Texas Water Savers
News of Water Conservation and Reuse in Texas

Volume 4, Number 2, Spring 1998

Treated wastewater supplies dye plant

In 1988, the City of Harlingen sought to attract new industry to expand its economic base. The Lower Rio Grande Valley appealed to Fruit of the Loom as the site of a new textile bleaching and dyeing production facility. Labor and land were in plentiful supply, but the limited water supply from the Rio Grande combined with the water's natural salinity seemingly formed a barrier to building the plant in Harlingen.

Harlingen Water Works System Engineer Dennis Raymond in the pressurized sand filter plant installed by Harlingen Water Works to filter wastewater in preparation for reverse osmosis and eventual delivery to the adjacent Fruit of the Loom factory. This 66-tank installation is the largest in existence.

Fruit of the Loom required 2 million gallons per day (mgd) of water with exacting requirements for hardness, dissolved solids, pH, and mineral concentrations for their startup operations.

Working in partnership, the industry and the utility arrived at a solution in this water-strapped south Texas city--specially treated wastewater from the Harlingen wastewater treatment plant would furnish process water to the adjacent Fruit of the Loom plant. Reuse is nothing new to Harlingen--its golf course has been irrigated with treated wastewater since 1962. The city's water supply comes from its permit for 22,000 acre-feet per year from the Rio Grande. The Fruit of the Loom reuse saves 2,750 acre-feet of water per year from being diverted from the Rio Grande.

Harlingen Water Works System contracted out the design and construction of a reverse osmosis (RO) plant. Two separate 1-mgd trains were on line by 1991. A separate wastewater treatment section was constructed to handle industrial wastewater return. Fruit of the Loom sited their facility adjacent to the wastewater treatment plant.

The partnership has proved so successful that Harlingen Water Works has now embarked on a project to double the total output, from 2 mgd to 4 mgd. Along with Rice University and the U.S. Bureau of Reclamation, the utility is now researching the feasibility of reusing the Fruit of the Loom return flow. On the drawing board are plans to put a portion of Fruit of the Loom water in a continuous loop: first, use as process water by the production plant, next, returning to Harlingen's plant for sand filtration and RO treatment, and finally back to the factory for use as process water. Using this configuration, Fruit of the Loom will demand only make-up water from the Harlingen wastewater plant.

"Because you can't wear out water, we're going to treat and recycle the wastewater back to the factory once again," said System Engineer Dennis Raymond. "Then, the factory will demand only makeup water from us, and we could use 3 mgd of municipal wastewater for another application."

Harlingen Water Works Technician Javier Trevino prepares to work on purple pumps which move reverse osmosis (RO) treated wastewater to storage tanks. RO membranes are seen in the background. The RO plant has a present capacity of 2 mgd, which will soon be doubled.

Conversion of the wastewater treatment plant from a secondary municipal treatment and discharge process to an RO pretreatment process was accomplished solely by in-house engineering expertise. Raymond designed a unique treatment facility to supply water meeting the specifications of the RO plant.

First, water from the final clarifier step of secondary treatment is pumped to the segmented-disk filters, the first pretreatment step, which remove particles larger than 10 microns. Water is then sent to covered storage tanks.

From the storage tanks, water is pumped to an array of 66 pressurized sand filters, with a combined output of 7 mgd, capable of filtering particulate matter larger than 0.45 microns. This bank of filters is the largest such installation in existence, according to the manufacturer, Sonitec.

From the pressurized sand filters, water is pumped directly to the cellulose acetate RO unit to filter out dissolved solids down to 0.001 microns. RO-treated water is stored in two clear well tanks totaling 8 million gallons. A 20-inch pipe leads from the storage tanks to the Fruit of the Loom factory. RO output is now 2 mgd. After completion of a planned second phase expansion, output will double to 4 mgd.

Water Savers welcomes new, renewing sponsors

Texas Water Savers welcomes three new sponsors: Margiloff & Associates; Camp Dresser & McKee, Inc.; and Turner Collie & Braden, Inc. We also wish to express our appreciation to three renewing sponsors: **Texas Natural Resource Conservation Commission,** the **City of Houston Water Conservation Division** and **San Antonio Water System**.

Since 1982, **Margiloff & Associates** has provided business and technical services to process industries and to other clients concerned with industrial issues. Clients have ranged in size from major international corporations to small businesses. A natural outgrowth was an interest in water and energy conservation.

Clients have included manufacturers of commodity chemicals, petrochemicals, cement, chlorinated products, alcohol, fermentation and pharmaceutical products, metals, petroleum products, as well as those engaged in alternative energy, utilities, essential oils, and foods and food additives.

Irwin B. Margiloff, P.E., has served industry in design, research and development, business development, and corporate management. He has organized a water district, developed desalination technology, written major studies of water usage, conducted research for the Texas Water Development Board (TWDB), trained water agency staff to perform water surveys in several states including Texas, and provided technical critique of many hundreds of water conservation surveys.

Margiloff & Associates has conducted hundreds of site-specific water and energy surveys and studies; assisted in the development of fuel resources; conceptualized cogeneration projects; pointed out ways to minimize water and energy consumption; and trained staff, clients, and students.

