

**Clean Water Act Section 319(h) Nonpoint Source Pollution  
Control Program**

**Implementation of the Double Bayou Watershed Protection Plan: Monitoring,  
Coordination, and Stakeholder Outreach  
TSSWCB Project No. 22-13  
Revision No. 0**

**Monitoring Quality Assurance Project Plan**

**Texas State Soil and Water Conservation Board**

**Prepared by:**

**Houston Advanced Research Center/  
Geotechnology Research Institute (GTRI),  
United States Geological Survey**

**Effective Period: Upon EPA Approval through August 31, 2025**  
(with annual revisions required)

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

**Dr. Ryan Bare, GTRI  
8801 Gosling Road  
The Woodlands, Texas 77381  
(281) 364-6050  
rbare@harcresearch.org**

*This page intentionally left blank*

**A1 APPROVAL PAGE**

Monitoring Quality Assurance Project Plan (QAPP) for *Implementation of the Double Bayou Watershed Protection Plan: Monitoring, Coordination, and Stakeholder Outreach*

**United States Environmental Protection Agency (EPA), Region VI**

Name: Nelly Smith  
Title: EPA Chief; State/Tribal Programs Section

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Name: Anthony Suttice  
Title: EPA Texas Nonpoint Source Project Officer

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

**Texas State Soil and Water Conservation Board (TSSWCB)**

Name: Brian Koch  
Title: TSSWCB Project Manager (PM)

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

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

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

**Houston Advanced Research Center/Geotechnology Research Institute (GTRI)**

Name: Ryan Bare  
Title: GTRI PM/Data Manager

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Name: Ebrahim Eslami  
Title: GTRI Safety Coordinator and QAO

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

**United States Geological Survey (USGS)**

Name: Mike Lee  
Title: Project Chief

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Name: Zulimar Lucena  
Title: GCPO Water Science Center QAO

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

**North Water District Laboratory Services (NWDLS)**

Name: Monica Martin  
Title: NWDLS Project Manager

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

GTRI will secure written documentation (via a return receipt memorandum) from each project participant within 30 days, e.g., laboratories, partners, etc., stating the organization's awareness of and commitment to requirements contained in this quality assurance plan and any amendments or revisions of this plan. The GTRI QAO will maintain this documentation as part of the project's quality assurance records.

**A2 TABLE OF CONTENTS**

A1 APPROVAL PAGE ..... 3  
A2 TABLE OF CONTENTS ..... 5  
A3 DISTRIBUTION LIST ..... 6  
A4 PROJECT/TASK ORGANIZATION ..... 9  
A5 PROBLEM DEFINITION/BACKGROUND ..... 13  
A6 PROJECT/TASK DESCRIPTION ..... 16  
A7 QUALITY OBJECTIVES AND CRITERIA ..... 18  
A8 SPECIAL TRAINING/CERTIFICATION ..... 24  
A9 DOCUMENTS AND RECORDS ..... 25  
B1 SAMPLING PROCESS DESIGN ..... 29  
B2 SAMPLING METHODS ..... 32  
B3 SAMPLE HANDLING AND CUSTODY ..... 37  
B4 ANALYTICAL METHODS ..... 40  
B5 QUALITY CONTROL ..... 42  
B6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE.. 48  
B7 INSTRUMENT CALIBRATION AND FREQUENCY ..... 49  
B8 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES..... 50  
B9 NON-DIRECT MEASUREMENTS..... 51  
B10 DATA MANAGEMENT ..... 53  
C1 ASSESSMENTS AND RESPONSE ACTIONS ..... 56  
C2 REPORTS TO MANAGEMENT ..... 57  
D1 DATA REVIEW, VERIFICATION, AND VALIDATION ..... 58  
D2 VERIFICATION AND VALIDATION METHODS ..... 59  
D3 RECONCILIATION WITH USER REQUIREMENTS..... 61  
References..... 62  
*Appendix A. USGS Field Forms*..... 64  
*Appendix B. Laboratory Forms*..... 65  
*Appendix C. Corrective Action Report*..... 66  
*Appendix D. Data Summary Report* ..... 67

**Figures and Tables**

Figure A4.1 - Project Organizational Chart\* – Lines of Communication ..... 12  
Figure A5.2- Double Bayou Watershed Impairments and Sampling Locations ..... 15  
  
Table A6.1a- QAPP Milestones..... 17  
Table A7.1b- Measurement Performance Specifications for Water Quality ..... 19  
Table A7.2c- Data Quality Objectives for Laboratory Parameters (in Water) ..... 21  
Table A9.1d- Project Quality Assurance Documents and Records ..... 26  
Table B1.1e- Sampling regime with site locations and number of samples of each type.\* ..... 31  
Table B2.1f- Min. Sample Vol., Container Types, and Preservation & Holding Requirements.. 34  
Table B5.1g - Number and type of field quality-control samples ..... 42  
Table C1.1h - Assessments and Response Requirements..... 56  
Table D2.1i - Data Review Tasks ..... 60

### **A3 DISTRIBUTION LIST**

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

#### **EPA, Region 6**

##### **Water Division (WDAS)**

**1201 Elm Street**

**Dallas, TX 75270**

Name: Anthony Suttice

Title: Texas Nonpoint Source Project Officer, Water Quality Division

#### **TSSWCB**

**1497 Country View Lane**

**Temple, TX 76504**

Name: Brian Koch

Title: TSSWCB PM

Name: Mitch Conine

Title: TSSWCB QAO

#### **GTRI**

**8801 Gosling Road**

**The Woodlands, TX 77381**

Name: Ryan Bare

Title: GTRI PM/Data Manager

Name: Ebrahim Eslami

Title: GTRI Safety Coordinator and QAO

#### **USGS Water Resources**

**19241 David Memorial Drive, Suite 180**

**The Woodlands, TX 77385**

Name: Mike Lee

Title: Project Chief

Name: Zulimar Lucena

Title: GCPO Water Science Center QAO

**North Water District Laboratory Services (NWDLS)  
130 S. Trade Center Pkwy  
Conroe, TX 77385**

Name: Monica Martin  
Title: NWDLS Project Manager

GTRI will provide copies of this QAPP and any amendments or appendices of this QAPP to each person on this list and to each sub-tier project participant, e.g., subcontractors, other units of government, laboratories. GTRI will document distribution of the QAPP and any amendments and appendices, maintain this documentation as part of the project's QA records, and will be available for review.

