# Standard Operating Procedures for the Collection of Water-Quality Data Using a Vertical Profiling Water-Quality Monitor on the Arroyo Colorado, South Texas

Effective Date: February 2016

Revision No. 1

APPROVALS:

Cassi Crow
USGS Project Manager
USGS Texas Water Science Center
5563 De Zavala Rd Suite 290
San Antonio, TX 78249

C L Crow 2-9-2016
Cassi Crow Date

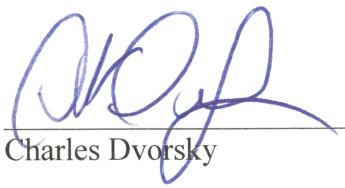
APPROVALS (continued)

Michael Canova
USGS QA/QC Officer
USGS Texas Water Science Center
1505Ferguson Lane
Austin, TX 78754

Michael Canova 8/10/2016
Michael Canova Date

APPROVALS (continued)

Charles Dvorsky
TCEQ Project Manager and Continuous water Quality Monitoring Network Coordinator
Texas Commission of Environmental Quality
P.O. Box 13087
MC234
Austin, TX 78711-3087



2/9/2016

Charles Dvorsky Date

# Standard Operating Procedures for the Collection of Water-Quality Data Using a Vertically Profiling Water-Quality Monitor on the Arroyo Colorado, South Texas.

## 1.0 Purpose/Scope

The U.S. Geological Survey (USGS) has been contracted by the Texas Commission on Environmental Quality (TCEQ) to collect, validate, and report water-quality and gage height monitoring data from the Arroyo Colorado at FM 106, Rio Hondo, TX, following USGS guidelines and procedures.

The project's Quality Assurance Project Plan (QAPP) is available at: (www.texaswaterdata.org).

The USGS documents with internet addresses are listed below.

TM1D3: USGS – Guidelines and Standard Procedures for Continuous Water-Quality Monitors: Station Operation, Record Computation, and Data Reporting.
http://pubs.usgs.gov/tm/2006/tm1D3/

OFR03-123: User's Manual for the National Water Information System of The U.S. Geological Survey Automated Data Processing System (ADAPS).
http://pubs.usgs.gov/of/2003/ofr03123/

USGS Texas Water Science Center QAPPs are available upon request:

1. Quality-Assurance Plan for Water Quality Activities in the Texas Water Science Center.
2. Texas Water Science Center Surface-Water Quality-Assurance Plan

This document is an adaptation and interpretation of the USGS water-quality monitoring procedures outlined in TM1D3 for the Arroyo Colorado Continuous Water-Quality Monitoring Project application. This adaptation is necessary for data collection and validation when water-quality monitors are used when collecting data in a vertical profile in a stratified and tidally-influenced environment. These procedures are specific for the USGS-operated TCEQ continuous water-quality profiling station located on the Arroyo Colorado at FM 106 in Rio Hondo, Texas (USGS station 08470500). Refer to TM1D3 for any procedures not specifically covered in this standard operating procedure (SOP) document.

On June 4, 2014, the USGS began operating the Arroyo Colorado station according to guidelines and procedures in TM1D3. The procedures detailed in this document apply to all data collected at this station beginning August 1, 2014. Excluding extreme events, a minimum of seventy-five percent (75%) of the scheduled data will be collected and validated meeting at least the USGS "fair" data criteria as outlined in TM1D3.

As data are validated and processed, these procedures may be modified as needed. If significant changes to procedures are required, the USGS will contact the TCEQ for concurrence/approval. The USGS will track and update procedures within this SOP when changes are made. When changes are made, the USGS will provide TCEQ updated procedures.

## 2.0 Background

The vertical profiling system is mounted to one column of the west pier bumper on the upstream side of the CR 106 Bridge over the Arroyo Colorado in Rio Hondo (fig. 1). The profiler is designed to automatically raise and lower the water-quality monitor through the water column beginning at the top of every hour. The profiler will stop the monitor at equally-distributed, discrete points (known as steps) in the water column. The monitor will remain at each step for a specified number of minutes to allow the sensors to equilibrate, and then the station's data logger will record instantaneous dissolved oxygen (DO) concentration, specific conductance, water temperature, and sample depth measurements. The gage height reading for the site will be measured and recorded at the top of each hour using a separate, stationary reference sonde deployed at the site.

