Status Report:

Implementing Total Maximum Daily Loads in Texas

Texas Commission on Environmental Quality

October 2006

Prepared by the
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Texas Commission on Environmental Quality
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In This Report

From the Office of the Chief Engineer

Water is an essential part of our lives. We want it to be clean and safe for all the many uses we have for it. When a water body does not meet the standards by which we measure its quality, we must develop a "budget" for pollutant reductions — a TMDL — and an implementation plan to achieve them — an I-Plan. TMDLs and I-Plans are integral components in our state's overall program to improve and protect the quality of Texas rivers, lakes, and bays.

The TCEQ is committed to restoring impaired surface waters, and with the help of citizens and organizations throughout Texas, the TMDL Program made significant progress in 2005.

This report highlights the achievements of the Program in improving water quality and managing its activities, processes, and funds. Three themes emerge from the report:

- Commitment to action
- Collaborative partnerships
- Accountability

A commitment to action is apparent in the work of the program and its stakeholders. By the end of 2005, we implemented 11 plans to reduce 50 pollutants in 31 water bodies. We track how we're doing on implementing the plans and we already see some improvements in water quality.

Collaborative partnerships are critical to the program's success, and the TCEQ took several actions in 2005 to strengthen our partnerships with other local, regional, and federal government agencies that are responsible for environmental quality. In 2005, the TMDL Program sponsored 13 advisory groups to involve stakeholders in developing and implementing TMDLs and their I-Plans for specific watersheds. More advisory groups were formed in 2006.

The TMDL Program also implemented improvements in 2005 to its processes for administration, plan development, tracking and reporting, and contracting. These improvements strengthen the accountability of the TCEQ and its partners in restoring our impaired rivers, lakes, and bays.

As you read this report, I hope you will see not only the progress we've made in restoring impaired surface waters to attain standards, but also how you can become part of the solution to water pollution.

Sincerely,

David C. Schanbacher, P.E.
Chief Engineer
Texas Commission on Environmental Quality

INTRODUCTION

This report highlights the progress of the Total Maximum Daily Load Program of the Texas Commission on Environmental Quality. It summarizes the progress of the TCEQ's activities to plan, manage, and track the restoration of impaired surface waters to the attainment of quality standards. Through this report, the TMDL Program hopes to help watershed stakeholders, state leaders, and other interested people and organizations to better understand the state's water quality goals, achievements, and challenges, and to encourage their participation in improving impaired water bodies in Texas.

In this report, the reader will find:

- a brief overview of the state's water quality and TMDL programs
- the status of TMDLs in Texas
- highlights of the statewide program during 2005
- the TMDL Program's priorities for the future
- a summary of each implementation project and its progress

Water Quality Management: A Primer

In order to protect water quality, we must first define and measure it. Under the federal Clean Water Act, Texas and other states must establish water quality standards that describe how surface water bodies are used, carry out a program to regularly monitor the status of water quality in relation to those standards, and implement actions necessary to achieve and maintain those standards, including the issuance of water quality permits.

To successfully manage the quality of rivers, lakes, and bays, the TCEQ must work closely with people and organizations at the local, regional, state, and federal levels that have a stake in preserving water quality — collectively called *stakeholders*. The TCEQ must also closely coordinate its own internal programs across its several offices; this coordination is achieved primarily through its intra-agency Water Quality Coordination Team.

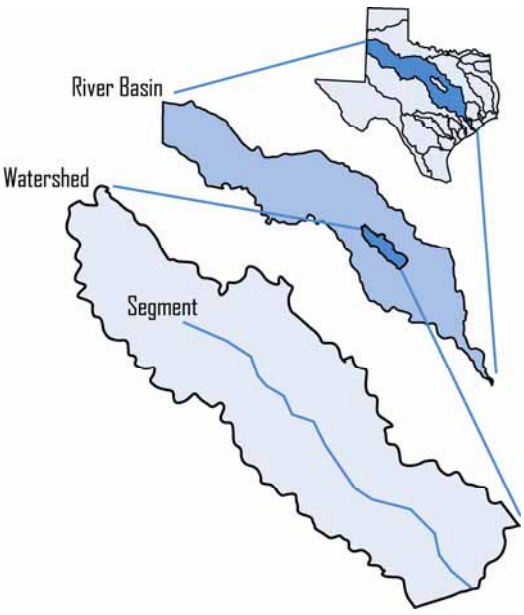


Figure 1. Geographic Units for Managing Water Quality

Geographic Organization

Water quality management in Texas is organized around two geographic units: the *segment* and the *watershed*. A segment is a discrete water body or a portion of one. For example, a long river

may be made up of many different segments. The TCEQ assigns unique identification numbers to the segments. A watershed is the area of land that drains to a particular body of water. The watershed of a long river will contain many smaller watersheds that drain to the segments within it. Everyone lives in a watershed, and almost everyone lives downstream from another one.

Surface Water Quality Standards

Water quality standards are the foundation for managing surface water quality. The Standards designate the uses for which water bodies in the state should be suitable and establish the criteria by which water quality can be evaluated.

Four major categories for use are defined under the *Texas Surface Water Quality Standards*:

- **Aquatic Life**: Is the water quality good enough to provide a healthy environment for fish and other aquatic species?
- **Contact Recreation**: Is it safe for people to swim and wade in the water?
- **Public Water Supply**: Is the water good enough to be used as a source of drinking water?
- **Fish and Shellfish Consumption**: Can people safely eat the fish from it?

Certain general criteria are also established to maintain the overall quality of water for all of its uses, such as the concentrations of certain minerals or the clarity and odor of the water.

Surface Water Quality Monitoring and Assessment

The TCEQ, in concert with other federal, regional, and local agencies, carries out a regular program of monitoring and assessment to determine which water bodies are meeting the standards and which are not. The state produces a biennial report, called the *Texas Water Quality Inventory and 303(d) List*, which compares existing water quality conditions to established standards, as required by Sections 305(b) and 303(d) of the federal Clean Water Act.

The report has two main parts:

- **The Inventory**, which gives the status of all the assessed surface waters in the state, and
- **The List**, which identifies segments that do not meet one or more of the standards.

TMDL Program

When current standards or pollution prevention strategies are not sufficient to maintain water quality, the state takes action to restore impaired segments through its TMDL Program. The core approaches of the TMDL Program are

commitment and accountability — commitment to action and the follow-through to be successful.

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

The TCEQ and its stakeholders follow a disciplined, focused, and coordinated approach that is calculated to achieve success in restoring impaired waters.

What Is A TMDL?

Before an action plan can be developed, it is first necessary to determine the sources of the pollutant and the amount by which it must be reduced to attain standards. This is accomplished by developing a *total maximum daily load* — a budget for a pollutant. A TMDL:

- determines the maximum amount (load) of a particular pollutant that a segment can receive each day and still both attain and maintain its water quality standards;
- identifies the sources that contribute to the load of the pollutant;
- allocates the allowable load, and the necessary reductions in it, to the sources in the watershed.

TMDLs must allow for seasonal variations, anticipate future growth, and include a margin of safety to cover uncertainties in the analysis.

TCEQ staff prepare a TMDL report on which stakeholders have the opportunity to advise and comment. Several steps go into preparation of the report: collection and assessment of additional data as needed, identification of possible sources, analysis of possible pollutant reduction scenarios, and determination of measurable pollutant reduction targets. The Commission formally adopts TMDLs, and they must then be submitted to the U.S. Environmental Protection Agency (EPA) for review and approval.

The Making of an I-Plan

After developing a TMDL, the TCEQ works with stakeholders to formulate a plan to implement it — the I-Plan. An I-Plan is a blueprint that describes how the pollutant reductions described in the TMDL will be achieved. It identifies the actions that will be taken to restore water quality conditions and establishes the means by which these actions will be tracked, evaluated, and reported. I-Plans are approved by the Commission but are not subject to EPA approval.

Management activities included in I-Plans incorporate both non-regulatory and regulatory mechanisms, such as permit effluent limits and recommendations,

management practices for nonpoint source pollution, monitoring to track changes in water quality, proposed revisions to stream standards, special projects, pollution prevention, public education, and watershed-specific rule recommendations.

The best strategies for each individual watershed are developed in cooperation with regional and local stakeholders. The stakeholders evaluate a wide range of strategies and weigh factors such as cost, technical feasibility, environmental effectiveness, commitment, and acceptability of various control actions in the development of the I-Plan. Although the activities in an I-Plan are not all mandated by law, the people and organizations responsible for pollution sources have an obligation to take the actions necessary to reduce pollution. I-Plans are fully integrated into state and federal administrative procedures.

Even after I-Plans are fully implemented, it is difficult to predict accurately how long it will take for improvements to occur in the stream, or how much improvement will be seen. For this reason, I-Plans are subject to periodic revisions if tracking indicates a need to alter course. Through this adaptive management approach, the plan is reassessed, and adjustments are made in the implementation activities as needed to attain water quality standards in the stream.

Time for Improvement

TMDLs may sound simple as described above, but the process of developing a TMDL and then implementing the necessary pollutant reductions may take several years. The time needed to complete a TMDL varies from one year to several years, depending on factors like the complexity and extent of the impairment, the data available at the outset of the project, and the number of stakeholders involved in the process. Development of the I-Plan itself usually takes about one year.

Status of the TMDL Program in 2005

The TMDL program had 23 active projects to develop TMDLs during 2005. These 23 projects are addressing 100 impairments in 85 water bodies for the most prevalent impairments on the state's 303(d) list: 50 impairments from bacteria, 23 impairments due to low dissolved oxygen, 14 impairments by organic compounds, and several impairments due to nutrients, metals, and high or low pH.

Developing TMDLs and I-Plans

The TCEQ is committed to developing TMDLs and their I-Plans in a timely manner, and is making steady progress toward completing TMDLs for all the impairments listed from 1998 through 2004 (see Figure 2).

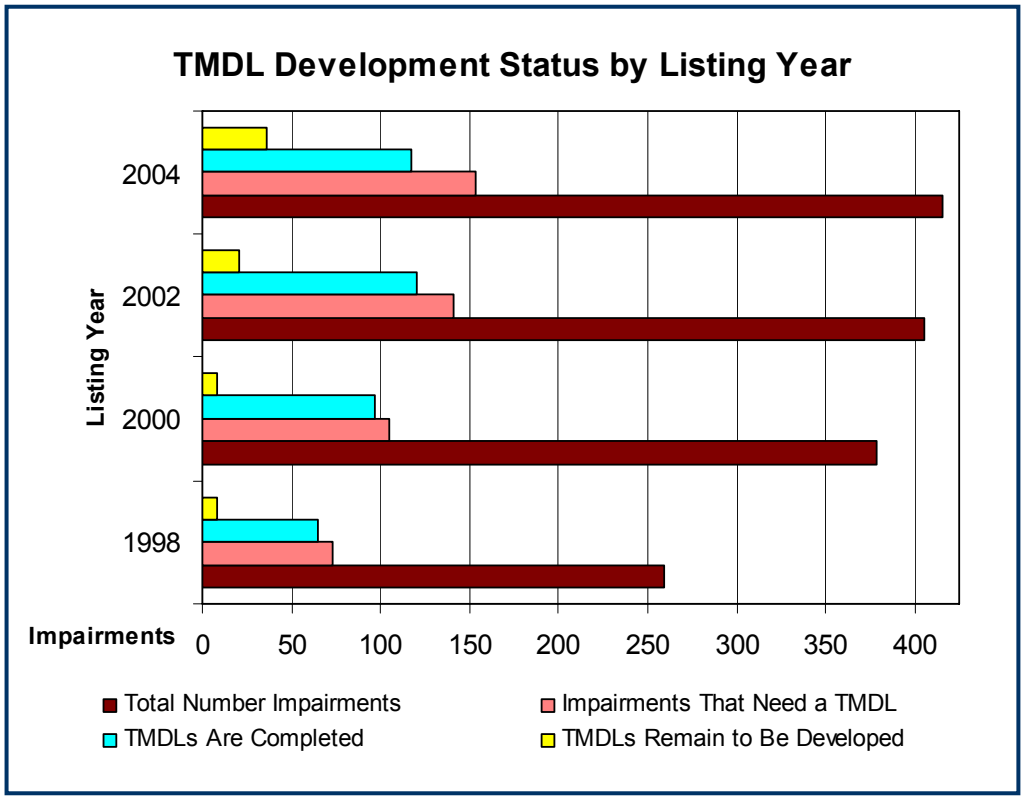


Figure 2. Status of TMDL Development by Listing Year

Changes in List Management

Prior to 2002, the TMDL Program was responsible for addressing all segments on the 303(d) list. However, further evaluation found that many segments on the 303(d) list did not require a TMDL; this led to a large backlog of work for the TMDL Program because it was spending its time not on developing TMDLs, but on segments that were more appropriate for a review of the standards, or for which there were insufficient data to determine whether a TMDL was necessary.

Work performed by the TMDL program prior to 2002 contributed to delisting approximately 30% of the impairments identified on the 303(d) lists for 1998 and 2000.

Since 2002, the TCEQ has published a 303(d) list that assigns segments to three categories: those that need a TMDL (Category 5a), those that require a review of the standard (5b), or those for which more data is required to determine the best course of action (5c).

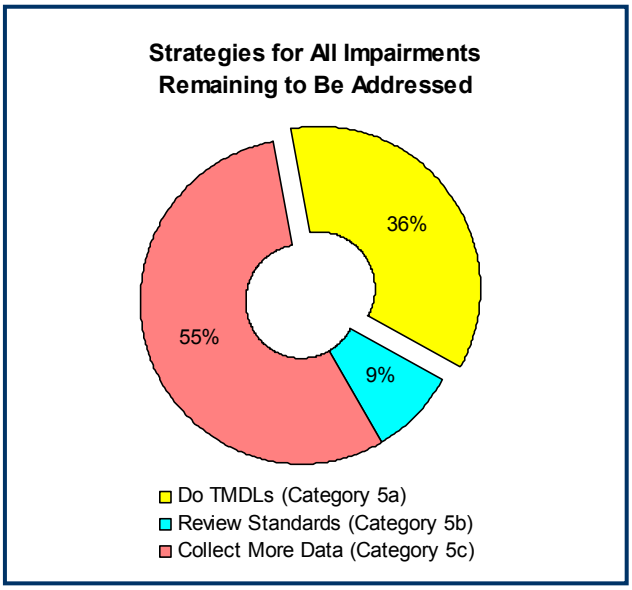


Figure 3. Strategies for All Impairments Remaining to Be Addressed

Impairments may be de-listed if additional data indicate that the use is being attained, or that the segment should be evaluated for development of site-specific standards. When deciding whether to de-list an impairment, the TCEQ evaluates the data originally used to list the impairment, along with any other data collected since the listing.

As of 2005, other TCEQ programs will address listings for which developing a TMDL may not be the best course of action. This change of procedure should increase the likelihood that TMDL projects will result in development of load allocations, and improve the program's overall speed in developing TMDLs for impaired segments. The Surface Water Quality Monitoring Program and the Surface Water Quality Standards Program will address segments for which more data is needed or for which the standards need review. Figure 3 shows the percent of impairments remaining to be addressed in each of the three categories for all water bodies listed from 1998 through 2004.

TMDLs Adopted in 2005

By June 2006, the commission adopted TMDLs for five pollutants in the four water bodies listed below. The TCEQ expects to approve four I-Plans for the TMDLs in late 2006. These TMDLs aim to restore 287 stream miles for general uses and as a source for drinking water supply, and 22,260 lake acres for support of aquatic life and the safety of fish consumption.

Clear Creek, Segment 1102 – General uses in Clear Creek are impaired due to elevated concentrations of chloride and total dissolved solids. The watershed of Clear Creek includes parts of Brazoria, Fort Bend, Galveston, and Harris counties.

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

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

Lower Sabinal River, Segment 2110 – Elevated concentrations of nitrate-nitrogen are affecting the river's use as a source for public drinking water. The watershed of the Lower Sabinal River includes parts of Medina and Uvalde counties.

