Texas Water Savers
News of Water Conservation and Reuse in Texas

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From the Editor

Remember the gasoline "crisis" of the early 70's? The jockeying for position at the pump? The demand for fuel-efficient transportation? Now gas is plentiful, and fuel-hearty land yachts once again ply the asphalt, and V-8 is more than a vegetable juice.

The public has a short memory about shortages of natural resources, falling easily back into wasteful patterns of consumption when the supply side loosens up. Old habits, once revived, die hard. Yet Texas has experienced at least one serious drought in every decade of the twentieth century. Must Texans wait for a crisis before we're prompted to take water-conserving actions that make sense anyway?

Absent low water pressure, when we turn the handle, the system delivers. No problem.

But there are problems. Dwindling ground water supplies in several aquifers, land subsidence in Southeast Texas, and population growth outstripping the capacity of existing water treatment plants.

Naturally, residential, agricultural, and industrial sectors respond to monetary incentives and disincentives. Here are some examples of water saving efforts:

The City of Austin has proposed boosting rebates for low-flush toilets and xeriscape landscaping.

The San Antonio Water System implemented a rate structure that imposes surcharges on high-water-use customers.

Many communities have instituted voluntary water conservation measures, including odd-even watering schedules.

The key is educating the public, especially water resource managers, that the wise use of a finite natural resource like water is in everyone's best interest.

Sincerely,

Jan Gerston
Editor, *Texas Water Savers*

Using Less Water, Increasing Yields, is goal of A&M Irrigation Research

Much of the recent focus on water conservation in Texas has been on municipal and industrial programs of conservation, reclamation, and reuse. Agriculture is no stranger to diligent and long-standing efforts in water conservation. In fact, many of this country's water conservation ideas got their start over 20 years ago on Texas farms where arid conditions and increasingly high ground water pumping costs forced the agricultural community to seek out new and better ways to make the most of limited water supplies. The agricultural community was motivated to pursue water conservation primarily because it was profitable to do so, just as the municipal and industrial sectors are motivated today. In time, the agricultural water conservation technologies developed in Texas and other arid western states spread. Today, the water conservation ethic is entering the mainstream, not only in agriculture, but in municipal and industrial sectors as well.

A portable drip irrigation trailer, shown here with Starr County Extension Agent Enrique Perez, delivers filtered pressurized water through tape-type tubing buried in melon field beds. The beds are covered with plastic mulch to reduce evaporation from the soil and prevent weed growth.

Such developments have been partially responsible for significant declines in agricultural water use in Texas, and the Texas Water Development Board (TWDB) predicts continued declines in the future. The TWDB attributes the drop in agricultural water use partly to conservation technology and partly to acreage being taken out of production. Either way, it may be that some of the water supplies which have historically been used for agriculture might now be available for other uses.

Water use statistics from the TWDB indicate that irrigation water use peaked in Texas in 1974 with total on-farm use at 14.5 million acre-feet (MAF) and 8.6 million acres under irrigation. Water use declined to a low, in 1989, of 10.2 MAF (and 6.1 million irrigated acres). It rose slightly because of very dry growing season conditions in 1994 to 11 MAF of water use on 6.3 million irrigated acres. The TWDB expects long-term declines in

irrigation water use. For more information on irrigation water use trends and projections, contact Comer Tuck at TWDB at (512) 463-7988.

Research on irrigation efficiency continues throughout Texas, helping to ensure that the trend in water conservation will continue. In the Texas High Plains, vital information on crop water demand is being made available to irrigation farmers on a daily basis. Farmers use this information to determine the amount of irrigation water to use and when to apply it. It is in the farmers' best economic interest to apply only as much water as the plants need, but no more. Information on which to base that decision has been historically hard for producers to obtain.

