



Texas Surface Water Quality Monitoring and Assessment Strategy FY 2012-2017

Rev. 1



Surface Water Quality Monitoring Program
Water Quality Planning Division
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List of Abbreviations Used in the Strategy

ADB	assessment database
ALA	aquatic life assessment
ALM	aquatic life monitoring
ALU	aquatic life use
ARRA	American Recovery and Reinvestment Act
AU	assessment unit
AWRLs	ambient water reporting limits
CDX	Central Data Exchange
CFR	Code of Federal Regulation
Chl <i>a</i>	chlorophyll <i>a</i>
CRP	Clean Rivers Program
CWA	Clean Water Act
CWQMN	Continuous water Quality Monitoring Network
DMRG	Data Management Reference Guide
DQO	data quality objectives
DSHS	Texas Department of State Health Services
DO	dissolved oxygen
EMRS	Environmental Monitoring and Response System
EPA	United States Environmental Protection Agency
FTE	full time employee
FY	fiscal year
GARCC	Golden Alga Research Coordinating Committee
GLO	Texas General Land Office
Hg	mercury
IBWC	International Boundary and Water Commission
IR	Texas Integrated Report
IS	intensive survey
JAD	joint application development
LCRA	Lower Colorado River Authority
m	meter
MAS	Monitoring and Assessment Section
MCL	maximum contaminant level
µg/L	micrograms per liter
mg/L	milligrams per liter
mL	milliliter
MPN	most probable number (bacteria)
MTBE	methyl tert butyl ether
NCCA	National Coastal Condition Assessment
NELAP	National Environmental Laboratory Accreditation Program
NFTS	national fish tissue study
NHD	National Hydrography Dataset
NLA	National Lakes Assessment
NRSA	National Rivers and Streams Assessment
NWCA	National Wetlands Condition Assessment
NWSA	National Wadeable Streams Assessment
NPS	nonpoint source
PCB	polychlorinated biphenyl

List of Abbreviations Used in the Strategy (continued)

PI	Planning & Implementation
QA	quality assurance
QAP	quality assurance plan
QAPP	quality assurance project plan
QC	quality control
QMP	quality management plan
7Q2	seven-day, two-year low flow
RWA	receiving water assessment
STORET	Storage and Retrieval System
SWQM	surface water quality monitoring
SWQMIS	Surface Water Quality Monitoring Information System
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
TDS	total dissolved solids
TMDL	total maximum daily load
TOC	total organic carbon
TP	total phosphorus
TPWD	Texas Parks and Wildlife Department
TSI	Carlson's Trophic Index
TSWQS	Texas Surface Water Quality Standards
TWC	Texas Water Code
TXBAD	Texas Basin Assessment Database —305(b)/303(d)
TXHAB	Texas Harmful Algal Bloom (Workgroup)
USGS	United States Geological Survey
UAA	use attainability analysis
VBAT	Virtual Biological Assessment Team
WQX	water quality exchange
WQD	Water Quality Division
WQPD	Water Quality Planning Division
WQS	Water Quality Standards

Major Accomplishments (FY 2005-2011)

- The Surface Water Quality Monitoring (SWQM) database, Surface Water Quality Monitoring Information System (SWQMIS) came on line in April 2007. This database allows TCEQ to submit data to the EPA Storage and Retrieval System (STORET) database. Database enhancements continue as funding allows. In 2012, a biological data module that allows entry of benthic macroinvertebrate, fish, and habitat data into SWQMIS was completed.
- Built a tool using SAS[®] Enterprise Guide to improve the efficiency and accuracy of Texas Integrated Report (IR) tasks. This tool interfaces directly with SWQMIS.
- Implemented use of the National Hydrography Database (NHD) during the 2008 Texas IR. The geospatial data for the 2010 Texas IR, including segments and assessment units, was completed in July 2011 and posted on the TCEQ website.
- Participated in seven National Aquatic Resource Surveys (NARS); National Wadeable Streams Assessment (NWSA), National Lakes Assessment (NLA), National Rivers and Streams Assessment (NRSA), National Coastal Condition Assessment (NCCA), and National Wetlands Condition Assessment (NWCA).
- Published revised SWQM water, sediment, and tissue collection methods August 2012.
- Revised statewide biological and habitat collection and assessment methods in 2007. Currently under revision for fiscal year (FY) 2014.
- Planned and implemented numerous special projects to evaluate water quality standards and increase datasets for impaired water bodies.
- Developed process to obtain summarized data from the Texas Beach Watch Program for use in the 2010 Texas IR.
- Conducted monitoring tasks in support of the TCEQ Border Initiative that enhance binational coordination to evaluate water quality in the Rio Grande.
- Enhanced the Coordinated Monitoring Schedule (CMS) website to make it a more effective tool for monitoring coordination.
- Developed a multi-agency watershed action planning process (WAP) to identify strategies and lead agencies to address water quality impairments.
- Implemented the Virtual Biological Assessment Team (VBAT) which utilizes resources from multiple agencies to coordinate and enhance biological monitoring in all parts of Texas. The VBAT was instrumental in the success of the NARS in Texas and will be instrumental in the success of the Texas Least Disturbed Streams Project.
- Developed agency quality control and measurement equipment expertise associated with Continuous Water Quality Monitoring Network (CWQMN). This allows TCEQ to focus efforts on implementing critical quality control protocols and to improve data quality. TCEQ continues to evaluate and refocus network resources to ensure data generated by the network supports agency objectives.
- The successful operation and maintenance of a large network of continuous water quality monitoring stations in the Rio Grande Basin. As of 2013, the Upper Rio Grande Basin (including the Pecos River) has 14 sites. The Upper Rio Grande and Pecos River continuous water quality monitoring sites are operated and maintained under a contract with United States Geological Survey (USGS). These sites provide water quality and

stream discharge data for a variety of data uses primarily measuring increased salinity and support of the *Pecos River Watershed Protection Plan*.

- The addition and refinement of eight TCEQ operated Environmental Response System (EMRS) CWQMN sites in the Lower Rio Grande Valley. These sites provide near real-time water quality information to TCEQ's Rio Grande Watermaster for the timely management of irrigation water suitable for crop production.
- Initiated the development of methods to be used as part of a routine seagrass monitoring program for Texas Coastal waters.
- Evaluated the effects of increased holding times for bacteriological samples in order to improve data collection efficiency.
- Completed the first phase of a cooperative TCEQ/USGS project to delineate watershed boundaries, calculate drainage area, and compute other standard watershed characteristics for over 3,000 surface water quality monitoring sites in Texas.

Introduction

The federal Clean Water Act (CWA) gives states the primary responsibility for implementing programs to protect and restore water quality, including monitoring and assessing the nation's waters and reporting on their quality. In Texas, the Texas Commission on Environmental Quality (TCEQ) is the agency with primary responsibility for implementing the monitoring, assessment, and reporting requirements of the CWA. CWA Section 106 requires that the U.S. Environmental Protection Agency (EPA) determine whether states have monitoring programs that meet the requirements of the CWA prior to awarding Section 106 grant funds. EPA has published guidance that facilitates this determination, Elements of a State Water Monitoring and Assessment Program (EPA, 2003). This document identifies 10 basic elements for a state water monitoring program and serves as a tool to help EPA and the states determine whether a monitoring program meets the requirements of the CWA Section 106(e)(1).

The recommended 10 elements of a state water monitoring and assessment program are:

1. Monitoring Program Strategy
2. Monitoring Objectives
3. Monitoring Design
4. Core and Supplemental Water Quality Indicators
5. Quality Assurance
6. Data Management
7. Data Analysis and Assessment
8. Reporting
9. Programmatic Evaluation
10. General Support and Infrastructure Planning

Monitoring Program Strategy

The TCEQ surface water quality monitoring (SWQM) programs provide for an integrated evaluation of physical, chemical, and biological characteristics of aquatic systems in relation to human health concerns, ecological condition, and designated uses. SWQM data provide the basis for establishing effective TCEQ water quality management policies that promote the protection, restoration, and responsible use of Texas surface-water resources. This strategy, developed following the EPA guidance, (EPA 2003), fulfills the monitoring strategy requirements of the CWA.

Organizational Structure

Since the last revision of this monitoring strategy document, the water programs at TCEQ were reorganized into the Office of Water (OW). The OW houses the Water Quality Permits, Water Supply, Water Availability, and Water Quality Planning Divisions. This document covers activities performed by the Water Quality Planning Division. This division includes the following sections and programs, Monitoring & Assessment Section (MAS)—SWQM, CRP, Water Quality Standards (WQS) Development, Data Management & Analysis (DMA); Planning and Implementation (PI)—Nonpoint Source (NPS), Galveston Bay Estuary Program (GBEP), and Total Maximum Daily Load (TMDL); Houston Lab Section (see Appendix B.)

Surface Water Quality Monitoring Program

The TCEQ SWQM Program, established in 1967 by the Texas Water Quality Board, encompasses the full range of activities required to obtain, manage, store, assess, share,

and report water quality information to other TCEQ water programs, agency management, other agencies and institutions, local governments, and the public. Primary statutory authority for the SWQM Program is provided under Section 26.127 of the Texas Water Code (TWC), which states, *“The executive director has the responsibility for establishing a water quality sampling and monitoring program for the state. All other state agencies engaged in water quality or water pollution control activities shall coordinate those activities with the Commission.”* Activities of the SWQM Program are significantly driven by Sections 104(b), 106, 205(j), 303(d), 305(b), 314, 319, and 604(b) of the Federal CWA of 1987 and associated guidance. The TCEQ SWQM Program is largely funded by a CWA Section 106 cooperative grant agreement with EPA Region 6.

The state statutory basis for the SWQM Program is outlined in the Texas Administrative Code (TAC), Title 30, Part 1, Chapter 307.9, *Determination of Standards Attainment of the Texas Surface Water Quality Standards* (TSWQS). The SWQM Program methods are further defined in the *SWQM Procedures—Volumes 1 and 2* (2007, 2008) and the *Guidance for Assessing and Reporting Surface Water Quality in Texas*.

Texas Clean Rivers Program

Established in 1991, the CRP is a state fee-funded, non-regulatory program created to provide a framework and forum for managing water quality issues in a more holistic manner within a river basin, both locally and regionally, by coordinating the efforts of diverse organizations. The CRP is a collaboration of 15 partner agencies and the TCEQ.

Primary statutory authority for the CRP is provided under Section 26.0135 of the TWC which states, *“To ensure clean water, the commission shall establish the strategic and comprehensive monitoring of water quality and the periodic assessment of water quality in each watershed and river basin of the state. In order to conserve public funds and avoid duplication of effort, subject to adequate funding under Section 26.0291, river authorities shall, to the greatest extent possible and under the supervision of the commission, conduct water quality monitoring and assessments in their own watersheds.”*

The basis for the CRP is outlined in the TAC Title 30, Part 1, Chapter 220, Regional Assessments of Water Quality, Subchapter A-*Program for Monitoring and Assessment of Water Quality by Watershed and River Basin*.

CRP Long Term Plan

To achieve the goals of the CRP, a long term plan was developed with input from all partner agencies to outline the focus of the program. The program goal is to *“Maintain and improve the quality of water within each river basin in Texas through an ongoing partnership involving the Texas Commission on Environmental Quality, river authorities, regional entities, local governments, industry, and citizens. The program’s management approach will identify and evaluate water quality issues, establish priorities for corrective action, work to implement those actions, and adapt to changing priorities”*. Associated with this goal, six specific objectives were defined and are implemented throughout Texas' 25 river and coastal basins. These objectives are described in the *CRP Long Term Plan* (March 22, 2006).

The long term objectives are:

1. Provide quality-assured data to the TCEQ for use in water quality decision-making
2. Identify and evaluate water quality issues
3. Promote cooperative watershed planning
4. Inform and engage stakeholders

5. Maintain efficient use of public funds
6. Adapt the CRP to emerging water quality issues

CRP Guidance

CRP revises their guidance document every two years. This guidance explains to partners how to accomplish the goals and objectives of the CRP (see Appendix C).

