Texas State Soil and Water Conservation Board
State Nonpoint Source Grant Program

Little River Continued Surface Water Quality Monitoring

TSSWCB Project # 23-50

Quality Assurance Project Plan

Texas State Soil and Water Conservation Board

Revision #0

prepared by

Texas A&M AgriLife Research
Texas Water Resources Institute

Effective Period: Upon final approval through September 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 *Little River Continued Surface Water Quality Monitoring*

Texas State Soil and Water Conservation Board (TSSWCB)

Name: Daniel Blair
Title: TSSWCB Project Manager (PM)
Signature: _____ Date: 3/8/2023

Name: Mitch Conine
Title: TSSWCB Quality Assurance Officer (QAO)
Signature: _____ Date: 3/8/2023

Texas A&M AgriLife Research – Texas Water Resources Institute (TWRI)

Name: Stephanie deVilleneuve
Title: TWRI QAO & Data Manager (DM)

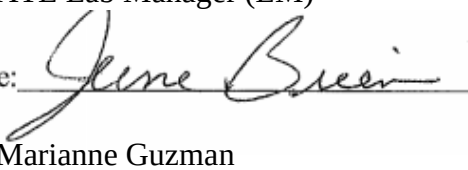
Signature:_____ Date: 03/06/2023

Name: Shaylynn Postma
Title: TWRI Project Manager & Field Supervisor

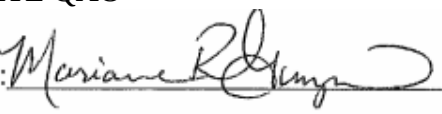
Signature:_____ Date: 03/06/2023

Aqua-Tech Laboratories, Inc. (ATL)

Name: June Brien
Title: ATL Lab Manager (LM)

Signature:  Date: 3-6-23

Name: Marianne Guzman
Title: ATL QAO

Signature:  Date: 3-6-23

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List of Acronyms and Abbreviations

ATL	Aqua-Tech Laboratories, Inc.
AWRL	Ambient Water Reporting Limits
CAR	corrective action report
COC	chain of custody
DM	Data Manager
DMRG	data management reference guide
DO	dissolved oxygen
DQO	data quality objectives
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LDC	load duration curve
LM	Laboratory Manager
LOD	limit of detection
LOQ	limit of quantitation
NELAP	National Environmental Laboratory Accreditation Program
NWS	National Weather Service
PM	Project Manager
QA	quality assurance
QAO	Quality Assurance Officer
QAPP	quality assurance project plan
QC	quality control
QM	quality manual
QPR	quarterly progress report
RPD	relative percent difference
SOP	standard operating procedure
SWQM	surface water quality monitoring
SWQMIS	Surface Water Quality Monitoring Information System
TCEQ SOP, V1	TCEQ's Surface Water Quality Monitoring Procedures, Volume 1
TCEQ	Texas Commission on Environmental Quality
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

Section A3: Distribution List

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

Texas State Soil and Water Conservation Board

1497 Country View Ln
Temple, TX 76504

Name: Daniel Blair
Title: TSSWCB PM

Name: Mitch Conine
Title: TSSWCB QAO

Texas A&M AgriLife Research - Texas Water Resources Institute

1001 Holleman Dr. East
2118 TAMU
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Name: Shaylynn Postma
Title: TWRI PM & Field Supervisor

Name: Stephanie deVilleneuve
Title: TWRI QAO & DM

Aqua-Tech Laboratories, Inc.

635 Phil Gramm Blvd.
Bryan, TX 77807

Name: June Brien
Title: ATL LM

Name: Marianne Guzman
Title: ATL QAO

Section A4: Project/Task Organization

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

TSSWCB – Texas State Soil and Water Conservation Board, Temple, Texas. Provide state oversight and management of all project activities and ensure coordination of activities with related projects and TCEQ.

Daniel Blair, TSSWCB PM

Responsible for ensuring that the project delivers data of known quality, quantity, and type on schedule to achieve project objectives. Provides the primary point of contact between TSSWCB and TWRI. 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. Notifies TSSWCB QAO of any project non-conformances or corrective actions reported or taken by TWRI.

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 Nonpoint Source Management Program.

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

Shaylynn Postma, TWRI; PM & Field Supervisor

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.

Responsible for supervising all aspects of the sampling and measurement of surface waters and other field parameters. Responsible for the collection of water samples and field data measurements in a timely manner that meet the quality objectives specified in Section A7 (Table A7.1), as well as the requirements of Sections B1 through B8.

Responsible for field scheduling, staffing, and ensuring that staff is appropriately trained. Reports status, problems, and progress to TWRI PM.

Stephanie deVilleneuve, TWRI; QAO & Data Manager

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.

Responsible for acquisition, verification, and transfer of data to the TSSWCB PM. Oversees data management for the project. Performs data quality assurances prior to transfer of data to the Texas Commission on Environmental Quality (TCEQ) in the format specified in the most recent version of the Surface Water Quality Monitoring (SWQM) Data Management Reference Guide (DMRG). Ensures that the data review checklist is complete and data is submitted with appropriate codes. Provides the point of contact for the TSSWCB PM to resolve issues related to the data and assumes responsibility for the correction of any data errors.

ATL – Aqua-Tech Laboratories, Inc., Bryan, Texas. Responsible for conducting laboratory analysis.