**List of Acronyms**

ADAPS	Automated Data Processing System
ADCP	Acoustic Doppler Current Profiler
ARRA	American Recovery and Reinvestment Act
ASR	Analytical Services Request
ASTM	American Society for Testing and Materials
AWRL	Ambient Water Reporting Limits
CAR	Corrective Action Report
CCMP	Coastal Conservation and Management Plan
CCV	Continuing Calibration Verification
COC	Chain of Custody
CWA	Clean Water Act
DO	Dissolved Oxygen
DQO	Data Quality Objective
EPA	Environmental Protection Agency
GBEP	Galveston Bay Estuary Program
GIS	Geographic Information System
GTRI	Geotechnology Research Institute
HARC	Houston Advanced Research Center
H-GAC	Houston-Galveston Area Council
IT	Information Technology
LCS	Laboratory Control Standard
LIMS	Laboratory Information Management System
MS	Matrix Spikes
NCDC	National Climatic Data Center
NCR	Nonconformance Report
NELAP	National Environmental Laboratory Accreditation Program
NPS	Non-point source
NWDLS	North Water District Laboratory Services
NWIS	National Water Information System
NWQL	National Water Quality Laboratory

PM	Project Manager
QA	Quality Assurance
QA/QC	Quality Assurance Quality Control
QAM	Quality Assurance Manual
QAO	Quality Assurance Officer
QAPP	Quality Assurance Performance Plan
QC	Quality Control
QM	Quality Manual
QMS	Quality Management System
QWDATA	USGS Water Quality Database
RL	Reporting Limit
RPD	Relative Percent Difference
SAML	Soil and Aquatic Microbial Laboratory
SELECT	Spatially Explicit Load Enrichment Calculation Tool
SOP	Standard Operating Procedure
SWQMIS	TCEQ Surface Water Quality Monitoring Information System
TCEQ	Texas Commission on Environmental Quality
TDS	Total Dissolved Solids
TPDES	Texas Pollutant Discharge Elimination System
TSSWCB	Texas State Soil and Water Conservation Board
USGS	United States Geological Survey
USGSADAPS	USGS Automated Data Processing System
USGS NWIS	USGS National Water Information System
WPP	Watershed Protection Plan
WQMP	Water Quality Management Plan
WSC	Water Science Center
WWTF	Waste Water Treatment Facility



## **A4 PROJECT/TASK ORGANIZATION**

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

### **EPA, Region 6**

#### Anthony Suttice, EPA Project Officer

Responsible for managing the project for EPA. Reviews project progress and reviews and approves QAPP and QAPP amendments.

### **TSSWCB**

#### Brian Koch, 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 GTRI and TSSWCB. Tracks and reviews deliverables to ensure that tasks in the workplan are completed as specified in the contract. Responsible for verifying that the QAPP is followed by GTRI and USGS. Notifies the TSSWCB QAO of significant project nonconformances and corrective actions taken as documented in quarterly progress reports from GTRI PM. Enforces corrective action.

#### Mitch Conine, TSSWCB QAO

Reviews and approves QAPP and any amendments or revisions and ensures distribution of approved/revised QAPPs to TSSWCB participants. Assists the TSSWCB PM on QA-related issues. Coordinates reviews and approvals of QAPPs and amendments or revisions. Conveys QA problems to appropriate TSSWCB management. Monitors implementation of corrective actions. Coordinates and conducts audits.

### **GTRI**

#### Ryan Bare, PM/Data Manager

Guides and oversees the work of the GTRI Software Engineer, Senior GIS Analyst, and Senior Data Analyst. The PM drafts progress reports, communicates and coordinates with the TSSWCB PM and subcontractors. The PM acquires agency data, and with assistance from other members of the project team, conducts statistical analyses and oversees the final graphic and textual deliverables. Responsible for ensuring that data are properly reviewed and verified. Responsible for the transfer of project quality-assured water quality data to the TSSWCB. The PM also revises and submits the QAPP as needed, distributes the QAPP and revisions to project team members, and ensures that all quality assurance elements of the project are implemented by project staff and subcontractors per the QAPP and workplan. Ensures TSSWCB PM and/or QAO are notified of deficiencies and nonconformances, and that issues are resolved. Responsible for validating that data

collected are acceptable for reporting to the TSSWCB. Conducts statistical analyses of the quality assured data following QA procedures as outlined in the QAPP.

Ebrahim Eslami, GTRI QAO

The GTRI QAO assists the GTRI PM in the development and review of the QAPP and other QA/QC elements of the project as required by GTRI QA guidelines and granting agencies. The QAO is not directly involved in the data validation process at the project level. Data validation is overseen by the GTRI PM.

Likun Chen, GTRI Acting Software Engineer

The Software Engineer works under the supervision of the GTRI PM to maintain project servers and is responsible for all data backups. The Software Engineer follows QA procedures outlined in the QAPP under the direct supervision of the GTRI PM.

Qian Song, GTRI Senior GIS Analyst

Works under the supervision of the GTRI PM to develop mapping and GIS products required for the Double Bayou Project. The analyst follows QA procedures outlined in the QAPP under the direct supervision of the GTRI PM.

Kirsten Vernin, GTRI Senior Data Analyst

Works under the supervision of the GTRI PM to obtain data and associated metadata and performs spatial and statistical analyses. The Senior Data Analyst follows QA procedures outlined in the QAPP under the direct supervision of the GTRI PM.

## **United States Geological Survey**

Mike Lee, Project Chief, Data Manager, USGS Gulf Coast Branch of Texas Water Science Center

Responsible for overall project coordination and completion of all water-quality sample collection along the East and West Forks of Double Bayou. Duties also include data assessment, coordination of electronic data transfer, data collection and management activities to ensure that procedures meet project objectives and are consistent with this QAPP. This includes adherence to established protocol, data-accuracy criteria, documentation procedures, and entry of information into the database. Responsible for communication with laboratories to ensure compliance with project specifications.

Zulimar Lucena, Acting QAO, USGS Gulf Coast Branch of the Texas Water Science Center

Responsible for water-quality analyses performed in the USGS Houston laboratory, maintaining QC documentation for instrumentation and equipment, and verification of analytical data provided by the USGS NWQL and contract laboratories.