This precise data for irrigation scheduling are available in the Texas High Plains region from a computerized information system developed by a team of researchers at the Texas A&M Research and Extension Center in Lubbock, including Rose Mary Seymour, Bill Lyle, Robert Lascano, and Jackie G. Smith. The information system takes weather data and uses it to compute potential evapotranspiration (PET) and heat unit (HU) information, which are needed to accurately determine irrigation requirements. The PET, HU and irrigation requirement data are then faxed daily to the system users. Users include county extension agents, the news media, and individual farmers who subscribe to the service.

Producers in the area are taught to better manage irrigation using scheduling equations and the provided data. Producers becoming proficient with the information system will irrigate properly at the most advantageous times. That should translate into less total irrigation water use per acre, and ultimately, greater profits.

Seymour and others are also evaluating a new field instrument designed to measure evaporation for use in improving irrigation scheduling. The instrument, called an ETGage, is a type of evaporimeter, which is an evaporating surface hydraulically connected to a continuous water source. Water evaporates from the evaporimeter surface, and the evaporation rate from this surface can be directly related to the evapotranspiration of crops or plant materials at the same location. Evaporimeters are in widespread use, but they are generally bulky and expensive. The ETGage is less expensive, portable and can be used for irrigation scheduling on agricultural crops, landscapes, and turf areas.

Preliminary results with the ETGage indicate that it may be suitable for use by producers in the Texas High Plains. Research is underway to test the ability of the gage to reproduce reference evapotranspiration rates for different crops, including alfalfa, cool season grasses, and others. For more information on the computer information system providing PET and HU data, or on the ETGage, contact Seymour at (806) 746-6101.

Irrigation efficiency research is also underway in other regions of Texas. Guy Fipps, of the Texas A&M University Agricultural Engineering Department and Enrique Perez, Starr County Extension Agent, are evaluating the use of drip irrigation of melon crops in the Lower Rio Grande Valley (LRGV) area. The technique, known as drip under plastic, is being widely incorporated into farming practices in the LRGV. A plastic "drip tape" is

buried just below the soil surface near the center of the melon bed and then the beds are covered with a plastic mulch.

The drip under plastic practice has several benefits over conventional furrow irrigation, including higher production with reduced amounts of water and fertilizer, and earlier melon maturation. Results from a 1992 study indicate that melon fields using drip under plastic irrigation required 4.4 inches of irrigation water, while traditional furrow irrigation fields required 13.1 inches. Yields for the tests site were 500 boxes of melons per acre from the drip under plastic fields and 300 boxes per acre from the furrow fields. The drip under plastic method showed a significantly higher water use efficiency, measured in boxes of melons per inch of irrigation water applied. In the drip fields, water use efficiency was 71.8 boxes per inch, versus 19.1 boxes per inch in the furrow field. Frank Dainello of the Texas A&M University Horticultural Sciences Department is leading an effort to extend drip under plastic to other parts of Texas, especially for vegetable production in the Winter Garden area. For more information on drip under plastic irrigation, contact Fipps at (409) 845-7454.

In addition to studies such as those reviewed here, the Texas Agricultural Extension Service makes numerous publications and services available to producers regarding practices and technologies to reduce irrigation water use and operation costs.

For more information on those resources, contact the Extension Service at (409) 845-3977.

Economic Concerns Drive Industrial Water-Saving Measures

Nearly half of Texas industries surveyed consider water conservation to be "very important" to their overall operation, according to results from a Texas Natural Resource Conservation Commission (TNRCC) survey of water conservation attitudes in the State's manufacturing industries. The TNRCC surveyed 856 manufacturing industries throughout Texas in 1994, collecting information on production uses of water, sources of water, costs of water, reasons for implementing conservation programs, and the cost effectiveness of these programs.

Results show that only about 5% of the industries surveyed consider water conservation to be an "urgent" concern, 47% consider it to be very important, 41% consider it somewhat important, and 8% consider it not important. The food, apparel, electrical, and petroleum refining industries appear to consider water conservation most important. The lumber, printing, chemicals, rubber and plastics, stone, and instruments industries placed less emphasis on conservation activities.

