Texas Water Resources Institute

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Helping Small Water Systems in a Big Way

TWRI, TAMU Agriculture Program Assist in Research, Training

By Ric Jensen, TWRI Communications Manager

Throughout Texas, there are tens of thousands of small water systems that provide essential drinking water services for rural residents.

Often, small water systems are faced with a unique set of difficult challenges. Because small water suppliers are short-staffed, managers of water supply corporations often tackle a number of jobs at once—technician, water quality manager, public relations, bookkeeper, and other chores.

Making matters even tougher, small water systems are now being asked to comply with challenging technical issues and rapidly-growing regulatory requirements. For example, small water systems are required to protect source waters from a variety of contaminants; to regularly test for water quality concerns; to treat drinking water to higher levels; and to even plan for terroristic attacks that could compromise system security.

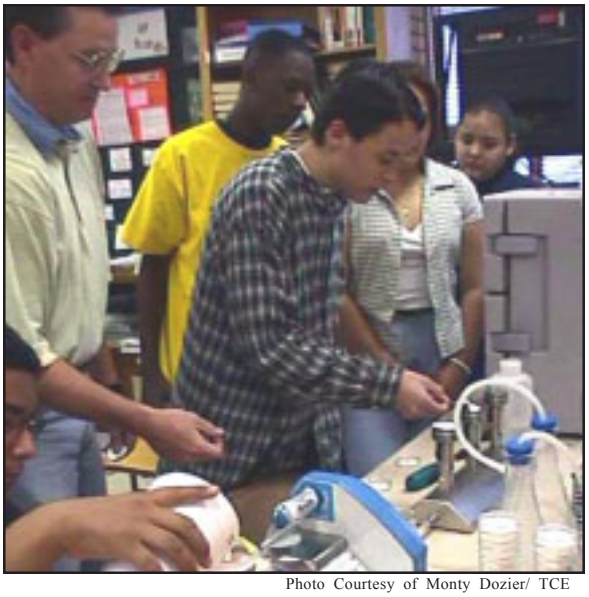

Photo Courtesy of Monty Dozier/ TCE

Monty Dozier of Texas Cooperative Extension (to left) works with students to screen well water samples for bacteria and nitrates.

The same types of management needs are also of concern to newly created and well-established groundwater conservation districts, as well as other types of water districts. Programs and resources are needed to instruct board members about their duties and responsibilities, and to clearly articulate the powers and benefits of these districts to the public.

In addition to small water systems, there are several other types of rural water users. Individual homeowners often use both a drinking water well and an onsite wastewater treatment system. These people need technical assistance and advice, especially when the tap water from the well looks or tastes odd, or when the septic system may not be functioning properly.

In this issue of the *Texas Water Resources* newsletter, we'll describe some of the ways in which the Texas A&M University System Agriculture Program and the Texas Water Resources Institute (TWRI) are involved in assisting rural residents in solving their water resources problems. In several cases, Texas Cooperative Extension (Cooperative Extension) is leading the way in providing outreach and education to rural Texas residents. Water resources needs were identified as a high priority in Extension's Texas Community Futures Forum program. In addition, Texas Agricultural Experiment Station (TAES) researchers are carrying out studies that will benefit rural water users throughout Texas.

TWRI, EPA, SE-TAC Train Rural Water Systems Managers

Since 1999, TWRI has participated in a joint program with the U.S. Environmental Protection Agency (EPA) and the Mississippi State University Water Resources Research Institute to provide training for rural water systems managers and operators. This training is facilitated through the Southeast Technology Assistance Center (SE-TAC), which is headquartered at Mississippi State University, one of eight technology assistance centers throughout the United States. These centers were created through amendments to the Safe Drinking Water Act passed in 1996.

The SE-TAC Program fosters cooperation between universities, state agencies that regulate drinking water and related issues, and other technical assistance providers. The overall program goal is to enhance the ability of small water systems to cope with critically important issues.

According to Jeff Ballweber of the Mississippi State Water Resources Research Institute, which supervises SE-TAC, the goal of the technology assistance centers is to provide resources that help small rural water systems keep up with pressing public health concerns.