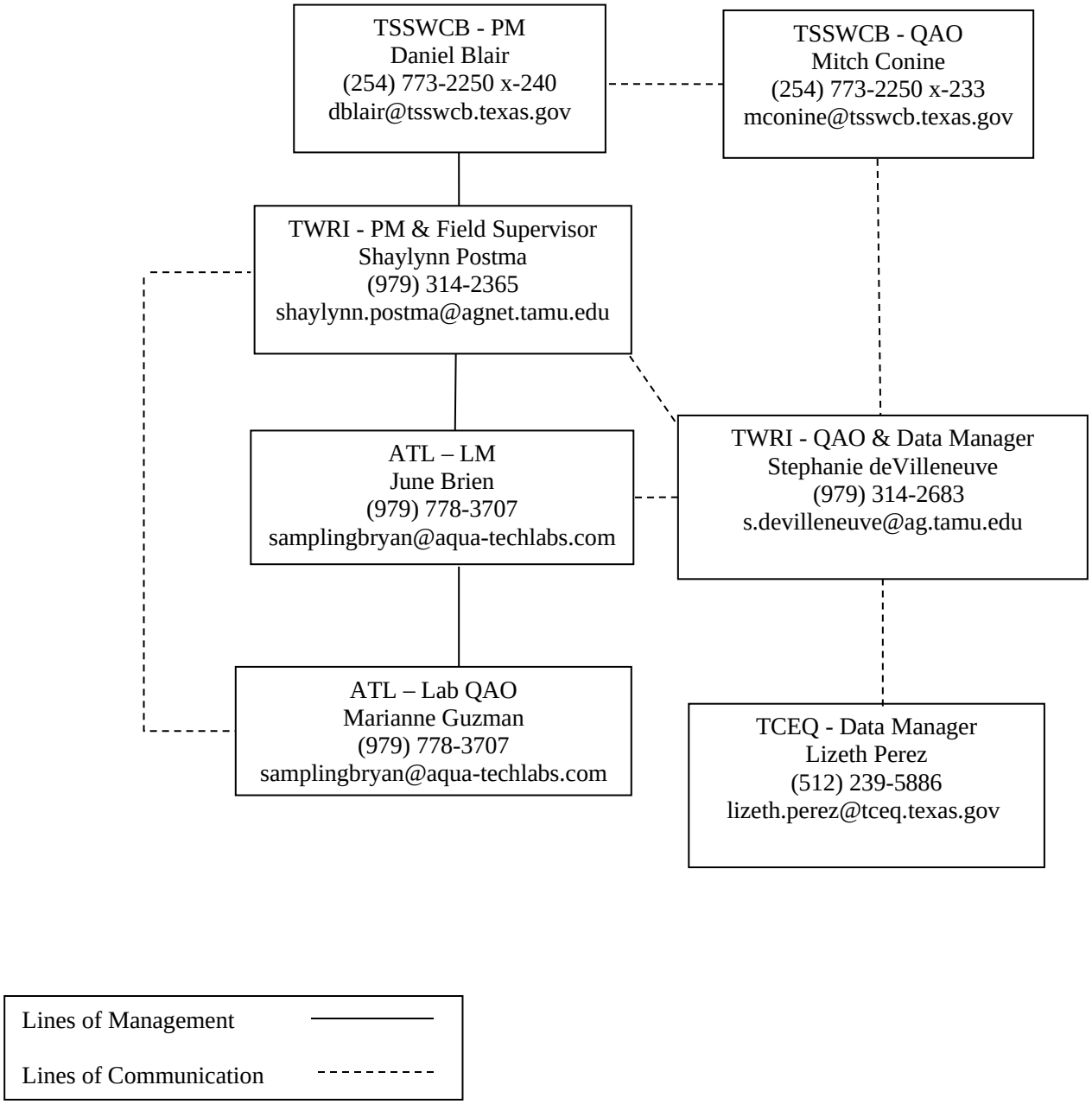
June Brien, ATL LM

Responsible for overall performance, administration, and reporting of analyses performed by ATL. 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. Enforces corrective action, as required. Facilitates monitoring systems audits. Reviews and verifies all laboratory data for integrity and continuity, reasonableness and conformance to project requirements, and then validates the data against the measurement performance specifications listed in Table A7.1 of the QAPP.

Marianne Guzman, ATL QAO

Monitors the implementation of the QAM and the QAPP within the laboratory to ensure complete compliance with QA objectives as defined by the contract and in the QAPP. Conducts internal audits to identify potential problems and ensure compliance with written SOPs. Responsible for supervising and verifying all aspects of the QA/QC in the laboratory. Performs validation and verification of data before the report is sent to TWRI. Ensures that all QA reviews are conducted in a timely manner from real-time review at the bench during analysis to final submittal of data to TWRI QA officer.

Figure A4.1. Project Organization Chart



Section A5: Problem Definition/Background

The Leon and Lampasas Rivers below Belton Lake and Stillhouse Hollow Lake, respectively, transect the urban areas of Temple, TX and Belton, TX, flowing downstream where they merge to form the Little River. The Little River then flows to the southeast until it joins the Brazos River. Major tributaries of the Little River are the San Gabriel River and Big Elm Creek. Currently, one assessment unit of the Little River has a concern for elevated bacteria. The other, assessment unit 1213_04, was delisted in the 2022 Integrated Report. Data collected for 1213_04 as part of this project can be used in future watershed planning efforts. There are also concerns for nitrate and chlorophyll-a along the length of the river.

Historically, water quality monitoring in the watershed has occurred quarterly at three locations and monthly at a fourth location. However, the distribution of these sampling sites and the frequency of data collected may not adequately represent water quality conditions in the bulk of the watershed. For example, assessment unit 1213_01, which extends from the Brazos River upstream to Cameron, TX, is evaluated on samples collected at two sites very near the City of Cameron. These sites are influenced by wastewater inflows to the river and may not adequately represent instream water quality conditions farther downstream, where more primary contact recreation is known to occur.

A 14-month water quality monitoring project ended in August 2022 for Little River (MPG-02 Little River Supplemental Watershed Monitoring). Samples were collected at two sites monthly near the furthest upstream and downstream TCEQ monitoring stations in the watershed. This project will allow monitoring to continue for an additional 18 months. Monthly sampling will include field parameters and grab samples and allow data gaps to be filled, providing a more robust picture of surface water quality in the watershed and improving future watershed analysis.

Section A6: Project Goals and Task Description

TWRI will conduct supplemental water quality monitoring with a focus on collecting paired flow rates and *E. coli* concentration data. Data will be collected at two sites monthly, TCEQ monitoring stations 11887 and 13546 (Figure A6.1). Monthly sampling will allow data gaps to be filled and will improve watershed analysis.

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 under Task 3. Table A6.1 provides specific subtask milestones for this project.

