caution should be taken in the disposal of such materials.

• For a list of recycling centers which accept various types of used or old household products, consult the phone book for reclamation centers, or contact the solid waste department of your local government.

Septic Systems

While it is recommended that residential development atop the recharge and transition zones be tied into centralized sewer facilities, on-site disposal (septic) systems are still permitted if prescribed soil permeability and depth standards are met. Individual homeowners, however, should properly maintain septic systems in the rural and urban fringe areas of the recharge zone to avoid groundwater pollution from disposing sewage in an unsanitary manner. BMPs call for:

• Water conservation: the most common reason for septic system failure is the use of more water than the soil can absorb. Changing to low water using appliances (toilets, showerheads, etc.) and altering water use habits can help address the problem.

•Similarly, make sure drainage from roofs, roads, and driveways is not being diverted to the system's soil absorption field.

• Driving, paving, or building atop the soil absorption field can cause drain pipes to shift or crack and can compact the soil.

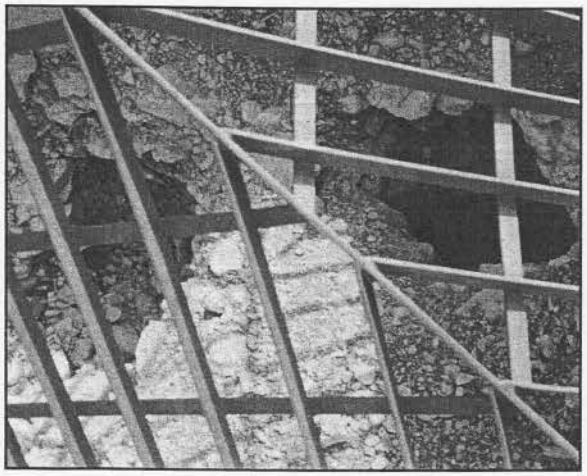
• Don't plant trees or shrubs over or around the soil absorption field because their roots can cause clogging.

• Proper maintenance is crucial. The septic tank should be pumped at least every three years; more frequently if a garbage disposal is used. Failure to do so causes the system to fail to treat wastes as it should, creating a nuisance and a health hazard.

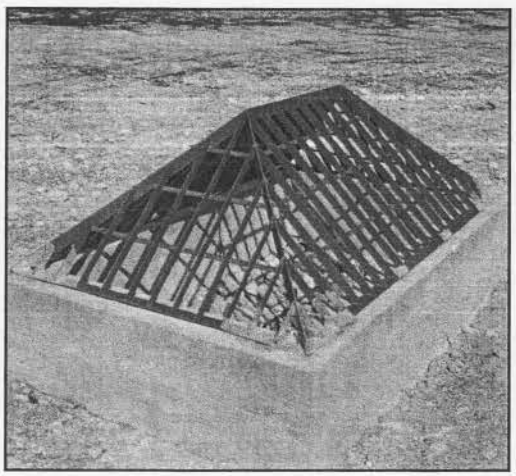
• Adding additional lines to the soil absorption fields increases the system's capacity to accept wastewater. Consult with a local sanitarian before construction.

In the absence of water treatment facilities, contamination of our sole source aquifer can spell calamity for public health and the vitality of local economies. Stewardship of the Edwards Aquifer requires the active involvement of aquifer users individually and collectively. Government regulations and controls can go a long way to assure the proper location, type and extent of land use activities on the recharge zone. But the cumulative effect of individual actions can lead to the continuation of superlative water quality or spoilage which will be handed to future generations. Concerns about water supply matter little when the water in question is fouled. ■

Sinkhole Gets Caged...



The EUWD has placed a grate over a sinkhole located in the flood pool of the San Antonio River Authority's dam site #10. The grate was installed to protect curious explorers and to keep the recharge feature intact. The sinkhole was acquired last summer as part of the Edwards Aquifer Preservation Program, and is located within a 51 acre conservation easement.



News Briefs...

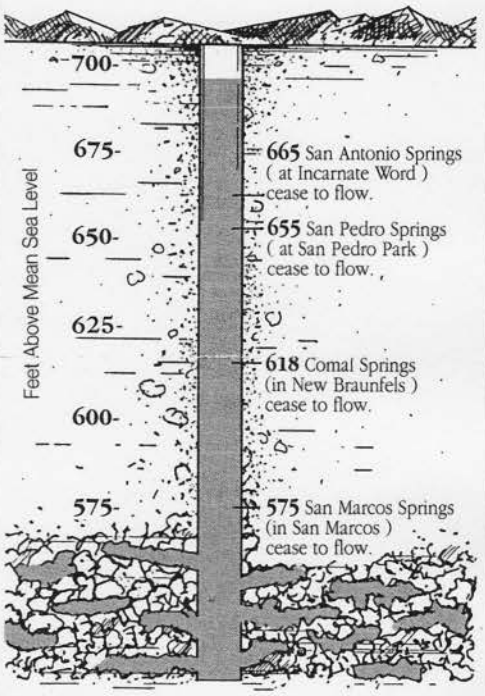
☐ The Edwards Underground Water District has a new documentary available for free rental. "Inside the Edwards Aquifer" is a technical film which addresses the technical dynamics of the aquifer's hydrology and geology. In great detail, it describes the origin of the aquifer and uses computer animation sequences to explain groundwater flow paths and to take a new look at the "bad water" line. The film also uses expanded charts to explain how the water level in the aquifer varies throughout the region and discusses several aspects of recharge, including augmentation. Aerial and underwater photography helps capture the uniqueness of the aquifer.

"Inside the Edwards Aquifer" is the second in a trilogy of films about the Edwards Aquifer. The first film, "The Edwards Aquifer: A Texas Treasure," was produced in 1989 and was designed to be an entertaining and informative means to educate the general public about the value of the Edwards Aquifer. "Inside the Edwards Aquifer" goes one step further in describing the complex dynamics of an aquifer which is the sole source of water for 1.4 million people. Both films are part of the District's overall education effort because the EUWD believes that an informed public will be better prepared to meet the challenges which face the region in protecting this amazing resource.

☐ Three students won awards for their projects about the Edwards Aquifer at the Alamo Regional Science Fair in March. Jennifer Jamison, from Dahlstrom Middle School, won first place for her project, "Fecal Coliform Bacteria in the Edwards Aquifer and San Marcos River." Second place went to Jeremy Hansen of Goodnight Junior High for "Phosphates and the Edwards Aquifer: What effects do detergents have on our source of water?" Kelley Wisley, from Kirby Jr. High School, received third place for her project entitled, "Oops! An oil spill!" ■

The Water Level

This reading reflects the daily high artesian water elevation at the Bexar County Edwards Aquifer Index Well.



Current Status: On April 22, 1992 the water elevation was recorded at 696.3 Average for April is 666.3

THE WATER SOURCE

The Water Source is published quarterly by the Public Information Office of the Edwards Underground Water District, 1615 N. St. Mary's, San Antonio, Texas, 78212. 512/222-2204 or 800/292-1047

Contributors to this issue:
Editor: *Carolyn Eagle;* Feature Articles: *Philip Farrington;* Guest Columnist: *Rev. John Moder, S.M.*

EDWARDS UNDERGROUND WATER DISTRICT

1615 N. ST. MARY'S ~ P.O.BOX 15830
SAN ANTONIO TEXAS 78212

FORWARD & ADDRESS CORRECTION

BULK RATE
U.S. POSTAGE
PAID
PERMIT # 771
SAN ANTONIO
TX 78212

Recycled Paper

THE WATER SOURCE

Winter 1991

The Big Splash!

"Be the solution! Stop the pollution!" That's the credo Robby the Raindrop learns during his adventure from rain cloud jump school into an underground aquifer.

Eddy Aquifer realizes that Paula Purewater is really the evil W.C. Fieldspoiler in disguise!

Robby the Raindrop splashed down in the Edwards Aquifer region in 80 schools this fall. The Edwards Underground Water District is sponsoring "The Big Splash," a live educational theater production designed to give students an awareness of groundwater, as well as conservation and pollution.

The 30-minute play follows Robby the Raindrop and Paula Purewater. Paula teaches Robby the importance of groundwater and how young raindrops percolate down through the earth into the aquifer, where they are stored until being pumped out to irrigate farms and to supply fresh water to cities. With the help of a student volunteer, Robby stops W.C. Fieldspoiler from polluting the aquifer, for now, but learns it will take everyone working together to stop pollution.

Small Change Original Theater, a Minnesota based national touring company, uses simple sets and audience participation to convey their message. After the production gets children excited, teachers reinforce the play's message by working with classroom activities delivered by the actors. There are two versions: one for grades K-3 and one for grades 4-6.

"The Big Splash" was presented by the EUWD as a pilot program last spring. District General Manager Russell Masters stated, "It was so successful, and the response was so overwhelming, that the performances were doubled to accommodate more schools."

"The Big Splash" is just one of the many programs developed and initiated by the District as part of its ongoing commitment to education. The District's educational effort focuses on reaching consumers through their children, as well as shaping the attitudes and habits of these future water users. To fulfill that mission, the EUWD has a full-time education coordinator on staff. Cynthia Jimenez is responsible for coordinating and implementing all educational activities. This includes arranging workshops for elementary and secondary school teachers, developing water conservation and groundwater curriculum, and conducting in-classroom presentations on the Edwards Aquifer and the importance of conservation. "Children need to know they can make a difference in preserving our source of water for their generation," said Jimenez.

A free brochure listing all of the District's programs, as well as education and information material, is available by calling (512) 222-2204 or 1-800-292-1047. ■

Editor's Note:

The Water Source EXTRA is a new publication of the EUWD. It is designed to update readers on activities, programs and information that occur between regular editions of the **Water Source** newsletter. Your comments and suggestions are welcome. Please contact the Public Information Office during regular business hours at (512) 222-2204 or 1-800-292-1047.

■ The Edwards Underground Water District is expanding its observation well network which monitors water levels in the aquifer, as well as upgrading the recording equipment in existing wells. The improved equipment includes digital water level recording devices and the installation of solar panels with rechargeable batteries.

New observation wells are being established from existing wells in the water-table portion of the Edwards Aquifer. At least eight wells will be added to the network.

A float and counterweight pulley system was originally installed in the 17 continuously recording observation wells operating in Bexar, Comal, Hays, Medina and Uvalde counties. This system recorded water levels on a paper chart. It is being replaced with a digital recording device which stores levels on a small data card. The card is retrieved monthly then read and stored on computer disc. The advantage of this new system is in time saved. It is no longer necessary to interpret each chart to determine daily high water levels..

Until recently, the batteries used to power recorders usually lasted between three and four months. Now the District installs solar panels and rechargeable batteries. This will lower costs, as well as help prevent waste.

The water level monitoring program is an intricate part of the EUWD's operations, reflecting the conditions of the aquifer on a continuous basis. A better understanding of the Edwards Aquifer, through expansion of the well network, will assist in determining the aquifer's storage capacity, the measurement of discharge, and overall management of our sole source of water.

Earl Parker, BS Geology
EUWD Water Resources Technician

■ A "how to" guide on converting a traditional landscape to a Xeriscape is available from the Texas Agricultural Extension Service. The booklet costs $3 and is directed to families and individuals with limited money to spend on landscaping and who plan to do some or most of the work themselves. Included are tips on how to get started, sketching your own plan, selecting plants, the seven principles of Xeriscape, money saving tips and much more. Pick up a copy at participating retail nurseries or mail $3 plus .50 cents postage ($3.50) to Xeriscape Conversion, 1143 Coliseum Road, San Antonio, Texas, 78219.

■ Did you know...that your sewer rate is based upon the average consumption measured in the three consecutive bills you'll receive between November 15 and March 15? By conserving water you can lower your sewer bill. Be Water Tight!

■ Colorful bookmarks that show the endangered species that live in the aquifer and have a message of conservation are available at several locations around the region. Call to find out the location nearest you.

■ Did you know...the Edwards Underground Water District has a resource library which is open to the public during regular business hours. Some of the material which can be found in it includes technical information on the aquifer and groundwater, planning information and historical data.

■ In January, a new film will be available entitled "Inside the Edwards Aquifer." The 30-minute video is targeted at an audience which already has some knowledge of the aquifer. It will include a description of the origin of the aquifer, how index well levels are measured, and what those measurements mean. It has computer animation sequences which explain groundwater flow paths and their significance, the concept of "transmissivity," and new thoughts on the "bad water line." The new film also shows how recharge can be augmented, how recharge is measured and how the District is planning to improve recharge. Look for an announcement on the film's release in a future edition of **The Water Source.**

EDWARDS UNDERGROUND
WATER DISTRICT

1615 N. ST. MARY'S ~ P.O.BOX 15830
SAN ANTONIO TEXAS 78212

BULK RATE
U.S. POSTAGE
PAID
PERMIT # 771
SAN ANTONIO
TX 78212

THE WATER SOURCE

A QUARTERLY PUBLICATION OF THE EDWARDS UNDERGROUND WATER DISTRICT

August 1992

Consensus Grows for an Edwards Management Plan

John Hall, Chairman
Texas Water Commission

Editor's Note: In the last issue of The Water Source, readers were promised that future editions would discuss the changes concerning the status of the Edwards Aquifer and its accompanying effects. Fulfilling this commitment, Chairman Hall agreed to write this column and address our readers. As the newsletter goes to print, the Edwards Aquifer management situation continues to change and future editions will continue to address the issue as it evolves.

An increasing number of citizens and political leaders are signing on to the efforts underway to shape a management plan for the Edwards Aquifer or underground river. We commend and appreciate this level thinking and sincere interest in resolving a matter which has divided communities, created hostilities and which endangers the future of one of this nation's most beautiful and vibrant economic regions.

During five public hearings held in June, more than 400 citizens, business representatives and public officials provided their comments regarding the proposed management of the Edwards. The Texas Water Commission (TWC) appreciates these comments and the time taken by each presenter. These comments and the results of extensive consultations that have taken place over time, will be factored into the final rules that will be considered by the Commission this summer.

Here is the timetable for additional action: The Commission will approve final management rules for the Edwards by early August. Each user of the Edwards will then have 30-45 days to submit a history of their water use and a claim for their water right. Those claims will be reviewed by the TWC staff which will prepare a detailed summary of recommendations.

Implementation of the TWC management plan and water rights would be set for April or May 1993. This would allow the Texas Legislature the opportunity to enact a management plan for the Edwards and to confirm the water right of each user. The Legislature would also decide the entity or entities that would administer and enforce the Edwards management plan. This could be a regional entity already in place such as the Edwards Underground Water District. It would not be the Texas Water Commission.

Meanwhile, the TWC has asked that a federal trial regarding endangered species be delayed. The trial involves a lawsuit that seeks to drastically limit pumpage from the Edwards to protect endangered species in Comal Springs and the San Marcos River. We hope that the record water levels of the Edwards, a sound TWC management plan developed and ready to go and the interest expressed by the Legislature for addressing the problem will persuade the court to allow the delay.

The TWC will also continue extensive talks that are underway with the U.S. Fish and Wildlife Service and the Sierra Club. These efforts are aimed at reaching agreement on pumping limits from the Edwards that would provide reasonable interim protection for endangered species without the drastic reductions that could wreck the region's economy.

The work, of course, is far from complete, and there are still major hurdles, but we applaud the consensus-building that so many are joining. The Edwards is the sole source of water for 1.5 million people and 700,000 jobs. Protecting it and properly managing it is not only desirable but is vital. ■

River or Not: Compromise Key to Achieving Edwards Management Plan

Russell Masters, M.S., Environmental Management
EUWD General Manager

In 1989, the Guadalupe-Blanco River Authority filed suit in state court contending that the Edwards Aquifer was an underground river. The Edwards Underground Water District (EUWD) Board of Directors went on record opposing the action. The Edwards Aquifer was once again declared an underground river three years later when the Texas Water Commission took action on April 15, 1992. The EUWD Board continues to reaffirm its position that the Edwards Aquifer is not an underground river.

This designation by the Texas Water Commission however, has not affected the EUWD Board's interest in working with the Texas Water Commission. During recent action taken by the Board of Directors, Bexar County representative Jo Ann De Hoyos summarized the District's position by stating, "the District will continue to work with the Texas Water Commission in developing technical, legal, and administrative information that will contribute to the resolution of the regional controversy."

Since 1983, the Edwards Underground Water District has worked diligently with diverse interest groups in the region, especially the City of San Antonio, to arrive at an acceptable regional plan. In 1988, those efforts resulted in a consensus-based Regional Water Management Plan. The issues today remain the same as those in 1988. The key issue, yesterday and today, remains the establishment of a regulatory process that is fair and equitable to everyone involved.

The Texas Water Commission and John Hall are to be commended for their efforts at attempting to forge an agreement on a management approach for the Edwards Aquifer. While there have been countless talks with individuals, groups and entities, the difficult task remains; getting everyone to agree to the same limitations and regulatory controls. The Texas Water Commission has reached "agreements" with various groups on several issues of concern, however these "agreements" must come together in the form of a workable regional plan.

The 1988 Regional Water Resources Management Plan contained the following components:

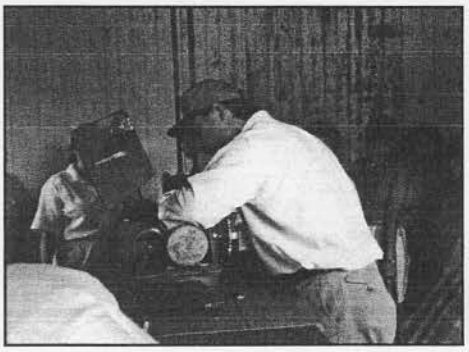
- Reuse
- Alternative sources
- Recharge
- Allocation
- Conservation

With the exception of the "allocation" component, the 1988 Regional Water Plan had the support of all the key players in the region. This plan however, was never put into place because the enabling legislation failed in the 1989 legislative session.

Since that time, numerous attempts have been made at taking a "different look" at solving the issue, such as the current efforts by the Texas Water Commission. In nearly every instance the "different approaches" have always come back to the basic principles set out in the 1988 Regional Water Plan.

There are no new approaches. There are no "different looks." What remains is the acknowledgement that the Edwards Aquifer must be protected. In order to accomplish that end for the well-being of everyone who relies on the aquifer, there must be compromises. ■

Teachers' Turn to Learn



Randy Williams, EUWD Geologist, explains how the water level is recorded at the Bexar County Index Well during a field trip for workshop participants.

The Edwards Underground Water District offered six summer workshops on the geology and biology of the Edwards Aquifer for elementary and secondary school teachers. After completing the Texas Education Agency AAT (Advanced Academic Training) credit approved workshops, participants had the opportunity to attend a day-long field trip highlighting the unique features of the aquifer. ■

EUWD Education Coordinator Cinde Thomas-Jimenez (center) assists Jo Ham from Hondo ISD (left) and Susan Palmer from NEISD in building a model of the aquifer during the "Water Down Under" workshop for elementary school teachers.

THE WATER SOURCE
Reader Survey

The Water Source newsletter was created in 1989 to provide a forum for discussing critical water issues, as well as the various programs of the Edwards Underground Water District. Please take a moment to complete the following survey and return it in the enclosed envelope. Your feedback will help determine if any changes need to be made. It will also let us know how the newsletter can better provide you with the information you wish to receive. Additional comments and suggestions are welcome.

1. Overall, the content of the articles is:

___ excellent
___ above average
___ good
___ average
___ below average
___ poor

2. I find the articles (check all that apply):

___ interesting
___ boring
___ too technical
___ too general
___ have too much information
___ have too little information
___ fine the way they are

3. Overall usefulness of published information:

___ excellent
___ very good
___ average
___ fair
___ poor

4. After reading The Water Source, do you feel you have learned more about the Edwards Aquifer?

___ yes ___ no

5. After reading The Water Source, do you feel you have learned more about what the EUWD does?

___ yes ___ no

6. Generally, the newsletter focuses on EUWD programs. Would you like to see (check all that apply):

___ more water related issues covered
___ more guest columnists
___ other _____

Who are you?

Age
___ 20-25
___ 26-35
___ 36-45
___ 46-55
___ 56+

Career Field
___ Government
___ Education
___ Industrial/Technical
___ Consulting/Law
___ Other _____

Salary Range
___ 10,000+
___ 20,000+
___ 30,000+
___ 40,000+
___ 50,000+

Location
___ Bexar Co.
___ Comal Co.
___ Hays Co.
___ Medina Co.
___ Uvalde Co.

Comments/Suggestions: _____

News Briefs...

☐ The Leon Valley City Council has agreed to participate in a plumbing rebate program funded by the Edwards Underground Water District. This will be the first program in the Edwards Aquifer region to reimburse homeowners who replace existing fixtures with those that are water efficient.

The rebate program will encourage retrofitting by offering a rebate incentive of $50 to offset replacement costs of ultra low flow (ULF) toilets. Showers, faucets, and toilets account for nearly two-thirds of indoor usage —toilets are the largest consumptive fixture in the home. Residents who install ULF fixtures will recoup their investment in under two years.

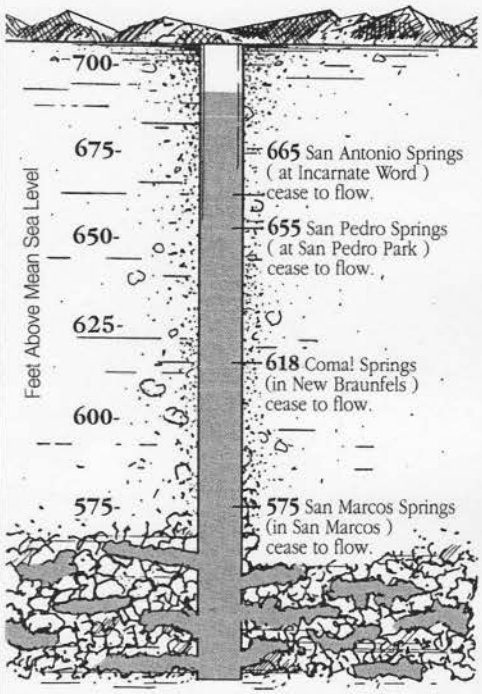
The pilot program funded by the District will provide $30,000 for the replacement of 600 fixtures. Leon Valley residents will save an estimated 936,000 cubic feet of water per year, or roughly 13% of average indoor use. The Leon Valley/EUWD pilot retrofit rebate program is part of the District's ongoing commitment to work with local governments to protect the water resources of the region. Low volume fixtures will prolong our limited water supplies through the efficient use of water.

☐ As part of the Edwards Aquifer Preservation Program (EAPP), the Edwards Underground Water District recently completed construction of a grate over the Hills & Dales Cave (or Pit) in northern Bexar County. The grate was installed to keep the recharge feature intact, as well as protect curious explorers.

The protection of the cave is important because of its location on the sensitive recharge zone. Located in a floodplain, all of the rain or storm water runoff in the immediate vicinity is directly recharged into the cave. A conservation easement protecting the surrounding property is pending with the owners. ■

The Water Level

This reading reflects the daily high artesian water elevation at the Bexar County Edwards Aquifer Index Well.



Current Status: On July 27, 1992 the water elevation was recorded at 692.6 Average for July is 660.4

THE WATER SOURCE

The Water Source is published quarterly by the Public Information Office of the Edwards Underground Water District, 1615 N. St. Mary's, San Antonio, Texas, 78212. 512/222-2204 or 800/292-1047

Contributors to this issue:

Editor: *Carolyn Eagle;* Feature Articles: *Russell L. Masters;* Guest Columnist: *Chairman John Hall;* Photographer: *Gayle Kipp*

EDWARDS UNDERGROUND WATER DISTRICT

1615 N. ST. MARY'S ~ P.O.BOX 15830
SAN ANTONIO TEXAS 78212

FORWARD & ADDRESS CORRECTION

BULK RATE
U.S. POSTAGE
PAID
PERMIT # 771
SAN ANTONIO
TX 78212

THE WATER SOURCE

Summer 1992

Walk on Water

My Trip To The Recharge Zone

Christye Gruen,
EUWD intern

Editors note: Christye Gruen is an intern from St. Mary's University who is earning credit hours by working at the District. She spent a Saturday helping the Division of Information and Education conduct a program for area girl scouts at Eisenhower Park. One hundred 4th, 5th and 6th grade girls earned a patch after spending three hours learning about the recharge zone and the importance of protecting our water supply. After speaking with several of the girls, Christye wrote the following article from a 10-year old's perspective.

It was Saturday...the day you're supposed to sleep in. But not this Saturday. This Saturday my Girl Scout troop went to Eisenhower Park to learn about the Edwards Aquifer. My friends and I were excited; we could tell this was going to be fun!

We got to the park and joined the other troops by the pavilion. The lady teaching my group was named Cinde. The other two ladies were named Carolyn and Kelly. They all worked at the Edwards Underground Water District. Cinde showed us a map of the aquifer and told us that it had three zones: drainage, recharge and reservoir. She explained how each zone is necessary to the aquifer.

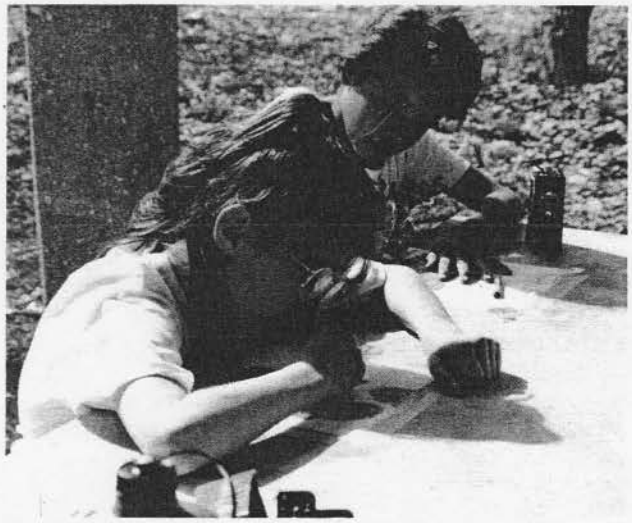
Cinde told us that there are two types of aquifers: sand and stone. We were going to do an experiment that would help us understand how water got underground. She put dirt in one cup, sand in another, and rocks in a third. Then she asked us which of the cups the water would flow through the fastest. My group said the rocks. She chose three volunteers to pour water in the cups. We were right!

Next, Cinde told us that our aquifer was made of limestone, which is porous, and that water goes into the limestone and into the aquifer. The limestone makes it very easy to recharge the aquifer. She also told us that San Antonio is the largest city in the nation that uses only groundwater, so we have to be careful not to use our water carelessly.

After the three groups were done, we set off on a hike. We walked along the path looking at the things pointed out to us. We saw dry creekbeds that should have had water in them; after all, it had rained hard on Tuesday. We even saw a small sinkhole. The water that goes inside the sinkhole also recharges the aquifer. We learned how important it was to prevent pollution. Because a sinkhole doesn't filter out the dirt and debris the way limestone does, polluted water could get down into the aquifer and hurt our water supply. Cinde and Carolyn told us to "Be the solution. Stop the pollution."

We hiked up the rest of the trail to the observation tower. It was so foggy that we really couldn't see anything clearly, even with our binoculars. Cinde said that the park was on the edge of the recharge zone. If it hadn't been foggy, we would have seen a limestone

(continued)



At the end of the program, the girls were asked to draw something they learned about the aquifer.

Walk on Water *(continued)*

quarry. We climbed down and hiked back along the trail.

We turned off the trail which led us to Shady Creek. It was a dry creekbed with a lot of limestone in it. Cinde told us that the reason there was no water in the creek, even after all of the rain we just had, was that it had soaked through the limestone into the aquifer. I thought that was pretty neat.

I went down the creek a little ways to see what it was like. Limestone pretty much covered the entire creekbed. I also saw a few trees that looked like they had been hit by lightening. We walked back to the pavilion where pieces of cloth were taped to the tables. We had to draw something that we learned today about the aquifer. I drew a sinkhole with water going into it. Above the sinkhole I wrote, "Be the solution. Stop the pollution."

It was a fun day! I learned about our aquifer and I earned a badge to put on my vest. Now I can visit the park with my family and tell them about our aquifer. □

■ *Texas Water Facts* is the state's official primer on water in Texas. This 30-page, four-color booklet is filled with photos and graphics detailing important facts about rainfall, surface water, groundwater, water use, water and money, water and the environment, water issues, and the future of water in Texas—an excellent reference and educational tool for secondary students.

A map of Texas features major cities, area population, primary rivers, and major aquifers in eight regions of the state. Interesting and little-known water facts are listed for each region.

Much of the information in *Texas Water Facts* is taken directly from the Texas Water Plan. To get copies of *Texas Water Facts* at $1.00 per copy, send your name, address and check payable to the Texas Water Development Board to:

Texas Water Facts
Texas Water Development Board
P.O. Box 13231
Austin, Texas 78711-3231

■ According to the Texas Water Commission, 8.8 pounds of hazardous waste are generated in the average American household. Most household septic tanks contain over 100 chemical fluids, degreasers, deodorants, pesticides and other common household products. And Americans dump an estimated 230 million gallons of used motor oil onto the nation's watersheds each year!

Water from the Edwards Aquifer is some of the cleanest in the country, exceeding federal standards. However, scientists agree that due to the unique nature of our aquifer, it could easily become contaminated.

The Edwards Underground Water District has a simple brochure listing ways you can help prevent contamination of our water supply. For a free copy, call (512) 222-2204 or 1-800-292-1047.

■ The unusually heavy rainfall has caused the springs in San Antonio to flow constantly since December. The following quote came from *The Springs of Texas* by Gunnar Brune.

"There are, besides the missions, several pleasant points for excursions in the neighborhood, particularly those to the San Antonio and San Pedro Springs...The San Antonio Springs may be classed as of the first water among the gems of the natural world. The whole river gushes up in one sparkling burst from the earth. It has all the beautiful accompaniments of a smaller spring: moss, pebbles, seclusion, sparkling sunbeams, and dense overhanging luxuriant foliage. The effect is overpowering. It is beyond your possible conceptions of a spring. You cannot believe your eyes, and almost shrink from sudden metamorphosis by invaded nymphdom."

