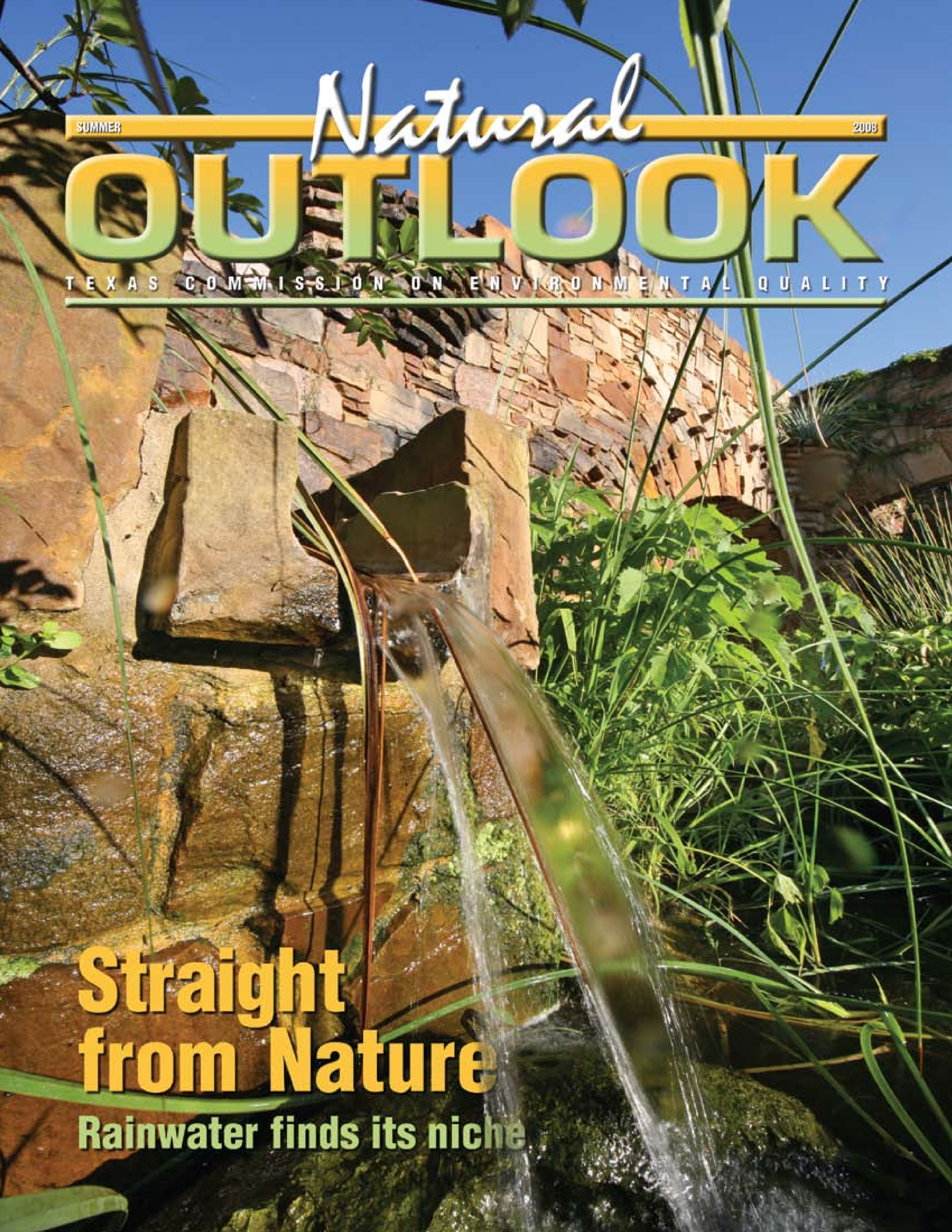
SUMMER 2008

Natural OUTLOOK

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY



Straight from Nature

Rainwater finds its niche

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Natural OUTLOOK

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Exploring environmental issues and challenges in Texas

COVER: After a good shower, rainwater courses through pipes and aqueducts at the Lady Bird Johnson Wildflower Center in Austin. This stone fountain delivers rainwater to a pond filled with water lilies and other native wetland plants. The center helped pioneer the concept of large-scale rainwater harvesting. *Photo by Bob Daemmrich.*

WATER WIZARDS

Advances in monitoring provide a more comprehensive picture of water quality

Just seven years ago, the TCEQ installed its first automated water quality monitor capable of taking continuous readings and reporting the results to agency headquarters. Much to the relief of staff, who spent months planning the rural project near Stephenville, the equipment worked.

The TCEQ confirmed that data on basic water quality characteristics can be collected on a frequent basis by remote monitors and reported to the TCEQ.

Since then, the Continuous Water Quality Monitoring Network has spread across the state. Now at 57 sites, the automated equipment operates quietly and deliberately—day and night—at rivers, streams, reservoirs, and bayous. Every 15 minutes, the autonomous monitors collect data on key environmental conditions in places as diverse as Caddo Lake in East Texas and the Pecos River in the Chihuahuan Desert.

After TCEQ computers receive the data, updates are posted on the agency's Web site at **www.texaswaterdata.org**.