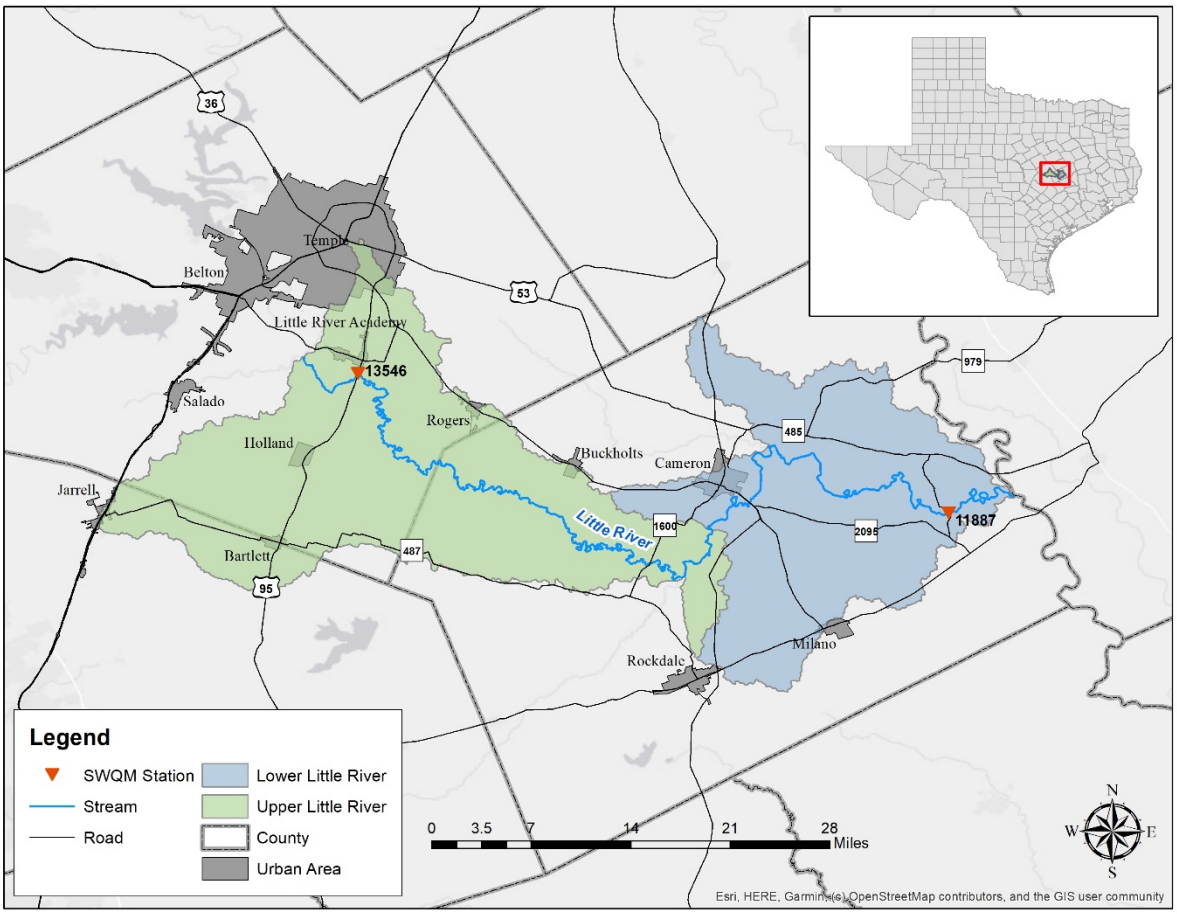


Figure A6.1. Little River Watershed and SWQM monitoring stations

Table A6.1. Project Plan Milestones

Task	Project Milestones	Agency	Start Month	End Month
3.1	Water Quality Monitoring – Upon QAPP approval, TWRI will conduct monthly ambient water quality monitoring at two sites for 18 months (36 total samples). Sampling will include basic field parameters (temperature, pH, DO, specific conductivity, Secchi depth, and flow where conditions allow) and grab sample collection (analyzed for *E. coli*). Water samples will be delivered to ATL within the appropriate holding time for bacterial analysis.	TWRI/ ATL	5	22
3.2	ATL will transfer completed lab analysis data to TWRI who will maintain a master database of collected data. Data will be submitted to TSSWCB by TWRI for submission to SWQMIS on a quarterly basis.	TWRI/ ATL	5	24

TWRI will be responsible for the collection and transport of all water quality samples to ATL within appropriate sample holding times and in accordance with this QAPP. Sampling will be conducted routinely at the sampling sites designated in Tables A6.2.

ATL will receive water samples and analyze them for *E. coli* enumeration.

Table A6.2. Little River

TCEQ Station ID	Site Description	Latitude	Longitude	Start Date (Upon QAPP approval)	End Date	Mode of Sampling	Sample Matrix	# of Monitoring Events	Sampling Entity	Monitor Type*
11887	LITTLE RIVER 63 METERS UPSTREAM OF MILAM CR 264 NORTH OF GAUSE	30.825001	-96.744446	03/2023	08/2024	Grab	Water	18	TWRI	RT
13546	LITTLE RIVER IMMEDIATELY DOWNSTREAM OF SH 95 NEAR LITTLE RIVER ACADEMY	30.966629	-97.345985	03/2023	08/2024	Grab	Water	18	TWRI	RT

*Monitor type description can be found in table A9.1.

Section A7: Quality Objectives and Criteria for Data Quality

Personnel at TWRI will conduct water quality monitoring on stations 11887, and 13546 in the Little River Watershed. The objectives of the water quality sampling for this project are as follows:

1) Collect additional water quality data at two locations to build a sufficient data set to allow for future instream water quality condition assessments

Surface Water Quality Monitoring (SWQM) – The goal of this section is to ensure that data collected meets the data quality objectives (DQOs) of the project. The objective of this project is to gather supplemental water quality data for the Little River Watershed.

Following are actions that will be undertaken by this project to assess bacterial pollution within the Little River watershed:

- Monitor water quality as related to bacteria

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

Consistent with the most recent version of the TCEQ *Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods* (TCEQ SOP, V1) (TCEQ 2012), routine grab samples will be collected on a monthly basis. During routine sampling measurements of DO, specific conductance, Secchi depth, pH, stream flow, and water temperature will be obtained *in situ*. These data will be logged on field data sheets and incorporated into a computer-based database maintained by TWRI.

Water samples collected will be transported to ATL for bacteria enumeration. TWRI will deliver water samples to ATL within designated holding times for respective analysis; ATL 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 bacteria and yield data acceptable for the TCEQ's water quality assessment. A full listing of AWRLs can be found at https://www.tceq.texas.gov/assets/public/waterquality/crp/QA/awrlmaster.pdf.

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 by the laboratory analyzing the sample. Analytical results shall be reported down to the laboratory's LOQ (i.e., the laboratory's LOQ for a given parameter is its reporting limit).