Margiloff & Associates seeks to develop ways to reuse and recycle water, as well as to minimize total usage, and identifies benefits from savings in water, energy, labor, materials and capital investment. The company looks for methods of integrating the utility process into the manufacturing process, recommends better cooling tower operation, and reviews ultrapure water systems to their potential for improved economics.

Margiloff & Associates can be reached at (626) 303-1266.

Camp Dresser & McKee, Inc. (CDM) is currently designing a surface water treatment facility for the City of Victoria. The 21-million gallon per day facility will be the first surface water treatment facility for the City of Victoria and Victoria County, which to date has relied solely on the Gulf Coast Aquifer for its existing water supply.

CDM previously conducted a regional water supply study for the City and County of Victoria funded through TWDB. That study concluded that projected population growth would place greater demands on the limited water supply, causing aquifer water levels to

continue to decline while possibly increasing land subsidence and diminishing water quality. A state-approved regional water conservation plan was also developed for the City and County of Victoria in conjunction with this study.

Several water supply options were evaluated, but CDM's recommended alternative was to pump water from the Guadalupe River into an off-channel reservoir for surface water treatment and for conjunctive use with the existing groundwater supply. The off-channel reservoir would allow water from the river, which is variable in quality, to be blended with groundwater to produce a more consistent raw water supply for treatment and distribution. CDM assisted the City of Victoria to obtain the necessary water rights permit for authorized Guadalupe River withdrawals from the Texas Natural Resource Conservation Commission.

Camp Dresser & McKee can be reached at (512) 345-6651 or at their web site at www.cdm.com.

Turner Collie & Braden, Inc. (TC&B) has maintained a practice in public works since its establishment as a consulting engineering firm in 1946. The public works division provides engineering services for the planning, design, and construction of major infrastructure projects and has served clients--both foreign and domestic--including municipalities, river authorities, special utility districts, and private clients. Projects have included effluent reuse and sludge treatment and disposal; drainage, flood protection, and storm water management; environmental planning and design; surface water and groundwater supply systems; and wastewater collection and treatment.

A significant portion of planning projects now includes the use of geographic information system applications to better evaluate alternative solutions. For more information, visit http://www.tcandb.com.

Reclamation publishes water management guides for irrigators

The U.S. Bureau of Reclamation has released two publications on water management for irrigators and irrigation districts: *Achieving Efficient Water Management: A Guidebook for Preparing Agricultural Water Conservation Plans* and *Incentive Pricing Handbook for Agricultural Water Districts.*

Both guides, written by Hydrosphere Resource Consultants, are simple-to-use tools to help irrigation districts work through the process of realizing efficient water management.

In a logical, step-by-step manner, *Achieving Efficient Water Management* outlines the process of developing a water management plan using a hypothetical case study of an irrigation district. The manual guides the user through planning, data-gathering, goal-setting, evaluation of water management options, implementation, and consideration of potential water management improvement strategies. The final chapter, targeted at an irrigation district's Board of Directors, is a guide to preparing a water management plan.

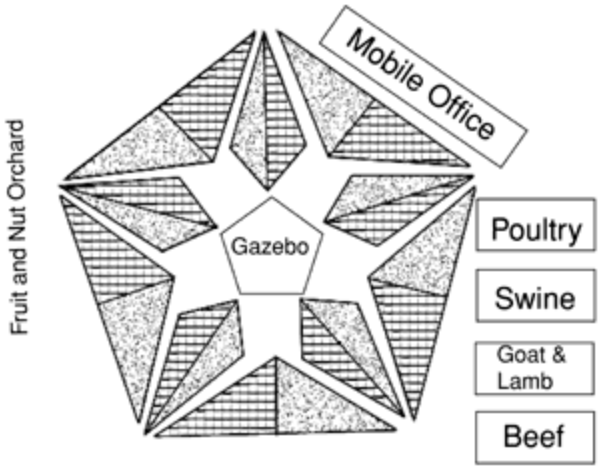
Recognizing that irrigation districts are faced with the triple challenge of decreasing federal support, heightened public scrutiny, and increasing competition for water, Reclamation prepared *Incentive Pricing Handbook for Agricultural Water Districts* to guide irrigation districts in the setting of water rate schedules. Water rates are a powerful tool to encourage improved water management, and incentive pricing can encourage efficient use in a flexible and equitable manner.

This manual first explains incentive pricing and its benefits and pitfalls, then introduces various rate schedules, including fixed charge, water rate per acre-foot, and tiered rate schedule. Revenue consideration and elasticity of demand are also addressed. Communcation with irrigators and implementation and monitoring are covered in the final two chapters.

Copies of these books can be obtained from the Austin office of the U.S. Bureau of Reclamation (512) 916-5648.

AgriFood Masters teach impact of ag; relation to natural resources and the environment

Texas has a population of 18.5 million, of which only 225,000 are involved in food and fiber production. The mission of Texas AgriFood Masters volunteers is bring to urban consumers the message of the importance of the food, fiber, and forestry industry and the relationship of agriculture to natural resources and the environment.



