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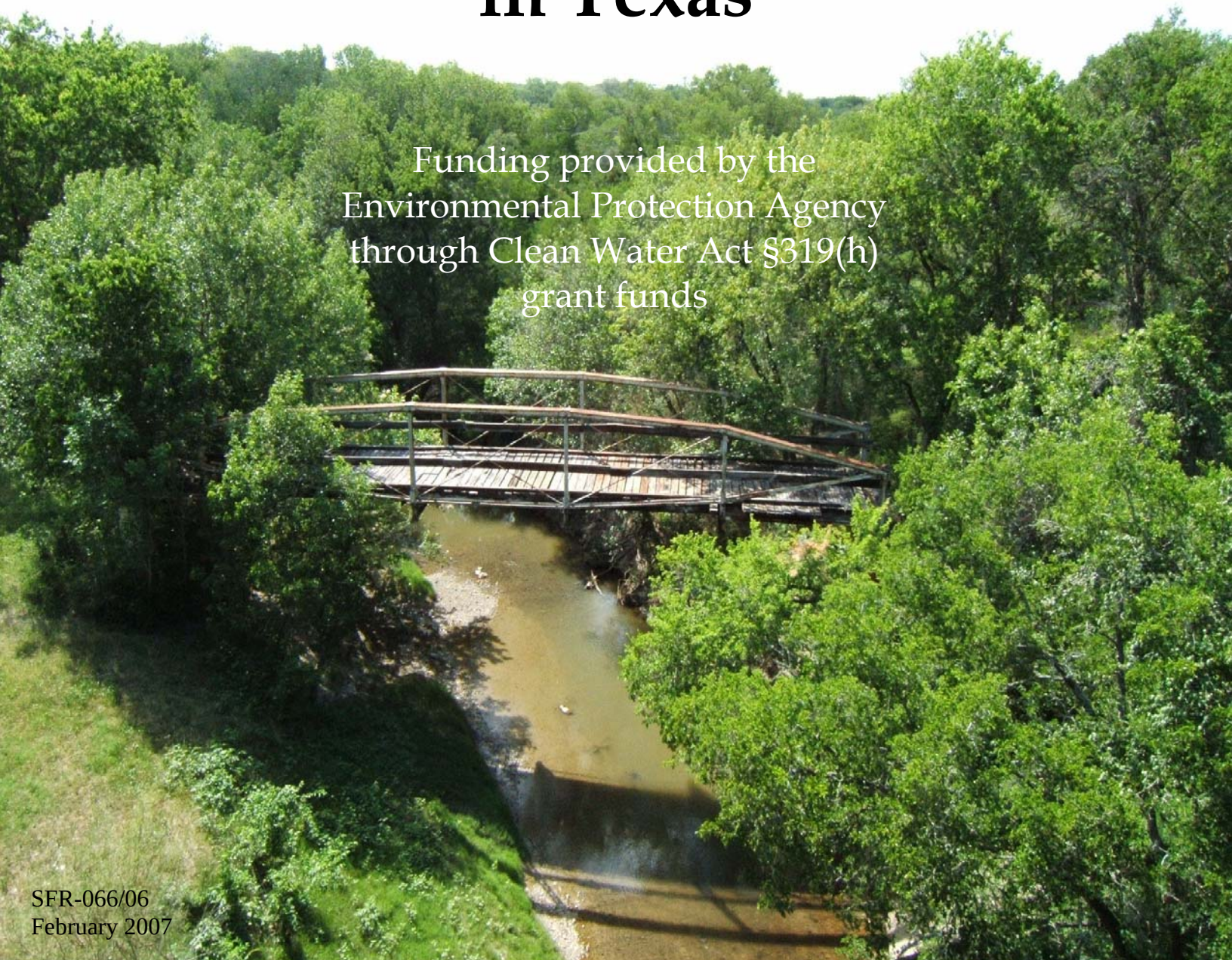
2006 Annual Report

Managing Nonpoint Source Pollution in Texas



Funding provided by the Environmental Protection Agency through Clean Water Act §319(h) grant funds

SFR-066/06
February 2007

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Published and distributed
by the
Texas State Soil and Water Conservation Board
P.O. Box 658
Temple, TX 76503

and by the
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, TX 78711-3087

*The cover photo was taken on Plum Creek, in Caldwell County, Texas, by Brian Koch.

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From the Executive Directors

The Environmental Protection Agency provides grant funding to Texas (and the other states) through Section (§) 319(h) of the Clean Water Act. These funds allow for the implementation of activities that aid in the abatement of nonpoint source pollution (NPS) pollution. In Texas, this grant is divided between the Texas State Soil and Water Conservation Board and the Texas Commission on Environmental Quality. These two agencies are responsible for maintaining a statewide program, known as the Texas Nonpoint Source Management Program, which satisfies federal requirements contained in the Clean Water Act.

The Texas Nonpoint Source Management Program strives to protect the quality of water resources from adverse effects due to nonpoint sources of pollution. This is accomplished through the cooperative implementation of a wide range of strategies based upon common sense, good science, and fiscal responsibility. These strategies emphasize pollution prevention, a watershed perspective, and community-based solutions.

Texas manages water pollution from nonpoint sources primarily through voluntary programs, along with common-sense regulations designed to prevent pollution. Voluntary programs put control where it belongs—at the local level, where residents and water quality professionals have a grass roots understanding of what will work best in their areas. Public involvement processes can greatly enhance water management efforts. Stakeholder processes support and complement legally required actions such as achieving water quality standards, protecting drinking water supplies, and restoring habitat. Generally speaking, the stakeholder process in Texas has a significant beneficial impact on our goal of keeping the State's waters fishable and swimmable.

In the past year, the Texas State Soil and Water Conservation Board and the Texas Commission on Environmental Quality focused on developing new partnerships and strengthening old ones. We are improving the interagency cooperation that allows us to find new ways to work together, to spark new ideas for solving problems, and to make the most effective use of precious resources.

We all depend on clean water; water that is safe for citizens to swim in, to fish from, to drink; water that provides a healthy habitat for aquatic creatures and wildlife. These are the goals of water quality programs in Texas and we continually strive for ways to improve our ability to achieve these goals.

Rex Isom
Executive Director
Texas State Soil and Water Conservation Board

Glenn Shankle
Executive Director
Texas Commission on Environmental Quality

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CHAPTER 1

INTRODUCTION

Defining Nonpoint Source Pollution

Nonpoint (NPS) source pollution occurs when rainfall runoff from urban and agricultural lands carries pollutants such as fertilizers, herbicides, insecticides, oil, grease, sediments, and animal wastes into streams, lakes, bays and aquifers. NPS pollution comes from many diffuse sources across the landscape that are difficult to specifically identify or abate in contrast to point source pollution, which is discharged from a single, identified and regulated source. Impairment occurs when the rate at which pollutants entering a water body or groundwater exceeds their natural capacity to assimilate those pollutants.

What Guides NPS Pollution Management in Texas?

Partnerships: The Texas Commission on Environmental Quality (TCEQ) is designated by law as the lead state agency for water quality in Texas. The Texas State Soil and Water Conservation Board (TSSWCB) is the lead agency in the State for abatement of agricultural and silvicultural NPS pollution. The TCEQ administers the NPS Program for all other sources of NPS pollution.

Management of NPS pollution in Texas involves partnerships among many organizations. With the extent and variety of NPS issues across Texas, the need for cooperation across political boundaries is essential. Many local, regional, state, and federal agencies play an integral part in managing NPS pollution, especially at the watershed level. They provide information about local concerns and infrastructure and build support for the kind of pollution controls that are necessary to prevent and reduce NPS pollution. By establishing coordinated frameworks to share information and resources, the State can more effectively focus its water quality protection efforts.

The Texas NPS Management Program: According to the federal Clean Water Act (CWA) §319(b), Texas is required to develop and update a plan every five years that identifies management measures which will be undertaken to prevent and reduce NPS pollution. This plan, known as the *Texas Nonpoint Source Management Program* is prepared jointly by the TCEQ and the TSSWCB. The *2005 Plan* was finalized by the TCEQ and the TSSWCB in 2005. TSSWCB staff and TCEQ submitted the document to the Governor's Office on December 13, 2005. The Governor submitted the *2005 Plan* to the Environmental Protection Agency (EPA) in December for final approval and was approved by EPA on February 10, 2006.

The *Texas Nonpoint Source Management Program* provides details of the Watershed Approach that Texas uses as its water quality management strategy, as well as milestones by which progress in preventing and reducing NPS pollution is assessed. It also provides a description of

the agencies and organizations that address NPS issues within the State along with an account of the numerous programs and best management practices (BMPs) implemented by these entities.

The Watershed Approach: Protecting the state's streams, lakes, bays, and aquifers from the impacts of NPS pollution is a complex process. The Watershed Approach is the water quality management strategy Texas implements to focus private and public efforts on the highest priority water quality problems of both surface and groundwater. By examining water quality issues on a watershed basis, problems can be observed in relationship to their sources so that the causes can be addressed in the most effective manner. The Watershed Approach is based on four basic principles:

- geographic focus based on hydrology rather than political boundaries
- water quality objectives based on scientific data
- coordinated priorities and integrated solutions
- diverse, well-integrated partnerships

For groundwater management, the geographic focus is on aquifers rather than watersheds. Otherwise, the approach is the same. Wherever interactions between surface water and groundwater are identified, management activities will support the quality of both resources.

The Texas Water Quality Inventory and 303(d) List: The TCEQ and other organizations collect water quality data statewide to develop the *Texas Water Quality Inventory and 303(d) List (Inventory and List).* The *Inventory and List* includes identification of surface water bodies that do not meet one or more of the standards defined in the *Texas Surface Water Quality Standards* and also indicates whether NPS pollution is a contributing factor to the impairment. The TCEQ prioritizes water bodies identified as impaired or threatened by NPS pollution for CWA §319(h) grants and other available funding.

For the groundwater portion of the *Inventory and List*, select aquifers are represented by maps showing both the locations of water wells sampled and those exceeding health or risk-based criteria for constituents of concern. It also summarizes sources and types of groundwater contamination taken from the *Joint Groundwater Monitoring and Contamination Report* which is prepared by the Texas Groundwater Protection Committee.

Clean Water Act §319(h) Grant Program: A majority of the activities designed to prevent and reduce NPS pollution are supported by Texas' NPS Program which is administered under the CWA §319. This Section established a grant that is awarded annually by Congress to the EPA. The EPA then allocates these funds to implement activities supporting the Congressional goals of the CWA. The TCEQ and the TSSWCB target these grant funds toward assessment, implementation, and education projects that are consistent with Texas' long- and short-term goals defined in the *Texas Nonpoint Source Management Program.*

In FY2006, the TCEQ had 60 ongoing 319(h) grant-funded projects addressing a wide range of NPS issues. Federal funds totaling $20 million were primarily being used for assessment,

implementation, and education work to address multiple activities and sources as indicated on Figure 1.1.

In FY2006, the TSSWCB had 66 ongoing 319(h) grant-funded projects addressing a wide array of agricultural and silvicultural NPS issues. Federal funds totaling $20 million were primarily being used to address NPS pollution from dairy and poultry operations, prevent atrazine runoff, implement BMPs, support various NPS education programs, and develop Watershed Protection Plans (WPPs) as indicated on Figure 1.2.

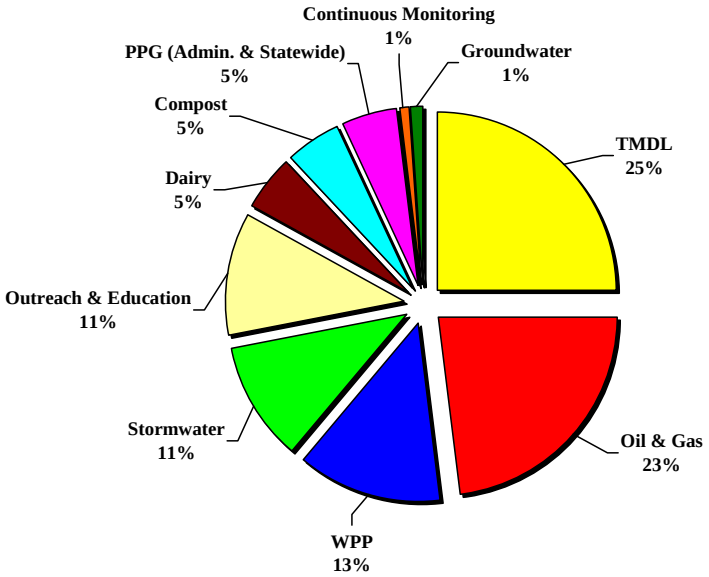


Figure 1.1 TCEQ current NPS grant-funded projects.

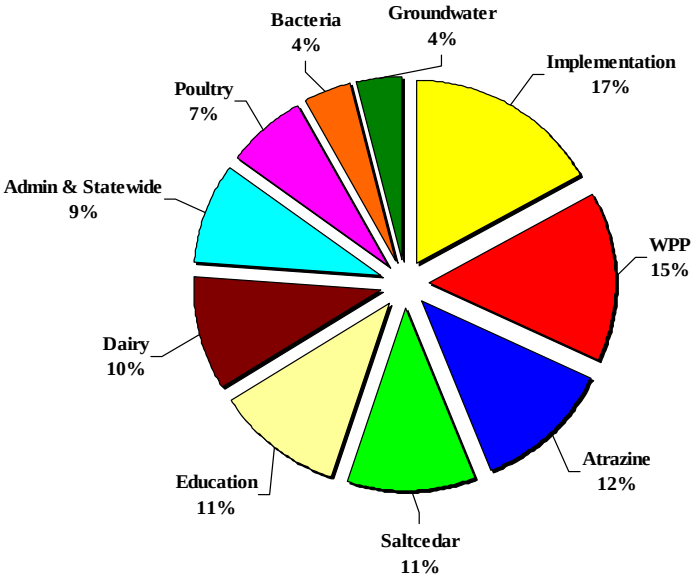


Figure 1.2 TSSWCB current NPS grant-funded projects.

