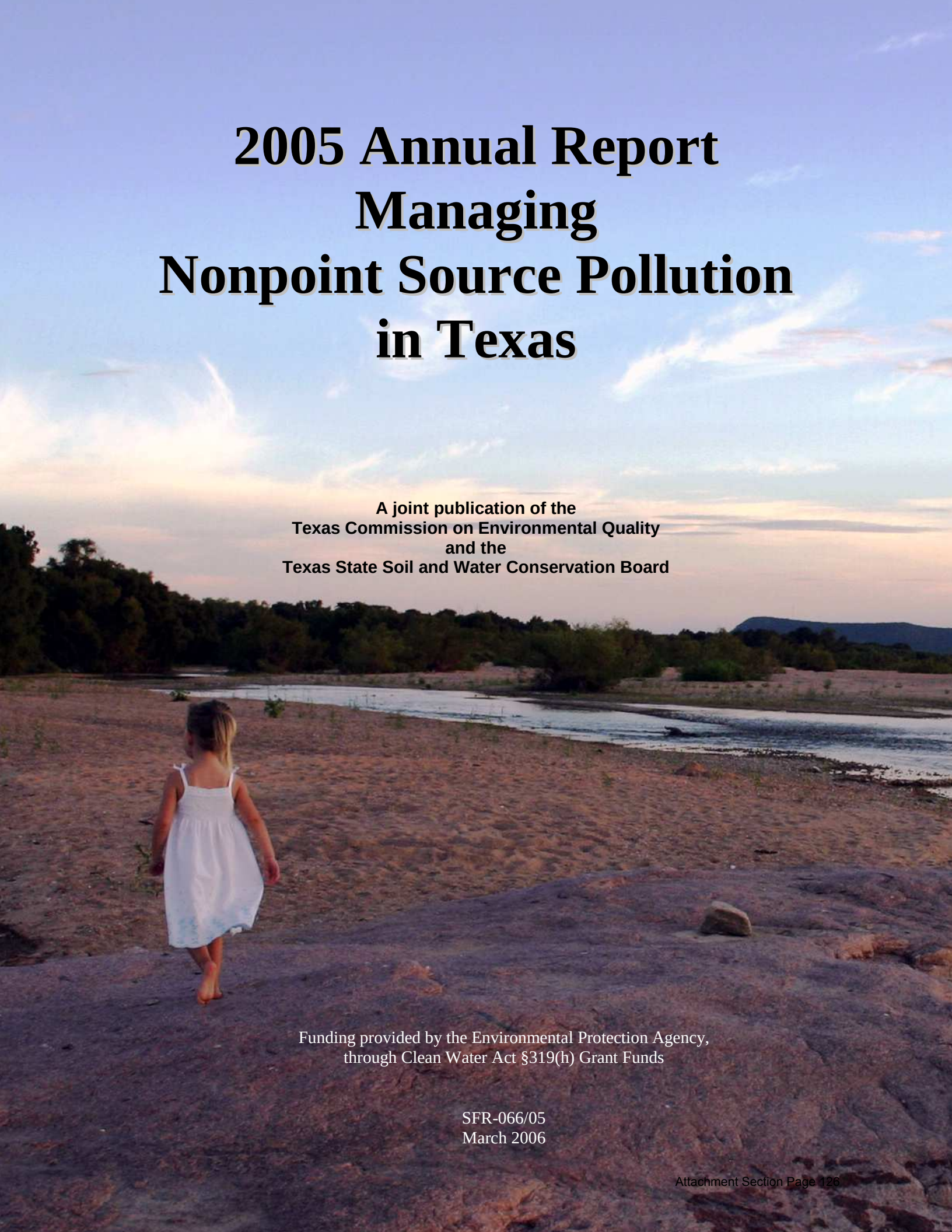
2005 Annual Report Managing Nonpoint Source Pollution in Texas



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and the
Texas State Soil and Water Conservation Board

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*Cover photo was taken on the Llano River near Kingsland, Texas by Cory Horan.

LETTER FROM THE EXECUTIVE DIRECTORS

The Texas Commission on Environmental Quality and the Texas State Soil and Water Conservation Board jointly lead the State of Texas in implementing nonpoint source pollution prevention and abatement activities in partnership with the U.S. Environmental Protection Agency and other federal, state, regional and local watershed stakeholders. The extent and variety of nonpoint source impairments make the voluntary efforts of citizens, businesses, service organizations, and other groups an essential part of the effort to address nonpoint source pollution.

The State of Texas implements a watershed approach to address nonpoint sources of pollution in both surface and ground water. The watershed approach is used to identify water quality issues, establish statewide and local water quality priorities, develop holistic community-based solutions, and to collaborate with local stakeholders to implement those solutions. This watershed approach is based on four principles: 1) a geographic focus based on hydrology rather than political boundaries; 2) water quality objectives based on scientific data; 3) coordinated priorities and integrated solutions; and 4) diverse, well-integrated partnerships. The federal Clean Water Act §319(h) Grant Program has afforded Texas the ability to implement and maintain this strategy.

This *2005 Nonpoint Source Annual Report* as required by §319 of the Clean Water Act, reports Texas' progress towards reducing nonpoint source pollution. It highlights the State's efforts during 2005 to collect data and assess water quality, implement projects that reduce or prevent nonpoint source pollution, and educate and involve the public to improve and maintain the quality of water resources for current and future generations of Texans.

Glenn Shankle
Executive Director
Texas Commission on Environmental Quality

Rex Isom
Executive Director
Texas State Soil and Water Conservation Board

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CHAPTER 1
Introduction

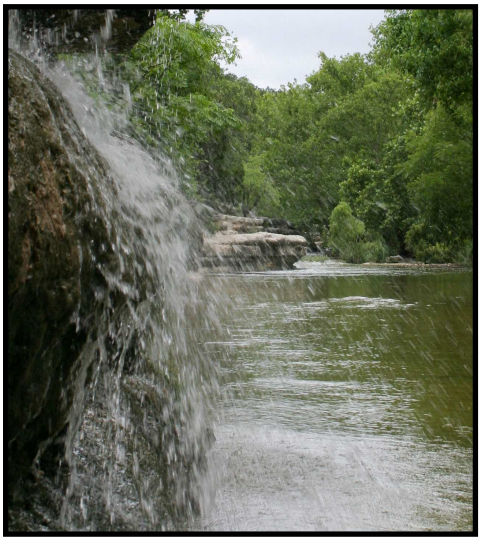
Defining Nonpoint Source Pollution

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.



Bull Creek Waterfall

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. Final approval is expected by the Environmental Protection Agency (EPA) in early 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 (BMP) 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 (TWQI) and 303(d) 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 (TGPC).

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 FY2005, the TCEQ had 44 ongoing 319(h) grant-funded projects addressing a wide range of NPS issues. Federal funds totaling $27 million were primarily being used for assessment, implementation, and education work to address multiple activities and sources as indicated on the chart below.

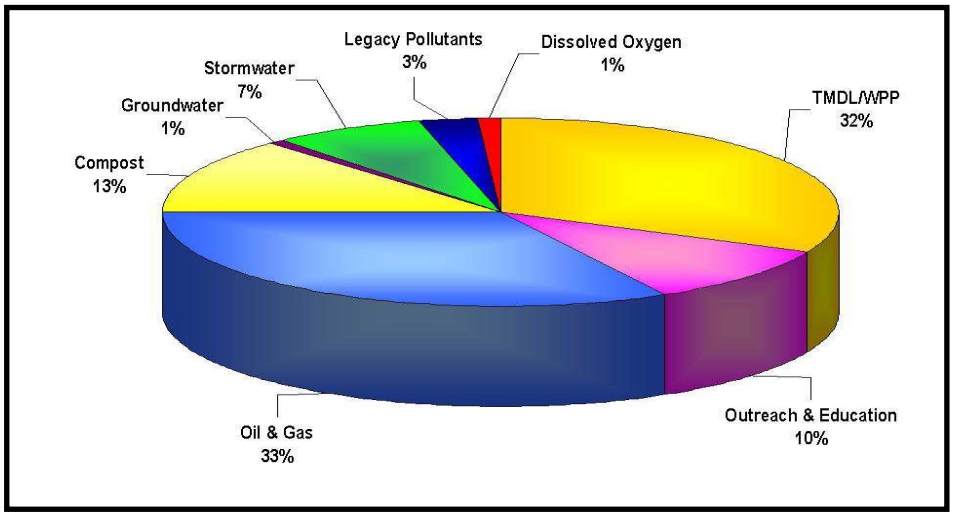


Figure 1.1 TCEQ current NPS grant-funded projects.

In FY2005, the TSSWCB had 56 ongoing 319(h) grant-funded projects addressing a wide array of agricultural and silvicultural NPS issues. Federal funds totaling $26 million were primarily being used to address NPS pollution from dairy and poultry operations, prevent atrazine runoff, implement best management practices (BMPs), support various NPS education programs, and develop Watershed Protection Plans (WPP) as indicated on the chart below.

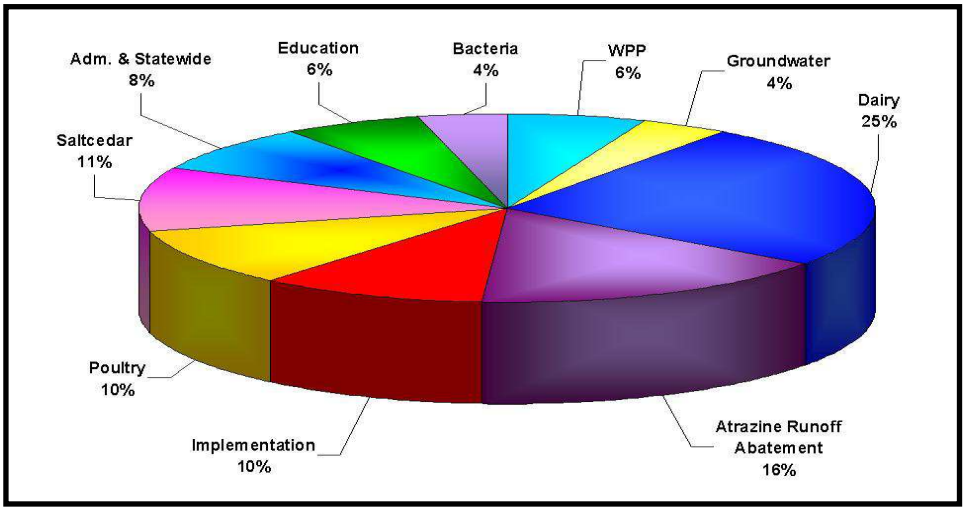


Figure 1.2 TSSWCB current NPS grant-funded projects.