Frederick Olmsted
1857

EDWARDS UNDERGROUND
WATER DISTRICT
1615 N. ST. MARY'S ~ P.O.BOX 15830
SAN ANTONIO TEXAS 78212

BULK RATE
U.S. POSTAGE
PAID
PERMIT # 771
SAN ANTONIO
TX 78212

THE WATER SOURCE

A QUARTERLY PUBLICATION OF THE EDWARDS UNDERGROUND WATER DISTRICT

November 1992

Data is Key to Future Regional Water Planning

Gregory E. Rothe, P.E.
Technical Consultant
South Central Texas Technical Data Review Panel

This spring and summer, a unique and enlightening chapter on the management of the Edwards Aquifer and the region's water supplies was written. At a time when the region's water interests were preoccupied with litigation and proposed regulation related to the Edwards Aquifer, technical representatives of those interests met in a non-partisan effort aimed at improving the technical data base for future regional water planning and policy debates.

The landmark effort was unique in that it represented the first objective evaluation of available data on water uses and supplies in the region separate from a planning forum. It was enlightening for the questions it raised about the accuracy and utility of data used in previous planning exercises.

The Edwards Underground Water District organized and funded the effort, which convened as the South Central Texas Technical Data Review Panel, or Panel for short. The entire region of the Guadalupe, San Antonio and Nueces River Basins will be affected by the resolution of the dispute over the Edwards Aquifer, so representatives from each of these areas were invited to participate. Included were state and federal agencies, river authorities, cities, water districts, irrigators, and environmental interests. Thirty-five participants attended seven day-long meetings. John Folk-Williams, a professional facilitator who mediated an attempt to negotiate a regional management plan for the Edwards Aquifer in 1990, was engaged to guide the process, and a technical consultant was retained to research and compile data.

A final report will be available in November containing all of the technical data reviewed by the Panel, as well as information on how it was accumulated and estimated. This will give the reader a better understanding of the data's accuracy. More importantly, the opinions of the Panel members are recorded for the benefit of future planning efforts which would use the report as a resource. The opinions provide an acknowledgement of problems with the data, cautions about its misuse, and gives individual and collective judgements on its reliability. How the data may or may not be used is a valuable output of the effort. Five technical areas were addressed.

Water Demands

Significant discrepancies in estimates of historical use were noted in the review of two sets of data on the Edwards Aquifer available from the Texas Water Development Board and the United States Geological Survey. The difference led to questions about the estimates' accuracy, with the least amount of confidence in the irrigation use estimations. The data sets are included and compared in the report.

The Panel also addressed water needs for instream flows, springflows, and bays and estuaries, but noted that little technical information existed to quantify those needs. The Texas Water Development Board is the only source for projections of future water use. Their projections extend to the year 2040 and are included in the report.

Sources of Supply

Technical reports addressing reservoirs, recharge, desalination, reuse, and aquifer storage and recovery projects were researched for information on amounts and cost of water available from sources other than the Edwards Aquifer. Both existing and proposed projects were included. An attempt was made to compare all of the identified supply sources on a consistent unit cost basis. Adjustments were made for estimates calculated in different years.

Earlier estimates failed to take into consideration environmental costs, different levels of effort in estimating

(continued)

Readers Reveal Likes & Dislikes

In the August edition of *The Water Source*, a reader survey was included so that you would have an opportunity to offer feedback on the quality and content of the publication. *The Water Source* newsletter was created in 1989 to provide a forum for discussing critical water issues, as well as the various programs of the Edwards Underground Water District. It has evolved and expanded over the last three years. Guest columnists have appeared in several issues, and more than just District programs are covered.

Your comments and suggestions were appreciated and will enable the editorial staff to continue to upgrade the publication and reflect your interests. For example, the survey revealed you wanted to see more water related issues covered. Gregory Rothe's article summarizing the South Central Texas Technical Data Review Panel's efforts addresses a major water issue—the lack of a consistent data base on the Edwards Aquifer for use in planning. From the editorial staff of *The Water Source,* thanks to everyone who took the time to complete the survey. Close to 10% of our readers responded, revealing the following results:

Overall, the content of the articles is:

36%	above average
30%	excellent
26%	good
6%	average

I find the articles (allowed more than one response):

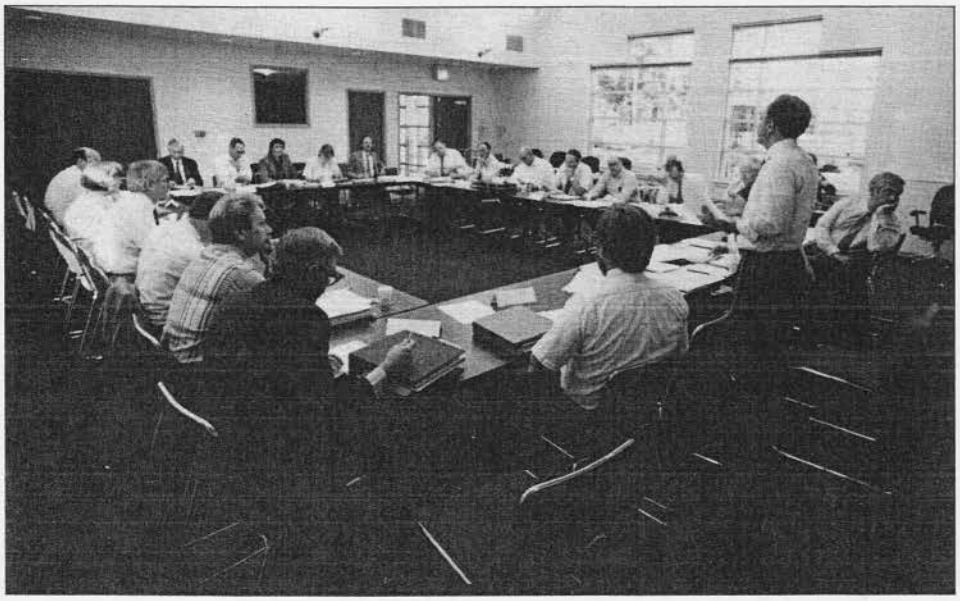
82%	interesting
38%	fine the way they are
16%	have too little information
12%	too general
3%	too technical
2%	boring

Overall usefulness of published information:

54%	very good
20%	excellent
20%	average
5%	fair

Do you feel you have learned more about the Edwards Aquifer after reading The Water Source?

93%	yes
5%	no



John Folk-Williams moderated seven sessions of the South Central Texas Technical Data Review Panel. (See story on cover)

Do you feel you have learned more about what the EUWD does after reading The Water Source?

83%	yes
12%	no

80% responded that they wanted to see more water related issues covered.

32% wanted more guest columnists.

Selected comments and suggestions:

"More about water economics: cost effective use for maximum value to the region"

"A historical approach and explanation of the jurisdictional boundaries and functional distinctions of the EUWD, San Antonio River Authority, etc."

"Water history of Texas, and water rights disputes in other states"

"Data updates: regulatory activity and actions taken, effectiveness of water conservation efforts"

"Kudos for conservation—an honor roll for communities and other users"

"More technical information on the aquifer"

"Highlights on workers, scientists and their jobs"

"Information on different formations in the Edwards Aquifer"

"What is being done to combat contamination hazards"

"Relationship of bays and estuaries."■

Teachers Use Water Wizards to Help Students Understand Edwards Aquifer

The Edwards Underground Water District (EUWD) has developed Water Wizards, the first in a series of curriculum supplements for schools in the Edwards Aquifer region. The curriculum has been distributed to all public school districts and private schools in Bexar, Comal, Hays, Medina and Uvalde counties, and is part of the District's comprehensive education program.

Water Wizards is an interdisciplinary collection of activities created to provide 4th-6th grade students with a greater understanding of water and the Edwards Aquifer. The emphasis of the lessons is hands-on, minds-on activities, with maximum student involvement and minimum teacher direction.

Residents of the Edwards Aquifer region are becoming increasingly aware that management of the resource is necessary and important. How people use water from the Edwards Aquifer is directly related to how well they understand the nature and characteristics of the resource itself.

Cinde Thomas-Jimenez, Education Coordinator for the District, wrote and compiled the curriculum. "The Edwards Aquifer is a subject which only recently has become an issue, so many teachers don't have a background knowledge of the aquifer's complexities and dynamics." Jimenez continued, "We want to provide high quality information and materials to teachers so they can lead activities for their students which will explain how the aquifer works and its importance."

Providing students with information about the physical and chemical properties of water, the hydrologic process, the geologic and hydrologic dynamics of the Edwards Aquifer, and the social implications of its use will help them make wise decisions regarding water management.

The Water Wizards curriculum supplement compliments the EUWD's goal of fostering a water conservation ethic among present and future water users, which is the cornerstone of the District's overall conservation effort. For more information or a list of education materials, contact the Edwards Underground Water District Education Department at (210) 222-2204 or (800) 292-1047. ■

Data *(continued)*

costs and yields, and varying methods for calculating yields. These all detracted from an objective comparison of unit costs. Of special note is the difference in reservoir project yield that can occur, depending upon the operating conditions imposed for a particular project evaluation.

Reductions in Use

The Texas Water Development Board has the only comprehensive regionwide projection of reductions in future use that can be expected from conservation measures. The projections cover a planning period up to the year 2040. These reductions range up to approximately 15% of total use for most cities, and do not consider cutbacks in use from more stringent measures that might be instituted during drought conditions or shortages due to water demand. Other conservation projections made by the Texas Water Commission and the 1988 Regional Water Management Plan for the Edwards Aquifer were reviewed. Comparisons were made of expected savings from the various projections.

Natural Recharge

One of the most important elements in determining how the aquifer will be used is natural recharge. Recharge is the primary source of water for the region. Methodologies for estimates, and the resulting figures, were researched and compared in this section of the report. Significant differences exist between data sets. More important are the uncertainties within each data set reported by technical staff responsible for preparing recharge estimates—deviations as high as 25% for the average annual recharge, and as high as 50% for any particular annual estimate.

Water Quality

This section of the report addresses water quality only in terms of potential restrictions in use, with emphasis on the Edwards Aquifer. Specifically, information is provided on known water quality problems and the freshwater/saline-water interface. Additional material provided to the Panel described major sources of water quality data, but did not include the actual data base.

Future Studies

The final section of the report is a list of technical areas Panel members recommended for further study to complete the technical record for future planning efforts by the region's policy makers. Better techniques on natural recharge estimates and springflow augmentation are examples of areas which made the list.

It is important to note that the South Central Texas Technical Data Review Panel effort did not have an "action agenda" for settling the Edwards Aquifer dispute. Rather, it was a cooperative effort of technical representatives of the region's water interests who had a genuine concern in constructing a resource document of technical information to be used as a foundation for future negotiation, legislation, or regulation relative to the Edwards Aquifer and the entire region. ■

News Briefs...

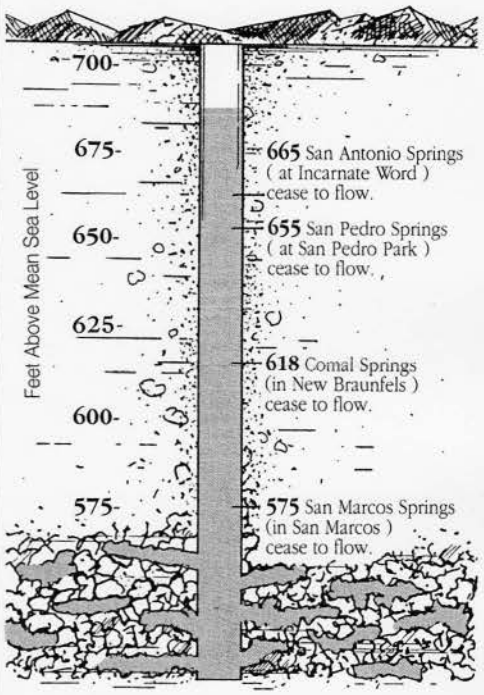
☐ This fall, water conservation moves indoors. The average person uses 163 gallons of water a day, and 65% of that amount is used indoors. The Edwards Underground Water District is conducting a promotion which targets the homeowner. The goal is to give away 2000 low flow (water efficient) showerheads through selected radio stations in the Edwards Aquifer region. Participating stations include WOAI-AM and KSMG-FM (Magic 105) in Bexar County, KGNB/ KNBT in Comal County, and KSPL-AM in Hays County. The stations are running promotional spots which discuss the benefits of water conserving fixtures, as well as giving away cards which outline other ways to "Be WaterTight" indoors.

☐ As part of its Edwards Aquifer Preservation Program, the Edwards Underground Water District has recently completed the construction of a protective gate over a cave in northeast Bexar County. Protecting the cave was a high priority for the District due to its location in a recharging streambed adjacent to a newly developed subdivision. The gate will protect the recharge feature while allowing for unimpeded recharge to the aquifer. Negotiations are underway to obtain a protective easement on the property surrounding the cave, thereby establishing a buffer which will help protect water quality of runoff from nearby development.

☐ "Investigation of the Fresh/Saline Water Interface in the Edwards Aquifer in New Braunfels and San Marcos, Texas" has been published. Two well transects were drilled to collect hydrogeologic data regarding the interface between the fresh and saline zones of the Edwards Aquifer, as well as monitor the movement of the interface over a long period of time. The comprehensive report presents the data and resulting anaylsis from each site and lays a technical foundation for the long-term monitoring of the fresh/ saline interface, as well as for other hydrogeologic studies regarding the Edwards Aquifer. ■

The Water Level

This reading reflects the daily high artesian water elevation at the Bexar County Edwards Aquifer Index Well.



Current Status: On October 22, 1992 the water elevation was recorded at 686.6 Average for October is 661.5

THE WATER SOURCE

The Water Source is published quarterly by the Public Information Office of the Edwards Underground Water District, 1615 N. St. Mary's, San Antonio, Texas, 78212. 512/222-2204 or 800/292-1047

Contributors to this issue:

Editor: *Carolyn Eagle;* Guest Columnist: *Gregory Rothe, P.E.;* Photographer: *John Dyer*

EDWARDS UNDERGROUND WATER DISTRICT

1615 N. ST. MARY'S ~ P.O. BOX 15830
SAN ANTONIO TEXAS 78212

FORWARD & ADDRESS CORRECTION

BULK RATE
U.S. POSTAGE
PAID
PERMIT # 771
SAN ANTONIO
TX 78212

THE WATER SOURCE

Winter 1992

Pirates Invade Edwards Aquifer Region

Ahoy! Pirates invaded 80 schools in the Edwards Aquifer region this fall, teaching students the importance of preserving water *quality*, not just quantity. The live theatrical presentation, "The Water Pirates of Neverland," was sponsored by the Edwards Underground Water District and featured a cast of characters played by Dan Workman and John Mikelson from Minnesota-based Small Change Original Theatre. There are two versions of the play - one for kindergarten through third grades, and another for grades four through six.

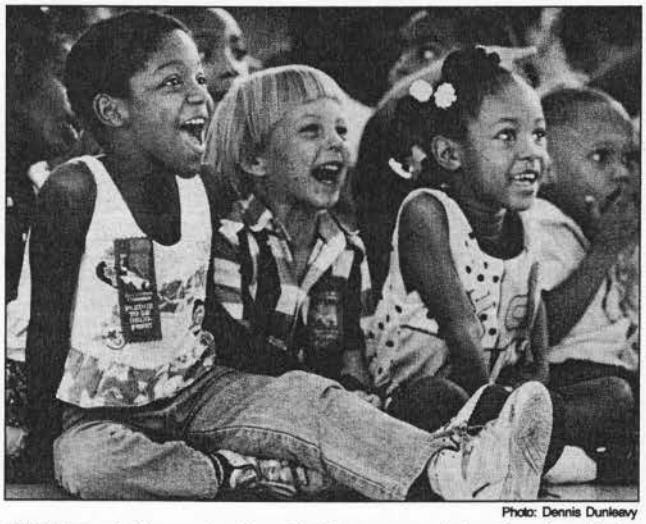


Photo: Dennis Dunleavy

Children at Henry A. Carroll Elementary School enjoy "The Water Pirates of Neverland."

The younger students met Captain Hook, who has been polluting all of his adult life and couldn't care less. Hook's highly educated nephew, Nobby, is alarmed by his uncle's lack of knowledge about water and the hazards pollution can cause. Through active participation, Hook and his followers learn how water makes its way underground. With the help of some water creatures, Nobby goes about setting his uncle straight on the dangers of pollution by explaining why we need to be careful with the earth's water supply.

The older students are also transported to Neverland where Captain Doorknob and his crew of slime pirates are destroying the fresh water supply. But famous oceanographer and renowned water expert Pierre Cleauseau comes to the rescue! After a quick duel, Captain Doorknob listens to what Pierre has to say. To complicate matters, the two are comically harassed by Pierre's old nemesis, Squishy the Meddling Great Green Octopus. The important lesson they learn is that a lot of fresh water comes from beneath the ground, and groundwater pollution is something everyone needs to work on.

The District offered the theatrical presentation as an alternative method of teaching from traditional lesson plans. The focus on water pollution compliments a renewed concentration on water quality. Cinde Thomas-Jimenez, EUWD Education Coordinator, agrees. "In the past, we've focused on water quantity, putting a lot of emphasis on water conservation." She continued, "Teachers and students are familiar with the how's and why's of conservation, but preserving the aquifer's water quality is a more difficult concept." Record rainfall last winter and spring provided the impetus to focus on water quality. "With water levels so high, we saw an opportunity to make people aware that the water in the Edwards Aquifer could become contaminated."

The play introduces children to environmentally sound concepts and gets them excited. The actual learning takes place back in the classroom where teachers reinforce the play's message.

"The Water Pirates of Neverland" is part of the EUWD's multi-level, multi-faceted, in-school effort which targets the special needs of teachers and students alike. For a brochure listing the District's information and education materials, call (210) 222-2204 or (800) 292-1047 during regular business hours. □

■After seeing "The Water Pirates of Neverland," students at Leon Springs Elementary School wrote letters to Nobby, Captain Hook's highly educated nephew. The following are some excerpts from their letters:

"My family will try very hard to recycle as much as we can. One thing I learned is that trash could sink underground and go into our underground water supply. I would not want to drink dirty water."

Your friend, Chris

"I will try to convince my family to recycle more. I won't pollute the water, and try not to pollute the air with car exhaust. Thanks for teaching us so much about pollution and why it is so important to recycle."

Delaney Hamilton

"To make the earth safer, we should make products that won't pollute the water. Polluting will just leave less water which we can conserve."

Your friend, Bradley

The Edwards Underground Water District also makes in-class presentations around the Edwards Aquifer region. The following are from some of our "pen pals":

"Thank you for coming to our school to tell us about the Edwards Aquifer. Please come again. I would like you to know I'M A WATER TIGHT KID!"

Teresa McPike

"I learned a lot about the Edwards Aquifer. I also learned about using water and how to save it. Maybe some day I will become a geologist."

Kathy Skloss

■Toilets are the largest users of water in the home, and account for up to 90 percent of water use in some businesses. Residents and businesses in Windcrest are now eligible to receive a $50 rebate if they replace an existing toilet with an Ultra Low Flow (ULF) model, thereby saving a considerable amount of water. The plumbing rebate program is sponsored by the Edwards Underground Water District and the Bexar County Water Control and Improvement District (WCID) #10, which services the city of Windcrest.

ULF fixtures use 1.6 gallons per flush, while older units use between 3.5 and 7 gallons per flush. An average three-person household using a ULF toilet rather than a five gallon per flush model can save approximately 15,000 gallons of water annually.

According to Joe Brooks, President of WCID #10's Board of Directors, "Windcrest is an older suburb, and many of the homes have older fixtures. Our goal is to save water, and residents can save money." Brooks continued, "The best way to encourage residents to replace their toilets is to provide an incentive."

This is the second plumbing rebate program sponsored by the Edwards Underground Water District, following the success of a program launched in Leon Valley last August. In the first four months, 105 fixtures have been replaced in Leon Valley, saving over 215,000 gallons of water a day.

The rebate programs are part of the District's ongoing commitment to work with local governments to protect the water resources of the region. For more information, contact the Division of Planning at (210) 222-2204 or (800) 292-1047.

■Despite below average rainfall from July through October, heavy spring rains, coupled with above average rainfall last month has left the aquifer in good shape. On November 30, the water level in the Edwards Aquifer was recorded at 692 feet above mean sea level. The historical average water level for the month is 664.6 feet above mean sea level.

EDWARDS UNDERGROUND
WATER DISTRICT

1615 N. ST. MARY'S ~ P.O.BOX 15830
SAN ANTONIO TEXAS 78212

THE WATER SOURCE

A QUARTERLY PUBLICATION OF THE EDWARDS UNDERGROUND WATER DISTRICT

February 1993

Water Wars:
Resolving Disputes in the West

John Folk-Williams, Partner
Western Network

Editor's Note: John Folk-Williams is an environmental mediator who has been involved in the resolution of several water problems in the West. He was selected by the Special Legislative Committee on the Edwards Aquifer in 1990 to mediate a solution for equitable management of the resource, and is familiar with the dispute which still surrounds it. As the Texas Legislature convenes in 1993 and once again grapples with the issue of managing the Edwards Aquifer, Folk-Williams offers some food for thought drawn from his experiences in mediating other water disputes.

The Edwards Aquifer region of south central Texas is one of many areas of the West facing complex water problems that have been sources of conflict for decades. As a mediator, I am often asked to compare a dispute I am working on with those in other parts of the country. The Edwards Aquifer situation is unique, but there may be some general lessons that can be learned from experience in resolving complex water disputes in other states.

Referred to for years as the "Middle East" of western water disputes was the problem of the Truckee River, a closed surface water basin that flows from Lake Tahoe in California to Pyramid Lake in Nevada. Involved in this dispute were the lake levels of Tahoe, the water supply needs of the booming Reno-Sparks area, major diversions for irrigated agriculture, the future of an Indian reservation, endangered species, wetlands...and more. The parties tried to overcome each other through litigation that lasted decades and tested every possible legal theory. The result was deadlock. When the costs and futility of continuing that strategy finally became clear to all, everyone agreed to a complex compromise mediated by a U.S. Senator that required the approval of Congress as well as local governments.

Progress has been made on several other long-standing water disputes. In Montana, Idaho, New Mexico and southwest Colorado, states, Indian tribes and non-Indian water users have worked out negotiated settlements in difficult water rights cases. The Gila River in Arizona is the subject of a massive adjudication, involving 60,000 claims to water rights, including those of several Indian tribes. There have been negotiated settlements resolving parts of this case; other aspects will remain in adjudication for years.

Participants in these and other cases have cited several factors that helped them reach their goals. One factor is the very definition of the problem to be solved. The various parties to these cases bring different needs to the table; they do not want the same thing and do not view the problem in the same way. But in order to reach a negotiated solution, the problems to be solved must be defined in a way that makes sense to all sides.

"Without the broad-based understanding of the people at large, there is little chance for acceptance of any agreement that requires major new investments, and most water agreements do."

We once worked on a case in Wyoming that looked at first sight like an

(continued)

What Springs Up Must Flow Down

Downstream from the Edwards Aquifer

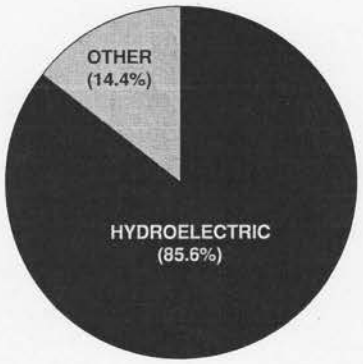
Michael J. Albach, M.S. Natural Resources Management
EUWD Division Manager of Planning & Environmental Management

Demands for water downstream of Comal and San Marcos Springs are significant and varied. Springflow tends to buffer the effects of drought and diminished flows in the Guadalupe River, thus helping to meet those demands. Downstream water users and their representatives are playing a prominent role in the ongoing controversy over management of the Edwards Aquifer. Their position is simple. They seek to maintain optimal flow from Comal and San Marcos Springs in order to meet current demands within the river basin under less than optimal meteorological conditions (i.e. drought). Their message is clear. Any meaningful management plan must consider the needs of water users, from the springs down to the coast.

Historically, Edwards Aquifer springflows have contributed to meeting downstream water rights, bay inflows, and recreation activity, and to maintaining natural vegetation and wildlife in the Guadalupe River and its tributaries fed by the springs—the San Marcos and Comal Rivers. Flows from San Marcos and Comal Springs constitute a substantial portion of Guadalupe River baseflow, some of which is currently diverted by downstream users with the remainder flowing into San Antonio Bay. The average amount of Guadalupe River baseflow attributable to springs is 325,000 acre feet, or 25% of average river flow. However, in 1956 at the peak of an extended drought, springflow accounted for 75% of Guadalupe River flow, albeit a much diminished flow. The reason that springflow makes up such a large percentage of river flow during a drought is that springs are fed by water previously accumulated in aquifer storage, whereas the contribution from rainfall drops immediately in response to drier weather conditions.

Water users in the Guadalupe River basin have a keen interest in this springflow and the reason is clear. Currently issued, there are approximately 420 water right permits in the basin authorizing the diversion of over six million acre feet of water from the Guadalupe River and its tributaries. Though this seems large, over 94% of these diversions are non-consumptive. In other words, approximately 5.6 million acre feet of permitted diversions are intended to be used, reused, recycled, treated and then discharged back into the river. In fact, over 5.2 million acre feet of water is permitted to hydroelectric generators (see graphic), far more water than the average flow in the river. This is possible because the same river flow passes through a dozen sets of turbines on its way to the Gulf of Mexico.

Total Water Rights by Use in the Guadalupe River Basin
(Total = 6,181,259 acre feet)

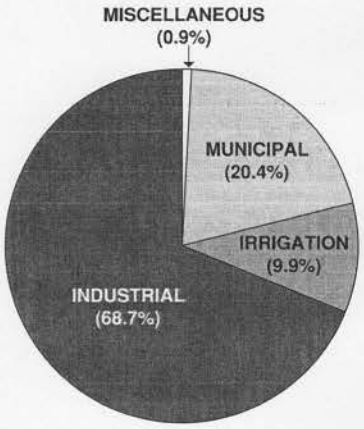


Source: Technical Data Review Panel of South Central Texas

The remaining permitted diversions are for consumptive uses—uses that do not provide return flows. Consumptive uses include agricultural irrigation and some portion of municipal and industrial diversions. All told, consumptive use permits amount to approximately 400,000 acre feet which is about 6% of the sum of all permits in the basin.

Irrigation water rights in the basin total 89,000 acre feet distributed among 262 permits. Actual use for 1989, the last year for which records for all uses are available, amounted to 55,800 acre feet applied to 10,500 acres. Irrigated crops include rice, corn, hay, oats, sorghum and pecans. Among the 46 municipal permittees in the basin are the cities of New Braunfels, Seguin and Gonzales. Of the 182,000 acre feet permitted for municipal use, approximately 18,600 acre feet was actually used in 1989. In general, 70% of water used for municipal purposes is returned to the Guadalupe River or its tributaries as treated wastewater effluent and thus, is not considered consumptively used.

Non-Hydroelectric Water Rights by Use in the Guadalupe River Basin
(Total = 892,674 acre feet)



Source: Technical Data Review Panel of South Central Texas

The last major water rights category is industry. Chemical industry giants such as E. I. Dupont deNemours, Union Carbide, GAF Corporation, Gulf Oil Chemicals Company and others are authorized to divert approximately 600,000 acre feet from the Guadalupe. Of this amount, however, only 22% is consumed in industrial processes with the remainder returned to the river. In 1989, slightly more than 550,000 acre feet were diverted from the Guadalupe River for industrial use.

(continued)

What Springs Up *(continued)*

Poorly understood, but no less important, is the benefit of fresh water inflow from Edwards Aquifer springs to endemic flora and fauna of the Guadalupe River, its tributaries, and the San Antonio Bay system. From springhead to estuary, springflow sustains an array of biological communities, some of which are commercially significant. Total business associated with sport and commercial fishing in the Guadalupe estuary exceeds $100 million and sustains nearly 3,000 jobs. The amount of fresh water inflow necessary to establish salinity gradients essential to reproduction, growth, and development of marine species in the estuary is still under study and a source of debate. But some studies suggest a recommended annual inflow of approximately 1.5 million acre feet.

Potentially the most controversial demand for springflow is for the protection of endangered species habitat. Two endangered fish, an aquatic plant, and a salamander inhabit San Marcos River immediately downstream of the springs. One species of endangered fish also inhabits a small lake at Comal Springs. Few definitive studies to quantify required flows for these rare species have been conducted. However, one study suggests that one third of the historical average flow, approximately 110,000 acre feet, is necessary to maintain the biota at both springs.

The job of balancing demands for Edwards Aquifer water with the needs of downstream users is frought with difficulty and emotion. But the job is no less an imperative and one for which time is not an ally. ■

Water Wars *(continued)*

enforcement matter under the Safe Drinking Water Act. The parties only made progress after the problem was re-defined as one of creating a new regional water supply system. That change of perspective enabled the parties to get over some long held hostilities relating to the original way the issues were approached and ultimately to agree on a comprehensive solution.

Settlement of long-standing disputes about water also requires incentives, both carrot and stick, that can motivate the parties to settle. It can take a long time before the incentives equal or surpass the disincentives (like cost or political unacceptability) that make litigation and other forms of resolution look more attractive than voluntary negotiation.

Participants have talked about the need for good faith in the negotiations. So long as people feel they are being manipulated out of their resources, they can hardly engage in honest bargaining. It is not necessary that the parties trust each other completely. They have to ensure that the agreement itself provides the safeguards that protect against bad faith manipulation.

These cases also emphasize the importance of keeping the public informed of what is going on. It is the public that ultimately pays the costs and receives the benefits of any settlement about water. It is also the public that may be called upon to ratify an agreement, either directly through a referendum or indirectly through legislative approval. Many agreements fail this crucial test.