**Figure 1.** Profiling system on the Arroyo Colorado

The section of the Arroyo Colorado in which the vertical profiling system is located (Segment 2201) is tidally influenced and habitat to a diverse range of aquatic organisms. The bottom of the water column at the site is typically anoxic with specific conductivity values that can reach almost 60,000 microsiemens per centimeter (µS/cm), while the water near the surface is typically more oxygenated with specific conductivity values that can be as low as 5,000 µS/cm. Bio-fouling by algae, barnacles, and bivalves can be an issue with any infrastructure and equipment used above the anoxic zone at the site, while corrosion can be an issue in the anoxic zone itself.

## 3.0 Procedures

SITE VISIT

Equipment List for Site Visit

Field meter (calibrated in lab using methods described in TM1D3) - FM

Replacement sonde (calibrated in lab using methods described in TM1D3) - RS
Profiling sonde (at the monitoring site) - PS
YSI 650MDS
Field sheet (appendix 1)
Laptop with Loggernet software installed
25' serial computer cable
Desiccant (Dustless color indicating desiccant)
Desiccant deployment bag (knee-high pantyhose)
Bucket
Cleaning supplies

- Scrub brushes and pads
- Deployment Tube Interior Cleaning Tool (fig. 2)
- Chimney brush rods
- Drill
- Putty knives/scrapers (for scraping barnacles)

Figure 2. Interior Deployment Tube Cleaning Tool

**Before launching the boat, field personnel are required to call Texas Department of Transportation Rio Hondo Bridge Master at 956-241-2961** to leave a contact number so you can be reached. The Bridge Master receives about an hour's notice from the barge operators so he can be ready to lift the bridge. If you receive a call from the Bridge Master informing you that a barge will be passing, secure the site and return to the boat ramp and allow the barge to pass before returning to the site.

1. Upon arrival at the site, read the gage height from the staff plate (OG) and record it on the field sheet along with the time. Immediately after, obtain the inside gage height (IG) reading from the pressure transducer by reading the data collection platform (DCP) display and record it on the field sheet. If needed, reset the IG reading on the DCP to match the reading from the OG.

2. Connect to the profiler to the laptop PC using the 25' serial computer cable. Open the Loggernet software and connect to the profiler by clicking on the "ArroyoCOM" and then the "Connect" button on the "Connect Screen ArroyoCOM" window. Once connected, monitor the "ArroyoCOM Numeric Displays" windows to determine if a profile is in progress. If a profile is not in progress, place the profiler in set up mode using Flag 2 the "Ports and Flags" window and begin maintenance procedures. If profile is in progress, wait until the end of the profile to place profiler in set up mode to begin maintenance procedures.

3. Remove the profiling sonde (PS) from the deployment tube and remove the deployment tube from its brackets and swing up and out of the water using the block and tackle. Tie off the deployment tube to keep it out of the water to facilitate cleaning and to keep it from interfering with collection of field parameters in step 4 (fig. 3).

**Figure 3.** Deployment tube tied off to keep it out of the water for cleaning.

4. The modified standard protocol for the operation and maintenance of a continuous water-quality monitor at a site with rapidly changing conditions (as described in TM1D3; pg. 14-16) is used at the site. Collect a bucket of water from the stream. Place both the profiling sonde (PS) and the field meter (FM) into the bucket to get the initial field readings. Allow readings to stabilize and record them in the "Before Readings" section of the field sheet. DO NOT THROW OUT THE BUCKET OF WATER.

5. Clean the profiling sonde (PS) using scrub pads and small soft-bristled brushes to carefully remove any bio-fouling, sediment buildup, and any other foreign matter from the sonde housing and probes. After cleaning, place both the profiling sonde (PS) and the field meter (FM) back into the bucket of water collected in step 4, allow to stabilize, and record readings from both sondes in the section of the field sheet labeled "After Cleaning". DO NOT THROW OUT BUCKET OF WATER.

6. Zero the depth sensor on the replacement sonde (RS) in air while on location just prior to deployment. Be sure to attach the copper anti-fouling sensor guard to the replacement sonde (RS) prior to deployment. If black film was present on the copper sensor guard on the profiling sonde (PS) prior to cleaning, do not cover temperature/conductance sensor of the replacement sonde (RS) with copper tape or screen; and remove the wiper pad from the dissolved oxygen sensor prior to field deployment. If black film was not present on the profiling sonde (PS) install copper tape/screen on temperature/conductance sensor on replacement sonde (RS); and equip dissolved oxygen sensor on replacement sonde (RS) with wiper.

7. Place the replacement sonde (RS) and the field meter (FM) into the bucket of water collected in step 4. Allow to stabilize and record readings from both sondes in the section of the field sheet labeled "Final Readings".