"Early on, these systems were designed to demonstrate and document the technical feasibility of continuous water quality monitoring," explained Commissioner Larry Soward. "We found that we had a reliable system for getting information every 15 minutes on basic conditions like dissolved oxygen, water clarity, temperature, pH, and water levels. Also, at select sites we showed that certain nutrients, such as phosphorus, can be monitored several times a day by automated chemistry labs."

The TCEQ is recognized as a pioneer in the use of long-distance continuous monitoring and reporting of water quality, and still the agency is finding ways to advance the practice.

A New Era

For decades, the method of collecting water quality data remained relatively unchanged. Either TCEQ staff or contractors would drive to a designated site, manually take measurements with a variety of instruments, and collect water samples for laboratory analysis. This process was necessary to determine whether the water segment was contaminated and, if so, by what. These site visits generally occurred only once every three months.

"That meant we were only getting a partial picture of what was happening with that water body at a given point in time," said Soward. "In some cases, we needed more in-depth information and on a regular basis."

With more than 3,000 monitoring sites around the state, quarterly visits are still suitable at most locations. However, some sites require much more scrutiny.

That was the case in 2001 near Stephenville where a large number of dairies populated the watersheds of the North Bosque and Leon rivers. Dairy operations, if not run properly, can produce contaminated runoff. Because both rivers serve as the source of drinking water for several cities, including Waco, the TCEQ needed frequent data on the changing conditions in the rivers and their tributaries.

From that first project near Stephenville, continuous monitoring not only expanded but became more complex, including the use of solar panels, satellite telemetry, data-acquisition electronics, and meteorological sensors.

Management Tools

The TCEQ is taking continuous water monitoring to higher levels as newer systems are designed to address the data needs of individual sites.

Photos by Christine Kolbe, TCEQ

Monitoring doesn't get much more remote than this isolated station on the lower Pecos River in West Texas. With the success of automated continuous monitoring, the TCEQ is boosting its stations in the Rio Grande basin to a total of 11. Analysis shows that all water bodies in the basin have increasing levels of salinity.

These needs include documenting water quality trends, tracking cleanup of a water body under the implementation plan of the Total Maximum Daily Load program, prioritizing field investigations, and providing water quality data to local governments.

The TCEQ also uses the monitoring network to guide decisions on how to better protect certain segments of rivers or lakes. Here are three examples:

Brazos River Basin. By the end of this summer, the TCEQ will have seven continuous water quality monitors in the six-county area comprising much of the North Bosque-Leon watersheds, an area northwest of Waco. The monitors are part of the agency's Environmental Monitoring and Response System (EMRS). Two monitors being added this summer, as well as one existing monitor, will attempt to focus on potential pollution sources at the "microwatershed" level. The streambeds in these microwatersheds are normally dry and run only after significant rainstorms. By monitoring areas of just 1,000 to 1,500 acres, which have a limited number of potential sources for contamination, the agency can better monitor the runoff and target staff resources and potential field investigations. (See "Multiple Strategies at Play," page 4.)

Lower Rio Grande. The Rio Grande has long provided irrigation water to both Texas and Mexico. Under an international treaty, each side gets an allotted amount each year. Water taken by Mexico from the Rio San Juan, Rio Alamo, and Rio Grande below the Falcon Reservoir dam eventually drains back to the Rio Grande upstream from the Anzalduas Reservoir, near Mission. At this point, the TCEQ continuously monitors the quality of reservoir water near the El Morillo drain, where water draining off Mexican agricultural fields returns to the Rio Grande at the reservoir. These agricultural return flows sometimes have high concentrations of total dissolved solids (salts). When water quality monitors detect high salt levels, the TCEQ's Rio Grande watermaster requests that the International Boundary Water Commission (IBWC) release more water from Falcon Reservoir to freshen water in the Anzalduas Reservoir. If the IBWC confirms that Mexico failed to properly operate the El Morillo drain to divert the salty return flows, the water released by the IBWC comes out of Mexico's water allotment.

Rio Grande Basin. Two sources of fresh water will soon be continuously monitored: Independence Creek near Fort Stockton and Devil's River at Baker's Crossing, north of Del Rio. Both streams yield crystal clear water. They provide freshening flows to the Pecos River and the Rio Grande, which improves the quality of both rivers downstream. But levels of salt have been increasing in both streams, so continuous monitoring will be performed for assessment purposes and to document water quality trends.

Expansion of the Continuous Water Quality Monitoring Network

Fiscal year	Number of monitors
2008	61*
2007	51
2006	31
2005	22
2004	11
2003	8
2002	4

*Total projected for fiscal year, which ends Aug. 31, 2008.

Greg Larson of the TCEQ Midland region performs maintenance on a water quality monitor. He cleans the pipe holding a multiprobe instrument.

Team Efforts

In building and maintaining these monitoring systems, the TCEQ gets assistance from around the state. In some cases, the agency works with "cooperators," entities that want to initiate their own continuous water monitoring but lack the means to do so.

For instance, the Caddo Lake Institute, an East Texas nonprofit, took over the operation of two continuous monitoring stations. The TCEQ had developed the sites to collect water quality data needed to assess Caddo Lake, as required by the federal Clean Water Act. After the assessment, the nonprofit assumed responsibility for the stations and for validating incoming data. The TCEQ continues to post the data online.

The TCEQ also has "partners" in continuous water quality monitoring—typically entities from government or industry that fund an entire project.

