PRESERVING & IMPROVING WATER QUALITY

The Programs of the Texas Commission on Environmental Quality for Managing the Quality of Surface Waters

GI-351 (revised 8/18)

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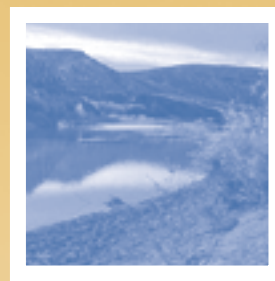
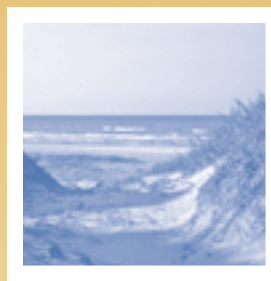
Abbreviations in This Document

State Agency
TCEQ—Texas Commission on Environmental Quality

Federal Agency
EPA—U.S. Environmental Protection Agency

Names & Other Terms
AU—assessment unit
CRP—Clean Rivers Program
TMDL—total maximum daily load
UAA—use attainability analysis
WPP—watershed protection plan





WATER is an elemental part of our lives. It quenches our thirst. We swim in it, boat on it, and eat the fish that live in it. Our farms, ranches, and industries depend on it. We want it to be clean and safe for all of those uses.

The Texas Commission on Environmental Quality is charged with managing the quality of surface water resources in Texas. However, the job of protecting our environment is complex, and requires cooperation from many parties. We must work together to protect water resources and restore water quality.

Key Partners in Managing Water Quality

State Agencies

- Railroad Commission of Texas
- Texas Department of State Health Services
- Texas Forest Service
- Texas General Land Office
- Texas Parks and Wildlife Department
- Texas State Soil and Water Conservation Board
- Texas Water Development Board

Federal Agencies

- U.S. Department of Agriculture
- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service
- U.S. Geological Survey

Local & Regional Entities & Others

- Agricultural producers and associations
- Business, industry, and trade associations
- County and municipal governments
- Educators, universities, and research organizations
- Interest groups and individuals
- Regional councils of government
- Texas river authorities

Key Terms

There are a number of key terms and concepts that are necessary to understand how the state manages water quality. Those key terms will be highlighted throughout this document in boxes like this one.

Water Quality—What Is It and How Is It Measured?

In order to protect water quality, we must first define what it is and how we will measure it. Texas has established standards that describe how state waterways are used. The TCEQ and its partners also carry out various programs to regularly monitor the status of water quality in relation to those standards.

This document provides an overview of the standards and criteria that the TCEQ uses to define and evaluate the quality of surface waters in Texas, and of the programs and practices that the state employs to protect and restore water quality.

What Causes Pollution?

Water pollution can arise from a variety of sources, including urban growth, suburban development, mining, industry, agriculture, and even natural sources such as wildlife. The sources of water pollution fall into two main categories, called point and nonpoint sources.

Pollution from *point sources* can be traced to a specific location and point of discharge, such as a regulated industrial operation or a wastewater treatment facility. Pollution from most point sources is controlled through regulations that require treatment of a facility's wastewater before it is discharged into a nearby waterway.

KEY TERM

Nonpoint Source Pollution

Nonpoint source pollution originates from multiple locations, and is carried primarily by rainfall runoff.

Point Source Pollution

Point source pollution can be traced to a specific location, such as an industrial operation or a wastewater treatment facility.

Nonpoint source pollution comes from multiple locations, and is carried primarily by rainfall runoff. For example, pollutants may wash off from lawns, construction areas, farms, or highways during a heavy rain, and then be carried to a nearby waterway. Nonpoint source pollutants are more difficult to control because they often come from many different people's everyday activities, such as fertilizing a lawn, using a pesticide, or constructing a new building. Pollution may also originate from natural sources such as weather, erosion, and wildlife, which are also classified as nonpoint sources.

Most waterways may be affected by more than one source of pollution. For example, high levels of bacteria indicate that disease-causing microorganisms might be present in a waterway. The bacteria might be originating from point sources, such as inadequately treated sewage or improperly managed animal waste from regulated livestock operations. It might also be coming from nonpoint sources, such as pet wastes, wildlife, aquatic birds, or failing septic systems.

A Watershed Approach

By looking at a *watershed*—the geographic area that drains to a common body of water—the TCEQ can evaluate the sources of pollution that may be affecting water quality. This watershed approach is used primarily to accomplish four basic tasks:

- identify water quality problems and issues
- establish statewide, regional, and local priorities
- develop community-based solutions
- cooperate with local stakeholders to implement those solutions

The watershed approach depends on four basic operating principles:

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

Watershed

A watershed is a geographic area in which water, sediments, and dissolved materials drain into a single body of water. This waterway could be a stream, lake, playa, estuary, or ocean. Watersheds are also commonly called basins or drainage areas.

Everything that runs off or is discharged in a watershed can affect the quality of the receiving waterway.

These principles guide all of the TCEQ's water quality programs. They provide the framework for coordinating resources, people, and activities to achieve the state's goals for clean water.

Using a watershed approach, we often find that problems seen at one point in a stream or lake are caused farther upstream. With that in mind, we work to identify and remedy water quality problems at their source. Protecting our lakes, bays, and streams is a complex process—not only because of the number of sources of pollution and the variety of waterway types and interactions, but also due to the number of people that are necessarily involved.