Approved I-Plans

By the end of 2005, the TCEQ had approved I-Plans for 83 percent of the TMDLs it had adopted. The TCEQ and its partners had 7 active I-Plans underway for 43 impairments in 28 water bodies. The progress of the specific I-Plans toward improving water quality is described later in this document. The TMDL Program expects to develop another 21 I-Plans for 71 impairments by the end of 2008 (see Figure 4). Eleven of the new I-Plans will address bacteria impairments, which account for almost half of the listed waters in Texas, in 40 segments.

Reporting Measures

In addition to this annual report, the TMDL Program regularly reports its progress by other means in order to satisfy state and federal requirements.

State Reporting - In 2005, the TCEQ met its strategic goal to complete four TMDLs, as established in the agency's five-year Strategic Plan. Legislators use the Strategic Plan to allocate the state's financial resources during the Legislature's biennial appropriations process.

Federal Reporting - The EPA grants money to the states to protect, assess, and improve water quality, and to develop TMDLs in a timely manner. The TCEQ met its program activity measure (PAM) for TMDL development in 2005.

Environmental Progress through TMDLs

As of May 2006, the Texas TMDL Program had restored water quality to attain standards for 21 impairments to surface waters. Overall, the TMDL Program restored fishing uses, conditions for aquatic life, and proper salinity to 278 stream miles; made water suitable as a source of drinking water for 3,943 reservoir acres; and restored conditions for aquatic life in 12 estuary square miles.

Table 1 shows the streams, reservoirs, and estuaries for which the TCEQ has approved implementation plans. For each plan, the table shows the basin and identification number of the impaired water body, the use that is affected, and the geographic extent of the impairment.

Table 1. Environmental Progress through TMDL Implementation

I-Plan	Basin & Segment(s)	Use Affected	Year Begun	Status	Area of Impairment
Aquilla Reservoir: Atrazine	Brazos River; 1253	Source for drinking water	2002	Goals met	3,943 lake acres
Arroyo Colorado: Legacy Pollutants and Organics	Nueces–Rio Grande Coastal; 2202 & 2202A	Safety of fish consumption	2001	Under-way	504 stream miles 333 lake acres
Clear Creek: Chlordane	San Jacinto-Brazos Coastal; 1101 & 1102	Safety of fish consumption	2001	Goals met	42 stream miles
Clear Creek: Dissolved Solids	San Jacinto-Brazos Coastal; 1102	General (not tied to a specific use)	2006	Under-way	60 stream miles
Clear Creek: Volatile Organic Compounds	San Jacinto-Brazos Coastal; 1101 & 1102	Safety of fish consumption	2001	Goals met	84 stream miles
Dallas and Tarrant County Waterways: Legacy Pollutants	Trinity River; 0805, 0841, 0841A	Safety of fish consumption	2001	Under-way	18,970 lake acres 127 stream miles
E.V. Spence Reservoir: Total Dissolved Solids	Colorado River; Segment; 1411	General (not tied to a specific use)	2001	Under-way	29,900 lake acres
Fort Worth Waterways: Legacy Pollutants	Trinity River; 0806, 0806A, 0806B, 0829, 0829A	Safety of fish consumption	2001	Under-way	101 lake acres 47 stream miles
Houston Ship Channel: Nickel	San Jacinto River & Bays; 1001, 1005, 1006, 1007, 1013, 1014, 1016, 1017, 2426, 2427; 2428; 2429; 2430; 2430; 2436	Support of aquatic life	2001	Goals met	152 stream miles 24 bay square miles
Lake Austin	Colorado River; 1403	Support of aquatic life	2001	Under-way	1,830 lake acres
North Bosque River: Soluble Reactive Phosphorus	Brazos River; 1226 & 1255	General (not tied to a specific use)	2002	Under-way	121 stream miles

Successful TMDL Implementation, 2004 to 2006

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

Concentrations of nickel in 14 segments of the **Houston Ship Channel** continue to meet the criteria to protect aquatic life from toxic effects. The TMDL Section

receives updated information from the Office of Permitting, Remediation, and Registration as new wastewater permits are issued, and reviews it to ensure continued compliance with the TMDL.

Table 2. Progress in Reducing Dissolved Salts in the E.V. Spence Reservoir

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

In 2004, annual average concentrations of chloride and sulfate, two salts causing concern for the use of **E.V. Spence Reservoir** in Coke County as a source of drinking water supply, were in compliance with TMDL target levels (Table 2). However, overall concentrations of total dissolved solids remain significantly above target levels, though they have declined, on average, from 1999 through 2005. A rainfall event in late 2005 brought the lake elevation up 18 feet. This influx of relatively low-salinity water should further reduce the chloride and sulfate concentrations in the lake.

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

Phosphorus concentrations were also measured at five index sites from October 1997 through September 2002, before the start of TMDL implementation. The reductions shown in Table 3 compare the concentrations prior to implementation with those measured after implementation, from October 2002 through September 2005. The TCEQ will monitor water quality at the five index sites for several years in order to track environmental progress.

Table 3. Progress in Reducing Phosphorus Concentrations in the North Bosque River

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

Technical Progress

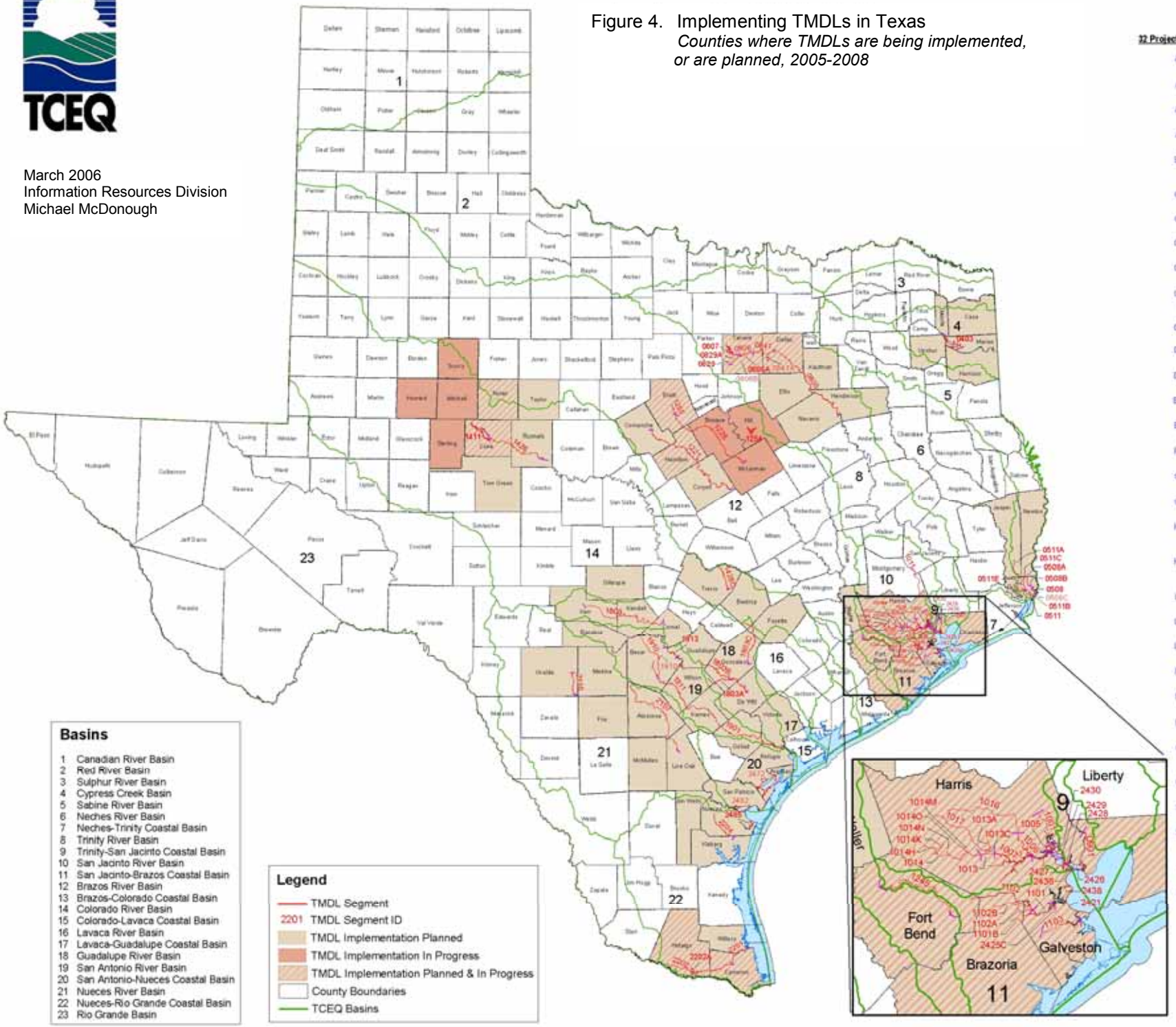
Bacteria accounted for 47 percent of the impairments listed in the *2002 Texas Water Quality Inventory and 303(d) List*. Mercury contamination in water and fish tissue is another very complicated problem, and one that can affect human health. These impairments present unique technical challenges for assessment and control.

TCEQ

March 2006
Information Resources Division
Michael McDonough

Figure 4. Implementing TMDLs in Texas

Counties where TMDLs are being implemented, or are planned, 2005-2008



32 Projects / 75 Segments / 121 Impairments / 67 Counties

Aquilla Reservoir (Atrazine)
Segment: 1254

Arroyo Colorado (Organics)
Segments: 2202 & 2202A

Arroyo Colorado Tidal (Dissolved Oxygen)
Segment: 2201

Atascosa River (Bacteria)
Segment: 2107

Buffalo and Whiteoak Bayous (Bacteria)
Segments: 1013, 1013A, 1013C, 1014, 1014H, 1014K, 1014M, 1014N, 1014O, 1017

Clear Creek (Bacteria)
Segments: 1101, 1101B, 1102, 1102A, 1102B, 2425C

Clear Creek (Chlordane)
Segments: 1101, 1102

Clear Creek (Dissolved Solids)
Segment: 1102

Clear Creek (VOCs)
Segments: 1101 & 1102

Colorado River Below E.V. Spence Reservoir and Petronila Creek (Dissolved Solids)
Segments: 1426, 2204

Copano Bay (Bacteria in Oysters)
Segment: 2472

Dallas & Tarrant Counties Legacy
Segments: 0805, 0841, 0841A

Dickinson Bayou (Dissolved Oxygen)
Segment: 1103

Elm and Sandies Creeks (DO and Bacteria)
Segments: 1903A, 1903B

E.V. Spence Reservoir (TDS)
Segment: 1411

Fort Worth Legacy
Segments: 0806, 0806A, 0806B, 0829, 0829A

Gilleland Creek (Bacteria)
Segment: 1428C

Guadalupe River Above Canyon Lake (Bacteria)
Segment: 1806

Houston Ship Channel (Dioxin)
Segments: 0901, 1001, 1005, 1006, 1007, 2421, 2426, 2427, 2428, 2429, 2430, 2436, 2438

Houston Ship Channel (Nickel)
Segments: 1001, 1005, 1006, 1007, 1013, 1014, 1016,1017, 2426, 2427, 2428, 2429, 2430, 2436

Lake Austin (Dissolved Oxygen)
Segment: 1403

Lake O' the Pines (Dissolved Oxygen)
Segment: 0403

Lake Worth (PCBs)
Segment: 0807

Mid Cibolo Creek (Dissolved Oxygen)
Segment: 1913

North Bosque River (Phosphorous)
Segments: 1226 & 1255

Nueces Bay (Zinc in Oysters)
Segment: 2482

Orange County (Bacteria, DO, and pH)
Segments: 0508, 0508A, 0508B, 0508C, 0511, 0511A, 0511B, 0511C, 0511E

Oso Creek and Oso Bay (Bacteria)
Segment: 2485

Sabinal River (Nitrate and Nitrite)
Segment: 2110

San Antonio River Basin, Leon River and Peach Creek (Bacteria)
Segments: 1221, 1803C, 1901, 1910, 1910A, 1911

Trinity River, Dallas & Below (Bacteria)
Segments: 0805, 0806, 0841

Upper Oyster Creek (Bacteria and DO)
Segment: 1245

Bacteria

In 2005, the TCEQ had projects in progress to address 72 bacteria impairments. The TCEQ and its partners continue to coordinate this large effort. An internal work group coordinates research, assessment, and control issues in agency work related to bacteria contamination.

High concentrations of bacteria may cause non-attainment of the standards for contact recreation use or result in the closure of oyster beds to harvesting in order to protect consumers. High levels of certain bacteria in water indicate an increased chance that disease-causing microorganisms (pathogens) may also be present. Pathogens pose a health risk to people who swim or enjoy other forms of recreation in rivers, lakes, or bays. Oysters that live in bays where bacteria concentrations are high may be unsafe for people to eat.

The indicator bacteria used to assess the safety of contact recreation and oyster harvesting include fecal coliform, *E. coli*, and enterococci. These bacteria are commonly found in the wastes of warm-blooded animals. Tests currently used to measure bacteria in water do not identify the specific sources of pollution; they simply count the number of colony-forming units of bacteria that are present.

Developing a Sound Approach for Bacteria TMDLs

In 2005, the TMDL Program worked to define a strategic approach to these technical issues, in concert with other agency programs, external partners, and TCEQ executive management. In working to build this approach, the program identified a need to evaluate the findings of research funded over the last several years by TCEQ and other agencies to determine the best scientific tools for developing and implementing bacteria TMDLs for the state's diverse watersheds (see "Tracking Sources" following). As expected, the program also found that stakeholder interest in TMDLs for bacteria was very high.

Consequently, in September 2006, the commissioners and the members of the Texas State Soil and Water Conservation Board (TSSWCB) appointed a joint technical task force to review the current scientific methods and research for establishing and implementing bacteria TMDLs and make recommendations to the Commission and the Board. The task force will recommend approaches for developing and implementing TMDLs for bacteria and a science and research roadmap for further investigations.

The TCEQ and the TSSWCB also strengthened their partnership to preserve the quality of water resources by updating the cooperation agreement between the two agencies. The TMDL Program expects to complete more than 100 TMDLs for bacteria by August 2009, using the resulting direction from the Commissioners and the task force. Concurrently, both the TCEQ and the TSSWCB have funded several stakeholder-driven watershed protection initiatives for bacteria and other impairments. These initiatives jump-start local involvement in strategies to reduce pollution.

Tracking Sources

With funding from the TCEQ, the TSSWCB, and the EPA, scientists with Texas A&M University System have developed bacterial source tracking (BST) libraries for thousands of *E. coli* bacteria isolated from more than 1,500 human and animal source samples. The BST libraries catalogue bacteria using both genotype and phenotype, and are used to indicate possible animal and human origins of *E. coli* bacteria. The libraries were built using data from the watersheds of Waco Lake and Belton Lake, and from other watersheds in the San Antonio area. The libraries developed through this research are the foundation of a state wide bacterial source tracking database and aid in the development of effective water-quality protection strategies.

Mercury

Mercury is a neurotoxin that accumulates and becomes concentrated in the tissues of fish and shellfish. People who eat fish that contain high concentrations of mercury are at risk of adverse health effects. Fourteen segments in Texas are under health advisories that advise people to limit their consumption of the fish from the water bodies. Most of these segments are located in East Texas.

Airborne mercury is a significant source of contamination in Texas water bodies. Wind carries mercury-bearing vapor and particles, often over great distances, through the atmosphere. These pollutants fall onto land and into rivers, lakes, and bays during rainfall and through other natural processes.

Mercury is emitted to the air from a variety of natural and man-made sources. Coal-fired power plants, aggregately, are the single largest source of mercury emissions that originate within Texas. The EPA finalized the Clean Air Mercury rule in 2005, which requires reductions of mercury emissions from power plants.