The San Antonio River Basin Monitoring Network has been generating real-time water quality data at six sites for three years. This voluntary partnership, which involves 15 participants from both the public and private sectors, also produces information about baseline conditions so that long-term water quality trends can be monitored during urban development. The program has saved the state almost $500,000 in equipment, installation, monitoring, and maintenance costs.

Decisions by Remote

The TCEQ is working to prove that automated monitors can not only take complex measurements and report the results, but can also make timely management decisions.

The agency is working with cooperators and partners to develop instruments that use continuous water quality monitoring data to take independent action, such as closing a valve, initiating monitoring, or turning on pumps to prevent water contamination.

One example of this new generation of monitoring sites is a project on Onion Creek, southwest of Austin. In the mid-1990s, the Barton Springs/Edwards Aquifer Conservation District received a pass-through grant from the TCEQ to control the quality of water entering the Edwards Aquifer through an underground cave. The goal was to prevent the first flush of stormwater runoff—which often contains pesticides, oil and grease, and bacteria—from entering the cave and the aquifer.

The district built a structure, which an on-site worker could activate with pneumatically controlled valves, over the cave opening.

Now, the district and the TCEQ are collaborating to develop an automated system that uses continuous water quality monitoring data to activate the valves to exclude the first flush of stormwater. Then the valves will reopen to allow recharge by less contaminated water.

The success of the Continuous Water Quality Monitoring Network has expanded the ways the agency receives information about water bodies. The speed and accuracy of the data has enabled staff to respond more quickly to environmental conditions, and soon some of the monitors themselves will be reacting independently.

Emission-Reducing Programs Go the Distance

Fiscal 2008 will prove to be a big year for two TCEQ programs designed to lower emissions from cars, trucks, and heavy machinery.

The Aircheck Texas Drive a Clean Machine program, which got under way in December 2007 with legislative enhancements, has enjoyed overwhelming success. By June 1, 2008, the program had removed almost 10,000 older, polluting vehicles from counties having a vehicle inspection and maintenance (I&M) program. The program helps these areas reduce air pollution.

www.driveacleanmachine.org

Drive a Clean Machine offers residents of the Houston, Dallas-Fort Worth, and Austin areas vouchers of $3,000 toward the purchase of new or qualifying used cars or trucks and $3,500 toward hybrid vehicles. The gasoline-powered vehicles being permanently retired must be 10 years or older or have failed the I&M emissions test.

The public response was so great that local program administrators had to add telephone lines and hire additional staff. In all, phone calls to the program hotline topped 250,000, and more than 40,000 applications were received.

Funding went fast. In May, the Houston-Galveston Area Council stopped issuing vouchers and began placing applicants on a waiting list until new funds become available in September. Also, the North Central Texas Council of Governments halted applications until August. Travis and Williamson counties continued to accept applications.

In another program, the Texas Emissions Reduction Plan (TERP) oversaw the largest round of grants and rebates offered to date. The funding is aimed at lowering emissions from older heavy-duty vehicles and equipment.

www.terpgrants.org

From January to April, the agency received about 1,400 applications, totaling $204 million in sought-after funding for 2,800 vehicles, locomotives, marine vessels, pieces of equipment, and on-site infrastructure facilities. Eligible projects must be diesel-powered.

When the applications have been processed by the end of this summer, the TCEQ expects to award more than $106 million in grants.

Since 2001, the agency has issued $545.5 million under TERP, for a total of more than 3,400 projects, or 8,000 individual vehicles or equipment. That represents an overall reduction of about 127,700 tons of nitrogen oxides, a component of ozone. On a daily basis, the reduction is 57.5 tons of NO_X.

Multiple Strategies at Play

Cleanup projects are under way in the North Bosque River

In one of the more complex water quality projects it has undertaken, the TCEQ is meeting most of its goals in the North Bosque River watershed, northwest of Waco, as various cleanup strategies are being implemented.

Concern over water quality in that area has been an agency priority for more than a decade. High levels of nutrients have contributed to an overabundance of algae and other aquatic plants. Excessive growth of algae can lead to taste and odor problems in drinking water and to low dissolved oxygen, which can kill fish.

The primary pollutant targeted by the TCEQ has been phosphorus, a nutrient found in animal waste and in discharges from wastewater treatment plants.

The North Bosque River empties into Lake Waco, which is the main source of drinking water for about 200,000 people in and around Waco. The rural area in the upper half of the watershed is a hub of commercial dairy operations—home to an estimated 55,000 dairy cows.

In response to the area's environmental problems, the TCEQ in 2001 developed a total maximum daily load (TMDL) project for each segment of the North Bosque River to ultimately lower phosphorus levels.

A comprehensive implementation plan, containing both regulatory and voluntary measures, was developed to address a host of concerns.