"We recognize that small water systems face special challenges, especially as new requirements are imposed on them," Ballweber said. "The problem is often that small water systems simply don't have access to the resources they need to cope with emerging water quality problems. In SE-TAC, we build partnerships between EPA,

state primacy agencies, technical assistance providers, and universities to maximize the capabilities and expertise of each of these groups. We want to effectively develop and deliver technical, managerial, and capacity development training to small public water systems in the region."

Throughout SE-TAC's region (which includes Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, and Texas) academic programs have been coordinated through water resources research institutes, including TWRI. Within each state, the water resources institute works with an advisory committee to identify training needs, and develop and implement continuing education programs. In Texas, TWRI works with an advisory committee consisting of representatives from the Texas Commission on Environmental Quality (TCEQ), the Texas Rural Water Association (TRWA), and the Community Resource Group, Inc.

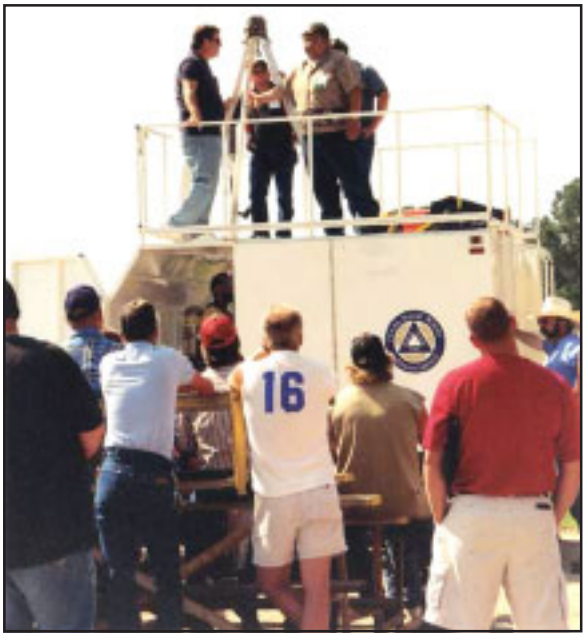

Photo by Robert Stewart/ TRWA

The Texas Rural Water Association provides training for small water systems managers in how to deal with safety concerns. The development of this training unit was funded in part through the SE-TAC Program.

The types of training offered through this program over the past two years illustrate the linkages that can occur to best meet the water needs of rural Texans.

In 2001, TWRI worked with TRWA, the Texas State Board of Plumbing Examiners (TSBPE), the TCEQ, TAES, and Cooperative Extension to provide a day of hands-on training at the Texas A&M University Agricultural Research and Extension Center in Overton and at the Hornsby Bend Environmental Center in Austin. Presentations covered strategies to prevent contamination from cross-connections, how to select proper backflow prevention devices, and problems associated with thermal expansion. TSBPE furnished a mobile training laboratory at these sites that provided participants with hands-on demonstrations. More than 100 personnel working with small water systems, including customer service inspectors, water operators, and utility personnel took part in these efforts.

According to Robert Stewart of TRWA, preventing problems associated with cross-connections and backflows is an important water quality concern for small water systems serving rural areas. Water supply corporations and other small systems that do not operate under plumbing codes must implement a customer service inspection program to check for illegal cross connections that might contaminate drinking water distribution systems.

"The SE-TAC training allowed us a way to provide free training about this important issue to the personnel who supervise and carry out customer service inspections," Stewart said, "and this helps improve their ability to protect drinking water quality."

In 2002, TWRI again worked with the advisory committee for this program to develop a day-long training program focusing on source water protection. This year's continuing education sessions include presentations by TAES and Extension scientists, as well as regulators and TRWA staff. Researchers George Di Giovanni of the Texas A&M University Agricultural Research and Extension Center in El Paso and Suresh Pillai of the TAMU Poultry Science Department provided state-of-the-art information about bacterial contaminants that will affect rural water systems. Monty Dozier of Cooperative Extension discussed programs to screen rural water wells for potential pollution risks, as well as education programs designed to reduce the likelihood of pesticide contamination. Greg Rogers of the TCEQ described programs to help communities plan and develop source water protection strategies, as well as water quality sampling requirements small water systems have to comply with. Other presenters included staff from TRWA and TWRI.

Dozier described efforts to screen private water wells for potential fecal coliform contamination throughout the High Plains, the Southern High Plains, and other regions of Texas for a Cooperative Extension program. Throughout 2001, Dozier led efforts to sample nearly 2,000 water wells, but only 3% to 9% of them showed any potential signs of water quality degradation. The procedure to screen water well samples was demonstrated to various publics, including school children through Extension outreach activities.

