Clean Water Act §319(h) Nonpoint Source Grant Program

Coordinating Facilitation and Implementation of the Attoyac Bayou Watershed Protection Plan and Monitoring Implementation Effectiveness

TSSWCB Project # 21-10

Quality Assurance Project Plan

Texas State Soil and Water Conservation Board

prepared by

Texas AgriLife Research, Texas Water Resources Institute

Angelina & Neches River Authority

Stephen F. Austin State University Arthur Temple College of Forestry and Agriculture

Effective Period: Upon EPA approval through November 30, 2024

Questions concerning this quality assurance project plan should be directed to:

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Section A1: Approval Sheet

Quality Assurance Project Plan (QAPP) for the *Coordinating Facilitation and Implementation of the Attoyac Bayou Watershed Protection Plan and Monitoring Implementation Effectiveness* project.

United States Environmental Protection Agency (USEPA), Region VI

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Title: USEPA Chief State/Tribal Programs Section

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Title: USEPA Texas Nonpoint Source Project Officer

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Name: Mitch Conine
Title: TSSWCB Quality Assurance Officer (QAO)

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Title: TWRI Program Specialist

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Stephen F. Austin State University – Arthur Temple College of Forestry and Agriculture (SFASU) & Waters for East Texas Center (WET)

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Title: Associate Dean and Professor

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Name: Rene Barelas
Title: Clean Rivers Program (CRP) Coordinator

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Name: Melissa Garcia
Title: Laboratory Services Director

Signature:_____ Date:_____

Name: Hannah Crawford
Title: Lab Manager (LM)

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Name: Jeremiah Poling
Title: Information Resources Manager

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Lower Colorado River Authority (LCRA), Environmental Laboratory Services (ELS)

Name: Dale Jurecka
Title: Director, Environmental Laboratory Services

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Name: Angel Mata
Title: Regulatory Compliance and Safety Program Manager

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Name: Jason Woods
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Name: Tracy Easley
Title: Operations Manager

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Name: Gabrielle Jones
Title: Quality Manager

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Name: Karen Brown
Title: Project Manager

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Section A2: Table of Contents

List of Acronyms

ANRA	Angelina & Neches River Authority
AWRL	ambient water reporting limits
BMP	best management practice
CAR	corrective action report
CMS	coordinated monitoring schedule
COC	chain of custody
CRP	Clean Rivers Program
CWA	Clean Water Act
DM	Data Manager
DMRG	data management reference guide
DO	dissolved oxygen
DQO	data quality objectives
DUP	duplicate sample
ELS	Environmental Laboratory Services
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LIMS	laboratory information management system
LM	Laboratory Manager
LOD	limit of detection
LOQ	limit of quantitation
NELAP	National Environmental Laboratory Accreditation Program
NOLA	New Orleans, Louisiana
NWS	National Weather Service
OSSF	onsite sewage facility
PM	Project Manager
QA	quality assurance
QAPP	quality assurance project plan
QAO	Quality Assurance Officer
QC	quality control
QM	quality manual
QPR	quarterly progress report
RPD	relative percent difference
SFASU	Stephen F. Austin State University
SOP	standard operating procedure
SPWAL	Soil, Plant and Water Analysis Laboratory
SWCD	Soil and Water Conservation District
SWQM	surface water quality monitoring
SWQMIS	surface water quality monitoring information system
TCEQ	Texas Commission on Environmental Quality
TCEQ SOP V1	TCEQ's Surface Water Quality Monitoring Procedures, Volume 1
TSSWCB	Texas State Soil and Water Conservation Board
TWRI	Texas AgriLife Research, Texas Water Resources Institute
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WET	Waters of East Texas Center
WPP	watershed protection plan
%R	percent recovery

Section A3: Distribution List

Organizations, and individuals within, which will receive copies of the approved QAPP and any subsequent revisions include:

United States Environmental Protection Agency, Region VI

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Name: Hannah Crawford

Title: LM

Name: Jeremiah Poling

Title: Information Resources Manager

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Name: Dale Jurecka
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Name: Angel Mata
Title: Regulatory Compliance and Safety Program Manager

Name: Jason Woods
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Pace Analytical, Pace Environmental Sciences

1000 Riverbend Blvd, Suite F
St. Rose, LA 70087

Name: Tracy Easley
Title: Operations Manager

Name: Gabrielle Jones
Title: Quality Manager

Name: Karen Brown
Title: Project Manager

Section A4: Project/Task Organization

The following is a list of individuals and organizations participating in the project with their specific roles and responsibilities:

USEPA – United States Environmental Protection Agency, Region VI. Provides project oversight and funding at the federal level.

Anthony Suttice, USEPA Texas Nonpoint Source Project Officer
Responsible for overall performance and direction of the project at the federal level. Ensures that the project assists in achieving the goals of the Clean Water Act (CWA). Reviews and approves the QAPP, project progress, and deliverables.

TSSWCB – Texas State Soil and Water Conservation Board, Temple, Texas. Provides project overview at the State level.

Jett Preston, TSSWCB PM
Responsible for ensuring that the project delivers data of known quality, quantity, and type on schedule to achieve project objectives. Tracks and reviews deliverables to ensure that tasks in the work plan are completed as specified. Reviews and approves QAPP and any amendments or revisions and ensures distribution of approved/revised QAPPs to TSSWCB participants.

Mitch Conine, TSSWCB QAO

Reviews and approves QAPP and any amendments or revisions. Responsible for verifying that the QAPP is followed by project participants. Monitors implementation of corrective actions. Coordinates or conducts audits of field and laboratory systems and procedures. Determines that the project meets the requirements for planning, quality assessment (QA), quality control (QC), and reporting under the TSSWCB Total Maximum Daily Load Program.

TWRI – Texas Water Resources Institute, College Station, Texas. Responsible for general project oversight, coordination administration, reporting and development of data quality objectives (DQOs) and a QAPP.

Emily Monroe, Program Specialist
The TWRI Project Manager is responsible for ensuring that tasks and other requirements in the contract are executed on time and with the QA/QC requirements in the system as defined by the contract and in the project QAPP; assessing the quality of subcontractor/participant work; and submitting accurate and timely deliverables to the TSSWCB PM.

Stephanie DeVilleneuve, QAO

Responsible for determining that the QAPP meets the requirements for planning, QA and QC. Conducts audits of field and laboratory systems and procedures. Responsible for maintaining the official, approved QAPP, as well as conducting quality assurance audits in conjunction with TSSWCB personnel. Also responsible for supporting the development and ensuring the timely delivery of project deliverables, ensuring cooperation between project partners, providing fiscal oversight and completing project reporting.

SFASU – Arthur Temple College of Forestry and Agriculture and the Waters for East Texas Center at Stephen F. Austin State University, Nacogdoches, Texas. Responsible for collecting environmental data.

Matthew McBroom, Associate Dean and Professor, SFASU; Project Co-Lead

Responsible for overseeing environmental monitoring conducted through scheduled routine monitoring, sample collection, sample preparation and coordinating delivery of collected samples to ANRA. This includes ensuring that field and laboratory personnel involved in collecting and processing environmental samples have adequate training and thorough knowledge of the QAPP and its requirements specific to the task or analysis performed. Responsible for oversight of all field and laboratory operations ensuring that all QA/QC requirements are met, documentation related to the data collection and analysis are complete and adequately maintained, and that results are reported accurately. Responsible for ensuring that corrective actions are implemented, documented, reported and verified.

ANRA – Angelina & Neches River Authority, Lufkin, Texas. Responsible for conducting water quality analysis, maintaining a water quality database and transmitting project data to TSSWCB in a format such that it is ready for submission to the Texas Commission on Environmental Quality (TCEQ) for inclusion in their Surface Water Quality Monitoring Information System (SWQMIS). Responsible for watershed coordination and stakeholder engagement in the Attoyac Bayou watershed. Responsible for tracking WPP implementation success.

Rene Barelas, ANRA CRP Coordinator

Responsible for ensuring that project tasks, deliverables, and requirements are met on time and as described. Monitors and assesses the quality of work. Coordinates attendance at conference calls, training, meetings, and related project activities with the TWRI. Responsible for verifying the QAPP is followed and the project is producing data of known and acceptable quality. Ensures adequate training and supervision of all monitoring and data collection activities. Complies with corrective action requirements. Coordinates with the ANRA Laboratory Services Director, TWRI QAO, and TSSWCB QAO to resolve QA- related issues as appropriate.

Responsible for collaborating with the project team to track Attoyac Bayou WPP implementation. Responsible for stakeholder engagement throughout the course of the project and ensuring that project related information is relayed to stakeholders.

Melissa Garcia, ANRA Laboratory Services Director

Responsible for coordinating development and implementation of the QA program. Responsible for contributing to the development of the QAPP. Responsible for identifying, receiving, and maintaining project quality assurance records. Notifies the ANRA CRP Manager of particular circumstances which may adversely affect the quality of data. Responsible for validation and verification of all data collected according to procedures described in the QAPP after each task is performed. Coordinates the research and review of technical QA material and data related to water quality monitoring system design and analytical techniques. Conducts laboratory inspections. Develops, facilitates, and conducts monitoring systems audits.

Hannah Crawford, ANRA LM

Responsible for coordinating the receipt of water samples from SFASU and ensuring required analytical analyses are performed on all samples received. Responsible for assimilating and storing environmental water quality data in a form such that it is prepared for delivery to TCEQ. This includes ensuring that laboratory personnel involved in processing environmental samples have adequate training and thorough knowledge of the QAPP and its requirements specific to the analysis performed.

Jeremiah Poling, ANRA Information Resources Manager

Responsible for the acquisition, verification, and transfer of data to the TCEQ. Oversees data management for the study. Performs data quality assurances prior to transfer of data to TCEQ. Responsible for transferring data to the TCEQ in the Event/Result file format specified in the TCEQ *Surface Water Quality Data Management Reference Guide* (DMRG) (TCEQ 2016). Ensures data are submitted according to workplan specifications. Provides the point of contact for the TCEQ Data Manager to resolve issues related to the data.

LCRA – Lower Colorado River Authority, Austin, Texas. Responsible for conducting necessary water quality analyses in the event of an instrument failure at ANRA that prevents them from being able to complete required analyses.

Jason Woods, LCRA ELS Customer and Project Services Supervisor

Responsible for overall performance, administration, and reporting of analyses performed by LCRA's Environmental Laboratory Services.

Dale Jurecka, LCRA ELS Director

Responsible for supervision of laboratory personnel involved in generating analytical data for the project. Ensures that laboratory personnel have adequate training and a thorough knowledge of the QAPP and related SOPs. Responsible for oversight of all

laboratory operations ensuring that all QA/QC requirements are met, documentation is complete and adequately maintained, and results are reported accurately.

Reviews and verifies all laboratory data for integrity and continuity, reasonableness and conformance to project requirements, and then validated against the measurement performance specifications listed in Table A7.1 of the QAPP.

Angel Mata, LCRA Regulatory Compliance and Safety Program Manager

Maintains operating procedures that are in compliance with the QAPP, amendments, and appendices. Responsible for the overall quality control and quality assurance of analyses performed by LCRA's Environmental Laboratory Services.

Pace – Pace Analytical Services, St. Rose, Louisiana. Responsible for conducting necessary water quality analyses in the event of an instrument failure at ANRA that prevents them from being able to complete required analyses.

Karen Brown, Pace Project Manager

Responsible for overall performance, administration, and reporting of analyses performed by LCRA's Environmental Laboratory Services.