A different crop is to be grown in each star point. Texas Star Farms provide an opportunity to educate tens of thousands of children and to enhance agricultural awareness in urban populations. It will be constructed on the grounds of James Madison High School in San Antonio.

"Many citizens within urban America who possess pride, intrinsic values, and a deep appreciation for agriculture and can become an effective vehicle for urban education," states the organization's Master Vision.

Since 1992, Texas AgriFood Masters volunteers have presented illustrated lectures, hosted agricultural science fairs, and presented research-based information about agriculture and food technology. This program is implemented by county extension agents and directed by Andy Vestal, an extension specialist and former county agent who is now state coordinator of the AgriFood Education Program.

AgriFood Masters' mission is to recruit and train urban volunteers to provide agricultural, natural resources, and food and environmental education for consumer and youth audiences to ensure wise decisions are made regarding America's food and fiber systems.

AgriFood Masters speakers bring to urban dwellers news of agricultural water conservation techniques and research, such as low energy precision application (LEPA) irrigation and how ranchers clear brush in a sustainable manner, said Helen Holdsworth, Bexar County extension associate.

In Bexar County, a speakers bureau of about a dozen volunteers trained by extension specialists and industry professionals from around the state teach conservation of natural resources in talks to civic groups and in the classroom. This public outreach fulfills part of the AgriFood Masters' mission of providing accurate information about food, natural resources and the environment. Aside from the speaker's bureau, about 90 volunteers work with schools, agricultural fairs, and career days.

"These folks understand the importance of agriculture, although many did not grow up on a farm," said Holdsworth. Many are business professionals, but all share an appreciation of farm and ranch lifestyles.

"We also rely on the [U.S. Department of Agriculture] Natural Resource Conservation Service to demonstrate the advantages of grass cover to reduce runoff and to discuss how water is absorbed into the soil," said Holdsworth.

AgriFood Masters enjoy a presence in Bexar, Dallas, Tarrant, Tom Green, and Travis counties, and in a combined group of Panhandle counties.

The outreach of the AgriFood Education Program has now moved into more than 60 Texas counties through Ag Fair events on elementary school campuses. These Ag Fair events will reach an estimated 100,000 youths.

In several of these counties, AgriFood Masters have published a guide entitled *The Impact of Agribusiness*, intended to increase awareness of the local agribusiness market. This report highlights sales, payroll, employment and economic impact of producing, processing, transporting, and storing wholesale and retail products originating on the farm or the ranch. See http://www.tamu.edu/ageduc/Initiatives/index.html a full-text version of *The Impact of Agribusiness on San Antonio/Bexar County.*

The report breaks the agribusiness sector down into five categories: retail trade; wholesale trade; manufacturing; agricultural services; and transportation and public utilities. Agricultural workers account for about 13% of the salaried private work sector in Bexar County.

Under development in Bexar County is an interactive demonstration project for children--Texas Star Farms--to be located on the campus of James Madison High School in San Antonio. Texas Star Farms is a 7-acre tract whose centerpiece will be a 2-acre star-shaped crop display. A one-cow milking parlor, livestock exhibits, and a fruit and nut orchard are also planned. The interactive learning experience is expected to reinforce required academic skills.

The AgriFood Masters website is http://www.tamu.edu/ageduc/Initiatives/index.html.

For more information on AgriFood Masters, contact Helen Holdsworth (210) 930-3086 or email h-holdsworth@tamu.edu or Andy Vestal, State Coordinator-AgriFood Education Program, at (409) 862-3013 or email t-vestal@tamu.edu.

Council to seek EPA Section 319 water stewardship grant

The Texas WaterWise Council, after several months of debate, has agreed to enter into a contract with SourceAg to apply for an Environmental Protection Agency Section 319 grant in May. Section 319 grants target improvement of water quality by reduction of nonpoint source pollution.

The WaterWise Council's water stewardship mission to promote resource-efficient management of urban landscapes that minimizes runoff meshes well with the Section 319 goals of water stewardship.

The three-year grant, to be administered by the consulting firm of SourceAg, would allow expanded programs of educational outreach on water management and stewardship and a technology transfer project starting with development of best management practices with the Texas Agricultural Extension Service.

A successful grant proposal will move the Texas WaterWise Council toward its 1998 goal of continuing and expanding the Partner's Project and hiring a staff person to compile and catalog a database, as well as to handle administrative functions.

Other current WaterWise Council goals are to double membership and to continue to expand the Partner's Project of educating nursery personnel.

The grant will help fund WaterWise Council activites for three years. The WaterWise Council will be responsible for matching funds in the amount of 40% of the total project budget. Matching funds can be in-kind contributions and private donations. For more information, contact Marilyn Good, Texas Association of Nuserymen, (512) 280-5182 or email plantx@onr.com.

WaterWise Council produces consumer-oriented videotape

The Texas WaterWise Council, a coalition of water providers, regulatory agencies, and nursery industry members, has produced a video highlighting the importance of water-efficient landscaping techniques in terms of water supply and availability in Texas.