The status of the primary cleanup programs is as follows:

- The cities of Stephenville and Clifton have upgraded their treatment plants with loans from the Texas Water Development Board. The upgrades, completed in 2005, reduced the concentration of phosphorus in wastewater effluent that empties into the river.
- A compost program initiated by the TCEQ accomplished its goal of removing at least half the solid cattle manure from the dairy operations called CAFOs (concentrated animal feeding operations with 200 or more head of cattle). From 2002 to 2006, incentives were offered to companies to turn the manure into compost, which can be sold to landscapers. The agency also conducted a marketing campaign to find customers for the compost. As a result, about 650,000 tons of dairy manure had been collected from the North Bosque watershed by the time the incentives expired in August 2006. Of that, 329,000 tons of manure was exported in the form of compost, representing the removal of 740 tons of phosphorus. Even without incentives, the business continues. Five of the nine original facilities in the program are still composting and removing manure from the watershed.
- The TCEQ is expanding its Environmental Monitoring Response System, which performs continuous water quality monitoring, to seven spots in the watershed. The EMRS alerts regional staff when phosphorus concentrations rise to a designated level, requiring immediate investigation. The EMRS is also beginning a new phase by targeting smaller "microwatersheds" and therefore fewer possible sources of pollution. When EMRS monitors issue an alert, investigators will have a much smaller area to check.

What's a Nutrient?

Just as people need nutrients, so do water bodies—to support healthy plant life. But an overabundance of nutrients like phosphorus and nitrogen can have the opposite effect in a river or stream.

High levels of nutrients can produce harmful algae blooms. Excess algae can lower levels of dissolved oxygen to the point that most aquatic life cannot survive. This type of degradation also can affect the taste and smell of drinking water.

Where do phosphorus and nitrogen come from? Beyond natural sources like soil and wildlife, common causes of nutrient pollution are:

- **excess application of fertilizer**
- **discharge from waste treatment plants**
- **overflow from septic systems**
- **rainfall runoff from animal production areas that have not been properly contained**

Courtesy of Texas Institute for Applied Environmental Research

The Bosque River meanders through the rural countryside northwest of Waco. Behind the bucolic scenery lies an ambitious, multipronged program by the TCEQ to detect and deal with sources of water pollution. Five monitors along the river operate continuously, measuring water flow, temperature, and a host of other parameters. Two more monitors are being added this summer.

- The TCEQ has increased enforcement and efforts to ensure compliance. Personnel from the Stephenville office conduct annual inspections of each CAFO and are available seven days a week, day or night, to respond to pollution complaints.
- The Texas State Soil and Water Conservation Board is working with animal feeding operations (AFOs), which have fewer than 200 head of cattle, to develop water quality management plans designed to reduce runoff from these operations, which are not covered under CAFO permits.
- The TCEQ developed rules requiring individual permits for CAFOs in the watershed. The revised rules require comprehensive nutrient management plans, which range from feed management to land application of animal waste, and include enhanced inspection, testing, and recordkeeping. Dairy CAFOs must construct larger retention control structures to capture rainfall from their production areas. The CAFOs are also required to satisfy certain education requirements to ensure that operators and staffers are trained in dairy waste management.

This last component concerning individual permit requirements is important to achieving overall success within the watershed. Of more than 50 dairy CAFOS, eight permits have been issued so far. Approvals have been delayed by stakeholders' requests for extensive review and discussion of each permit. Of the remainder, about half have undergone technical review, and the others are still in administrative review.

After the permits are issued, the TCEQ will be able to start assessing the long-term progress of the Bosque reforms.

Meanwhile, the agency and its partners continue monitoring water quality to obtain information before and after pollution-reduction measures are put in place in the watershed. This information is collected every two weeks at sites identified in the TMDL to determine progress toward the project goals.

In addition, the TCEQ has hired researchers to refine the TMDL models used to simulate conditions in the river. The project stems from an agreement made with the Environmental Protection Agency when it approved the TMDL plans in 2001. The model refinement involves reviewing conditions in the watershed to determine whether existing cleanup plans are satisfactory or need to be updated.

When the TMDL review is completed this summer, TCEQ personnel will meet with stakeholders in the watershed to present the results.

The TCEQ is also working with stakeholders on the first TMDL project for the adjoining Leon River watershed, which exhibits water quality problems similar to those of the North Bosque.

For a full report (in PDF) on the North Bosque watershed, go to **www.tceq.state.tx.us/goto/bosque_river/**.

Need Water? Look to the Sky

Proponents say it pays to capture, store, and use rainwater

Billy Kniffen was introduced to the day-to-day uses of rainwater as a youngster when his family lived near Abilene. Rainwater was the family's only source of water for drinking, cooking, and other necessities.

"My mother even kept a barrel that she used for washing her hair and for watering certain plants," he recalls.

Now employed by Texas A&M University, Kniffen is one of the state's leading proponents of recycling what nature sends to earth during rainfall. He holds training sessions on how to capture rainwater for watering lawns and gardens and even on how to pump it into the home for domestic use, after proper filtering and cleaning.

Kniffen himself is a daily consumer of rainwater. His home in Menard near San Angelo is rigged to capture rain that falls on the roof and to store it in tanks near the house. He and his wife have no water source other than clouds.

As president of the newly formed Texas Rainwater Catchment Association and through his professional duties with Texas A&M, Kniffen travels widely, demonstrating how to make the most of the cheapest source of water around. He also holds accreditation classes for installers of rainwater-catchment systems.

When talking to groups, Kniffen asks: "Water is very valuable to us, but as our population grows, are we going to have enough? Will there be water to supply the needs of generations to come?

"Fortunately," he says, "there are a number of ways we can collect and use rainwater, whether it's for livestock, wildlife, outdoor plants, or inside the home. And it reduces water bills."

