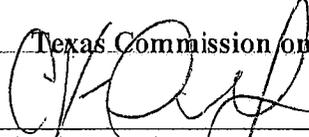


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LAKE GRANBURY  
CONTINUOUS WATER QUALITY MONITORING  
PROJECT PLAN

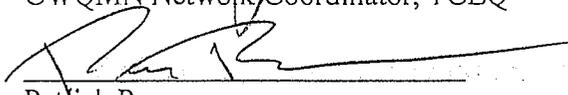
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A1 APPROVAL PAGE

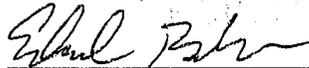
Texas Commission on Environmental Quality Central Office

  
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Chuck Dvorsky  
CWQMN Network Coordinator, TCEQ

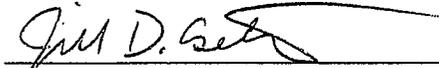
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Patrick Roques  
Section Manager, TCEQ WQM&A Program

9/20/07  
Date

  
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Edward Ragsdale  
CWQMN Quality Control Officer

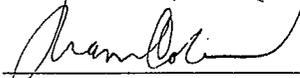
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Jill Csekitz  
Lake Granbury CWQMN Project Lead

9/18/07  
Date

  
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Brenda Archer  
Team Leader, TCEQ SWQM Program

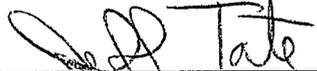
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Sharon Coleman  
CWQMN Quality Assurance Officer

10/11/07  
Date

**A1 APPROVAL PAGE**

**Texas Commission on Environmental Quality Region 4, Dallas Ft. Worth**

  
\_\_\_\_\_

Jeff Tate  
Water Team Leader, TCEQ Region 4

9-26-07

Date

  
\_\_\_\_\_

Alec MacDonald  
Site Operator, TCEQ Region 4

9/26/07

Date

**A1 APPROVAL PAGE**

**Texas Parks and Wildlife**

  
\_\_\_\_\_  
Joan Glass  
Data Customer, Texas Parks and Wildlife

26 Sept. 2007  
Date

This Project Plan documents specific details for a new continuous water quality monitoring project not covered in the Continuous Water Quality Monitoring Network (CWQMN) Quality Assurance Project Plan. Please see the CWQMN QAPP for other network details.

## **A2 TABLE OF CONTENTS**

A1	Approval Page
A2	Table of Contents
A3	Distribution List
A3	List of Acronyms
A4	Project/Task Organization
A5	Problem Definition/Background
A6	Project/Task Description
A7	Quality Objectives and Criteria
A8	Special Training/Certification
A9	Documents and Records
B1	Sampling Process Design
B2	Sampling Methods
B3	Sample Handling and Custody
B4	Analytical Methods
B5	Quality Control
B6	Instrument/Equipment Testing, Inspection, and Maintenance
B7	Instrument Calibration and Frequency
B8	Inspection/Acceptance of Supplies and Consumables
B9	Non-Direct Measurements
B10	Data Management
C1	Assessment and Response Actions
C2	Reports to Management
D1	Data Review, Verification and Validation
D2	Verification and Validation Methods
D3	Reconciliation with User Requirements
D4	Literature Cited

### **Appendices:**

None

### **Tables:**

**Table A7.1: YSI Sonde (Multiprobe) Data Quality Objectives**

### **Figures:**

Figure 1: A4.1 Project Organizational Chart

Figure 2: Location Map of Lake Granbury Continuous Monitoring Station

### LIST OF ACRONYMS

CAMS	Continuous Ambient Monitoring Station
CVS	Calibration Verification Sample
CWQMN	Continuous Water Quality Monitoring Network
DO	Dissolved Oxygen
DM&QA	Data Management and Quality Assurance
DQO	Data Quality Objective
FOD	Field Operation Division
mg/L	Milligram per Liter
LEADS/RHONE	Leading Environmental Analysis and Display System
MOPs	Monitoring Operation Division
MQO	Measurement Quality Objective
NA	Not Applicable
NIST	National Institute of Standards and Technology
PMA	Preventative Maintenance Code
QA	Quality Assurance
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	Quality Control
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
TPWD	Texas Parks and Wildlife
$\mu\text{S/cm}$	micro Siemens per centimeter
WQM&A	Water Quality Monitoring & Assessment Section