"Although small water system managers were the target audiences for this training, most of them are in rural areas and face the same problems as individuals with their own water wells. These water quality screening efforts are important because they create teachable moments and increase awareness," Dozier said. "Once people see that their water well might be vulnerable to water quality concerns, they often want to become much more involved in solving these problems."

Dozier also provided an overview of conditions in which pesticide use and runoff might affect water quality. He also described education and monitoring efforts to better manage pesticide use to lessen water quality risks faced by small water system managers.

Di Giovanni and Pillai are carrying out studies to learn more about bacteriological contaminants that have the potential to cause water quality concerns, the impacts of these pollutants on human health, and ways to better track or identify the specific source of bacteria found in waters throughout Texas. Much of the research centers on bacterial source tracking—developing methods that will improve the ability to determine whether fecal contamination at a specific site originated from humans, livestock, or animals in the wild, thus allowing water resources managers to develop pollution prevention plans. Some of the contaminants Di Giovanni and Pillai are investigating include *E. coli*, fecal coliform, *Cryptosporidium*, and *giardia*. Di Giovanni also described challenges these contaminants pose for water treatment, and strategies that small water systems might consider utilizing to deal with these water quality threats.

Rogers presented information on how small water systems and rural communities can develop and implement source water assessment programs. He also described the frequency at which small systems have to take water quality samples, and what corrective

actions must be done if water contamination is noted.

Free training was provided at the Texas A&M University Agricultural Research and Extension Center at Corpus Christi, the Hornsby Bend Environmental Center in Austin, and a site in Midland. More than 175 individuals received training and continuing eduction credits at these workshops.

In addition to the grants supervised by TWRI, SE-TAC worked directly with TRWA to help develop technical training resources that provide hands-on, local instruction for small water systems personnel. In this effort, TRWA created two custom-built trailers that serve as mobile classrooms. Each classroom houses demonstration equipment that enhances training that promote worker safety.

Photo Courtesy of George Di Giovanni/ TAES

Researcher George Di Giovanni of the Texas Agricultural Experiment Station is leading bacterial source tracking studies. The projects are administered by TWRI.

Providing Education Resources for Groundwater Conservation Districts

During the past two years, TWRI began efforts to work with Cooperative Extension and Texas A&M University to increase the amount of education materials available to help groundwater conservation districts.

The education program is led by researcher Ronald Kaiser of the TAMU Recreation, Parks, and Tourism Sciences Department, Extension Specialist Bruce Lesikar of the Biological and Agricultural Engineering Department, and Valeen Silvy, the program coordinator for the Texas A&M Office of the Vice President for Research. TWRI works with Kaiser, Lesikar, and Silvy to facilitate the publication and distribution of products resulting from this project, including publications, videotapes, and websites.

To-date, their efforts have included developing user-friendly handbooks as well as educational videotapes.

According to Silvy, this coordinated effort is playing a big role in bringing together resources from higher education to benefit groundwater users and managers.

"We are working with groundwater conservation districts to share important water resources issues between the legal, agency and educational communities to help them manage their operations. The opportunities to do so are especially timely right now with so many new groundwater conservation districts," Silvy said.

One of the first products developed through this project is an Extension handbook, *Questions About Groundwater Conservation Districts in Texas*. The handbook describes how groundwater conservation districts are created, administered, and managed, as well as regulations that affect these entities. The handbook also provides an overview of Texas aquifers, Texas water law, and Texas water planning. Recently, Kaiser, Lesikar, and Silvy developed a series of videos that discuss groundwater resources. One video titled "Crossroads—Texas Water Law," discusses how Texas regulates surface and ground water resources.

Lesikar, Kaiser, and Silvy, developed a series of training sessions for groundwater district managers and other stakeholders. This training is co-sponsored by TWRI, Cooperative Extension, the TCEQ, the Texas Alliance of Groundwater Districts, the Office of Rural Community Affairs, the TAMU System, the Texas Department of Agriculture, the Texas Water Development Board, and the Texas State Soil and Water Conservation Board.