A Finite Resource

Forecasts are that Texas will continue to boom in the coming decades but water supplies will decline. The state's population, which stood near 21 million in 2000, may well double by 2060, along with the demands on municipal water systems.

Meanwhile, the state's total water supply is projected to fall from 17.8 million acre-feet in 2010 to about 14.6 million acre-feet in 2060 due to factors such as sedimentation and reduced aquifer yields, according to the Texas Water Development Board.

Over the years, the Legislature has passed several measures that helped advance rainwater as an alternative water source. Among these are:

- Granting property tax relief to commercial and industrial facilities that use rainwater harvesting systems.
- Allowing local taxing entities to exempt all or part of the assessed value of property modified for water conservation, such as rainwater harvesting.
- Excluding rainwater harvesting equipment from the state sales tax.
- Preventing homeowner associations from banning outdoor water conservation features, such as rainwater harvesting.

In 2007, lawmakers also ordered that new state facilities with 10,000 square feet or more of roof area incorporate rainwater harvesting systems into the design and construction for use in restrooms and landscape irrigation.

The TCEQ was instructed to disallow the use of rainwater for potable indoor use when a facility uses both public water supplies and rainwater indoors. If a facility uses the water indoors for non-potable uses, it must have appropriate cross-connection safeguards.

If a public water system uses rainwater for potable uses, the rainwater needs the same level of treatment as water obtained from a lake or river.

The commissioners are taking public comment and will vote on that proposed rule in September.

Photo by Jorjanna Price, TCEQ

A moderately steep roof and a sturdy gutter are about all it takes to collect rainwater. Experts say first-time users are surprised at how fast their rain barrels fill up. A roof area of about 2,000 square feet will generate an estimated 1,000 gallons of water for every inch of rain.

Collection Methods

Catching rainwater for outdoor purposes is relatively easy. Rain that lands on the roof and runs into gutters can be channeled into a barrel or other large container. Homeowners can use this water at any time to water gardens and plants. It is important to cover containers with lids or screens to keep mosquitoes from breeding.

Indoor use is another matter. Just because rainwater appears to be clean doesn't mean it is. Any water used for drinking or food preparation should be held to higher standards.

Rain lands on rooftops that are dirty and leaf-strewn, and could be made of materials containing chemicals or metals. Rain also washes down drainpipes that contain bird and animal droppings, which carry contain microscopic parasites and bacteria.

The harvested water must be treated before it reaches the inside of the home where it is consumed.

This means deploying one or more filters to remove biological and chemical contaminants, and disinfecting the water by applying a technology such as ultraviolet light as well as adding a lasting disinfectant such as chlorine.

Rainwater users like to point out the environmental benefits of the practice. Collecting rainwater minimizes the storm water runoff that can

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Reference Materials

The TCEQ has published *Harvesting, Storing, and Treating Rainwater for Domestic Indoor Use* (GI-366) for the general public, and *Rainwater Harvesting: Guidance for Public Water Systems* (RG-445) for the regulated community. See www.tceq.state.us/goto/publications.

The Texas Water Development Board also has helpful publications, such as *The Texas Manual on Rainwater Harvesting.*

School Aims to Conserve Every Drop

After the Boerne school district opens a new high school in August, groundskeepers might never need to turn on the regular outside faucets. According to plans, harvested rainwater stored above and below ground will likely be sufficient to water all the grounds, including the athletic fields.

"The district came up with a three-part system to irrigate the entire campus. We're planning on having up to 250,000 gallons in storage at Boerne–Samuel V. Champion High School," explains Jeff Haberstroh, project bond manager at Boerne ISD.

He said most of the water will be collected thusly:

- A 14,000-gallon tank will receive air conditioning condensate and rain hitting the school's main roof.
- A 15,500-gallon tank will catch rain from the roofs of three other campus buildings.
- An underground stormwater drain, which formerly fed runoff to a nearby creek, was made watertight and turned into storage. At five feet in diameter and 800 feet long, the pipe will hold 195,000 gallons.

The entire system, including pumps to send water into irrigation pipes, cost $265,000. According to estimates, the

Water Independence

When John and Mary Evelyn Kight planned a move to a rural area outside of San Antonio, they boldly decided against a well to meet their water needs and pinned all their hopes on occasional rainfall.

John Kight designed their dream home—a 3,500-square foot house and adjoining three-car garage—atop a hill overlooking Lake Boerne. That gave them 6,500 square feet of roof space, enough for one inch of rainfall to deposit 4,000 gallons of water in storage tanks.

Rain lands on the large standing-seam metal roofs, tumbles into gutters with leaf screens, and runs through underground pipes to tanks sitting just downhill from the house.

"I planned for drought conditions," says Kight, a retired engineer, "and as a result I have two tanks that filled up during the 2002 floods that we haven't even touched yet."

In all, the wooded property has six 5,000-gallon polypropylene tanks and three 1,550-gallon tanks, all linked with 2-inch pipe. Before being pumped to the house, the water goes through two in-line filters—a 5-micron sediment filter and a 5-micron carbon filter—and finally under an ultraviolet light for disinfection. Water diverted for lawn watering is not treated.

Thanks to their ingenuity, the Kights drink rainwater and use it for cooking, bathing, and washing clothes. They estimate their indoor and outdoor water consumption at less than 150 gallons a day.

When guests come over, the couple enjoy pulling ice from the freezer to show how mineral-free water produces transparent cubes that are crystal clear.