Cleaning up mercury contamination involves several complicated technical, jurisdictional, and policy issues, such as cross-media regulation, the transport of mercury across state lines and international borders, and scientific uncertainty about how mercury is transformed in natural water bodies. Executive management and staff from both the air and the water quality programs are evaluating several options for addressing mercury contamination.

Programmatic Progress

In addition to TMDL development and TMDL implementation project work conducted during 2005, the TCEQ TMDL program worked on several initiatives designed to increase the effectiveness and efficiency of the program. These initiatives were designed to enhance coordination with both internal and external partners, and to streamline administrative and contracting procedures within the program.

TMDL Partnership Conference

The TCEQ and the TSSWCB hosted a conference in September 2005 to focus on implementing TMDLs. The TCEQ's goal for the conference was to bring governmental stakeholders together to share their experiences with implementing TMDLs, to identify effective and ineffective components of their implementation projects, and to determine what issues these agencies and the TMDL Program need to address to improve their success in meeting environmental goals.

The conference also reinforced cooperation among the regional, state, and federal agencies that are critical to the effort to implement TMDLs. Eighty-seven people representing 35 organizations attended the conference.

Streamlined Administrative Procedures

The Program has streamlined its administrative processes to speed up the development of TMDLs. It has also refined its processes for assessment, listing, TMDL development, and implementation methodologies through work with the Surface Water Quality Monitoring Program and the Surface Water Quality Standards Program.

Funding to Implement TMDLs for Agricultural Sources

The TCEQ and the TSSWCB worked together to identify priority watersheds for funding assistance under the federal Environmental Quality Incentives Program (EQIP) administered by the U.S. Natural Resource Conservation Service (NRCS) of the U.S. Department of Agriculture. The close coordination of the state's priorities for water quality and agricultural assistance with the EQIP funding request marks a significant milestone for the state's TMDL programs.

Approval of Quality Assurance Project Plans

The TCEQ is nearing agreement with EPA Region 6 staff on the delegation of authority to approve quality assurance project plans (QAPPs). The EPA requires QAPPs for the collection of environmental data under a TMDL project. Delegation of this authority will reduce the duration of individual TMDL projects by several months.

Improvements in TCEQ's Contracting Process

The TMDL Program developed an alternate process that reduces the cumulative time required to complete interagency contracts by approximately 30 percent. The improved process was developed in cooperation with staff and management in the Procurements and Contracts Section and the Environmental Law Division.

Coordination with Texas Board of Professional Engineers (TBPE)

The TCEQ worked with the TBPE throughout its development of a revised "Policy Advisory Opinion Regarding Water Quality Planning." Had the TBPE adopted its original draft opinion, the TMDL process would have been several months longer for most projects, and there would have been additional restraints on the TMDL Program's ability to execute contracts for TMDL-related work. In its final opinion, the TBPE eliminated its draft requirement that all work related to TMDL development be under the direction of a professional engineer.

Fiscal Status

In Texas, the TMDL program is implemented largely through contracts with external organizations, both private and public. In 2005, the TMDL program spent $6.4 million on contracts for TMDL development and related work. Overall, the TCEQ has spent more than $17 million on TMDL contracts in the period from 2002 through 2005, for an average of about $4.4 million per year.

Contractual costs are paid from state and federal funds (see Figure 5). Several federal grants created and authorized in sections of the Clean Water Act are used to support the TMDL Program:

- Section 106 grants
- Section 319 grants (nonpoint sources only)
- performance partnership grants (PPG)

Section 106 grants accounted for more than a third of the funds used to support TMDL projects during 2005. Overall, federal funds accounted for approximately 74% of TMDL spending, with state funds accounting for the remaining 26%. PPG funding for TMDLs in 2005 was a singular opportunity: grant money originally targeted for other programs was not spent, and was reallocated to fund TMDLs. The TCEQ decided to use the funds in this way due to a large cut in revenues from state sources.

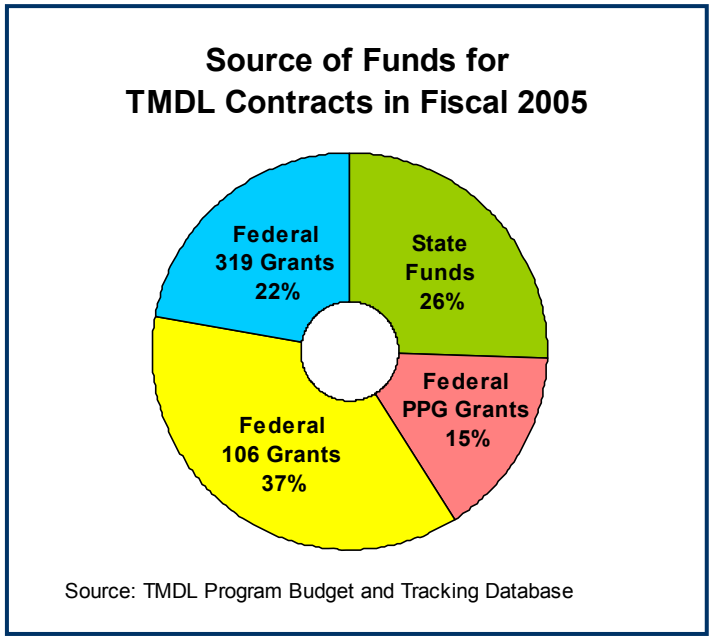


Figure 5. Source of Funds for TMDL Contracts in Fiscal 2005

The TCEQ also receives a special appropriation from the Texas Legislature to fund the TMDL Program. In 2005, the TCEQ used approximately $1.6 million in state general revenue to pay for contract expenses and to leverage

approximately $4.8 million in federal funds, a ratio of federal to state funding of almost three to one.

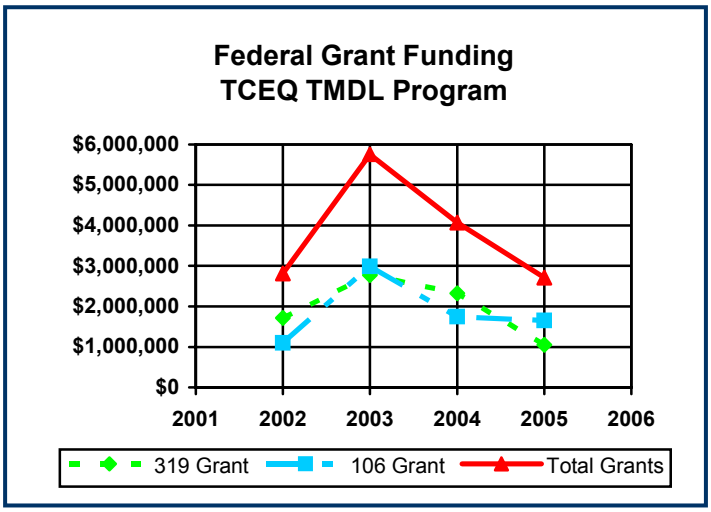


Figure 6. Federal Grant Funding for the TMDL Program

Funding sources for TMDL work in Texas are not secure, and were significantly reduced in 2005 (Figure 6). The TMDL Program competes with many other programs and agencies for federal grant funds. Grants to the Texas TMDL Program have declined significantly over the past 2 years (see chart). In 2005, the Section 319 grant was reduced by more than 50% compared to 2004. Instability and variations in funding directly affect the TMDL Program's ability to meet its performance objectives.

To partially address this problem, the TCEQ decided in 2005 to set aside a certain amount of funding from the Section 106 grant for each eligible program area. Beginning in 2007, the TMDL Program's set-aside is $1.65 million per fiscal year, assuming federal 106 grants remain at current levels. This amount is approximately equal to the TMDL Program's average expenditure of 106 funds for the three fiscal years from 2002 through 2004. This provides the program with some security in planning for the work necessary to meet its goals.

Challenges to Implementing TMDLs

The TCEQ faces a number of challenges in meeting its goal to complete the necessary TMDLs within 13 years of the date an impairment is listed. Financial and resource constraints limit the number of projects that the program can pursue. As discussed in the "Fiscal Status" section, funding sources for TMDL work in Texas are not secure and were significantly reduced in 2005.

TMDL implementation also raises numerous technical and social challenges. Some of these include public awareness, the complexity of the science underlying many water quality issues, stakeholder support, and uncertainties about pollutant sources and control measures.

Rising Work Load

Another challenge is the rise in the overall amount of work. Figure 2 shows that the number of listings that need a TMDL has approximately doubled in the six years between 1998 and 2004. Part of the reason for this rise in listing is the success of the Texas Clean Rivers Program, a partnership of the TCEQ and regional authorities to monitor the quality of the state's surface waters. Since 1996, the to-

tal number of river miles the state assesses has grown by 41%. The increase in the number of water bodies and conditions that are monitored has led to a concurrent rise in the number of water bodies that are identified as impaired. Throughout the last nine years, overall, the state's water quality has remained good, with most water bodies attaining their standards.

On average, it took approximately four years to complete the projects for all of the 43 TMDLs developed by the end of 2005. The TMDL projects currently in development are expected to take somewhat longer to complete because they address problems of greater complexity.

Scientific and Social Challenges

Many water quality problems represent very complex scientific phenomena that may not be well understood by the scientists and engineers who study the problems or by the citizens and agencies that are trying to develop solutions for them. Some problems are not easily observed; for example, low dissolved oxygen levels may reduce the quality of habitat for aquatic organisms but that condition may not be apparent to the casual observer. A related issue is that many people do not realize that their ordinary activities like maintaining their lawns or automobiles, if not properly done, may be detrimental to water quality.

Similarly, the effectiveness of some control measures in reducing pollutant loadings cannot be estimated with certainty. The exact costs of implementation cannot be accurately estimated due to such factors as unanticipated technical issues or the cost of time needed to reach consensus about the appropriate solutions.

The uncertainties inherent in the scientific analyses to support TMDLs may tempt stakeholders and agencies to delay the completion of TMDLs. It is also becoming clearer to policy-makers in Texas and in other states that restoration measures will have to be implemented using an adaptive management approach. Adaptive management allows stakeholders to implement measures step by step, according to their feasibility and reliability. Progress is measured after steps are implemented to determine if additional measures are needed.

Balancing TMDL Development, Implementation, and Funding

In the 2004-2005 biennium, the TMDL Program spent an estimated 30 to 40 percent of its funding on implementation. This percentage is expected to rise throughout the period between 2005 and 2011, as TMDLs that were begun from 1998 through 2000 are completed and implemented. Increasing implementation means that unless resources can be redirected or additional funding can be secured, fewer TMDLs can be initiated in the coming years, as compared with the number developed during 1998 through 2003. Balancing the priorities for developing new TMDLs and implementing the completed ones will be challenging.

Summaries of Active Implementation Projects

Summaries of all the projects operating under an I-Plan are provided in the following section. Each summary follows the same format.

Header Bar

The header bar of each summary:

- Contains a map showing the project area;
- Identifies the use(s) that the I-Plan is designed to restore, and the pollutant(s) for which TMDLs have been established;
- Lists the titles and dates of the TMDL and its I-Plan;
- Gives a brief description of the location of the watershed.

Environmental Problem

This section describes the problem addressed by the I-Plan, including relevant factors that were considered in developing the TMDL and the plan. It also lists the segments included in the project. Where pollutants differ among the water bodies, the pollutants of concern are listed next to each water body.

Water Quality Goal

This section includes the environmental goal by which plan's success will be measured.

Environmental Progress

This section describes the environmental progress to date — whether the goal has been met, or whether progress has been made.

Implementation Activities

This section describes programmatic progress to date — how well the activities are proceeding. It identifies the key partners in the project, and outlines the planned activities and their status.

Successes

This section highlights the project's successes.

Problems

This section discusses issues and problems that are hindering the project's progress.

Recommendations

This section lists the TMDL Program's recommendations for the project's future.

Abbreviations Used in this Document

AWSD	Aquilla Water Supply District
BMPs	Best management practices
CAFO	Concentrated animal feeding operation
CRMWD	Colorado River Municipal Water District
DSHS	Texas Department of State Health Services
EPA	Environmental Protection Agency (U.S.)
FWDEM	Fort Worth Department of Environmental Management
I-Plan	Implementation plan
LCRA	Lower Colorado River Authority
NPS	Nonpoint source

PCBs	Polychlorinated biphenyls
PS	Point source
RRC	Railroad Commission of Texas
TCE	Texas Cooperative Extension
TCEQ	Texas Commission on Environmental Quality
TDA	Texas Department of Agriculture
TDS	Total dissolved solids
TMDL	Total maximum daily load
TSSWCB	Texas State Soil and Water Conservation Board
WWTF	Wastewater treatment facility
USGS	United States Geological Survey
VOCs	Volatile organic compounds

Arroyo Colorado and Donna Reservoir & Canal

Impairment & Listing Year: The fish consumption is not met due to legacy pollutants and PCBs in fish tissue (1996)

TMDL: Commission adopted: January 17, 2001
EPA approved: June 14, 2001

I-Plan: Commission Approved: September 14, 2001

Location: Nueces-Rio Grande Coastal Basin; Cameron, Hidalgo, and Willacy counties

Environmental Problem

In 1993 and 1994, the DSHS advised the public not to eat fish from the Arroyo Colorado and Donna Reservoir due to elevated concentrations of legacy pollutants in fish tissue. Legacy pollutants are substances whose uses have been banned or restricted by the EPA, but which remain in the environment.

The use of pesticides on surrounding cropland probably accounts for a substantial portion of the fish tissue contaminant residues in the Arroyo Colorado. The source of PCB contamination in the Donna Canal is probably the result of spills or improper disposal of PCB-containing material along a 75-meter section of the canal.

Project Segments

Segment Number	Segment Name	Pollutant(s)
2202	Arroyo Colorado Above Tidal	Chlordane, toxaphene, DDE
2202A	Donna Canal	PCBs

Water Quality Goal

The ultimate goal of these TMDLs is the reduction of contaminant concentrations in fish tissue to levels that constitute an acceptable risk to consumers. Success will be measured by the removal of consumption bans issued by the DSHS.

Environmental Progress

The fish consumption use is not yet supported, although the advisory was modified in 2001. The consumption restrictions were lifted except for those associated with one species, small mouth buffalo. Concentrations are generally declining over time (see Figures 7 and 8). The DSHS will reassess the risk to consumers in 2005.

Implementation Activities

Evidence suggests that concentrations of legacy pollutants in the environment will decline over time through natural attenuation. Therefore, implementation consists primarily of monitoring to determine whether pollutant concentrations are decreasing and whether there are any current sources of contamination.