Roughly 32% of industries surveyed have a water conservation plan, while 37% are currently implementing conservation strategies. Among the industries that do have conservation plans (notably, the textiles, apparel, stone, clay, glass, and concrete and metals), financial and water problems are the most frequently stated reasons for adopting a plan. Study results show that finance is the main reason for adopting water conservation plans in firms with high water costs (defined as greater than 1% of total costs). That is

consistent with findings of other studies showing that firms mainly engage in water conservation if it is profitable.

The TNRCC survey addressed water conservation concerns, including supply limits, wastewater limits, financial limits, treatment costs, products costs, environmental needs, public relations, and corporate effort. Production costs and wastewater limits appear to be the main problems addressed by water conservation. For specific industries (petroleum refining, stone, clay, glass, and concrete), supply limitations are the primary motivation for water conservation. Treatment costs are a major concern among paper, printing, chemicals, metals, and machinery industries. Environmental needs for fresh and high quality water were not major motivations for firms to adopt a conservation plan.

Reducing consumption and increasing water reuse were the predominant reasons stated for implementing conservation, particularly among the electrical, stone, and petroleum industries. Other reasons given were to reduce delivery, increase efficiency, and increase return flow.

Information on general industry characteristics related to water was also gathered in the TNRCC survey, including water costs, costs of conservation programs, water sources and availability, and the production uses of water. Results show that petroleum refining, chemicals, paper, food, and electrical industries are by far the biggest users of industrial water, in terms of total water cost and water costs as a percent of the total budget. Relatively few firms provided information on conservation costs, but among those that did, the average annual cost of conservation is about $192,500.

Results also show that each industry uses an average of about 60,000 annual acre-feet of water, and that very few firms foresee water shortages. More than 75% of the respondents predicted at least a 25-year water supply. Manufacturing processes appear to be the largest use of water in industry, using an average of 38% of total water according to the survey. Cooling uses an average of 28%; sanitary processes, 19%; boilers, 9% and landscape irrigation, 5%.

Many of the industries surveyed noted plans for water conservation, including reuse projects, cooling projects, equipment upgrades, and facility improvements. For more information or copies of the survey and its results, contact Stacey Dukes-Rhone at TNRCC, (512) 239-1000.

Bryan Xeriscape Is a Live Reference Work

Industrialist Andrew Carnegie endowed his namesake libraries for the ideal of a citizen's library--making available to every citizen the basic set of literature and reference works. Now the soon-to-be renovated Carnegie Library in downtown Bryan adjoins a "citizen's garden"--a virtual living reference work of the art and science of xeriscape gardening

The initial intent of the garden, according to Michelle LaVigne of Bryan Water Services Division, is to suggest xeriscape landscaping ideas to local residential and commercial gardeners. The garden is also designed as a "walk-through" park between the old

Carnegie Library on Main Street and the modern Bryan City Library, providing a refreshing respite from the downtown concrete and asphalt as well as an educational garden example. The garden is already so popular that the city has fielded several requests to reserve it for tea parties. Phase I of the garden development includes jasmine ground cover, sand verbena, salvia, daylilies, artemisia, turk's cap and antique roses arranged in beds beside yaupon hollies, existing oleanders and elms, and crepe myrtles. Phase II plans for turning the garden into a dappled crepe myrtle bosque with more free-standing benches, according to LaVigne.

With the Carnegie library forming a backdrop, the Bryan demonstration xeriscape forms an inviting walk-through respite and an educational facility. Jasmine flower beds with an over-hanging crepe-myrtle are shown.

What's more, the Carnegie Garden is an *historical* xeriscape, featuring plants indigenous to this central Texas town before the importation of non-native vegetation. Planners hope that the combination of a newly renovated historic building and xeriscape demonstration will become a centerpiece of a revitalized downtown.

Soil amendments used in the garden are a combination of fine-ground mulch from yard waste and municipal biosolids from the City of Bryan composting facility, Brazos Valley Biosolids. All irrigation is subsurface, with drip lines beneath the shredded bark mulch in the flowerbeds. Irrigation pipes buried beneath the soil forces water up toward the roots of the jasmine ground cover.