CHAPTER 2
NPS DATA COLLECTION AND ASSESSMENT ACTIVITIES

TCEQ coordinates the water quality assessment activities within Texas.

Water quality is assessed for a variety of reasons. Assessment is used to determine if water is meeting its designated uses or if water quality improvement activities are achieving their intended goals. For impaired waters, water quality data can be used in the development of a Total Daily Maximum Load (TMDL). Data is also used to determine sources of pollution, the adequacy of regulatory measures, watershed improvements, and restoration plans.

Water quality assessment can take many forms. Field collection and lab analysis are the primary methods of assessing water quality. The TCEQ Surface Water Quality Monitoring Program and partners in the Clean Rivers Program conduct these activities. There are, however, other methods to assess water quality such as bacterial source tracking (BST), aerial surveys, and continuous water quality monitoring. Each of these methods is discussed in this chapter.

Water Quality Assessment

Every two years, Texas and other states must assess the quality of their water and submit a report to the EPA detailing the extent to which each water body meets water quality standards. The TCEQ publishes this biennial assessment as the *Texas Water Quality Inventory and 303(d) List.* The *2004 Inventory and List* was approved by the EPA on May 8, 2006. The 2006 *Inventory and List* is currently in progress and expected to be submitted to EPA by mid-2007. There are 306 water bodies listed as impaired for one or more parameters in the *2004 Inventory and List*.

Bacterial Source Tracking

Water quality standards use indicator organisms to determine support of the contact recreation use. *Escherichia coli* (*E. coli*) is used in freshwater and *Enterococcus* in marine waters. The presence of high numbers of these bacteria indicates that disease-causing microorganisms (pathogens) commonly found in human and animal wastes may also be present, posing a risk to public health. Current regulatory tests used to measure these bacteria in water do not identify the sources of bacteria pollution. They simply count the number of bacteria present to indicate the severity of contamination.

Numerous surface waters in Texas are impaired by high levels of bacteria. To address these impairments it is necessary to determine bacteria sources so that best management practices can be implemented. Bacterial source tracking is an emerging scientific breakthrough that can differentiate the source of bacteria as human, livestock, or wildlife.

Scientists with the Texas Agricultural Experiment Station and Texas A&M University System have developed genetic and phenotypic BST libraries for thousands of *E. coli* bacteria isolated from more than 1,500 human and animal source samples (e.g. fecal specimens, septic systems, domestic sewage) in the Lake Waco and Belton Lake watersheds. The BST libraries have been used to indicate possible animal and human origins of *E. coli* bacteria isolated from water samples collected in these watersheds, thereby identifying the nonpoint sources of fecal contamination. The libraries developed through this research are the foundation of a statewide bacterial source tracking database and aid in the development of effective water quality protection strategies. The final report for this study was released in February 2006. A peer-reviewed scientific journal article is also in press. Similar BST studies have been conducted in the San Antonio area, Houston Ship Channel, and Copano Bay.

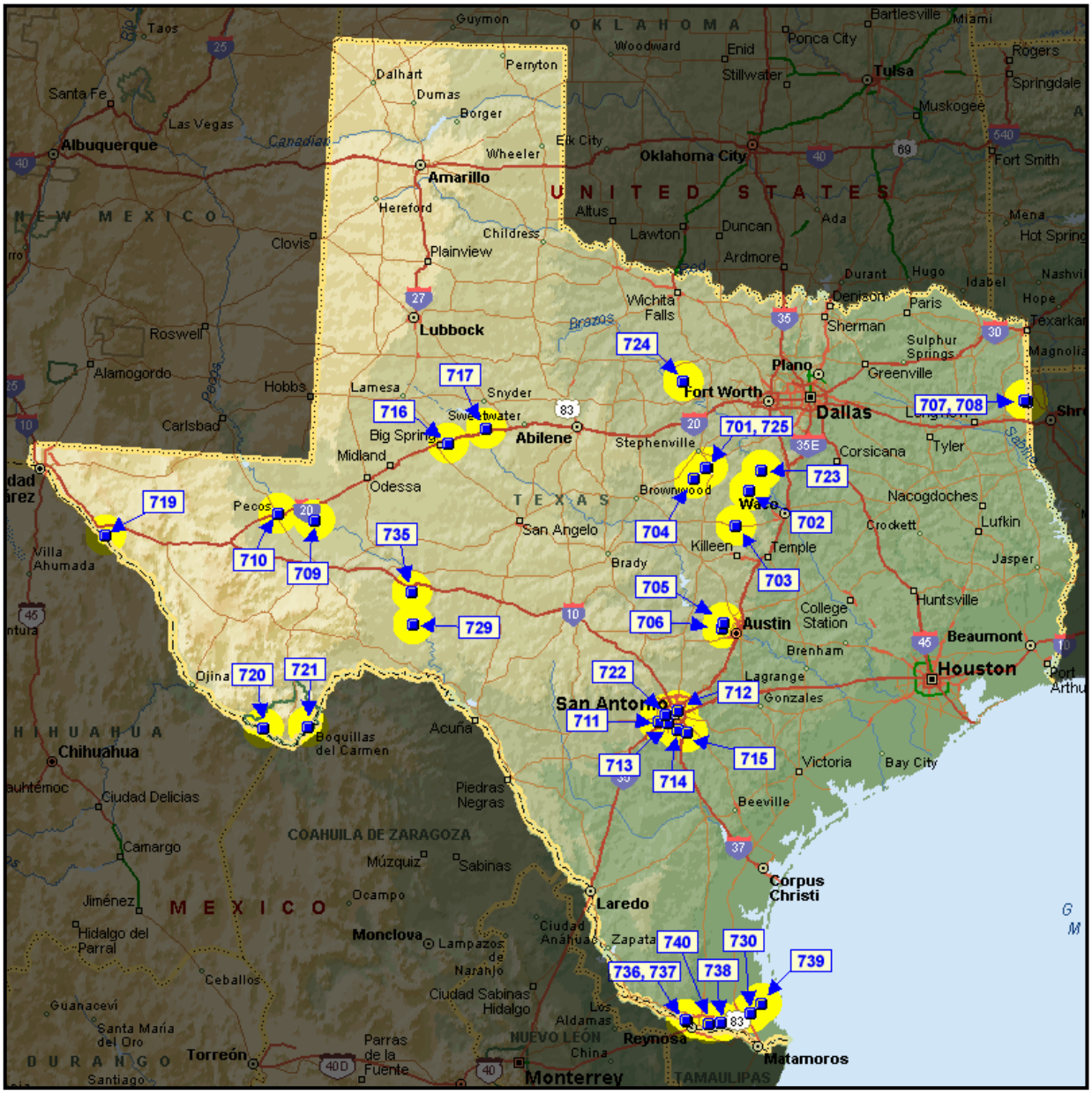
Aerial Surveys: A new technique to monitor land use activities impacting water quality

In the Brazos basin, a jointly funded effort by the TCEQ, Brazos River Authority, and EPA documented the status of the Brazos as well as all of the North Bosque tributary using aerial videography. The project entailed a helicopter fly-over of the lower two-thirds of the Brazos River originating at the confluence of the Salt and Double Mountain Forks southward to the Gulf Coast. The purpose of the flights was to obtain a photographic record of the riparian zones along the rivers to document land uses, such as illegal dumps or quarrying activities that may be impacting water quality. An interactive DVD documenting the flight as well as a hardcopy atlas was produced. These new tools will aid the Brazos River Authority and other partners in their oversight and protection of water resources in the basin.

The Lower Colorado River Authority (LCRA) conducted an aerial survey of the lower Colorado River and it's major tributaries. The goal of the project was to identify illegal solid waste dumps sites and other environmental concerns that may impact water quality. LCRA used a helicopter with a mounted video camera to survey the river. The survey covered more than 1,600 miles of river frontage from O.H. Ivie Reservoir in McCulloch County to Matagorda Bay at the Gulf of Mexico. The survey documented more than 300 significant solid waste dump sites, and other "points of interest" that are located within proximity of the river. As a result of the project, LCRA produced an interactive DVD that includes video documentation of the solid waste dump sites and a map that identifies the location of each site using a Global Positioning System (GPS). The interactive DVD will be distributed to state and local environmental agencies to be used as a tool to combat illegal dumping and to protect water quality.

Continuous Water Quality Monitoring Network

The TCEQ established a Continuous Water Quality Monitoring Network (CWQMN) to enhance the State's surface water quality monitoring program at selected high priority sites. CWQMN sites are designed to meet specific data needs at these sites within technology and resource limits. The specific data needs addressed by each continuous monitoring site vary. Most sites monitor conventional parameters such as temperature, pH, dissolved oxygen, and specific conductance. However, some sites also monitor nutrients, turbidity, and/or chlorophyll. The map shows the thirty-three (33) existing CWQMN sites. The TCEQ plans to establish 11 additional CWQMN sites during FY2007.



TCEQ staff from various agency water programs, with input from cooperators outside the agency, develops and maintain a prioritized list of continuous monitoring proposals for FY2008 and beyond based on:

- demonstrated data needs
- availability of monitoring technology to address the specific data needs
- intended use of data
- the availability of internal and/or external staff to provide operation and maintenance (including data validation)

The TCEQ has numerous cooperators in the CWQMN including the Caddo Lake Institute, Lower Colorado River Authority, Colorado River Municipal Water District, Nueces River Authority, San Antonio River Authority, San Antonio Water Supply, Bexar Metropolitan Water Supply, San Antonio Metropolitan Health District, City Public Service Energy, Public Center for Environmental Health, United States Geological Survey, United States National Park Service, and United States International Boundary and Water Commission.

Several of the CWQMN sites are specifically designed to monitor NPS pollution. These include five (5) sites in the Bosque and Leon River watersheds, two (2) sites in the Pecos River watershed, one (1) site in the Lower Rio Grande River watershed, and two (2) sites in the Upper Colorado River watershed. Additional CWQMN sites are scheduled for 2007 addressing recharge to the Edwards Aquifer.

Pecos River: As part of the CWQMN, TCEQ has established two (2) continuous water quality monitoring sites in the Pecos River watershed where TCEQ, TSSWCB, and EPA are working to improve water quality by managing salt cedar.

Natural geologic deposits in the Pecos River watershed increase the concentration of chloride, sulfate, and dissolved solids to levels that are ten times higher than typical surface waters. In addition to these natural deposits, the salt cedar plant, (*Tamarisk* sp.), contributes to elevated salinity levels in the Pecos River. Salt cedar is an invasive, non-indigenous, salt tolerant species that increases salinity by transpiration of freshwater sources. The Pecos River Ecosystem Project involved aerial herbicide application to eradicate the salt cedar plant from the banks of the Pecos River. The Pecos River Ecosystem Project proposes to eliminate the plant and reintroduce native plants and grasses in its place. Preliminary estimates of water quality indicate that salt cedar removal will decrease the salinity and increase flow in the Pecos River. The objective of this project is to employ existing technology capable of continuous monitoring and logging of conventional water quality parameters. The data generated will be used to monitor changes in salt concentrations and surface water flow associated with salt cedar removal.

San Antonio River Basin: The San Antonio River Basin Monitoring Network was inaugurated in a ceremony at the Witte Museum on the San Antonio River. The Network will collect water quality data every 15 minutes from six monitoring sites on the Medina River, Leon Creek, and the San Antonio River. The information is checked by the United States Geological Society (USGS) and transmitted to the TCEQ, which posts the data on its public website. The

USGS operates and maintains the current sites. Several companies have expressed interest in funding additional sites in the future.

The monitoring sites measure flow, dissolved oxygen, specific conductance, pH, and temperature. The data will be used to bring the state into compliance with federal clean water guidelines and establish water quality baselines.

EMRS Spatial Data Integration Viewer: During 2006, TCEQ developed an Environmental Monitoring and Response System (EMRS) Spatial Data Integration Viewer which allows the public to access continuous monitoring data without overburdening local computer systems. The Viewer integrates various geographic information system data coverages for both air and water. Initial development focused on the North Bosque. In addition, TCEQ has developed a system to ingest NEXRAD precipitation data and National Weather Service precipitation forecasts for the Bosque and Leon watersheds to assist TCEQ in identifying and scheduling field investigations in areas likely to experience NPS laden rainfall runoff. TCEQ plans to expand the precipitation accumulation forecast capabilities to other areas of interest, as resources permit.

Major Water Quality Accomplishments and Watershed Restoration

North Bosque River: Nutrient concentrations in excess of screening levels occur in the North Bosque and Upper North Bosque Rivers. These concentrations sometimes cause excessive growth of algae and other aquatic plants in those rivers. Phosphorus has been identified as the limiting nutrient --- the one whose relative quantity controls algal and plant growth. In December 2002, the TCEQ and the TSSWCB adopted *An Implementation Plan for Soluble Reactive Phosphorus in the North Bosque Watershed* to implement two TMDLs approved by the EPA in December 2001. Soluble reactive phosphorus showed the highest correlation with algal growth, and was therefore chosen as the basis for these TMDLs.