Activities for this project are carried out by the:

- TCEQ
- DSHS
- USGS

Activities fall into five general categories:

- Monitoring to identify trends and continuing sources of contamination;
- Investigating trends that indicate current sources of pollutants;

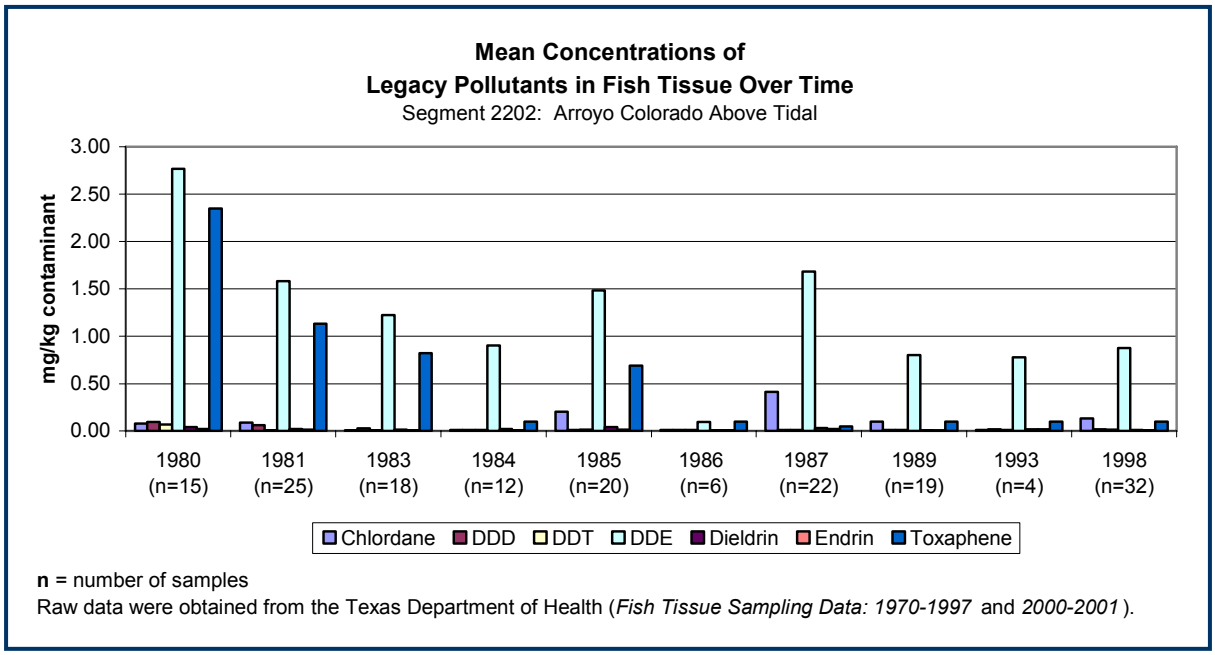


Figure 7. Mean Concentrations of Legacy Pollutants in Fish Tissue, Arroyo Colorado Above Tidal

- Implementing remediation at three facilities through the Superfund program;
- Implementing a remediation plan for PCB sources in the Donna Canal;
- Conducting follow-up risk assessments to determine whether the fish consumption use has been restored, or whether further action is required.

Status

Cleanup has been completed at the three Superfund sites. Monitoring of groundwater will continue at those sites through 2008. The USGS completed its evaluation of historical pollutant trends in the watershed.

The TCEQ received a grant from the EPA to remediate the PCB contamination in the Donna Canal. The TCEQ's TMDL and Superfund Programs are coordinating the project with the Donna Canal Irrigation District. The TCEQ is conducting a feasibility study to determine the most cost-effective way to address the problem.

The DSHS will collect fish from the Arroyo Colorado and the Donna Reservoir and reassess the risk to public health during 2006 and 2007.

Successes

Pesticide contamination in fish tissue has declined, allowing the DSHS to lift the consumption advisory for all but one fish species.

Concentrations of pesticides have declined over time as observed in sediment cores taken from the watershed.

Remediation of three pesticide-contaminated Superfund sites in the watershed is complete.

Funding has been secured to support the DSHS's assessment of health risks.

Work has begun to remediate PCB contamination in Donna Canal.

The TMDL document was revised in July 2003 to include eight new pollutants found in fish tissue. The EPA approved the additional TMDLs in May 2004. The I-Plan is being revised.

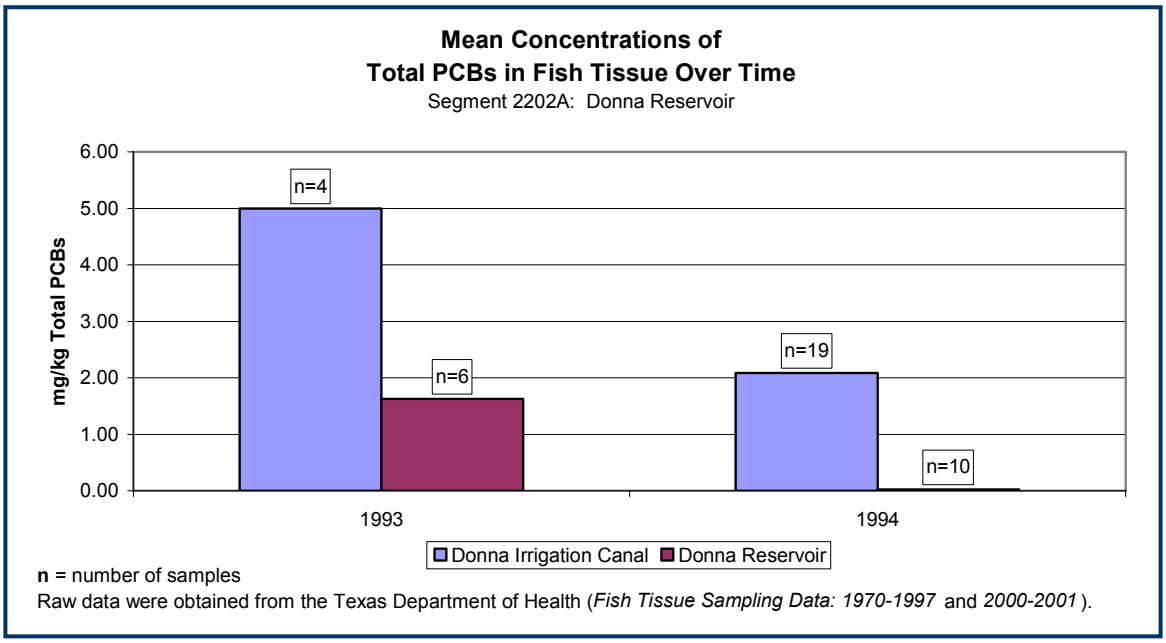


Figure 8. Mean Concentrations of PCBs in Fish Tissue, Donna Reservoir

Recommendations

Support the DSHS's assessment of health risks for consuming fish from both the Arroyo Colorado and the Donna Canal.

Support the remediation of the Donna Canal.

E.V. Spence Reservoir

Impairment & Listing Year: General uses were not met due to high concentrations of sulfate and total dissolved solids (1996).

TMDL: Commission adopted: June 14, 2002
EPA approved: May 9, 2003

Implementation Plan: Commission approved: August 10, 2001

Location: Upper Colorado River Basin; Borden, Coke, Howard, Mitchell, Nolan, Scurry, and Sterling counties; Upper Colorado River Basin; north of San Angelo and southeast of Big Spring

Environmental Problem

High concentrations of salts in the reservoir affect its use as a source of drinking water (see Figure 9.) Approximately 90% of the pollutants impacting E.V. Spence Reservoir are from nonpoint sources; roughly half are natural and half are anthropogenic. Anthropogenic sources of pollution in the reservoir are associated with oil and gas production. Extensive mineral deposits, low rainfall amounts, and high rates of evaporation tend to make water quality in the E.V. Spence watershed naturally saline. In the late 1980s, a spill of saline water from an upstream diversion reservoir caused a spike in TDS concentrations.

Project Segments

Segment Number	Segment Name
1411	E.V. Spence Reservoir

Water Quality Goal

The goal of these TMDLs is achievement of water quality standards at least 80% of the time. The segment standards are 450 milligrams/liter

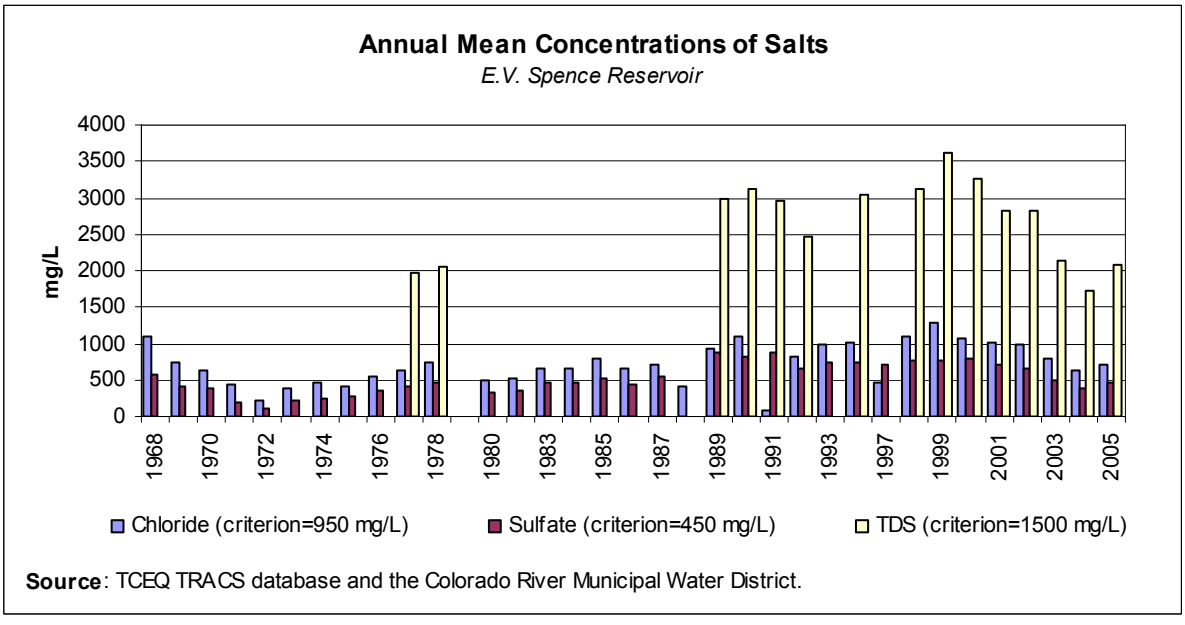


Figure 9. Annual Mean Concentrations of Salts in E.V. Spence Reservoir

(mg/L) sulfate, 1,500 mg/L total dissolved solids (TDS), and 950 mg/L chloride. The loads allocated in the TMDL are 1,427 tons/day of chloride, 268 tons/day of sulfate, and 438 tons/day of TDS. The TMDL allocates these loads to point source discharges, natural nonpoint sources, and anthropogenic nonpoint sources.

Environmental Progress

The measure of success has not been achieved, but there is progress (Table 4, Figure 9). The annual mean concentrations for chlorides and sulfate in 2004 were in compliance at all times, an enormous improvement from previous years. This is probably due in large part to good rainfalls and exceptional work by the CRMWD to accurately manage their diversions using real-time water quality monitors. However, the mean concentration for TDS was never in compliance during 2004.

Implementation Activities

Activities for this project are carried out by the:

- CRMWD
- RRC
- TSSWCB
- TCEQ
- EPA

Activities fall into seven general categories:

- Managing water diversions and releases to increase the flow of non-saline water into the reservoir;
- Controlling salt cedar trees;
- Seeding clouds to increase rainfall;
- Plugging abandoned oil and gas wells to reduce nonpoint sources of saline water;
- Stopping saline seeps from an abandoned magnesium plant
- Reviewing the attainability of the use and a possible change of the standards;

Status

Currently, the TSSWCB is funding three brush control projects to support the I-Plan. Herbicides and biological control of salt cedar are used in riparian habitats to control nonpoint source loadings from this species. Chemical treatment is scheduled to treat almost 3,000 acres in 2006.

Table 4. Concentrations of Dissolved Salts in E.V. Spence Reservoir

Dissolved Salt Concentrations, Milligrams/Liter			
	1994-1999	2000-2005	Percent Decrease
Chloride	1095	878	19.8%
Sulfate	765	583	23.8%
TDS	3395	2466	27.4%

In areas where herbicide use is not feasible, the TSSWCB is using the Chinese leaf beetle. Biological control using the beetle is going well, and is in the third year of implementation. Especially when combined with herbicide application, biological control is proving to be a useful tool.

The results of brush control efforts are analyzed utilizing satellite imagery. TSSWCB personnel are also modeling the dispersion rate of the Chinese leaf beetle.

The CRMWD weather modification program remains in progress.

Phase I of the RRC's project plugged 197 abandoned oil and gas wells in the watershed under the Oil Field Cleanup Fund program. Phase II of the well plugging project is in progress; its goal is to plug 80 abandoned wells. Due to the recent initiation of the project, only six wells had been plugged by September 2005. The RRC is monitoring water quality adjacent to its plugging operations in an attempt to quantify load reductions from specific BMPs.

Don Horner, District 7C Director, summed up the work completed so far: "Having the TCEQ grant money has helped the RRC to re-enter and re-plug wells in Runnels and Coke counties sooner than would otherwise be possible, since the RRC Oil Field Clean Up Fund has put a priority on unplugged well-bores. Most of the wells we re-entered were found to have a water flow at the surface after the plug was drilled out, and most, if not all, of these wells had an inadequate surface casing based on today's water quality protection depths set by the TCEQ. The data gathered from these plugs has proved how necessary this program is to protecting fresh water."

Rainfall in the summer of 2005 brought the lake elevation up 18 feet. This influx of relatively good quality water will further reduce the chloride and sulfate concentrations in the lake. Unfortunately, the drought is not over, so conditions are still likely to result in high rates of evaporation and saline deposition.

Successes

The TCEQ and the RRC coordinated well on Phase I, and Phase II is also going well.

The TCEQ and the CRMWD have developed a strong working relationship.

Recent work to remediate seeps has dried up some seeps that were contributing highly saline water to tributaries above E.V. Spence Reservoir.

The TCEQ installed two stations that monitor and report water quality in real time. The stations are located at two CRMWD pumping stations to aid them in more accurately controlling diversions of saline water. The TCEQ is currently coordinating with the CRMWD to install two more real time monitoring stations that will increase their control over water diversions.

The TCEQ is developing a TMDL for dissolved solids for the Colorado River Below E.V. Spence Reservoir, Segment 1426. Coordinating these two TMDLs for adjacent segments is having a beneficial effect on the implementation of management measures.

Recent rainfalls have increased the volume and quality of water in the reservoir, further reducing the chloride and sulfate concentrations. This has resulted in full compliance with the criteria for chloride and sulfate. However, TDS remains out of compliance with the standard.

Problems

Water quality improvement is slow, despite the success in reducing pollution from abandoned wells and increasing inflows of fresh water.

Despite the recent rains that substantially increased the volume of the reservoir, the area is still experiencing drought conditions. The reservoir is only at 30 percent capacity.

CRMWD could not implement their activities until the EPA approved the TMDLs in 2003, allowing them to secure funding.

The I-Plan provides for the TCEQ to assess the appropriateness of the water quality criteria for the E.V. Spence Reservoir. TCEQ data indicate that the ratio of chloride, sulfate, and TDS defined in the standards is not consistent with the normal, natural composition of water in E.V. Spence Reservoir, making it likely that the reservoir will continue to have concentrations that exceed the screening criteria used to determine compliance with the standards.

It is difficult to quantify the load reductions achieved by some of the BMPs being used.

The EPA withheld nonpoint source grant funds for some time because the I-Plan does not state how much load reduction each of the measurement measures is expected to achieve. The EPA finally approved Phase II of the RRC's well plugging project after the RRC agreed to analyze water quality from tributaries of the reservoir before and after the targeted wells are plugged.

Roughly half of the impairment appears to be natural in origin. There may be limits to what can be accomplished through implementation.

Some of the activities require amendments to water rights permits from the TCEQ.

Recommendations

Continue review of water quality standards.

Continue to support the CRMWD's efforts to make their water quality diversion system more effective by installing two more stations for monitoring water quality in real time.

Continue to coordinate efforts with the RRC on the well plugging program.

Support efforts to remedy seeps from an abandoned magnesium plant.

Support TSSWCB brush control initiatives.

Monitor amendment applications for water rights permits.

Houston Ship Channel

Impairment & Listing Year: The aquatic life use was not met in the Ship Channel due to concentrations of nickel in water that cause chronic exposure of aquatic organisms to sublethal, deleterious effects (1996).

TMDL: Commission adopted: June 14, 2002
EPA approved: May 9, 2003

I-Plan: Commission approved:
July 13, 2001

Location: San Jacinto River Basin, and associated bays; Harris County; Houston Texas

Environmental Problem

Permitted nickel discharges account for more than 99% of the current loading of nickel to the HSC system. Data indicate that the nickel criterion is being met in the Houston Ship Channel (HSC) system. Any exceedances that may have occurred historically were apparently quite localized and/or of short duration.