The following requirements must be met in order to report results to TCEQ for inclusion in SWQMIS:

- The laboratory's LOQ for bacteria must be at or below the AWRL as a matter of routine practice

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) or sample/duplicate pairs in the case of bacterial analysis. 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.

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 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. For this project, monthly sampling will be conducted. 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.

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 and as described in this QAPP and in 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 the Data Management Plan Section B10.

Completeness
The completeness of the data is basically a relationship of 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.

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.

Table A7.1. Measurement Performance Specifications

	Bacteriological Parameters in Water										
Parameter	**Units**	**Matrix**	**Method**	**Parameter Code**	**AWRL**	**LOQ**	**LOQ Check Sample %Rec**	**Precision (RPD of LCS/LCSD)**	**Bias %Rec. of LCS**	**Lab**	**Completeness (%)**
E. coli, IDEXX	MPN/100 mL	water	9223 B	31699	1	1	NA	0.50*	NA	ATL	90
E. coli IDEXX, Holding Time	hours	water	NA	31704	NA	NA	NA	NA	NA	ATL	90

* 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.

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, 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).

Table A7.2. Measurement Performance Specifications for Field Parameters

Parameter	Units	Matrix	Method	Parameter Code	AWRL*	Limit of Quantitation (LOQ)	Recovery at LOQ (%)	PRECISION (RPD of LCS/LCSD)	BIAS %Rec. of LCS	Completeness (%)
pH (standard units)	s.u.	water	SM4500 H^+-B and TCEQ SOP V1	00400	NA	NA	NA	NA	NA	90
Oxygen, dissolved	mg/L	water	SM4500 O-G and TCEQ SOP V1	00300	NA	NA	NA	NA	NA	90
specific conductance, field (us/cm @ 25c)	uS/cm	water	SM2510 B and TCEQ SOP V1	00094	NA	NA	NA	NA	NA	90
Temperature	°C	water	SM2550B and TCEQ SOP V1	00010	NA	NA	NA	NA	NA	90
FLOW STREAM, INSTANTANEOUS (CUBIC FEET PER SEC)*****	cfs	water	TCEQ SOP V1 and USGS 2013	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 and USGS 2013	89835	NA	NA	NA	NA	NA	90
Secchi Depth	meters	water	TCEQ SOP V1	00078	NA	NA	NA	NA	NA	90
Days since last significant rainfall	days	other	TCEQ SOP V1	72053	NA	NA	NA	NA	NA	90
Depth of bottom of water body at sample site	meters	water	TCEQ SOP V1	82903	NA	NA	NA	NA	NA	90
Maximum pool width[1]	meters	water	TCEQ SOP V1	89864	NA	NA	NA	NA	NA	90
Maximum pool depth[1]	meters	water	TCEQ SOP V1	89865	NA	NA	NA	NA	NA	90
Pool length in meters[1]	meters	water	TCEQ SOP V1	89869	NA	NA	NA	NA	NA	90
Percentage the pool covers within a 500 meter reach[1]	meters	water	TCEQ SOP V1	89870	NA	NA	NA	NA	NA	90

[1] Parameters for pools to be reported only if pooled conditions are sampled as outlined under the TCEQ Interim Guidance for Routine Surface Water Quality Monitoring During Extended Drought.

References:
* Reporting to be consistent with SWQM guidance and based on measurement capability.
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.)
USGS 2013 – Techniques and Methods 3-A22. Measuring Discharge with Acoustic Doppler Current Profilers from a Moving Boat.
TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods, 2012 (RG-415).
TCEQ SOP, V2 - TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data, 2014 (RG-416).

Section A8: Special Training Requirements/Certification

Surface Water Quality Monitoring

Work conducted for this project is covered under and documented in this QAPP. 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 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

SWQM- Hard copies of 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 for at least five years. In addition, TWRI will archive electronic forms of all project data for at least five years. All electronic data are backed up on an external networked server. 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* (2016) 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, ATL generates a Report Cover Page, a Laboratory Analysis Report, and a Quality Control Data Report. The chain of custody documentation, field data sheets, and subcontract laboratory reports (if applicable) are attached to form the final report. ATL reviews the report and submits it to the TWRI QAO for additional review. Upon final review by the TWRI QAO, the report is submitted to the TWRI PM for electronic submittal to SWQMIS.

Electronic Data

Data will be submitted to the TCEQ by TWRI in the event/result format specified in the most current version of the TCEQ DMRG for upload to SWQMIS. The DMRG can be found at https://www.tceq.texas.gov/waterquality/data-management/dmrg_index.html. 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 alphanumeric codes 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 condition (for example, high flow events), and intent of sample collection.

Table A9.1. SWQMIS Data Entry Codes

Sample Description	Tag Prefix	Submitting Entity	Collecting Entity	Monitoring Type
Routine Monitoring	TX[1]	TX[1]	WR[2]	RT*

[1]TX: code for the Texas State Soil and Water Conservation Board
[2]WR: code for the Texas Water Resources Institute
*RT: samples are scheduled in advance without intentionally trying to target any certain environmental condition. The sample is collected regardless of the conditions encountered.
Water quality monitoring data which are determined to meet spatial, temporal, and other sample collection and quality requirements necessary for 305(b)/303(d) assessment should be coded "RT". Additional details about the sampling considerations for the 305(b)/303(d) assessment are included in the *Guidance for Assessing and Reporting Surface Water Quality in Texas.* Data which do not meet applicable requirements should be coded "RTWD".

Combined 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 LDC analysis will be developed.

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 routinely. 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 A9.2. Project Documents and Records

Document/Record	Location	Retention	Form
QAPP, amendments, and appendices	TWRI	5 years	Electronic
QAPP distribution documentation	TWRI	5 years	Paper/Electronic
Corrective Action Reports (CARs)	TWRI/ATL	5 years	Paper/Electronic
Training Records	TWRI	5 years	Paper/Electronic
Field notebooks or field data sheets	TWRI	5 years	Paper/Electronic
Field equipment calibration/maintenance	TWRI	5 years	Paper/Electronic
Chain of custody records	TWRI/ATL	5 years	Paper/Electronic
Laboratory QA manuals	ATL	5 years	Paper/Electronic
Laboratory SOPs	ATL	5 years	Paper/Electronic
Laboratory procedures	ATL	5 years	Paper/Electronic
Instrument raw data files	ATL	5 years	Paper/Electronic
Instrument readings/printouts	ATL	5 years	Paper/Electronic
Laboratory data reports/results	ATL	5 years	Paper/Electronic
Laboratory equipment maintenance logs	ATL	5 years	Paper/Electronic
Laboratory calibration records	ATL	5 years	Paper/Electronic
Progress Reports/Final Reports	TWRI/TSSWCB	3 years	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)

SWQM- The sampling conducted for this project is intended to assess water quality in the Little River watershed. Sampling will be conducted on a monthly basis at two stations in the watershed for all constituents, following TCEQ SOP, V1. *E. coli* bacteria is the primary parameter of concern. Sampling types, frequencies and locations are described in Table A6.2. 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 as outlined in Table A7.1. If warranted, flow measurements made in waters deeper than 2.5 feet will be conducted as described in the U.S. Geological Survey's Measuring Discharge with Acoustic Doppler Current Profilers from a Moving Boat (USGS 2013) using a Son-Tek model M9 River Surveyor.

