Nonpoint Source Pollution **Management in Texas**

2022 Annual Report

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

Texas Commission on Environmental Quality

Texas State Soil & Water Conservation Board

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Vivid Bluebonnets and Indian Paintbrush Wildflowers (Source iStock)

Nonpoint Source Pollution
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2022 Annual Report

Wildflowers at Muleshoe Bend on the Shore of Lake Travis (Source iStock)

Purple seaside morning glory in Texas
(Source iStock)

Letter from the **Executive Directors**

The Nonpoint Source Management Program outlines Texas' comprehensive strategy to protect and restore waters across the state impacted by nonpoint source pollution. This strategy is implemented by utilizing voluntary, regulatory, financial, and technical assistance approaches, while working with a multitude of partners, to achieve a balanced program. The United States Environmental Protection Agency (EPA) provides grant funding to Texas for the components and goals in the Texas Nonpoint Source Management Program. The responsibility for implementing this program is shared between the Texas Commission on Environmental Quality (TCEQ) and the Texas State Soil and Water Conservation Board (TSSWCB).

Texas has consistently worked with partners across the state to develop and implement watershed-based plans (WBPs) to improve water quality. At the close of fiscal year 2022, more than 35 watershed protection plans that satisfy EPA's nine key elements have been accepted by EPA. Together with partners and stakeholders, TCEQ and TSSWCB are actively engaged in implementing voluntary management measures identified in the WBPs.

We are pleased to present the ***2022 Annual Report of the state's Nonpoint Source Management Program***. The report highlights our accomplishments in managing nonpoint source pollution and meeting the goals of the program. In partnership with EPA and other federal, state, regional, and local watershed stakeholders, TCEQ and TSSWCB look forward to the continued implementation of an efficient, accountable, and transparent program.

Erin E. Chancellor
Interim Executive Director
Texas Commission on
Environmental Quality

Rex Isom
Executive Director
Texas State Soil and
Water Conservation Board

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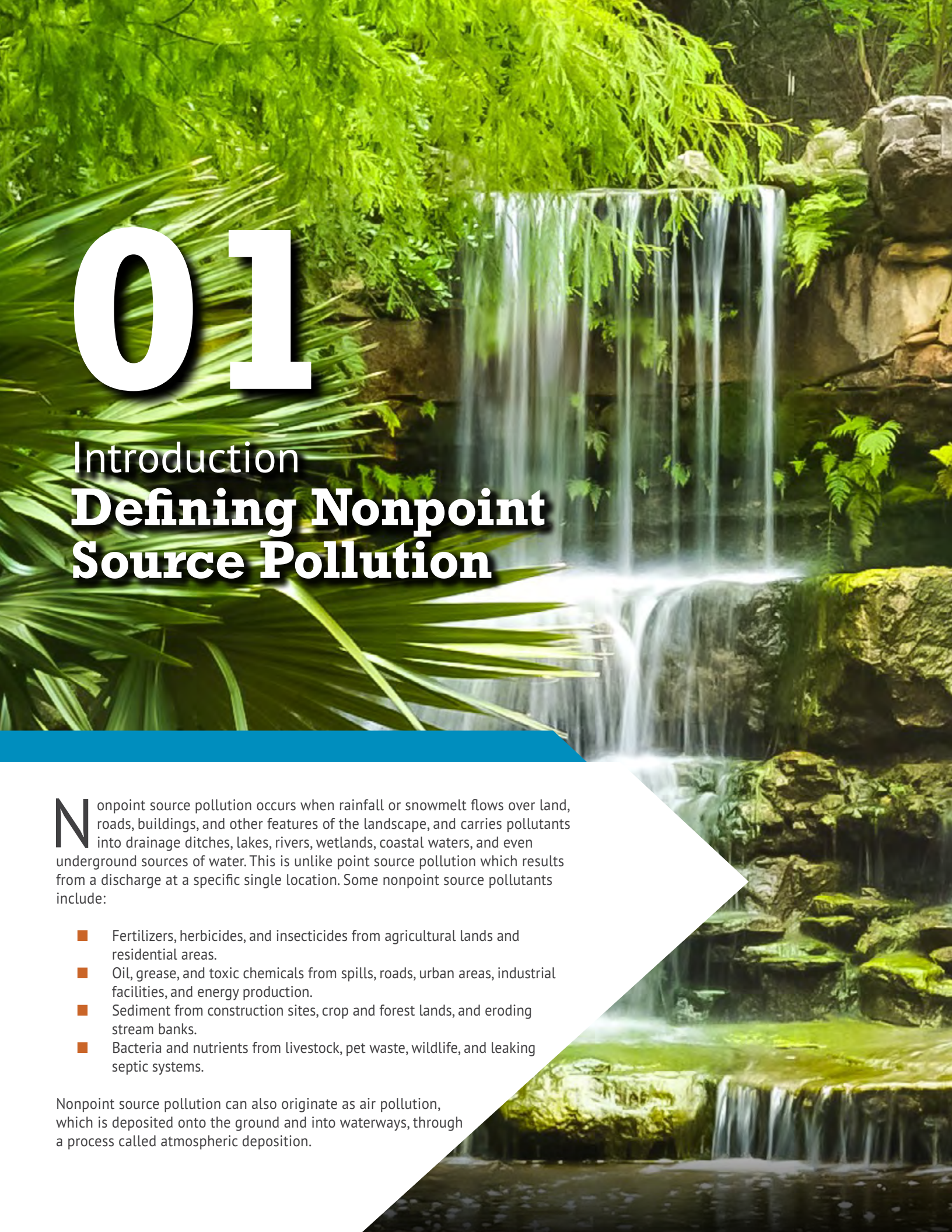
Abbreviations

AU	Assessment Unit
BMP	Best Management Practice
BIG	Bacteria Implementation Group
CBBEP	Coastal Bend Bays and Estuaries Program
CFU	Colony Forming Units
CWA	Clean Water Act
CZARA	Coastal Zone Act Reauthorization Amendments
E. coli	*Escherichia coli*
EPA	U.S. Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
GBEP	Galveston Bay Estuary Program
GLO	Texas General Land Office
GRTS	Grants Reporting Tracking System
H-GAC	Houston–Galveston Area Council
I-Plan	Implementation Plan
lb	Pounds
LCRA	Lower Colorado River Authority
LID	Low Impact Development
Meadows Center	The Meadows Center for Water and the Environment at Texas State University
mL	Milliliter
NELAP	National Environmental Laboratory Accreditation Program
NRCS	Natural Resources Conservation Service
OSSF	On-Site Sewage Facility
PPG	Performance Partnership Grant
SARA	San Antonio River Authority
SWCD	Soil and Water Conservation District
TBET	Texas Best Management Practices Evaluation Tool
TCEQ	Texas Commission on Environmental Quality
Texas Integrated Report	Texas Integrated Report of Surface Water Quality Sections 305(b) and 303(d)
TGPC	Texas Groundwater Protection Committee
TMDL	Total Maximum Daily Load
TSSWCB	Texas State Soil and Water Conservation Board
TWON	Texas Well Owner Network
TWRI	Texas Water Resources Institute
WAP	Watershed Action Planning
WBP	Watershed-Based Plan
WPP	Watershed Protection Plan
WQMP	Water Quality Management Plan
WWTF	Wastewater Treatment Facility
yr	year

Blooming Wildflowers in Texas
(Source iStock)



01

Introduction
Defining Nonpoint Source Pollution

Nonpoint source pollution occurs when rainfall or snowmelt flows over land, roads, buildings, and other features of the landscape, and carries pollutants into drainage ditches, lakes, rivers, wetlands, coastal waters, and even underground sources of water. This is unlike point source pollution which results from a discharge at a specific single location. Some nonpoint source pollutants include:

- Fertilizers, herbicides, and insecticides from agricultural lands and residential areas.
- Oil, grease, and toxic chemicals from spills, roads, urban areas, industrial facilities, and energy production.
- Sediment from construction sites, crop and forest lands, and eroding stream banks.
- Bacteria and nutrients from livestock, pet waste, wildlife, and leaking septic systems.

Nonpoint source pollution can also originate as air pollution, which is deposited onto the ground and into waterways, through a process called atmospheric deposition.

Zilker Botanical Gardens in Austin, Texas
(Source iStock)

What Guides Nonpoint Source Pollution Management in Texas?

Under the federal Clean Water Act (CWA) and the Texas Water Code, Texas must adopt surface water quality standards for waters in the state, assess the status of water quality, and take actions necessary to achieve and maintain those standards. The long-term goal of the Texas Nonpoint Source Management Program, developed under CWA Sections 319(a) and 319(b), is to protect and restore the quality of the state's water resources from the adverse effects of nonpoint source pollution. This is accomplished through the cooperative organizational tools and strategies below.

Partnerships

The Texas Commission on Environmental Quality (TCEQ) is the lead state agency responsible for establishing the level of water quality to be maintained in Texas. According to Texas Water Code, Chapter 26, the primary responsibilities of TCEQ include the issuance of permits for point source discharges and abatement of nonpoint source pollution from sources which are not agricultural or silvicultural. The Texas State Soil and Water Conservation Board (TSSWCB) is the lead agency in the state responsible for planning, implementing, and managing programs and practices that prevent and abate agricultural and silvicultural nonpoint source pollution. TCEQ and TSSWCB coordinate closely to jointly administer the Texas Nonpoint Source Management Program.

Managing nonpoint source pollution in Texas involves partnerships with many organizations to coordinate, develop, and implement the program. With the extent and variety of nonpoint source issues across Texas, cooperation across political boundaries is essential. Many local, regional, and state agencies play an integral part in managing nonpoint source pollution. They provide information about local concerns and infrastructure and build support for the management measures that are necessary to prevent and reduce nonpoint source pollution. By coordinating with these partners to share information and resources, the state can more effectively manage its water quality protection and restoration efforts.

The Texas Nonpoint Source Management Program

The Texas Nonpoint Source Management Program outlines Texas' comprehensive strategy to protect and restore waters impacted by nonpoint source pollution. Nonpoint source pollution is managed through assessment, planning, implementation, and education. The state has established long-term and short-term goals and objectives for guiding and tracking the progress of its nonpoint source management program. This report highlights the success in achieving these goals and objectives.

Goals for Nonpoint Source Management

Long-term Goal

The long-term goal of the Texas Nonpoint Source Management Program is to protect and restore water quality affected by nonpoint source pollution through the following short-term goals: data collection and assessment, implementation, and education.

Short-term Goals

Goal One—Data Collection and Assessment

Coordinate with appropriate federal, state, regional, and local entities, and stakeholder groups to target water quality assessment activities in high priority, nonpoint source-impacted watersheds, vulnerable and impacted aquifers, or areas where additional information is needed.

Goal Two—Implementation

Implement Total Maximum Daily Load (TMDL) Implementation plans (I-Plan) or watershed protection plans (WPPs) and other state, regional, and local plans/programs to reduce nonpoint source pollution by targeting activities to the areas identified as impacted or potentially degraded by nonpoint source pollution with respect to use criteria.

Goal Three—Education

Conduct education and technology transfer activities to increase awareness of nonpoint source pollution and activities which contribute to the degradation of water bodies, including aquifers, by nonpoint source pollution.

The Watershed Approach

Protecting the state's streams, lakes, bays, and aquifers from the impacts of nonpoint source pollution is a complex process. Texas uses the watershed approach to focus efforts on the highest priority water quality issues of both surface water and groundwater. It is based on the following principles:

- A 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. Wherever interactions between surface water and groundwater are identified, management activities will support the quality of both resources.

The watershed approach recognizes that to achieve restoration of impaired water bodies, solutions to water quality issues must be socially equitable, economically viable, and environmentally bearable.

FIGURE 1.1

Social, Economic, and Environmental Considerations for Water Quality Restoration

Pedernales Falls in the Texas Hill Country
(Source iStock)

Watershed Action Planning

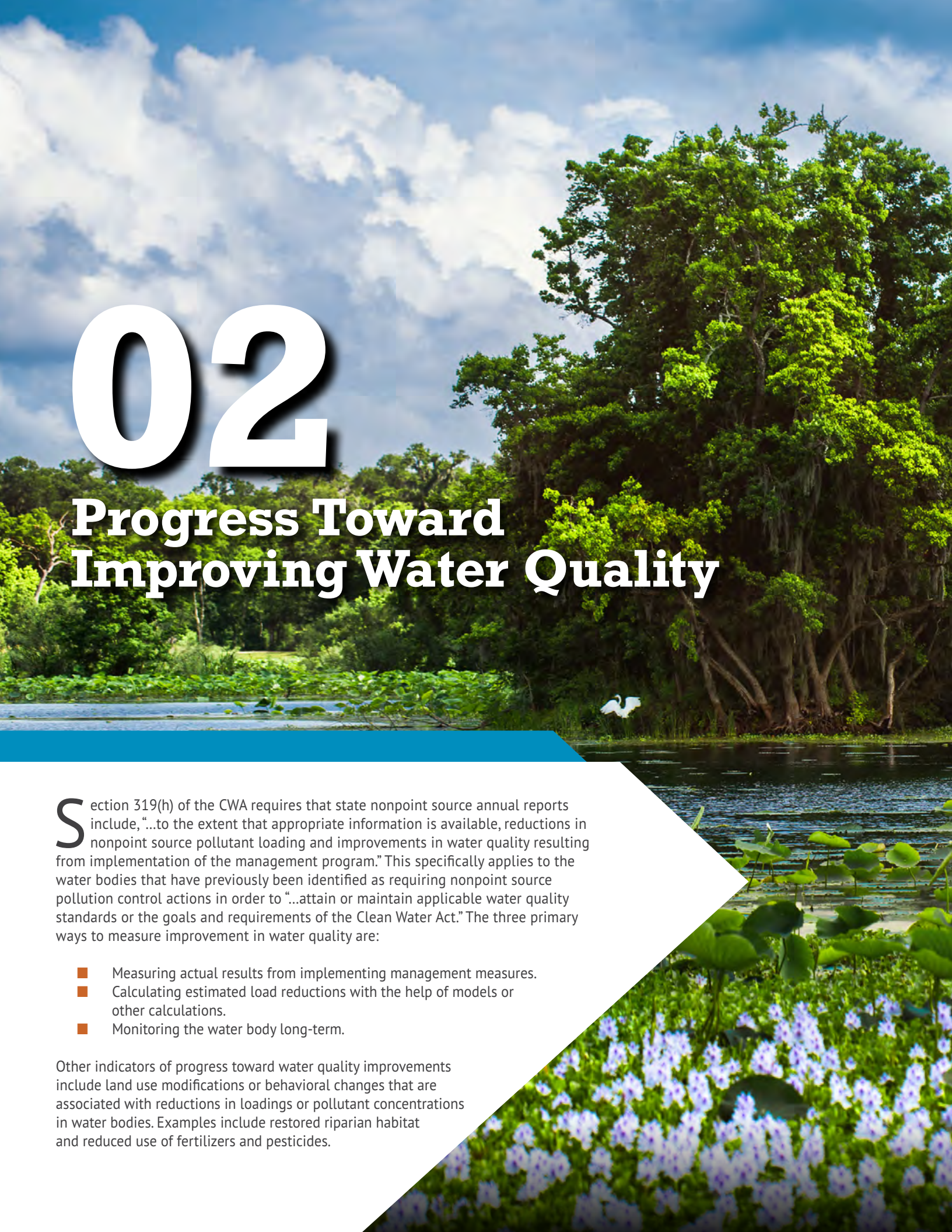
A major element in the Texas Nonpoint Source Management Program is the inclusion of the Watershed Action Planning (WAP) process and the Nonpoint Source Priority Watersheds Report.