One answer to this problem is to ensure that the public is fully informed about the risks and benefits of proposals for resolution. Without the broad-based understanding of the people at large, there is little chance for acceptance of any agreement that requires major new investments, and most water agreements do.

Greater public exposure of the issues in forums that are free of the pressure of impending elections and propaganda might prove important in preparing the residents of the region to make careful judgements about what they are willing to pay for and live with. Experience has shown that there is no "right" way to settle such problems. Each region must craft its own solutions, and it will have a better chance of doing so, as many cases suggest, with broad public involvement and support. ■

News Briefs

☐ The Edwards Underground Water District has launched leak detection surveys of the water distribution systems in the cities of Uvalde and Schertz. The City of Uvalde serves almost 15,000 customers and pumps over one billion gallons of Edwards Aquifer water annually; Schertz serves 10,000 customers and pumps over 650 million gallons. Both surveys are expected to last several months.

Unseen leaks in water distribution systems can waste an enormous amount of water. Nationally, these hidden water wasters account for water losses ranging from 10-40%. The leak detection program is offered at no charge to cities and water purveyors within the five counties which make up the Edwards Aquifer region. The objective is to locate leaks in buried water pipes, valves and hydrants and to assist the utility in reducing "unaccounted for" water losses. Since the District initiated the leak detection program in 1989, over 3,000 leaks have been pinpointed, saving over 4.1 million gallons of water a day.

☐ In 1992, the Edwards Underground Water District initiated a comprehensive study of the water resources in north Bexar County and the adjacent areas. Preliminary findings from the data collected to date indicate that of the three zones which make up the Trinity Aquifer, the primary groundwater source for the area, the Middle Trinity Aquifer contains the best water quality.

Hydrogeologic data indicates water level drawdown of the Middle Trinity Aquifer in the Fair Oaks area of approximately 50 feet and extending laterally four to five miles. Well pumpage is currently less than recharge in the study area; however, natural recharge is hindered by low values of transmissivity (the capacity of an aquifer to transmit water) that greatly reduce the amount of water that is available.

(continued)

News Briefs *continued*

Another conclusion reached from the hydrogeologic data is that the Trinity system is a leaky artesian aquifer, allowing for water movement between zones of lesser water quality. This would suggest that continued development in the area could result in a decrease in water quality in the Middle Trinity Aquifer. Next, data will be collected to analyze the surface water resources in the area, with the study scheduled to be completed by September.

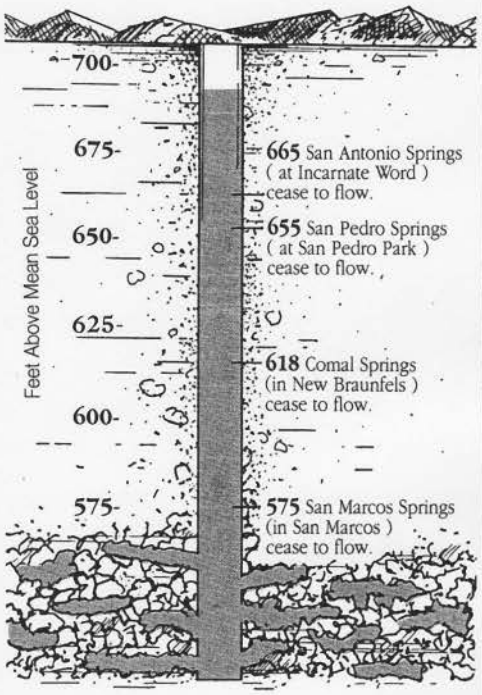
☐ The Edwards Underground Water District and Universal City are sponsoring a plumbing rebate program which encourages residents and businesses to replace existing fixtures with those that are water efficient. Studies show that approximately 50-60% of residential water use occurs inside the home. Toilets use more water than any other fixture in the home, so improving the efficiency of this fixture can significantly reduce water use.

Residents and businesses in Universal City are eligible for a $50 rebate if they retrofit an existing toilet with an ultra low flow model. The plumbing rebate program funded by the District will provide $30,000 for the replacement of 600 fixtures. This is the third rebate program in the Edwards Aquifer region, and follows the success of programs initiated in Leon Valley and Windcrest. Since August, 115 fixtures have been replaced in Leon Valley, and 25 have been retrofitted in Windcrest, which entered the program in December, resulting in a savings of over half a million gallons of water a day.

The plumbing rebate program is part of the District's commitment to work with local governments to protect the water resources of the region. For more information, contact the Division of Planning during regular business hours at (210) 222-2204 or (800) 292-1047. ■

The Water Level

This reading reflects the daily high artesian water elevation at the Bexar County Edwards Aquifer Index Well.



Current Status: On January 27, 1993 the water elevation was recorded at 690.7. Average for January is 668.

THE WATER SOURCE

The Water Source is published quarterly by the Public Information Office of the Edwards Underground Water District, 1615 N. St. Mary's, San Antonio, Texas, 78212. 210/222-2204 or 800/292-1047

Contributors to this issue

Editor: *Carolyn Eagle;* Feature Articles: *Michael Albach;* Guest Columnist: *John Folk-Williams*

EDWARDS UNDERGROUND WATER DISTRICT

1615 N. ST. MARY'S ~ P.O. BOX 15830
SAN ANTONIO TEXAS 78212

FORWARD & ADDRESS CORRECTION

BULK RATE
U.S. POSTAGE
PAID
PERMIT # 771
SAN ANTONIO
TX 78212

Recycled Paper

THE WATER SOURCE

A QUARTERLY PUBLICATION OF THE EDWARDS UNDERGROUND WATER DISTRICT

May 1993

Oil & Water:
Superior Water Quality & Urbanization on the Recharge Zone – Can They Mix?

Philip Farrington, M.S. Community & Regional Planning
EUWD Water Resources Planner II

Editor's Note: May 3-9, 1993 is National Drinking Water Week—a nationwide campaign sponsored by the American Water Works Association (AWWA). As part of this annual celebration, citizens are urged to conserve water, protect it, and get involved in water-related issues in their communities. Locally, the Edwards Underground Water District will join the AWWA in encouraging citizens of the Edwards Aquifer region to help preserve and protect the resource. Currently, water from the Edwards Aquifer surpasses all federal drinking water standards, but due to the unique nature of our aquifer, it can become easily contaminated. Stewardship of the Edwards Aquifer requires the active involvement of all aquifer users. Collective actions do make a difference.

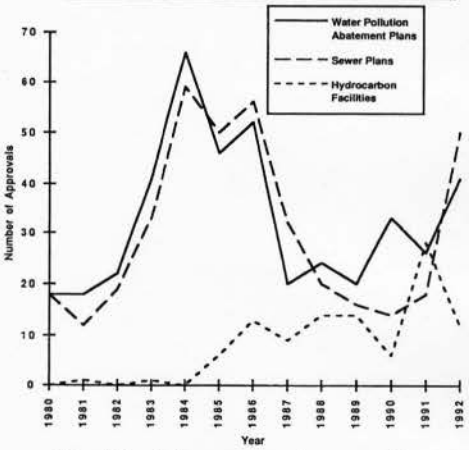
Development is the engine of economic growth that spurs job creation and greater opportunities for us all. However, when urban development occurs on the sensitive Edwards Aquifer Recharge Zone, there is an increased threat of contaminants harming our sole source of potable water and, potentially, averting future economic opportunities.

Generally, water quality can be degraded by either point source or non-point source pollution. Point source contaminants originate at identifiable discharge points, such as a leaking gasoline storage tank. Non-point source (NPS) pollution enters stormwater from diffuse sources, such as fertilizer and pesticide runoff from residential and commercial applications, as well as automotive oil and grease from streets and parking lots.

As urbanization encroaches on the recharge zone, the risk of degrading our water's quality from both point source and NPS pollution increases. Watersheds undergoing the transition from rural to urban land uses become unstable, yielding greater sediment and pollutant loadings in surface runoff.

In Bexar County particularly, the recharge zone is poised for explosive development as the economy rebounds. Figure 1 illustrates development growth curves as expressed in approved Water Pollution Abatement Plans, sewer plans and hydrocarbon storage facilities. These approvals are based on filings required for recharge zone development through the Texas Water Commission's "Edwards Rules," which govern activities on the recharge and transition zones. The chart shows recharge zone development growth during the real estate boom years of the mid-1980's and the incipient boom of the 1990's.

Figure 1:
State Approvals for Development on the Recharge Zone in Bexar Co.: 1980 - 1992



The District's concern is not with development per se, but with its location on the fragile recharge zone. Here, caution must be taken in the type of development, the manner in which it is performed, and in its intensity. The Edwards Aquifer is renowned for its ability to rapidly replenish itself through the highly fractured and permeable limestone outcrop that characterizes the recharge zone. These same geologic

(continued)

Studies to Help Unlock Mysteries of the Edwards Aquifer

Robert Bader, B.S. Geology
EUWD Division Manager of Field Operations

Intelligent management decisions concerning the Edwards Aquifer can only be made if pertinent data concerning the total water resource is available to decision makers. With impending management and regulation of the Edwards Aquifer, it is critical that the amount of water available for use be determined. Information needs include data for determining the maximum recharge potential and the maximum amount of water that can be safely withdrawn from the aquifer.

Studies Show New Boundaries for Saline Water

The current boundaries of the Edwards Aquifer were established by the Texas Board of Water Engineers (now the Texas Water Commission) in 1957 based upon available information. The southern boundary of the Edwards Aquifer is an arbitrary line of "bad water" which marks the transition between water of good chemical quality and saline water (1000 parts per million dissolved solids). This line is known as the fresh/saline water interface. The Edwards Underground Water District has completed two studies which redefine the boundary as shown on current maps. The studies were prompted by concern and speculation over possible movement of saline water into the fresh water portion of the aquifer during periods of low water level conditions.

In San Marcos and New Braunfels, the study revealed that saline water is much closer to city supply wells and springs than was previously known. Data was collected by drilling four wells in New Braunfels and three in San Marcos near the transition zone between good quality water and saline water. In San Marcos, the saline zone was found to be within 300 feet of Aquarena Springs, significantly changing the location of the fresh/saline water interface as previously reported. Site specific information was collected, establishing a technical foundation for further hydrogeologic studies of the Edwards Aquifer. In addition, the wells will provide a means for long-term water quality monitoring to detect any movement of saline water into the fresh water zone.

In another study, geophysical logs from exploratory oil and gas wells were used to better define the fresh/saline water interface between Uvalde and San Antonio. Data such as rock color, information indicating lost circulation and/or caverns, and reports of fresh water on well tests supplemented water quality parameters derived from geophysical logs. Existing water quality data from several wells represented a high degree of correlation between calculated and measured results when used in conjunction with the logs.

The results of this study indicated that the fresh/saline water interface is irregular, both vertically and horizontally, and extends farther south than was shown in earlier studies. In southern Medina County, for example, the interface is now believed to extend into Frio County, contrary to the previously estimated location. The District is continuing its study of the fresh/saline water interface by conducting another log analysis study along the interface between Kyle and San Antonio. Results are expected by October, 1993.

The Edwards Underground Water District will use the data from all of these studies as it continues its efforts to increase supporting evidence which will accompany a formal request to the Texas Water Commission recommending the hydrologic boundary be changed to reflect the true location of the southern limit of the Edwards Aquifer fresh water zone.

Edwards Aquifer Storage Assessment Study

Experts agree that it is difficult to measure precisely how much water is in the aquifer because of the limestone's porosity and interconnected network of open caverns and microscopic pores, as well as extensive faults and fractures. The storage assessment study will specifically investigate the volume of water stored in the aquifer, and will include an estimate of how much water can be withdrawn.

The current estimate of water in the Edwards Aquifer ranges from 25-50 million acre feet, representing a difference of 100%. The figure was determined in the early 1980's by the United States Geologic Survey through estimations primarily derived from limestone core samples of eight wells across the aquifer region. A current study will examine 300-400 wells, as well as geophysical well logs, core analyses, field investigations, and computerized simulations to determine results.

The storage assessment study is scheduled for completion by October, 1993. It will yield a three-dimensional model that can more accurately characterize how the aquifer works and how it will respond to different hydrologic situations, such as periods of below average rainfall.

Study to Determine Sites for Measuring Recharge

The Edwards Aquifer is unique in its ability to replenish rapidly. Rain falling on the recharge zone impacts water levels across the entire aquifer. To more accurately estimate the quantity of groundwater recharge from the Edwards Aquifer, it is important that streamflow and rainfall gauges be strategically placed to reflect true conditions on the aquifer's recharge area.

(continued)

Board Elects New Chairman

The Edwards Underground Water District Board of Directors has elected Jo Ann De Hoyos as Chairman for a two year term. De Hoyos represents Bexar County, Precinct One, and is the first woman to serve as Chairman. De Hoyos is an attorney practicing mainly criminal juvenile defense and family law. She received her A.B. degree from Princeton University, and her J.D. degree from New York University School of Law. De Hoyos was elected to the 12-member board in 1989.

Other new board officers were also elected. Hays County board member Jerri Martin was re-elected Vice-Chairman. Harry Bishop, Hays County, was elected Secretary. Kenneth Ikels, from Comal County, was elected Treasurer. In addition, chairmen were elected to represent each county delegation. Jesse Zuniga will chair the Bexar County delegation; Jack Ohlrich, Comal County; and Frances Emery, Hays County. ■

Mysteries *(continued)*

Currently, there are 30 streamflow and 30 rainfall gauging sites in the Edwards Aquifer region. Their placement was dictated by convenience so that manual data retrieval was possible. Utilizing the latest technology, this study will determine the optimum streamflow and rainfall gauging sites along the recharge zone. Sites will be determined by examining records at existing gauging stations, topographic and geologic maps, National Weather Service data and other hydrologic data.

A second phase of the study will consist of outfitting sites with equipment that will electronically transmit data back to the District's offices. By transmitting data instantaneously, a more accurate and timely determination of the relationship between rainfall, recharge, water level changes in the aquifer, and the effect of springflow will help reveal how the Edwards Aquifer will respond to various hydrologic conditions.

Data from these studies will be added to the large body of information which already exists regarding the physical characteristics, hydrology, and uses of the Edwards Aquifer, providing a source of information to researchers, scientists and decision makers. Understanding the Edwards Aquifer is the key to its protection and preservation. ■

Oil & Water *(continued)*

attributes also mean that contaminants are not filtered through the recharge process, as they are in sand and gravel aquifers. As a result, increasing urbanization on the recharge zone can pose a legitimate threat to Edwards Aquifer water quality.

The negative relationship between urban land use and water quality is evident in new stormwater runoff regulations enacted by the Environmental Protection Agency. Anyone can confirm this relationship by viewing the rainbow sheen of engine oil and water on virtually any expanse of parking lot after a heavy rain.

Despite city and state standards for sewer infrastructure and underground storage tanks, there are still no site-specific water quality performance standards that developers on the recharge zone must meet. Existing regulations do not require either passive or structural water quality controls on land use. Examples of passive controls include:

- vegetative strips and buffers between development and recharging streams,
- set-back requirements from sensitive recharge features such as caves, sinkholes and streambeds,
- requirements for greater open space or limitations on the amount of paved surface for recharge zone developments.

Structural controls are engineered designs to treat runoff from development. These include:

- filtration basins designed to remove sediments and contaminants from the "first flush" of runoff,
- the use of berms to divert runoff or guard against sedimentation,
- and a host of construction and post-development facilities and practices which can reduce pollution potential.

Because of the dearth of water quality controls to mitigate the potential ill-effects of development on the recharge zone, the intensity of land use development is virtually indistinguishable from that not on the recharge zone.

While no single development is likely to cause irreparable damage to the aquifer in and of itself, the sum of additional pollutant loadings on an increasingly urbanized recharge zone could seriously degrade water quality at some unknown point in the future. The District has consistently called for amending the "Edwards Rules" to include an assessment of the *cumulative* impact of recharge zone development on aquifer water quality but, as yet, to no avail.

The drama surrounding management of the Edwards Aquifer has overshadowed water quality considerations while large-scale development on the recharge zone looms. For our economic future, the region needs growth and development, but for the future of our water supply, development on the recharge zone should be different from that done elsewhere. It is up to the beneficiaries of the excellent quality of water in the Edwards Aquifer - its users - to safeguard our bountiful resource. It is undoubtedly easier and less costly to *prevent* pollution or to hope that it will never occur than it is to treat it. ■

News Briefs

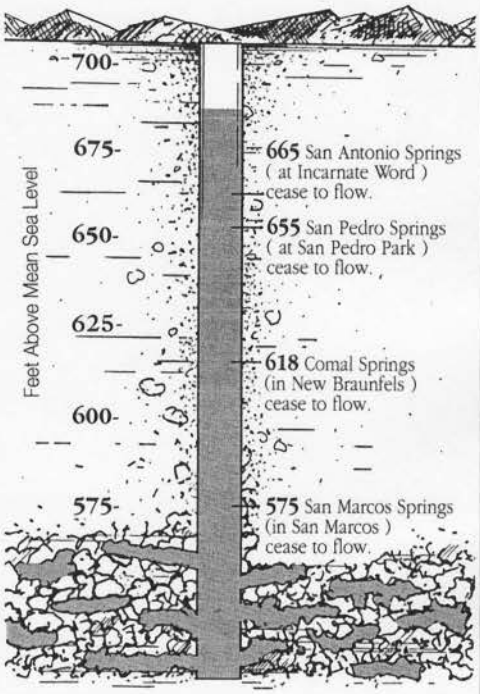
☐ The Texas Water Development Board (TWDB) has recognized the Edwards Underground Water District for its efforts to conserve the water resources of the state of Texas. The TWDB cited the District as a pioneer in the field of water conservation and noted its "outstanding contributions" in the areas of public education, public school programs and materials, leak detection, and water-efficient landscaping. District programs which were specifically mentioned included funding of plumbing fixture rebate programs, the multi-level, multi-faceted, in-school programs for teachers and students, and the videos on the Edwards Aquifer which are "not only informative, but also vividly display the beauty of a unique underground phenomenon that would not otherwise be visible."

☐ Six students won awards for their projects about the Edwards Aquifer at the Alamo Regional Science Fair in March. In the junior division, Jamie Baker was awarded first prize for her project, "Exploring and comparing what the most effective means of cleaning up oil spills on the limestone rocks of the Edwards Aquifer." Second place went to Melissa Waryas for her project, "Blue Thumb Basics: How does the Edwards Aquifer handle water pollution?" Both Baker and Waryas are students at Eisenhower Middle School. Jason McKinnie of Wood Middle School placed third for his project, "Do pH, iron, chlorine or hardness vary in different locations in the Edwards Aquifer?"

In the senior division, Matt Schroeder was awarded first prize for "Acid rain: The effects of nitric acid on limestone." Amy Waterman placed second with her project, "How effective are various soils in filtering contaminated water?" Third place went to Jeremy Henson for "Nitrates, nitrates, methemoglobinemia and the Edwards Aquifer: Is our source of drinking water harming us?" Schroeder and Hansen attend San Marcos High School. Waterman is a student at Boerne High School. ■

The Water Level

This reading reflects the daily high artesian water elevation at the Bexar County Edwards Aquifer Index Well.



Current Status: On April 21, 1993 the water elevation was recorded at 687.3. Average for April is 666.3.

THE WATER SOURCE

The Water Source is published quarterly by the Public Information Office of the Edwards Underground Water District, 1615 N. St. Mary's, San Antonio, Texas, 78212. 210/222-2204 or 800/292-1047

Editor: Carolyn Eagle.

Feature Articles: Phillip Farrington; Robert Bader

EDWARDS UNDERGROUND WATER DISTRICT

1615 N. ST. MARY'S ~ P.O. BOX 15830
SAN ANTONIO TEXAS 78212

FORWARD & ADDRESS CORRECTION

BULK RATE
U.S. POSTAGE
PAID
PERMIT # 771
SAN ANTONIO
TX 78212

Recycled Paper

THE WATER SOURCE

Summer 1993

Film Takes Viewers on A Journey Through the Edwards Aquifer

The Edwards Underground Water District's newest documentary film, "A Journey Through the Edwards Aquifer," is now available to the public. The film is the third in a series of educational documentaries about the Edwards Aquifer. Using a combination of live footage and animation, the film introduces elementary school students to a new and unfamiliar world: *groundwater*. Over 300 video copies of the film, as well as a teacher's guide specifically developed to accompany the film, have been distributed to elementary schools throughout the five county region of the Edwards Aquifer.

Animated characters Sal the Salamander and Teddy the Horned Toad leave the hot, dry climate of Brackettville in West Texas and discover they can travel to Sal's home in San Marcos through the Edwards Aquifer. They learn important hydraulic concepts along the way. Sal and Teddy's teacher/student relationship enables young viewers to learn about recharge, hydraulic pressure, artesian wells, and the unique species living in the springs of the Edwards Aquifer. The twelve-minute film was designed for elementary school students in grades three through five. "Knowledge and understanding of our natural environment is a major focus of schools throughout the nation," states Cinde Thomas-Jimenez, EUWD Education Coordinator. She continues, " 'A Journey Through the Edwards Aquifer' identifies one of the most precious natural resources in south central Texas and helps students understand the difficult concept of groundwater."

"A Journey Through the Edwards Aquifer" was directed and produced by Zimmerman & Associates. Copies are available for free loan by calling the District at (210) 222-2204 or (800) 292-1047. It is also available at HEB Video Central locations in San Antonio, San Marcos and Uvalde, and at Blockbuster Video locations in San Antonio, New Braunfels and San Marcos. □

■ Two new monitoring wells will be drilled in Medina and Uvalde counties, becoming part of the Edwards Underground Water District's observation well network. The network spans the six counties of the Edwards Aquifer region and enables District geologists to monitor changes in water levels and water quality in the aquifer.

The two wells will be drilled in the unconfined portion of the aquifer. Water in the Edwards Aquifer is under pressure because it is confined between layers of impermeable rock. However, there is a narrow portion of the aquifer along the southern boundary of the recharge zone which is unconfined. Wells in the unconfined area provide a more accurate assessment of water levels because they take a direct measurement from the water table. In addition, they do not react as much to aquifer stresses, such as recharge and pumping, as do wells located in the confined area. The new wells will provide additional geologic and hydrologic information on the Edwards Aquifer by expanding into undocumented areas.

■ The Edwards Underground Water District is conducting a leak detection survey of the water distribution system in Leon Valley. The City of Leon Valley serves 5,100 customers and pumps over 469 million gallons of Edwards Aquifer water annually. The survey is expected to last six weeks and is the 16th performed by the District since the program was initiated in 1989.

Unseen leaks in distribution systems can waste a tremendous amount of water. According to Susan Butler, Leon Valley's Assistant Director of Public Works, "Based upon our estimates, we may be losing up to 30% of what is being pumped." She continued, "Finding these hidden water-wasters will benefit not only Leon Valley, but the entire Edwards Aquifer region."

The EUWD's leak detection program is offered at no charge to cities and purveyors throughout the region. Sophisticated electronic equipment is used to identify and accurately pinpoint leaks in pressurized distribution systems. District leak detection technicians just completed surveys in Uvalde and Shertz, and to date, the program has saved over 4.3 million gallons of water a day. Currently, there are 17 purveyors or municipalities on a waiting list. The District's leak detection program will make a long lasting contribution to conserving water in the Edwards Aquifer because of its ability to identify this concealed waste of water.

■ Phase IV of a study which will determine optimum recharge enhancement sites in the Nueces River Basin is now underway. Three river basins comprise the Edwards Aquifer system: the San Antonio and Guadalupe, located in the east, and the Nueces, located in the west. Approximately seventy percent (70%) of the recharge to the Edwards Aquifer occurs in the western counties of Medina and Uvalde, with the headwaters of the Nueces River Basin contributing about 57% of the recharge to the aquifer.

The first phase of the study was conducted in 1990. According to results from Phase I which was conducted by HDR Engineering, Inc., the potential for increasing artificial recharge to the Edwards Aquifer can be significantly enhanced through the construction of additional recharge structures in the Nueces River Basin.

Phase I sought to determine how much water was available for recharge. The study determined that the average annual recharge to the Edwards Aquifer could be enhanced by as much as 35%. Phase II of the study addressed unrelated water supply options and was conducted independently by the City of Corpus Christi.

Phase III was completed in 1991 and evaluated the feasibility of 19 potential recharge enhancement sites in the Nueces River Basin. The results identified six projects (or sites) for additional study. Phase IV will include further refinement of technical information obtained in earlier phases. The six sites identified in Phase III will be evaluated in greater detail in order to maximize recharge enhancement while minimizing the cost of development and operation of any potential recharge dams.

Phase IV will be executed by HDR Engineering, Inc. and will include establishing criteria for site selection, prioritizing sites for permitting studies, and investigating geology, environmental and archeology factors for final site locations. Phase IV, part A, of the Nueces River Basin study is scheduled for completion in February 1993. Part B will focus on final analysis to advance each selected project to the permitting phase prior to actual dam construction. It is scheduled to begin in 1994.

EDWARDS UNDERGROUND
WATER DISTRICT

1615 N. ST. MARY'S ~ P.O. BOX 15830
SAN ANTONIO TEXAS 78212

THE WATER SOURCE

A QUARTERLY PUBLICATION OF THE EDWARDS UNDERGROUND WATER DISTRICT

October 1993

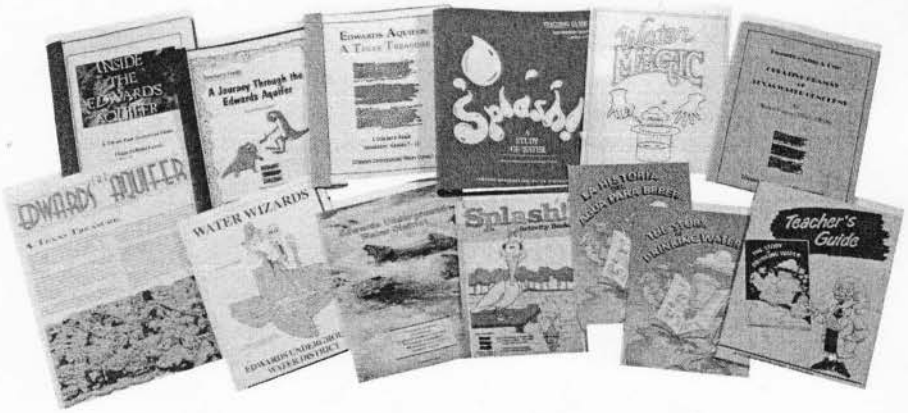
EUWD Education Program:
A Class Act

The Edwards Aquifer is a difficult concept to understand. To help educate those who will be affected in years to come, the Edwards Underground Water District has an extensive program to educate our children so they can help preserve this Texas treasure.

It begins each fall as teachers and students return to school. Early in the school year, the EUWD undertakes a massive distribution of educational materials to every public and most private schools in the five county Edwards Aquifer region. Last year, over 2,600 packets of information—which translates to over 93,000 pieces of information—were sent out. The distribution is supervised by Cynthia Thomas-Jimenez, EUWD Education Coordinator.

Thomas-Jimenez is a former classroom teacher. She began the direct-to-the-schools distribution program when she arrived in 1991. Her goal is to address the special needs of teachers and students by providing high-quality materials to support education programs and increase public knowledge of the Edwards Aquifer.

Available materials include curriculum supplements, teacher's guides for the District's video series, map/posters, stickers, educational comic books, bookmarks and much more.



The Edwards Underground Water District has an array of educational materials for ages six through adult.

Complementing the materials is a teacher training program offered each summer. Four elementary and two secondary workshops provide teachers the opportunity to learn in depth about the Edwards Aquifer. The workshops also give teachers the perfect opportunity to participate in many of the hands-on activities found in the materials. A separate field trip to various aquifer-related sites enhances the in-workshop lectures.

Is the program working?

Gloria Longoria teaches fourth grade at Kindred Elementary in the South San Antonio School District. Longoria has taught a unit on the Edwards Aquifer for years because she believes it is important for students to understand where the water in the tap comes from. This past summer she attended one of the teacher workshops offered at the EUWD. "Attending the workshop clarified a lot of things for me," states Longoria. "There were several aspects of the aquifer I didn't fully understand. For instance, I always knew there were sinkholes, but I didn't really know what they were."

Now, not only does Longoria know, but her students do too. One Monday she introduced her class to a three week unit on the Edwards Aquifer by

(continued)

Display Springs Up In New Braunfels

A new Edwards Aquifer/Comal Springs kiosk is located at Landa Park in New Braunfels.

Five-hundred thousand (500,000) people visit Landa Park in New Braunfels each year. Known for its beautiful scenery, the park is home to the largest springs in Texas–Comal Springs. The springs feed Landa Lake, which feeds the Comal River, which provides flow to the Guadalupe River. The source of all of this water is the Edwards Aquifer.

The culmination of two years of planning came to fruition in August when a three-sided Edwards Aquifer/ Comal Springs kiosk was installed at Landa Park. The new educational display is located next to the main spring orifice, and replaces a sign which simply listed the cubic feet per second discharging from the springs, as well as a dire prediction of when Comal Springs would go dry. David Whatley, Director of New Braunfels Parks & Recreation, actively pursued the development of a new display. "For years, people would stand at the head of the springs and want to know more. We didn't have the resources to build a display, and approached the Edwards Underground Water District. With their help, we now have something which gives visitors lots more information."

The kiosk illustrates the biology of the Comal Springs and River, as well as the importance of the springs to the City

(continued)

EUWD Education *(continued)*

transforming her door into a sinkhole. Everyone had to go through the sinkhole's whirlpool and spin through the door...including the principal. "The door generated lots of excitement and got others in the school thinking about it [the Edwards Aquifer]."

And her class is a testament to the success of her efforts. Robert learned how the aquifer worked. He knew water started in the drainage area, went into the aquifer in the recharge zone, and ended up in the artesian area. Daniel's favorite activity was building a model of the Edwards Aquifer in a clear plastic shoe box. Le Roy's favorite activity was the experiment where he watched vinegar dissolve the limestone. Since Le Roy knew that water dissolved limestone, he knew what caused a sinkhole, and also how caves were formed. The class enthusiastically reported that they told their parents and friends what they had learned.