Key Components of TCEQ Surface Water Monitoring Programs

The statewide surface water monitoring programs are responsible for the collection of data that accurately describes the physical, chemical, and biological characteristics of state waters. The following are the key components of the surface water monitoring programs:

- Collect data for a wide range of indicators used to provide assessment information including, physicochemical measurement; chemical constituents in water, sediment, and tissue; biological assemblage and habitat measurements; and ambient toxicity.
- Coordinate a consistent data sharing process with other monitoring entities including all TCEQ water programs (SWQM, TMDL, NPS), EPA, International Boundary and Water Commission (IBWC) and US Geological Survey (USGS), Texas Parks and Wildlife (TPWD), Texas State Soil and Water Conservation Board (TSSWCB), Texas Department of State Health Services (DSHS), Texas General Land Office (GLO), and river authorities and local cooperators in the CRP.
- Ensure that all data are collected under an approved Quality Assurance (QA) program. The SWQM Programs conduct monitoring activities under EPA or state approved Quality Assurance Project Plans (QAPP).
- Provide guidance for developing the statewide coordinated monitoring schedule. This guidance is revised annually, in December, for use in developing the monitoring schedule for the following fiscal year.
- Coordinate the participation of TCEQ regional offices, CRP partner agencies, federal, and citizen volunteer monitoring in the development of the coordinated schedule.
- Prepare and oversee preparation of QAPPs for agency monitoring activities that support TCEQ water management decisions.
- Monitor compliance with established procedures through audits to ensure consistency among other monitoring entities contributing data for regulatory decisions.
- Develop and improve SWQM procedures and provide the *SWQM Procedures Volume 1 and 2* for field collection, sample handling, analysis and data reporting.
- Provide updates to monitoring personnel when significant guidance changes occur in the between revisions.
- Provide an annual update to the *SWQM Data Management Reference Guide* for data handling, transfer, and review.
- Provide workshops and training sessions to TCEQ regional offices and CRP partner agencies on field monitoring methods. Support other agency programs by providing technical advice and presentations at training events. A statewide SWQM workshop is held each fall at the start of the new fiscal year.
- Conduct performance audits on all TCEQ regional office staff involved in SWQM and audits for CRP partner agencies that provide data for water quality regulatory purposes.

- Improve and develop tools for the assessment of water quality data to further refine assessments and provide accurate representation of water quality status and trends.

On-line Monitoring Resources

The TCEQ SWQM Program maintains a web page with resources for all entities monitoring surface water in Texas. The site allows access to all current SWQM guidance documents, forms, and reference information. This web page is updated on a regular basis with to include the most current information. Guidance documents and monitoring resources available on the internet are listed in Appendix C.

Monitoring Objectives

Routine surface water quality monitoring is a key component of the TCEQ's overall strategy for managing water quality. In addition to the Texas Integrated Report (IR), data produced by the monitoring programs are used extensively for regulatory activities, including setting WQS, developing TMDLs for water bodies that do not meet standards, and evaluating wastewater-permit applications.

Data collected as part of the statewide monitoring program and special projects are used to answer the following questions:

What is the overall quality of waters in the State? The TCEQ determines the extent to which state waters meet the objectives of the CWA, attain water quality standards, and provide for the protection and propagation of balanced populations of fish, shellfish, and wildlife—Code of Federal Regulations (CFR), Title 40, Section 130.8. Specific causes and sources of pollution that contribute to impairments, concerns, and water quality contamination are identified when possible. This combined information is reported every two years under Sections 305 (b) and 303(d) of the CWA and is used to determine abatement and control priorities and identify emerging water quality problems (40 CFR §130.4). Data collected as part of probabilistic surveys may also be used to determine overall quality of waters in the State.

To what extent is water quality changing over time? States report to EPA on the extent to which control programs have improved water quality or will improve water quality for the purposes of "...the protection and propagation of a balanced population of shellfish, fish, and wildlife and ...recreational activities in and on the water." [40 CFR §§130.8(b)(2) and 130.8(b)(1)]. Under Section 319(h)(11) of the CWA, TCEQ reports on reductions in NPS loadings and related improvements in water quality. These activities are the responsibility of the WQPD Planning and Implementation (PI) Section.

What are the problem areas and areas needing protection? Under Section 303(d) of the CWA, TCEQ identifies impaired waters and the specific causes and sources of impairment when possible.

How effective are clean water programs? TCEQ monitors to evaluate the effectiveness of specific CWA programs, including but not limited to Sections 319 (NPS control), 314 (Clean Lakes), 303(d), 402 NPDES permits, WQS modifications, compliance programs (discharge monitoring report information), and generally to determine the success of management measures.

How is the quality of lakes reported? Section 314 of the CWA requires all states to classify lakes and reservoirs according to the trophic state. Through the statewide monitoring program data is collected that allows the determination of the trophic status of

lakes in Texas. Major reservoirs have been evaluated and ranked by the TCEQ using Carlson's Trophic Index (TSI). The results of this analysis are reported every two years in the Texas IR. Probabilistic data collected in Texas during the National Lakes Assessment (NLA) could also be used to enhance the assessment lake water quality.

How are waters identified as not impaired but having water quality concerns addressed? TCEQ has developed the *Guidance for Assessing and Reporting Surface Water Quality in Texas* which contains steps to be taken when assessing water bodies which are not impaired but where data indicates potential water quality concerns.

Monitoring Design

SWQM Methods

To ensure that data are collected in a consistent and appropriate manner, the SWQM Program has established standard methods for collection, sample handling, and reporting. Routine training and annual quality assurance site visits to the TCEQ regional offices are conducted by central office SWQM staff.

Each year personnel from the TCEQ and CRP partner agencies involved in the surface water monitoring participate in a three-day workshop to review administrative requirements, learn new procedures relevant to the monitoring program and promote consistency related to data collection. Additional training workshops may be conducted for TCEQ personnel and CRP partners, to improve their skills in field protocols, data reporting and data analysis and QA.

The *SWQM Procedures, Volume 1: Physical and Chemical Monitoring Methods* (RG-415) provides a single source of information describing procedures used by SWQM Program personnel in the collection of surface water quality data. The purpose of this document is to promote consistent methods statewide and is made available to all entities engaged in surface water monitoring. The procedures also outline quality assurance and quality control measures used to demonstrate that data are of known and adequate quality.

Procedures for conducting biological and habitat monitoring are developed and revised by a biological workgroup comprised of TCEQ and TPWD staff. Biological and habitat monitoring procedures are outlined in *SWQM Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data* (RG-416).

Both documents are reviewed and updated every three to five years or as needed for major changes. Interim procedure changes are posted on the web between major manual revisions (see Appendix C).

Coordinated Monitoring Schedule

The coordination of monitoring resources throughout the State increases the efficiency of surface water data collection and analysis by the SWQM Program and participating entities. Coordinated statewide monitoring reduces duplication of effort and improves spatial coverage of monitoring sites and consistency of parametric coverage.

Coordinated monitoring meetings (CMM) are held in each major river basin and are hosted by the CRP Basin Planning Agency. Planning and development of the coordinated monitoring schedule (CMS) takes place in January through May of the preceding fiscal year. The schedule is continually updated during the annual planning process with a final version available on September 1 of each fiscal year. The CMS is a web based tool that allows monitoring entities to make changes during the year so the schedule is kept current.

Those participating in the CMMs include the CRP, TCEQ SWQM staff, other state agencies, federal agencies, municipalities, and others. All water quality monitoring groups that collect SWQM data and commit to comply with TCEQ requirements for collecting quality-assured data are invited to participate in the meetings.

Key topics discussed at CMS meetings include,

- the merits of maintaining or relocating existing monitoring sites
- changing parameters are discussed in relation to historical baseline sampling
- identification of use impairments and water quality concerns from the Texas IR
- local knowledge of water quality problems
- distribution of significant point source discharges, special studies, and TMDL monitoring projects.
- special attention is focused on spatial gaps in station locations and changing data needs
- new sites are added, existing sites may be relocated, and parameters monitored may be changed based on the discussions.

Monitoring Coordination Tools

Online Interactive Monitoring Schedule

The TCEQ has contracted with the Lower Colorado River Authority (LCRA) to maintain an interactive database that contains more than 1,800 sites monitored annually by 59 agencies in Texas. The database is accessible through LCRA’s website. This website serves as the official CMS for the State of Texas each year and is a deliverable of the CWA Section 106 grant. The website can display previous monitoring schedules back to FY 2003. The schedule can be queried by basin, fiscal year, monitoring entity, and type of monitoring event.

Special Project Tracking

TCEQ maintains a database of special projects that is displayed on the CMS website to assist in planning routine monitoring efforts in each of the Texas river basins. The special project database is updated three times a year, January (before the CMMs), May (after the CMMs), and September (beginning of the new fiscal year). See Table 1 for examples of special projects.

Table 1. Example of special project summary from CMS website.

Project	Target Complete	Group	Status
Lower Pecos River Continuous Water Quality Monitoring (CWQM) Project	8/31/2012	SWQM	Sampling
Lower Rio Grande Continuous Water Quality Monitoring (CWQM) Project	8/31/2012	SWQM	Sampling
Pecos River Biological and Habitat Survey	8/31/2007	CRP	Completed
Rio Grande - Bacteria	3/27/2013	TMDL	Planning
Upper Pecos River Continuous Water Quality Monitoring (CWQM) Project	8/1/2012	SWQM	Sampling
Upper Rio Grande Biological Sampling (ALM)	8/31/2012	SWQM	Sampling
Upper Rio Grande Continuous Water Quality Monitoring (CWQM) Project, Part 2	8/31/2010	SWQM	Sampling

Texas Watershed Delineation Project

In FY2011, TCEQ partnered with the USGS Texas Science Center to delineate watersheds and develop watershed characterizations for monitoring sites in Texas (see Appendix D). The initial phase of this project was to delineate watershed boundaries, calculate drainage areas, compute other standard watershed characteristics such as land use statistics, and develop draft documentation on the delineation/characterization process for over 3,000 active monitoring stations.

Monitoring data are used to characterize water quality in the State's surface waters for on-going regulatory activities, including permitting actions, water quality standards development, and the Texas IR. Watershed size and land use are critical factors affecting water chemistry, biological assemblages, and physical habitat at each of these monitoring stations, and are important in accurately assessing water quality for regulatory purposes. Data from this project facilitates state scale analysis of the relationships between these factors, as well as providing an important planning tool for resource allocations.

The main goals of this project are,

- To delineate watershed boundaries, calculate drainage area, and compute other standard watershed characteristics for over 3,000 surface water quality monitoring sites.
- Identify watershed characteristics such as watershed area, elevation, riparian land cover and percent slope.
- To develop documentation on the delineation/characterization process for use by SWQM as well as other TCEQ program areas and CRP partner agencies.

Resource Issues. The initial phase of this project received funding from the American Recovery and Reinvestment Act (ARRA), CWA Section 604(b) and is complete. As future funding allows, possibilities to expand this project include the following:

- Create a public facing website for watersheds and stations.
- Provide for the ability to add new stations to the system.
- Provide for ongoing maintenance of the system.
- Link SWQMIS data (e.g. water chemistry and biological data) to stations/watersheds.
- Conduct time series analyses to examine temporal patterns for water quality and biological health as related to land-cover, flow, and other characteristics.
- Link permit data to watersheds allowing analysis of relationships between permits and water quality/biology at the watershed level.
- Link permit documents to watersheds allowing review of existing permits at watershed level.
- Link other documents such as special projects, to watersheds.
- Link photos to stations/watersheds.
- Develop a custom tool to access and download data at the watershed level via ArcGIS.

Monitoring Categories

In order to balance the needs of multiple programs, monitoring is divided into the following categories:

- Routine Monitoring

- Special Project Monitoring
- Permit Support Monitoring
- Systematic Watershed Monitoring
- Trend and Statistically-Based Monitoring

Routine Monitoring

The routine monitoring network includes the collection of physicochemical, biological, and hydrological data at varying frequencies from most of the 367 classified stream, reservoir, and estuary segments across Texas, as well as the Gulf of Mexico. Smaller unclassified water bodies are also monitored to evaluate and define water quality as well as responding to potential risk for pollution including water bodies that do not support water quality standards. Objectives and priorities for routine monitoring are summarized in Table 2 and are discussed each year at CMMs across the state. Priorities are updated based on the most recent Texas IR. Detailed monitoring requirements are outlined in *SWQM Procedures, Volume 1*, Chapter 2 “Routine Monitoring” (see Appendix C).

Table 2. Routine monitoring objectives.

