March 2011
Rev. 5

Quality Assurance Project Plan for Continuous Water Quality Monitoring Network Program

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Water Quality Planning Division
TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Quality Assurance Project Plan for Continuous Water Quality Monitoring Network Program

Prepared by
Monitoring and Assessment Section
Water Quality Planning Division
(512) 239-1314

March 2011

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A1.1 Preface

Continuous Water Quality Monitoring Network Quality Assurance Project Plan

EPA Grant No. 98665305

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Curry Jones 4/6/11
Curry Jones Date
Section Chief, State/Tribal

The TCEQ will secure written documentation from each sub-tier project participant (e.g., subcontractors, organizations operating sites, laboratories) stating the organization's commitment to requirements contained in this quality assurance project plan and any amendments. The TCEQ will maintain this documentation as part of the project's quality assurance records, and will ensure this documentation is available for review. (See sample letter in Appendix E of this document.)

A2 Table of Contents

The current revision of the Continuous Water Quality Monitoring Network (CWQMN) Quality Assurance Project plan (QAPP) is available at:
(www.texaswaterdata.org)

Section	Title	Pages	Revision	Date
	PROJECT MANAGEMENT			
A1	Title and Approval Sheet A1.1 Preface A1.2 Approval Page	11	5	1/11
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A3	Distribution List	5	5	1/11
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A5	Project Definition/Background	6	5	1/11
A6	Project/Task Description	7	5	1/11
A7	Quality Objectives and Criteria A7.1 Multiprobe Galvanic Membrane Electrode DO Method A7.2 Specifications for Water level and Sample Depth Measurements A7.3 CWQMN Turbidity Measurements A7.4 Ambient Water Reporting Limits A7.5 Representatives A7.6 Comparability	8	5	1/11

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A8	Special Training/Certification	1	4	1/10
A9	Documentation and Records A9.1 Documentation of Procedures and Objectives A9.2 Record Keeping A9.3 Data Reporting A9.4 Documentation Control Plan	3	4	1/11
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B1	Sampling Process Design B1.1 Network Design/Siting Rationale B1.2 CWQMN Site Proposals B1.3 Monitoring Station Design	2	5	1/11
B2	Sampling Methods B2.1 Monitoring Equipment B2.2 Sampling/Measurement System Corrective Action	8	5	1/11
B3	Sample Handling and Custody	1	3	1/09
B4	Analytical Methods	2	5	1/11
B5	Quality Control	6	5	1/11
B6	Instrument/Equipment Testing, Inspection, and Maintenance	2	5	1/11
B7	Instrument Calibration and Frequency	2	5	1/11
B8	Inspection/Acceptance for Supplies and Consumables B8.1 Spare Parts B8.2 Standards and Reagents	1	4	1/10
B9	Non-Direct Measurements	1	4	1/10
B10	Data Management B10.1 Data Reporting	4	4	1/11
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C1	Assessments and Response Actions	3	5	1/11
C2	Reports to Management	2	5	1/11

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Section	Title	Pages	Revision	Date
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D3	Reconciliation with User Requirements	1	4	1/10

A2.1 List of Figures

Section		Title	Pages	Revision	Date
A4	Figure A4.1	Project Organization Chart	1	5	1/11

A2.2 List of Tables

Section		Title	Pages	Revision	Date
A5	Table A5.1	CWQMN Objectives and Locations	5	5	1/11
A6	Table A6.1	Site Operators and Data Validators	2	5	1/11
A6	Table A6.2	Schedule of Activities	2	5	1/11
A7	Table A7.1	DQOs for Sondes (Multi-Probes)	2	5	1/11
A7	Table A7.2	MQOs for In-Situ TROLL 500 Level Sensor	1	5	1/11
A7	Table A7.3	DQOs and MQOs for Greenspan Aqualab Auto Analyzer	2	3	1/11
A9	Table A9.1	CWQMN Record Location	1	3	1/11
B2	Table B2.1	Monitoring Methods and Equipment	4	5	1/11
B2	Table B2.2	Aqualab Analyzer Measurement Frequencies	1	3	1/09
B10	SWQMIS Table B10.1 Parameters		1	4	1/10/11
C2	Table C2.1	Reports to Management and Actions Taken	1	5	1/11
D1	Table D1.1	Greenspan Aqualab Analyzer Performance Criteria and Frequency of QC Checks	1	4	1/10/10
D2	Table D2.1	Data Validation Flags (Qualifiers)	1	4	1/10/10

A2.3 List of Appendices

Appendix	Title	Pages	Revision	Date
A	Definitions	5	4	1/09
B	Acronyms	3	4	1/11
C	CWQMN Project Plan Shell	11	5	1/11
D	References	1	4	1/11
E	Operator Log Content	2	3	1/11
F	Site Evaluation Form	1	0	1/11
G	Example Letter to Document Adherence to the QAPP	1	0	1/09

A2.4 CWQMN Standard Operating Procedures

Table A2.4

CWQMN Standard Operating Procedures are available via the internet at: (www.texaswaterdata.org)

SOP	Title	Pages	Revision	Effective Date
MANP-001	SOP for Site Selection, Preparation, and Deployment of CWQMSs	24	1	2/13/07
DQRP-015	Validation of Continuous Water Quality Monitoring Data Collected by Multiparameter Sonde	9	1	8/1/07
NA	Validation of Continuous Water Quality Monitoring Data Collected by Multiparameter Sonde	2	2	1/19/10
AMPM-008	Measurement of Water Level and Sensor Depth in Surface Water using the In-Situ Level TROLL 500	9	0	10/1/07
NA	QA of External Party Continuous Water Quality Data Validation	9	2	12/22/09
MAIN-022	Procedure to Perform Preventive Maintenance Inspections (PMIs) for the Greenspan Aqualab Auto-Analyzers AQ1098, AQ1110, AQ1111, AQ1112, and AQ 1113	21	1	6/22/07
AMPM-011	Analysis of DO, SC, pH, Temperature, Sample Depth, and *in vivo* Chlorophyll Detection in Ambient Surface Water Using Yellow Springs Instrument (YSI) 6-Series Sondes	19	1	6/16/08
AMPM-012	Analysis of Nitrate (NO_3) in Ambient Surface Water Using an Aqualab Greenspan Continuous Auto-Analyzer	15	0	6/1/06
AMPM-013	Analysis of Ammonia (NH_3) in Ambient Surface Water Using an Aqualab Greenspan Continuous Auto-Analyzer	15	0	6/1/06
AMPM-014	Analysis of Total Reactive Phosphorus in Ambient Surface Water Using a Aqualab Greenspan Continuous Auto-Analyzer	16	1	6/16/08
AMPM-015	Analysis of DO in Ambient Surface Water Using an Greenspan Aqualab Continuous Auto-Analyzer	12	0	6/22/06
AMPM-016	Analysis of Electrical Conductivity in Ambient Surface Water Using an Greenspan Aqualab Continuous Auto-Analyzer	16	0	6/22/06
AMPM-017	Analysis of pH in Ambient Surface Water Using an Greenspan Aqualab Continuous Auto-Analyzer	14	0	6/22/06
AMPM-018	Analysis of Turbidity in Ambient Surface Water Using an Greenspan Aqualab Continuous Auto-Analyzer	13	0	6/30/06

A2.4 CWQMN Standard Operating Procedures (continued)

Table A2.4

SOP	Title	Pages	Revision	Effective Date
AMPM-019	Analysis of DO, Electrical Conductivity, pH, and Temperature, in Ambient Surface Water Using Greenspan CS4-1200 Sondes	17	0	6/16/08
AMPM-020	Analysis of TP and TRP in Ambient Surface Water Using a Aqualab Greenspan Continuous Auto-Analyzer TP1119	16	0	6/16/08

A2.5 CWQMN Project Plans

CWQMN Project Plans are available via the internet (see link below). Throughout the year, approved CWQMN Project Plans may be posted on the CWQMN web page. Consequently, the CWQMN web page may contain additional Project Plans that are not listed in this table.

(www.texaswaterdata.org)

Table A2.5

CWQMN Project Plans

CAMS	Title	Pages	Date
TCEQ Project Plans			
726	Scarborough Creek Environmental Monitoring and Response System Project Plan	22	4/3/07
742	TCEQ/City of Waco Lake Waco Headwater Project Plan	21	5/17/07
743, 744	North Concho River Project Plan	37	8/13/07
748	Lake Granbury Project Plan	19	9/20/07
746, 747	Wichita River Project Plan	17	12/4/07
768	Devils River Project Plan	18	3/5/08
764	Independence Creek Project Plan	24	3/13/08
749	Pine Island Bayou	17	3/17/08
728, 765	Little Duffau Creek and Un-named Tributary of Little Duffau EMRS Project Plan	21	4/28/08
767, 781, 782	Lower Rio Grande Valley Project Plan	15	3/25/09
787	Big Cypress Bayou Project Plan	18	4/5/10
793, 789, 792,736, 791	Lower Rio Grande Valley EMRSProject Plan	19	6/14/10
United States Geological Survey (USGS)/TCEQ Project Plans			
757, 758, 759	USGS Rio Grande River Project Plan (Water Quality & Stream Discharge)	106	7/31/07
729, 735, 709, 710	USGS Pecos River Project Plan (Stream Discharge)	72	7/31/07
762	USGS North Bosque River at Valley Mills, TX Project Plan (Stream Discharge)	78	7/31/07
761	USGS Clear Creek at Mykawa Street near Pearland, TX Project Plan (Water Quality)	42	7/31/07
746	USGS Wichita River Project Plan (Stream Discharge)	71	12/19/07

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The Texas Commission on Environmental Quality will provide copies of this Quality Assurance Project Plan and any amendments or appendices of this plan to each person on this list and to each sub-tier project participant, e.g., subcontractors, organizations operating sites, laboratories. The TCEQ will document distribution of the plan and any amendments and appendices, maintain this documentation as part of the project's quality assurance records, and will ensure this documentation is available for review.

A4 Project/Task Organization

The TCEQ CWQMN Program is administered by the Monitoring & Assessment Section of the WQPD. The CWQMN is operated by TCEQ regional staff, cooperators, and contractors. The TCEQ's FOSD provides critical network infrastructure support. This QAPP is specific to the activities of the TCEQ. The organization of the CWQMN project is shown in Figure A4.1. The interrelationships and responsibilities of the participants in these projects are listed below:

A4.1 Project Sponsor, WQPD (Kelly Holligan)

Sets the preliminary objectives for the project.

- Allocates adequate resources to ensure completion of the project in compliance with the stated objectives.

A4.2 CWQMN Network Coordinator, WQPD (Chuck Dvorsky)

- Overall coordination of the CWQMN and primary contact.
- Develops and communicates objectives for the CWQMN.
- Coordinates and facilitates development of site-specific DQOs or MQOs.
- Approves sampling sites after consultation with TCEQ staff and stakeholders.
- Responsible for establishing new monitoring stations and integrating stations into the existing monitoring network.
- Completes Site Initiation Forms, Lease Agreements, Site Access Agreements, and Data Validation Initiation forms for new sites.
- Provides project planning and prepares comments and project status reports.
- Provides WQPD Management quarterly updates on CWQMN and EMRS.
- Organizes quarterly training for site operators.
- Coordinates all document reviews.
- Facilitates quarterly CWQMN and EMRS team meetings.
- Provides WQPD management quarterly network site updates.

A4.3 CWQMN Program Manager, WQPD (Andrew Sullivan)

- Maintains a thorough knowledge of program work activities, commitments, deliverables, and time frames.
- Develops necessary lines of communication and good working relationships between the lead division staff and personnel of other divisions and organizations participating in the program.
- Determines acceptability of the measurement data process and QA/QC protocols.
- Advises management when CWQMN objectives, timetables, tasks, and coordination procedures are not being met.
- Elevates CWQMN/FOSDs scheduling conflicts and other issues requiring resolution through the appropriate management chain(s) when appropriate.
- Maintains oversight of contracts and intergovernmental agreements of the CWQMN.

- Manages various budgets associated with the EPA grants and state funding.
- Implementation of CWQMN deployment schedule with FOSD.
- Monitors the effectiveness of the overall program quality system.
- Participates in the development of site specific DQOs or MQOs.
- Selects SWQM Project Leads for specific CWQMN projects.
- Provides feedback to supervisory and administrative personnel as necessary regarding the performance of project leads and managers.
- Participates in CWQMN/EMRS meetings.

A4.4 Project Leads, WQPD, Surface Water Quality Monitoring

- Responsible for the overall coordination of a project.
- Identifies representative project site(s) with input from interested parties.
- Participates in the development of DQOs or MQOs.
- Writes CWQMN Project Plans.
- Participates in the installation of sampling equipment.
- Researches, tests, prepare specifications, and purchase requests for monitoring instrumentation.
- Primary lead to coordinate station monitoring equipment repair and identification and resolution of analytical failures.
- Trains operators and cooperators on monitoring instrumentation and quality control procedures.
- Prepares purchase request for items or services related to Continuous Ambient Monitoring Stations site preparations, equipment maintenance contracts, and CWQMN operation contracts.
- Prepares and manages contractual agreements for support services related to the project.
- Coordinates with FOSD Ambient Monitoring staff to establish and modify priorities for station deployment and repairs.
- Coordinates travel and hotel reservations for CWQMN deployments and/or revisits for repairs (if a project lead is participating in the travel event).
- Participate in the development, implementation, and revisions of SOPs.
- Provides technical assistance to managers and operators.
- Notifies Data Management and Analysis staff when sites are deployed and determines a start date for data validation activities.
- Participate in CWQMN/EMRS meetings.

A4.5 FOSD

- Provides overall support and logistics for monitoring site deployments, including: building, modifying and repairing equipment, support structures, and trailers; fabricating monitoring equipment support structures; and preparing specifications and Purchase Requests for support equipment.
- Researches, test, and prepare specifications for infrastructure items and prepare Purchase Requests for infrastructure items and submit the specifications to WQPD for approval.
- Provides technical support for testing and installation of new water quality monitoring technology or applications.

- Maintains a stocked and inventoried supply of parts, equipment, and instrumentation for CWQMN deployments, operations, maintenance/repair, and a supply of parts for SWQM water quality equipment with unit costs under $3,000.
- Maintains an inventory of, and allow WQPD access to, items commonly used in both the air and the water monitoring networks.
- Maintains a database of modems used by the air and water monitoring programs with assistance from WQPD.
- Initiates TCEQ inventory control documentation for purchased items received over $3,000.
- Provides overall support of monitoring station communication and electronic data acquisition needs and provide training on the operation of communications equipment.
- Primary lead on training operators, and cooperators on monitoring station communication equipment and infrastructure.
- Lead for identification of communication/telemetry problems.
- As needed, FOSD will provide shipping, tracking, and receiving services to WQPD for CWQMN parts and supplies.
- Coordinates activities related to the LEADS for both water and air monitoring.
- Provides LEADS site registration for CWQMN sites and will establish accounts for CWQMN operators and validators to access Manual Validation.
- Maintains the repository and the internal/external LEADS-based web. This includes FOSD RHONE web pages with water data reports, water data status pages, and online network documentation.
- Maintains the WQPDs Interactive Flash Maps, the Static Maps and associated scripted map files, the EMRS water listserv administration, and water related Perl script edits to Rhone and WWW.
- Responsible for commenting on, signing, and adhering to the CWQMN QAPP, CWQMN Project Plans, and CWQMN SOPs.
- Participate in CWQMN/EMRS meetings.

A4.6 Data Management and Analysis Team, WQPD

- Reviews, verifies and validates CWQMN data.
- Provides technical support for analyzing and interpreting the data collected from the CWQMN.
- Provides data validation training to interested parties, cooperators and contractors.
- Provides technical support on statistical evaluation issues that may arise.
- Documents all data management activities.
- Establishes procedures to routinely assess data precision, accuracy, and completeness.
- Participates in the development, approval, implementation and maintenance of written QA standards (e.g., SOPs, QAPPs) and other guidance documents.
- Participate in CWQMN/EMRS meetings.
- Audits validation of CWQMN data performed by non-TCEQ data validators.
- Responsible for generating data completeness reports for CWQMN sites.

- Coordinates the development and maintenance of the SWQMIS for warehousing all CWQMN data.
- Coordinates the development of interfaces between LEADS and SWQMIS with FOSD.

A4.7 CWQMN QA Officer, FOSD (Sharon Coleman)

- Provides oversight of all QA activities.
- Participates in the development, approval, implementation and maintenance of written QA standards (e.g., QMP and QAPPs).
- Participates in the preparation of quality reports (e.g., annual reports).
- Determines conformance with program quality system requirements.
- Recommends to division directors and project managers and through them to deputy directors, that work be stopped in order to safeguard programmatic objectives, worker safety, public health, or environmental protection.
- Assists grant, program, and project managers in developing and implementing quality systems.
- Receives and maintains assessment records.
- Provides technical expertise and/or consultation on quality services.
- Prepares and forwards an annual QA report to EPA.
- Participates in data quality assessments.
- Reports on the status of corrective action programs.
- Identifies positive and adverse trends in program quality systems.
- Serve as quality system representative.
- Participate in CWQMN/EMRS meetings as needed.

A4.8 CWQMN QC Officer, WQPD (Edward Ragsdale)

- Responsible for annual CWQMN QAPP revisions.
- Facilitates CWQMN QA meetings
- Assists Program Manager, Network Coordinator, and project managers in developing and implementing quality systems.
- Reviews and comments on CWQMN Project Plans.
- Provide QC oversight for network activities.
- Participates in the development of DQOs or MQOs.
- Lead for developing, coordinating, writing, and revising CWQMN SOPs.
- Develops, prepares, conducts, and distributes performance and technical systems/audits/inspections of CWQMN CAMS.
- Responsible for determining if responses to audit findings are acceptable or not.
- Maintain files for Project Plans, performance and technical systems/audits.
- Trains operators on monitoring equipment and QC procedures.
- Assists grant, program, and project managers in developing and implementing quality systems.
- Assesses the effectiveness of program quality systems.
- Ensures maintenance of records that will demonstrate defensibility of data.
- Participates in the preparation of quality reports (e.g., annual reports).
- Evaluates proposed corrective actions and verifications.
- Concurs with proposed corrective actions and verifications.

- Receives and maintains assessment records.
- Monitors the implementation of corrective actions.
- Participate in CWQMN/EMRS meetings.

A4.9 Primary Data Users

- Assists in the development of DQOs and MQOs.

A4.10 TCEQ Field Operations Staff, Local Cooperators, or Contractors

- Participates in locating, evaluating, establishing and documenting sites for monitoring stations.
- Provides overall support for the operation and maintenance of station.
- Operates and maintains monitoring sites and sampling equipment according to current TCEQ QAPPs and SOPs.
- Calibrates measurement instrumentation.
- Performs QC checks on monitoring, sampling equipment according to current TCEQ QAPPs and SOPs.
- Reviews QC data and ensures quality data is being generated.
- Trains operators and cooperators on monitoring equipment and QC procedures.
- In some cases, reviews, verifies, and validates CWQMN data according to TCEQ SOPs.
- Assists auditors with performance evaluations and technical systems audits.
- Participates in the development of SOPs for instrumentation.
- Performs preventative maintenance on monitoring equipment.
- Assists in the development of DQOs or MQOs.

A4.11 Administrative, WQPD

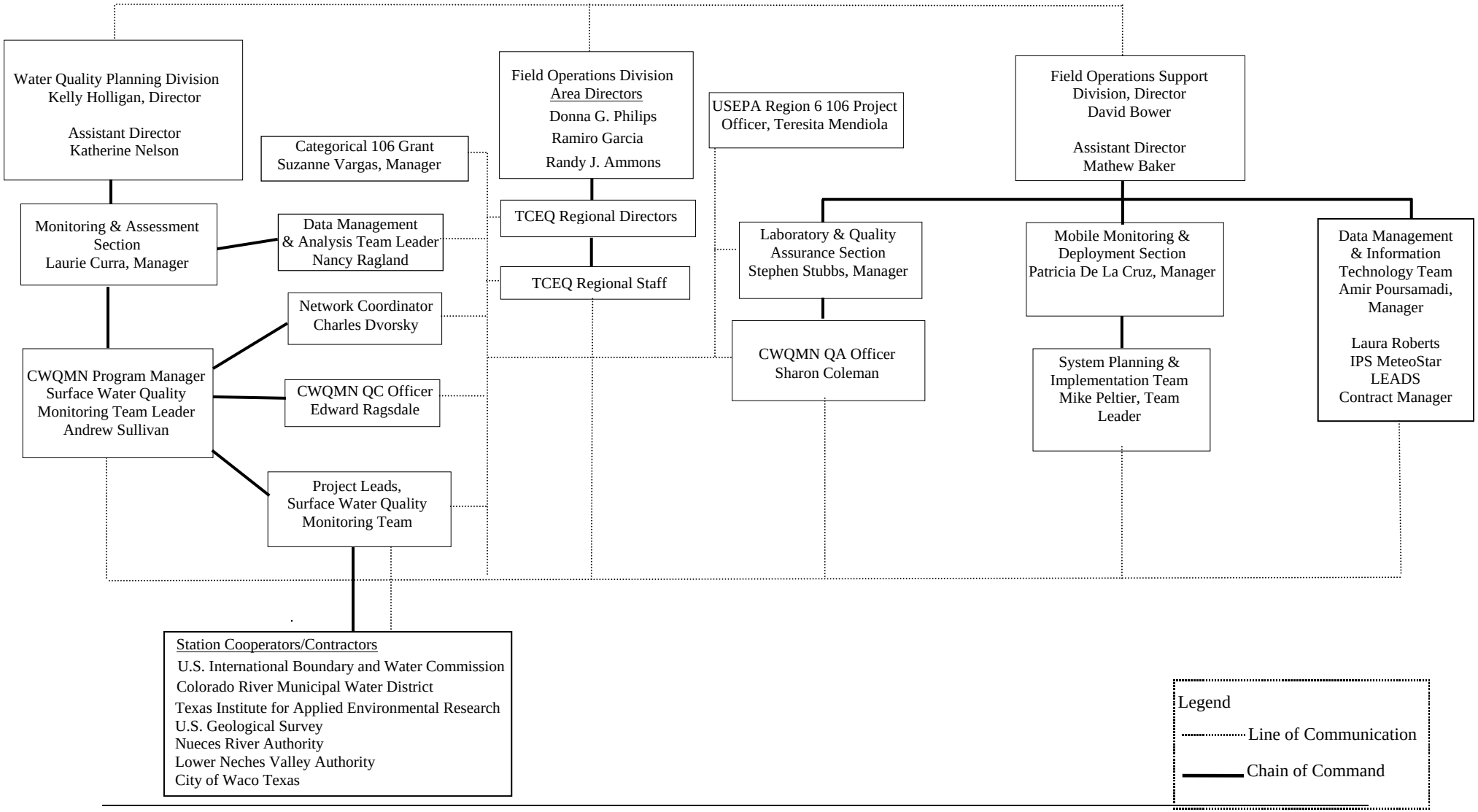
- Performs administrative reviews for CWQMN documents.
- Provides document control for CWQMN QAPP and SOPs.
- Process travel authorization and travel reimbursements for CWQMN activities.
- Purchases various network items and services.
- Provide administrative support for Aqualab analyzer maintenance contract.

