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Irrigation district swaps water rights for rehab funds

As project manager for the City of Roma Economically Distressed Area Program (EDAP), Turner Collie & Braden, Inc. found an innovative solution to the city's water needs. Turner Collie & Braden proposed that the $2.8 million available to the City of Roma through EDAP to purchase water rights be instead used to fund improvements in irrigation canal conveyance efficiency within Cameron County Irrigation District No. 2 (CCID#2). The irrigation district would then transfer approximately 4,100 acre-feet (AF) of agricultural water rights to the City of Roma.

In the Lower Rio Grande Valley, almost all water--municipal, industrial, and agricultural--comes from surface water. Agriculture accounts for nearly 90 percent of total water use, but population in the area is projected to more than double in the next 50 years, and M&I water use to increase by 220 percent, according to Texas Water Development Board projections. Urban water use will shift from 15 percent of the total to 40 percent. Since firm yield is finite, some type of transition of water rights is indicated.
Since irrigated agriculture is a major component of the economy of the Lower Rio Grande Valley, it was important to make additional water rights available for conversion to municipal and industrial uses without reducing supplies needed for agriculture.

Improvements to canals such as this one in the Lower Rio Grande Valley will mean a net increase in available water sue to lessened conveyance losses.

This exchange of "conserved" water satisfied the city's need for more water without impacting agricultural irrigation water. In fact, rehabilitating irrigation canals could save about 4,900 AF annually, leaving the district with a net gain of approximately 800 AF per year, according to Turner Collie & Braden.

The City of Roma needed major improvements to its water and wastewater facility to bring its system into compliance with state standards, to provide service to the residents of existing colonias, and to meet future needs. Overall, the planned improvements will serve approximately 20,000 people. TWDB financing for the planned improvements was contingent upon the City of Roma acquiring additional water rights sufficient to meet projected demands. (Colonias are economically distressed subdivisions lacking state-approved water supply and wastewater collection systems.)

The plan, the brainchild of Mike Personett and Keith Kindle of Turner Collie & Braden, was based loosely on a similar arrangement by the Imperial Irrigation District in California, but in which agricultural land was taken out of production and those water rights converted to urban use. "All signs pointed to CCID#2. As the largest, and one of the most inefficient irrigation districts in the Lower Rio Grande Valley, this district presented the biggest opportunities for conservation," said Personett.

"It is important to note that through conservation, agricultural land was not taken out of production to sell water rights," said Kindle.

The single-source water rights transfer was critical, as obtaining water rights from multiple sources would greatly increase legal and permitting costs.
The Lower Rio Grande Valley was into its fifth year of drought. Convincing agricultural interests to support the water rights transfer during the second worst drought of record in time to meet a critical deadline for eligibility in the Drinking Water State Revolving Fund was one of the biggest challenges of the project.

"We had our doubts about the possibility of obtaining such a large amount of water rights during such a severe drought," said Roma mayor Fernando Pena. "We are delighted with this accomplishment by Turner Collie & Braden and for their creative solution to our problem."

In fact, public hearings on the proposed plan drew crowds of more than 300. Interestingly, farmers were in favor of the project, while landowners offered some resistance. There was also division within the irrigation district board.

"It was a hard-fought battle and a courageous decision by the irrigation district board to go ahead with the project," said project manager Keith Kindle.

Said CCID #2 board president Ronnie Helmer of the decision, "We thought it was a good deal for the district. We felt selling the water rights for a good price would allow us to make improvements and conserve even more water than we will transfer. Once people understood, they went along with the idea." Helmer is a farmer as well as a landowner.

`It was a hard-fought battle and a courageous decision by the irrigation district board.'
-Keith Kindle, Turner Collie & Braden
In hearings, agricultural irrigation expert Guy Fipps of the Texas Agricultural Extension Service compared efficiencies of irrigation districts, showing how CCID #2 is plagued by irrigation water conveyance losses and also holding a water right of more than 150,000 AF per year.

With funding in place CCID #2 is preparing to implement improvements. The transaction between the city of Roma and the irrigation district was the first such cooperative

agreement in Texas. Now similar agreements are in the works now in the Lower Rio Grande Valley, according to Personett.

CCID #2 initially considered five potential rehabilitation projects. The district eventually settled on two--lining main canals and replacement of open-ditch laterals in sandy soils with underground pipe.

"Turner Collie & Braden worked with Cameron County Irrigation District No. 2 to identify capital improvements," said Thomas Burke of the engineering firm. "We determined potential water savings through historical and Texas Water Development Board records to get some idea how much water could potentially be saved. For example, in a lined channel, infiltration would be reduced by a certain percentage. Using the length of the channel, the amount of savings could be calculated."

"We chose rehabilitation projects returning the most bang for the buck," said Kindle. "What makes this project a win-win situation is that the irrigation district will benefit from reduced energy costs for pumping, improved efficiency of irrigation water delivery, and compliance with state water conservation requirements. With a more efficient system, we can extend the water further."

Administered by the Texas Water Development Board, EDAP was established by comprehensive legislation passed in 1989 to provide financial assistance to bring water and wastewater services to economically distressed areas where inadequate services exist.

The exchange project has won two awards--the 1998 Texas Section American Water Works Association Conservation and Reuse award in the Nonutility Direct category and the 1999 award for Engineering Excellence from the Consulting Engineers Council of Texas.

For more information, please contact Personett at (512) 472-4519 or personettm@tcbaus.com or Kindle at (956) 781-6991 or k_kindle@swbell.net.

San Antonio pilot study finds turf thrives on deficit irrigation

Next phase involves 5,000 ET kits to SAWS customers

Results of the two-year pilot turfgrass evapotranspiration (ET) study in San Antonio mean good news for the water conservation community.