Tracy Easley, Pace Operations Manager

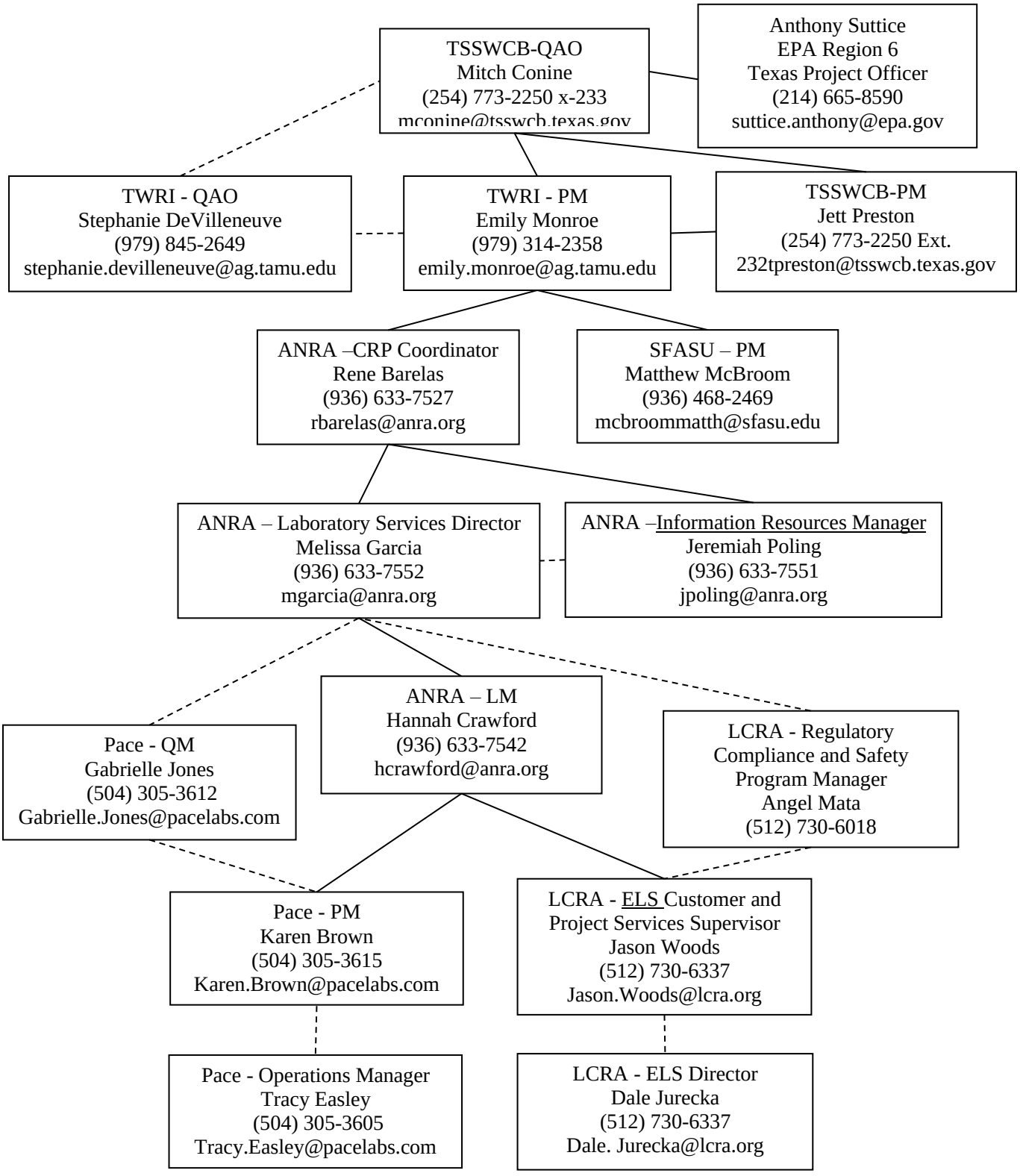
Responsible for supervision of laboratory personnel involved in generating analytical data for the project. Ensures that laboratory personnel have adequate training and a thorough knowledge of the QAPP and related SOPs. Responsible for oversight of all laboratory operations ensuring that all QA/QC requirements are met, documentation is complete and adequately maintained, and results are reported accurately.

Reviews and verifies all laboratory data for integrity and continuity, reasonableness and conformance to project requirements, and then validated against the measurement performance specifications listed in Table A7.1 of the QAPP.

Gabrielle Jones, Pace Quality Manager

Maintains operating procedures that are in compliance with the QAPP, amendments, and appendices. Responsible for the overall quality control and quality assurance of analyses performed by LCRA's Environmental Laboratory Services.

Figure A4.1. Project Organization Chart



Section A5: Problem Definition/Background

The Attoyac Bayou, Segment 0612, is one sub-watershed within the Upper Neches River Watershed that is considered impaired due to excessive levels of monitored fecal indicator bacteria. The Bayou extends approximately 82 miles from its headwaters in Rusk County and flows through Nacogdoches, San Augustine and Shelby counties before emptying into Sam Rayburn Reservoir. The watershed contains several named communities including Chireno, Attoyac, Martinsville, Grigsby, Garrison and others; however, these are small rural communities. The remainder of the area is predominantly managed for agricultural (cattle and poultry), silvicultural, recreational and wildlife uses and contains many rural residents and four known permitted wastewater discharges totaling less than 500,000 gallons per day.

In 2009, the Attoyac Bayou Watershed Partnership was formed to address the noted bacteria impairments. Using technical support from the Angelina & Neches River Authority (ANRA), Stephen F. Austin State University (SFASU), Texas A&M University and the Texas Water Resources Institute (TWRI) and funding from TSSWCB (Project 09-10) through a project entitled Development of a Watershed Protection Plan for Attoyac Bayou, the Attoyac Bayou Watershed Protection Plan (WPP) was completed. This plan outlines an appropriate strategy to address bacteria source contributions in this rural watershed and describes practices that, when implemented, will reduce loading contributions to the watershed. The plan was published in July 2014.

Coordinating the delivery of monitoring and implementation programs and tracking the progress toward meeting WPP implementation milestones requires a concerted effort. Currently, the project team is implementing the Attoyac Bayou WPP through a TSSWCB State Nonpoint Source grant program, Attoyac Bayou Watershed Protection Plan Implementation Effectiveness Monitoring and Facilitation Continuation (Contract No. 19-53), which ended in May 2021. The TWRI and ANRA project managers continue to work through their roles as watershed coordinators to implement the WPP. While no single management measure implemented can obtain the levels of E. coli reduction needed in the Attoyac Bayou to meet current water quality standards, an integrated approach through the continued implementation of the WPP can make strides towards meeting that goal. Current and previous WPP implementation projects have been successful in building relationships with stakeholders such as producers, residents, and local agencies, educating them on the importance of the WPP, and assisting with acquiring technical and financial support needed to implement the plan’s management measures.

The project team has been addressing one of the highest priority needs identified in the WPP: failing on-site sewage facilities (OSSFs). Through an FY 2013 CWA Section 319(h) grant funding provided by TCEQ, ANRA administered the project entitled Lake Sam Rayburn OSSF Program Support and Attoyac Bayou OSSF Remediation. The project identified and replaced 26 failing or non-existent OSSFs, and conducted water quality monitoring to document BMP effectiveness at five locations. The project team also developed a database to house information on OSSFs in a portion of the Attoyac Bayou watershed and collected and digitized OSSF data and locations for existing and new OSSFs. This project was completed

June 2018. Building upon this project's success, a subsequent effort led by TWRI, ANRA, Pineywoods RC&D and SFASU repaired or replaced an additional 24 failing septic systems between January 2017 and January 2020 and developed recommendations for streamlining OSSF data management for TCEQ. The team is currently leading a third OSSF project to repair or replace at least 15 more systems.

Education and outreach programs are another aspect of WPP implementation that has and continues to occur. Due to the COVID-19 global health pandemic of 2020, traditional face-to-face meetings and programs have been difficult to impossible to organize and host due to federal, state, and local policies. Although circumstances may change by the time this project would begin, the pandemic has provided an opportunity for watershed coordinators to develop and build upon unique tools to aid in education and outreach efforts. There is a need for alternative strategies that can be effective regardless of extenuating circumstances since meeting and maintaining water quality standards is still important during a pandemic. Through this project, TWRI and ANRA will develop an education and outreach plan with TWRI and ANRA communications experts to build upon the general water quality knowledge that has been developed in the watershed through the many years the team has been implementing the WPP.

Section A6: Project Goals and Task Description

TWRI and ANRA will continue to work closely with local stakeholders to implement the WPP. Primarily, this will continue to be through organizing and hosting public meetings and educational programs, as well as meeting with individual stakeholders and organizations to seek out additional needs and relevant funding. The project team will continue to provide water quality and WPP progress updates at those meetings and participate in local events related to natural resource conservation and awareness. In the event that in-person meetings are not able to take place due to health policies, the project team will work with TSSWCB and local partners to host these meetings either online or provide an alternate format.

The watershed coordinator will also focus on facilitating and supporting effective implementation of the WPP. This will be accomplished by continuing to work with watershed stakeholders to identify specific implementation needs across the watershed. Support will also be provided to assist stakeholders to acquire the needed funds to implement the plan. Maintaining contact with parties implementing aspects of the WPP and documenting implementation success will also be critical. Successful WPP implementation activities will be relayed to watershed stakeholders and agencies alike.

Coordinating delivery of education and outreach programming will also be carried out. The watershed coordinator will work with local entities to schedule programs. Evolving educational needs will also be noted and efforts will be made to address those needs if possible. This project will also focus on development of content that can be easily shared via online media outlets, radio, newspapers, or other methods as developed. Statewide education programs are already redirecting their efforts to providing webinars in place of face-to-face meetings, and TWRI will

work with local partners to ensure residents are informed about those opportunities as appropriate.

In support of other WPP implementation activities funded with separate resources, instream water quality monitoring will be conducted to document BMP implementation effectiveness; specifically, OSSF repair and replacements. The SFASU WET Center will coordinate with ANRA to continue conducting targeted water quality monitoring across the watershed to document implementation impacts on instream water quality that complements existing Clean Rivers Program monitoring. Monthly monitoring will be carried out at five locations across the watershed where SFASU has monitored in the past (SFASU WPP and ANRA CRP Monitoring Sites in map provided). Water samples collected will be delivered to ANRA for Nitrate-N, Nitrite-N, Ammonia-N, Total Phosphorus, Chloride, Sulfate, Total Suspended Solids, and E. coli. Field parameters including pH, dissolved oxygen, temperature, conductivity, and stream flow volume will also be collected during each sampling event.

Lastly, TWRI and ANRA will evaluate the overall progress made toward WPP implementation. A final report will be developed in the last quarter of the project that describes all activities carried out through this project and related implementation efforts.

The purpose of this QAPP is to clearly delineate the QA policy, management structure, and procedures, which will be used to implement the QA requirements necessary to conduct water quality monitoring. Table A6-1 provides specific subtask milestones for this project.

Figure A6.1. Attoyac Bayou watershed monitoring sites

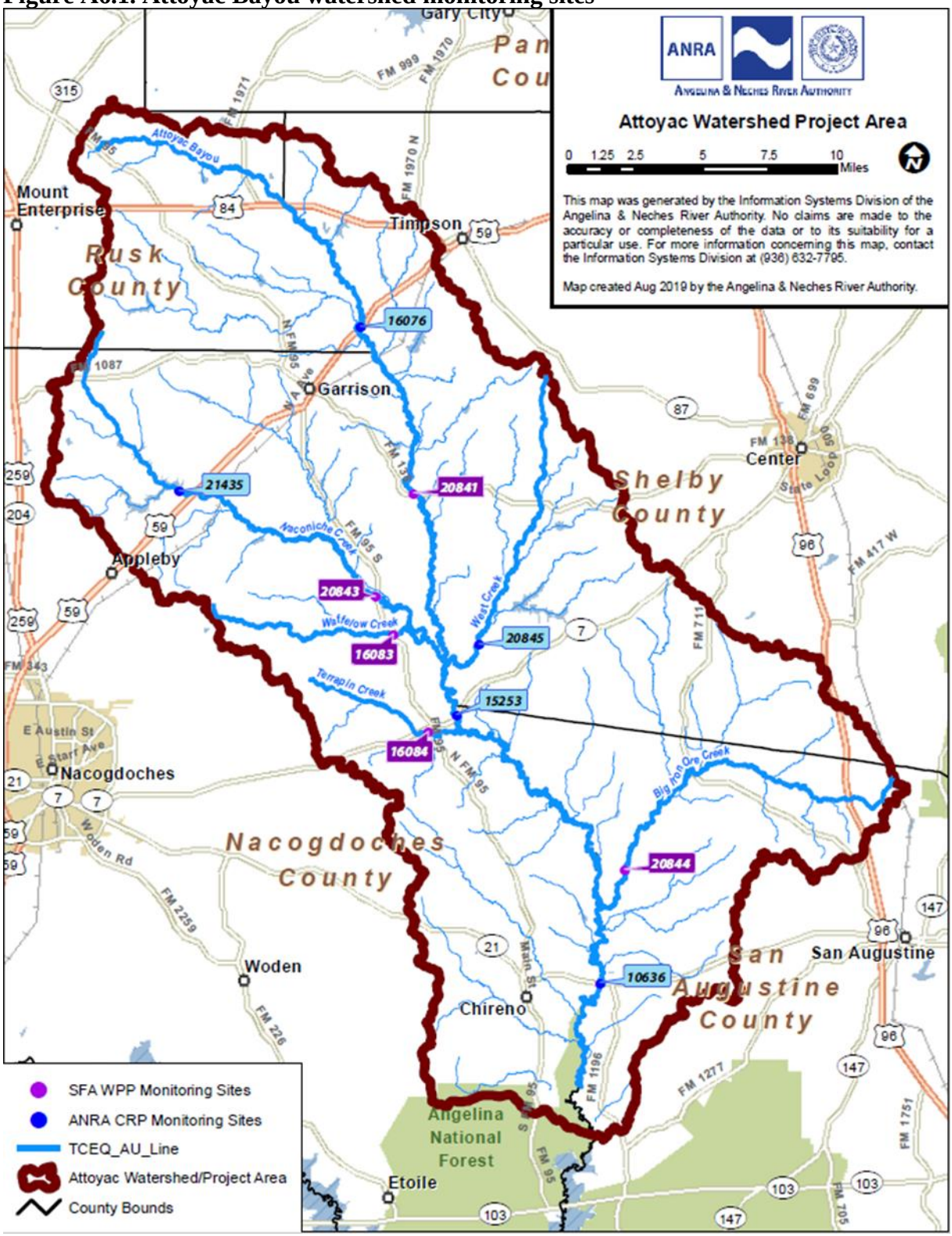


Table A6.1. Project Plan Milestones

Task	Project Milestone	Agency	Start	End
5.1	Conduct routine, monthly, ambient water quality monitoring at 5 locations throughout the Attoyac Bayou watershed over the course of 2 years to document WPP implementation impacts on water quality. Sampling will include routine field parameters (Temp, pH, DO, conductivity, flow) and collection of water samples of the volume required by the QAPP. Water samples will be delivered to ANRA's NELAP certified lab within the appropriate holding time for bacteriological and nutrient analysis (includes ammonia-N, nitrate-N, nitrite-N, Total P, Total Suspended Solids, Chloride, Sulfate, and *E. coli* enumeration utilizing the IDEXX method).	SFASU	4	34
5.2	Receive and process water samples from SFASU WET Center. These samples will be analyzed for the same parameters as listed in Subtask 5.1.	ANRA	4	34
5.3	Review, verify and validate water quality data to ensure its consistency with the project QAPP and will submit data to TCEQ for inclusion in SWQMIS semi-annually.	ANRA	8	36
5.4	Evaluate water quality data collected through this project and that available in SWQMIS to determine the impacts of WPP implementation on instream water quality through statistical analyses and trend analysis as appropriate for inclusion in the project final report.	SFASU WET Center, ANRA, TWRI	20	36
5.5	Process effluent samples from inspected systems prior to and post repair/replacement to quantify load reductions achieved through the repair/replacement.	ANRA	4	36

SFASU WET Center will be responsible for the collection and transport of all water quality data and samples to the ANRA Environmental Laboratory within appropriate sample holding times and in accordance with this QAPP. Sampling will be conducted routinely at the sampling sites designated in Table A6.2.