Project Segments

Segment Number	Segment Name
1001	San Jacinto River Tidal
1005	Houston Ship Channel/ San Jacinto River Tidal
1006	Houston Ship Channel Tidal
1007	Houston Ship Channel/ Buffalo Bayou Tidal
1013	Buffalo Bayou Tidal
1014	Buffalo Bayou Above Tidal
1016	Greens Bayou Above Tidal
1017	Whiteoak Bayou Above Tidal
2426	Tabbs Bay
2427	San Jacinto Bay
2428	Black Duck Bay
2429	Scott Bay
2430	Burnett Bay
2436	Barbours Cut

Water Quality Goal

The goal of these TMDLs is continued compliance with the chronic water quality criterion for nickel of 13.02 micrograms per liter (µ/L).

Environmental Progress

Water quality standards for nickel are being met at all monitoring stations in the project segments. Personnel from the TCEQ's Region 12 Office monitor five stations within the system quarterly.

Implementation Activities

Activities for this project are carried out by the:

- TCEQ Wastewater Permitting Section
- TCEQ Water Quality Assessment Section
- TCEQ TMDL Program
- TCEQ Region 12 Office
- Industrial Dischargers

Activities fall into two major categories:

- Permit actions for specific industrial facilities;
- Tracking compliance with the established load.

The model for the TMDL predicted exceedances of the dissolved nickel criterion only when three existing permitted facilities in Tucker Bayou, and

one in the San Jacinto River, discharged at their full permitted loadings. Amended permits are completed or planned for all four dischargers.

The TCEQ's Water Quality Assessment Section produces an inventory of all the permitted discharges of nickel. This inventory is used to determine whether the aggregate discharges to the Ship Channel are approaching the limit of 147 pounds per day that triggers the reopening of the TMDL I-Plan. Additional management measures may be required if this occurs.

Status

Three of the four permits have been amended to include reduced nickel loadings. The process for renewing the fourth permit began in October 2001. The permit renewal, which is a major amendment, is still in progress. Current loadings are 4% below the allocation (see Figure 10).

Successes

The environmental goal is being achieved.

The TCEQ programs are coordinating well on the project.

Problems

The EPA delayed action on all permits in the Houston Ship Channel because language referencing the TMDL was not included in the Fact Sheet they require with each permit. Approximately 50 permits were delayed by up to three months because of this issue. The Water Quality Division has since negotiated acceptable language for the Fact Sheet with the EPA. For all segments affected by a TMDL, the TCEQ must demonstrate that the permits for them have been written in accordance with the approved TMDL.

The allowance for future growth has declined by 78% over a 3-year period.

Recommendations

Continue activities specified in the I-Plan.

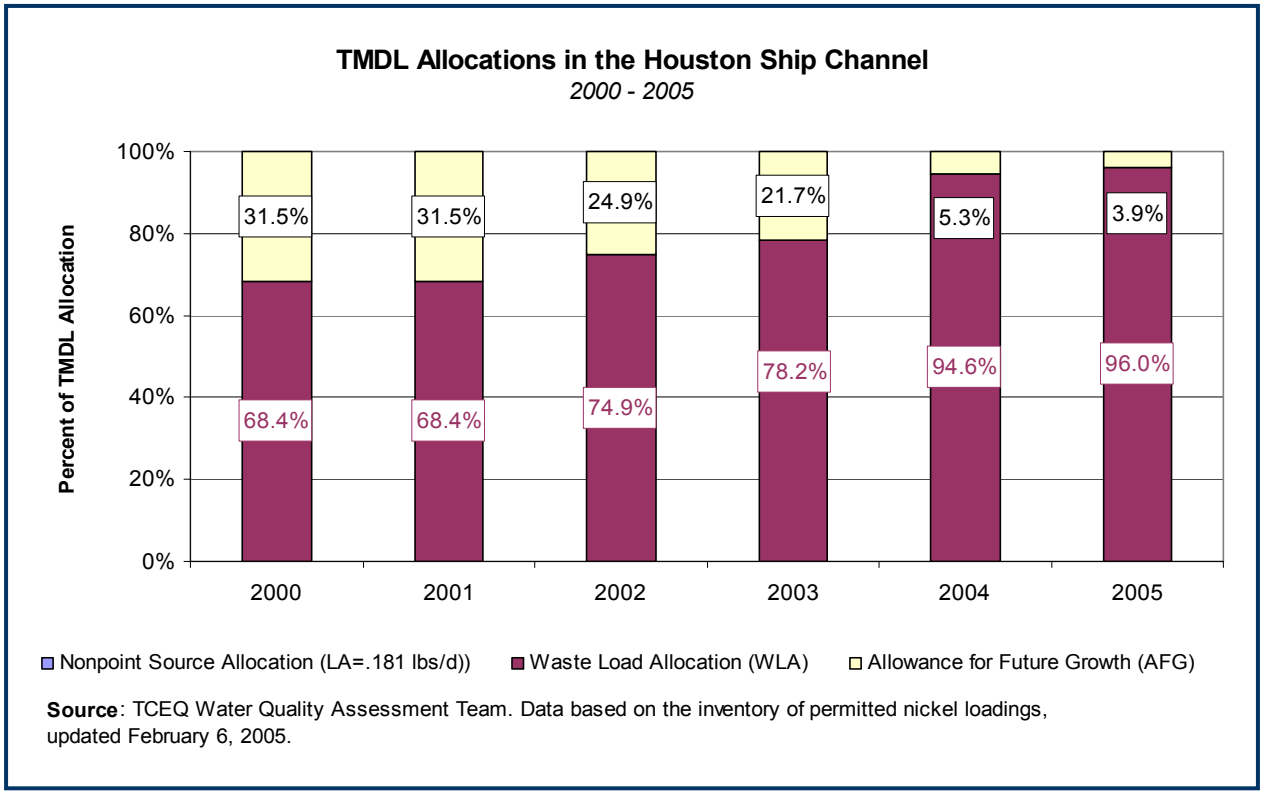


Figure 10. TMDL Allocations for Nickel in the Houston Ship Channel

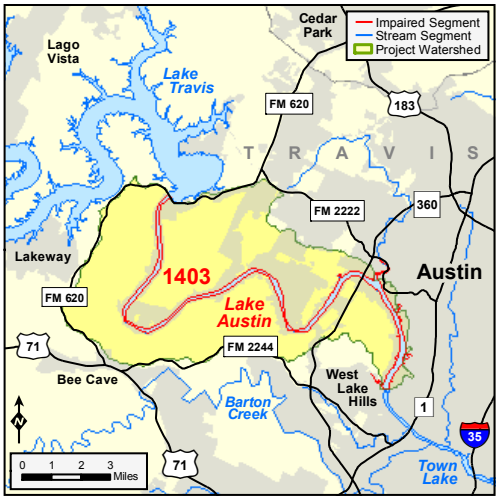
Lake Austin

Impairment & Listing Year: Dissolved oxygen concentrations are below the standard established for the aquatic life use (1996).

TMDL: Commission adopted: November 17, 2000
EPA responded: December 5, 2001

I-Plan: Commission approved: July 13, 2001

Location: Colorado River Basin; Travis County; upstream of the City of Austin



Environmental Problem

Lake Travis is the source of headwater flow to Lake Austin during the summer months, when water is released through penstocks in Mansfield Dam. The penstocks release water from below the thermocline, where the water is relatively cold and low in dissolved oxygen. As a result, low dissolved oxygen levels occur in the upper three miles of Lake Austin during the summer. Low dissolved oxygen content in dam releases is a common phenomenon.

Project Segments

Segment Number	Segment Name
1403	Lake Austin

Water Quality Goal

The goal of this project is to attain and maintain the water quality criterion of 5 milligrams per liter (mg/L) of dissolved oxygen in the waters of Lake Austin.

Environmental Progress

Dissolved oxygen concentrations are not yet meeting the criteria. Data has been collected for three years of a planned five-year monitoring program. Fifty percent of the measurements during this period were below the criterion (see Table 5).

Dissolved oxygen concentrations during 2004 were, on average, lower than values during 2003. More than half of the values during 2004 were below the criterion. Dissolved oxygen concentrations during 2003 were higher compared with those observed during the same period in 2002. Because rainfall was unusually heavy during the summer of 2002, the dissolved oxygen levels observed during that period are probably not representative of long-term conditions.

Implementation Activities

Activities for this project are carried out by the:

- LCRA
- TCEQ

Activities fall into three major categories:

- Installing an aerator to increase oxygen concentrations;
- Monitoring the physical performance of the aerator and modifying it as needed to achieve the plan goals;
- Monitoring water quality to track progress.

Since neither point source nor nonpoint source loadings of pollutants are causing the low levels of dissolved oxygen, this TMDL does not assign

Table 5. Dissolved Oxygen Concentrations at Lake Austin Headwaters in Milligrams/Liter, February 2000-October 2004

Month	2000[1]	2001[1]	2002[2]		2003[2]		2004[2]	
			Mean	Minimum	Mean	Minimum	Mean	Minimum
January								
February	8.4	9.5						
March								
April	6.9	9.8			8.5	7.3		
May			7.1	6.0	7.9	6.5	6.8	6.0
June	4.1	6.5	7.7	6.6	7.4	6.7		
July			4.0	3.7	5.7	3.9	4.6	3.4
August	1.1	2.9	2.7	2.1	4.1	2.6	5.7	2.9
September			1.8	.55	4.7	3.7	3.7	1.4
October	1.2	2.9	4.2	1.9	3.8		3.4	1.6
November								
December	9.3	8.0						

[1]Instantaneous sample data (criterion = 3.0 mg/L)

[2]24-hour average data (criteria = 5.0 mg/L mean or 3.0 mg/L minimum)

Samples that did not meet the criteria

specific loads to pollutant sources. Instead, the I-Plan calls for the use of an aerator installed on one of the turbines operating at Mansfield Dam. The aerator is intended to increase oxygen concentrations in the water being released from the dam into the lake.

Status

The LCRA completed installation of the aerator at Mansfield Dam. Despite several subsequent modifications, the aerator does not appear to result in significant increases in the oxygen content of the lake water below the dam. The LCRA continues to monitor and evaluate the performance of the aerator.

Successes

The LCRA has been very proactive in addressing the problem.

The aerator was installed in a timely manner, and significant resources have been devoted to monitoring its performance and to making modifications to improve it.

Two real-time monitors were installed June 2005 to sample during the index period. Preliminary analysis indicates that the BMPs may be having a positive effect on dissolved oxygen levels.

Problems

The technology has not yet proven effective.

The EPA did not approve this TMDL, stating that no official action was required for an impairment caused by pollution rather than a pollutant. Low dissolved oxygen below the dam is due to hydraulic conditions, not to discharge of a specific pollutant. Lake Austin is now listed in Category 4c of the Texas Water Quality Inventory, which identifies water bodies that do not support one or more uses due to pollution.

Recommendations

Discontinue tracking implementation since the EPA did not act on the TMDL.

Continue with the real-time monitoring in order to quantify the effectiveness of the aerator.

North Bosque River

Impairment & Listing Year: The narrative criteria were not met due to high concentrations of nutrients (1996).

TMDL: Commission adopted: February 9, 2001
EPA approved: December 13, 2001

I-Plan: Commission approved: December 13, 2002

Location: Brazos River Basin; Bosque, Erath, Hamilton, McLennan, and Wood counties

Environmental Problem

Nutrient concentrations in excess of screening levels were found in the North Bosque and Upper North Bosque Rivers. These concentrations sometimes cause excessive growth of algae and other aquatic plants in those rivers.

Phosphorus was identified as the limiting nutrient --- the one whose relative quantity controls algal and plant growth. Soluble reactive phosphorus showed the highest correlation with algal growth, and was therefore chosen as the basis for these TMDLs.

Project Segments

Segment Number	Segment Name
1226	North Bosque River
1255	Upper North Bosque River

Water Quality Goal

The goal is to reduce the average annual concentration of soluble reactive phosphorus (SRP) at five index sites along the North Bosque River. Site-specific reduction goals range from 39% to 62%, with an overall average of about 50%.

Environmental Progress

Monitoring at the index sites has shown some positive change in the lower reaches of the river. However, it will probably take several years for the environmental benefits of the implementation activities to be documented conclusively through monitoring. In the meantime, many regulatory and outreach activities to implement the planned control measures are underway.

Implementation Activities

The activities in the I-Plan are designed to reduce phosphorus loading from animal feeding operations and wastewater treatment plants.

Activities for this project are carried out by the:

- TCEQ
- TSSWCB

Activities fall into nine general categories:

- issuing new and amended permits for dairies and municipal wastewater treatment plant operators;
- revising rules for agricultural operations;
- institutionalizing the composting program and its associated permit requirements;
- developing and implementing best management practices;
- educating stakeholders;
- monitoring results;
- enforcing compliance;
- developing a database to track results;
- refining the model.

Status

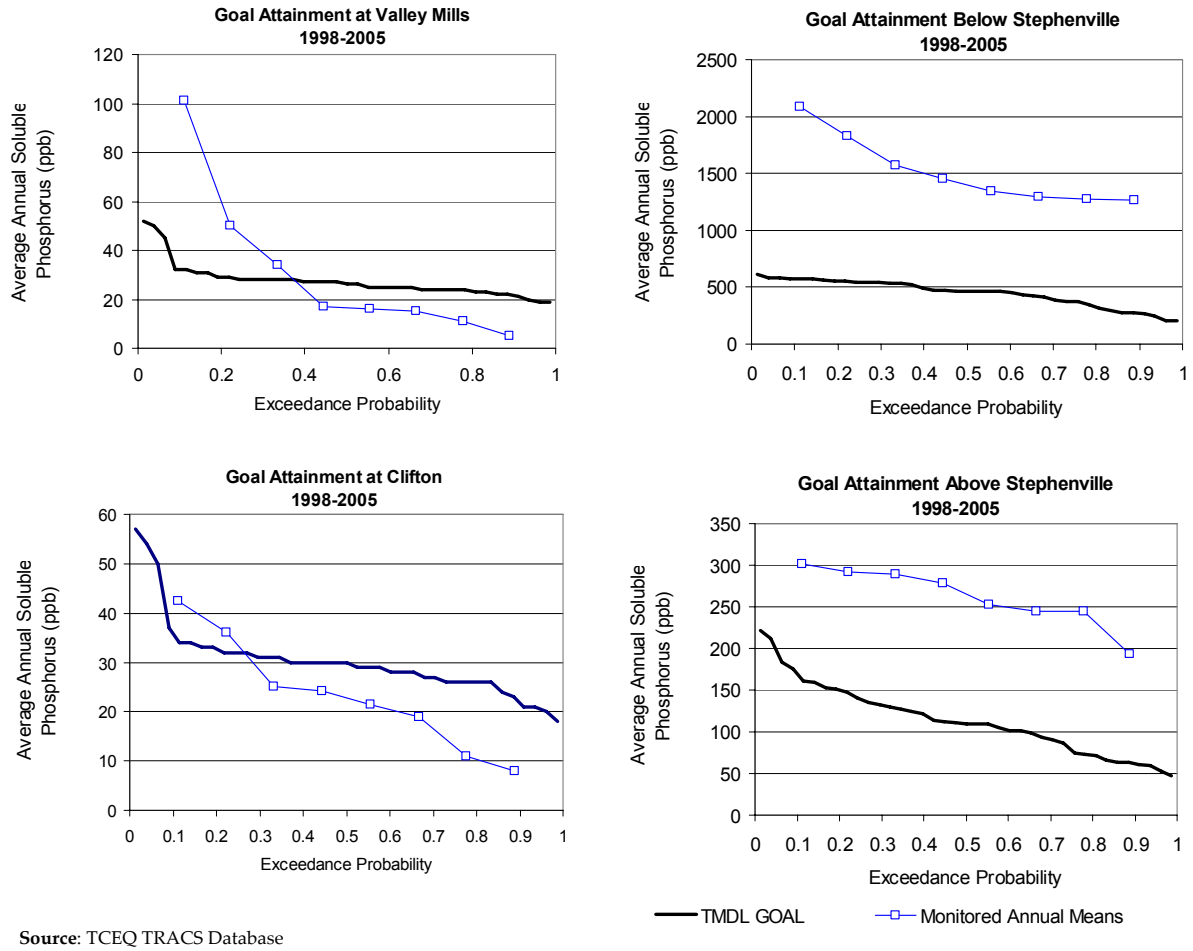
As of August 2005, more than 907,364 tons of manure were hauled away from both the Bosque and Leon watersheds under the Dairy Manure Export Support (DMES) program. The program offers financial assistance to commercial haulers that transport raw manure from dairy farms in the two watersheds to commercial operations.