Longoria used many of the materials available to her from the EUWD, including the *Water Wizards* curriculum, the video *A Journey Through the Edwards Aquifer*, the colorful map/ posters, and class sets of *A Story of Drinking Water*. She feels that having access to the materials developed by a former teacher is an asset. "These are excellent materials because they integrate many curriculum areas; not just science, but social studies, language arts, and math." She continued, "It's helpful to have someone who knows the process of teaching." Longoria has expanded her unit to include the water cycle and caves.

Is all this making a difference? According to Longoria, it is. "Not only are we reaching the children, but parents too." However, the true measurement of success will become evident in the future, as we see if our children truly are "water tight" adults. ■

Gloria Longoria's 4th grade class at Kindred Elementary School poses in front of their "sinkhole."

Edwards Aquifer Well Produces Fresh Water From Record Depth

Edwards Underground Water District geologists have found fresh water three miles south of the fresh water/saline water interface of the Edwards Aquifer, in an area previously considered to produce only saline water. "This is the deepest well producing fresh water from the Edwards Aquifer in this region," according to Robert Bader, EUWD Division Manager of Field Operations.

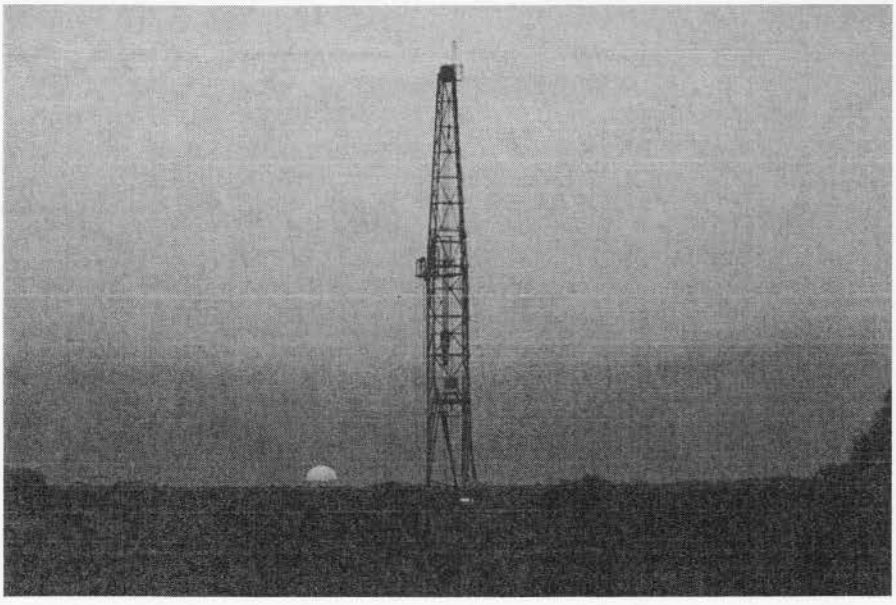
In July of 1993, the District completed a 3,400 foot observation well in south Medina County aimed at better defining the southern limit of the Edwards Aquifer's fresh water zone. The well was drilled after results from a study in which geophysical logs from exploratory oil and gas wells were used to better define the fresh water/saline water interface between Uvalde and San Antonio showed that the interface was irregular, both vertically and horizontally, and extended farther south than was shown in earlier studies *(see May 1993 edition of The Water Source)*. The location for drilling the well was chosen in an area several miles from any known wells producing fresh water from the Edwards Aquifer.

The new well confirmed speculation that the fresh water/saline water interface did indeed extend farther south than was previously mapped. The southern boundary of the Edwards Aquifer is an arbitrary line which marks the transition between water of good chemical quality and saline water (1000 parts per million dissolved solids). The current interface location was officially established in 1957 by the Texas Board of Water Engineers (now the Texas Natural Resources Conservation Commission).

"The new well confirmed speculation that the fresh water/saline water interface did indeed extend farther south than was previously mapped"

The observation well in south Medina County provides a means for long-term water quality monitoring to detect movement of saline water into the fresh water zone, as well as information on local water level conditions. It is the fourth in a series of projects designed to better define the transition area where Edwards Aquifer water changes from fresh to saline. The data and conclusions will be forwarded to the Texas Natural Resources Conservation Commission with the recommendation that the position of the interface be re-evaluated in light of the new data provided by this project. District geologists will continue to collect and evaluate new data to refine and improve understanding of the 176 mile-long southern boundary of the Edwards Aquifer.

A report summarizing the findings, entitled "South Medina County Observation Well Project 93-11" is available to the public. A copy may be obtained by contacting the EUWD's Division of Field Operations at (210) 222-2204. ■



Due to the depth of the Edwards formation an oil and gas rig was used to drill the new observation well in Medina County.

Display *(continued)*

of New Braunfels and downstream communities, showing how the springs affect everyone from industry to agriculture. The display introduces visitors to the Edwards Aquifer, and also presents the historical development of Landa Park.

According to Jack Ohlrich, Comal County Chairman of the District's Board of Directors, "These springs are the staff of life to our community. But most people don't understand that there are also thirteen counties involved in the Edwards Aquifer system." He continued, "I hope visitors will walk away from the kiosk with a better understanding of this precious resource." ■

News Briefs

☐ *Water Magic*, the second in a series of curriculum supplements developed by the Edwards Underground Water District, has been distributed to schools throughout the Edwards Aquifer region. It is an interdisciplinary collection of activities created to provide primary level (grades 1-3) students with a greater understanding of the importance of water and the Edwards Aquifer. The emphasis in all the lessons is on hands-on, minds-on activities, with maximum student involvement and minimum teacher direction.

The text was written and compiled by Cynthia Thomas-Jimenez, EUWD Education Coordinator. Rebecca Dowdy, a teacher with the Northeast Independent School District and Terry Fucles, with the San Antonio Independent School District, assisted in the publication's development.

Copies of *Water Magic* were sent to primary teachers via school districts in the five county region. For more information, contact the EUWD Division of Information & Education during regular business hours.

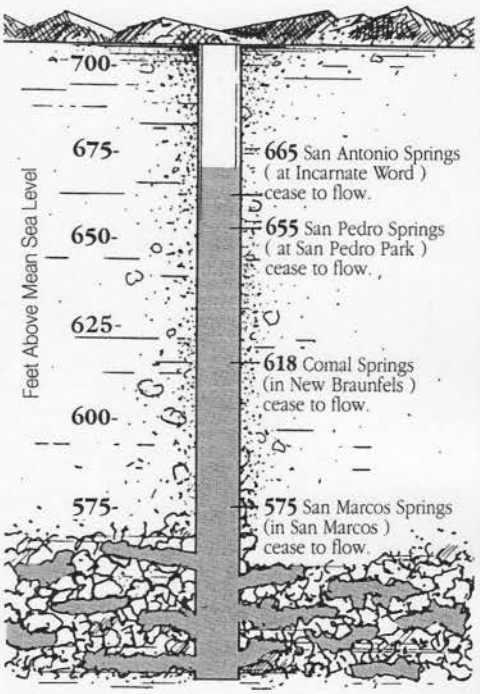
☐ This fall water conservation moves indoors! Most people only think about conserving water during the summer. Yet conserving in the fall and winter months is just as important.

During October and November, the Edwards Underground Water District is teaming together with radio stations and newspapers throughout the Edwards Aquifer region to give away water-saving showerheads.

Co-sponsors of the fall water conservation campaign are: The San Marcos Daily Record (Hays County); KGNB-AM/KNBT-FM (Comal County); The Hondo Anvil Herald (Medina County), and KVOU-AM/KYUF-FM (Uvalde County). ■

The Water Level

This reading reflects the daily high artesian water elevation at the Bexar County Edwards Aquifer Index Well.



Current Status: On October 14, 1993 the water elevation was recorded at 673.6. Average for October is 661.5.

THE WATER SOURCE

The Water Source is published quarterly by the Public Information Office of the Edwards Underground Water District, 1615 N. St. Mary's, San Antonio, Texas, 78212. 210/222-2204 or 800/292-1047

Editor: Carolyn Eagle

Photographers: Mark Mayfield, Robert Bader, Carolyn Eagle

EDWARDS UNDERGROUND WATER DISTRICT

1615 N. ST. MARY'S ~ P.O. BOX 15830
SAN ANTONIO TEXAS 78212

FORWARD & ADDRESS CORRECTION

BULK RATE
U.S. POSTAGE
PAID
PERMIT # 771
SAN ANTONIO
TX 78212

Recycled Paper

THE WATER SOURCE

A QUARTERLY PUBLICATION OF THE EDWARDS UNDERGROUND WATER DISTRICT

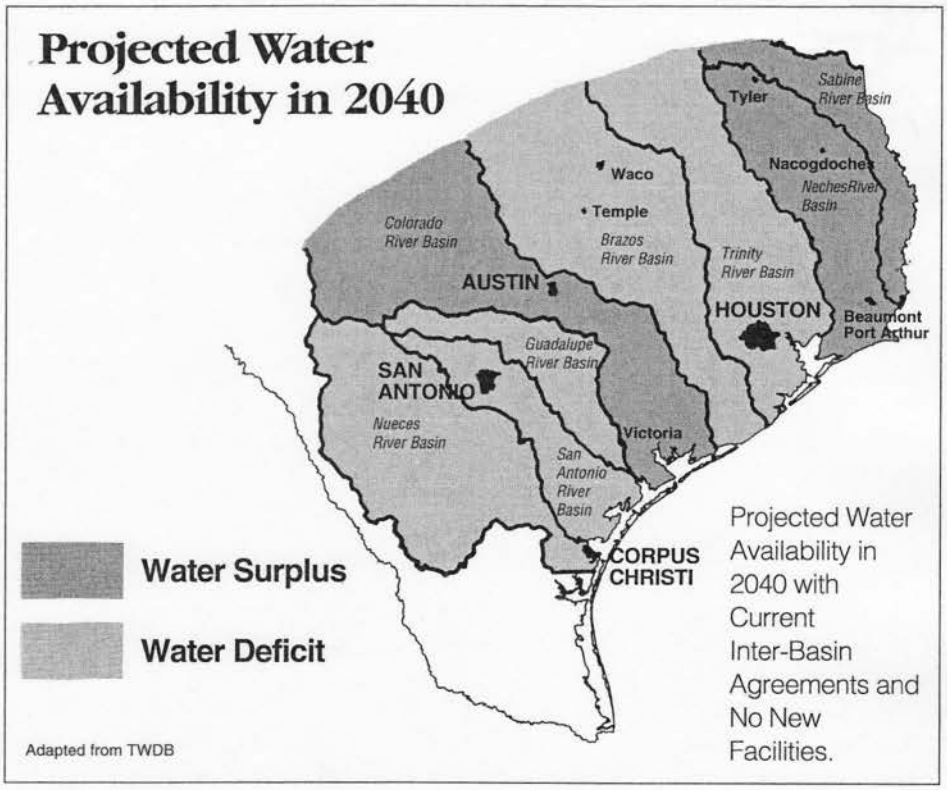
January 1994

Trans Texas Water Program: Alternatives for the Future

Greg Rothe, P.E.
Consulting Project Engineer

The Trans Texas Water Program is a long-term project representing a new and innovative approach to water resource planning and development for Texas. Some areas, such as Southeast Texas, have an abundant supply of water, while other areas with high demands, such as Houston and San Antonio, could be left with a potential shortfall. Trans Texas proposes to move water from river basins which have a surplus to areas which have a deficit. This will require that water be moved by pipeline from east to west, across southeast and south central Texas (see map). The program's mission is to determine the best method of providing supplies to meet Texas' needs in a cost-effective and environmentally-sensitive manner, as well as examine local alternatives for water supplies.

The large scale diversions proposed by Trans Texas are a departure from the historic pattern of water resource planning and development in Texas. This change in concept will not come easily. Yet none of the state, regional or local agencies with water resource responsibilities can dispute the obvious need for making more efficient use of existing resources, nor the opportunity which Trans Texas will provide to accomplish that end.



Background

The historic development of water resources in the state has been on a river basin-by-river basin basis. Generally, new surface water projects have been constructed in each basin in response to needs that have arisen. This pattern of development has created a prejudice against trans basin diversions, fostering a sense of "let's keep our supplies at home." If Trans Texas is to be successful, this attitude will be a significant obstacle which must be overcome.

The lead agency promoting Trans Texas is the Texas Water Development

(continued)

Study Determines Aquifer's Storage Capacity

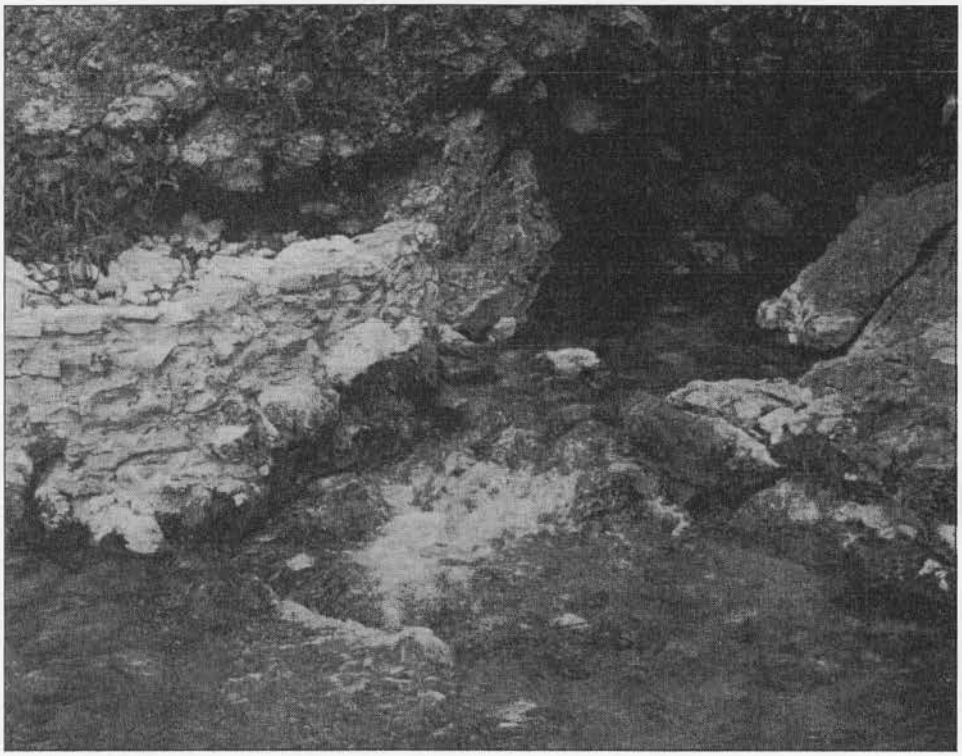
There may be as much as 215 million acre-feet of ground water stored in the Edwards Aquifer according to a study conducted by the Bureau of Economic Geology (BEG) for the Edwards Underground Water District (EUWD).

This is the best estimate to date of how much water can be stored in the total pore spaces of the Edwards Aquifer, but EUWD and BEG geologists caution that it does not mean all the water is recoverable. According to Rick Illgner, Acting General Manager of the EUWD, the next step is to determine how much of the water can be retrieved and how it moves through the aquifer. "The Bureau of Economic Geology helped determine how much water the aquifer could hold. Next we need to know how attainable it is."

The previous estimate of 25 to 55 million acre-feet was derived from a study conducted by the United States Geologic Survey in 1989. It is an estimate of the amount of water which can be drained from the aquifer (net storage), and was calculated using eight wells across the 176 mile-long aquifer.

In comparison, the BEG evaluated hundreds of geophysical well logs. Data from the geophysical logs was used to construct a stratigraphic model of the Edwards Aquifer which shows the different layers in the aquifer and where the water is stored.

Hydrologist Dr. Alan Dutton was the research scientist in charge of the study for the BEG. He points out that the previous number was not an estimate of total storage, but an educated guess of how much water could be recovered. "What we [the BEG] have given the District is the first ever quantifiable, reproducible estimate of total water in storage." Dutton continued, "The amount of water that is recoverable depends on the relationship between the volume of water that can be discharged and the corresponding change in water level. Once you determine how far the water level is going to drop in an area, it becomes a policy issue ... what are the consequences of a drop in water levels?"



Water in the Edwards Aquifer is under pressure because it is confined between layers of nonporous rock. However, there is a narrow portion of the aquifer along the northern boundary of the recharge zone which is unconfined.

The BEG estimates there are 156.5 million acre-feet of water in the confined zone of the Edwards Aquifer, and 58.5 million acre-feet in the unconfined portion. Changes in the amount of water actually present in the aquifer occur in the unconfined portion, allowing the confined part to remain fully saturated. Thus the change in the water level in the confined zone reflects the regional change in water pressure as water fills and drains in the unconfined zone.

The total usable amount of water in the Edwards Aquifer depends on variables such as storage capacity in the confined zone, the amount of water held in the unconfined zone, and saline water intrusion.

According to Dutton, the number of 215 million acre-feet is not important. "The BEG contributed a building block in the form of a computer model which shows where the water is." Results from this study will be used to begin the development of an interactive, dynamic 3-D model of the Edwards Aquifer. The model will assist scientists in understanding the intricate workings of the aquifer and can be modified and expanded as new information from future studies becomes available. ■

Trans Texas *(continued)*

Board (TWDB). This activity represents a new role for an agency which has traditionally been responsible only for planning and financing at a state level. For the first time, the TWDB is initiating a cooperative effort between state, local and regional water agencies.

The Texas Parks and Wildlife Department and the Texas Natural Resources Conservation Commission also have a management role. These agencies were instrumental in prescribing a uniform set of environmental criteria for the technical analyses performed as part of the program.

Goals & Objectives

Trans Texas will be carried out in several phases. Phase I will last eight months and tabulate water demands for a fifty (50) year period, as well as describe a menu of water supply alternatives. Phase II will entail a more detailed analysis of the feasibility of alternatives selected from the menu prepared in Phase I. Later phases include permitting, construction, and operation of alternatives selected for development.

Three Areas

The Trans Texas Water Program has been divided into three study areas: West Central, Southeast, and South Central. The West Central area encompasses the Edwards Aquifer region, including the Guadalupe, San Antonio, and Nueces River Basins. The City of San Antonio is the major demand center. The Southeast area extends along the Texas Gulf Coast from the Sabine River in the east to the Brazos River in the west, and includes the Houston metropolitan area. The South Central area encompasses the region west of the Brazos River, including the lower Lavaca, Guadalupe, and Nueces River Basins. The City of Corpus Christi is the major demand center.

West Central Study Area

The Edwards Underground Water District is a major sponsor in the West Central study area. Other sponsors include the San Antonio River Authority, the San Antonio Water System, Bexar Metropolitan Water District, the Lower Colorado River Authority, the Guadalupe-Blanco River Authority, and the Nueces River Authority. Currently in Phase I, the West Central study area is compiling water demands for the fifty year planning period. Forty-five (45) water supply alternatives are being analyzed for their potential for meeting future demands. Conservation, reuse, recharge of the Edwards Aquifer, surface water supplies, groundwater sources, and aquifer storage and recovery are some of the alternatives being examined. Importing water from the Southeast area is a part of the surface water supply investigation.

Importance to the Edwards Aquifer Region

The alliance of water interests in the West Central study area forged through the advent of Trans Texas represents the best opportunity to date to seriously address the water supply needs of the area on a region wide, non-competitive, non-partisan basis. The timing could not be better for water users in the Edwards Aquifer region as they move toward regulation and more aggressive management of the aquifer. Water users, both present and future, will profit from the evaluation of alternative supplies that is being conducted through Trans Texas. The interaction among the agencies responsible for water resource development and use in the region will result in consensus on which alternatives are necessary, and which are the most feasible. Such consensus is significant for addressing the actual development of alternatives to supplement the Edwards Aquifer. ■

Catfish Farm Lawsuit Settled

The governing bodies of the Edwards Underground Water District (EUWD), San Antonio River Authority (SARA), the Texas Natural Resources Conservation Commission, and Bexar County have approved the terms of an agreement settling the lawsuit against the owners of Living Waters Artesian Springs (LWAS), otherwise known as the "Catfish Farm."

The lawsuit was filed in State District Court, in October of 1991, by the EUWD and SARA and resulted in immediate closure of the operation's main well. District officials estimate that since the well was closed, an estimated 95,000 acre-feet of water have been saved.

One of the provisions of the settlement agreement is a permanent injunction that will prevent the owners from reopening the well. The injunction will be in place until the owners receive a withdrawal permit from a permitting authority empowered to permit water from the Edwards Aquifer, or until June 15, 1995, after the 1995 legislative session. Other provisions are:

- The owners will be required to meet all the water quality standards of all discharge permits governing the operation of the facility.
- In response, the cooperating agencies will withdraw their appeal of the Texas Natural Resources Conservation Commission's decision to grant LWAS a discharge permit and an exemption from air quality standards. The agencies will also withdraw objections submitted to the U.S. Environmental Protection Agency on the issue of water quality.
- The owners of LWAS will pay the agencies the sum of $400,000 to help defray the costs of pursing this action. The amount will be divided proportionately among the agencies.
- The agencies will retain the right to present arguments and to be a part of any permit process in which a decision is made regarding how much water the operation can use. ■

News Briefs

☐ The Edwards Underground Water District will be providing technical assistance and partial funding to the San Antonio Children's Museum for an *Edwards (Almost Underground) Aquifer* display. The Museum is scheduled to open in 1994 and will be located downtown. Children will have an opportunity to learn more about themselves and the world around them through hands-on exhibits, displays, and activities.

The proposed Edwards Aquifer exhibit will be a three-dimensional interactive model and simulation of the aquifer showing the physical relationship between the hill country (drainage area), the recharge zone, and the artesian portion of the system. Children will learn about the interrelationship of rainfall, aquifer levels, spring and river flows. The Edwards Aquifer model will be located in the Urban Ecology area. ■

☐ Rachel Katz, a sophomore at Lee High School, has won first place in the Edwards Underground Water District's book cover design contest. The theme of the contest was "Be Water Tight."

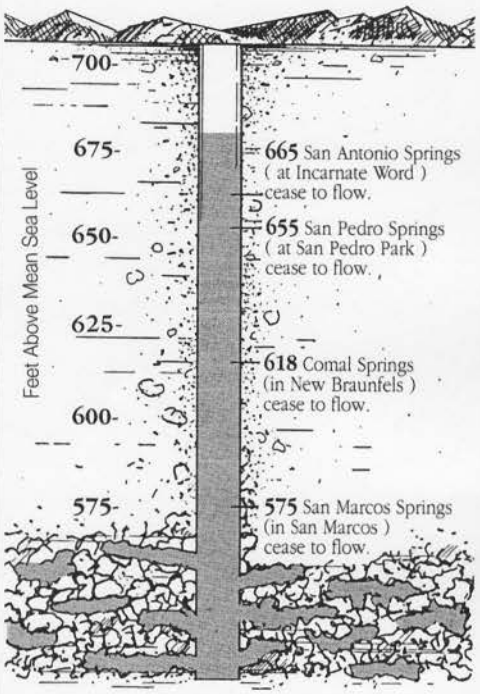
Katz's winning design, which creatively portrayed how important it is for people to "tighten up" on water usage, will be displayed on over 125,000 book covers provided free of charge by the District to high schools and middle schools in Bexar, Comal, Hays, Medina and Uvalde counties. Katz received a $250 savings bond as first prize.

Second place was awarded to Victor Mendoza, a freshman at Edison High School, and third place went to sophomore Jose Hernandez, also from Edison High School. They received a $100 and a $50 savings bond respectively.

The bi-annual book cover design contest is open to all high schools in the five-county Edwards Aquifer region. ■

The Water Level

This reading reflects the daily high artesian water elevation at the Bexar County Edwards Aquifer Index Well.



Current Status: On December 29, 1993 the water elevation was recorded at 677.5. Average for December is 661.1.

THE WATER SOURCE

The Water Source is published quarterly by the Public Information Office of the Edwards Underground Water District, 1615 N. St. Mary's, San Antonio, Texas, 78212. 210/222-2204 or 800/292-1047

Editor: *Carolyn Eagle*
Guest Columnist: *Greg Rothe*

EDWARDS UNDERGROUND WATER DISTRICT

1615 N. ST. MARY'S ~ P.O. BOX 15830
SAN ANTONIO TEXAS 78212

FORWARD & ADDRESS CORRECTION

BULK RATE
U.S. POSTAGE
PAID
PERMIT # 771
SAN ANTONIO
TX 78212

Recycled Paper

THE WATER SOURCE

A QUARTERLY PUBLICATION OF THE EDWARDS UNDERGROUND WATER DISTRICT

April 1994

You Never Miss It 'Til It's Gone
Is A Drought In Our Forecast?

John Willing, KMOL Chief Meteorologist

Nobody likes to be the bearer of bad news! But you know what they say—"It's dirty work, but someone's got to do it." Bad news to South Texans, particularly farmers and ranchers, is drought. Unless you are new to the area, you already know how parched the ground is becoming, especially after last summer.

The first half of last year was looking great for rainfall. Right when the temperatures usually get uncomfortably hot, our rainfall was actually coming on strong. May registered 12.47 inches, a whopping 8.25 inches above average for that month. June was still exceptionally wet with 6.43 inches, about 2 2/3 inches above normal.

But then it happened. The tap was shut off. Only a trace of rain fell in July, and a mere .01 of an inch fell in August. San Antonio set a new record of 63 consecutive days without measurable rain, crushing the old record of 54 days back in the summer of 1962. This new record was NOT broken by blockbuster rains. Only .01 of an inch fell, and that anemic storm was followed by more dry weeks that yielded only 1/2 inch of rain (.52) for the month of September–traditionally our wettest month of the year. In October, we rebounded as 3 inches of rain came in, but that was still below normal. Since then, every month has registered below average rainfall. February marked the eighth consecutive month of drought.

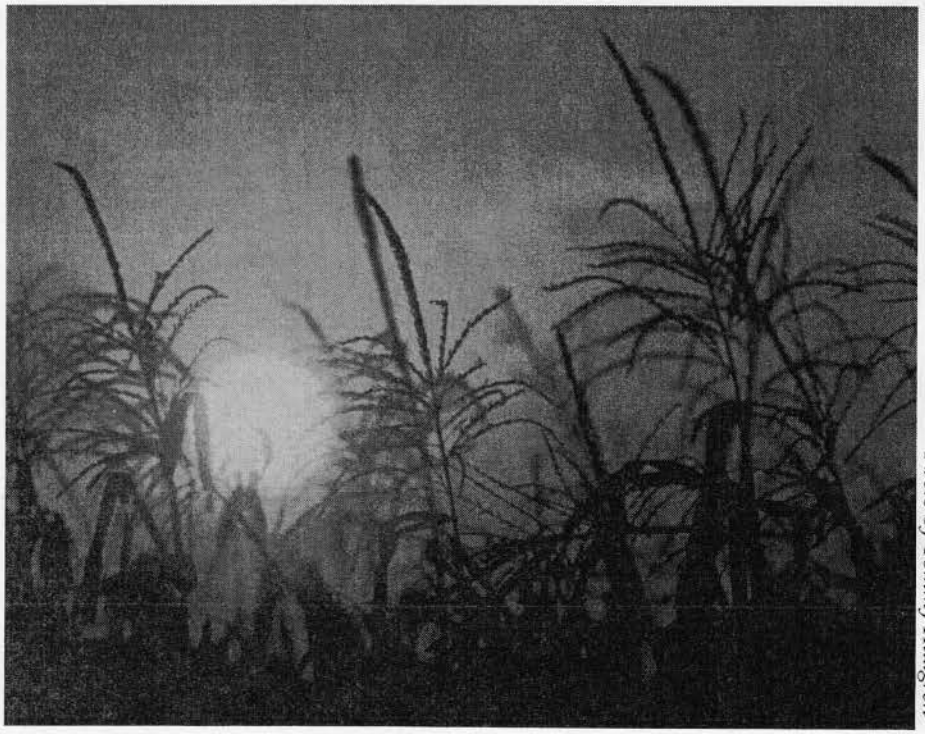


Photo by Tommy Hultgren

So what's next? Will El Niño, which has blessed us with record rainfall since 1991, help us out again this year? Don't count on it. El Niño, which is the abnormal warming of the surface waters of the tropical Pacific Ocean off the west coast of South America, is responsible for altering the weather worldwide by radically diverting the storm track. Drought hits the areas that are usually wet, and massive rains pound dry areas. New information shows that El Niño is finally dying out.

In March, I spoke with Jerry Bell, meteorologist at the Climate Analysis

(continued)

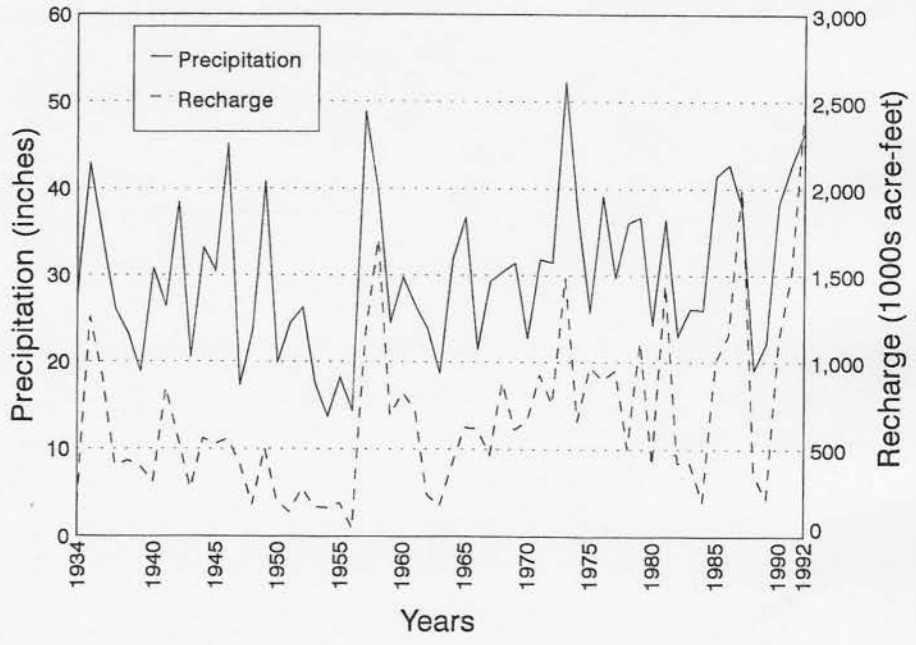
No Rain, No Gain. Are We Prepared?