Level of Support for Parameter	General Monitoring Objective	Priority
Concern for standard support with a limited data set or not supporting with a limited data set	Sample until an adequate data set is available for assessment.	1st
Concern for near nonattainment with adequate data Concern for DO grab samples	Continue routine monitoring to establish that near nonattainment is ongoing. When DO grab samples identify a concern, schedule 24-hour sampling to determine support of the average and minimum criteria.	2nd
Concern with adequate data for narrative criteria, i.e., nutrients (water bodies without nutrient criteria) and sediment	Continue monitoring to establish that concern is ongoing. Monitor other water quality causes and sources related to the parameter of concern.	3rd
For water bodies where uses are fully supported with adequate data, or no concern with limited data	Continue monitoring to establish support of the designated uses. Include conventional parameters on high use water bodies and water bodies of local interest. Monitor at least one station in each classified segment and important water body. Monitor toxics and biological monitoring in areas where this monitoring has not been conducted.	4th
For water bodies that have not been monitored previously, or recently	Implement monitoring to develop an adequate data set to assess uses and concerns.	no specific priority

Spatial Considerations for Monitoring Station Locations

During water quality assessments, data are reviewed in each assessment unit within classified and unclassified waters to determine the geographical extent of use and criteria support, and identify water quality concerns. The extent of use and/or criteria support, and identification of concerns in a water body are estimated based on the review of existing data, spatial distribution of monitoring sites, known sources of pollution, influence of tributaries and hydrological modifications, and the best professional judgment (BPJ) of TCEQ and CRP assessment personnel. Details on spatial considerations with respect to assessment procedures are outlined in the *Guidance for Assessing and Reporting Surface*

Water Quality in Texas and SWQM Procedures, Volume 1, Chapter 2 “Locating Representative Sites” (see Appendix C).

Temporal Considerations for Monitoring Station Locations

Water quality conditions vary from year to year. Data sets used to characterize water quality and make use attainment determinations must be representative of the range of seasonal conditions. A minimum of two years of samples is typically needed to characterize conditions with no more than half of the samples in any one year. Quarterly sampling best represents the range of temperature and flow conditions. Data collection for routine monitoring parameters is done regardless of flow conditions, provided sampling can be performed safely. Details on temporal considerations are outlined in the *Guidance for Assessing and Reporting Surface Water Quality in Texas and SWQM Procedures, Volume 1*, Chapter 2 “Locating Representative Sites” (see Appendix C).

Routine Monitoring During Extended Drought

To ensure continuity of statewide routine SWQM activities during extended periods of drought, the program has developed a guide to fulfill the monitoring plan outlined in the CMS (see Appendix C).

Special Project Monitoring

Special project monitoring involves data collection efforts to better characterize nonattainment of water quality standards, NPS pollution loading in a watershed, and stakeholder concerns. Special projects are developed in consultation with other basin monitoring entities and TCEQ coordinators for the SWQM, CRP, WQS, NPS, and TMDL programs. Table 4 summarizes the monitoring priorities for special projects. See *SWQM Procedures, Volume 1*, Chapter 2 “Special Project Monitoring” for detailed monitoring requirements (see Appendix C).

Table 3. Monitoring priorities for special projects.

Level of Support for Parameter	General Monitoring Objective	Category for Parameter	Impairment Parameter Priority for SWQM and CRP	Impairment Parameter Priority for TMDL
For water bodies where uses are not supported	A special project can be planned to address a specific impairment	4a	5th	2nd
		4b	3rd	4th
		4c	4th	5th
		5a	6th	1st
		5b	2nd	3rd
		5c	1st	6th

Permit-Support Monitoring

Permit support monitoring is conducted to directly assist with a TCEQ wastewater discharge permit action by the Water Quality Division (WQD). The TCEQ identifies specific water bodies where permitting programs would benefit from additional information on water quality and quantity. Generally this type of monitoring includes use attainability analysis (UAA), recreational use attainability analysis (RUAA), receiving water assessments (RWAs), and targeted flow monitoring to collect two years of monthly flow data to help calculate seven-day, two-year low flow (7Q2) values. Intensive surveys (IS) are used to evaluate loading from wastewater discharges. Table 4 summarizes permit support monitoring objectives.

Table 4. Permit support monitoring objectives.

General Monitoring Objective	Monitoring Approach	Prioritizing Monitoring Resources
UAA—To determine if existing designated or presumed uses and criteria are appropriate and, if not, to develop designated use and/or criteria adjustment information.	Collect chemical, biological and habitat information following prescribed protocols	Scheduled by Water Quality Standards Development Team following review of recent monitoring data
RWA—To determine appropriate aquatic life use and criterion for unclassified water bodies receiving permitted discharges.	Collect biological and habitat information following prescribed protocols	Scheduled by Water Quality Standards Implementation Team in response to permit requests
RUA—a specific type of UAA done to evaluate and determine the appropriate recreational use category for a water body.	Collect site specific information including physical and flow characteristics of a stream such as water depth and flow; also surveys of individuals and organizations with firsthand knowledge of water body used to assess historical and existing patterns of recreational use	Scheduled by Water Quality Standards Development Team following review of recent monitoring data
IS—Evaluate loading from wastewater discharges.	Collect hydraulic and water quality information under low-flow conditions.	Requested by TCEQ water quality modelers

Systematic Watershed Monitoring

Systematic watershed monitoring is similar to routine monitoring but with a shorter duration (1 to 2 years) and is designed to screen water quality in smaller, unclassified water bodies that are not routinely monitored. Systematic monitoring has several objectives including:

- Screening waters that would not normally be included in the routine monitoring program.
- Monitoring at sites to check the status of water bodies (improvements or concerns).
- Investigate areas of potential concern.

This type of monitoring, primarily used by CRP partner agencies, can follow either a rotational watershed approach or an intensive watershed evaluation. Additional information on this monitoring approach can be found in the CRP Guidance—Task 3: Water Quality Monitoring and Constituents (see Appendix C). Table 5 summarizes systematic watershed monitoring objectives.

Table 5. Systematic watershed monitoring objectives.

General Monitoring Objective	Monitoring Approach	Prioritizing Monitoring Resources
Impairment characterization- for water bodies on the 303(d) List	Continue monitoring to develop an adequate data set to define geographic extent and severity of the impairment.	State agencies and local stakeholders assist in determining priority
Develop ecoregion specific background data	Develop ecoregion specific monitoring plan.	Plan developed with TPWD by the biological workgroup

Table 5. Systematic watershed monitoring objectives.

General Monitoring Objective	Monitoring Approach	Prioritizing Monitoring Resources
ALA—Aquatic life assessment to confirm support or nonsupport of presumed aquatic life use and criteria for unclassified water bodies not included in Appendix D of the TSWQS; and to identify appropriate aquatic life use and DO criteria.	Collect chemical, biological and habitat information following prescribed protocols.	State agencies and local stakeholders assist in determining priority
Determine statewide percentages for use support and concerns—Reports to the Texas legislature and USEPA	Comprehensive probability-based or watershed- integrator monitoring plan	10-30% of total resources for all routinely monitored parameters
Determine sources of pollutants	Develop watershed and parameter specific plan	Local interest determines priority at this time; or part of TMDL-initiated investigation
Determine if existing point source controls are effective	Conduct compliance monitoring of effluents and receiving waters	Plan is developed from results of the assessment, compliance history, grant commitments, and relative risk to the environment
Verify effectiveness of BMPs for controlling NPS pollution	Develop watershed and parameter specific plan	As required by TMDL implementation plans

Biological Monitoring

Texas Aquatic Ecoregion Monitoring

Defining realistic ambient water quality standards for impacted water bodies can be difficult. Originally, the approach of sampling upstream and downstream of a point source was used. However, the validity of using an upstream control site which can be affected by pollution or habitat modifications to establish attainable conditions is questionable.

To address this concern the TCEQ began to develop a more defensible approach to establishing attainable conditions for Texas streams. Studies such as *An Assessment of Six Least Disturbed Unclassified Texas Streams* (Twidwell and Davis 1989) and the *Texas Aquatic Ecoregion Project* (Bayer et al., 1992) established the utility of the ecoregion approach. These studies identified minimally impacted reference streams in eleven of the twelve ecoregions found in Texas. Streams with watersheds containing no urban development, no point sources pollution, no channelization and no atypical NPS pollution were identified as candidate reference streams.

The *Texas Aquatic Ecoregion Project: Water Quality, Instream Habitat, Biotic Integrity and Riparian Characteristics of Least Disturbed Streams in Texas* project is a continuation of this work. The study is being done in cooperation with the TPWD/TCEQ Interagency Workgroup for Biological Sampling.

The tasks for this project fall into four major categories:

- 1). Organize and compile all data on streams currently identified as least disturbed ecoregion reference streams.
- 2). Evaluate streams currently identified as least disturbed ecoregion reference streams to determine if the streams are still suitable.
- 3). Evaluate candidate least disturbed streams to determine the necessity for adding to the least disturbed streams database.

- 4). Conduct field sampling according to procedures described in SWQM Procedures Volumes 1 and 2 in 60 to 75 streams either currently identified as least disturbed ecoregion reference streams or as candidate least disturbed streams. Sampling is being done over a five to six year period with approximately 10 streams sampled in each Level III Ecoregion.

Virtual Biological Assessment Team (VBAT)

Biological monitoring is resource intensive and specialized work. To be responsive to water program needs and provide high quality assessments the TCEQ developed a “Virtual Biological Assessment Team” or VBAT. VBAT is an effort to coordinate biological monitoring in all parts of the state or for specific assessment issues. VBAT is not an actual team but a way to utilize available monitoring staff resources across regional boundaries. The VBAT consists of TCEQ SWQM staff (both in the central office and in 15 regional offices), CRP partner agencies, and contracted staff (TPWD, USGS, University of Houston-Clear Lake). The VBAT has been instrumental in the success of the NARS work in Texas. NARS work in Texas is discussed in a following section.

Trend and Statistically-Based Monitoring

Basin Trend Analysis

The TCEQ has identified trend analysis as a tool to determine if a water body is not expected to meet applicable water quality standards, or is threatened as defined in 40 CFR Section 130.2(j) and EPA guidance. In general, trend analysis provides information which contributes to a quantitative, objective assessment of whether or not the values for a random variable, such as the chlorides concentration, or biological integrity (the dependent variable), are increasing or decreasing over time as a function of an independent variable such as time.

The trend analysis of water quality data serves to develop a greater understanding of water quality conditions and enhances the ability to make decisions regarding water quality issues. Basin trend analysis is designed to accomplish several goals, including:

- define long-term water quality variability and significant relationships
- provide supplementary information for concerns and use impairments
- set priorities for water quality monitoring
- identify areas where water quality is deteriorating so that action strategies may be developed to address potential problems
- highlight areas where water quality management actions have resulted in water quality improvements
- assess the success of water quality improvement projects and other changes in the watershed
- support water quality standards revisions

Every year, each CRP planning agency produces a synoptic report of the goals, objectives, and accomplishments of the CRP—*Basin Highlight Report*.

Every five years, a *Basin Summary Report* is produced for each river basin in Texas. Basin Summary Reports are produced on a revolving schedule with a different set of CRP basin planning agencies preparing a report each year. The intent of the report is to provide a comprehensive review of water quality data, and to develop a greater understanding of water quality conditions. The reports serve as a way to communicate information between

the planning agency, the general public, and the basin steering committee. The Basin Summary Report includes the analysis and reporting of trends.

On a five-year rotating cycle, the CRP requires each basin planning agency to review a list of stations that contain enough data for a trend analysis. The TCEQ will integrate the trend analysis information into the management decisions making process. *Basin Highlight Reports* are not produced when a *Basin Summary Report* is due for a given river basin. Guidelines for both reports are outlined in the CRP Guidance—Task 5: Data Analysis and Reporting (see Appendix C).

Probabilistic Monitoring and Assessment

Texas has historically relied on targeted monitoring as the primary tool in evaluating the status of water quality in the state. This type of monitoring provides invaluable information about site-specific water quality issues. However, the data provided by targeted monitoring is of limited use in contributing to resolving large scale water quality issues. Alternately, implementation of a statistically designed monitoring network using probability-based sampling of explicitly defined resource populations can help answer the following:

- What is the current extent of ecological resources in Texas, and how are they distributed geographically?
- What proportion of the resources is currently in acceptable ecological condition?
- What proportions are degrading or improving, in what regions, and at what rates?
- Are these changes correlated with patterns and trends in environmental stresses?
- Are adversely affected resources improving in response to control and mitigation programs? Are our water quality management strategies working?

This type of approach for evaluating status and trends of water quality at the national level was initiated by the EPA with the establishment of the Environmental Monitoring and Assessment Program (EMAP) in the late 1980's.

TCEQ has participated in probabilistic monitoring and assessment with the NARS and Texas Coastal Assessment.