Since 2003, phosphorus concentrations in the river have been below the TMDL target at 3 of the 5 index sites being monitored to measure the success of implementation activities. The average reduction for all 5 sites is 7.3 percent, ranging from no change at the most upstream station to 76.3 percent at the most downstream station. A new modeling project is underway to better analyze the conditions in the watershed. The modeling effort is making use of newly acquired data, as well as data used in the original model.

As of August 2006, approximately 1,043,000 tons of manure has been hauled from dairy facilities to composting facilities and approximately 468,336 yds^3 was removed from both the Bosque and Leon watersheds in the form of compost. These efforts were funded by CWA §319 under the Dairy Manure Export Support and Compost Manure Incentive Project programs. The regional hauling and composting system these two programs created is approaching the I-Plan goal of 50% removal from the North Bosque watershed. The Texas Institute for Applied Environmental Research released a report that details reductions in orthophosphate

concentrations at three microwatershed-monitoring sites. Reductions appear to be correlated to the level of participation in the manure composting program. As noted in Chapter 3 of this report, additional projects are underway to further develop markets for the composted manure which will increase the future viability of the manure composting program.

All municipal wastewater discharge permits are now consistent with the wasteload allocation in the TMDL. Upgrades to the city of Clifton plant have been completed. The improvements should greatly reduce the concentration of phosphorus at the index site below the plant's discharge.

Trinity River Basin: The Texas Department of State Health Services has issued a ban prohibiting the capture or consumption of fish from Trinity River water bodies (Segments 0805, 0841, and 0841A) due to elevated concentrations of legacy pollutants (e.g., polychlorinated biphenyls (PCBs) and chlorinated pesticides) in fish tissue. These substances originate from a variety of land use practices, including military installations, and industrial, residential, and agricultural runoff. Their uses have been banned or restricted by the EPA, but they remain in the environment. Concentrations in fish tissue have declined to below target levels for a number of chlorinated pesticides. However, the consumption bans are still in place because of the continuing risk of PCBs.

The Fort Worth Department of Environmental Monitoring has been very active in tracking and removing legacy pollutants from this area. They have been sampling the storm water system. Over the course of five years of sampling a storm water outfall draining a residential area within the city, they have only twice detected chlordane at significant levels.

The Fort Worth Department of Environmental Monitoring is also tracking the amount of legacy pollutants collected at its Environmental Collection Center. To date, the collection center has collected over 8,000 pounds of materials containing legacy pollutants. As materials are collected, the collection center correlates the addresses of residents disposing of legacy pollutants to watersheds surrounding the impacted water bodies. This provides baseline data for describing historical trends in the occurrence of these materials and allows educational activities to be targeted to appropriate communities.

Through August 2005, two community-based festivals and cleanups were held in the Fort Worth metropolitan area. These efforts increase public awareness of the need to dispose safely of hazardous household wastes, and prevent pollution of local streams. This educational program resulted in a 21% increase in citizen usage of the household hazardous waste facility.

A consultant was hired to study the possible remedies for legacy pollutants in Fort Worth waterways. The report recommended a monitoring program that moves progressively upstream to isolate potential sources. The report recommended removing lake sediments, which expose fish to contaminants, if current loadings are found to be sufficiently low. Alternatively, if current loadings are found to be significant and sources cannot be identified, the report recommended continuing fishing bans.

CHAPTER 3

IMPLEMENTATION ACTIVITIES

Best Management Practices prevent and reduce NPS pollutant loadings in Texas' surface water bodies, aquifers, wetlands, and estuaries.

Texas uses various implementation strategies to protect water quality, such as the issuance of permits for discharges to streams and lakes or the implementation of Water Quality Management Plans on cooperating producers' agricultural operations. Since the state does not have statutory authority to enact certain types of NPS regulatory measures, it must work cooperatively with local authorities to implement solutions. Activities highlighted in this chapter represent a few of the noteworthy strategies related to the NPS short-term goal of Implementation.

Illegal Dumping Abatement Efforts in Texas

Illegal disposal of waste materials is one of the major sources of nonpoint water pollution in Texas. Environmental enforcement and community efforts are essential to controlling the adverse impacts of illegal dumping on surface and groundwater in Texas. The following programs are illustrative of statewide efforts to controlling improper waste disposal.

The purpose of the Texas Illegal Dumping Resource Center is to assist local governments in enforcing illegal dumping regulations and to conduct seminars and classes for professionals and law enforcement officials. The center recently completed the 2006 edition of a manual titled *Local Control of Illegal Dumping* and began publication of a monthly newsletter featuring successful efforts to control illegal waste disposal around Texas. The website address is www.tidrc.com.

The Smith County Environmental Crimes Department began with a $30,000 grant from the East Texas Council of Governments and TCEQ. Under the supervision of Detective Sergeant Danny Brasher, the Smith County Environmental Crimes Department enlisted media and community support to curb illegal dumping and hired two additional officers to work illegal dumping and illegal burning cases in Smith County. In addition, an informal aerial surveillance program was arranged in cooperation with medical evacuation pilots in order to allow environmental enforcement officers to view illegal dump sites from the air.

Keep Texas Beautiful annually sponsors the Governor's Community Achievement Award, one of the most prestigious environmental awards in Texas. The City of Baytown in Harris County was awarded first place in the 2005-2006 competition for its litter abatement program. This program assigns litter and trash clean-up tasks to adult probationers in fulfillment of community service requirements. Financial funding for the City of Baytown's program was provided by a grant from the Houston-Galveston Area Council and TCEQ.

Storm drains are often inappropriately used as dumps for pesticides, fertilizers, motor oil, household paint, and animal waste. These pollutants are washed through storm drains and adversely impact water quality. Texas communities such as Fort Worth, Irving, Garland, San Antonio, Houston, El Paso, and Austin are placing pollution prevention messages on storm water drains and inlets. These messages advise against illegal dumping through storm drains. TCEQ provides information, booklets, and public service announcements promoting storm drain marking as a means of protecting surface water from polluted storm water runoff.

Improper disposal of household hazardous waste such as automobile lubricants, cleaners, paints, solvents, and lawn chemicals pose water contamination hazards. Since 1992, the LCRA and TCEQ have jointly developed the Household Hazardous Waste Collection and Education Program. The April 22, 2006, collection was the largest since the program was launched in 1992. Over one thousand households participated in this event. Fifty tons of recyclable materials (including used tires, lead-acid batteries, oil, paint, and electronic components) were collected and properly disposed. In addition, 40 tons of household hazardous chemical wastes (including pesticides, flammables, corrosives, toxics) were collected.

City of Austin Ban on Parking Lot Sealants

The City of Austin became the first city in the nation to ban the use of coal tar sealants after research found significant levels of polycyclic aromatic hydrocarbons (PAHs) in streams near parking lots treated with coal-tar based products. The ban took effect on Jan. 1, 2006.

Pavement sealants are applied to parking lots, driveways, and airport runways to provide a protective barrier coat against weathering and motor chemicals. Small particles of sealant flake off as due to abrasion by vehicle tires. Coal-tar based sealants contain high levels of PAHs, which are suspected human carcinogens and are toxic to aquatic life.

Concerns over PAHs found in sediments from Barton Springs Pool and Barton Creek during routine monitoring by the City of Austin prompted the TCEQ to conduct soil, sediment, and water sampling in this area. Elevated levels of PAHs were confirmed in soil and sediment samples. Research conducted in 2005 by the City of Austin and the USGS concluded that PAHs in sealant flakes enter urban creeks and streams via stormwater runoff from coal-tar sealed parking lots. The USGS study found that particles in runoff from parking lots treated with coal-tar based sealants have PAH concentrations that are 65 times higher than in particles washed off untreated parking lots. The City of Austin estimated that about 600,000 gallons of sealcoat were applied yearly in the greater Austin area.

Findings were published in the Aug. 1, 2005 issue of Environmental Science & Technology, which is a publication of the American Chemical Society, the world's largest scientific society.

The City of Austin is providing information on enforcement, product disposal, and alternative products on the City's web site as follows: www.cityofaustin.org/watershed/coaltar_main.htm.

Colonias Initiatives Program

The Texas Legislature initiated the Colonia Initiatives Program in 1999. Colonias are economically distressed areas located within 100 kilometers of the border with Mexico. These areas generally lack wastewater infrastructure and potable water. Untreated wastewater is often discharged into local canals, creeks, and streams, which in turn flow into the Rio Grande River or the Gulf of Mexico. Poor quality roads in the colonias prevent proper drainage, thereby resulting in pooling of sewage on the ground during heavy rains. Many homes cannot meet county building codes because they lack indoor bathrooms and plumbing, a prerequisite for connection to local water lines and sewage systems. Hidalgo, El Paso, Starr, Webb, Cameron and Maverick counties have the highest colonia populations.

The Texas Water Development Board administers three programs to connect colonia residents' homes to water and wastewater services: the Colonias Wastewater Treatment Assistance Program, the Colonias Plumbing Loan Program, and the Economically Distressed Areas Program. These programs provide loans and grants to sponsoring local governments for sewers and wastewater treatment facilities and low interest loans to colonias residents for basic plumbing facilities. The Program coordinators serve as advocates among border colonia residents, state agencies, local governments, and utility companies.

The quality of life in the colonias has greatly improved in recent years due to the efforts of these programs. Since the inception of this program, a total of 62 projects have been completed in 432 colonias, with an additional 19 projects under construction, and 3 projects in the planning stages. These projects will provide water and/or wastewater service to approximately 270,000 residents. This equates to 15,935,400 gallons per day of untreated wastewater that is no longer discharged into the environment.

More information is available on the Texas Water Development Board's website at: www.twdb.state.tx.us/assistance/financial/fin_infrastructure/edapfund.asp.

Evaluating New Technologies for Reducing Nutrients in Dairy Lagoon Effluent

The TSSWCB, Texas Cooperative Extension, and Texas Water Resources Institute are collaborating to demonstrate and evaluate five technologies that will attempt to remove phosphorus from dairy lagoon effluent before it is applied to waste application fields. Geotube® and Electrocoagulation Technologies chosen for the first year of demonstrations have completed testing and results from these studies have been presented in comprehensive reports and fact sheets. Both technologies proved very effective for removing phosphorus from the dairy lagoon effluent. A demonstration that evaluates the effects of incorporating residual material contained within a Geotube® on sod and soil profiles is also being planned for implementation in 2007. It will show if Geotube® residual material will have beneficial or negative impacts on sod and soil properties.

Technologies chosen to be demonstrated during the second year of the project were EnviroLink's L4DB microbial technology and Envirotech's Bauxsol™ technology. The EnviroLink demonstration is being conducted at the Sherwyn Wood dairy in the Bosque River watershed. Sampling began in June 2006 and will conclude in June of 2007 with the final report and fact sheet being produced shortly thereafter. Envirotech was slated to implement their demonstration in October 2006, but preliminary tests showed that treatment of an entire lagoon would be highly uneconomical. Due to these costs, Envirotech decided not to participate in the project.

One technology has already been chosen for year three demonstrations and one other technology will be selected to participate in the project in early December 2006. A demonstration of NBT-100 *Lactobacillus* bacteria will be demonstrated at Wild West Dairies in the Bosque River watershed by Natural Biotechnology. This demonstration is scheduled to be implemented in early 2007 and conclude during summer 2007. Materials reporting the results of these projects will be produced by the end of the project in 2008 and will be available along with all other project documents on the project website. http://twri.tamu.edu/project-info/NewTechnologies/

Composting Biosolids

Biosolids are the treated sludge residue from municipal wastewater treatment. Biosolids contain nutrients and organic matter valuable for crop production. Because they also contain significant levels of fecal bacteria and trace elements, federal rules regulating biosolids require that they be tested to determine these levels. Class A biosolids are processed such that bacteria and other potential pollutants are decreased to a level acceptable for general use and distribution to the public. Class B biosolids have higher pollutant values because they do not undergo as much treatment. Class B biosolids can only be used on permitted land application sites or they must be sent to permitted landfills. Over 700,000 tons of Texas biosolids are sent to landfills annually, where their agricultural value is wasted. In the landfill, their methane generating potential and pollutant content adds to the facility's burden in containing landfill gas and leachate. EPA promotes the treatment of biosolids to Class A standards for beneficial use. Composting biosolids is one method used to meet Class A standards, and this practice is growing in Texas.

Biosolids composting is a regulated process that begins with segregating treated sludge from wastewater and mixing it with bulking materials such as wood chips. The mixture is placed into long piles (windrows) and re-mixed repeatedly. The self-generated heat of decomposition results in windrow temperatures of 130 to 170 degrees Fahrenheit. This heat, sufficient to kill human and plant pathogens within 3 days, is maintained for a minimum of 15 days. The result is a stable, disinfected, nutrient rich, soil amendment. Marketed end-products include compost, container mix, and contractor's mix which can be applied to lawns, landscape gardens, and public parks.

The LCRA's Highland Lakes Biosolids facility in Burnet won an EPA award in 2002 for its composting operations. This facility produces an average of 380 dry tons of compost a year, which is then returned to wastewater treatment customers in Kingsland, Lake LBJ, and the cities of Burnet and Marble Falls.

The San Antonio Water System Leon Creek Biosolids Compost Facility processes 50% of biosolids in San Antonio along with yard trimmings collected by the City of San Antonio Solid Waste Department. This composting program can divert up to 208,000 cubic yards of biosolids and 150,000 cubic yards of wood chips from landfills each year. This produces 25,000 dry tons of compost a year, defraying annual landfill disposal fees of $1.3 million.

The City of Austin composts over 50% of its biosolids as Dillo Dirt. This composting process was the first program of its kind in the State of Texas and was awarded an EPA Environmental Excellence Award. Dillo Dirt is made from treated wastewater sludge that is combined with yard trimmings collected throughout the City of Austin. This mixture is composted for a month, screened and bagged, then sold to garden retailers or applied throughout the City by the Parks and Recreation Department.