At first, however, "I told my husband I wouldn't drink the water until he had it tested," recalls Mary Evelyn. The water coming out of the kitchen faucet was shown to be bacteria free, as has every lab test since then.

"You can't find anything purer than this," he explains. "It has no hardness, minerals, or chemicals."

What's more, harvesting rainwater cost less than putting in a well. Drilling a well 900 feet deep was estimated at

Tips from the Kights

- **Use a moderately steep roof so that during rainfall the roof is drained and cleaned more quickly.**
- **Metal roofs are ideal; composition roofs should not be used for potable water because the shingles may contain chemicals or harbor contaminants from birds or animals.**
- **Screen for leaves and twigs because organic matter will sour the water in storage tanks. A "first-flush" system will screen out leaves and twigs.**
- **Keep long-term storage tanks completely dark to prevent algae growth.**

Courtesy of Boerne ISD

A metal cistern positioned at the entrance of Boerne–Samuel V. Champion High School is a visible reminder that Boerne ISD is serious about water conservation. The new school was built to store 250,000 gallons of rainwater. School officials plan on using rainwater for all outdoor water needs, including irrigation.

stored water will replace about 86 percent of city water, yielding a savings of $35,000 a year.

Haberstroh predicts that air conditioning condensate alone will produce 1,000 gallons of water a day for the campus of 2,000 students and staff. Also, underground springs discovered during construction can be tapped for an additional 680 gallons a day.

District officials concede that a prolonged drought would force them to fall back on city water to keep the school's athletic fields in proper condition to minimize injuries and satisfy state regulations. Otherwise, they say, the school can avoid using purchased water outdoors, which will give them bragging rights to having the largest rainwater harvesting system of any K-12 school in Texas.

$26,000. Kight figures he spent less than $15,000 to install the rainwater harvesting equipment, and annual expenses run about $100 for electricity and filter replacements.

The couple is so enthusiastic about the environmental and economic benefits of rainwater that they have held dozens of workshops in their living room. They estimate more than 1,600 people have made the trip to see their catchment system and to learn about installation options.

Kight, a former Kendall County commissioner, even suggested the local school district incorporate rainwater collection in plans for a new high school (see article above).

The rapid growth in the San Antonio region is what motivates Kight to beat the drum for rainwater. "There's a strong likelihood there may not be enough groundwater to support this population in 25 years. Having an optional source of water supply won't be an option—it will be a necessity."

Photos by Jorjanna Price, TCEQ

With an impressive array of cisterns on his rural property, John Kight of Boerne has enough water in reserve to last several years. The retired engineer designed the rainwater harvesting system in 2001. He and his wife rely solely on rainwater collected from the roofs of their home and garage. Before use inside the home, the rainwater is filtered, then disinfected.

Need Water? Look to the Sky *continued from page 7*

erode land and deliver oil, pesticides, and other contaminants into rivers and streams.

Rural homeowners say there is also an economic benefit: assembling a potable catchment system is cheaper than drilling a well.

Rainwater also has the potential to offset some of the demands on existing water supplies. About half of residential use typically goes for outdoor purposes—mainly watering lawns.

The Texas Rainwater Harvesting Evaluation Committee has estimated potential water savings for various parts of the state, pointing out that Texas ranges from the semi-arid to the semi-tropical. El Paso may receive only 8 to 10 inches in the same year that Houston gets 50 inches.

Assuming that 80 percent of the rain hitting the roof drains into a catchment system, a roof area of 2,000 square feet would generate about 1,000 gallons of water for every inch of rain, according to the committee, which included a representative of the TCEQ. In San Angelo, where rainfall averages an annual 19 inches, a homeowner with a roof that size might collect about 19,000 gallons of rainwater a year. In East Texas where rainfall is greater, the same roof might collect 60,000 gallons a year.

Plan for the Future

Kniffen learned ways to catch rainwater while serving as a county extension agent. "The master gardeners were the ones who first taught me about it." Soon after, he rigged up a system at the office and began to include rainwater education in his seminars.

With the Legislature encouraging higher education to provide instruction

Wildflowers Receive Rain Held in Reserve

In a scene that is repeated countless times every year, buses pull up to the front of the Lady Bird Johnson Wildflower Center and unload schoolchildren and their sponsors for a field trip.

Visitors assemble next to a 20-foot-tall stone tower, which few realize is a functioning cistern, holding up to 10,000 gallons of rainwater. Rain landing on a nearby roof slides into the cistern on a sloping aqueduct. Through gravity flow, the stored water irrigates surrounding beds of yucca, cenizo, and prickly pear cactus.

The cistern is of one of several throughout the center, which was founded by the former first lady from Texas and now is part of the University of Texas at Austin.

Rainwater harvesting was an integral part of planning and designing the building and grounds. Since opening in 1995, the wildflower center has operated one of the largest rainwater collection systems in the country, with a storage capacity of 58,000 gallons.

"The decision was made early on to go light on the land," explains Joe Marcus, collections manager at the center. "The choice of this location in southwest Austin was controversial at the time because the site sits atop the Edwards Aquifer. Nearby is a sinkhole that drains directly into the aquifer."

Rainwater supplies 10-15 percent of the water used to irrigate seven core acres of native plant beds. Marcus notes that rainwater collection not only saves on water bills, it also reduces runoff. As rain runs over surfaces, it captures contaminants that can be swept into surface and ground waters.