A4.12 CWQMN External Web Page Maintenance

- Maintain various internal and external water-related web pages with guidance from WQPD staff.

Figure A4.1

Project Organizational Chart



A5 Project Definition/Background

The TCEQ was tasked by executive management and commissioners to develop and deploy a CWQMN built on the existing air monitoring infrastructure. The vision of these leaders was to provide more timely and comprehensive water quality information.

In 2001, a request to monitor water quality was received by the TCEQ from the Texas Legislature to assess the impacts of CAFOs to water quality on the Bosque River. The TCEQ responded by establishing two CWQMN sites on the Bosque River and two CWQMN sites on the Leon River. The CWQMN was expanded to include the additional sites listed in Table A5.1.

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

This QAPP is reviewed by multiple parties within the TCEQ to help ensure that data generated for the purposes described above are scientifically valid and legally defensible. This process supports that all data submitted to SWQMIS have been collected and analyzed in a way that substantiates their reliability.

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

1. Characterizing baseline conditions.
2. Identifying trends.
3. Assessing impacts of point and non-point sources discharges, including short term pollution events.
4. Providing timely surface water quality data for screening and targeting field responses and investigations for the EMRS pilot program.
5. Providing SC, DO, pH, and temperature data for the CWA Section 305(b) assessment.
6. Providing data to support TSWQS reviews.
7. Providing timely surface water quality data for water management decisions.
8. Providing data to support the development of watershed protection plans.
9. Providing real-time measurements for use as surrogates to estimate constituent concentration loading.
10. Characterizing water quality conditions that lead to blooms of toxic golden algae.
11. Developing new water quality monitoring technology, applications, and methodologies.
12. Developing water quality controls and assessing improvement after watershed management and implementation plans are in place.
13. Providing continuous water quality data to the public (via internet) for water bodies of interest.
14. Collecting data for water quality models.

Table A5.1**

CWQMN Objectives and Locations

River Basin	Seg. No.	CAMS	Station Location	Objective	Station Parameters
Rio Grande	2307	719	Rio Grande River at the USIBWC Fort Quitman Gaging Station	1) Provide data to support TSWQS review for total dissolved solids and chloride. Redefine segment boundary to be more protective. 2) Support USNPS, USGS, and TCEQ joint salinity survey project. 3) Support modeling of flow related to riparian vegetation removal. 4) Supports research into low DO/high flow related fish kills. 5) Supports the TCEQ Border Initiative (GI-394). 6) Monitor SC in the basin to provide information about increasing salinity to protect agricultural and domestic water supplies.	Surface Water temperature SC Water Level Water Flow Rate^
	2306	759	Rio Grande at Fosters Ranch upstream of Amistad Reservoir		Surface Water Temperature* SC* DO* pH* Sample Depth* Water Flow Rate ^
	2307	757	Rio Grande upstream of the confluence of Rio Conchos near Presidio, TX		
	2306	758	Rio Grande downstream of the confluence of Rio Conchos near Presidio, TX		
		720	Rio Grande River at Castolon, Big Bend National Park		Gage Height* Water Flow Rate (Full Range)* Water temperature* SC* DO* pH*
		721	Rio Grande River at Rio Grande Village, Big Bend National Park		
	2311	709	Pecos River at FM 1776 near Coyanosa, TX	1) Monitor changes in SC and surface water flow associated with salt cedar eradication. 2) Provide data (segment 2311) for DO modeling purposes. 3) Track water quality improvements associated with TWRI's WPP. 4) Characterize water quality conditions that lead to blooms of toxic golden alga. 5) Monitor SC in the basin to provide information about increasing salinity to protect agricultural and domestic water supplies.	Surface Water Temperature SC DO pH Gage Height* Water Flow Rate (Low Range)*
		710	Pecos River at TX at Business 20, west of Pecos, TX		
	2310	729	Lower Pecos River near the Terrel/Val Verde/ Crocket County lines		
	2311	735	Pecos River near US Highway (Hwy) 290 Southeast of Sheffield, TX		
	2310	764	Independence Creek at Caroline Springs (T-5) on the Nature Conservancy's Independence Creek Preserve south of Sheffield, TX	Independence Creek is a spring-fed tributary of the Pecos River. Monitoring at Caroline Springs will detect potential changes in groundwater that might occur due to the presence of the oil and gas industry. This site is paired with CAMS 735 and 729. Monitor SC in the basin to provide information about increasing salinity and to aid in golden alga research.	Surface Water Temperature SC DO pH

Table A5.1 (continued)

CWQMN Objectives and Locations

River Basin	Seg. No.	CAMS	Station Location	Objective	Station Parameters
	2309	768	Devils River downstream (State Hwy [SH] 163) Baker's Crossing	The Devil's River, a spring-fed stream, is one of the most pristine water bodies in the state of Texas. The station will provide dense temporal water quality data to document status and trends and to screen water quality conditions for possible impacts from oil and gas exploration. Monitor SC in the basin to provide information about increasing salinity.	Surface Water Temperature SC DO pH Water Flow Rate (Full Range)^
	2302	767	Rio Grande at Roma, Texas	Monitor SC to manage dissolved solids in irrigation water.	Surface Water Temperature SC/TDS
		795	Rio Grande downstream of Rio San Juan confluence		
		796	Rio Grande downstream of Arroyo Los Olmos		
		789	Rio Grande ~3.45 miles upstream of the of the bridge at County Rd. 409 (Harlingen Irrigation DST #1)		
		791	Rio Grande ~2.7 miles upstream of the confluence with El Morillo Drain (United Irrigation DST)		
		792	Rio Grande ~2.5 miles downstream of the confluence of El Morillo Drain (Hidalgo County Irrigation DST#18)		
		793	Rio Grande ~5.0 miles downstream of FM 1015 (HC&CC Irrigation DST #9)		
		736	Anzalduas Dam near Pier 7	Monitor SC to manage dissolved solids in irrigation water. Monitor Spillage of water over dam for TCEQ Water Master to maximize potential use as irrigation water	Surface Water Temperature SC/TDS Reservoir Water Elevation
Nueces-Rio Grande	2204	731	Petronila Creek at FM 70 east of Bishop, TX	Measure improvements in SC associated with TCEQ's TMDL implementation aimed at reducing high salinity concentrations.	Surface Temperature SC/TDS

Table A5.1 (continued)

CWQMN Objectives and Locations

River Basin	Seg. No.	CAMS	Station Location	Objective	Station Parameters
Colorado	1421	743	North Concho River downstream of Koenigheim St. San Angelo, TX	Provide data to Upper Colorado River Authority and the City of San Angelo, Texas to evaluate the effectiveness of BMPs at reducing the impacts of storm water run-off. Provide data to minimize the risks of fish kills through water releases from O.C Fisher reservoir.	Surface Temperature DO SC pH Water level Precipitation (CAMS 744)
		744	North Concho River at S. Oakes Rd., San Angelo, TX		
	1412	716	Beals Creek Pump Station southeast of Big Spring, TX	Provide SC data to Colorado River Municipal Water District to manage Water diversions.	Surface Water Temperature SC Sample Depth
		717	Colorado River Pump Station northwest of Colorado City, TX		
Brazos	1226B	701	Greens Creek (Bosque River tributary) at CR 266 near Clairette, TX	1) Provide timely surface water quality data (DO, ammonia-nitrogen, nitrate-nitrogen, and total reactive phosphorus) for screening and targeting field responses and investigations for the EMRS Pilot Program. 2) Track reduction of total reactive phosphorus concentrations in the Bosque River as management plans, including TMDL implementation, are established in the watershed.	Surface SC Water Temperature DO pH Turbidity Nitrate-nitrogen Ammonia-nitrogen Total Reactive phosphorus Precipitation (CAMS 701 & 704)
	1221A	704	Resley Creek (Leon River tributary) at FM 2823 near Dublin, TX		
	1226	725	North Bosque River at SH 6 Bridge		
	1226	702	North Bosque River at Clifton, TX	Track reduction of total reactive phosphorus concentrations in the Bosque River as management plans, including TMDL implementation, are established in the watershed	
	1255B	726	Scarborough Creek (Upper North Bosque River Tributary) at County Road (CR) 423	Provide timely surface water quality data (ammonia-nitrogen, nitrate-nitrogen, total reactive phosphorus, and SC) for screening and targeting field responses and investigations for the EMRS Pilot Program.	Surface TRP Nitrate-nitrogen Ammonia-nitrogen SC (Little Duffau sites only) Sample Depth
	1226K	728	Little Duffau Creek (Bosque River Tributary) near FM 1824		
	NA	765	Un-named Tributary of Little Duffau Creek (Bosque River Tributary) near FM 1824		

Table A5.1 (continued)

CWQMN Objectives and Locations

River Basin	Seg. No.	CAMS	Station Location	Objective	Station Parameters
Brazos	1226	742	Bosque River at Coopers Crossing near Lake Waco	Provide water quality and discharge data to City of Waco, Texas.	Surface Water Temperature DO SC pH TRP Total Phosphorus Water Level
	1203	723	Lake Whitney	TBD	Vertical Profile of Water Column Water Temperature SC DO pH Percent Fluorescence Total Chlorophyll Sample Depth Meteorological Wind Direction Wind speed and Temperature
Neches	0607	749	Pine Island Bayou at Lower Neches Valley Authority Pump Station near U.S Hwy 69	Provide data in support of determining the TSWQS DO criteria. Provide Lower Neches Valley Authority with timely water quality data for water management decisions.	Surface SC/TDS DO pH Turbidity Water Temperature Sample Depth
Cypress	0402	787	Big Cypress Bayou approximately 5.7 miles upstream of SH 43	1) Provide data to support Caddo Lake Institute's WPP development. 2) Document long term trends in DO, pH, and temperature.	Surface Water temperature DO pH SC Sample Depth Water Flow Rate ^^
San Jacinto-Brazos	1004	771	West Fork San Jacinto River at IH 45 South of Conroe, TX	Provide data to Houston-Galveston Area Council of governments to support development of watershed protection plan for Lake Houston. Provide real-time measurements for use as surrogates to estimate constituent concentrations and loading.	Surface Water temperature* DO* pH* SC* Turbidity* Gage height*
		772	West Fork San Jacinto River near SH 105 northwest of Conroe, TX		

*Stage, discharge, and water quality measurement data provided by USGS under TCEQ/USGS contract
** Table A5.1 is updated as part of QAPP annual revisions and lists active network sites. CWQMN sites may be added and/or de-activated throughout the course of the year. This table is not intended to list the current operational status of CWQMN sites.
^Discharge measurements made by USIBWC for these locations. These stations are not under TCEQ's CWQMN QAPP
^^Discharge measurements made by USGS. These stations are not under TCEQ's CWQMN QAPP

BMP = Best Management Practice

CAMS = Continuous Ambient Monitoring Station

DO = Dissolved Oxygen

HC&CCID #9 = Hidalgo & Cameron County Irrigation District #9

NA = Not Applicable

SC = Specific Conductance

TDS = Total Dissolved Solids. TDS is calculated from SC using TCEQ's correction factor of 0.65

TMDL = Total Maximum Daily Load

TSWQS = Texas Surface Water Quality Standards

TWRI = Texas Water Resource Institute

USGS = United States Geological Survey

USNPS = United States National Park System

WPP = Watershed Protection Plan

A6 Project/Task Description

Network Description

Continuous surface water quality, sample depth, water level, and stream discharge may be measured automatically (365 days a year) at CWQMN sites located on water bodies of interest. Data from CWQMN sites are telemetered to the TCEQ headquarters in Austin, Texas.

See TCEQ website for maps and locations of sites. (www.texaswaterdata.org)

Some TCEQ CWQMN projects are funded in whole or in part by federal funds CWA Sec 106 or other federal grants). Other projects are funded entirely with non-federal funds (state and local funds). All TCEQ CWQMN projects listed in Table A5.1, regardless of funding source(s), are covered under the TCEQ CWQMN QAPP. The USGS has been contracted by Houston-Galveston Area Council of governments to operate CAMS 771 and 772 under the CWQMN QAPP using federal funds. Independent CWQMN sites are covered under separate quality assurance systems and are not included under the TCEQ CWQMN QAPP. QAPPs for independent stations are updated annually

This QAPP describes and documents policies, procedures, infrastructure requirements, assessments and response actions, and data management, needed to provide and maintain quality data for the monitoring objectives in Section A5. Additionally, the QAPP describes procedures for developing new technology and methodologies.

The CWQMN QAPP lists active network projects for each year, and is updated annually. When new sites are added to the network during the year, project leads, CWQMN Network Coordinator and/or contractors will document project details and requirements in CWQM Project Plans (Appendix C) using EPA QA/R5 format. The plans will set forth project-specific requirements (or criteria) against which results can be compared, and help ensure that project data will be of the type and quality needed for its intended use. These project plans will refer to the CWQMN QAPP where applicable.

CWQMN Project Plans will be written as addenda to the CWQMN QAPP and will require an abbreviated sign-off by the CWQMN Network Coordinator, various TCEQ managers and staff, CWQMN Program QA Officer, CWQMN QC Officer, Data Management & Analysis, and relevant project participants/cooperators or contractors.

If a new project is substantially different from those described in the QAPP, and if the project is funded with §106 monies, TCEQ will send the associated project plan to EPA for comment during project development. Copies of all completed/approved Project Plans will be available to EPA regardless of project funding sources and will remain on file in the central office CWQMN program QA files.

Project Plans may be written and approved throughout the year. Once approved, the plans are available via the internet (at the link below). Please see Table A2.5 for a list of approved project plans available at the time of this particular QAPP revision. (www.texaswaterdata.org)

The TCEQ's WQPD is responsible for the overall administration of the network. The TCEQ's FOSD provides logistic support for the network. Continuous water quality monitoring stations (CWQMS) are operated by Site Operators who may be:

- FOSD SWQM staff in some of the TCEQ's 16 regional offices;
- Local Cooperators; and/or
- Contractors working with Regional or Central SWQM staff.

USGS Generated data

The TCEQ has contracted with the USGS to provide stream discharge and water quality measurement data at various sites around the state. See Table A5.1 for USGS site locations and parameters and Section/Table A2.5 for a list of USGS/TCEQ Project Plans and internet location for these documents. The USGS has been contracted by Houston-Galveston Area Council of Governments to measure turbidity at CAMS 771 and 772 under the TCEQ CWQMN QAPP using federal and local funds.

For monitoring sites where USGS generates water quality data, USGS will follow the applicable policies, procedures, documentation, and criteria outlined in the most recent revision of the CWQMN QAPP and applicable USGS/TCEQ Project Plans.

For monitoring sites where USGS generates stream stage and discharge data, USGS will conform to the quality system outlined in the applicable USGS/TCEQ CWQMN Project Plans.

Table A6.1

Site Operators and Data Validators

Basin	TCEQ Region	CAMS Number	Station ID	Operator CWQMN Element	Data Validator CWQMN Element	Site Location
Rio Grande	6	719	13706	USIBWC-Water Quality	TCEQ/WQPD-Water Quality	Fort Quitman Gaging Station
Rio Grande	6	720	18482	USGS-Water Quality/Discharge	USGS-Water Quality/Discharge	Big Bend National Park-Castolon
Rio Grande	6	721	18483	USGS-Water Quality/Discharge	USGS-Water Quality/Discharge	Big Bend National Park-Rio Grande Village
Rio Grande	7	709	13260	TCEQ Region 7-Water Quality USGS-Discharge	TCEQ/WQPD-Water Quality USGS-Discharge	FM 1776 near Coynosa, TX (Upper Pecos)
Rio Grande	7	710	13261	TCEQ Region 7-Water Quality USGS-Discharge	TCEQ/WQPD-Water Quality USGS-Discharge	West of Pecos, TX at BUS 20 (Upper Pecos)
Rio Grande	7	729	18801	TCEQ Region 7-Water Quality USGS-Discharge	TCEQ/WQPD-Water Quality USGS-Discharge	Pecos River near the Terrel/Val Verde/ Crocket County lines
Rio Grande	16	759	13223	USGS-Water Quality	USGS-Water Quality	Rio Grande at Fosters Ranch upstream of Amistad Reservoir
Rio Grande	6	757	13230	USGS-Water Quality	USGS-Water Quality	Rio Grande upstream of the confluence of Rio Conchos near Presidio, TX
Rio Grande	6	758	13229	USGS-Water Quality	USGS-Water Quality	Rio Grande downstream of the confluence of Rio Conchos near Presidio, TX
Rio Grande	7	735	13249	TCEQ Region 7-Water Quality USGS-Discharge	TCEQ/WQPD-Water Quality USGS-Discharge	Pecos River near US Hwy 290 southeast of Sheffield, TX
Rio Grande	16	768	13238	TCEQ Region 16-Water Quality	TCEQ/WQPD-Water Quality USGS-Discharge	Devils River downstream of SH 163
Rio Grande	7	764	20338	TCEQ Region 7-Water Quality	TCEQ/WQPD-Water Quality USGS-Discharge	Independence Creek at Caroline T-5 Spring, Independence Creek Preserve
Rio Grande	15	736	13182	TCEQ Region 15-Water Quality	TCEQ/WQPD-Water Quality	Rio Grande at Anzalduas Dam near Pier 7
Rio Grande	15	767	20737	TCEQ Region 15-Water Quality	TCEQ/WQPD-Water Quality	Rio Grande at Roma, Texas
Rio Grande	15	795	TBD	TCEQ Region 15-Water Quality	TCEQ/WQPD-Water Quality	Rio Grande downstream of Rio San Juan confluence
Rio Grande	15	796	TBD	TCEQ Region 15-Water Quality	TCEQ/WQPD-Water Quality	Rio Grande downstream of arroyo Los Olmos
Rio Grande	15	789	TBD	TCEQ Region 15-Water Quality	TCEQ/WQPD-Water Quality	Harlingen Irrigation District #1
Rio Grande	15	791	TBD	TCEQ Region 15-Water Quality	TCEQ/WQPD-Water Quality	United Irrigation District

Table A6.1 (continued)
Site Operators and Data Validators

Basin	TCEQ Region	CAMS Number	Station ID	Operator CWQMN Element	Data Validator CWQMN Element	Site Location
Rio Grande	15	792	TBD	TCEQ Region 15-Water Quality	TCEQ/WQPD-Water Quality	Hidalgo Irrigation District #18
Rio Grande	15	793	TBD	TCEQ Region 15-Water Quality	TCEQ/WQPD-Water Quality	HC&CC Irrigation District # 9
Colorado	7	716	18815	CRMWD-Water Quality	TCEQ/WQPD-Water Quality	Beals Creek Pump Station southeast of Big Spring, TX
Colorado	3	717	18816	CRMWD-Water Quality	TCEQ/WQPD-Water Quality	Colorado River Pump Station northwest of Colorado City, TX
Colorado	8	743*	20105	TCEQ Region 8-Water Quality	TCEQ/WQPD-Water Quality	North Concho River downstream of Koenigheim St, San Angelo, TX
Colorado	8	744*	15889	TCEQ Region 8-Water Quality	TCEQ/WQPD-Water Quality	North Concho river at S. Oakes Rd,, San Angelo, TX
Brazos	9	742	20127	City of Waco-Water Quality	TCEQ/WQPD-Water Quality	Bosque River at Coopers Crossing near Lake Waco
Brazos	4	701	13486	TCEQ Region 4, Stephenville-Water Quality	TCEQ/WQPD-Water Quality	Greens Creek at CR 266 near Clairette, TX
Brazos	9	702	17500	TIAER-Water Quality	TCEQ/WQPD-Water Quality	Bosque River at Riverside Road in Clifton, TX
Brazos	3	704	17377	TCEQ Region 4, Stephenville-Water Quality	TCEQ/WQPD-Water Quality	Resley Creek at FM 2823 near Dublin, TX
Brazos	4	725	15123	TIAER-Water Quality	TCEQ/WQPD-Water Quality	Bosque River at State Hwy 6
Brazos	4	726	17222	TCEQ Region 4, Stephenville-Water Quality	TCEQ/WQPD-Water Quality	Scarborough Creek (Upper North Bosque River tributary) at CR 423
Brazos	4	728	20322	TCEQ Region 4, Stephenville-Water Quality	TCEQ/WQPD-Water Quality	Little Duffau Creek (Upper North Bosque River Tributary) near FM 1824
Brazos	4	765	20323	TCEQ Region 4, Stephenville-Water Quality	TCEQ/WQPD-Water Quality	Unnamed Tributary of Little Duffau Creek (Bosque River Tributary) near FM 1824
Brazos	4	723	18654	TCEQ Region 9-Water Quality	TCEQ/WQPD-Water Quality	Lake Whitney
Brazos	9	762	11953	NA	USGS-Discharge	Bosque River at Valley Mills
Neches	10	749	10602	Lower Neches Valley Authority	TCEQ/WQPD-Water Quality	Pine Island Bayou near U.S. Hwy 69
Cypress	5	787	20635	TCEQ Region 5-Water Quality	TCEQ/WQPD-Water Quality	Big Cypress Bayou approximately 5.7 miles upstream of SH 43
Nueces-Rio Grande	14	731	13093	NRA-Water Quality	TCEQ/WQPD-Water Quality	Petronilia Creek at FM 70 east of Bishop, TX
San Jacinto-Brazos	12	771	11246	USGS-Water Quality	USGS-Water Quality	West Fork San Jacinto River at IH 45

Table A6.1

Site Operators and Data Validators

Basin	TCEQ Region	CAMS Number	Station ID	Operator CWQMN Element	Data Validator CWQMN Element	Site Location
San Jacinto-Brazos	12	772	11251	USGS-Water Quality	USGS-Water Quality	West Fork San Jacinto River at SH 105

*TCEQ Region 8 will operate CAMS 743 and 744 through Fiscal year 2011
CAMS = Continuous Ambient Monitoring Station
CRMWD = Colorado River Municipal Water District
HC&CCID#9 = Hidalgo & Cameron County Irrigation District #9
NRA = Nueces River Authority
TCEQ-WQPD Texas Commission on Environmental Quality Water Quality Planning Division
TIAER = Texas Institute for Applied Environmental Research
USGS = United States Geological Survey
USIBWC = United States International Boundary Water Commission

Table A6.2

Schedule of Activities

Table A6.2 contains a list of activities required to plan, implement, and assess the CWQMN.