8. Remove both the gage height PT and the YSI 600 XL profiler reference sonde from the small deployment tube. Carefully clean both units using scrub pads and scrapers as needed. Allow the YSI 600 XL to stabilize in air for a minimum of 10 minutes and then set the unit to zero in air (every visit). Return the YSI 600 XL to the deployment tube first followed by the gage height PT. After redeploying the YSI 600 XL, be sure the depth reading has stablized before running a profile. Check the gage height shown on the DCP with that on the OG. Reset the DCP to the OG reading, if needed.

9. Perform all cleaning and maintenance on the station infrastructure. The profiling sonde deployment tube must be cleaned inside and out during every visit to remove any bivalves, barnacles, or other organisms that might have accumulated since the last visit. Attach the cleaning tool (fig. 2) to the end of a chimney brush rod. Attach the end of the rod to a power drill. Insert the cleaning tool into the bottom of the deployment tube. Run the drill (clockwise) while moving the tool up and down the length of the deployment tube. Add additional rods as needed to reach all biofouled areas of the deployment tube. Continue until interior of tube is cleared of all biological growth. Scrub the outside of the tube thoroughly with scrub brushes and scrub pads to remove algae and any other foreign material. Use various scrapers to remove any barnacles that are growing inside or outside of the deployment tube. Make sure deployment tube is properly secured in its brackets after cleaning is completed. Desiccant inside the gage house must be replaced during every visit.

10. After securing the profiler deployment tube back in its brackets, place the replacement sonde (RS) back into the clean deployment tube. Place profiler back into profile mode and manually start a profile (or wait for profile to start if the time is near the top of the hour). Ensure the profiler has moved through at least 2 steps before leaving the site. The profiling sonde (PS) that is being removed from the site must be returned to the laboratory for post-calibration checks as described in TM1D3 and detailed in the Arroyo Colorado QAPP. Post-calibration checks must occur within 2 days of removal from site.

## SONDE CALIBRATIONS

All calibrations will be done in a temperature-controlled environment following guidelines and standard procedures published in TM1D3 and detailed in the Arroyo Colorado QAPP. The field meter (FM) and replacement sonde (RS) should be calibrated in the lab no sooner than 2 days prior to use at the site. After all calibrations are complete, the replacement sonde bulkhead and sensors should be sprayed with C-Spray and allowed to air dry before deployment.

### Temperature Checks

As described in TM1D3, temperature sensors are checked against NIST- traceable thermometers and thermistors at a single point, after every deployment. The accuracy of the thermistors is ± 0.2 °C. Temperature checks are conducted in a vessel of water and not in a circulated water bath. Thermistors that exceed a 0.5 °C difference from the NIST traceable thermistor or thermometer

will be replaced. Temperature sensors also will be checked at 2 temperatures bracketing the temperature range expected to be observed at the site a minimum of 3 times per year, and at 5 temperatures within the range of 0-40° C checked annually in a circulating water bath.

**Dissolved Oxygen Sensors**

1. Dissolved oxygen calibrations and calibration drift checks will occur in air-saturated water.

2. The project will employ single-point DO calibrations. Remove the DO membrane wiper prior to calibration. DO will be calibrated to 100% saturation using an air-saturated water bath, and a zero DO check will be performed in the laboratory prior to each deployment using a sodium-sulfite solution certified to be oxygen free, purchased from Cole-Parmer © . Replace the membrane wiper pad at each service before reinstalling the membrane wiper. If the DO sensor fails calibration, the sensor should first be uncalibrated and then recalibrated. If the sensor still fails to calibrate, the sensor will need to be replaced.

3. The sondes will be calibrated in a USGS laboratory. Each USGS laboratory has a dedicated barometer that is checked against an NIST-certified barometer annually.

4. Optical DO membranes will be replaced at least annually. Membranes may be replaced more frequently if necessary to achieve project data quality objectives. If the surface area of an optical DO membrane's protective black coating is worn off by more than approximately 25%, based on visual inspection, the membrane must be replaced prior to calibration prior to deployment.

5. USGS personnel will ensure that the optical DO membranes have the correct calibration and temperature coefficients by checking the documentation sent by the manufacturer with any new membrane. Coefficients must be changed in the sensor's firmware any time a membrane is replaced. New sensors will be checked to ensure they are were properly pre-programmed by the manufacturer prior to calibration and deployment.

6. Optical DO gains must be between 0.85 – 1.15 after calibration. If not, the sensor should first be uncalibrated and then recalibrated. If the gains still fail to fall within range, the sensor will need to be replaced.

**Specific Conductance Calibrations and Calibration Drift Checks**

1. The range of specific conductance at the site is approximately 5,000 – 50,000 µS/cm based on past data collected at the site. The conductivity sensors will be calibrated to a conductivity value of 10,000 µS/cm and multi-point calibration drift checks will be done using specific conductance values of 1,000 and 50,000 µS/cm.