North Bosque River Restoration Initiative

The largest composting program ever implemented in Texas continued in the North Bosque and Leon River watersheds in 2006. These watersheds have a concentrated dairy industry. Phosphorus contained in storm water runoff from manure waste application fields has been identified by the TCEQ as one source of the water quality impairment in the North Bosque stream system. In December 2002, the TCEQ and the TSSWCB adopted *An Implementation Plan for Soluble Reactive Phosphorus in the North Bosque Watershed* to implement two TMDLs approved by the EPA in December 2001.

A key management strategy in the implementation plan is the removal of approximately half of the compostable dairy-generated manure from the North Bosque River watershed for use outside of the watershed. Utilizing CWA §319(h) funds, the TSSWCB and the TCEQ began a large-scale collaborative project in 2000 to process and export manure out of the North Bosque and Leon River watersheds.

The TSSWCB Dairy Manure Export Support (DMES) program offers financial incentives to commercial haulers to transport raw manure from dairy farms to composting facilities. The TCEQ's Composted Manure Incentive Program (CMIP) is designed to stimulate a sustainable compost industry in the two watersheds and market the compost for governmental and agricultural uses.

Dairy Manure Export Support: The DMES program can claim a remarkable achievement: As of September 30, 2006, over 1,043,000 tons of manure have been removed from North Bosque and Leon watershed dairies and transported to commercial composting operations (Figures 3.1 and 3.2). The initial goal of the DMES program was to export 300,000 tons of manure from participating dairy farms from November 2000 through October 2003. That benchmark was exceeded in less than two years.

Since the program began in the winter of 2000/2001, the rate at which haulers have been reimbursed has gradually been reduced. The original rate was $2.25 per ton of manure hauled for the first mile between a dairy and the nearest composting operation, with an additional $0.15 for each additional mile. On February 1, 2002, the hauling rate was reduced to $1.80 and $0.12; in October of 2002, it was reduced again to $1.35 and $0.10; and in October of 2005 it was reduced again to $0.90 and $0.08. On July 1, 2006, the final rate reduction went into effect, to $0.45 per ton for the first mile, and $0.04 for each additional mile.

Starting October 1, 2005, the DMES program was provided additional federal and state appropriations for one additional year. This would have resulted in an end date of September 30, 2006. However, because there is significant funding remaining for the program, TSSWCB staff have conducted communications with the Texas Legislature and the EPA. The decision was made to carry the program forward at the current incentive rate through August 31, 2007, or until funding is exhausted.

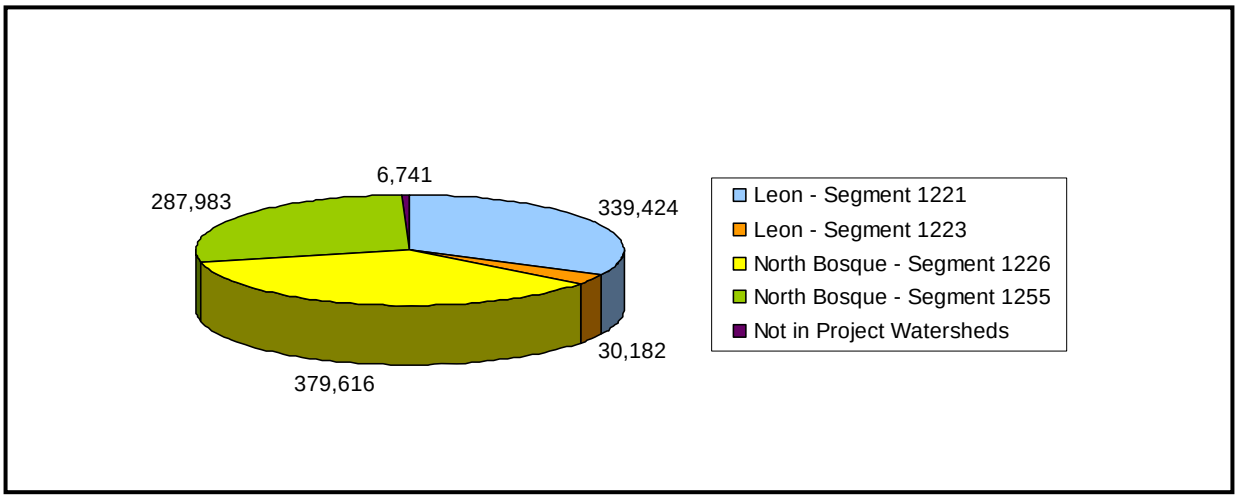


Figure 3.1 Tons of Dairy Manure Hauled to Compost Facilities through September 30, 2006

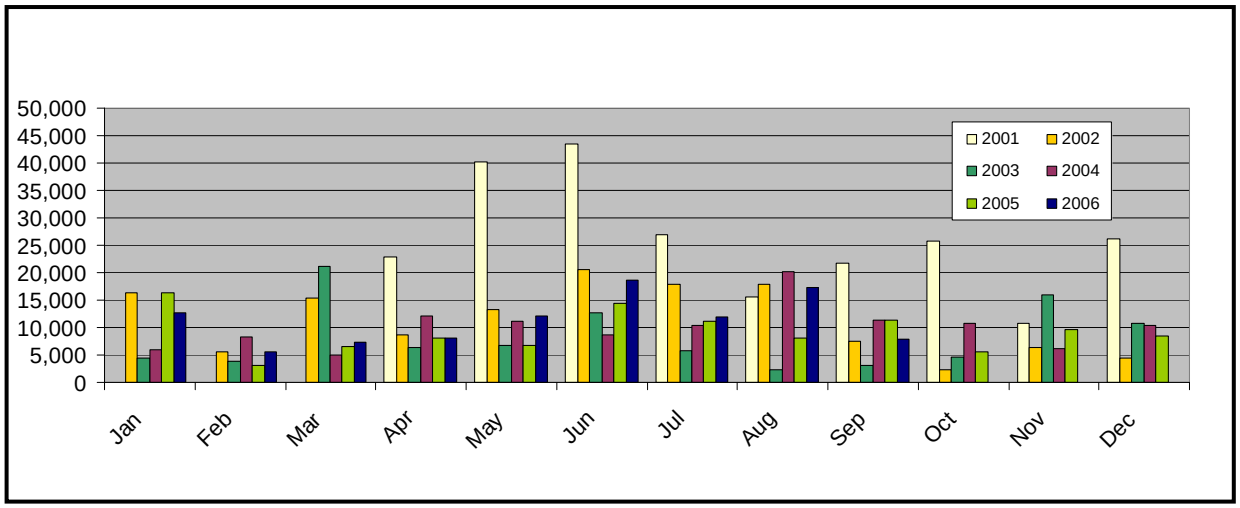


Figure 3.2 Tons of Dairy Manure hauled to Compost Facilities by Month (2001-2006)

Composted Manure Incentive Program: During FY 2006, the program recorded its highest annual sales total of 169,192 cubic yards (yd^3) of manure compost, bringing total sales to 575,886 yd^3 since inception of the program. Out of this amount, 468,336 yd^3, or 81%, was exported outside of the Bosque and Leon watersheds thereby preventing the land application of over 2 million pounds of phosphorus in the area. Despite a reduced incentive of $4/$yd^3$, the rebate program also recorded its most successful year in 2006. As expected, the Texas Department of Transportation (TxDOT) was the largest governmental market for compost having purchased 58% of the total compost produced. A total of 46,245 yd^3 of compost were rebated to private and governmental purchasers (non-TxDOT) through the Upper Leon Soil and Water Conservation District and TCEQ rebate programs.

Private purchasers, including agricultural producers and commercial operations, accounted for the next largest group of customers, followed by municipalities, universities, counties, special

districts, and other organizations. Primary uses cited for compost application were top dressing for athletic fields, parks, golf courses and general landscaping.

The CMIP ended on August 31, 2006. Over $255,000 has been refunded to CMIP customers since 2002. Many first time users were introduced to the benefits of compost as a result of the program. Figure 3.3 shows the hauling, composting and exporting of manure from the Bosque watershed in relation to the TMDL target for manure export.

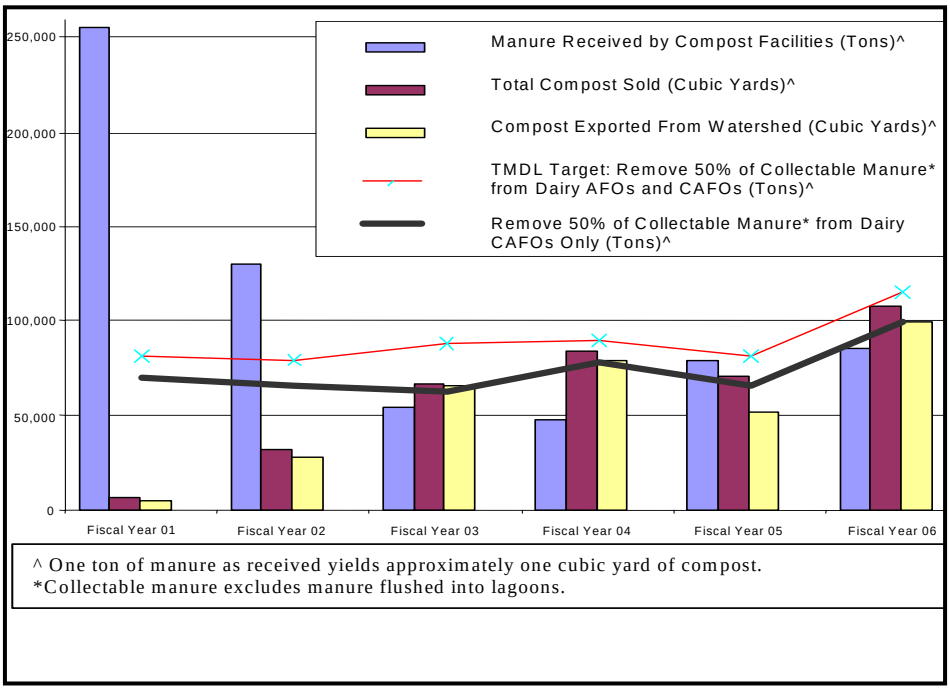


Figure 3.3 Fate of Dairy Manure Received by Compost Facilities

Field of Dreams: There are thousands of communities, school districts, and universities/colleges in Texas with athletic fields. Each grassed field should have annual or more frequent maintenance to preserve the quality and safety of the playing surface. The maintenance, in addition to the normal cultural practices of irrigation and fertilization, includes aeration and topdressing. Topdressing is typically done with sand. The Leon-Bosque Resource Conservation and Development Council teamed with Tomlinson Ball Field Material to gain commercial acceptance of a blend of dairy manure compost and sand for topdressing of athletic fields. This demonstration project contributed to the North Bosque Restoration Initiative by utilizing dairy manure compost from the Bosque River Watershed.

In 2003, the Leon-Bosque Resource Conservation and Development Council was awarded an EPA CWA §319(h) grant through the TSSWCB for an incentive based program to provide 60% cost share to participants who utilized the compost/sand blend. Thirteen entities used a total of 1,053 yd^3 of composted dairy manure. These sites were then used to demonstrate to other entities the benefits of using the blend over sand alone as a topdressing material. The athletic field maintenance industry is very pleased with the performance of the compost/sand blend and

has added it to their product line. End users were also pleased and rated improved grass vigor and improved playing surface as benefits of the blend.

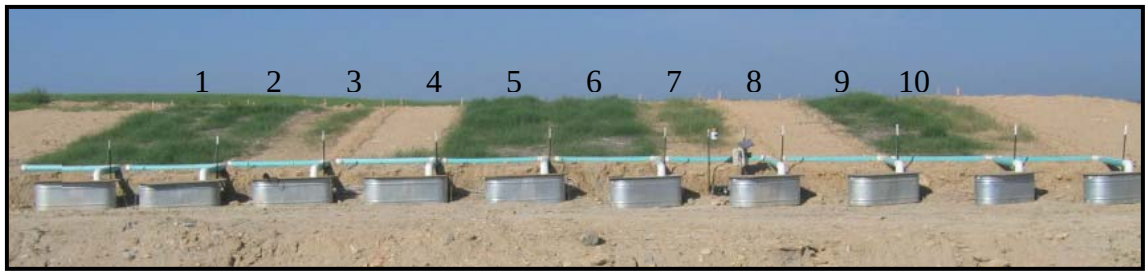
Supplemental funding was provided in 2004 to expand the demonstration to additional areas of the state and to increase the number of athletic fields that could be topdressed with the compost/sand blend. The cost share was reduced to 50%. Currently, 26 new entities have used a total of 4,840 yd^3 of composted manure. The supplemental project expires in March 2007.

Five participants from the original project became repeat customers during the supplemental project. Furthermore, eight of the new participants in the supplemental project requested repeated applications. Repeat business is an indicator that the product is well received and that athletic field managers will continue to use the compost/sand blend.

These projects have succeeded in establishing a new commercial market for composted manure from the Bosque River Watershed. This high-volume market can afford the production and transportation costs of the compost and is expected to continue long after the cost share incentives are no longer available.

Using Composted Manure in Mining Operations: This project, located in Vulcan Mine in Milsap, Texas, is demonstrating the use of compost/mulch in erosion control blankets, filter berms and filter tubes for surface stabilization and erosion and sediment control in rock quarry reclamation in Parker County. It also helps implement the North Bosque TMDL by removing manure from the North Bosque watershed in the form of compost to other watersheds that can use its organic matter and nutrients in vegetative reclamation. It was designed to expand the market for composted manure into land reclamation for rock quarries and other mining operations.