The WAP process provides a framework for tracking priority water quality issues from selection through implementation. Participants in the WAP process first review identified water quality issues, which are typically water bodies listed as impaired on the CWA Section 303(d) list of impaired waters, then determine the best strategy for addressing the issue. Strategies may include collecting more data, evaluating appropriate water quality standards, or developing a watershed-based plan (WBP) with specific restoration activities. Once a strategy is determined, a lead program for implementation is assigned. Restoration activities identified in WBPs are eligible and prioritized for federal funding.

Management strategies to address nonpoint source water quality issues are determined through a collaborative approach and documented in the Nonpoint Source Priority Watersheds Report. This comprehensive planning process fosters relationships and facilitates greater coordination between state and local water resource agencies.

Funding limitations, new guidelines, increasing populations, and evolving environmental policies create new challenges for the state water quality planning programs. This elevates the importance of incorporating the WAP process in the Nonpoint Source Program. The coordination process allows stakeholders the opportunity to provide a local perspective into water quality management strategies and priorities. Interagency coordination of the state's water quality programs allows for more effective development of projects, leveraging of resources, and the implementation of water quality management strategies with stakeholder support. The WAP process integrates information from existing planning tools and from the coordination process to develop and track water quality management strategies and implementation. As part of the WAP process, these strategies are documented and periodically updated with the cooperation of the WAP partners. Partners include TSSWCB, Clean Rivers Program partners (typically river authorities), and the five TCEQ Water Quality Planning Division program areas—Texas Surface Water Quality Standards Group, Surface Water Quality Monitoring Program, Clean Rivers Program, TMDL Program, and the Nonpoint Source Program. The result of this process is a list of all water quality impairments and special interest water bodies in the state and the actions that are planned to address the impairment or concern, the party responsible for undertaking the action, and a means of tracking progress. The recommended strategies and special projects for impaired water bodies are available through the WAP Public Viewer[1], an interactive, web-based application, available to the public. Water quality management strategies identified through the WAP process are implemented regularly. This process has helped identify and track restoration efforts, collect water quality data, adopt TMDLs, and complete WPPs.

[1] https://www80.tceq.texas.gov/WapWeb/public/map.htm



02

Progress Toward Improving Water Quality

Section 319(h) of the CWA requires that state nonpoint source annual reports include, "...to the extent that appropriate information is available, reductions in nonpoint source pollutant loading and improvements in water quality resulting from implementation of the management program." This specifically applies to the water bodies that have previously been identified as requiring nonpoint source pollution control actions in order to "...attain or maintain applicable water quality standards or the goals and requirements of the Clean Water Act." The three primary ways to measure improvement in water quality are:

- Measuring actual results from implementing management measures.
- Calculating estimated load reductions with the help of models or other calculations.
- Monitoring the water body long-term.

Other indicators of progress toward water quality improvements include land use modifications or behavioral changes that are associated with reductions in loadings or pollutant concentrations in water bodies. Examples include restored riparian habitat and reduced use of fertilizers and pesticides.

Brazos Bend, Texas
(Source iStock)

Reductions in Pollutant Loadings

Plum Creek WPP Implementation: Low Impact Development for the City of Kyle's Wastewater Treatment Facility Operations Center

The Plum Creek Watershed has a drainage area of 397 square miles and lies within the Guadalupe River Basin, which drains South Central Texas from the Hill Country to the Gulf of Mexico. The Plum Creek Watershed includes portions of Hays and Travis counties and much of Caldwell County. Northern sections of the watershed, particularly near Kyle and Buda along the Interstate 35 corridor, have been marked by rapid suburban growth.

The City of Kyle began designing an expansion of their wastewater treatment facility (WWTF) in 2015 and the project was completed in May 2022. A new Operations Center building was included in the expansion of the WWTF, which will be used as a focal point in efforts to educate the public on the importance of wastewater treatment and to showcase low impact development (LID) features that minimize stormwater runoff and reduce pollutants' impact on nearby Plum Creek. The LID features installed around the Operations Center will also be used to educate Kyle residents about the positive water quality impacts of these features. LID features include a 2,500-gallon rainwater harvesting system; 400 square feet of xeriscaping; 33,580 square feet of vegetated open space; 5,880 square feet of permeable pavers; and a vegetated swale with 1.8 acres of catchment area and six inches of ponding depth.

The Operations Center will be used to host tours of the WWTF with the LID features being a large component to the tour. The city intends to use this space to educate residents on LID features and help them recognize strategies for their home or business. The LID best management practices (BMPs) will reduce the volume of stormwater runoff and therefore reduce the bacteria, sediment, and nutrient loads discharging into Plum Creek.

Using the United States Environmental Protection Agency (EPA) Pollution Load Estimation Tool, the following load reductions were achieved from these efforts in fiscal year 2022:

TABLE 2.1
Estimated Load Reductions from BMPs Implemented in the City of Kyle in Fiscal Year 2022

Pollutant	Load Reduction
Nitrogen	38 lb
Phosphorus	15 lb
Sediment	21 tons

FIGURE 2.1
Vegetated Bioswale (0.36 acre) Surrounded by Crushed Granite Walkway (Source City of Kyle)

Desert Landscape at Big Bend (Source iStock)

Continuation of the Lower Colorado River Authority Creekside Soil and Water Conservation Program

The Lower Colorado River Authority (LCRA) has continued to collaborate with TSSWCB, the United States Department of Agriculture's Natural Resources Conservation Service (NRCS) and local Soil and Water Conservation Districts (SWCDs) to offer technical and financial incentives through the LCRA Creekside Conservation Program. Since 2004, LCRA has received six separate EPA CWA Section 319(h) nonpoint source pollution grants to assist agricultural producers with BMPs on private land within the lower Colorado River basin.

During fiscal year 2022, LCRA and project partners assisted six new producers, placing a total of 2,752 acres of private lands under conservation management plans. Notable BMPs were 14,839 feet of crossing fencing, 1,275 feet of water pipeline, 66 acres of range planting, seven livestock watering facilities, one pond, and one grade-stabilization structure.

Currently, the program is offered within an 11-county project region of the Colorado River watershed which includes Bastrop,

Blanco, Burnet, Colorado, Fayette, Lampasas, Llano, Matagorda, San Saba, Travis, and Wharton counties. For more information, visit the LCRA Creekside Conservation Program website[2].

Using the Texas Best Management Practices Evaluation Tool (TBET), the following load reductions were achieved from these efforts in fiscal year 2022:

TABLE 2.2
Estimated Load Reductions from BMPs Implemented Through the LCRA Ceekside Conservation Program in Fiscal Year 2022

Pollutant	Load Reduction
Nitrogen	14,278 lb
Phosphorus	1,798 lb
Sediment	870 tons

Continued Implementation of Agricultural Nonpoint Source Components of the Leon River WPP

The Leon River watershed, located in the Brazos River Basin, is bound by Proctor Lake upstream and Belton Lake downstream. The Leon River (Segment 1221) is approximately 190 miles long and the watershed is approximately 1,375 square miles covering portions of Comanche, Bell, Erath, Hamilton, and Coryell counties. A small portion of the watershed lies within Mills County. The Leon River watershed is a predominantly rural, agricultural watershed dominated by rangeland with some cropland.

TCEQ and TSSWCB work together to identify water quality improvements that occur as a result of utilizing nonpoint source BMPs.

Desert Landscape at Big Bend (Source iStock)

TSSWCB has partnered with Hamilton–Coryell SWCD and Upper Leon SWCD on multiple EPA CWA Section 319(h) grants to develop and implement water quality management plans (WQMPs) in the Leon River watershed. In fiscal year 2022, four WQMPs covering 2,683 acres were certified. The BMPs in these WQMPs include prescribed grazing, range planting, herbaceous weed control, and brush management.

Using TBET, the following load reductions were achieved from these efforts in fiscal year 2022:

TABLE 2.3
Estimated Load Reductions from BMPs Implemented in the Leon River Watershed in Fiscal Year 2022

Pollutant	Load Reduction
Nitrogen	6,743 lb
Phosphorus	758 lb
Sediment	18 tons

Water Quality Improvements

TCEQ and TSSWCB work together to identify water quality improvements that occur as a result of utilizing nonpoint source BMPs. Once a water body candidate is identified, a "success story" is written and sent to EPA for review and approval. Linking instream nonpoint source pollutant reductions to land management practices is challenging. Changes to the land can occur over varying temporal and spatial scales and contributions to the stream are rainfall driven. As a result, changes in water quality often lag behind the implementation of nonpoint source BMPs, and many years of implementation may be needed before significant improvements in a water body are observed. Despite these challenges, Texas continues to see measurable water quality improvements.

Success Story Highlights

Implementing BMPs and Low Impact Development Improves Water Quality in the Upper San Antonio River

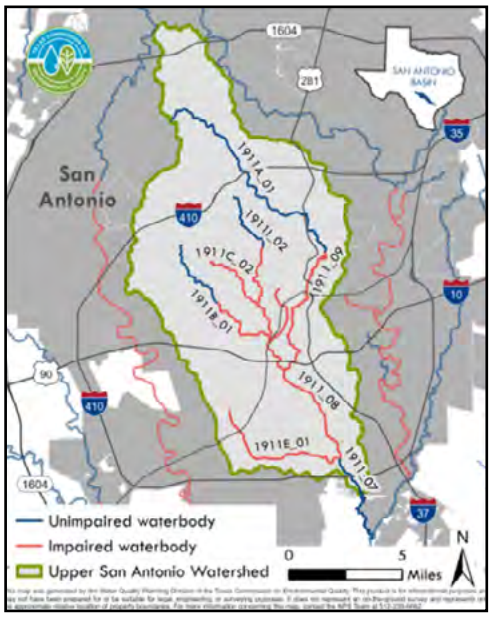
Water Quality Improved

The Upper San Antonio River, assessment unit (AU) 1911_07, was first identified as impaired due to elevated bacteria in the 1996 Texas Integrated Report of Surface Water Quality Inventory and CWA Section 303(d) List. Since then, efforts to improve water quality by state and federal agencies and local outreach have focused on implementing BMPs, education and outreach, and construction of LID. These combined efforts have led to water quality improvements in the Upper San Antonio River. As a result, AU 1911_07 was identified as fully supporting recreational use water quality standards in the *2020 Texas Integrated Report of Surface Water Quality Sections 305(b) and 303(d)* (Texas Integrated Report).

[2] https://www.lcra.org/community-services/land-conservation/

FIGURE 2.2

Map of the Upper San Antonio River Watershed



Problem

The San Antonio River in South Central Texas flows 240 miles through Bexar, Wilson, Karnes, Goliad, and Refugio counties, converging with the Guadalupe River before flowing into San Antonio Bay on the Gulf of Mexico. The Upper San Antonio River (Segment 1911) is located in the southern portion of the Salado Creek–San Antonio River Watershed. AU 1911_07 has a designated primary contact recreation 1 use and must meet an ***Escherichia coli (E. coli)*** criterion of 126 colony forming units (cfu) per 100 milliliters (mL) of water (126 cfu/100 mL).

Project Highlights

In 2006, the San Antonio River Authority (SARA) completed the Upper San Antonio River WPP and an update to the WPP was accepted by EPA in 2015. From 2008 to 2010, EPA CWA Section 319(h) grant funds were used for the San Antonio River Walk implementation project. Funded activities include 23 educational workshops, installation of 10 signs to educate the public about why they should not feed wildlife, and daily power washings to clean the San Antonio River Walk's sidewalks and recapture the waste.

EPA CWA Section 319(h) grant funds were also used to implement several LID projects in the watershed. At the Mission Library, LID features including permeable pavement, a bioswale, a bioretention area, and a rain garden with a rainwater harvesting system were installed from 2011 to 2015. In addition, six workshops and five site tours of the installed LID features were conducted. Another LID project utilizing EPA CWA Section 319(h) grant funds to implement the Upper San Antonio River WPP was conducted from 2015 to 2018 at two sites located at SARA's corporate campuses. One permeable parking lot, nine bioretention cells, and seven water-capturing cisterns were installed. Monitoring analyses of these sites estimated the combined potential to remove 46 percent of the annual bacterial load from stormwater runoff. The bioretention cells also served as an outdoor classroom that SARA used to educate the public about native plant species, LID, BMP features, and reduction of potable water use. To date SARA has hosted more than 13 site tours and two workshops at this location.

In 2007, a TMDL for bacteria in Segment 1911 was adopted by TCEQ and approved by EPA. A TMDL I-Plan for Segment 1911 followed and was approved by TCEQ in 2016. Thirty management measures to reduce bacteria are specified in the TMDL I-Plan. Some of the nonpoint source pollution management measures include avian management for the San Antonio River Walk and riparian areas, expansion of the Pooper Scooper Program, and feral hog management. Since 2016, the City of San Antonio has implemented measures to reduce the grackle population in the downtown area and installed over 173 pet waste dispensers in 75 public parks via the Pooper Scooper Program. Texas A&M AgriLife Extension Service hosted three feral hog workshops. A new outreach campaign emphasizing "Don't Feed the Wildlife" was also launched in the Fall of 2019 for all areas of the San Antonio River Walk, Museum Reach, and Mission Reach.

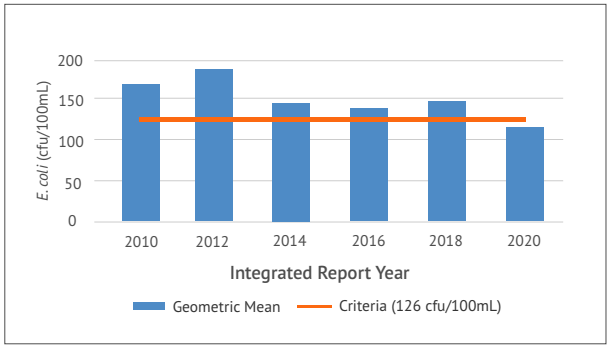
Along with activities funded by TCEQ, TSSWCB has funded programs responsible for 12 workshops with over 700 attendees from 2015 to 2020. Programs offered included Texas Well Owner Network (TWON), Texas Watershed Stewards, feral hog education, and Texas Riparian and Stream Ecosystem workshops partnering with Texas Water Resources Institute (TWRI), Texas A&M AgriLife Extension Service, and Texas A&M AgriLife Research.