One copy of the videotape will be distributed to all WaterWise Council members, and additional copies are available for $10.

Targeted at the nursery-product consumer, the videotape conveys the role of efficient landscape design and maintenance in the context of Texas' overall water supply using

images, captions, and a voice-over by sports announcer Wally Pryor. The picture of Texas' water situation is developed with drought facts, the realities of expanding the water supply and wastewater infrastructure to meet average and peak demand, the "hydro-illogical" cycle, the role of plants in controlling erosion and filtering water, surface water dependable yield, declining groundwater levels, and the threat of pollution. Next, the viewer learns about water use by sector, the wide range of precipitation distribution from east to west, and the potential of conservation to reduce demand by 15 percent. Finally, the last third introduces common-sense specific waterwise landscaping techniques.

Gathering slides and scripting of the video was a joint task of the Council. Council member Brent Wiseman, Director for Horticultural and Forestry Marketing for the Texas Department of Agriculture, undertook the task of committing the images, captions, and voice-over to videotape. Production of the tape was accomplished by the videotape production facility at Austin Community College.

For more information on ordering the videotape, contact Marilyn Good (512) 280-5182 or Brent Wiseman at (512) 463-7472.

WaterWise Council to sponsor commercial landscape award

Commercial landscape contractors will have the opportunity to compete for the first-ever WaterWise Landscape Award sponsored by the Texas WaterWise Council in conjunction with the Texas Association of Nurserymen (TAN) and the Texas Association of Landscape Contractors. (TALC).

Judging criteria for professionally installed landscapes include (1) a dominant plant selection of native or adapted plant materials; (2) proper hydrozoning (plants grouped according to water need); (3) appropriate turf areas, (4) sloped areas of less than 3:1, or terraced to such a slope; (4) use of mulch; (5) extensive runoff captured by wales or berms; (6) suitable shade trees placed for long-term sustainability of landscape; (7) no narrow irrigated strips; and (8) if irrigation systems are used, shrub beds must be zoned separately from turf, and sunny areas zoned separately from shady areas. An as-built diagram must be submitted for irrigated landscapes.

Judging will be done from slides submitted by competitors. An adjunct benefit of this competition will be that the slides, which become property of the Excellence in Landscape Program, will form the seed for a catalog of resource-efficient and beautiful "Great Texas Landscapes."

The WaterWise Landscape Award is just one category in the TALC competition, open to professional landscape contractors. Winners will be announced at the annual four-state TAN-MISSLARK Convention in August at the George R. Brown Convention Center in Houston. For more information, contact Marilyn Good at (512) 280-5182.

Law firm web site a clearinghouse for reuse resources

The Booth, Ahrens & Werkenthin law firm has instituted on its web site (www.baw.com) a clearinghouse for water reuse background and development in Texas.

Not only does the site include up-to-date tracking of water reuse issues, including the closely followed progress of the Texas Natural Resource Conservation Commission (TNRCC) Reuse Study Committee, it also offers a thorough analysis of the policy and statement of legal precedents for water reuse.

Particularly valuable is the Water Reuse overview, summarizing the evolution of the TNRCC's rulemaking process on reuse policy and implementation of Senate Bill 1 provisions. The site makes excellent use of downloadable files, including a memo summarizing TNRCC policy on the distinction between bed-and-banks transfer of developed groundwater and permitted surface water and the firm's response to those TNRCC recommendations; a shorter version of the response, entitled, "Respecting Rights of Indirect Reuse in Texas," by Carolyn Ahrens; and Michael Booth's comments on the TNRCC work session on the use of streams for reuse projects.

All documents are clickable on a separate Reuse Documents Page.

The site provides an array of links, including links to the Texas Water Resources Institute reuse database, to case studies in *Texas Water Savers* and to the WateReuse Association of California. Also updated regularly is a calendar of upcoming water- and reuse-related events and meetings.

A separate, straight-forward links page connects the user to federal agencies, legislative resources, environmental and water agencies and associations, and water reuse sites.

Reuse Conference: May 28 in San Antonio

The 1998 Texas Water Reuse Conference: A Discussion of Financial, Regulatory, and Institutional Factors will focus on water reuse success stories in Texas, Florida, and California and ways and means of facilitating water reuse in Texas communities.

The conference will be 8:00 a.m. to 5:00 p.m., May 28 at the San Antonio Airport Hilton and Conference Center, 611 N.W. Loop 410. Registration fee is $40. One conference objective is to bring reuse information to the smaller cities, especially in the water-short Edwards Aquifer and South Texas areas.

Reuse regulation, as laid out in Senate Bill 1, Chapter 210, Chapter 217, and TNRCC on-site wastewater systems and graywater reuse rules will serve as an overview of non-water rights issues, to be followed by a session on water rights as they relate to reuse.

A financing session will include discussion of state and federal programs and tax incentives. Following lunch will be case studies of successful reuse projects.

The conference will close with a moderated open-floor discussion with the goal of developing a priority list of issues that need to be addressed to facilitate the implementation of water reuse in Texas communities.