The approximately $50,000 cost of the project was shared by the City of Bryan and the Main Street Project. Private donations came from two local garden clubs, the Master Gardeners Club, and a $700 donation from the "Pennies for the Park" campaign from students in Bryan Independent School District's 1994 summer school .

The demonstration garden design was originated by Nancy Volkman of the Texas A&M University Landscape Architecture Department. The design was modified by landscape architect Bob Ruth. Plants were acquired from nurseries throughout central Texas. Dayscapes was the contractor for the actual planting, with Manriquez Landscape Construction providing the "hardscape" masonry work.

For more information, contact LaVigne at the City of Bryan at (409) 361-3635.

Waterwise Landscaping Hints

Waterwise landscaping need not be relegated to cactus-and-rock groupings. A cool, green, Texas-style landscape can be achieved by carefully planning the right choice of native Texas plants and well-adapted exotics.

Analyze your site. Sketch your yard with locations of existing structures, trees, shrubs, and grass areas. Note views (to enhance or hide), sun orientation, sunny and shady spots, utility lines, contours, drainage and soil types. Plan for additional features, such as seating and barbecue areas.

Plan carefully. Consider the function the landscaping is to serve. Typically the front yard projects a public image. The back yard served the activity and esthetic needs of the family. If budgets are a constraint, consider "phasing in" the landscape over several years, focusing first on priorities: shade, turf, raised beds, walkways. Locate plants according to their water requirements, keeping higher-water-use plants closer to the home for an oasis effect. The perimeter of the landscape should require little or no supplemental watering.

Select adaptable plants and grass. Select trees, shrubs, flowers, and ground covers based on their native adaptability to the region's soil and climate. Texas is blessed with an abundance of native plants naturally adapted to each region. A list of such plants is available in a fact sheet, *Landscape Water Conservation . . . Xeriscape* (B-1584), published by the Texas Agricultural Extension Service. Lawns require constant attention and can use four times as much water as the rest of the landscape on an area basis. Limit the lawn to practical areas and choose grasses appropriate to climate. Allow grasses to go "off color" during dry periods. They will green up after the next rain.

Soil preparation. Organic matter added to the soil increases the soil's ability to absorb and store water in a form available to the plant. As a rule of thumb, till in 4 inches of organic material, such as shredded pine bark, peat, compost, and rice hulls to form plant beds. For trees and grass areas, incorporating organic matter is not economically feasible or necessary. Apply only 1 pound of actual nitrogen fertilizer per 1,000 square feet of lawn.

Mulch. Mulches (a layer of nonliving material covering the surface around plants) reduce evaporation and erosion, help moderate soil temperature, slow weed growth and aid in root growth. Mulches can be organic materials such as pine bark, compost and wood chips, and inorganic materials, such as lava rock, limestone, or permeable plastic.

Water judiciously. The old adage is true: "Plants don't waste water, people do." Of the tremendous amount of water applied to lawns and gardens (between 40 and 60 percent of the water supply in urban areas) much is never absorbed. Some water is lost by runoff by being applied to rapidly, some evaporates from unmulched soil, but the greatest waste is too frequent watering.

Editor's Note: Information for this article came from the Texas Agricultural Experiment Station, Texas A&M University System, College Station, TX 77843 and the Texas Water Development Board, P.O. Box 13231, Austin, Texas 78711-3231.

For detailed information on the principles of xeriscape gardening, along photographs and how-to pointers, consult *Xeriscape Gardening: Water Conservation for the American Landscape*, written by Texas A&M University Extension Horticulturist Doug Welsh, Connie Ellefson and Tom Stephens. To order, call Macmillan Publishing, (609) 461-6500.

Innovative Water Strategies Slake Golf Courses' Thirst, Replenish Ground Water Supply, Maintain Links' Quality

The lush emerald green golf courses that soothe the eyes and refresh the spirits of golfers nonetheless create headaches for maintenance supervisors and water managers.

Using supplemental sources of irrigation, Texas golf courses will stay green and playable, while making fewer demands on grounf and surface water.