ANRA will receive water samples and process them for *E. coli* isolation, nutrient, and solids analysis. In the event that ANRA cannot process and analyze samples, they will be shipped to LCRA or Pace Analytical for analysis within required holding times as described in this QAPP.

Table A6.2. Attoyac Bayou Sampling Site Locations

TCEQ Station ID	Site Description	Latitude	Longitude	Expected Start Date (Upon QAPP approval)	End Date	Mode of Sampling	Sample Matrix	Annual Monitoring Freq.
16083	Waffelow Creek at FM 95	31.691862	-94.437890	1/2022	9/2024	Grab	Water	12
16084	Terrapin Creek at SH 95	31.639128	-94.414803	1/2022	9/2024	Grab	Water	12
20841	Attoyac Bayou at FM 138	31.768502	-94.426251	1/2022	9/2024	Grab	Water	12
20843	Naconiche Creek at FM 95	31.712166	-94.449405	1/2022	9/2024	Grab	Water	12
20844	Big Iron Ore Creek at FM 354	31.565953	-94.289458	1/2022	9/2024	Grab	Water	12

Section A7: Quality Objectives and Criteria for Data Quality

The objectives for this project are as follows:

1) Develop and obtain approval for a QAPP
2) Collect environmental and water quality data to support the implementation of a WPP

The objective of this section is to ensure that data collected meets the DQOs of the project. One objective is to identify specific sources of bacteria and ammonia entering the Attoyac Bayou. A second objective is to monitor micro-watersheds through data collection and analysis and provide data to inform soil and water conservation districts (SWCD's), stakeholder committee, and landowners of any potential or existing water quality issues and/or problems. Achievement of these objectives will support decisions for implementation of appropriate BMPs in order to reduce fecal bacteria levels in the Attoyac Bayou watershed to comply with existing water quality standards.

Following are actions that will be undertaken by this project to assess bacterial pollution within the Attoyac Bayou Watershed:

- Monitor water quality as related to bacterial pollution in Attoyac Bayou and designated tributaries by in-stream water sampling
- Determine the source of the bacterial impairment using BST

The measurement performance criteria to support the project objective are specified in Table A.7-1.

Consistent with the most recent version of TCEQ's *Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods* (TCEQ SOP, V1), routine grab samples will be collected on a monthly basis. During routine sampling measurements of DO, conductivity, pH, specific conductance, stream flow, and water temperature will be obtained *in situ*. These data will be logged on field data sheets, incorporated into a computer-based database maintained by SFASU and transmitted to ANRA for inclusion in the master database that they will maintain.

Water samples collected will be transported to the ANRA Environmental Laboratory for nutrient analysis, bacteria enumeration, and data logging. SFASU will deliver water samples to ANRA within designated holding times for respective analysis; ANRA will use designated methods outlined in Tables A7.1, A7.2 and B2.1. Appropriate DQOs and QA/QC requirements for this analysis are also reported in Tables A7.1 and B2.1.

Ambient Water Reporting Limits (AWRLs)

The AWRL establishes the reporting specification at or below which data for a parameter must be reported to be compared with freshwater screening criteria. The AWRLs specified in Table A7.1 are the program-defined reporting specifications for each analyte and yield data acceptable for the TCEQ's water quality assessment. A full listing of AWRLs can be found at http://www.tceq.state.tx.us/compliance/monitoring/crp/qa/index.html.

The limit of quantitation (LOQ) is the minimum level, concentration, or quantity of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. The following requirements must be met in order to report results:

- The laboratory's LOQ for each analyte must be at or below the AWRL.
- The laboratory must demonstrate its ability to quantitate at its LOQ for each analyte by running an LOQ check sample for each analytical batch of samples analyzed.

Laboratory Measurement Quality Control Requirements and Acceptability Criteria are provided in Section B5.

Precision
Precision is the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves. It is a measure of agreement among replicate measurements of the same property, under prescribed similar conditions, and is an indication of random error.

Laboratory precision is assessed by comparing replicate analyses of Laboratory Control Samples (LCS) in the sample matrix (e.g. deionized water, sand, commercially available tissue), Matrix Spike/Matrix Spike Duplicate (MS/MSD), or sample/duplicate (DUP) pairs, as applicable. Precision results are compared against measurement performance specifications and used during evaluation of analytical performance. Program-defined measurement performance specifications for precision are defined in Table A7.1.

Bias
Bias is a statistical measurement of correctness and includes multiple components of systematic error. A measurement is considered unbiased when the value reported does not differ from the true value. Bias is determined through the analysis of LCS and LOQ check samples prepared with verified and known amounts of all target analytes in the sample matrix (e.g. deionized water, sand, commercially available tissue) and by calculating percent recovery. Results are compared against measurement performance specifications and used during evaluation of analytical performance. Program-defined measurement performance specifications for bias are specified in Table A7.1.

Representativeness
Site selection, the appropriate sampling regime, the sampling of all pertinent media according to TCEQ SOP, V1, and use of only approved analytical methods will assure that the measurement data represents the conditions at the site. Routine data collected for water quality assessment are considered to be spatially and temporally representative of routine water quality conditions. Water quality data are collected on a routine frequency and are separated by approximately even time intervals. At a minimum, samples are collected over at least two seasons (to include inter-seasonal variation) and over two years (to include inter-year variation) and include some data collected during an index period (March 15- October 15). Although data may be collected during varying regimes of weather and flow, the data sets will not be biased

toward unusual conditions of flow, runoff, or season. The goal for meeting total representation of the water body will be tempered by the potential funding for complete representativeness.

Completeness

The completeness of the data describes how much of the data are available for use compared to the total potential data. Ideally, 100% of the data should be available. However, the possibility of unavailable data due to accidents, insufficient sample volume, broken or lost samples, etc. is to be expected. Therefore, it will be a general goal of the project(s) that 90% data completion is achieved.

Comparability

Confidence in the comparability of routine data sets for this project and for water quality assessments is based on the commitment of project staff to use only approved sampling and analysis methods and QA/QC protocols in accordance with quality system requirements as described in this QAPP and TCEQ SOP, V1. Comparability is also guaranteed by reporting data in standard units, by using accepted rules for rounding figures, and by reporting data in a standard format as specified in Section B10.

Limit of Quantitation

AWRLs (Table A7.1) are used in this project as the *limit of quantitation specification*, so data collected under this QAPP can be compared against the Texas Surface Water Quality Standards. Laboratory *limits of quantitation* (Table A7.1) must be at or below the AWRL for each applicable parameter.

Laboratory Measurement Quality Control Requirements and Acceptability Criteria are provided in Section B5.

Analytical Quantitation

To demonstrate the ability to recover a given parameter at the limit of quantitation, the laboratory will analyze an LOQ check standard with each batch of samples run for this QAPP.

Laboratory Measurement Quality Control Requirements and Acceptability Criteria are provided in Section B5.

Table A7.1. Measurement Performance Specifications

Conventional Parameters in Water											
Parameter	**Units**	**Matrix**	**Method**	**Parameter Code**	**AWRL**	**LOQ**	**LOQ Check Sample %Rec**	**Precision (RPD**	**Bias %Rec. of LCS**	**Lab**	**Completeness (%)**
RESIDUE, TOTAL NONFILTRABLE (MG/L)	mg/L	water	SM 2540D	00530	5	2.5	NA	NA	NA	ANRA	90
	mg/L	water	SM 2540D	00530	5	1	NA	NA	NA	LCRA ELS	90
	mg/L	water	SM 2540D	00530	5	4	NA	NA	NA	Pace	90
NITROGEN, AMMONIA, TOTAL (MG/L AS N)	mg/L	water	SM 4500-NH_3-D (20th)	00610	0.1	0.1	70-130	20	80-120	ANRA	90
	mg/L	water	EPA 350.1 Rev. 2.0 (1993)	00610	0.1	0.02	70-130	20	80-120	LCRA ELS	90
	mg/L	water	EPA 350.1 Rev. 2.0 (1993)	00610	0.1	0.1	70-130	20	80-120	Pace	90
*NITRITE PLUS NITRATE, TOTAL ONE LAB DETERMINED VALUE (MG/L AS N)	mg/L	water	SM 4500 - NO_3 H*	00630	0.05	0.02	70-130	20	80-120	LCRA ELS	90
	mg/L	water	SM 4500 - NO_3 F*	00630	0.05	0.05	70-130	20	80-120	Pace	90
NITRITE NITROGEN, TOTAL (MG/L AS N)	mg/L	water	EPA 300.0 Rev. 2.1 (1993)*	00615	0.05	0.05	70-130	20	80-120	ANRA	90
NITRATE NITROGEN, TOTAL (MG/L AS N)	mg/L	water	EPA 300.0 Rev. 2.1 (1993)*	00620	0.05	0.05	70-130	20	80-120	ANRA	90
PHOSPHORUS, TOTAL, WET METHOD (MG/L AS P)	mg/L	water	EPA 365.1 (1993)	00665	0.06	0.02	70-130	20	80-120	ANRA	90
	mg/L	water	EPA 365.4 Rev. 2.0 (1993)	00665	0.06	0.02	70-130	20	80-120	LCRA ELS	90
CHLORIDE (MG/L AS CL)	mg/L	water	EPA 300.0 Rev. 2.1 (1993)	00940	5	5	70-130	20	80-120	ANRA	90
	mg/L	water	EPA 300.0 Rev. 2.1 (1993)	00940	5	5	70-130	20	80-120	LCRA ELS	90
	mg/L	water	SM 4500-Cl E	00940	5	1	70-130	20	80-120	Pace	90
SULFATE (MG/L AS SO4)	mg/L	water	EPA 300.0 Rev. 2.1 (1993)	00945	5	5	70-130	20	80-120	ANRA	90
	mg/L	water	EPA 300.0 Rev. 2.1 (1993)	00945	5	5	70-130	20	80-120	LCRA ELS	90
	mg/L	water	EPA 9038	00945	5	1	70-130	20	80-120	Pace	90
E. COLI, COLILERT, IDEXX METHOD, MPN/100ML	MPN/100 mL	water	SM 9223B***	31699	1	1	NA	0.50**	NA	ANRA	90
E. COLI, COLILERT, IDEXX, HOLDING TIME	hours	water	NA	31704	NA	NA	NA	NA	NA	ANRA	90

References:
United States Environmental Protection Agency (USEPA) Methods for Chemical Analysis of Water and Wastes, Manual #EPA-600/4-79-020
American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 21st Edition, 2005.
TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods, 2012 (RG-415).
*Direct laboratory analysis for **Parameter Code 00630 is only performed** when Parameter Codes 00615 and 00620 cannot be analyzed individually due to hold time or other issues. In cases where 00615 and 00620 are analyzed, 00630 will not be analyzed as a matter of routine laboratory practice. If 00630 is reported, it will be a laboratory determined value by analysis using the prescribed method. Results for 00630 will not be determined by calculation (summation of 00615 and 00620).
** This value is not expressed as a relative percent difference. It represents the maximum allowable difference between the logarithm of the result of a sample and the logarithm of the duplicate result. See Section B5.
****E. coli* samples analyzed by these methods should always be processed as soon as possible and within 8 hours. When transport conditions necessitate delays in delivery longer than 6 hours, the holding time may be extended and samples must be processed as soon as possible and within 30 hours.