Activity	Status
Annual CWQMN QAPP (due to EPA by March 1 of each year)	Revision 4 approved May 2010
CWQMN Project Plans	Ongoing, for each new CWQMN Project
CWQMN Data Quality Objectives (measurement performance specifications for multiprobe fouling and drift quality control measurements) development where applicable	Ongoing

Table A6.2
Schedule of Activities

Activity	Status
Retrofit multiprobe deployment structures and/or measurement equipment and deployment structures (non EMRS sites) to meet the technical requirements of the USGS-based fouling measurement method.	Completed for CAMS, 731, 749, 787. Multiprobe fouling measurements being made at these sites. CAMS, 709, 710, 729, 735, 768, 764 are on the list of sites to be retrofitted by TCEQ. TCEQ USGS contracted CAMS 757, 758, 759, 720, 721, 771, and 772. USGS to start making fouling measurements at these locations.
Evaluation of USGS-based multiprobe fouling measurement procedures	Ongoing.
Develop empirically derived site-specific SC conversion factors for TDS.	Ongoing
CWQMN Audits	Ongoing
Appendix E, Operator Log Guidance Document	Revision 1 completed

Table A6.2
Schedule of Activities

Standard Operating Procedures (SOPs)	
Instrument-Specific Analytical SOPs AMPM-011, Yellow Springs Instrument (YSI) Series-6	Revision 2 draft SOP under review (includes fouling measurement procedures)
AMPM-019, Greenspan CS4-1200	Revision 0 completed
Lower Rio Grande River EMRS Greenspan CS4-1200 temp/conductivity	TBD
In-Situ Aqua Troll 200	Revision 0 under review (includes fouling measurement procedures)
AMPM-008 Level TROLL 500	Revision 1 under review
Validation of Continuous Water Quality Monitoring Data Collected by Multiparameter Sonde	Revision 2 under review
Design Analysis H-3611 Radar Water Level Sensor Aqualab Physiochemical and Nutrient Analyzer Aqualab Total Phosphorus Analyzer	TBD Completed Completed
Data Validation SOPs Aqualab Data Validation SOP Multiparameter Sonde SOP	 Completed Completed
Equipment Maintenance SOPs YSI Series-6 Multi-probe Greenspan CS4-1200 Multi-probe In-Situ Aqua Troll 200 Aqualab Physiochemical and Nutrient Analyzer Aqualab Total Phosphorus Analyzer	 TBD TBD TBD Completed TBD
Monitoring Station Technical Systems and Performance Evaluation Audits Technical Systems Audit.	
Aqualab analyzers	Developed
Multiprobe Sonde	YSI Series-6 developed Greenspan CS4-1200 developed Aqua TROll 200
YSI 6951 Vertical Profiler and YSI Series 6 Chlorophyll Sensor	Developed

Table A6.2 (continued)
Schedule of Activities

Table A6.2 contains a list of activities required to plan, implement, and assess the CWQMN.

Activity	Status
Negative audit finding/non conformance corrective action plan	TBD
CWQMN MeteoStar/LEADS Development	
SWQMIS Data Loader, allowing LEADS CWQMN data to be loaded into SWQMIS	Completed
LEADs automatic calculation of CWQMN data completion.	Completed for Multiprobe sites. Not technically feasible for Aqualab Analyzer sites.
Data management systems and methods for high-density temporal data.	TBD

TBD= to be determined

A7 Quality Objectives and Criteria

Methods used for water quality measurements in the CWQMN are based on *Standard Methods for the Examination of Water and Wastewater*, 20th Edition, 1998 unless otherwise noted.

A7.1 Multiprobe CWQMN Quality Control Measurements and Data Quality Objectives

CWQMN QC measurement procedures and DQO's for multiprobe physicochemical parameters were adopted from the SWQM Program. SWQM monitoring activities include grab sampling and 24-hour deployments. Currently, CWQMN QC measurements for multiprobe data validation consist of analyzing standards (as well as checking multiprobe temperature sensors) after deployment periods in a temperature controlled environment. Multiprobe sensor responses to standards are compared against DQO's found in Table A7.1. If results exceed criteria found in A7.1, the corresponding data are flagged as invalid (AQI).

CWQMN water quality measurement sensors are deployed in various water bodies around the state for extended periods of time. Over deployment periods, the interface between sensors and the environment can become fouled by a variety of organisms, sedimentation, and chemical coatings. Sensor fouling can compromise data quality. Since existing CWQMN QC protocols (analyzing standards) were adapted from SWQM routine protocols the procedures may not accurately assess potential effects of fouling on sensor performance for sensors used in longer term deployments.

The USGS has developed measurement techniques for assessing sensor fouling and electronic drift. The TCEQ has incorporated USGS-based procedures into draft multiprobe SOPs and is currently evaluating the application of the procedures at four CWQMN locations (CAMS 731, 787, 749, and 743). If adopted, the goal will be to measure fouling and drift at all non-EMRS CWQMN multiprobe sites at the conclusion of each deployment period and to use the sum of sensor fouling and electronic drift measurements for data validation purposes. Currently, sensor fouling and electronic drift measurements are being recorded into LEADS operator logs.

If fouling measurement results are used for data validation purposes, it is possible (with current station service intervals) that many CWQMN sites may not routinely meet DQO's listed in Table A.7.1. The program is currently in the early stages of trying to develop continuous water quality DQO's for multiprobe sensor fouling and electronic drift measurements.

A7.2 Lower Rio Grande River Multiprobe EMRS sites

TCEQ Region 15 Watermaster staff operates seven multiprobe sites on the Lower Rio Grande River (CAMS 736, 767, 781, 782, 789, 791, 792, and 793). These sites monitor SC and temperature. The TCEQ Watermaster uses this near real-time information to manage TDS (calculated from SC) levels for crop irrigation purposes. When in-stream

SC values reach 1308 µS/cm (850 mg/l TDS) at a given station as outlined in the Rio Grande Salinity SOP at a given station, LEADS automatically sends email notifications to Watermaster Staff. After an EMRS notification is received, Watermaster staff makes separate SC measurements in accordance with the Rio Grande Salinity SOP at the stations for confirmational purposes.

Data generated by the sites are intended for EMRS purposes only. Consequently, data collected from the sites are not routinely validated. Data validation for particular time periods can be requested. Sensor fouling will not be measured at the sites and QC measurements will consist of measuring sensor drift using standards. A conductivity sensor drift DQO of ≤5 RPE is the data validation criterion for these sites.

A7.3 Petronila Creek CAMS 731 SC DQO

The Petronila Creek CWQMN station was installed to track changes in SC associated with TCEQ's TMDL Implementation Plan (segment 2204) aimed at reducing high sulfate, chloride and TDS levels. This site as well as other CWQMN sites reports TDS in mg/l using a statewide developed SC to TDS conversion factor of 0.65 (SC*0.65 =TDS mg/l). The program will collect 20-30 grab samples at CAMS 731 for TDS laboratory gravimetric analysis and use the information to develop a water-body-specific TDS conversion factor.

The TDS segment standard is 4,000 mg/l. For 2008 and 2009 annual CAMS 731 SC averages were obtained from LEADS. The conductivity results for 2008 and 2009 were 14,324 µS/cm (9311 mg/l TDS) and 14,937 µS/cm (9307 mg/l TDS) respectively. These results might be biased low due to sensor fouling. The annual SC results significantly exceed the 4,000 mg/l TDS segment standard through the range of potential TDS conversion factors. Consequently, the intended data use for the site includes tracking trends in SC and TDS to determine implementation progress and compliance with water quality standards. An SC fouling and drift DQO of ≤ 10% RPE has been proposed for the site in addition to the implementation of USGS-based fouling measurement procedures. As mentioned previously, if the procedures are accepted, the plan is to implement the ≤ 10% RPE SC sensor fouling and electronic drift criterion for data validation purposes.

A7.4 Bosque/Leon River EMRS Pilot Project Quality Objectives

For CAMS 701, 704, and 725, DO, Ammonia-nitrogen (NH_3-N), Nitrate-nitrogen (NO_3-N), and TRP data from the Aqualab Analyzers are being used in the EMRS pilot program only for screening and targeting field responses and investigations on the Bosque and Leon Rivers watersheds. CAMS 726, 728, and 765 measures only TRP, NO_3-N, and NH_3-N as part of the EMRS pilot project. See Scarborough Creek (CAMS 726) and Little Duffau Creek (CAMS 728 and 765) CWQMN Project Plans for quality objectives and criteria for these sites. See Table A7.3 for Aqualab Analyzer DQO's for CAMS 701, 702, 704, and 725.

A7.5 Multiprobe Galvanic Membrane Electrode DO Method

The CWQMN utilizes Galvanic DO membrane electrodes to measure DO concentrations. Galvanic membrane electrodes utilize a measurement process that consumes oxygen. According to *Standard Methods for the Examination of Water and Wastewater*, 20th Edition, 1998 Galvanic membrane electrodes require sufficient sample flow across the membrane to overcome erratic responses. TCEQ requested that the USGS Hydrological Instrumentation Facility (HIF) develop a study to determine the minimum sample flow requirements for the CS4-1200 Galvanic DO sensor. To date, TCEQ has not received study results from the HIF.

The program stopped collecting CS4-1200 DO data at all sites with exception of the following CAMSs: 709, 710, 729, 735, 764, and 768. The CS4-1200 DO sensor has a delayed response time to changes in DO concentrations. The USGS fouling measurement procedures require instantaneous sensor responses. The program plans to replace measurement equipment at these locations with optical DO sensors. Optical DO sensors do not consume oxygen and have near-instantaneous sensor response times.

A7.6 USGS Stream Stage and Discharge Quality Objectives

The TCEQ has contracted with the USGS to provide stream discharge and water quality measurement data at various sites around the state. See Table A5.1 for USGS site locations and parameters and Section/Table A2.5 for a list of USGS/TCEQ Project Plans and internet address for data access. These Project Plans contain information about USGS stage and discharge measurement methods and quality objectives, and criteria for stage and discharge measurements.

Table A7.1

DQOs for Sondes (Multiprobes)

Parameter	LEADS Parameter Code	Units	Measurement Equipment	Method	Calibration Verification Sample Acceptance Limit (CVS)
pH*	10400	pH /units	YSI 6-Series Greenspan CS4-1200	Glass electrode, Standard Method 4500-H+B	0.50 pH unit*
DO*	10300	mg/L	Greenspan CS4-1200	Galvanic membrane electrode, Standard Method 4500-O G	% Saturation ±6.0%* 0.50 mg/L*
DO*	10300	mg/L	YSI 6-Series	Optical (luminescence quenching) ASTM D888-05 **	% Saturation 6.0%* 0.50 mg/L*
SC*	10095	µS/cm	YSI 6-Series In-Situ Aqua TROLL 200	Conductivity cell, Standard Method 2510B	5.0% RPE*
SC*	10095	µS/cm	Greenspan CS4-1200	Toroidal**	5.0% RPE*
Temperature*	10010	ºC	Thermistor	Standard Method 2550 B	0.50 ºC*
Sample Depth	10078	Feet	YSI 6-Series	Pressure Transducer	NA
TDS	10294	mg/L	YSI 6-Series In-Situ Aqua TROLL 200 Greenspan CS4-1200	Calculated by LEADS. SC measurements are multiplied by 0.65	5.0% RPE (SC CVS)
Percent Fluorescence Chlorophyll	10109 10103	0 – 100% 0 – 400 µg/L	YSI 6600 EDS with Chlorophyll Sensor	Fluorometric, Standard Method 10200H+3	0.6 % Fluorescence NA
Turbidity	10104	NTU^^	YSI 6-Series Sondes with optical ports.	Method number ISO7027, method code TS087 using YSI sensor 6136**	± 3.0 FNU/NTU or ± 5%^^

*Parameters and CVS acceptance criteria for use in the Clean Water Act 305(b) Inventory and 303(d) Lists per SWQM DQOs.

**Method not based on *Standard Methods for the Examination of Water and Wastewater*, 20th Edition, 1998. U. S. Environmental Protection Agency (EPA) Region 6 has approved Toroidal and Optical DO methods for use in the CWQMN.

***LEADS reports turbidity measurements in NTUs.

^^USGS DQO. USGS reports FNU (parameter code 63680) and TCEQ will recode the unit values as NTU

(LEADS parameter code 10104) in order to populate the LEADS database until an appropriate Surface Water Quality Monitoring Information System (SWQMIS)/EPA Storage and Retrieval Database (STORET) code can be identified.
°C = degrees centigrade
mg/L = milligrams per liter
µS/cm = micro siemens per centimeter
µg/L = micro grams per liter
ASTM = American Society for Testing and Materials
CWA = Clean Water Act
DO = dissolved oxygen
DQO = Data Quality Objective
FNU = Formazin Nephelometric Units
USGS = United States Geological Survey
LEADS = Leading Environmental Analysis and Display System
NA = Not Applicable
NTU = Nephelometric Turbidity Unit
RPE = relative percent error
SC = specific conductance
TBD = to be determined
TDS = total dissolved solids
YSI = Yellow Springs Instrument

Water Level/Sample Depth Measurements

Water level and sample depth measurements are used for water quality measurement data interpretations and for data validation purposes. At most sites YSI multiprobes utilize non-vented pressure sensors to measure sample depth. An In-Situ TROLL 500 pressure sensor is used at CAMS 725 to measure water level. In-Situ Level TROLL 500 and Aqua TROLL 200 instruments are used to trigger the Aqualab Analyzer to begin sampling and analysis in intermittent stream applications.

Table A7.2

Specifications for Water level and Sample Depth Measurements

Instrument/Parameter	LEADS Parameter Code	SOP	Units	Range	Method	Acceptance Criteria
(Level TROLL 500) Water level/Sample Depth	10079/10078	AMPM -008	Feet/Meter	0 -35.0 Feet	Vented Pressure Transducer	NA*
(YSI 6-Series Multiprobes) Sample Depth	10078	AMPM -011	Feet/Meter	Model Dependent	Non Pressure Transducer	NA*
(Aqua TROLL 200)-Sample Depth	10078	TBD Draft SOP	Feet/Meter	0 -35.0 Feet	Vented Pressure Transducer	NA*

*Water level/sample depth measurements are not assessed for accuracy.
LEADS = Leading Environmental Analysis and Display System
SOP = Standard operating procedure

Design Analysis H-3611 Radar Water Level Sensor
Development of quality objectives and criteria for the radar water level sensor is to be determined. This instrument is only used at one CWQMN site (CAMS 736).

Table A7.3

DQOs and MQOs for Greenspan Aqualab Auto Analyzers

(CAMS 701, 702, 704, 725, and 742^)

Parameter/ CAMS	LEADS Parameter Code	Units	Analytical SOP	Method	MDL	AWRL	Blanks	Recovery at AWRL (LCS)	Calibration Verification Sample Acceptance Limit (CVS)	Precision (Relative Percent Difference)	Bias (Rec. of LCS)
pH*	10400	pH units	AMPM-017	Glass electrode, Standard Method 4500-H+B	NA	NA	NA	NA	pH CVS Standard of 4.00 pH Units: Between 3.80 - 4.50 pH Units*	≤ 20.0%	NA
DO*	10300	mg/L	AMPM-015	Galvanic membrane electrode, Standard Method 4500-O-G	NA	NA	NA	NA	0.5 mg/L*	≤ 10.0%	NA
SC*	10095	µS/cm	AMPM-016	Conductivity cell, Standard Method 2510B	NA	NA	100 uS/cm	NA	≤ 5.0% RPE*	≤ 10.0%	NA
Turbidity	10104	NTU^^	AMPM-018	Method number ISO7027**	NA	NA	Between -30 and 50 NTU	NA	NA	NA	NA
Temperature*	10010	°C	NA	Thermistor Standard Method 2550 B	NA	NA	NA	NA	NA	NA	NA
NH_3-N	10107	mg/L	AMPM-013	Ion Selective Electrode 4500 -NH3 D	0.100	NA	≤ 0.160	NA	NA	≤ 20.0%	70 – 130% (0.500 mg/L LCS)
NO_3-N	10101	mg/L	AMPM-012	Ion Selective Electrode, Standard Method 4500-NO3 D	0.100	NA	≤ 0.160	NA	NA	≤ 20.0%	70 – 130% (0.500 mg/L LCS)
TRP (0-0.600 mg/L range)	10105	mg/L	AMPM-014	Photometric, Standard Method 4500-P F	0.003	0.040	≤ 0.006	75 – 125%	NA	≤ 20.0%	NA

Table A7.3 (continued)

DQOs and MQOs for Greenspan Aqualab Auto Analyzers

(CAMS 701, 702, 704, 725, and 742^)

Parameter/ CAMS	LEADS Parameter Code	Units	Analytical SOP	Method	MDL	AWRL	Blanks	Recovery at AWRL (LCS)	Calibration Verification Sample Acceptance Limit (CVS)	Precision (Relative Percent Difference)	Bias (Rec. of LCS)
TRP (0-4.00 mg/L range)	10105	mg/L	AMPM-014	Photometric, Standard Method 4500-P F	0.015	NA	≤ 0.015	NA	NA	≤ 20.0%	75 – 125% (0.050 mg/L LCS)
TP*** (0-0.600 mg/L range)	10110	mg/L	AMPM-020	Persulfate Oxidation and Photometric 4500-P, B, F	0.003	0.060	≤ 0.006	NA	NA	≤ 20.0%	75 – 125% (0.300 mg/L LCS)

*Parameters and CVS acceptance criteria for use in the Clean Water Act 305(b) Inventory and 303(d) Lists per SWQM DQOs.
**Method not based on *Standard Methods for the Examination of Water and Wastewater*, 20th Edition, 1998
***TP LCS is prepared from a stock solution of B-Glycerophosphoric acid disodium salt, 5 hydrate. The TP analyzer measures both TP and TRP. A TP sample is digested to reactive P and measured by a spectrophotometer. The TP LCS assesses both TP and TRP recoveries.
^ CAM 742 Aqualab analyzer only measures TP and TRP.
^^TCEQ will code the unit values as NTU (LEADS parameter code 10104) in order to populate the LEADS database until an appropriate SWQMIS/STORET code can be identified.
☐C = Degrees Centigrade
AWRL = Ambient Water Reporting Limit
CWA = Clean Water Act
LCS = Laboratory Control Sample
LEADS = Leading Environmental Analysis and Display System
MDL = Method Detection Limit
mg/L = milligrams/Liter
µS/cm = micro siemens/centimeter
NA = Not Applicable
NH_3-N = ammonia-nitrogen
NO_3-N = nitrate-nitrogen
ppb = part per billion
ppm = parts per million
RPE = Relative Percent Error
SOP = Standard Operating Procedure
TP = total phosphorus

A7.7 CWQMN Turbidity Measurements

A variety of measurement techniques can be used to measure turbidity. Data from differing instrumentation and sample matrixes can be highly variable. The only approved EPA method for turbidity is EPA Method 180.1. EPA Method 180.1 utilizes a white or broadband light source. Data produced by this method are reported as NTU. EPA Method 180.1 is a laboratory method.

Currently, the CWQMN utilizes ISO Method 7027 for turbidity (for more details see section B4). CWQMN turbidity data is not appropriate for regulatory purposes. The CWQMN uses NTUs to report turbidity data collected by the ISO Method 7027 until the appropriate SWQMIS/Parameter code can be identified.