In addition to the front cistern, the wildflower center has a 10,000-gallon concrete cistern located inside an observation tower, a 2,000-gallon container next to the children's center, and two 18,000-gallon storage tanks in back of the facility beyond public view.

When the two largest tanks overflow, as happened last year during several months of repeated showers, the excess rainwater runs to a creek bed that drains to the aquifer sinkhole.

Metal roofs on various buildings total 17,000 square feet, which yields about 10,000 gallons of water after one inch of rainfall, says Marcus. Rain drains into gutters and downspouts and travels directly to beds or through pipes to the tanks. A pressurized distribution system delivers water from the tanks to an irrigation system. The nonpotable water is used only outdoors.

"Our wildlife pond is recharged by rainfall, for the most part, as is the on rainwater harvesting technology, Texas A&M has appointed Kniffen a water resource specialist, charged with spreading the word on rainwater technologies and providing advanced training. He instructs installers, designers, architects, and engineers on proper installation and sanitation requirements.

A&M materials, including how-to videos, are available at **http://rainwaterharvesting.tamu.edu**.

Courtesy of Joe Marcus, Lady Bird Johnson Wildflower Center

This 20-foot-tall stone cistern at the entrance to the Wildflower Center holds 10,000 gallons of rainwater. Five cisterns and tanks on the property have a storage capacity of 58,000 gallons.

butterfly garden pond," says Marcus. "The center has the largest outdoor butterfly garden anywhere, with about 300 species of larval food plants."

Rainwater harvesting is also a component of the center's educational mission, he adds.

By day's end, the visitors will know that the front stone-and-masonry cistern is reminiscent of the ones that early Texas settlers built to store their own rainwater, and that such systems can have an important role in today's society.

Kniffen is not alone in predicting that water from the sky will become more important as the state's population soars and existing water supplies become increasingly stressed, possibly to the point of running dangerously low in some areas.

Homeowners Explore Options

Rodney Love established his North Texas landscape business to install drought-tolerant plants and lawns. But more and more, his clients also want to add rainwater catchment to their homes.

"Since the drought a couple of years ago, this part of my business has really taken off," says Love. "Some people lost entire landscapes in 2006, so they like the idea of living a little more off the grid. They think it's neat that during a rain they know their tanks are filling up."

Love estimates that his company, Tierra Designs in Denton, installed rainwater catchment systems for 30 homes last year. Now he is getting jobs with business clients wanting to lower their water bills. He is also consulting with architects and builders whose customers want rainwater features incorporated into their new custom-built houses.

"People are interested in a whole range of options," he explains. "Some will spend as much as $20,000 to irrigate their two-acre lawns with rainwater. Others want a more affordable package for $2,500 to $4,000. My goal is to create systems that are low maintenance and provide pressurized rainwater."

Love says some equipment, such as prefiltration devices, has to be purchased from Germany or Australia. "These countries are at least 10 years ahead of us, but we're starting to catch up. I think in the next decade rain-water harvesting will be something that the big-volume builders are doing, too."

His company also offers stormwater management and graywater reuse, which directs water used in the house to outside irrigation.

Comeback on the Coast

Revival of a once pristine estuary restores an important asset

Picture this scene: Winds howling across a barren landscape. Dust blowing so fiercely that schoolchildren abandon playgrounds for the safety of the indoors. Motorists who can barely see the roadway. And dust so thick that spectators at a high school football game can't see the players on the field.

West Texas? No. Try the southernmost tip of Texas, next to the Gulf of Mexico.

Improbably, near desert-like conditions existed for decades on the southern coastline of Cameron County. The desolation of thousands of acres of former wetlands began in the late 1930s with construction of the Brownsville Ship Channel, which cut off the wetlands from the Gulf of Mexico. Completion of state Highway 48 in the 1950s further isolated the area from marine waters.

For decades, intense winds eroded the flat, arid acreage. Nearby residents had to endure an airborne mixture of sand, salt, and dust that clogged air conditioners and accumulated on power lines, causing outages. People with respiratory problems were at risk for more serious health problems.

Today, local residents talk about that environmental plight in the past tense.

The re-emergence of the Bahia Grande has restored ocean water to the basin and re-established the ecosystem.

Instead of comparing the landscape to scenes from *Lawrence of Arabia*, residents proudly point to an expansive body of water, thriving vegetation, and returning wildlife.

The Bahia Grande Restoration Partnership was singled out this year for one of the TCEQ's Texas Environmental Excellence Awards. As the winner in the "civic/nonprofit organization" category, the massive restoration project was lauded for "reviving an estuary to what it was seven decades ago—a vital nursery for recreationally and commercially important aquatic species."

The coordinated effort called on the resources of 75 businesses, private individuals, and government partners.

Restoration began in 2000 when the Conservation Fund, the Natural Resources Conservation Service, and the U.S. Fish and Wildlife Service jointly purchased the property. At that time, the land was incorporated into the Laguna Atascosa National Wildlife Refuge.

Scientists and engineers enacted a plan to flood 10,000 acres of former wetlands, then workers and volunteers went to work planting 3,000 black mangrove seedlings and native grasses on the perimeters of basins and channels to stabilize the low-lying coastal lands.