Table A7.2 Measurement Performance Specifications for Field Parameters

Parameter	Units	Matrix	Method	Parameter Code	AWRL*	LOQ	LOQ Check Sample %Rec	Precision (RPD)	Bias %Rec. of LCS	Completeness (%)
PH (STANDARD UNITS)	s.u.	water	EPA 150.1 and TCEQ SOP	00400	NA	NA	NA	NA	NA	90
OXYGEN, DISSOLVED (MG/L)	mg/L	water	SM4500 O-G and TCEQ SOP	00300	NA	NA	NA	NA	NA	90
SPECIFIC CONDUCTANCE, FIELD (US/CM @ 25C)	uS/cm	water	EPA 120.1 and TCEQ SOP	00094	NA	NA	NA	NA	NA	90
TEMPERATURE, WATER (DEGREES CENTIGRADE)	degree C	water	SM2500B and TCEQ SOP	00010	NA	NA	NA	NA	NA	90
FLOW STREAM, INSTANTANEOUS (CUBIC FEET PER SEC)	cfs	water	TCEQ SOP V1	00061	NA*	NA	NA	NA	NA	90
FLOW SEVERITY: 1=No Flow, 2=Low, 3=Normal, 4=Flood, 5=High, 6=Dry	NU	water	TCEQ SOP V1	01351	NA*	NA	NA	NA	NA	90
STREAM FLOW ESTIMATE (CFS)	cfs	water	TCEQ SOP V1	74069	NA*	NA	NA	NA	NA	90
FLOW MTH 1=GAGE 2=ELEC 3=MECH 4=WEIR/FLU 5=DOPPLER	NU	other	TCEQ SOP V1	89835	NA*	NA	NA	NA	NA	90
SECCHI DEPTH	meters	water	TCEQ SOP V1	00078	NA	NA	NA	NA	NA	90
DAYS SINCE PRECIPITATION EVENT (DAYS)	days	NA	TCEQ SOP V1	72053	NA	NA	NA	NA	NA	90
DEPTH OF BOTTOM OF WATER BODY AT SAMPLE SITE	meters	NA	TCEQ SOP V2	82903	NA	NA	NA	NA	NA	90
PRESENT WEATHER (1=CLEAR,2=PTCLDY,3=CLDY,4= RAIN,5=OTHER)	NU	other	TCEQ SOP V1	89966	NA	NA	NA	NA	NA	90

References:
* Reporting to be consistent with SWQM guidance and based on measurement capability.
United States Environmental Protection Agency (USEPA) Methods for Chemical Analysis of Water and Wastes, Manual #EPA-600/4-79-020
American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998. (Note: The 21st edition may be cited if it becomes available.)
TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods, 2012 (RG-415).

Section A8: Special Training Requirements/Certification

Work conducted for this project is covered under a documented quality management system. Personnel conducting work associated with this project are deemed qualified to perform their work through educational credentials, specific job/task training, required demonstrations of competency, and internal and external assessments. Laboratories are NELAP-accredited as required. Records of educational credentials, training, demonstrations of competency, assessments, and corrective actions are retained by project management and are available for review.

Staff responsible for operating the field-use multi-parameter sondes and flow loggers will undergo training by a qualified trainer (the equipment manufacturer, TCEQ SWQM personnel, an experienced field sampler, or the QA Officer). Training may also occur at set statewide training events, such as the annual SWQM Workshop.

Field personnel will receive training in proper sampling and field analysis. Before actual sampling or field analysis occurs, they will demonstrate to the QA officer (in the field), their ability to properly operate the field-use multi-parameter sondes and retrieve the samples. The QA officer will sign off on the training for each field staff in their field logbooks. Field personnel training is documented and retained in the personnel file and will be available during a monitoring systems audit.

Section A9: Documentation and Records

General maintenance records, all field data sheets, chain of custody (COC) forms, laboratory data entry sheets, calibration logs, and corrective action reports (CARs) will be archived by each laboratory for at least five years. In addition, SFASU and ANRA will archive electronic forms of all project data for at least five years. All electronic data are backed up on an external hard drive monthly, compact disks weekly, and is simultaneously saved in an external network folder and the computer's hard drive. A blank CAR form is presented in Appendix A, a blank COC form is presented in Appendix C, and blank field data reporting forms are presented in Appendix B.

Laboratory Documentation

Test/data reports from the laboratory must document the test results clearly and accurately. Routine data reports should be consistent with the TNI Volume 1, Module 2, Section 5.10 and include the information necessary for the interpretation and validation of data. The requirements for reporting data and the procedures are provided.

Reports of results of analytical tests performed by the laboratory contain the following elements:

- Title of report
- Name and address of the laboratory
- Name and address of the client
- A clear identification of the sample(s) analyzed (unique identifiers)
- Identification of method used
- Identification of samples that did not meet QA requirements (by use of data qualifiers)
- Sample results
- Units of measurement
- Sample matrix
- Station information
- Date and time of collection
- LOQ and limit of detection (LOD) (formerly referred to as the reporting limit and the method detection limit, respectively), and qualification of results outside the working range (if applicable)
- Certification of NELAP compliance
- Clearly identified subcontract laboratory results (as applicable)
- A name and title of the person accepting responsibility for the report
- Project-specific QC results

Upon completion of all analyses, the ANRA Environmental Laboratory generates a Report Cover Page, a Laboratory Analysis Report, and a Quality Control Data Report. The chain of custody and subcontract laboratory reports (if applicable) are attached to form the final report. The ANRA LM reviews the report and submits it to the ANRA Laboratory Services Director for additional review. Upon final review by the ANRA Laboratory Services Director, the report

is submitted to the ANRA Information Resources Manager for electronic submittal to SWQMIS.

Electronic Data

Data will be submitted to the TCEQ in the event/result format specified in the TCEQ DMRG for upload to SWQMIS. The Data Review Checklist and Summary as contained in Appendix D of this document will be submitted with the data.

All reported Events will have a unique TagID (see DMRG). TagIDs used in this project will be seven-character alphanumerics with the structure of the two-letter Tag prefix followed by a five-digit number: for example – TX01234, TX01235, etc.

Submitting Entity, Collecting Entity, and Monitoring Type codes will reflect the project organization and monitoring type in accordance with the DMRG. The proper coding of Monitoring Type is essential to accurately capture any bias toward certain environmental conditions (for example, high flow events).

Sample Description	Tag Prefix	Submitting Entity	Collecting Entity	Monitoring Type
Routine, BMP Effectiveness Monitoring	TX	AN	SF	RTBA

Project Documentation

Quarterly progress reports disseminated to the individuals listed in section A3 will note activities conducted in connection with the water quality modeling project, items or areas identified as potential problems, and any variations or supplements to the QAPP. Final reports on the SELECT modeling analysis and the LDC analysis will be developed as chapters to the WPP. Outcomes will be submitted to the established stakeholder group and utilized in future WPP development.

CARs will be utilized when necessary (Appendix A). CARs will be maintained in an accessible location for reference at TWRI and will be disseminated to the individuals listed in section A3. CARs resulting in any changes or variations from the QAPP will be made known to pertinent project personnel and documented in updates or amendments to the QAPP.

All electronic data are backed up on an external hard drive monthly, compact disks weekly, and is simultaneously saved in an external network folder and the computer’s hard drive. A blank CAR is presented in Appendix A and a blank COC form is presented in Appendix C.

The TSSWCB may elect to take possession of records at the conclusion of the specified retention period.

Table A9.1 Project Documents and Records

Document/Record	Location	Retention	Form
QAPP, amendments, and appendices	TWRI	5 years	Electronic
QAPP distribution documentation	TWRI	5 years	Electronic
Training records	ANRA/SFASU	5 years	Paper or Electronic
Field notebooks or field data sheets	ANRA/SFASU	5 years	Paper or Electronic
Field equipment calibration/maintenance	SFASU	5 years	Paper or Electronic
Chain of custody records	ANRA/SFASU	5 years	Paper or Electronic
Laboratory QA manuals	ANRA/LCRA/Pace Lab	5 years	Paper or Electronic
Laboratory SOPs	ANRA/LCRA/Pace Lab	5 years	Paper or Electronic
Laboratory procedures	ANRA/LCRA/Pace Lab	5 years	Paper or Electronic
Instrument raw data files	ANRA/LCRA/Pace Lab	5 years	Paper or Electronic
Instrument readings/printouts	ANRA/LCRA/Pace Lab	5 years	Paper or Electronic
Laboratory data reports/results	ANRA/LCRA/Pace Lab	5 years	Paper or Electronic
Laboratory equipment maintenance logs	ANRA/LCRA/Pace Lab	5 years	Paper or Electronic
Laboratory calibration records	ANRA/LCRA/Pace Lab	5 years	Paper or Electronic
Corrective action documentation	ANRA/LCRA/Pace Lab	5 years	Paper or Electronic

Data Transfer between Entities

Data transfer between entities occurs via electronic means. Specific format of the data transferred depends on the specific data and includes ArcMap, MS Office, and PDF formats.

QAPP Revision and Amendments

Until the work described is completed, this QAPP shall be revised as necessary and reissued annually on the anniversary date or revised and reissued within 120 days of significant changes, whichever is sooner. The last approved versions of QAPPs shall remain in effect until revised versions have been fully approved; the revision must be submitted to the TSSWCB for approval before the last approved version has expired. If the entire QAPP is current, valid, and accurately reflects the project goals and the organization's policy, the annual re-issuance may be done by a certification that the plan is current. This can be accomplished by submitting a cover letter stating the status of the QAPP and a copy of new, signed approval pages for the QAPP.

Amendments to the QAPP may be necessary to reflect changes in project organization, tasks, schedules, objectives and methods; address deficiencies and non-conformances; improve operational efficiency; and/or accommodate unique or unanticipated circumstances. Requests or amendments are directed from the TWRI Project Lead to the TSSWCB PM in writing. The changes are effective immediately upon approval by the TSSWCB PM and QAO, or their designees. Amendments to the QAPP and the reasons for the changes will be documented, and copies of the approved QAPP Expedited Amendment form will be distributed to all individuals on the QAPP distribution list by the TWRI QAO. Amendments shall be reviewed, approved, and incorporated into a revised QAPP during the annual revision process.

Section B1: Sampling Process Design (Experimental Design)

The sampling conducted for this project is intended to assess water quality in the Attoyac Bayou watershed. Sampling will be conducted on a monthly basis at five stations within watershed for all constituents as directed by TCEQ SOP, V1. *E. coli* bacteria and nutrients are the primary parameters of concern. Sampling types, frequencies and expected numbers are described in Table B1.1. Physical parameters that will be measured *in situ* during routine sampling and include flow, specific conductance, DO, pH, and water temperature; other noted items will include the flow severity, days since last significant rainfall and present weather conditions. Water quality samples collected as part of the routine sampling schedule will be analyzed for bacteria and nutrients as outlined in Table A7.1.

In order to obtain representative results, ambient water sampling will occur on a routine schedule over the course of 24 months, capturing dry and runoff-influenced events at their natural frequency. There will be no prejudice against rainfall or high flow events, except that the safety of the sampling crew will not be compromised in case of lightning or flooding; this is left up to the discretion of the sampling crew. In the instance that a sampling site is inaccessible, no sample will be taken and will be documented in the field notebook and the event will be made up at a later date when safe conditions return.

Site Descriptions
Monitoring will be conducted at five stations that were previously monitored under the Attoyac Bayou Watershed Protection Plan project. The five stations are as follows:

- **Station 16083, Waffelow Creek at FM 95**, is located 3.65 miles northwest of the city of Martinsville. This monitoring station is located on Segment 0612B.

- **Station 16084, Terrapin Creek at SH 95**, is located 1 mile south of Martinsville. This monitoring station is located on Segment 0612A.

- **Station 20841, Attoyac Bayou at FM 138**, is located 9.65 km southeast of US 59 in Garrison. This monitoring station is located on Segment 0612.

- **Station 20843, Naconiche Creek at FM 95**, is located approximately 9 km north of the intersection with SH 7 in Martinsville. This monitoring station is located on Segment 0612D.

- **Station 20844, Big Iron Ore Creek at FM 354**, is located approximately 9.65 km north of the intersection with SH 21 and northeast of the city of San Augustine. This monitoring station is located on Segment 0612E.

The monitoring stations are included in Table A6.2. The monitoring stations for this project will be added to the Coordinated Monitoring Schedule (CMS) located at cms.lcra.org. A detailed site location map is located in Section A6.

Section B2: Sampling Method Requirements

Field Sampling Procedures

Field sampling will be conducted according to procedures documented in the *TCEQ Surface Water Quality Monitoring Procedures Volume 1* (TCEQ SOP, V1). Additional aspects outlined in Section B below reflect specific requirements for sampling. Sampling will be done so that it is consistent with sampling conducted under the guise of the Clean Rivers Program. Field sampling activities are documented on field data reporting forms as presented in Appendix B.

All sample information will be logged into a field log. The following will be recorded for all water sampling:

- station ID
- location
- sampling time
- date
- water depth
- flow rate
- sample collector's name/initials

Detailed observational data are recorded including water appearance, weather, biological activity, stream uses, unusual odors, specific sample information, days since last significant rainfall, estimated hours since rainfall began (if applicable), and flow severity.