A7.8 Ambient Water Reporting Limits (AWRLs)

The AWRL establishes the reporting specifications at or below which data for a parameter must be reported to be compared with freshwater criteria. AWRLs have been set by water programs for ambient data to be used in assessments that have a regulatory purpose. These levels are established for each analyte as a minimum concentration where data can be reliably reported. Currently, LCSs at AWRL are being analyzed for the low range TRP analysis. The method detection limits of NO_3-N and NH_3-N are too high to allow for analysis of LCSs at required AWRL concentrations. AWRL LCS concentrations are listed in the *Surface Water Quality Monitoring Quality Assurance Project Plan*. ***Note:*** *While the AWRL is established as a reporting limit for TRP, data users should consider all possible uses of the data and specify reporting limits for their purposes.*

A7.9 Representativeness

By design, the CWQMN measures water quality in greater temporal detail and resolution than is possible with grab samples or short term deployments of monitoring instrumentation. Areas of excessive vegetation, turbulence, shifting stream bottoms should be avoided. Back-water area with little flow should be avoided unless this type of area is representative of the water body.

A7.10 Comparability

CWQMN water quality measurements are based on *Standard Methods for the Examination of Water and Wastewater*, 20th Edition, 1998, unless otherwise noted. Comparability is also achieved by using SOPs, reporting data in standard units by using accepted rules for significant figures, and by reporting data in standard formats.

A7.11 Bias, Precision, CVS, DQOs, and MQOs

Definitions for bias, precision, CVS, DQOs, and MQOs are provided in Appendix A. Determining and calculating bias and precision for the purposes of this quality assurance project plan is discussed in Section B5.

A7.12 Completeness

A general requirement for data completeness has been set at 75 percent data return. Periods of no flow or dry conditions necessitate shutdown of some instrumentation and these times are not considered in the goal for data completeness. Data completeness for Aqualab analyzer sites is not calculated due to LEADS technical issues. Calculation method for data completeness is discussed in Section C. Requirements for data completeness for use in the CWA 305(b) and 303(d) Lists are discussed in Section D2.3.

A8 Special Training/Certification

The TCEQ has an extensive base of professional and skilled employees to enable it to successfully complete the projected tasks and activities associated with this network. Currently, most training is conducted informally on an as-needed-basis by project leads, QC Officer, project participants, vendors, and FOSD. Data validation training is provided to network participants who validate the data they collect.

When developing new instrumentation, sampling techniques or applications training may be limited to vendor support or what is learned during method development. Expertise and SOPs are derived from this developmental process.

Available approved SOPs shall be used by employees, cooperators and contractors, who audit, calibrate, operate sampling and analytical instrumentation, or validate network data. Instrument manuals are available for reference.

All TCEQ personnel associated with the project have detailed functional job descriptions describing the requirements for their positions. All formal training is documented by the administrative staff.

According to the TCEQ *Quality Management Plan*, training requirements for contract staff shall be stated in contract specifications if contracted work is part of the project.

The TCEQ has contracted with the USGS to provide stream discharge and water quality measurement data at various sites around the state. See Table A5.1 for USGS site locations and parameters and Section/Table A2.5 for a list of USGS/TCEQ Project Plans and internet location of Project Plans. These Project Plans contain information about USGS special training/certification.

A9 Documents and Records

The CWQMN QAPP, Project Plans, SOPs, Audit Reports, and Finding Summary Reports are filed and maintained by the SWQM Central Office. Measurement data and other site information can be found on TCEQ's CWQMN website. Instrument calibration and calibration verification forms, instrument logbooks, and certificate of analysis are filed and maintained by site operators.

Each site operator is expected to maintain records that include sufficient information to reconstruct each final reported measurement from the variables originally gathered in the measurement process. This includes, but is not limited to, information (raw data, electronic files, and/or hard copy printouts) related to sample collection, measurement instrument calibration, QC checks of sampling or measurement equipment, "as collected" measurement values, an audit trail for any modifications made to the "as collected" measurement values and traceability documentation for reference standards.

Difficulties encountered during sampling or analyses are documented in operator logs to clearly indicate the affected measurements.

The TCEQ has contracted with the USGS to provide stream discharge and water quality measurement data at various sites around the state. See Table A5.1 for USGS site locations and parameters and Table A2.5 for a list of USGS/TCEQ Project Plans and internet location of Project Plans. These Project Plans contain information about USGS documents and records.

A9.1 Documentation of Procedures and Objectives

1. Published guidance (*Code of Federal Regulations* EPA, and EPA *Quality Assurance Handbook*)
2. CWQMN Project Plan
3. Method specific SOPs
4. Instrument manufacturer's technical support manuals
5. *TCEQ QMP, SOPs, and the CWQMN Quality Assurance Project Plan*
6. *TCEQ SWQM Procedures, Volume 1*

A9.2 Record Keeping

CWQMN written records are kept for five years. Electronic records are kept indefinitely or for a life of a project. Please see Table A9.1 for type of record and location.

Table A9.1

CWQMN Record Location

Record	Location
Sampling Information	TCEQ Website
Instrument calibration and calibration verification data forms	TCEQ Regional offices/Cooperators/Contractors
Certificate of Analysis for pH and Conductivity standards	TCEQ Regional offices/Cooperators/Contractors
Instrument and equipment logbooks	Should be located with instrumentation
LEADS electronic Operator logs Validator logs and Calibration Verifications	CFEP
Validators notes	Data Validators office
CWQMN Project Plans	SWQM Central Office
Standard Operating Procedures	SWQM Central Office
Finding Summary Reports	SWQM Central Office
Technical systems and performance evaluation audits	SWQM Central Office

CFEP = Comms Front-End Processor computer located at TCEQ headquarters in Austin, Texas

A9.3 Data Reporting

CWQMN environmental data is stored electronically in the MeteoStar/LEADS System. Selected validated CWQMN data may be loaded into the SWQMIS database. See Section B10 and Sections D1 and D2 for more details.

A9.4 Documentation Control Plan

This section describes the procedure and responsibilities for document control used by the TCEQ CWQMN Project for environmental sample collection and analysis.

All SOPs must have a document title, a revision number, approval signatures, and effective date. The official copy of this document is the hard copy document with the original signatures. SOPs are formally reviewed and re-signed on an as needed basis. SOPs will stay in effect until superseded by a later version or the project is completed. Copies of the official documents shall be clearly identified as such.

The administrative staff is responsible for obtaining and providing the document control number, maintaining the official copy, controlling and documenting access to the documents, maintaining an electronic version of the current copy of the QAPP. PDFs of the QAPP, SOPs and Project Plans are available via the internet at: (www.texaswaterdata.org)

It is the responsibility of each CWQMN participant to ensure they are properly following the most current revision of these documents. The WQPD, Monitoring & Assessment Section Manager, CWQMN Program Manager, and QC Officer are responsible for approving new SOPs and SOP revisions. The QC Officer is responsible for changes to the SOPs.

All logbooks containing data or sample information are uniquely identified with a logbook number. Each site operator has the responsibility of maintaining the logbooks for a minimum of 5 years or until all sample information contained within is no longer required to be kept. Analytical data records are stored on site for a minimum of 5 years, unless otherwise required by a project or regulation. Indelible ink will be used for all hand-written documents. Changes made to hand-written documents must be done by using a single line to strike-out the text. The changes are then initialed and dated.

B1 Sampling Process Design

B1.1 Network Design/Siting Rationale

The CWQMN sites are selected according to TCEQ SOP MANP-001. The TCEQ CWQMN measurement parameters are outlined in Table A5.1.

B1.2 CWQMN Site Proposals

The TCEQ continues to improve the CWQMN. Those interested in partnering with TCEQ to establish new CWQMN sites are encouraged to download (see link below) the CWQMN Pre-Proposal Form and complete the form and submit it to swqmn@tceq.texas.gov Pre-Proposals will be evaluated by a TCEQ panel familiar with the project river basin. TCEQ will consider the data need and expected use, the availability of instruments to monitor the water quality parameter of concern, and the availability of TCEQ and/or in-kind resources for deployment, operation, maintenance, and/or data validation when evaluating project proposals.

TCEQ will evaluate each proposal submitted but may or may not determine to develop and deploy the proposed project. TCEQ will consider the information submitted, the availability of TCEQ and in-kind resources, and the evaluation of the proposed project. Project proposals can be submitted at: (www.texaswaterdata.org)

B1.3 Monitoring Station Design

Monitoring and/or support equipment are installed in weather-tight enclosures or climate controlled trailers containing a data logger, modem, telemetry equipment, and various other support equipment.

Multiprobe Instruments

Multiprobe instruments are typically deployed in a four inch diameter PVC tubes that extends into the water body via a support structure. Deployment tubes include 48 evenly spaced one-inch holes per linear foot for at least the lower two feet of the deployment tube to allow water to flow across the sensors. These types of installations usually utilize a weather-tight aluminum “Traffic Box” containing a data logger, wireless cellular modem or GOES communications equipment, and a deep cycle battery. Solar panels can be installed for battery charging purposes. If wireless cellular service is available at the monitoring site a wireless modem is used to transmit data to TCEQ. In remote areas, equipment can be installed that will relay data using GOES.

Aqualab Analyzers

Aqualab Analyzers are deployed in climate controlled trailers that contain a Zeno data logger, PC, and two U.S. Robotic modems. One modem is dedicated to the Zeno data logger and the other is dedicated for off-site PC analyzer operation. Currently, land-line telephone service must be used for Aqualab Analyzer Zeno data transmittal. The

Analyzer's submersible pump is deployed on track systems, suspended by cables via trees, bridges or other support structures.

Floating Vertical Profilers

Vertical profilers utilize a mooring system with two anchors and stainless steel chains. The profilers are equipped with a deep cycle battery and solar panels. The profiler has a Campbell Scientific data logger to perform process control of the station instrumentation, as well as collect and store ambient measurements. The Campbell Scientific data logger executes a user-defined program to collect water quality profile measurements of the water column and meteorological data if supplied. In addition to the Campbell Scientific data logger, the site communications equipment consists of a wireless cellular modem to transmit data from the site to TCEQ.

Water Level Sensors

Water level sensors are secured at a fixed point in the water column. These sensors are usually deployed in aluminum or PVC tubes that are attached to the multi-probe four inch PVC tubing. Water level sensors are also deployed in tubing that is attached to stream beds, bridges, track systems, or other support structures.

Compressed Gas Sensor Cleaning Systems

Multiprobe sensors on the Upper Rio Grande River can experience extreme fouling due to fine silt. As a result, USGS has installed compressed gas sensor cleaning systems at several sites. The USGS utilizes a system that uses compressed carbon dioxide every six hours to clean measurement sensors.

United States Geological Survey Sites

TCEQ has contracted with the USGS to provide stream discharge and water quality measurement data at various sites around the state. See Table A5.1 for USGS site locations and parameters and Table A2.5 for a list of USGS/TCEQ Project Plans and internet location of Project Plans. These Project Plans contain information about USGS monitoring station design.

B2 Sampling Methods

Continuous monitoring auto analyzers collect and measure discrete water samples. Sondes or Multiprobes measure water quality parameters *in situ*. Data from CWQMN sites are collected and stored in a data logger via communication cables. The data are transmitted via telephone land line, wireless modem, or GOES to the TCEQ MeteoStar/LEADS system in Austin, Texas, where the data are ingested and archived. Averaged data are then posted to the appropriate TCEQ internet site. Table B2.1 describes equipment, sampling method, and telemetry method for specific CWQMN sites.

The TCEQ has contracted with the USGS to provide stream discharge and water quality measurement data at various sites around the state. See Table A5.1 for USGS site locations and parameters and Section/Table A2.5 for a list of USGS/TCEQ Project Plans and internet location of Project Plans. These Project Plans contain additional information about sampling methods.

Table B2.1

Monitoring Methods and Equipment

CAMS	Station Location	Measurement Method	Measurement Equipment	Telemetry	Station Parameters
719	Rio Grande River at the USIBWC Fort Quitman Gaging Station	Sonde: *In situ*	Hydrolab H2O	Wireless Modem	Surface Water Temperature SC, DO, pH Sample depth Water Flow Rate
759	Rio Grande at Fosters Ranch upstream of Amistad Reservoir	Sonde: *In situ*	YSI 6600 EDS (optical DO)	GOES	Surface Water Temperature* SC* DO* pH* Sample Depth*
757	Rio Grande upstream of the confluence of Rio Conchos near Presidio, TX				
758	Rio Grande downstream of the confluence of Rio Conchos near Presidio, TX				
720	Rio Grande River at Castolon, Big Bend National Park	Sonde: *In situ*	YSI 6600 EDS (optical DO)	GOES	Water Temperature* SC* DO* pH*
721	Rio Grande River at Rio Grande Village, Big Bend National Park	Bubbler CAMS 720 and 721 utilizes a compressed CO_2 system. Compressed CO_2 cleans sonde sensor every 6-hours	DA H350/355		Gage Height* Water Flow Rate (Full Range)*
709	Pecos River at FM 1776 near Coyanosa, TX	Sonde: *In situ*	Greenspan CS4-1200 (Galvanic DO)	Wireless Modem	Surface Water Temperature SC DO pH
710	Pecos River at TX at Business 20, west of Pecos, TX				
729	Pecos River near the Terrel/Val Verde/ Crocket County lines	Bubbler	DA H350/355	GOES	Gage Height* Water Flow Rate (Low Range)*
735	Pecos River near US Hwy 290 Southeast of Sheffield, TX				

Table B2.1

Monitoring Methods and Equipment (continued)

CAMS	Station Location	Measurement Method	Measurement Equipment	Telemetry	Station Parameters
767	Rio Grande at Roma, Texas	Sonde: *In situ*	Greenspan CS4-1200	Wireless Modem	Surface Water Temperature SC/TDS
795	Rio Grande downstream of Rio San Juan confluence				
796	Rio Grande downstream of Arroyo Los Olmos				
789	Rio Grande ~3.45 miles upstream of the of the bridge at County Rd. 409 (Harlingen Irrigation DST #1)				
791	Rio Grande ~2.7 miles upstream of the confluence with El Morillo Drain (United Irrigation DST)				
792	Rio Grande ~2.5 miles downstream of the confluence of El Morillo Drain (Hidalgo County Irrigation DST#18)				
793	Rio Grande ~5.0 miles downstream of FM 1015 (HC&CCID# 9)				
736	Rio Grande (Anzalduas Dam) near Pier 7	Non-contact Radar	DA H-3611 Radar	Wireless Modem	Reservoir Surface Elevation (CAMS 736 only)
768	Devils River downstream of (SH 163) Baker's Crossing	Sonde: *In situ*	Greenspan CS4-1200 (Galvanic DO)	GOES	Surface Water Temperature SC DO pH
764	Independence Creek at Caroline Springs (T-5) on the Nature conservancy's Independence Creek Preserve south of Sheffield, TX	Sonde: *In situ*	Greenspan CS4-1200 (Galvanic DO)	GOES	Surface Water Temperature SC DO pH
731	Petronila Creek at FM 70 east of Bishop, TX	Sonde: *In situ*	In-Situ Aqua TROLL 200	Wireless Modem	Surface Water Temperature SC/TDS Sample Depth

Table B2.1

Monitoring Methods and Equipment (continued)

CAMS	Station Location	Measurement Method	Measurement Equipment	Telemetry	Station Parameters
716	Beals Creek Pump Station southeast of Big Spring, TX	Sonde: *In situ*	YSI 600 XLM	GOES	Surface Water Temperature SC/TDS Sample Depth
717	Colorado River Pump Station northwest of Colorado City, TX				
743	North Concho River Downstream of Koenigheim St. San Angelo, TX	Sonde: *In situ*	YSI 6920 (optical DO)	Wireless Modem	Surface SC DO pH Water Temperature Sample Depth Precipitation (CAMS 744)
744	North Concho River at S. Oaks Rd, San Angelo, TX				
701	Green Creek (Bosque River Tributary) at CR 266 near Clairette, TX	Auto Analyzer: Submersible Pump, sub sample collected from sample pot	Greenspan Aqualab Analyzer (Galvanic DO) Level Troll 500**	Land line	Surface Water Temperature DO pH SC Turbidity NO_3-N NH_3-N TRP Water Level Precipitation (CAMS 701 & 704)
704	Resley Creek (Leon River Tributary) at FM 2823 near Dublin, TX				
725^	North Bosque River at State Hwy 6 Bridge				
702	Bosque River at Riverside Rd. in Clifton, TX				
726^	Scarborough Creek (Upper North Bosque River intermittent tributary) at CR 423	Auto Analyzer: Submersible pump triggered by level sensor, sub sample collected from sample pot Sonde: *In situ*	Greenspan Aqualab Analyzer Level Troll 500** Aqua TROLL 200	Land Line	Surface NO_3-N NH_3-N TRP^ Sample depth SC, Sample Depth, and Water Temperature (CAMS 728 and 765 only)
728	Little Duffau Creek (Bosque River Tributary) near FM 1824				
765	Un-Named Tributary of Little Duffau Creek (Bosque River Tributary) near FM 1824				
742	Bosque River at Coopers Crossing near Lake Waco	Auto Analyzer: Submersible pump, sub sample collected from sample pot	Greenspan Aqualab Analyzer TP and TRP Analyzer	Land Line	Surface TRP TP
		Sonde: *In situ*	Greenspan CS4-1200 (Galvanic DO) Level Troll 500**		Water Temperature DO SC pH Water Level

Table B2.1

Monitoring Methods and Equipment (continued)

CAMS	Station Location	Measurement Method	Measurement Equipment	Telemetry	Station Parameters
723	Lake Whitney	Sonde: *In situ*	YSI 6600 EDS (optical DO) YSI 6951	Wireless Modem	Vertical Profile of Water Column Water Temperature SC Percent Fluorescence Total Chlorophyll Sample Depth Meteorological Resultant Wind Direction, Speed, and Temperature
749	Pine Island Bayou at Lower Neches Valley Authority Pump Station near U.S. Hwy 69	Sonde: *In situ*	YSI 6600 EDS (optical DO)	Wireless Modem	Surface Water Temperature SC/TDS DO pH Turbidity Sample Depth
787	Big Cypress Bayou approximately 5.7 miles upstream of SH 43	Sonde: *In situ*	YSI 6600 EDS (optical DO)	Wireless Modem	Surface Water Temperature SC DO pH Sample depth
771	West Fork San Jacinto River at IH 45 south of Conroe, TX	Sonde: *In situ*	YSI 6600 EDS (optical DO)	GOES	Surface Water Temperature* SC* DO* pH* Turbidity*
772	West Fork San Jacinto River near SH 105 northwest of Conroe, TX				

*Sites operated by United States Geological Survey under TCEQ contract
**Level TROLL 500 measurement method = vented pressure transducer
^Continuous Ambient Monitoring Station [CAMS] 725, 726, 728, and 765 utilizes high range TRP sensors (0 – 4.00 parts per million [ppm]). The Aqualab analyzer at all other sites utilize low range TRP sensors (0 – 0.600 ppm)
DA = design analysis
DO = dissolved oxygen
GOES = Geostationary Operational Environmental Satellite
HC&CCID#9 = Hidalgo & Cameron County Irrigation District #9
NO_3-N, = nitrate-nitrogen
NH_3-N, = ammonia-nitrogen
SC = specific conductance
TBD = To Be Determined
TDS = total dissolved solids
TP = total phosphorus
TRP = total reactive phosphorus
USIBWC = United States International Boundary and Water Commission
YSI = Yellow Springs Instrument

Multiprobe and Water Level Sensors

In-situ water quality, water level, and sample depth measurements are logged once every 15 minutes by the data logger. The data are then transmitted to the MeteoStar/LEADS system in Austin, Texas where the data are stored. Data are averaged into one-hour averages and displayed on the external TCEQ web pages.

Compressed Carbon Dioxide Sensor Cleaners

At locations on the Rio Grande Rivers (CAMS 720 and 721) compressed carbon dioxide is used to clean sensors. These locations can experience high sedimentation loads comprised of fine silt. Sensors are cleaned every 6 hours.

Auto Analyzer (Greenspan Aqualab)

The analyzers collect and analyze discrete water samples. Water is pumped by a primeless submersible pump to a sample pot via sample line. The sample line and sample pot are flushed for several minutes prior to the collection of a sub-sample. A sub-sample is collected and sent to the analysis area of the analyzer. Two types of Aqualab analyzers are deployed in the network, a 7 parameter nutrient and physiochemical analyzer and an analyzer at one location that measures only total and reactive phosphorus (see Table B2.1).

Aqualab analyzers are deployed in intermittent rainfall dependent tributaries of the North Bosque River (CAMS 726, 728, and 765). The analyzers are configured to start and stop sample collection and analysis based on in-stream water level measurements. A Zeno data logger has been programmed to trigger the analyzer on and off based on water level set-points.

Please see Table B2.2 for analyzer measurement frequencies for a given site. The analyzer measures and stores (holds) the concentration until a new sample is analyzed. Water quality measurements from the Aqualab are logged once every 15 minutes by the data logger. The data are then transmitted every 15 minutes to the MeteoStar/LEADS system in Austin, Texas where the data are averaged into one-hour averages.