In order to obtain representative results, ambient water sampling will occur on a routine schedule over the course of 18 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 two stations, one of which that has been historically monitored by the Brazos River Authority (BRA).

Station 11887, Little River at CR 264 Located on segment 1213, is north of the town of Gause, and is the most downstream publicly accessible point before the confluence with the Brazos River

Station 13546, Little River at SH 95 Located on segment 1213, is south of Little River Academy. It is the first accessible point downstream of the confluence of the Lampasas and Leon Rivers, and Salado Creek.

The monitoring stations are included in Table A6.2. Detailed site location maps are located in Section A6.

Section B2: Sampling Method Requirements / Data Collection Method

SWQM

Field Sampling Procedures

Field sampling will be conducted according to procedures documented in the latest version of the TCEQ SOP, V1. Additional aspects outlined in Section B below reflect specific requirements for sampling. 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
- flow rate
- sample collector's name/signature

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. Perennial pool measurements will also be recorded with observations such as maximum pool width, maximum pool depth, pool length, and percent pool coverage in 500 meter reach.

Typically, water samples will be collected directly from the stream (midway in the stream channel) into approved sample containers.

Certificates from sample container manufacturers are maintained by ATL.

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 three times between stations. 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 or using an established rating curve as described in the TCEQ SOP, V1 (https://www.tceq.texas.gov/publications/rg/rg-415) or in USGS's Measuring Discharge with Acoustic Doppler Profilers from a Moving Boat (USGS 2013, https://pubs.usgs.gov/tm/3a22/pdf/tm3a22.pdf). 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
E. coli *	Water	SPS	< 6°C (but not frozen); sodium thiosulfate	100 ml (minimum); 250 ml (duplicates)	8 hours

* *E.coli* samples should always be processed as soon as possible and within 8 hours.
**Container Types: SPS = Sterile Polyethylene

Sample Containers
The preferred bacteriological sample containers are the 120 and 290 mL bottles from QEC or IDEXX (or equivalent). The bottles contain sufficient sodium thiosulfate to remove 10 mg/L or 15 mg/L total chlorine, respectively. ATL will provide sealed, sterile glass and/or plastic bottles for bacteria samples.

Processes to Prevent Contamination
The most recent version of the TCEQ SOP, V1 (https://www.tceq.texas.gov/publications/rg/rg-415) outlines the necessary steps to prevent contamination of samples. These include: direct collection into sample containers, when possible. Field QC samples as discussed in Section B5 are collected to verify that contamination has not occurred.

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 TWRI PM. The project managers in consultation will determine if the deviation from the QAPP compromises the validity of the resulting data. The project managers, in consultation with the TWRI 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 Requirements

SWQM

Chain-of-Custody (COC)

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 list of items below is included on the COC form (See Appendix C for sample form).

1. Date and time of sample collection, shipping and receiving
2. Site identification and short description
3. Sample matrix
4. Number of containers
5. Preservative used
6. Analyses required
7. Name of collector
8. Custody transfer signatures and dates and time of transfer

Sample Labeling

Samples will be labeled on the container with an indelible, waterproof marker. Label information will include site identification, date, sampler's initials, and time of sampling. 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.

Upon collection, sealing of the sample and following proper labeling, water samples are placed in an insulated cooler on ice and transported to the designated lab along with appropriate COCs within prescribed holding times. Routine samples will be delivered to ATL for processing. Once at the lab, samples and COCs are transferred to lab staff, are logged into the lab and analysis/bench sheets specific to the respective laboratory are established for each

sample. Samples are placed in a refrigerated cooler dedicated to sample storage until sample processing begins. The LM has the responsibility to ensure that holding times are met with water samples. The holding time is documented on the COC.

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 used to document sample handling during transfer from the field to the laboratory and among contractors. The following information concerning the sample is recorded on the COC form (See Appendix C):

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

Sample Tracking Procedure Deficiencies and Corrective Action
All failures associated with chain-of-custody procedures as described in this QAPP are immediately reported to the TWRI PM. These 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 TWRI PM, in consultation with the TWRI QAO, will determine if the procedural violation may have compromised the validity of the resulting data. Any failures that have reasonable potential to compromise data validity will invalidate data, and the sampling event should be repeated. The resolution of the situation will be reported to the TSSWCB PM in the project progress report. CARs will be prepared by the TWRI QAO and submitted to the TSSWCB PM along with project progress reports.

Section B4: Analytical Methods

SWQM- 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 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 SOP, V1 or other reliable procedures acceptable to TCEQ.

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 ATL LM, who will make the determination and notify the TWRI QAO. If the analytical system failure may compromise the sample results, the resulting data will not be reported to the TCEQ SWQMIS database. 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 it with the QPR, which is sent to the TSSWCB PM.

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

The TCEQ has determined that analyses associated with the qualifier codes (e.g. "holding time exceedance", "sample received unpreserved", "estimated value", etc.) may have unacceptable measurement uncertainty associated with them. 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 most recent version of the SWQM DMRG.

Section B5: Quality Control Requirements

SWQM
Sampling Quality Control Requirements and Acceptability Criteria

The minimum Field QC Requirements are outlined in the TCEQ SWQM Procedures, Volume 1 *(*2012). Specific requirements are outlined below. These procedures were revised in 2014 to eliminate the requirement for a Field Split. Field blanks are also not required for bacteriological samples.

Table B5.1. Required Quality Control Analyses

Parameter	Matrix	LCS	Lab Dup	Field Blank	Method Blank
E. coli	*Water*	*NA*	√	*NA*	√

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, digestate. 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, are run (e.g., sample duplicates, surrogates, internal standards, continuing calibration samples, interference check samples, positive control, negative control, and media blank) 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.