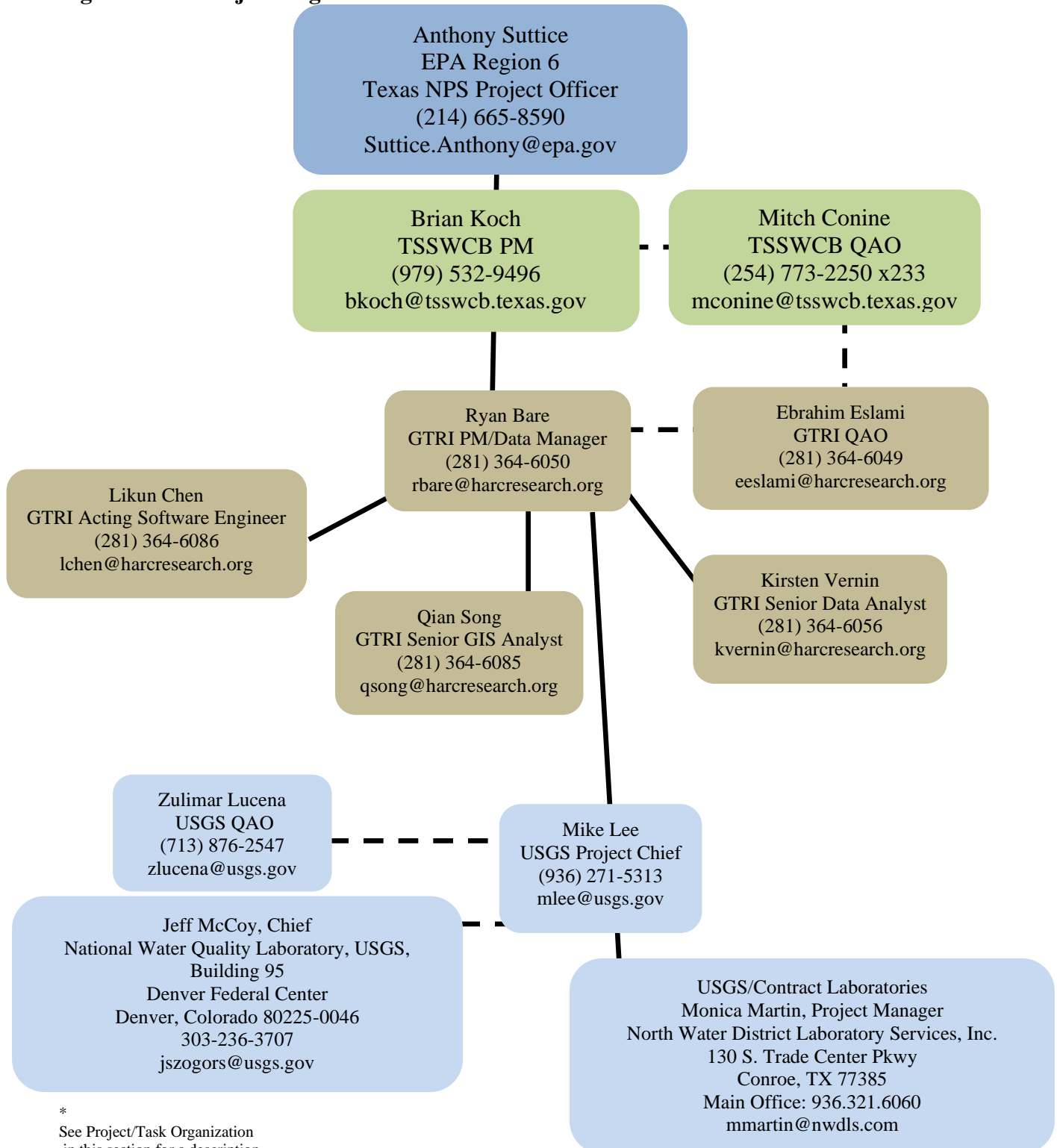
Jeff McCoy, Chief, National Water Quality Laboratory

Responsible for oversight of the National Water Quality Laboratory, which provides quality analytical data, consistent with this QAPP, and maintains verification of procedures that establish the level of quality.

### **Contract Laboratory**

Monica Martin, Project Manager, North Water District Laboratory Services (NWDLS)  
Responsible for supervision of laboratory personnel that generate analytical data for the project. Responsible for ensuring NELAP accreditation is obtained and maintained in order to analyze project samples. Responsible for ensuring that laboratory personnel involved in generating analytical data have adequate training and a thorough knowledge of the QAPP and all SOPs specific to the analyses or task performed and/or supervised. Responsible for oversight of all laboratory operations relating to the project and ensuring that all QA/QC requirements are met, documentation related to the analysis is complete and adequately maintained, and that results are reported accurately. Responsible for ensuring that corrective actions are implemented, documented, reported, and verified.

**Figure A4.1 - Project Organizational Chart\* – Lines of Communication**



\* See Project/Task Organization in this section for a description of each position's responsibilities.

## A5 PROBLEM DEFINITION/BACKGROUND

The Double Bayou Watershed (the Watershed) is situated in the eastern portion of the Lower Galveston Bay Watershed on the Upper Texas Gulf Coast and is identified as a priority watershed by the Texas State Soil and Water Conservation Board (TSSWCB) for Watershed Protection Plan implementation projects. The Watershed drains 98 square miles (61,445 acres) of predominantly rural and agricultural land directly into Trinity Bay and, ultimately, into the larger Galveston Bay system. The majority (93%) of the watershed lies within Chambers County while the remaining 7% of the watershed is in Liberty County, Texas.

The 2020 Texas Integrated Report – Texas 303(d) List documents the following impairments for segment ID 2422B (Double Bayou West Fork): bacteria in water (Recreation Use) category 5c, depressed dissolved oxygen in water (aquatic life use) category 5b, dioxin in edible tissue category 5a, and PCBs in edible tissue category 5a. In addition, the 2020 Texas Integrated Report – Texas 303(d) List documents the following impairments for segment ID 2422D (Double Bayou East Fork): bacteria in water (Recreation Use) category 5c, dioxin in edible tissue category 5a, and PCBs in edible tissue category 5a. Despite multiple impairments, the primary pollutant of concern is fecal waste which has caused the East and West Forks of Double Bayou to be of concern for recreational uses. Potential sources of fecal waste in the Double Bayou Watershed include sanitary sewer overflows, failing on-site sewage facilities, stormwater runoff, animal waste, livestock such as cattle, improper disposal of waste from boats, a wastewater treatment facility (WWTF), and wildlife, including feral hogs.

The association of the West Fork having a longer history of impairment and historically higher concentrations of fecal indicator bacteria (FIB) compared to the East Fork continues to be evident in the water quality monitoring data collected during the “*Coordinating Facilitation and Implementation of the Double Bayou Watershed Protection Plan and Monitoring for Implementation Effectiveness*” project (#18-07). FIB primary contact recreation screening level exceedances and high concentrations of targeted event samples indicate that sources of fecal waste are still present, rainfall results in runoff of nonpoint source (NPS) fecal waste, and additional management measures are needed to protect and restore the water quality of these waterways. This project meets this need by generating surface water quality data, performing data analysis and reporting, and implementing stakeholder outreach and participation management measures. These activities will serve to implement stakeholder-approved management measures from the Double Bayou WPP, increase the engagement of stakeholders through a participatory process, and inform adaptive management of the WPP to provide a continued path forward for implementation.