The demonstration includes a scientific field trial to compare erosion control blankets, consisting of a blend of composted manure and mulch, with the more common BMPs of spray fiber mulch applications and direct applications of seeds and fertilizer. Preliminary data from several storm events collected through August 2006, after a late spring seeding with Bermuda grass and through a hot dry summer, indicate that the compost blanket treatments have yielded significantly less total runoff and sediment, have released less total nutrients, and have recovered a much healthier grass cover than the control treatments. The greatest challenge at the end of the summer was how to address the encroachment of Bermuda grass into the mostly bare control plots from the compost treatments.



Compost Plots: 1, 2, 5, 6, 9 Hydromulch Plots: 3, 7, 10 Untreated Plots: 4, 8

Vulcan Materials has hosted four workshops and demonstrations at their Parker County quarry for TCEQ staff, other responsible agencies, contractors, and consultants. Vulcan Materials has also provided equipment and hundreds of staff hours in the planning, earthwork, irrigation, experimental site construction, and other aspects of this project. Vulcan Materials has completed an on-site compost facility that will serve the community by providing a drop-off point for clean wood material that will be mulched and used for additional reclamation projects. By providing a local drop-off site landfill space will be saved and illegal dumping can be reduced.

Land Reclamation and Storm Water Best Management Practices: Military activities, such as armored vehicle training, can have a significant impact on water quality in the form of sedimentation. As storm water flows over a disturbed site, it picks up pollutants like sediment, debris, and chemicals. Polluted storm water runoff causes low dissolved oxygen levels in surface water, which can harm or kill fish and other wildlife. Sedimentation can destroy aquatic habitats. The lack of vegetation on these disturbed sites also contributes to higher storm water velocities that scour stream banks causing further sedimentation. With over 250,000 acres affected, runoff is a significant problem for Fort Hood, in Killeen, Texas.

Fort Hood staff have partnered with TCEQ to apply erosion control compost, filter berms and filter socks to over 28 acres of disturbed ground. Filter socks have been placed in strategic locations at a number of stream tributaries to control sediment at its beginning. Composted dairy manure from the Bosque Watershed and compost produced on-site has been utilized to stimulate revegetation of disturbed sites. Additionally, clean wood materials diverted from the Fort Hood landfill generated more than 1,300 yd^3 of mulch used to stabilize the soil during revegetation.

Creekside Conservation Program

Thousands of acres of valuable soil are washed into tributaries and lakes every year. Gullies and bare rock now exist where once rich topsoil and healthy plants occurred. As farmers and ranchers lose topsoil to erosion, land productivity decreases. Waterways also suffer from sedimentation and nonpoint source pollution. This sediment can build up to create flood management problems, threaten aquatic habitats, impair water quality, and reduce groundwater recharge.

In 2004, LCRA was awarded an EPA CWA §319(h) grant through the TSSWCB. The funding supports LCRA's Creekside Conservation Program, a 15-year-old effort to help farmers and ranchers in Central Texas reduce soil erosion and keep topsoil from washing into the waterways of the lower Colorado River basin.

The project's overall objective is to work cooperatively with private landowners to reduce soil erosion and increase water infiltration, thereby reducing sediment loading in the Highland Lakes and improving water quality by reducing NPS pollution. The project provides technical and financial assistance to participating landowners to implement best management practices designed to improve vegetative cover to reduce erosion and sedimentation. Examples of these include but are not limited to brush management, prescribed grazing, alternative water source development, critical area planting, vegetative buffers and slope stabilization.

A minimum of 30 conservation plans were proposed to be developed under this project. Thus far, a total of 71 applications have been submitted, 32 of which have received assistance in implementing land conservation plans on more than 25,000 acres throughout the grant region. Additional applications will be selected for assistance, as funding is available.

This project also includes an outreach component to demonstrate the effectiveness of erosion control best management practices. Field days, presentations and newspaper articles are used to highlight project successes and encourage additional landowners to implement these best management practices. Seven field days have been conducted with a cumulative audience of over 800 people.

The final objective of the project is to utilize the Revised Universal Soil Loss Equation or similar tool to estimate sediment load reductions resulting from implementation of these best management practices. This task is currently in progress. The project goal is to reduce sedimentation by approximately 55,700 tons.

Texas Silvicultural BMP Effectiveness Monitoring Project

For 15 years, the Texas Forest Service has promoted the use of BMPs to prevent or reduce the amount of water pollution related to forestry operations. While it is common knowledge that these environmental guidelines are an effective and practical means of preventing water pollution, there is no quantifiable data to substantiate their obvious aesthetic improvements.

The Texas Forest Service recently began a biological and physiochemical stream monitoring project designed to test the effectiveness of the state recommended BMPs. This project, funded by an EPA CWA §319(h) grant, includes plans to monitor and test four streams in East Texas for a year and a half, harvest the surrounding timber stand using BMPs, and continue testing for two more years to capture changes, if any, associated with the harvest. High-tech monitoring equipment has been placed upstream (reference) and downstream (test) of the planned harvest sites to assist with the data collection.

The biological monitoring aspect of this project focuses on sampling the fish and benthic macroinvertebrate communities found in the selected streams. The physiochemical monitoring component measures dissolved oxygen, pH, temperature, conductivity, turbidity, sediment, and nutrient concentrations in grab and stormwater samples.

Currently, the project sites have all been harvested, site prepared, and reforested. Initial results have shown low nutrient concentrations, relatively high dissolved oxygen, and high stream biodiversity at all four sites. To date, over 35 fish species and almost 100 benthic macroinvertebrate species have been identified. A final report documenting the results of this project will be produced after the project is completed (September 2007). For more information about this project, contact Hughes Simpson at 936-639-8180 or hsimpson@tfs.tamu.edu.

Texas Coastal Management Program

The Texas Coastal Management Program (CMP) is responsible for the development and implementation of the Texas Coastal Nonpoint Source Pollution Control Program, which identifies potential sources of coastal NPS pollution and develops prevention programs to protect coastal natural resources. The CMP is funded by the National Oceanic and Atmospheric Administration and administered by the General Land Office. The CMP is a participant in the federal Coastal Zone Management Program.

Water Quality Management Plans: Thirty-three water quality management plans were developed and implemented in seven coastal Soil and Water Conservation Districts. These plans prescribe BMPs to reduce sediment, herbicides, pesticides, and fertilizers in stormwater runoff from agricultural land. The implemented BMPs include irrigation land leveling, brush management, installation of filter strips, creation of grassed waterways, creation of parallel terraces, pasture and hayland planting (conversion of marginal cropland to grassland), installation of subsurface drain systems, installation of irrigation pipeline, cross-fencing, and precision land forming.

Coastal Native Prairie and Wetlands Demonstration: The Coastal NPS Program provided funding to Texas R.I.C.E. to create wetlands and restore native grasslands at Mad Island Preserve in Matagorda County. The project was completed in March 2006. It created 360 acres of wetlands and restored approximately 400 acres of grasslands. Wetland units and native grasslands have been proven to be very effective in reducing sediment, herbicide, pesticide, fertilizer, and animal waste loading in stormwater runoff. Studies have shown that wetlands have the ability to strip pollutants at a rate equal to, or greater than, that of water treatment facilities.

Sanitary Pumpout Station: In February 2006, the Aransas County Navigation District completed a project to install a fixed, self-service pumpout and dump station to collect sanitary wastes from recreational and commercial boats, thereby reducing overboard sewage discharges. It is located on a prime section of Cove Harbor, south of Rockport, in a highly visible, high traffic area. The station is wired with “push-to-start” operation for ease of use and a timed, safety shutoff mechanism.

Installation of an oily bilge water reclamation facility is planned adjacent to the pumpout station. The combination of these facilities in a central location will make both more easily accessible and the one-stop convenience will increase the chances that both will be used. The pumpout station is also accessible from the landward side to provide a waste disposal site for trailers and recreational vehicles.

George W. Shannon Wetlands Water Recycling Facility

The Tarrant Regional Water District has constructed and maintained the George W. Shannon Wetlands Water Recycling Facility located 80 miles southeast of Dallas and Fort Worth on the North Unit of the Richland Creek Wildlife Management Area, land owned by the Texas Parks and Wildlife Department. The facility is comprised of constructed wetlands, which are the first water recycling wetlands in Texas. The first phase of the project was constructed four years ago

and includes 243 acres with planned expansion to an eventual project size of 2000 acres. A similar project is planned for the Cedar Creek reservoir and both projects will eventually encompass 3,600 acres of the Trinity Basin.

Water flows from the Trinity River into a series of wetland cells that are designed to remove point and nonpoint sources of pollutants and suspended sediments before being pumped over a dam into the Richland-Chambers Reservoir for drinking water purposes. The maximum diversion from the Trinity River will be 90 million gallons per day or 13.92 cubic feet per second. During the past four years of testing, the Richland Creek wetland removed 99% of suspended solids, 63% of total nitrogen, and 54% of total phosphorus. The goal of this project is to provide high quality water for human consumption.

Natural wetlands have received wastewater for many years. Data on the quality of water exiting natural wetlands led scientists and engineers to realize the potential benefits of constructed wetlands in wastewater management systems. Over the past 40 years, constructed wetlands have been designed for wastewater treatment. Constructed wetland technology for treating urban wastewater and creating eco-habitats was developed during the 1980s in the arid southwestern states. Constructed wetland technology includes systems with open water surface flow, subsurface flow through a gravel or soil media, or aquatic systems with deeper water and floating aquatic plants. Through a partnership with Texas Parks and Wildlife, the George W. Shannon

Wetlands Water Recycling Facility contains native vegetation such as sedge, bulrush, smartweed, wild millet, azolla, and duckweed – all of which serve to attract wildlife and remove pollutants in a cost effective and environmentally sound manner. In late 2007, the wetland will be connected to the Richland-Chambers Reservoir to augment drinking water supply for Tarrant County residents.

The Galveston Bay Estuary Program

The Galveston Bay Estuary Program (GBEP), a program of TCEQ, is part of a network of twenty-eight National Estuary Programs in the United States, working with local stakeholders to restore and protect estuaries that are threatened by pollution, development, or overuse. Galveston Bay is classified as an estuary, which is a semi-enclosed body of water where freshwater from rivers, bayous and tributaries mixes with salt water from the Gulf of Mexico. This mixing provides an environment that shelters aquatic plants unique to this area and offers a nutrient rich environment that nurtures juvenile marine organisms such as shrimp, oysters, crabs, and numerous fish.

GBEP is a partnership of stakeholders, which includes an advisory committee, the Galveston Bay Council and its six standing subcommittees. GBEP and its stakeholders implement a Comprehensive Conservation Management Plan, the Galveston Bay Plan. The second highest priority of the Plan is controlling or eliminating NPS pollution. The Nonpoint Source Pollution Action Plan is the portion of the Plan that was developed in order to reduce and eliminate pollutants from nonpoint sources entering Galveston Bay, including toxins, nutrients, pathogens, sediment, and oxygen-depleting substances. The specific goals of this action plan are to reduce NPS pollutant loads from industry, agriculture, construction, sewage, and marinas.

GBEP provides technical information on storm water quality to Galveston Bay area municipalities required to develop a stormwater management program to address the quality of their storm water runoff. The stormwater management program must provide minimum control measures for six areas: public education and outreach, public involvement and participation, illicit discharge detection and elimination, construction site storm water runoff control, post-construction storm water management in new developments, and pollution prevention for municipal operations.

GBEP partnered with the Galveston County Health District to advise small businesses on pollution prevention and conduct workshops on waste management strategies. Problem areas and pollutants in the watershed were identified and assessed. This information was then used to develop technical assistance programs. As a result of this project, a pollution prevention manual was produced: *Preventing Non-Point Source Pollution: A Guide to Pollution Prevention for Small Businesses*.

Beginning in 2000, GBEP partnered with the Texas Cooperative Extension to promote environmentally friendly landscaping in the Galveston Bay area. This effort is designed to provide information on NPS pollution reduction and proper watershed maintenance using WaterSmart landscaping techniques. WaterSmart landscaping incorporates native plants that

require less maintenance, water, fertilizer and pesticides, thereby reducing non-point source pollution from residential, commercial and public landscapes.
GBEP is supporting locally driven watershed management planning efforts to improve water quality, including streams listed as impaired. Since 2005, five non-regulatory, watershed management planning efforts have been initiated in the Galveston Bay area. A major focus of each plan is dealing with NPS pollution, including developing best management approaches for implementation by local governments and citizens.

GBEP is currently funding a project with local Phase I and Phase II cities involved in the construction alliance. This project is developing a training video for developers and builders to review prior to receiving a permit. The training video discusses the recommended BMPs to use to prevent construction site NPS pollution. The project will also develop an evaluation database to record the impact the training video has on compliance with use of BMPs.

CHAPTER 4

NPS EDUCATION AND PUBLIC OUTREACH ACTIVITIES

Education is a critical aspect of managing NPS pollution. Public outreach and technology transfer are integral components of every NPS grant project, WPP, TMDL or Implementation Plan (I-Plan). This chapter highlights some of the NPS education and public outreach activities conducted in Texas in FY2006. These activities are related to the NPS short-term goal of Education and Public Outreach.

Education and public outreach activities provide opportunities for public involvement in activities which help reduce the amount of NPS pollution entering Texas water bodies and ensure the quality of water resources for future generations.