Results

In the 2010 to 2018 Texas Integrated Reports, the geometric mean concentration of ***E. coli*** samples from the Upper San Antonio River (AU 1911_07) was not meeting the criterion of 126 cfu/100 mL and therefore not attaining the primary contact recreation 1 use. During the period of 2008 to 2020, targeted implementation activities in the watershed have helped to reduce nonpoint source pollution. In addition, TMDL I-Plan management measures focused on point sources such as sanitary sewer overflows, have also helped to reduce bacteria. SARA has continued to promote LID projects, and since 2016, 96 LID projects have been received and 41 have been approved. After management measures were put in place, new data was assessed in the 2020 Texas Integrated Report, and the geometric mean of E. coli samples were 118.56 cfu/per 100mL. As a result, AU 1911_07 was identified as fully supporting primary contact recreation 1 use water quality standards in the 2020 Texas Integrated Report.

FIGURE 2.3

Upper San Antonio River (AU 1911_07) *E. coli* Geometric Means from the 2010–2020 Texas Integrated Reports



Partners and Funding

Watershed partners have spent approximately $2,078,791 on education and outreach efforts and implementing BMPs, combining $1,247,275 in federal EPA CWA Section 319(h) grant funds with $831,516 in non-federal funds from local entities. Watershed partners include the City of San Antonio, SARA, San Antonio Water System, TWRI, Texas A&M AgriLife Extension Service, and Texas A&M AgriLife Research.

Along with activities funded by TCEQ, TSSWCB has funded programs responsible for 12 workshops with over 700 attendees from 2015 to 2020.

Implementing Conservation Practices and Conducting Watershed Outreach Improves Water Quality in the Lower Colorado River Watershed

Water Quality Improved

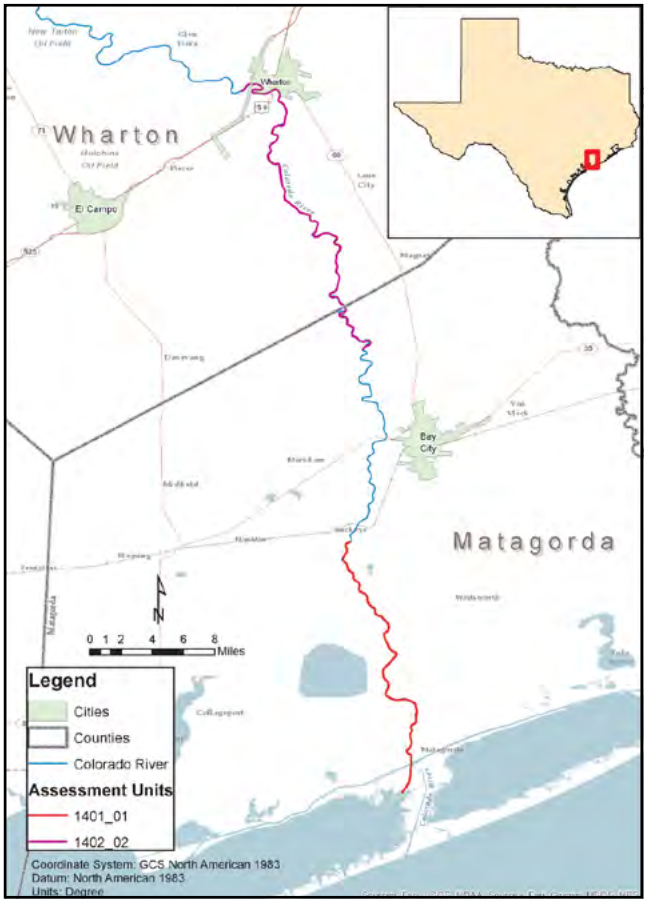
The Lower Colorado River is one of many rural water bodies listed as impaired on the Texas 303(d) list due to elevated levels of bacteria (*E. coli* and Enterococcus). The Colorado River Tidal (AU 1401_01) was first listed in the 2006 Texas Integrated Report and Colorado River Below La Grange (AU 1402_02) was listed in 2014. TSSWCB utilized EPA CWA Section 319(h) grant funding and partnered with local SWCDs, U.S. Department of Agriculture's NRCS, Texas A&M AgriLife Extension Service, TWRI, Texas A&M AgriLife Research, and LCRA to host numerous educational events for stakeholders to provide them with information about their local water quality issues. These events also focused on the management of feral hogs, riparian areas, septic systems, livestock, and water wells. Many of these outreach events led to landowners participating in the TSSWCB WQMP Program, the NRCS Environmental Quality Incentives Program (EQIP), and the LCRA Creekside Conservation Program. Through these combined efforts water quality was improved and two AUs of the Colorado River (1401_01 and 1402_02) were removed from the state's list of impaired waters in 2014 and 2018, respectively.

Problem

The Colorado River Below La Grange (AU 1402_02) and Colorado River Tidal (AU 1401_01) (Figure 2.4) are within watersheds in Southeast Texas that drain into Matagorda Bay. Most of the land in this area is rural and is used for cattle, rice, row crops, wildlife, and recreational operations. And most of the towns' populations are less than 10,000, except for Bay City in Matagorda County.

Water quality data collected in the Colorado River Tidal from 1998 to 2005, and Colorado River Below La Grange from 2006 to 2013 showed that Enterococcus and *E. coli* levels exceeded the bacteria water quality standard for primary contact recreation 1 (geometric mean criterion of 126 cfu/100 mL). As a result, TCEQ added Colorado River Tidal to the 2006 303(d) List of impaired waters for Enterococcus, and the Colorado River Below La Grange in 2014 for *E. coli*.

FIGURE 2.4
Map of the Colorado River Tidal (AU 1401_01) and Colorado River Below La Grange (AU 1402_02)



Project Highlights

TSSWCB, TWRI, Texas A&M AgriLife Extension Service, Texas A&M AgriLife Research, and LCRA have been hosting education and outreach programs in these watersheds for years. These programs focus on:

- Water quality improvement
- Feral hog management
- Riparian area protection
- Livestock management
- Septic system maintenance
- Private water well protection

Field days to demonstrate conservation practices to landowners have also been hosted as part of some events.

TSSWCB partnered with the Colorado County, Wharton County, and Matagorda County SWCDs to develop and implement 33 WQMPs in these watersheds with specific plans for grazing, rice, and row crop operations that covered over 14,700 acres. The practices prescribed in these plans included:

- Alternative water sources
- Prescribed grazing
- Cross-fencing
- Nutrient management
- Grade stabilization structures

A swimming hole surrounded by wildflowers (Source iStock)

The NRCS also worked with landowners to implement conservation practices using EQIP funding on more than 10,000 acres in these watersheds. The practices included:

- Prescribed grazing
- Grass and range planting
- Nutrient management
- Grade stabilization structures
- Conservation cover
- Cross fence
- Water wells
- Livestock pipeline
- Water troughs and ponds

Additionally, LCRA's Creekside Conservation Program worked with three landowners to develop conservation plans for their operations.

FIGURE 2.5

The Colorado River Flowing Through Wharton County in Southeast Texas (Source Brian Koch, TSSWCB)

Results

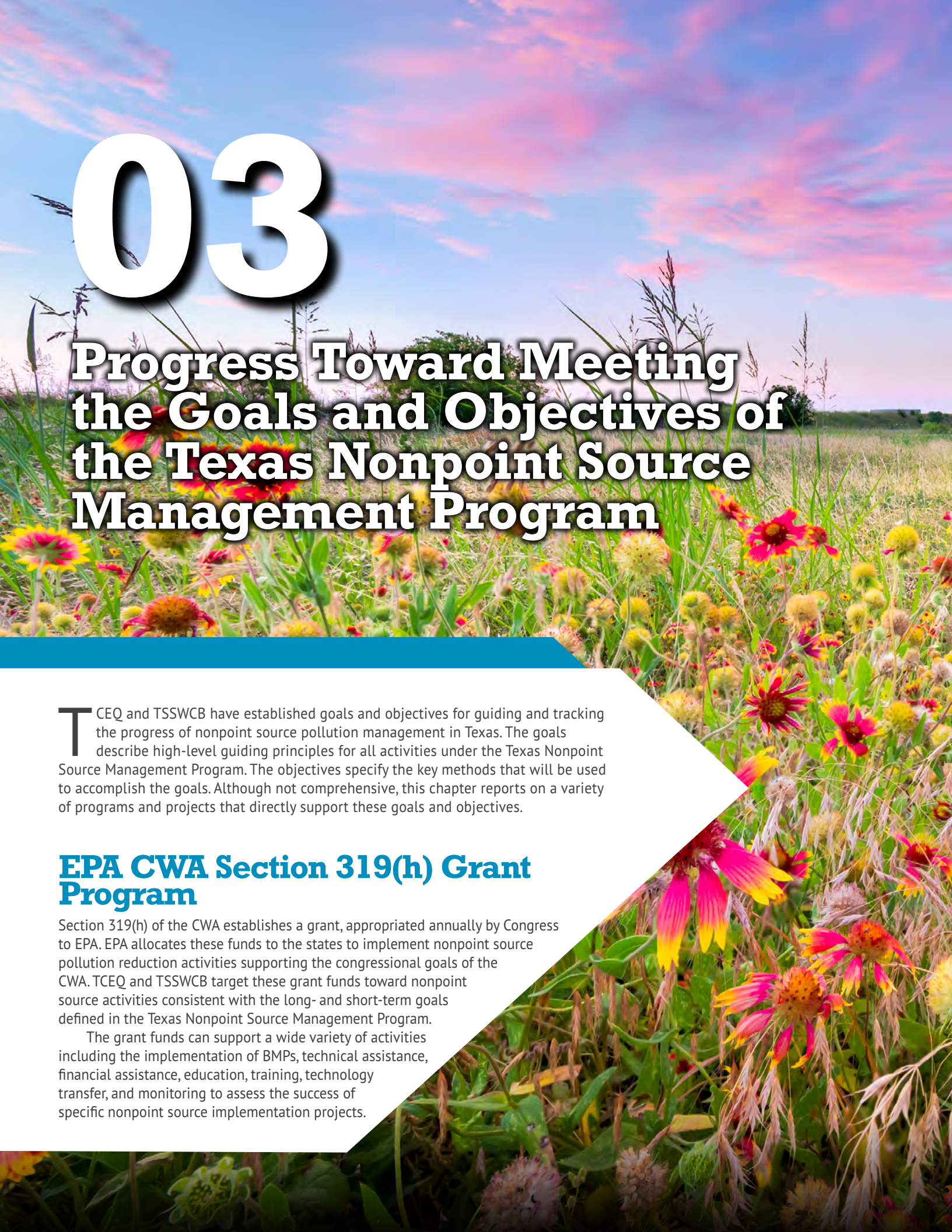
Water quality monitoring data review showed that the long-term Enterococcus and *E. coli* geometric means meet the state water quality criteria for primary contact recreation 1 use in portions of the Colorado River. Data collected during 2006–2012 for AU 1401_01 showed a geomean of 31.34 cfu/100 mL for Enterococcus. Data collected during 2009–2016 for AU 1402_02 showed a geomean of 122.58 cfu/100 mL for *E. coli*. Consequently, these portions of the Colorado River were removed from the Texas Integrated Report in 2014 and 2018, respectively. The success of this effort can be attributed to increased stakeholder awareness due to educational programs focused on improving water quality and conservation practices being implemented in these watersheds.

Partners and Funding

Over $205,000 in EPA CWA Section 319(h) grant funds (provided by TSSWCB), combined with more than $136,000 in non-federal funds from TSSWCB, LCRA, TWRI, Texas A&M AgriLife Extension Service, Texas A&M AgriLife Research, and landowners supported implementing conservation practices and educational programs.

The Colorado, Wharton, and Matagorda counties' SWCDs worked with landowners to voluntarily implement conservation practices to enhance sustainable livestock production and improve soil and water resources. TSSWCB and the NRCS worked with the SWCDs to provide $124,462 in state funding and $1,097,334 in federal Farm Bill funding to landowners as financial incentives to implement such practices and provide technical assistance in the Lower Colorado River watershed.

Colorful Texas wildflowers in early dawn light
(Source iStock)



03

Progress Toward Meeting the Goals and Objectives of the Texas Nonpoint Source Management Program

TCEQ and TSSWCB have established goals and objectives for guiding and tracking the progress of nonpoint source pollution management in Texas. The goals describe high-level guiding principles for all activities under the Texas Nonpoint Source Management Program. The objectives specify the key methods that will be used to accomplish the goals. Although not comprehensive, this chapter reports on a variety of programs and projects that directly support these goals and objectives.

EPA CWA Section 319(h) Grant Program

Section 319(h) of the CWA establishes a grant, appropriated annually by Congress to EPA. EPA allocates these funds to the states to implement nonpoint source pollution reduction activities supporting the congressional goals of the CWA. TCEQ and TSSWCB target these grant funds toward nonpoint source activities consistent with the long- and short-term goals defined in the Texas Nonpoint Source Management Program.

The grant funds can support a wide variety of activities including the implementation of BMPs, technical assistance, financial assistance, education, training, technology transfer, and monitoring to assess the success of specific nonpoint source implementation projects.

Colorful Texas wildflowers in early dawn light
(Source iStock)

In fiscal year 2022, Texas received $6,715,528 in EPA CWA Section 319(h) federal grant funds to utilize and award to sub-grantees across the state. In turn, sub-grantees provided $4,477,019 in matching funds to leverage resources used for addressing nonpoint source pollution.

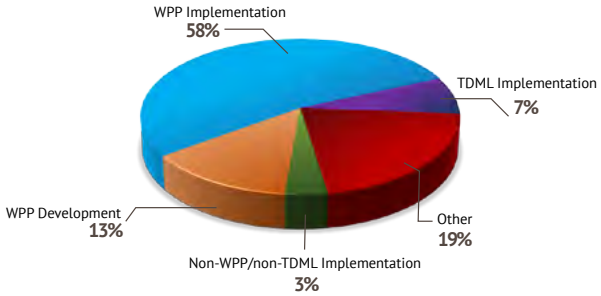
Status of EPA CWA Section 319(h) Grant-Funded Projects

Summary of projects in fiscal year 2022:

TCEQ - 47 active projects totaling approximately $11 million.

- Projects addressed a wide range of nonpoint source issues (Figure 3.1).
- A primary focus was developing and implementing WPPs to address urban nonpoint source pollution and targeted outreach and education activities.

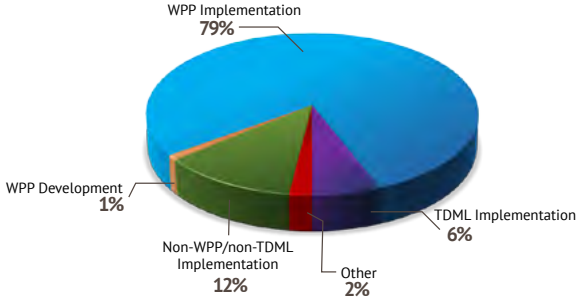
FIGURE 3.1
TCEQ Fiscal Year 2022 Nonpoint Source Grant Funds by Project Type



TSSWCB - 39 projects totaling approximately $10.2 million.

- Projects addressed agricultural and silvicultural nonpoint source pollution (Figure 3.2).
- Specific projects included developing and implementing WPPs, supporting targeted educational programs, and implementing BMPs to abate nonpoint source pollution from agricultural and silvicultural operations.