Since 2009, GTRI has worked with the USGS and Shead Conservation Solutions with funding from the Galveston Bay Estuary Program (GBEP)/the Texas Commission on Environmental Quality (TCEQ), through the American Recovery and Reinvestment Act of 2009 (ARRA), to develop a watershed characterization for Double Bayou. The watershed characterization project included the establishment of a baseline data set, identification of data gaps, development, and initiation of a Quality Assurance Protection Plan (QAPP), and initial stakeholder work. This

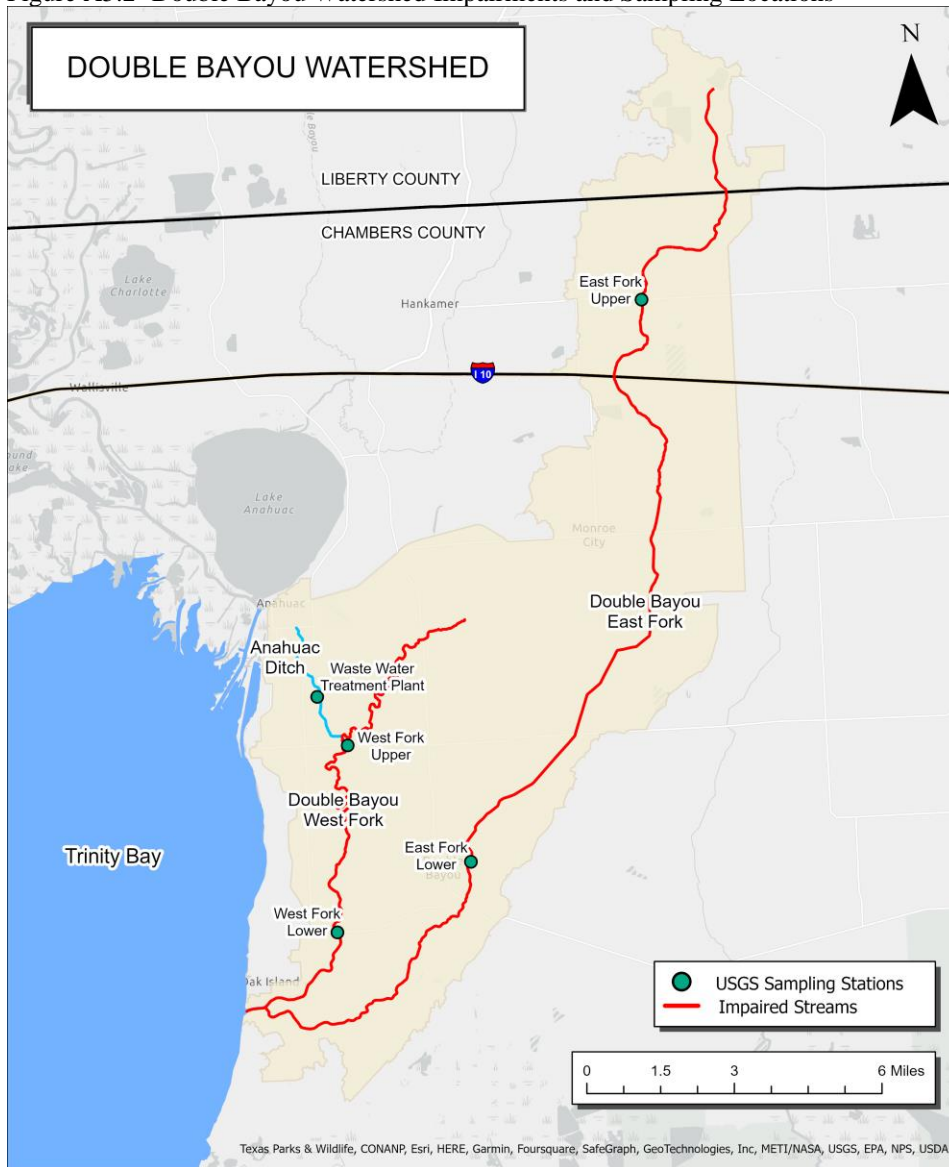
initial characterization project was further developed into a WPP for Double Bayou in 2012, when GTRI started a partnership with the USGS with funding from TSSWCB/EPA and GBEP/TCEQ.

Through the WPP process, stakeholders in the Double Bayou watershed including community leaders, elected officials, landowners, nonprofit organizations, and representatives of relevant local, state, and federal agencies met through a series of larger stakeholder meetings and smaller workgroup meetings to collaborate on the development of the WPP. Water quality was monitored on both the East and West Forks throughout the WPP process, and stakeholders were informed about the results of water quality monitoring and analysis. Working with the stakeholders, ideas for water quality management measures were discussed and analyzed by the three main workgroups (Ag/Wildlife/Feral Hog, Recreation/Hunting and Waste Water Treatment Facility (WWTF)/Septic) for inclusion in the Double Bayou WPP. The Double Bayou Watershed Protection Plan (<http://www.doublebayou.org/wpp-document/>) was approved by stakeholders and accepted by the EPA in July 2016.

Implementation of the Double Bayou WPP supports the goals and actions outlined in the Water and Sediment Quality (WSQ) Action Plan and the NPS Action Plan of the Galveston Bay Comprehensive Conservation and Management Plan (CCMP), the Galveston Bay Plan 2<sup>nd</sup> edition. Specifically, the Double Bayou WPP satisfies the following CCMP actions:

- NPS-1: Support Watershed-Based Plan Development and Implementation
- NPS-2 Support Nonpoint Source Education and Outreach Campaigns
- NPS-3 Implement NPS Best Management Practices
- NPS-4 Host Nonpoint Source Workshops

Figure A5.2- Double Bayou Watershed Impairments and Sampling Locations



## A6 PROJECT/TASK DESCRIPTION

The continued collection of surface water quality data can enhance available information to have the greatest potential of reducing NPS loads. Using newly collected and historical quality-assured data, GTRI will develop assessment methodologies to identify current conditions, spatial and temporal relationships, and trends to assess the effectiveness of implementation efforts, increase adaptive capacity, and provide data for impairment assessment.

The monitoring plan for this project is comprised of surface water quality data collection to occur during a 24-month period. USGS will perform field collection for the project's monitoring plan and provide technical support, including assisting with the development of the project QAPP. Surface water quality monitoring consists of routine ambient sample collection at four established East and West Fork (mainstem) sites once every other month and at one WWTF site once per quarter. In addition, event-based targeted sampling at four mainstem sites will be performed during or immediately after two storm events. A total of 64 routine and targeted samples will be collected for the field, conventional, flow, and bacteria parameter groups.

This project will engage the established Partnership, which serves as the participatory mechanism for interested stakeholders. The Partnership continues to be instrumental in the implementation of management measures. GTRI will host in-person or virtual stakeholder meetings to share all analysis results and findings, communicate management measures milestones, and provide opportunities for education and outreach. In addition, GTRI will develop, publish, and distribute three newsletters and other digital content, such as management measure Fact Sheets, that are designed to keep stakeholders informed of ongoing WPP implementation activities. GTRI will work with state and federal agencies, as appropriate, to bring technical and financial resources to the Watershed and coordinate education and outreach management measures as identified in the WPP. This project will maintain and update the Double Bayou Watershed website to host outreach materials and enhance stakeholder communication (<https://www.doublebayou.org/>).