Chapter 2

NPS Data Collection and Assessment Activities

Water quality assessment activities in Texas are coordinated by the TCEQ and include identification of high priority impaired and/or impacted water bodies, vulnerable or impacted aquifers, and areas where additional information is needed. Monitoring is conducted to evaluate the effectiveness of management practices, regulatory measures, watershed improvements, and restoration plans. This chapter highlights some of the noteworthy activities, conducted in Texas in FY2005, related to the NPS short-term goal of Data Collection and Assessment.

Generation of the biennial *Texas Water Quality Inventory and 303(d) List* is mandated by the CWA §305(b) and § 303(d). The *Joint Groundwater Monitoring and Contamination Report* is required under the Texas Water Code 26.408.

Assessment of Water Quality in Texas

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 *2002 Inventory and List* was approved by the EPA on February 3, 2005. The TCEQ expects approval of the *2004 Inventory and List* by the EPA in early 2006. The development of the *2006 Inventory* and *List* is currently in progress and due to EPA in April, 2006.

There were 306 water bodies listed as impaired for one or more parameters in the *2004 Inventory and List*. Table 2.1 illustrates the relative proportion of ten general causes of impairment and the number of those caused by NPS sources only, or both NPS and point sources.

Improvements in water quality have been identified for several areas that have NPS implementation projects in place. The E.V. Spence Reservoir has demonstrated a notable improvement in sulfate and chloride concentrations and these new data will be assessed for the *2006 Inventory and List*. Nine water bodies surrounded by farmlands were identified several years ago as having elevated levels of the herbicide atrazine which threatened or impaired the use of the resource as drinking water supplies. As a result of voluntary BMPs, atrazine concentrations in water have dropped dramatically in all of these water bodies. In the *2004 Inventory and List*, seven of the water bodies demonstrated safe levels based on surface water assessments, and the other two water bodies will be assessed with recent data for 2006. NPS controls have been underway for several years in the North Bosque River watershed and extensive monitoring is expected to document improvements in water quality within the next several years.

Table 2.1 2004 Texas Water Quality Inventory and 303(d) List

Category	Sub-category	2004 Number of Water Body/Parameter Combinations	Use	NPS only	Both NPS and PS
Bacteria	in water	183	Recreation	54	124
	in shellfish	14	Oyster Waters	14	0
Dissolved Oxygen		104	Aquatic Life	22	79
Toxicity	in ambient water	7	Aquatic Life	1	6
	in ambient sediment	5	Aquatic Life	2	3
Organics	in water	0	Fish Consumption, Aquatic Life	0	0
	in fish/ shellfish	38	Fish Consumption, Aquatic Life	11	1
Metals	in water	10	Fish Consumption, Oyster Waters, Aquatic Life	1	7
	in fish/ shellfish	14	Fish Consumption, Oyster Waters, Aquatic Life	14	0
Dissolved Solids	chloride	8	General Use	7	1
	sulfate	2	General Use	2	0
	total dissolved solids	11	General Use	9	2
Temperature		1	General	0	0
pH		13	General	3	10
Nutrients	nitrogen	1	General, Public Water Supply Use	1	0
Biological	habitat, macrobenthos community, or fish community	7	Aquatic Life	5	2

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.

The map shows the existing CWQMN sites. The TCEQ plans to establish 10 additional CWQMN sites during FY2006.

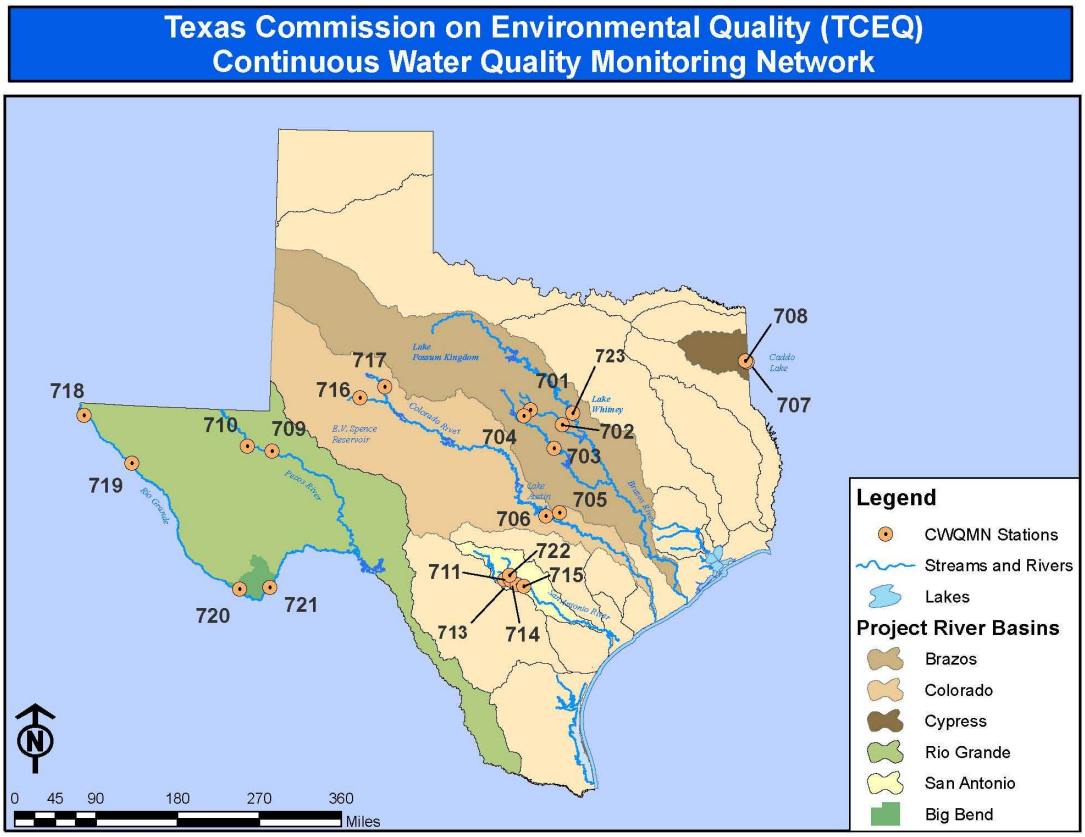


Figure 2.1 Continuous Water Quality Monitoring Network

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 FY2007 and beyond based on:

- demonstrated data needs
- availability of monitoring technology to address the specific data needs
- the benefit to human health and the environment
- 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 Caddo Lake Institute, Lower Colorado River Authority, Colorado River Municipal Water District, 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 four sites in the Bosque and Leon River watersheds and two sites in the Upper Colorado River watershed.

Bosque and Leon River Watersheds

The four sites in the Bosque and Leon River watersheds are monitored for nutrients (ammonia, nitrate, and total reactive phosphorus), as well as conventional parameters. Collectively, these four sites constitute the TCEQ's Environmental Monitoring and Response System (EMRS) Bosque/Leon Water Pilot Project. The EMRS was designed to monitor water quality at remote sites on a continuous basis, communicate the results electronically to TCEQ headquarters where the data are displayed on the Internet, and issue automated notifications when established trigger levels are exceeded. This information is used to target field responses to investigations of likely sources of pollutants. Expansion of the EMRS Bosque/Leon Water Pilot with four additional sites in the Bosque River watershed is scheduled for FY2005. These sites will monitor individual subwatersheds.

Upper Colorado River and E.V. Spence Reservoir

The two CWQMN sites on the Upper Colorado River monitor temperature and specific conductance. The sites are operated by the Colorado River Municipal Water District (CRMWD), which uses the data to make decisions concerning diversion of waters with high concentrations of total dissolved solids from the river to off-channel evaporation ponds. The dissolved solids are, at least in part, a NPS pollutant associated with past oil and gas exploration and development in the area. The diversions reduce the loading of total dissolved solids to E.V. Spence Reservoir, a domestic water supply reservoir, and reduce potable water treatment costs for CRMWD and the public.

Assessing Bacteria Impairments

Numerous surface waters in Texas are impaired by high levels of bacteria, which are indicators of fecal pollution. The presence of high numbers of these fecal 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 *E. coli* and other fecal coliform bacteria in water do not identify the human or animal sources of pollution. These methods simply count the number of bacteria present to indicate the severity of fecal contamination.

Tracking of Sources Further Defines Impairments

Scientists with The Texas A&M University System have developed genetic and phenotypic bacterial source tracking (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 and the San Antonio area. The BST libraries are used to indicate possible animal and human origins of *E. coli* bacteria isolated from water samples collected in these water-sheds; 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. Funding has been provided by the EPA, TSSWCB, TCEQ, and the Texas Agricultural Experiment Station.

Bacteria Workgroup of the TMDL Program

Bacteria impairments present unique technical challenges for assessment and control. The TCEQ Total Maximum Daily Load (TMDL) Program has established an internal workgroup to oversee the development of TMDLs and implementation plans (IP) for water bodies impaired by bacteria. The workgroup discusses TMDL development, provides consistency among bacteria TMDLs developed by the agency, provides support for project managers, and facilitates communication among TCEQ programs and external organizations on issues related to bacteria impairments.

Watershed Protection Plans Under Development in 2005

In Texas, Watershed Protection Plans (WPPs) are implemented to coordinate activities and resources that facilitate restoration of impaired water bodies where TMDLs are not yet planned or have not been fully developed. These plans may also be developed to address threatened waters before they become impaired or to protect water quality.

Total Maximum Daily Load (TMDL)
A document that allocates daily loading limits of pollutants to an impaired water body. This document requires state and federal approval.

Implementation Plan (IP) - A plan that provides a summary of management and implementation strategies needed to restore water quality in an impaired water body as allocated by a TMDL. This document requires only state approval.

Watershed Protection Plan (WPP) –
A plan that guides water quality management measures and implementation strategies needed for impaired or threatened water bodies. WPPs may also be developed to prevent water quality impairments. This document requires no formal state or federal approval.