2. Conductivity cell constants must be between 5 ± .45 after calibration. If not, corrective action must be performed before sensor can be used to collect project data.

3. If the copper tape or copper screen on the conductivity sensor appears to no longer be preventing bio-fouling, wrap the conductivity sensor with new copper tape and/or replace the copper screen.

## DATA MANAGEMENT

Data will be transmitted via cell modem and loaded into the NWIS database once per day at a minimum. Provisional data will be uploaded to TCEQ. Within 150 days of data collection, USGS will review and compute unit values based on fouling and drift data and upload these data to TCEQ.

## RECORD PROCESSING

Each water-quality property (water temperature, specific conductance, and DO) at each step in the profile will be processed as an individual record as described in TM1D3. The gage height will be collected every 15 minutes and processed as described in OFR03-123.

# APPENDIX I

## USGS Water-Quality Monitor Field Form

USGS
science for a changing world

**U.S. GEOLOGICAL SURVEY**
**CONTINUOUS WATER-QUALITY MONITOR**

Station No. 08470500

**Station No.** 08470500 Station Name Arroyo Colorado at FM106 nr Rio Hondo, TX

Monitor Inspected By _____ Date _____ Watch Time _____ Time Datum _____

Gage Ht _____ (Rising, Falling, Steady, Peak) Channel Conditions _____

Monitor Make/Model YSI 6920 Monitor Serial No. _____

Field Meter Make/Model YSI 6920 Field Meter Serial No. _____

**Weather** Cold Cool Warm Hot Rain Mist Sleet Snow Humid Dry Cloudy Pt Cloudy Overcast Clear Windy Gusty Breeze Calm

Monitor removed: _____

Monitor installed: _____

Comments:

| MONITOR FOULING CHECKS | | | | | | |
|---|---|---|---|---|---|---|
| | Before Cleaning | | After Cleaning | | Final Readings | |
| | Time _____ | | Time _____ | | Time _____ | |
| **Parameter** | Recorded/ Live Monitor | Field Meter Reading | Recorded/ Live Monitor | Field Meter Reading | Recorded/ Live Monitor | Field Meter Reading |
| **Temp (°C)** | | | | | | |
| **SC (µS/ cm)** | | | | | | |
| **DO (mg/L)** | | | | | | |

# Standard Operating Procedures for the Collection of Water Quality Data Using a Vertically Profiling Water-Quality Monitor on the Arroyo Colorado, South Texas.

---

## 1.0 Purpose/Scope

The U.S. Geological Survey (USGS) has been contracted by the Texas Commission on Environmental Quality (TCEQ) to collect, validate, and report water-quality and gage height monitoring data from the Arroyo Colorado at FM 106, Rio Hondo, TX, following USGS guidelines and procedures.

The project's Quality Assurance Project Plan (QAPP) is available at: (www.texaswaterdata.org).

The USGS documents with internet addresses are listed below.

TM1D3: USGS – Guidelines and Standard Procedures for Continuous Water-Quality Monitors: Station Operation, Record Computation, and Data Reporting.
http://pubs.usgs.gov/tm/2006/tm1D3/

OFR03-123: User's Manual for the National Water Information System of The U.S. Geological Survey Automated Data Processing System (ADAPS).
http://pubs.usgs.gov/of/2003/ofr03123/

USGS Texas Water Science Center QAPPs are available upon request:

1. Quality-Assurance Plan for Water Quality Activities in the Texas Water Science Center.
2. Texas Water Science Center Surface-Water Quality-Assurance Plan

This document is an adaptation and interpretation of the USGS water-quality monitoring procedures outlined in TM1D3 for the Arroyo Colorado Continuous Water-Quality Monitoring Project application. This adaptation is necessary for data collection and validation when water-quality monitors are used when collecting data in a vertical profile in a stratified and tidally-influenced environment. These procedures are specific for the USGS-operated TCEQ continuous water-quality profiling station located on the Arroyo Colorado at FM 106 in Rio Hondo, Texas (USGS station 08470500). Refer to TM1D3 for any procedures not specifically covered in this standard operating procedure (SOP) document.

On June 4, 2014, the USGS began operating the Arroyo Colorado station according to guidelines and procedures in TM1D3. The procedures detailed in this document apply to all data collected at this station beginning August 1, 2014. Excluding extreme events, a minimum of seventy-five percent (75%) of the scheduled data will be collected and validated meeting at least the USGS "fair" data criteria as outlined in TM1D3.