National Aquatic Resource Surveys

In 2004, TCEQ participated in the first EPA NARS—NWSA. In addition to NWSA, TCEQ led additional NARS on rivers and streams, lakes, coastal bays, and wetlands in a revolving sequence (see Table 6). The purpose of these assessments is to generate statistically-valid reports on the condition of our Nation's water resources and identify key stressors to these systems. The next round of NARS will continue with a return to lakes in the NLA in 2012, NRSA in 2013-2014, NCCA in 2015, and the NWCA in 2016.

The NARS in Texas have set the stage for future developments in large-scale approaches to monitoring such varied and often difficult to reach waters in the state. After a period of five years, each ecosystem type will be revisited, using the same methods to assess changes. As these studies are carried out on a national level, Texas is building the capacity to carry out state-level assessments based on a probabilistic design. The number of samples collected in Texas during the NRSA, the NLA and the NCCA provides adequate data to do state-level statistical estimates for a variety of water quality parameters.

The NARS projects provide special funds which help build the capacity of the state's monitoring program through the purchase of additional equipment. These purchases are made after the completion of NARS work and with the approval of the EPA grant manager.

Texas Coastal Assessment

The Texas Coastal Assessment, developed in FY 2007, was an effort to develop a statistically-based network of sampling sites on the coast to meet the data needs for Texas. The main work product was the design of the coastal network that will likely be a hybrid of the TCEQ's current fixed-station system and statistically-based network. Since 1996, sampling in the Galveston Bay complex has used a hybrid system. Each year 34 to 38 random sites are sampled for water quality. A total of approximately 140 candidate sites are divided into four sets used in rotation. About 18 random sites are sampled for sediment each year. In addition 10 routine monitoring sites are maintained in the Galveston Bay complex. The effort in addition to the SWQM Program's experience with NARS will be an important starting point for designing a new system for the entire coast. Full implementation of the new system in the coastal region (particularly related to the frequency of sampling) will take one or more additional phases. The initial phase is in the planning stage with implementation in 2016.

Use of Probabilistic Assessments in the Texas IR

TCEQ will begin using probabilistic survey results in the 2014 Texas IR starting with the 2007 NLA and TCA. Additional evaluations using state level probabilistic data will occur as data becomes available.

Table 6. Summary of probabilistic monitoring projects in Texas.

Probabilistic Monitoring Project	Year	Coordinating Agency/Program	Field Crew Lead
National Wadeable Streams Assessment	2004	TCEQ/SWQM	TCEQ
National Lakes Assessment	2007 (2012)	TCEQ/SWQM	TCEQ
National Rivers and Streams Assessment	2008-2009 (2013-2014)	TCEQ/SWQM	TCEQ/TPWD
National Coastal Condition Assessment	2010 (2015)	TCEQ/SWQM	TCEQ Contractor
Texas Coastal Assessment	2007	TCEQ/TPWD	TPWD
National Wetlands Condition Assessment	2011 (2016)	TCEQ/SWQM	TCEQ Contractor

Wetlands Monitoring

Currently, the TCEQ does not have a wetlands monitoring and assessment program. TCEQ's participation in the EPA National Wetlands Condition Assessment (NWCA) project in 2011 will serve as TCEQ's initial effort into developing wetlands monitoring and assessment guidance.

Seagrass Monitoring

The development of a seagrass monitoring program was a major recommendation of the *Seagrass Conservation Plan for Texas*, adopted in 1998 by TPWD, TCEQ, and GLO. The *Texas Seagrass Monitoring Program Strategic Plan* was completed in 2000. In July 2000, the TSWQS were revised to include "seagrass propagation" as a new aquatic life use. This designation requires that saltwater with significant stands of submerged seagrass be protected.

In 2010, TCEQ, in cooperation with TPWD, began to test and refine coastal monitoring protocols, described in the final report of *A Seagrass Monitoring Program for Texas Coastal Waters*, to evaluate seagrass condition along the entire Texas coast. These efforts emphasize the development of monitoring protocols that can be employed by coordinating state agencies as part of a routine seagrass monitoring program. Environmental factors,

water quality, and seagrass condition indicators, which are characterized either as potential stressors or as seagrass condition indicators, are evaluated through probabilistic sampling and regional rapid assessments at fixed stations.

Resource Issues. The initial cooperative project is supported by 106 Categorical funds from FY2012–FY2014. Seagrass field work will be done by TPWD under contract to TCEQ. Additional method refinement and data generated from the project may ultimately lead to the development of an index of seagrass community health and implementation of routine seagrass monitoring as part of the TCEQ routine SWQM program. The extent of a routine seagrass monitoring program will be dependent on available resources.

Oyster Water Monitoring

The DSHS Seafood and Aquatic Life Group (SALG) are responsible for monitoring and regulating closures of state shellfish (oysters, clams, and mussels) waters to protect human health (see Appendix C). All shellfish in Texas waters must be harvested from approved or conditionally approved areas as designated on the shellfish classification maps developed by DSHS. The TCEQ SWQM Program uses this information in the assessment of the oyster water use is outlined in the most current version of the *Guidance for Assessing and Reporting Surface Water Quality in Texas*. The status of shellfish growing waters in Texas estuaries is subject to change by the DSHS. These changes may occur due to high rainfall and runoff, flooding, hurricanes and other extreme weather conditions, major spills, red tides, or the failure or inefficient operation of wastewater treatment facilities.

Statewide Fish Tissue Monitoring

The TCEQ SWQM and the DSHS SALG coordinate monitoring for contaminants in fish tissues to address potential concerns for human health and ecological risks statewide (see Appendix C).

Three state agencies have significant interest in and responsibilities related to contaminants in fish tissue and make up the Fish Tissue Monitoring Workgroup.

- *DSHS*—responsible for determining if contaminants in fishes pose a risk to consumers and issuing health advisories or closures when risks are identified.
- *TCEQ*—responsible for establishing state water quality criteria, managing the quality of state waters, and addressing any impairments or concerns in state surface water resources.
- *TPWD*—responsible for managing state fish and wildlife resources, addressing any pollution problems that may adversely impact these resources, and enforcing human health closures issued by DSHS.

The Statewide Fish Tissue Monitoring Project was designed as a two-tiered cooperative effort involving the shared resources of the TCEQ, TPWD, and DSHS. The project allowed the screening of contaminant levels in fisheries resources across the state for possible human health, water quality, and ecological risks for four years (FY 2004–2007). It greatly expanded the number of water bodies evaluated for toxic substances in fish tissue. The basic strategy focused on lakes and large rivers where fishing was most likely to occur.

Under Tier 1 human health risk screening studies were conducted on 82 reservoirs and 15 major rivers. Tier 2 of the project consisted of human health risk studies started in FY2005. The human health risk studies were conducted by DSHS SALG on sites identified with elevated contaminant concentrations during Tier 1 of the project. If an unacceptable level

of risk to consumers was identified, appropriate actions to protect public health were evaluated. Four fish consumption advisories resulted from the initial Tier 2 work, Canyon Lake (mercury-Hg), Neches River (Hg), Alan Henry Reservoir (Hg), and Ellison Creek Reservoir (polychlorinated biphenyls-PCBs).

DSHS SALG and TCEQ SWQM staff maintain a prioritized list of water bodies previously identified for potential fish tissue contamination and water bodies with existing advisories, which may warrant an updated quantitative risk characterization due to implementation of remedial efforts to improve water quality. See Appendix D for the *Fish Tissue Monitoring Priority List*. This list is subject to revision due to changing priorities and data needs.

DSHS SALG, in consultation with TCEQ SWQM and the Fish Tissue Monitoring Workgroup, collects fish tissue samples of established target species from each selected water body as part of Tier 2. For each of these water bodies, DSHS prepares a quantitative risk characterization to assess the theoretical human health risks from consuming chemical contaminants in fish and issue a fish consumption advisory or fish consumption ban for each water body where chemical contaminants in fish pose a public health hazard.

Coastal Fish Tissue Monitoring

Monitoring to screen tissue for contaminants is labor intensive and resources for routine coastal tissue monitoring are decreasing. Most coastal tissue screening is done as a special project. Priorities for coastal tissue monitoring are discussed by the Fish Tissue Monitoring Workgroup. DSHS receives funding from various sources in addition to TCEQ. The most recent coastal work resulted in an expanded risk advisory for the Galveston Bay System and a new advisory for Sabine Lake and Sabine Pass. The Galveston Bay Estuary Program, the Coastal Bend Bays and Estuary Program, and the GLO support fish tissue monitoring efforts along the Texas coast. These programs fund efforts to collect and analyze data from bays to determine if current advisories need to be expanded or if additional advisories are needed (see Appendix C).

Resource Issues. These projects were funded by the TCEQ using EPA 106 Categorical funds with most of the funding allocated to laboratory analysis of fish tissue. DSHS pays for the data analysis and toxicology work. Statewide fish tissue monitoring has continued but with a reduction in effort. Continuation of this monitoring effort is included as a program element in the TCEQ FY2012-2013 106 Categorical Grant Application. One constraint to this effort is the limited funding available to DSHS to perform the data analysis and toxicology work.

Nutrient Monitoring

Low level nutrient data are needed to fully characterize water bodies and assist with the development of nutrient criteria in Texas. The primary nutrient parameters of interest include total phosphorus (TP) and total nitrogen (TN). Currently there is little TN data. For initial nutrient criteria purposes, data will be derived by totaling other nutrient parameters (TKN, nitrate, and nitrite). In many cases, the detection limit for TP data collected as part of the routine monitoring program is too high for nutrient criteria development. A nutrient monitoring effort is planned for FY2012-2013 using 106 Categorical and National Monitoring Initiative funds. Nutrient monitoring objectives for the next several years will include collection of site specific data to support numeric nutrient criteria development; support the development of low-level nutrient lab analysis; and monitoring of water quality parameters that are related to nutrient variability. During 2012 and 2013, monthly samples

are being collected by CRP partners under a project specific QAPP. Work is also being done to identify a method and equipment necessary to achieve low level nutrient results.

Texas Recreational Beach Monitoring

Beginning in November 2000, the GLO rejuvenated its Texas Beach Watch Program with funds from the Texas Coastal Management Program under the *Beaches Environmental Assessment and Coastal Health Act of 2000*, Public Law 106-282. Public notification procedures consist of posting advisory signs at designated beaches when the EPA-recommended standards for bacteria are exceeded. The GLO is expanding its existing program to include all 15 counties adjacent to the Gulf of Mexico and/or coastal bays and estuaries to meet the requirements of the Beach Act.

GLO coordinates the collection of bacteria samples at 162 stations covering 58 beach areas in seven coastal counties. Samples are analyzed for the presence of enterococcus bacteria. The GLO is currently developing the Beach Watch database to capture all of the data required by the EPA. Real-time data is made available to the public via a website maintained by the GLO (see Appendix C).

Monitoring occurs weekly from May through September and biweekly from October through April. Weekly sampling for the Gulf beaches in Cameron and Nueces Counties begins in March of each year to coincide with Spring Break.

TCEQ acquires summarized Beach Watch data from the GLO. An assessment method was developed for the summarized data and integrated into the 2010 *Guidance for Assessing and Reporting Surface Water Quality in Texas* (see Appendix C).

Continuous Water Quality Monitoring

The TCEQ CWQMN measures water quality parameters in various water bodies around the state at greater frequency than is possible with grab samples or short-term deployment of monitoring instrumentation.

Initially CWQMN was focused in the Bosque River and Leon River watersheds. By 2009, the network was expanded to thirty one TCEQ surface water monitoring sites located throughout the state. Data from other non-TCEQ stations are also hosted by TCEQ. The network is funded by CWA grants under Sections 106, 319(h), and 604(b), as well as state funds.

Sites are operated by TCEQ staff, cooperators, and contractors. The CWQMN is supported by the equivalent of three full-time staff in the central office, providing project planning, installation, contract management, data validation, daily data reviews, oversight of the monitoring instrument operation, equipment procurement and testing, quality control/assurance, and training. Sites may be added to address specific data needs; deleted when data needs are met; and/or modified to better address data needs.

As of September 1, 2011 sites on the upper Rio Grande River and Pecos River are operated and maintained by USGS using their protocols (Wagner, *et al.*, 2006). The USGS will also validate site data which includes “correcting” data records based on documented multiprobe fouling and electronic drift measurements. New TCEQ data validation procedures (for non EMRS sites) consist of comparing multiprobe fouling and electronic drift measurements against data quality objective criteria.

The CWQMN was expanded to include additional sites operated by TCEQ, by contractors, and cooperators. Sites may be added to address specific data needs; deleted when data needs are met; and/or modified to better address data needs.