And as increasing demands--municipal, agricultural, industrial--compete for shares of a finite water supply, Texas golf course maintenance supervisors seek out creative strategies emphasizing wastewater reuse and conservation.

A total of roughly 65,000 acre-feet (AF) of wastewater is reused annually for all applications in Texas, according to research by Bill Hoffman and Abu Sayeed of the Texas Water Development Board. Of this total, almost 43,000 AF was used for irrigation in 1990, increasing to nearly 60,000 acre-feet in 1992. The researchers speculate that potential for increased wastewater reuse is tremendous, projecting that wastewater reuse could total more that 1.6 million acre-feet annually by 2050.

Use of Treated Effluent for Golf Course Irrigation

Water reuse is on the minds of golfing Texans in both the arid and rainy portions of the state, as well as in ecologically delicate areas, such as Barton Springs and the Colorado

River area. Many golf courses in Texas Hill Country near Austin have been irrigating with treated wastewater since the 1970s.

In fact, golf courses and water reuse have a symbiotic relationship in Central Texas golf courses. A main objective in around the Colorado River has been use of the fairways and greens as vegetative buffers providing tertiary wastewater treatment or wastewater polishing (removal of suspended solids). That's because many cities in the greater Austin area are prohibited from discharging wastewater into the Colorado River to prevent nutrient blooms and eutrophication.

An example of innovative treated effluent reuse is implemented at the environmentally sensitive Barton Springs area, which is well-known for its clear, clean, high quality waters. There, the Barton Creek Golf and Country Club uses treated wastewater and raw water from the Colorado River to irrigate more than 250 acres. Roughly half the irrigation needs are supplied by Colorado River water, 40% are served by treated wastewater, and nearly 10% originates from storm water runoff collected at ponds at the site.

Tim Long, who works for Barton Creek Landscape, Inc. and coordinates much of the golf course maintenance, says that an overall goal of the project is to ensure that it is environmentally compatible and protects water quality without sacrificing playing surface quality. Other progressive efforts here include integrated pest management using fewer chemicals, sponsorship of research into grass water use, and educating area residents about environmentally friendly golf course management methods.

Another environmentally sensitive issue--overpumping of the Edwards Aquifer--is driving efforts in San Antonio to develop a long-term plan that will supply treated wastewater to a number of city courses. Overpumpage threatens endangered species that exist only in nearby San Marcos and Comal Spring and depend upon discharges from the Edwards for spring flows.

Agatha Wade helps market the San Antonio Water System (SAWS) wastewater reuse system. She said that part of SAWS' overall regional plan included developing regional "water factories" where wastewater is treated for reuse and distribution. Once available, the reuse water would be offered to public and private golf courses and will probably be used to augment flows in the San Antonio River along the famous downtown River Walk.

Wade expects that SAWS will be able to provide treated wastewater to as many as 10 private, public, and military golf courses by next summer. Each golf course will be offered up to 400 AF.

Coming up with supplemental sources of irrigation like water reuse is also of major interest in parched West Texas areas like Odessa and El Paso.

Odessa has planned and implemented one of the most aggressive and wide-ranging wastewater reuse plans in the state. Their efforts include using treated effluents to irrigate not only golf courses, but highway rights-of-way, other landscapes, grounds of the University of Texas-Permian Basin, and to provide process water for industries. They are now considering a pilot program to deliver treated wastewater directly to individual residential lots through a dual pipe distribution system (one pipe would be for drinking water, the other would carry treated wastewater).

Even in the rainiest regions, residents accept the idea of golf course irrigation with treated wastewater Dual systems have been used in some Florida cities for several years.

A suburban area south of Houston--the Clear Lake City Water Authority--has been using treated wastewater to irrigate the Bay Oaks Country Club since 1992. In 1993, 331 acre-feet of treated effluent was used for irrigation at Bay Oaks. There are plans to extend supplies to another golf course this year.