The conference is sponsored by the Water Conservation and Reuse Committee of the Texas Section, American Water Works Association; San Antonio Water System; TNRCC; Water Environment Association of Texas; and the U.S. Bureau of Reclamation.

For more information, contact John Sutton, Texas Water Development Board, (512) 463-7988 or email jsutton@twdb.state.tx.us.

Austin offers rebates for waterwise landscapes

The City of Austin Water Conservation Division recently launched a landscape rebate program for its residential customers and customers of its wholesale suppliers.

The Waterwise Landscape Rebate Program offers financial incentives to customers who plant water-efficient landscapes using trees and shrubs from an approved list.

To apply for the rebate, customers must submit a scaled site plan showing the location of their house and other buildings, location of walkways, existing plant material, and installed irrigation plan. The Water Conservation Division then reviews the plan for approval. Once the application is approved, the customer may purchase and install the planned landscape.

Customers are eligible for rebates of $1 per qualifying 1-gallon shrub, 50% per qualifying 5-gallon minimum small tree (up to $15) and 50% per qualifying 10-gallon shade tree (up to $25).

Enough plant material must be purchased to qualify for the minimum $80 rebate. The maximum rebate is $240. Landscapes must be installed before the October 1 deadline.

Proposed planting areas must receive six or more hours of direct sun during the months of May through October, and must have less than a 3:1 (run-to-rise ratio) slope or be terraced to within this limit.

Mulching and edging between turf and beds is encouraged.The Water Conservation staff will perform a free irrigation audit on sprinkler systems. When installation is complete, an inspector visits the property to verify its eligibility for rebate.

The Waterwise Landscape Rebate Program is Austin's second. Starting in 1993, Xeriscape-It! offered residential customers up to a $150 water bill credit for installing sodded buffalograss and drought-tolerant shrubs and ground covers in areas that receive at least six hours of direct sunlight daily.

Participants in the Xeriscape-It! program are not eligible for the Waterwise Landscape Rebate Program. For more information, call Dick Peterson, Conservation Program Supervisor, (512) 499-3514.

TNRCC writes guidelines for conservation plans

by John Warden, AICP
Water Conservation Team Leader
Texas Natural Resource Conservation Commission

If you're in the water utility business or you know someone who is, you've probably heard and read much about what Senate Bill 1 (SB1) means for your local water utility. SB1 was passed by the 75th Texas Legislature in 1997. It amends the Texas Water Code, and it will result in a new state water plan developed by regional interests. The new law has broad implications for water utilities, local and state government, and different types of water users. "It is the policy of the state that water resource management, water conservation and drought planning should occur on an ongoing basis." (Water Code, Sec. 16.054) To further the adoption of the new state water plan in 2001, the Texas Water Development Board has appointed the initial members of 16 regional planning groups. SB1 provides that these regional planning groups shall consider any local water plans submitted to them in preparation of their regional water plans.

Water conservation will be a significant element of water plans at all levels--local, regional and state. The new law requires that a water conservation plan be prepared by (1) every applicant for a new or amended water right (as previously); (2) every holder of a water right for 1,000 acre-feet or more water for municipal, industrial, and other use except irrigation; and (3) every holder of a water right for 10,000 acre-feet or more water for irrigation use.

By Fall 1998, the Texas Natural Resource Conservation Commission (TNRCC) will develop deadlines for the submission of required water conservation plans to TNRCC by water right holders in the second and third groups. The rules for the contents of a water conservation plan are in Chapter 288, Texas Administrative Code, Title 30. In reviewing a water conservation plan, TNRCC checks to see that the plan includes reasonable and attainable conservation goals. The agency recognizes that there is not a "one size fits all" standard for water conservation goals among water utilities and districts in Texas.

SB1 also requires wholesale and retail public water suppliers and irrigation districts to develop drought contingency plans. TNRCC has contracted with Turner Collie & Braden, Inc. to draft guidelines for the preparation of drought plans. The guidelines will be adopted by the Commission and will be tailored to different types of water utilities and irrigation districts. Drought plans should address water shortages as well as relatively

short-term problems in water treatment and distribution. These might result from contamination or equipment failure. Typical elements of a drought plan or "emergency demand management plan" include public awareness, trigger levels, public notification procedures, and both voluntary and mandatory measures to reduce water use.

The TNRCC water conservation team is expanding in order to help water right holders and water suppliers comply with the agency's water conservation rules. Water conservation specialists Todd Edwards and Gayla McCarty come from the water utilities division of TNRCC. Two additional positions in water conservation will soon be filled to assist with TNRCC's response to the requirements of SB1.

Watch *Texas Water Savers* in 1998 for information on the rules to be drafted by TNRCC regarding water conservation plans and drought plans. For information on current TNRCC requirements for conservation and drought plans, contact any Water Conservation Team member at (512) 239-1072 or jwarden@tnrcc.state.tx.us.

Extension Service launches Blue Gold information campaign

The Texas Agricultural Extension Service will launch its Blue Gold water campaign this summer. The title reflects the fact that water has become the most valuable natural resource in Texas. The Extension Service will use this campaign to promote water conservation and water education across the state.