Laboratory Duplicates
A laboratory duplicate is prepared by taking aliquots of a sample from the same container under laboratory conditions and processed and analyzed independently. For bacteriological parameters, precision is evaluated using the results from laboratory duplicates. Bacteriological duplicates are collected on a 10% frequency (or once per sampling run, whichever is more

frequent). These duplicates will be collected in sufficient volume (200 mL or more) for analysis of the sample and its laboratory duplicate from the same container.

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

If the difference in logarithms is greater than the precision criterion, the data are not acceptable for use under this project and will not be reported to TCEQ. Results from all samples associated with that failed duplicate (usually a maximum of 10 samples) will be considered to have excessive analytical variability and will be qualified as not meeting project QC requirements.

The precision criterion in Table A7.1 for bacteriological duplicates applies only to samples with concentrations > 10 MPN/100mL. Field splits will not be collected for bacteriological analyses.

Quality Control or Acceptability Requirement Deficiencies and Corrective Actions

Sampling QC excursions are evaluated by the TWRI PM, in consultation with the TWRI QAO. In that differences in sample results are used to assess the entire sampling process, including environmental variability, the rejection of results based on pre-determined limits may not be necessary for project purposes. Therefore, the professional judgment of the TWRI PM and QAO will be relied upon in evaluating results.

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 ATL QAO. The Laboratory QAO will discuss with the TWRI PM. If applicable, the TWRI PM 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, nonconformance, and corrective action are defined in Section C1.

Section B6: Equipment Testing, Inspection, & Maintenance Requirements

SWQM

All sampling equipment testing and maintenance requirements are detailed in the most recent version of the 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

SWQM- In-stream field equipment calibration requirements are contained in the most recent version of the TCEQ SOP, V1 or manufacturers manuals. Equipment will be tested, maintained, inspected, and calibrated according to these procedures. Post calibration error limits and the disposition resulting from error are adhered to. Data not meeting post-error limit requirements invalidates associated data collected subsequent to the pre-calibration and are not submitted to the TCEQ.

Detailed laboratory calibrations are contained within the laboratory QM(s), SOPs, and manufacturers manuals as appropriate and will be tested, maintained, inspected, and calibrated according to these procedures.

Section B8: Inspection/Acceptance Requirements for Supplies and Consumables

SWQM- New batches of supplies are tested before use to verify that they function properly and are not contaminated. The laboratory QM provides additional details on acceptance requirements for laboratory supplies and consumables.

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

SWQM- Water quality data available in TCEQ's SWQMIS will be used as historical references for instream water quality and conditions. US Geologic Survey (USGS) flow data available in the watersheds 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	TCEQ SWQM Program	TCEQ	9/1/1990 - Current at stations historically monitored by TCEQ in Table A6.2	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 in Table A6.2	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

Any non-direct measurements will comply with all requirements under this QAPP. Sampling conducted by the TCEQ and USGS is not covered under this QAPP and will not be reported to the TSSWCB PM by the TWRI. However, data collected by the above organizations that meet the data quality objectives of this project will be useful in satisfying the data and informational needs of the project. The collection and qualification of the TCEQ and USGS data are addressed in the TCEQ Surface Water Quality Monitoring QAPP. Parameters utilized will include instantaneous stream flow, temperature, pH, specific conductance, Secchi depth, DO, and *E. coli* as available. Potential sources where data will be acquired from are included in Table B9.1. No limitations will be placed on these data as they have been vetted by the TCEQ SWQM Data Management and Assessment Team and were collected under a TCEQ approved QAPP.

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

Data Management Process

Samples are collected by field staff and delivered to the laboratory for analyses as described in Sections B1 and B2. Sampling information (e.g. site location, date, time, sampling depth, etc.) is used to generate a unique sampling event in alphanumeric format by TWRI into a Microsoft Access database and/or Microsoft Excel spreadsheet and visually inspected for errors. Measurement results from the field data sheets are manually entered by field personnel into the TWRI database for their corresponding event. Data generated by the lab are entered on to the lab data sheets which are then transferred to TWRI. TWRI staff will enter these lab data into their database for the corresponding event. Customized data entry forms facilitate accurate data entry. Following data verification and validation by the TWRI Data Manager, the data are exported from the TWRI database into the pipe delimited Event/Result format required for submission to TCEQ's SWQMIS (as described in the SWQM DMRG December 2016 or later version). Once TCEQ approval of the data is obtained, the data are loaded into SWQMIS by TCEQ data managers.

Personnel

Ms. Shaylynn Postma is the TWRI PM/Field Supervisor and will provide overall project management for TWRI. She is responsible for ensuring that the data are managed according to the data management plan and QAPP, and for ensuring the use of appropriate data collection techniques in the field, its proper documentation on field data sheets and the timely delivery of samples to the appropriate lab.

Ms. Stephanie deVilleneuve is the TWRI QAO/Data Manager and is responsible for ensuring that project data are scientifically valid, legally defensible, of known precision, accuracy and integrity, meet the data quality objectives of the project, and are reportable to TSSWCB. She is also responsible for data storage, processing and delivery to TSSWCB.

Hardware and Software Requirements

Hardware configurations are sufficient to run Microsoft Access 2010 or newer under the Windows 10 or newer operating system in a networked environment. Information Technology (IT) 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 IT department.

The types of TWRI computer equipment, hardware, and software to be used on the project are provided below. Data for this project will submitted to TSSWCB using Excel workbooks, Word documents, and GIS files both in a format and using media compatible with TSSWCB systems.

Table B10.1. Listing of Project Hardware and Software

Equipment & software name	Type	Specification	Use
Dell/HP PC Computers	Hardware	Intel Core Processor, 8 GB Ram or more, Windows 10 Enterprise	Support data gathering, data analysis, and report generation.
Microsoft Teams and OneDrive	Software	Enterprise managed software	Project file management and data backup.
ArcGIS Pro	Software	Window interface	Development of maps and spatial analyses
Microsoft Office 365 Software (Excel, Word, PowerPoint)	Software	Windows platform	Data preparation, report writing, presentations

Data Handling

Data are processed using the Microsoft Access 2010 or newer suite of tools and applications. Data integrity is maintained by the implementation of password protections which control access to the database and by limiting update rights to a select user group. No data from external sources are maintained in the database. The database administrator is responsible for assigning user rights and assuring database integrity.