Michael J. Albach, M.S. Natural Resources Management
EUWD Division Manager of Planning & Environmental Management

Are we prepared for a drought, a real drought? Can we effectively moderate the impact of years of sub-normal rainfall on our economy and environment? Are business owners, irrigators, local governments and citizens prepared to make the sacrifices and willing to share the pain that accompanies the inevitable drought?

Most of us don't think about drought until we are urged or required to curtail lawn watering at our homes or businesses. But, if the prognostications cited in John Willing's article become reality, much more than our lawns and gardens are at stake. Consider this: San Antonio's and the region's economy is inextricably linked to water. More so, in fact, than many other major American cities. Tourism in the region accounts for one and a half to two billion dollars of revenue, and much of that revenue is generated by water-dependent theme parks and water recreation parks. The San Antonio River would be a dry ditch if it were not for deep Edwards Aquifer wells pumping millions of gallons daily. Similarly, Comal and San Marcos rivers would cease to flow if their springheads dried up. Computer chip manufacturers and other high tech industries depend on abundant supplies of fresh water, as does the multi-million dollar economy of irrigated agriculture.

"...plans are designed to act in concert with permanent water use efficiency..."



Comparison of Precipitation in the San Antonio Area to Groundwater Recharge of the Edwards Aquifer

The natural amenities that make our region of Texas such an attractive place to live are equally dependent on water. Those Hill Country rivers that recharge our spirits as well as our aquifer are at risk during a drought. Our park lands, open spaces and landscapes, and the wildlife that depend upon them will surely suffer from prolonged spells of dry weather.

Well then, are we prepared? The answer is an unqualified maybe. If the drought isn't too severe and too long, then contingency plans now in place can effectively manage water demand to minimize the drought's effects. The Edwards Underground Water District has set forth a Demand Management Plan (DMP) that establishes the framework by which the groundwater of the Edwards Aquifer can be managed during low water level conditions. The plan imposes reasonable restrictions on water use to protect the water resources of the aquifer and to ensure equitable distribution of groundwater in the region.

The District defines drought as when 1) there is not enough water to meet the needs of users, 2) precipitation is insufficient to meet user's expectations as to present or future supply, or 3) conditions require temporary reductions in total water use to protect the water resources of the region from serious harm. Under the District's DMP, reduction stages are established based on water level elevations in the aquifer. Each stage has a corresponding demand reduction goal.

(continued)

Stage	Feet Above Mean Sea Level	Reduction Goals
I	649	15%
II	640	20%
III	632	30%
Extreme Water Emergency	See Note*	See Note*

Measured at the Bexar County Index Well (10 day moving average)

Note: Implementation of the Extreme Water Emergency Stage and the associated reduction goal will be declared at the discretion of the Board of Directors when necessary to prevent injury to water resources of the region, economic hardship, danger to public health or safety, or inequitable distribution of water, which cannot be adequately remedied by the declaration of Stages I-III.

Upon declaration of a plan stage, users who supply or produce more than 18 million gallons of groundwater per year will be required to reduce the amount of groundwater they supply or produce (some "qualified" uses are exempt from reduction goals). This user group includes public water suppliers, industries and irrigators within the Edwards Underground Water District. Users of less than 18 million gallons per year are not regulated by the DMP, but may be required to curtail their use if they are supplied by an entity that is.

But what about the long term drought? The big one? The Demand Management Plan and all other drought contingency plans can only do so much to minimize the impact of severe drought. These plans are designed to act in concert with permanent water use efficiency improvements and the development and use of alternative sources of water. All users, including industry, irrigators, homeowners and all residents in the region, should adopt water conserving techniques and habits. Permanent improvements in plumbing fixtures, industrial processes, irrigation techniques on the farm and in the landscape must be a high priority. Additionally, the region must examine all feasible water development and management options and implement the best of those. The economic vitality of our region depends on it. ■

You Never Miss It *(continued)*

Center (CAC), who researches and monitors El Niño events. He said ocean temperatures, which were still at a peak last fall with a very mature El Niño, are quickly returning to normal. Clouds and thunderstorm activity are decreasing over that critical region of the Pacific, and weather patterns are back to normal. Bell said the El Niño we just came out of was not the most intense on record (1982), but it certainly ties with a few others for the longest. The years 1911-1913 and 1939-1941 were similarly long episodes.

Bell wishes there was a consistently clear signal for the long range weather forecast following El Niño events. After all, with that information we could be planning in advance for water usage and conservation, not to mention the value it would have for agricultural interests. But to his knowledge, there is not a correlation we can depend upon. His group at the CAC will, however, let us know the next 90 days' weather. They expect above normal temperatures and slightly below normal rainfall (more droughts!) through May.

For a more far-reaching forecast of this drought we are in, I turned to local meteorologist Larry Wallace, who matches historical weather/sunspot cycles with the current solar cycle to produce a long range weather forecast. Unlike Jerry Bell, he believes there is a way to project the weather for months, even years, using past cycles. Through the end of the year, here is what he expects:

April—2.5"	September—3"
May—3"	October—2.75"
June—2"	November—1"
July—1.5"	December—2"
August—3"	

Add it all up with the precious little rain we have already had this year and we end up with about 26 inches of rain ... approximately 5 inches below normal. The trend of below average rainfall continues nearly every month, says Wallace.

Believe it or not, that is the *good* news. Looking ahead to the rest of the decade, Wallace says as we come off the solar sunspot maximum reached in 1989 and enter into a sunspot minimum in late 1996 or early 1997, anticipate a painfully long extension of drought, rivaling the ones we experience in the 1950's and the period from 1909 to 1912. Notice the separation between these major droughts. It is no coincidence that these droughts were approximately 44 years apart—the length of time it takes to go through two consecutive sunspot cycles. The sunspot maximums were a lot stronger preceding these droughts, similar to the one in 1989.

As we head toward this next sunspot minimum, Wallace says we should expect about 16-17 inches of rain in 1995 (more if we are lucky and get some unexpected tropical activity), 15-16 inches in 1996 (the bottom of the drought cycle), 18-19 inches in 1997, 18-20 inches in 1998, and with the onset of what will probably be our next El Niño, we can expect to break out of the drought with a blast of 37-39 inches of rain in 1999.

We won't be the only ones suffering. Larry Wallace expects this to be a widespread drought, extending from east of the Rockies to the Mississippi River area, and north to south from southern Canada to northern Mexico. The implications are pretty scary when you consider that most of the productive farmland in our nation lies precisely in the forecasted drought belt. Visions of people hoarding food and soaring commodity prices go though my mind.

Does this have to happen? No. Anybody knows that weather is incredibly variable and not the easiest thing to predict. But if past years have anything to tell us, there are some dark clouds ahead, and they don't carry rain! ■

Illgner Named General Manager

At the March Board of Directors meeting, Rick Illgner was appointed General Manager of the Edwards Underground Water District. Illgner joined the District as Assistant General Manager in 1991, and had served as Acting General Manager since October 1993.

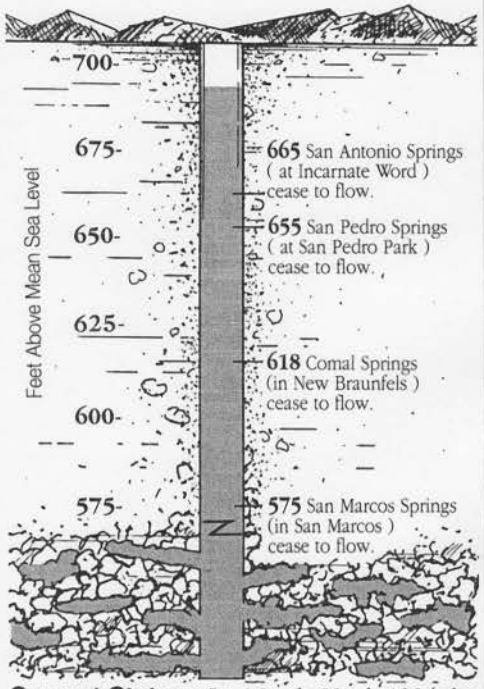
Illgner holds a B.A. in Geology from Wichita State University and a M.A. in Geography (Natural Resource Management) from Kansas State University. Before joining the District, he served for seven years as Manager of the Hickory Underground Water Conservation District in Brady, Texas. Prior to that, he had seven years of experience in Kansas working in groundwater management and water rights administration.

As General Manager, Illgner is looking forward to taking the helm of the District at a pivotal and challenging time in Texas water law, pointing out that "the decisions and actions regarding management of the Edwards Aquifer will have ripple effects over the entire state." He characterizes his new role as "mending on the move." Illgner wants to build better relations with the western counties, the City of San Antonio and the Texas Natural Resource Conservation Commission. He continued, "I will be working with the board of directors to develop a strategic plan that will allow us to effectively carry out our mission of stewardship."

Illgner is a member of the Association of American Geographers, the Texas Water Conservation Association (TWCA), and the Texas Alliance of Groundwater Districts. He served as chairman of the TWCA's Groundwater Panel from 1989-1991.

The Water Level

This reading reflects the daily high artesian water elevation at the Bexar County Edwards Aquifer Index Well. The bottom of the graph represents the depth of the well which is 143 feet below mean sea level.



Current Status: On March 22nd, 1994 the water elevation was recorded at 676.5. Average for March is 667.7.

THE WATER SOURCE

The Water Source is published quarterly by the Public Information Office of the Edwards Underground Water District, 1615 N. St. Mary's, San Antonio, Texas, 78212. 210/222-2204 or 800/292-1047

Editor: *Carolyn Eagle.*
Feature Articles: *Michael Albach;* Guest Columnist: *John Willing*

EDWARDS UNDERGROUND WATER DISTRICT

1615 N. ST. MARY'S ~ P.O.BOX 15830
SAN ANTONIO TEXAS 78212

FORWARD & ADDRESS CORRECTION

BULK RATE
U.S. POSTAGE
PAID
PERMIT # 771
SAN ANTONIO
TX 78212

Recycled Paper

THE WATER SOURCE

A QUARTERLY PUBLICATION OF THE EDWARDS UNDERGROUND WATER DISTRICT

July 1994

District Enters "Real-Time"

Steven Walthour, M.S. Geology
EUWD Hydrologist III, RPG

The Edwards Underground Water District conducts a variety of programs aimed at evaluating and enhancing natural recharge to the Edwards Aquifer across the 1,500 square mile recharge zone in south central Texas. Recharge is the amount of water which is added to the aquifer through percolation from overlying streams and from rainfall. The District is installing an automated rainfall and streamflow measurement network comprised of 100 sites scattered throughout Kinney, Hays, Uvalde, Medina, Real, Edwards, Bandera, Bexar, Blanco, Kendall and Comal counties. From remote gauging sites, the network will notify scientists in real-time (instantly) of rainfall or stream flooding events that may affect recharge. By knowing how much and how fast water is going into the aquifer, scientists will be better prepared to know how much can be taken out.

Remote Operating Systems of San Antonio (ROS) will be installing the system for the District during the summer and early fall. ROS installed similar equipment for the early flood warning network in Kerr County, Texas. The installation was sponsored by the Upper Guadalupe River Authority in 1989 after floodwaters from the Guadalupe River claimed the lives of ten teenagers when their church camp bus was swept into the river. An outstanding performance was reported in 1991 when the equipment was put to the test during flooding along the Guadalupe.

"By knowing... how fast water is going in... scientists will... know how much can be taken out."

While District scientsts are interested in knowing the amount of water recharging the aquifer, the National Weather Service and local communities are interested in how much or how fast water is moving down rivers and streams during flooding. With access to this network, local communities can implement emergency procedures such as barricading roads and evacuating residences in advance of flood waters.

The sensors developed by ROS will be capable of relaying information by a combination of radio, microwave and telephone to the District's office in San Antonio, to the National Weather Service, and to local communities' emergency operation centers.

The system is flexible and can be expanded by any of the cooperators to provide additional sites or local weather information, such as barometric pressure, evaporation, wind velocity or soil moisture conditions. The National Weather Service will utilize the data to "ground truth" their weather radar in New Braunfels and the U.S. Department of Defense weather radar in Brackettville to provide more accurate weather forecasts for the entire region. District scientists are excited about the prospect of utilizing the National Weather Service's radar information in combination with the streamflow and rainfall measurement network to more precisely calculate recharge.

The Edwards Underground Water District will have the system installed and running by the end of the year. Plans are for the weather radar telemetry from the National Weather Service to be incorporated with the streamflow and rainfall measurement network for recharge calculation purposes by the end of 1996. ■

Finding Hidden Water Wasters
Listening for Leaks

Jim Shipley,
EUWD Leak Detection Technician II

In Texas, and especially in the Edwards Aquifer region, water is becoming a limited and precious commodity. When you turn on the faucet, you probably don't think about the system that carried the water to your house. We're often reminded that water conservation has become a necessary fact of life for all of us, and that also goes for the water utilities that provide water to your home.

A growing water conservation ethic, limited resources, and reduced revenues are causing water utilities to reconsider the economic benefits of reducing water loss by improving their system's efficiency. Every water system loses some water from leaks. While the amount varies from system to system, nationally, it is estimated that between 10% and 30% of the total water pumped is lost to leaks in distribution systems.

Technician Mark McGinnis "listens" for leaks.

Visible leaks are easily located and repaired, but a large percentage of leaks are hidden (since the pipes are buried underground) and may not come to the surface at all due to the underlying limestone strata that characterizes our area. Water from leaks often enters storm or sanitary sewers or percolates down through the soil. Studies have shown that the life of a leak depends on the type of soil in which the pipe is buried. For example, in sand, gravel or rock (such as limestone), a leak can grow and grow because the water is continuously absorbed by the soil.

One proven way for recapturing water lost from leaks is to conduct a leak detection/location survey on a water distribution system. This type of survey is accomplished by listening to all valves, fire hydrants, and service connections with equipment that electronically amplifies the acoustical signal created by pressurized fluid escaping from the pipe or valve through a fracture or other opening. Once the general area of a leak has been determined, a sophisticated leak sound correlation instrument is used to accurately pinpoint its location. San Antonio Water System and Bexar Metropolitan Water District are two good examples of utilities that have ongoing, successful survey programs.

Unfortunately, the cost of the equipment needed to perform this type of survey is beyond the financial means of most utilities in the Edwards Aquifer region. For this reason, the Edwards Underground Water District acquired the most advanced equipment for detecting and locating leaks in pressurized distribution systems and has offered the service free since 1989. All publicly and privately owned water utilities that use water from the Edwards Aquifer are eligible for the service. The program is part of the District's continuing effort to conserve and protect the aquifer.

"Every water system loses some water from leaks."

Three leak detection technicians are currently assigned to the program. All technicians are state certified water and wastewater operators with a minimum of eight years experience in water system operation, maintenance, and management. The primary objectives are to assist utilities in identifying and targeting areas of actual

(continued)

water loss and potential loss. As part of a comprehensive survey, the District will submit a revised master water plat and a thorough distribution system evaluation to the utility. This evaluation will allow the utility to select and implement programs to reduce loss and enhance water system efficiency.

The program has been a resounding success. The key has been the cooperation and active participation of the utilities in promptly repairing leaks. Thirty-one urban and rural utilities have been surveyed. District technicians have detected 4,885 leaks and witnessed repairs saving an estimated 5,711,868 gallons of water PER DAY. A total of 118,000 access points covering 2,022 miles of water distribution mains in eight counties have been surveyed.

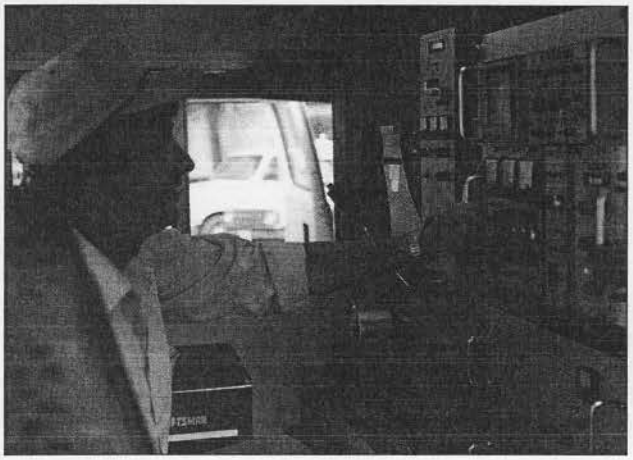
Everyone can benefit from reducing the water loss. Utilities can recover lost pumping capacity and possibly defer expenditures for additional pumping equipment or water system improvements. Reducing costs and extending the life of pumping equipment will benefit customers because lower operating costs will mean smaller and less frequent rate increases. ■

NOTE:

The Edwards Underground Water District is available to provide assistance and support, if needed, to the water utilities in the Edwards Aquifer region. The leak detection program is offered at no charge and is designed to assist utilities in reducing "unaccounted for" water losses. Questions regarding the program, or a complete information packet containing a brief history of the program, a description of the services, and an application, can be obtained by contacting Jim Shipley at (210) 222-2204 or (800) 292-1047.

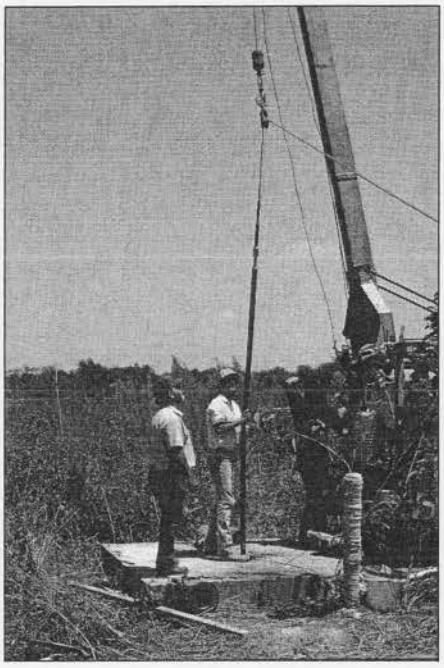
Geologists Log On

For over nine years, the Edwards Underground Water District (EUWD) has operated a geophysical logging unit which has logged over 500 Edwards Aquifer wells in south central Texas. This service has aided drillers in properly drilling, casing and completing wells in the aquifer, as well as gathering valuable data concerning the hydrogeology of the aquifer for current and future studies.



Jim O'Connor, EUWD Well Logging Technician, receives data in the District's logging van.

Geophysical logging consists of lowering cylindrical metal tools that are attached to an electrical cable into open wellbores. The cable, which is over 3,000 feet long, sends signals from the geophysical tools into a computer system that is permanently mounted in the District's logging van.



A sonic logging tool is lowered into an open wellbore.

The EUWD currently runs four logging tools – the caliper, gamma ray, electric and sonic. Each measures different properties of the rock and fluids in the various wells. Data from these logs have been used by the public, as well as by District hydrologists, to learn more about the geology and hydrology of the Edwards Aquifer. By combining information from each type of log run in a well, hydrologists can determine the depth to the top of the aquifer, the porosity of the aquifer rock, the general quality of water in the aquifer, and whether the well was completed properly to produce high quality water from the Edwards Aquifer at that location. Scientists have determined locations of faults, direction of groundwater movement, the volume of water in the aquifer, the dividing line between fresh and saline water, and more from using these geophysical logs.

Anyone wishing to learn more about this valuable data source should contact the Division of Field Operations for more information. ■

News Briefs

☐ Each spring, the Edwards Underground Water District (EUWD) sponsors a "Blue Thumb" essay and poster contest. Students were asked to draw or write why it is important that we protect the quality of our drinking water and what steps can be taken to protect the Edwards Aquifer. Winners were announced during National Drinking Water Week, which kicked-off May as Water Awareness Month.

According to Cinde Thomas-Jimenez, EUWD Education Coordinator, many of the entries were outstanding and reflected a level of understanding that most adults do not possess. "These students [the winners] truly understand the sensitive nature of the Edwards Aquifer Recharge Zone and the need to preserve it." The District received over 300 posters and almost 600 essays from schools across the five-county aquifer region. Excerpts from some of the essays follow:

"Our aquifer is something that should be taken seriously and be respected by everyone. Our water source is the most valuable thing our city has. With it polluted, we would have to purify it. This would not only cost us just money, but it would also cost us our good tasting water."

Jared May (Wood Middle School – 7th grade)

"The Edwards Aquifer is a very special place. It is the only place in San Antonio where we get good, clean, refreshing water. That is why we should keep it nice and clean... The aquifer is also one of our most precious natural resources. We should not pollute the water."

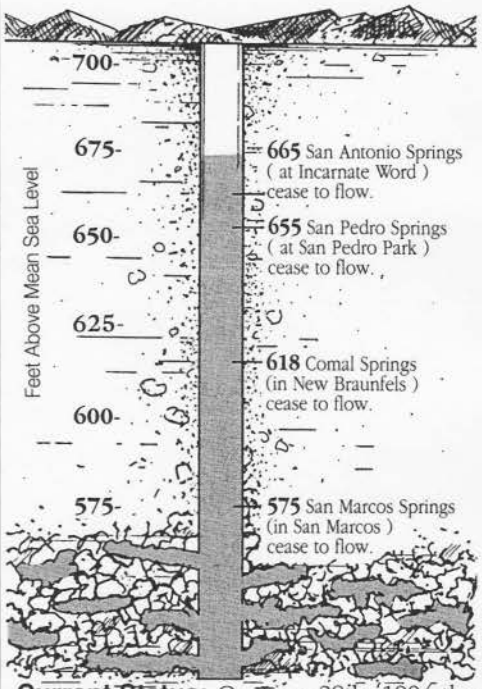
Lori Beltran (St. John the Evangelist – 5th grade)

"The Edwards Aquifer is the only source of water our area has, so it is up to us to protect the aquifer in order to keep our water clean. One way of protecting the aquifer is to protect the recharge zone."

Dustin Marsh (John Glenn Elementary – 5th grade) ■

The Water Level

This reading reflects the daily high artesian water elevation at the Bexar County Edwards Aquifer Index Well. The bottom of the graph represents the depth of the well which is 143 feet below mean sea level.



Current Status: On June 28th, 1994 the water elevation was recorded at 664.7 Average for June is 664.8.

THE WATER SOURCE

The Water Source is published quarterly by the Public Information Office of the Edwards Underground Water District, 1615 N. St. Mary's, San Antonio, Texas, 78212. 210/222-2204 or 800/292-1047

Editor: *Carolyn Eagle.*
Feature Articles: *Steven Walthour; Jim Shipley.*

EDWARDS UNDERGROUND WATER DISTRICT

1615 N. ST. MARY'S ~ P.O.BOX 15830
SAN ANTONIO TEXAS 78212

FORWARD & ADDRESS CORRECTION

BULK RATE
U.S. POSTAGE
PAID
PERMIT # 771
SAN ANTONIO
TX 78212

Recycled Paper

THE WATER SOURCE

A QUARTERLY PUBLICATION OF THE EDWARDS UNDERGROUND WATER DISTRICT

October 1994

Students Manage Aquifer

Blake Weissling
TBEE Educational Consultants

The complexities of the Edwards Aquifer system have proven to be a challenge for decision makers for decades. However, as is so often noted, the future is in the hands of our children.

As part of its aggressive education program, the Edwards Underground Water District (EUWD) has created an insightful means for tomorrow's decision makers to tackle an understanding of the aquifer conflict. The 1994 fall semester provides high school students throughout the five county region with a unique opportunity to examine the competing interests and uses of the aquifer's water. By participating in a cooperative learning environment of decision making, critical thinking and role playing, students can realistically experience the present-day dilemmas caused by the diversity of aquifer consumers.

Two software programs have been completed for use in area high schools and universities: the Edwards Aquifer Management Simulator and the Edwards Aquifer Multimedia Tutorial. Developed specifically for the Geography classroom, these interactive programs provide students with an overview of the location, physical characteristics, and relationships of water movement and distribution throughout south central Texas.

It all started two years ago when the EUWD embarked on a program to extend its successful aquifer education outreach program to the region's high schools. Cinde Thomas-Jimenez, EUWD Education Coordinator, and Rick Illgner, EUWD General Manager, envisioned the development of an interactive computer simulation of the Edwards Aquifer that could be incorporated into the increasingly sophisticated and technologically-oriented curriculum of the secondary science and geography student. After examining other water resource simulation models, they decided that the EUWD should direct its efforts toward a regional model, reflecting the unique circumstances and hydrologic characteristics of the Edwards Aquifer.

In early 1993, they contracted with TBEE Educational Consultants to design and develop two educational computer software programs. The first would be a dynamic simulation of the Edwards Aquifer, reflecting both the hydrologic operation of the system and the management of the system in its current cultural, political and economic environment. The second program would be a multimedia-based tutorial on the aquifer that would serve as a resource tool through the use of text, maps, photographs, graphics, and animation. These two programs, along with collateral materials developed by the EUWD, would ultimately be donated to all high schools in the five county area. The project came to fruition this summer and the software has been distributed to fifty teachers who have attended training workshops.

The Edwards Aquifer Management Simulator serves as the kingpin of the curricular unit developed for the secondary geography classroom. It is an interactive tool which can be used to explore the natural processes that influence and control the operation of the aquifer, as well as human exploitation and management of the aquifer resource. The program is capable of simulating meteorological patterns, recharge, pumping, future water demands, and flow of the major springs. Downstream flow in the Guadalupe River system is also represented. In addition, minimum springflow requirements to maintain ecological habitats recently established

(continued)

Recent Developments In Recharge Zone Protection

Michael Albach, M.S. Natural Resources Management, Division Manager, Planning & Environmental Management
Gayle K. Kipp, M.S. Environmental Management, Environmental Coordinator

Although the city limits of San Antonio cover only two percent of the Edwards Aquifer Recharge Zone, efforts to protect this environmentally sensitive area from the ill effects of unfettered urban development gained considerable momentum when San Antonio's City Council unanimously approved a four month moratorium on development over the recharge zone. The city will not accept any plats or zoning cases for development over the recharge zone until January 8, 1995. During the moratorium, a Water Quality Task Force appointed by the Mayor will be drafting regulations based upon 33 recommendations produced by a City Council Committee of the Whole, and approved by City Council in the spring of this year. Should the task force complete its work and City Council adopt the regulations before January 8, the moratorium can be rescinded.

The Edwards Underground Water District has been spreading a message since its inception that protection of the aquifer is of paramount importance to effective, long-term water resources management. City Council's bold action affirms this message clearly. In August of 1993, the District's board adopted a staff report entitled "Urban Development on the Edwards Aquifer Recharge Zone." Widely viewed as one of the catalysts in the recent local ground swell of concern, this report points out the disturbing trend in high density residential and commercial development occurring in the sensitive watersheds that recharge our aquifer.

In addition to the work of the Water Quality Task Force, several committees and agencies in Bexar County are revising existing regulations and devising plans that, directly or indirectly, will provide for more effective protection of the Edwards Aquifer.

The **Edwards Rules** regulate construction activity over the recharge zone. The Texas Natural Resource Conservation Commission (TNRCC) is responsible for promulgating and enforcing these rules, and the District is charged by the State to assist the TNRCC within the area of the District's jurisdiction. The TNRCC is directed to conduct annual public hearings to receive public testimony regarding actions to protect the Edwards Aquifer from pollution. At the most recent hearing in March of this year, a variety of public and private entities, as well as the District, presented testimony which urged the TNRCC to strengthen the Rules in order to more adequately protect the aquifer from pollution associated with development activities. Currently, TNRCC staff is considering these recommendations which may be reflected in future revised Rules.

In 1991, the State Legislature passed the **Clean Rivers Act**, which requires a program for water quality assessment by watershed, providing a mechanism for identification of water quality problems and their sources. The San Antonio River Authority was given the responsibility to plan, coordinate and implement an intensive water quality assessment program for the San Antonio River basin.

San Antonio Water System staff is designing and implementing a stormwater management program pursuant to the federal Water Quality Act of 1987. The Act prohibits the discharge of any pollutant to U.S. water unless authorized through the National Pollutant Discharge Elimination System (NPDES). Heretofore the NPDES has regulated municipal and industrial wastewater point discharges. Attention now is being turned to reducing pollutant loads to water bodies from non-point sources such as stormwater runoff from urban areas.

In July of 1993, the San Antonio City Council adopted a **Master Plan** for the physical growth and development of the city. The natural resources component of the Master Plan contains more than a dozen objectives that directly and indirectly address recharge zone protection. Currently, an ad hoc committee is meeting to draft specifically worded policies for city planners to use in developing or revising codes, ordinances and strategies.

Created in 1989 by the San Antonio City Council, the **Open Space Advisory Board** was charged with the task of developing an open space plan to include a process to compile an inventory of open space resources and the criteria used to identify potential resources. One of the four goals of the plan calls for utilizing open space as a means to protect the quality and quantity of groundwater and surface water throughout Bexar County, as well as an alternative means to manage stormwater runoff. The Edwards District recognizes the value of open space on the recharge zone as an effective means of protecting water quality.

The work of all the committees and boards described above will likely result in enhanced protection of the aquifer. But we should do more. We should look for innovative ways to develop the recharge zone without reducing the quality or quantity of recharge water. Above all, we must remain vigilant. ■

The Edwards' Library: Something To Look Into

Where can you find the most extensive collection of information on the Edwards Aquifer PLUS literature on meteorology, agriculture, irrigation, recharge, discharge, water plans and conservation? In the Edwards Underground Water District's technical resource library.

Over 2,500 technical documents, books and reports can be found there, along with 30 professional journals, periodicals and water resource newsletters. Vertical file holdings include pamphlets, brochures, fact sheets and maps concerning various water-related issues.