In 2003, the TSSWCB completed its guidelines for the Comprehensive Nutrient Management Plan program. CNMPs are aimed at reducing phosphorus throughout a dairy's operations. Ten CNMPs were submitted as of August 2005.

All municipal permits are now consistent with the wasteload allocation in the TMDL. No agricultural permits have been processed by the TCEQ; therefore, no new phosphorus-based nutrient management plans have been incorporated into agricultural permits in the watershed.

Two locations in the North Bosque River watershed have been continuously monitored since June 2001. The sites were upgraded in 2004 to include sensors that detect soluble reactive phosphorus, nitrate, and ammonia. However, the data from the phosphate sensors will not be used to determine compliance with the TMDL endpoint concentration because the instruments' detection limits are not sensitive enough for that particular purpose at this time.

A new modeling project is underway to better analyze the conditions in the watershed. The modeling effort is making use of newly acquired



Source: TCEQ TRACS Database
Note: Scale is different for each graph to allow for differences in local conditions.

Figure 11. Attainment of the Goal to Reduce Phosphorus at Four of the Index Sites

Table 6. Annual Mean Concentrations of Soluble Reactive Phosphorus in Parts per Billion

Index Site	TMDL Goal	Water Year (October - September)							
		1998	1999	2000	2001	2002	2003	2004	2005
Valley Mills	**28**	50	34	101	17	16	5	15	11
Clifton	**30**	43	22	24	36	11	8	25	19
Above Meridian	**54**	–	–	–	–	–	28	25	27
Below Stephenville	**448**	1299	1451	2083	1573	1342	1276	1831	1265
Above Stephenville	**114**	278	253	244	245	289	302	292	193

data, as well as data used in the original model.

Successes

Since 2003, phosphorus concentrations in the river have been below the TMDL target at 3 of the 5 index sites being monitored to measure the success of implementation activities. However, phosphorus concentrations at 2 of the sites remain above targets. The average reduction for all 5 sites is 7.3 percent, ranging from no change at the most upstream station to 76.3 percent at the most downstream station (Figure 11, Table 6).

The revised CAFO rule, with special, more stringent provisions for dairies in the Bosque watershed, was adopted in June 2004.

All municipal wastewater discharge permits are now consistent with the wasteload allocation in the TMDL.

The compost program has grown steadily in the four years it has been operational. It is approaching the I-Plan goal of 50% removal from the North Bosque watershed.

Innovative management measures such as waste-to-energy technologies are being tested in the watershed. Federal, state, and local organizations are working together to provide funding to construct and promote a dairy waste management project in the North Bosque watershed on a working dairy. This new project was not included in the I-Plan, but will result in significant additional phosphorus reductions if successful.

Upgrades to the city of Clifton plant have been completed. The improvements should greatly reduce the concentration of phosphorus at the index site below the plant's discharge. Upgrades to the City of Stephenville's WWTP are in the construction phase.

The Texas Institute for Applied Environmental Research (TIAER) released a report that details reductions in orthophosphate concentrations at three microwatershed-monitoring sites. Reductions appear to be correlated to the level of participation in the manure composting program.

The TSSWCB contracted with the Brazos River Authority to coordinate the various pollution abatement activities in the watershed to maximize funding and prevent duplication of efforts.

Problems

It may take a long time to see improvements in water quality. The two sites associated with Stephenville still do not comply with the target; however, the other two sites are now in compliance with the TMDL goal.

The compost program is currently subsidized by federal grants. It is uncertain whether the program can continue to operate if this funding is not continued.

Recommendations

Continue with implementation activities.

Trinity River Basin, Dallas & Tarrant Counties

Impairment & Listing Year: The fish consumption use was not supported due to elevated concentrations of legacy pollutants in fish tissue (2000).

TMDL: Commission adopted: November 17, 2000
EPA approved: June 27, 2001

I-Plan: Commission approved: August 10, 2001

Location: Trinity River Basin; Dallas and Tarrant counties

Environmental Problem

The DSHS issued a ban prohibiting the capture or consumption of fish from these water bodies due to elevated concentrations of legacy pollutants in fish tissue. Legacy pollutants are substances whose uses have been banned or restricted by the EPA, but which remain in the environment.

Chlordane contamination in the Trinity River appears to originate in urban runoff. Legacy pollutant contamination in Mountain Creek Lake probably originated from a variety of land use sources, including agricultural runoff, urban runoff, and military installations.

Project Segments

Segment Number	Segment Name	Pollutant(s)
0805	Upper Trinity River (upper 19 miles)	Chlordane
0841	Lower West Fork Trinity River (entire segment)	Chlordane
0841A	Mountain Creek Lake (entire lake)	Chlordane, DDT, DDD, DDE, Dieldrin, Heptachlor epoxide, PCBs

Water Quality Goal

The ultimate goal of these TMDLs is the reduction of contaminants in fish tissue to levels that constitute an acceptable risk to consumers. Success will be measured by the removal of consumption bans. Interim measures of success include declining concentrations of the legacy pollutants in fish tissue and the surrounding environment.

Environmental Progress

Fish consumption bans are still in place for segments 0805 and 0841. In 2002, the DSHS revised its consumption bans to include PCBs in the Trinity River. The PCB contamination is not addressed in this TMDL.

Analyses indicate that legacy pollutants are still being actively transported to streams and lakes and that fish in project water bodies will continue to be exposed to legacy pollutants in sediment for years or even decades to come.

Chlordane concentrations in fish tissue have declined to below target levels. However, the consumption ban remains in place because of the cumulative risk of both PCBs and chlordane (see Figure 12).

A hazard index is used to assess the possible cumulative, non-cancerous effects of multiple chemicals. The index is calculated from the risk quotients of all the chemicals found in fish tissue.

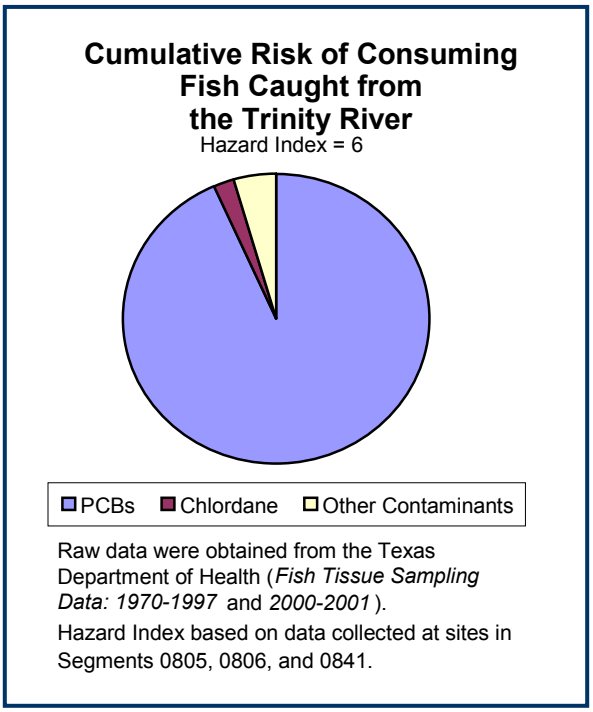


Figure 12. Risk of Consuming Fish from the Trinity River

The DSHS may issue an advisory if the hazard index, or cumulative risk, is greater than one.

The DSHS continued its advisory for Mountain Creek Lake (Segment 0841A). The data indicates that, of the seven contaminants addressed by the TMDL, only PCBs are currently detected at elevated levels in fish tissue (see Figure 13).

Implementation Activities

Available evidence suggests that concentrations of legacy pollutants in the environment will decline over time through natural attenuation.

Activities for this project are carried out by the:

- TCEQ
- DSHS
- FWDEM
- U.S. Navy
- USGS

Activities fall into five general categories:

- Monitoring to identify trends and additional sources of contamination;
- Investigating whether there are current sources of legacy pollutants;
- Evaluating practices that reduce or mitigate the loading of legacy pesticides;
- Implementing management practices and remediation plans as needed;
- Conducting a follow-up risk assessment and evaluation.

Status

The USGS completed its evaluation of sediment data from Mountain Creek Lake and sampling of suspended sediment. They found pesticide levels in the lake sediment to be similar to those of other relatively uncontaminated lakes. PCB concentrations in lake sediment are elevated near the U.S. Naval Weapons Industrial Reserve Plant (NWIRP) and the U.S. Naval Air Station - Dallas. The sources of the PCBs are the former wastewater lagoons and transformer storage areas at these facilities.

PCB concentrations are much greater in the deeper sediments, indicating that PCB loadings have been greatly reduced following more recent remediation activities. Additional remediation activities are proposed for the NWIRP site, including some additional soil removal. The Navy will prepare a remedial action plan for review by the TCEQ.

The FWDEM has been sampling its storm water system. Over the course of five years of sampling a storm water outfall draining a residential area within the city, they have twice detected chlordane at levels between 0.1 and 1.5 micrograms per liter (µg/l).

The FWDEM is tracking the amount of legacy pollutants collected at its Environmental Collection Center (ECC). To date, over 8,000 pounds of materials containing legacy pollutants have been logged through ECC activities.

The ECC correlates the addresses of residents disposing of legacy pollutants to watersheds sur-

rounding the impacted water bodies. This provides baseline data for describing historical trends in the occurrence of these materials and allows educational activities to be targeted to appropriate communities. Through August 2005, the FWDEM had hosted two community-based festivals and cleanups to inform residents of watersheds surrounding the impacted water bodies about legacy pollutions and related environmental issues.

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

Successes

Coordination among the participating agencies has been good.

The USGS has successfully used sophisticated methods of sampling for suspended sediment to analyze pollutants in area water bodies.

The FWDEM increased public awareness in the Fort Worth metropolitan area of the need to dispose safely of hazardous household wastes, and prevented pollution of local streams by the wastes they collected. Their educational program resulted in a 21% increase in citizen usage of FWDEM's household hazardous waste facility.

Concentrations in fish tissues of chlordane and other legacy pesticides have declined.

Problems

The TMDL and I-Plan did not include PCBs in the Trinity River segments. However, PCBs are now the primary constituent of concern in the DSHS's latest advisory, which covers a 150-mile portion of the Trinity River.

Environmental results from the project are mixed. PCB concentrations in fish tissue remain high. The legacy pollutants continue to be detected in runoff.

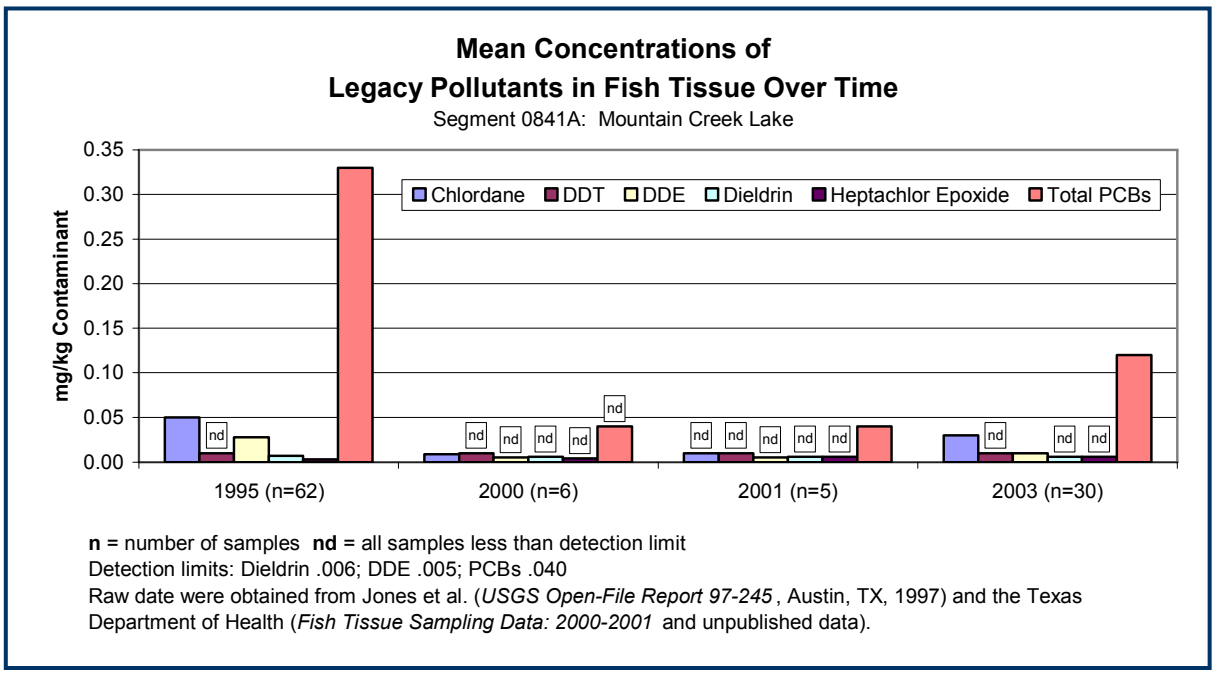


Figure 13. Mean Concentrations of Legacy Pollutants in Fish Tissue, Mountain Creek Lake

Recommendations

Continue to monitor the concentration of legacy pollutants in fish tissue.
Coordinate with the City of Fort Worth and the TCEQ Storm Water Permit Program on the evaluation and implementation of BMPs.

Develop a new TMDL to address PCB contamination in Segments 0805 and 0841.

Include funding for the DSHS risk assessment in budgetary planning.

Monitor investigations and remediation of naval facilities on Mountain Creek Lake.

Combine the response to new PCB advisories with that for the project "Trinity River Basin: Fort Worth" (see page 38).

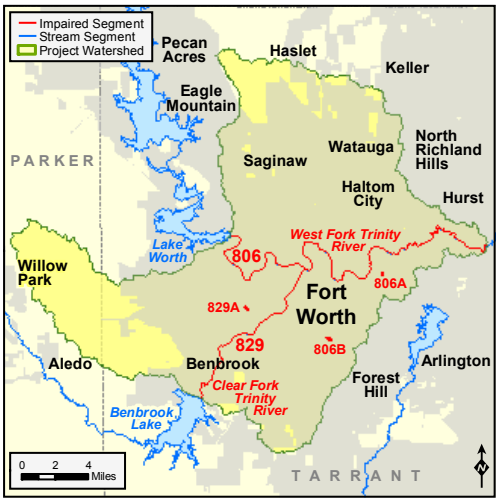
Trinity River Basin, Fort Worth

Impairment & Listing Year: The fish consumption use was not met due to chlordane, DDE, dieldrin, and/or PCBs in fish tissue (1998).

TMDL: Commission adopted: November 17, 2000
EPA approved: May 24, 2001

I-Plan: Commission approved: July 13, 2001

Location: Trinity River Basin; Parker and Tarrant Counties; Fort Worth, Texas



Environmental Problem

The DSHS issued a ban prohibiting the capture and consumption of fish from these water bodies due to elevated concentrations of legacy pollutants in fish tissue. Legacy pollutants are substances whose uses have been banned or restricted by the EPA, but which remain in the environment. The contamination appears to originate in urban runoff.