Media advisory packets will be sent from Agricultural Communications at Texas A&M University to media outlets in Texas. These packets will contain several articles, including an overview of the water month, projects dealing with water issues and tips for both agricultural and urban audiences. Educational material from the Extension Service and from other agencies such as the Texas Water Development Board will also be included as background material for journalists.

Information about water will also be packaged and sent to Extension agents for use in their own educational efforts. With agents in every Texas county, the water conservation message can be magnified manyfold. Extension agents can use this material for their news columns, one-on-one meetings, media contacts, and planned programs, including field days. Agents and subject-matter specialists will be encouraged to keep water issues as a key priority during the summer.

The Extension Service will also continue its successful water education efforts through the Master Gardener program, irrigation conferences, and 4-H programs. For more information, contact Agricultural Communications, (409) 862-3309.

Editor's note: The "Texas Water Bank" logo designates Texas Agricultural Extension Service Water Supply and Conservation Education efforts, a Senate Bill 1 initiative.

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Meetings and Conferences

Water Crises in Texas and the Southwest, May 21-25, Trinity University, San Antonio, sponsored by the American Society of Environmental History. Includes a public forum on the Edwards Aquifer, as well as an interdisciplinary debate on water in a historical context. Accommodations at Trinity University dormitories. Conference coordinator is Hugh Daschbach (210) 736-7601. See the website http://www.trinity.edu/departments/continuing_ed.

The **6th Annual On-site Wastewater Treatment Research Council Conference**, May 20-22, Corpur Christi. Sessions include wastewater reuse and graywater systems for landscape irrigation. Call Paula Callaway (512) 239-6330 or pcallawa@tnrcc.state.tx.us for more information.

1998 Texas Water Reuse Conference, May 28, San Antonio Airport Hilton and Conference Center. Topics to include regulatory issues, case studies, financing, and overview of reuse regulations and incentives. Registration is $40. Call John Sutton, (512) 463-7988 or email jsutton@twdb.state.tx.us for more information. See page 12 of this issue for more information.

The Texas Agricultural Extension Service and Texas Water Resources Institute will sponsor a **Water for Texas Conference** December 1-2 in Austin. The purpose of the conference is to identify ways and means to help urban and agricultural entities develop water management strategies. Call Jan Gerston (409) 845-1852 or jan@twri.tamu.edu for more information.

Amarillo Field Days to focus on soils, remote sensing, irrigation

Agricultural field days are a combination show-and-tell and science fair of the Texas A&M University agricultural research and extension community and industry for the dissemination of knowledge to the local farmers, ranchers, and other agricultural interests.

On May 21, the Texas A&M University Agricultural Research and Extension Center (AREC) at Amarillo will sponsor a field day focusing on precision agriculture and spring crops at the North Plains Research Field in Etter.

Topics will include the value, accuracy and costs of yield mapping, remote sensory methods, and determining the variability of soils. Hands-on field demonstrations will include the use of global positioning systems and automatic vision spot sprayers.

The Bushland Summer Crops Field Day, August 12, will feature irrigation and precision agriculture exhibits along with field tours. The field tours will include subsurface drip and sprinkler irrigation, the use of potential evapotranspiration, dryland cropping systems, animal waste management and irrigation best management practices.

For more information on field days, contact the resident director of the Amarillo AREC, John Sweeten, (806) 359-5401.

Master Gardeners `Make Every Drop Count'

Master Gardeners remove catch-cans on a residential landscape after a 15-minute sprinkler irrigation test. Irrigation and Water Conservation Specialist David Smith records data, averaging the amount in all containers to determine sprinkler output

Texas' Master Gardeners are becoming irrigation MEDICs--Making Every Drop Count -- in residential landscape irrigation.

By adapting the professional Landscape Irrigation Audit Management course for Master Gardeners, David Smith and Lisa

Whittlesey of the Texas Agricultural Extension Service have developed a "graduate" master gardener course in proper irrigation management.

"The intent of MEDIC is to give Master Gardeners the skills to assess sprinkler irrigation efficiency and to then adjust water schedules in accordance with climate, soil, and vegetation," said Smith, an irrigation and water conservation specialist with the Extension Service.

"Most residential users set their irrigation timers with no regard to the actual needs of the plant or turf. Our goal is to teach Master Gardeners to analyze and correct irrigation practices," said Whittlesey, a horticultural water conservation specialist.

Thus far, courses have been offered in Bexar and Nueces/Aransas Counties, with about 12 total participants.

For more information on the Master Gardener landscape irrigation program, contact Whittlesey, (409) 845-8565 or Smith, (409) 845-5614.

Hoffman recognized for conservation work

Bill Hoffman, chief of municipal, industrial, and agricultural water conservation at Texas Water Development Board (TWDB), was lauded with a special "Water Conservation Guru" award for 1997 by the Chair of the Conservation and Reuse Division, Texas Section-American Water Works Association. Division Chair Carole Baker presented Hoffman with the award at the Texas Section conference in Galveston in April.