The pilot study, conducted by the Bexar County Master Gardeners and the Texas Agricultural Extension Service in cooperation with San Antonio Water System (SAWS), both confirmed and confounded conventional wisdom.

What the study confirmed is the common knowledge that homeowners tend to overwater their lawns, a practice which not only wastes water, but also creates a turfgrass with a weak root system. Two years ago, SAWS and the Bexar County Master Gardeners set out to learn what amount of replacement irrigation can maintain an acceptable lawn.

Karen Guz of the Texas Agricultural Extension Agency and volunteer monitor Wilbur Watje examine the status of Watje's lawn during the summer.

About 60 volunteer homeowners were chosen on the basis of having relatively unmixed turfgrass plots--Bermudagrass, St. Augustine, Buffalograss, or Zoysia--with a soil profile of at least 4 inches. Volunteers were assigned to either a full ET replacement regimen or a deficit replacement at 70%, 50% and 0% of ET. (*Texas Water Savers,* Winter 1998)

ET varies, based upon turf type, temperature, relative humidity, wind speed, and solar radiation.

For a number of years, the Texas Agricultural Extension Service has recommended 1 inch per week irrigation for St. Augustine grass, the most sensitive of the popular species to water deficit.

The results of the San Antonio study indicate, however, that 100% ET replacement of St. Augustine required only a total of 16.5 inches in the course of a 24-week study, a reduction of approximately one-third. I

At 70% and 50% of ET replacement, experimenters experienced some decline of St. Augustine, but the grass rebounded to its original spring rating in the fall.

Even more surprising, perhaps, is that Buffalograss performed best at 50% ET replacement. Bermudagrass performed as well at 70% of ET as it did at 100%. The study included only a few Zoysia lawns. With limited evidence, it appears that Zoysia does best at 100% of ET.

Deficit irrigation performance is not to be confused with drought-tolerance. The latter is the ability of a turfgrass to go dormant during extended periods without water with a good recovery potential.

"The study confirms what we have suspected--that turfgrass shows little or no decline in performance under deficit ET replacement as compared with full replacement, with some slight differences between species," said SAWS Conservation Director Chris Brown. "Historical studies have shown that homeowners in Texas overwater their lawns by as much as 50%. By irrigating efficiently, San Antonio residents will be able to maintain a healthy lawn by using the optimum amount of water."

Two other factors--soil depth and bulk density--had a moderate impact on appearance. At low irrigation levels, Buffalograss and St. Augustine exhibited lower mean ratings at

higher bulk densities (weight per unit volume) by experimenters. The opposite relation existed for Bermudagrass, which seemed to perform better in dense soils. Buffalograss does better in lighter soils.

"Not only were we pleased that the lawns we studied performed very well with less water, but we were impressed with the response of homeowner participants," said Extension Assistant Karen Guz. "They followed the ET instructions diligently and provided us with the feedback we needed. The people who selected the lower replacement rates were accepting of a slightly poorer appearance during the middle of the summer, then found their lawns recovered well."

"The main complaint of the volunteers seemed to be they wanted their neighbors to follow the same regimen so the city could save more water," said Guz.

Now the volunteers may get their way.

SAWS staff has compiled recommendations for leveraging this pilot to a city-wide effort. For 1999, SAWS is looking ambitiously at participation of 5,000 homes with the potential for conserving 126 million gallons of water annually. To encourage participate, the city will provide free ET lawn kits.

"We will announce this ET program through the printed and broadcast media, and we hope that seven-day ET replacement rates will become a regular feature of the weather reports, as the Edwards Aquifer level is now," said Dee Emory, environmental support coordinator for Bexar County Master Gardeners.

The ET lawn kits consist of a plastic rain gauge, sprinkler catch-pans and testing instructions, information on ET, lawn worksheets, ET lawn signs, and charts of expected water savings.

In addition, the pilot study will be extended, this time with another 48 St. Augustine and Zoysia lawns being assessed at ET replacement rates of 0%, 50%, 70%, and 100% in both sun and shade, with resident volunteers reporting back results for analysis. With this test, Master Gardeners hope to determine if supplemental watering of St. Augustine in shade can be dispensed with entirely, and even if irrigation in shade is deleterious to this turf. Zoysia data, lacking in the first study, will be gathered in this second effort.

"Our original research goals were to learn whether homeowners could follow an ET-based watering system and whether we could conserve more water than when using an traditional irrigation schedule," said Guz. "We were pleased that the answer to both questions was yes."

In its report on the pilot study, SAWS staff also recommended a curriculum enrichment program for secondary school students, with incentives for youth to collect data at home and school sites, and an interactive web site.

Also, future Master Gardener courses will include the ET study as part of the turfgrass portion of their training. "From now on, each new Master Gardener should be capable of explaining how the project works and help spread the word," said Guz.

The two-year pilot study was a team effort involving Emory, Guz, and County Extension Agents Joe Taylor and County Director Calvin Finch of the Texas Agricultural Extension Service-Bexar County; David Smith and Guy Fipps of the Texas Agricultural Extension Service, and 10 volunteer monitors, who advised and recorded homeowner data.

The Texas Agricultural Extension Service Potential Evapotranspiration website is an excellent tool for looking up or calculating turfgrass water requirements. An easy-to-use tutorial explains three methods for determing turfgrass requirement, including use of an interactive PET calculator. Data from the statewide networks weather station is updated on a regular basis.

For more information, contact Dee Emory, Bexar County Master Gardeners at (210) 225-5848 or e-mail to evapo_t@texas.net.