FIGURE 3.2
TSSWCB Fiscal Year 2022 Nonpoint Source Grant Funds by Project Type




A field of wildflowers, Industry, Texas (Source iStock)

Implementation

Goal One—Data Collection and Assessment

One of the goals of the Texas Nonpoint Source Management Program is to collect and assess water quality data. Data collection requires the coordination of appropriate federal, state, regional, and local entities as well as the private sector and citizen groups. TCEQ's Surface Water Quality Monitoring Program, operating from the Austin central office and 16 regional offices, conducts both routine ambient monitoring and special studies. In addition, the Clean Rivers Program, which is a collaboration between TCEQ and 15 regional water agencies, collects surface water quality data throughout the state in response to both state needs and local stakeholder interests. Furthermore, TCEQ acquires water quality data from other state and federal agencies, river authorities, and municipalities after assuring the quality of the data is comparable to that of data collected by TCEQ's programs.

TCEQ assesses data to determine if a water body meets its designated uses or if water quality improvement activities are achieving their intended goals. For impaired or special interest waters, water quality data can be used in the development of WPPs and TMDLs. Data are also used to determine potential sources of pollution, the adequacy of regulatory measures, watershed improvements, and restoration plans. The data collection guides the distribution of EPA CWA Section 319(h) grant funds toward the development of WPPs and water quality assessment activities in high priority watersheds, nonpoint source-impacted watersheds, vulnerable and impacted aquifers, or areas where additional information is needed.

Texas Integrated Report

The Texas Integrated Report describes the status of all surface water bodies in the state evaluated for the given assessment period. TCEQ uses data collected during the most recent seven-to-ten-year period to assess the quality of surface water bodies in the state. The descriptions of water quality for each assessed water body in the Texas Integrated Report represent a snapshot of conditions during the period considered in the assessment. Water bodies identified as impaired by nonpoint source pollution are given priority for EPA CWA Section 319(h) grant funds. The assessment guidance includes methods to determine use

attainment for water quality standards. The guidance document is developed by TCEQ with the input of an external advisory work group. The assessment methods for the 2022 Texas Integrated Report are detailed in the 2022 Guidance for Assessing and Reporting Surface Water Quality in Texas. The 2022 Texas Integrated Report was adopted by TCEQ in June 2022 and was approved by EPA in July 2022.

Water Quality Status Categories

The Texas Integrated Report assigns each assessed water body to one of five categories in order to report water quality status and potential management options to the public, EPA, state agencies, federal agencies, municipalities, and environmental groups. These categories indicate the status of a water body and describe how the state will approach identified water quality problems. Table 3.1 defines the five categories and shows the number of water bodies assigned to each assessment category in the 2022 Texas Integrated Report.

TABLE 3.1
Number of Water Bodies Assigned to Each Assessment Category in the 2022 Texas Integrated Report

Category	Definition	Number of Water Bodies
1	All designated uses are supported, no use is threatened.	90
2	Available data and/or information indicate that some, but not all of the designated uses are supported.	310
3	Insufficient or unreliable available data and/or information to make a use support determination.	103
4	Available data and/or information indicate that at least one designated use is not being supported or is threatened, but a TMDL is not needed.	131
5	Available data and/or information indicate that at least one designated use is not being supported or is threatened, and a TMDL is needed. Category 5 is the CWA Section 303(d) list of impaired waters.	457
Total		**1091**

The 303(d) list of impaired waters, Category 5 of the Texas Integrated Report, identifies waters that do not meet Texas Surface Water Quality Standards. It is an important management tool produced as part of the Texas Integrated Report and must be approved by EPA. Water bodies on the 303(d) list of impaired waters are those that require action to restore water quality. An impairment occurs when a water body or a portion of that water body called an assessment unit, does not meet the water quality criteria to protect a specific use. The same AU can have multiple impairments. For example, a water body may not meet the criteria for both dissolved oxygen and bacteria; this is considered two impairments. Since a water body has multiple uses, it may fall into different categories for different uses. In that case, the overall category for the water body is the one with the highest category number.

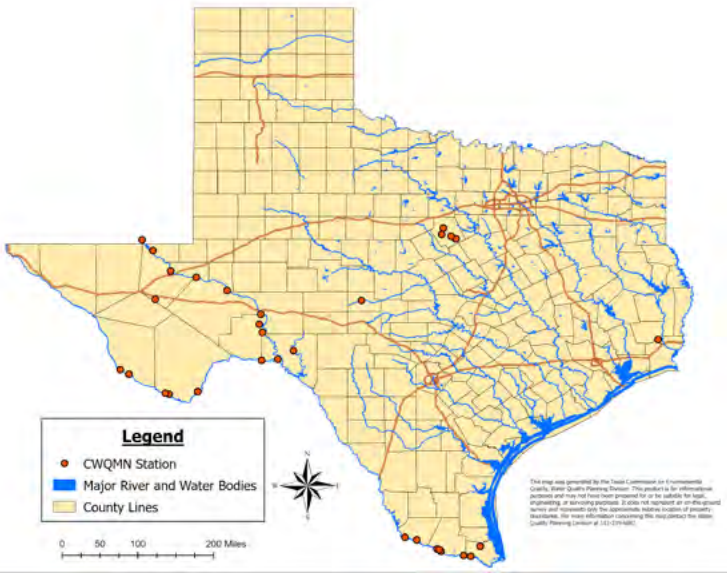
The Texas Integrated Report further divides Category 5 water bodies into subcategories to reflect additional options for addressing impairments:

- Water bodies in Category 5a have a TMDL underway, scheduled, or to be scheduled.
- Water bodies in Category 5b require a review of the water quality standards for the water body to be conducted before a management strategy is selected.
- Water bodies in Category 5c require additional data and information to be collected or evaluated before a management strategy is selected.
- Water bodies in Category 5n require additional nutrient data and information to be collected or evaluated before a management strategy is selected.

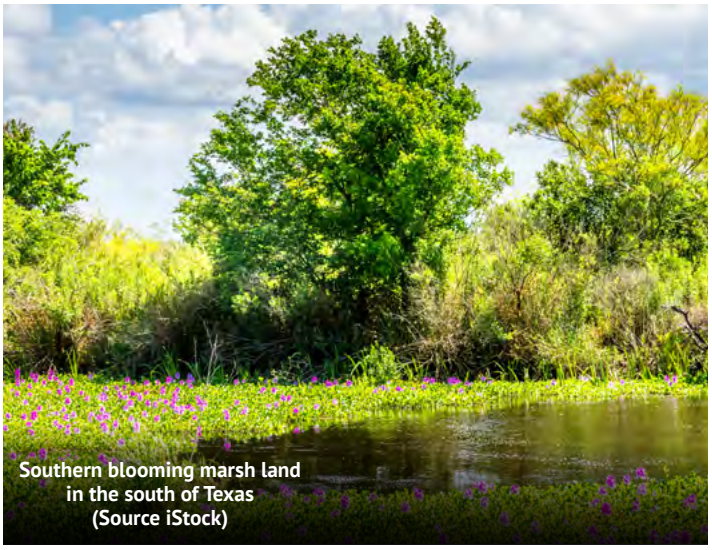
Continuous Water Quality Monitoring

TCEQ has a network of continuous water quality monitoring sites on priority water bodies. The agency maintains 30 to 45 sites in its Continuous Water Quality Monitoring Network. The number and locations of sites varies from year to year. In fiscal year 2022, TCEQ had 32 active sites (Figure 3.3). At these sites, instruments measure basic water quality conditions every 15 minutes. The continuous water quality monitoring data may be used by TCEQ or other organizations to make water resource management decisions, target field investigations, evaluate the effectiveness of water quality management programs such as TMDL I-Plans and WPPs, characterize existing conditions, and evaluate spatial and temporal trends. You can find site information and data at the Continuous Water Quality Monitoring webpage[3].

FIGURE 3.3
Active Continuous Water Quality Monitoring Stations in Fiscal Year 2022



[3] https://www.tceq.texas.gov/waterquality/monitoring/swqm_realtime.html

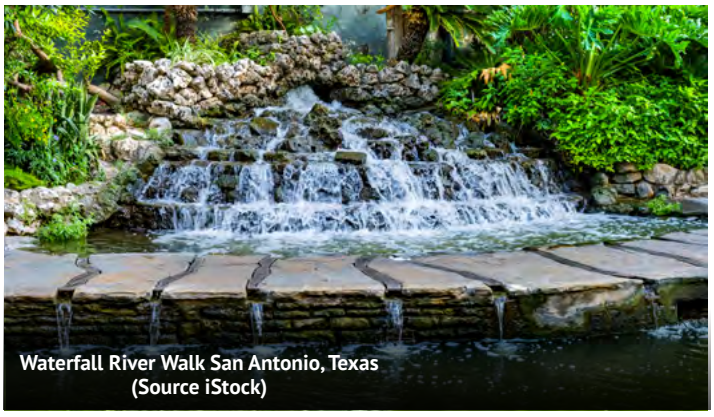


Southern blooming marsh land in the south of Texas (Source iStock)

Texas Stream Team Monitoring

The Texas Stream Team program is administered within the Watershed Services Division at the Meadows Center for Water and the Environment (the Meadows Center), a research institute located at Texas State University. This statewide network of trained water quality citizen scientists and supportive partner organizations works to gather information about the natural resources of Texas. Texas Stream Team citizen scientists receive certification after completing training to collect water quality and environmental parameters from monitoring sites along rivers, lakes, and streams. All water quality and environmental data collected under the program is available to the public. The Meadows Center receives EPA CWA Section 319(h) grant funds from TCEQ to administer the statewide program.

In fiscal year 2022, Texas Stream Team and its partners conducted 57 trainings across the state, which resulted in over 315 volunteers trained in surface water quality monitoring. Additionally, citizen scientists volunteered 2,792 hours of their time, traveled a cumulative distance of 36,691 miles, and conducted 2,616 monitoring events at 276 active stations on rivers, lakes, streams, bays, and estuaries across Texas. A total of 32 new monitoring sites were created in water bodies where no sampling activities existed. Although in-person activities have resumed, select trainings will continue to be offered online to increase program versatility, functionality, and accessibility for all Texans.



Waterfall River Walk San Antonio, Texas (Source iStock)

Texas Steam Team connected with 15,404 individuals through in-person, virtual, and socially distanced education and partner events in fiscal year 2022. The largest event of the fiscal year was the Stream Team Fest which gathered current and future citizen scientists, partners, and trainers in one space to learn about the program and interact with Texas Stream Team staff directly. The event celebrated the successes accomplished over the past 30 years and honored the dedicated work of the many people who have and continue to contribute to the program's success.

FIGURE 3.4
Texas Stream Team Meeting (Source Rachel Cywinski)

A total of 32 new monitoring sites were created in water bodies where no sampling activities existed.

FIGURE 3.5
Texas Stream Team Volunteer Checks pH Sample (Source Edwards Aquifer Habitat Conservation Plan)

Many Texas Stream Team activities took place on water bodies that had WPP implementation activities such as: Bastrop Bayou, Clear Creek, Cypress Creek (Segment 1815), Cypress Creek (Segment 1009), Dry Comal Creek, Comal River, Hickory Creek, Lake Lavon, Navasota Below Lake Limestone, Plum Creek, Rowlett Creek, Spring Creek, San Bernard River, Upper Cibolo Creek, Upper San Antonio River, Upper San Marcos River, West Fork of the San Jacinto River, and Lake Creek. The program strives to continue to expand monitoring efforts within and beyond WPPs to enhance the data provided for water bodies.

For more information and for future events and trainings, visit the Texas Stream Team website[4].

FIGURE 3.6
Active Texas Steam Team Monitoring Sites in Fiscal Year 2022

Goal Two—Implementation

The second goal of the Texas Nonpoint Source Management Program is to implement activities that prevent and reduce nonpoint source pollution in surface water, groundwater, wetlands, and coastal areas. The objective of this goal is to implement WPPs, TMDL I-Plans, the Texas Groundwater Protection Strategy, and TSSWCB-certified WQMPs, as well as implement BMPs on agricultural and silvicultural lands, and other identified priorities.

Implementation Project Highlights

Implementing the Lampasas River WPP

The Lampasas River was originally listed as not meeting water quality standards for primary contact recreation 1 use in the 2002 Texas Integrated Report based upon bacteria levels. In response, the Lampasas River Watershed Partnership was formed in 2009 and initiated the development of a WPP. The Lampasas River watershed is comprised of 1,247 square miles across parts of Bell, Burnet, Coryell, Hamilton, Lampasas, Mills, and Williamson counties. Local stakeholders worked with Texas A&M AgriLife Research to identify the potential sources of pollutants and developed the Lampasas River WPP, which was approved by the Partnership and accepted by EPA in 2013.

Stakeholders prioritized concerns about contributions from failing on-site sewage facilities (OSSFs) near the Lampasas River and its tributaries since much of the watershed is not served by a municipal wastewater system. They recommended developing a financial assistance program to repair or replace failing OSSFs within the watershed. Texas A&M AgriLife Extension Service and Texas A&M AgriLife Research partnered on an EPA CWA Section 319(h) grant to implement these recommendations. At the onset of the Lampasas OSSF remediation project, program staff worked with local permitting authorities and stakeholders to develop a needs assessment, ranking criteria, and other program materials.

Interested homeowners submitted 20 applications during fiscal year 2022. Of those applications, project staff conducted visual inspections of 19 OSSFs, which were prioritized by degree of failure, proximity to a water body, and order of application submittal. Twelve systems were selected for full replacement through the program. While the program did not include financial criteria, most homeowners stated that they would not have been able to replace their failing systems without assistance. The average cost of systems replaced through this project was $9,950; the program provided up to $8,000 in financial assistance and homeowners were responsible for any remaining balance.

FIGURE 3.7
Failing OSSF Near Lampasas River (Source Texas A&M AgriLife Extension Service)

Implementing Riparian Buffers at Three Parks on Sims Bayou

The Sims Bayou watershed is in the heavily urbanized area of Houston and contains approximately 75 miles of streams. Sims Bayou Above Tidal (Segment 1007D) does not support the primary contact recreation 1 use because it does not meet the water quality criterion for *E. coli*. Sims Bayou Tidal does not meet state standards for several legacy pollutants and has concerns for excess nutrients. Two of the Sims Bayou sites for the Three Parks project (Charlton Park and Reveille Park) are within the

[4] http://www.texasstreamteam.org/

tidal portion of Sims Bayou and the third (Robert C. Stuart Park) is in the above-tidal portion. All three parks are located within relatively dense urban residential developments.

To better inform and invest Sims Bayou stakeholders in watershed stewardship and habitat restoration, the Student Conservation Association engaged over 60 local residents in hands-on service projects from 2020 to 2022 during community planting events and monthly service opportunities. In two separate events on October 23, 2021 and November 12, 2021, community volunteers planted native trees and removed debris in Charlton Park and Stuart Park. During the two events and monthly community service opportunities, fifty 50-gallon bags of trash were removed at Charlton, Stuart, and Reveille Parks in addition to regular removal of trash by Houston Parks and Recreation staff. Participants were recruited through social media, flyers, and the Student Conservation Association's existing network of local partner organizations.