The library also houses several research publications from the Texas Water Resources Institute at Texas A&M University, as well as United States Geological Survey reports, on subjects ranging from precipitation to soil samples. All sides of the "fluid" water issue are represented, and soon eight years of newspaper clippings covering local water concerns will be available on microfiche.

Lisa Fullagar is the District's librarian. She has the undaunting task of cataloging each new piece of material under subject heading(s), title, and author so that all information is easily accessible. According to Fullagar, the library has materials which can't be found anywhere else. "We have studies that were done exclusively for the District, and we also have some studies that are very old, dating back to the 1920's." She continued, "Anyone who is looking for historical data has hit a gold mine."

While the library is probably best for research because of the technical nature of its contents, Fullagar is in the process of diversifying the collection by adding publications that are designed more for the layman. Subjects such as water conservation, xeriscape, urban development, and safe drinking water standards are recent additions. College students are the most frequent users of the library, but anyone is welcome. It's a good place to start if you're not knowledgeable or if you are unsure of which aspect of water to work on. Junior or high school students may find the District's library a helpful place to start when doing a science project. Because there are so many subject headings, it is a good place to browse. An added benefit to the library is its location in the District's offices where staff experts on hydrology, geology, and environmental planning are available to answer questions.

Fullagar suggests you make an appointment by calling (210) 222-2204 just in case you want or need assistance. So take advantage of this wonderful service. The Edwards Underground Water District is located at 1615 North St. Mary's in downtown San Antonio. ■

Students *(continued)*

by various federal agencies are included.

The user can make a variety of inputs to the simulation program, such as selecting rainfall patterns, imposing an assortment of pumping restrictions, and allocating water to primary users based on need. Additional user inputs include supplementing municipal water supply with non-aquifer sources, establishing conservation and reuse programs, and enhancing recharge. The "real time" display of data in the simulation and the ability to input "on the spot" management decisions allows the user to test the response of the aquifer to a variety of different management scenarios.

The Edward's Aquifer Multimedia Tutorial is both an integral part of the curricular package for the geography classroom and a self-standing program for use in any library system. The tutorial comprises over 70 pages of text on more than 25 individual topics on the aquifer system, an interactive map base with map features cross-linked to the text, key concepts and time-based events pertaining to the aquifer system in animation, and a collection of 60 color photographs taken from the EUWD's slide and print collection.

The Edwards District, in cooperation with TBEE Educational Consultants, will monitor and evaluate the use and effectiveness of the two programs this coming year.

The Edwards Underground Water District has long believed that by understanding the nature and characteristics of the resource itself, today's students will be better equipped to meet the challenges facing them with respect to resource management.

The software and supporting materials are available at no cost to all high school geography teachers currently teaching in Bexar, Comal, Hays, Uvalde and Medina counties, provided they attend a training workshop. Other interested educators or individuals who are outside of the hydrologic region can obtain the software through TBEE Educational Consultants. For more information, contact the Edwards Underground Water District at (210) 222-2204. ■

News Briefs

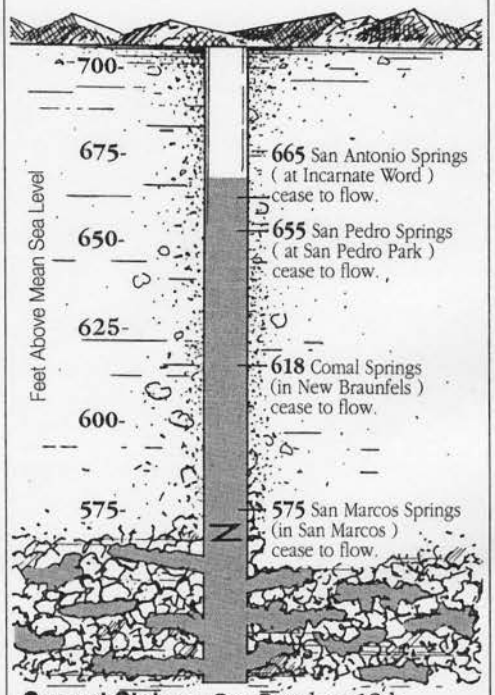
☐ The Edwards Underground Water District offers a variety of material which targets the special needs of teachers and students alike. Each fall the District conducts a mass distribution of educational material. In the first six weeks of the '94-'95 school year, the District received 174 requests for information from teachers, sending out 10,550 pieces of material.

☐ A draft final report on Springflow Augmentation was delivered by the Texas Water Development Board to sponsoring agencies in August. A "local level" liaison committee, consisting of representatives from the Edwards Underground Water District, San Antonio, Nueces and Guadalupe-Blanco River Authorities, Medina and Uvalde County Underground Water Conservation Districts, the cities of New Braunfels and San Marcos, the San Antonio Water System, and the Lower Guadalupe Industrial Interests, met in September to discuss the report and requested a second final draft to review. The second draft final will incorporate the significant comments received after the initial report's release. The second draft final is expected by the end of October.

☐ The Edwards Underground Water District has a booklet entitled, "What's Bugging You? A Practical Guide to Pest Control." It discusses pesticides and how they can get into our groundwater supplies, integrated pest management, traditional chemical controls, mechanical and biological controls, and alternatives to traditional synthetic pesticides. For a free copy, contact the Office of Public Information at (210) 222-2204 or (800) 292-1047. ■

The Water Level

This reading reflects the daily high artesian water elevation at the Bexar County Edwards Aquifer Index Well. The bottom of the graph represents the depth of the well which is 143 feet below mean sea level.



Current Status: On October 18th, 1994, the water elevation was recorded at 670.8. Average for October is 666.0.

THE WATER SOURCE

The Water Source is published quarterly by the Public Information Office of the Edwards Underground Water District, 1615 N. St. Mary's, San Antonio, Texas, 78212. 210/222-2204 or 800/292-1047

Editor: *Carolyn Eagle.*
Feature Articles: *Michael Albach, Gayle Kipp;* Guest Columnist: *Blake Weissling.*

EDWARDS UNDERGROUND WATER DISTRICT

1615 N. ST. MARY'S ~ P.O. BOX 15830
SAN ANTONIO TEXAS 78212

FORWARD & ADDRESS CORRECTION

BULK RATE
U.S. POSTAGE
PAID
PERMIT # 771
SAN ANTONIO
TX 78212

Recycled Paper

THE WATER SOURCE

A QUARTERLY PUBLICATION OF THE EDWARDS UNDERGROUND WATER DISTRICT

January 1995

District Signs Historic Accord

Rick Illgner, M.A. Geography
EUWD General Manager

The Edwards Underground Water District recently joined with the underground water conservation districts in Medina and Uvalde counties in signing the Edwards Aquifer Interlocal Contract. After a five-year lapse, this Interlocal Contract restores regional management, subject to local control, over the Edwards Aquifer in a fair and equitable manner.

The original 1959 legislation creating the Edwards Underground Water District (EUWD) included the five major counties which rely on the Edwards Aquifer: the current EUWD counties of Bexar, Comal and Hays, and the two western counties of Medina and Uvalde. In 1989, the western counties withdrew from the Edwards District in a disagreement that focused on some of the regulatory concepts listed in the 1988 Regional Water Plan.

The new Interlocal Contract resolves historical conflicts about how to manage the Edwards Aquifer. The different needs and perspectives of western agricultural interests, central municipal interests, and eastern spring interests have, in the past, divided communities in the region. The Interlocal Contract will, over time, heal these divisions and unite all the interests in a regional perspective.

Recent divisions have included:

- A 1989 lawsuit which declared the aquifer an underground stream, and therefore subject to state control.
- A 1990 warning from the U.S. Fish & Wildlife Service (USFWS) that insufficient rainfall had caused spring flows to drop, jeopardizing endangered species, and that federal intervention was pending.
- The 1991 opening of the catfish farm, and its subsequent shut down the same year due to a lawsuit filed by the EUWD and San Antonio River Authority.
- The 1991 San Antonio citizens' initiative that halted construction of the Applewhite Reservoir.
- A 1992 action by the Texas Water Commission (now the Texas Natural Resource Conservation Commission) declaring the aquifer an underground stream. A court decision promptly reversed this attempt to regulate the aquifer.
- A 1992 decision by federal judge Lucius Bunton of Midland, finding the USFWS negligent, and directing it and the State of Texas to protect endangered species at Comal and San Marcos Springs. The lawsuit had been filed by the Sierra Club, Guadalupe-Blanco River Authority and others the previous year.
- The 1993 passage of Senate Bill 1477 by the Texas Legislature in response to Judge Bunton's directive. The bill would use government regulations to reduce aquifer pumping, create new underground water rights, and levy fees to buy water rights from well owners.
- A 1993 objection to S.B. 1477 by the U.S. Department of Justice on grounds that it violated the Voting Rights Act. This objection stopped the new law's implementation and preserved the current elected EUWD board as the aquifer's primary regional manager.
- A 1994 referendum that defeated the San Antonio Water System's long-range plan, and with it, a revised version of the Applewhite Reservoir.

To resolve these conflicts, the EUWD board of directors decided in early 1994 to develop a strategic plan –

(continued)

Don't Forget About Conservation

Charles Ahrens, B.A. Urban & Regional Planning
EUWD Water Resource Planner III

Simplicity. In today's complicated world, we are bombarded with choices and alternatives, often times overlooking the obvious. Residents of the Edwards Aquifer region have experienced this over the last three years, hearing about alternatives such as augmentation, recharge, reservoirs, inter-basin transfers, and more being advocated by activists and policy-makers alike. Yet there always seems to be constraints in the acquisition of these additional supplies. Political, legal, environmental and institutional issues face any effort to obtain water supplies from various sources other than the Edwards Aquifer.

But there is one alternative which has few of the constraints mentioned above ... increasing water-use efficiency, or more commonly, water conservation. To most of us, water-use efficiency is a noble and desirable goal. But to decision makers, the formation of such policy presents an inexpensive alternative. What is water-use efficiency, and how much water can be made available as a result of this type of program?

Water-use efficiency is defined as changes in lifestyle or equipment which results in a smaller volume of water used to accomplish any given task. These changes are usually components of water conservation plans or drought management plans. Water-use efficiency can be as simple as shutting off the water while brushing your teeth, or as complex as determining an appropriate water rate structure which penalizes excessive use while maintaining the financial strength of a utility.

Regardless of the type of plan or program implemented, a common thread determines its effectiveness – the level of acceptance by the public. Experience tells us that most individuals will respond favorably to a call-to-action once they understand the reasons for undertaking the effort. Water-use efficiency should be the most accepted and effective means of providing this region an additional supply in a relatively short period of time. Yet very few methods are effectively legislated, as most are tied to some action, or lack of action, by the end user. This presents a challenge to the water planners of the region.

These Chinese figures represent simplicity. The Chinese believe that simplicity is an important concept, reminding us that "getting back to basics" is a noble goal.

So why haven't we heard more about water conservation as a component of water management in the past, and why should we look to it in the future? Historical reasons for not practicing water conservation include:

- water has been inexpensive,
- few incentives have been offered,
- people didn't believe they could make a difference,
- there was no threat of outside intervention by other levels of government.

I propose that users of the Edwards Aquifer have the power in their own hands to affect the amount of water available today and in the future. Water conservation has not been practiced to the degree it should, and all of us should step up efforts to increase the efficiency of our water use. If we all saved five gallons a day (the equivalent of one flush or knocking one minute off our shower time), we could provide the region with an additional **2.7 billion gallons** of water per year!

The risk of federal intervention has galvanized the region into searching for additional supplies, and strides are being made. The price of water has recently gone up, with additional increases to those who use more than their fair share. More agencies are providing cash incentives in the form of rebates for plumbing fixture replacement, or proper landscape design and installation. On-going education efforts have helped convince the public that individual actions can make a difference.

Many times we look too hard for an answer to a situation when in fact the answer, or part of it, is right before us. Efforts which increase the level of water-use efficiency are not the sole solution to any water management dilemma. But they are the most easily accomplished if the users of the resource understand the need for such actions and believe that they can make a difference, regardless of the success or failure of other efforts to manage our most precious resource. ■

Historic Accord *(continued)*

a ten year blueprint and written public policy direction for the District and region's future. Throughout the five-month effort, board members came together and developed a mission statement, goals and objectives that would ensure a sustainable supply of high quality water, with a spirit of regional cooperation. Demonstrating this cooperative spirit, the board was united in its endorsement of the plan.

A critical element of the plan is, "To create a regional cooperative agreement ... among the underground water authorities in Bexar, Comal, Hays, Medina and Uvalde Counties, leading to a regionally-supported water management plan." This agreement would be a cornerstone for 1995 legislative proposals. The three districts reached a preliminary agreement in May. In July, EUWD negotiators began weekly open meetings with Medina and Uvalde representatives in Castroville. A team of professional facilitators helped with the sensitive negotiations. After three months, the negotiators reached consensus on managing the Edwards Aquifer.

On October 10, 1994, representatives of the Edwards, Medina and Uvalde Districts signed the Edwards Aquifer Interlocal Contract (EAIC), a binding document based on four principles:

- local control with regional cooperation,
- whoever benefits, pays,
- preservation of property rights, and
- equitable funding.

The main points are as follows:

Governance

The three districts will work in unison with an obligation to manage each section of the aquifer with appropriate techniques. An Edwards Aquifer Liaison Committee will provide a forum for communicating and coordinating actions among the three districts.

Financing

All districts will continue to levy ad valorem taxes. The Edwards District will also seek authority to levy production fees, while the Medina and Uvalde Districts may seek authority for special production surcharge fees in times of drought or other appropriate conditions.

Aquifer Management Guidelines

Districts will be required to provide money for alternative sources of water at times whenever they need to pump more than their historical high. The amounts for each district are:

Edwards:	375,000 acre-feet per year
Bexar:	325,000 acre-feet
Comal:	30,000 acre-feet
Hays:	15,000 acre-feet
Medina:	120,000 acre-feet per year
Uvalde:	160,000 acre-feet per year

These management guidelines are less than the average recharge to the aquifer each year. The guidelines are *not* allocations that are expected to be issued to individual well owners on a "use it or lose it" basis. Rather, they are production thresholds that require development of new supplies. The advantages of this system are its basis on actual numbers, its responsiveness to property rights, and its emphasis on developing new water supplies. Moreover, it does not encourage wasteful use to maintain an artificial water right.

Water Supplies

The Edwards District has already begun looking for 75,000 acre-feet of new water supplies for the region. A comprehensive, but not exhaustive, list of supply alternatives is contained in the EAIC.

Springflow Protection

Protecting Comal and San Marcos Springs has long been a commitment of the Edwards Underground Water District. The yardstick for measuring the effectiveness of any water management strategy is its responsiveness to protecting spring flows that are now mandated for these two natural resources that provide habitat for four endangered species.

Special Tools

The EAIC requires all three districts to develop and enforce drought response plans or demand management plans, conservation plans, reuse policies and water quality protection plans. These plans were adopted in November.

The EAIC is the framework for legislation in the 1995 session. Because of the EAIC, the Edwards District will be able to work cooperatively with its regional partners from Medina and Uvalde counties in ways that have not been possible since 1989. The EAIC is easily the most comprehensive and forward-thinking commitment put forth to manage the Edwards Aquifer. Most of the work can begin immediately, while other elements will require legislative action. The good news is that the EAIC can be implemented with an existing governmental framework that has already received the blessings of the Department of Justice. There is much to be done, but the Edwards Underground Water District is ready for the challenge.

If you would like a copy of the Edwards Aquifer Interlocal Contract, contact the Public Information Office during regular business hours at 222-2204 or (800) 292-1047. ■

News Briefs

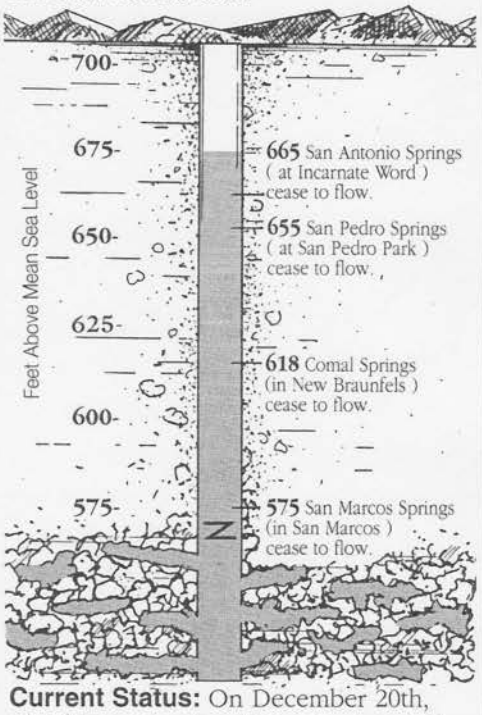
☐ The Texas Water Development Board (TWDB) has awarded a $12,000 grant to the Edwards Underground Water District to purchase water quality testing equipment. The new equipment will be used in sampling and analyzing water in Edwards Aquifer wells as part of the District's annual sampling program. The program involves the collection and laboratory analysis of water samples from Edwards and Glen Rose Aquifer observation wells, as well as surface water samples from streams, rivers and springs in the recharge zone of the Edwards Aquifer. The TWDB's Agricultural Conservation Grants Program provided 75% funding of the new equipment.

☐ The Edwards Underground Water District is developing a "DRASTIC" style mapping process which will assist in the agency's work in assessing the cumulative impact of development over the Edwards Aquifer Recharge Zone. "DRASTIC" is an acronym for seven hydrologic, geologic and pedologic (soil) parameters that, when evaluated collectively, describe the vulnerability of an aquifer to contamination. Data sets will be digitized and entered into the District's G.I.S. system, providing a more comprehensive view of land sensitivity.

The goal of "DRASTIC" mapping is two-fold: 1) to provide more exacting data with which to guide the EUWD's land preservation efforts, and 2) to provide more exacting data with which to establish pollution prevention criteria for development projects. Since "DRASTIC" addresses the physical environment including the built environment, changes in building density can be measured by "DRASTIC" parameters, in effect, measuring cumulative impact. Two subwatersheds will be selected for a pilot study, which is expected to be completed by September, 1995. ■

The Water Level

This reading reflects the daily high artesian water elevation at the Bexar County Edwards Aquifer Index Well. The bottom of the graph represents the depth of the well which is 143 feet below mean sea level.



Current Status: On December 20th, 1994 the water elevation was recorded at 674.3. Average for December is 669.2.

THE WATER SOURCE

The Water Source is published quarterly by the Public Information Office of the Edwards Underground Water District, 1615 N. St. Mary's, San Antonio, Texas, 78212. 210/222-2204 or 800/292-1047

Editor: *Carolyn Eagle.*
Feature Articles: *Rick Illgner, Charles Ahrens.*

EDWARDS UNDERGROUND WATER DISTRICT

1615 N. ST. MARY'S ~ P.O. BOX 15830
SAN ANTONIO TEXAS 78212

FORWARD & ADDRESS CORRECTION

BULK RATE
U.S. POSTAGE
PAID
PERMIT # 771
SAN ANTONIO
TX 78212

Recycled Paper

THE WATER SOURCE

A QUARTERLY PUBLICATION OF THE EDWARDS UNDERGROUND WATER DISTRICT

April 1995

Studies Provide Pieces of Edwards Aquifer Puzzle

John Waugh, II, M.S. Geology
EUWD Hydrologist II

While there is a great deal we know about the Edwards Aquifer and how it works, there is much that remains a mystery. The Edwards Underground Water District has conducted a series of hydrologic studies over the past three years that were designed to better define the boundaries of the Edwards aquifer.

The Edwards aquifer is a network of drainage, recharge and artesian/ reservoir areas which encompass 8,000 square miles and 17 south central Texas counties. The movement of water through the aquifer appears to be simple, with the aquifer functioning in a seemingly uncomplicated manner. But a more detailed examination indicates that the flow is very complex.

The aquifer began to form one hundred million years ago when South Texas was covered by a shallow, warm sea. The remains of plants and animals that lived in this area settled to the sea floor and built up thick layers of lime mud. Over millions of years, this mud was buried under more sediment, and was compressed and heated to form [Edwards] limestone. Later, a large portion of Central Texas was pushed upward, causing layers of Edwards limestone to be tilted down towards the southeast and exposed to the atmosphere. As rain water began to filter into the limestone, a chemical reaction caused portions of the limestone to dissolve and be carried away, forming small holes and channels throughout the layers.

This uplift and exposure of the limestone to the atmosphere happened several times and was aided by major periods of faulting which occurred approximately 17 million years ago. The faults and fractures dropped most of the Edwards limestone layers down towards the southeast, creating a zone of highly fractured and faulted rock through which groundwater could flow. These openings were enlarged as the limestone continued to dissolve.

Later, erosion of the tilted layers of Edwards limestone produced the aquifer's recharge zone, where today these layers are exposed at the surface. The cavernous channels, numerous sinkholes and fractured limestone we see in the creekbeds in the recharge zone are evidence of this period of faulting and erosion. Briefly, the recharge zone is the area where rain falling on the surface runs down streams and rivers and eventually filters through the fractures, faults and sinkholes and enters the reservoir portion of the Edwards Aquifer.

"This ...data can be utilized...to more efficiently manage an extremely valuable resource."

The following studies have provided hydrologic data that can be used to model how water moves through the aquifer. The model will assist researchers in determining the optimum plan for providing adequate water to the diverse users of the aquifer while maintaining flow at Comal and San Marcos Springs. A short summary will explain the purpose of these studies, as well as the results and conclusions.

(continued)

Aquifer Puzzle *(continued)*

East/West: Edwards Aquifer Groundwater Divides Study

The Edwards aquifer actually extends northeast past Austin, and west into Mexico. The eastern and western boundaries of the San Antonio portion of the Edwards aquifer are believed to be in Hays and Kinney counties. The boundaries are called groundwater divides and represent imaginary lines that separate groundwater flow in one direction from flow in another. Groundwater divides usually occur along highs in the land surface. The eastern divide, located in Hays County between the cities of Kyle and Buda is believed to isolate flow toward Austin from flow toward San Marcos Springs. The western divide, located in Kinney County near Brackettville, is believed to isolate flow toward Del Rio from flow toward San Antonio. This study examined the geology and hydrology of the two areas so that we could determine the locations of the divides and their hydrogeologic controls.

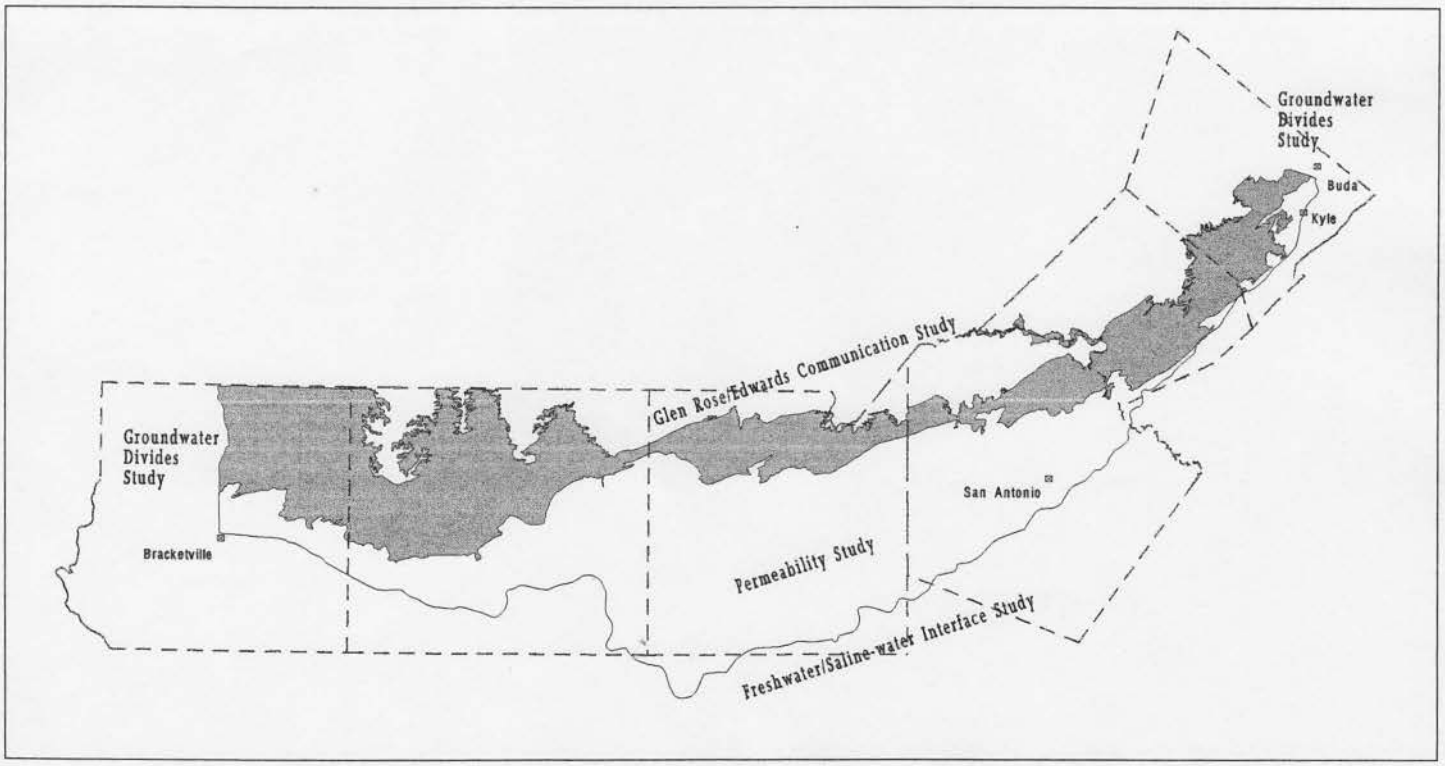
Results of the study indicate that the eastern groundwater divide is located west of Buda, along Onion Creek, in the recharge zone portion of the Edwards aquifer. Previously, scientists thought all the water which filtered into the aquifer through the bottom of Onion Creek flowed towards Buda and Austin. The study indicates that a portion of the recharge in Onion Creek actually flows toward Kyle and San Marcos during normal-to-wet periods.

In the artesian portion of the aquifer, data shows that during times of low water levels, the groundwater flow from the Blanco River and Onion Creek may not be toward San Marcos Springs, but instead moves toward pumping centers near Kyle and Buda, and to Barton Springs near Austin. Proposed tracer research in the Onion Creek area by the Barton Springs/Edwards Aquifer Conservation District will hopefully determine specific flow paths in this area.

Results from the western divide indicate that it should be positioned west of Las Moras Springs, extending northward past Pinto Mountain. A significant finding in this study was that a portion of recharge resulting from stream losses in the West Nueces River flows toward Pinto and Las Moras Springs. The stream losses are currently being used to calculate recharge in the San Antonio region of the aquifer, but the springflow is not being used in calculating discharge. Therefore, discharge from both of these springs should be used when calculating the water balance of the Edwards aquifer.

South: Fresh Water/Saline Water Interface Studies

Beginning in 1992, the District conducted for three studies that would better define the position of the fresh water/saline water interface (or "bad water line") of the Edwards aquifer. This line represents the southern limit of fresh water in the aquifer. The previously mapped position of the interface had been determined in 1978 by the Texas Water Development Board and United States Geological Survey through a study which used a limited number of wells. The District's study used data from geophysical logs



run in oil and gas wells that were drilled through the Edwards aquifer, as well as all available logs from Edwards aquifer water wells. A mathematical relationship between the geophysical log values for water quality and measured water quality from actual well samples was determined, and the resulting data provided water quality values for several hundred new wells. This permitted hydrologists to more accurately locate the position of the interface.

We discovered that the interface between fresh and saline water extended all the way into northwest Frio county in an area previously thought to contain saline water. To confirm the theory, the EUWD drilled and completed a 3,400 foot monitoring well in 1993. The well is approximately four miles southwest of Yancy, Texas in southern Medina County. Analysis of drill cuttings, as well as hydrologic and water quality testing showed that the Edwards aquifer did indeed contain fresh water in a location over four miles south of the previously mapped interface position.

The interface in southeastern Uvalde County was found to be further north than was previously mapped. Between Kyle and San Antonio, we discovered the interface was controlled by faulting, and did not differ substantially from its previously mapped position.

The newly defined position of the fresh water/saline water interface is now the official southern boundary of the aquifer used for current and future EUWD research.

North: Glen Rose / Edwards Aquifer Communication Study

The Edwards aquifer is bounded on its northern edge by the recharge zone. Here, Edwards limestone is deposited on top of another limestone formation called the Glen Rose. In portions of the recharge and artesian zones, the Edwards is faulted and has dropped down to approximately the same elevation as the Glen Rose. In some of these areas, it has been theorized that water in the Glen Rose aquifer can move across the faults and into the Edwards, providing additional recharge. Researchers have previously estimated that this additional recharge from the Glen Rose represents approximately five percent of the total recharge to the Edwards aquifer.

This study analyzed both water-level and water-quality data to determine if water really does move across these faults. It does, but the study confirmed that only small amounts of Glen Rose water enter the Edwards aquifer compared with other recharge sources. Researchers estimate the amount to range between 2,700 to 11,400 acre-feet per year. This represents less than two percent of the total water budget of the Edwards aquifer during average recharge conditions, and is not considered a significant amount that would require annual recharge to be recalculated.

Inside: Regional Distribution of Permeability in the Edwards Aquifer

Permeability is a measurement of the ability of rock to transmit fluid. In terms of the Edwards aquifer, this means how easily water can move through the limestone. This study looked at the aquifer's permeability distribution and where the areas of high flow might be located. A tremendous amount of data was synthesized. Researchers analyzed data concerning the structure and thickness of the aquifer, the affect the limestone's composition had on the flow of water, and permeability data from well tests. Now we have a better picture of how much water can move through the aquifer, and the paths it might take.

The study, completed earlier this year, revealed that the presence of faults and caverns increases permeability by as much as 10 to 100 times more than in non-faulted porous rock. It also revealed that the areas with the highest permeability are adjacent to the aquifer's southern boundary ... the fresh water/saline water interface.