Camp instills water stewardship in youth

Each July, the Texas State Water Camp in Monahans instills in junior and senior high school youth a respect for water resources, with the hope that they will be the future leaders in water resource management. Several camp graduates are now in college preparing for such careers.

This one-week educational experience uses hands-on techniques and field trips to train students in conservation and preservation and to show them how municipalities, industry, and agriculture utilize water resources.
After an initial day of instruction in water resource basics and chemical analysis, campers are assigned college-level group projects.

Campers are also taught about residential conservation both inside and outside the house, including effective water-conserving habits they can teach their families and plant and turf choice and cultural practices. Students also perform a home water audit and an irrigation audit. They learn about what constitutes efficient agricultural irrigation systems, and actually test water for contaminants in a lab.

Field trips include visits to sites where water plays a key role, as in the steam generation of electricity, the recovery of petroleum products, and farms, where state-of-the-art irrigation technology is being practiced. Another field trip is to the Aquaculture Projects in Ward and Pecos counties where research is being conducted on alternative uses of saline water resources.

Campers are also taken on a trip that follows water through its cycle of use. They visit the groundwater wells supplying drinking water to the City of Odessa, then to wastewater treatment plants, and finally to the fields where treated effluent is applied to crops.

Of course, no summer camp is complete without recreation, and the Texas State Water Camp keeps its recreational theme consistent. Campers visit the Balmorhea State Park with its spring-fed pool and Water Wonderland in Odessa.

The Texas State Water Camp is staffed by professionals from the Texas Agricultural Extension Service, Natural Resource Conservation Service, Texas Water Development Board, Texas Natural Resource Conservation Commission, State Attorney General's Office, State Soil and Water Conservation Districts, and Permian Basin Underground Water District, as well as TU Electric, Chevron Corp., and Pecos Valley Resource Conservation and Development Area.

This year's camp will be in session July 18 through 23. It is housed at the George and Opal Bentley 4-H Center in Monahans. Tuition is $150. For more information on Texas State Water Camp, call (915) 943-2682. The camp is open to students eighth grade through high school senior on a first-come, first-served basis. Many campers have been sponsored by local water officials or soil and water conservation districts.

Extension agents amplify water awareness message

Coleen Catlett, Harlingen Garden Project Coordinator, and Mary Guttierrez, Master Gardener, prepare a bed at the Harlingen demonstration garden for weed cloth.

Forty-four county agents with the Texas Agricultural Extension Service (TAEX) educated citizens about their communities' water supplies during Water Week, May 3-7. Participating counties were spread from the High Plains to the Rio Grande Valley.

Agents got the message out in local newspapers, radio, television, newsletters, displays and meetings to promote the concept of wise water use. More than 70 newspaper articles and 27 columns from the Agricultural Extension Service ran in at least 60 newspapers, with a combined circulation of more than 350,000 readers. The majority (77%) were weekly papers. In Bexar County, where wise water use is a priority due to the pumping restrictions of the Edwards Aquifer, the Extension Service has been the source of 26 news articles and 14 columns so far in 1999.

Part of the Water Week campaign was the use of a public service announcement (PSA) provided by the Texas Natural Resources Conservation Commission featuring Junior Brown singing "Water Patrol." TAEX reports that the PSA played at least 147 times on 21 radio stations across Texas. Many stations ran it several times a day and will continue to do so throughout the summer.

Eight county agents also dedicated their radio programs to water issues or were guests on call-in shows about landscape water use. Wade Hibler, Extension agent in Burnet County, answered 21 calls about irrigation equipment for the lawn after his water radio show ran on two local stations. Agents also took water stories to the radio station where at least 29 stories ran in 12 counties.
Many agents also conducted special events and invited local media. These resulted in several news stories and local attention.

Extension agent Doug Andrews in McLennan County conducted a water audit as part of the Sports Athletic Field Education (SAFE) Program and invited the local media. That event resulted in a full-page news story in the Waco Tribune Herald and a news story on KCEN-TV newscast. The SAFE landscape audit was developed by Extension Assistant David Smith.

Gene Taylor, Agricultural Extension Turfgrass Specialist, conducts an athletic field manager's program at San Antonio's Burbank High School. The training included an irrigation audit, soil testing, and fertilizing strategies

SAFE was also on the agenda in Ellis County, where school athletic director Jerry McLemore hosted a media event spotlighting the SAFE irrigation efficiency program. In Freestone County, agent Dale Hurst conducted an educational program featuring turfgrass irrigation data collected in a previous SAFE audit.
Extension Turfgrass Specialist Gene Taylor led athletic field manager training courses in Conroe, El Paso, Midland-Odessa, San Antonio, Dallas, and College Station.

In Lamb County, county agent Dirk Aaron teamed up with a local radio station for a call-in contest, in which people could call in to compete win circus tickets by correctly answering a question about wise water use. One hundred tickets valued at $10 each were paid for and given out by the station, said Aaron.

Extension water exhibits showed up across the state--in the Hardin County Courthouse, at the South Plains Soil and Water Conservation Conference and Trade Show, at the Bavarian Manor City Fair, City of New Braunfels Folkfest and the Texas Natural Festival in San Marcos, to name a few.

Bexar County Agricultural Extension Service Director Calvin Finch was involved in the San Antonio Water System Xeriscape and Jazz Festival.

In Webb County in the Lower Rio Grande Valley, city and county department heads received the brochure, *Seven Ways to Save a Billion Gallons of Water*. "We're making a concerted effort in Webb County because of the extended drought, said county agent George Gonzales. "We're more concerned with water awareness now than ever before during my 19 years as an agent."

Master Gardeners are also making their mark in disseminating the wise water use message.