This voluntary, locally-driven process:

- serves as a tool to better leverage the resources of local governments, state and federal agencies, and non-governmental organizations
- addresses complex water quality problems that cross multiple jurisdictions
- integrates activities and prioritizes implementation projects based upon technical merit and benefits to the community
- promotes a unified approach for implementation, and
- creates a coordinated public communication and education program

While WPPs have a variety of components and can take many forms, Texas 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 Watershed Protection Plan Program, visit the website http://www.tsswcb.state.tx.us/programs/watershed.html

The following WPPs have been initiated across the state within the past two years:

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 geomorphology of the Arroyo Colorado as it is to the loading of nutrients and oxygen-demanding substances (BOD) from the non-tidal portion (Segment 2202). Based on this information, the Arroyo Colorado Watershed Partnership and Steering Committee is developing a WPP to improve conditions in the watershed. The Steering Committee has established several work groups to address the five major components of this

plan: wastewater infrastructure, agricultural issues, habitat restoration, refinement of the TMDL analysis, and public education. A final draft plan for approval by the stakeholders is due in early 2006. The Arroyo Colorado Watershed Coordinator is Laura de la Garza with the Texas A&M Texas Sea Grant (TSG) Program (lauradlg@neo.tamu.edu or (956) 239-2132).

Cedar Creek Reservoir Watershed

Cedar Creek Reservoir (Segment 0818) has several parameters of concern according to the *draft 2004 Texas Water Quality Inventory (TWQI)*. It is impaired for high pH and has concerns for dissolved oxygen, ammonia, orthophosphate, total phosphorus, and excessive algal growth. The eutrophic state of Cedar Creek Reservoir is being addressed by participants in the North Central Texas Water Quality Project. 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. The point of contact is Woody Frossard with the Tarrant Regional Water District (wfrossard@trwd.com or (817) 335-2491).

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 *draft 2004 TWQI and 303(d) List*. Lake Lewisville is not currently on the *303(d) List*, but there are significant issues of concern that have the potential to threaten the designated uses. Significant growth is anticipated within the surrounding area in the course of the next several years which will increase stress to the assimilative capacity of this water body. The City of Denton has opted for development of a WPP with primary objectives for development of targeted assessment data and a program that will use incentive-based approaches to accelerate specific BMP implementation. The point of contact is Kenneth Banks, with the City of Denton (KennethBanks@cityofdenton.com or (940) 349-7165).

Concho River Watershed

According to the *draft TWQI and 303(d) List*, the macrobenthic community is impaired along Segment 1421 of the Concho River and Segment 1425 is impaired for chlorides and total dissolved solids. This WPP is designed to evaluate and assess potential sources of NPS pollution basin-wide and to provide for development of control strategies. Some components of this plan include continued water quality monitoring at numerous sites, hydrologic monitoring of ground and surface waters, development of water quality and hydrologic databases, continued development of a comprehensive basin-wide GIS system and public participation/outreach efforts. The point of contact for this watershed is Fred Teagarden with the Upper Colorado River Authority (fteag@ucra.tx.org or (325) 655-0565).

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, Susan Benner with Texas Sea Grant , is responsible for encouraging stakeholder involvement, along with the development of a consensus-based watershed plan. The point of contact is Susan Benner with Texas Sea Grant (sbenner@tamu.edu or (281) 218-6340).

Lake Granbury Watershed

This WPP will address the concern of elevated bacterial concentrations in Lake Granbury (Segment 1205). It is in the initial developmental stages and preparations are being made to clearly define the plan objectives prior to organizing stakeholder meetings. The Lake Granbury Watershed Coordinator is Tiffany Morgan with the Brazos River Authority (tmorgan@brazos.org or (254) 761-3100).

North Bosque River Watershed

This water body is listed for bacterial impairments and nutrient concerns. Segments 1226 and 1255 are currently operating under a federal and state approved TMDL and a state approved Implementation Plan (IP) for soluble reactive phosphorus. A WPP would facilitate remediation efforts in remaining segments of the water body and enhance the existing TMDL/IP. The objectives of this WPP 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 this watershed is John Ellis with the Brazos River Authority (jellis@brazos.org or (254) 761-3175).

Pecos River Watershed

Segment 2310 of the Pecos River is on the *2002 TWQI and 303(d) List* for chloride, sulfate, and total dissolved solids. Objectives of this WPP include development of a baseline assessment on the Pecos River Basin with regard to stream channel morphology, riparian vegetation, land use, salinity mapping, water inflows and outflows, aquatic habitats, historical perspectives and economic modeling. Effectiveness of salt cedar control within the watershed will be analyzed to estimate the effect on salinity concentrations and fate of salvaged water. The Texas Cooperative Extension (TCE) will work with various state and local agencies to assemble a series of publications and to conduct a series of educational meetings targeted toward landowners and policymakers in the Pecos River Basin. The point of contact for this watershed is Charles Hart, with the TCE (cr-hart@tamu.edu or (254) 761-3175).

Upper San Antonio River Watershed

The *2002 TWQI and 303(d) 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 the San Antonio River basin. The Bexar Regional Watershed Management Partnership has initiated a WPP for the upper eight miles of the San Antonio River. This project will complement the TMDL activities by establishing a framework for local implementation planning for the urbanized portion of the watershed. 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

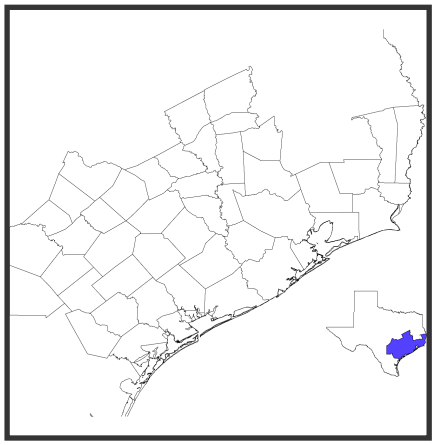


Figure 2.2 TSSWCB Wharton Field Office Service Area

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 (SWCDs) comprising 47 counties across southeast and south central Texas (see Fig. 2.2). A Regional Watershed Coordination Steering Committee (WCSC), 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, has been established. This WCSC is tasked with steering the project toward achievement of successful WPP development and implementation by identifying and prioritizing those watersheds most in need of coordinated watershed protection planning. The Regional Watershed Coordinator will utilize this prioritized list to facilitate locally driven stakeholder groups and

to provide technical expertise to those groups in developing and implementing WPPs.

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 second year (FY2006). This coordinated watershed protection planning project is funded through TSSWCB with a CWA §319(h) grant. For additional information, visit the project website: http://www.tsswcb.state.tx.us/programs/wharton_wcsc.html or contact Brian Koch at (972)532-9496 or bkoch@tsswcb.state.tx.us.

The Arroyo Colorado TMDL

A TMDL is generally defined as the maximum amount of a pollutant that can be assimilated by a water body while still maintaining surface water quality standards. Between 1998 and 2002, the TCEQ conducted a TMDL analysis of the Arroyo Colorado. The analysis concluded that the physical setting in the Arroyo Colorado (particularly segment 2201, the tidally influenced portion of the Arroyo), contributes significantly to the observed dissolved oxygen (DO) impairment and that even extreme reductions (up to 90 percent) in the loading of constituents of concern into the Arroyo Colorado will not achieve the TMDL endpoint target.

Given this conclusion, the 2002 TMDL analysis could not support implementation of a quantitative, water quality target-based allocation of loadings of constituents of concern. However, the analysis showed improvements in water quality and reduction in the environmental stresses to aquatic life can be achieved through the reduction of nutrients, biochemical oxygen demand (BOD), and sediment loadings into the Arroyo Colorado.

The predictive water quality models used to develop the TMDL for the Arroyo Colorado in 2002 were limited by the availability of physical, biological, and biochemical data for critical areas of the tidal segment. In an effort to reduce uncertainty in the TMDL analysis, the Arroyo Colorado Watershed Partnership formed the TMDL/Further Study Work Group. The goal of the work group is to collect the data necessary to address data limitations and information gaps. The work group convened in June of 2004 and developed a preliminary sampling plan to collect the necessary data in October 2004. Sampling began in fall 2005.

Assessment of Arsenic in Texas Groundwater

The federal standard (i.e., maximum contaminant level (MCL)) for the presence of arsenic in drinking water was recently lowered from 50 µg/L to 10 µg/L, which indicated that arsenic is a widespread concern for groundwater in Texas. Approximately six percent of all wells tested exceed the new MCL. Contamination is concentrated in the southern High Plains and southwestern Gulf Coast regions where about one third of area wells exceed the MCL.

The Texas Groundwater Protection Committee funded a study, conducted in FY2005 by the University of Texas' Bureau of Economic Geology (BEG), which assessed the extent of arsenic contamination found within these two regions. The study comprised the following tasks:

- Groundwater arsenic concentrations in surrounding states were examined and research pertaining to elevated arsenic levels within the United States was reviewed.

- Potential anthropogenic sources of arsenic, such as pesticides, in the southern High Plains and the southwestern Gulf Coast, were examined using GIS-overlay analyses and soil sampling data.

- Potential geologic sources of elevated arsenic concentrations in groundwater were evaluated in the southern High Plains and southwestern Gulf Coast using relationships between arsenic concentrations and various geologic units.

- Relationships between arsenic concentrations and other ions, particularly oxyanions, were evaluated using existing databases (TWDB, National Uranium Resource Evaluation-NURE, and TCEQ) to assess sources of arsenic.

- In addition, a limited amount of groundwater sampling was conducted in Duval County in the Gulf Coast region. The impact of different redox conditions on the distribution of arsenic was also examined.

Results showed that groundwater arsenic concentrations were not correlated with land use or nitrate concentrations in the southern High Plains area. The lack of correlation between arsenic concentration and water table depth does not support a surface source for arsenic. Volcanic ash associated with the Catahoula Formation is the most likely source of high arsenic concentrations in the southwestern Gulf Coast aquifer. Correlations between arsenic and other oxyanions typically associated with volcanism (molybdenum and vanadium), as well as the general decrease in arsenic contamination away from this formation strongly support this hypothesis.

Numerous questions were raised by this study which should be addressed in future studies. The widespread distribution of water soluble arsenic in soils in both regions should be evaluated to determine if arsenic in rangeland and in deeper portions of cultivated profiles is related to this type of volcanic ash.