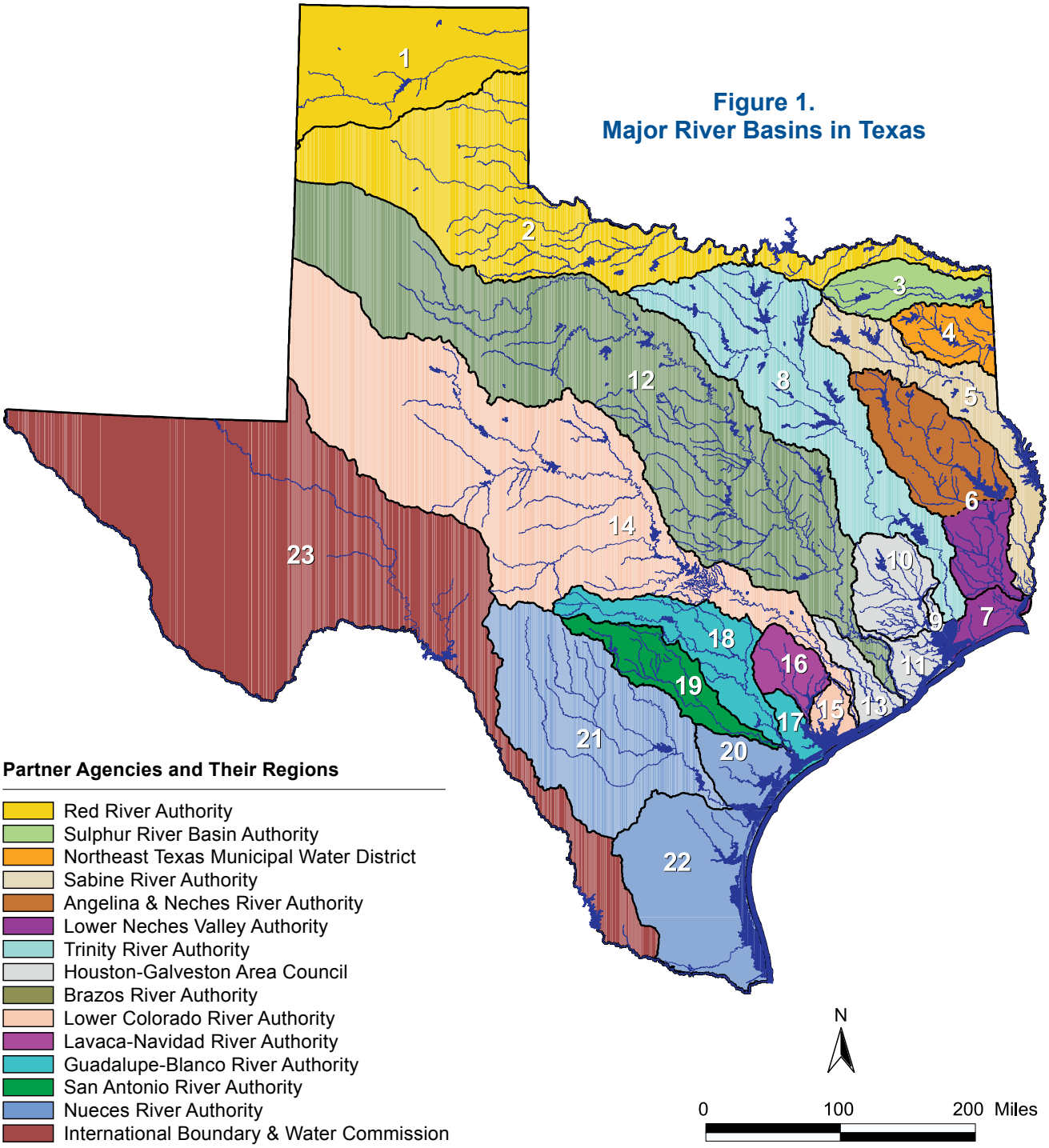


Figure 1.
Major River Basins in Texas

Partner Agencies and Their Regions

- Red River Authority
- Sulphur River Basin Authority
- Northeast Texas Municipal Water District
- Sabine River Authority
- Angelina & Neches River Authority
- Lower Neches Valley Authority
- Trinity River Authority
- Houston-Galveston Area Council
- Brazos River Authority
- Lower Colorado River Authority
- Lavaca-Navidad River Authority
- Guadalupe-Blanco River Authority
- San Antonio River Authority
- Nueces River Authority
- International Boundary & Water Commission

River and Coastal Basins

1. Canadian River Basin
2. Red River Basin
3. Sulphur River Basin
4. Cypress Creek Basin
5. Sabine River Basin
6. Neches River Basin
7. Neches-Trinity Coastal Basin
8. Trinity River Basin
9. Trinity–San Jacinto Coastal Basin
10. San Jacinto River Basin
11. San Jacinto–Brazos Coastal Basin
12. Brazos River Basin
13. Brazos-Colorado Coastal Basin
14. Colorado River Basin
15. Colorado-Lavaca Coastal Basin
16. Lavaca River Basin
17. Lavaca-Guadalupe Coastal Basin
18. Guadalupe River Basin
19. San Antonio River Basin
20. San Antonio–Nueces Coastal Basin
21. Nueces River Basin
22. Nueces–Rio Grande Coastal Basin
23. Rio Grande Basin
24. Bays and Estuaries
25. Gulf of Mexico Jurisdictional Area

Managing Surface Water by Geographic Area

Texas uses the major watersheds of the state—its river and coastal basins—as the geographic units around which it builds its approach to managing surface water quality.

Surface Waters

Surface waters in the state include lakes, bays, ponds, impounding reservoirs, springs, rivers, streams, creeks, estuaries, wetlands, marshes, inlets, canals, the Gulf of Mexico inside the territorial limits of the state, and all other bodies of surface water, natural or artificial, inland or coastal, fresh or salt, navigable or non-navigable. They include the beds and banks of all watercourses and bodies of water that are wholly or partially inside or bordering the state or subject to the jurisdiction of the state. Waters in treatment systems that are authorized by state or federal law, regulation, or permit, and that are created for the purpose of waste treatment, are not included.

– Texas Administrative Code, Title 30, Section 307

Classifying Waters by Geographic Area

Because of the vast extent of surface waters in Texas and the ecological diversity of the state, the major rivers, lakes, and estuaries have been subdivided into areas called *classified segments*. The classified segments are each given a unique number that also identifies the major river basin in which it is located.

For example, the Brazos River, one of the state's longest rivers, has been divided into 57 classified segments and its watershed is designated as Basin 12. Many lakes lie within the Brazos River Basin, and are also assigned segment numbers. All the segment numbers have four digits—the first two indicate the basin number, and the second two indicate the specific segment. For example, Segment 1210 is Lake Mexia in the Brazos River Basin and Segment 1243 is Salado Creek, in the same basin, while Segment 1427 is Onion Creek in the Colorado River Basin.

The areas of the classified segments are defined in the Texas Surface Water Quality Standards. Most of the perennial (always flowing) rivers in the state are classified, along with the lakes and estuaries with large areas. Figure 1 shows the state's major river and coastal basins and the basin numbers assigned to them.

However, not all waterways in Texas are classified in the Standards. For example, when managing a classified segment of the Brazos River, it may be necessary to examine water quality in the tributaries that flow into that segment. Some of those tributaries may not be part of the system of classified segments. For management purposes, when that happens, the tributary is referred to as an *unclassified segment*.

For monitoring and assessment purposes, the unclassified tributary will be assigned a tracking number related to the classified segment it belongs with, along with a letter. For instance, unclassified tributaries of Onion Creek would be identified as Segments 1427A, 1427B, and so on. The same numbering system applies to unclassified lakes.

Classified Segment

A classified segment is a waterway or portion of a waterway that is individually defined in the Texas Surface Water Quality Standards. A segment should have relatively homogeneous chemical, physical, and hydrological characteristics. A segment provides a basic unit for assigning site-specific standards and for implementing the agency's programs to manage water quality. Classified segments may include streams, rivers, bays, estuaries, wetlands, lakes, or reservoirs.

The classified segments are assigned four-digit numbers. The first two digits correspond to the major basin in which they are located. The last two digits distinguish individual segments within the particular basin.

Both classified and unclassified segments are referred to generically as *segments*. The terms *waterway* and *water body* are used to refer to entire rivers, reservoirs, or estuaries. Segments can be further subdivided into assessment units, or AUs.

The Water Quality Management Cycle

The *water quality management cycle* describes the process of continuously identifying water quality issues, establishing statewide and local priorities, developing community-based solutions, and collaborating with local stakeholders to implement those solutions.

Because environmental planning and implementation are not one-time activities, the water quality management cycle has five phases that are repeated regularly (Figure 2). As each round is completed, water quality and the programs that support it are continuously improving. This repeating cycle reflects the dynamic nature of watershed management. Figure 2 illustrates the major steps of the cycle.