The first seminar was offered in January 2003 and focused on training new groundwater district board members about their duties and responsibilities. It provided participants with an overview of the powers and authorities of groundwater conservation districts. Issues pertaining to funding, fiscal and administrative responsibilities of key personnel, and risk management were also presented. More than 200 people participated in this workshop.

The second seminar was offered in May 2003. This training was given at the George Bush Presidential Conference Center on the Texas A&M University campus, and was broadcast live to five sites throughout Texas. The workshop provided expert advice about issues pertaining to the buying, selling, and exporting of groundwater. A special emphasis was placed on how different parties may be affected by groundwater transactions, including groundwater conservation districts and landowners. Presentations were given by Kaiser, groundwater district managers, attorneys, and consultants.

According to Kaiser, seminars dealing with issues related to the importing and exporting of groundwater are vitally needed now, as competition for water resources increases throughout Texas.

"Cities need to protect themselves from times of drought," Kaiser said. "To do so, they have increasingly been turning to groundwater. This means that cities are turning to rural areas and to landowners with proposals to lease or sell their water and move the water to cities."

The next seminar, "Programs, Plans, and Rules for Your Groundwater Conservation District," is set for August 2003 in College Station. Results of these workshops are being communicated to the public through a technical report that is available from the Texas Cooperative Extension bookstore. Plans are also underway to allow individuals to view the talks given at this workshop over the Internet.

TWRI has also contributed to efforts to help manage other types of small water districts. Through the Mills Scholarship Program,

TWRI provided a grant to assist with the research of TAMU graduate student Matt Wagner. His graduate studies focus on determining whether voluntary wildlife management associations (WMAs), or cooperatives, could be a strategy to protect water rights and flows. Forming a WMA program may allow landowners to develop cooperatives to maintain or protect water resources, other ecosystem components, or to enhance conditions for wildlife.

Photo Courtesy of Monty Dozier/ Texas Cooperative Extension

Monty Dozier (to right) explains how this water sample will be screened for water quality concerns. Dozier is leading Cooperative Extension work to screen water wells in many regions of Texas.

Helping Individuals with Water Wells

Two types of programs affiliated with TWRI are aimed at helping rural residents who use water wells.

Through the Soil and Water Conservation Grants Program, TWRI has supported several efforts led by Extension Specialist Monty Dozier. Throughout 2001, Dozier conducted initial screenings of groundwater wells in the Hill Country, the Edwards Aquifer Region, the High Plains and along the Texas Gulf Coast to determine if there might be potential problems with fecal bacteria and nitrate pollution. If a problem was detected, well owners were urged to contact other laboratories to determine if follow-up testing was needed. This program is continuing this year so that well screening can be carried out in other regions of Texas.

Along with the actual testing efforts, this project also includes an educational component. In several cases, Dozier taught groups of schoolchildren and adults about how the testing should be carried out and how to identify if there might be a problem.

"By participating in this well screening program, well owners receive specific instructions about how to treat their wells to reduce contaminant levels and how to lessen the threat of contamination in the future," Dozier said. "Our data show that the level of awareness about groundwater quality increased by 26% among individuals who participated in the well screening. This shows the program is making a difference."

In another part of this project, researcher Dennis Hoffman of the Blackland Research Center in Temple developed a fact sheet for the Tex*A*Syst program that describes source water protection issues.

These source water assessments and wellhead protection efforts continued in 2002 through another Soil and Water Conservation grant. This effort involves expanding the groundwater sampling to additional counties, and complements efforts of Cooperative Extension's Texas Community Futures Forum.

Dozier is now working with Cooperative Extension Specialist Bruce Lesikar of the TAMU Biological and Agricultural Engineering Department and Mills County Extension Agent Tom Guthrie to improve water quality in private wells throughout Mills County. During the water well screening program, Dozier found that more than 15% of the private water wells in the county had fecal coliform bacteria present, while more than a third of those wells exceeded recommended nitrate levels (8 milligrams per liter). As a result, Dozier and Guthrie developed a program to make the purchase of reverse osmosis units more affordable for homeowners. Funds from this Soil and Water grant are paying for 75% of the price of these devices. Other aspects of this project involve locating abandoned water wells and creating a database in which the position of these wells will be noted through the use of global positioning system software. Once abandoned wells have been plugged, follow-up screening will be carried out to determine if water quality has improved.