Innovative conservation methods work, too

In El Paso, roughly 1 million AF of treated wastewater annually irrigates two golf courses. One of these, Painted Dunes, is designed as a "target golf course" to save water: only the tee-off boxes, fairways, and greens are irrigated, while the surrounding areas are left in a natural desert-life condition. The Fred Hervey Water Reclamation Plant, which supplies high-quality treated wastewater that is injected into the Hueco Bolson Aquifer to replenish ground water supplies, also provides treated effluent to golf courses. Anai Padilla of El Paso Water Utilities, which is working to provide treated wastewater in the region, says that reuse water is the best, and often, only option for golf course irrigation in the region. By the year 2040, Padilla anticipates that nearly 4,000 acre-feet of treated wastewater annually will be used for golf course irrigation in the El Paso area.

Public acceptance of treated wastewater reuse

Two studies suggest that Texans are willing to accept the use of treated wastewater. A 1995 Lower Colorado River Authority survey of the Lakeway region near Austin showed that more than 87% of survey respondents either strongly agreed or agreed that irrigation with treated wastewater is beneficial. More than 80% even said they would be willing to use reclaimed wastewater on their own property for landscape irrigation.

Research by Roger Durand of the Bureau of Research at University of Houston--Clear Lake suggests that many Texas golfers think reuse is a good idea. Durand surveyed golfers and the public in the Houston area in the late 1980s to rank strategies to slow rising costs associated with parks and golf courses. More than 60% responded that using filtered, treated, non-drinking quality water was more acceptable than alternatives such as privatizing parks and golf courses, reducing payrolls, and building fewer new parks.

A peaceful coexistence

Employing judicious irrigation techniques and wastewater reuse, Texas golf courses can reduce and/or eliminate the amount of potable water use for irrigation and become better neighbors in the waterwise community.

LIAM Course Teaches Effective Irrigation Auditing Strategies

A major effort to make irrigation of all landscapes, including golf courses, more efficient, is being implemented by the Texas Agricultural Extension Service (TAEX).

A team of TAEX professionals including Guy Fipps, Bruce Lesikar and David Smith of the Texas A&M University (TAMU) Agricultural Engineering Department; Doug Welsh of the TAMU Horticulture Department; Rose Mary Seymour of TAEX-Lubbock; and Joe Henggeler of TAEX-Fort Stockton have developed a two-day Landscape Irrigation Auditing Management (LIAM) Short Course. Benefits of auditing are increased water savings, reduced costs, and lowered risk of nonpoint source pollution associated with over-irrigation.

The LIAM Short Course teaches persons involved in landscape irrigation the basics of irrigation system management, measurement of sprinkler efficiency, and analysis of soil type and root zone depth. The course teaches landscape managers to factor in several variables to the irrigation equation: irrigation uniformity, average rainfall, and existing turf and soil conditions. The course involves both classroom and field work. Classroom instruction covers the basic principles of irrigation water management, scheduling, and landscape irrigation auditing procedures. Field work provides the "hands-on" experience of two irrigation system audits.

The Texas LIAM computer software performs all calculations to produce an irrigation schedule. It contains rainfall and turf water requirements for 19 major metropolitan areas, and provides for entry of local weather data.

"The bottom line is that we should be able to reduce water use in almost every landscape, including golf courses, by 20%, " Smith said. "We try to teach people to conduct an irrigation audit to evaluate actual irrigation performance. We then teach them to produce an irrigation schedule for the system that most closely meets water requirements of their specific landscape."

For example, comparing current water consumption with the recommended irrigation schedule, an audit at Brookhaven College predicted an annual cost savings of $7,300 and 7.5 acre-feet (2.4 million gallons).

The next LIAM Short Course will be offered August 23-25, 1995 in Austin. Participants completing the course will obtain 5 hours of Certified Landscape Professional renewal points. The course is approved by the Irrigation Association as a prerequisite for taking the exam to become a Certified Landscape Irrigation Auditor.

Future courses will be offered September 20-21 in Austin, and November 8-9 in College Station. For more information, Call Dave Smith at (409) 845-5614.