Education of Best Management Practices in the Arroyo Colorado Watershed

The Arroyo Colorado, an ancient channel of the Rio Grande, drains approximately 700 square miles as it extends eastward from near the City of Mission to the City of Harlingen, eventually discharging into the Laguna Madre. Almost 500,000 acres in the Arroyo Colorado Watershed are irrigated for cotton, citrus, vegetables, grain sorghum, corn, and sugarcane production. Thus, much of the watershed is sustained by runoff and return flows from these areas. Use of the water in the Arroyo Colorado for municipal, industrial or irrigation purposes is severely limited because of poor quality conditions. Thus, the TSSWCB provided funds to the Texas Water Resources Institute and Texas Cooperative Extension to provide agricultural producers with education on better production and management practices, thereby, reducing the potential for nonpoint source pollution. In addition, the project supports and promotes associated programs implementing BMPs related to water quality protection. In the first year, a total of 1,808 watershed stakeholders participated in project educational activities.

Texas Watch Volunteer Monitoring and Environmental Education Program

Texas Watch is a statewide, volunteer-based organization that is committed to improving water quality through monitoring and nonpoint source pollution education. Based at Texas State University–San Marcos, Texas Watch is administered through a cooperative partnership between the university, the TCEQ, and the EPA. Texas Watch volunteer monitors are currently active in 17 of the 23 major river basins in Texas.

Texas Watch trained 220 new water quality monitors in 2006. Monitors tested surface waters in a total of 1,743 monitoring events and submitted data for 222 sites statewide. In addition to training water quality monitors and educating citizens about NPS issues, Texas Watch also participates in an annual TCEQ-funded program called "Teaching Environmental Sciences". This program sponsors summer institute-type courses for science teachers at universities across Texas. Texas Watch staff taught watershed education workshops, including water quality monitoring and NPS education, at six courses in 2006. NPS presentations were also made at different educational venues in Austin, Wimberley, San Angelo, Houston, Grand Prairie, Laredo, Del Rio, Beaumont, Corpus Christi, San Marcos, Blanco, Burnet, and McAllen.

In 2006, Texas Watch implemented intensive projects in several key sites across Texas. In coordination with TCEQ personnel in the TMDL Program, Texas Watch developed and is implementing education and outreach programs at three TMDL locations: Orange County TMDL, the combined Petronila Creek and Oso Bay/Oso Creek TMDLs, and Arroyo Colorado. Two additional partnership projects are also underway – the "Dos Laredos" Project in Laredo and Nuevo Laredo, and the "Learning Urban Watersheds" Project in Houston and Dallas/Fort Worth. These two projects have trained local-area teachers in water quality monitoring and in the use of Texas Watch curriculum, and Texas Watch staff and partner agencies are working with these teachers and their students throughout the 2006-07 school year in intensive, hands-on environmental learning activities, service-learning projects, and public events such as World Water Monitoring Day and Earth Day celebrations.

In April 2006, Texas Watch underwent an organizational change when Texas State University–San Marcos transferred Texas Watch from its home of seven years in the Department of Geography to its new home in the River Systems Institute. The diverse nature of the Institute provides a rich organizational framework for Texas Watch to pursue its objectives of data collection and analysis, NPS education, and school-based environmental education. The diversity of educational programs and water-related institutional support at the River Systems Institute provides Texas Watch with an expanded platform from which to conduct its programs.

e-Life: a Window to the Upper Trinity River Watershed

A recent survey conducted by the University of North Texas in 14 counties within the Upper Trinity River watershed revealed that ninety-two percent of citizens do not know they live in a watershed. Forty-four percent of respondents said they are extremely concerned about water pollution, and over seventy percent still blame industrial wastes (point sources) as the major causes for pollution. The survey also revealed that nearly forty percent of citizens hold county and city governments most responsible for maintaining water quality. Concern for environmental issues is high across the region including forty-six percent of residents who are extremely concerned about the loss of agricultural land to development in the region where they live.

Continued population growth combined with the lack of public awareness and understanding for nonpoint source pollution in the Upper Trinity River watershed is one reason why the EPA Region 6, the TSSWCB, CBS KTVT-11, StormCenter, Inc., and the North Central Texas

Council of Governments formed an unprecedented partnership that is working to improve the way North Central Texans view and understand their local watersheds.

The Environmental Quality of Life, or e-Life, project is intended to increase awareness about local environmental issues, and individual, voluntary measures that the public can take to protect the Upper Trinity River watershed resources. This project provides the distribution and communication mechanism to effectively and efficiently deliver environmental information to nearly 2.3 million TV viewing households in 31 counties via the news and weather reports. The featured components of this project include on-air broadcasting of environmental stories and pollution prevention tips, and a specialized web site providing in-depth information about the Upper Trinity River watersheds.

The website focuses on 10 Upper Trinity River watersheds, providing citizens with a direct link to information about their watershed. The site also includes features on a variety of other weather- and climate-specific topics, including drought, flooding, wildfires and more. The content for the website is being provided by local stakeholders consisting of municipalities, federal and state agencies, Soil and Water Conservation Districts, water districts, universities, and environmental educational and non-profit groups that operate in the project area. Over 44 individuals representing 25 entities operating in the region are currently participating as information contributors, or Local Content Providers.

The e-Life project is modeled after the successful Envirocast® effort anchored by the EPA and supported by StormCenter, Inc. The first Envirocast® was originally implemented in Washington, D.C. In the North Central Texas area, e-Life made its public debut on April 20th, 2006.

The e-Life website can be accessed at www.cbs11tv.com or at http://ktvt.iewatershed.com/. For questions regarding e-Life, please contact Leslie Rauscher, at lrauscher@nctcog.org or 817-608-2341.

Nueces Basin Headwaters Stewardship

The Nueces River Authority, with funding through the TSSWCB, implemented an innovative education project aimed at improving and protecting water quality in five Nueces Basin headwater watersheds. Documented water quality impairments and concerns in three stream segments and rapid changes in land ownership and land use threaten water quality degradation in these headwater streams and the aquifers that depend on their recharge. Mechanical disturbances, degradation of riparian function, introduction and proliferation of non-native plant species, litter and illegal dumping, improper sewage disposal, and municipal and agricultural runoff threaten these waters. The Nueces Basin Headwaters Stewardship Project was designed to educate people about their watersheds and how their actions can contribute to nonpoint source pollution. The project accomplished this goal by creating a watershed model, a creative advertising campaign, and holding annual land stewardship conferences.

It is much more difficult to affect behavioral changes in adults than to develop positive behaviors in youth. A plastic, scaled, relief model of the Nueces Basin was created and used to demonstrate the connectedness of the headwaters to coastal waters and how personal behavior effects water quality. This lesson develops those positive behaviors to prevent future nonpoint source pollution. During the past two years, the model has reached every 5th & 6th grade classroom in the five county project area, involving over 1,350 students per year. Additionally, over 1,000 adults have experienced this hands-on activity through civic organizations and public events.

Although the project area has a resident population of less than 100,000, visitors such as river enthusiasts, tourists, and hunters exceed millions each year. The Up2U challenge was created as a high profile litter prevention campaign. The campaign slogan, “Clean Rivers/Rios Limpios – Up to You” has been displayed on litterbags, bookmarks, billboards, and posters and featured in news stories. Over 60,000 Up2U litterbags have been distributed to schools, tourists, river enthusiasts, and hunters. The bags encourage the public to become involved in pollution prevention. It is estimated that this program prevented or removed about 2,000 yd^3 of river litter each year.

The project also hosted three annual conferences on Land Stewardship and Water Resources, bringing timely and informative presentations from leading experts to those who manage the private lands of the Nueces Basin headwaters. Over 380 land stewards have attended the conferences. More than 1,400 acres of streamside agricultural land has been enrolled in USDA’s Continuous Conservation Reserve Program, which helps protect riparian areas from disturbance and preserve their pollution abatement functions.

CHAPTER 5

WATERSHED PROTECTION PLANS

In Texas, Watershed Protection Plans (WPPs) are holistic plans implemented to coordinate activities and resources to improve water quality or facilitate restoration of impaired water bodies. These plans may also be developed to address threatened waters before they become impaired or to protect water quality.

A WPP guides water quality management measures and implementation strategies needed for impaired or threatened water bodies. This document requires no formal state or federal approval.

While WPPs have a variety of components and can take many forms, Texas grant funded WPP projects utilize guidelines promulgated by the EPA and incorporated into the *2005 Texas Nonpoint Source Management Program.* These guidelines describe nine elements fundamental to a successful plan.

The EPA, TCEQ, and the TSSWCB are facilitating the development of Texas WPPs by providing technical assistance and funding through CWA §319(h) grants to local stakeholder groups. For more information on the TSSWCB WPP Program, visit the website http://www.tsswcb.state.tx.us/wpp.

Arroyo Colorado Watershed

Results of a TMDL analysis developed in 2002 indicated that the dissolved oxygen problem in the tidal portion (Segment 2201) is related as much to the physical setting and modifications of the Arroyo Colorado as it is to the loading of nutrients and oxygen-demanding substances from the non-tidal portion (Segment 2202). Based on this information, the Arroyo Colorado Watershed Partnership is developing a WPP to improve conditions in the watershed. The Partnership established several work groups to address the seven major components of this plan: wastewater infrastructure, agricultural issues, habitat restoration, refinement of the TMDL analysis, public education, land use/development, and monitoring. A final draft plan for approval by the stakeholders is due by the end of 2006. Texas Water Resources Institute will be implementing the watershed protection plan by continuing the position of a watershed coordinator and funding a full time grant writer.

Bastrop Bayou Watershed

Bastrop Bayou (Segment 1105) is one of the last remaining unchannelized bayous along the upper Texas coast, and eventually confluences with the Christmas Bay Coastal Preserve, which hosts some of the last remaining sea grass beds along the Texas coast. Although the majority of the watershed is rural and agricultural, there is increased pressure from the tremendous growth in the region. The Houston-Galveston Area Council and the Galveston Bay Estuary Program

recently completed a Watershed Risk Assessment, and plan to address concerns of elevated bacteria concentrations and nutrient loading in Bastrop Bayou with a WPP. The WPP is in the initial developmental stages and preparations are being made to further define the plan objectives prior to organizing stakeholder meetings. The point of contact is Om Chawla with HGAC, om.chawla@h-gac.com or (713) 993-4586.

Buck Creek Watershed

Segment 0207A of the Buck Creek Watershed was listed as an impaired water body on the 2002 and 2004 *Inventory and List* because it did not meet bacterial water quality standards. The TSSWCB, Texas Water Resources Institute, Texas Agricultural Experiment Station, and Hall-Childress, Salt Fork and Donley County Soil and Water Conservation Districts have collaborated on the Bacterial Monitoring for the Buck Creek Watershed in an effort to determine temporal and spatial bacteria levels in Buck Creek and provide educational meetings where local stakeholders can learn more about the project and its goals. Monitoring was conducted every two weeks and after rainfall events at 15 locations along the creek. Water quality sampling has ceased; the final report is currently being drafted and is scheduled to be complete by early 2007.

A second phase of this project is scheduled to start in the fall of 2006. The second phase will focus on identifying the sources of bacteria in Buck Creek, evaluating potential management

alternatives, and developing a watershed protection plan to restore the waterbody through a stakeholder driven process. For more information on this project, visit the project Web site at http://twri.tamu.edu/buckcreek/.

Caddo Lake Watershed

The *Inventory and List* identifies impairments to the aquatic life and fish consumption uses due to low dissolved oxygen, low pH, and mercury in fish tissue. The 305(b) Water Quality Inventory identifies concerns for future impairments due to nutrient enrichment (ammonia) and sediment contamination (barium, mercury, selenium, lead, and zinc). Caddo Lake's Watershed Protection Plan will strive to identify the causes and sources of pollution affecting the lake and its tributaries. The plan is in the initial developmental stages. The stakeholders have organized into three workgroups (Physical Concerns, Water Quality, and Hydrologic Concerns). They are responsible for developing recommendations for improving water quality, including significantly reducing current pollutant loadings, increasing public awareness and education, improving natural habitat, and conducting additional monitoring and research. These recommendations will be integrated into a comprehensive Watershed Protection Plan for Caddo Lake.

The Caddo Lake Watershed Coordinator is Beverly Allen with the Northeast Texas Municipal Water District (ballennetmwd@aol.com or (903) 639-7538).

Cedar Creek Reservoir Watershed

Cedar Creek Reservoir (Segment 0818) has several parameters of concern according to the 2004 *Inventory and List*. It is listed as category 5c impairment for high pH values at ten assessment areas on the reservoir. This designation indicates that additional data and information will be collected prior to scheduling a TMDL. In addition, areas of the reservoir have been classified as a concern for dissolved oxygen, high pH, ammonia, orthophosphorus, total phosphorus, and excessive algal growth. Participants in the North Central Texas Water Quality Project are addressing the eutrophic state of Cedar Creek Reservoir. This group will generate a WPP based on the results of a watershed and reservoir modeling project, economic analysis and stakeholder inputs. Educational, agricultural, urban and in-lake BMPs will be assessed for their impact on reducing sediment and nutrient loads in the reservoir. As of October 2006, the watershed and reservoir modeling has been completed. The modeling allows for quantification of the nutrient loads from nonpoint and point sources. The model also allows for systematic reduction of nutrient loads for various sources and the subsequent observation of changes in Chlorophyll 'a' production. Watershed BMP's and inlake BMP's are being evaluated. The technical committee for this project will address the next steps soon. The point of contact is Woody Frossard (wfrossard@trwd.com or (817) 335-2491).