Table B2.2

Aqualab Analyzer Measurement Frequencies

CAMS	Location	Measurement Frequencies	Parameters
701	Greens Creek (Bosque River tributary) at CR 266 near Clairette, TX	Physiochemical Parameters One discrete sample analyzed every hour Nutrients One discrete sample analyzed every six-hours	Temperature DO pH SC Turbidity NO_3-N NH_3-N TRP
704	Resley Creek (Leon River tributary) at FM 2823 near Dublin, TX		
725	Bosque River at State Hwy 6 Bridge		
702	Bosque River at Riverside Rd. in Clifton, TX		
726	Scarborough Creek (Upper North Bosque River, intermittent tributary) at CR 423	Analyzer sample collection and analysis triggered by water level sensor. When triggered, a repeating nutrient measurement sequence continues until water level recedes below water level set-point.	NO_3-N NH_3-N TRP
728	Little Duffau Creek (Bosque River Tributary) near FM 1824		
765	Un-Named Tributary of Little Duffau Creek (Bosque River Tributary) near FM 1824		

CAMS = Continuous Ambient Monitoring Station
DO = dissolved oxygen
NO_3-N = nitrate-nitrogen
NH_3-N = ammonia-nitrogen
SC = specific conductance
TP = total phosphorus
TRP = total reactive phosphorus

USGS Stage and Discharge Measurements

For stream discharge, USGS hydrographers develop and maintain a stage to discharge rating. A "Look-up Table" is developed for each site, this table is used to provide discharge values for a given stage measurement. Stream discharge data is periodically uploaded from USGS to the TCEQ LEADS system.

Stage and water quality measurements are logged once every 15 minutes by the data logger. The data are then transmitted to the MeteoStar/LEADS system in Austin, Texas where the data are stored. Data are averaged into one-hour averages and displayed on the external TCEQ web pages.

B2.1 Monitoring Equipment

Instrument specific SOPs describe support equipment, sampling, analytical procedures, and criteria. Please see Table A2.4 for a list of completed instrument SOPs and Table A6.2 for a complete instrument SOP list/status. Only one SOP for instrument maintenance has been completed (Aqualab Analyzer). Instruments' Operation Manuals are being used as guidance for maintenance activities.

Auto Analyzer (Greenspan Aqualab)

Auto Analyzers collect discrete water samples using a submersible pump and sample line. Once the samples are collected they are analyzed automatically in a climate controlled trailer that houses support equipment including a data logger, modem, and telemetry equipment.

Limitations and Performance Criteria

See Section A7 for performance criteria for the network.

B2.2 Sampling/Measurement System Corrective Action

Corrective action measures in the CWQMN will be taken to ensure the DQOs and MQOs are attained. The site operator is responsible for monitoring the performance of the measurement and support equipment and identifying problems or potential problems. It is expected that any individual in the CWQMN who discovers a problem will initiate corrective action appropriate to the situation. Corrective action is accomplished at the lowest level and shall be documented in the MeteoStar/LEADS operator log. The QC Officer, Network Coordinator, and Project Lead must be notified of any proposed corrective action that can affect data quality and/or CWQMN protocols. When problems are identified that cannot be resolved by the site operator, the site operator notifies the project lead that is responsible for coordination with appropriate personnel to resolve the problem. The project lead reports the problem and necessary corrective action to the network coordinator.

The FOSD stocks various consumable and replacement items for the CWQMN. The project lead is responsible for coordinating the necessary supply and parts shipments to the site operator. When necessary, personnel from FOSD, System Planning and & Implementation Team will travel to a particular site to repair or replace support equipment that cannot be repaired or replaced by the site operators. Monitoring equipment that cannot be repaired by TCEQ staff is sent to the manufacturer for repair.

Some CWQMN sites are located in or near flood plains. Consequently, various CWQMN sites have the potential to be damaged or destroyed by flood waters during severe floods. Potential flooding is a consideration in the site development process. Additionally, sondes, sampling and/or support equipment are located in stream beds and are subject to frequent flooding. These components are secured to the stream banks and have proved capable of surviving a given flood. However, it is accepted that the support systems and components will need periodic replacement and repair.

B3 Sample Handling and Custody

See Section B10 for electronic managing of CWQMN data. Water quality is measured *in situ* for the sonde instrumentation. The Aqualab analyzer collects water samples via a sample line and submersible pump. The Aqualab sample line and sample pot is flushed for several minutes with ambient water before a sub sample is sent to the analysis area of the analyzer.

B4 Analytical Methods

Water quality measurement methods used by the CWQMN are based on the *Standard Methods for the Examination of Water and Wastewater*, 20th Edition, 1998, unless otherwise noted. Data comparability is achieved by following approved standardized analytical methods and operating procedures. Methods must be documented to minimize variation in procedures and results. Method-specific SOPs are used to document exact procedures necessary to perform the method or operate a specific instrument or apparatus.

CWQMN method summaries are presented in Section A7. These tables include methods, analytical techniques, performance, and criteria.

Analytical system corrective actions are addressed in Section C1 of this quality assurance project plan.

The TCEQ has contracted with the USGS to provide stream discharge and water quality measurement data at various sites around the state. See Table A5.1 for USGS site locations and parameters and Section/Table A2.5 for a list of USGS/TCEQ Project Plans and internet location. These Project Plans contain information about USGS stage and discharge analytical methods.

Greenspan CS4-1200 Multiprobe DO Salinity Corrections

The CWQMN has several sites located on saline water bodies. Greenspan CS4-1200 multiprobes do not correct DO measurements for the affects of salinity on the solubility oxygen in water. Consequently, LEADS was programmed to correct DO measurements for salinity using calculations found in *Standard Methods for the Examination of Water and Wastewater*, 20th Edition (0-42 Practical Salinity Scale). The correction factor was also applied to historic data.

CWQMN Turbidity Measurements

Continuous water quality monitoring network turbidity measurement methods are not based on *Standard Methods for the Examination of Water and Wastewater*, 20th Edition, 1998. Turbidity measurements are made using a near infrared (780 – 900 nanometers) or monochrome light source with 90 degree detection angle, one detector (ISO Method 7027). ISO Method designates measurement units for this method as Formazin Nephelometric Units (FNU).

B5 Quality Control (QC)

For a QA/QC program to be successful, it is essential that specific controls be established and maintained throughout the measurement process. QC includes technical activities that measure the attributes and performance of the sampling and analysis process against defined standards to verify that they meet the needs of the project. Data quality is assessed, controlled, and measured by using SOPs, QC samples, and audits. Specific QC samples, frequency of QC samples, and procedures shall be described in instrument-specific SOPs. Program-defined measurement performance specifications are specified in Tables A7.1-3.

The TCEQ has contracted with the USGS to provide stream discharge and water quality measurement data at various sites around the state. See Table A5.1 for USGS site locations and parameters and Section/Table A2.5 for a list of USGS/TCEQ Project Plans and internet location. These Project Plans contain information about USGS stage and discharge measurement QC.

Multiprobe Quality Control

Currently, CWQMN multiprobe QC measurements consist of analyzing standards for calibration purposes and analyzing CVS at the conclusion of deployments for data validation purposes. Multiprobe temperature sensors are also checked at the conclusion of deployments. As mentioned previously in Section A7, the TCEQ is currently evaluating the application of USGS-based fouling measurement procedures at several network sites.

Calibration Verification Samples

Instrument calibration is assessed at the conclusion of deployment periods using CVSs. These standards are analyzed to determine if fouling and/or instrument drift has caused sensors to exceed criteria. The CVS is prepared from the same standard used to generate the initial calibration curve. The CWQMN CVS procedures may not accurately measure the effects of fouling on sensor performance.

Temperature Sensor Checks

After every deployment period, network multiprobe temperature sensors are checked against NIST-traceable thermometers and thermistors. The multiprobe measured temperature must be within ± 0.50 °C of the NIST-traceable thermometer. If the multiprobe temperature sensor does not meet the ± 0.50 °C criterion the corresponding DO, SC, and temperature data are invalidated.

USGS-Based Multiprobe Sensor Fouling/Drift Measurements and Calculations

The USGS-based procedures are designed to measure the potential effect of various forms of sensor and deployment tube fouling on sensor performance. The procedure measures and compares the responses of non-cleaned and cleaned sensors/deployment tubes. Measurements are made in the deployment tube. An additional multiprobe/field meter is deployed at the same location as the deployed multiprobe. Field meter measurements are made at the beginning and at the conclusion of the procedure. Field meter measurements are used to correct fouling measurements for changes in water quality.

The TCEQ has written draft instrument-specific fouling measurement procedures (SOP AMIN-011, Rev. 2 and an Aqua TROLL 200, Rev. 0 SOP). The USGS uses sensor fouling and drift measurements to "correct" data collected over a deployment period. The TCEQ has modified USGS calculations to quantify and sum sensor fouling and sensor drift measurements. Below are TCEQ's calculations.

1.0 Multiprobe Calibration Drift Calculations

1.1 Conductivity sensor calibration drift (*CD*) over the deployment period is evaluated using relative percent error:

$$CD = \frac{(S_r - S_v)}{S_v}(100)$$

Where:

S_r= Sensor response; and
S_v = specific conductance KCL standard value

1.2 DO and pH sensor *CD* over the deployment period is evaluated by the following:

$$CD = (S_r - S_v)$$

Where:

S_r = DO or pH sensor response; and
S_v = DO mg/l theoretical value; pH KCL standard value

2.0 Multiprobe Sensor Fouling Calculations

2.1 Multiprobe percent conductivity sensor fouling (µS/cm) over the deployment period is evaluated during field service events by comparing not cleaned and cleaned conductivity sensor responses:

$$\%Fouling = \left(\frac{(S_i - S_f) - (F_i - F_f)}{Sf} \right) 100$$

Where:

S_i = sensor response initial; and
S_f = sensor response final,
F_i = field meter response initial,
F_f = field meter response final

2.2 Multiprobe temperature, DO (mg/l), and pH (SU) sensor fouling over the deployment period is evaluated during field service events by comparing not cleaned and cleaned sensor responses:

$$Fouling = (S_i - S_f) - (F_i - F_f)$$

Where:

S_i = sensor response initial; and
S_f = sensor response final,
F_i = field meter response initial,
F_f = field meter response final

3.0 Total Error Calculations

3.1 To be determined.

Potential Fouling Measurement Limitations

Fouling measurements are estimates of potential environmental effects on sensor performance. Stream scouring events can clean sensor interfaces and deployment tubes prior to performing the procedure; this can result in the fouling measurement not being representative of the entire deployment period.

When performing the procedure multiprobe measurements must be stable. Measurement stability criteria have not been developed.

Fouling measurement procedures are intended for use in situations when water quality conditions are not considered rapidly changing or fluctuating. The USGS defines (*TM1D3*) rapidly changing for DO, EC, pH and temperature as follows: *Rapid change is relative to the length of time needed to service the monitor and generally is defined as a change that exceeds the (USGS) calibration criteria within 5 minutes* (Table 1).

Table 1

Parameter	USGS Calibration Criteria
Temperature	± 0.2 °C
SC	± 5 µS or 3% use greatest
DO	± 0.3 mg/l
pH	± 0.2 pH units
Percent Fluorescence	TBD

The TCEQ and cooperators are currently measuring fouling at several CWQMN locations. Without any complicating factors fouling measurement procedures are routinely taking longer than 5 minutes.

At some locations (and/or times of year) there is not enough stream flow to disperse biological and/or sediment debris clouds in a timely manner that can result from deployment tube cleaning activities. The debris can cause changes in water quality measurements that are not representative of stream conditions and can skew sensor/field meter final measurements. Debris clouds can also cause water quality measurements to fluctuate. Consequently, during low or no stream flow, site operators are allowing significant amounts of time to elapse in order for debris clouds to disperse before sensor/field meter final measurements are recorded. Due to extended time allowed, changes in water quality can exceed Table 1 criteria as measured by the field meter.

USGS Bucket Fouling Measurement Procedure

The USGS has developed a ‘bucket” method for measuring sensor fouling when water quality conditions are considered rapidly changing or fluctuating. Fouling measurements are made in an insulated bucket using water from the water body. A field meter is placed in the bucket to measure any changes in water quality during the procedure. This procedure does not measure the potential effects of fouled deployment tubes on sensor performance.

Multiprobe Anti-Fouling Measures

Multiprobes can be equipped with various anti-fouling measures. Anti-fouling measures can improve data quality and increase deployment periods. Generally, the program is not prescriptive of the type of anti-fouling measures that must be used at a particular site. USGS-based fouling measurement procedures might be useful in evaluating the various anti-fouling measures. The YSI optical DO sensor is outfitted with a mechanical wiper that utilizes disposable foam pads. Foam wiper pads must be replaced prior to each deployment period.

Multiprobe Deployment Tube Cleaning

Multiprobe deployment tubes can become fouled by a variety of organisms and sediment, which can compromise data quality. Every multiprobe deployment tube in the network must be cleaned with a chimney brush (inside and out) as part of every service event.

Aqualab Analyzer IB and LCS

Automated nutrient IB and LCS capabilities have been installed at all Aqualab Analyzer locations. Nutrient IBs and LCSs are analyzed once daily. IBs are analyzed using de-ionized water.

The Aqualab total phosphorus LCS is prepared from a stock solution of B-Glycerophosphoric acid disodium salt, 5 hydrates.

Precision

Precision is assessed by comparing replicate analyses of LCSs or CVSs in the sample matrix (e.g., de-ionized water). Currently, sonde precision is not being calculated.

Analytical data precision is evaluated using RPD. RPD is a measure of variability adjusting for the magnitude of the measured values. It is used when the true value is unknown, as is the case with duplicate samples, and is given by:

$$RPD = \frac{|X1 - X2|}{(X1 + X2)/2} \times 100$$

Where:

X1 = duplicate sample measurements; and
X2 = duplicate sample measurements.

Bias

Bias is determined through the analysis of LCSs prepared with certified amounts of all target analytes in the sample matrix (e.g., de-ionized water) and by calculating percent recovery. Currently, sonde measurement bias is determined using CVSs. See Table A7.1 for sonde performance specifications. See Table A7.3 for Greenspan Aqualab LCS performance specifications.

Analytical data bias can be presented in terms of percent recovery as given by:

$$\% \text{ Recovery} = \frac{\text{Measured Value}}{\text{Actual Value}} \times 100$$

Conversely, measurement bias can be expressed in terms of RPE

$$RPE = \frac{(Y - X)}{X} X\,100$$

Where:
Y = measured value; and
X = known value.

Sensitivity

Method sensitivity is estimated using method detection limit studies after initial instrument setup, after major modifications, and at least annually thereafter. Detection limit determination is consistent with *40 Code of Federal Regulation Part 136*, Appendix B to the extent possible. This requires replicate fortification of 7 different blanks at a concentration 3-to-5 times the expected detection limit, if possible. Each fortified sample is analyzed and the measured analytical standard deviation is multiplied by the appropriate Student's "t" value to determine the concentration at which there is a 99 percent certainty that the measured concentration is not due to background noise. The calculated detection limit is confirmed by analyzing one standard at 2-to-5 times the calculated detection limit.

Corrective Action Related to QC

Any deviation from the procedures documented in the SOP should be documented in the operators log by the site operator. The log entry should contain a description of the exception, the cause (if possible), the affected data, and the impact on the data record. Any affected data should be qualified by a data validator accordingly. **Note:** A failing QC sample can be followed by a single replicate analysis to determine if there is a systematic problem. If the replicate analysis meets all acceptance criteria, then the system may be deemed as providing acceptable data. Conducting multiple analyses, however, to obtain a single passing QC sample when no corrective action as a result of an assignable cause or instrument maintenance is performed is not acceptable. If either the original QC sample or its rerun passes, then the failing QC analysis is considered to be an anomaly, and its results are not used for data assessment. Best professional judgment is needed at times to determine if QC sample is representative of ambient measurements. QC sample anomalies should be documented.

B6 Instrument/Equipment Testing, Inspection and Maintenance

Instruments and equipment for specific projects included in the *CWQMN QAPP* may be funded by any combination of federal funds (Clean Water Act Sec 106 or other federal grants) and/or non-federal funds (state and local funds).

Instrument maintenance activities are documented in equipment dedicated logbooks. PMA records contain information on periodic routine maintenance, symptoms, troubleshooting effort descriptions, results and follow-up observations. Records should include the date, time, and the name or initials of the site operator performing the maintenance. These records are vital tools in historic instrument performance and are an aid to future troubleshooting. TCEQ maintenance documents are based on manufacturers' recommendations. See Section B2 on how critical spare parts will be supplied and stocked.

The TCEQ has contracted with the USGS to provide stream discharge and water quality measurement data at various sites around the state. See Table A5.1 for USGS site locations and parameters and Section/Table A2.5 for a list of USGS/TCEQ Project Plans and internet location. These Project Plans contain information about USGS stage and discharge instrument/equipment testing, inspection and maintenance.

Sondes (Multiprobes)

Currently, the instruments' operation manuals are being used as guidance for maintenance activities.

Multiprobe Optical DO Membranes (YSI)

According to the YSI manufacturer, multiprobe optical DO membranes should be replaced on an annual basis; the membrane's luminescent dye can degrade and the membrane's black protective coating can degrade and/or be worn down. The black coating keeps ambient light from affecting sensor response. It has been determined that optical DO membranes can be stored indefinitely in their shipment box (no light) in a temperature controlled environment. The site operator is responsible for ensuring optical DO membranes are replaced on an annual basis. Site operators can request new optical DO membranes from their respective project lead.

Aqualab Analyzer

See SOP MAIN-022 for instrument cleaning and maintenance procedures. The TCEQ has contracted with Greenspan to provide 24-hour 6 days a week analyzer phone support for TCEQ and Texas Institute for Applied Environmental Research site operators. In the event a repair problem can not be resolved via telephone the service

contract includes on-site repair services by Greenspan. Newly deployed analyzer components are under warranty for one year after installation. The 1-year warranty includes on-site repairs by Greenspan.

Level TROLL 200 and 500

Currently, the instruments' operation manuals are being used as guidance for maintenance activities.

Design Analysis H-3611 Radar Water Level Sensor

Currently, the instruments' operation manuals are being used as guidance for maintenance activities.

B7 Instrument Calibration and Frequency

Before multiprobe deployments, calibration standards are analyzed to establish instrument response. Concentrations or constituents are calculated using multipoint or single-point calibration responses.

Standards

Calibration, CVS, and LCS shall be National Institute of Standards and Technology (NIST) - traceable standards or prepared from NIST - traceable materials. Class "A" glassware and NIST traceable weights shall be used when making SC, pH, polymer B or formazin standards (turbidity standards), ammonia-nitrogen, nitrate-nitrogen, phosphate-phosphorus, and TP LCS standards. All CWQMN non EMRS multiprobe standards must have a COA that contains traceability and accuracy statements. Expired standards should not be used.

Instrument Calibrations

Multipoint and single-point calibrations are performed whenever:

1. The instrument response has drifted so that the CVSs or other quality control checks do not meet established acceptance criteria; or
2. Instrumentation is calibrated at routine frequencies; or
3. Prior to *in situ* field deployment.

Greenspan CS4-1200 Multiprobe Conductivity Loop Calibrator Resistor Standards

Greenspan CS4-1200 multiprobes are deployed at various locations in the network (see Table B2.1 for locations). Greenspan CS4-1200 conductivity sensors utilize the Toroidal measurement method. These sensors are calibrated and CVSs are analyzed using Loop Calibrator resistor standards provided by the manufacturer and a vendor. The resistors are "mated" to a particular conductivity sensor and according to the manufacturer the resistors are not interchangeable between units. If interchanged, CS4-1200 conductivity sensor may not meet manufacturer stated accuracy. COAs for these standards are not available. It is the goal of the program to replace CS4-1200 multiprobes at all non-EMRS sites with measurement equipment that requires the use of wet KCL standards.

Greenspan CS4-1200 multiprobe conductivity sensors are utilized at the lower Rio Grande River EMRS sites. For these sites, loop calibrator standards are assayed before they are used at these sites. The assay consists of calibrating the CS4-1200 conductivity sensor with a "mated" resistor and the sensor is tested with a wet KCL 1500 µS/cm conductivity standard. Sensor responses must be within 5.0 RPE of the KCL standard

Sonde (Multiprobe) Temperature Checks

After every deployment period, network multiprobe temperature sensors are checked against NIST- traceable thermometers and thermistors.

The TCEQ site operators have been issued spirit filled thermometers. These thermometers are calibrated annually by TCEQ against a mercury filled NIST-calibrated (7-point) thermometer. The TCEQ's NIST-calibrated (7-point) thermometer has been deemed valid for 5-years between NIST traceable seven point re-calibrations.

Site operators who are cooperators are issued mercury filled NIST-calibrated (ice point) thermometers. The TCEQ has deemed the calibration for these types of thermometers valid for 5-years.

USGS site operators use a NIST traceable thermistors. The thermistors are calibrated annually against NIST-calibrated or traceable thermometer.

USGS Instrument Calibration and Frequency

The TCEQ has contracted with the USGS to provide discharge measurement and water quality data at various sites around the state. See Table A5.1 for USGS site locations and Section/Table A2.5 for a list of USGS/TCEQ project plans and internet location of Project Plans. These Project Plans contain information about USGS stage and discharge instrumentation calibrations and frequency.

B8 Inspection/Acceptance of Supplies and Consumables

The FOSD procures, stores, and dispenses various spare parts, equipment, consumable items, and other items to CWQMN TCEQ staff and Cooperators.

The TCEQ has contracted with the USGS to provide stream discharge and water quality measurement data at various sites around the state. See Table A5.1 for USGS site locations and parameters and Section/Table A2.5 for a list of USGS/TCEQ Project Plans and internet location. These Project Plans contain information about USGS stage, discharge, and water quality inspection/acceptance of supplies and consumables.

B8.1 Spare Parts

The TCEQ spare parts are tracked on a personal computer-based system. Restock orders are automatically posted when the stock levels go below a certain level that has been established for each inventoried item.

B8.2 Standards and Reagents

The TCEQ provides standards and reagents that are purchased through the state contract system or through inter-agency contracts.

B9 Non-Direct Measurements

This QAPP does not include the use of routine data obtained from non-direct measurement sources.

B10 Data Management

Water quality data, sample depth data, water level data and operator logs are sent to TCEQ by a variety of methods; wireless cellular modem, by modem over a standard phone line, or GOES. See Table B2.1 for telemetry methods for specific sites.