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

Tag Prefix:	TX - Texas State Soil and Water Conservation Board
Submitting Entity:	TX - Texas State Soil and Water Conservation Board
Collecting Entity:	WR- Texas Water Resources Institute

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
- 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
- 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
- Data not meeting post-cal requirements
- Post-calibration error limits for multiprobe instrumentation (Table 8.3 in SWQM PM)

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 TCEQ.

Archives/Data Retention
Complete original data sets are archived on permanent paper and electronic media and retained on-site by TWRI for a retention period specified in section A9.

Record-keeping and Data Storage
TWRI record keeping and document control procedures are contained in the water quality sampling and SOPs and this QAPP. Original field and laboratory data sheets are stored in the TWRI offices in accordance with the record-retention schedule in Section A9. Electronic copies of the data sheets are also maintained on network servers, external drives and personal computers. The database backed up following each data entry event on network servers, external drives and personal computers. If necessary, disaster recovery will be accomplished by information resources staff using the backup database.

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

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, etc.	Continuous	TWRI	Monitor project status and records to ensure requirements are being fulfilled. Monitoring & review performance & data quality	Report to TSSWCB in QPR.
Equipment testing	As needed	ATL/TWRI	Pass/Fail equipment testing	Repair or replace
Data completeness	As needed	ATL/TWRI	Assess samples analyzed vs. planned analysis	Reanalyze or amend objectives
Laboratory Inspections	TBD by TSSWCB	TSSWCB	Analytical and QC procedures in the laboratory	45 days to respond to TSSWCB with corrective actions
Technical systems audit	As needed	TSSWCB	Assess compliance with QAPP; review facility and data management as they relate to the project	45 days to respond to TSSWCB with corrective actions
Monitoring Systems Audit	Once per life of project	TSSWCB	Assess compliance with QAPP; review field sampling and data management as they relate to the project	45 days to respond to TSSWCB with corrective actions

In-house review of data quality and staff performance to assure that work is being performed in compliance with the QAPP will be conducted by all entities. If review 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) will 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 require 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
- Evaluate the need for qualification or exclusion of data

The status of CARs will be included with quarterly progress reports. In addition, significant conditions (i.e., situations which, 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 PM and Project Co-Leaders 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 for this project will summarize the activities completed and conclusions reached during the project and discuss the extent to which project goals and measures of success have been achieved. Data collected under this QAPP will be summarized in the final report. Items in this report will include a very brief description of methodologies utilized and implications of these findings.

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 which are listed in Section A7. Only those data which 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 ATL LM and ATL QAO are responsible for ensuring that laboratory data are scientifically valid, defensible, of acceptable precision and bias, and reviewed for integrity. The TWRI DM 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 ATL QAO is responsible for validating a minimum of 10% of the data produced in each task. Finally, the ATL QAO 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

SWQM

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

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 TWRI DM and QAO. 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 TWRI PM verifies 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 TWRI DM with the data. This information is communicated to the TSSWCB by the TWRI in the Data Summary (See Appendix D).

Section D3: Reconciliation with User Requirements

SWQM

Data produced in this project, and data collected by other organizations will be analyzed and used in the development of water quality restoration plans. Data that do not meet requirements described in this QAPP will not be submitted to SWQMIS nor will it be considered appropriate for any of the uses noted above.

Data collected from this project will be analyzed by TWRI to document the current state of water quality in Little River. Data will be used to augment the existing geometric means that will be compared to the water quality standard.

Data produced in this project will be analyzed and reconciled with project data quality requirements. Data meeting project requirements may be used for TMDL development, water quality standards development, and permit decisions as appropriate. Data that do not meet data quality objectives outlined in this document will not be submitted to SWQMIS.

References

TCEQ. 2019. Surface Water Quality Data Management Reference Guide. Water Quality Planning Division, Monitoring & Assessment Section, Data Management & Analysis Team. https://www.tceq.texas.gov/assets/public/waterquality/dma/dmrg/dmrg_complete.pdf

TCEQ. 2019. Draft 2018 Guidance for Assessing and Reporting Surface Water Quality in Texas (May 2019): In Compliance with Sections 305(b) and 303(d) of the Federal Clean Water Act. https://www.tceq.texas.gov/assets/public/waterquality/swqm/assess/gawg/2018/2018_guidance.pdf

TCEQ. 2012. Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods. TCEQ, RG-415 Revised August 2012. https://www.tceq.texas.gov/publications/rg/rg-415

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

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USGS 2013. "Measuring Discharge with Acoustic Doppler Current Profilers from a Moving Boat." In Surface-Water Techniques. Techniques and Methods 3-A22 Version 2.0. https://pubs.usgs.gov/tm/3a22/pdf/tm3a22.pdf

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Appendix A: 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: Field Data Reporting Form

Little River Supplemental Watershed Monitoring Field Data Form

PLEASE PRINT (Black, Indelible Ink)

Monitor's Name:		Station ID #:
Sample Location:		Sample Type: Routine
Date: (M M D D Y Y)	Sample Time (6 hr): (H H M M)	Sample Depth (Meters): [Not Total Depth]

Field Measurements

Code	Data	Descriptor
00400		pH (Standard Units)
00010		Water Temperature (Celsius)
00300		Dissolved Oxygen (mg/L)
00094		Specific Conductance (micro S/cm)
00061		Instantaneous Stream Flow (cfs)
00078		Secchi Depth (meters)
31699		*E. coli* IDEXX Method MPN/100mL
31704		*E. coli* IDEXX Holding Time (hours)
82903		Depth to water bottom at sample site (Meters)
74069		Steamflow estimate (cfs)
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-wier/flume, 5-doppler)
72053		Days since last significant rainfall
If sampling from an perennial pool (isolated pool)		
89864		Maximum pool width (Meters)
89865		Maximum pool depth (Meters)
89869		Pool length (Meters)
89870		Percentage the pool covers within a 500 meter reach

Parameters Collected (Circle Appropiate): *E. coli* (IDEXX) 9223 B

Other Observations:

Comments:

I CERTIFY THAT ALL PROCEDURES HAVE BEEN FOLLOWED AND THIS INFORMATION IS ACCURATE TO THE BEST OF MY ABILITY.