The TCEQ CWQMN may be used for a variety of purposes, including:

- Characterizing baseline conditions and identifying trends.
- Assessing impacts of point and non-point sources discharges, including short term pollution events.
- Providing timely surface water quality data for screening and targeting field responses and investigations for the EMRS program.
- Providing data to support TSWQS reviews.
- Providing timely surface water quality data for water management decisions.
- Providing data to support the development of watershed protection plans.
- Developing water quality controls and assessing improvement after watershed management and implementation plans are in place.
- Providing continuous water quality data to the public (via internet) for water bodies of interest.
- Collecting data for water quality models.

CWQMN Issues: As expected when developing new capabilities, costs have been considerable and the agency faced a significant learning curve. Technical evaluations have enabled TCEQ to identify and correct various network issues. Network size is constrained by available staff, program organizational structure, and LAR Capital. As TCEQ staff resources have become more constrained, the program has come to increasingly rely on contractors using federal funds.

Other issues include:

- Currently, there are no EPA standards, guidelines, or protocols for CWQM. The National Water Quality Monitoring Council, Methods and Data Comparability Board is compiling and developing various national standards and protocols.
- The program has lacked resources to update CWQMN web pages with needed functionality/information and to perform routine web page maintenance.
- Data analysis tools, data storage capacity, expertise, protocols are insufficient to adequately utilize data to the fullest extent possible.
- DQOs for CWQMN projects are difficult to define. DQOs are extremely important in determining site service processes to ensure collected data are of appropriate quality for their intended use.

CWQMN is funded by CWA grants under Sections 106, 319(h), and 604(b), as well as state funds.

Texas Harmful Algal Blooms (TXHABs)

The Texas Harmful Algal Bloom (TXHAB) Workgroup, a subcommittee of the Texas Toxic Substances Coordinating Committee has representation from many different agencies, universities and other organizations. The workgroup meets quarterly to discuss issues related to harmful algal blooms in Texas. Information regarding the status of red tide and golden alga events is maintained by TPWD (see Appendix C). TCEQ participates in the TXHAB.

Red Tide Issues

TPWD is responsible for responding to, monitoring, and researching the causes of red tide events along the Texas coast through the coordinated efforts of the TXHAB Work Group. The actual investigation of red tide events is shared with the DSHS SLAG.

Golden Alga (*Prymnesium parvum*)

TPWD is responsible for responding, monitoring, and researching the causes of golden alga events through the coordinated efforts of the TXHAB Workgroup. TPWD has worked with researchers, other agency officials, and interested parties within and outside of Texas to better understand and potentially control harmful golden alga (*Prymnesium parvum*) in Texas. Potential projects are submitted to the Golden Alga Research Coordinating Committee (GARCC) which makes recommendations to TPWD management. TCEQ participates in the GARCC. The focus of research includes the development of management tools, approaches and technologies to help aquatic managers detect, combat, and manage golden alga in Texas. The focus has shifted from researching aspects of *P. parvum* to researching tools to help mitigate the effects of toxin producing blooms.

Core and Supplemental Water Quality Indicators

A core set of water quality indicators are monitored at all sites and supplemental water quality indicators are monitored at some sites to provide information on the fundamental attributes of the aquatic environment and assess water quality standards attainment or impairment (Table 7). A standard set of parameters are used during routine monitoring by both SWQM and CRP. The core indicators are based on those with corresponding uses and criterion in the TSWQS (not public water supply use) and those with screening levels defined in the Texas IR guidance. Supplemental indicators are monitored to evaluate local conditions. These indicators are used to help identify causes and sources of impairments and appropriate source controls. Appendix A lists the core monitoring parameters and identifies those parameters considered key to the developing the IR. The methods and water quality indicators used for the Texas IR and development of the 303(d) List can be found in the most current version of the *Guidance for Assessing and Reporting Surface Water Quality in Texas*. A list of key core parameters collected as part of the routine monitoring program is available in Appendix A. The complete list of all parameters that may be included in water quality monitoring can be found in Table A7.1 in the SWQM.

Table 7. Core and supplemental indicators.

Indicators	Aquatic Life Use	Recreation Use	Public Water Supply Use	Fish Consumption Use/Oyster Water Use	General Use
Baseline or Core — Applied Statewide	fish assemblages benthic macroinvertebrate assemblages DO habitat assessment	bacterial indicators	Toxic organics and metals in water fluoride nitrate	bioaccumulative substances in fish tissue and water (mercury, chlordane, DDT, PCBs) fish consumption advisories shellfish bed closures	pH water temperature total dissolved solids chloride sulfate specific conductance nutrients
Supplemental (Generally applied to special studies and targeted monitoring)	toxicity metals and organics in water and sediment organics in water and sediment toxic algal blooms	nutrients nuisance plant growth aesthetics	noxious algae chlorophyll <i>a</i>	other bioaccumulative toxic substances	

Quality Assurance

Quality Management Plans (QMPs) and QAPPs are developed, maintained, and peer reviewed in accordance with EPA policy to ensure the scientific validity of monitoring and laboratory activities, and to ensure that reporting requirements are met. The TCEQ has an agency wide QMP that is reviewed and approved by the EPA annually. See Appendix C for QA resources available on the internet.

SWQM Program QA

The SWQM Program has an EPA approved QAPP that covers routine activities conducted by agency staff and describes the methodology for acquiring data and information from outside sources to meet the data quality objectives (DQOs) of the program. The SWQM QAPP is revised every two years.

Special projects which include objectives covered by the SWQM QAPP, are included as addendums known as quality assurance plans (QAPs). CRP projects are described in basin specific QAPPs or as subsequent amendments, and TMDL projects have independent project QAPPs.

At the beginning of each fiscal year the SWQM Program QA Specialist compiles an annual QA report for the previous fiscal year. This report summarizes all QA activities that includes at a minimum, the number of technical systems audits, the number and type of findings, any QA deficiencies, QA program enhancements, and staff training. This report is sent to the TCEQ QA Section and is included in the TCEQ annual agency QA report submitted to EPA Region 6 QA staff.

CRP QA

The CRP QAPPs are submitted by each basin planning agency and clearly delineate each agency QA policy, management structure, and procedures which will be used to implement the QA requirements necessary to verify and validate the surface water quality data collected. The CRP QAPPs are reviewed by the TCEQ to help ensure that data generated for the purposes described above are scientifically valid and legally defensible. This process will ensure that data collected under these QAPPs and submitted to the statewide database have been collected and managed in a way that guarantees its reliability and appropriateness for water quality assessments and other water quality management programs. The CRP has developed a QAPP shell that is used by all Basin Planning Agencies. The QAPP shell is available at the TCEQ CRP Web page (see Appendix C).

QA Oversight

To coordinate QA activities throughout the WQPD the MAS oversees a Quality Assurance Advisory Committee (QAAC). This workgroup includes participants from all of the water quality management programs as well as staff from TCEQ Quality Assurance Section. This group meets at regular intervals and discusses issues regarding quality assurance, data collection procedures and analytical methods. In many instances these discussions will result in recommendations for changes to procedures to improve data quality.

In some instances the TCEQ will need to initiate studies or projects to evaluate methods or procedures from a quality assurance perspective. As new or revised methods are developed the SWQM Program evaluates the impacts on current practices or to determine data quality objectives. Studies designed to answer specific questions about data collection or analytical procedures are necessary to support SWQM activities.

Data Management

The Data Management and Analysis (DM&A) Team within the MAS manages surface water quality data and metadata in cooperation with other TCEQ water programs (see Appendix C). The DM&A Team maintains a water quality database, making data readily available for assessments. The primary purpose of this database is to store and provide data from the agency's water quality management programs. The SWQM network contains more than 40 years of physicochemical and biological data from over 9,000 stations collected by the TCEQ, contributing river authorities, cities and other state and federal agencies.

Data management begins in the field office where field staff collects the samples, completes field data forms, and enters field data into a web based data management system that is linked to the application server in Austin. Editing, entry of laboratory results, database management, and report generation are carried out by staff in Austin.

The DM&A Team writes and maintains the SWQM Data Management Reference Guide (DMRG). Revisions are made annually (see Appendix C). The purpose of this guide is to assist TCEQ CRP Planning Agencies, TMDL Program contractors, TCEQ SWQM staff, and any other entities submitting data to the SWQMIS. This guide outlines the processes for requesting parameter codes, station ID numbers, submitting and collecting entity codes, monitoring type codes, tag prefixes, corrections to data in SWQMIS, and data reports. It also describes the data review, validation, verification, and reporting processes and contains reference maps, tables, and descriptions.

The DM&A Team also maintains a web page of references for all entities who submit surface water quality data to the SWQMIS database. This web page contains the DMRG and forms for managing surface water quality data (see Appendix C).

SWQMIS

The current information resources system to manage, store, assess, share, and report SWQM information is SWQMIS. SWQMIS is composed of an Oracle database, a SAS[®]-based Assessment Tool (see “Data Analysis” section), and the Water Quality Exchange (WQX) data flow, used to transmit data to EPA’s Storage and Retrieval System (STORET) warehouse. The SWQMIS Oracle database is the major component of the system. While the database can function independent of the SAS[®]-based Assessment Tool or the WQX data flow, the latter two components cannot function without the Oracle database. SWQMIS came on line in April 2007. It replaced a legacy system that had been in place since the early 1990’s to meet the business needs of multiple program areas throughout the agency—SWQM, DM&A, CRP, TMDL, WQS development, WQS implementation, permitting, and QA.

Biological Data

Upon initial deployment, one limitation of the SWQMIS database was the management of biological data (fish, benthic macroinvertebrates, and habitat). In November 2009, the MAS initiated Joint Application Development (JAD) sessions to improve management and reporting of biological data in SWQMIS. Biological data are important components of aquatic life use assessments for the IR, UAAs, and RWAs. The biological data module was testing and went online in FY2012.

Resource Issues: Current funding support of SWQMIS is from the 106 Categorical Grant. This allows the agency to retain contract employees, who possess the full skill set necessary to maintain the current level of service, fix system defects, and make modifications to the core SWQMIS application and the other components. Competition for resources with other agency information technology initiatives may limit support in the coming fiscal year. TCEQ is planning three significant server migrations that will affect SWQMIS and require use of these contract resources. Client enhancements and system updates to increase efficiencies or add functionality might still be possible, but would be limited due to resource constraints.

Public Access to SWQM Data

Easy public access to the state’s SWQM data was included as part of the SWQMIS database development. Access is facilitated through the *Surface Water Quality Web Reporting Tool* (see Appendix C). SWQM data are also available in ASCII files formatted for loading into spreadsheets or databases. Other state and federal agencies, institutions, consultants, local governments, and the public can obtain SWQM data for specific water bodies in a report format from the DM&A Team by submitting a *Standard Data Request Form* to <wdma@tceq.texas.gov>. Data are available from September 1967 to present. Data generated by the CWQMN is also available to the public as daily, monthly or yearly summary reports.

Data Analysis

Texas Integrated Report

Formerly called the *Texas Water Quality Inventory and 303(d) List*, the Texas IR provide information on the quality of surface waters in Texas, and provides resource managers with a tool for making informed decisions when directing agency programs. The IR describes the status of Texas' natural waters based on data collected during the most recent seven-year period. The period may be extended to ten-years if there is insufficient data within the seven-year period to assess water quality. It identifies water bodies on the 303(d) List that are not meeting criteria set for their use. The Texas IR satisfies the requirements of the Federal CWA Sections 305(b) and 303(d). The TCEQ produces a new report every two years in even-numbered years, as required by law. The Texas IR must be approved by the EPA before it is final. See Appendix C for data analysis resources available on the internet.

Assessment Guidance Development

To develop the Texas IR, water quality is evaluated using procedures outlined in the *Guidance for Assessing and Reporting Surface Water Quality in Texas*. This guidance was developed by TCEQ staff and is revised through a stakeholder process. The year prior to submission of the IR, TCEQ works with the Guidance Advisory Work Group. This group of stakeholders represents a wide range of interests including state agencies, environmental consultants, river authorities, environmental groups, industry, agricultural interests, and municipalities.

The *Guidance* is divided into five chapters.

Chapter 1—Summary of the Reporting Approach

Chapter 2—General Assessment Methodology

Chapter 3—Assessment of Beneficial Uses

Chapter 4—Methodology for Assigning Pollutant Causes and Sources

Chapter 5—Categorizing Water Quality Conditions for Management Action

Texas Surface Water Quality Standards

The basis for the Texas IR guidance is the TSWQS. The TSWQS establish explicit goals for the quality of streams, rivers, lakes, estuaries, and bays throughout the state. The TSWQS are developed to maintain the quality of surface waters in Texas to support public health, recreation, and aquatic life protection consistent with the sustainable economic development of the state.