Hoffman was recognized for service and innovation in the promotion of water conservation and reuse for many years. Since passage of a Constitutional Amendment in 1985 requiring TWDB loan applicants borrowing more than $500,000 to write water conservation plans, Hoffman and his staff have developed guidelines for conservation and drought management that have been at the national forefront of such activity.

He is a vocal and active proponent of alternative strategies such as reuse, rainwater harvesting, and waterwise landscaping. Most recently, Hoffman has actively supported Senate Bill 1 from its path through the legislature to its implementation at TWDB. Hoffman was also instrumental in promoting plumbing fixture studies and legislation to require water conserving fixtures. Hoffman can be reached at (512) 463-7932 or bhoffman@twdb.state.ts.us.

Questions remain as to efficacy of brush management for water yield

Recently, Senate Bill 1 added brush control to conventional water development activities eligible for loans from Texas Water Development Board and for funds from the issue of bonds under the State Participation Fund. Also, capital equipment to effect brush control is now eligible for conservation loans from TWDB or lender districts.

For more than 40 years, rangeland managers in arid areas have suspected that brush was soaking up water that would otherwise flow to creeks or percolate to the aquifer. Brush is defined as all woody and succulent plants--trees, shrubs, vines, cacti and subshrubs--deemed undesirable for livestock production. Fully two-thirds of the state is classified as rangeland.

Years of research and experience, however, have produced inconclusive--and often contradictory--results. On one hand, seven documented Texas field research tests over the course of almost 30 years document water yields below predictions. On the other hand, observations credit brush removal with bringing one long-dry creek back to life.

First, however, an understanding of the basic water balance equation is helpful. Precipitation accounts for most of the water received by a land area. Once it falls on land, the amount of water is distributed, in varying proportions, among runoff, evapotranspiration, and infiltration.

Brush diverts moisture to evaporation two ways: first, evapotranspiration from the leaves sends moisture back to the atmosphere; and second, canopy and litter intercept rain before it reaches the soil.

Canopy and litter can intercept as much as 19% of incoming precipitation. Of the precipitation that then reaches the soil, evapotranspiration can account for 90% to 95% of water loss in arid and semiarid land. Efforts to maintain water on the site, therefore, concentrate on reducing evapotranspiration losses. The best way to do that is to replace wood brush with grasses, which have less biomass than brush and are dormant some part of the year.

Changing the variables of the water balance equation brings into focus the different outcomes from brush management desired by rangeland managers and water managers.

Depending upon hydrogeologic setting, infiltration may or may not lead to groundwater recharge or extended base flow of streams. It is likely recharge occurs only in the recharge zone. Conversely, if water does percolate to a deep aquifer, base flows to streams will not increase.

Increasing water yield off-site may decrease the amount of water available for production of forage for livestock.

"Rangeland management practices depend upon the landowners objectives, whether it be wildlife habitat, grazing, and/or hunting," said Brian Hays, rangeland water conservation specialist for the Texas Agricultural Extension Service. "Ranchers often build dikes to capture diffused surface water. Will greater infiltration dry up those stock tanks?"

"Rangeland managers have to strike a balance between enhanced water, wildlife habitat, and forage for livestock. We have to look at the economic as well as the ecological benefit," said said Wayne Hanselka, Extension Range Specialist at the Texas A&M University Research and Extension Center in Corpus Christi. "Certain brush complexes provide habitat for wildlife."

Brian Hays is the rangeland specialist for water conservation, Texas Agricultural Extension Service

In the clay loam soils of south Texas, it takes extraordinary measures to get deep infiltration, according Hanselka. Removing brush fractures soil to facilitate drainage. In this case, runoff may actually decrease in favor of infiltration.

"There are just so many variables to consider that we can't make a hard-and-fast statement about brush management increasing water yield. And would brush removal guarantee continued success? Perhaps the first year. If you clear away the brush, other vegetative cover may grow, and it may use available water. Also this vegetation may have different evapotranspiration rates and may also encourage infiltration rather than runoff," said Hays.

Hays continues, "Our goal is to maintain the integrity of the watershed without adversely affecting someone else's property. One of our efforts is to encourage ranchers to maintain good cover on their grazing land."

Herein lies the basic conflict--should the principal objective of brush management be to increase water yield to benefit off-site interests, or is it to increase rangeland productivity. Also, can both objectives be met at the same time?

"To provide maximum benefit to the rancher, brush management must promote the reallocation of water among vegetation components, rather than promoting runoff. Best management strategies aim to capture rainfall and slow down runoff. If you're going to grow vegetation, you've got to get rainfall into the soil, and plants must be strong enough to use it. If desirable plants are not strong enough or if they are absent, just getting water into the soil is not good enough to meet objectives." Hanselka said.

"Through proper management, range managers can reallocate water supplies and use water efficiently, but there are still questions as to whether such practices can also enhance water supplies in reservoirs or groundwater." In the 1960s, a study by the Soil and Conservation Service (now the Natural Resources Conservation Service) estimated that 10.2 million acre-feet of water (more than 50% of Texas' total water use at the time), could become available through a statewide brush management program.

Mixed results of brush management projects over the years raise the question of whether the practice increases water yields, or just changes the values of the water balance equation variables.