Project Segments

Segment Number	Segment Name	Pollutant(s)
0806	West Fork Trinity River Below Lake Worth	Chlordane
0806A	Fosdic Lake	Chlordane, DDE, Dieldrin, PCBs
0806B	Echo Lake	PCBs
0829	Clear Fork Trinity River Below Benbrook Lake	Chlordane
0829A	Lake Como	Chlordane, DDE, Dieldrin, PCBs

Water Quality Goal

The ultimate goal of this TMDL is the reduction of contaminants in fish tissue to concentrations that constitute an acceptable risk to consumers. Success will be measured by the removal of consumption bans issued by the DSHS.

Environmental Progress

The fish consumption bans have not been removed. In 2002, the DSHS revised the existing bans to include PCBs in two Trinity River segments (806 and 829). Although sampling indicated that mean chlordane concentrations in fish were below the target levels, the bans remain in place because of the cumulative risk of both PCBs and chlordane (see Figure 12).

A hazard index is used to assess the possible cumulative, non-cancerous effects of multiple chemicals. The index is calculated from the risk quotients of all the chemicals found in fish tissue. The DSHS may issue an advisory if the hazard index, or cumulative risk, is greater than one.

For the urban lakes (0806A, 0805B, 0829A), data indicates a declining trend in concentrations of legacy pollutants in fish tissue (see Figure 14). However, the ban remains in place because the DSHS was unable to collect a sufficient range of fish species to assess the current risk to human health from fish consumption.

Analyses indicate that legacy pollutants are still being actively transported to area streams and lakes, and that fish in project water bodies will continue to be exposed to legacy pollutants in

sediment for years or even decades to come. Sampling suggests recent or continued input at low levels for most of the legacy pesticides. Pollutants levels are generally low, except for chlordane, which was observed at elevated levels in several locations. The source of PCBs is currently unknown.

The FWDEM collected over 200 pounds of legacy pesticides, including chlordane, DDT, and dieldrin, through its Environmental Collection Center, preventing those pollutants from contaminating water bodies in the area.

Implementation Activities

Evidence suggests that concentrations of legacy pollutants in the environment will decline over time through natural attenuation.

Activities for this project are carried out by the:

- TCEQ
- USGS
- DSHS
- FWDEM

Activities fall into four major categories:

- Monitoring to track progress;
- Investigating whether there are current sources of legacy pollutants;
- Evaluating practices that reduce the loading of legacy pesticides into the listed segments;
- Evaluating practices that may be useful in identifying illegal use or disposal.

Status

Most activities specified in the I-Plan have been completed satisfactorily. The USGS completed its sampling of suspended sediment and sediment cores, and reported its results to the TCEQ. The DSHS completed its risk assessment on schedule.

The FWDEM continues its sampling of the storm water system. Over the course of 5 years of sampling a storm water outfall draining a residential area within the city, chlordane was detected twice at levels between 0.1 µg/l and 1.5 µg/l.

The FWDEM is tracking the amount of legacy pollutants collected at its Environmental Collection Center. To date, over 8,000 pounds of materials containing legacy pollutants have been logged through ECC activities.

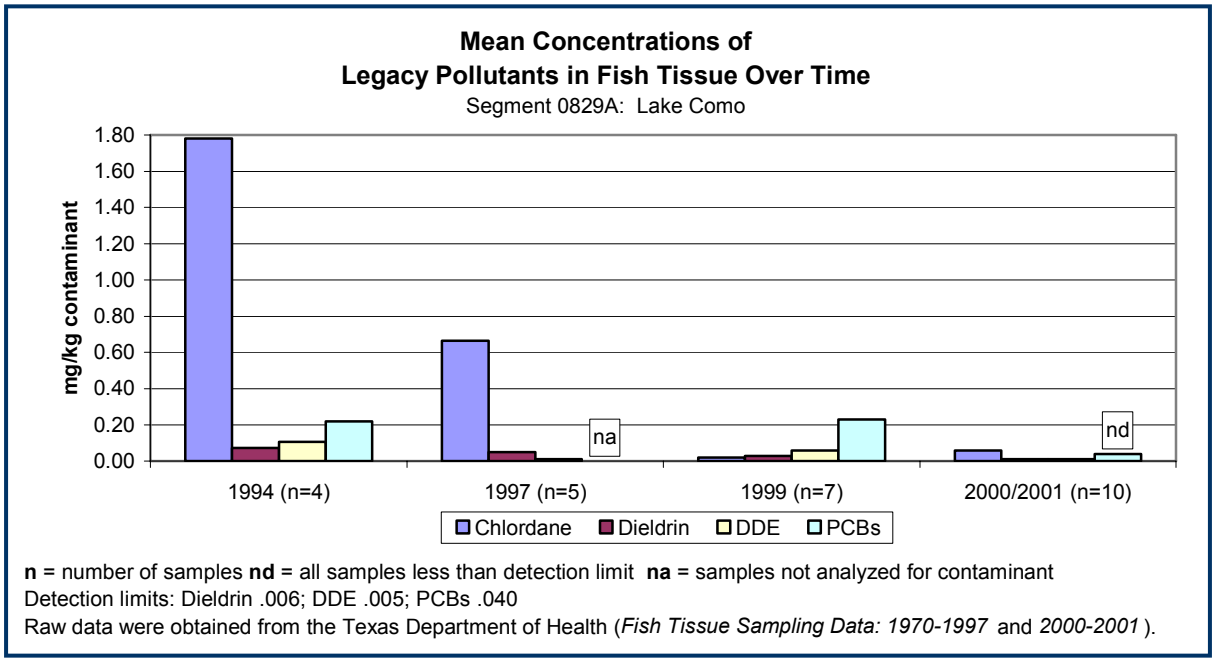


Figure 14. Mean Concentration of Legacy Pollutants in Fish, Lake Como

The ECC correlates the addresses of residents disposing of legacy pollutants to watersheds surrounding the impacted water bodies. This provides baseline data for describing historical trends in the occurrence of these materials and allows educational activities to be targeted to appropriate communities. As of August 2005, FWDEM had hosted two community-based festivals and cleanups to inform residents of the watersheds surrounding the impacted water bodies about legacy pollution and related environmental issues.

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

Successes

Coordination among the participating agencies has been good in this project.

The USGS successfully used sophisticated methods of sampling for suspended sediment to analyze pollutants in area water bodies.

The FWDEM increased public awareness in the Fort Worth metropolitan area of the need to safely dispose of hazardous household wastes, and prevented pollution of local streams by the wastes they collected. This educational program resulted in a 21% increase in citizen usage of FWDEM's household hazardous waste facility.

Problems

The TMDL in the Trinity River segments (0806 and 0829) did not include PCBs. However, PCBs are now the primary concern in the DSHS's revised health risk assessment. The latest advisories cover a 150-mile portion of the Trinity River.

Environmental results from the project are mixed. PCB concentrations in fish tissue remain high. The legacy pollutants continue to be detected in runoff.

Recommendations

Continue to monitor the concentration of legacy pollutants in fish tissue. The DSHS is scheduled to collect fish samples from Fosdic Lake, Echo Lake, and Lake Como to reassess the risk to public health during the years 2006 and 2007.

Coordinate with the City of Fort Worth and the TCEQ Storm Water Permit program on the evaluation and implementation of BMPs.

Develop a new TMDL to address PCB contamination in the Trinity River.

Include funding for the DSHS's next risk assessment in budgetary planning.

Combine the response to new PCB advisories with the project "Trinity River Basin: Dallas and Tarrant Counties" (see page 34).

Summaries of Completed Implementation Projects

When implementation is successful and water bodies are again meeting the affected standards, the TCEQ tracks continued success through the monitoring programs of the various state agencies that have responsibility for specific aspects of health and environmental management. If the problem recurs, the TMDL Program will reactivate the project in cooperation with the stakeholders.

Summaries of all the projects that have been successfully implemented are provided in the following section. Each summary follows the same format.

Header Bar

The header bar of each summary:

- Contains a map showing the project area;
- Identifies the beneficial use(s) that the I-Plan is designed to restore, and the pollutant(s) for which TMDLs have been established;
- Lists the titles and dates of the TMDL and its I-Plan;
- Gives a brief description of the location of the watershed.

Environmental Problem

This section describes the problem addressed by the I-Plan, including relevant factors that were considered in developing the TMDL and the plan. It also lists the segments included in the project. Where pollutants differ among the water bodies, the pollutants of concern are listed next to each water body.

Water Quality Goal

This section includes the environmental goal by which plan's success will be measured.

Environmental Progress

This section describes the environmental progress to date — whether the goal has been met, or whether data are available to indicate progress.

Monitoring Status

This section describes the type and schedule of monitoring that is being done to ensure that the water body continues to attain standards.

Aquilla Reservoir

Impairment & Listing Year: The use of the reservoir as a source of drinking water was not met due to high concentrations of atrazine in treated drinking water (1998)

TMDL: Commission adopted: June 14, 2002
EPA approved: October 30, 2002

I-Plan: Commission approved: January 18, 2002

Location: Brazos River Basin; Hill and Johnson Counties; west of the City of Hillsboro

Environmental Problem

The maximum contamination level (MCL) for atrazine in treated drinking water is 3 micrograms per liter (3 µg/L), as established in the state's drinking water standards. In 1998, the running annual average concentration of atrazine exceeded the MCL. Consequently, Aquilla Reservoir was identified on the 303(d) List as not supporting its use as a source of drinking water.

All atrazine loadings to the Aquilla Reservoir originate from nonpoint sources associated with human activities. There are no natural background sources or authorized point source discharges.

Atrazine is widely used for control of weeds in the production of corn and grain sorghum. Atrazine is used on approximately 63,600 acres of cropland in the Aquilla Reservoir watershed, or approximately 40% of the watershed area.

Project Segments

Segment Number	Segment Name
1254	Aquilla Reservoir

Water Quality Goal

The goal of this project was to reduce atrazine concentrations in Aquilla Reservoir to a level below the MCL, based on the running annual average of samples collected monthly from the reservoir. The concentrations had to remain below the MCL for two consecutive years before the project would be considered successful.

The activities for this project were carried out by:

- Agricultural producers
- TSSWCB
- TDA
- TCE
- TCEQ
- AWSD
- NRCS
- TAES
- Texas A&M
- EPA

Environmental Progress

The water quality goal has been achieved. The results of four consecutive years of monthly sampling indicate that atrazine concentrations are well below the MCL (see Figure 15).

Agricultural producers in the Aquilla Reservoir watershed made a concerted effort to reduce atrazine discharges in runoff by voluntarily implementing BMPs. In a coordinated response, multiple agencies supplied assistance in the form of educational outreach programs, technical assistance to producers in developing BMPs and

complying with regulations for use of agricultural chemicals, and cost-share funding.

The BMPs developed and implemented for the Aquilla watershed were used to reduce atrazine pollution in nine threatened water bodies.

Monitoring Status

The TCEQ will continue to monitor reservoir quality quarterly.

The AWSD will continue to monitor finished drinking water in compliance with the Safe Drinking Water Act.

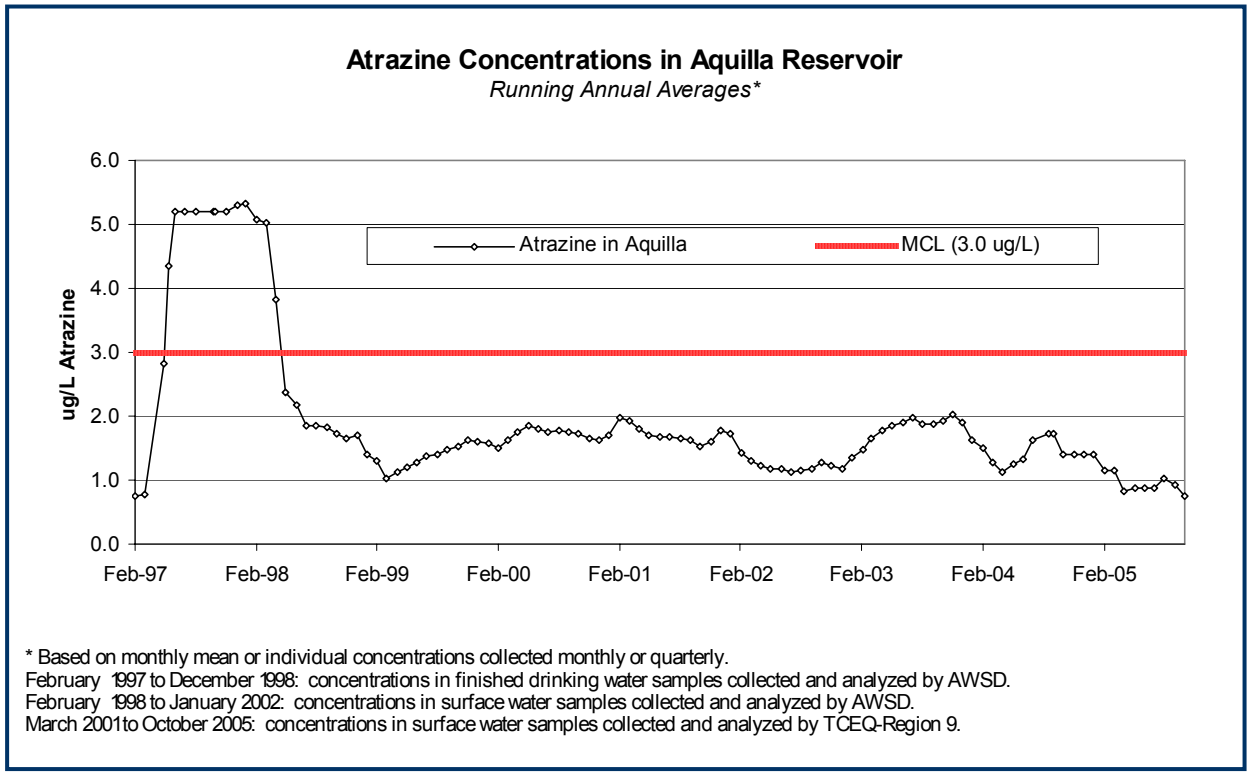


Figure 15. Atrazine Concentrations in Aquilla Reservoir, Running Annual Average

Clear Creek, Chlordane

Impairment & Listing Year: The fish consumption use was not supported due to elevated concentrations of legacy pollutants in fish tissue (2000).

TMDL: Commission adopted: January 17, 2001
EPA approved: June 14, 2001

I-Plan: Commission approved: September 14, 2001

Location: San Jacinto-Brazos Coastal Basin; Harris, Galveston, Fort Bend, and Brazoria Counties

Environmental Problem

The DSHS issued a fish consumption ban due to elevated concentrations of legacy pollutants in fish tissue. Legacy pollutants are substances whose uses have been banned or restricted by the EPA, but which remain in the environment. This plan is for the legacy pollutant chlordane.

Nonpoint sources were the main contributors of chlordane to Clear Creek. There were no significant point sources of chlordane in the watershed. Chlordane pollution is common in urban areas.

Project Segments

Segment Number	Segment Name
1101	Clear Creek Tidal (upper 15 kilometers)
1102	Clear Creek above Tidal (entire segment)

Water Quality Goal

The ultimate goal of this TMDL was the reduction of contaminant concentrations in fish tissue to levels that constitute an acceptable risk to consumers.

Environmental Progress

The goal of this project has been met. The consumption ban was rescinded in October 2001. The fish consumption use is no longer impaired.

The DSHS assessment that resulted in a lifting of the consumption ban found that chlordane concentrations were actually higher in the fish tissue samples than they were in the previous assessment. However, the DSHS evaluates health risk based on the cumulative effect of all compounds detected. This value was reduced to acceptable levels because the concentrations of the other legacy pollutants have declined.

Results from a study by the USGS suggest that chlordane contamination is no longer occurring at high concentrations. However, variable method reporting limits (which increase up the sediment core) could be masking an increasing trend with time. This concern is supported by the most recent DSHS risk assessment.