Cellular and standard phone line data are transferred to the TCEQ Headquarters (Austin, Texas) CFEP computer through Regional Hub (Hewlett Packard 712/60) computers that automatically download a discrete measurement from a Zeno data logger every 15 minutes. The data are secured from tampering or corruption over the carrier line through an unlisted telephone number, pass code protection, and error checking protocol. Operator logs may be entered on-site or remotely via the Zeno data logger. Operator logs may also be entered via TCEQ's web based RHONE page (for those operators who have access to the page).

For sites that utilize GOES, stage and water quality measurements are logged once every 15 minutes by a Sutron Datalink2 data logger and relayed to the GOES once every hour. The data is then decoded and ingested from the NOAA Port and ingested into the CFEP.

Measurement instrumentation is connected to the data logger systems. The data logger systems records the analog output voltage of each instrument once every 15 minutes, digitizes it, and stores the data. Data is available as discrete 15-minute samples and 15-minute samples are averaged into 1-hour averages. A record consists of sequential fields of data for as many channels as are activated for each monitoring station.

If the telemetry method fails at a given site, the data loggers are capable of recording and storing data until the data are overwritten with newly generated data. Once communications are re-established the data are automatically downloaded to the CFEP computer. The site operator and data validator should check the operational status of the station every business day via the TCEQ website. If communication problems are detected, the site operator needs to initiate corrective action in a timely manner or data can be lost. The site operator should alert FOSD staff and the SWQM WQPD project lead to initiate corrective action. Once FOSD staff has been notified, FOSD will ensure that corrective action was taken and that the action was effective. **NOTE:** The CRMWD checks the operational status of their sondes (see Table A6.1) via hardwire connections. Consequently, data communication problems to the TCEQ will not be detected by CRMWD. The project lead for the CRMWD sites will be responsible for monitoring and reporting communications problems between the sites and TCEQ using the procedure discussed above.

The MeteoStar/LEADS processing program checks for correct date, time, sampling site number, and proper formatting of raw data fields. For the water quality parameters it then calculates 5-minute and hourly averages, converting voltages to engineering units. The data are stored in a temporary disk file. The CWQMN data validators work from

this file through their personal computer on a graphical interface. Data validators obtain sonde QC information from the Operator Log external webpage, which is typically entered by site operators and cooperators/contractors. TCEQ site operators access the web page operator log at http://tceqwatercal.ipsmtx.com/. A password is needed to access the external web page. Network participants can obtain passwords from the Network Coordinator.

The data validators periodically download Aqualab Analyzer QC data via telephone modem. The sonde and Aqualab Analyzer QC results are used in the data validation process. The data maintained on the CFEP are accessible through Internet web page reports.

After data validation, the data are coded in the file. The coded data in this file are considered "validated data" and are archived on optical disk indefinitely.

USGS and Discharge Measurements

For information concerning USGS data management of discharge data please see USGS/TCEQ Project Plans (Table A2.5). Stream discharge data is periodically uploaded from USGS to the TCEQ LEADS system.

For USGS discharge data, the MeteoStar/LEADS system downloads the Look up Table once every day from USGS and reports a discharge value for a given stage measurement. Discharge and stage data going into MeteoStar/LEADS is non-validated data. The data are averaged into 1-hour averages by MeteoStar/LEADS. The non-validated data will not be loaded into the SWQMIS. USGS submits formatted continuous water quality and gage height data hourly to TCEQ using an automated script that extracts the data from the USGS data base, formats it and sends the data to a file transfer protocol (ftp) site.

TCEQ uses an automated data ingest script that sets up and retrieves USGS water quality and gage height data, examines the data for problems, archives the data, and inserts the data into LEADS in the normal ingest sequence.

USGS discharge data is submitted in March and September in formatted files that are manually loaded to LEADS.

SWQMIS Data Base

A data loader has been developed that loads validated CWQMN data into the SWQMIS data base for long term storage and management. Only data collected and validated under an EPA or TCEQ approved QAPP will be stored in SWQMIS. The dataset of record will be considered the SWQMIS dataset. Data collected and validated by the CWQMN, and stored in SWQMIS may be requested from the Water Data Management & Analysis team

Only CWQMN data collected and validated under an EPA or TCEQ approved QAPP will be stored in SWQMIS. Calculated parameters such as total dissolved solids and salinity will not be stored in the SWQMIS. Additionally, water level and sample depth parameters will not be stored in SWQMIS.

See Table B10.1 for a complete list of CWQMN parameters that will be stored in SWQMIS. The table also contains a crosswalk of parameters codes from LEADS to SWQMIS.

Table B10.1

Surface Water Quality Monitoring Information System Parameters

Parameter	LEADS Parameter Code	SWQMIS Parameter Code	Units
Temperature	10010	00010	ºC
Specific Conductance	10095	00094	µS/cm
Dissolved Oxygen	10300	00300	mg/L
Dissolved Oxygen, Percent Saturation	10301	00301	%
pH	10400	00400	pH units
Ammonia-Nitrogen	10107	13851	mg/L
Nitrate-Nitrogen	10101	13852	mg/L
Total Reactive Phosphorus	10105	17527	mg/L
Total Phosphorus	10110	17528	mg/L
Turbidity	10104	NA*	FNU
USGS Gage Height		00065	Feet
USGS Water Flow Rate		00061	CFS

*SWQMIS parameter code for CWQMN turbidity measurements being requested. Units associated with the new parameter code will be Formazin Nephelometric Units.
CFS = Cubic feet per second
FNU = Formazin Nephelometric Units
NA = not available
mg/L = milligrams/Liter
µS/cm = micro Siemens / centimeter
ºC = Degrees Centigrade

Data Users

Data stored in the MeteoStar/LEADS system may be provided to internal users (TCEQ data analyst, etc.) by email, on disk, on printouts, or through TCEQ web page reports. Other internal customers have read-only access. Public requests for CWQMN data, as well as MeteoStar/LEADS data, are made through the Water Data Management & Analysis Team. Non-validated data may be released to the public with disclaimers regarding the validity of the data.

B10.1 Data Reporting

Data collected in the CWQMN are internally hosted on the Meteostar/LEADS TCEQ RHONE data server. Internal and external reports and summaries are compiled from data hosted on this server.

Data are reported internally on the RHONE Daily Reporting Page at various frequencies, which are dependent upon project monitoring instrumentation. Data collected with multiprobes and level sensors every 15 minutes are reported in the SWQM Daily Report in the 15-minute increment of their collection. Data collected by Aqualab Auto-analyzers in 1 or 6 hour frequencies are reported in the SWQM Daily Report in 15-minute increments, with values updated in the hour of their collection. Data collected with Floating Vertical Profilers every hour are reported in the Profiler Daily Printout in the hour and depth of their collection. Internal summary reports are available for all CWQMN data.

Hourly data summary reports are externally available on the TCEQ-hosted website (www.texaswaterdata.org) for all stations in the network except Floating Vertical Profilers. Profile data are not available externally, but are available upon request. See Section B10 Data Users for specific information regarding data requests. Raw data, reported with the time of collection, are not available for external reporting.

C1 Assessments and Response Actions

The management of the TCEQ advocates and encourages a "continuous improvement" philosophy in personnel development and work processes. Each employee is responsible for implementing and evaluating the effectiveness of quality improvement activities with which he/she is involved. Fostering a "no-fault" attitude to encourage the identification of opportunities for improvement so they can be brought to the forefront and addressed accordingly is recognized to be a critical factor in a continuous improvement environment. Review of process performance is done on a continuous basis. This section addresses the assessment and response actions for the CWQMN.

The TCEQ has contracted with the USGS to provide stream discharge and water quality measurement data at various sites around the state. See Table A5.1 for USGS site locations and parameters and Table A2.5 for a list of USGS/TCEQ Project Plans and internet location for the Project Plans. These Project Plans contain information about USGS stage and discharge assessments and response actions. TCEQ does not currently have staff with required expertise to conduct assessments of stage and discharge monitoring related activities.

Based upon audit reports, the Network Coordinator, QA Officer, and QC Officer will work collaboratively on recommendations to the Division Director and project leads to stop work if necessary to safeguard programmatic objectives, worker safety, public health, or environmental protection.

CWQMN Participant-Initiated Corrective Action

It is expected that any individual in the CWQMN who discovers a problem will initiate corrective action appropriate to the situation. Corrective action is accomplished at the lowest level and shall be documented in the MeteoStar/LEADS operator log. The QC Officer, Network Coordinator, and Project Lead must be notified of any proposed corrective action that can affect data quality and/or CWQMN protocols.

CWQMN Assessments

The following types of assessments are conducted under the CWQMN Program:

- Annual CWQMN Site Reviews
- Monitoring Station TSAs and PEAs
- Data Management Assessments
- Multiprobe Data Completeness Assessments

Annual CWQMN Site Reviews

Each year, the Network Coordinator manages a process to review every CWQMN station. The reviews are used to make decisions to continue, modify, and/or terminate stations. The Network Coordinator request SWQM project leads to complete a Site Evaluation form for each network site. See Appendix G for a copy/content of the form. Based on this form, the Project Lead, Network Coordinator, QA officer, QC officer, Data Validator, meet and discuss the individual site(s) and develop recommendations for TCEQ management.

Monitoring Station TSAs and PEAs

The TCEQ staff conducts monitoring station TSAs and PEAs for CWQMN water quality monitoring related activities.

Monitoring station TSAs and PEAs focus on project objectives, station operations, and measurement systems. Currently, a minimum of audits of 2 stations are being conducted each year.

TSAs include a thorough systematic, on-site qualitative audit of station operation, equipment, training, personnel, documentation, sampling and measurement systems, QC procedures, and safety of a system. TSAs focus on conformance to procedures, if available.

PEA audit procedures test the ability of measurement systems to obtain acceptable results. Audit results are compared against applicable quality control acceptance criteria. Audit results are documented on forms and spreadsheets.

To help communicate the structure and approach of an upcoming audit, the auditor notifies the auditee and details the scope, participating auditors, and the expected schedule. The auditors and participants review and discuss preliminary results during a post-audit conference. The auditor prepares a detailed audit report for each Monitoring Station Audit.

Each audit report is individually numbered, dated, and identifies the auditor, auditee, and nonconformity (findings and observations). The audit report may suggest recommended corrective action to findings.

Data Management Assessments

Data Management has developed assessment procedures for CWQMN validation activities external to the TCEQ. This process allows TCEQ Data Management staff to ensure the quality and integrity of CWQMN data validated by external cooperators and contractors. For more information see the following SOPs: Quality Assurance of External Party Continuous water Quality Data Validation.

Multiprobe Data Completeness Assessment

Data completeness reports for multiprobe sites can be obtained automatically from LEADS. Data completeness for Aqualab analyzer sites is not being assessed due to technical issues with obtaining these reports from LEADS. See calculation below for how data completeness is calculated. Sites in the CWQMN may be located in intermittent streams. Needless to say, suspension of water monitoring can occur in times of drought.
Data completeness is calculated as follows for stream sites:

$$\% \text{ Completeness} = \frac{\text{Number of valid measurements during stream flow} \times 100}{\text{Total possible measurements} - \text{Total possible measurements during no stream flow}}$$

Monitoring Station Audit Response Requirements

If an audit report contains findings, a written response to the findings is required within thirty days of the issuance of the audit report. Written responses are used to track and verify the proposed corrective action initiated by the finding.

Audit report findings and observations can be categorized as program or project. Program findings/observations are typically associated with SOP/QC procedures, measurement systems, multiprobe deployments, or are process related. Project findings are typically associated with the site operator not following procedures. It is the responsibility of the Network Coordinator to respond program findings. Responses to Project findings are the responsibility of the site operator. Management may respond / provide comments as appropriate for site operators.

It is the responsibility of the CWQMN QC officer to determine if responses to audit findings are acceptable or not. If a finding or proposed corrective action is disputed and cannot be readily resolved, the recommendation is pushed to successively higher management levels for resolution. The Network Coordinator is responsible for managing this process. Corrective actions can be verified during following inspections.

Audit Finding Response Requirements

Written audit responses are required within thirty (30) days of the issuance of the Audit Report. The response to finding must describe:

1. The nature and extent of the finding's impact on data quality,
2. The specific corrective actions taken or planned to address the finding,
3. Actions taken or planned to prevent recurrence,
4. The timetable for completing each action; and
5. The means to be used to document completion of each action.

Audit findings will remain open until an acceptable response has been received for negative findings. Audit finding responses may be submitted via email to the CWQMN QC Officer. Ed.Ragsdale@tceq.texas.gov

C2 Reports to Management

Reports are distributed according to the TCEQ *Quality Management Plan*.

Audit Reports

Final reports are submitted to the auditee and the various TCEQ managers who support the CWQMN, team leaders, Categorical 106 Grant Project Manager, and to the QA Officer. Audit reports and audit responses are available upon request.

Within TCEQ Regional Offices, regional managers have the ultimate responsibility (when applicable) for ensuring corrective action for project related findings. The Network Coordinator is ultimately responsible for ensuring corrective action for program related findings. SWQM project leads have the ultimate responsibility for ensuring the correction of any deficiencies when site operators are cooperators. The Network Coordinator is responsible for ensuring corrective action for project deficiencies when sites are operated by contractors.

USGS Water Quality and Discharge Data

The USGS must notify TCEQ CWQMN Network Coordinator in writing if any USGS collected data that has been subsequently identified by USGS and/or TCEQ as not meeting USGS/TCEQ quality objectives or criteria.

Reports to TCEQ Project Management

USGS will provide TCEQ with a report providing the following information when any USGS validated data does not meet quality objectives or criteria:

- Specific data not meeting quality objectives or criteria.
- The quality objective or criteria not met.
- An explanation of impact to data.
- Corrective action

Table C2.1

Reports to Management and Actions Taken

Report Title	Frequency	Originator	Recipient	Actions To be Taken
Monitoring Station TSA (partial) and PEA	Audits of two stations per year	QC Officer	Network Coordinator TCEQ Regional Manager CWQMN Program Manager Site Operator/Cooperator CWQMN QA Officer CWQMN QC Officer Categorical 106 Grant Project Manager Monitoring & Assessment Section Manager WQPD Quality Assurance & Data Management Team Leader	1. Contact the Site operator to determine probable cause 2. Determine corrective action. 3. Notify QA/QC Officers, Categorical 106 Grant Project Manager, and Project Management if DQOs and/or MQOs are not met. MQOs are not met
Quality Assurance of External Party Continuous Water Quality Data Validation	See SOP	Data Management & Analysis Team		
Multiprobe Data Completeness Reports	Annual	Network Coordinator	Network Coordinator TCEQ Regional Manager CWQMN Program Manager Site Operator/Cooperator CWQMN QA Officer CWQMN QC Officer Categorical 106 Grant Project Manager WQPD Quality Assurance & Data Management Team	
CWQMN Site Reviews		Network Coordinator	WQPD Management	NA
EMRS Water Pilot Project Summary				
Annual QA Report		QA Officer	EPA	NA
CWQMN site update and progress reports	Biannual	Network Coordinator	Categorical 106 Grant Project Manager	NA

DQO = Data Quality Objective
EMRS = Environmental Monitoring Response System
EPA = U.S. Environmental Protection Agency
MQO = Monitoring Quality Objective
NA = Not Applicable
PEA = performance evaluation audit
SOP = standard operating procedure
WQPD= Water Quality Planning Division

D1 Data Review, Verification, and Validation

The TCEQ and various cooperators and contractors verify and validate water quality data generated by the CWQMN. See Table A6.1 for CWQMN data validators. For information concerning USGS stage and discharge Data Review, Verification, and Validation methods, see USGS/TCEQ project plans. (See Table A2.5)

For the purposes of this document, the term verification refers to the data review processes used to determine data completeness, correctness, and compliance with technical specifications contained in applicable documents (SOPs, QAPPs, analytical methods). Validation refers to a specific review process that extends the evaluation of a data set beyond method and procedural compliance (data verification) to determine the quality of a data set specific to its intended use.

Ambient measurement and QC data are accessed, verified, and validated by personnel from WQPD Data Management & Analysis Team and by various CWQMN cooperators or contractors. Data validation processes and procedures are detailed and documented in TCEQ SOPs. All CWQM data are reviewed and verified for integrity and continuity, reasonableness, and conformance to project requirements. Data validators perform data review using the MeteoStar/ LEADS interface to graphically display the data. Collection and transmission of the data are confirmed, and communications with site operators and/or project leads are initiated if problems are detected. Data validators perform weekly verification of data generated by sonde instrumentation and Aqualab Analyzers. Only those data which are supported by appropriate QC samples and meet the measurement performance specifications defined for this project will be considered acceptable. Data that have been validated and have been designated as acceptable will be identified as validated data in the MeteoStar/LEADS data base.

Table A7.1 lists the criteria for QC sample results for sonde measurement data. Verification of SC, pH, and DO includes the analysis of DO, pH, and SC CVSs that are performed at a minimum of once monthly after instrument deployment. Sondes are calibrated prior to each deployment. After every deployment period the sonde's temperature sensor is checked. When a temperature check does not meet criteria, the corresponding DO and SC data are invalidated back to the last passing temperature check. CVS and temperature check results are entered into the MeteoStar/LEADS operator logs.

The data validator manually verifies sonde CVS data that is accessed from the Calibration Verification web page, and compares it to criteria in Table A7.1. Operator log notes contain related information about the sonde switch out and non-CVS information is also accessed from Operator Logs. (See Appendix E for Operator Log content information). Any failed CVSs will result in all data back to the last calibration of that parameter being qualified as invalid. All data within one hour after any PMA flag is qualified as invalid. This 1-hour time period allows the sonde to equilibrate/stabilize to

ambient water quality conditions before data may be considered valid. For further details see Validation of Continuous Water Quality Monitoring Data Collected by Multiparameter Sonde SOP.

Lower Rio Grande River Valley

Lower Rio Grande Valley Environmental Monitoring Response System (EMRS) site data (CAMS 736, 767, 781, 782, 789, 791, 792, and 793) will not be validated on a routine basis. Data validation for a particular time period can be requested.

Aqualab Analyzers

Aqualab analyzers are deployed at mostly perennial stream locations and at locations where stream flow is totally rainfall dependent. Measurement parameters and QC protocols are site dependent. For both types of locations the Aqualab analyzer automatically analyzes various QC samples.

Data validators download Aqualab QC data weekly via telephone modems that are connected directly to the analyzers. Once downloaded, the QC data are stored on the CEO server at \\Ceo\VOL1\Groups\WQPDD\01MnA\DMA\WaterData\AqualabData. The data validator opens these downloaded files using Aqualab user software (Aquagraph). The software allows for both tabular and graphical displays of the data. When a QC sample analysis for a particular parameter is not within criteria, the corresponding ambient data is invalidated back to the last passing QC analysis. A SAS program compiled and maintained by Water Data Management & Analysis Team data validators is used to process the Aqualab QC data. For further details see the SOP for the Validation of Continuous Water Quality Monitoring Data Collected by a Greenspan Aqualab AutoAnalyzer (DQRP-017).

Aqualab Analyzer – CAMS 726, 728, and 765

Aqualab analyzers at these sites are deployed in dry rainfall dependent tributaries. These sites are configured to start and stop ambient sample collection and analysis based on triggering from water level sensors in the dry creek beds. Only nutrients are measured by the analyzers at these locations. See Scarborough Creek, Little Duffau Creek, and Un-named Tributary of Little Duffau Creek Project Plans for details concerning data validation.

Table D1.1

Greenspan Aqualab Analyzer Performance Criteria and Frequency of QC Checks*

Parameters	Units	Standard Concentrations	Frequency of QC Checks	CVS	CVS Precision (RPD)	LCS Percent Recovery Criteria	LCS Precision (RPD)	Blank* (DI water)
EC	uS/cm	2040	Once every 24-hours	≤ 5.0 % RPE	≤ 10.0%	NA	NA	-100 <> 100
pH	pH units	4.00	Once every 24-hours	3.8 <> 4.5	≤ 20.0%	NA	NA	NA
DO	Machine Counts	Ambient Air	Every Sample	± 0.50 mg/L (± 1,000 machine counts)	≤ 10.0%	NA	NA	NA
Turbidity	NTU/FNU	DI Water	Once every 24-hours	NA	NA	NA	NA	-30 <> 50
NO_3-N	ppm	0.500	Once every 24-hours	NA	NA	70 – 130%	≤ 20.0%	≤ 0.160
NH_3-N	ppm	0.500	Once every 24-hours	NA	NA	70 – 130%	≤ 20.0%	≤ 0.160
Low Range TRP	ppm	0.040	Once every 24-hours	NA	NA	75 – 125%	≤ 20.0%	≤ 0.006
High Range TRP	ppm	0.050	Once every 24-hours	NA	NA	75 – 125%	≤ 20.0%	≤ 0.015
TP*	ppb	300	Once every 24-hours	NA	NA	75 – 125%	≤ 20.0%	≤ 6

*CAMS 742 is a TP analyzer and measures only TP and TRP (low range).
NA = Not applicable
ppm = parts per million
ppb = parts per billion
mg/L = milligrams per liter
NO_3-N = nitrate-nitrogen
NH_3-N = ammonia-nitrogen
NTU = nephelometric turbidity unit
TP = total phosphorus
TRP = total reactive phosphorus
FNU = Formazin nephelometric unit
CVS = calibration verification sample
LCS = laboratory control sample
RPE = relative percent error
RPD = relative percent difference
uS/cm = micro siemens/centimeter
DI = de-ionized water
RPD = relative percent difference
EC = electrical conductivity
DO = dissolved oxygen
QC = quality control

Design Analysis H-3611 Radar Water Level Sensor

Data generated by the radar water level sensor are not validated.