FIGURE 3.8
Tree Planting at Charlton Park (Source Cassidy Kempf)

The association's field partner, the Houston Parks and Recreation Department's Natural Resources Management Program, is targeting all parks adjacent to bayous and tributaries for the restoring forested riparian buffers. Historically, much of the Houston area was coastal prairie habitat with forested riparian habitat lining the bayous. Many of the riparian buffers have been removed or degraded due to development or stream channelization.

This project is helping to increase green infrastructure within parks to mitigate flooding, improve water quality, reduce erosion, create wildlife habitat, and establish areas for passive recreation. A total of 70 parks have been identified as having an area adjacent to a bayou or tributary where a riparian buffer could be enhanced or created. The Riparian Restoration Initiative is scheduled to be completed by the year 2030, with an estimated 1,000 acres of habitat restored and an installation of approximately 200,000 native trees.

The combined efforts of seven Student Conservation Association interns, two crews of young adults, and community volunteers resulted in 1,792 trees planted along the Sims Bayou at Charlton, Reveille, and Stuart Parks, and offers additional potential for riparian zone development and pollutant load reductions.

Implementing the Mill Creek WPP

Mill Creek (Segment 1202K) is formed by two forks, East and West Mill Creek, in southwest Washington County. The two forks unite near Bellville, Texas, in Austin County to form the main stem. Mill Creek then flows 14 miles southeast to its confluence with the Brazos River. Located in Austin and Washington counties, the Mill Creek watershed drains an area of nearly 412 square miles. The greater portion of the watershed is comprised of undeveloped or agricultural land, with only approximately 8 percent associated with urban uses. Since 2010, Mill Creek (AU 1202K_01) has been identified as impaired in the Texas Integrated Report due to the elevated levels of ***E. coli***. In response to this impairment, the Mill Creek Watershed Partnership formed to develop a WPP to restore and protect water quality in the creek. Accepted by EPA in 2016, the Mill Creek WPP has been guiding public outreach and education to help improve water quality.

During fiscal year 2022, the partnership facilitated multiple educational events offering the watershed stakeholders an opportunity to learn about BMPs for riparian zone restoration, livestock and grazing management, feral hog control, and rainwater harvesting.

Feral hogs are a known issue in this watershed. Along with harmful effects on native ecosystems and agriculture, these invasive species are detrimental to water quality in Mill Creek. During the development of the Mill Creek WPP, the widespread activity of feral hogs in the watershed was linked to the elevated levels of ***E. coli*** in the creek. To address public concerns the partnership hosted a meeting providing over 80 participants the opportunity to express their ideas, provide input, and ask questions about feral hogs to local biologists, game wardens, researchers, and other experts.

In August 2022, the second annual "Cleanup Day" facilitated through the partnership was implemented in the Mill Creek watershed. As part of this event, local landowners were invited to clean their properties and bring the collected items to a centralized trash drop-off location. Participants removed 2,840 pounds of trash and debris from 1,313 acres covering 2.4 miles of Mill Creek.

FIGURE 3.9
Mill Creek (Source H-GAC)

FIGURE 3.10
Surface Water Quality Monitoring at Mill Creek (Source Evgenia Spears)

Total Maximum Daily Loads and I-Plans

The TMDL Program develops targets for reducing pollution and helps communities build plans to improve water quality in local waterways. TMDL I-Plans may be developed concurrently with TMDLs to leverage resources and increase the pace at which Texas improves impaired waterways. In fiscal year 2022, the TMDL Program continued to implement the CWA Section 303(d) Vision. The CWA Section 303(d) Vision enhances overall efficiency of the CWA Section 303(d) Program and focuses attention on priority waters. The CWA Section 303(d) Vision provides flexibility to state programs to use available tools such as TMDLs, TMDL I-Plans, WPPs, or other TMDL alternatives to attain water quality restoration and protection. In fiscal year 2022, TCEQ's NPS and TMDL programs and TSSWCB coordinated with stakeholders to continue surface water quality monitoring in the Mission and Aransas rivers watershed, and to continue the development of the Arenosa and Garcitas Creeks WPP. Stakeholders provide local expertise to identify site-specific problems, targeting areas for attention, and determining what management measures will be most effective. Ultimately, it is stakeholders who implement the plans to improve water quality in the rivers, lakes, and bays and achieve long-term success. Several TMDL I-Plans that address nonpoint sources of pollution are supported by EPA CWA Section 319(h) grant funds from TCEQ and EPA.

Texas Coastal Management Program

The Texas Coastal Management Program coordinates coastal management between local, state, and federal entities that manage coastal resource use. The Texas Coastal Management Program's mission is to ensure the long-term economic and ecological productivity of the coast. The Texas General Land Office (GLO) administers the program and is advised by members of the Coastal Coordination Advisory Committee.

[5] https://cleancoast.texas.gov/

The Coastal Nonpoint Pollution Control Program establishes a set of management measures for states to use to control coastal nonpoint source runoff from five main sources: urban, forestry, agriculture, hydromodification, and marinas. Details of these management measures are included in the Texas Coastal Nonpoint Source Pollution Control Program [established in 1990 by Section 6217 of the Coastal Zone Act Reauthorization Amendments (CZARA)]. In fiscal year 2022, EPA and the National Oceanic and Atmospheric Administration found that Texas has satisfied all conditions and formally approved the Texas Coastal Nonpoint Source Pollution Control Program.

Septic Systems

The Texas Coastal Nonpoint Source Pollution Control Program is implementing several projects to help satisfy CZARA requirements to inspect septic systems in the coastal zone. In fiscal year 2022, Texas A&M AgriLife Extension Service secured EPA CWA Section 319(h) grant funds from TCEQ and EPA to update the Coastal On-site Sewage Inventory database and conduct OSSF inspections and education events in watersheds with malfunctioning systems. The database stores septic system information such as location, age, type, permit information, and inspection date. This database helps the state efficiently direct funding and resources to designated areas.

In fiscal year 2022, Texas continued to implement the septic system inspection strategy that includes a five-pronged approach:

- Authorized agents and maintenance on-site disposal system inspections.
- WBP on-site disposal system inspections.
- Point-of-sale real estate on-site disposal system inspections.
- Direct contracting for on-site disposal system inspections.
- On-site disposal system education and outreach.

Using this strategy, Texas estimates that the required number of inspections will be obtained within a 15-year timeframe. In fiscal year 2022, Texas A&M AgriLife Extension Service inspected an estimated 1,669 systems.

Clean Coast Texas and the Coastal Stormwater Management Manual

Clean Coast Texas, a program of the Texas Coastal Nonpoint Source Pollution Control Program, works to support a thriving Gulf Coast economy and environment through research, planning, constructed improvements, collaboration, and partnership activities that manage nonpoint source pollution to keep our coastal waters clean. Clean Coast Texas is guided by GLO, in partnership with numerous stakeholders and state and local agencies.

Resources provided by this program can help Texas coastal communities reduce the environmental impacts of stormwater runoff from existing and new urbanized areas and enhance wastewater treatment. Under the program, the state developed the Clean Coast Texas website[5] that includes information on the Texas Coastal Zone, stormwater runoff, and community and technical resources. A technical manual, Guidance for Sustainable Stormwater Drainage on the Texas Coast, was developed to

provide additional guidance and resources to coastal communities. Since its launch in January 2021.the program has hosted 49 meetings and events for approximately 1,820 people. A monthly series, "Lunch and Learn[6]," continues to feature timely content focused on coastal nonpoint source pollution.

Hydromodification

The Hydromodification Best Management Practices Manual (2008) describes several recommended practices consistent with the hydromodification management measures. The Texas program, to address these management measures, encourages voluntary adoption of the State's manual. To encourage the voluntary adoption of these practices and recommendations, Texas has included relevant hydromodification practices and guidance in the *Guidance for Sustainable Stormwater Drainage on the Texas Coast*. This guidebook is available to communities, county authorities, and other relevant planning authorities in the coastal nonpoint management area through the website, workshops, and other outreach efforts. Additional voluntary initiatives and regulatory activities, further support the implementation of the hydromodification management measures.

Estuary Programs in Texas

Galveston Bay Estuary Program

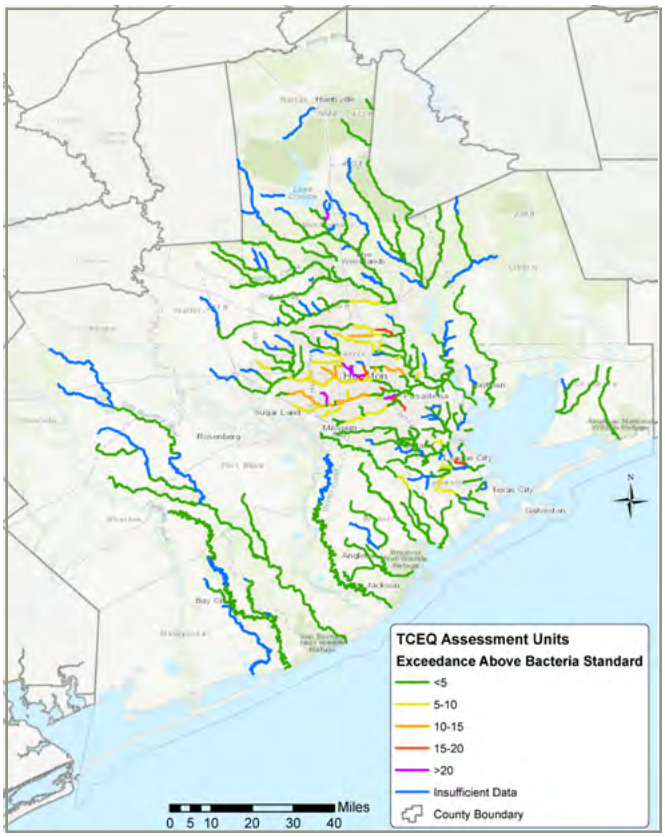
The Galveston Bay Estuary Program (GBEP) is one of two estuary programs in the state of Texas and one of 28 nationwide. GBEP is a non-regulatory program of TCEQ, and together with its partners is tasked with implementing *The Galveston Bay Plan, 2nd Edition*. This comprehensive conservation and management plan seeks to preserve the bay for future generations. The action plans, which are to improve water quality through both nonpoint and point source pollution abatement, continue to be top priorities of the program. These are two of the three action plans listed in the Galveston Bay Plan's first priority, which are to ensure safe human and aquatic life use.

This comprehensive conservation and management plan seeks to preserve the bay for future generations.

Targeted Bacteria Monitoring Project

Bacteria continue to be one of the most pervasive pollutants in the Houston–Galveston area, with most stream segments that are monitored by TCEQ and its partners having geometric means of *E. coli* well above the primary contact recreation 1 criterion of 126 cfu/100 mL (Figure 3.11). Tracking the actual sources of bacteria is not something that was historically done. The Bacteria Implementation Group (BIG) is now seeking to find and eliminate some of these sources through the Targeted Bacteria Monitoring Project.

FIGURE 3.11
Bacteria Geometric Means in the Houston–Galveston Area (Source H-GAC)



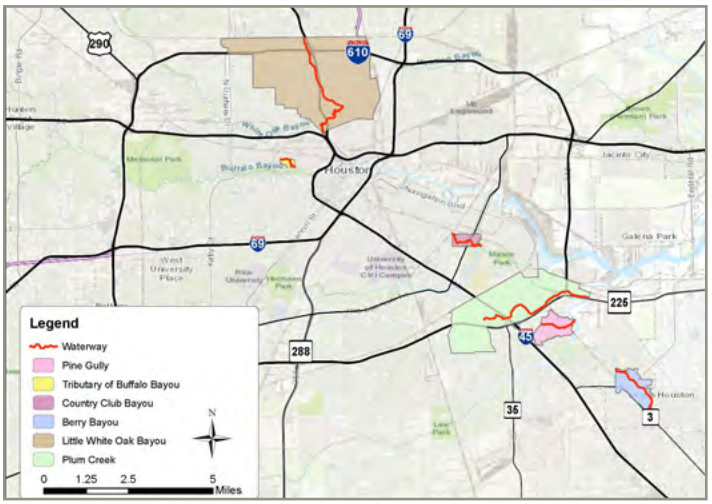
In its annual reports, the BIG identifies the top 10 "Most Wanted" streams—those designated stream segments with the highest geometric means of *E. coli* concentrations in the BIG project area[7]. For the past 10 years, the Bayou Preservation Association and the Houston–Galveston Area Council (H-GAC) have conducted intensive bacteria monitoring within most impaired stream segments to help remove these streams from the Texas Integrated Report.

In 2019, in coordination with the Bayou Preservation Association and its Student Conservation Association interns, H-GAC obtained EPA CWA Section 320 grant funding through GBEP to complete a targeted bacteria monitoring project, with a goal to significantly reduce bacteria levels in prioritized AUs located within the BIG's project area. Six total AUs were selected in Brays Bayou, Buffalo Bayou, Greens Bayou, Sims Bayou, West Fork San Jacinto River, and White Oak Bayou (Figure 3.12).

The focus of the project was to identify relative differences in bacteria levels for the purpose of narrowing down the geographic location of potential sources. When these potential sources were identified, the information was then passed on to local authorities for further investigation and remediation. A unique and cost-effective approach to this project is the use of Texas Stream Team protocols for bacteria testing versus a National Environmental Laboratory Accreditation Program (NELAP)-certified laboratory. This has allowed interns to collect samples, since the purpose is to locate potential sources rather than use the data for any sort of regulatory purposes.

[6] https://www.eventbrite.com/cc/clean-coast-texas-lunch-learn-series-83869
[7] https://h-gac.maps.arcgis.com/apps/MapSeries/index.html?appid=a75ba4bb46ca40658066c5755a8dba6e

FIGURE 3.12
H-GAC Targeted Bacteria Monitoring Project Areas (Source H-GAC)



To date, bacteria reductions have been achieved in several of the identified AUs. These successes have been attributed to working with local authorities rather than first reporting them for issues of non-compliance. Identifying the issue first (e.g., sanitary sewer overflows, illicit discharges, failing infrastructure, bad connections), before reporting to local authorities, has enabled communities to fix issues that they previously may not have had the resources to locate themselves. Not only has this project been successful in eliminating sources of bacteria but it has also created the framework for a cost-effective approach to tackling the issue of point source pollution across the watershed.

FIGURE 3.13
Student Conservation Association Interns Discuss Sampling Methods (Source TCEQ)

In fiscal year 2022, monitoring was completed on nearly five of the six identified AUs. A total of 78 samples have been collected, 74 percent of which had bacteria levels greater than 399 cfu/100mL. Additionally, 17 percent of those samples were greater than 20,000 cfu/100mL. Unreported sanitary sewer overflows are suspected to be the primary contributor. Data have been compiled into reports and submitted to the appropriate jurisdictions for remediation. Additional GBEP funding has been secured to complete an additional phase beginning in Fall 2022. Phase III of the project will allow completion of any remaining monitoring, provide targeted outreach in identified problem areas, and work with the City of Houston to develop a new "Eyes on the Bayou" initiative that will empower residents to become stewards of their waterways.