Activities for this project are carried out by the:

- TCEQ
- DSHS
- USGS

Monitoring Status

The TCEQ will seek funding for a DSHS assessment of risk to public health in 2005.

Clear Creek, VOCs

Impairment & Listing Year: The fish consumption use was not supported due to elevated concentrations of volatile organic compounds in fish tissue (1999).

TMDL: Commission adopted: June 14, 2002
EPA approved: May 9, 2003

I-Plan: Commission approved: October 12, 2001

Location: San Jacinto-Brazos Coastal Basin; Harris, Galveston, Fort Bend, and Brazoria Counties

Environmental Problem

The DSHS issued a fish consumption ban due to elevated concentrations of volatile organic compounds (VOCs). This plan is for three VOCs: 1,2-dichloroethane; 1,1,2-trichloroethane; and carbon disulfide.

The Brio Refinery, a Superfund site, was identified as a major source of VOCs to the creek. The refinery site is located along Clear Creek near the tidal boundary.

Project Segments

Segment Number	Segment Name
1101	Clear Creek Tidal (upper 15 kilometers)
1102	Clear Creek above Tidal (entire segment)

Water Quality Goal

The goal of these TMDLs was the reduction of contaminant concentrations in fish tissue to levels that constitute an acceptable risk to consumers.

Environmental Progress

The water quality goal has been met. The consumption ban was rescinded in October 2001. The fish consumption use is no longer impaired.

Monitoring verifies the success of the I-Plan. Concentrations of VOCs in Clear Creek have declined by over 90% since 1993 (see Figure 16).

The activities for this project are carried out by the:

- TCEQ TMDL Program
- TCEQ Field Operations
- DSHS
- Brio Task Force

Monitoring Status

The TCEQ will seek funding for a DSHS assessment of public health risk in 2005 to ensure that improvements in water quality continue and that the fish are still safe to eat.

Routine water quality monitoring will continue in Clear Creek.

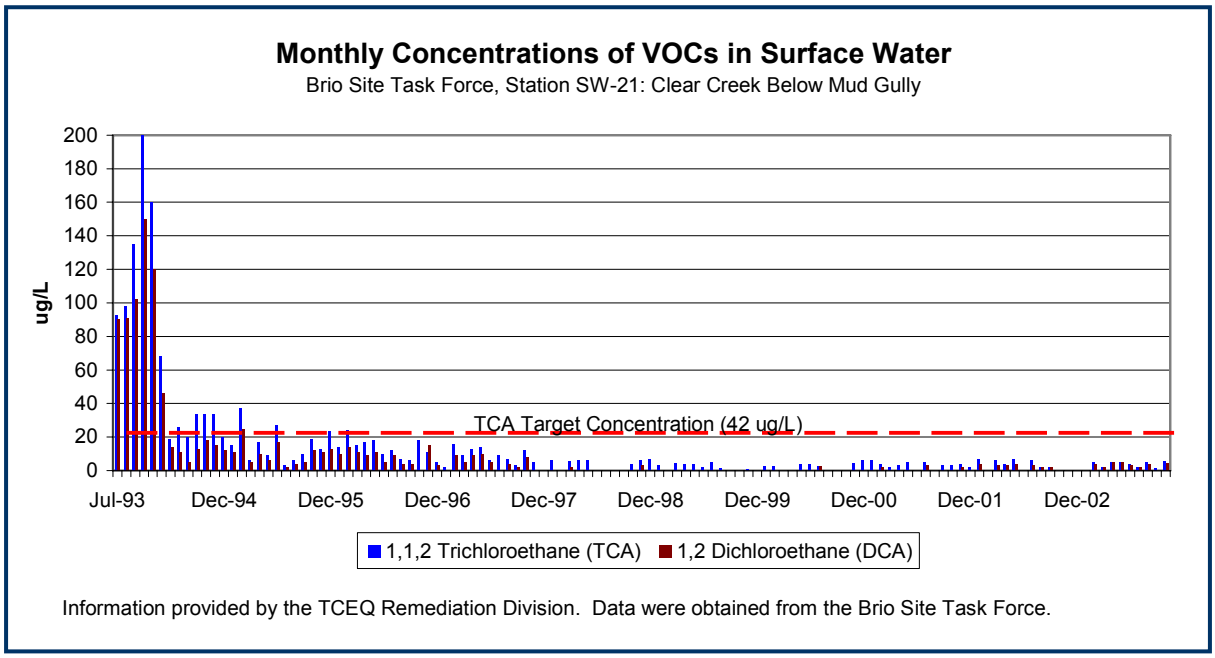


Figure 16. Monthly Concentrations of VOCs in Clear Creek

SUMMARY OF ALL PROJECTS OF THE TMDL PROGRAM

In order by project number. Includes all projects in the order in which the project was formally initiated by the program.

Definitions: *Impairment* – one pollutant or adverse condition in one water body.

Parameter – a pollutant or adverse condition

TMDL not required – indicates that the project resulted in a determination that a TMDL was not required

Project Name	Number of Impairments	Segments	Parameter(s)	Impaired Use	Fiscal Year Started	Fiscal Year Ended (or Projected to End)	TMDL Approved by EPA
Houston Ship Channel - Nickel	14	1001, 1005, 1006, 1007, 1013, 1014, 1016, 1017, 2426, 2427, 2428, 2429, 2430, 2436	Nickel	Aquatic Life	1999	2003	5/09/03
Fort Worth - Legacy	11	0806, 0829	Chlordane	Fish Consumption	2000	2001	5/24/01
		0806A, 0829A	Chlordane, DDE, dieldrin, PCBs				
		0806B	PCBs				
Lake Austin – Dissolved Oxygen	1	1403	Dissolved oxygen	Aquatic Life	2000	2001	
E.V. Spence – Total Dissolved Solids	2	1411	Sulfate, total dissolved solids	General	1998	2003	5/09/03
Dallas & Tarrant Counties – Legacy Pollutants	9	0805, 0841	Chlordane	Fish Consumption	2000	2001	6/27/01
		0841A	Chlordane, DDD, DDE, DDT, dieldrin, heptachlor epoxide, PCBs				
N Bosque River - Phosphorus	2	1226, 1255	Orthophosphorus	General	2000	2003	12/31/01
Arroyo Colorado – Legacy Pollutants	4	2202	Chlordane, DDE, toxaphene	Fish Consumption	2000	2002	6/14/01
		2202A	PCBs				

Project Name	Number of Impairments	Segments	Parameter(s)	Impaired Use	Fiscal Year Started	Fiscal Year Ended (or Projected to End)	TMDL Approved by EPA
Clear Creek - Chlordane	2	1101, 1102	Chlordane,	Fish Consumption	2000	2002	6/14/01
Clear Creek – VOCs	4	1101, 1102	Dichloroethane, trichloroethane	Fish Consumption	2000	2003	5/09/03
Aquilla - Atrazine	1	1254	atrazine in finished drinking water	Public Water Supply	1999	2003	10/30/02
Salado Creek - Dissolved Oxygen	1	1910	dissolved oxygen	Aquatic Life	1998	2003	8/08/03
Martin Creek Reservoir - Selenium in Fish	1	0505F	selenium in tissue	Fish Consumption	2002	2003	TMDL not required
Arroyo Colorado - Dissolved Oxygen	1	2201	dissolved oxygen	Aquatic Life	1998	2006	
Welsh Reservoir – Selenium in Fish	1	0404D	selenium in tissue	Aquatic Life	2002	2003	Non-TMDL
Brandy Branch – Selenium in Fish	1	0505E	selenium in tissue	Aquatic Life	2002	2003	TMDL not required
Dickinson Bayou - Dissolved Oxygen	1	1103	dissolved oxygen	Aquatic Life	1999	2008	
Patrick Bayou - 3rd party	4	1006A	Copper, toxicity in ambient water and sediment	Aquatic Life	2000	2004	TMDL not required
			thermal modifications	General			
Lake O' the Pines - Dissolved Oxygen	1	0403	dissolved oxygen	Aquatic Life	1999	2006	
N & NE Texas NPS - Bacteria	4	0207A, 0502A, 0608B, 0612B	bacteria	Contact Recreation	2000	2004	TMDL not required
Nueces Bay - Zinc in Oysters	1	2482	zinc in oyster tissue	Shellfish Consumption	2001	2006	
Buffalo & Whiteoak Bayous - Bacteria	3	1013, 1014, 1017	bacteria	Contact Recreation	2000	2007	
Armand Bayou - Dissolved Oxygen	2	1113, 1113A	dissolved oxygen	Aquatic Life	1999	2004	TMDL not required
Oso Bay - Dissolved Oxygen	2	2485, 2491	dissolved oxygen	Aquatic Life	2000	2006	

Project Name	Number of Impairments	Segments	Parameter(s)	Impaired Use	Fiscal Year Started	Fiscal Year Ended (or Projected to End)	TMDL Approved by EPA
Upper Oyster Creek - Bacteria & Dissolved Oxygen	2	1245	Bacteria	Contact Recreation	2001	2007	
			dissolved oxygen	Aquatic Life			
Houston Ship Channel - Dioxin	13	0901, 1001, 1005, 1006, 1007, 2421, 2426, 2427, 2428, 2429, 2430, 2436, 2438	dioxin in tissue	Fish Consumption	2001	2008	
Lavaca Bay - Mercury & Dissolved Oxygen	3	2453	dissolved oxygen	Aquatic Life	2001	2004	TMDL not required
			mercury	Fish Consumption			
Clear Fork Trinity - Dissolved Oxygen	2	0831, 0833	dissolved oxygen	Aquatic Life	2002	2004	TMDL not required
Tidal Streams Use Assess	3	0511, 1501, 2453A	dissolved oxygen	Aquatic Life	2003	2007	
Statewide Ambient Toxicity	8	0702A	sediment toxicity (ambient), water toxicity (ambient)	Aquatic Life	2000	2004	TMDL not required
		1007A, 1209A, 1209B, 2201	sediment toxicity (ambient)				
		2304, 2306	water toxicity (ambient)				
South Central Texas - Bacteria & Dissolved Oxygen	13	1427, 1908, 1913, 2104, 2113	dissolved oxygen	Aquatic Life	2002	2008	
		1803A, 1803B, 1906, 2107	Bacteria, dissolved oxygen	Contact Recreation, Aquatic Life			
Colorado & San Gabriel Rivers - Total Dissolved Solids	7	1426	Chloride, total dissolved solids	General	2001	2007	
		2204	Chloride, sulfate, total dissolved solids	General			
Middle Brazos - Dissolved Oxygen	2	1217A, 1243	dissolved oxygen	Aquatic Life	2002	2004	TMDL not required
San Antonio River & Leon River - Bacteria	10	1221, 1803C, 1901, 1903, 1910, 1910A, 1911	bacteria	Contact Recreation	2001	2008	

Project Name	Number of Impairments	Segments	Parameter(s)	Impaired Use	Fiscal Year Started	Fiscal Year Ended (or Projected to End)	TMDL Approved by EPA
Gulf Coast Oyster Waters - Bacteria	13	2421, 2422, 2423, 2424, 2432, 2439, 2441, 2442, 2451, 2452, 2453, 2456, 2462	bacteria in oyster waters	Shellfish Consump-tion	2002	2007	
Sam Rayburn Reservoir - Aluminum, Dissolved Oxygen, & pH	5	0610	Aluminum, dissolved oxygen	Aquatic Life	2002	2003	TMDL not required
			pH	General			
		0615	dissolved oxygen, impaired fish community	Aquatic Life Use Aquatic Life Use			
Orange County - Bacteria, Dissolved Oxygen, & pH	17	0508, 0508A, 0508B, 0508C, 0511B, 0511C	Bacteria, dissolved oxygen	Contact Recreation, Aquatic Life	2002	2007	
		0511	Bacteria, dissolved oxygen, pH	Contact Recreation, Aquatic Life, General			
		0511A	dissolved oxygen	Aquatic Life Use			
		0511E	bacteria	Contact Recreation			
Bacteria Source Characterization & Modeling	Project does not address specific impairments.				2002	2004	
Bacteria Source Tracking		1226	chlorophyll a, excessive algal growth	General	2002	2006	
Caddo Lake – Evaluating Dissolved Oxygen, pH & Mercury	3	0401	dissolved oxygen	Aquatic Life	2003	2006	
			mercury in tissue	Fish Consumption			
			pH	General			

Project Name	Number of Impairments	Segments	Parameter(s)	Impaired Use	Fiscal Year Started	Fiscal Year Ended (or Projected to End)	TMDL Approved by EPA
Copano Bay Oysters – Bacteria Source Tracking	1	2472	bacteria in oyster waters	Shellfish Consump-tion	2003	2007	
Clear Creek - Dissolved Solids	2	1102	Chloride, total dissolved solids	General	2003	2005	8/10/05
San Jacinto River - PCBs	1	1005	PCBs		2003	2004	TMDL not required
Sabinal River - Nitrate & Nitrite	1	2110	nitrite + nitrate nitrogen	Public Water Supply	2003	2004	8/10/05
Arroyo Colorado - Organics	8	2202	DDT, DDD, dieldrin, endrin, heptachlor, heptachlor epoxide, hexachlorobenzene, lindane,	Fish Consumption	2003	2006	5/13/04
San Jacinto River Tidal – Legacy Pollutants	2	1001, 1005	pesticides in tissue	Fish Consumption	2003	2004	TMDL with-drawn; impair-ment will be ad-dressed by other means
Lower Sabinal River – Nitrate and Nitrite	1	2110	Nitrate-nitrogen	General	2003	2005	10/13/05
Reservoir Research	Project does not address specific impairments.				2004	2008	
Effluent Trading Policy Review	Project does not address specific impairments.				1998	1999	
Arroyo Colorado PCB Remediation	1	2202A	PCBs in tissue	Fish Consumption	2004	2008	
TMDL Guidance	Project does not address specific impairments.				1998	1999	
TIAER Umbrella WO#1	Project does not address specific impairments.				2000	2001	
Bacteria Indicator Study	Project does not address specific impairments.				1997	2000	
Antibiotic Resistance- TXA&M	Project does not address specific impairments.				2001	2001	
1999 Report on Assessment of Models	Project does not address specific impairments.				1999	1999	

Project Name	Number of Impairments	Segments	Parameter(s)	Impaired Use	Fiscal Year Started	Fiscal Year Ended (or Projected to End)	TMDL Approved by EPA
Brazos Colorado Coastal Land Use – Land Cover	Project does not address specific impairments.				2000	2000	
Basin Group C - Geospatial Database	Project does not address specific impairments.				2001	2001	
Trinity River Geospatial Database	Project does not address specific impairments.				2001	2001	
Segments Watershed Delineation - TAES	Project does not address specific impairments.				1999	2004	
Lake Worth PCBs	1	0807	PCBs in tissue	Fish Consumption	2003	2005	8/10/05
Guadalupe Above Canyon - Bacteria	1	1806	bacteria	Contact Recreation	2005	2007	
Trinity River - Bacteria	3	0806, 0805, 0841	bacteria	Contact Recreation	2005	2007	
Oso Creek & Oso Bay - Bacteria	2	2485, 2485A	bacteria	Contact Recreation	2005	2007	
Clear Creek Watershed - Bacteria	6	1101, 1101B , 1102, 1102A, 1102B, 2425C	bacteria	Contact Recreation	2005	2008	
Gilleland Creek - Bacteria	1	1428	bacteria	Contact Recreation	2005	2008	
Houston Metropolitan Area – Bacteria	27	1016, 1006E, 1007C, 1007B, 1007R, 1007D, 1006D, 1016B, 1007E, 1016A, 1007K, 1016D, 1007I, 1016C, 1007Q, 1006J, 1006H, 1007G, 1007P, 1007F, 1006F, 1007O, 1007N, 1007L, 1007M, 1007H, 1006I	Bacteria	Contact Recreation	2005	2008	