### A3 DISTRIBUTION LIST

#### TEXAS COMMISSION ON ENVIRONMENTAL QUALITY REGION 4 DALLAS FORT WORTH REGIONAL OFFICE

2309 Gravel Dr.

Fort Worth, Texas 76118-6951

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**TEXAS PARKS AND WILDLIFE**

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**TEXAS PARKS AND WILDLIFE WACO OFFICE**

1601 E. Crest Drive  
Waco, Texas 76705

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**TEXAS COMMISSION ON ENVIRONMENTAL QUALITY CENTRAL**

P.O. Box 13087  
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Mr. Charles Dvorsky, Network Coordinator, Ambient Monitoring Section, Monitoring Operations Division, (512) 239-5550

Mr. Patrick Roques, Section Manager, Water Quality Monitoring & Assessment Section, Monitoring Operations Division, (512) 239-4604

Mr. Scott Mgebroff, Section Manager, Ambient Monitoring Section, Monitoring Operations Division, (512) 239-5836

Mr. Leroy Braun, Ambient Monitoring Communications Coordinator, Ambient Monitoring Section, Monitoring Operations Division, (512) 239-2254

Mr. Larry Lehman, System Planning and Implementation Team, Ambient Monitoring Section, Monitoring Operations Division, (512) 239-1778

Mr. Edward Ragsdale, Surface Water Quality Monitoring Team, Water Quality Monitoring & Assessment Section, (512) 239-0386

Ms. Jill Csekitz, Surface Water Quality Monitoring Team, Water Quality Monitoring & Assessment Section (512) 239-3136

Ms. Elizabeth Fawcett, Data Management Technology Team, Data Management & Quality Assurance Section, Monitoring Operations Division, (512) 239-3966

Ms. Nancy Ragland, Data Management Technology Team, Data Management & Quality Assurance Section, Monitoring Operations Division, (512) 239-6546

Ms. Sharon Coleman, CWQMN Quality Assurance Officer, Compliance Support Division, (512) 239-6340

Mr. David Manis, Section Manager, Data Management & Quality Assurance Section, Monitoring Operations Division

Ms. Anne Panko, Quality Assurance & Audit Team, Data Management & Quality Assurance Section, Monitoring Operations Division

Ms. Brenda Archer, Surface Water Quality Monitoring Team Leader, Monitoring Operations Division

Ms. Gail Rothe, Categorical 106 Grant Project Manager

Ms. Laurie Curra, Watershed Management Team, Water Quality Monitoring & Assessment Section

## 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.

### A4.1 TCEQ Network Coordinator (Charles Dvorsky)

- Provides overall support for coordination, development, and installation of new Continuous Ambient Monitoring Station (CAMS).
- Responsible for ensuring external data customers have access to TCEQ data behind firewall.

### A4.2 TCEQ Project Lead (Jill Csekitz)

- Responsible for writing Project Plan.
- Responsible for site selection.
- Responsible for monitoring equipment purchases.
- Participate in station deployment.
- Provide operation and maintenance supplies to site operator when requested.
- Provide assistance to site operator, QC officer, and data validator to resolve data quality problems as needed.

### A4.3 TCEQ Region 4 (Alec MacDonald)

- Responsible for site operation.
- Responsible for water quality monitoring equipment quality control activities.
- Participate in site deployment.
- Communicate equipment needs for operation and maintenance of site to project lead.

### A4.4 TCEQ Ambient Monitoring (Leroy Braun)

- Responsible for site communication.
- Participate in site deployment.

### A4.5 TCEQ Data Validation (Elizabeth Fawcett)

- Responsible for validation of site data record.