City of New Braunfels Assessment Project Leads to Drainage Area Master Plan

In 2004, the City of New Braunfels initiated a CWA §319(h) project funded by the TCEQ to conduct assessments of the major water bodies within the City and its extra territorial jurisdiction (ETJ). The water bodies included Dry Comal Creek, Bleiders Creek, Comal River, Guadalupe River, North Tributary of the Guadalupe River and South Tributary of the Guadalupe River. Over the past 30 years, these watersheds have experienced intense storm events that produced major flooding throughout the City. As a result, City officials developed a master plan that evaluated existing drainage conditions and proposed solutions to mitigate or eliminate future flood threats to the City and its inhabitants.

As part of the master plan, the City included a water quality component with guidelines that addressed the impacts of NPS pollution to preserve and enhance water quality. Project activities included: stream assessment, estimation of NPS loads, and master plan development. Stream assessment consisted of: developing assessment guidelines, field instructions, conducting walk-through and windshield surveys of the watersheds; and preparing inventories of wetlands, threatened endangered species, and cultural resources. Estimation of NPS loads included: delineating watershed boundaries, developing/ calibrating a model, identifying/reviewing event mean concentration (EMC) values of the area, mapping model results, and preparing a technical memorandum. Master plan development included: identifying stream erosion and/or habitat problems, proposing BMPs, amending the City's Drainage Master Plan to address BMPs, and developing an implementation strategy for the BMPs.

Using the watershed modeling approach, the City determined that there was a need for storm water BMPs that would maintain or improve aquatic integrity. Based on the model results, several areas were identified as “hot spots” where annual nutrient and sediment loadings were significant per unit area. The lowest pollutant loads were found in the more rural areas in the northern portion of the City’s service area. The City of New Braunfels will use the results of the assessment to forecast the impacts of future land use changes on storm water runoff and to guide decision making for BMP placement throughout the City and its ETJ.

CHAPTER 3

Implementation Activities

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 (WQMPs) 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.

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

North Bosque River Restoration Initiative

The largest composting program ever implemented in Texas continued in the North Bosque and Leon River watersheds in 2005. 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 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. Based on remaining funds, the DMES program was projected to end in September 2005. However, an additional appropriation from the 79th Texas Legislature and a CWA §319(h) grant through the TSSWCB will enable the project to be phased out at a reduced reimbursement rate over the course of an additional year.

As of September 30, 2005 more than 918,000 tons of manure has been hauled to commercial composting facilities (Figures 3.1 and 3.2). It is estimated that this prevented the land application of more than 3 million pounds of phosphorus.

Texas Institute for Applied Environmental Research (TIAER) has released a report titled *Evaluation of the Manure Composting Program on Stream Water Quality: Interim Update Through 2004.* The report indicates that at three sampling sites in the tributaries of the North Bosque River there is a positive correlation between participation in the compost program and reduction in phosphorus concentrations in

the stream. Significant decreases from 19 to 23 percent were indicated at these three sites which had the highest level of manure removed per cow and drainage area.

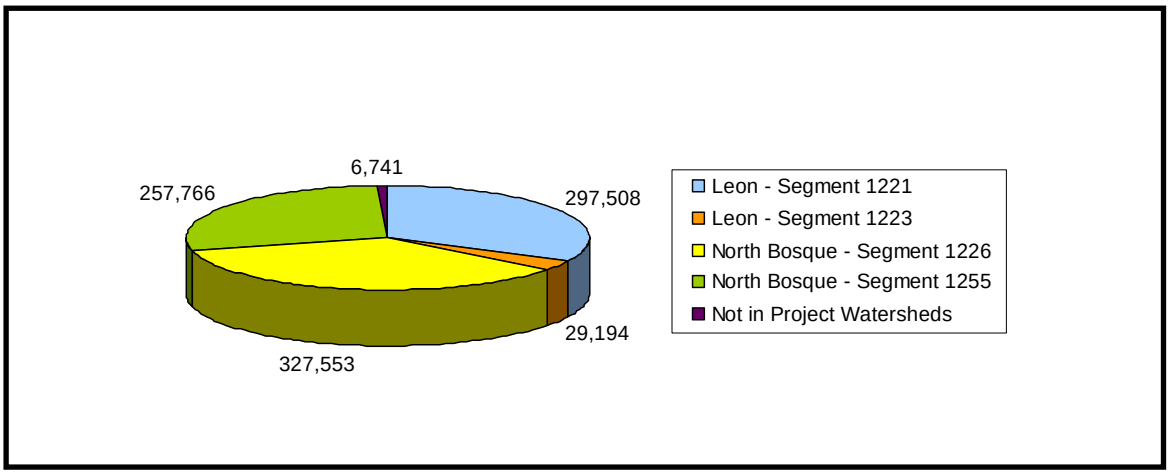


Figure 3.1 Dairy manure tons hauled by watershed through September 30, 2005.

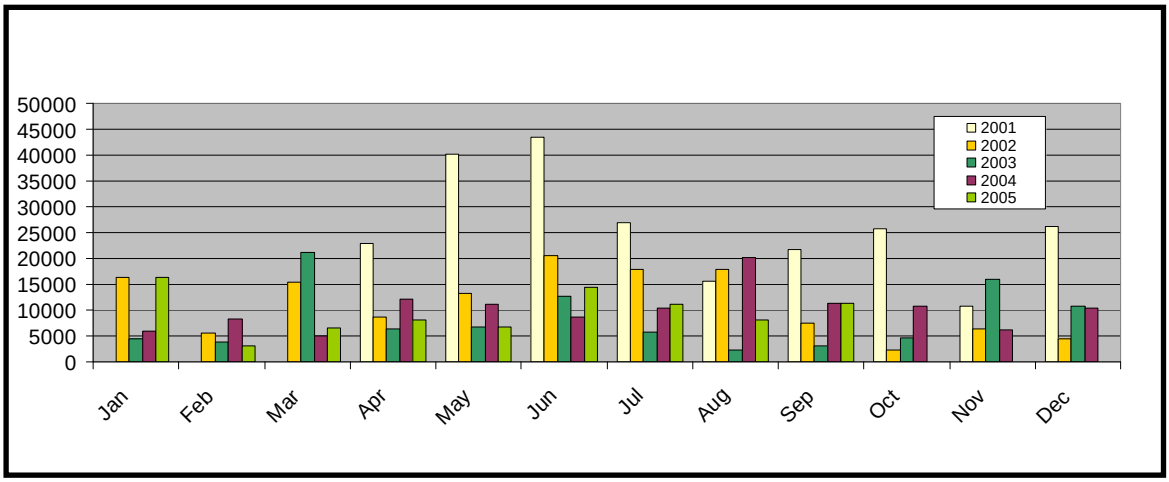


Figure 3.2 Dairy manure tons hauled by month – April 1, 2001 – September 30, 2005.

Composted Manure Incentive Program

Some important achievements in removing phosphorus-rich manure from the watersheds and developing markets for compost were made in 2005.

- The Texas Department of Transportation (TxDOT) bought and applied more than 385,000 cubic yards of composted manure originating in the North Bosque and Leon River watersheds for over 200 highway construction and maintenance projects utilizing compost for stabilizing and re-vegetating roadsides.

- More than 20 cities, counties, school districts, and universities bought compost for parks, athletic fields, and golf courses. The City of Arlington is converting all four of its municipal golf

courses to an organic approach based on preliminary results demonstrating the use of dairy manure compost to reduce irrigation and pesticide use.

- Private developers began to utilize composted dairy manure to prevent erosion at construction sites and to establish vegetation in new subdivisions. Two nationally known homebuilders incorporated the use of compost mulch and filter berms in their Houston division operations.

- Both Texas Cooperative Extension and TCEQ's Small Business and Environmental Assistance Program conducted workshops and demonstrations in 2005 for the CMIP to support awareness and market development for composted manure.

The TCEQ, in partnership with U.S. Army's Fort Hood and the Texas Water Resources Institute (TWRI), is currently demonstrating the benefits of using composted dairy manure to improve vegetation growth in denuded and drastically disturbed areas on Fort Hood's combat vehicle training grounds.

In a similar project, TCEQ in partnership with Vulcan Materials Co, the University of Texas Centre for Research in Water Resources, and TIAER, is testing the effectiveness of composted manure erosion control treatments in reclaiming rock quarries in Parker County.

As of August 31, 2005, the CMIP recorded sales of over 406,000 cubic yards of manure compost. Approximately 78 percent of the total sales went to beneficial uses outside the North Bosque and Leon watersheds, which equates to more than 900,000 lbs of phosphorus exported from the two watersheds. The figure below shows the hauling, composting and exporting of manure from the North Bosque watershed in relationship to the TMDL target for manure export.

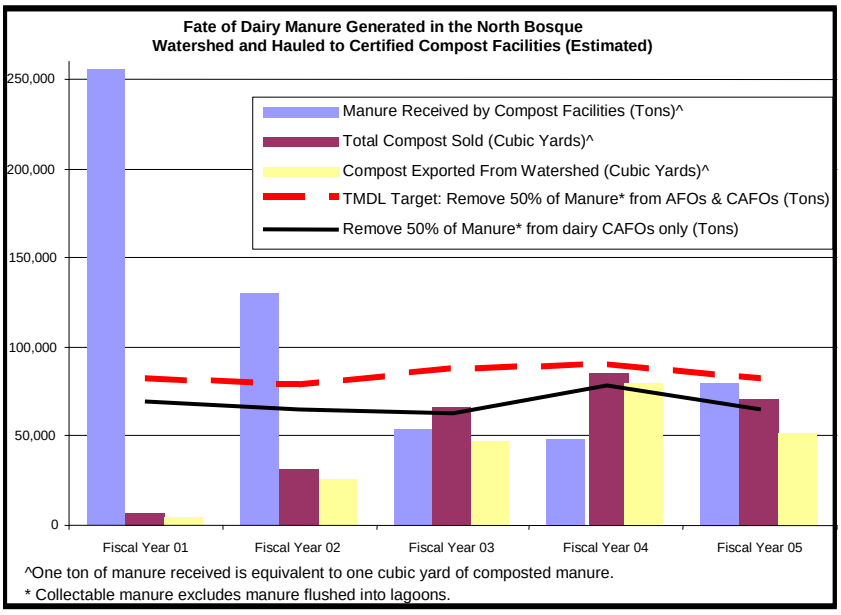


Figure 3.3 Fate of North Bosque watershed dairy manure received at CMIP facilities

The 79th Texas Legislature appropriated funds to the TCEQ enabling the agency to expand its North Bosque and Leon watershed compost marketing efforts. The TCEQ will continue to implement the CMIP until August 31, 2006; however, the purchase incentive will be reduced in conjunction with the reduced

DMES hauling incentive, helping to wean all parties gradually from the cost-share assistance. During the upcoming year, the TCEQ will be working with the quarry and mining industry and Fort Hood as other potential markets for dairy manure compost.