Typically, water samples will be collected directly from the stream (midway in the stream channel) into sterile wide-mouthed polypropylene bottles or bags. Water samples used for *E. coli* analysis will be collected in sterile bags, those undergoing the IDEXX method will be collected in sterile polyethylene bottles provided by ANRA. All sample containers will be labeled with the following information:

- collection date
- collection time
- Station ID
- Station Description

Care will be exercised to avoid the surface microlayer of water, which may be enriched with bacteria and not representative of the water column. In cases where, for safety reasons, it is inadvisable to enter the stream bed, and boat access is not practical, staff will use a clean bucket and rope from a bridge to collect the samples from the stream. If a bucket is used, care will be taken to avoid contaminating the sample. Specifically, technicians must exert care to ensure that the bucket and rope do not come into contact with the bridge. The bucket must be thoroughly rinsed between stations. Buckets are also to be sanitized between sampling stations with a bleach- or isopropyl alcohol-soaked wipe. The first bucketful of water collected from a bridge is used to rinse the bucket. Rinse water is not returned to the stream, but is instead disposed of away from the sampling site to ensure that the collected sample will not be affected by the bleach or alcohol residual. Samples are collected from subsequent buckets of water. This type of sampling will be noted in the field records.

Water temperature, pH, specific conductance, and DO will be measured and recorded *in situ* with a multiprobe whenever samples are collected. Flow is measured with an electronic flow

meter as described in the *TCEQ Surface Water Quality Monitoring Procedures Volume 1* (TCEQ SOP, V1). All field measurements will be conducted in accordance with the methods listed in Table B.4-1. All samples will be transported in an iced container to the laboratory for analysis.

Table B2.1. Storage, Preservation and Handling Requirements

Parameter	Matrix	Container	Preservation	Sample Volume	Holding Time
TSS	Water	Plastic	<6ºC (but not frozen)	1000 ml	7 days
Ammonia-N	Water	Plastic	Acidify with H_2SO_4 to pH<2, <6ºC (but not frozen)	500 ml	28 days
Nitrate+Nitrite-N	Water	Plastic	Acidify with H_2SO_4 to pH<2, <6ºC (but not frozen)	500 ml	28 days
Nitrate-N	Water	Plastic	<6ºC	125 ml	48 hours
Phosphorus, Total	Water	Plastic	Acidify with H_2SO_4 to pH<2, <6ºC (but not frozen)	500 ml	28 days
E. coli	Water	Sterile Plastic	Sodium thiosulfate, <6ºC (but not frozen)	100 ml (minimum) 250 ml (for duplicates)	8 hours*
Chloride	Water	Plastic	<6ºC (but not frozen)	125 ml	28 days
Sulfate	Water	Plastic	<6ºC (but not frozen)	125 ml	28 days

**E. coli* samples should always be processed as soon as possible, and incubated no later than 8 hours from time of collection. When transport conditions necessitate sample incubation after 8 hours from time of collection, the holding time may be extended. Samples must be processed as soon as possible and within 30 hours from time of collection.

Sample Containers

The sample container types used for sampling are as follows:

The preferred bacteriological sample containers are sterile 120 and 290 mL bottles. The bottles contain sufficient sodium thiosulfate to remove 5 mg/L or 15 mg/L total chlorine, respectively. Sample containers used for conventional parameters are various sizes, purchased pre-cleaned, and are disposable. Sample containers are either HDPE or LDPE. Certificates from sample container manufacturers are maintained by the ANRA Environmental Laboratory.

Failures in Sampling Methods Requirements and/or Deviations from Sample Design and Corrective Action

Examples of failures in sampling methods and/or deviations from sample design requirements include but are not limited to such things as sample container problems, sample site considerations, etc. Failures or deviations from the QAPP are documented on the field data reporting form and reported to the SFASU Project Leader. The SFASU Project Leader will determine if the deviation from the QAPP compromises the validity of the resulting data. The SFASU Project Leader, in consultation with the TWRI, ANRA, and TSSWCB PM and QAO, will decide to accept or reject data associated with the sampling event, based on best professional judgment. The resolution of the situation will be reported to the TSSWCB in the quarterly progress report (QPR).

Section B3: Sample Handling and Custody

Sample Tracking
Proper sample handling and custody procedures ensure the custody and integrity of samples beginning at the time of sampling and continuing through transport, sample receipt, preparation, and analysis.

A sample is in custody if it is in actual physical possession or in a secured area that is restricted to authorized personnel. The COC form is a record that documents the possession of the samples from the time of collection to receipt in the laboratory. The following information concerning the sample is recorded on the COC form (See Appendix C):

- Site identification
- Sample matrix
- Date and time of collection
- Number of containers
- Analyses required
- Preservative used
- Name of collector
- Custody transfer signatures, and dates and time of transfer
- Bill of lading (*if applicable*)

Sample Labeling
Samples will be labeled on the container with an indelible ink. Label information will include site identification, date and time of collection. The COC form will accompany all sets of sample containers.

Sample Handling
Field data sheets (Appendix B) are supplied to all field personnel prior to initiation of collection procedures. The field data sheets have spaces dedicated to recording of all pertinent field observations and water quality parameters. The field staff has the prime responsibility to ensure that all pertinent information is recorded correctly and in the proper units.

All samples brought to the ANRA Environmental Laboratory are examined for proper documentation, holding times, sample temperature, and preservation by the ANRA Sample Custodian. The Sample Custodian accepts delivery by signing the final portion of the official COC submitted with the samples. The accepted samples are immediately logged into the laboratory LIMS and assigned a unique laboratory sample ID number. It is the responsibility of the sample custodian to login collected water samples in the proper format, and to record the unique laboratory sample ID number on the sample container. The sample container is placed in the proper laboratory refrigerator by the sample custodian.

Proper sample custody is a joint effort of the field sampling staff, the sample transporter, and the laboratory staff. The main documentation of proper sample custody for all events up to the

arrival of the sample at the laboratory is the COC form, which is provided in Appendix C. If any information or signatures on the COC form are not completely filled out, there is a gap in the documentation of sample custody. In such an event, the laboratory sample custodian will question whether the sample should be accepted. All data acceptance questions are referred to the Laboratory Manager and ANRA PM.

The following procedures outline sample handling from collection to receipt of analytical results:

1. After a sample is transferred into the proper sample container, the container is tightly capped as quickly as possible to prevent the loss of volatile components and to exclude possible oxidation. Where appropriate, samples are preserved and/or split in the field. All samples are placed on ice immediately following field measurements and transported to the laboratory as soon as possible.

2. The container is labeled with the proper laboratory sample identification number (a unique designation) on a label securely affixed to the container. A marker with waterproof ink is used when labeling the sample container and filling out the appropriate COC form.

3. The COC form is filled out completely and accurately.

4. A copy of the COC form is retained for ANRA records. Copies of COC forms are kept along with the laboratory analysis reports and associated field sheet(s).

Sample Tracking Procedure Deficiencies and Corrective Action
All failures associated with COC procedures are to be immediately reported to the TSSWCB PM. Failures include such items as delays in transfer resulting in holding time violations; violations of sample preservation requirements; incomplete documentation, including signatures; possible tampering of samples; broken or spilled samples, etc. The Project Leader and the TSSWCB PM/QAO will determine if the procedural violation may have compromised the validity of the resulting data. Any failure that potentially compromises data validity will invalidate data, and the sampling event should be repeated. The resolution of the situation will be reported to the TSSWCB in the QPR. Copies of the CARs will be maintained by the appropriate Laboratory Supervisor(s), TWRI PM, and TSSWCB PM.

Section B4: Analytical Methods

The analytical methods are listed in Table A7.1 and A7.2 of Section A7. Laboratories must be accredited in accordance with NELAP requirements for the matrix, method, parameter combinations listed in Table A7.1 and A7.2 of the QAPP. Procedures for laboratory analysis will be in accordance with the most recently published or online edition of *Standard Methods for the Examination of Water and Wastewater*, the latest version of the TCEQ *Surface Water Quality Monitoring Procedures Volume 1: Physical and Chemical Monitoring Methods, RG-415, August 2012* (TCEQ SOP, V1) or most recent version, or other reliable procedures acceptable to TCEQ.

Laboratories that produce analytical data under this QAPP must be NELAP accredited. Copies of laboratory quality manuals (QMs) and SOPs are available for review by the TCEQ.

Standards Traceability
All standards used in the field and laboratory are traceable to certified reference materials. Standards and reagent preparation is fully documented and maintained in a standards log book. Each documentation includes information concerning the standard or reagent identification, starting materials, including concentration, amount used and lot number; date prepared, expiration date and preparer's initials/signature. The bottle is labeled in a way that will trace the standard or reagent back to preparation. Standards or reagents used are documented each day samples are prepared or analyzed.

Analytical Method Deficiencies and Corrective Actions
Deficiencies in field and laboratory measurement systems involve, but are not limited to such things as instrument malfunctions, failures in calibration, blank contamination, quality control samples outside QAPP defined limits, etc. In many cases, the field technician or lab analyst will be able to correct the problem. If the problem is resolvable by the field technician or lab analyst, then they will document the problem on the field data sheet or laboratory record and complete the analysis. If the problem is not resolvable, then it is conveyed to the applicable Laboratory and/or Quality Manager, who will make the determination if the problem compromises sample results. If the analytical system failure may compromise the sample results, the resulting data will not be reported to the TCEQ. The nature and disposition of the problem is reported on the data report, which is sent to the ANRA Project Manager. The ANRA Project Manager will include this information in the CAP and submit with the Progress Report, which is sent to the TCEQ NPS Project Manager.

The definition of and process for handling deficiencies and corrective action are defined in Section C1.

The TCEQ has determined that analyses associated with qualifier codes (e.g., "holding time exceedance", "sample received unpreserved", "estimated value", etc.) may have unacceptable measurement uncertainty associated with them. This will immediately disqualify analyses from submittal to SWQMIS. Therefore, data with these types of problems should not be reported to the TCEQ. Additionally, any data collected or analyzed by means other than those stated in the

QAPP must have an appropriate data qualifier assigned which can be found in the SWQM DMRG (2019, or most recent version).

Failures in Measurement Systems and Corrective Actions

Failures in field and laboratory measurement systems involve, but are not limited to such things as instrument malfunctions, failures in calibration, blank contamination, QC samples outside QAPP defined limits, etc. In many cases, the field technician or lab analyst will be able to correct the problem. If the problem is resolvable by the field technician or lab analyst, then they will document the problem on the field data sheet or laboratory record and complete the analysis. If the problem is not resolvable, then it is conveyed to the SFASU field supervisor or ANRA LM, who will make the determination in coordination with the ANRA and TWRI PM/QAO. If the analytical system failure may compromise the sample results, the resulting data will not be reported to the TSSWCB as part of this project. The nature and disposition of the problem is reported on the data report. The TWRI PM/QAO will include this information in the CAR and submit with the QPR which is sent to the TSSWCB PM.

Section B5: Quality Control Requirements

Sampling Quality Control Requirements and Acceptability Criteria

Samples are collected in accordance with SWQM Procedures. The SWQM Procedures were revised in 2014 to eliminate the requirement for a Field Split.

Laboratory Measurement Quality Control Requirements and Acceptability Criteria

Batch

A batch is defined as environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A **preparation batch** is composed of one to 20 environmental samples of the same NELAP-defined matrix, meeting the above-mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An **analytical batch** is composed of prepared environmental samples (extract, digestates, or concentrates) which are analyzed together as a group. An analytical batch can include prepared samples originating from various environmental matrices and can exceed 20 samples.

Method Specific QC requirements

QC samples, other than those specified later this section (e.g., sample duplicates, surrogates, internal standards, continuing calibration samples, interference check samples, positive control, negative control, and media blank), are run as specified in the methods. The requirements for these samples, their acceptance criteria or instructions for establishing criteria, and corrective actions are method-specific.

Detailed laboratory QC requirements and corrective action procedures are contained within the individual laboratory QMs. The minimum requirements that all participants abide by are stated below.

Limit of Quantitation (LOQ)

The laboratory will analyze a calibration standard (if applicable) at the LOQ listed in Table A7.1 and A7.2 on each day calibrations are performed. In addition, an LOQ check sample will be analyzed with each analytical batch. Calibrations including the standard at the LOQ will meet the calibration requirements of the analytical method, or corrective action will be implemented.

LOQ Check Sample

An LOQ check sample consists of a sample matrix (e.g., deionized water, sand, commercially available tissue) free from the analytes of interest spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes. It is used to establish intra-laboratory bias to assess the performance of the measurement system at the lower limits of analysis. The LOQ check sample is spiked into the sample matrix at a level less than or equal to the LOQ listed in Table A7.1 and A7.2 for each analyte for each analytical batch of samples

run that fall under this QAPP. If it is determined that samples have exceeded the high range of the calibration curve, samples should be diluted or run on another curve.

The LOQ check sample is carried through the complete preparation and analytical process. LOQ Check Samples are run at a rate of one per analytical batch.

The percent recovery of the LOQ check sample is calculated using the following equation in which %R is percent recovery, S_R is the sample result, and S_A is the reference concentration for the check sample:

$$\%R = {}^{S_R}/_{S_A} \times 100$$

Measurement performance specifications are used to determine the acceptability of LOQ Check Standard analyses as specified in Table A7.1.