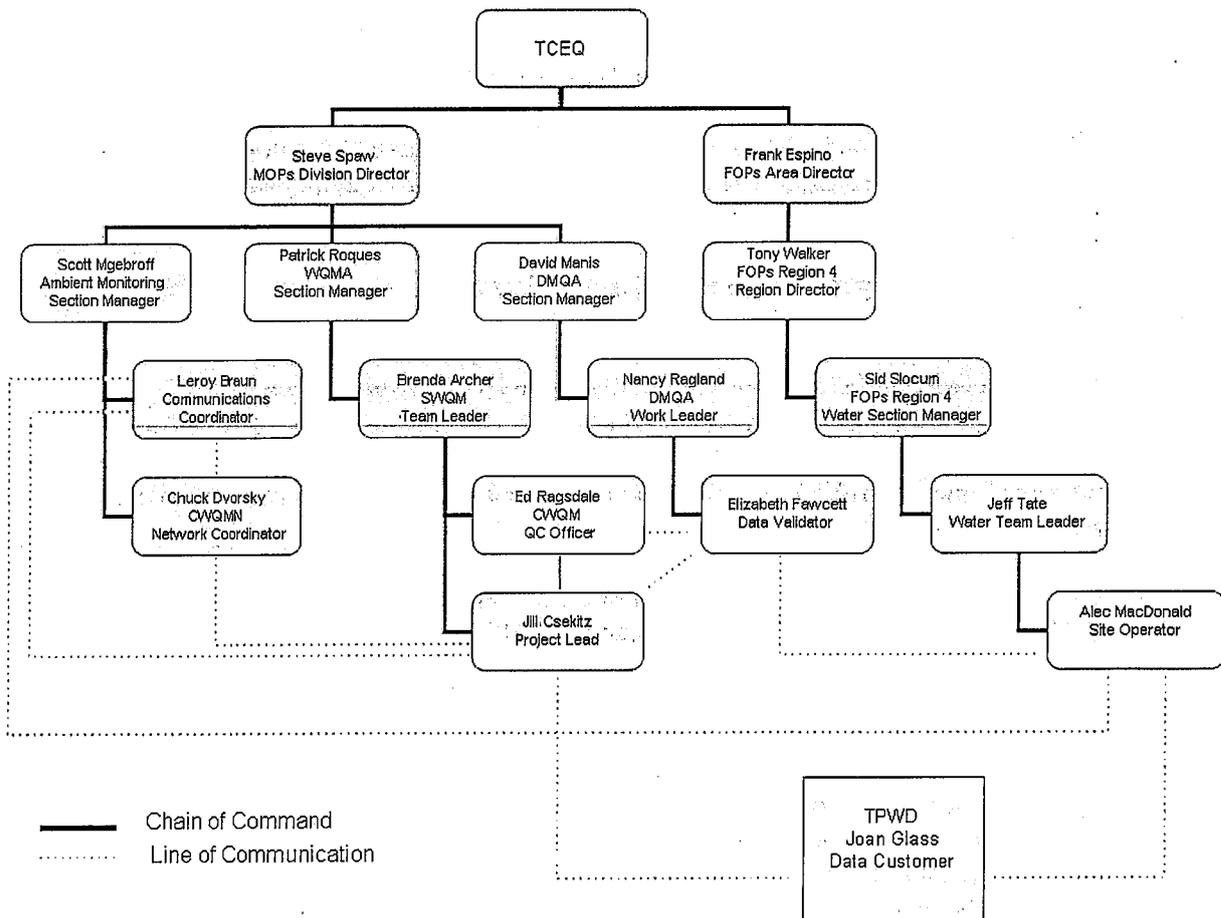
### A4.6 TPWD Golden Algae Research (Joan Glass)

- Data customer.
- Provides feedback to TCEQ for specific data needs.

**A4.7 TCEQ Continuous Water Quality Monitoring Quality Control Officer (Ed Ragsdale)**

- Provides QC oversight of project.
- Reviews and comments on proposed project plan.

**PROJECT ORGANIZATION CHART**  
**Figure A4.1 Organization Chart**



## A5 PROBLEM DEFINITION/BACKGROUND

### Golden Alga

Golden alga, *Prymnesium parvum*, is a naturally occurring flagellated alga that is common in brackish waters. Under certain environmental conditions, these alga produce toxins which produce massive fish and mussel kills. Golden alga related kills have been documented in inland Texas waters since 1985. The environmental conditions leading up to a toxic golden algae bloom are largely unknown. Texas Parks and Wildlife (TPWD) is coordinating an extensive research initiative to identify environmental factors (including water quality), that contribute to a golden alga bloom, and to develop management strategies to mitigate the ecological and economic impacts associated with a toxic golden alga bloom (TPWD, 2007).

### Golden Alga in Lake Granbury

Golden alga is particularly active in the Brazos River Basin, whose water quality is characterized by naturally occurring salts. Lake Granbury is one of several waterbodies in the Brazos with fish kills reported since December, 2004. The most extensive bloom on Lake Granbury killed over four million fish during winter and spring 2005. The most recent event at Lake Granbury occurred on March 20, 2007.