Coastal Bend Bays and Estuaries Program

The Coastal Bend Bays and Estuaries Program (CBBEP) is one of the 28 National Estuary Programs that works with local government, stakeholders, conservation groups, industry groups, and resource managers to improve water quality and restore critical habitats. The program targets nonpoint source pollution issues by conducting research projects to determine sources of pollution and participates in developing and implementing WPPs and TMDL I-Plans. Other priorities include land conservation and management and education through the Delta Discovery Program.

CBBEP continues to focus efforts on investigating sources of nutrients that may periodically be found in high concentrations in bay systems by partnering with stakeholders and scientists to sample soils and runoff to identify areas of concern. The information is being used to focus outreach efforts to deter practices that may lead to introducing elevated pollutants and nutrients in runoff and improve water quality.

In fiscal year 2022, CBBEP and the Nueces River Authority designed a project, now underway, to engage landowners in the Baffin Bay watershed and encourage conservation practices that reduce nonpoint source pollution and improve water quality. The health of Baffin Bay has been a concern to scientists and citizens due to fish kills, water quality problems, and food web changes. The project's goals are to:

- Reduce pollutant and nutrient runoff by enhancing riparian function along the tributary streams of the Baffin Bay system.
- Identify approximately 150 landowners and agricultural operators of riparian lands along Petronila, San Fernando, and Los Olmos creeks and their drainages.

CBBEP is engaging with these stakeholders to provide information about the economic and environmental benefits of healthy riparian lands, to encourage engagement in the watershed planning process, and to promote participation in future restoration efforts. For more information about this project, visit the Coastal Bend Bays and Estuary Program's website[8].

[8] https://www.cbbep.org/

Texas Groundwater Protection Committee

Groundwater is a major source of water in Texas. Texans use groundwater for drinking, livestock, irrigating crops, and mining and industrial processes. It also serves as habitat for plants and animals, some of which are endangered species.

The interagency Texas Groundwater Protection Committee (TGPC) protects groundwater resources and includes nine state entities and an association of groundwater districts. TGPC strives to improve interagency coordination and continues developing and updating the comprehensive groundwater protection strategy for Texas. The committee may also identify new programs or enhancements to existing programs to improve groundwater protection.

Two subcommittees accomplish the majority of TGPC's responsibilities:

- The Groundwater Issues Subcommittee.
- The longstanding Public Outreach and Education Subcommittee.

The Groundwater Issues Subcommittee and TGPC each have standing agenda items at every meeting to discuss nonpoint source pollution issues.

What the Groundwater Issues Subcommittee does:

- Oversees the cooperative groundwater monitoring program for select pesticides of interest in groundwater.
- Coordinates and assists TGPC member agencies with monitoring programs for emerging contaminants or constituents of concern.
- Develops white papers on groundwater issues, including recommendations or policy options for TGPC.
- May also form task force working groups to address individual issues, such as nonpoint source pollution.

TGPC emphasizes groundwater quality awareness in its outreach and education efforts.

What the Public Outreach and Education Subcommittee does:

- Works with TGPC member agency Texas A&M AgriLife Extension Service to develop fact sheets and "frequently asked questions" documents aimed at private drinking water well owners, which often include information on nonpoint source pollution and BMPs.
- Facilitates a TGPC booth at various events, answering questions and distributing fact sheets and information on groundwater protection, including nonpoint source pollution.

While COVID-19 restrictions limited the number of events TGPC members could attend in person in fiscal year 2022, the committee participated in virtual events to the extent possible, maintained a physical booth at TCEQ's annual Environmental Trade Fair, and supported Texas A&M AgriLife Extension Service's TWON program as it conducted educational events for private drinking water well owners.

TGPC's biennial report to the Texas Legislature describes activities for the two preceding years and includes any recommendations for groundwater protection to be considered by the Legislature. The Legislative Report Subcommittee was activated in fiscal year 2022 and will develop a draft report for consideration by TGPC prior to the next Legislative Session. Additional information on TGPC, including activities related to nonpoint source pollution, is available on TGPC's website[9].

Clean Water State Revolving Fund Loans for Nonpoint Source Projects

Another tool available in Texas for addressing nonpoint source pollution is the Clean Water State Revolving Fund, which is administered by the Texas Water Development Board. This financing program, authorized under the federal CWA, is partially capitalized by an annual grant from EPA. The program provides funding assistance in the form of up to 30-year loans at interest rates lower than the market offers, as well as a limited amount of funds which do not have to be repaid. The funds that do not have to be repaid are available to disadvantaged communities and green projects.

Although most of the funds finance publicly owned wastewater treatment and collection systems, the Texas Water Development Board can also use the fund for nonpoint source pollution abatement and stormwater projects. Funds are available to cities, counties, groundwater conservation districts, SWCDs, and other public agencies, as well as to nonprofit organizations and mainly water supply or sewer service corporations.

A water quality-based priority system is used to rank potential applicants and fund projects, including nonpoint source projects. To be eligible, a nonpoint source project must be one of the following:

- An identified practice within a WQMP, TMDL I-Plan, or WPP.
- A nonpoint source management activity that has been identified in the Texas Groundwater Protection Strategy.
- A BMP identified in the Texas Nonpoint Source Management Program or the National Estuary Program.

All applications are initiated with the Texas Water Development Board, and then reviewed by TCEQ in cooperation with Councils of Government participating in the CWA Section 604(b) Grant Program to ensure conformance with the Texas Water Quality Management Plan. Loans can be used for planning, designing, acquiring, and constructing wastewater treatment facilities, wastewater recycling and reuse facilities, and collection systems. Other activities eligible for funding assistance include:

- Agricultural, rural, and urban runoff control.
- Estuary improvement.
- Nonpoint source education.
- Wet weather flow control, including stormwater management activities.

Staff members from the Texas Water Development Board, TCEQ, and TSSWCB meet regularly to coordinate efforts to identify water bodies impacted by nonpoint source pollutants and to identify potential applicants for assistance under this funding program.

[9] https://tgpc.texas.gov/

Goal Three—Education

The third goal of the Texas Nonpoint Source Management Program is to conduct education and technology transfer activities to raise awareness of nonpoint source pollution and activities that contribute to the degradation of water bodies by nonpoint source pollution. Education is a critical aspect of managing nonpoint source pollution. Public outreach and technology transfer are integral components of every WPP, TMDL, and TMDL I-Plan. This section highlights some of the nonpoint source education and public outreach activities in fiscal year 2022.

Oso Bay and Oso Creek Education and Outreach Program

CBBEP partnered with the Nueces River Authority and the Center for Coastal Studies at Texas A&M University–Corpus Christi to develop an education and outreach program that connects urban and rural communities of the Oso Bay and Oso Creek watershed. By educating the public about runoff and the connectivity of the watershed in which they live, this project seeks to create personal responsibility for water quality and polluting behaviors.

Oso Bay (Segment 2485) and Oso Creek (Segment 2485A) are listed on the 2004 and 2002 Texas Integrated Reports, respectively. Oso Bay is listed for depressed dissolved oxygen and elevated bacteria in oyster waters, and Oso Creek is listed for not meeting the primary contact recreation 1 use for bacteria. To address the bacteria impairment, a TMDL project for Oso Bay was completed and stakeholders decided to develop an I-Plan for both the creek and the bay. The I-Plan is currently under development.

Spring Wildflowers in Rural Texas
(Source iStock)

Stakeholders identified a number of point and nonpoint source human activities as potential contributors to water quality problems. However, underlying these existing water quality impairments are a lack of natural resource awareness and a depreciated value for clean streams coupled with a deficit in the understanding of the human activities that contribute to nonpoint source pollution. Refrigerators, tires, animal carcasses, and household garbage dumped at public road crossings testify to this awareness problem.

To address this information gap and foster connections to Oso Creek and Oso Bay, a model of the watershed was constructed in 2022 for use in educational efforts throughout the watershed. This interactive model provides participants the opportunity to locate their place in the watershed, apply different kinds of "pollutants" on the land, and see how water flows through the watershed and into the bay. The model is being used in every fifth-grade classroom in the watershed to reinforce the Texas Essential Knowledge and Skills and cultivate student understanding of a watershed, reaching approximately 2,000 students over two years.

Additionally, bilingual informational materials have been developed and the model is being taken to six community events that target underserved populations over a period of three years. As part of the educational and outreach activity, participants answer a brief, informal questionnaire to measure increased awareness. They are also encouraged to "Take the Pledge" to reduce pollution in the watershed and are provided reusable grocery bags and Up2U trash bags to collect trash in their neighborhood and further the empowering message that trash-free waters are "Up2U!"

FIGURE 3.14
Watershed Model at Clean-Up Event (Source Texas A&M University–Corpus Christi, Center for Coastal Studies)

The COVID-19 pandemic resulted in delays in scheduling classroom programming early in 2021, but demand has rapidly increased in 2022 as word of the educational program spreads to educators throughout the watershed.

Healthy Lawns and Healthy Waters Program

Healthy Lawns and Healthy Waters is an educational program designed to improve and protect surface water quality by enhancing awareness and knowledge of BMPs for residential landscapes. This program was made possible through a partnership between Texas A&M AgriLife Extension Service's Department of Soil and Crop Sciences and TWRI with EPA CWA Section 319(h) grant funds from TCEQ and EPA. Program participants learn about reducing runoff through rainwater capture, planting appropriate turf grass species, and using appropriate quantities and timing of nutrient inputs to residential lawns. Participants also receive a free soil-test analysis through the Texas A&M AgriLife Extension Soil, Water and Forage Testing Laboratory to guide them on proper fertilizer application that is appropriate for their soil.

During fiscal year 2022, the Healthy Lawns Healthy Waters team delivered seven half-day training events to 99 participants in four watersheds of central Texas with impairments for bacteria and concerns for nutrients. Pre- and post-evaluations were administered at the trainings to measure knowledge gained. On average, test scores increased by 43 percent. Sixty soil samples were processed this fiscal year to date. Six months after the trainings, an additional evaluation was sent out to determine which BMPs have been implemented so that behavioral changes associated with reduced use of fertilizers and therefore reductions in nutrient loadings could be quantified. The evaluations showed that 81 percent of respondents either installed some type of rainwater capture system or were planning installations, and 40 percent indicated that they had reduced the amount of fertilizer applied.

Texas Well Owner Network

TWON is an educational training program developed by the Texas A&M AgriLife Extension Service in the Departments of Soil and Crop Sciences and Biological and Agricultural Engineering in partnership with TWRI and TSSWCB. TWON educates well owners about water quality BMPs to protect their wells and surface waters from contaminants. TWON works with other project partners to support watershed protection planning and implementation.

There are more than one million private water wells in Texas providing water to rural areas and, increasingly, to those living on small acreages in the rural-urban interface. Public drinking water supplies are monitored through requirements of the federal Safe Drinking Water Act. However, private well owners are responsible for monitoring the quality of their wells and are therefore at a greater risk for exposure to compromised water quality. Bacteria and nitrates are two of the most common contaminants in private water wells in Texas, as well as frequent causes of surface water quality impairments or concerns.

TWON delivers training via "Well Educated," a four-hour course, and "Well Informed," an hour-long presentation. The "Well Educated" training course covers aquifers, household wells, improving and protecting water resources, groundwater resources, septic system maintenance, well maintenance and construction, water quality, and water treatment. The "Well Informed" presentation focuses on wellhead protection and recommendations for remediating well contamination. Through both programs, private well owners can bring in water samples to screen for fecal coliform bacteria, nitrate-nitrogen, salinity, and in some areas, arsenic.

Bluebonnet field and blue sky in Ennis, Texas
(Source iStock)

[10] http://twon.tamu.edu/

FIGURE 3.15
TWON Education Event
(Source Christina Lopez)

In fiscal year 2022, nine "Well Educated" and 10 "Well Informed" training events were conducted. These events resulted in education and water well screenings for 1,206 samples or participants. Results from pre-test and post-test evaluations indicate that participants increased their knowledge. On average, they increased their program test scores 53 percent from pre-program to post-program. Most participants indicated that they were satisfied with the trainings, and more than 94 percent intend to adopt behavioral changes. Results from one-year follow-up evaluations showed that 67 percent of well owners needing to remove hazardous material from their well house had complied. For those whose septic tanks needed pumping, 77 percent had pumped their septic tanks within six months following the program, with an additional 15 percent planning to do so. Seventy-seven percent said they had shared TWON educational materials with other well owners. For more information visit the TWON website[10].

Public drinking water supplies are monitored through requirements of the federal Safe Drinking Water Act.

Implementing Agriculture and Rural Management Measures in the Arroyo Colorado Watershed

The Arroyo Colorado stretches for 90 miles and flows from east of McAllen, transecting Hidalgo and Cameron counties and forming the boundary for Cameron and Willacy counties for the last 16 miles until it reaches the Lower Laguna Madre. The lower 25 miles of the Arroyo Colorado is an important estuary and a nursery for many fish and shrimp species.

The Arroyo Colorado watershed has a drainage area of 706 square miles of predominately agricultural land used for production of row crops, sugar cane, citrus, and vegetables; however, rapid urbanization is occurring across the watershed. Return flows and stormwater from agricultural and urban landscapes carry bacteria, nutrients, and sediment resulting in elevated bacteria, nutrients, and low dissolved oxygen concentrations.

Colorful Wildflowers in Texas Springtime in Front of a Vineyard (Source iStock)

In fiscal year 2022, nine WQMPs were developed and certified in the watershed covering 143.3 acres of crops and grazing land. Practices to improve irrigation water management and reduce agricultural return flows are the most common implementation activity. Within these plans, land-levelling and irrigation pipeline were common practices implemented to reduce nonpoint source pollution impacts from these properties and conserve water resources.

FIGURE 3.16

Irrigation Pipeline Installation in Arroyo Colorado Watershed (Source Ronnie Ramirez)

FIGURE 3.17

Farmer Program Workshop (Source Vidal Sanez, Hidalgo County)

EPA accepted the Arroyo Colorado WPP Update in 2017. The Arroyo Colorado Watershed Partnership promotes education programs throughout the year through monthly emails, news articles, and annual newsletters. The partnership also works closely with the Hidalgo, Cameron, and Willacy counties' extension agents to develop and host Underserved, Disadvantaged, and Small-Acreage Farmer workshops to educate farmers on the cost-share education programs available to producers and introduce them to BMPs they can implement on their farms. In fiscal year 2022, the project team developed five separate workshops:

- Grow Your Farm Horticulture Workshop
- Goat and Poultry Workshop
- Brush and Forage Management
- Beef Cattle Workshop
- Ag Value-Added Workshop

Ninety-three participants attended the Grow Your Farm Horticulture and the Goat and Poultry workshops. Based on evaluations, the attendees indicated that they value the workshops and want more that cover cost-share programs, technical assistance developing business plans, marketing and bringing your product to the public for sale, and other similar topics.