Laboratory Control Sample (LCS)
An LCS consists of a sample matrix (e.g., deionized water, sand, commercially available tissue) free from the analytes of interest spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes. It is used to establish intra-laboratory bias to assess the performance of the measurement system. The LCS is spiked into the sample matrix at a level less than or near the mid-point of the calibration for each analyte. In cases of test methods with very long lists of analytes, LCSs are prepared with all the target analytes and not just a representative number, except in cases of organic analytes with multipeak responses.

The LCS is carried through the complete preparation and analytical process. LCSs are performed at a rate of one per preparation batch.

Results of LCSs are calculated by percent recovery (%R), which is defined as 100 times the measured concentration, divided by the true concentration of the spiked sample.

The following formula is used to calculate percent recovery, where %R is percent recovery; S_R is the measured result; and S_A is the true result:

$$\%R = {}^{S_R}/_{S_A} \times 100$$

Measurement performance specifications are used to determine the acceptability of LCS analyses as specified in Table A7.1.

Laboratory Duplicates
A laboratory duplicate is an aliquot taken from the same container as an original sample under laboratory conditions and processed and analyzed independently. Both samples are carried through the entire preparation and analytical process. Laboratory duplicates are used to assess precision and are performed at a rate of one per preparation batch.

For most parameters except bacteria, precision is evaluated using the relative percent difference (RPD) between duplicate results as defined by 100 times the difference (range) of each duplicate set, divided by the average value (mean) of the set. For duplicate results, X_1 and X_2, the RPD is calculated from the following equation:

$$RPD = \frac{|X_1 - X_2|}{\left(\frac{X_1 + X_2}{2}\right)} \times 100$$

For bacteriological parameters, precision is evaluated using the results from laboratory duplicates. Bacteriological duplicates are analyzed on a 10% frequency (or once per preparation batch, whichever is more frequent). These samples will be collected in sufficient volume (>200 mL) for analysis of the sample and its laboratory duplicate from the same container.

The base-10 logarithms of the results from the original sample and its duplicate will be calculated. The absolute value of the difference between the two logarithms will be calculated and compared to the precision criterion in Table A7.1.

The precision criterion in Table A7.1 for bacteriological duplicates applies only to samples with concentrations > 10 MPN/100mL.

Matrix Spike (MS)
Matrix spikes are prepared by adding a known quantity of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available.

Matrix spikes indicate the effect of the sample on the precision and accuracy of the results generated using the selected method. Matrix-specific QC samples indicate the effect of the sample matrix on the precision and accuracy of the results generated using the selected method. The information from these controls is sample/matrix specific and would not normally be used to determine the validity of the entire batch. The frequency of matrix spikes is specified by the analytical method, or a minimum of one per preparation batch, whichever is greater. To the extent possible, matrix spikes prepared and analyzed over the course of the project should be performed on samples from different sites.

The components to be spiked shall be as specified by the mandated analytical method. The results from matrix spikes are primarily designed to assess the validity of analytical results in a given matrix, and are expressed as percent recovery (%R).

The percent recovery of the matrix spike is calculated using the following equation, where %R is percent recovery, S_{SR} is the concentration measured in the matrix spike, S_R is the concentration in the parent sample, and S_A is the concentration of analyte that was added:

$$\%R = \frac{S_{SR} - S_R}{S_A} \times 100$$

Matrix spike recoveries are compared to the same acceptance criteria established for the associated LCS recoveries, rather than the matrix spike recoveries published in the mandated test method. The EPA 1993 methods (i.e. ammonia-nitrogen, ion chromatography, etc.) that establish matrix spike recovery acceptance criteria are based on recoveries from drinking water that has very low interferences and variability and do not represent the matrices sampled in the CRP (ambient surface water). If the matrix spike results are outside laboratory-established criteria, there will be a review of all other associated quality control data in that batch. If all of quality control data in the associated batch passes, it will be the decision of the ANRA Laboratory Services Director or ANRA PM/TWRI PM to report the data for the analyte that failed in the parent sample to TCEQ or to determine that the result from the parent sample associated with that failed matrix spike is considered to have excessive analytical variability and does not meet project QC requirements. Depending on the similarities in composition of the samples in the batch, ANRA may consider excluding all of the results in the batch related to the analyte that failed recovery.

Method Blank

A method blank is a sample of matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as the samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses. The method blanks are performed at a rate of once per preparation batch. The method blank is used to document contamination from the analytical process. The analysis of method blanks should yield values less than the LOQ. For very high-level analyses, the blank value should be less than 5% of the lowest value of the batch, or corrective action will be implemented. Samples associated with a contaminated blank shall be evaluated as to the best corrective action for the samples (e.g. reprocessing or data qualifying codes). In all cases the corrective action must be documented.

The method blank shall be analyzed at a minimum of once per preparation batch. In those instances for which no separate preparation method is used (example: TSS) the batch shall be defined as environmental samples that are analyzed together with the same method and personnel, using the same lots of reagents, not to exceed the analysis of 20 environmental samples.

Quality Control or Acceptability Requirement Deficiencies and Corrective Actions

Sampling QC excursions are evaluated by the ANRA Project Manager, in consultation with the ANRA Laboratory Services Director. In that differences in sample results are used to assess the entire sampling process, including environmental variability, the arbitrary rejection of results based on pre-determined limits is not practical. Therefore, the professional judgment of the ANRA Project Manager and Laboratory Services Director will be relied upon in evaluating results.

Field blanks for trace elements and trace organics are not required for this project, as analyses for these parameters are not required for this project. Equipment blanks for metals analysis are not required for this project, as metals analysis is not included in the scope of the project.

Laboratory measurement quality control failures are evaluated by the laboratory staff. The disposition of such failures and the nature and disposition of the problem is reported to the ANRA Laboratory Services Director. The Laboratory Services Director will discuss the failure with the ANRA Project Manager. If applicable, the ANRA Project Manager will include this information in the CAR and submit with the Progress Report, which is sent to the TSSWCB PM.

The definition of and process for handling deficiencies and corrective action are defined in Section C1.

Additionally, in accordance with CRP requirements and the 2016 TNI Standard (Volume 1, Module 2, Section 4.5, Subcontracting of Environmental Tests) when a laboratory that is a signatory of this QAPP finds it necessary and/or advantageous to subcontract analyses, the laboratory that is the signatory on this QAPP must ensure that the subcontracting laboratory is NELAP-accredited (when required) and understands and follows the QA/QC requirements included in this QAPP, including methodology. The signatory laboratory is also responsible for quality assurance of the data prior to delivering it to the Basin Planning Agency, including review of all applicable QC samples related to CRP data. As stated in section 4.5.5 of the 2016 TNI Standard, the laboratory performing the subcontracted work shall be indicated in the final report and the signatory laboratory shall make a copy of the subcontractor's report available to the client (Basin Planning Agency) when requested.

Failures in Quality Control and Corrective Action

Notations of blank contamination will be noted in QPRs and the final report. Corrective action will involve identification of the possible cause (where possible) of the contamination failure. Any failure that has potential to compromise data validity will invalidate data, and the sampling event should be repeated. The resolution of the situation will be discussed with pertinent project PMs and QAOs. The TWRI PM and QAO will include this information in the CAR and submit with the Progress Report that is sent to the TSSWCB PM.

Section B6: Equipment Testing, Inspection, & Maintenance

All sampling equipment testing and maintenance requirements are detailed in the *TCEQ Surface Water Quality Monitoring Procedures Volume 1* (TCEQ SOP, V1). Sampling equipment is inspected and tested upon receipt and is assured appropriate for use. Equipment records are kept on all field equipment and a supply of critical spare parts is maintained.

All laboratory tools, gauges, instrument, and equipment testing and maintenance requirements are contained within laboratory QM(s).

Section B7: Instrument Calibration and Frequency

In-stream field Equipment calibration requirements are contained in the *TCEQ Surface Water Quality Monitoring Procedures Volume 1* (TCEQ SOP, V1) (most recent version). Post calibration error limits and the disposition resulting from error are adhered to. Data collected from field instruments that do not meet the post-calibration check error limits are invalidated and are not submitted to the TCEQ.

Detailed laboratory calibrations are contained within the laboratory QM(s) and SOPs.

Section B8: Inspection/Acceptance Requirements for Supplies and Consumables

The ANRA Environmental Laboratory ensures that purchased supplies and services that affect the quality of sample collection and preservation procedures, calibration of field equipment, and analysis of environmental tests are of the required or specified quality, by using approved suppliers and products. The laboratory has procedures for the purchasing, receiving, and storage of such supplies. Refer to the laboratory QM for more specific information regarding the procedures for approving suppliers, and inspecting and receiving supplies. No special requirements for acceptance are specified for other field sampling supplies or consumables.

Section B9: Data Acquisition Requirements (Non-direct Measurements)

Water quality data available in TCEQ's SWQMIS will be used as a historical reference for instream water quality and conditions. US Geologic Survey (USGS) flow data available in the watershed may also be useful for evaluating instream conditions. These data will support the development of trend analysis during the waterbody assessment. This is the only water quality data collected outside this project that will be utilized.

Table B9.1 Monitoring Data Sources

Data Type	Monitoring Project/Program	Collecting Entity	Dates of Collection	QA Information	Data Use(s)
Monitoring Data	ANRA Clean Rivers Program	ANRA	9/1/1990 - Current at stations on Segment 0612 and tributaries	ANRA-CRP QAPP; SWQMIS database	summary statistics, trend analysis
Monitoring Data	TCEQ SWQM Program	TCEQ	9/1/1990 - Current at stations on Segment 0612 and tributaries	TCEQ SWQM QAPP; SWQMIS database	summary statistics, trend analysis
Flow Data	United States Geological Survey (USGS) flow data	USGS	For the period of record collected by the USGS at stations on Segment 0612	USGS QAPP; USGA database	Flow measurements
Precipitation Data	National Weather Service (NWS)	NWS	Most up-to-date precipitation data will be downloaded from the NWS website	NWS Website	Days since last precipitation

Only data collected directly under this QAPP will be submitted to the TCEQ for storage in SWQMIS. This project will not submit any acquired or non-direct measurement data to SWQMIS that has been or is going to be collected under another QAPP. All data collected under this QAPP and any acquired or non-direct measurements will comply with all requirements/guidance of the project.

Section B10: Data Management

It is imperative that data and associated applications be maintained and managed in a manner consistent with the development and use of the data; in this case, data will be maintained so that they are consistent with CRP requirements. For scientifically valid results, the data, program applications, and reports must be handled in an orderly and consistent manner. Documented quality assurance and quality control checks/procedures are applied to all received data sets, individual data points and data manipulation programs.

Data will be incorporated into the ANRA database and subject to varying levels of review. The QA/QC checks evaluate each data set as a whole, and the validity of individual data points. Each data set to be processed into the database is evaluated for any problems that might impose a limitation on the use of the data. This check is performed prior to processing/importing to the database. The following information is considered:

a. Credibility of data source
b. Acceptable QA/QC procedures
c. Intended use of the data
d. Frequency of data collection/impact of missed sampling events
e. Sample size
f. Sample collection and preservation methods
g. Field and laboratory test procedures
h. General documentation

Upon passing the evaluation of a data set's limitations, the data are incorporated into the ANRA Database. Data are entered either manually or electronically, into a set of working directory files that are consistent with the ANRA Database file structures. Any deviation found in the data set will be conveyed to the TWRI PM by ANRA. Disqualified data will be removed from the dataset and will not be submitted to the TSSWCB for inclusion in SWQMIS. The reason for the data removal will be listed on the data summary.

Electronic data input procedures vary according to the source and format of the data. Manual data input will be made to appropriately structured MS Access tables. Standardized procedures are followed to ensure proper data entry.

After the data/data sets have been input/converted into an appropriate working directory database, the individual data points will be evaluated to determine their reasonableness. Data values that are considered outliers will be discarded or coded prior to entry into the records directory. The criteria for determination of outliers will be based on individual data sets being processed for entry into the TCEQ’s SWQMIS database. Once the data set is complete, any individual points falling outside the most recent Max/Min range as defined by the TCEQ SWQM Parameters Table will be considered outliers. If an outlier does occur, then it will be noted in the remark section of the database and verified against the original data report, and if necessary, verified by the laboratory. After verification, outliers will either be assigned the

appropriate remark code or documented as verified with a 1 in the verify_flag section of the results table.

After the final QA checks are performed by ANRA, data are submitted to the TSSWCB PM. Data are then transferred from the TSSWCB PM to the TCEQ CRP Data Manager, who then loads the data into SWQMIS.

Only data collected under this project and its QAPP will be transferred. The tag series transferred is documented on the Data Summary (QAPP Appendix D) that is submitted to the TCEQ upon the completion of the data transfer. All QA data sets associated with the data transfer will be submitted in the form of a QA Table. The files are transferred as pipe delimited text file format as described in the *SWQM Data Management Reference Guide* (TCEQ 2019) to the TSSWCB PM. After data have been transferred, reviewed, and loaded into the TCEQ Database, a link will provided to the TCEQ's Surface Water Quality Web Reporting Tool at http://www8.tceq.state.tx.us.SwqmisWeb/public/index.faces for public access.