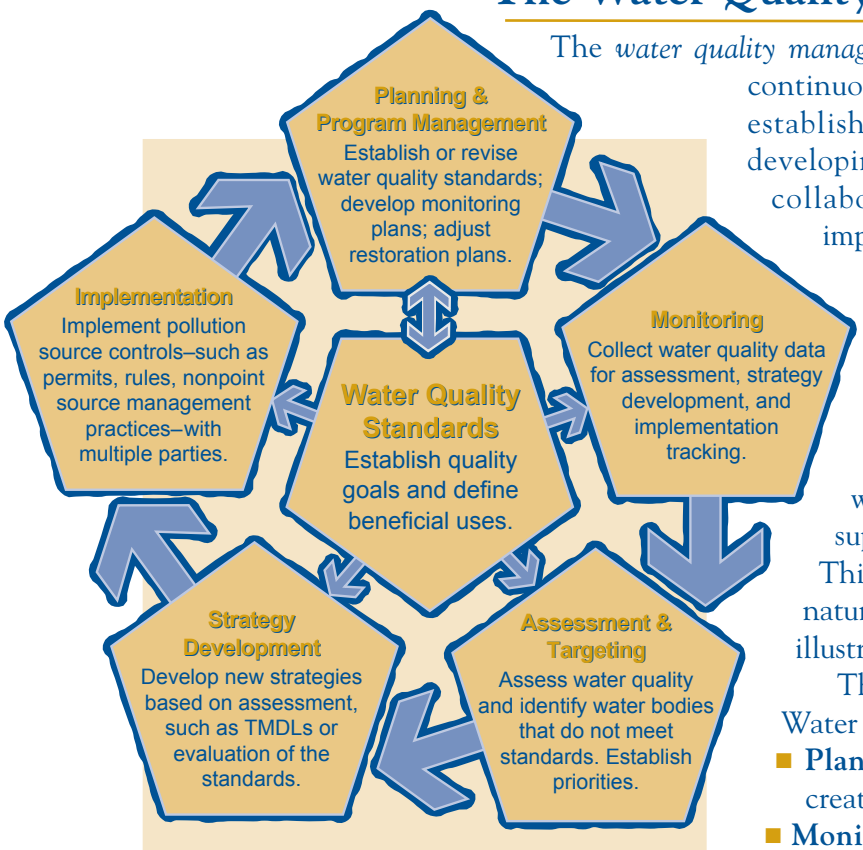


Figure 2.
Water Quality Management Cycle

The ongoing cycle of tasks, driven by the Water Quality Standards, includes:

- **Planning and Program Management**—creating and adjusting plans and programs.
- **Monitoring**—collecting data to monitor conditions.
- **Assessment and Targeting**—assessing data to determine status and to identify any impairments.
- **Developing Strategies**—for protecting, improving, or restoring water quality.
- **Implementing Pollution Controls**—for both point and nonpoint sources and evaluating progress, which may lead back to revising those plans or formulating new ones.

Water Quality Standards

Water quality standards define the goals for a body of water. They are the foundation for managing surface water quality. And they are determined by combining these two basic elements:

- a use
- the criteria necessary to attain and maintain that use

The uses prescribe the purposes for which the water should be suitable. Five general categories of use are defined under the Texas Surface Water Quality Standards:

- aquatic life
- contact recreation

- public water supply
- fish consumption
- general uses

The criteria define the instream conditions necessary to support those uses. Criteria are either one of these two kinds:

- Numeric—a limit on the amount of a certain pollutant that a waterway may contain.
- Narrative—a prohibition on a certain condition in the water, such as color, odor, or excessive turbidity.

Water quality standards are the basis for the following three activities:

- Evaluating monitoring data to see if water quality is being maintained.
- Setting levels of treatment for permitted wastewater discharges.
- Establishing water quality targets to reduce pollutants.

The standards assign specific uses for most medium to large water bodies, and general uses for all water bodies. For example, Possum Kingdom Lake must meet the requirements for the specific uses as public water supply, for swimming and other recreation, and as a high-quality environment for fish and other aquatic species. Each use defined in the standards is linked to measurements for specific conditions or pollutants. These measurements are used to assess whether water quality is sufficient to maintain the designated uses.

Other basic uses—such as navigation, agricultural water supply, and industrial water supply—are applicable to all waters in the state where they can be achieved. Some indicators of water quality, such as the narrative requirements in the general criteria, are intended to protect multiple uses and aesthetic conditions. The standards also define an antidegradation policy that protects existing uses and the state's highest quality waters.

Water Quality Standards

Water quality standards are the foundation for managing surface water quality. A water quality standard consists of the following two parts:

- A use, or purpose for a specific body of water.
- Criteria, or the indicators that will be used to determine if the water quality is suitable for the use.

Uses and criteria are paired to set the standards for water quality. For example, one use is as a healthy environment for fish and other aquatic organisms. It is called *aquatic life use* in the standards. Criteria used to determine whether the water quality is suitable for aquatic life may include how much dissolved oxygen is present in the water and how diverse the population of aquatic organisms is.

The complete Texas Surface Water Quality Standards are available in Title 30 of the Texas Administrative Code, Chapter 307.

Aquatic Life

The standards associated with *aquatic life use* are designed to protect plant and animal species that live in and around the water. Conditions that may result in harm to aquatic species include low levels of dissolved oxygen. Because oxygen is necessary to support life, its concentration in water is an easy-to-measure characteristic that generally reflects the ability of a waterway to support a healthy, diverse aquatic population.

Other important indicators of suitability for aquatic life use include concentrations of substances that can be toxic, such as certain metals (for instance, selenium, mercury, and zinc) or certain organic pollutants (for instance, pesticides and some industrial chemicals).

Contact Recreation

The standards associated with *primary contact recreation uses* are designed to ensure that water is safe for swimming or other sports that involve direct contact with the water, and especially the possibility of swallowing it. High concentrations of certain bacteria in water indicate that there may be a risk of becoming ill from recreational activities. Though it is possible to swim in water that does not meet these standards without becoming ill, the probability of illness is higher.

The standards associated with *secondary contact recreation uses* are designed to ensure that water is safe for activities such as fishing, canoeing, or motor boating, where the risk of ingestion is not as significant.

Public Water Supply

The standards associated with *public water supply use* indicate whether water from a lake or river is suitable for use as a source for a public water supply system. Source water is treated before it is delivered to consumers; a separate set of standards, found in 30 Texas Administrative Code 290, governs treated drinking water. The presence of high concentrations of certain substances is a good indicator that a waterway is not suitable as a source for drinking water. These substances include certain chemicals, microbiological contaminants, or metals, and dissolved minerals such as sulfate or chloride. Too many dissolved minerals in drinking water may cause a disagreeable taste, even after it is treated by a public water-supply facility. Furthermore, treatment to remove high levels of minerals from drinking water may be expensive.