04

Developing and Implementing WPPs

TCEQ and TSSWCB apply the watershed approach to managing nonpoint source pollution by supporting the development and implementation of WPPs. These plans are developed through local stakeholder groups who coordinate activities and resources to manage water quality. In Texas, WPPs facilitate the restoration of impaired water bodies and the protection of threatened waters before they become impaired. These stakeholder-driven plans give the decision-making power to the local groups most vested in the goals specified in the plans. Bringing groups of people together through watershed planning efforts combines scientific and regulatory water quality factors with social and economic considerations. While WPPs can take many forms, plans funded by EPA CWA Section 319(h) grants must follow EPA guidelines. You can find these guidelines in the Nonpoint Source Program and Grants Guidelines for States and Territories[11].

At the end of fiscal year 2022, TCEQ and TSSWCB have facilitated the development and implementation of approximately 44 WPPs throughout Texas by providing technical assistance or funding through grants to regional and local planning agencies and, thereby, to local stakeholder groups.

[11] https://www.epa.gov/nps/319-grant-program-states-and-territories

Beautiful Texas Spring Sunset
(Source iStock)

A significant portion of the funding to address nonpoint source pollution under the federal CWA is dedicated to WPPs in areas where nonpoint source pollution has contributed to the impairment of water quality. In Texas, WPPs are also developed by third parties independent from TCEQ and TSSWCB. WPPs being developed or implemented in Texas at the end of fiscal year 2022 are shown in Figure 4.1 and are listed in Table 4.1. Neither the map nor table are intended to be a comprehensive list of all the watershed planning efforts underway in Texas because there may be other local planning efforts not funded by EPA CWA Section 319(h) grant funds.

FIGURE 4.1
Watersheds with WPPs Being Developed or Implemented

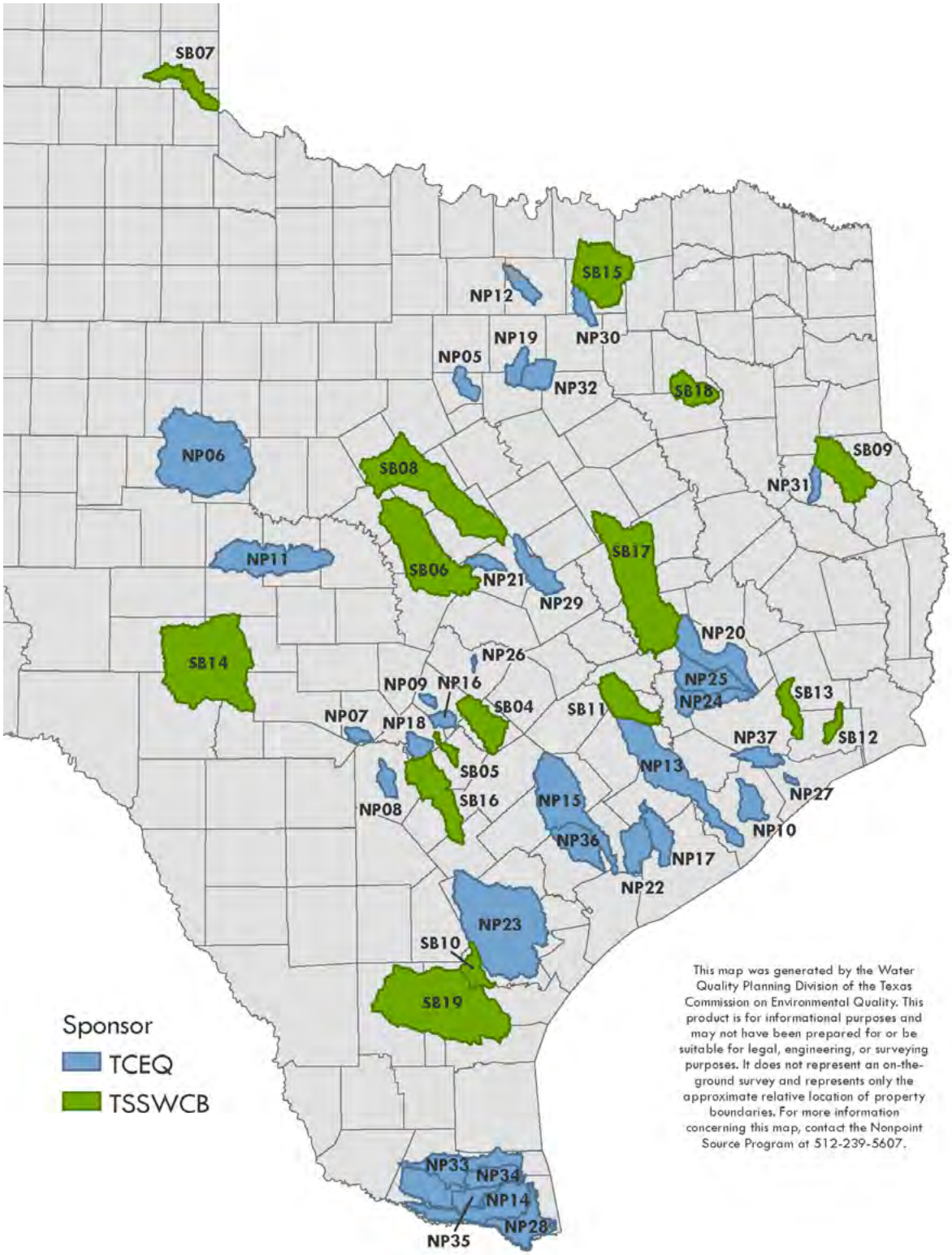


TABLE 4.1

WPPs Accepted, Implemented, or Under Development*

ID	TSSWCB WPPs
SB04	Plum Creek
SB05	Geronimo and Alligator Creeks
SB06	Lampasas River
SB07	Buck Creek
SB08	Leon River
SB09	Attoyac Bayou
SB10	Lower Nueces River
SB11	Mill Creek
SB12	Double Bayou
SB13	Cedar Bayou
SB14	Upper Llano River
SB15	Lake Lavon
SB16	Mid and Lower Cibolo Creek
SB17	Navasota River
SB18*	Kickapoo Creek
SB19	Petronila and San Fernando Creeks

ID	TCEQ WPPs
NP05	Lake Granbury
NP06	Colorado River Below EV Spence Reservoir
NP07	Upper Cibola Creek
NP08	Upper San Antonio River
NP09	Cypress Creek (Segment 1815)
NP10	Bastrop Bayou
NP11	Brady Creek
NP12	Hickory Creek
NP13	San Bernard River
NP14	Arroyo Colorado
NP15	Lavaca River
NP16	Upper San Marcos River
NP17	Tres Palacios Creek
NP18	Dry Comal/Comal River

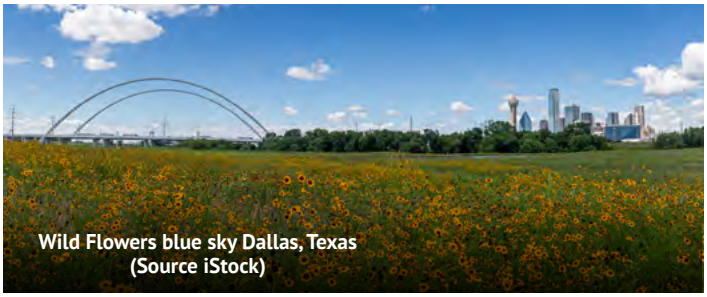
ID	TCEQ WPPs
NP19	Lake Arlington/Village Creek
NP20	West Fork of San Jacinto River/ Lake Creek
NP21	Nolan Creek
NP22	Carancahua Bay
NP23	Mission and Aransas Rivers
NP24	Cypress Creek (Segment 1009)
NP25*	Spring Creek
NP26	Shoal Creek
NP27	Highland Bayou
NP28*	Lower Laguna Madre/Brownsville Ship Channel
NP29	Big Elm Creek
NP30*	Rowlett Creek
NP31*	La Nana Bayou
NP32	Joe Pool Lake
NP33*	Raymondville Drain
NP34*	Hidalgo Main
NP35*	North Floodway
NP36	Arenosa & Garcitas Creeks
NP37*	Clear Creek

Ennis, Texas Bluebonnets
(Source iStock)

WPP Highlights

Joe Pool Lake WPP

Joe Pool Lake is a popular recreational destination for Dallas-Fort Worth residents and a municipal water supply for surrounding communities. The area around the lake is expected to experience further development and greater demand for municipal water use. Joe Pool Lake watershed has a total drainage area of 304 square miles and is fed by the waters of Walnut Creek and Mountain Creek. Walnut Creek's headwaters are in the City of Burleson and flow approximately 24 miles northeast, emptying into Joe Pool Lake in southeastern Tarrant County. Mountain Creek's headwaters originate from the City of Alvarado and flow approximately 19 miles northeast, emptying into Joe Pool Lake in northwestern Ellis County.



Wild Flowers blue sky Dallas, Texas
(Source iStock)

FIGURE 4.2
Aerial View of Joe Pool Lake and Dam in the Dallas-Fort Worth Metropolitan Area (Source U.S. Army Corps of Engineers Digital Visual Library)

The Joe Pool Lake watershed is comprised of urban areas in the northern end, with industrial, municipal complexes, and agricultural use throughout the center and southern extent. Portions of 10 incorporated communities and one unincorporated community call the watershed home, varying in population from nearly 72,000 to less than 400. There is significant potential for urban growth in the southeastern, southern, and southwestern extent in the unincorporated areas around Grand Prairie, Mansfield, Midlothian, and Venus.

These areas are mostly undeveloped land, with prominent pasture, grassland, cropland, and deciduous forest. In these areas, cattle are the most prominent livestock species, constituting just over 75 percent of the estimated livestock population in the watershed. The remainder is composed of a nearly equal representation of goats and horses, and a smaller population of sheep. These three species, while well-represented in more rural areas, were also observed with frequency in many lower-density urban areas in the watershed, on small-acreage properties commonly referred to as "hobby farms." Industry appears to be most dense along the United States Route 67 and 287 highway corridors, but examples of larger industrial complexes are also found throughout the watershed.

Development of the WPP – Joe Pool Lake

In 2014, TCEQ identified elevated levels of nitrate in Mountain Creek (Segment 0838A) and elevated levels of bacteria in Walnut Creek (Segment 0838C). In 2018, the Trinity River Authority of Texas received an EPA CWA Section 319(h) grant through TCEQ to investigate the bacteria impairment and nutrient concern through a watershed characterization. In 2019, the Trinity River Authority of Texas received another EPA CWA Section 319(h) grant to develop a WPP. These projects progressed concurrently with the goal of improving water quality through the WPP and mitigating future impacts of rapid urbanization.

FIGURE 4.3

Flow Monitoring in Joe Pool Lake Watershed, Hollings Branch (Segment 0838D) (Source Trinity River Authority)

Stakeholders involved in developing the plan included a group of 203 stakeholder meeting attendees, on average 40 per meeting, representing a range of interests in the watershed, including those of business owners, residents, researchers and educators, government representatives, and environmental nonprofit organizations. A steering committee was formed to provide continued leadership as the WPP moves into implementation.

The committee includes representatives from public and private sector entities whose participation is critical to implementation. The draft Joe Pool Lake WPP was submitted to TCEQ and is currently under review. After the plan is accepted by TCEQ and EPA, the partnership, in conjunction with Trinity River Authority and the cities of Cedar Hill, Grand Prairie, Mansfield, and Midlothian, will begin implementing the plan.

Education and Outreach – Joe Pool Lake

Based on the results of water quality data, modeling, land uses, and stakeholder input, the Joe Pool Lake Partnership identified potential pollutant sources and recommended management measures and education resources to address them. Holding education and outreach events in person has been challenging due to COVID-19. Since the start of fiscal year 2022, the partnership held two virtual steering committee meetings to review the draft WPP and public comments, and a virtual stakeholder meeting to review the draft WPP. Other outreach programs that supported WPP goals included an in-person Urban Stream Processes and Restoration Program, a hybrid Understanding Urban Wildlife Workshop, and a hybrid Healthy Lawns and Healthy Waters Workshop.

The committee includes representatives from public and private sector entities whose participation is critical to implementation.

Petronila and San Fernando Creeks WPP

Baffin Bay is considered a jewel of the Texas coast. It supports some of the highest commercial and recreational fishery landings in the state and provides critical habitat for numerous bird and wildlife species. Petronila Creek and San Fernando Creek are two of the three major tributaries that flow into Baffin Bay. Combined, these watersheds cover roughly 1,945 square miles of largely rural land. Approximately 93 percent of this land area is cropland, forests, pastures, or rangeland. Urbanization also has a significant influence on the watershed and housing developments south of Corpus Christi are increasingly common.

Petronila Creek and San Fernando Creek have been considered impaired since 2010 and 2006 respectively for not meeting the state's water quality criteria for primary contact recreation 1 use because of elevated levels of Enterococcus and *E. coli*, as well as problems with pH, elevated nitrates, chlorophyll-a, and total phosphorus. Fish kills in the early 2000s increased local community awareness about the importance of water quality and its impact on Baffin Bay and the surrounding ecosystem.

FIGURE 4.4
Petronila Creek Above Tidal (Source Nueces River Authority)

Development of the WPP – Petronila and San Fernando

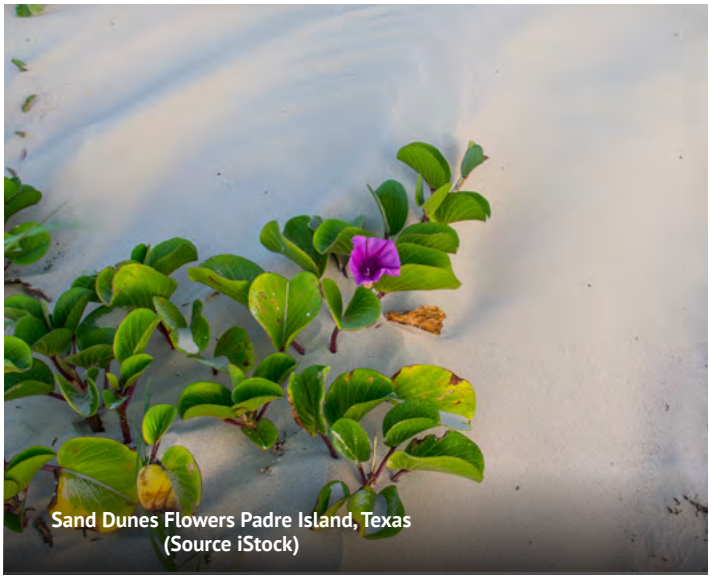
Local residents, scientists, and conservation organizations came together to create the Baffin Bay Stakeholder Group to better understand water quality issues in the bay and develop coordinated solutions to address these issues. This group represents a long-term collaborative effort to develop solutions to protect and improve water quality in Baffin Bay.

TWRI partnered with TSSWCB, the Nueces River Authority, the Harte Research Institute for Gulf of Mexico Studies at Texas A&M University–Corpus Christi, Texas Sea Grant, and CBBEP to engage local stakeholders and lead them in the process of developing a WPP that encompasses the drainages for Petronila and San Fernando creeks.