Water quality standards identify appropriate uses for the state's surface waters, including aquatic life, recreation, fish consumption, general water quality, aquifer protection, oyster waters, and public water supply sources. The criteria for evaluating support of those uses include DO, temperature, pH, dissolved minerals, toxic substances, and bacteria. Statewide standards may be revised on a site-specific basis when sufficient information is available.

TSWQS—State Rules

The TSWQS are codified in Title 30, Chapter 307 of the TAC. The Standards are written by the TCEQ under the authority of the CWA and the TWC, Title 2, Chapter 26, Section 26.023, Water Quality Standards. The TSWQS are effective for CWA purposes when they are approved by EPA.

The Texas IR process is driven by Sections 307.9 and 307.10 of the TAC Title 30, Chapter 307. Sampling and analytical procedures to assess standards attainment are described in

Section 307.9. Site-specific standards for designated water bodies are individually listed in Section 307.10 (Appendices A, C, D, E, F, and G).

The water quality segments listed in Section 307.10 (Appendix A) are divisions of major river basins, bays, and estuaries. All water bodies in the state have been divided into segments based on regional hydrologic and geologic diversity. These water bodies are referred to as classified or designated segments. All other water bodies are designated as unclassified segments. Classified segments are listed and defined in Appendices A and C of the TSWQS and depicted graphically in the *Atlas of Texas Surface Waters*, which is a collection of maps showing all the state's classified surface waters. The application of the TSWQS for permitting purposes is outlined in the *Procedures to Implement the Texas Surface Water Quality Standards* (TCEQ, RG-194).

Surface Water Quality Data

Water quality data are reviewed station by station within assessment units (hydrologically distinct portions of classified and unclassified waters) to determine the geographic extent of use and criteria support, and any water quality concerns. All data used in the Texas IR are collected under approved QAPPs that ensure the data are of known and appropriate quality for assessment, or are acquired under procedures described in the SWQM QAPP. The TCEQ provides a mechanism, through the CRP QAPP, for obtaining data collected by other monitoring entities that is of a known and documented quality. All assessment data is stored in the SWQMIS database and qualified as appropriate for use in IR development.

SAS[®]-IR Assessment Tool

The SAS[®] IR Assessment Tool was developed to improve the efficiency and accuracy of assessment-related tasks. The tool has been used by the MAS since the 2008 Texas IR. This tool was built on a SAS[®] Enterprise Guide platform, and interfaces directly with the agency's SWQMIS database. Support and maintenance of the SAS[®] IR Assessment Tool and SWQMIS database is contracted to a private vendor and is supervised by the TCEQ MAS. The tool and database have improved the assessment process by increasing the efficiency and accuracy of evaluations. As a result, assessment results are more scientifically sound and legally defensible due to less error. Use of these tools has allowed the SWQM team to complete the 2010 draft assessment in five months, rather than 1.5 years, and evaluate more information than in previous reporting years. Use of SWQMIS and the SAS[®] IR Assessment Tool has allowed data considered during assessment evaluations to be made readily available (through SWQMIS), thus improving transparency and coordination among the TCEQ water programs and partners.

Resource Issues. The SAS[®] IR Assessment Tool requires frequent updating and refinement. Ideally the SAS[®] tool requires one FTE with specialized expertise and a vendor for the Oracle to SAS[®] interface. Resources for the maintenance of the SAS[®] Tool are tied to those described in the SWQMIS section. Current funding support of SWQMIS is from the 106 Categorical Grant.

Texas Basin Assessment Database

Assessment records for the Texas IR are stored in an Access database called the Texas Basin Assessment Database (TXBAD). This information represents the output from the SAS[®] Assessment Tool produced during development of the IR. TXBAD is TCEQ's version of the EPA Assessment Database (ADB). Assessment data is submitted to EPA for each Texas IR based on outputs from the TXBAD database. Plans are being developed to

switch TXBAD from Access to Oracle. This will improve the interface between SWQMIS, the SAS[®] Assessment Tool, and TXBAD.

Using the National Hydrography Dataset

TCEQ began the process of using the National Hydrography Dataset (NHD) to define stream boundaries for the 2010 Texas IR. Stream information used in earlier IRs was not based on the NHD. TCEQ staff has defined all water bodies, including unclassified segments based on the NHD layer. TCEQ currently has assigned segment ID and assessment unit attributes to the 1:24,000 NHD flow lines. The geospatial data layers for the 2010 IR are available on the web. This data set contains segment and assessment unit layers for all classified and unclassified water bodies identified in the 2010 Texas IR. Further refinements to the segment and assessment unit GIS layers were completed for the 2012 Texas IR.

Water Quality Categories and Management Strategy

After the assessment is complete water bodies are placed in appropriate categories. This information is reflected in the IR. EPA guidance recommends that all water bodies be placed into one of five categories. The categories indicate the status of water quality. Categories 4 and 5 (impaired waters) are further divided into subcategories that define specific strategies to address surface waters not meeting water quality standards.

Water Quality Categories

The five water quality categories are defined as follows.

Category 1—Attaining the water quality standard and no use is threatened.

Category 2—Attaining some of the designated uses; no use is threatened; and insufficient or no data and information are available to determine if the remaining uses are attained or threatened.

Category 3—Insufficient or no data and information to determine if any designated use is attained.

Category 4—Standard is not supported or is threatened for one or more designated uses but does not require the development of a TMDL.

Category 4a—TMDL has been completed and approved by USEPA.

Category 4b—Other pollution control requirements are reasonably expected to result in the attainment of the water quality standard in the near future.

Category 4c—Nonsupport of the water quality standard is not caused by a pollutant.

Category 5—The water body does not meet applicable water quality standards or is threatened for one or more designated uses by one or more pollutants. **Category 5 is the 303(d) List of impaired water bodies.**

Category 5a—A TMDL is underway, scheduled, or will be scheduled.

Category 5b—A review of the water quality standards will be conducted before a TMDL is scheduled.

Category 5c—Additional data and information will be collected before a TMDL is scheduled.

Details on each of these categories are included in Chapter 5—*Categorizing Water Quality Conditions for Management Action* of the *Guidance for Assessing and Reporting Surface Water Quality in Texas*.

Addressing Category 5 Impairments

To more effectively address Category 5 impairments TCEQ has initiated the Watershed Action Planning (WAP) process as a coordinated multi-agency approach to develop, coordinate, and track actions to address water quality issues. WAP is a flexible approach that utilizes a range of strategy options from addressing impaired water bodies on the 303(d) List. Information related to these strategies is stored in a database called the WAP Tool. The WAP tool can be queried to identify current and planned activities to address water quality issues in the state. This process provides the framework that each program area, partner agency, and stakeholder can use for planning, budgeting, and implementing activities related to addressing water quality issues.

Public Participation in the IR Process

Public and stakeholder participation are an essential aspect of effective water quality management. Following review by the SWQM Guidance Advisory Workgroup the draft guidance document is revised and assessment of the state's water bodies begins in accordance with the TCEQ guidance.

TCEQ publishes a draft of the Texas IR for a 30-day comment period prior to finalizing the IR. The draft includes a description of the water quality for all water bodies assessed. Detailed information, such as the number of measurements for each parameter, percent of measurements attaining standards, and calculated averages is also included in the IR. The SWQM Program addresses these comments and makes changes as necessary.

Reporting

The TCEQ prepares the following reports, required under the CWA or the Texas Clean Rivers Act, describing the results of the SWQM Program and CRP.

- The Texas IR characterizes the condition and quality trends of waters within the State and is submitted to EPA on April 1 of even numbered years. This is the primary State monitoring program report to EPA and draws upon information from the CRP, NPS program, TMDLs, and other national, state, and local assessments.
- The CWA Section 106(e) report is an annual update of monitoring data.
- CRP Basin Highlight (annual) and Basin Summary reports (every 5 years) are submitted to the TCEQ by the Basin Planning Agencies. The summary reports include the analysis of water quality trends.

Programmatic Evaluation

The TCEQ provides monitoring information to support current and upcoming water quality management program decisions. Overall assessments are supplemented with needed program-specific monitoring to support implementation of water quality management programs. The TCEQ has feedback mechanisms for reporting useful information to water quality managers and incorporating comments for data needs regarding future monitoring designs.

Monitoring conducted by the TCEQ staff, CRP Basin Planning Agencies, and other participating entities (on the local, state, and federal level) is coordinated annually at meetings held in all major river basins. Monitoring schedules generated at these meetings

serve to coordinate the monitoring resources of participating entities at the river basin level. Data gaps identified during the Texas IR assessment and water bodies identified as concerns are considered during the development of the CMS.

Examples of programmatic information needs include, UAAs for site specific criteria modification, validation of the success of best management practice control measures, validation of expected impairments, modeling for TMDLs, RWAs and other related activities. Information from the overall monitoring program is considered when determining intensive monitoring needs.

The TCEQ evaluates its overall monitoring program by undertaking audits of the monitoring program, quality assurance protocols, laboratory procedures, and data assessment procedures.

The TCEQ QA Section completes audits of TCEQ, CRP partner and contract laboratories to ensure that quality assurance protocols, laboratory procedures and correct analytical methods are being utilized. Any laboratory analyzing samples for the SWQM Program are audited by the QA Section. Every other year the TCEQ staff audit CRP partners to ensure that procedures outlined in the SWQM Procedures Manual are followed. Audits of TCEQ regional office SWQM field staff are conducted every other year for field sample collection and data management methods. Audits may be conducted annually on a risk basis. Procedures for these audits are outlined in CRP and SWQM monitoring guidance documents identified in Appendix C.

General Support and Infrastructure

TCEQ identifies current and future monitoring infrastructure needs through the development of federal grant applications. The following needs are assessed every two years, considering current conditions and planned improvements, and negotiated in CWA Section 106 and Planned Partnership Grants (PPG).

- staff and training
- equipment resources
- laboratory resources

Staff and Training

The TCEQ identifies the required number of staff needed for an adequate state monitoring program, as well as necessary training for field, laboratory, data management and data assessment staff, and documents adequacies and shortfalls. The ability of TCEQ regional SWQM staff to provide adequate monitoring coverage to meet program needs is limited in some regions. The gaps in monitoring have been partially filled by CRP. For example, in FY2010 TCEQ field staff monitored 585 sites and CRP 1,241. Between FY2003 and FY2010 the number of sites monitored by TCEQ regional staff has been reduced by approximately 20% or 147 sites. The CRP has seen a reduction of approximately 2.2% or 28 sites over this same time period.

Training on SWQM procedures, including topics such as water, sediment, tissue, and biological sampling methods, use and care of monitoring equipment, safety, and QA occurs for any monitoring entity on a request basis, at special statewide training events, and at the annual SWQM workshop. Topic specific trainings include biological monitoring methods, fish identification, freshwater mussel sampling, or boater safety.

In FY2011, TCEQ applied for CWA Section 106 Categorical Grant funds to support the annual SWQM Workshop as well as travel to water quality related training. This workshop

represents an important part of the statewide monitoring program and is attended by key monitoring staff from the TCEQ central and regional offices and by CRP partner agencies.

In 2009, the TCEQ began development of training modules as a companion to the SWQM procedures manuals. The pilot module was “Measuring Stream Flow”. Each module will consist of a PowerPoint presentation with step by step instructions and a supporting video. The Measuring Stream Flow training module is available on the TCEQ website (see Appendix C).

Equipment Resources

The TCEQ identifies equipment resources needed to carry out statewide monitoring activities. This equipment includes things such as field vehicles, boats, and monitoring equipment. See *SWQM Procedures, Volume 1*, Chapter 9 “Required Equipment and Spare Parts” for a detailed list of required monitoring equipment (see Appendix C).