Fish Consumption

The standards associated with *fish consumption use* are designed to protect people from eating fish or shellfish that may be contaminated. These standards identify levels at which certain toxic substances may accumulate in the tissue of aquatic species. In addition, fish tissue is examined for accumulated toxins to determine the risk to human health. If a significant risk is identified, the Texas Department of State Health Services issues advisories that restrict or prohibit consumption of fish taken from the affected waterways. The standards also specify limits on bacteria levels in marine waters, to ensure that oysters or other shellfish are safe to sell and eat.

Planning and Program Management

The TCEQ carries out regular planning reviews for the various programs that make up its overall water quality management plan. These planning reviews serve to continuously improve the TCEQ's management of water quality.

Every two years, an assessment of the state's surface waters is completed. The TCEQ, partner agencies, and other stakeholders meet annually to develop or update monitoring plans based on the assessment. A two-year plan is developed in the year the assessment is completed and a major update is considered the following year. These monitoring plans are continuously reviewed and updated.

Every three years, the TCEQ reviews the water quality standards to determine if revisions are needed. Revisions are proposed based on scientific studies, and go through an extended peer review. All proposed revisions are then put before the public for further review and comment through the TCEQ's formal rulemaking process. After approval by the commission, they are submitted to the EPA for approval.

Restoration plans and their progress are reviewed annually. Schedules and management activities are adjusted as needed, both for individual projects and for the programs as a whole.

Periodic administrative reviews ensure that the TCEQ's operating processes—such as issuing and renewing permits for wastewater discharges, assessing water quality, and developing restoration plans—are as efficient and cost-effective as possible while still protecting water quality.

Monitoring Conditions and Collecting Data

Data on water quality are gathered regularly to monitor the condition of the state's surface waters. The data include chemical, physical, biological, hydrological, hydraulic, and land-use features. The data are collected by the TCEQ, the regional agencies of the Clean Rivers Program, and other organizations (such as other state agencies, federal agencies, educational institutions, volunteer monitoring groups, and private organizations under contract to the state). Monitoring plans are guided by quality assurance project plans to ensure that data are collected according to generally accepted practices and are of sufficient quality to be used in making scientific assessments and management decisions.

Texas collects data to monitor the status of water bodies for five main purposes:

- **Routine monitoring**, designed to assess the status and trends of overall water quality in the state's classified waterways.
- **Systematic monitoring** to evaluate subwatersheds and unclassified waterways.
- **Targeted monitoring** to investigate specific concerns or evaluate possible strategies.
- **Permit support monitoring** to provide information needed in developing permits for wastewater discharges.
- **Effectiveness monitoring** to evaluate whether strategies and activities are producing the desired results.

Monitoring

Collecting data and information on hydrological, biological, and physical conditions in water bodies.

Assessment and Targeting

Every two years, the TCEQ must assess the quality of the state's waterways and submit a report to the EPA detailing the extent to which each waterway in the state meets water quality standards. The TCEQ publishes this biennial assessment on its website as the *Texas Integrated Report of Surface Water Quality for Clean Water Act Sections 305(b) and 303(d)*.

Assessment

The evaluation of data and information against a set of standards or benchmarks.

The Integrated Report describes the status of all surface water bodies of the state that were evaluated for a particular assessment period. The TCEQ uses data collected and reported during the most recent seven-year period in making its assessment. The data are gathered by many different organizations that all operate according to approved quality-control guidelines and sample-collection procedures. Since water quality is dynamic, the report represents a snapshot of water quality conditions during the time period considered in the assessment.

The assessment guidance describes the methods that the TCEQ uses to evaluate whether water bodies are meeting the standards for surface water quality. These methods are developed by the TCEQ with the advice of a diverse group of stakeholders, and are made available to partner organizations and stakeholders every two years, prior to the biennial assessment in which they will be used.

The 303(d) List

The 303(d) List is an important management tool produced as part of the assessment. It identifies waters for which preventive measures have not been sufficient to achieve water quality standards. The 303(d) List is subject to review and approval by the EPA.

When a segment is identified on the 303(d) List, certain new requirements may apply. Listing a waterway on the 303(d) List has immediate implications for facilities that discharge wastewater into the listed segment. The TCEQ cannot allow any new or expanded discharges of a listed pollutant into a listed segment if the discharge would contribute to the impairment.

Impaired Segment

A segment of a waterway is called *impaired* if it fails to meet one or more of the standards established for its use. For example, a segment may be designated as impaired for aquatic life use because dissolved oxygen concentrations are chronically low. The segment might be meeting the standard for all its other uses—as a source for drinking water, and as a safe place to fish or swim—but it will still be designated as impaired, because it does not meet the standard for every one of its uses.

After listing a segment, the TCEQ may develop a restoration plan, evaluate the appropriateness of the standard, or collect more data and information to determine what management steps are needed. When a restoration plan is developed, permits for the segment might be affected in the following ways:

- The TCEQ may initiate amendments to impose new limits, or may impose new limits with routine renewals or amendments.
- Permitted loading from existing facilities may be substantially reduced.
- New facilities may be required to meet more stringent effluent limits.
- In some cases or areas, stormwater permits may receive new or more stringent requirements.
- Dischargers may no longer be eligible for general permits.
- There may be additional requirements for monitoring and reporting.

Implementation of nonpoint source management practices may also be addressed in restoration plans, such as:

- Management of runoff by such means as detention basins, filter strips, infiltration basins, porous pavement, retention ponds, and swales.
- Management of operations to decrease or eliminate pollutants in runoff, such as spill prevention and control, or source controls.
- Education in schools and continuing education for adults, along with events to reach out to the public.

Impairment

An impairment is the combination of one use with one pollutant or condition of concern.

Parameter

A parameter is a pollutant or condition affecting a body of water; also, a criterion used to measure attainment of a specific use. Examples include low dissolved-oxygen concentrations, a particular metal such as zinc, or a particular pesticide such as DDT.

Categories of Water Quality Status

The Integrated Report assigns each assessed segment to one of five categories to provide information about water quality status and management activities (see Table 1). The categories indicate how the segment measures up against standards and how the TCEQ will approach water quality problems.

The higher the category number, the greater the required effort. For example, Category 5 corresponds to the 303(d) List, and segments in this category require remedial action by the state to restore water quality. For segments in Category 5a, the TCEQ must develop a scientific allocation called a *total maximum daily load* (TMDL) and a plan to implement the TMDL (these are discussed in more detail in the section "Restoring Water Quality"). By contrast, segments in Category 1 are meeting the standards for all their uses, and require only routine monitoring and preventive action.

Further, these categories must be applied to each combination of a use and the *parameter* (pollutant or condition of concern) that determines support of that use. An *impairment* occurs when a particular use for an individual segment is not supported with the corresponding parameter of concern. For example, the concentration of dissolved oxygen is one of the criteria used to determine the support of the aquatic life use. If a specific segment displays dissolved oxygen concentrations that are too low, that segment would have an impairment.

Since a waterway has multiple uses, it may fall into different categories for different uses. In that case, the overall category for the segment is the one with the highest (or worst) category number.

For example, a particular segment does not attain the standard for contact recreation use (Category 5a) nor for aquatic life use (Category 5b). It attains the standards for public water supply and general uses, and the fish consumption use has not been assessed. The designation for the entire segment is 5a, since that is the highest category associated with any one of its uses.