In Cameron and Hidalgo counties, ribbon-cutting ceremonies took place at two water-smart demonstration gardens planned, designed, and installed by Master Gardener volunteers and the Agricultural Extension Service, with support from local businesses, community organizations, and school groups, according to horticultural agent Barbara Cutrer.

In Bexar County, Master Gardeners assisted in judging the Xeriscape contest. Dallas County kicked off a landscape irrigation audit graduate course called Making Every Drop Count (MEDIC), which has also been offered to Master Gardeners in four other counties.

Dallas County kicked off a landscape irrigation audit "graduate course" aimed at Master Gardeners. The course had already been incorporated into Master Gardener training in several other counties.

The younger generation, future stewards of the state's water, were not left out. The Hidalgo Count Extension office conducted a week-long program for school age children. Somervell county agents distributed "Water Saving Tips" handouts through schools to reach parents. County agent Ted Fisher presented water-use efficiency programs to Rusk Elementary School.

Now under installation in Terry County as part of a 4-H Educational Center is a drip irrigation system on a 5-acre demonstration plot. "The drip irrigation will be used not only for demonstration purposes, but also to educate youth and producers alike on new technologies and water conservation practices," said agent Steve Bradshaw.

Many agents amplified the water awareness message with presentations at civic organization meetings. Rotary Club meetings in Comanche and Cherokee featured agents explaining the importance of water-use efficiency. In Eastland County, agent Davy Vestal was the invited speaker at the Saturday Club, where he distributed water-conserving tips. In Hidalgo County, an evening presentation at a local high school focused on irrigation options and low water use plants.

Agents in Comanche and Somervell took advantage of the central location of county courthouses, using the courthouse marquee to promote awareness of Water Week.

Extension horticultural agent Mark Terning in Wichita County conducted a series of workshops on water-conserving techniques for landscapes and gardens. "Sewer in a Suitcase" is a creative object lesson in how improper application or disposal can render common urban substances toxic, with the potential to contaminate groundwater.

The *Extension Outreach Newsletter* of Caldwell County, circulation 460, written by agents Deborah Watt and Lyle Arche featured articles on land stewardship for small acreage landowners and lawn irrigation tips that could potentially halve the amount of water used for irrigation.

The Extension Service used Water Week as a time to promote its water education programs and received a lot of attention from local media that will serve to increase the visibility of its programs.

Penny Banks of the Texas Agricultural Extension Service contributed to this article.

Divers inspect full water tanks for damage

Diver Mike Erinakes of U.S. Underwater Services Inc. is sprayed with a disinfectant solution before entering a water tank on the Texas A&M University campus in College Station.

Drinking water storage tanks must be inspected on an annual basis for evidence of corrosion, pitting and blistering, and other signs of degradation. Draining tanks, however, poses problems. Larger systems are reluctant to drain the tank and waste the stored water. Small systems may be temporarily impaired by draining a tank for inspection or cleaning, and may even find their communities without fire protection with a tank temporarily empty.

Since 1992, U.S. Underwater Services, Inc. of Burleson, Texas has offered an alternative to traditional inspection methods. With commercial diving gear, a 200-watt halogen light, waterproof video and still cameras, and an audio link, divers descend into water tanks for inspections and cleanings.

The diver, in a dry suit, is disinfected to American Water Works Association standards to avoid contaminating potable water. Tethered to the operations truck, he descends into the tank with a video camera strapped to his helmet. An audio link allows communication between the diver and technicians outside the tank.

All dive inspections are done by commercially certified divers using full surface-supplied air and full voice communications. The diver inspects for corrosion, does a pit and blister analysis, a review of cathodic protection components, and checks for needed repairs, videotaping the entire inspection and taking still photographs. The customer receives a written report with still photos of the inside and outside of the tank and a narrated videotape of the inspection.

U.S. Underwater Services, Inc. has developed a proprietary method of cleaning sediment from the bottom of tanks without stirring up turbidity. According the company founder and CEO Mike Erinakes, the average water storage facility has two to three inches of

sediment taking up storage volume. In one of his most dramatic clean-ups, Erinakes vacuumed up two feet of debris and sediment from a tank.

A 1995 article in *Civil Engineering* magazine describes how divers can even enter pipes extending into a water treatment plant.

According to Dudley Farr, superintendent of utilities operations of the Texas A&M University Physical Plant, the main advantage of diver inspections is convenience. "Tanks were inspected without being taken out of service. We experienced no loss of service, nor was it necessary to drain the tanks."

The company's divers have performed more than 28,000 commercial dives, including off-shore dives to inspect and repair oil-drilling platforms.

Down the hatch! *The technician feeds the tether as the diver descends into the tank. The tether contains a light cord, video cable, and audio cable, which allow for communication between the diver, the technician with the tether, and the technicians in the truck.*

Contact U.S. Underwater Services at (800) 860-2178 or underwtr@cowtown.net.

Texas Supreme Court upholds rule of capture

The Texas Supreme Court in May upheld the rule of capture for underground water, keeping in place the 1904 law allowing landowners to pump as much groundwater as can be put to beneficial use, regardless of the effect on neighboring wells.

In a case watched closely by water stakeholders, the court ruled that two East Texas families had no claim against the Ozarka Water Company, a bottled water supplier which had drilled a well in Henderson County, about 80 miles southeast of Dallas, and pumped 90,000 gallons per day.

Supreme Court Justice Craig Enoch, said that while the case, *Sipriano et al vs. Ozarka Natural Spring Water, et al*, presents "compelling reasons for groundwater use to be regulated," he tempered his remarks by instead opting first to see if the Senate Bill 1 provisions for groundwater districts would be successful in regulating groundwater.