### Monitoring Water Quality to Support Golden Alga Research

TPWD coordinated with the Texas Commission on Environmental Quality (TCEQ), in March 2004 to collect quarterly water quality samples as part of a statewide *P. parvum* survey. Since then, research has intensified in waterbodies with frequent blooms and an extensive historical water quality data record, including Lake Granbury. These research efforts were augmented with the deployment of two continuous water quality profilers by TCEQ in cooperation with TPWD on the following Brazos reservoirs:

- CAMS 723 Lake Whitney, TCEQ segment 1203, downstream of Lake Granbury
- CAMS 724 Lake Possum Kingdom, segment 1207, upstream of Lake Granbury

These stations were deployed in October 2005 and May 2006 respectively, and continue to provide data. The deployment of a third continuous monitor in Lake Granbury will allow water quality trends in a consecutive series of affected reservoirs to be monitored. The objective of the continuous monitoring is to describe the physical water quality conditions before, during, and following a golden alga bloom in each of these reservoirs. TPWD researchers hope to identify the water quality conditions that may contribute to the trigger of toxin production by *P. parvum*, as well as bloom status. Trend analysis of *in vivo* chlorophyll fluorescence may identify relationships between phytoplankton and golden alga populations. The ability of the continuous monitor to conduct vertical profiles through the water column allows measurement of effects from stratification and mixing processes, two important components of reservoir dynamics.