Table 1. Categories of Use Attainment in the Integrated Report

Category	Description
1	Attaining the water quality standard and no use is threatened.
2	Attaining some of the designated uses, no use is threatened, and insufficient information (or none) is available to determine whether the remaining uses are attained or threatened.
3	Insufficient information (or none) is available to determine whether any designated use is attained.
4	The standard is not supported or is threatened for one or more designated uses but this does not require the development of a TMDL.
4a	A TMDL has been completed and approved by the EPA.
4b	Other pollution-control requirements are reasonably expected to result in the attainment of the water quality standard in the near future.
4c	Nonsupport of the water quality standard is not caused by a pollutant.
5	Category 5 is the 303(d) List. The segment does not meet applicable water quality standards or is threatened for one or more designated uses by one or more pollutants.
5a	A TMDL is under way or scheduled, or will be scheduled.
5b	A review of the water quality standards will be conducted before a TMDL is scheduled.
5c	Additional data and information will be collected before a TMDL or review of the water quality standard is scheduled.

Total Maximum Daily Load (TMDL)

A TMDL has two principal functions:

- Determine the maximum amount of a pollutant that a segment can receive and still both attain and maintain its water quality standards.
- Allocate this allowable amount (load) to point and nonpoint sources in the watershed.

Strategy Development

Making successful management decisions depends on understanding the relationships among water quality, water use, and conditions within a watershed. When developing strategies, Texas integrates policy, science, and people to ensure clean water for years to come.

Protection Strategies

Just the act of monitoring and assessing water quality is a form of protection, since it informs state officials and the public about the status of Texas rivers, lakes, and estuaries and about water quality management needs. But much more is being done continually—such as issuing permits that limit pollutant discharges to protect rivers,

lakes, and bays; developing plans to protect sources of drinking water; and informing Texans about water quality issues. When these protective strategies do not keep water bodies clean enough, the state takes action to restore water quality.

Restoration Strategies

After a segment is listed in Category 5 [the 303(d) List], several different courses may be pursued to bring it into compliance with the standards. Further evaluation may be necessary to determine if the current standard is appropriate or to determine the cause of the impairment. The TCEQ may work with stakeholders to reduce pollution and restore the impaired use by developing a watershed protection plan or a TMDL and its implementation plan. With each new assessment, the TCEQ begins new management activities to restore water quality, while continuing to complete and implement strategies for waters listed in previous years.

Watershed Action Planning

The goal of watershed action planning (WAP) is to determine and document the restoration strategies for all of the state's impaired waters. This involves a detailed review of water quality impairments, looking at strategies already in use, and recommending new strategies as needed. The plan provides a bird's-eye view of the many activities in the complex repeating cycle for managing water quality.

The major objectives of the WAP process are to:

- Inform the public about management activities in their watersheds.
- Engage stakeholders more fully in determining strategies that restore water quality.
- Improve access to state agencies' decisions and increase transparency of decision-making.
- Make state agencies more accountable for improving water quality.

WAP coordinates planning and activities among the TCEQ, the Texas State Soil and Water Conservation Board, the Texas Clean Rivers Program partners, and stakeholders at the watershed level.

Coordination of State and Regional Priorities

The Texas Clean Rivers Program plays a vital role in setting regional priorities for protecting and improving the state's surface waters. The Clean Rivers Program brings together state, regional, and federal agencies to fulfill all of the following goals:

- Eliminate duplication in monitoring surface water quality and thereby leverage resources.
- Support data sharing and quality assurance by creating uniformity in methods.
- Establish regional stakeholder forums to involve the public in identifying, prioritizing, and managing local water quality issues.
- Set priorities and schedules for monitoring.
- Identify problems and preventive or remedial measures.

The TCEQ meets with Clean Rivers partners yearly to integrate various monitoring needs into a coordinated monitoring schedule for the entire state. The schedule shows the surface water monitoring being conducted by the TCEQ or under its cooperative agreements with the Clean Rivers Program partners for each planning year. It does not include monitoring of effluent discharges by wastewater permit holders; those discharges are reported to the TCEQ as a condition of the wastewater permits.

To support coordinated monitoring, the TCEQ has developed guidance for selecting sites and sampling methods. The coordinated monitoring schedule is hosted by the Lower Colorado River Authority, a Clean Rivers Program partner, on its website, at <cms.lcra.org/>.

The partner agencies for the CRP, and the regions for which they are responsible, are shown in Figure 1.

Implementation

The state's primary strategies for implementing activities that manage water quality are described in the following sections. Some strategies are protective, while others aim to restore impaired uses.

Permits and Plans to Protect Water Quality

The TCEQ protects water quality through various programs. One of those is the regulation of wastewater discharges into waters of the state.

Permits

The TCEQ issues permits that control discharges of wastewater into the surface waters of the state. Many types of discharges are regulated, such as the effluent from industries, domestic wastewater from city treatment facilities, discharges from certain agricultural operations, and the stormwater that runs off urban areas. The TCEQ also establishes pretreatment requirements in permits for some publicly owned wastewater treatment facilities.

The owners and operators of these regulated facilities, called *dischargers* or *permittees*, are responsible for using the best technologies that are both available and practical to reduce pollutants in the effluent from their facilities. Many different kinds of pollutants are regulated by permit, including metals, pesticides, organic compounds, and sewage.

The TCEQ also works to protect water sources through permits that regulate the recycling, beneficial reuse, and disposal of sludge—the muddy solid waste produced during water and sewage treatment. Federal and state requirements for wastewater and sludge permitting are codified in TCEQ rules.

The TCEQ's wastewater and sludge permitting activities are required under Section 402 of the federal Clean Water Act. In 1998, the TCEQ was authorized by the EPA to issue Section 402 permits on behalf of the federal government, with the exception of discharges associated with oil, gas, and geothermal exploration and development activities, which are regulated by the Railroad Commission of Texas. The TCEQ named this program the Texas Pollutant Discharge Elimination System.

The TCEQ also protects wetlands and other surface waters through its certification of federal permits that regulate the discharge of dredge or fill material into the waters of Texas. The state's certification that federal dredge and fill activities will not degrade wetlands or other surface waters is required under Section 401 of the federal Clean Water Act. The U.S. Army Corps of Engineers issues permits for dredging and filling after certification by the TCEQ.

Protecting Water Rights and Instream Flows

Surface water in Texas is owned by the state, which holds it in trust for its citizens. The TCEQ administers the state's program that grants the right to use this water to different people, such as farmers or ranchers, cities, industries, businesses, and other public and private interests.

Water rights authorize the impoundment, diversion, and use of state water. They have priority dates that indicate the seniority of one water right over another. This seniority is known as "first in time, first in right" or the "prior appropriation doctrine." In times of drought, those with seniority have the right to get water before those with junior rights.

State Water

- The water of the ordinary flow, underflow, and tides of every flowing river, natural stream and lake, and of every bay or arm of the Gulf of Mexico, and the storm water, floodwater, and rainwater of every river, natural stream, canyon, ravine, depression, and watershed in the state.
- Water imported from any source outside the boundaries of the state for use in the state and which is transported through the beds and banks of any navigable stream within the state or by utilizing any facilities owned or operated by the state.