Concho River Watershed

The Concho River basin lies within thirteen West Texas Counties and encompasses a watershed of approximately 4.5 million acres. Four major reservoirs, O.H. Ivie, O.C. Fisher, Twin Buttes and Lake Nasworthy are located within the watershed boundaries. These reservoirs provide potable water, either wholly or in part to approximately one half million people. This WPP is designed to evaluate and assess potential sources of NPS pollution basin-wide and to provide for the development of control strategies. Components of the plan include fixed station water quality monitoring, special study water quality monitoring, hydrologic monitoring and research involving surface and groundwater, development of Geographic Information Systems (GIS), hydrologic modeling, and public outreach activities. The plan is scheduled to be completed by August 31, 2007. Investigations to date have resulted in the preparation of an interim hydrologic report, identification of initial BMP's and the identification of several existing and potential sources of NPS water pollution. Development of initial BMP's has included considerable effort in planning strategy for plan implementation following completion.

Dickinson Bayou Watershed

The tidal segment of Dickinson Bayou (Segment 1103) is listed as impaired due to low dissolved oxygen levels. It was determined that a WPP would be the best approach to dealing with the impairment. The Dickinson Bayou Watershed Coordinator is responsible for encouraging stakeholder involvement, along with the development of a consensus-based watershed plan. There is currently a Dickinson Bayou Watershed Partnership consisting of more than fifty stakeholders, which includes five workgroups. The point of contact is Bud Solmonsson with the Texas Coastal Watershed Program at bsolmonsson@tamu.edu or (281) 218-6340.

Eagle Mountain Reservoir

Participants in the North Central Texas Water Quality Project are addressing the eutrophic state of Eagle Mountain Reservoir. This group will generate a WPP based on the results of a watershed and reservoir modeling project, economic analysis and stakeholder inputs. Educational, agricultural, urban and in-lake BMPs will be assessed for their impact on reducing sediment and nutrient loads in the reservoir. As of October 2006, watershed modeling (SWAT) is awaiting results from a sediment survey on Eagle Mountain Reservoir to estimate the rate of sedimentation and the density of the sediment. This information will allow for final calibration of the model and generation of a watershed loading estimate for the reservoir model. The reservoir model (WASP) is up and running but has not been calibrated to a watershed load. This modeling effort will quantify the nutrient loading to the reservoir and allow for systematic reductions in loads and evaluation of impact on eutrophication.

Granger Lake Watershed

Mankins Branch and Willis Creek are listed on the *2004 Inventory and List* for bacteria and the San Gabriel River is listed for total dissolved solids. In addition, the growing importance of Granger Lake as a regional water supply has heightened a long-standing concern of excessive sedimentation to the reservoir. This WPP will address these water quality concerns and assist local stakeholders in developing long-term management measure to protect water quality and extend the life of the reservoir. The point of contact for the project is Jay Bragg with the Brazos River Authority (jbragg@brazos.org or (254) 761-3135).

Hickory Creek Watershed

The Hickory Creek arm of Lake Lewisville (Segment 0823) was identified as a water body of concern for ammonia nitrogen in the *2004 Inventory & List*. In 2006, Denton hosted several WPP meetings to receive stakeholder input on the goals and objectives of the plan. With stakeholder input, Denton developed a BMP Implementation Plan that featured several demonstration projects to show how new BMPs can be constructed and older BMPs can be retro-fitted to have a natural appearance and still be effective in reducing pollutant loads in Hickory Creek. The BMPs are expected to appeal to developers of both residential and commercial properties. Denton also completed modeling of Hickory Creek to determine the pollutant loads and major pollutant sources in the watershed. The point of contact is Kenneth Banks, with the City of Denton (KennethBanks@cityofdenton.com or (940) 349-7165).

Lake Granbury Watershed

Lake Granbury is located in North Central Texas and serves as a water supply for more than 250,000 people in the area. In recent years, golden algae (*Prymnesium parvum*) blooms have caused numerous fish kills in the lake resulting in substantial economic and biological losses.

The Brazos River Authority has recently noted excessive fecal coliform levels in the lake in several areas as well. These problems have led to the collaboration between TCEQ, Brazos River Authority, Texas Water Resources Institute and local stakeholders to develop a watershed protection plan and water quality education program for Lake Granbury in addition to an effort by Texas Parks and Wildlife Department, Baylor University, the University of Texas at Arlington, and Texas Water Resources Institute to investigate the linkages between water conditions, nutrients, dissolved organic matter and golden algae blooms. Management options for golden algae will also be explored to evaluate their effectiveness in preventing or disrupting blooms. Further information on this project can be found on the project Web site at http://lakegranbury.tamu.edu/.

North Bosque River Watershed

A number of unclassified segments within this watershed are listed for bacterial impairments and nutrient concerns, and in 2001, Two TMDLs for Soluble Reactive Phosphorus were approved by the state. An accompanying Implementation Plan (I-Plan) was later adopted to address phosphorus concerns. A WPP would facilitate remediation of other pollutants not listed in the I-Plan and may enhance the existing TMDL/I-Plan efforts. The objectives of the WPP Project include identifying all pollution prevention projects and measures that are underway in the watershed, tracking the progress of these projects, tracking rules and regulations, identifying water quality trends, providing opportunities for the efficient and effective use of resources, and communicating regularly with watershed stakeholders through the use of websites, newsletters, brochures, and meetings. The point of contact for the project is Jay Bragg with the Brazos River Authority (jbragg@brazos.org or (254) 761-3135).

Pecos River Watershed

The Pecos River Basin Assessment Program was developed as a comprehensive approach to developing a research baseline for water quality and water quantity monitoring in the watershed; educating stakeholders on issues related to water quality and quantity; and to develop a watershed protection plan for segments 2310, 2311 and 2312 of the Pecos River. The project is currently entering its third year and much of the basin assessment; educational programming and watershed monitoring are complete. Some of the tasks included in this project are aerial photography and delineation of the entire basin in Texas, conducting aquatic life and habitat surveys, identifying the volume and quality of Pecos tributaries and springs, and identifying saline water sources entering the river. In addition, the project has produced and will continue to produce educational materials and meetings for interested parties. The major monitoring components of the project were collecting water quality data and determining the quantity and fate of water salvaged from saltcedar control.

The development of a watershed protection plan is the main deliverable of the project. Currently, the initial draft of the watershed protection plan is being developed and is scheduled to be completed during the fall of 2007. Further information on the Pecos River Basin Assessment Program is available online at http://pecosbasin.tamu.edu/.

Plum Creek Watershed

The 2004 *Inventory and List* identifies the upper reaches of Plum Creek (Segment 1810) as exceeding the contact recreation standard criterion for *E. coli* bacteria. The lower reaches of Plum Creek have concerns for nutrients (ammonia, nitrate+nitrite nitrogen, and total phosphorous). The TSSWCB Wharton Regional Watershed Coordination Steering Committee selected the Plum Creek Watershed for a WPP in December 2005 as a pilot WPP from a list of prioritized watersheds within the Wharton Region service area. The project began in April 2006 with three public meetings to introduce the WPP and engage stakeholders within the watershed

in the process. The Plum Creek Watershed Partnership involves a steering committee and five workgroups, which have had monthly meetings since May 2006.

The Texas Watershed Steward Program is being piloted in the Plum Creek Watershed to provide science-based, watershed education to help citizens identify and address local water quality impairments. In July 2006, sixty-four stakeholders toured the watershed to view the diverse land use and potential sources of water quality pollution. WPP development is currently underway. For more information please contact: Nikki Dictson (979) 458-3478, n-dictson@tamu.edu or Matthew Berg (979) 485-2862, mberg@ag.tamu.edu.

Upper San Antonio River Watershed

The *2002 Inventory and List* identifies the upper eight miles of the Upper San Antonio River (Segment 1911), along with several other reaches of the river, as exceeding the contact recreation criterion for fecal coliform bacteria. These headwaters of the San Antonio River, entirely within the City of San Antonio, are included in an ongoing TMDL project addressing bacterial impairments in several reaches of the San Antonio River. In 2004, the Bexar Regional Watershed Management Partnership initiated a WPP for the upper eight miles of the San Antonio River, with the San Antonio River Authority managing the compilation of the plan document. This project complements the TMDL activities by establishing a framework for local implementation planning to address storm water and nonpoint source contributions in the urbanized portion of the watershed. In FY 2006, the San Antonio River Authority prepared a draft WPP after extensive stakeholder consultation with the Bexar Regional Watershed Management Partnership and three public meetings. The WPP was still under review as of August 31, 2006. The point of contact is Steve Lusk with the San Antonio River Authority (stevelusk@sara-tx.org or (210) 302-3637).

Regional Coordination of Watershed Protection Planning

This project provides a Regional Watershed Coordinator in the TSSWCB Wharton Field Office to assist local stakeholder groups in developing and implementing WPPs. This project's service area includes watersheds in 40 Soil and Water Conservation Districts comprising 47 counties across southeast and south central Texas. In January 2005, a Regional Watershed Coordination Steering Committee was established to steer the project toward successful WPP development and implementation by identifying and prioritizing those watersheds most in need of coordinated watershed protection planning. The Steering Committee is composed of water quality monitoring and improvement partners from across the service area, including other state agencies, federal agencies, river authorities, national estuary programs, and councils of governments.

The Regional Watershed Coordinator has assisted stakeholders in the Plum Creek Watershed Partnership and WPP, the Dickinson Bayou Watershed Partnership and WPP, several TMDL projects, and regional partners in the Clean Rivers Program. The Regional Watershed

Coordinator develops a monthly newsletter to keep regional stakeholders informed on projects, news, and information within the project service area.

If successful, this regional approach to coordinated watershed protection planning may be used as a model for other TSSWCB Field Offices throughout the state. This project is entering its third year (FY2007). This coordinated watershed protection planning project is funded through TSSWCB with a CWA §319(h) grant. For more information please contact Brian Koch at (972) 532-9496 or bkoch@tsswcb.state.tx.us. The project website can be accessed at www.tsswcb.state.tx.us/cwp.

CHAPTER 6
TOTAL MAXIMUM DAILY LOADS (TMDLS)

Developing TMDLs and Implementation Plans (I-Plans)

When a water body does not meet the standards by which we measure its quality, the state develops a "budget" for pollutant reductions — a TMDL — and an I-Plan to achieve them. TMDLs and I-Plans are integral components in our state's overall program to improve and protect the quality of Texas rivers, lakes, and bays.

A TMDL determines the maximum amount of a pollutant a stream can receive and still maintain its water quality standards. It also states how much each source (point and nonpoint) can contribute to the watershed.

The TCEQ makes an extensive effort to identify the people who have a stake in restoring an impaired water body, and to collaborate with them to develop TMDLs and I-Plans. The goals and methods of both are developed and reported in public forums: with existing groups such as basin steering committees or with advisory groups formed specifically to work on a particular TMDL development project.

The TCEQ had 33 active TMDL projects to develop TMDLs during 2006; the majority of which address nonpoint source or a combination of point and nonpoint source water quality. These 33 projects are addressing 135 impairments in 108 water bodies for the most prevalent impairments on the current *Inventory and List*: 84 impairments from bacteria, 17 impairments due to low dissolved oxygen, 26 impairments by organic compounds, and several impairments due to nutrients, metals, and high or low pH.

The state is committed to developing TMDLs and their I-Plans in a timely manner, and is making steady progress toward completing TMDLs for all the impairments listed from 1998 through 2004 (see Figure 6.1).

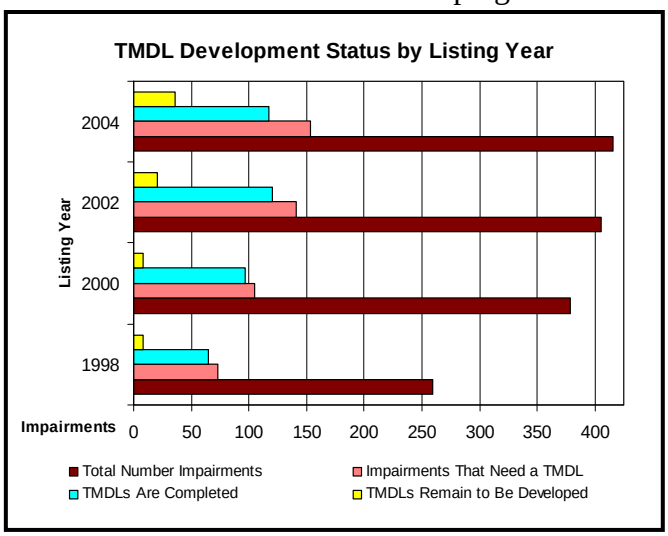


Figure 6.1

By June 2006, the TCEQ adopted TMDLs for the following two nonpoint source impacted water bodies listed below.

Lake O' the Pines, Segment 0403 – Low dissolved oxygen in Lake O' the Pines provides suboptimal conditions for support of aquatic life. The lake's watershed includes parts of Cass, Harrison, Marion, Morris, and Upshur counties.

Lake Worth, Segment 0807 – This TMDL was developed because the Texas Department of State Health Services determined that there was a safety risk to consumers from elevated levels of PCBs in the lake's fish. Lake Worth is located in northwest Tarrant County near the City of Fort Worth.

By August 2006, the TCEQ had approved I-Plans for 84 percent of the TMDLs it had adopted. The TCEQ and its partners had 13 active I-Plans underway for 54 impairments in 33 water bodies; the majority of which address nonpoint source or a combination of point and nonpoint source water quality. The TCEQ expects to develop another 21 I-Plans for 71 impairments by the end of 2008. Eleven of the new I-Plans will address bacteria impairments, which account for almost half of the listed waters in Texas, in 40 segments.