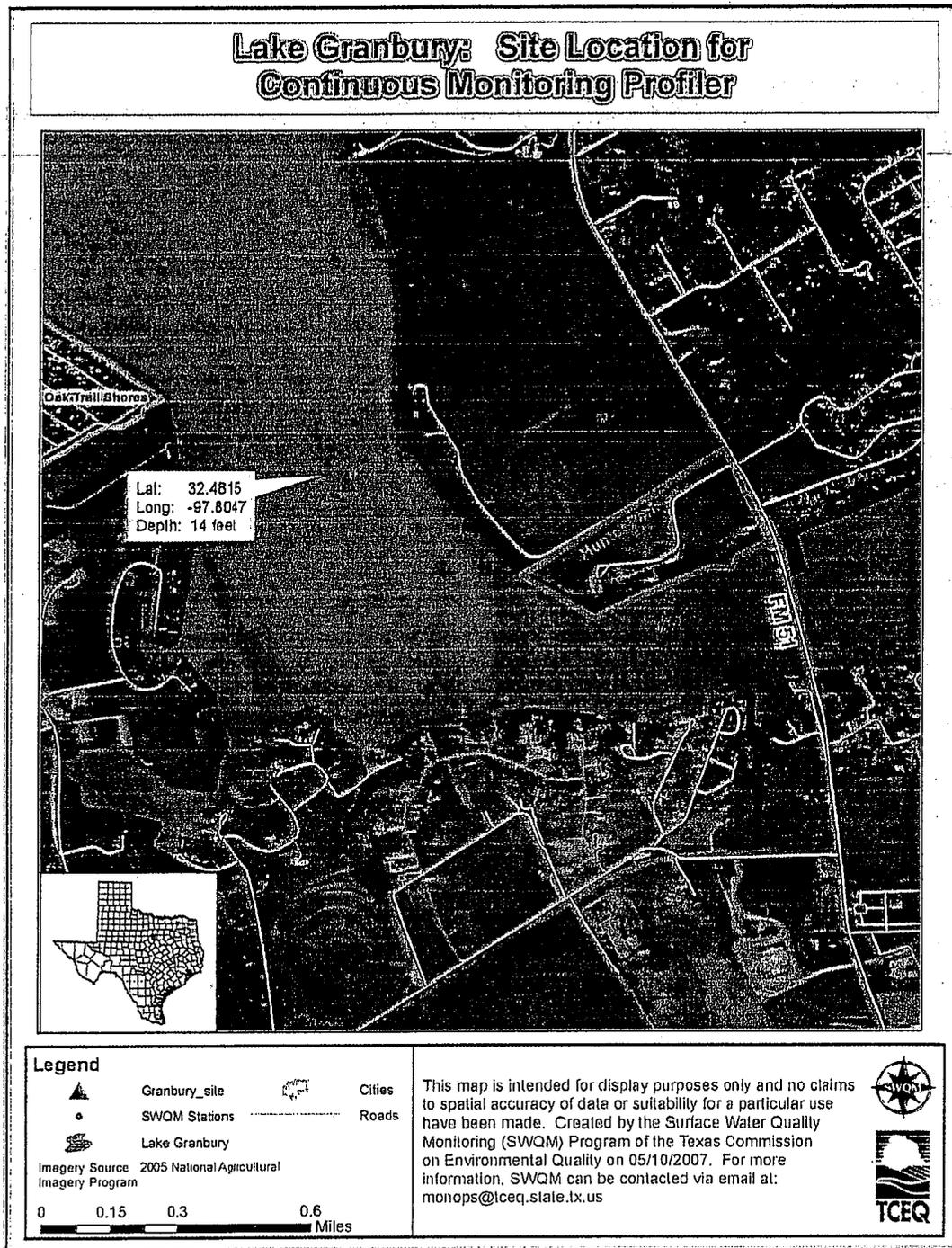
## A6 PROJECT/TASK DESCRIPTION

TCEQ will deploy a Continuous Ambient Monitoring Station (CAMS) number 0748 on Lake Granbury near Hunter Park. Location information is depicted on Figure 1. Deployment will take place in fall of 2007 and continue indefinitely, or until TCEQ and TPWD decide data collection from this station is no longer necessary for research purposes. CAMS measurement equipment will include a Yellow Springs Instruments (YSI) Model 6600 V2 multiprobe sonde and meteorological package mounted on a YSI Vertical Profiling Pontoon. The YSI multiprobe will measure dissolved oxygen (DO), pH, temperature, specific conductance (SC), and *in vivo* fluorescence of chlorophyll. The YSI MET meteorological package will collect wind speed, wind direction, air temperature, and relative humidity data. The purpose of this station is to generate data to be used by TPWD for golden alga research.

Work products discussed in this Project Plan are: CAMS station design, deployment, and operation; and data access for TPWD data customer, Joan Glass. Deliverables for this project include the station data record, with a completeness goal of 75%.

### Figure 2: Map of Continuous Monitoring Station Location

*See next page*



## A7 QUALITY OBJECTIVES AND CRITERIA

Methods used for the YSI multiprobe are based on *Standard Methods for the Examination of Water and Wastewater*, 20<sup>th</sup> Edition, 1998, and *Luminescence of Dissolved Oxygen in Water and Wastewater*, Hach Method 10360, 2006.

The measurement performance specifications to support the project objectives are specified in Table A7.1.

Methods for the YSI 6600V2 are based on *Standard Methods for the Examination of Water and Wastewater*, 20<sup>th</sup> Edition, 1998 unless otherwise noted.

Quality Objectives and criteria have not been developed for data collected with meteorological equipment. These data are not quality assured, nor displayed on TCEQ website as part of the project. They will be provided to TPWD upon request.

**Table A7.1 – YSI Sonde (Multi-Probe) Data Quality Objectives**

Parameter	Parameter Code	Units	Method	Calibration Verification Sample (CVS)
pH	00400	pH / units	Glass electrode, Standard Method 4500-H+B	±0.50 pH unit
Dissolved Oxygen	00300	mg/L	Luminescence, Hach Method 10360	% Saturation ≤ 6.0% ±0.50 mg/L
Specific Conductance	00094	µS/cm	Conductivity cell Standard Method 2520B	≤5.0% RPE
Temperature	00010	°C	Standard Method 2550 B	± 1.5°C
Fluorescence	NA	% Fluorescence	Fluorometric, Standard Method 10200H+3	NA
<i>in vivo</i> Total Chlorophyll	NA	µg/L	Fluorometric, Standard Method 10200H+3	NA

### Ambient Water Reporting Limits (AWRLs)

NA.

### Precision

NA.

### Bias

As described in Section A7.4 of the CWQMN QAPP for DO, SC, and pH. TCEQ has not established criteria to assess fluorometric sensor drift and accuracy.

### **Representativeness**

As described in Section B2 of the CWQMN QAPP.

### **Comparability**

As described in Section B2 of the CWQMN QAPP for DO, SC, and pH.

### **Completeness**

A general requirement of 75 percent data completeness goal has been set for the CWQM network. Periods of flood or other conditions that necessitate the shutdown of any or all instrumentation during these times are not considered in the calculation for data completeness. See Section A7.5 CWQM QAPP. Fluorometric data are not included in data completeness determination.

## **A8 SPECIAL TRAINING/CERTIFICATION**

As described in section A8 of the CWQMN QAPP.