Data Dictionary - Terminology and field descriptions are included in the *SWQM Data Management Reference Guide* (TCEQ 2019). For the purposes of verifying which entity codes are included in this QAPP, the following will be used when submitting data under this QAPP:

Name of Monitoring Entity:	Stephen F. Austin State University WET Center
Tag Prefix:	TX - Texas State Soil and Water Conservation Board
Submitting Entity:	AN - Angelina Neches River Authority
Collecting Entity:	SF - Stephen F. Austin State University WET Center
Monitoring Type Code:	RTBA – routine, BMP assessment

Data Errors and Loss

To prevent loss of data and minimize errors, all data generated under this QAPP are verified against the appropriate quality assurance checks as defined in the QAPP, including but not limited to chain of custody procedures, field sampling documentation, laboratory analysis results, and quality control data.

Automated and manual Data Reviews are performed prior to data transmittal to TCEQ. Examples of checks that are used to review for data errors and data loss include:

- Parameter codes are contained in the QAPP
- Sites are in the QAPP Coordinated Monitoring Schedule
- Transcription or input errors
- Relationships among analytes (ex: TDS $\geq$ SO_4 + Cl)
- Count of reported analytes (ex: # pH = # DO = # Temperature)
- Significant figures
- Values are at or above the LOQs
- Values are below the highest standard of the calibration curve, and appropriate dilutions (if necessary) have been used
- Check for outliers

- Verified outliers are flagged
- Use of correct reporting units
- Flows should have a flow method associated with the data
- If flow severity = 1, then flow = 0
- If flow severity = 6, then no value is reported for flow
- Depth of surface sample is reported
- Post-calibration error limits for multiprobe instrumentation (Table 8.3 in SWQM PM)

Results and Events files are automatically generated from the ANRA Database. These files contain the correct number of fields for inclusion in SWQMIS.

Data exceeding holding times, improperly preserved samples, and estimated concentrations have unacceptable measurement uncertainty associated with them. This uncertainty will immediately disqualify analyses for submittal to SWQMIS. Therefore, data with these types of issues are not reported to the TCEQ and will be noted in the Data Summary Report.

All data is uploaded to the SWQMIS User Acceptance Test environment, and a validator report is generated. The validator report is reviewed and any issues are corrected prior to the data being transmitted to the TSSWCB PM.

Record Keeping and Data Storage
Field sheets are scanned and stored on ANRA's servers on a routine basis.

All data on ANRA's servers are backed up on a daily basis Monday through Friday, with data stored at an off-site location to prevent loss due to a disaster such as fire or flood. Scans or electronic copies of field data sheets and laboratory reports are stored for a minimum period of five years.

Archives/Data Retention
Complete original data sets are archived in electronic format and retained for a period specified in section A9. Electronic data is stored for a minimum of 5 years on ANRA's servers.

Data Verification/Validation
The control mechanisms for detecting and correcting errors and for preventing loss of data during data reduction, data reporting, and data entry are contained in Sections D1, D2, and D3.

Forms and Checklists
See Appendix B for the Field Data Reporting Form
See Appendix C for the Chain-of-Custody Form
See Appendix D for the Data Review Checklist and Summary

Data Handling
ANRA's server provides security by limiting access to restricted users. The ANRA LIMS is also protected by user-level login and user-specific menus, which can be used to restrict access to certain functions in the system.

The Laboratory's LIMS program has user-level access control. From the LIMS, analytical results are exported to ANRA's Database, which is a MS Access-based database. Several data checks have been implemented into the ANRA Database to identify values which do not meet criteria for inclusion into SWQMIS. The ANRA Database sequentially assigns Tag IDs to samples entered into the system. The database is capable of automatically generating Results and Events files that are compliant with the specifications listed in the DMRG**.**

Hardware and Software Requirements

Hardware configurations are sufficient to run Microsoft Access 2010 under the Windows operating system. Information Resources staff are responsible for assuring hardware configurations meet the requirements for running current and future data management/database software as well as providing technical support. Software development and database administration are also the responsibility of the information resources department. Information Resources develops applications based on user requests and assures full system compatibility prior to implementation.

Hardware – The ANRA water quality database is stored on a Windows-based server. The ANRA Laboratory's LIMS (Lablite) is run from a Windows Server-based system.

Software – Laboratory data is stored in Lablite LIMS, a SQL-based database program.

Staff uses Microsoft Office software (Word, Excel, Access, PowerPoint, and Outlook). For GIS, ANRA uses ESRI ArcGIS.

Information Resource Management Requirements

Data will be managed in accordance with the DMRG, and applicable ANRA information resource management policies.

Data analyzed by the ANRA Laboratory is stored in Lablite LIMS, a commercially available SQL-based relational database. The ANRA Database, created in-house and based on MS Access, has been modified to import data directly from Lablite LIMS, automating the process and eliminating the manual reentry of the data, reducing the chance of transcription errors. Additional validity checks have also been included in the ANRA Database. Imported data is linked to parameter code tables in the ANRA Database, ensuring that results are reported under the correct parameter code. Additional functions, such as a graphing module, have been added to the database for data review purposes. Results and Events files are automatically generated by the database in the proper format for submittal to SWQMIS.

Data in both Lablite and the ANRA Database are stored on a password-protected server, and access is granted only to authorized individuals. Data backups are performed nightly, with copies of backups stored off-site.

Data Validation

Following review of laboratory data, any data that is not representative of environmental conditions, because it was generated through poor field or laboratory practices, will not be submitted to the TSSWCB. This determination will be made by the ANRA PM, TWRI PM/QAO, TSSWCB QAO, and other personnel having direct experience with the data collection effort. This coordination is essential for the identification of valid data and the proper evaluation of that data. The validation will include the checks specified in Table D2.1.

Data Dissemination

At the conclusion of the project, the TWRI Project Leader will provide a copy of the complete project electronic spreadsheet via recordable media to the TSSWCB PM, along with the final report. The TSSWCB may elect to take possession of all project records. However, summaries of the data will be presented in the final project report.

Section C1: Assessments and Response Actions

The following table presents types of assessments and response actions for data collection and analysis activities applicable to the QAPP and all facets of the project.

Table C1.1: Assessments and Response Actions

Assessment Activity	Approximate Schedule	Responsible Party	Scope	Response Requirements
Status monitoring oversight	Continuous	ANRA, CES, SFASU, TWRI	Monitor project status, performance & records to ensure requirements are being fulfilled.	Report to TSSWCB PM in Quarterly Reports
Laboratory inspections	TBD by TSSWCB	TSSWCB	Analytical and quality control procedures in the lab	45 days to respond to TSSWCB w/ corrective actions
Technical systems audit	As needed	TSSWCB	Assess compliance with QAPP; review facility & data management as they relate to the project	45 days to respond to TSSWCB w/ corrective actions
Monitoring systems audit	TBD by TSSWCB	TSSWCB	Assess compliance with QAPP; review field sampling, facility & data management as they relate to the project	45 days to respond to TSSWCB w/ corrective actions

In-house review of data quality and staff performance to assure that work is being performed according to standards will be conducted by all entities. If reviews show that the work is not being performed according to standards, immediate corrective action will be implemented. CARs will be submitted to TSSWCB and documented in the project QPRs.

The TSSWCB QAO (or designee) may conduct an audit of the field or technical systems activities for this project as needed. Each entity will have the responsibility for initiating and implementing response actions associated with findings identified during the on-site audit. Once the response actions have been implemented, the TSSWCB QAO (or designee) may perform a follow-up audit to verify and document that the response actions were implemented effectively. Records of audit findings and corrective actions are maintained by the TSSWCB PM and TWRI QAO. Corrective action documentation will be submitted to the TSSWCB PM with the progress report. If audit findings and corrective actions cannot be resolved, then the authority and responsibility for terminating work is specified in agreements or contracts between participating organizations.

Corrective Action Process for Deficiencies

Deficiencies are any deviation from the QAPP, TCEQ SOP, V1, DMRG, or lab QMs or SOPs. Deficiencies may invalidate resulting data and may require corrective action. Corrective action may include for samples to be discarded and re-collected. Deficiencies are documented in logbooks, field data sheets, etc. by field or laboratory staff. It is the responsibility of each respective entity's Project Leader or PM, in consultation with the TWRI QAO, to ensure that the actions and resolutions to the problems are documented and that records are maintained in accordance with this QAPP. In addition, these actions and resolutions will be conveyed to the

TSSWCB PM both verbally and in writing in the project progress reports and by completion of a CAR. All deficiencies identified by each entity will trigger a corrective action plan.

Corrective Action

Corrective Action Reports (CARs) should:

- Identify the problem, nonconformity, or undesirable situation
- Identify immediate remedial actions if possible
- Identify the underlying cause(s) of the problem
- Identify whether the problem is likely to recur, or occur in other areas
- Evaluate the need for Corrective Action
- Use problem-solving techniques to verify causes, determine solution, and develop an action plan
- Identify personnel responsible for action
- Establish timelines and provide a schedule
- Document the corrective action

The status of CARs will be included with quarterly progress reports. In addition, significant conditions (i.e., situations that, if uncorrected, could have a serious effect on safety or on the validity or integrity of data) will be reported to the TSSWCB immediately.

The Project Lead or PM or each respective entity is responsible for implementing and tracking corrective actions. Records of audit findings and corrective actions are maintained by the Project Lead or PM of each respective entity. Audit reports and corrective action documentation will be submitted to the TSSWCB with the Progress Report.

Section C2: Reports to Management

Quarterly progress reports developed by the PMs will note activities conducted in connection with the project, items or areas identified as potential problems, and any variations or supplements to the QAPP. CAR forms will be utilized when necessary (Appendix A). CARs will be maintained in an accessible location for reference by all project personnel and at TWRI and disseminated to individuals listed in section A3. CARs that result in any changes or variations from the QAPP will be made known to pertinent project personnel and documented in an update or amendment to the QAPP.

If the procedures and guidelines established in this QAPP are not successful, corrective action is required to ensure that conditions adverse to quality data are identified promptly and corrected as soon as possible. Corrective actions include identification of root causes of problems and successful correction of identified problem. CARs will be filled out to document the problems and the remedial action taken. Copies of CARs will be included with the project's quarterly reports. These reports will discuss any problems encountered and solutions made. These reports are the responsibility of the QAO and the PM and will be disseminated to individuals listed in section A3.

The final report will be a culmination of the work conducted under this project and QAPP.

Section D1: Data Review, Validation, and Verification

For the purposes of this document, data verification is a systematic process for evaluating performance and compliance of a set of data to ascertain its completeness, correctness, and consistency using the methods and criteria defined in the QAPP. Validation means those processes taken independently of the data-generation processes to evaluate the technical usability of the verified data with respect to the planned objectives or intention of the project. Additionally, validation can provide a level of overall confidence in the reporting of the data based on the methods used.

All data obtained from field and laboratory measurements will be reviewed and verified for conformance to project requirements, and then validated against the data quality objectives that are listed in Section A7. Only those data that are supported by appropriate quality control data and meet the measurement performance specification defined for this project will be considered acceptable and submitted to the TCEQ for entry into SWQMIS.

The procedures for verification and validation of data are described in Section D2, below. The ANRA Laboratory Manager is responsible for ensuring that laboratory data are scientifically valid, defensible, of acceptable precision and bias, and reviewed for integrity. The ANRA Data Manager will be responsible for ensuring that all data are properly reviewed and verified, and submitted in the required format to be loaded into SWQMIS. The ANRA Laboratory Services Director is responsible for validating a minimum of 10% of the data produced in each task. Finally, the ANRA Project Manager, with the concurrence of the ANRA Laboratory Services Director, is responsible for validating that all data to be reported meet the objectives of the project and are suitable for reporting to TCEQ.

Section D2: Validation Methods

Field and laboratory data will be reviewed, verified, and validated to ensure conformance with project specifications and adherence to end use as described in Section A7 of this document.

Data review, verification, and validation will be performed using self-assessments and peer and management review as appropriate to the project task. The data review tasks to be performed by field and laboratory staff are listed in the first column of Table D2.1. Potential errors are identified by examination of documentation and by manual or computer-assisted examination of corollary or unreasonable data. If a question arises or an error is identified, the manager of the task responsible for generating the data is contacted to resolve the issue. Issues that can be corrected are corrected and documented. If an issue cannot be corrected, the task manager consults with the higher level project management to establish the appropriate course of action, or the data associated with the issue are rejected and not reported to the TSSWCB for submission to TCEQ for storage in SWQMIS. Field and laboratory reviews, verifications, and validations are documented.