– Texas Water Code, Sections 11.021(a) and (b)

The availability of water in streams is an issue of quality as well as quantity. The amount of water that flows in streams can affect the quality of the aquatic environment. It also affects the flow of freshwater into downstream estuaries, which are dependent on freshwater for their ecological health and fisheries uses. The TCEQ is jointly responsible with the Texas Parks and Wildlife Department and the Texas Water Development Board to determine flow conditions in rivers and streams necessary to support a sound ecological environment.

The TCEQ adopts environmental flow standards to protect instream uses. These environmental flows standards are based on recommendations from scientists and people who live or work in the various river basins. Specific standards have been adopted for several basins and their associated bay systems, and are codified in the Texas Administrative Code, Chapter 298.

The flow standards are based on an environmental flow regime for each basin—a characterization of a river that includes the variation of flows, seasons, and geography throughout the river and as it flows into bays and estuaries. Environmental flow standards

must be taken into account when granting new or amended appropriations of water. In basins where no standards have been adopted, the TCEQ considers available information on fish and wildlife habitat, water quality, and instream uses associated with the affected waterway in determining the amount of water use that can be granted.

Environmental Flow Regime

A schedule of flow quantities that reflects seasonal and yearly fluctuations that typically would vary geographically, by specific location in a watershed, and that are shown to be adequate to support a sound ecological environment and to maintain the productivity, extent, and persistence of key aquatic habitats in and along the affected water bodies.

– Texas Water Code, Section 11.002.16

Protecting Sources of Drinking Water

The aquifers, lakes, and rivers that are designated by law for use as sources of drinking water are called *source waters*. The TCEQ protects source waters in two principal ways:

- Assessing their susceptibility to pollution.
- Helping local communities develop source-water protection programs.

Source-water protection is a state program to prevent contamination of groundwater or surface water that is used as a source of public drinking water. Water suppliers implement local source-water protection programs by working cooperatively with community members and by educating people about issues that affect their drinking water. All public water-supply systems may receive assistance in developing plans and implementation measures free of charge. Priorities for state assistance with plan development are set according to the results of the susceptibility assessments.

The TCEQ provides a report assessing the vulnerability of each source water to the operators of systems that supply public drinking water. The reports include the location of pollutant sources, intrinsic characteristics of the watershed, contaminants found, well construction, geology, known point sources, and land uses. The watershed in these reports is the area within the capture zone of groundwater wells and within the watersheds of surface water intakes.

The assessment reports provide the scientific basis for the implementation of projects to protect source water. Water systems are encouraged to take an active role in verifying the completeness and accuracy of the data used in the assessment report.

The protection and assessment of source waters are required and authorized under Section 1453 of the federal Safe Drinking Water Act.

Watershed Protection Plans

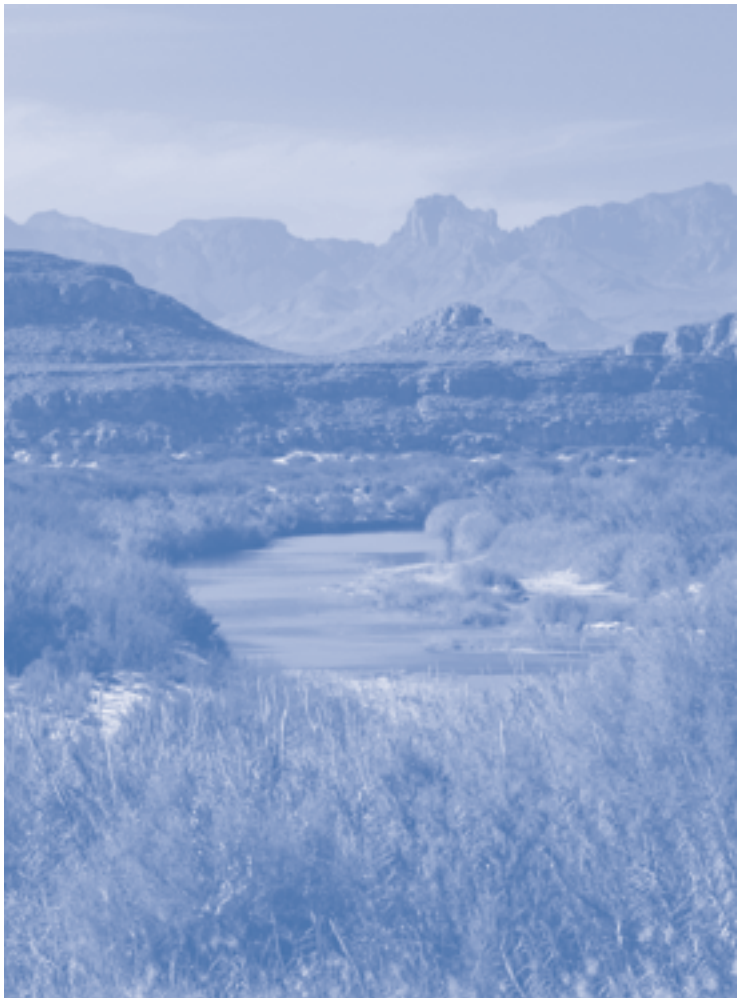
Watershed protection plans may be developed to protect high-quality waters, or to address threatened waters before they become impaired. In the next section, watershed protections plans are described more fully: what they are and their use in protecting or restoring water quality.

Plans to Restore Water Quality

The amount of time it takes to address a listed segment varies greatly. In some cases, a segment may be addressed within one to three years of its listing; in other cases, several years may be needed.

The scheduling of management activities for all three categories (5a, 5b, and 5c) of the 303(d) List is influenced by several factors, such as the number of successive years a segment has been on the list, scheduled permit renewals, or administrative demands. Availability of funding ultimately determines how many new restoration or management projects will be initiated annually.

For water bodies that are impaired due wholly or in part to nonpoint source pollution, federal grant funds provided under Section 319 of the Clean Water Act play a key role in implementing restoration projects. These grants provide support for management practices that improve the quality of impaired or threatened waters, and may be used to support development and implementation of TMDLs. Federal grants are also used to implement watershed action plans that are not associated with TMDLs; to conduct special projects that assess impacts due to nonpoint source pollution; and to prevent the degradation of healthy rivers, lakes, and bays.



Segments Targeted for Analysis of Standards

Segments are placed in Category 5b if there is reason to believe that one or more of the assigned standards may be inappropriate because of local conditions. Waters in this category are slated for a review of their standards, called a *use attainability analysis*, or UAA.

For example, to determine appropriate aquatic life uses and related dissolved oxygen criteria, a UAA may consider aspects such as regularity of flow, habitat structure, typical water chemistry, and fish and other aquatic organisms that are characteristic in the area. Some rivers and lakes naturally support an abundant and diverse aquatic community, while others—such as small streams with intermittent flow—tend to have fewer types and total numbers of aquatic organisms. In addition, some waterways might support a diverse aquatic community and fishery even though some components of their overall water quality are not superior under natural conditions.