Justice Nathan Hecht said that the rule of capture seemed contrary to the legislature's preference for local control.

The plaintiffs in this case asked the Texas Supreme Court to change Texas water law from a right of capture to a reasonable use law. They contended that Ozarka's pumping dried up their wells. Ozarka countered that drought conditions and local water use was responsible.

In 1995, Ozarka proposed to establish a commercial bottled water operation in rural Henderson County, pumping from the Carrizo Aquifer. Prior to commercial production, Ozarka contracted out a 72-hour pumping test to determine the well's productivity and the extent of the cone of depression. A monitoring well 800 feet away showed no effect from the pumping, as substantiated by Texas Water Development Board. The Supreme Court, however, ignored the technical issues, addressing only the points of law in this case.

City of Austin benchmarks urban programs

Former New York City Mayor Ed Koch greeted his constituents with his trademark question: "How am I doing?"

With its National Benchmarking Survey, the City of Austin is asking--and answering--much the same question.
Conservation Program Specialist Wendy Worley of the City's Planning, Environmental, and Conservation Services Department developed and sent to large utilities across the country the 1999 Water Conservation Program National Benchmarking Survey.

The survey requested information about indoor and outdoor water conservation programs targeting single-family and multifamily dwellings and industrial-commercial-institutional customers. The survey also asked about the extent of community education programming. Finally, respondents were questioned on the use of water rate structures to encourage water conservation through financial incentives.

The most universal programs, implemented by 32 of 34 respondents, are community education efforts which raise public awareness of water and water-conserving techniques.

Among indoor programs, water audits scored high, offered by 47% of respondents for single-family and industrial-commercial-institutional (ICI) customers, and 35% for multifamily dwellings.
Toilet retrofits, both free and rebated, were the most common direct program for multifamily dwellers (47% of respondents) and just slightly less popular (44%) for single-family customers. For ICI customers, 35% offered toilet retrofit rebates and 15% even offered rebates for waterless urinals. Rebates averaged $75 per toilet. Retrofit kits for faucet aerators and low-flow showerheads were employed by 29% of respondents for single-family residences.

The efficient clothes washer programs gaining momentum in Texas are also spinning off into other states as well--24% reported single-family rebates; 18%, multifamily. Rebate amounts range from $75 to $150.

Outdoor programs, while less common than indoor programs, are dominated by irrigation systems audits. Of respondents, 35% offered irrigation system audits to single-family customers, 25% to multifamily dwellings, and just 6% to ICI customers. A scattering of utilities offered irrigation system rebates and waterwise landscape rebates. The City of Austin was alone in its innovative rainbarrel and rainwater harvesting rebates.

Half the utilities responding had an increasing block rate structure, and all but two implemented such a structure to encourage water conservation. One city, Seattle, has a seasonal increasing block structure during the summer only.
Worley draws some cogent conclusions from the results analysis.
Despite the popularity of community education, the water savings effected by such indirect programs are difficult to quantify.

On the other hand, some of the least commonly implemented programs--landscape, irrigation, and rainwater harvesting rebates--attempt to reduce outdoor irrigation, which accounts for 60 percent of municipal use in Texas and often doubles water use for residential customers in the summer. In addition, water saved as result of such programs is easier to quantify by comparing before and after water use.

The study provides the framework for further analysis of water conservation programs and for long-range conservation effort planning, according to Worley.

The City of Austin plans to use survey results to evaluate its own program and to update its five-year plan," Worley said. "This survey is an update of a similar effort undertaken in 1995."

In other words, it gives utilities an idea of "how they're doing."
Worley presented a paper on the National Benchmarking Survey at the American Water Works Association National Conference in June.

Contact Worley at (512) 499-2893 or wendy.worley@ci.austin.tx.us.

Guides address home turf management during drought and normal rainfall

In the summer, outdoor irrigation can account for as much as 60 percent of total urban water use. Most homeowners with automated sprinkler systems tend to overwater their lawns, not only producing a plant with a weak root structure, but also unnecessarily increasing peak demand and wasting water.

To address the issue of proper turfgrass water management, Texas Agricultural Extension Service turfgrass specialists Gene Taylor and Scott Abernathy have written two guides for home lawn water management.

Home Lawn Irrigation During Drought Conditions (SCS-1998-12) addresses irrigation practices appropriate to the three states of drought water restrictions.

Water Management for the Home Lawn (SCS-1998-14) describes general turf cultivation practices for a healthy lawn. The publication addresses soil types, grass species, fertilization, mowing, and thatch and soil compaction remediation practices, as well as irrigation scheduling.

These publications can be downloaded in PDF format from http://soil.testing.tamu.edu/pubsearch.phtml. They are also available in hard-copy free from the Extension Service's Publication and Supply Division by fax (409) 862-1566 or by mailing a request to Publication and Supply Division, P.O. Box 1207, Bryan, TX 77806-1209. The telephone number is (409) 845-6573.

Conferences

Water Conservation in Landscape Irrigation, for irrigators, manufacturers, and municipal officials, Aug. 6., Dallas Convention Center, jwarden@tnrcc.state.tx.us.

Texas Animal Manure Management Conference, Sept. 9-10, Austin. Contact Saqib Mukhtar, Texas A&M University, (409) 458-1019 or mukhtar@tamu.edu

Texas Alternative Water Strategies Conference, Texas Section, American Water Works Association/Water Environment of Texas, Sept. 17. See http://www.tawwa.org.

AWWA Water Resources Conference, Sept. 26-29, 1999, Norfolk, Virginia, (303) 347-6195 or rharmon@awwa.org.