In 1983, A.R. Hibbert of the U.S. Forest Service, published research results from Arizona and California rangeland studies showing the potential exists for increasing water yield by brush management on watersheds where annual precipitation exceeds 18 inches.

Results in Texas, however, do not seem to bear out scientific predictions, and even within Texas, results from one rangeland site cannot be projected onto another.

"Owing to the number of variables in the brush management equation, deciding whether the practice would work on a particular rangeland is almost site-specific," said Hays. "Brush species, geology, hydrology, soil, climate, and topography all play a role in whether brush management will increase water yields."

For example, water yield from field studies in the 1970s on the South Texas Plains and the Blackland Prairie fell far short of estimates. Hibbert's equations predicted brush management would free up the equivalent of 2.3 and 4.9 inches of water, but actual yields in these Texas studies were zero and 0.95, respectively.

Actual water yield in another South Plains study in the 1980s also fell far short of predictions. Soil-moisture water budget studies for mesquite brush replaced with grasses showed increased annual runoff and percolation of 1.18 inches, far short of Hibbert's optimistic 5.17 inches for the same area.

From 1988 through 1991, researchers at the Texas Agricultural Experiment Station at Sonora, led by Thomas Thurow, monitored runoff from several 10-acre watersheds. In 1991, all woody vegetation on three watersheds was cut and carried from the watershed. For the next two years, researchers monitored runoff, movement of moisture through the soil profile, and evapotranspiration. Rangeland with 100% grass cover allowed 3.7 inches of water per year to infiltrate into the soil, as compared with zero inches for mixed cover. The high organic content of the soil, due to decomposition of litter, promoted infiltration. No difference in runoff was observed due to various cover.

From 1991 through 1995, a study of Seco Creek by Bill Dugas of the Texas Agricultural Experiment Station and the researchers from Natural Resources Conservation Service produced conflicting runoff results for the removal of ashe juniper in Uvalde county. The study found, however, that evapotranspiration was reduced for two years following the

treatment, but steadily climbed upward as grasses proliferated and brush species began to regrow.

In both the Sonora and Seco Creek studies, little increase in runoff was detected, but decomposed litter dropped by the trees left a soil with high organic content, promoting high infiltration rate--the amount of water passing through the soil surface per unit time.

Observations Rocky Creek, northwest of San Angelo tell another tale. A dry creek bed, Rocky Creek was observed to "come back to life" in the late 1960s after extensive brush removal from its watershed. The volume of water in Rocky Creek as a consequence of brush management was estimated at 525.6 million gallons or 0.26 inches per acre per year. This estimate may be suspect because the Texas State Soil and Water Conservation Board used stream gauging, which does not take into consideration infiltration through the soil and the movement of storm water. A new brush management effort is about to begin on upper Concho Creek outside San Angelo to attempt to resolve some of these conflicts.

Even the type of brush can have an effect. For example, in 1956, an Arizona researcher estimated a per-acre yield of between 0.5 and 1.0 acre-inches from the removal of pinon and juniper, and in the next decade, a considerable number of acres was cleared using mechanical methods. Almost 20 years later, continued research and field results found that chaparral-infested lands, which had been dismissed by the first study, exhibited significantly more potential for water yield, while the pinon-juniper acres provided disappointing results.

Initially, range managers feared an increase in erosion and sedimentation from cleared rangeland. In most studies, however, sedimentation and erosion from Texas rangelands actually decreased following brush removal.

"The myriad variables in the brush management picture demand a large-scale pilot test sited where all water balance components--evapotranspiration, stream base flow, runoff, infiltration, aquifer recharge--can be measured over a long term," said Wayne Jordan, director of Texas Water Resources Institute. It may take some time for water infiltrating the watershed to work its way to increase base flow of streams.

Hays concurs, "Rangeland management generates a complex set of questions. "Replacing brush with grass may promote infiltration rather than runoff. In that case, we are just shifting distribution. And say that infiltration occurs in an area other than a recharge zone. In this case is the groundwater being replenished?

If a city downstream is depending upon water from proper range management upstream, should there be some tax incentive for landowners to put these practices in place? If a rancher clears mesquite and increases surface water volume, should the rancher or the city downstream benefit from the increased flow? If brush management directly and substantially increases surface water flow, could that increase possibly constitute a new water right?

"All these questions need to be worked out--who benefits, who pays, in a tax-supported system," said Hanselka.

Texas landowners are entitled to capture and put to beneficial use groundwater beneath their land. Since surface water is allocated by permit, conserved water creates two dilemmas: (1) if a sponsoring agency increases groundwater flows, individuals rather than an agency or the public, may benefit; (2) if a rancher creates additional surface water, is he then entitled to a corresponding surface water right? If it is determined that brush management enhances water yield, then there is the difficult policy question of who is entitled to a permit to that water.

As Texas plans for the next 50 years' water supply, it seeks new and unconventional sources of water. Brush management may have the potential for increased water yield, but its implementation presents a complex challenge from scientific, environmental, social, fiscal, and policy standpoints.

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