Depending on the results of the UAA, uses or supporting criteria may be revised to be more appropriate for the local conditions. Revisions of the standards are reviewed by the public, adopted by the TCEQ, and subject to review and approval by the EPA. When a review and any resulting revisions of the standard are completed, the segment may be moved to another category of the 303(d) List, or to another category of the Integrated Report.

Segments Targeted for Monitoring and Additional Assessment

Segments in Category 5c are targeted for additional monitoring and assessment. Segments may be placed in this category when there is insufficient information to determine the best course of action. The TCEQ and its monitoring partners collect the additional data and information needed to determine whether a standards review is appropriate, whether a TMDL should be scheduled, or (more rarely) the degree and geographic extent of nonsupport. Depending on the results, the segment may be moved to another category of the 303(d) List, to Category 4, or to Category 1 or 2, if standards are attained.

Segments Targeted for Restoration

Two types of watershed-based plans are used in Texas for restoring impaired waters—Watershed Protection Plans (WPPs) and TMDL Implementation Plans (I-Plans). The ultimate goal of both types of plan is the attainment of the water quality standard. Additionally, interim results may be evaluated to assess progress toward that goal.

TMDL I-Plans generally include both regulatory and non-regulatory measures. WPPs use solely non-regulatory measures. Both plans describe a suite of activities expected to restore water quality along with the schedule for implementing them. Because they are at a watershed scale, the plans routinely include multiple political jurisdictions.

In order to restore water quality, it is first necessary to be reasonably certain of the sources and causes of the pollution. Consequently, both types of plan are based on environmental targets—usually the applicable water quality standards. Rigorous scientific methods are used to determine what pollutant limits are needed to meet those standards. The description of the environmental target and the methods for developing it are included within a WPP. With an I-Plan, a separate document—the TMDL—describes the environmental target and the methods behind it. The TMDL is included in the I-Plan by reference.

Each type of plan is developed by stakeholders in the affected watershed with support from the state. Ultimately, the people in the community implement the plans to clean up their rivers, lakes, and bays. They have the best understanding of local conditions, their goals, and their resources. WPPs and TMDL I-Plans are road maps to help stakeholders achieve their goals for water quality.

Even after plans are fully implemented—whether WPPs or I-Plans—it is difficult to accurately predict how long it will take for improvements to occur in the stream, or how much improvement will be seen. For this reason, there is a schedule for phasing in implementation activities, especially those that address nonpoint sources of pollution. In more complex cases, less expensive, time-tested activities are often implemented first, and their effects are assessed. If water quality standards are not achieved within a given time frame, then another set of regulatory or non-regulatory activities is implemented. Through this adaptive management approach, progress is assessed, and adjustments are made as needed.

Watershed Protection Plans

Watershed Protection Plans can address multiple pollutants. As mentioned previously, WPPs may be developed for protection as well as for restoration strategies. Each WPP provides a framework for prioritizing and integrating multiple water quality management strategies. The types of goals and strategies that may be used in WPPs are outlined in the EPA's guidance for federal nonpoint source grants authorized under Section 319 of the Clean Water Act.

In general, WPPs have three principal components. They:

- Describe the sources of pollution affecting a particular segment.
- Define the voluntary actions that will be taken to reduce pollution or restore water quality.
- Are developed in cooperation with regional and local stakeholders.

WPPs are developed by river authorities, cities, or other local government entities. They are reviewed by the TCEQ or the Texas State Soil and Water Conservation Board, and are then submitted to the EPA for acceptance. Projects that implement WPPs are prioritized for Section 319 grant funding.

TMDLs and Implementation Plans

TMDLs and their I-plans are developed to address segments listed in Category 5a. States must establish a TMDL for each impairment in each segment in Category 5a.

Total Maximum Daily Loads

One way to determine the sources and causes of pollution is to develop the scientific allocation called a *total maximum daily load*. As mentioned earlier in this document, a TMDL has two principal functions:

- Determine the maximum amount of a pollutant that a segment can receive and still both attain and maintain its water quality standards.
- Allocate this allowable amount (load) to point and nonpoint sources in the watershed.

TMDLs must be submitted to the EPA for review and approval. A TMDL is normally prepared for one pollutant in each impaired segment. This may mean that several TMDLs are developed for one river or lake.

Implementation Plans

The TMDL I-Plan describes the activities necessary to improve water quality, using the TMDL as its scientific basis. Management activities in the I-Plan incorporate both regulatory and non-regulatory mechanisms, such as permit-effluent limits and recommendations, watershed-specific rule recommendations, proposed revisions to stream standards, nonpoint source pollution management practices, special projects, pollution prevention, and public education.

TMDL Implementation Plans and Watershed Protection Plans

Both I-Plans and WPPs have the same goal—improving water quality in rivers, lakes, or bays.

- How they differ:
  - I-Plans are remedial actions for impaired waters; WPPs may be either remedial or preventive.
  - I-Plans usually have a regulatory component; WPPs are non-regulatory.
- How they are alike:
  - They both define actions needed to reduce pollution and preserve water quality.
  - They are both developed by regional and local stakeholders in cooperation with the state.
  - They are both based on the best available scientific methods and tools.

A Joint Effort—Stakeholder Involvement

We believe that the best decisions are made by people closest to the issue at hand. Who better to be involved in cleaning up local water bodies than those who have lived or worked in the area, who know it, who have raised their families there, and who care about their future? We call these people stakeholders. They are individuals, organizations, and communities. They represent government, agriculture, business, environmental and community groups, and themselves.

Stakeholders are involved in each phase of the water quality management cycle through participation in standing and special committees. A coalition of government agencies and citizens is necessary to develop and implement water quality protection and restoration strategies. Public participation in watershed planning produces six principal benefits:

- Improves the quality and increases the quantity of information that is used as the basis for plans.
- Promotes government accountability.
- Ensures that state government considers the local perspective in its decisions.
- Helps stakeholders gain greater insight into the nature of water quality problems and how alternate solutions affect their communities.
- Leads to voluntary individual actions to curb pollution.
- Fosters local ownership of water quality.

The TCEQ is designated by law as the lead state agency for water quality in Texas. The Texas State Soil and Water Conservation Board also plays an important role as the lead state agency for the management of agricultural and silvicultural (forestry-related) nonpoint source runoff. The Texas Clean Rivers Program—a partnership of regional

water management authorities—plays a key role in providing forums for stakeholder involvement and coordinating water quality management activities within specific river basins.

Many other local, regional, state, and federal agencies have specific responsibilities that are critical to the restoration of polluted water bodies. Nongovernmental organizations, especially at the watershed level, can provide information about local concerns and infrastructure, and can help build support for the kind of pollution controls that may be required to restore water quality.

Who Are the Stakeholders?

The stakeholders include all individuals or organizations with an interest in the watershed that have one or more of these attributes:

- They are significant contributors of pollutant loadings or otherwise significantly affect water quality.
- They are significantly affected by water quality problems.
- They are directly affected by project outcomes or decisions.
- They may be required to undertake control measures because of statutory or regulatory requirements.
- They have statutory or regulatory responsibilities closely linked to water quality—for example, flood control.
- They can help develop or implement actions to remedy water quality problems.
- They live in the watershed or use the water resource.