TWRI and the Texas A&M University System Agriculture Program are also assisting people who rely on individual water wells. The Extension Forage, Soil, and Water Testing Laboratory tests water well samples for individuals. The Lab provides information about the types of contaminants most often found in drinking water, their sources, the potential health effects of these pollutants, and how to treat them. John Pitt, an analyst at the Lab, is a Texas A&M University graduate student supported by a 2002 Mills Scholarship. In his research, Pitt is investigating ways to analyze nutrients to determine how they affect water quality.

Aiding Individuals Who Utilize On-Site Wastewater Treatment Systems (OSSF)

Many of the same rural Texans who rely on individual wells for drinking water also utilize on-site wastewater treatment systems to treat and dispose of domestic wastes.

TAMU has developed an interdisciplinary team of Cooperative Extension professionals and researchers who are leading the way in this field.

Bruce Lesikar of Cooperative Extension and the Biological and Agricultural Engineering Department is nationally recognized for his efforts to develop training opportunities and to conduct applied research. Some of his efforts involve the creation of hands-on demonstration centers that facilitate OSSF training. These centers are located in Bryan and at the Texas A&M Agricultural Research and Extension Centers in Weslaco and El Paso. Lesikar has worked to improve training and continuing education about OSSFs by developing training classes, fact sheets, and educational videotapes. The fact sheets (which are available in English and Spanish) cover a variety of topics, including how people should select the appropriate system; the advantages and costs of several different technologies; and maintenance needs. OSSF videotapes produced by Lesikar discuss several related issues. This information can be accessed at Lesikar's website, http://ossf.tamu.edu.

At the same time, Lesikar has also been involved in several applied research and demonstration projects that examine the performance of OSSFs.

Lesikar and Suresh Pillai recently completed a study to examine the extent to which OSSFs treat and remove specific microbial pathogens from the waste stream. This study tested how well a sand filter and a constructed wetland might lower levels of *Salmonella spp.* and bacteriophages. A conservative tracer, bromide, was used to understand the fate and transport of these contaminants with these OSSFs. Results show that viruses were reduced by 3-logs in the constructed wetland and 2-logs in the sand filter. Still, results of the tracer tests suggest that the removal of bacterial pollutants may vary greatly depending on site-specific conditions that influence such processes as adsorption, desorption, and the inactivation of microorganisms. A report about this project was recently published by TWRI.

Photo Courtesy of Bruce Lesikar/ TAMU

In a recent study, Bruce Lesikar led efforts to rehabilitate an OSSF used for a convenience store and restaurant near San Angelo, including the installation of leaching chambers.

Recently, Lesikar led efforts to remediate a failed OSSF in the San Angelo region using funds from the TCEQ Supplemental Environmental Program. Lesikar's efforts included designing, installing, and demonstrating an on-site wastewater treatment system that serves a restaurant and convenience store in the small town of Wall. This comprehensive project involved developing a media bed system for pretreatment, as well as soil absoprtion trenches for wastewater treatment and disposal. The soil absorption trenches include both media-filled units and leaching chambers. Monitoring results from demonstrations associated with this project show that biochemical oxygen demands were greatly reduced once the new system was in place

TWRI has contributed to Lesikar's programs by helping support Vance Weynand, who is one of Lesikar's graduate students. Weynand is studying the performance of drip irrigation systems used for onsite wastewater treatment, and how such factors as slopes and soil types affect the level of treatment that is obtained.

Lesikar has also been involved in other education and demonstration projects pertaining to OSSFs. For example, Lesikar and TAES researcher Dennis Hoffman developed a program to educate Central Texas residents about the benefits of OSSF technology in the Nolan Creek watershed, and several research-based projects that examined the performance of sand filters, drip distribution systems, and many other technologies.

Rick Weaver, a researcher in the TAMU Soil and Crop Sciences Department, is also working with OSSF issues. His focus is on studying the extent to which constructed wetlands may be a viable strategy for on-site wastewater treatment, as well as examining the role of microbes in successfully treating domestic wastewater. TWRI assisted in Weaver's research funding one of his graduate students, Amanda Richmond Richter, with a Mills Scholarship. Richter played a key role in helping Weaver sample water quality at several East Texas sites where constructed wetlands have been used for onsite wastewater treatment. Her graduate research examined both the effects of using various substrates to line wetland beds (gravel and other media) as well as whether non-traditional disinfection methods (ultraviolet light) could be effective in treating effluents.