## **A9 DOCUMENTS AND RECORDS**

As described in sections A9 of the CWQMN QAPP.

## **B1 SAMPLING PROCESS DESIGN**

### **Site Selection Criteria**

The Hunter Park site was chosen based on the following criteria:

- Golden alga monitoring by TPWD currently conducted near the site.
- Historical golden alga bloom occurrences.
- Historical water quality data near the site.
- Sufficient depth to adequately measure change in water quality through the water column.
- Adequate snag debris present to minimize boat traffic near the site and vandalism to the equipment.

## **Monitoring Station Design**

### Monitoring and Support Equipment

The CAMS site will include the following monitoring and support equipment;

- YSI 6600V2 Multiprobe and associated cables.
- YSI Vertical Profiling Pontoon with platform, winch and cables.
- Campbell data logger
- YSI meteorological package.
- Mooring system complete with two anchors and stainless steel chain.
- Solar power supply
- Wireless cellular modem

### Monitoring Equipment Configurations and Measurement Frequencies

The YSI multiprobe and profiling software will be configured to profile the water column each hour, taking water quality measurements at 1.0 meter depth increments. The first measurement will be taken 0.5 meters below the surface; the last taken at 0.5 meters from the bottom, for a total of (4) measurements per profile trip. The Vertical Profiler will park the multiprobe at each depth for approximately 2 minutes, adequate time to allow the multiprobe to equilibrate with the ambient water and take a measurement.

Initial parking depths will be determined during the deployment of the station, and may be modified as data are collected.

The multiprobe will measure DO, pH, specific conductance, temperature, and percent fluorescence during each profile.

## **B2 SAMPLING METHODS**

As described in sections B2 of the CWQMN QAPP.

### **Sampling/Measurement System Corrective Action**

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

## **B3 SAMPLE HANDLING AND CUSTODY**

As described in Section B3 of the CWQMN QAPP.

## B4 ANALYTICAL METHODS

Analytical methods are listed in Section A.7.1

## B5 QUALITY CONTROL

Quality control procedures are described in Section B5 of the CWQMN QAPP.

Please see Table A7.1 for sonde multiprobe QC criteria.

### YSI Model 6600 Multiprobe SC, pH, and Sample Depth Sensors

For QC procedures please see SOP AMPM – 11: *Analysis of Dissolved Oxygen (DO), Specific Conductance (SC), pH, Temperature, and Sample Depth in Ambient Surface Water Using Yellow Springs Instrument (YSI) 600 XLM and 6600 Extended Deployment System (EDS) Sonde*, TCEQ June 2006.

### YSI Model 6600 Optical DO Sensor

A specific SOP for the QC of Optical DO sensors using the Luminescence Hach Method 10360 has not been developed by TCEQ. Site Operator should follow QC procedures described in the *6-Series Multiparameter Water Quality Sondes User Manual*, Version D, Yellow Springs Instruments, October 2006.

### YSI Model 6600 Multiprobe Fluorometric Sensor

SOPs for the calibration of chlorophyll fluorescence sensors using Fluorometric Standard Method 10200H+3 have not been developed by TCEQ. Site Operator should follow the 1-point calibration procedure to zero the fluorescence detector using deionized (chlorophyll-free) water as described in the *6-Series Multiparameter Water Quality Sondes User Manual*, Version D, Yellow Springs Instruments, October 2006. This method estimates chlorophyll content in ambient waters. Additional method limitations are discussed in the User manual.

QC procedures should be performed with a minimum frequency of once per month, or greater to achieve the goal of 75 percent capture of valid station data. Since chlorophyll fluorescence data are not validated by TCEQ these data will not be included in percent data capture determination.

### **Corrective Action Related to Quality Control**

As described in Section B5 of the CWQMN QAPP.

## B6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION AND MAINTENANCE

As described in Section B6 of the CWQMN QAPP.

## **B7 INSTRUMENT CALIBRATION AND FREQUENCY**

### YSI Model 6600 Multiprobe SC, pH, and Sample Depth Sensors

Calibrations of specific conductance, pH, and sample depth will be performed according to SOP AMPM-11: Analysis of Dissolved Oxygen (DO), Specific Conductance (SC), pH, Temperature, and Sample Depth in Ambient Surface Water Using Yellow Springs Instrument (YSI) 600 XLM and 6600 Extended Deployment System (EDS) Sonde, TCEQ June 2006.