Laboratory Resources

The TCEQ identifies needed laboratory support to provide scientifically appropriate documented methods, such as methods listed in 40 CFR Part 136 or published in Standard Methods. EPA also encourages the use of performance-based methods (scientifically appropriate methods that meet established criteria for accuracy, sensitivity, bias, precision and comply with specified data quality needs or requirements). The TCEQ Houston Laboratory provides analytical work on water, wastewater, soils, sediment, and sludge for the various TCEQ water programs and EPA. The laboratory also has a state-of-the-art metals-testing area and continues to upgrade and enhance analytical methods and instrumentation capabilities to meet increasing customer demands. The TCEQ Houston Laboratory analyzes approximately 6,000 samples a year. The TCEQ SWQM Program also uses the LCRA Environmental Laboratory for analysis of organics in sediment and organics and metals in tissue. The CRP monitors the partner agency laboratories or contract laboratories to ensure that appropriate methods and resources are being applied to the analysis of samples. To ensure the quality of data used by the TCEQ, the Texas Legislature enacted TWC, Section 5.134(a), which states that the Commission may only accept data for making commission decisions from National Environmental Laboratory Accreditation Program (NELAP) accredited environmental testing laboratories with a few limited exceptions. As of July 1, 2008, analytical data submitted to TCEQ that is intended to characterize or assess an environmental process or condition must be generated by a laboratory accredited by the Texas Laboratory Accreditation Program under the NELAP Standards (see Appendix C).

Resource Issues: Currently, NELAC documentation requirements are the burden of the laboratories and the costs are passed on to the data collectors resulting in some reduction in the number of samples collected (see Appendix C).

Funding

The TCEQ identifies required funding (salaries, training, travel, equipment, laboratory analysis) for an adequate state monitoring program, along with anticipated sources and amounts of funding and the effects of any shortfalls. Funding for water quality management activities comes from a wide range of federal and state sources. However, impacts to maintaining a state monitoring program include have sufficient resources as well as funding.

SWQM Funding

CWA Section 106 Performance Partnership Grant Funds

The basic funding source for the SWQM Program is the CWA Section 106 Performance Partnership Grant (PPG). TCEQ regional staffs that perform SWQM related tasks receive a portion of these 106 funds allocated for field inspections and complaint response. Other programs funded by the 106 PPG include wastewater permitting, compliance support, and enforcement.

CWA Section 106 Categorical Funds

SWQM also receives Section 106 Categorical funds for special projects. Project proposals are reviewed and prioritized by WQPD management. Projects funded with this grant for FY2012-2013 include statewide fish tissue monitoring, travel and training for MAS staff, TMDL monitoring and development, 5b and 5c projects, support of the Pecos River CWQMN, WQS development, monitoring and assessment training, maintenance and support for SWQMIS data base, seagrass monitoring protocol development, and nutrient monitoring. Project proposals vary in different grant cycles and may support the full range of activities defined in this monitoring and assessment strategy.

CRP Funding

The CRP funds spent on monitoring are a portion of the total state funds provided to the CRP planning agencies. The CRP provides funding annually to the 15 planning agencies. In FY 2010-2011, approximately 50% was spent on monitoring; the partners spent the rest of the funds on quality assurance, data management, public outreach, and report writing. The in-kind contributions are estimated to be approximately 35% of total CRP funding, so an additional \$1,575,000 was contributed to monitoring efforts statewide. The CRP was authorized by the state legislature in 1991 with a \$5,000,000 fee revenue structure. Funding remained at or near the originally authorized \$5,000,000 until FY 2012. In FY 2012 and 2013, state funding for the CRP has been reduced.

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- . 2010e. *Continuous Water Quality Monitoring Network Quality Assurance Project Plan*. Surface Water Quality Monitoring Program, Water Quality Planning Division, Austin TX.
- Twidwell, S. and J. Davis. 1989. *An Assessment of Six Least Disturbed Streams*. Texas Water Commission, Austin, TX.
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- Wagner, R.J., R.W. Boulger, Jr., C.J. Oblinger, and B.A. Smith. 2006. *Guidelines and Standard Procedures for Continuous Water-Quality Monitors: Station Operation, Record Computation, and Data Reporting*. U.S. Geological Survey, Techniques and Methods 1-D3 (TM1D3). Reston, Virginia.

Appendix A

Core Routine Water and Field

Y - Priority Parameters for Regulatory Purposes

Conventional Parameters-Inorganic	Priority Parameters	Use in Assessment
Alkalinity, Total (mg/L as CaCO ₃)		
Total Suspended Solids (mg/L)**		
Volatile Suspended Solids (mg/L)		
Total Dissolved Solids (mg/L)	Y	General Use
Chloride (mg/L as Cl)	Y	General Use
Sulfate (mg/L as SO ₄)	Y	General Use
Total Organic Carbon (mg/L as C)		
**Total suspended solids are not used for regulatory purposes but are extremely important as an indicator of water quality degradation by sedimentation.		
Conventional Parameters-Nutrients	Priority Parameters	Use in Assessment
Nitrate + Nitrate-Nitrogen (mg/L as N)	Y	Concern
Ammonia-Nitrogen (mg/L as N)	Y	Concern
Orthophosphorus (mg/L as P)	Y	Concern
Total Phosphorus (mg/L as P)	Y	Concern
Chlorophyll- <i>a</i> (µg/L)	Y	Concern
Bacteria	Priority Parameters	Use in Assessment
Fecal Coliform (#/100 ml)	Y	Recreation
<i>E. coli</i> (#/100 ml) (freshwater only)	Y	Recreation
Enterococcus (#/100 ml) (marine only)	Y	Recreation
Flow	Priority Parameters	Use in Assessment
Flow:1=No Flow, 2=Low, 3=Normal, 4=Flood, 5=High, 6=Dry	Y	7Q2
Instantaneous Flow Stream (cfs, ft ³ /s)	Y	7Q2
Field	Priority Parameters	Use in Assessment
Water Temperature (°C)	Y	General Use
pH (standard units)	Y	General Use
Dissolved Oxygen (mg/L)	Y	Aquatic Life
Specific Conductance (µS/cm @ 25°C)	Y	General Use
SecchiDisk Transparency (meters)	Y	Trophic Status

Core Metals-In-Water

Metals- in- Water	Priority Parameters	Use in Assessment
Dissolved (µg/L)		
Aluminum (Al)	Y	Aquatic Life
Arsenic (As)	Y	Aquatic Life/Human Health
Cadmium (Cd)	Y	Aquatic Life/Human Health
Chromium (Cr)	Y	Aquatic Life
Copper(Cu)	Y	Aquatic Life
Lead (Pb)	Y	Aquatic Life/Human Health
Nickel (Ni)	Y	Aquatic Life
Silver (Ag)	Y	Aquatic Life
Zinc (Zn)	Y	Aquatic Life
Barium (Ba)	Y	Human Health
Total (µg/L)		
Mercury (Hg)	Y	Aquatic Life/Human Health
Selenium (Se)	Y	Aquatic Life/Human Health
Total Hardness (mg/L as CaCO ₃)	Y	Calculating Site Specific Standards (Aquatic Life)

Core Metals-In-Sediment

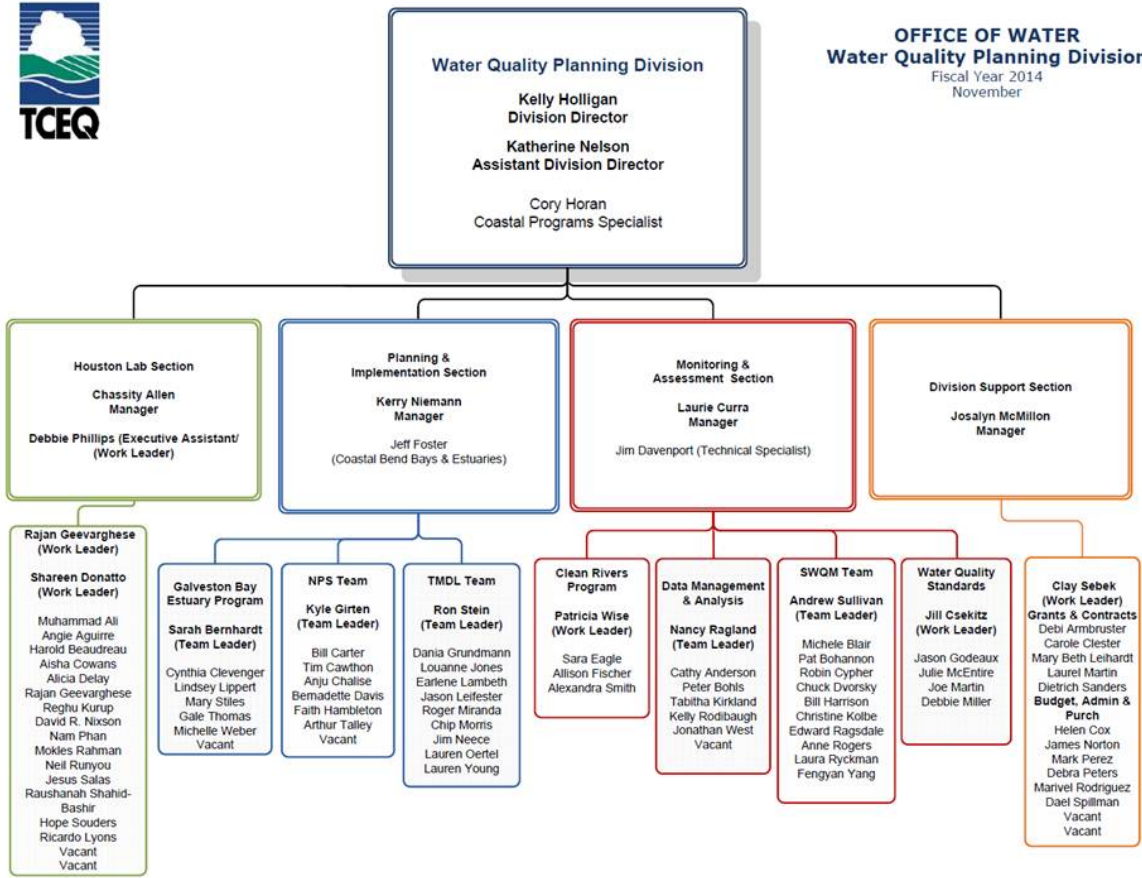
Metals in Sediment (mg/kg-dry weight)	Priority Parameters	Use in Assessment
Aluminum (Al)	Y	Concern
Arsenic (As)	Y	Concern
Barium (Ba)	Y	Concern
Cadmium (Ca)	Y	Concern
Chromium (Cr)	Y	Concern
Copper (Cu)	Y	Concern
Lead (Pb)	Y	Concern
Manganese (Mn)	Y	Concern
Mercury (Hg)	Y	Concern
Nickel (Ni)	Y	Concern
Selenium (Se)	Y	Concern
Silver (Ag)	Y	Concern
Zinc (Zn)	Y	Concern

Appendix B

Organizational Chart



OFFICE OF WATER
Water Quality Planning Division
 Fiscal Year 2014
 November



Appendix C

Internet Resources

Resource	Internet URL
Guidance Documents	
Texas Administrative Code (TAC), Title 30, Part 1, Chapter 307.9, <i>Determination of Standards Attainment of the Texas Surface Water Quality Standards</i>	http://www.tceq.texas.gov/permitting/water_quality/wq_assessment/standards/eq_swqs.html
<i>SWQM Procedures, Volumes 1 and 2 Manuals</i>	http://www.tceq.texas.gov/waterquality/monitoring/swqm_guides.html ;
Forms and Worksheets	http://www.tceq.texas.gov/waterquality/monitoring/swqm_forms-n-quality.html
Interim Change Procedures	http://www.tceq.texas.gov/waterquality/monitoring/swqm_manualupdate.html
Drought Monitoring Guidance	http://www.tceq.texas.gov/waterquality/monitoring/swqm_guides.html
<i>Guidance for Assessing and Reporting Surface Water Quality in Texas</i>	http://www.tceq.texas.gov/waterquality/assessment/305_303.html
Texas Water Code (TWC), Title 2. Water Administration, Section 26.0135- <i>Watershed Monitoring and Assessment of Water Quality</i>	http://www.tceq.texas.gov/waterquality/standards/WQ_standards_intro.html
Texas Administrative Code (TAC), Title 30, Part 1, Chapter 220, Regional Assessments of Water Quality, Subchapter A- <i>Program for Monitoring and Assessment of Water Quality by Watershed and River Basin</i>	http://www.tceq.texas.gov/waterquality/clean-rivers/index.html#governing
CRP Long Term Plan	http://www.tceq.texas.gov/assets/public/compliance/monops/crp/CRP-LongTermPlan06.pdf
<i>Clean Rivers Program Guidance—Task 3: Water Quality Monitoring</i>	http://www.tceq.texas.gov/waterquality/clean-rivers/guidance/index.html
Statewide Coordinated Monitoring Schedule	http://cms.lcra.org/
Monitoring Documents and Resources	
Texas Clean Rivers Program Partners	http://www.tceq.texas.gov/waterquality/clean-rivers/partners.html
TCEQ Watershed Characterization	http://txpub.usgs.gov/TCEQ/index.aspx
Texas Seagrass Monitoring Program	http://www.tpwd.state.tx.us/landwater/water/habitats/seagrass/monitoring.phtml
Seagrass Monitoring Program for Texas Coastal Waters	http://texasseagrass.org/index.html
DSHS Shellfish Classification Maps	http://www.dshs.state.tx.us/seafood/classification.shtm
DSHS information, maps, and risk characterizations related to fish consumption advisories or bans	http://www.dshs.state.tx.us/seafood/survey.shtm
<i>Texas Health and Safety Code; Chapter 436 Texas Aquatic Life Act—Fish Consumption Advisories</i>	http://www.statutes.legis.state.tx.us/Docs/HS/htm/HS.436.htm
Fish Tissue Monitoring	http://www.gbep.state.tx.us/hot-topics/seafood-safety.asp http://www.cbbep.org/projectsfishsurvey.html
General Land Office —Texas Beach Watch Program	http://texasbeachwatch.com/
Harmful Algal Blooms (HABs)—golden alga and red tide status and response	http://www.tpwd.state.tx.us/landwater/water/environconcerns/hab/