D2 Verification and Validation Methods

D2.1 Data Validation

The Water Data Management & Analysis validators review post-deployment CVS data, including temperature, for multi-parameter sondes. A CVS failure for any given parameter results in the invalidation of that parameter back to the last passing post-deployment CVS. In the event of a failing temperature check, all temperature data, as well as any associated DO and SC data are invalidated back to the last passing temperature check.

For data collected by Aqualab analyzers, data validators download QC data directly from the analyzers. Data validators use a SAS program to process the QC data. If QC data for any given parameter falls outside of specified criteria, the associated ambient data is invalidated back to the last passing QC analysis.

Any other data deemed questionable by the data validator due to inexplicable extreme values, data dropouts, flat-lined data, etc. may be qualified as invalid. During data validation, certain issues or questions may arise about particular data point(s). In this case, the data validator refers to the operator logs. If no logs exist, or the log does not identify a source for the questionable data, the validator contacts the site operator via phone or email to try to resolve any issues and verify affected data. Additionally, sonde sample depth and water level measurement data may be used as a source of additional information for data validation decisions.

After validating any data, and for MeteoStar/LEADS to consider the data as being validated, the data validator must enter validator notes. These notes document and explain any data qualifications made, other than valid (VAL flag), and why the qualification was made. In addition to the electronic validator notes, each validator also keeps a hard copy Validator Notebook containing the same information. These notebooks are kept on file for 5 years and are available upon request for audits.

The Water Data Management & Analysis Team conducts audits of cooperator and contractor data validation as well as self-audits of team member data validation. For complete details about this process, see SOP for the QA of External Party Continuous Water Quality Data Validation (DATA-019).

D2.2 Data Tracking

End data users can access validated data via the Internet (TCEQ web pages). Actual measurement values (or averages of these) are shown for data that has been qualified as valid, while the validation flag is shown for data that were qualified as invalid. All data, no matter the qualifier assigned by the system, is manually verified. For a list of validation flags and their definitions, see Table D2.1. After data is verified by the data validator, it is flagged as such in MeteoStar/LEADS.

Table D2.1

Data Validation Flags (Qualifiers)

Flag	Definition
AQI	Ambient Quality Invalid – Flag manually assigned when data point deemed invalid by the data validator.
PMA	Preventive Maintenance – Flag manually assigned when site operator is performing maintenance on analytical equipment.
VAL	Valid – Flag automatically assigned to any data that does not fall above or below pre-defined limits. Valid – Flag manually assigned to any data that was previously automatically assigned a Limit Exceeded (LIM) flag that was later deemed valid by the data validator.
LIM	Limit Exceeded – Flag automatically assigned to any data that fall above or below a pre-defined range.
LST	Lost Data – Flag automatically assigned when data is not retrievable by the data logger because of power outages, equipment malfunction, etc.

D2.3 Criteria for using CWQMN data for the CWA Section 305(b) Assessment

Continuous water quality sampling may be conducted for a variety of reasons, but to be used in the 305(b) and 303(d) list, specific requirements must be met. Parameters evaluated for use attainment are the summary statistics and are considered for each day the data is available and meets the SWQM DQOs. Currently, CWQMN data from sonde (Multiprobe) instrumentation can be used for 305(b) and 303(d) assessment purposes.

- 24-hour average, minimum, and number of measurements for DO
- Minimum and maximum for pH
- 24-hour maximum for temperature
- 24-hour average and number of samples for specific conductance

Sites and instrument placement at the station must be representative of the water body or assessment unit if the data are used for determining compliance with the water quality standards.

Data from continuous monitoring sites must meet requirements for temporal representation, including a period of at least 2 years of sampling; no more than 2/3 of the samples collected in any 1 year; and no more than 1/3 of the samples from any 1 of the 4 seasons. **Note:** For continuous monitoring data, DO samples are considered for the entire year rather than only the index period. If it appears the data are considerably biased toward any given time period during the period of record due to data gaps, steps may be taken to minimize the bias such as removing some samples from the over-represented period. If, for example, only 20 valid days in August meet the requirements, only the first 20 valid days from the remainder of the months might be used.

To report valid samples, statistics should be developed from days that have at least 90 percent data return from midnight to midnight with intervals of 1 hour or less. Specific conductance, DO, and pH data are verified monthly by analyzing CVSs. Only data with CVS results meeting SWQM DQOs in Table A7.1 for field data will be used in the assessment.

D3 Reconciliation with User Requirements

Problems with potential limitations of the data are handled at three different levels:

1. At the time of audit of the monitoring stations or by the site operators, who have prime responsibility for routine calibrations, maintenance, and analysis of quality control samples;
2. Data validators who review verify and validate station data; and
3. By users of the data.

Issues are reconciled at the lowest level and at the earliest time possible. The mechanism for communication between the producers and the users of the data are telephone, e-mail, and the operator's log.

The auditors, validators, site operators, project leads, and managers are empowered to review and question any part of the measurement process and may initiate data reviews and corrective actions to bring the process back into compliance.

To assess the quality of the data produced during the monitoring efforts, the precision, accuracy, and completeness will be assessed in comparison to the data quality objectives and measurement quality objectives as discussed in Section A7.

Appendix A

Definitions

equipment blank (EB)
Definition - A clean sample that is introduced at the sample inlet. The point at which a normal ambient sample would enter the sampling system.

Application - Used to determine sampling system contamination.

instrument blank (IB)
Definition - Instrumental analysis with no sample injection. (Modified National Environmental Laboratory Accreditation Conference (NELAC); Glossary of Quality Assurance Terms, QAMS, 8/31/92)

Application - Used to determine instrument contamination.

reagent blank (RB)
Definition - A sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps. (NELAC; Glossary of Quality Assurance Terms, QAMS, 8/31/92)

Application - Analyzed to determine the contribution of the reagents and of the analytical systems.

Duplicate Samples

instrument duplicate (ID)
Definition - Repeated but independent analytical determinations from the same sample.

Application - Used to estimate instrument precision.

laboratory control sample (LCS)
Definition - An uncontaminated sample matrix spiked with known amounts of analytes from a source independent of the calibration standards. LCSs are taken through the entire sample preparation and analysis procedure. (NELAC; Glossary of Quality Assurance Terms, QAMS, 8/31/92)

Application - Used to establish intra-laboratory or analyst specific accuracy or to assess the performance of all or a portion of the measurement system.

laboratory control sample duplicate (LCSD)
Definition - A replicate LCS.

Application - Prepared and analyzed with the laboratory control sample to obtain a measure of precision for the recovery of each analyte.

Other Samples

performance evaluation (PE) sample
Definition - A sample, the composition of which is unknown to the analyst, provided to test whether the analyst/laboratory can produce analytical results within specified performance limits. (NELAC; Glossary of Quality Assurance Terms, QAMS, 8/31/92)

Application - Data from PE samples are used to evaluate method accuracy (and precision if duplicate PE samples are submitted). This is commonly referred to as an audit sample.

calibration standard (CS)
Definition - A mixture prepared from the primary standard mixture or stock standard mixture and, when appropriate, containing the internal standards and surrogates. (Modified NELAC; Glossary of Quality Assurance Terms, QAMS, 8/31/92)

Application - Used to calibrate the instrument response with respect to analyte concentration.

calibration verification sample (CVS)
Definition - An analytical standard analyzed during a batch to ensure acceptable instrument calibration.

Application - Used to verify analytical system calibration.

calibration verification standard duplicate (CVSD)
Definition - A replicate calibration verification standard.

Application - Prepared and analyzed with the calibration verification standard to obtain a measure of precision for each analyte.

General Quality Control

chain-of-custody (COC)
Definition - An unbroken trail of accountability that documents the possession of samples, data, and records. (Modified NELAC; Glossary of Quality Assurance Terms, QAMS, 8/31/92)

Application - Provides documentation to establish sample integrity.

instrument detection limit (IDL)
Definition - Constituent concentration that routinely produces an analytical signal significantly greater than at least three times the signal to noise ratio and provides 99 percent confidence that the instrument response detected above this level is not due to instrument noise.

Application - The IDL estimates the lower limit of analytical detectability.

method detection limit (MDL)
Definition - The constituent concentration of a substance (an analyte) that can be measured and reported with a 99 percent confidence that the concentration is greater than zero and is determined from replicate analysis of a sample in a given matrix containing the analyte as described in 40 CFR Part 136, Appendix B. (Modified NELAC/40 CFR Part 136)

Application - Estimates the lower limit of method detectability. This measurement should be made under the same conditions as sample analysis and incorporate sample preparation, collection, and analysis to the extent possible to truly reflect method sensitivity. The concentration used to measure method variability should be one to ten times the expected MDL, if possible.

General Terminology

accuracy - The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that are due to sampling and analytical operations; a data quality indicator. (NELAC; Glossary of Quality Assurance Terms, QAMS, 8/31/92)

audit (quality) - A systematic and independent examination and evaluation to determine whether quality activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve specified objectives. (American National Standard Institute [ANSI]/American Society for Quality Control [ASQC], Standard E4-19)

bias - The systematic or persistent distortion of a measurement process that causes errors in one direction (i.e., the expected sample measurement is different from the sample's true value). (ANSI/ASQC, Standard E4-19)

comparability - A measure of the confidence with which one data set can be compared to another. (ANSI/ASQC, Standard E4-19)

completeness - A measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct, normal conditions. (ANSI/ASQC, Standard E4-19)

data quality objectives (DQOs) - Established quantitative measurements (with associated precision and bias or acceptable uncertainty) that must be obtained from the environmental data operations in order to demonstrate that the desired and expected result has been achieved. (ANSI/ASQC, Standard E4-19)

deficiency - An unauthorized deviation from acceptable procedures or practices, or a defect in an item. (ANSI/ASQC, Standard E4-19)

matrix - Substance being tested.

measurement quality objective (MQO) - The desired sensitivity, range, precision, and bias of a measurement. (NELAC; Glossary of Quality Assurance Terms, QAMS, 8/31/92)

precision - A measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions, expressed generally in terms of the standard deviation. (ANSI/ASQC, Standard E4-19)

quality - The sum of features and properties/characteristics of a process, item, or service that bears on its ability to meet the stated needs and expectations of the user. (ANSI/ASQC, Standard E4-19)

Quality Management Plan (QMP) - A formal document or manual, usually prepared once for an organization that describes the quality system in terms of the organizational structure, functional responsibilities of management and staff, lines of authority, and required interfaces for those planning, implementing, and assessing all activities conducted. (ANSI/ASQC, Standard E4-19)

Quality Assurance Project Plan (QAPP) - A formal document describing in comprehensive detail the necessary QA, QC, and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. (ANSI/ASQC, Standard E4-19)

quality assurance (QA) - An integrated system of activities involving planning, implementation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the customer. (ANSI/ASQC, Standard E4-19)

quality control (QC) - The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality. (ANSI/ASQC, Standard E4-19)

representativeness - A measure of the degree to which data accurately and precisely represent a characteristic of a population, parameter, variations at a sampling point, a process condition, or an environmental condition. (ANSI/ASQC, Standard E4-19)

sample depth - Depth of sonde in the water column (TCEQ).

standard operating procedure (SOP) - A written document that details the method of an operation, analysis, or action whose techniques and procedures are thoroughly prescribed and that is accepted as the method for performing certain routine or repetitive tasks. (NELAC; Glossary of Quality Assurance Terms, QAMS, 8/31/92)

water level – (also known as stage) is the height of water in the stream above a reference point. (USGS)

Appendix B

Acronyms

A

ADCP	Acoustic Doppler Current Profiler
ADCP	Angelina Neches River Authority
AQI	Ambient Quality Invalid
AWRL	Ambient Water Reporting Limit
ASTM	American Society for Testing and Materials

B

BMP	Best Management Practices

C

CAFO	Concentrated Animal Feeding Operation
CAMS	Continuous Ambient Monitoring Station
CFEP	Comms Front End Processor
CFR	Code of Federal Regulations
CFS	Cubic Feet per Second
CLI	Caddo Lake Institute
CM	centimeters
COA	Certificate of Analysis
COMMS	Communications
CVS	Calibration Verification Sample
CRMWD	Colorado River Municipal Water District
CWA	Clean Water Act
CWQMN	Continuous Water Quality Monitoring Network

D

DI	De-ionized water
DO	Dissolved Oxygen
DQO	Data Quality Objective

E

EB	Equipment Blank
EC	Electrical Conductance (Reported as Specific Conductance)
EMRS	Environmental Monitoring Response System
EPA	United States Environmental Protection Agency

F

FNU	Formazin Nephelometric Units
FOSD	Field Operation Support Division
ft/s	Feet per Second

	FY	Fiscal Year
G		
	GOES	Geostationary Operational Environmental Satellite
H		
	HC&CC	Hidalgo & Cameron County Irrigation District
I		
	IB	Instrument Blank
	ISO	International Organization for Standards
K		
	KCL	Potassium Chloride
L		
	LCRA	Lower Colorado River Authority
	LCS	Laboratory Control Sample
	LEADS	Leading Environmental Analysis and Display System
	LIM	Limit Exceeded
	LNVA	Lower Neches Valley Authority
M		
	MDL	Method Detection Limit
	mg/L	milligram per liter
	MQO	Measurement Quality Objective
N		
	NA	Not Applicable
	NH_3-N	Ammonia-nitrogen
	NIST	National Institute of Standards and Technology
	NOAA	National Oceanic & Atmospheric Administration
	NO_3-N	Nitrate-nitrogen
	NRA	Nueces River Authority
	NTU	Nephelometric Turbidity Units
P		
	PC	Personal Computer
	PEA	Performance Evaluation Audit
	PMA	preventative maintenance
	ppb	parts per billion
	ppm	parts per million
	ppt	parts per thousand
	PVC	Poly Vinyl Chloride

Q

QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
QMP	Quality Management Plan

R

RL	Reporting Limit
RPD	Relative Percent Difference
RPE	Relative Percent Error
RRA	Red River Authority

S

SAS	Statistical Analysis Software
SC	Specific Conductance
SOP	Standard Operating Procedure
STORET	Storage and Retrieval
SWQM	Surface Water Quality Monitoring Team
SWQMIS	Surface Water Quality Monitoring Information System

T

T	Temperature
TBD	To Be Determined
TCEQ	Texas Commission on Environmental Quality
TDS	Total Dissolved Solids
TIAER	Texas Institute for Applied Environmental Research
TMDL	Total Maximum Daily Load
TP	Total Phosphorus
TPWD	Texas Parks & Wildlife Department
TRP	Total Reactive Phosphorus
TSA	Technical System Audit
TSWQS	Texas Surface Water Quality Standards

U

µS	micro Siemens
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
USIBWC	United States International Boundary Water Commission
USNPS	United States National Park Service

W

WQPD	Water Quality Planning Division

Y

YSI	Yellow Springs Instrument

Misc.

^{o}C	Degrees Centigrade
µS/cm	micro Siemens/centimeter

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

(Project Name)

CONTINUOUS WATER QUALITY MONITORING

PROJECT PLAN

(Note to user: This form provides some of the text to be used in the project plan. Instructions are provided in italics, and should be deleted during completion of the form.)

A1 APPROVAL PAGE

_____ _____
Charles Dvorsky Date
CWQMN Network Coordinator, TCEQ SWQM

_____ _____
Andrew Sullivan Date
SWQM Team Leader, TCEQ SWQM

_____ _____
Laura Curra Date
Section Manager, TCEQ Monitoring & Assessment Section

_____ _____
Sharon Coleman Date
CWQMN Quality Assurance Officer

_____ _____
Name Date
Project Lead, TCEQ SWQM Program

_____ _____
Edward Ragsdale Date
CWQMN Quality Control Officer, TCEQ SWQM

_____ _____
Name Date
Data Management and Analysis Section

_____ _____
Other Project Participants Date

This CWQMN documents project specific details for new continuous water quality projects. Critical project specific details for new CWQMN stations are not covered in the CWQMN QAPP. Please see the CWQMN QAPP for other network details.

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TABLES:

Table A7.1: Multiprobe Measurement Performance Specifications
Table A7.2: Level Troll Measurement Performance Specifications

LIST OF ACRONYMS (common Acronyms)

CAMS	Continuous Ambient Monitoring Station
CFS	Cubic Feet per Second
CVS	Calibration Verification Sample
CWQMN	Continuous Water Quality Monitoring Network
DO	Dissolved Oxygen
EC	Electrical Conductance (Reported as Specific Conductance)
FOSD	Field Operation Support Division
FY	Fiscal Year
LEADS	Leading Environmental Analysis and Display System
MDL	Method Detection Limit
mg/L	Milligram per Liter
NA	Not Applicable
NIST	National Institute of Standards and Technology
NTU	Nephelometric Turbidity Units
ppmv	parts per million by volume
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RPD	Relative Percent Difference
RPE	Relative Percent Error
SC	Specific Conductance
SOP	Standard Operating Procedure
SWQM	Surface Water Quality Monitoring Team
T	Temperature
TBD	To Be Determined
TCEQ	Texas Commission on Environmental Quality
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
TSWQS	Texas Surface Water Quality Standards
µS/cm	micro Siemens per centimeter
WQPD	Water Quality Planning Division
^{o}C	Degrees Centigrade

A3 DISTRIBUTION LIST

Include project participants (e.g., site operators, contractors, etc.).

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Katherine Nelson, Assistant Division Director, Water Quality Planning Division
Laurie Curra, Manager, Monitoring & Assessment Section, Water Quality Planning Division
Mathew Baker, Assistant Division Director, Field Operations Support Division
Andrew Sullivan, Team Leader, Surface Water Quality Monitoring Team, Monitoring & Assessment Section, Water Quality Planning Division
Charles Dvorsky, Network Coordinator, Surface Water Quality Monitoring Team, Monitoring & Assessment Section, Water Quality Planning Division
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Amir Poursamadi, Data Management & Information Technology Team, Field Operations Support Division
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Michele Blair, Surface Water Quality Monitoring Team, Monitoring & Assessment Section, Water Quality Planning Division

A3 DISTRIBUTION LIST (continued)

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Robin Cypher, Surface Water Quality Monitoring Team, Monitoring & Assessment Section, Water Quality Planning Division
Pat Bohannon, Surface Water Quality Monitoring Team, Monitoring & Assessment Section, Water Quality Planning Division
Christine Kolbe, Surface Water Quality Monitoring Team, Monitoring & Assessment Section, Water Quality Planning Division
Anne Rogers, Surface Water Quality Monitoring Team, Monitoring & Assessment Section, Water Quality Planning Division
Debbie Peters, Monitoring & Assessment Section, Water Quality Planning Division
Rebecca Ross, Data Management & Analysis Team, Monitoring & Assessment Section, Water Quality Planning Division
Cathy Anderson, Data Management & Analysis Team, Monitoring & Assessment Section, Water Quality Planning Division
Tabitha Kirkland, Data Management & Analysis Team, Monitoring & Assessment Section, Water Quality Planning Division

List other TCEQ staff if applicable. Also list contractors if applicable.

A4 PROJECT/TASK ORGANIZATION

This section is intended to identify individuals and organizations that will be responsible for developing and/or supporting new CWQMN projects. For a list of additional project/task and responsibilities please refer to section A4 of the CWQMN QAPP.

The Project Lead is responsible for the development of the Project Plan.

A4.1 TCEQ CWQMN Coordinator (Charles Dvorsky)

A4.2 TCEQ SWQM Project Lead *(Name)*

- Develop Project Plan

A4.3 Site Operator (Name and Agency)

- Site Operation and Maintenance

A4.4 (Name and Agency)

- Data Validation

A4.5 Project Participant (Name and Agency)

A4.6 Contractor (Name)

A5 PROBLEM DEFINITION/BACKGROUND

State the specific problem to be solved or decision to be made, or the outcome to be achieved. Include enough background information to provide a historical perspective and scientific perspective. The
The discussion should include enough information (i.e., past history, regulatory context, and previous work) to understand the project objective.

A6 PROJECT/TASK DESCRIPTION

Summarize the work to be performed and the schedule for implementation as well as monitoring site geographic location(s) and TCEQ segment numbers.

In some CWQMN projects, project/task descriptions are laid out **in detail** in contractual/ subcontractual work plans. If the work plan addresses the following information **in detail**, then the contractual/subcontractual work plan may be attached and referenced.

See Appendix C of the CWQMN QAPP for Site Selection, Preparation, and Deployment of Continuous Water quality Monitoring Stations, SOP MANP-001, revision 2.

A7 QUALITY OBJECTIVES AND CRITERIA

The measurement performance specifications to support the project objectives are specified in Table(s) A7.1 – x.

Add tables as needed. Reference applicable CWQMN analytical SOPs if available.

Methods used are based on Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998 unless otherwise noted.