Table D2.1. Data Review Tasks

Data to be Verified	Field	Lab	ANRA Data Manager
Sample documentation complete; samples labeled, sites identified	X	X	
Field QC samples collected for all analytes as prescribed in the TCEQ *SWQM Procedures Manual*	X		
Standards and reagents traceable	X	X	
Chain of custody complete/acceptable	X	X	
NELAP Accreditation is current		X	
Sample preservation and handling acceptable	X	X	
Holding times not exceeded	X	X	
Collection, preparation, and analysis consistent with SOPs and QAPP	X	X	
Field documentation (e.g., biological, stream habitat) complete	X		X
Instrument calibration data complete	X	X	X
Bacteriological records complete	X	X	
QC samples analyzed at required frequency		X	X
QC results meet performance and program specifications		X	X
Analytical sensitivity (LOQ/AWRL) consistent with QAPP		X	X
Results, calculations, transcriptions checked		X	X
Laboratory bench-level review performed		X	
All laboratory samples analyzed for all scheduled parameters		X	X
Corollary data agree		X	X
Nonconforming activities documented	X	X	X
Outliers confirmed and documented; reasonableness check performed		X	X
Time based on 24-hour clock			X
Absence of transcription error confirmed	X	X	X
Absence of electronic errors confirmed	X	X	X
Sampling and analytical data gaps checked	X	X	X
Field instrument pre and post calibration results within limits	X		X
10% of data manually reviewed		X	X

After the field and laboratory data are reviewed, another level of review is performed once the data are combined into a data set. This review step as specified in Table D2.1 is performed by the ANRA Information Resources Manager and Laboratory Services Director. Data review, verification, and validation tasks to be performed on the data set include, but are not limited to, the confirmation of laboratory and field data review, evaluation of field QC results, additional evaluation of anomalies and outliers, analysis of sampling and analytical gaps, and confirmation that all parameters and sampling sites are included in the QAPP.

The Data Review Checklist (See Appendix D) covers three main types of review: data format and structure, data quality review, and documentation review. The Data Review Checklist is transferred with the water quality data submitted to the TSSWCB to ensure that the review process is being performed.

Another element of the data validation process is consideration of any findings identified during the monitoring systems audit conducted by the TSSWCB QAO. Any issues requiring corrective action must be addressed, and the potential impact of these issues on previously collected data will be assessed. After the data are reviewed and documented, the ANRA PM validates that the data meet the data quality objectives of the project and are suitable for reporting to TSSWCB and subsequently TCEQ.

If any requirements or specifications of the QAPP are not met, based on any part of the data review, the responsible party should document the nonconforming activities and submit the information to the ANRA Information Resources Manager with the data. This information is communicated to TSSWCB by ANRA in the Data Summary (See Appendix D).

Section D3: Reconciliation with User Requirements

Data produced in this project, and data collected by project personnel will be analyzed and reconciled with project data quality requirements. Data meeting project requirements will be submitted to TCEQ for inclusion in SWQMIS. Data which do not meet requirements will not be submitted to SWQMIS nor will be considered appropriate for any of the uses noted above.

References

Standard Methods for the Examination of Water and Wastewater, 21st Edition, 2005.

Texas Commission on Environmental Quality (TCEQ). 2019. "Surface Water Quality Monitoring Data Management Reference Guide." https://www.tceq.texas.gov/assets/public/waterquality/dma/dmrg/dmrg_complete.pdf

Texas Commission on Environmental Quality (TCEQ) SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue, 2012 (RG-415)

United States Environmental Protection Agency (USEPA) Methods for Chemical Analysis of Water and Wastes. Manual #EPA-600/4-79-020

APPENDIX A: Corrective Action Report

Corrective Action Report

SOP-QA-001
CAR #:_____

Date:_____ Area/Location:_____

Reported by:_____ Activity:_____

State the nature of the problem, nonconformance or out-of-control situation:
_____
_____
_____
_____
_____

Possible causes:
_____
_____
_____

Recommended Corrective Actions:
_____
_____
_____

CAR routed to:_____
Received by:_____

Corrective Actions taken:
_____
_____
_____
_____

Has problem been corrected? YES NO

Immediate Supervisor:_____

Program Manager:_____

TWRI Quality Assurance Officer:_____

TSSWCB Quality Assurance Officer:_____

APPENDIX B: Surface Water Quality Monitoring Field Data Sheet

Surface Water Quality Monitoring
Field Data Sheet

Stephen F. Austin State University
P.O. Box 6109, SFA Station
Nacogdoches, TX 75962-6109
(936) 468-2469

Sample Location: _____

Station ID: _____ **Date Collected:** _____

Sample Matrix: Water **Time Collected:** _____

Collector(s) Name/Signature: _____

Sample Type: Routine **Sample Depth:** _____

	Field Tests and Measurements:				Parameters Collected:		
	pH (standard units)	00400		E. coli (IDEXX)		Total N
	water temperature °C	00010		Chloride		NNN
	Dissolved Oxygen (mg/L)	00300		TSS		Total P
	Specific Conductance (µS/cm)	00094		TDS		Nitrate-N
	Instant. Stream Flow (cfs)	00061		Ammonia-N		Sulfate
	Field Observations					
	01351 - Flow Severity (1 - no flow, 2 - low, 3 - normal, 4 - flood, 5 - high, 6 - dry)					
	89835 - Flow measurement method (1-gage, 2-electric, 3-mechanical, 4-weir/flume, 5-doppler)					
	00078 - Secchi Depth (meters)					
	72053 - Days since last significant rainfall					
	82903 - Total water depth (meters)					
	89978 - Pimary contact, observed activity (number of people engaged)					
	89979 - Evidence of primary contact recreation (1-observed, 2-not observed)					
	89966 - Present weather (1 - clear, 2 - partly cloudy, 3 - cloudy, 4 - rain, 5 - other)					
	74069 - Stream flow estimate (cfs) *Required measurements to calculate flow estimates					
	Stream width (feet)*					
	Averagae depth of stream (feet)*					
	Distance object travels (feet)*					
	Time for object to travel distance (seconds)*					

Note: Instantaneous stream flow is preferable to a stream flow estimate

Comments:

APPENDIX C: Chain of Custody Record

ANRA
Angelina & Neches River Authority

2901 N. John Redditt Dr.
Lufkin, TX 75904
Phone: 936-632-7795
Website: www.anra.org

CHAIN-OF-CUSTODY RECORD

NELAP ACCREDITED TNI LABORATORY

SECTION A – CLIENT & SAMPLER INFORMATION		SECTION B – SAMPLE RECEIPT INFORMATION (LAB USE ONLY)		
Client Name	Texas Agrilife Research-TSSWCB Attoyac #22-xx	Temperature, °C:	Observed: / Corrected:	Receipt #:
Project Name		Thermometer ID / Correction Factor:	THERM- / CF:	Client Notification:
Phone #	936-633-7527	Preservative & pH paper Standard ID #s:		Comments:
Sampler Name		Subcontract Lab / PO #:	Sub Lab: PO #:	

SECTION C – SAMPLE CONTAINERS AND PRESERVATION							SECTION D – INSTRUCTIONS/KEYS	
Container Letter	A	B	C	D			Label each individual sample container with a letter (A, B, C, etc.). If multiple analyses come from the same container, assign them the same letter, or write them in the same column.	Matrix Codes: DW = Drinking Water, NP = Non-Potable Water, S = Soil, SL = Sludge
Container Type	P	P	S	P			Container Type Codes: A = Amber, AG = Amber Glass, G = Glass, P = Plastic, S = Sterile, V = Vial	
Preservative	2	1	3	1			Preservative Codes: 1 = None, 2 = Sulfuric Acid (H_2SO_4), 3 = Sodium Thiosulfate ($Na_2S_2O_3$), 4 = Nitric Acid (HNO_3), 5 = Sodium Hydroxide (NaOH), 6 = Hydrochloric Acid (HCl)	Sample Type Codes: C = Composite, G = Grab, SP = Special (DW matrix only)

SECTION E – SAMPLE INFORMATION AND ANALYSES REQUESTED												SECTION F – FIELD ANALYSES/INFORMATION				SECTION G – SAMPLE ID	
												Enter the applicable parameters in the fields below.				LAB USE ONLY	
Item #	Sample Description	Analyses: Ammonia, Total Phosphorus	Chloride, Nitrate, Nitrite, Sulfate	E. coli Enumeration	Total Suspended Solids			Matrix (see Section D)	Sample Type (see Section D)	Collection Date	Collection Time					pH of preserved containers (e.g. A <2)	Work Order #: Sample ID #s
1	20841 -Attoyac Bayou at FM 138	X	X	X	X			NP	G								
2	20843 -Naconiche Creek at FM 95	X	X	X	X			NP	G								
3	16083 -Waffelow Creek at FM 95	X	X	X	X			NP	G								
4	16084 -Terrapin Creek at SH 95	X	X	X	X			NP	G								
5	20844 -Big Iron Ore Creek at FM 354	X	X	X	X			NP	G								
6																	
7																	
8																	
9																	
10																	

SECTION H – COMPOSITE DATA (if Composite marked above)				SECTION I – TRANSFER OF SAMPLE CUSTODY						
	Date	Time	Totalizer	Relinquished by (Signature)	Date	Time	Transported on ice	Received by (Signature)	Date	Time
Start							☐ Yes ☐ No			
End							☐ Yes ☐ No			
Total Flow (MGD)							☐ Yes ☐ No			

Form ID: LAB-027
Revision #: 3
Effective: 6/9/2020
Approved: MDG

NOTE: Section I – Transfer of Sample Custody must reflect all transfers from sample collection to receipt at the ANRA Environmental Laboratory.
NOTE: Chain-of-Custody must be completed by the customer (or corrected, if needed, at the time of sample drop-off) before ANRA staff will accept samples and sign the COC as received.

Clear Form

APPENDIX D: Data Review Checklist and Data Summary Sheet

Data Review Checklist

This checklist is to be used by the Planning Agency and other entities handling the monitoring data in order to review data before submitting to the TCEQ. This table may not contain all of the data review tasks being conducted.

Data Format and Structure	**Y, N, or N/A**
A. Are there any duplicate Tag Id numbers in the Events file?	
B. Do the Tag prefixes correctly represent the entity providing the data?	
C. Have any Tag Id numbers been used in previous data submissions?	
D. Are TCEQ station location (SLOC) numbers assigned?	
E. Are sampling Dates in the correct format, MM/DD/YYYY with leading zeros?	
F. Are sampling Times based on the 24 hr clock (e.g. 09:04) with leading zeros?	
G. Is the Comments field filled in where appropriate (e.g. unusual occurrence, sampling problems, unrepresentative of ambient water quality)?	
H. Are submitting Entity, Collecting Entity, and Monitoring Type codes used correctly?	
I. Do sampling dates in the Results file match those in the Events file for each Tag Id?	
J. Are values represented by a valid parameter code with the correct units?	
K. Are there any duplicate parameter codes for the same Tag Id?	
L. Are there any invalid symbols in the Greater Than/Less Than (GT/LT) field?	
M. Are there any Tag Ids in the Results file that are not in the Events file or vice versa?	
Data Quality Review	**Y, N, or N/A**
A. Are "less-than" values reported at the LOQ? If no, explain in Data Summary.	
B. Have the outliers been verified and a "1" placed in the Verify_flg field?	
C. Have checks on correctness of analysis or data reasonableness been performed? e.g., Is ortho-phosphorus less than total phosphorus? Are dissolved metal concentrations less than or equal to total metals? Is the minimum 24 hour DO less than the maximum 24 hour DO? Do the values appear to be consistent with what is expected for site?	
D. Have at least 10% of the data in the data set been reviewed against the field and laboratory data sheets?	
E. Are all parameter codes in the data set listed in the QAPP?	
F. Are all stations in the data set listed in the QAPP?	
Documentation Review	**Y, N, or N/A**
A. Are blank results acceptable as specified in the QAPP?	
B. Were control charts used to determine the acceptability of duplicates?	
C. Was documentation of any unusual occurrences that may affect water quality included in the Event files' Comments field?	
D. Were there any failures in sampling methods and/or deviations from sample design requirements that resulted in unreportable data? If yes, explain in Data Summary.	
E. Were there any failures in field and/or laboratory measurement systems that were not resolvable and resulted in unreportable data? If yes, explain in Data Summary.	

F.	Was the laboratory's NELAP Accreditation current for analysis conducted?	

Data Summary

Data Set Information

Data Source: **SFA/ANRA**

Date Submitted: **YYYY-MM-DD**

Tag_id Range: **TXxxxxx – TXxxxxx**

Date Range: **YYYY-MM-DD – YYYY-MM-DD**

□ I certify that all data in this data set meets the requirements specified in Texas Water Code Chapter 5, Subchapter R (TWC §5.801 et seq) and Title 30 Texas Administrative Code Chapter 25, Subchapters A & B.

□ This data set has been reviewed using the criteria in the Data Review Checklist.

Planning Agency Data
Manager: _____Date:_____

Comments
Please explain in the table below any data discrepancies discovered during data review including:

- Inconsistencies with LOQs
- Failures in sampling methods and/or laboratory procedures that resulted in data that could not be reported to the TCEQ (indicate items for which the Corrective Action Process has been initiated and send Corrective Action Status Report with the applicable Progress Report).

Parameter	Tag Ids Affected	Type of Problem	Reason for Problem	Percent Loss*	Corrective Action (Y/N/SOP)

* Percent Loss = # Data Points Lost / # Data Points Expected for that parameter in the data set.