Environmental Progress through TMDLs

As of May 2006, due to efforts of both the TCEQ and the TSSWCB, and their various partners around the state, water quality has been restored to attain standards for 21 impairments to surface waters. Overall, fishing uses, conditions for aquatic life, and proper salinity have been restored to 278 stream miles; made suitable as a source of drinking water for 3,943 reservoir acres; and restored conditions for aquatic life in 12 estuary square miles. Table 6.1 shows the streams, reservoirs, and estuaries for which the TCEQ has approved implementation plans. For each plan, the table shows the basin and identification number of the impaired water body, the use that is affected, and the geographic extent of the impairment.

Table 6.1

I-Plan	Basin & Segment(s)	Use Affected	Year Begun	Status	Area of Impairment
Aquilla Reservoir: Atrazine	Brazos River; 1253	Source for drinking water	2002	Goals met	3,943 lake acres
Arroyo Colorado: Legacy Pollutants and Organics	Nueces–Rio Grande Coastal; 2202 & 2202A	Safety of fish consumption	2001	Underway	504 stream miles 333 lake acres
Clear Creek: Chlordane	San Jacinto-Brazos Coastal; 1101 & 1102	Safety of fish consumption	2001	Goals met	42 stream miles
Clear Creek: Dissolved Solids	San Jacinto-Brazos Coastal; 1102	General (not tied to a specific use)	2006	Underway	60 stream miles
Clear Creek: Volatile Organic Compounds	San Jacinto-Brazos Coastal; 1101 & 1102	Safety of fish consumption	2001	Goals met	84 stream miles
Dallas and Tarrant County Waterways: Legacy Pollutants	Trinity River; 0805, 0841, 0841A	Safety of fish consumption	2001	Underway	18,970 lake acres 127 stream miles
E.V. Spence Reservoir: Total Dissolved Solids	Colorado River; Segment; 1411	General (not tied to a specific use)	2001	Underway	29,900 lake acres
Fort Worth Waterways: Legacy Pollutants	Trinity River; 0806, 0806A, 0806B, 0829, 0829A	Safety of fish consumption	2001	Underway	101 lake acres 47 stream miles

I-Plan	Basin & Segment(s)	Use Affected	Year Begun	Status	Area of Impairment
Houston Ship Channel: Nickel	San Jacinto River & Bays; 1001, 1005, 1006, 1007, 1013, 1014, 1016, 1017, 2426, 2427; 2428; 2429; 2430; 2430; 2436	Support of aquatic life	2001	Goals met	152 stream miles 24 bay square miles
Lake Austin	Colorado River; 1403	Support of aquatic life	2001	Underway	1,830 lake acres
Lake Worth	Trinity River; 0807	Safety of fish consumption	2005	Underway	3,558 lake acres
Lower Sabinal River	Nueces River; 2110	Source of supply for public water systems	2005	Underway	27 miles
North Bosque River: Soluble Reactive Phosphorus	Brazos River; 1226 & 1255	General (not tied to a specific use)	2002	Underway	121 stream miles

It is now safe to consume fish caught in Segments 1101 and 1102 of **Clear Creek** in Harris County. Concentrations of volatile organic compounds and chlordane in the tissue of fish are now within acceptable levels of risk for consumers. To ensure that fish consumption remains safe, the TCEQ is funding further risk analyses by the Texas Department of State Health Services on fish from both segments.

In 2004, annual average concentrations of chloride and sulfate, two salts causing concern for the use of **E.V. Spence Reservoir** in Coke County as a source of drinking water supply, were in compliance with TMDL target levels (Table 6.2). However, overall concentrations of total dissolved solids remain significantly above target levels, though they have declined, on average, from 1999 through 2005. A rainfall event in late 2005 brought the lake elevation up 18 feet. This influx of relatively low-salinity water should further reduce the chloride and sulfate concentrations in the lake.

Table 6.2

E.V. Spence Reservoir: Average Dissolved Salt Concentrations, Milligrams/Liter			
	1994-1999	**2000-2005**	**Decrease**
Chloride	1,095	878	19.8%
Sulfate	765	583	23.8%
TDS	3,395	2,466	27.4%

Since 2003, phosphorus concentrations in the **North Bosque River** (Erath, McLennan, and Bosque Counties) have been below the TMDL target at 3 of the 5 index sites being monitored to measure the success of implementation activities. However, phosphorus concentrations at 2 of the sites remain above targets. The average reduction for all 5 sites is 7.3 percent, ranging from no change at the most upstream station to 76.3 percent at the most downstream station.

Phosphorus concentrations were also measured at five index sites from October 1997 through September 2002, before the start of TMDL implementation. The reductions shown in Table 6.3 compare the concentrations prior to implementation with those measured after implementation, from October 2002 through September 2005. The TCEQ will monitor water quality at the five index sites for several years in order to track environmental progress.

Table 6.3

North Bosque River: Percent Reduction in Phosphorus Concentrations				
Valley Mills	Clifton	Above Meridian	Below Stephenville	Above Stephenville
76.3%	35.9%	New site	6.0%	0.0%

Stakeholder Involvement and Education through the Texas TMDL Program

The TCEQ's TMDL Program uses five primary forums for statewide education: its Web site, the brochure *Clean Water for Texas*, an annual report on the status of TMDL implementation, an e-mail news list, and coordination with statewide forums like the Stakeholder Work Groups of the Clean Rivers Program and the NPS Management Program. Regionally, the TMDL Program coordinates its projects with the Clean Rivers Program Basin Steering Committees. For some TMDL projects, the existing Clean Rivers Program forum may serve as the advisory group for the project; for other projects, a separate advisory group is formed.

The TCEQ and the TSSWCB hosted a conference in September 2005 to focus on implementing TMDLs. The TCEQ's goal for the conference was to bring governmental stakeholders together to share their experiences with implementing TMDLs, to identify effective and ineffective components of their implementation projects, and to determine what issues these agencies and the TMDL Program need to address to improve their success in meeting environmental goals. The conference also reinforced cooperation among the regional, state, and federal agencies that are critical to the effort to implement TMDLs. Eighty-seven people representing 35 organizations attended the conference.

CHAPTER 7

TEXAS NPS MANAGEMENT PROGRAM ACHIEVEMENTS AND PROGRESS TOWARDS MEETING MILESTONES

Measures of Success

Texas measures the progress and success of its NPS management program in terms of two types of achievements, programmatic and environmental. Programmatic achievements relate to the implementation of projects and/or the improvement of programs that support the long and short term goals defined in the *Texas NPS Management Program*. They are designed to support improvements in environmental quality. Environmental achievements are measurable, demonstrable results in the quality of either surface or groundwater impacted by NPS pollution.

Progress towards meeting Texas NPS Management Program Milestones

The CWA §319 requires that Texas include as part of its NPS Annual Report, progress in meeting the milestones defined in the *Texas NPS Management Program*. There are 51 priority watershed projects listed in the Texas Nonpoint Source Management Program. The table below indicates the number of projects that have incorporated the specific milestone(s) listed.

Project/Waterbodies	2006-Projected	2006-Actual	Comments
Assessing Aquatic Life use in Tidal Streams	Modeling	Modeling	
Aquilla Reservoir	Implementation	Implementation	TMDL approved-2001 I-Plan approved-2002
Armand Bayou Local Initiative Watershed Plan	Implementation	Implementation	WPP finalized-2006
Arroyo Colorado (D.O.)	Action Plan Implementation	Targeted Assessment Implementation	
Arroyo Colorado Legacy Pollutants	Targeted Assessment Implementation	Targeted Assessment Implementation	TMDLs approved-2001/2004 I-Plans approved-2001
Brandy Branch Reservoir	Implementation	Implementation	
Buck Creek	Targeted Assessment	Targeted Assessment	
Buffalo and White Oak Bayous	Action Plan	Targeted Assessment Modeling	
Cedar Lake	Stakeholder Group Targeted Assessment Modeling	Stakeholder Group Targeted Assessment Modeling	Determining TMDL applicability-2006
City of Denton Watershed	Targeted Assessment	Targeted Assessment	

Project/Waterbodies	2006-Projected	2006-Actual	Comments
Plan (Hickory Creek)	Implementation	Implementation	
Clear Creek Legacy and VOC Pollutants	Targeted Assessment Implementation	Targeted Assessment Implementation	TMDLs approved-2001/2003 I-Plans approved-2001
Clear Creek Watershed	Implementation	Modeling Action Plan Implementation	TMDL adopted-2006 I-Plan approved-2006
Coastal Bend Bays Plan	Implementation	Implementation	
Colorado and San Gabriel Rivers, Brushy and Petronilla Creeks	Implementation	Modeling	Brushy Creek / San Gabriel River delisted.
Concho River Basin	Targeted Assessment Implementation	Targeted Assessment Implementation	
Copano Bay Oyster Waters	Stakeholder Group Modeling Action Plan Implementation	Stakeholder Group Modeling	
Dallas Legacy Pollutants	Targeted Assessment Implementation	Targeted Assessment Implementation	TMDL approved-2001 I-Plan approved-2001
Dickinson Bayou	Action Plan Implementation	Targeted Assessment	
E.V. Spence	Implementation	Implementation	TMDL approved-2003 I-Plan approved-2001
Fort Worth Legacy Pollutants	Targeted Assessment Implementation	Targeted Assessment Implementation	TMDL approved-2001 I-Plan approved-2001
Galveston Bay Plan	Implementation	Implementation	
Gilliland Creek	Stakeholder Group Modeling Implementation	Stakeholder Group Modeling	
Guadalupe above Canyon	Stakeholder Group Modeling Implementation	Stakeholder Group Modeling	
Gulf Coast Oyster Waters	Implementation		
Houston Ship Channel-Dioxin Study	Modeling Implementation	Modeling Implementation	
Houston Ship Channel-Nickel Study	Implementation	Implementation	TMDL approved-2003 I-Plan approved-2001
Lake Austin	Implementation	Implementation	TMDL approved-2000 I-Plan approved-2001
Lake Granbury	Targeted Assessment Implementation	Targeted Assessment	
Lake Granger Watershed Plan	Stakeholder Group Implementation	Stakeholder Group Targeted Assessment Implementation	
Lake O'the Pines	Implementation	Implementation	TMDL adopted-2006
Lavaca and Chocolate Bays	Implementation	Implementation	
Martin Creek Reservoir	Implementation		waterbody delisted
MatagordaBay / Tres Palacios Bay	Stakeholder Group Modeling Implementation	Stakeholder Group Modeling Implementation	
Middle Brazos River Basin	Implementation		waterbody delisted
North Bosque River	Implementation	Implementation	TMDL approved-2001

Project/Waterbodies	2006-Projected	2006-Actual	Comments
			I-Plan approved-2002
Nueces Bay Zinc Project	Action Plan Implementation	Targeted Assessment Implementation	
Orange County	Action Plan Implementation	Targeted Assessment	
Oso Bay	Action Plan Modeling	Targeted Assessment Modeling	
Oso Creek and Oso Bay	Stakeholder Group Data Review Targeted Assessment Modeling	Data Review Targeted Assessment Modeling	
Pecos Watershed Plan	Targeted Assessment Implementation	Targeted Assessment Modeling	
Sabinal River	Stakeholder Group Targeted Assessment Modeling Implementation	Stakeholder Group Action Plan Modeling Implementation	TMDL approved-2005 I-Plan approved-2006
Salado Creek	Implementation	Implementation	TMDL approved-2003
San Antonio River Authority	Targeted Assessment Implementation	Action Plan	WPP finalized-2006
San Antonio River Basin, Leon River, and Peach Creek	Modeling Implementation	Modeling Implementation	
South Central Texas	Implementation	Modeling	
Tarrant Regional Water District Watershed Plan	Targeted Assessment Implementation	Targeted Assessment Implementation	
Trinity River	Stakeholder Group Modeling	Stakeholder Group Modeling	
Upper Oyster Creek	Targeted Assessment Modeling	Targeted Assessment Modeling	
Welsh Reservoir	Implementation	Implementation	waterbody delisted

Milestone Descriptions:

Stakeholder Group - Employ or develop a Local Watershed Committee to solicit input and encourage the participation of affected stakeholders in the decision-making process.
Data Review - Complete the assessment of pollutant problems by reviewing existing water quality data, conducting an inventory of point/nonpoint sources, land use data, and all known stressors influencing water quality.
Targeted Assessment - Complete water quality monitoring. Analyze data, assess loadings, and determine the origin and distribution of pollutants.
Modeling - Develop and apply model(s) to determine numerical load allocations. Recommend control strategies for implementation.
Action Plan - Develop a detailed action plan (TMDL, I-Plan, or WPP) which establishes goals and objectives, load allocations, strategy for load allocation, timetable for implementation, and a list of expected results.
Implementation- Implement voluntary and regulatory actions in the watershed the BMP implementation based on follow-up verification monitoring of effectiveness**.**

Acronyms

BMP–Best Management Practice
BST–Bacterial Source Tracking
CMIP–Composted Manure Incentive Program
CMP—Coastal Management Program
CWA–Clean Water Act
CWQMN–Continuous Water Quality Monitoring Network
DMES–Dairy Manure Export Support
EMRS–Environmental Monitoring and Response System
EPA–Environmental Protection Agency
GBEP–Galveston Bay Estuary Program
GIS–Geographic Information System
GPS—Global Positioning System
I-Plan–Implementation Plan
LCRA-Lower Colorado River Authority
NPS–Nonpoint Source
PAHs—Polycyclic Aromatic Hydrocarbons
PCBs—Polychlorinated Biphenyls
TCEQ–Texas Commission on Environmental Quality
TMDL–Total Maximum Daily Load
TSSWCB–Texas State Soil and Water Conservation Board
TxDOT—Texas Department of Transportation
USGS—United States Geological Society
WPP–Watershed Protection Plan