Resource	Internet URL
CWQMN Resources	
CWQMN Resources	http://www.tceq.texas.gov/waterquality/monitoring/swqm_realttime.html
<i>CWQMN QAPP</i>	http://www.tceq.texas.gov/assets/public/compliance/monops/water/wqm/cwqmn_qapp.pdf
CWQMN Site Information	http://www.tceq.state.tx.us/cgi-bin/compliance/monops/water_site_info.pl
CWQMN Project Plans	http://www.tceq.texas.gov/waterquality/monitoring/cwqmn_projectplans.html
CWQMN Standard Operating Procedures	http://www.tceq.texas.gov/waterquality/monitoring/cwqmn_sops.html
CWQMN Rio Grande Basin-Project Highlights— <i>Lower Rio Grande</i>	http://www.tceq.texas.gov/assets/public/compliance/monops/water/wqm/lrg_cwqm_proj_summ.pdf
CWQMN Rio Grande Basin-Project Highlights— <i>Upper Rio Grande</i>	http://www.tceq.texas.gov/assets/public/compliance/monops/water/wqm/riogrande_salinitysummary.pdf
Quality Assurance	
TCEQ <i>Quality Management Plan</i>	http://www.tceq.texas.gov/compliance/compliance_support/qa/quality.html
<i>SWQM QAPP</i>	http://www.tceq.texas.gov/waterquality/monitoring/swqm_guides.html
CRP Quality Assurance Information	http://www.tceq.texas.gov/waterquality/clean-rivers/qa/index.html
NELAC Accreditation	http://www.tceq.texas.gov/compliance/compliance_support/qa/lab_accred_certif.html
<i>Clean Rivers Program Guidance Document—Task 2: Quality Assurance</i>	http://www.tceq.texas.gov/waterquality/clean-rivers/guidance/index.html
Data Management	
Managing Surface Water Quality Data	http://www.tceq.texas.gov/waterquality/data-management/wdma_data.html
<i>Data Management Reference Guide (DMRG)</i>	http://www.tceq.texas.gov/waterquality/data-management/dmrg_index.html
Surface Water Quality Web Reporting Tool	http://www8.tceq.state.tx.us/SwqmisWeb/public/index.faces
Data Management Forms and References for Monitoring Surface Water Quality	http://www.tceq.texas.gov/waterquality/data-management/wdma_forms.html
Texas Water Data	http://www.tceq.texas.gov/waterquality/monitoring/txwaterdata.html
CWQMN Data Access	http://www.tceq.state.tx.us/cgi-bin/compliance/monops/water_site_info.pl
Water Quality Assessment Resources	
Texas Integrated Report	http://www.tceq.texas.gov/waterquality/assessment/305_303.html
Guidance for Assessing and Reporting Surface Water Quality in Texas	http://www.tceq.texas.gov/waterquality/assessment/305_303.html
Guidance Advisory Workgroup	http://www.tceq.texas.gov/waterquality/assessment/swqmgawg.html
<i>Clean Rivers Program Guidance Document—Task 5: Data Analysis and Reporting</i>	http://www.tceq.texas.gov/waterquality/clean-rivers/guidance/index.html
Texas Surface Water Quality Standards	http://www.tceq.texas.gov/waterquality/standards/WQ_standards_intro.html
Procedures to Implement the Texas Surface Water Quality Standards	http://www.tceq.texas.gov/permitting/water_quality/wq_assessment/standards/WQ_standards_implementing.html

Resource	Internet URL
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Water Quality Assessment Resources (continued)

Texas Administrative Code (TAC), Title 30, Part 1, Chapter 307, Texas Surface Water Quality Standards	http://info.sos.state.tx.us/pls/pub/readtac\$ext.ViewTAC?tac_view=4&ti=30&pt=1&ch=307&rl=Y
Texas Water Code (TWC), Title 2, Chapter 26, Section 26.023, Water Quality Standards	http://www.statutes.legis.state.tx.us/Docs/WA/htm/WA.26.htm
Atlas of Texas Surface Waters	http://www.tceq.texas.gov/publications/gi/gi-316/index.html
Geospatial data layers for Texas water bodies (segments and assessment units)	http://www.tceq.texas.gov/gis/hydro.html
Watershed Action Planning	http://www.tceq.texas.gov/waterquality/nonpoint-source/mgmt-plan

General Support and Infrastructure Information

Stream Flow Measurement Training Module	http://www.tceq.texas.gov/waterquality/monitoring/swqm_guides.html#training
NELAC Accreditation	http://www.tceq.texas.gov/compliance/compliance_support/qa/lab_accred_certif.html

Appendix D

Fish Tissue Monitoring Priority List

DSHS Tier 2 Fish Tissue Monitoring and Human Health Risk Assessment Priority Water Body Assessment Ranking List *

Assessment Ranking	Water Body	TCEQ Segment(s)	Contaminant(s) of Concern	Assessment Ranking Notes
1	Trinity River Basin	0801, 0802, 0804, 0805, 0819, 0822, 0825	PCBs and dioxin	Existing fish advisory in Upper Trinity River Basin. DSHS most downstream site at SH 31, fish had high PCB and dioxin concentrations. High concentrations of PCBs documented in alligator gar by TPWD above and below Lake Livingston
2	Lake Livingston	803	PCBs and dioxin	Old DSHS PCB data and known PCB and dioxin contamination of Upper Trinity River Basin
3	Houston Ship Channel	1001, 1005, 1006, 1007, 1013	PCBs, pesticides, and dioxin	Existing fish advisory in place for Houston Ship Channel (HSC). Pesticide concentrations have steadily declined over the years and may have declined to concentrations that may allow DSHS to remove pesticides from the contaminant(s) of concern list for the HSC.
4	Arroyo Colorado	2202	DDE, mercury, and PCBs	Existing fish advisory in place for Arroyo Colorado Above Tidal. Pesticide concentrations have steadily declined over the years and may have declined to concentrations that may allow DSHS to remove DDE from the contaminant(s) of concern list for the Arroyo Colorado Above Tidal
5	Sabine River	0501, 0502, 0503, 0505, 0506	Mercury	TPWD data mercury screening exceedance in LMB, SPG, FHC, FWD, and bowfin
6	Lake Amistad	2305	Mercury	TPWD data mercury screening exceedance in LMB and STB
7	Lake Travis	1404	Mercury and PCBs	TPWD data mercury screening exceedance in LMB; EPA NFTS data mercury screening exceedance in LMB; EPA NFTS data PCBs screening exceedance in CRP
8	Echo Lake	0806B	PCBs	Existing fish possession/consumption ban in place for Echo Lake. PCBs concentrations have slowly declined over the years and may have declined to concentrations that may allow DSHS to rescind the possession ban and issue a fish consumption advisory.
9	Fosdic Lake	0806A	PCBs	Existing fish advisory in place for Fosdic Lake. PCBs concentrations have slowly declined over the years and may have declined to concentrations that may allow DSHS to rescind the fish consumption advisory.

DSHS Tier 2 Fish Tissue Monitoring and Human Health Risk Assessment Priority Water Body Assessment Ranking List *

Assessment Ranking	Water Body	TCEQ Segment(s)	Contaminant(s) of Concern	Assessment Ranking Notes
10	Trinity River Advisory Area (TPWD stocked rainbow trout)	829	PCBs and dioxin	TPWD and Trinity River Authority annually stock rainbow trout at Trinity Park and River Park on the Clear Fork of the Trinity River. This fish are stocked in an existing advisory area. No rainbow trout contaminant data available
11	Palo Duro	0199A	Mercury	Statewide Fish Tissue Monitoring Project mercury screening exceedance in LMB
12	Lake Tawakoni	507	PCBs	EPA NFTS data PCBs screening exceedance in CCF
13	Lake Lewisville	823	PCBs	EPA NFTS data PCBs screening exceedance in BUF and LMB
14	Toledo Bend Reservoir	504	Dioxin	EPA NFTS data dioxin screening exceedance in BUF
15	Bardwell Reservoir	815	Arsenic, DDE, and PCBs	Statewide Fish Tissue Monitoring Project arsenic screening exceedance in FWD; EPA NFTS data DDE, PCBs screening exceedance in CRP
16	Lake Texoma	203	DDE and PCBs	EPA NFTS data PCBs screening exceedance in BUF
17	Lake Lavon	821	DDE and PCBs	EPA NFTS data DDE and PCBs screening exceedance in BUF and CRP
18	Lake Palestine	605	PCBs	EPA NFTS data PCBs screening exceedance in CRP
19	Lake Belton	1220	PCBs	EPA NFTS data PCBs screening exceedance in BUF
20	Hubbard Creek Reservoir	1233	PCBs	EPA NFTS data PCBs screening exceedance in BUF
21	Stillhouse Hollow Reservoir	1216	PCBs	EPA NFTS data PCBs screening exceedance in CRP
22	Lake O' the Pines	403	PCBs	Public concerns regarding PCBs due Ellison Creek Reservoir outfall into Lake O' Pines
23	Lake Arrowhead	212	Arsenic	Statewide Fish Tissue Monitoring Project arsenic screening exceedance in LMB
24	Lake Kickapoo	213	Arsenic	Statewide Fish Tissue Monitoring Project arsenic screening exceedance in LMB
25	Lake Dunlap	1804	Arsenic	Statewide Fish Tissue Monitoring Project arsenic screening exceedance in CRP
26	Lake McQueeney	1804	Arsenic	Statewide Fish Tissue Monitoring Project arsenic screening exceedance in CRP

* This list is subject to revision based on changing priorities and data needs.

Appendix E

Timelines

FY 2012-2017 Timeline	January	February	March	April	May	June	July	August	September	October	November	December	
Coordinated Monitoring Schedule (CMS) Development — (annually prior to each new fiscal year)	CMS guidance development		Coordinated Monitoring Meetings										
			CMS development										
	CMS monitoring (Sept 1—Aug 31)												
Annual SWQM Workshop			Planning							Workshop			
SWQM QAPP (annually)	Prepare QAPP annual update; complete revision every two years			Internal review (30 days) and edits		Internal approval	Submit to EPA for 60 day review		Final QAPP 9/1				
CRP Partner QAPPs (annually)	Annual update draft due June 15th to TCEQ; New QAPP every two years						Approved QAPP revision or update due on 8/31						
CWQMN QAPP (annually)											Prepare annual revision		
	Internal review and signature		EPA 60 day review and approval										
Integrated Report (every 2-years)	Final data submittal to SWQIS for IR period of record (odd year)			IR Guidance Advisory Workgroup Preparation & Meeting (odd year)					Data analysis (odd year)		Data provider & internal review (odd year)		
					SAS Assessment Tool Preparation (odd year)								
	Public comment (even year)	Revision and internal approval; submission to EPA by April 1 (even year)											

FY 2012-2017 Timeline	January	February	March	April	May	June	July	August	September	October	November	December
Low Level Nutrient Monitoring (2-year project)									Annual QAPP update			
	Monthly sample collection											
Seagrass Monitoring (2-year project; 2012-2014)		QAPP development and approval-Year 1						Field work-Year 1		Data analysis-Year 1		
	Data analysis-Year 2											
Least Disturbed Streams In Texas (5 year project)		Annual QAP updates			Field work					Data analysis		
	Data analysis											
Probabilistic Monitoring									Grant application			
	Planning and training				Field work—FY12 NLA; FY13-14 NRSA; FY15 NCCA; FY16 NWCA; FY17 NLA					Submit final samples and data packets		