This study compliments a porosity study completed in 1993 which estimated how much water could be stored in the pore spaces of the aquifer. While there may be as much as 215 million acre-feet of total water in the aquifer, it is not known how much of the water is recoverable. The permeability study was the next step in a long process to determine the total retrievable amount of water, and how that water moves through the aquifer.

Data from both studies will be used in developing an interactive, dynamic 3-D model of the Edwards aquifer which will help us better understand the flow patterns water takes when moving through the aquifer. Someday, this will allow us to determine the areas where pumpage from the aquifer has a greater or lesser effect on flow from Comal or San Marcos Springs. This would allow for continued development in our region while lessening its impact on springflow.

Summary

The results of the studies conducted and funded by the EUWD over the past three years have added greatly to understanding the boundaries of the Edwards aquifer. This additional data can be utilized by the region's leaders to more efficiently manage an extremely valuable resource. All the data from these studies has been entered into the District's computer database for use in future research so that we may continue to increase our knowledge of the Edwards aquifer. ■

News Briefs

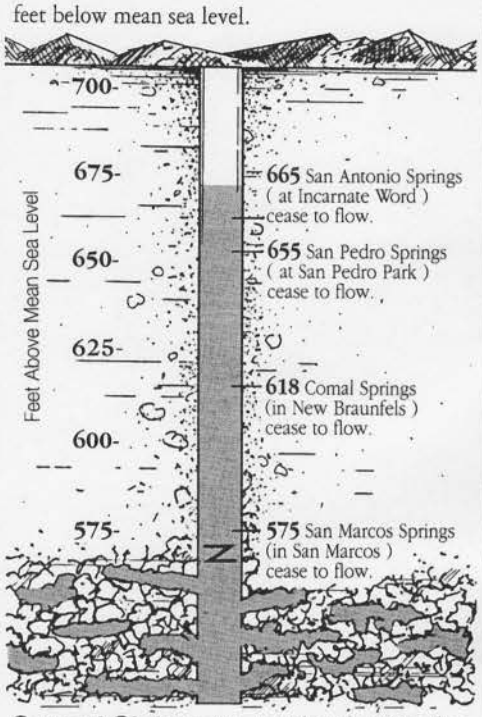
☐ Seven students received special awards from the Edwards Underground Water District at the 1995 Alamo Regional Science Fair. In the senior division, first place was awarded to Amy Coliander from MacArthur High School. She received a limestone plaque and $100 savings bond for her project, "Bacterial Contamination of Zoos." Second place went to Kelly Bendele from LBJ High School for her project entitled "What is Clean Water, Really?" Third went to Shavonne Freeman from Marshall High School for her project, "How Deep is the Well?"

In the junior division, William Verner and Nicholas Hagendorf captured first place for their project, "Water Works." They attend Alamo Heights Junior High. Second place went to Robbie Gonzales and Robbie Klekar from Canyon Middle School for their project entitled, "Water Pollution." All students received a limestone plaque, with first and second place winners also receiving a $100 and $50 savings bond respectively.

☐ For the fourth year, the Edwards Underground Water District is sponsoring a xeriscape contest. First prize in three different categories is a $1,000 gift certificate to your favorite nursery. Entry deadline is May 15, 1995. The three categories are: best existing xeriscape designed by the homeowner; best existing xeriscape designed by a professional (entry must be submitted by the homeowner); and best PLAN for a xeriscape. Second, third and two honorable mentions will also be awarded in each category. Entry forms and guidelines can be found in the WOAI Spring Gardening Almanac. Or call the EUWD at (800) 292-1047 and one will be mailed to you. Other sponsors include the Bexar County Master Gardeners, WOAI radio, San Antonio River Authority and San Antonio Water System.■

The Water Level

This reading reflects the daily high artesian water elevation at the Bexar County Edwards Aquifer Index Well. The bottom of the graph represents the depth of the well which is 143 feet below mean sea level.



Current Status: On April 3rd, 1995 the water elevation was recorded at 671.2. Average for April is 667.2.

THE WATER SOURCE

The Water Source is published quarterly by the Public Information Office of the Edwards Underground Water District, 1615 N. St. Mary's, San Antonio, Texas, 78212. 210/222-2204 or 800/292-1047

Editor: *Carolyn Eagle*
Feature Article: *John Waugh*

EDWARDS UNDERGROUND WATER DISTRICT

1615 N. ST. MARY'S ~ P.O.BOX 15830
SAN ANTONIO TEXAS 78212

FORWARD & ADDRESS CORRECTION

BULK RATE
U.S. POSTAGE
PAID
PERMIT # 771
SAN ANTONIO
TX 78212

Recycled Paper

THE WATER SOURCE

A QUARTERLY PUBLICATION OF THE EDWARDS UNDERGROUND WATER DISTRICT

July 1995

The Spirit of the West: An Endangered Economy

Mike Saathoff and Joe Fohn believe their sentiments on the Edwards Aquifer are very clear. Water is essential to their livelihoods. Their bottom line ... their way of life ... is directly affected by what they can and cannot get.

Mike and Joe are farmers in Medina County who are facing an uncertain future. They are wondering if their lives will change drastically pending the outcome of the battles surrounding their water supply, the Edwards Aquifer.

Joe Fohn is a sixth generation farmer whose land is in the Verde Creek area where the old Vandenberg settlement was located. He drilled his first well in 1967 "because we always lacked that one rain which made a good crop." So, he decided to "supplement the good Lord's rainfall" and currently irrigates 500 acres. He waters by the furrow method, but has purchased his first center pivot this year.

Mike Saathoff took over his father's farming operation along the Hondo Creek in 1979. Like Joe, the family began irrigating in the late 1960's and he currently irrigates 1,500 acres. Last year Mike expanded, which he admits with a smile, "probably wasn't too smart." He doesn't regret his action, but thinks about its implications all the time.

When Mike purchased the additional property, the bank would only lend him its dry land value, not the irrigated value (dry land farming depends solely on rainfall). In a relaxed drawl, he states "It hurt a lot. I had to put up other property as collateral." Joe recently refused an opportunity to buy land because he did not want to pay irrigated land prices and then have his water supply capped.

Both men argue that they don't waste water. Joe flatly states, "We're not going to be running that water down the road because it's costing us money." Mike estimates it costs him $3.50 to $4.00 per acre-inch (therefore, an acre-foot of water on 100 acres would cost between $4,200 and $4,800). Add that amount to the $57,000 he paid recently for one of eight center pivots he uses. According to Mike, the pivots have cut his water use almost in half.

Everything is invested in the land they own. With that in mind, water assumes a new importance.

(continued)

Editor's Note: So often we hear about the diverse uses and users of the Edwards Aquifer. The region has been grappling with the problem of fair and equitable treatment for decades. The Edwards Aquifer issue, in part, is difficult to solve because the users all have very different needs.

As public information officer for the District, I talk to many people who cannot understand why the farmers and the residents of San Marcos and New Braunfels are so passionate about their water supply. While it may be easier for us to understand what the uses and needs are for a city with over a million residents, we are not as familiar with the other uses and needs of those who are also dependent upon the aquifer.

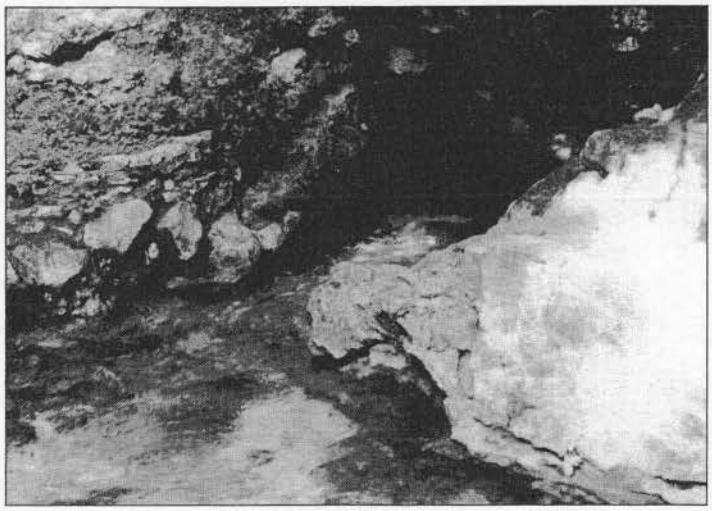
When putting together this issue of The Water Source, I searched for residents who are not involved in the politics surrounding the Edwards Aquifer. Those whose viewpoints are reflected agreed to be a part of this edition because they too felt it was important that these two sides be understood. The following articles are designed to give us all some perspective and a greater understanding of other points of view.

Comal Springs: The Heart & Soul of New Braunfels

Iris T. Schumann, C.A.

Editor's Note: Iris Schumann was born in Guadalupe County in 1930 and has spent most of her life in New Braunfels. Since 1976, she has been the Archives Chairman and Archivist at the Sophienburg Museum and Archives in New Braunfels.

I was a very little girl when I first saw the sparkling waters of the Comal Springs in Landa Park. So young in fact, that I cannot visualize the very first time that our extended family picnicked in the park in the 1930's. It was a weekly ritual to prepare a picnic supper at my grandparents' home in downtown New Braunfels and join other families who sought the beauty of the rippling Comal Springs water.



Part of that ritual included a stroll, by the grandchildren, to the Big Spring. As we stood around the bubbling waters, we speculated on the depth of the seemingly bottomless hole. We were almost overpowered by the outpouring of water that endlessly filled the basin and joined the water supplied by hundreds of other springs at the foot of Klappenbach Hill. We, as a community, were so proud of our springs that a sign was hung near the Big Spring which announced the millions of gallons that poured from its source each minute and each day.

The waters of the Comal River were a central part of our lives then, as they have been for over 150 years of our existence as a community. But long before 1845, the Indians of this region also knew the springs. They bent marker trees, some of which remain, pointing the direction to the mighty and life giving springs. The Spaniards also recognized their abundance and named the springs Las Fontanas, or fountains, an indication of the bounty of water the springs provided.

As the first German settlers moved into this area, some residents, including the father of Texas botany, Ferdinand Lindheimer, used the Comal Springs as a return address when writing to friends. While New Braunfels was not a well known location, the springs were. Water was the reason that our founders chose this site for settlement. There were two great sources of water coming together at this location: the Guadalupe and Comal Rivers. As the Comal provided water for the Guadalupe, the newcomers quickly recognized that the springs were a gift of life to the whole area and they have been treated that way ever since.

William H. Merriwether, the 19th century industrialist, was among the early residents to recognize the immense economic potential of that gift. He channeled the power of the springs in the 1850's for use in his mills when he created the mill race. He followed others, however, who had built water wheels along the river to rung the mills that sawed the wood, ground the grain, and helped us grow to become a community which welcomed industries as part of our economic growth.

It was water then and now which continues to be the fuel which ignites our economy. It allows healthy growth and expansion of our businesses and industries thus providing jobs for our residents. Those jobs are not only the river-related ones, but as a community, we consciously have tried to act responsibly by attracting industries that use our precious water resources in a conservative manner. We recognize water as a finite resource that must be protected and remain pure for the good of us all.

The waters of the Comal Springs are a living force to those of us who make our homes here. In our joyful times we are drawn to the springs: for small family gatherings, for weddings, for holiday celebrations, and for big events like our city's 150th anniversary. At these and many other times you will find our citizens and our guests wading, swimming, boating and gathering by the waters of the Comal. But the springs come to our rescue in our sad times too. They serve as a place for comfort and meditation where we can be alone and yet not be alone; a place where we can nurse our wounds and be renewed by the life and the purity of the waters.

The springs are the heart and soul of our community. They weave a thread of togetherness, of communion, of depth and breadth of life to a diverse group of people who call Comal County their home. They may change with the seasons, but they never abandon us. The springs are now and have always been the equilibrium that maintains the emotional and physical balance of our community. ■

Spirit of West *(continued)*

Mike believes that if it is a dry year and his water supply is capped, his crops may fail. He will have trouble making payments on the pivot, the land, the tractors, and his house. As he points out, "It won't just hurt me. It'll be like dominos." Joe is quick to agree. "Only your operating income is in the bank. We put everything we've got back into the soil." Joe also brings up the fact that costs continue to rise, and farmers have less buying power today than they did 50 years ago. "My father got $3 per bushel for corn in 1946. Last year, I got the same."

Both wonder what the future holds for agriculture. Mike isn't sure if his son will follow in his footsteps because of all the uncertainty. Joe looks at his nieces and nephews and says he can't blame them for not pursuing agriculture. "They can go and get a job without making a large investment, work 8:00 am to 5:00 pm, and get good retirement benefits."

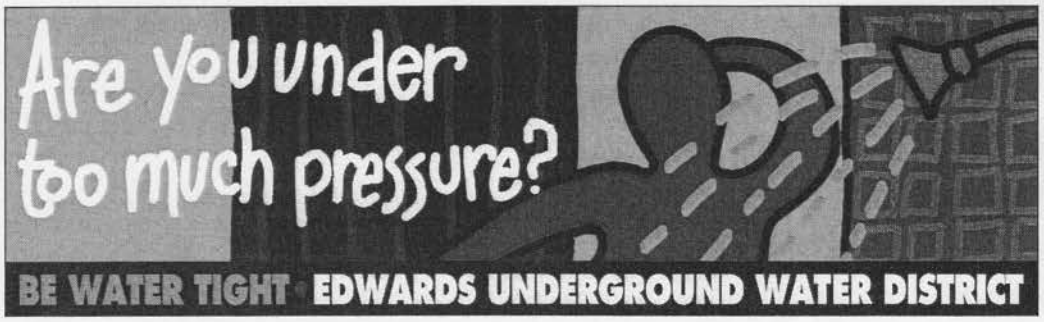
But neither one of them would change the paths they've chosen. "It's a way of life. I love it ... seeing those first plants coming up ... there is nothing better," says Joe. Mike echoes his sentiments. "I like doing it. It's my life and my livelihood."

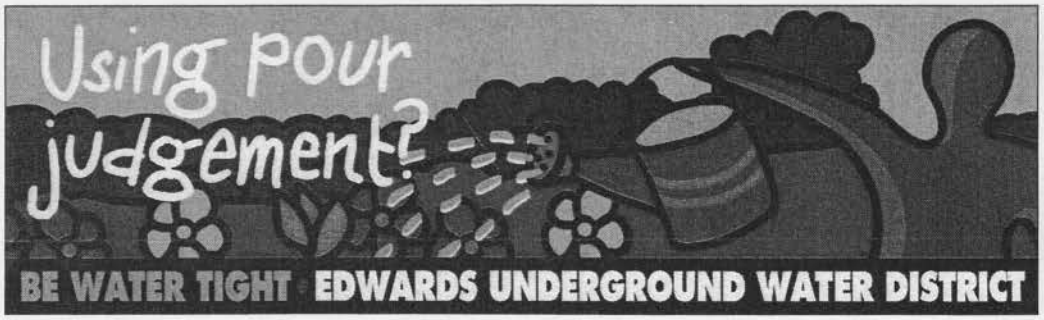
He also makes another argument. "What would other businesses do if they were told they couldn't expand? If I can't have any more water, I can't expand. In other businesses, all they have to do is raise their prices of whatever they're selling. We're just trying to make it." Joe summarizes, "Sure, recreation brings in money, but we need farming too. We need food on the table."

On average, irrigation accounts for 30% of the water used from the aquifer. Both hope that if cutbacks are implemented, everyone will be squeezed. But until then, both men will keep on harvesting the corn and cotton, and wait and see. ■

1995 Summer Campaign: "Be Water Tight"

You may have noticed some colorful billboards with a water conservation message scattered throughout San Antonio, New Braunfels and San Marcos. They are part of the Edwards Underground Water District's annual summer campaign which reminds the public to "Be Water Tight". During the hottest part of the year, it's important that we all use our water efficiently. That means watering landscapes in the cool of the day and only giving your lawn what it needs: about an inch a week. The Edwards Underground Water District has free information on how you can Be Water Tight — indoors and out. Call 222-2204 or (800) 292-1047 between 8:00 am and 5:00 pm, Monday through Friday.





News Briefs

☐ This summer, the Edwards Underground Water District Board of Directors agreed to implement voluntary emergency withdrawal reduction measures as set out by a panel of attorneys appointed by Federal Court Judge Lucious Bunton. The plan would only be in effect this year, temporarily changing the District's current Demand Management Plan until January 1, 1996.

The reductions are triggered when water levels in the Bexar County Index Well (J-17) reach 655, 648 and 644 feet above sea level. The plan affects water suppliers, municipalities and other non-industrial and non-agricultural water users in Bexar, Comal and Hays Counties. Reduction goals are as follows:

Stage I	1.8 x base usage
Stage II	1.6 x base usage
Stage III	1.2 x base usage

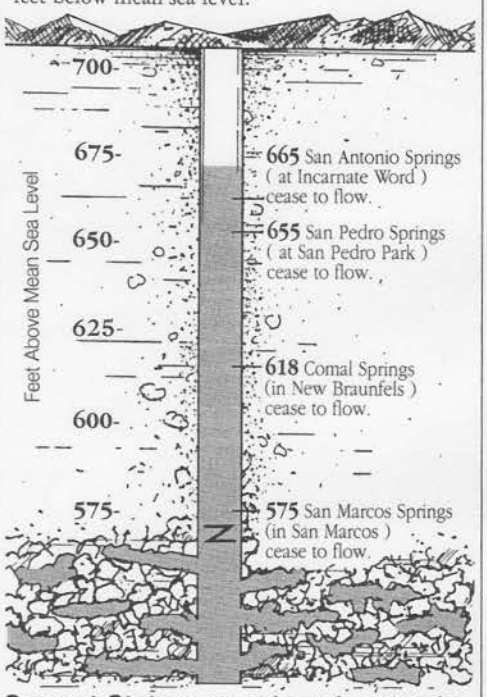
Base usage is calculated by taking the average of the lowest three months, from November, 1994 until February, 1995. ■

☐ Aquarena Springs located in San Marcos, Texas is refocusing its vision to become an environmental interpretative center. Southwest Texas State University purchased Aquarena Springs in 1994 and envisions the park as an environmental and cultural center, educating the public about the history of the area, as well as native life found at the springs.

As part of this new emphasis, an endangered species exhibit opened in June. The exhibit houses five endangered species in specialized aquariums and tanks built to protect them. These species are at the heart of the Edwards Aquifer controversy. The park hopes to teach visitors about the plants and animals, as well as have them leave with a better understanding of the relationship between humankind and the springs. For more information, call 1-800-999-9767. ■

The Water Level

This reading reflects the daily high artesian water elevation at the Bexar County Edwards Aquifer Index Well. The bottom of the graph represents the depth of the well which is 143 feet below mean sea level.



Current Status: On July 10th, 1995 the elevation was recorded at 668.1. Average for July is 667.3

THE WATER SOURCE

The Water Source is published quarterly by the Public Information Office of the Edwards Underground Water District, 1615 N. St. Mary's, San Antonio, Texas 78212 210/222-2204 or 800/292-1047

Editor: *Carolyn Eagle*
Guest Columnist: *Iris T. Schumann, C.A.*

EDWARDS UNDERGROUND WATER DISTRICT

1615 N. ST. MARY'S ~ P.O.BOX 15830
SAN ANTONIO TEXAS 78212

FORWARD & ADDRESS CORRECTION

BULK RATE
U.S. POSTAGE
PAID
PERMIT # 771
SAN ANTONIO
TX 78212

Recycled Paper

THE WATER SOURCE

A QUARTERLY PUBLICATION OF THE EDWARDS UNDERGROUND WATER DISTRICT

November 1995

Wood Students Soak Up Water Wisdom

Three years ago, teachers at Wood Middle School in the Northeast Independent School District found themselves in a position familiar to many educators — making the transition to "team" teaching. That summer, three of the school's seventh grade teachers attended a workshop hosted by the Edwards Underground Water District (EUWD). Their attendance spawned an interdisciplinary unit on the Edwards Aquifer which is viewed as the most successful unit presented by the grade level today. It includes 12 teachers and every discipline in the team: Math, English, Science, Social Studies (Texas History), and an advisory period.

Jean Hopkins, head of the Science Department, was one of the teachers who came to the workshop. "We were looking for something we could do across the board that had some commonality to it. The topic of the Edwards Aquifer stood out because science and history could do this, and we knew it could mesh with other subjects."

Cinde Thomas-Jimenez, EUWD Education Coordinator, agrees. "The aquifer is an ideal topic to address in an interdisciplinary team unit because all the pieces fit: current events for social studies; geology and biology for science; recharge, precipitation, water levels, and conservation figures for math; and addressing all the information through research and writing assignments for language arts."

Thus began a unit which has grown every year. Students are literally saturated for one week, five classes a day, on the Edwards Aquifer. During the advisory period, students are given a daily dilemma which encourages problem solving. The unit concludes with a grade-wide debate on managing aquifer use.

"This is truly active learning," states Norm Goldberg, one of the Texas History teachers. "The kids are participating in every event. When they go through it the whole day in school, and then see it on the news that evening, it's real. It's not just something in a textbook."

Cindy Marthes, an English teacher, points out that the writing aspect really pulls students in and makes them think about it. The team emphasizes creative writing during the unit, and students also enter the EUWD's Blue Thumb Essay Contest which is held each spring. The contest asks how our water supply can be protected from contamination. According to Sid Seidenberger, also in the English Department, that is where he could see science and English pulled together. "When I read the essays, I could see how the students drew from everything they had learned ... it all came together."

Janice Williams, Texas History teacher, indicates that the unit provides a unique opportunity to pull local geography, current events and natural resources together in a relevant way. "From a Texas History class point of view, we have a real hook in this neighborhood." She points out to her students that when they go out Loop 1604 to Rolling Oaks Mall and cross Cibolo Creek, they are just south of where the creek recharges the aquifer. Or when they take Loop 1604 over to Hwy. 281, they are on the recharge zone. Or when they go to Fiesta Texas, they are on the recharge zone. It all of a sudden becomes real. "They can tie into it in a very personal way. They even understand how Balcones Heights got its name."

When discussing the debate, all the teachers become excited. Goldberg broke his classes into groups and challenged students with a role-playing assignment. One group was farmers, one was city residents, and one was environmentalists. All the major users were represented. Students had to look at different aspects of who should have the water, develop a plan stating why their group should have the water, and determine what resources had to be shared. Each group had to make a formal presentation to a "water board" composed of fellow students. The "water board" then

(continued)

Water Quality in the Edwards Aquifer

John Waugh, M.S. Geology
EUWD Hydrologist II

"Water, which so many townspeople never think about, having an obedient spring in the kitchen, is really among the most fragile of life's necessities."
H.V. Morton, *The Waters of Rome*

Archaeologists have discovered evidence of human presence dating back 10,000 years in and around the natural springs which flow from the Edwards Aquifer. Settlers were drawn to this area primarily because of the quality of plentiful water, thus water quality in the Edwards Aquifer has always been a critical issue in South Texas. Official monitoring of water quality began in the 20th century as development in the region accelerated. Records from water quality sampling in San Antonio date back to the 1930's.

One of the primary responsibilities of the Edwards Underground Water District (District), as stated in its enabling act, is "conserving, protecting, and recharging" the Edwards Aquifer. This refers to both the quality as well as quantity of a valuable resource that over 1.4 million of us depend upon for our sole source of safe, clean drinking water. The District, in cooperation with other agencies, has been collecting and reporting data from wells, springs, and rivers across the aquifer region for over 30 years.

The United States Environmental Protection Agency (EPA) has established standards for safe drinking water which specify the maximum concentrations of various naturally occurring constituents, as well as maximum concentrations of various natural and man-made pollutants. Although water from the Edwards Aquifer surpasses these drinking water standards, the possibility of aquifer contamination from various sources must be prevented through continued monitoring, as well as through education.

In South Texas, water begins its journey to our houses as rainfall in the hill country, which is located above the Edwards Aquifer recharge zone. Runoff from the hills enters the streams and rivers which carry the water over the recharge zone — the area where fractured and faulted Edwards limestone is exposed on the surface. Water in the streambeds enters the aquifer through these fractures, as well as through the many sinkholes and caverns which dot the recharge zone. It eventually moves through the aquifer to springs and wells where it is discharged and used for various purposes. Throughout this journey, pollutants can enter the water at many points and could potentially cause contamination to portions of our water supply. Regardless of the quantity of water available in the Edwards Aquifer, if it were to become contaminated, we would be severely challenged to overcome a potentially dangerous situation.

The major reason for monitoring water quality in the Edwards Aquifer is to maintain the excellent overall quality of water in the aquifer through the analysis of results from the annual monitoring of a network of wells, springs and rivers. Other reasons include:

- monitoring possible changes in water quality which may be attributed to increased development in sensitive portions of the aquifer area
- investigating reports of possible contamination of the aquifer, including both groundwater and surface water sampling, and providing this information to assist in remediation
- long-term monitoring of possible water quality changes along the freshwater/saline-water interface as aquifer levels fluctuate.

The District maintains a network of over 140 wells, as illustrated on the map, which are sampled on an annual or rotational (every two to three years) basis. These wells are a mixture of municipal, agricultural, industrial, domestic, and livestock wells that have been sampled, in some cases, for over 30 years. Many of these wells are located on or close to the recharge zone to monitor for possible changes in water quality related to further development activities in this sensitive area.

Historical data is maintained and updated in the District's water quality database. Samples from wells and springs are analyzed for 78 constituents, including field parameters (ex. pH), inorganic constituents (such as calcium), nutrients (ex. nitrates), trace metals (ex. arsenic), pesticides, herbicides, and volatile organic compounds (such as industrial solvents).

If evidence of contamination is detected in a well during the annual monitoring program, and analysis of the data warrants further investigation, additional sampling may be performed to verify the problem and determine corrective action.

The District has also constructed and is continuously monitoring a second network of 19 transect wells across the freshwater/saline-water interface of the Edwards Aquifer. This interface marks the southern limit of the freshwater portion of the aquifer, and is defined by a water quality parameter known as the total dissolved solids (TDS) concentration. This parameter is a measure of the concentration of various salts which occur in water. The freshwater/saline-water interface is defined by TDS values greater than 1,000 milligrams per liter (mg/l) of water. The network of 19 wells which monitor the interface is sampled monthly or quarterly by District water quality staff for field parameters and inorganic compounds. This sampling is done primarily to monitor for possible changes in the position of this water quality boundary as water levels in the aquifer fluctuate during wet and dry periods.

The District's surface water monitoring network currently consists of seven sites on streams and rivers in the recharge and catchment areas of Uvalde,

(continued)

Water Quality *(continued)*

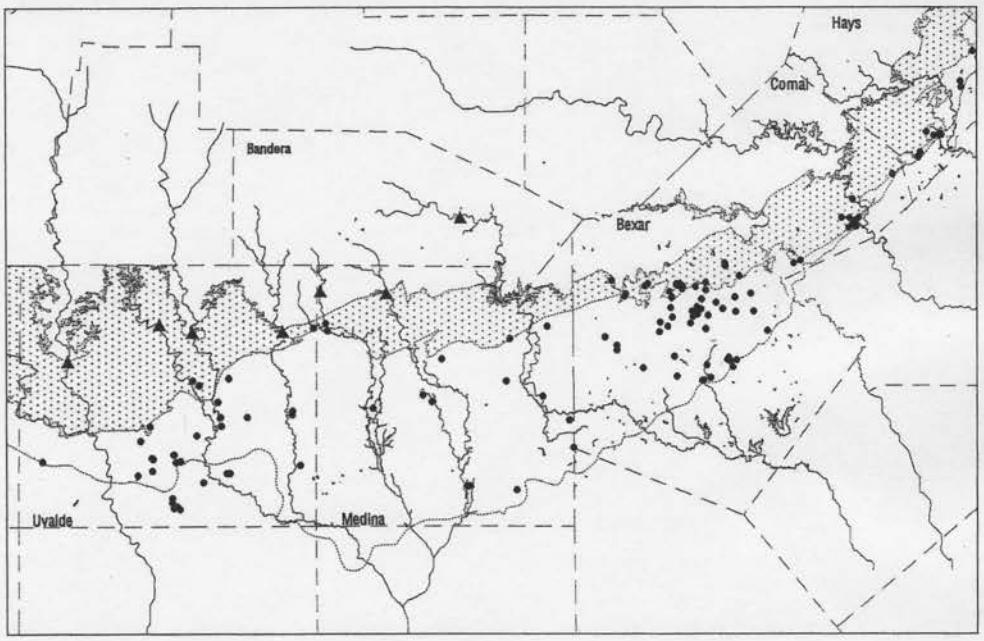
Medina and Bandera counties. This network provides data concerning the quality of water in streams and rivers about to enter the Edwards Aquifer through the recharge zone. These sites are sampled three times per year for the same parameters and constituents as the groundwater samples, as well as for biochemical oxygen demand (BOD), and for bacteria (fecal coliform and fecal streptococcus) concentrations.

All the field data and laboratory analyses from the annual water quality monitoring program are entered into the District's digital database for reporting and analysis. The information in the water quality database is available for use by District hydrologists and other scientists in conducting water quality research, as well as for use as a comparative tool and for baseline data.

District water quality staff has undergone extensive training during the past few years to assure that accurate, reproducible data will be generated by the monitoring program. This training included courses in field sampling techniques, laboratory analysis, data preparation, and statistical analysis of results.

Last year, the District received a grant from the Texas Water Development Board and purchased a field laboratory trailer which is capable of conducting extended sampling projects in remote areas of the aquifer region. This allows staff to sample and process bacteria samples in the field, and allows additional sampling of water entering the recharge zone from the streams and rivers originating in the hill country (Edwards Plateau). The additional sampling of rural areas will provide new data concerning water quality in the flowpaths leading toward the major springs in New Braunfels and San Marcos.