John Jacob, a TWRI Associate and a scientist with Cooperative Extension and the Texas Sea Grant Program, has also worked extensively with OSSFs. Jacob developed a series of detailed geographic information systems that allow regulators, homeowners, and industry professionals to screen specific sites within counties that may be poor locations for septic systems, based on the slope and the depth to groundwater. A pilot project, developed for Montgomery County, was funded by the Texas On-Site Wastewater Treatment Research Council (TOWTRC). Jacob has also created a web-based class that provides instruction about how to evaluate sites and soils to determine if they are suitable for OSSFs. By taking this class, people can meet TCEQ regulatory requirements to enable them to perform site evaluations. You can learn more about this class at Jacob's website, http://www.urban-nature.org.

TWRI has developed a wealth of resources dealing with onsite wastewater treatment on its website, including several years of issues of the *Texas On-Site Insights* newsletter.

Summary

Through various programs, the Texas A&M University System Agriculture Program and TWRI are providing resources to help rural communities, and individuals who live in suburban areas to deal with pressing water and wastewater issues. Often, these efforts are strengthened by TWRI's linkages to the Texas Agricultural Experiment Station and Cooperative Extension programs. In other cases, TWRI is engaged with several other state and federal agencies in outreach activities. Throughout the future, TWRI will continue to develop programs that can benefit rural communities and the people who obtain water from small systems.

For More Information

Customer Service Inspection and Cross-Connection Control, published by the Texas Rural Water Association, 2002. The Association's website is http://www.trwa.org.

Dozier, Monty, and Dennis Hoffman. *Determining the Presence of Fecal Coliform Bacteria in Private Water Well Samples of Texas*, TWRI Special Report SR 2002-21.

Lesikar, Bruce, Ronald Kaiser, and Valeen Silvy. *Questions About Groundwater Conservation Districts in Texas*, TWRI Special Report SR 2002-036.

Lesikar, Bruce. *Environmental Implications of An Advanced On-Site Wastewater Treatment System for the Food Service Industry*, TWRI Technical Report 223. June 2003.

Pillai, Suresh, and Bruce Lesikar. *Removal and Fate of Specific Microbial Pathogens within On-Site Wastewater Treatment Systems*,

TWRI Technical Report 217. June 2003.

SE-TAC Annual Report, Southeast Regional Small Public Water Systems Technical Assistance Center. Published by the Mississippi State University Water Resources Research Center, June 2003.

Weaver, Richard W., and Amanda Richter. *Disinfection Devices: Field Experiences*, SR 2003-013

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News from TWRI

A great way to keep up with water-resources news is to sign up for the Institute's email list server. We send out five messages per day that relate directly to water resources issues. The list is moderated and it's free. To learn more, contact Ric Jensen at rjensen@tamu.edu.

TWRI is continuing to expand its offerings of technical reports and special reports. The majority of these studies result directly from TWRI-funded projects. Most of these reports are available only on-line, and it is up to users to print their own copies. The reports are available in PDF format to allow for easy printing. In 2002 and 2003, TWRI published more than 70 technical and special reports.

TWRI held a successful conference in Weslaco in May that brought together researchers, Extension specialists and agents, agency representatives, commodity group leaders, and irrigation district managers, to discuss findings from the Rio Grande Basin Initiative. The Initiative, funded by the U.S. Department of Agriculture Cooperative States Research Education and Extension Program, is a joint effort with New Mexico State University. To learn more, go to http://riogrande.tamu.edu.

TWRI announced that it will support 25 graduate students at Texas A&M University and Texas A&M University–Galveston through its Mills Scholars Program. This program uses an endowed fund to support graduate student research and career development in water resources fields. To learn more about this year's Mills Scholars, contact Ric Jensen at rjensen@tamu.edu.

The Institute awarded funds for seven new water resources grants. These grants, given to Texas Agricultural Experiment Station personnel, are supported by the Soil and Water Conservation grants program TWRI administers. Contact Ric Jensen at rjensen@tamu.edu to learn more.

The TWRI family keeps on expanding. The most recent addition to our staff is Bill Fox. Fox, a range scientist, will lead efforts to rehabilitate rangelands at Fort Hood through the use of composted dairy wastes.

Texas Water Resources Institute
make every drop count

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