Texas Water: 2000 and Beyond, Sept. 30-Oct. 2, College Station. View preliminary program at http://www.tamiu.edu/water2000. For more information, e-mail Jim Norwine, kfjrn00@tamuk.edu.

Water Reuse Conference, AWWA/Water Environment, Jan. 30-Feb. 2, 2000, San Antonio.Exhibitor prospectus now available, http://www.awwa.org/00reuse/pros/overview.htm

Texas Water 2000, call for papers, April 4-7, 2000, Adams Mark Hotel, Dallas. See http://www.tawwa.org for more details.

A&M researchers examine irrigation conveyance efficiencies in Valley

Improved irrigation strategies in the Lower Rio Grande Valley could conserve as much as 440,000 acre-feet annually, preliminary results from a Texas Agricultural Extension Service study suggest.

Efficient water use by agriculture is especially important in the Lower Rio Grande Valley due to a burgeoning population expected to increase 228.5 percent by 2050 with an attendant increase in municipal and industrial water demand of 220 percent, according to the Texas Water Development Board. These figures do not take into account expected increases in Mexican demands.

Analysis of the data gathered in a study by agricultural engineer Guy Fipps of the Texas Agricutural Extension Service indicates this large savings could be achievable through a combination of improvements in conveyance efficiency and by more efficient on-farm irrigation practices.

A study led by Guy Fipps of the Texas Agricultural Extension Service and funded by the U.S. Bureau of Reclamation revealed that 440,000 acre-feet of water annually could be saved by irrigation canal rehabilitation and improved management packages.

Improvements in conveyance efficiencies could save up to 223,000 acre-feet/year. Fipps based water savings estimates on the difference between existing conveyance efficiencies and efficiencies that could reasonably be achieved by irrigation districts through renovation and rehabilitation. Physical improvements in conveyance efficiency include lining canals to cut down on seepage, replacing canals with pipes, and combining redundant main distribution canals. Interestingly, published studies indicate that compacted earth exhibits the lowest canal seepage rates.

But efficiencies can also be improved by better water management techniques, according to graduate research assistant Craig Pope of Texas A&M University. To service a farm at the end of a lateral (canals carrying water from mains to individual fields), the entire main and lateral must be charged with water. On the other hand, when demand is high and all laterals are charged, spillover occurs at the lateral dead-end when demand fluctuates. Some districts practice spill recovery at the dead end.

More efficient on-farm practices could achieve a savings of 217,000 acre-feet/year, according to Fipps. On-farm efficiency is defined as the ratio of the amount of water needed to grow a crop to the amount of water delivered to a field. Fipps and his assistants classify on-farm improvements into three components: metering, replacement of field ditches and siphon tubes with gated pipes, and improved water management. In areas with insufficient volume or pressure (inadequate head), on-farm improvements are limited to more efficient irrigation techniques, such as pressurized, sprinkler, or drip irrigation instead of furrow irrigation.

There are 28 irrigation districts in the Lower Rio Grande Valley, and agriculture accounts for 90 percent of the water rights and about 85 percent of the total withdrawals from the river. Almost all water used in the Lower Rio Grande Valley is surface water.

In addition, water rights on the Rio Grande are governed by the International Boundary and Waters Commission using a different set of rules from other Texas river basins. In the Lower Rio Grande Valley, municipal interests have priority over agricultural interests in the event of a water shortage. In addition, the Rio Grande is over-appropriated; in other words, there are more water rights than firm yield.

Thus, water to meet future demand will most likely be converted from agriculture. The purpose of this study was to determine how much water could be "freed up" by improvements in irrigation district infrastructure and methods.

The research team working with Fipps (Pope, Jalal Basahi, Azim Nazarov, Kyle Chilek, and Shad McDaniel) has developed a geographical information system data base of canal sizes and lining materials, as well as a digital map of district boundaries. Already mapped are 39% of lined main canals and 50% of unlined main canals. Particularly practical are color-coded digital maps dramatically showing number of irrigations per field, crops grown in each field, and irrigation district boundaries.

This study of Lower Rio Grande irrigation districts and on-farm irrigation was funded by the U.S. Bureau of Reclamation, the Lower Rio Grande Development Council as part of the Lower Rio Grande Integrated Water Resources Plan, and the local irrigation districts. The contract is administered by Texas Water Resources Institute.

For more details, please contact Fipps at g-fipps@tamu.edu or (409) 845-7454 or Craig Pope at (409) 845-3607 or cpope@tamu.edu.

City of Seymour opts for drinking water RO treatment

The City of Seymour in Baylor County, 50 miles southwest of Wichita Falls, has selected reverse osmosis (RO) as the solution to nitrate concentrations, higher-than-desirable hardness, and total dissolved solids concentrations in brackish groundwater.

Initially the plant, funded in part from the Rural Development Administration (formerly the Farm and Home Administration), will produce 3 million gallons per day of blended product water--62% RO permeate and 38% untreated groundwater using two 0.9-mgd RO trains. Brine concentrate will flow into the Salt Fork of the Brazos River.

SAWS to revisit fifth-tier block

In reponse to some public objections that insufficient public input had been sought regarding a disincentive fifth-tier water rate, the San Antonio Water System Board asked the staff to make further efforts to gauge community reaction to this measure.

"Although the Board declined to effect the fifth tier this time, it still accepts the concept that at some point there may have to be a penalty rate structure," said SAWS Conservation Director Chris Brown.
Responding to impending Edwards Aquifer withdrawal limits, the Community Conservation Committee, a volunteer advisory group, proposed in 1997 that SAWS study the potential of a fifth block ion top of its existing increasing-block structure as a way of sending a price message to larger water users. SAWS staff analyzed the plan and came up with a proposal that would target the top 15% of summertime water users. The fifth block rate represents an increase of 50% over the fourth tier for water use in excess of 25,435 gallons per month.