Three years ago, a 2,200-foot-long pilot channel was dug to link the ship channel to the dry basin. Within months, observers reported that marine organisms were resuming centuries-old migration patterns. Last year, interior channels were opened to connect secondary basins.

Today shrimp, oysters, crabs, flounder, and trout have begun to migrate to

Photos courtesy of Carrie Robertson for NOAA

BEFORE: For decades, the Bahia Grande sat as a dry, sandy eyesore. After man-made structures cut the basin off from the Gulf of Mexico, a devastating loss of native plants and habitat occurred. Only the elderly remembered the pristine wetlands that once adorned the coastline.

the habitat, and some 5,000 waterfowl occupy a nearby nesting island.

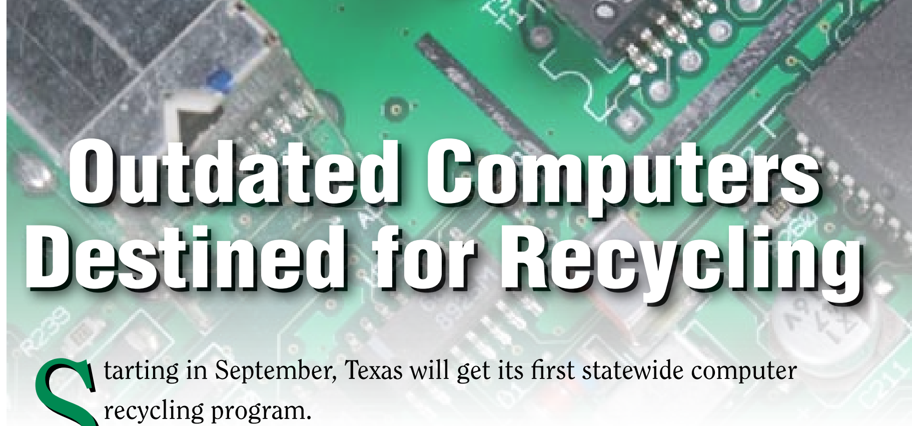
"I think the most important thing probably to come out of this project has been an awareness and appreciation of our natural beauty here," said Mary Jane Shands with the University of Texas at Brownsville/Texas Southmost College, one of the participants.

"These improvements will also have far-reaching results for the local economy in terms of shrimping, sports and commercial fishing, ecotourism, and recreation like canoeing and kayaking," she added.

Shands said restoration efforts continue, primarily to line up funding and permits for a wider permanent channel to ensure a reliable exchange of seawater and freshwater, which is essential for the estuary to fully recover.

Also, project participants want to do further work on the Bahia Grande's uplands by replanting native vegetation, she said.

AFTER: A deliberate flooding of 10,000 acres in 2005 began to restore the Bahia Grande to its former glory. All species of fish, shellfish, and migratory waterfowl returned as channeling reconnected the basin with the Gulf of Mexico. Native plants reinforce the shoreline.



Outdated Computers Destined for Recycling

Starting in September, Texas will get its first statewide computer recycling program.

Based on state legislation passed last year, the TCEQ is preparing to implement a program that provides for the collection, reuse, and/or recycling of used computer equipment.

The program is aimed at computer equipment that was purchased primarily for personal or home business use.

Manufacturers will be required to take back their own brands of desktops, laptops, monitors, keyboards, and mouse devices—at no cost to consumers at the time of recycling.

Retailers, including those on the Internet, may only sell the computer brands for which the manufacturers have submitted recovery plans to the TCEQ and verified that they have compliant collection programs.

The new program addresses a nationwide trend in which millions of personal computers become obsolete each year. The proliferation of used electronics is generating concerns over where such products end up. Computer equipment can contain potentially hazardous or toxic substances, which need to be managed responsibly.

This summer, the TCEQ will compile a list of computer manufacturers that meet the program requirements. Some manufacturers already offer take-back programs for their customers.

By Sept. 1, the agency will post information online to inform consumers how and where to return equipment for recycling. The TCEQ Web site will also link to computer manufacturers' pages and to information on computer reuse.

Agency rules for the recycling program (Chapter 328, Subchapter I) are available at **www.tceq.state.tx.us/goto/rules/recycling**.

Computer users needing recycling options before Sept. 1 can check their manufacturer's Web site, or go to **www.recycletexasonline.org**.

Ease on Down the Road

When the next school year begins, about 2,700 school buses around the state will provide a cleaner ride for drivers and their student passengers.

Under the Texas Clean School Bus Program, those buses were fitted with devices that prevent potentially harmful particulate matter (PM) from entering the bus cabin.

The TCEQ-administered program awarded grants totaling $5.5 million to 58 school districts in fiscal 2008.

The contract amounts varied, depending on each district's needs and the type of pollution-prevention device installed. The 58 school districts received grants ranging from $4,000 to $250,000.

The Legislature created the program to address the problem of diesel exhaust finding its way into school buses—through the crankshaft under the hood or from the tailpipe. The exhaust contains fine PM, which can aggravate respiratory problems or, with long-term exposure, lead to more serious disease.

The TCEQ will issue another round of grants this fall when $6 million becomes available. All sizes of diesel-powered buses will be considered.

The application deadline for school districts and charter schools will be announced this summer. ✩

For more information, visit www.texascleanschoolbus.org, or call 512-239-3100.

PD-020/08-03

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