Table A7.1 – Sonde Make and Model Sonde (Multiprobe) Performance Specifications

Parameter	Parameter Code	Units	Method	Calibration Verification Sample Acceptance Limit (CVS)**
pH	10400	pH / units	Glass electrode, Standard Method	0.50 pH unit
DO	10300	mg/L	Galvanic membrane electrode, Standard Method 4500-O-G	% Saturation ☐6.0% 0.50 mg/L
SC	10095	µS/cm	Toroidal*	5.0% RPE
Temperature	10010	°C	Standard Method 2550 B	0.50 °C

*Method not based on *Standard Methods for the Examination of Water and Wastewater*, 20th Edition, 1998
**CVS criteria for use in the 305(b) and 303(d) Lists per SWQM DQOs.
NA = Not Applicable

Table A7.2 - In-Situ TROLL 500 Performance Specifications MQOs for In-Situ TROLL 500 Level Sensor

Parameter	LEADS Parameter	SOP	Units	Range	Method	Acceptance Criteria
Water level/Sensor Depth	10079/10078	AMPM - 008	Feet	0 -33.0 Feet	Vented Pressure Transducer	6.0 inches*

*If sensor does not meet acceptance criteria, sensor corrective action and/or sensor re-calibrated is performed. Data is not invalidated as a result of not meeting acceptance criteria.
LEADS = Leading Environmental Analysis and Display System
SOP=Standard operating procedure

Ambient Water Reporting Limits (AWRLs)

As described in Section A7 of the CWQMN QAPP. (*If applicable)*

Precision

As described in Section A7 of the CWQMN QAPP. (*If applicable)*

Bias

As described in Section A7 of the CWQMN QAPP. (*If applicable)*

Representativeness

As described in Section A7 of the CWQMN QAPP. (*If applicable)*

Comparability

As described in Section A7 of the CWQMN QAPP. (*If applicable)*

Completeness

As described in Section A7 of the CWQMN QAPP. (*If applicable)*

A8 SPECIAL TRAINING/CERTIFICATION

Indicate who will train site operators, and how.
Discuss training schedule for site operators, data validators or other needed project training.
Provide any other training requirements.

A9 DOCUMENTS AND RECORDS

As described in sections A9 of the CWQMN QAPP. (*If applicable)*

B1 SAMPLING PROCESS DESIGN

Site Selection Criteria

Describe the rationale for selecting monitoring site(s).

Monitoring Station Design

Describe how monitoring equipment will be configured (including measurement frequencies) to collect data that will answer project objectives.

List specific monitoring and support equipment: measurement equipment, data logger, telemetry, modems, trailer, traffic box, etc.

Detail site developmental needs; pad, electricity, fence, phone, special items, etc. Discuss site development schedule.

Indicate who will be responsible for site operation and maintenance.

B2 SAMPLING METHODS

As described in sections B2 of the CWQMN QAPP. (*If applicable)*

Sampling/Measurement System Corrective Action

As described in sections B2.2 of the CWQMN QAPP.

B3 SAMPLING HANDLING AND CUSTODY

As described in Section B3 of the CWQMN QAPP. (*If applicable)*

B4 ANALYTICAL METHODS

Analytical methods and analytical SOPs are listed in Section A.7.

B5 QUALITY CONTROL

As described in Section B5 of the CWQMN QAPP. (*If applicable)*

Analytical method SOPs are listed in Section A.7 detailing QC procedures. *If SOPs are not available describe QC program for project.*

Corrective Action Related to Quality Control

As described in Section B5 of the CWQMN QAPP. (*If applicable)*

B6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION AND MAINTENANCE

As described in CWQMN QAPP. (If applicable)

List the equipment and/or systems needing periodic maintenance, testing, or inspection, and the schedule for such.

List all applicable equipment maintenance SOPs or equipment manuals.

B7 INSTRUMENT CALIBRATION AND FREQUENCY

As described in CWQMN QAPP. (*If applicable)*

B8 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

As described in CWQMN QAPP. (If applicable)

Describe how spare parts, standards and reagents will be obtained by site operators.

B9 NON-DIRECT MEASUREMENTS

There are no non-direct measurements used in this project. (*If applicable)*

B10 DATA MANAGEMENT

Indicate who will manage project data, and how, including communication, telemetry, data processing, and depository. State who is performing data analysis (and how) and what action will be taken with data results.

As described in CWQMN QAPP. (If applicable)

C1 ASSESSMENTS AND RESPONSE ACTIONS

As described in CWQMN QAPP. (*If applicable)*

Corrective Action

As described in Section C1 of the CWQMN QAPP. (*If applicable)*

C2 REPORTS TO MANAGEMENT

As described in Section C2 of the CWQMN QAPP.

Reports to TCEQ Project Management

As described in Section C2 of the CWQMN QAPP.

D1 DATA REVIEW, VERIFICATION, AND VALIDATION

As described in Section D1 of the CWQMN QAPP.

List the TCEQ data validation SOPs that will be used.

Indicate who will be responsible for validating station data, and if the person(s) will require training.

D2 VERIFICATION AND VALIDATION METHODS

As described in Section D2 of the CWQMN QAPP.

D3 RECONCILIATION WITH USER REQUIREMENTS

As described in Section D2 of the CWQMN QAPP.

Appendix D

References

1. *Texas Commission on Environmental Quality - Quality Management Plan*. Texas Commission on Environmental Quality, Rev. 16, January 2011
2. *United States Geological Survey* – Guidelines and Standard Procedures for Continuous Water-Quality Monitors: Station Operation, Record Computation, and Data Reporting TMD1D3
3. *United States Geological Survey – Turbidity 6.7,* Version 2.1 (9/2005)
4. *United States Environmental Protection Agency Requirements for Quality Assurance Project Plans*. United States Environmental Protection Agency QA/R-5.
5. *Standard Methods for the Examination of Water and Wastewater*. American Public Health Association, Washington, DC, 20th edition, 1998.
6. "Definition and Procedure for the Determination of the Method Detection Limit." Rev. 1.11, Chapter 40, *Code of Federal Regulations* Part 136, Appendix B.
7. *Guidance for the Data Quality Objectives Process*, Appendix D, Glossary of Quality Assurance Terms. United States Environmental Protection Agency, Quality Assurance Management Staff QA/G-4, Washington, DC, 1994.
8. *National Environmental Laboratory Accreditation Conference 5.0 Quality Systems* United States Environmental Protection Agency, June 2003.
9. *American National Standard Institute* [ANSI]/*American Society for Quality Control* [ASQC]*Z1,* Standard E4-19.
10. *Surface Water Quality Monitoring Quality Assurance Project Plan*. Texas Commission on Environmental Quality, Rev. 13, January 2010.
11. *Surface Water Quality Monitoring Procedures, Volume1: Physical and Chemical Monitoring Methods,* October 2008. RG-415
12. *Chemical Hygiene Plan*. Texas Commission on Environmental Quality, November 2000

Appendix E

Operator Calibration Data Entry, Public Flagging, and Site Termination Protocol (Revision 1)

CWQMN Water Calibration Data Entry and Operator Log Content

Overview: Following a site visit the operator is to enter either an Operator Log, or Calibration Verification Data Entry with an Operator Log. Both types of entries are to be performed by going to the web address of: http://tceqwatercal.ipsmtx.com which is an external version of the Calibration Verification web page on the internal TCEQ web site (rhone). Operator Logs and Calibration Verification Data Entry can no longer be entered in rhone. Three functions are provided by this web page. Site operators are to enter calibration values, update or edit calibration values, or if there are no calibration values they will enter an Operator Log without calibration values. Next, reviewers of the operator entries verify the entries are appropriate and complete and either rejects the entry back to the operator for edits, or push the entry out into the Calibration Report area to allow users to view the entries and enable data validators to perform data validation tasks. User identification (IDs) and passwords are required for the entry, review, and push of operator entries out to the Calibration Report area. Upon logging into the site the operator will have the option to either Add a New Calibration Record which requires an Operator Log Message, or to Add an Operator Log Message (without any calibration verification values) when the sonde calibration is not appropriate or required (examples: the sonde is broken, washed downstream, or only site maintenance activities have been performed other than sonde switch out).

Calibration Data entry and Operator Log content should include the following, as appropriate.

1. Name of site operator, organization conducting visit, and date of site visit.

2. Note station status, station/instrument(s) damages, repairs, troubleshooting, and communication problems etc. Note deployment tube cleanings and any other events or situations that can affect data quality.

3. Enter sonde deployment and retrieval information, including TCEQ asset number or serial number, deployment or retrieval dates, and times.

4. Enter post deployment CVS results* and standard values into the appropriate fields. The system calculates the difference from the standard and assigns a quality rating (excellent, good, or poor) to the data. The operator enters comments into the parameter–specific comment field if necessary.

5. If possible, note assignable cause(s) for any failing CVS or quality control (QC) checks either in the parameter-specific comment field, or in the Operator Log Message field.

6. Note field observations: Water conditions, meteorological conditions rain, drought, flood etc. in the Operator Log Message field.

7. Note deployment of new sonde. TCEQ asset number or serial number, date of calibration, and deployment date and time in the Operator Log Message field.

8. When the sonde is not being switched out or calibrated and only an Operator Log Message is to be entered there will be no values entered in the table of calibration verification data. At a minimum, the operator must provide at least what is listed above in line items 1, 2, and 7, plus any additional information that is pertinent to the site visit.

9. Click Save not Reset. The system will verify the entries and ask if the user wants to enter more records.

10. Either enter more Calibration entries, or exit the system.

*Sites with vertical profilers need to include CVS results for percent fluorescence in the Operator Log Message field.

Operator Log with Calibration Value Data Example Entry:

Operator Name, TCEQ Midland Region - On July 21, 2008

Routine site visit station on-line and operational. Cleaned deployment tube. Sediment debris cloud after cleaning. Recent (July 16, 2008) isolated heavy rains causing heavy sediment loading in river.

Retrieved serial number 022208 Greenspan sonde at 1200 hours (deployed on November 6, 2008 at 12:30 hrs).

CVS results passed criteria for all parameters except pH (SC - 4.2 % RPE, DO + 0.30 mg/l (or % sat), pH + 0.60.).

Temp Check = sonde #022208 passed temp check, +0.16 C.

Failing QC Checks = Water level pressure sensor clogged with debris, sensor cleaned. pH sensor heavily fouled with sediment, DO, SC, and temp sensors moderately fouled with sediment.

Field Observations = Water rising and turbid due to recent rains.

Deployed serial number 021512 Greenspan sonde that was calibrated on July 7, 2008.

Operator Log without Calibration Value Data Example Entry:

Operator Name, TCEQ Region Number – On November 21, 2008 an unscheduled site visit was made due to station off-line since November 20, 2008 at 15:30. Arrived at site 12:25. Sunny, cold and breezy; bank gauge at 0.73 m. Yellow fault light blinking on logger. All wires and cables connected properly. Quick view status window reported 'system malfunctions, measurements 1, 2, 3, 4 have failed readings'. Logger communications window reported 'no data' and 'bad' quality. Stopped and restarted measurements, but still no data. Disconnected and reconnected all wires and cables to and from sonde, battery, and logger but still no data. Retrieved Greenspan sonde # 12345 and deployed Greenspan sonde # 67890 at 13:00 that was calibrated on November 21, 2008. Data collection and transmission resumed. Departed site at 13:30. Unable to complete entire post-calibration on sonde #12345 as it would not communicate with computer. Request for replacement sonde was submitted on November 21, 2008. Operator Name.

A new process is under development to measure fouling at CWQMN sites. When an operator is instructed to start collecting fouling measurements the above information is required along with the following requirements.

Post Deployment Excel Workbook

A Post Deployment Excel Workbook will be provided to track fouling and drift measurements for each site conducting such measurements. There will be a workbook for each calendar year using the following naming convention (PDW_CAMSXXX_CalendarYear) with labeled tabs (MMMDDYYYY) for each site visit. Water Data Management and Analysis (WDM&A) will provide the template to the operator who will in turn complete a tab for each site visit. The operator will email the workbook to their site's data validator after each site visit. When a new calendar year starts a new Excel workbook will be started. WDM&A or the data validator will store the Post Deployment Workbook on their team's electronic folder for CWQMN documents.

The following naming convention examples need to be used for each Post Deployment Excel workbook and the tabs within the workbook.

Excel Workbook Naming Convention Example:
PDW_CAMS787_2011

Excel Workbook Tab Naming Convention Example:
MAR132011

Optional Photos of Sonde and Sensors

It is preferred that photos be taken during each site visit of the sonde and its sensors. The purpose of the photos is to photo-document fouling conditions of the probe and other pertinent areas at the Continuous Ambient Monitoring Station (CAMS). These optional photos will be emailed to the site's data validator along with the required Post Deployment Workbook. If the optional photos are not taken and submitted, greater detail is needed in the Operator Log to describe fouling conditions.

Operator Log

Along with the information that is required for non-foul collecting sites the following information needs to be conveyed in the Operator Log to give the data validator knowledge to properly validate the site.

- Debris cloud present around deployment tube after cleaning (if observed)
- Stream Flow at deployment tube (No Flow, Low, Normal, Flood, High, Dry)
- Sonde maintenance (replaced DO membrane, pH bulb, etc.)

Public Flagging and Site Termination Protocol

Background

It is essential the CWQMN Site Operators routinely and thoroughly complete Calibration Verifications (CV) and Operator Logs (OL) for the site(s) they operate. Without the CV/OL, Data Validators cannot validate CWQMN data. If the CV/OL entries are not completed in a timely manner, details may be lost and the opportunity to make early corrections to issues and errors in the field may be lost and additional invalid data may be collected.

All CWQMN site operators have been assigned a user name and password to access an internet based CV/OL entry form. The internet based CV/OL entry form is located on an external server at: http://tceqwatercal.ipsmtx.com. The site and form are available from any PC with an internet connection. All operators have received general instruction on the use of the internet based system and TCEQ Monitoring and Assessment staff is available to assist operators with system.

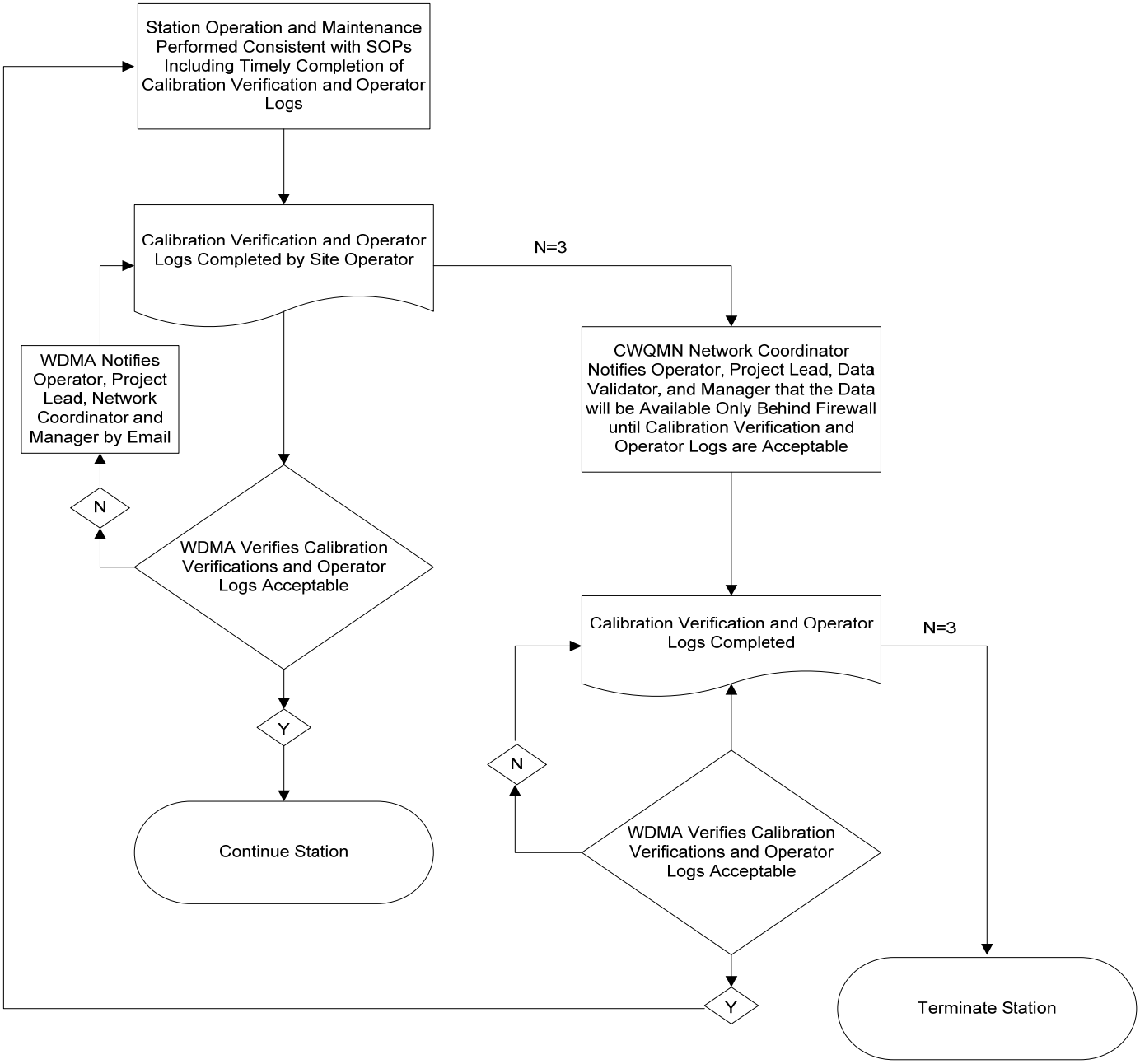
CWQMN Site Operators are expected to complete their CV/OL entries within 5 working days of any field visit or instrument exchange. In order to facilitate collection of valid data and the data validation process, a procedure is needed to monitor and confirm routine and timely completion of CV/OL entries. If CWQMN Site Operators cannot meet the requirements for CV/OL entry, the CWQMN site may be terminated.

Summary of Procedure

1. Operator performs routine operation and maintenance of site including calibration and deployment of instruments.
2. Operator completes CV/OL entry within 5 working days of field event.
3. WDM&A verifies CV/OL entries are complete and entered within 5 working days of the field event.
4. Three opportunities of 5 days duration will be afforded to correct the deficiency. If CV/OL entries are not completed within 5 working days and/or the CV/OL entries are not complete, WDMA will send email notification of the deficiency to the Site Operator, Project Lead, Network Coordinator, and/or the Site Operator's first-line manager:
    a. First occurrence – email to Site Operator and Project Lead
    b. Second occurrence – email to Site Operator, Project Lead, and Network Coordinator
    c. Third occurrence - email to Site Operator, Project Lead, Network Coordinator, and Site Operator's first-line manager.
5. If the deficiency is corrected under number 4 above, the site returns to normal state.
6. If the deficiency is not corrected under number 4 above, the site data will be removed from the public internet pages (the PUBLIC data flag will be removed) and the Site Operator, Project Lead, Network Coordinator, and/or the Site Operator's first-line manager will be notified.

7. Three additional opportunities of 5 days duration will be afforded to correct the deficiency. WDMA will send email notification to the Site Operator, Project Lead, Network Coordinator, and/or the Site Operator's first-line manager:
   a. First occurrence – email to Site Operator and Project Lead
   b. Second occurrence – email to Site Operator, Project Lead, and Network Coordinator
   c. Third occurrence - email to Site Operator, Project Lead, Network Coordinator, and Site Operator's first-line manager.
8. If the deficiency is corrected under number 7 above, the site returns to normal state.
9. If the deficiency is not corrected under number 7 above, WDMA will notify the Network Coordinator and the Network Coordinator will recommend termination of the site.

Process Flow Chart



Appendix F

Site Evaluation Form

Reset Form

FY 11 CWQMN Site Review

Review Quarter

SWQM Station ID | CAMS # | TCEQ Project Lead:

Station Description

Parameters Monitored

Check all that apply:

DO | pH | H2O Temp | Spec Cond | TDS (calc) | Depth | Discharge

Turbidity | Nitrate-Nitrogen | Ammonia-Nitrogen | Chl *a* | Total Reactive Phos (TRP)

Are all these parameters needed? Yes | No | Met.

Why or Why Not?

Period of Operation

Start-up Date

Is long-term continuous monitoring needed at this site? Yes | No

If no, would less intense monitoring satisfy data needs at this location? Yes | No

Additional Information:

Data User(s)

Check all that apply:

SWQM | Field Operations | TMDL | WQ Modeling | WQ Standards | Water Rights

Watermaster | CRP Partner | State Agency | Federal Agency

City | University | Other

No Current Data User Identified

Additional Information:

Intended Data Uses

Check all that apply:

- ◯ 305(b)
- ◯ Research
- ◯ Trends
- ◯ Public Education
- ◯ TMDL Implementation Monitoring
- ◯ WQ Standards
- ◯ Agriculture
- ◯ Water Quality Management
- ◯ Monitoring BMP Effectiveness
- ◯ Site supports an ongoing project
- Special Project Name
- ◯ Watershed Protection Plan
- ◯ No Current Data Use Identified

Additional Information:

Operator Performance

Operator:

Check all that apply:

- ◯ The operator follows SOP MAIN-017.
- ◯ Operator consistently follows instrument specific SOPs.
- ◯ Site maintained at appropriate intervals.
- ◯ Calibration Verifications routinely entered.
- ◯ Operator Logs are routinely entered.

Additional Information:

Project Objectives

What is the water quality issue associated with this site?

Are the original objectives still appropriate? ◯ Yes ◯ No

If No, how has the project changed?

Is the project still providing valid/useful data? ◯ Yes ◯ No

If No, why not?

Should this site continue? ◯ Yes ◯ No

Additional Information:

Save completed form to H:/WQPD/01MnA\CWQMN\FY11 CWQMN Site Evaluation\...
Select appropriate quarter and station folder; add CAMS # to file name.

Appendix G

Example Letter to Document Adherence to the QAPP

TO: (name)
(organization)

FROM: (name)
(organization)

Subject: RE: Commitments to requirements contained in Continuous Water Quality Monitoring Network (CWQMN) Quality Assurance Project Plan (QAPP) Revision 4

Please sign and return this form by (date) to:

(address)

I acknowledge receipt of the referenced document(s). I understand the document(s) describe quality assurance, quality control, data management and reporting, and other technical activities that must be implemented to ensure the results of work performed will satisfy stated performance criteria.

_____ _____
Signature Date

Copies of the signed forms should be sent by the Operator/Cooperator to the TCEQ CWQMN Network coordinator within 60 days of TCEQ approval of the QAPP.