General education and outreach were conducted throughout the watershed during the development of the WPP.

Watershed stakeholders were engaged through informational meetings, educational programs, and focused discussions about the current state of water quality, their concerns for future water resource issues, and what may be done to mitigate these issues. The process to develop the WPP began in the Spring of 2021 and continued into mid-2022. In total, 14 meetings were held to discuss plan development, including general stakeholder meetings and specialized workgroup meetings. These meetings provided technical information about current water quality and potential pollutant sources, which helped stakeholders to make informed decisions on management recommendations to reduce pollutant loading across the watershed. Through this process, stakeholders decided to focus recommendations on addressing bacteria sources that are feasible to manage: humans, livestock, and pets. Other recommendations include feral hog, lawn and landscape, and urban stormwater management.

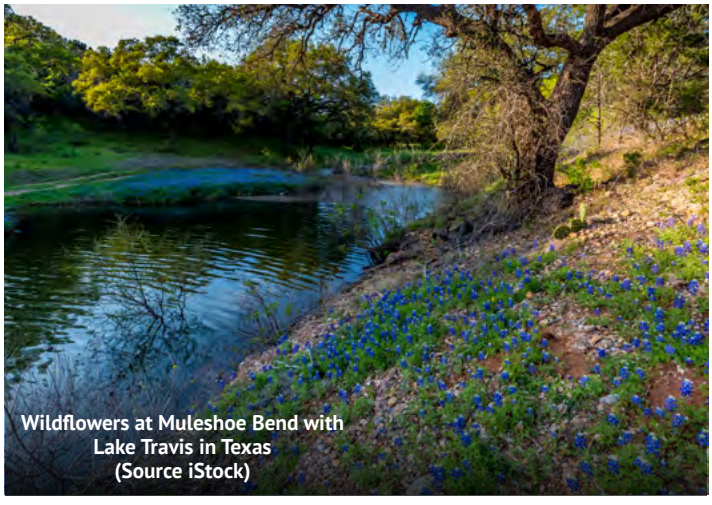
The Petronila Creek and San Fernando Creek WPP was completed in the Spring of 2022 and was accepted by EPA in June 2022. It is now moving into the implementation phase with several projects in the planning phase.



Sand Dunes Flowers Padre Island, Texas (Source iStock)

Education and Outreach–Petronila and San Fernando

General education and outreach were conducted throughout the watershed during the development of the WPP. Project team members gave presentations at several events including the Baffin Bay Symposium, Baffin Bay Stakeholder Group, a local Coastal Conservation Association banquet, local county commissioner's court meetings, and at local SWCD meetings. Before and during development of the WPP, education programs were offered through Texas A&M AgriLife Extension Service and were delivered in and around the watershed. These included the Texas Riparian and Stream Ecosystem Education, Texas Watershed Steward, and the Urban Riparian and Stream Restoration programs.



Wildflowers at Muleshoe Bend with Lake Travis in Texas (Source iStock)

Texas Bluebonnet Spring Wildflower Field at Sunrise (Source iStock)

Appendix A.

Texas Nonpoint Source Management Program Milestones

Wildflowers at Muleshoe Bend on Lake Travis
(Source iStock)

Texas Nonpoint Source Management Program Milestones

Goals / Objectives	Milestone	Milestone Description	Milestone Measurement	2022[1] Estimate	2022 Actual	Comments
ST1/A	Nonpoint Source Assessment Report	The state will produce the Integrated Report in accordance with applicable EPA guidance	Texas Integrated Report	1	1	
LT/2	Nonpoint Source Management Program Updates	The state will update the Management Program in accordance with applicable EPA guidance	Management Program updates	1	1	
LT/2	Nonpoint Source Performance Partnership Grant (PPG) End of Year Reports	The state will produce End of Year Report for PPG activities completed by TCEQ	PPG End of Year Reports	1	1	
LT/7	Nonpoint Source Annual Report	The state will produce the Nonpoint Source Annual Report in accordance with applicable EPA guidance	Nonpoint Source Annual Report	1	1	Due to EPA January 2022
LT/5	Implementation of Coastal Nonpoint Source Pollution Control Management Measures	Applicable Management Measure	Nonpoint Source Annual Report and the GLO Reporting Mechanisms	TBD	1,669	Estimated OSSFs inspected in the Coastal Zone Boundary
LT/2-5	Section 319(h) Grant Program Solicitation	The state will conduct individual TCEQ and TSSWCB solicitations for Section 319(h) grant funding	Grant Solicitation documentation	2	2	One from each agency

table continued on next page

Texas Nonpoint Source Management Program Milestones cont.

Goals / Objectives	Milestone	Milestone Description	Milestone Measurement	2022[1] Estimate	2022 Actual	Comments
LT/2-5	Section 319(h) Grant Program Application	The state will prepare individual TCEQ and TSSWCB grant program applications and submit them to EPA for Section 319(h) grant funding	Grant Application documentation	2	2	One from each agency
LT/2	Section 319(h) Grant Program Reporting	The state will report grant funded activities to the Grants Reporting and Tracking System (GRTS) in accordance with EPA guidance	GRTS updates	4	4	Two semi-annual updates from each agency
ST2/A	Priority Watersheds Report Updates	The state will update the Priority Watersheds Report based upon information and recommendations derived through the WAP process as described in the Management Program	Priority Watersheds Report Updates	1	1	
ST3/C,D	Watershed Training	The state will provide training to watershed professionals to ensure quality and consistency in the development and implementation of watershed protection efforts	Texas Watershed Planning Short Course	0	1	
ST3/A, B,F,G	Watershed Education	The state will provide watershed education to help citizens participate in programs designed to address water quality issues	Texas Watershed Steward Program (number of workshops)	7	10	

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Texas Nonpoint Source Management Program Milestones cont.

Goals / Objectives	Milestone	Milestone Description	Milestone Measurement	2022[(1)] Estimate	2022 Actual	Comments
ST3/C,D	Watershed Training	The state will provide a forum to facilitate the transfer of information between watershed professionals in the state	Texas Watershed Coordinator Roundtable	2	2	
ST3/B,F,G	Volunteer Monitoring	The state will provide support for local volunteer monitoring groups. These groups provide water quality data to the state water quality planning program and gain insight into resolving water quality issues	Texas Stream Team Participation (numbers of stations monitored)	250	276	
ST1/B	Quality Assurance	The state will ensure that monitoring procedures are in compliance with EPA-approved TCEQ and TSSWCB Quality Management Plans	Annual Quality Management Plan updates	2	2	One from each agency
ST1/C	Watershed Characterization	The state will support the implementation of projects designed to evaluate watershed characteristics and produce the information needed for watershed and water quality models	Watershed characterization projects	2	4	
ST2/A,C	Watershed Coordination	The state will support watershed coordination projects which facilitate the implementation of WPPs	Watershed coordination projects	12	33	

table continued on next page

Texas Nonpoint Source Management Program Milestones cont.

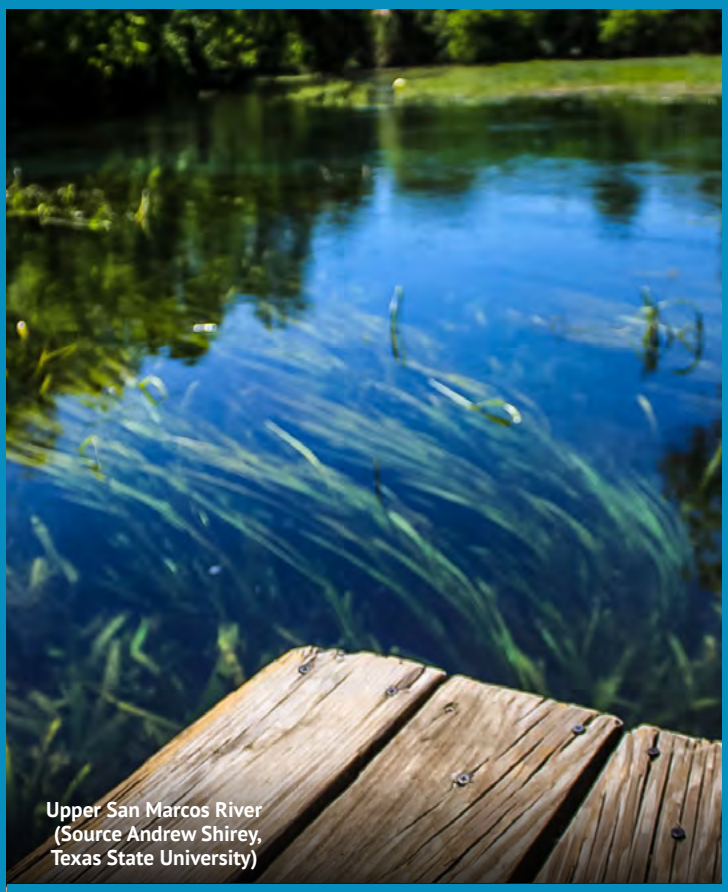
Goals / Objectives	Milestone	Milestone Description	Milestone Measurement	2022[1] Estimate	2022 Actual	Comments
ST1/D	Develop WPPs	The state will support projects which provide for the development of WPPs which satisfy applicable EPA guidance	WPP development projects	3	8	
ST2/D	Implement WPPs	The state will support projects which provide for the implementation of management measures specified in WPPs which satisfy applicable EPA guidance	WPP implementation projects	42	58	
ST1/D	Develop TMDLs and I-Plans	The state will support projects which provide for the development of TMDLs and I-Plans which satisfy applicable state, federal, and program regulations and guidance	TMDL and I-Plan development projects	0	0	
ST2/D	Implement TMDLs and I-Plans	The state will support projects which provide for the implementation of management measures specified in TMDLs and I-Plans which satisfy applicable state, federal, and program regulations and guidance	TMDL I-Plan implementation projects	3	9	
ST2/B,C	Load Reductions	The state will support projects which provide for the reduction of loadings of nonpoint source pollutants	Nonpoint source load reduction projects	16	31	

table continued on next page

Texas Nonpoint Source Management Program Milestones cont.

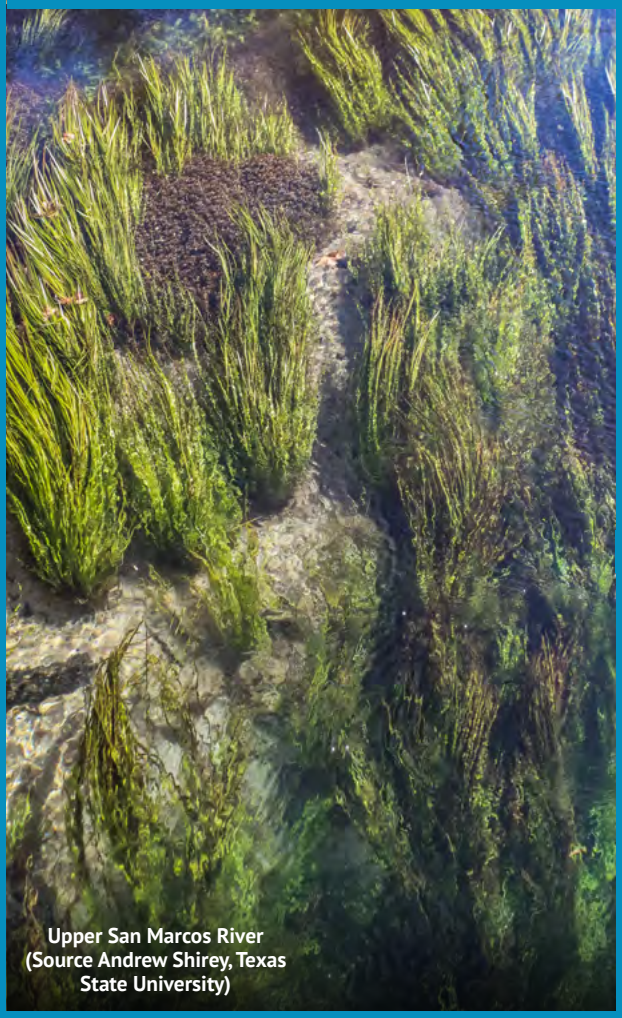
Goals / Objectives	Milestone	Milestone Description	Milestone Measurement	2022[1] Estimate	2022 Actual	Comments
ST2/B,C	Load Reductions (Nitrogen)	The state will ensure project reductions are reported utilizing GRTS	GRTS Report	RQ[2]	3,648.41 lb/yr[3]	Numbers reflect projects with load reductions reported in fiscal year 2022
ST2/B,C	Load Reductions (Phosphorus)	The state will ensure project reductions are reported utilizing GRTS	GRTS Report	RQ[2]	1,105.14 lb/yr	Numbers reflect projects with load reductions reported in fiscal year 2022
ST2/B,C	Load Reductions (Sediment)	The state will ensure project reductions are reported utilizing GRTS	GRTS Report	RQ[2]	28,754.26 tons/yr	Numbers reflect projects with load reductions reported in fiscal year 2022
ST2/E	Effectiveness Monitoring	The state will support projects which provide for the collection and analysis of water quality and other watershed information for evaluating the effectiveness of BMPs	Effectiveness monitoring projects	10	13	

(1) Estimates are from the *2022 Texas Nonpoint Source Management Program*
(2) RQ = Reportable Quantity
(3) yr = year

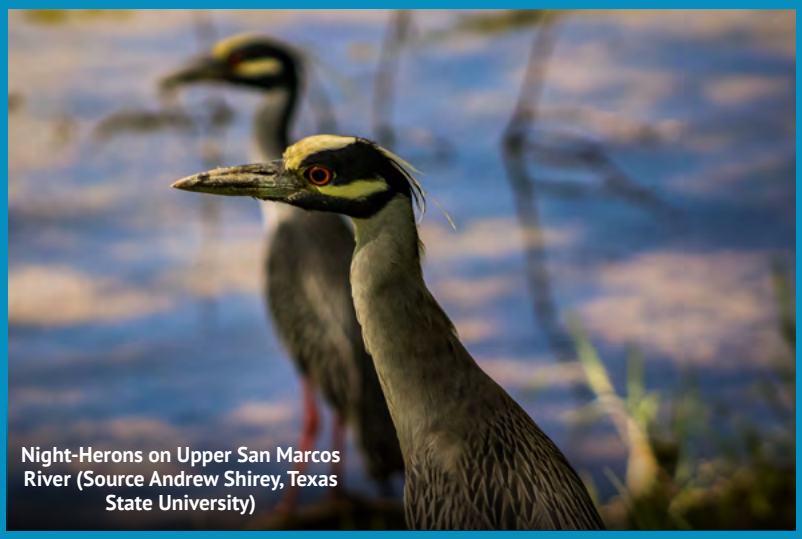


Upper San Marcos River (Source Andrew Shirey, Texas State University)

Upper San Marcos River (Source Andrew Shirey, Texas State University)



Upper San Marcos River (Source Andrew Shirey, Texas State University)



Night-Herons on Upper San Marcos River (Source Andrew Shirey, Texas State University)

Upper San Marcos River (Source Jennifer Idol)