Houston Hosts Conference About Conservation

About 200 representatives from Houston city water interests and state agencies learned about current and future water issues at at the Water Conservation Conference `95, hosted by Houston's Water Conservation Division. Topics discussed were future ground water permitting, emergency demand management, reuse, leak detection, National Energy Act features, and plumbing fixture requirements

Attending were representatives from Houston's contract water supply customers, municipal utility districts, the Texas Water Development Board and the Texas Natural Resource Conservation Commission . San Antonio conservation director Tom Fox explained how a 10% to 20% reduction in city water usage is attributed to an "inverted" water rate structure. Other conservation-promoting measures are a $500 rebate for xeriscaping, watering ordinance (including fines for water wasters), and a gardeners' workshop.

The conference, April 24-25, was cosponsored by the Harris-Galveston Coastal Subsidence District. Corporate sponsors were Montgomery Watson, Turner Collie & Braden and Frugo. For details, call Pat Truesdale at the City of Houston Water Conservation Division at (713) 864-1501.

Water Reuse Allows Expansion of Commercial Nursery

More and more companies throughout Texas are discovering that excess water recycling and reuse is good business. Turkey Creek Farms, Inc., in Humble, is a good example.

A series of concrete and plastic-lined ditches carry excess runoff to a central treatment area where the water is cleansed of organic matter, suspended solids and bacteria.

Turkey Creek Farms is a 120-acre wholesale nursery for container and greenhouse crops. The nursery uses, on the average, about one million gallons each day to irrigate during the heat of the summer. Currently, about 60% of that irrigation water is water that the nursery has reclaimed and recycled.

The company began capturing irrigation runoff in 1979, enabling the development of 20 additional acres for production. By 1985, more irrigation runoff was being captured, an additional 70 acres had gone into production, and a series of concrete ditches criss-crossed the property, bringing excess irrigation water into centrally located areas for reuse. By 1989, the company was withdrawing more than 100,000,000

gallons of water each year from ground water wells, and was searching for even more ways to reclaim and recycle irrigation runoff water. In 1991, the company installed a recycling and treatment system designed to increase storage capacity and treat excess water to allow for mixing with fresh ground water in holding tanks.

A large holding pond stores reclaimed runoff water and ground water for irrigation of nursery plants and trees. the tank is lined with high-density polyethylene to reduce percolation loss.

Today, runoff water is treated on site and stored with ground water for reuse. The two are used together in the irrigation processes, with any runoff coming back for more treatment and to be used yet again. The program has significantly reduced ground water withdrawals.

The wastewater treatment system used at the farm is capable of treating 1.2 million gallons per day using two different treatment processes: carbon filtration and ultraviolet radiation. Recaptured irrigation water is first filtered to strain out organic matter. The water then passes through a series of activated carbon chambers to "polish," or filter out suspended solids and other impurities. Then, the water passes through a system of 40 mercury lamps generating ultraviolet energy capable of killing bacteria and other pathogens.

The treated water is monitored for pH, nitrates, ammonia, total phosphorous, chemical oxygen demand, and trace organic chemicals such as pesticides. The company has a wastewater discharge permit, but only discharges during periods of very heavy rain; otherwise, all runoff is collected.

According to Don Wilkerson, Extension Horticulturist with the Texas Agricultural Extension Service, "The biggest challenge is not collecting runoff, but managing the collected water. The water management system must consider water quality factors--how to handle salts, and pesticide residues."

Turkey Creek Farms has taken other steps to maximize water conservation, in addition to their sizable reclamation effort. Drainage ditches throughout the farm are being lined with concrete or high density polyethylene to improve wastewater capture, and "shade houses" have been constructed over fields to reduce water losses from plant evapotranspiration. The company expects the water conservation and reclamation measures to pay for themselves in water savings and in environmental responsibility.

For more information on the water savings efforts used by Turkey Creek Farms, contact Craig Albiston at (713) 782-7611 or Greg Knowlton at (713) 446-7400.