Evaluating New Technologies for Reducing Nutrients in Dairy Effluent

The TSSWCB, TCE, and Texas Water Resource Institute (TWRI) are collaborating to demonstrate and evaluate six new technologies aimed at reducing phosphorus from dairy lagoon effluent before being applied to waste application fields. The two technologies evaluated in FY2005, Geotube™ de-watering and electrocoagulation, both appear to reduce phosphorus levels in lagoon effluent.

Partially filled Geotubes™

The Geotube™ de-watering system was demonstrated by Miratech Division on the Triple X Dairy in the Leon River watershed. Geotube™ technology uses large porous tubes made from heavy-duty synthetic fabric. Lagoon effluent is pumped into the tubes after alum and a polymer are added to bind and precipitate phosphorus. As the liquid leaves the porous tubes solids larger than the tube pore size are trapped. Once the tubes are full, the dried solids can be hauled off. Substantial reductions in total solids, volatile solids, and soluble phosphorus have been observed. Dairy producers are eager to learn more about the economics and performance of Geotube™.

Electrocoagulation (EC) technology was demonstrated by Ecoloclean Industries on the OSVE Dairy in the Bosque watershed. Lagoon effluent is pumped into a holding tank and processed to remove phosphorus with aluminum and/or iron electrodes. Positively charged ions from the electrodes attract negatively charged phosphorus ions. The phosphorus bound to aluminum or iron is then removed by filtration, dissolved air floatation, and skimming methods. Preliminary results of the Ecoloclean system show that significant reductions of soluble phosphorus were achieved. With the exception of one sampling date when only a 75 percent reduction was observed, the Ecoloclean system reduced soluble phosphorus by more than 99 percent.

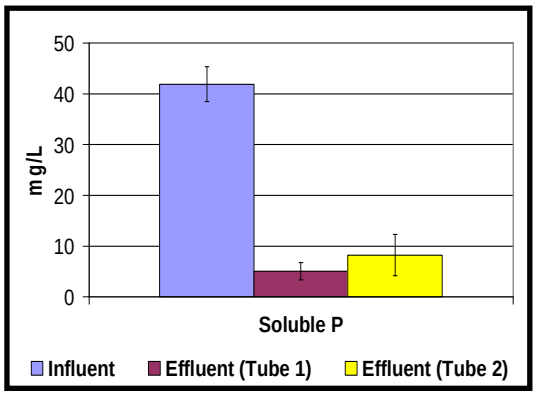


Figure 3.4 Soluble phosphorus reduction following Geotube™ treatment.

A further assessment of these data and the cost effectiveness of the two systems will be completed by the end of the year. Two other technologies will be evaluated during fiscal year 2006, EnviroLink's: L4DB microbial technology and Envirotech's: Bauxsol™ technology.

Two additional technologies will be evaluated in FY2007. The TCE will develop fact sheets on each technology for producers, regulators, and agri-businesses to utilize.

Urban Uses of Dairy Manure Compost

The construction of new homes and businesses is a continuous process in rapidly growing urban areas such as the Dallas-Fort Worth metroplex. Newly-constructed homes with landscapes consisting of ornamental plants and turf grasses tend to perform poorly over time due to inadequate initial soil preparation. Severely disturbed soil at construction sites lacks organic matter that serves to provide fertility and favorable physical properties. A practical soil amendment is dairy manure compost and it is readily available in many areas of Texas due to the presence of large dairy operations. A three-year study was conducted at the Texas A&M University Agricultural Research & Extension Center in Dallas to evaluate the effect of large single applications of dairy manure compost on the establishment of a typical urban landscape.

Effects of applying dairy manure compost on newly constructed landscape

Dairy manure compost had a positive impact on the growth of annual and perennial ornamental plants, but had little effect on woody ornamental plants. Bermuda turf grass exhibited increased growth and increased uptake of nitrogen and phosphorus with increasing amounts of dairy manure compost. Dairy manure compost also had a positive effect on soil physical properties. Soil was less compacted, which promoted root growth and improved water infiltration. The major concern with large applications of dairy manure compost is the build up of excess phosphorus in the soil. Soil tests showed sufficient phosphorus levels in the soils amended with dairy manure compost. Due to theses elevated levels, no additional phosphorus fertilizer applications would be required for several years. Repeated large applications of dairy manure compost are not recommended in order to reduce the potential for excess concentrations of soil phosphorus. Overall results of the study show an initial one-half to two inch application of dairy manure compost to soils impacted by construction will promote healthy plant growth and reduce the need for fertilizer and irrigation.

Texas Railroad Commission-Saltwater Minimization Projects

Salinity loadings contributing to the degradation of water quality are a consequence of both natural processes and human induced activities and are prevalent in numerous Texas river basins. Surface water traveling across mineral beds (salt flats), the dissolution of natural underground mineral deposits, and the concentration effects of plant life are the primary natural source loadings. Oil field activities, manufacturing, and farming practices are the primary anthropogenic sources.

Abandoned, unplugged and/or improperly plugged oil and gas wells with deteriorating casings provide a pathway for the migration of saline water into shallower fresh water aquifers and surface waters. This situation may be aggravated in areas where brine injection for disposal and/or secondary recovery operations may provide enough pressure to raise the level of naturally saline water into fresh water zones.

The Texas Railroad Commission (RRC) is charged with the regulation of oil field operations, which includes well plugging activities, and is working cooperatively with the TCEQ to perform saline reduction activities that will ultimately lead to elimination of the pollution threat posed by unplugged or improperly plugged wells. Plugging these dormant wells facilitates the abatement of chloride and mineral salts that contribute to impaired water body segments located within the Red/Canadian River watersheds (Segments 0205, 0211, 0812), the Upper Colorado River basin (Segment 1411), and Petronila Creek (Segment 2204). Well plugging activities performed by the RRC complement the TSSWCB's projects to control salinity from anthropogenic infestations of saltcedar.

The TCEQ awarded CWA §319(h) grant funding, to the RRC for the plugging of 230 wells. To date, the RRC has completed plugging efforts on 247 wells exceeding the original goal. In addition, another 42 wells have been approved for plugging. The RRC is gearing up for a new project targeting the Choke Canyon watershed (Segment 2116) with the goal of identifying, locating, and plugging many additional candidate wells.

Poultry Farm Activities in the Lake O' the Pines Watershed

Lake O' the Pines is located about 30 miles northeast of Longview and serves as a major drinking water supply for Longview and other municipalities in northeast Texas.

In the mid-1990s the poultry industry was identified as a possible contributor to low dissolved oxygen levels in the lake. A study was funded by TSSWCB through a CWA §319(h) grant to determine the impacts of land-applied poultry litter on runoff and groundwater. The study found no evidence that litter applied at agronomic rates was a significant contributor of pollutants to surface water or groundwater.

Between 1999 and 2001, another CWA §319(h) grant was funded to develop WQMPs for poultry farms located within the watersheds from Ferrells Bridge Dam upstream to Fort Sherman Dam.

WQMPs include appropriate agronomic rates of litter application, along with other BMPs suited for specific farms. Between 1995 and 2005, 65 WQMPs were developed and certified for poultry farms in this area. All farms within the watershed currently have WQMPs, except for five farms that are not required to obtain a WQMP until 2008.

Leveraging Other Federal Funding Mechanisms (USDA-NRCS EQIP)

The Environmental Quality Incentives Program (EQIP) was reauthorized in the 2002 federal Farm Bill to provide a voluntary conservation program for farmers and ranchers that promoted agricultural production and environmental quality as compatible national goals. Administered by USDA NRCS, EQIP offers financial and technical help to assist eligible participants install or implement structural and management practices on eligible agricultural land.

Financial assistance funds in Texas are used to address both local high priority practices identified by Local County Work Groups and statewide resource concerns identified by the State Technical Committee. Through-out FY2005, TSSWCB and TCEQ worked with the USDA Natural Resources Conservation Service (NRCS) and the State Technical Committee to establish a South Central Texas Water Quality State Resource Concern for FY2006 funding.

Impaired by high bacteria concentrations, several streams in south central Texas do not support their beneficial, designated use of contact recreation. TMDLs are being developed for Elm

Creek (Segment 1803A), Sandies Creek (Segment 1803B), Peach Creek (Segment 1803C), Lower San Antonio River (Segment 1901), and Atascosa River (Segment 2107). EQIP technical and financial assistance will leverage other federal and state programs addressing water quality in these watersheds.

The focus of EQIP funding will be towards protection of the streams from fecal deposition by livestock through fencing, alternative water sources and good grazing management on individual ranches along the five streams. Practices such as cross fencing, water wells, and watering facilities will be cost-shared at 50 percent based on the established county average cost of the practice. Incentive payments for prescribed grazing will also be offered. A sign-up period will be announced when Texas NRCS receives its FY2006 appropriation. For more information, see the Web site:
http://www.tx.nrcs.usda.gov/programs/EQIP/index.html

CHAPTER 4

NPS Education and Public Outreach Activities

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 is a critical aspect of managing NPS pollution. Public outreach and technology transfer are integral components of every NPS grant project, WPP, TMDL or IP. This chapter highlights some of the NPS education and public outreach activities conducted in Texas in FY2005. These activities are related to the NPS short-term goal of Education and Public Outreach.

Texas Watch Supports NPS Pollution Prevention Programs through Volunteers

Texas Watch supports the TCEQ's NPS pollution prevention program through a cooperative partnership between the TCEQ, Texas State University-San Marcos, and the EPA Region 6. Texas Watch conducts NPS education and training activities through a statewide network that includes the TCEQ Clean Rivers (CRP) and TMDL Programs, as well as universities, regional councils, municipalities and other basin planning agencies. Through this network Texas Watch supports monitoring projects by certifying volunteer monitors and trainers, coordinating watershed assessment projects, and conducting watershed education initiatives.