Table A6.1 - QAPP Milestones

<b>TASK</b>	<b>PROJECT MILESTONES</b>	<b>AGENCY</b>	<b>START</b>	<b>END</b>
2.1	Develop QAPP for review by USEPA.	GTRI, USGS	M1	M6
2.2	GTRI will implement the approved QAPP. GTRI will submit revisions and necessary amendments to the QAPP as needed.	TSSWCB, GTRI, USGS	M6	M36
3.1	During the sampling 24-month sampling period, USGS will conduct routine ambient monitoring at 4 mainstem sites once every other month (48 samples), collecting field, conventional, flow, and bacteria parameter groups.	USGS	M7	M31
3.2	During the 24-month sampling period, USGS will conduct targeted monitoring at 4 mainstem sites, during 2 storm events, collecting field, conventional, flow, and bacteria parameter groups.	USGS	M7	M31
3.3	One 24-hour multi-parameter sonde deployment measuring field parameters will be made during the TCEQ Index Period of each year (total of two deployments); 24-hour dissolved oxygen concentrations will be monitored.	USGS	M7	M33

## A7 QUALITY OBJECTIVES AND CRITERIA

The goal of this project is to generate surface water quality data of a known and acceptable quality to support the implementation of the Double Bayou WPP. The surface water quality data will be used to monitor the ongoing status and trends of NPS. The project's final report will further define water quality problems noted in the watershed characterization process, assess critical and possible sources, and analyze data trends.

The purpose of collecting routine ambient monitoring is to conduct water quality assessments in accordance with TCEQ's *Guidance for Assessing and Reporting Surface Water Quality in Texas*, as well as to support water quality status and changes and stakeholder decision-making.

The purpose of collecting biased-flow (storm flow) monitoring is to support the hydrologic characterization of the bayous as well as water quality status and changes and stakeholder decision-making.

The purpose of effluent monitoring is to characterize possible point source contributions (such as WWTF) in the watershed.

24-hour DO monitoring is measured to determine compliance with aquatic life use designations and support biological assessment, as well as aid with short-term temporal fluctuation analyses. As part of the coordination between TSSWCB and GTRI, GTRI will provide water quality data to TSSWCB for inclusion in TCEQ's SWQMIS. Routine water quality monitoring is needed for conducting water quality assessments in accordance with TCEQ's *Guidance for Assessing and Reporting Surface Water Quality in Texas*.

The measurement performance specifications to support the project objectives for a minimum data set are specified in Table A7.1 and A7.2 and the following text. The measurement performance specifications in Table A7.1 apply to the data collected under this QAPP only. The representative data collected during this project will be submitted to SWQMIS via the TSSWCB.

Table A7.1 - Measurement Performance Specifications for Water Quality

PARAMETER	UNITS	MATRIX	METHOD	PARA-METER CODE	AWRL	Lab Reporting Limit (RL)	RECOVERY AT RLs	PRECISION (RPD of LCS/LCS dup)	BIAS (%Rec. of LCS)	Lab
<b>Field Parameters (Water Column)</b>										
pH	Standard units	water	EPA 150.1 and TCEQ SOP, V1	00400	NA*	NA	NA	NA	NA	Field
Temperature	° C	water	EPA 170.1 and TCEQ SOP, V1	00010	NA*	NA	NA	NA	NA	Field
Specific Conductance	uS/cm	water	EPA 120.1 and TCEQ SOP, V1	00094	NA*	NA	NA	NA	NA	Field
DO	mg/L	water	EPA 360.1 and TCEQ SOP, V1	00300	NA*	NA	NA	NA	NA	Field
Turbidity	FNU	water	EPA 180.1 and TCEQ SOP, V1		NA*	NA	NA	NA	NA	Field
Salinity	ppt	water	<sup>8</sup> TCEQ SOP, V1	00480	NA*	NA	NA	NA	NA	Field
Instantaneous Flow Stream	cfs	water	QADCP	00061	NA*	NA	NA	NA	NA	Field
Flow measurement method	1-gage 2-electric 3-mechanical 4-weir/flume 5-doppler	water	<sup>7</sup> TCEQ SOP, V1	89835	NA*	NA	NA	NA	NA	Field
<b>24-Hour Field Parameters</b>										
Avg. 24-hour DO	mg/L	water	<sup>7</sup> TCEQ SOP, V1	89857	NA*	NA	NA	NA	NA	Field
Min. 24-hour DO	mg/L	water	<sup>7</sup> TCEQ SOP, V1	89855	NA*	NA	NA	NA	NA	Field
Max. 24-hour DO	mg/L	water	<sup>7</sup> TCEQ SOP, V1	89856	NA*	NA	NA	NA	NA	Field
No. of 24-hour DO measurements	# meas.	NA	<sup>7</sup> TCEQ SOP, V1	89858	NA*	NA	NA	NA	NA	Field
24-Hr Avg. water Temperature	Degrees Celsius	water	<sup>7</sup> TCEQ SOP, V1	00209	NA	NA	NA	NA	NA	Field
Max Daily water Temperature	Degrees Celsius	water	<sup>7</sup> TCEQ SOP, V1	00210	NA	NA	NA	NA	NA	Field
Min Daily water Temperature	Degrees Celsius	water	<sup>7</sup> TCEQ SOP, V1	00211	NA	NA	NA	NA	NA	Field
# water temp measurements during 24-Hrs.	# meas.	NA	<sup>7</sup> TCEQ SOP, V1	00221	NA	NA	NA	NA	NA	Field

24-Hr Avg. Spec Conductance	uS/cm	water	<sup>7</sup> TCEQ SOP, V1	00212	NA	NA	NA	NA	NA	Field
Max Spec Conductance	uS/cm	water	<sup>7</sup> TCEQ SOP, V1	00213	NA	NA	NA	NA	NA	Field
Min Spec Conductance	uS/cm	water	<sup>7</sup> TCEQ SOP, V1	00214	NA	NA	NA	NA	NA	Field
# Spec Conductance measurements during 24-Hrs.	# meas.	NA	<sup>7</sup> TCEQ SOP, V1	00222	NA	NA	NA	NA	NA	Field
Max Daily pH	Standard units	water	<sup>7</sup> TCEQ SOP, V1	00215	NA	NA	NA	NA	NA	Field
Min Daily pH	Standard units	water	<sup>7</sup> TCEQ SOP, V1	00216	NA	NA	NA	NA	NA	Field
# pH measurements during 24-Hrs.	# meas.	NA	<sup>7</sup> TCEQ SOP, V1	00223	NA	NA	NA	NA	NA	Field
24-Hr Avg. Turbidity	FNU	water	<sup>10</sup> USGS Field Manual	--	NA*	NA	NA	NA	NA	Field
Max Turbidity	FNU	water	<sup>10</sup> USGS Field Manual	--	NA*	NA	NA	NA	NA	Field
Min Turbidity	FNU	water	<sup>10</sup> USGS Field Manual	--	NA*	NA	NA	NA	NA	Field
# Turbidity measurements in 24-Hrs.	# meas.	water	<sup>10</sup> USGS Field Manual	--	NA*	NA	NA	NA	NA	Field
24-Hr Avg. Salinity	ppt	water	<sup>7</sup> TCEQ SOP, V1	00218	NA*	NA	NA	NA	NA	Field
Max Salinity	ppt	water	<sup>7</sup> TCEQ SOP, V1	00217	NA*	NA	NA	NA	NA	Field
Min Salinity	ppt	water	<sup>7</sup> TCEQ SOP, V1	00219	NA*	NA	NA	NA	NA	Field
# Salinity measurements in 24-Hrs.	# meas.	water	<sup>7</sup> TCEQ SOP, V1	00220	NA*	NA	NA	NA	NA	Field

\* Reporting to be consistent with SWQM guidance and based on measurement capability. References located on page 59.