"The SAWS staff designed a rate structure with the intent that at some point the rate should give an incentive to conserve," said Brown. "The fifth tier was the proposed solution to the problem of designing a rate structure to achieve conservation when the majority of customers are not overwatering, but a small minority is using a tremendous amount.

Brown said SAWS is still figuring projections of other conservation scenarios in light of an expected decline in the utility's allocation of water from the Edwards Aquifer Authority. Among the measures under consideration are a water "budget" based upon lot size and a water rate based upon monthly average evapotranspiration rates. Both measures strive to promote efficient outdoor irrigation.

Texas AWWA announces C&R award winners

For the sixth year, the Conservation and Reuse Division of the Texas Section, American Water Works Association has recognized utilities, companies, and others who have found effective ways to conserve and recycle water. Awards were announced at the Texas Section's annual conference in April at Fort Worth. John Sutton of the Texas Water Development Board chaired the awards committee.

Bob Derrington Water Reclamation Award--

San Antonio Water System Water Recycling Program
San Antonio Water System is now building one of the largest water recycling systems in the country, supplying reclaimed water to replace potable water for irrigation and industrial cooling tower use. Currently SAWS delivers 40,000 acre-feet annually of recycled water for City Public Service for use in their cooling tower lakes. Additionally, SAWS is developing a distribution systems to deliver 35,000 acre-feet annually for irrigation and cooling tower use by commercial and industrial customers, reducing SAWS' demand on the Edwards Aquifer by 20 percent by freeing up 11 billion gallons yearly for potable use.

Direct Program For A Large Utility--

El Paso Water Utilities Fred Hervey Water Reclamation Plant
Since it began operations in June 1985, the Fred Hervey Water Reclamation Plant has injected 15.5 billion gallons of wastewater treated to drinking water standards into the Hueco Bolson aquifer, which supplies most of the drinking water to El Paso and all of the drinking water to its sister city, Ciudad Juarez. About 685 million gallons of additional treated wastewater is used for irrigation and industrial reuse.

Prior to the treatment and injection program, the aquifer was depleted at a rate of two to three feet per year. The above conditions, coupled with the growth rate of both cities and the fact that the Hueco Bolson is not recharged, had caused accelerated depletion of the

aquifer. Since the advent of injection, the rate of depletion has dropped to less than one foot per year. It is estimated that for every 10 years the plant is operated, the life of the Hueco Bolson is extended one year.

Another effect has been to reduce the land area covered by oxidation ponds, removing a nuisance and possible source of pollution.

Indirect Program For A Large Utility--

El Paso Water Utilities Interactive CD-ROM
***Desert Blooms: A SunScape Guide to Plants for a Water-Scarce Region*.** It has been estimated that 40% to 60% of summer water use goes to maintain urban landscapes. A large portion of this water use could be eliminated by using waterwise landscape principles and native or adapted plants. El Paso Water Utilities, in partnership with the Texas Agricultural Extension Service, New Mexico State University, the University of Texas at El Paso, and Texas Forest Service, produced a bilingual, interactive CD to increase public awareness and to stimulate water conservation through reduction of waste

The first goal of the CD is to increase public awareness of the area's limited water supply, local water conservation ordinances, practical landscape and irrigation efficiency, and to provide an extensive interactive data base of about 400 native and adapted plant choices. A second goal was to increase the market for native and adapted plants. To ensure high market penetration of the CD, it is available in Windows and Macintosh format.

Direct Program For A Small Utility--

Fort Sam Houston Reuse Water Plan
In partnership with Fort Sam Houston, SAWS agreed to construct 36,000 feet of distribution and delivery network to service the military facility's two golf courses, four athletic field complexes, eleven cooling towers, and eight facility irrigation systems with projected annual requirements of 808.7 acre-feet.

An enlarged golf course detention pond will serve as the installation's only on-site storage basin. Brooke Army Medical Center will become the first San Antonio hospital to use reclaimed water for cooling tower operation.
It is expected that use of reclaimed water in cooling towers will save 177 acre-feet of Edwards Aquifer water per year, and irrigation savings are projected at 630 acre-feet annually.

Direct Program for a Non-Utility--

City of Roma EDAP: Water for the Future
As project manager for the City of Roma Economically Distressed Area Program, Turner

Collie & Braden, Inc. found an innovative solution to the city's water needs. (See article, page 1.) Turner Collie & Braden proposed that the $2.8 million available to the City of Roma through EDAP to purchase water rights be instead used to fund improvements in irrigation canal conveyance efficiency within Cameron County Irrigation District No. 2 The irrigation district could then transfer approximately 4,100 acre-feet of agricultural water rights to the City of Roma.

Rehabilitating irrigation canals would save about 4,900 acre-feet annually, leaving the district with a net gain of approximately 800 acre-feet per year.

The City of Roma and Turner Collie & Braden had to convince agricultural interests to support the water rights transfer during the second worst drought of record in time to meet a critical deadline for eligibility in the Drinking Water State Revolving Fund. With funding in place, Cameron County Irrigation District No. 2 is preparing to implement improvements. The transaction between the city of Roma and the irrigation district was the first such cooperative agreement in Texas.

Indirect Program for a Non-Utility--

Barton Springs/Edwards Aquifer Conservation District Secondary Social Studies Curriculum

The Barton Springs/Edward Aquifer Conservation District created a seven-lesson curriculum unit targeted to seventh graders. The curriculum combines activities in science, social studies, and mathematics to teach students about such subjects as the hydrogeology of the area's karst aquifer, residential water conservation, comparison of user group viewpoints, and environmental sensitivity of the recharge zone. Supplementing the curriculum are transparencies, color maps, a booklet and book covers, and a CD-ROM entitled *Barton Springs Interactive.* The objective of the program was to develop a curriculum teachers could easily integrate into their program.