CERTIFIED MONITOR'S SIGNATURE _____ DATE _____ DATA MANAGER'S SIGNATURE _____ DATE _____

Appendix C: Chain of Custody Record

AQUA-TECH LABORATORIES, INC.

Chain-of-Custody and Analysis Request

Client /Project:

Contact Info

Name
Address
City State ZIP
Phone / Email

Definitions

DW - Drinking Water
NP - Non-Potable Water
S - Solid

(+) Container Type
P - Plastic
G - Glass
T - Teflon©

CM - Custody Maintained
CTU - Custody Transfer Unbroken
CT - Corrected Temperature
SUB - Subcontracted Analysis

By relinquishing the samples listed below to Aqua-Tech, the client agrees to the following terms.
Samples will be analyzed by a method that is within Aqua-Tech Laboratories' NELAC fields of accreditation. Analytes requiring a certified method that is not within Aqua-Tech's fields of accreditation will be subcontracted to a NELAC certified lab that is certified for that method. Clients will be notified of the subcontract lab's details. Other analytes not requiring accreditation will be analyzed by a compendial method. If a specific method is required, the client will note the method in the "Analysis Requested" column. The client approves all method modifications documented by Aqua-Tech or the subcontract lab. A current list of Aqua-Tech's NELAC fields of accreditation and other methods are available on request.

Client Comments:

* Preservatives		Receipt in Lab		
1	< 6 °C (unfrozen)	Cooler ID :		
2	H2SO4	Temperature (°C) : read / CT		
3	HCl			
4	HNO3	Preservation Correct ?	YES NO	YES NO
5	Na2S2O3	Post Preservatives ?	YES NO	YES NO
6	NaOH	Thermometer ID :		
7		pH Paper ID :		

Lab Comments

Aqua-Tech Laboratories, Inc.

Austin
7500 Hwy 71 W Suite 105
Austin, TX 78735
512.301.9559

Bryan
635 Phil Gramm Blvd.
Bryan, TX 77807
979.778.3707

T104704371
TX239

Test results meet all accreditation/certification requirements unless stated otherwise.

Work Order / C-O-C

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V-0023 R03

Sample Custody

Relinquished by (print & sign)	☐ Sampler ☐ Client ☐ ATL Field	Date / Time	☐ Iced / Refrig ☐ Custody Sealed
Received by (print & sign)	☐ Client ☐ ATL Field	Date / Time	☐ Iced / Refrig ☐ CM / CTU
Relinquished by (print & sign)	☐ Client ☐ ATL Field	Date / Time	☐ Iced / Refrig ☐ CM / CTU
Received by (print & sign)	☐ Client ☐ ATL Field	Date / Time	☐ Iced / Refrig ☐ CM / CTU
Relinquished by (print & sign)	☐ Client ☐ ATL Field	Date / Time	☐ Iced / Refrig ☐ CM / CTU / sealed
Received by (print & sign)	☐ Lab	Date / Time	☐ Cond Good ☐ Iced / Refrig ☐ CM / CTU

Field Sample ID (record field data for each sample in space below)	Start Date	Start Time	End Date	End Time	Composite Type	Sample Matrix	Container(s) Bottle Count	Volume (Size in L)	Type (+)	Preserv-ative(s) *	LAB USE ONLY BELOW (initials) Cooler ID	pH Check	SUB	WORK ORDER
														Sample
Analysis Requested & Comments:														
														Sample
Analysis Requested & Comments:														
														Sample
Analysis Requested & Comments:														
														Sample
Analysis Requested & Comments:														
														Sample
Analysis Requested & Comments:														

Appendix D: Data Review Checklist and Data Summary Sheet

Data Review Checklist

Title of associated QAPP: _____

√, X, or N/A

Data Format and Structure

A. Are there any duplicate *Tag ID* numbers? _____
B. Are the *Tag prefixes* correct? _____
C. Are all *Tag ID* numbers 7 characters? _____
D. Are TCEQ station location (SLOC) numbers assigned? _____
E. Are sampling *Dates* in the correct format, MM/DD/YYYY? _____
F. Is the sampling *Time* based on the 24-hour clock (e.g. 13:04)? _____
G. Is the *Comment* field filled in where appropriate (e.g. unusual occurrence, sampling problems, unrepresentative of ambient water quality) and any punctuation deleted?

_____

H. *Source Code 1, 2* and *Program Code* are valid and used correctly? _____
I. Is the sampling date in the *Results* file the same as the one in the *Events* file? _____
J. Values represented by a valid parameter (*STORET*) code with the correct units and leading zeros? _____
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 numbers in the *Results* file that are not in the *Events* file? _____
N. Have confirmed outliers been identified? (with a ■1" in the Verify_flg field) _____
O. Have grab data (bacteria, for example) taken during 24-hr events been reported separately as RT samples? _____
P. Is the file in the correct format (ASCII pipe-delimited text)? _____

Data Quality Review

A. Are all the values reported at or below the AWRL? _____
B. Have the outliers been verified? _____
C. Checks on correctness of analysis or data reasonableness performed?
e.g.: Is ortho-phosphorus less than total phosphorus?
Are dissolved metal concentrations less than or equal to total metals? _____
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

A. Are blank results acceptable as specified in the QAPP? _____
B. Were control charts used to determine the acceptability of field duplicates? _____
C. Was documentation of any unusual occurrences that may affect water quality included in the Event file 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 on next page. _____
E. Were there any failures in field and laboratory measurement systems that were not resolvable and resulted in unreportable data? If yes, explain on next page. _____

√ = Yes **X = No** **N/A** = Not applicable

Describe any data reporting inconsistencies with AWRL specifications. Explain failures in sampling methods and field and laboratory measurement systems that resulted in data that could not be reported to the TCEQ. (attach another page if necessary):

_____

_____

_____

_____

_____

Date Submitted to TCEQ: _____
Tag ID Series: _____
Date Range: _____
Data Source: _____
Comments (attach README.TXT file if applicable):

_____

_____

_____

_____

Planning Agency's Data Manager Signature: _____

Date: _____

DATA SUMMARY

Data Set Information

Data Source: _____.

Date Submitted: _____.

Tag_id Range: _____.

Date Range: _____.

Comments:

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

- Inconsistencies with AWRL specifications or 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).
- Include completed Corrective Action Plans with the applicable Progress Report.

_____

_____

_____

_____

_____

_____

_____

_____

☐ 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 Data Review Checklist.

Planning Agency Data Manager: _____.

Date: _____.