Table A7.2 - Data Quality Objectives for Laboratory Parameters (in Water)

PARAMETER	UNIT S	MATRIX	METHOD	PARAMETER CODE	AWRL	Reporting Limit (RL)	RECOVERY at AWRL (% rec)*	PRECISION (RPD of LCS/LCS dup)	BIAS (% rec of LCS)*	Lab
<b>Conventional and Bacteriological Parameters (Water)</b>										
Ammonia-Nitrogen, Dissolved (mg/L as N)	mg/L	water	<sup>5</sup> I-2522-90***	00608	0.1	0.01	70-130	10	80-120	USGS - NWQL
Ammonia-Nitrogen, Total (mg/L as N)	mg/L	water	<sup>2</sup> EPA 350.1***	00610	0.1	0.05	70-130	10	80-120	USGS - NWQL
Enterococci, IDEXX-Enterolert	MPN /100 mL	water	Enterolert	31701	1.0****	1.0	NA	0.16 **	NA	NWDLS
<i>E. coli</i> , IDEXX-Colilert, MPN/100 ml	MPN /100 mL	water	SM 9223-B	31699	1.0	1.0	NA	0.5 **	NA	NWDLS
<i>E. coli</i> , Colilert, IDEXX Method Holding time	hours	water	<sup>NA</sup> NA	31704	NA	NA	NA	NA	NA	NWDLS
Total Phosphorus, (mg/L as P)	mg/L	water	<sup>4</sup> I-4610-91	00665	0.06	0.006	70-130	20	80-120	USGS - NWQL
Orthophosphate, Phosphorous, DISS, FLDFLT	mg/L	water	<sup>5</sup> I-2601-90***	00671	0.04	0.004	75-125	10	80-120	USGS - NWQL
Total KJELDAHL Nitrogen (mg/L as N)	mg/L	water	<sup>5</sup> I-4515-91	00625	0.2	0.10	75-125	10	80-120	USGS - NWQL
Chloride (mg/L as Cl)	mg/L	water	I-2057-85	00940	5	0.02	75-125	10	80-120	USGS - NWQL
Sulfate (mg/L as SO4)	mg/L	water	SM 4110B	00945	5	0.02	75-125	10	80-120	USGS - NWQL
Residue, Total Nonfilterable (mg/L)	mg/L	water	I-3765-85	00530	5	1	NA	20	NA	USGS - NWQL

\* Reporting to be consistent with SWQM guidance and based on measurement capability.

\*\* Based on a range statistic as described in Standard Methods, 23rd Edition, Section 9020-B, Quality Assurance/Quality Control - Intralaboratory Quality Control Guidelines.

\*\*\* USGS-NWQL is not NELAP accredited for methods EPA 350.1, I-2601-90, or I-2522-90

\*\*\*\* Only results for dilutions of 1:10 or greater will be reported to TCEQ for inclusion in SWQMIS.

References located on page 62.

### *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. 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 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. 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.

Field splits are used to assess the variability of sample handling, preservation, and storage, as well as the analytical process, and are prepared by splitting samples in the field. Control limits for field splits are defined in Section B5.

Laboratory precision is assessed by comparing replicate analyses of laboratory control samples 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.

### *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 laboratory control samples and LOQ Check Standards 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*

Samples must be collected that are representative of spatial components that influence conditions in the East and West Forks of Double Bayou. Site selection for this study captures various land uses and inputs from the watershed. For this project, water quality monitoring and discrete sampling will be performed at sites along both the East and West Forks of Double Bayou.

To collect samples representative of temporal components that influence conditions in the bayous, monitoring and water sampling will be conducted over a variety of flow conditions, and

at least every other month at each site. Discrete samples will be collected routinely, as well as during targeted storm events.

#### *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 TCEQ SOPs. 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 is 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 that 90% of data completion is achieved.

## A8 SPECIAL TRAINING/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. Records of educational credentials, training, demonstrations of competency, assessments, and corrective actions are retained by project management and are available for review. Due to the qualifications of the staff, no specialized training will be required.

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.

Measurement of stream flow using an Acoustic Doppler Current Profiler (ADCP) may be necessary – use of the ADCP requires a 5-day class that splits evenly between classroom instruction and hands-on application of basic principles. The class is taught by the USGS Office of Surface Water instructors. Successful completion of the class is mandatory within the USGS for use of the ADCP in stream flow data collection. Further information on measuring discharge with acoustic Doppler current profiles can be found in Mueller and others (2013<sup>11</sup>).



## A9 DOCUMENTS AND RECORDS

Records produced by this project will consist of data collection results, data monitoring, and data analysis. Progress reports on data processing and analysis will be submitted quarterly.

Data validation and QA checks will be conducted by the GTRI PM and GTRI Senior Data Analyst. Copies of data documentation generated by GTRI project personnel and agency metadata will be stored on multiple servers. HARC uses three servers with dual processors and high-capacity hard drives. The data servers are backed up nightly to an air-gapped archival system for additional security. Security systems and software to protect data from virus infection and tampering by unauthorized users are integrated. The data servers are equipped with emergency power supplies. Data sets for access by personnel not directly involved in data management or analysis will be provided with read-only permission.

All data reports, including GIS data reports, summaries, and other project documentation will be retained in a specially designated folder on the server. All electronically backed up information, which will include all data reports, summaries, and other project documentation will be retained by the GTRI PM for a minimum of one year after project completion. At the end of that one-year period, all backup files, data reports (including GIS data reports), summaries, and documentation will be available for transfer to the TSSWCB PM, upon request. If a transfer is requested the TSSWCB PM will retain the backup materials for a minimum of ten years.

The data report and web-based products will be organized according to data type (water quality, land use, etc.). Contributing agency programs, their quality assurance procedures, the parameters for which values are obtained, and associated metadata will be described (see Section B9).

Quarterly progress reports will be produced electronically for the TSSWCB and will note activities conducted in connection with audits of the water quality monitoring program, items or areas identified as potential problems, and any variations or supplements to the QAPP. Corrective Action Reports (CAR) will be utilized when necessary (Appendix C). CARs will be maintained in an accessible location for reference at GTRI. 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 when appropriate.

Individuals listed in Section A3 will be notified of approval of the most current copy of the QAPP by the GTRI PM. The GTRI PM will make the most recent version of the QAPP available to all entities listed in Section A3 of this QAPP. Current copies of the QAPP will be kept on file for all individuals on the distribution list.

The final assessment data report will be produced electronically, and all files used to produce the report will be saved electronically by GTRI for at least five years and will be available for transfer to the TSSWCB PM.

The documents that describe, specify, report, or certify activities are listed in Table A9.1. Water-quality data will be submitted by USGS to GTRI in spreadsheet format.