Indirect Program for a Non-Utility --

***Texas Water Savers* newsletter, Texas Water Resources Institute**

With statewide emphasis shifting from development of new water sources to reliance upon water conservation and reuse to ensure a future water supply, the *Texas Water Savers* newsletter serves as a vehicle for water managers, consultants, businesses, researchers, and county extension agents to keep informed of successful efforts within the state. The newsletter represents a partnership of Texas A&M University, state and federal, government, river authorities, and private interests working for better management of this scarce resource. Edited by science writer Jan Gerston, *Texas Water Saver*s in its fifth year of publication and has a circulation of 4,500.

Texas WaterWise Council launches website

The WaterWise Council of Texas has launched a multipurpose web site to disseminate information on waterwise outdoor watering practices and to keep members and partners abreast of council developments.
First and foremost, the web site (http://www.WaterWiseTexas.org) aims to educate the public in WaterWise landscaping and irrigation practices and to encourage the efficient use of water outside the home.
"With this site, the WaterWise Council has taken another step toward its objective of establishing an educational network to develop and disseminate water conservation information to residential and commercial users," said Council President John Sutton.

This web site, created by Council members, Jim McCabe of Sensible Technologies, Houston, and Jan Gerston of Texas Water Resources Institute, with input from the Council board, advances the WaterWise Council's mission of promoting water conservation practices in Texas through a public-private partnership that fosters awareness and implementation of sound water management

Business member nursery professionals may find that the website complements the "Ride the WaterWise Wave" video produced last year by the Council by making available easy-to-use waterwise practices in an accessible format.

The website also posts a current calendar of water-related public and specialized events statewide.

The Partners page lists city links and a of roster business members, with descriptions of waterwise activities at partner cities.
For more information, contact Jan Gerston at (409) 845-1852 or jan@twri.tamu.edu.

Extension personnel help install native and adapted plants at two waterwise demonstration gardens

Driplines are installed prior to planting of vegetation at the Johnson Space Center.

With technical assistance and support from the Texas Agriculutral Extension Service, two very different waterwise demonstration gardens were constructed in southern Harris County.

At the Armand Bayou Nature Center, a garden of native and adapted plants enhances a historical farmhouse reproduction. The 2,500-acre Nature Center, the second-largest urban natural preserve in the country, is dedicated to wildlife refuge and environmental education.

"We chose plants that perform well in southeast Texas, with its combination of drought and rain. And to maintain the turn-of-the-century look, we adhered to principles of

heirloom gardening," said Extension Assistant Colin Shackleford, who helped design the garden.

With irrigation equipment donated by Rainbird, landscape design donated by Susie Fischer of Fischer-Schalles Landscape Architecture, a team of Nature Center volunteers, Master Gardeners, and Extension Service employees planted the garden. The project was funded by an Environmental Protection Agency Section 319 grant for nonpoint source pollution abatement.

In the hydrozoned garden at the Johnson Space Center, plants with similar water needs are placed in the same irrigation zone.

Visitors to Armand Bayou include the general public and school and senior citizens' groups. In the works is a series of landscape classes taught in partnership by the Extension Service and the Nature Center.
Shackleford is seeking funding for a rainwater harvesting system for irrigation.

Close by, at Johnson Space Center (JSC), a different type of waterwise garden--one that demonstrates more modern waterwise gardening techniques--has been planted for the education of JSC employees and visitors.

At JSC, Extension Specialists David Smith and Shackleford designed and installed an efficient irrigation system using appropriate irrigation methods (bubbler, drip, or microspray) for each plant. Shackelford hydrozoned the garden, grouping plants with similar water demands. Irrigation controllers are individually programmed to apply just the amount of water needed to replace moisture lost through evapotranspiration.

Water Savers honored by Texas AWWA, WEAT

In April, *Texas Water Savers* newsletter, edited by Texas Water Resources Institute science writer Jan Gerston, received an award for the Indirect Program by a Non-Utility from the Conservation and Reuse Division of the Texas Section of the American Water Works Association (T-AWWA). The newsletter also garnered the Watermark Award, which is given jointly by the Public Information Committees of T-AWWA and the Water Environment Association of Texas for communications excellence.

"I like to think of Texas Water Savers as a tool that can help water managers build on the success of others to become more water efficient," Gerston says. "We present an idea or example of a water conservation success story which others can emulate, thus increasing water savings throughout the State."
The awards are significant, says TWRI Director Wayne Jordan, "in that the people who determined that this information source be recognized are the same ones who are using the information. Obviously, they place a great value on the products generated through this effort."

Other evidence of the success of Texas Water Savers, Jordan says, is that it is supported by more than 22 sponsors, including governmental agencies and water management districts, cities, and consultants and affiliated industries.
TWRI initially developed Texas Water Savers in 1994 to communicate water conservation information to major water providers and users as well as the general public.

In addition to developing the newsletter, Gerston and Texas A&M University student Eric Hinesley created the Texas Water Education web site which focuses on these issues. The address is http://tx-water-ed.tamu.edu. Gerston also distributes e-mail messages through an electronic mailing list which provides timely news about water conservation efforts.

Texas Water Savers is a joint effort between TWRI and the Texas Agricultural Extension Service (TAEX). Subscriptions are available free upon request by contacting TWRI at (409) 845-1851 or twri@tamu.edu. Gerston can be contacted at (409) 845-1852 or jan@twri.tamu.edu.