Texas Watch volunteers collect their data

In FY2005, the Texas Watch monitoring network was active in 17 of the 23 river basins in Texas with more than 3,416 volunteer hours contributing to 912 monitoring events at 157 sites, including three on-going watershed assessment projects. In addition, Texas Watch conducted 15 water quality monitoring certification sessions, conducted 15 presentations, hosted two regional meetings, produced three newsletters, helped coordinate and conduct nine Teaching Environmental Sciences classes, and redesigned its Web site at: http://www.texaswatch.geo.txstate.edu/

In an effort to support and enhance the CRP public input process, Texas Watch aided in promoting volunteer participation at some CRP Steering Committee meetings. Texas Watch is supporting the TCEQ's ongoing Arroyo Colorado and Petronila Creek TMDLs through monitoring and education activities in the project areas.

Texas Watch has received two additional grants from the EPA to expand activities in Dallas, Houston and Laredo during FY2006. These projects are designed to support under-served populations through activities that bring about water quality improvements.

As Texas Watch and the TCEQ look to the future, the program will work to further clarify Texas Watch's role in supporting CRP, TMDL and NPS public outreach in an effort to better address water quality and NPS pollution issues statewide.

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 CRP and of the NPS Management Program. Regionally, the TMDL Program coordinates its projects with the CRP Basin Steering Committees. For some TMDL projects, the existing CRP forum may serve as the advisory group for the project; for other projects, a separate advisory group is formed.

Statewide Coordination and Education

The TMDL Program stays in regular communication with its partners through project meetings and statewide stakeholder forums. Through its Web site, the TMDL Program provides an annual report, summaries of all completed and current TMDL projects, and program descriptions.

In September 2004, the TMDL Program began an e-mail news list to keep stakeholders up-to- date on TMDL program news. By November 2005, membership in the list had almost doubled, from 176 members to 315.

Regional and Local Participation

Members of advisory groups for TMDL projects represent the diverse interests of stakeholders in the project's watershed including local businesses, government agencies, agriculture, environmental and civic groups, wastewater dischargers, and individuals. In FY2005, the TCEQ's TMDL Program held 31 meetings working with 13 local stakeholder groups on projects that address surface waters impacted by NPS pollution. In addition, the TMDL staff met with CRP stakeholder groups or held public meetings to inform local residents about TMDL projects in their watersheds.

Each advisory group also works with the TCEQ and the project's lead organization to develop materials that are specific to local problems. Some examples of materials developed by and for advisory groups in 2005 are the brochures "Get to Know the Arroyo Colorado," and "Dioxin for Dinner? Why Catfish and Blue Crab Can be Harmful to Your Health," both of which are available in both English and Spanish.

Texas Silvicultural NPS Pollution Project

The Texas Silvicultural NPS Pollution Project funded by the TSSWCB has had a tremendous impact on water quality in the forested region of East Texas. By using forestry BMPs, the forestry community has prevented more than 12,000 tons of sediment from reaching streams and 100,000 tons of sediment from eroding off East Texas forestlands every year. This is enough sediment to cover a football field, to a depth of 35 feet.

The Texas Forest Service (TFS) recently began an innovative monitoring project designed to test the effectiveness of approved BMP recommendations.

East Texas near Palestine

This project will provide data on BMP effectiveness by measuring stream habitat, biological communities, and physiochemical properties on a before/after basis during forest operations. Preliminary results show that forestry BMPs are effective in maintaining water quality and aquatic stream health.

Recommended BMPs are proving to be very effective and are being implemented at a high rate. Implementation monitoring sites that have recently undergone some type of forest operation were randomly selected and evaluated to measure BMP implementation rates. The most recent set of evaluations showed an implementation rate of 92 percent, which is the highest consistent usage rate in the history of the program. To date, more than 1,000 forest operations have been evaluated for the implementation of BMPs and have demonstrated:

- Education and technical assistance have been vital to the success of this project.
- To date, almost 3,000 loggers have been trained in BMP utilization through 110 workshops. An online BMP refresher course was released in 2005 and 250 people have already participated in this course.
- More than 30 major forest landowner workshops targeting nearly 4,000 people have been held throughout Texas to inform landowners on the importance of BMPs, reforestation, and wildlife.
- New BMP demonstrations have been installed on the Jones State Forest showing loggers, landowners, and foresters innovative ways to protect water quality.
- An aggressive advertising campaign that includes radio and TV ads, newspaper articles, newsletters, and billboards has targeted more than one million people.

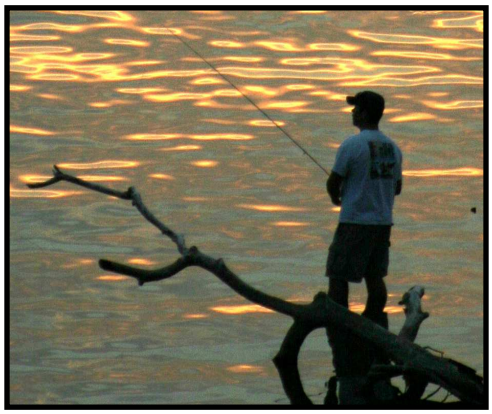
Billboard along East Texas highways

Clean Texas Marina Program

The Clean Texas Marina Program, supported by a grant from EPA, is aimed at reducing NPS pollution caused by boating activities on Texas water bodies. These activities include: prevention of sewage dumping from holding tanks, boat repair and maintenance, and general trash disposal.

As of September 26, 2005, the program certified 55 marinas as Clean Texas Marinas and 34 additional marinas have pledged to become certified. The certification checklist addresses the following areas of operation: marina design and maintenance, marina management, emergency planning, petroleum control, sewage handling, waste containment and disposal, vessel maintenance and repair, storm water management, and boater education.

The TCEQ has been working closely with Texas A&M University's Sea Grant Program. The Sea Grant Program coordinates statewide efforts to build the Clean Texas Marina program.



Fishing at Lake Buchanan

The Sea Grant Program conducts workshops for marina owners and, in conjunction with TCEQ staff, conducts site visits to certified marinas to confirm their status.

In addition to Sea Grant, the TCEQ has been working with the Brazos River Authority (BRA) and the Houston-Galveston Area Council (H-GAC) to host workshops in their areas, conduct inspections of pump-out stations at marinas, recruit marinas into the Clean Texas Marinas Program, and distribute educational material to boaters.

Hazardous Waste Collections Address NPS Pollution

The TCEQ's Small Business and Environmental Assistance (SBEA) Program's efforts to educate the public on NPS pollution include its Agricultural Waste Pesticide Collection Program. This program provides a means to collect and properly dispose of agricultural waste pesticides from rural Texans. In FY2005, Agricultural Waste Pesticide Collections drew 1,446 participants who brought in 92 tons of agricultural waste pesticides. The Texas Country Cleanup conducted 25 events that drew 1,794 participants. Collection items included:

- 10,339 empty pesticide containers
- 25,759 gallons of used motor oil
- 23,700 used motor oil filters and
- 3,237 lead-acid batteries to events held in rural areas around the state

Another project that promotes public awareness is the Texas Country Cleanup, which collects and recycles empty pesticide containers, used motor oil, used motor oil filters, lead acid batteries, and household hazardous waste (HHW). In FY2005, there were 17 permanent HHW facilities operated across the state, 45,251 participants brought in 1,618,158 pounds of HHW. There were also 153 one-day collection events held across the state that drew 29,615 participants who brought in 2,396,792 pounds of HHW.

Tres Palacios Campaign to Eliminate Illegal Dumping

The Lower Colorado River Authority (LCRA), in conjunction with the Matagorda County Environmental Health Department (MCEHD), conducted a NPS public education and enforcement campaign addressing illegal dumping in the Tres Palacios River Watershed. The goal of the project was to curtail illegal dumping and discharges through enforcement using the local crime stoppers hotline through a partnership with Matagorda County Crime Stoppers. The project also involves an education campaign that includes signs at bridge crossings, billboards throughout the watershed, and public service announcements in local newspapers and radio stations.

Trash in creek equals NPS

Law enforcement officials investigated approximately 27 reported incidents of illegal dumping and spills. Investigation of these incidents lead to the identification of a majority of the individuals responsible for committing the crimes and resulted in the cleanup of the materials. As a result of calls to the local crime stoppers hotline, emergency response teams from the TxDOT, RRC, MCEHD, and a private medical waste disposal company responded to incidents to cleanup hazardous materials.

National Estuaries Day with the Galveston Bay Estuary Program

Each year, the Galveston Bay Estuary Program (GBEP), along with the EPA, sponsors an event for local students honoring National Estuaries Day. This year the event was an Estuarine Art Contest. Students were given the option of creating an Eco-Art project or writing an essay about how Galveston Bay and the Texas Gulf Coast are impacted by the communities that surround the bay. Students in advanced science classes were encouraged to research such topics as subsidence, NPS pollution, impaired water quality, and its economic affect on commercial fisheries, and also what citizens can do to help prevent pollution in the bay.

A reception and award ceremony was held to recognize the students for their accomplishments on Sunday, October 23, 2005 at Armand Bayou Nature Center. Each student received a certificate from the EPA.

Coastal Nonpoint Source Pollution Control Program

A clean, sunny beach

In FY2005, four Council's of Government (COGs) (Lower Rio Grande Valley Development Council, Coastal Bend COG, Houston-Galveston Area Council, and Southeast Texas Regional Planning Commission), representing a majority of the Texas coast, were tasked with conducting education and outreach activities to support the Texas Coastal Nonpoint Source Pollution Control Program. The COGs identified specific water quality concerns in each region and designed an outreach program to target the major sources of water quality impairments.

The COGs used the Texas Coastal Nonpoint Source Pollution Control Program as a resource to identify water quality problems. They used the Pollution Prevention Management Measures identified in the plan to help target the outreach activities. The Pollution Prevention Management Measures used in the outreach programs include:

- Proper storage, use and disposal of household hazardous chemicals, including automobile fluids, pesticides, paints, solvents, etc.
- Lawn and garden activities, including the application and disposal of lawn and garden products, and the proper disposal of leaves and yard trimmings
- Proper Operation and Maintenance of Onsite Disposal Systems
- Preventing discharge of pollutants into storm drains including floatables, waste oil, and litter
- Proper disposal of pet waste

The COGs conducted a variety of activities to educate the public about coastal NPS pollution. Activities included presentations at public meetings, Earth Day /Bay Day celebrations, and at schools. They also worked with municipal officials to reduce NPS pollution. As a result of the education and outreach

campaign, coastal NPS education materials were made available to more than 300,000 individuals. In addition, education materials were posted on the COGs water quality Web sites.