Table A9.1 - Project Quality Assurance Documents and Records

<b>Document/Record</b>	<b>Location</b>	<b>Retention</b>	<b>Form</b>
QAPP, amendments, and appendices	GTRI/USGS	7 years	Electronic
QAPP distribution documentation	GTRI	7 years	Electronic
Field notebooks or field data sheets	USGS	7 years	Electronic
Field equipment calibration/maintenance logs	USGS	7 years	Electronic
Chain of custody records	USGS	7 years	Electronic
Field SOPs	USGS	7 years	Electronic
Laboratory sample reception logs	USGS/NWDLS	7 years	Electronic
Laboratory QA manuals	USGS/NWDLS	≥10 years	Electronic
Laboratory SOPs	USGS/NWDLS	≥10 years	Electronic
Laboratory internal/external standards	USGS/NWDLS	7 years	Electronic
Laboratory instrument performance	USGS/NWDLS	7 years	Electronic
Laboratory initial demonstration of capability	USGS/NWDLS	7 years	Electronic
Laboratory procedures	USGS/NWDLS	≥10 years	Paper/Electronic
Instrument raw data files	USGS/NWDLS	7 years	Electronic
Instrument readings/printouts	USGS/NWDLS	7 years	Paper
Laboratory data reports	USGS/NWDLS	10 years	Electronic/Paper
Laboratory data verification for integrity, precision, accuracy, and validation	USGS/NWDLS	7 years	Electronic
Laboratory equipment maintenance logs	USGS/NWDLS	7 years	Electronic
Laboratory calibration records	USGS/NWDLS	7 years	Electronic
Laboratory corrective action documentation	USGS/NWDLS	7 years	Electronic
USGS database verification	USGS	7 years	Electronic
Quality control verification/validation	GTRI/USGS	7 years	Electronic
Progress report/final report/data	GTRI	7 years	Electronic
Training records	GTRI/USGS	≥10 years	Electronic
Corrective Action Documentation	GTRI/USGS	7 years	Paper/Electronic
All Backup Information	GTRI	1 year	Electronic

The TSSWCB may elect to take possession of documents/records as stated in Table A9.1 after the specified retention period.

### **Laboratory Test Reports**

Test/data reports from the laboratory will document the test results clearly and accurately. The test report will include the information necessary for the interpretation and validation of data and will include the following:

- title of report and unique identifiers on each page
- name and address of the laboratory
- name and address of the client
- a clear identification of the sample(s) analyzed
- identification of samples that did not meet QA requirements and why (e.g., holding times exceeded)
- date and time of sample receipt

- identification of method used
- sample results
- field split results (as applicable)
- clearly identified subcontract laboratory results (as applicable)
- a name and title of person accepting responsibility for the report
- quality control results to include LCS sample results (% recovery), LCS duplicate results (%RPD), equipment, trip, and field blank results (as applicable), and RL confirmation (% recovery)
- notification of QC failures or deviations from requirements that may affect the quality of results as necessary for verification and validation of data.

Two laboratories will be performing analyses for this study. The USGS NWQL will perform chemical analyses of water for the parameters designated in table A7.2. The NWDLS is responsible for the Fecal Indicator Bacteria parameters *E. coli* and Enterococci, which will be analyzed using the IDEXX method, and for reporting the *E. coli*, holding time. At the NWQL, project specific LCS sample results are provided with organics, but inorganic LCS sample results are handled somewhat differently. These results are compared to established criteria. Relevant LCS data are entered into control charts.

Routine data reports should be consistent with the NELAP standards (Section 5.5.10) and include the information necessary for the interpretation and validation of data. The requirements for reporting data and the procedures are provided.

### **Revisions to the QAPP**

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. If the entire QAPP is current and valid, the document may be reissued by certifying that the plan is current and including a new copy of the signed approval page. The approved version of the QAPP shall remain in effect until revised versions have been approved only if the revised version is submitted for approval before the approved version expires. 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 will be accomplished by submitting a cover letter stating the status of the QAPP and a copy of new, signed approval pages for the QAPP.

#### *QAPP Amendments*

Amendments to the QAPP should be approved prior to implementation to reflect changes in project organization, tasks, schedules, objectives, and methods, to address deficiencies and non-conformance, to improve operational efficiency, and to accommodate unique or unanticipated circumstances. Requests for amendments are directed from the GTRI PM to the TSSWCB PM in electronic form (email). They are effective immediately upon approval by the TSSWCB PM and QAO, or their designees, and the EPA Project Officer.

Justifications, summaries, and details of the amendment will be documented and distributed to all persons on the QAPP distribution list under the direction of the GTRI PM. Amendments will be reviewed, approved, and incorporated into the next revision of the QAPP.

## B1 SAMPLING PROCESS DESIGN

### *Sample Design Rationale*

The sample design rationale is based on the intent of the study to collect water quality data in the East and West Forks of the watershed using standardized monitoring protocols. All samples will be collected with methods as established in TCEQ SWQM Procedures Manual (2012) or the National Field Manual for the Collection of Water-Quality Data: United States Geological Survey Techniques of Water-Resources Investigations, available online at <https://www.usgs.gov/mission-areas/water-resources/science/national-field-manual-collection-water-quality-data-nfm><sup>10</sup>

Measurement of water-quality parameters and constituents to describe stream quality will be used to investigate natural conditions (including low dissolved oxygen) as well as potential impacts from NPS anthropogenic stressors.

### *Site Selection Criteria*

A total of five sites were selected for this project; two tidally influenced sites on the West Fork of Double Bayou and two sites located on the East Fork Double Bayou with one of those sites located in an area of tidal influence and the other site is non-tidal. The fifth site is located at a WWTF on the Anahuac Ditch. The locations of all sites were determined after the preliminary land-use characterization study was completed by GTRI to strategically align the water quality monitoring goals with the needs of the WPP. The sites were all used as monitoring stations in the development of the Double Bayou Watershed Protection Plan. The Double Bayou watershed is a smaller watershed at only 98 square miles. Balancing the limitations faced by the scope of the project with the desire to monitor everything, everywhere, all the time, it was determined that four sites plus one WWTF effluent site were appropriate to capture adequate spatial and temporal coverage. The sample design rationale focused on the development of an upstream/downstream approach. The four monitoring locations provided enough spatial coverage to provide information that can be extended to a general representation of the watershed's response.

This data collection effort involves systematic monitoring of hydrologic conditions and stream quality at four sites in the East and West Forks of Double Bayou. To this end, some general guidelines were followed when selecting sample sites, as identified below. Overall consideration is given to accessibility and safety. All monitoring activities have been developed in coordination between GTRI, USGS, and the TSSWCB.

1. Monitoring sites are representative of in-stream water quality and hydrology during the study period. Where possible, sites are representative of typical land use.
2. Monitoring sites are spaced throughout the watershed to allow assessment of progressive changes in water quality along the entire reach of the stream. Sites that have historical water-quality or biological data were considered to provide continuity and a longer period-of-record for comparisons.
3. Location of sites attempts to bracket the effects of point sources on water quality and aquatic biota. Specifically, site selection places one site downstream of a Wastewater

Treatment Facility (WWTF).