### YSI Model 6600 Multiprobe Optical DO Sensor

An SOP for the calibration of Optical DO sensors using the Luminescence Hach Method 10360 has not been developed by TCEQ. Site Operator should follow procedures described in the 6-Series Multiparameter Water Quality Sondes User Manual, Version D, Yellow Springs Instruments, October 2006.

### YSI Model 6600 Multiprobe Fluorometric Sensor

SOPs for the calibration of chlorophyll fluorescence sensors using Fluorometric Standard Method 10200H+3 have not been developed by TCEQ. Site Operator should follow the 1- point calibration procedure to zero the fluorescence detector using deionized (chlorophyll free) water as described in the 6-Series Multiparameter Water Quality Sondes User Manual, Version D, Yellow Springs Instruments, October 2006. This method estimates chlorophyll content in ambient waters. Additional method limitations are discussed in the User manual.

All YSI multiprobe sensors should be calibrated with a minimum frequency of once per month, or greater to achieve the goal of 75 percent capture of valid station data. Since chlorophyll fluorescence data are not validated by TCEQ these data will not be included in percent data capture determination.

## **B8 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES**

MOPs ambient monitoring section keeps an inventory of common spare parts. The Project lead will be responsible for the coordination of parts replacement. Calibration standards are available to the site operator through TCEQ general supply.

## **B9 NON-DIRECT MEASUREMENTS**

There are no non-direct measurements used in this project.

## **B10 DATA MANAGEMENT**

A dedicated computer maintained at the TCEQ Central Office will poll CAMS 0748 at hourly intervals. The data record is then de-coded and processed into the RHONE database where it can be accessed by internal and external parties with access behind the TCEQ firewall.

Meteorological data collected by CAMS 0748 are included in the polled downloads, but are not displayed on LEADS/RHONE nor validated by TCEQ. These data will be provided upon request.

Joan Glass of Texas Parks and Wildlife and/or designee will have access to view CAMS 0748 data behind the TCEQ firewall.

Other data management procedures as described in Section B10 of the CWQMN QAPP.

## **C1 ASSESSMENTS AND RESPONSE ACTIONS**

As described in CWQMN QAPP.

### **Corrective Action**

As described in Section C1 of the CWQMN QAPP.

## **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**

### **YSI Multiprobe**

#### Data Review and Verification

As described in Section D1 of the CWQMN QAPP

#### Golden Alga Data Validation

YSI Multiprobe data quality will be assessed by TPWD staff for golden alga research purposes.

#### Station Data Record Validation

The station's data record will be validated based on calibration verification sample (CVS) results to be determined within 24 hours of sonde retrieval from the field. CVS criteria are described in table A7.1 of this project plan. If criteria are not met, then data collected back to the last calibration are qualified

as invalid. All data within one hour after any preventative maintenance will also be qualified as invalid, in order for the sonde to stabilize.

Validation methods as performed by assigned TCEQ data validator and described in Section D2 of the CWQMN QAPP.

### **Meteorological Data**

#### Data Review and Verification

As described in Section D1 of the CWQMN QAPP

#### Golden Alga Data Validation

Meteorological data quality will be assessed by TPWD staff for golden alga research purposes

#### Meteorological Station Data

Meteorological data will not be validated by TCEQ.

## **D2 VERIFICATION AND VALIDATION METHODS**

As described in Section D2 of the CWQMN QAPP with the exception of the meteorological and percent fluorescence data. These data are not validated as part of the project due to the absence of data quality objectives.

## **D3 RECONCILIATION WITH USER REQUIREMENTS**

As described in Section D3 of the CWQMN QAPP.

## **D4 LITERATURE CITED**

TPWD. Current Bloom Status of Golden Alga. Texas Parks and Wildlife website, 2007.  
<http://www.tpwd.state.tx.us/landwater/water/environconcerns/hab/ga/2007>

TCEQ. SOP AMPM – 11: Analysis of Dissolved Oxygen (DO), Specific Conductance (SC), pH, Temperature, and Sample Depth in Ambient Surface Water Using Yellow Springs Instrument (YSI) 600 XLM and 6600 Extended Deployment System (EDS) Sonde, TCEQ June 2006.

YSI. 6-Series Multiparameter Water Quality Sondes User Manual, Version D, Yellow Springs Instruments, October 2006.