Texas SmartScape

Texas SmartScape is an educational program intended to help homeowners design and maintain beautiful landscapes using native plants that require less water. This program discusses new methods for landscaping that incorporate drip irrigation systems for watering plants, proper use of mulch, and reducing the use of fertilizers and pesticides.

The Program was initially created in 2001 for North Central Texas homeowners through the leadership and vision of North Central Texas COG, Tarrant County Health Department, Texas Cooperative Extension, Tarrant Regional Water District, Texas Parks and Wildlife Department and Weston Gardens. The Texas SmartScape website (www.txsmartscape.com) was developed in 2003 through sponsorship from Dallas Water Utilities, City of Irving, North Texas Municipal Water District, Tarrant Regional Water District and the Upper Trinity Regional Water District.

Texas SmartScape expanded in 2005 to include the West Texas region through sponsorship by the City of Lubbock. The Texas SmartScape CD addresses the issues of NPS pollution, provides landscape principles for a water conserving landscape, has an interactive plant data base, and answers questions about soil preparation, planting, mulch and proper watering methods.

In 2005, the SmartScape program:

- Distributed more than 200,000 compact discs
- Hosted a program that aired daily on two cable networks
- Trained 25 Master Gardeners that made presentations to more than 1,400 people
- Supported several cities in the DFW metroplex that declared March to be official "SmartScape" month

CHAPTER 5

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.

Programmatic Achievements

Environmental goals may take many years to realize. Therefore, Texas also reports on programmatic achievements; activities that support environmental progress, like collecting and assessing data using quality-assured methods, developing TMDLs and WPPs, implementing NPS control strategies, educating people about the causes and sources of nonpoint source pollution, etc. The articles throughout this NPS Annual Report demonstrate many of the programmatic achievements Texas had in FY2005. One example of a significant programmatic achievement is the implementation of water quality controls in the North Bosque.

North Bosque River

Though efforts in the North Bosque have not resulted in the full restoration of water quality, the implementation of control measures enacted to date have been very successful. The efforts to reduce phosphorus concentrations in the river have removed an impressive amount of phosphorus-rich manure from the watershed, by converting it to compost for use as a soil amendment. The compost program has grown steadily in the four years it has been operational. It is approaching its implementation goal to remove 50 percent of the manure generated at dairies in the North Bosque watershed and convert it to compost. As of September 30, 2005, the Dairy Manure Export Support (DMES) program has hauled more than 918,000 tons of manure out of the dairies in the watershed to compost facilities. This manure contained more than three million pounds of phosphorus. More than 406,000 tons of this manure, containing more than 900,000 pounds of phosphorus has been exported from the watershed in the form of compost. The success of restoration efforts in the watershed are described in more detail in Chapter 3.

Environmental Achievements

Texas has realized several documented gains in water quality in FY2005. Some of those improvements are highlighted in this section.

E.V. Spence Reservoir

Although the ultimate environmental goal has not yet been met for the E.V. Spence Reservoir, water quality has improved. Data review performed in 2005 demonstrated the annual averages for chlorides and sulfates were in compliance 100 percent of the time, an improvement from previous years. This is due in part to freshwater inflows from an average rain season, and to the consistent work by the Colorado River

Municipal Water District (CRMWD) to accurately manage diversions of saline water utilizing the real-time water quality monitoring sites on the Colorado River. However, TDS had a zero percent compliance value. The reservoir is still continuing to recover from a spill of saline water in the 1980s from an upstream diversion reservoir that caused TDS concentrations to spike.

Table 5.1 Dissolved Salt Concentrations in E.V. Spence Reservoir

Average Milligrams/Liter			
	1994-1999	**2000-2005**	**Criterion**
Chloride	1095	878	950
Sulfate	765	583	450
TDS	3395	2466	1500

Water Bodies Threatened by Atrazine

In 1998 and 2000, eight lakes and one river in Texas, as indicated in the table below, were listed as threatened because atrazine concentrations in finished drinking water were approaching the maximum contaminant levels. A water body is classified as threatened when data indicate that one of its uses—in this case, as a source of drinking water—is not yet impaired, but indicate a decreasing trend in water quality.

The most recent data for five of the reservoirs indicate that management measures implemented by agricultural producers, with the support of the TSSWCB, have controlled the atrazine contamination and these water bodies may no longer be identified by the TCEQ as threatened.

Table 5.2 Atrazine Instream Data Summary

Segment	Water Body	Year Listed	2002 Category	Number of Avgs	Highest Running Avg (ug/L)	2004 Inventory and List Status
507	Lake Tawakoni	1998	4b	29	1.50	2
838	Joe Pool Lake **	1998	4b	30	1.21	2
836	Richland-Chambers**	1998	4b	30	0.7	2
0303A	Big Creek Lake	1998	4b	30	1.58	2
815	Bardwell Reservoir**	1998	4b	32	1.05	2
816	Lake Waxahachie**	1998	4b	29	1.46	2
821	Lavon Lake **	1998	4b	30	0.84	2
817	Navarro Mills	2000	4b	-	-	4b*
1213	Little River	2000	4b	-	-	4b*

* The special study for these water bodies was not completed in time for the 2004 Inventory and List but will be reviewed for the 2006 Inventory and List. **These waterbodies are no longer threatened.

Progress towards meeting Texas NPS Management Program Milestones

Section 319 of the CWA requires that Texas include as part of its NPS Annual Report, progress in meeting the milestones defined in the *Texas NPS Management Program.* The following tables reference the 2005 milestones for both surface and groundwater and provide a status of activities for each water body. These projects, which are underway, have a high priority for funding and completion under the CWA §319(h) NPS grant program.

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, IP, 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**.**

Table 5.3 2005 Annual Water Bodies Report

Project	Concern	Milestone	2005 Status
Assessing Aquatic Life Use in Tidal Streams (Segments 0511, 1501, 2453A)	bacteria depressed dissolved oxygen	Targeted Assessment	Water quality sampling for use attainability analysis and data review completed except for benthics Draft methodology report reviewed
Aquilla Reservoir (Segment 1254)	atrazine in finished drinking water	Implementation	TMDL approved 2002 Water quality goal met Segment removed from the 303(d) List in 2004 Routine monitoring for 305(b) assessment to track continued standards attainment
Arroyo Colorado (Segments 2201,2202)	depressed dissolved oxygen	Implementation	WPP in development WQMP program ongoing
Arroyo Colorado Legacy Pollutants (Segments 2201, 2202, 2202A)	DDE, DDT, DDD, dieldrin, endrin, lindane, hexachlorobenzene, heptachlor, heptachlor epoxide, chlordane, toxaphene, PCBs in fish	Implementation	TMDL adopted 2001, revised 2003 Expected to attain standards after natural attenuation TMDL Program is tracking and reporting progress of implementation
Brandy Branch Reservoir (Segment 0505E)	Selenium in fish	Implementation	Delisted in 2002 Fish consumption advisory rescinded October 2003

Project	Concern	Milestone	2005 Status
Buck Creek (Segment 0207A)	bacteria	Implementation	CWA §319 Assessment project ongoing
Buffalo and White Oak Bayous (Segments 1013, 1014, 1017)	bacteria depressed dissolved oxygen	Targeted Assessment Data Review	Sampling and bacteria source tracking investigation completed in August, 2005. Development of the TMDL allocation and report are underway. A survey and assessment of stormwater BMPs are being conducted
Cedar Lake (Segment 2442)	bacteria (oyster waters)	Implementation	No TMDL activity in FY2005 Targeted assessment planned for in FY2006
City of Denton Watershed Plan (Hickory Creek) (Segment 0823)	depressed dissolved oxygen	Stakeholder Group Data Review	Stakeholder meetings and data review conducted
Clear Creek Legacy and VOC Pollutants (Segments 1101,1102)	chlordane in tissue bacteria dichloroethane in fish and crab tissue trichloroethane in tissue	Targeted Assessment Implementation	TMDL approved 2001 Segment delisted for these pollutants Consumption advisory rescinded October 2001 Routine monitoring for 305(b) assessment to track continued standards compliance
Coastal Bend Bays Plan (Basin 24)	bacteria (oyster waters) dioxin nickel depressed dissolved oxygen mercury in water mercury in fish and crab tissue high pH zinc in oyster tissue selenium	Implementation	Bacteria Source Tracking study in Copano Bay ongoing Researching agricultural runoff in the Oso Creek/Oso Bay watershed Researching zinc contamination in oysters and zinc in water and sediments CBBEP is active in public participation and sponsorship of TMDL meetings in area
Colorado River below E. V. Spence Reservoir (Segment 1426)	chloride total dissolved solids	Modeling Implementation	RRC conducting CWA §319(h) implementation project (oil and gas well plugging) downstream of E. V. Spence Continuous water quality monitors are functioning in support of implementation plans Due to revised E.V. Spence release flows, a model recalibration is underway and expected to be finished by April 2006. A draft TMDL report will follow. TMDL development underway
Colorado and San Gabriel Rivers, Brushy and Petronilla Creeks (Segments 1214,1244, 1426,2204)	chloride sulfate total dissolved solids	Modeling Implementation	CWA §319(h) projects ongoing - RRC plugging abandoned oil wells in Runnels, Coke, Scurry, Borden, Sterling, Howard, Mitchell, and Nolan Counties and RRC remediation in Coke & Runnels Counties. RCC also plugging wells in Kleburg, Nueces, and Jim Wells Counties. Preliminary draft modeling results July 2005. Data showed San Gabriel River and Brushy Creek were meeting their criteria; therefore, they were removed from the project. Due to revised E.V. Spence release flows a Segment 1426 model recalibration is underway and expected to be finished by April 2006. A draft TMDL report will follow. A draft TMDL report for Segment 2204 is underway.