Figure 3. Stakeholder Forums

Although not an exhaustive list of possible stakeholders, the following categories are some examples of the kinds of groups and people who may become involved in protecting and restoring water resources:

- *Wastewater dischargers*—municipal and industrial.
- *Public*—individuals; civic groups such as those representing environmental, consumer, recreational, and community interests; schools and universities; and private landowners.
- *Agriculture and aquaculture*—individual and corporate farmers, ranchers, and producers; subsistence and commercial harvesters of fish and shellfish; and agricultural groups and organizations.
- *Business*—utilities, commercial and industrial firms, business groups, and trade associations.
- *Government*—river authorities; utility districts; tribes; and city, county, regional, state, federal, and international governmental agencies.

Coordination of Stakeholders

Stakeholders are coordinated through the watershed action planning process at three levels (see Figure 3):

- **Statewide**—for agencies and organizations that manage water quality across the entire state, to target and synchronize their efforts.
- **Regionally**—to assess conditions within a basin and establish basin-specific goals and priorities.
- **Locally—**to develop WPPs and TMDL I-plans that have local support and input.

Clean Rivers Program

The regional planning agencies of the Clean Rivers Program represent stakeholder interests at the state level and coordinate with the TCEQ, other state agencies, and local monitoring partners at annual meetings. They also produce and distribute educational materials and conduct promotional campaigns through various media. See Figure 1 for a list of the CRP planning agencies ("Partner Agencies") and the regions they manage. Learn more about the Texas Clean Rivers Program in its brochure, publication number GI-063.

Basin Steering Committees

Basin steering committees of the Clean Rivers Program provide the primary forum for coordinating stakeholder involvement at the regional level. In addition to monitoring conditions in their basins, these committees carry out educational activities within the basin, and coordinate volunteer programs.

Local Watershed Work Groups

These work groups, composed of stakeholders in special-project watersheds, provide valuable input about local conditions. They develop site-specific strategies for developing watershed protection plans or TMDL implementation plans.

Education

Education is integrated into most of the TCEQ's water quality programs. Educational activities range from technical assistance for business owners, to workshops and conferences, to the formation of stakeholder groups that create plans or advise the agency. Educational activities help people and regulated organizations protect and improve the environment.

The TCEQ's principal public education campaign—Take Care of Texas—provides information and materials that Texas residents can use to reduce nonpoint source pollution through their daily activities. TCEQ

staff work with government and nongovernmental organizations, as well as corporate sponsors, to promote the campaign throughout the state.

Gauging Success

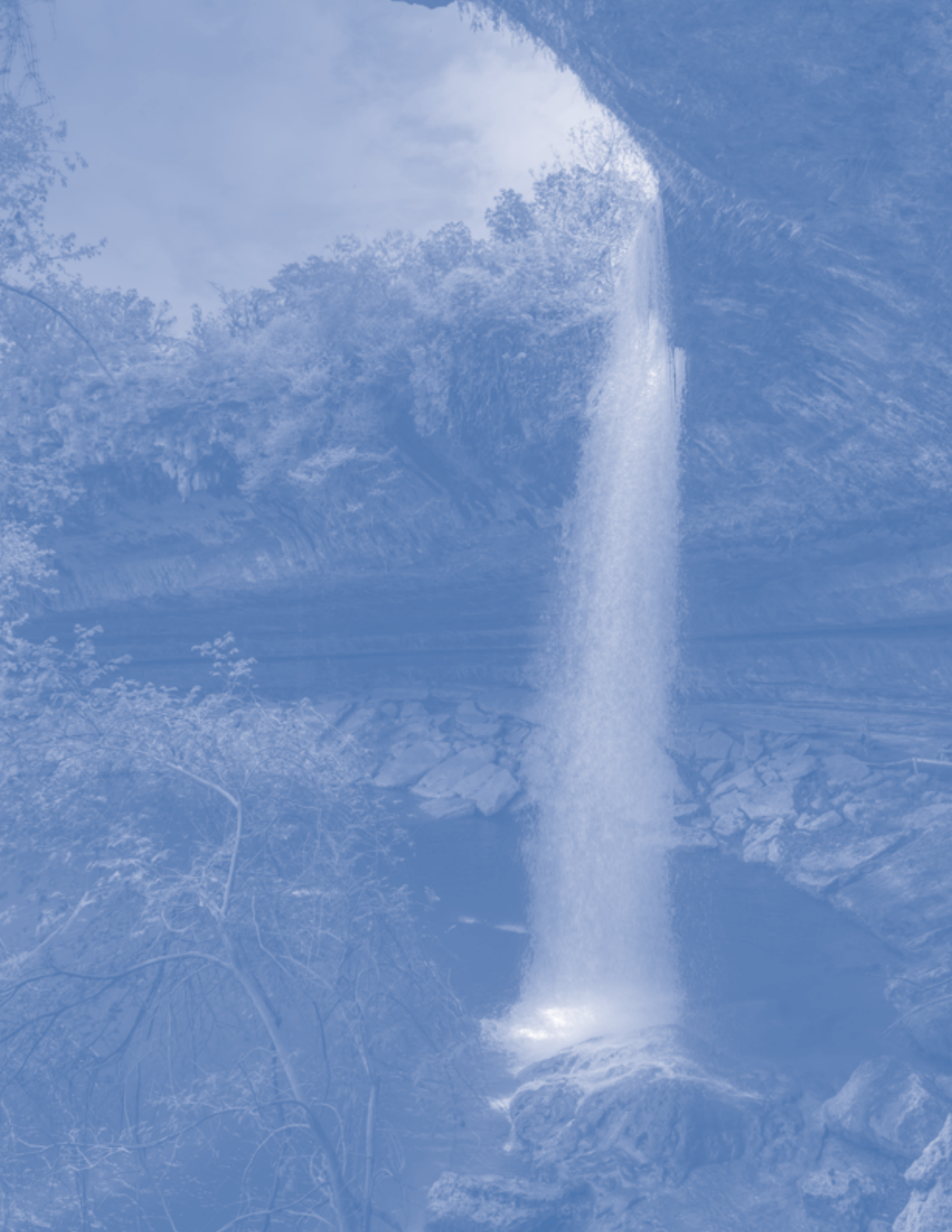
The success of the state's water quality management program is gauged by progress made toward protecting or restoring water quality uses that benefit people, wildlife, and the environment. Some of the reports that provide information on the success of the water quality management program are:

- Annual Report on Performance Measures (to the Texas Legislative Budget Board) (Pub. No. SFR-55)
- Biennial Report to the Texas Legislature (Pub. No. SFR-057)
- Managing Nonpoint Source Pollution in Texas: Annual Report (Pub. No. SFR-066)
- Texas Integrated Report of Surface Water Quality for Clean Water Act Sections 305(b) and 303(d) (biennial)

These reports and other information about the TCEQ's water quality programs are available on the web at <www.tceq.texas.gov>.

For More Information

Visit the TCEQ's website at <www.tceq.texas.gov/goto/water-main> for more information about managing the state's water quality. For specific information about this publication, contact the Office of Water at 512-239-6682.



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

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