The District's water quality program is designed to monitor and protect the excellent quality of water that we receive from the Edwards Aquifer. The sensitivity of the aquifer to possible contamination makes it vital that this program be maintained, especially as South Texas undergoes rapid growth. Not only must we protect the quality of water for our current use, we must also insure that our children and grandchildren will be able to enjoy the pure, clear water from our Texas treasure. ■



WATER QUALITY MONITORING NETWORK

Wood Students *(continued)*

decided who got the water. The activity had the hallways buzzing, with the entire seventh grade talking about it.

Are students responding? Marthes mentioned that she had students go home and tell their parents not to use fertilizer. According to Goldberg, some of the preconceived notions he hears (which presumably come from parents) disappear as the students go through the unit. Then he hears how students are changing their parents' behavior. "I think we're introducing something that many of them will come back to as adults," says Williams. "When we're talking about conservation, it's not uncommon for them to say they take 45 minute showers. They will tell me they had no idea that much water was coming through the shower."

To Williams, this is where the unit makes a difference. "I lived through the drought of the '50's, and we didn't understand how things worked. Today, I tell my students that they know so much more and they will be able to make good decisions when they become voting members of society."

Hopkins sums it up. "We reach 450 students a year. But it goes much further than that." Students share what they have learned with their parents and other adults, thus going far beyond the community at Wood Middle School. Thomas-Jimenez agrees with Hopkins' assessment. "Students' interest and knowledge is carried into high school and on into adulthood. Hopefully, we will have generated a life-long interest in local events dealing with water and natural resources, as well as fostered a conservation ethic that will follow them the rest of their lives."

To find out more about the EUWD's summer teacher workshop series or education programs and materials, call the District at (210) 222-2204 or (800) 292-1047. ■

News Briefs

☐ The Edwards Underground Water District's Board of Directors adopted rules at their regular meeting in August which requires all water wells within the District's boundaries to be registered. The Edwards Underground Water District covers parts of Bexar, Comal and Hays counties.

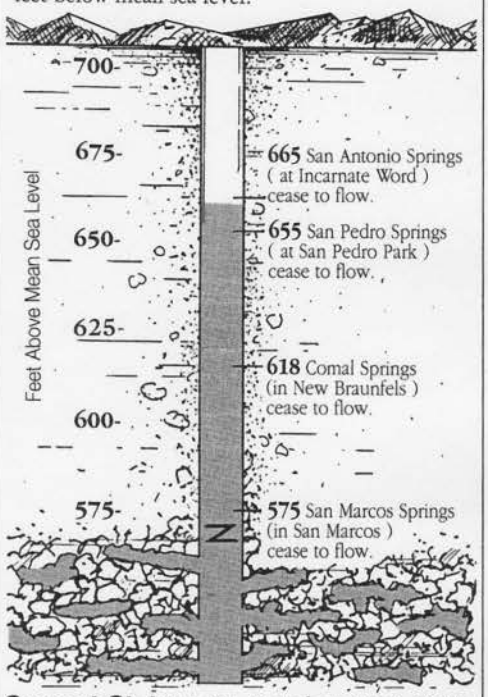
Well owners are required to supply information such as the size, depth, use and location of the well, and are subject to enforcement under the rules if they do not register. Those who have already registered their wells with the District do not have to do so again.

The Edwards Underground Water District's goal is to have accurate and complete records on how many wells are in the District, which includes the Edwards, Glen Rose, Cow Creek, and Carrizo-Wilcox aquifers. Copies of registration forms can be obtained at county courthouses, appraisal districts, city halls, main libraries and soil conservation services in San Antonio, New Braunfels and San Marcos, as well as at the District's office at 1615 North St. Mary's in San Antonio. For more information, call 222-2204 or (800) 292-1047.

☐ The Edwards Underground Water District has a speakers' bureau which is available to schools, civic and professional organizations. Topics can include the geology, hydrology and biology of the Edwards Aquifer, as well as water conservation or a general discussion on how the aquifer works. To schedule a presentation, contact the Office of Public Information at (210) 222-2204 or (800) 292-1047. ■

The Water Level

This reading reflects the daily high artesian water elevation at the Bexar County Edwards Aquifer Index Well. The bottom of the graph represents the depth of the well which is 143 feet below mean sea level.



Current Status: On October 31st, 1995 the elevation was recorded at 658.4. Average for October is 661.5.

THE WATER SOURCE

The Water Source is published quarterly by the Public Information Office of the Edwards Underground Water District, 1615 N. St. Mary's, San Antonio, Texas 78212 210/222-2204 or 800/292-1047

Editor: *Carolyn Eagle*
Columnist: *John Waugh*

EDWARDS UNDERGROUND WATER DISTRICT

1615 N. ST. MARY'S ~ P.O. BOX 15830
SAN ANTONIO TEXAS 78212

FORWARD & ADDRESS CORRECTION

BULK RATE
U.S. POSTAGE
PAID
PERMIT # 771
SAN ANTONIO
TX 78212

THE WATER SOURCE

A QUARTERLY PUBLICATION OF THE EDWARDS UNDERGROUND WATER DISTRICT

February 1996

The Beat Goes On ...

An Update on the Edwards District & Issues Affecting Management of the Edwards Aquifer

Rick Illgner,
EUWD General Manager

There have been numerous events in the last five years that have been directed at how and who should manage the Edwards Aquifer. The whole situation is extremely complicated to understand, even for those in the business. Hopefully, this article will sort out some of the confusion in a chronological manner and bring the reader up to date.

The Catalyst

In May of 1991, the Sierra Club filed a lawsuit in federal court against the U.S. Fish and Wildlife Service (USFWS). The suit claimed the USFWS was negligent in carrying out its mandated duty under the Endangered Species Act to protect the habitat of species which live in Comal and San Marcos Springs.

In January of 1993, U.S. District Judge Lucius Bunton ruled in favor of the Sierra Club and ordered that:

- The springflow levels for protection under the Endangered Species Act must be a number greater than zero (in other words, springflow must be maintained, even during a drought of record).

- The Texas Water Commission (now the Texas Natural Resource Conservation Commission) submit a management plan for the Edwards Aquifer by March 1993 that would provide adequate protection for the endangered species at Comal and San Marcos Springs.

- The USFWS develop threshold springflow levels for "take" and "jeopardy" for all federally protected species at Comal and San Marcos Springs. *["Take" and "jeopardy" are levels of injury to the species. "Take" is minimal injury, but potentially some individual members could be lost; "jeopardy" is the threatened extinction of the entire species.]*

- Additional action would be taken if the Texas Legislature did not provide a regional management solution for the Edwards Aquifer.

The New Deal – Part I

On May 30, 1993, the Texas Legislature responded to Judge Bunton by adopting Senate Bill (SB) 1477 which created the Edwards Aquifer Authority (Authority). SB 1477 presented many new approaches to the long-standing conflict over managing the Edwards Aquifer. The Authority was to replace the Edwards Underground Water District and its 12-member elected board. The new agency's affairs would be governed by a nine-member appointed board. There were also new boundaries, including all or parts of eight counties that rely on the Edwards Aquifer. Revenue would come from water use fees instead of ad valorem taxes, which is how the Edwards District is financed. The Authority would also have new powers, including a permitting system that specified the amount of water which could be used. SB 1477 also created the Uvalde Underground Water Conservation District.

(continued)

The Beat Goes On... *(continued)*

The Department of Justice (DOJ) must approve any changes that affect elections, and therefore was queried for approval since the bill replaced an elected body with an appointed one. In November 1993, DOJ denied the request for clearance stating, "While ... the state sought to assure some minority representation on the Bexar County appointed delegation, under federal law, this is not an adequate substitute for existing electoral rights," therefore, dissolving the Edwards District and replacing it with the Authority was legally unenforceable.

The District Continued to Move Forward

The Edwards District continued on in earnest, conducting business between 1993 and 1995 while legal quarrels related to the Endangered Species Act lawsuit and control over the Edwards Aquifer were pending. New research was conducted on the freshwater/saline water interface (also known as the "bad water line"), the amount of water in storage, and how the water moves through and recharges the aquifer, all of which added to our understanding of the Edwards Aquifer. The District's long-held tradition of data collection was enhanced with a state-of-the-art real time data collection network.

In the area of regional management of the Edwards Aquifer, the District worked on two very important items. In June 1994, the board of directors voted unanimously to adopt a strategic plan which set policy for the next 10 years. Second, the Edwards Aquifer Interlocal Contract was signed in October of 1994 by the Medina County and Uvalde County Underground Water Conservation Districts and the Edwards District. This agreement represented a general framework for management of the Edwards Aquifer.

The New Deal – Part II

During the 1995 legislative session, it appeared that the legislature only wanted to make minimal changes to SB 1477. Two bills were introduced to remedy the sticking points in SB 1477. The first, House Bill (HB) 3189, provided for a 15-member elected board instead of the nine-person appointed board found in the original bill. The second, HB 2890, moved forward dates that had expired with the delayed implementation of SB 1477. HB 3189 passed and was signed by the governor. However, HB 2890 was defeated in the final days of the session. The Department of Justice gave its approval of HB 3189 on August 8, 1995.

A New Challenge

Six days before the scheduled implementation date of HB 3189, a lawsuit was filed by the Medina County Underground Water Conservation District. The suit contended that SB 1477 was unconstitutional because it would create a taking of private property rights without compensation, violated due process and equal protection, its passage was improperly noticed to the public, and it was retroactively applied. A judge in state district court granted a temporary restraining order to prevent members of the Authority from taking office. After a hearing, the judge allowed members of the Authority to be sworn in and take office, but forbid them from conducting any business other than hiring attorneys to represent them in this matter. He also stated that the current law remained in effect, thus the Edwards District was not dissolved and was to continue its business.

A three week trial was held, and on October 27, 1995, State District Judge Mickey Pennington ruled that SB 1477 and HB 3189 were unconstitutional on all points argued by the plaintiffs and only the section creating the Uvalde County Underground Water Conservation District could be implemented.

What's Next

The decision has been appealed directly to the Texas Supreme Court because of the constitutional issues raised in the litigation. The Supreme Court will hear the case on March 20th, but it is difficult to know when the court will render its decision.

Since 1904, it has been the basic philosophy of Texas groundwater law that the landowner could use the groundwater beneath his or her land. SB 1477 would have changed that concept. The Supreme Court's opinion is necessary, as determining the constitutionality of SB 1477 is the most important case involving groundwater in years. Consequently, the Supreme Court must provide some direction, much as it did in the school finance litigation. Currently, Judge Bunton has been prevented by a federal appeals court from taking further action surrounding the aquifer until the legal challenges have gone through all the state court channels.

And the Beat Goes On ...

At this time, the Edwards District is continuing to concentrate on basics such as registering wells, collecting data, investigating recharge projects, implementing the District's Demand Management Plan, conducting research which aids in our understanding of the aquifer, and protecting the sensitive recharge zone. The District is currently meeting with representatives of the Medina and Uvalde Districts as part of the Edwards Aquifer Interlocal Contract to find ways to fund the purchase of water meters and implement a dry-year option, whereby irrigators would be provided financial incentives to cease pumping at times of low springflow conditions. While some wait for the Supreme Court to render its decision, the District continues to pursue its mission "... to ensure a sustainable supply of high quality water with a spirit of regional cooperation," just as it has since 1959.■

Time for Spring Cleaning

Get Rid of Your Household Hazardous Waste

Stacy Shipley, Project Coordinator
City of San Antonio Household Hazardous Waste Program

In just two months, San Antonio and the rest of the nation will celebrate Earth Day — a day set aside to remember our responsibility to protect the environment. By all accounts, the event keeps growing stronger with each passing year. The good news locally is that as a community, we are beginning to embrace the universal appeal to reduce, reuse and recycle. The bad news is that we're still throwing the really dangerous stuff down the drain.

Each of us has lurking under our sinks or in our garages a somewhat silent polluter known as household hazardous waste. It's silent because we don't think of the products in our homes as being hazardous. The truth is, when it comes to some of the everyday products that make our lives so much easier, we don't realize that many of them contain the same properties as industrial waste and can be potentially dangerous if not disposed of properly.

So just what is household hazardous waste? By definition, it is quantities of waste which originate at the residential level that are either toxic, corrosive, or can explode when mixed with other substances. This can be things like oil, paint, any kind of solvent or cleanser, pesticides, herbicides — even seemingly harmless things like nail polish and remover!

What can you do? **Reduce** the amount of these chemicals you buy. Use up all of the contents of a hazardous waste container, or **recycle** it by giving it to a neighbor or charitable organization who may be able to use it. Most importantly, we need to **learn to use alternatives**. For example, a good surface cleaner is a mixture of vinegar with salt and water. Or dissolve baking soda in water for a general cleaner. There are many more alternative products to address common household tasks: drain cleaners, tub and tile cleansers, air fresheners, roach killers, flea killers, ant killers and more.

If you would like additional information on simple actions you can take, call the Edwards Underground Water District's Office of Public Information at (210) 222-2204, or if you are a resident of San Antonio, call the city's Solid Waste Hotline at 207-8654. In addition, the City has four free household hazardous waste collections each year. The next one is scheduled for Saturday, February 24th at the United Methodist Church at 825 E. Basse from 8:00 am until 1:00 pm.■

Rainfall for the Edwards Aquifer region was four to five inches below normal last year. In January 1996, only a trace of precipitation was recorded. With hotter temperatures just around the corner, it is important to remember to water properly. Generally, landscapes need only an inch of water a week. You can measure how long this takes by simply placing a can next to your sprinkler and seeing how long it takes the water to rise one inch. So ***Be Water Tight.*** *Use your water wisely. Remember ... the next drought begins after the last rainfall.*

News Briefs

☐ The Edwards Underground Water District is conducting a study to monitor the water gains and/or losses in the Guadalupe River as it crosses the Edwards Aquifer Recharge Zone. The District wants to determine whether or not the river provides recharge to the Edwards Aquifer, and is working cooperatively with the Texas Water Development Board, Guadalupe-Blanco River Authority and the United States Geologic Survey.

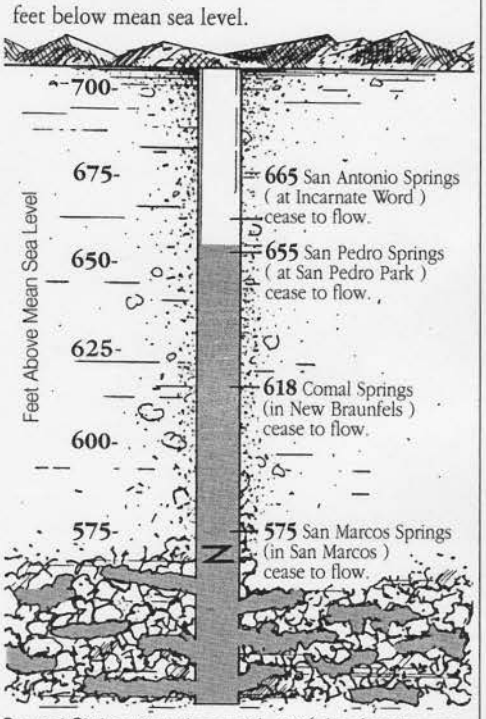
A gain/loss survey of a river or stream is a method where several measurements of the stream channel are taken to determine if the stream is losing water to underlying geologic formations, or is gaining water from springs in the river channel.

Most streams flowing from the Edwards Plateau, commonly known as the Texas hill country, lose all or most of their water through infiltration into the porous and fractured limestone in the stream channels as they cross the recharge zone. These stream losses account for a substantial amount of recharge to the aquifer. Scientists have long thought that the portion of the Guadalupe River which crosses the recharge zone does not lose much water to the Edwards Aquifer. For this reason, total recharge reported for the Edwards Aquifer does not take into account the Guadalupe River. If significant losses from the river are discovered entering the Edwards Aquifer, then the method for calculating recharge will be adjusted.

Components of the study will include: a review of historical streamflow and groundwater data; a groundwater well inventory; a field reconnaissance for gain/loss measurement sites along the reach of the Guadalupe River below Canyon Lake to the portion above the Comal River at New Braunfels; and the actual gain/loss surveys done in conjunction with technical staff from the four agencies. Results from the survey are expected this fall. ■

The Water Level

This reading reflects the daily high artesian water elevation at the Bexar County Edwards Aquifer Index Well. The bottom of the graph represents the depth of the well which is 143 feet below mean sea level.



Current Status: On February 9th, 1996 the elevation was recorded at 657.2. Average for February is 668.6. Flow from Comal Springs was recorded at 254 cfs on February 8th, 1996.

THE WATER SOURCE

The Water Source is published quarterly by the Public Information Office of the Edwards Underground Water District, 1615 N. St. Mary's, San Antonio, Texas 78212 210/222-2204 or 800/292-1047

Editor: *Carolyn Wheat*
Guest Columnist: *Stacy Shipley*; Columnist: *Rick Illgner*

EDWARDS UNDERGROUND WATER DISTRICT

1615 N. ST. MARY'S ~ P.O.BOX 15830
SAN ANTONIO TEXAS 78212

FORWARD & ADDRESS CORRECTION

BULK RATE
U.S. POSTAGE
PAID
PERMIT # 771
SAN ANTONIO
TX 78212

Recycled Paper

THE WATER SOURCE

A QUARTERLY PUBLICATION OF THE EDWARDS UNDERGROUND WATER DISTRICT

April 1996

No "Drought" About It– Not Much Rainfall In Our Forecast

John Willing, KMOL Chief Meteorologist

Most people don't get emotionally involved with the weather. It's just something that happens. One day it's sunny, another day is windy, once in a while it rains, and there isn't a whole lot we can do about it. That's right, even the weatherman is helpless to change it.

But this is one of those years when I can't help but get emotional about our weather. And what am I feeling? DEPRIVED!! With the exception of the Easter week rains, we've endured months and months of extreme drought. And not only is our present situation looking grim, but forecasters who peer into future weather patterns see even more drought ahead.

First, let's see just how bad it is. In San Antonio, we just completed our fourth driest first quarter of the year, as we registered just under an inch of rain (.99"). That's awfully dry, but in 1954, during a terrible four year drought in Texas and much of the Midwest, we had our driest January through March period when only 0.57" fell. Compare this with the same period just four years ago when we had over 18" of rain! Seems like it's all or nothing, doesn't it?

But you already know that this current drought didn't begin in January. Since last October rainfall has been far below average each month. Erratic rains earlier in the year and the sudden plunge into drought left us with annual rainfall almost eight inches below normal (a "normal" year brings about 30.98" of rain). All of this has been detrimental to the water level in the Edwards Aquifer, the only source of water for San Antonio and the primary source for five counties. Last year, the J-17 index well at Ft. Sam Houston measured 671.6 feet by the end of March. This year it was 653.9 feet, almost 18 feet below last year and 14 feet below average. We are in stage two of water conservation at a time of year when we never dream of water shortages. It's frightening to think that we are starting the hot season with such low water levels.

Drought stretches well beyond San Antonio. Corpus Christi is a glaring example. In the first quarter of this year they have received just 0.08" of rain! This was their driest start to a year since weather records began in 1887. Brownsville also had their driest quarter ever with 0.21", Victoria had their second driest with 0.85" and don't leave out Austin ... with their third-driest quarter as 1.29" fell. The list goes on and on ... Houston, Del Rio, North and West Texas, the Panhandle, and all of Oklahoma are in the grips of dry weather that has ruined crops, left gaping cracks in the ground, and made hazardous fire conditions. Until recent rains arrived in the Texas Panhandle, bulletins said that the region had experienced less than an inch of rain in over 150 days!

Those rains were a great comfort for dry land farmers and ranchers, and people just plain sick of the dry weather. But the stats don't lie. According to the National Weather

(continued)

Drought *(continued)*

Service, this year is showing signs of evolving into one of the worst droughts we've had since weather records began. There have been five disastrous drought years in our history, the worst in 1917 when only 10.11" fell. Other years were 1909, 1954, 1956, and 1988. Do we know why this is happening, and does it mean we're locked into a long-term drought of 1950's proportion?

One major change is the absence of an El Niño in the Pacific Ocean which usually brings plentiful rains to South Texas. El Niño is the abnormal warming of the equatorial waters of the Pacific off the west coast of South America. It is famous for throwing off the jet stream, or storm track, bringing drought to areas that are normally wet and drenching arid regions with very heavy rains. El Niño was declared dead at the beginning of last year, and isn't due back for another three to six years. This is a major reason for drier conditions.

As I browsed through my file on droughts I saw another clue to this drought. In an article which appeared in the October 1979 issue of "Weatherwise," researchers were doing studies on tree rings from the bristlecone pine, one of the oldest living things on earth. At the University of Arizona in Tucson they correlated changes in tree rings with temperature and precipitation and then reconstructed climatic conditions for ten-year periods over many hundreds of years for much of the Western United States. What they found was fascinating. There is a repeated pattern of widespread drought every 22 years, which coincides with the 22-year pattern of rising and falling numbers of sunspots (dark areas on the sun). Thirteen droughts were identified, all matching the 22-year sunspot cycle. At the end of the article they said "the odds seem to be good that the West will be hit by another big drought in the mid-1990's." That was 16 years ago!

So are sunspot cycles the cause of our recent drought? One local meteorologist thinks they are. Larry Wallace, who tracks sunspot cycles closely in making long range weather predictions, has demonstrated a skill in forecasting future weather patterns based on these cycles. And he believes the worst is yet to come. He told me that sunspots peaked in number back in July of 1989, and now we are almost at the bottom of the current sunspot cycle, at a sunspot minimum, which initiates a long-term drought. In fact, the weather pattern with this drought is similar to the one that produced the drought in the 1950's and the 1910's, and the scope of this drought may increase enough to put a crimp in our water supplies. Wallace is careful to mention that he is not predicting dust bowl conditions like the 1930's ... this pattern does not match that one. But if you look at his rainfall forecast for San Antonio for the next several years, you'll see why there is cause for concern.

1996 ... 20"
1997 ... 15-16"
1998 ... 18"
1999 ... 19-20"
2000 ... 40"

When you consider that normal annual rainfall is about 31", this is a dire forecast now that our population since the 1950's is much larger and our water use has soared.

Keep in mind that this is a forecast based on sunspot cycles alone, and the rainfall amounts are estimates -- you can expect variation in the numbers. Wallace mentioned that we could come out of the drought earlier if the sunspot number increases at a faster rate than projected. The earliest that could happen would be in late 1998 or early 1999, with an El Niño event.

Wouldn't it be wonderful if none of this would happen! But then I ask myself, if a guy who has had success in forecasting long range weather says a monster drought is coming, even if he uses an unconventional technique, maybe it's time to plan ahead. ■

Rainwater Harvesting

Jack W. Pool, PE

Editor's Note: Jack Pool is a registered engineer with Farm & Ranch Service company in San Antonio, Texas. For more information on rainwater harvesting, call (210) 633-0321

With this drought we're having in South Texas, rain is in great demand. Ask the dry land farmers and some of the South Texas ranchers. The level in the Edwards Aquifer is getting lower and lower and if it doesn't rain, we'll remain in the mandatory conservation stage. Remember the saying, "No pain, no gain?" Well, farmers and ranchers are saying, "No rain, no grain." We all need to have some interest in water conservation in our semi-arid part of the world. That is where the term rainwater harvesting enters the picture.

Rainwater harvesting means collecting and using rainwater that falls upon a given structure, such as a home, barn, or warehouse. Almost any roof will do. The rain falls on the roof, is collected via rain gutters, and then piped to some type of storage tank. The water is then used for a variety of purposes such as lawn watering, replenishing evaporated water from the swimming pool, or even for potable water (human consumption) using an appropriate water purifier.

Years ago in this area many rural homes had underground cisterns that provided their water. Some are still in use, and some still exist but are not in use. In the Caribbean, where there are not any water wells in some areas, the sides of hills are concreted to form a clean surface from which rainwater can be captured. It is required that most homes be built to capture rainwater before they are constructed.

Rain is free so far. If it falls on your place, it's yours. Rainwater harvesting can provide a means for you to capture it and control its later use. If you don't use it, you loose it.

Many folks have gutters on their houses now. The purpose in most cases is to control where the roof water hits the ground. It just runs off most of the time. If you can capture the roof water and contain it and use it at a later date for any purpose you chose, then you have harvested the rainwater. If you want to wash your hair in some very soft water, catch it in a small jug; or maybe you want to catch it in a barrel and water a backyard garden. You see, you are controlling its use. If you didn't catch and store it, you would loose it. Whatever your intent, it's easy to catch rainwater and use it.

I'm going to get a little technical now, but hang in there with me. If you have a 1,000 square foot roof and it rains one inch, then your capture area is 1,000 x 1/12 or about 83 cubic feet. A cubic foot of water holds about 7.48 gallons. Your roof has captured about 620 gallons of water. That water can be caught by rain gutters on your house and piped to some sort of storage vessel. You're going to loose some of the rain due to wind, gutter splash, and maybe some leaks, but if you can save 70%, you would still have 434 gallons. That is 434 gallons of water you don't have to buy. You can now use this water where you want it.

Now lets look at a more sophisticated system which I call a *rainwater harvesting system*. It consists of six inch gutters with four inch down spouts. The gutters have no screens. The reason for larger gutters and no screens is to reduce the loss of water due to wind and trash. It is a more efficient water-catcher. Of course, all the leaves and other stuff that is loose on your roof will be swept down your gutters as well. Use a roof washer to separate the leaves and other debris from your rainwater. The commercial roof washer is composed of several wire traps and a rather dense filter. It is connected directly in the path of the pipes that run from the down spouts to the water tank. Usually only one of these devices is necessary, however, if you have a fairly large roof, you may need two.

Now, out of the roof washer into the tank. The tank can be anything from a barrel to a high tech concrete water storage tank. Usually these tanks are buried in the ground to hide them or to provide enough drop to produce a good gravity flow and allow for the roof washer to be buried as well. If the tank is to be buried then a concrete water storage tank is recommended. If you're going to install a tank, it is good to be able to know just how much water you are putting into the tank and how much you are going to use. If you have a 2,500 square foot house, you are going to catch about 1,000 gallons per one inch of rain. A three-inch rainfall will give you 3,000 gallons of water. So if you have a 3,000 gallon capacity water tank and it rains any more than three inches, it will overflow.

Now you have to become a water manager to reduce the amount of overflow, so use the water in the tank to water plants, wash cars, or drink (if purified). In this area, you can expect about 29-30" of rain per year, so you'll be managing about 30,000 gallons of water. But the water is yours.

How would you like to wash your car during water rationing? Your neighbor will go wild. Better let the Edwards Underground Water District know how you got the water. Talk about water conservation, you'll be doing it. You will be facing up to a very real problem in this area and helping yourself at the same time. It is a noble thing to conserve nature's resources. And rainwater is rich in nutrients, soft, and good to drink (if handled correctly). Think about a whole town saving 30,000 gallons per year, per home or business, from the runoff system. It could be an enormous amount of savings. It's your water. If you don't use it, you loose it. ■

News Briefs

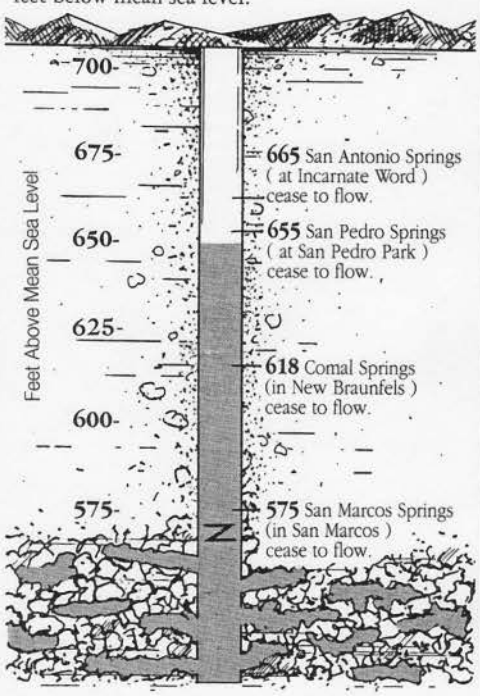
☐ The Edwards Underground Water District is now on the world wide web. Our internet location is **http://www.txdirect.net/corp/euwd.** Look us up! You can view items such as the daily water and springflow levels, current bids and proposals being let, general information about the Edwards Aquifer, procedures for obtaining information from the District and more. New items are being added every day.

☐ The Edwards Underground Water District joined with Kelly AFB, Seco Creek Water Quality Demonstration Project, Texas Natural Resource Conservation Commission, the Girl Scouts and two school districts located on the recharge zone to become Groundwater Guardians. The team will focus on the Edwards Aquifer region and is part of a national network of communities taking voluntary, pro-active steps towards groundwater protection. Team members represent the areas of education, agriculture and government. The national Groundwater Guardian program was developed by the Groundwater Foundation whose mission is to create an informed citizenry caring about groundwater.

☐ The City of San Antonio will hold another Household Hazardous Waste Collection Day on Saturday, May 4, 1996 from 8:00 am until 1:00 pm. The free collection is an opportunity for residents to properly dispose of items such as paint, oil, pesticides, herbicides or any type of solvent or cleanser. The collection site is located at 7030 Culebra Road. For more information, call the city's Solid Waste Hotline at 207-8654. ■

The Water Level

This reading reflects the daily high artesian water elevation at the Bexar County Edwards Aquifer Index Well. The bottom of the graph represents the depth of the well which is 143 feet below mean sea level.



Current Status: On April 16th, 1996 the elevation was recorded at 650.0. Average for April is 666.4. Flow from Comal Springs was recorded at 210 cfs on April 15th, 1996.

THE WATER SOURCE

The Water Source is published quarterly by the Public Information Office of the Edwards Underground Water District, 1615 N. St. Mary's, San Antonio, Texas 78212 210/222-2204 or 800/292-1047

Editor: *Carolyn Wheat*
Guest Columnists: *John Willing; Jack W. Pool*

EDWARDS UNDERGROUND WATER DISTRICT

1615 N. ST. MARY'S ~ P.O. BOX 15830
SAN ANTONIO TEXAS 78212

FORWARD & ADDRESS CORRECTION

7-36
4-30

BULK RATE
U.S. POSTAGE
PAID
PERMIT # 771
SAN ANTONIO
TX 78212

Recycled Paper