Project	Concern	Milestone	2005 Status
Concho River Basin (Segments 1421,1422,1423, 1424,1425)	impaired macrobenthos community, chloride, total dissolved solids	Stakeholder Group Data Review	Stakeholder meetings and data review conducted
Copano Bay Oysters (Segment 2472)	bacteria (oyster waters)	Implementation	Data collection/analysis for the bacteria source tracking completed and a draft report submitted August 2005. Watershed model will be completed spring 2006.
Dallas Legacy Pollutants (Segments 0805, 0841, 0841A)	chlordane DDT, DDD, DDE, dieldrin heptachlor epoxide, PCBs	Targeted Assessment Implementation	TMDL adopted 2001 Expected to attain standards after natural attenuation TMDL Program is tracking and reporting progress of implementation
Dickinson Bayou (Segment 1103)	depressed dissolved oxygen	Modeling	TMDL in development Watershed model presented in February 2005
E. V. Spence Reservoir (Segment 1411)	salinity	Implementation	TMDL approved 2003 TMDL Implementation Plan approved CWA §319(h) implementation project ongoing by the RRC to plug abandoned oil wells. EQIP funding brush control program ongoing CWA §319(h) assessment and remediation project upstream of the E. V. Spence TCEQ installed two continuous monitors at pump stations above the reservoir to assist CRMWD to have better control over their diversions of saline water TMDL Program is tracking and reporting progress of implementation
Ft. Worth Legacy Pollutants (Segments 0806, 0806A, 0806B, 0829, 0829A)	chlordane DDE dieldrin PCBs	Targeted Assessment Implementation	TMDL adopted 2001 Sampling completed in 2005 for 0806A, 0806B, 0829A Expected to attain standards after natural attenuation TMDL Program is tracking and reporting progress of implementation
Gilleland Creek (Segment 1428C)	bacteria	Implementation	First phase of data collection completed in September 2005
Guadalupe above Canyon (Segment 1806)	bacteria	Implementation	First phase of data collection completed in September 2005
Gulf Coast Oyster Waters (Segments 2421, 2422,2423, 2424,2432,2439, 2441,2442,2451, 2452, 2453,2456, 2462,2472)	bacteria	Action Plan Implementation	Bacteria source tracking sampling through December 2004 Draft report completed July 2005 Completed project December 2005
Houston Ship Channel Dioxin Study (Segments 0901, 1001, 1005, 1006, 1007, 2421, 2426, 2427, 2428, 2429, 2430, 2436, 2438)	dioxin	Modeling Implementation	Targeted monitoring completed in 2005 Modeling underway 2005 through 2006 TMDL development underway

Project	Concern	Milestone	2005 Status
Houston Ship Channel Nickel Study (Segments 1001, 1005, 1006, 1007, 1013,1014,1016, 1017, 2426, 2427, 2428,2429, 2430, 2436)	nickel	Implementation	TMDL adopted 2001 BMP implementation and public education and outreach campaigns ongoing TMDL Program is tracking and reporting progress of implementation
Lake Austin (Segment 1403)	depressed dissolved oxygen	Implementation	CWA §319(h) monitoring underway to evaluate effectiveness of aerators installed on Mansfield Dam. The EPA did not take action on the TMDL developed by the TCEQ, stating that the impairment was from pollution, not from a pollutant. With EPA's approval, the dissolved oxygen impairment was moved to Category 4c of the 303d List in 2002.
Lake Granbury (Segment 1205)	bacteria	Stakeholder Group Data Review	Stakeholder group formed CWA 319(h) WPP project ongoing
Lake Granger Watershed Plan (Segment 1247)	sediment	Stakeholder Group Implementation	Stakeholder group formed CWA §319(h) WPP project ongoing
Lake O' the Pines (Segment 0403)	depressed dissolved oxygen	Action Plan Implementation	CWA §319(h) assessment project ongoing
Lavaca and Chocolate Bays (Segment 2453)	mercury depressed dissolved oxygen	Implementation	Proposed delisting on draft 2004 303(d) list
Little Wichita River (Segments 0211,0212)	salinity depressed dissolved oxygen total dissolved solids	Stakeholder Group Data Review	EQIP & WQMP program funding ongoing
Martin Creek Reservoir (Segment 0505F)	selenium in fish	Implementation	Delisted in 2002 Fish consumption advisory rescinded October 2003
Matagorda Bay/ Tres Palacios Bay (Segments 2451, 2452,2456,2483A	depressed dissolved oxygen	Implementation	Targeted monitoring in October 2005
Middle Brazos River Basin (Segments 1217A,1243)	depressed dissolved oxygen	Modeling Action Plan	Targeted monitoring in 2004 Data Review Segments proposed for delisting in 2004 Modeling completed in 2005
North Bosque River Upper North Bosque River (Segments 1226,1255)	nutrients	Implementation	TMDL adopted 2001 with condition for extended modeling TMDL Implementation Plan approved CWA §319(h), EQIP, & WQMP program funding ongoing Multiple continuous monitors are being operated in the watershed to support implementation; monitors are part of the CWQM network (standard field parameters), plus are experimental sites for water EMRS measuring nutrient concentrations in "real Time: to low concentrations (first in nation, probably). TMDL Program is tracking and reporting progress of implementation

Project	Concern	Milestone	2005 Status
North Concho River (Segments 1421-1425	impaired macrobenthos community chloride total dissolved solids	Stakeholder Group Data Review	Stakeholders met Data review to address urban NPS UCRA has begun design work for a sixth BMP project in the downtown segment of the river in San Angelo.
Nueces Bay Zinc Project (Segment 2482)	selenium zinc in oysters	Implementation	Draft TMDL completed TCEQ review of TMDL underway Implementation monitoring underway
Orange County (Segments 0508, 0508A,0508B, 0508C 0511, 0511A, 0511B, 0511C, 0511E)	bacteria depressed dissolved oxygen pH	Modeling Implementation	Water quality modeling underway in 2005 TMDL development underway TMDL Stakeholder group underway Clean Bayous fair January 2005
Oso Bay (Segments 2485, 2491)	depressed dissolved oxygen	Targeted Assessment Modeling	Targeted monitoring completed 2005
Oso Creek Oso Bay (Segments 2485, 2485A)	bacteria	Implementation	Stakeholder group formed Targeted monitoring underway Preliminary model presented August 2005
Pecos Watershed Plan (Segments 2310,2311)	chloride sulfate total dissolved solids	Stakeholder Group Data Review	EQIP & WQMP program funding ongoing
Sabinal River (Segment 2110)	nitrate nitrite	Implementation	TMDL adopted by TCEQ August 2005 Education and outreach campaign to be initiated spring 2006
Salado Creek (Segment 1910)	depressed dissolved oxygen	Implementation	TMDL approved by EPA in 2002 TMDL Report concluded that implementation plan was unnecessary
San Antonio River Authority (Segment 1911)	bacteria	Stakeholder Group Data Review	Stakeholder group formed CWA §319(h) WPP project underway
San Antonio River Basin, Leon River, and Peach Creek (Segments 1221, 1803C, 1901, 1910, 1910A, 1911)	bacteria	Modeling Implementation	Modeling results presented to stakeholders in August 2005 Watershed Protection Plan for upper reach of San Antonio River – Segment 1911 (partial) TMDL reports for all segment are due by the end of 2006
South Central Texas (Segments 1427, 1806A, 1803A, 1803B, 2107, 2104, 2113, 1906, 1913, 1908, 2107)	bacteria depressed dissolved oxygen	Modeling Action Plan	Stakeholder meetings 2003-2004 Targeted monitoring completed in 2004 Initiated model for TMDL Development of 3 of 5 planned TMDL'S in 2005 TMDL development for Mid Cibolo creek and Camp Meeting Creek is scheduled to begin in FY2006
Tarrant Regional Water District Watershed Plans (Basin 08)	nutrient enrichment elevated pH	Stakeholder Group Data Review Targeted Assessment Modeling Implementation	Cedar Creek Reservoir (Segment 0818) Existing data reviewed Review of point sources for economic analysis completed Targeted assessment completed Modeling plan in development Eagle Mountain Reservoir (Segment 0809) Existing data reviewed Review of point sources for economic analysis completed Targeted assessment completed Modeling plan in development Richland Chambers Reservoir (Segment 0836) Existing data reviewed Review of point sources for economic analysis in progress

Project	Concern	Milestone	2005 Status
Trinity River (Segment 0805, 0806, 0841)	bacteria	Implementation	Targeted monitoring initiated in March, 2005 Public education and outreach campaigns ongoing
Upper Oyster Creek (Segment 1245)	bacteria depressed dissolved oxygen	Targeted Assessment Modeling	Bacteria source tracking monitoring completed December, 2004 Sampling for dissolved oxygen completed September, 2005 TMDL development underway
Welsh Reservoir (Segment 0404D)	selenium in fish		Delisted in 2002 Fish consumption advisory rescinded October 2003

Table 5.4 2005 Annual Groundwater Report

Aquifer	Region	Constituent(s) of Concern	Implementation or Assessment	2005 Status
Edwards Trinity (Plateau)	Terrell, Reagan, and Crockett Counties	Nitrate	Assessment	BMP Education and Training; Arsenic Assessment
Ogallala	Southern High Plains, Panhandle	Nitrate	Assessment	BMP Education and Training; Arsenic Assessment
Gulf Coast	Rio Grande Valley	Nitrate, Iron, TDS	Assessment	Arsenic Assessment
Dockum	Panhandle, West TX-Outcrop Area Only	Nitrate	Assessment	BMP Education and Training
Edwards-Trinity (High Plains)	Southern High Plains	Nitrate	Assessment	BMP Education and Training; Arsenic Assessment

Appendix

BMP–Best Management Practice
BRA–Brazos River Authority
BST–Bacterial Source Tracking
CAPCOG–Capital Area Planning Council of Governments
CMIP–Composted Manure Incentive Program
COG–Council of Governments
CRP–Clean Rivers Program
CWA–Clean Water Act
CWQMN–Continuous Water Quality Monitoring Network
DMES–Dairy Manure Export Support
D.O.–Dissolved Oxygen
EMRS–Environmental Monitoring and Response System
EPA–Environmental Protection Agency
EQIP–Environmental Quality Incentives Program
ETJ–Extra Territorial Jurisdiction
GBEP–Galveston Bay Estuary Program
GIS–Geographic Information System
H-GAC–Houston-Galveston Area Council
HHW–Household Hazardous Waste
IP–Implementation Plan
MCL–Maximum Contaminant Level
NPS–Nonpoint Source
NRCS–Natural Resource Conservation Service (a division of USDA)
RRC–Railroad Commission
TCE–Texas Cooperative Extension
TCEQ–Texas Commission on Environmental Quality
TMDL–Total Maximum Daily Load
TSSWCB–Texas State Soil and Water Conservation Board
TW–Texas Watch
TWQI–Texas Water Quality Inventory
TWRI–Texas Water Resources Institute
UCRA–Upper Colorado River Authority
USDA–United States Department of Agriculture
WPP–Watershed Protection Plan
WQMP–Water Quality Management Plan