4. Monitoring sites were chosen based on accessibility and safety. When possible, sites were selected where the collection of flow measurements and water samples during the entire range of hydrologic conditions is feasible.

### *Sampling Regime*

USGS will conduct routine ambient monitoring (RT) at 4 mainstem sites. Each monitoring event will include field, conventional, flow, and bacteria parameter groups. The sampling period extends over 24 months. Spatial and seasonal variation will be captured in these snapshots of watershed water quality. Currently, routine ambient monitoring is conducted once per quarter year at two stations by TCEQ (10657 and 10658 for field, conventional, and bacteria parameters only). Sampling through this subtask will complement existing routine ambient monitoring regimes.

USGS will conduct biased-flow monitoring (BF) at 4 mainstem sites during 2 storm events over the total sampling period, collecting field, conventional, flow, and bacteria parameter groups. The sampling period extends over 24 months.

USGS will conduct effluent monitoring at 1 WWTF once per quarter, collecting field, conventional, flow, and bacteria parameter groups. The sampling period extends over 24 months. WWTF data will not be reported to SWQMIS. Instead, data results will only be used to estimate bacteria loadings from wastewater discharges and to assist TPDES permittees in improving management and operations.

USGS will conduct 24-hour DO monitoring two times during the sampling period to collect field parameter groups. Sampling frequency will follow the Index and Critical period requirements described in TCEQ's Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods. Two 24-hour DO sampling events will occur during the index period representing warm-weather seasons of the year, March 15–October 15. Of these two, at least one will occur during the critical period (July 1–September 30). A minimum of one month will separate each 24-hour sampling event.

Field parameters are pH, temperature, specific conductance, turbidity, and dissolved oxygen. Conventional parameters are Nitrogen Ammonia, Dissolved (mg/L as N), Nitrogen Ammonia, Total (mg/L as N), Phosphorus, Total, wet method, Orthophosphate, Phosphorous FLDFLT, Total Kjeldahl Nitrogen, Chloride (mg/L as Cl), Sulfate (mg/L as SO<sub>4</sub>), and Residue, Total Nonfilterable (mg/L). Bacteria parameters are Enterococci, IDEXX-Enterolert and *E. coli*, IDEXX-Colilert (tidal and above tidal sites). Flow parameters are quantitative flow collected by gage, electric, mechanical, or Doppler.

All samples (tidal samples will follow correct methods where indicated<sup>6</sup>) will be sent to the USGS National Water Quality Laboratory (NWQL) in Denver, CO for analysis except where indicated.

- a. Bacteria – NWDLS
- b. Nutrients (includes Nitrogen and Phosphorus)

- c. Chloride
- d. Sulfate
- e. Total Suspended Solids

Table B1.1 - Sampling regime with site locations and number of samples of each type.\*

TCEQ Station ID	Site Description	Work plan Task	Monitor Type	Flow	Field Parameters	Conventional	Bacteria	24-Hour
10657	W. FK Double Bayou at Eagle Ferry Rd. nr Anahuac, TX	3	RT	14	14	14	14	1*
18361	W. Fk Double Bayou at FM 2936 nr Anahuac, TX	3	RT	14	14	14	14	-
21305	E. Fk Double Bayou at Carrington Rd	3	RT	14	14	14	14	1*
21306	E. Fk Double Bayou at FM 1663	3	RT	14	14	14	14	-
21307	Anahuac WWTP outflow***	3	RT	-	8	8	8	-
10657	W. FK Double Bayou at Eagle Ferry Rd. nr Anahuac, TX	3	BF**	2	2	2	2	-
18361	W. Fk Double Bayou at FM 2936 nr Anahuac, TX	3	BF	2	2	2	2	-
21305	E. Fk Double Bayou at Carrington Rd	3	BF	2	2	2	2	-
21306	E. Fk Double Bayou at FM 1663	3	BF	2	2	2	2	-
21307	Anahuac WWTP outflow***	3	BF	-	2	2	2	-

\*Note that 24-hr sampling will be a total of two deployments; sites for the 24-hour sampling will be chosen from the four mainstem sites and determined based on initial water quality sampling results. The 24-hr sampling is covered under Work plan Task 3 and will include one 24-hour multi-parameter sonde deployment measuring 23 field parameters during the TCEQ Index Period (total of two deployments). Deployment of the 24-hour monitoring events is dependent on weather and stream conditions.

\*\*Note that BF sampling numbers per location may have to be altered if a storm event compromises the safety of sampling at a site location.

\*\*\* The data collected from the Anahuac WWTP Outflow station will not be submitted for entry into SWQMIS.

## B2 SAMPLING METHODS

### *Field Monitoring and Conventional Water-Quality Sampling Procedures*

Field monitoring and conventional water-quality sample collection will be conducted using sampling procedures consistent with those documented in the TCEQ *Surface Water Quality Monitoring Procedures Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue, 2012 (RG-415)* or the National Field Manual for the Collection of Water-Quality Data: United States Geological Survey Techniques of Water-Resources Investigations, available online at <https://www.usgs.gov/mission-areas/water-resources/science/national-field-manual-collection-water-quality-data-nfm><sup>10</sup>. Stream depth at the sampling section, as well as the depth from which the sample is collected, will be documented on the field form.

The BF monitoring conducted for this project will be targeted based on the amount of rainfall generated and the event duration that creates bias stream flow representative of high discharge event conditions. The USGS West Fork Double Bayou at Eagle Ferry Rd (08042558) stream gage will be evaluated to determine when high flow event conditions are occurring based on an evaluation of current and historical flow conditions. If the minimum thresholds for the flow event are met and safety of the field crew is ensured, a BF sampling trip will occur. The USGS Project Chief and GTRI PM/Data Manager will communicate prior to a sampling event.

Samples at the WWTF will be collected to represent effluent that has been processed and discharged by the facility prior to entering the Anahuac Ditch. Samples will be collected directly from the WWTF's effluent flume.

Appropriate QA/QC samples will be collected field splits will comprise a 10% sample minimum. All samples will be immediately preserved and chilled upon collection and maintained at the appropriate temperature until submitted to the respective laboratories for analysis. Container types expected sample volumes, preservation requirements, and holding time requirements are specified in Table B2.1.

### *Hydrologic Monitoring*

Hydrologic monitoring will be conducted using standard methods documented by the USGS (Rantz, 1982). These data will include instantaneous discharge measurements that accompany each sampling visit.

### *Sample Containers*

Sample containers are specified in their respective method documentation as provided in Table B2.1 and are available upon request. The QA procedures for these bottles National Field Supplies Services stock number and their certificates of analysis are located at are available upon request.

Bottles used for indicator bacteria (*E. coli* and Enterococcus) will be provided by NWDLS.



Sample bottles for all other chemical and biological analyses are obtained from the USGS National Water-Quality Laboratory (NWQL), located in Denver, CO. A representative number of sample containers are checked by the NWQL to ensure that they are acceptable for the collection of water-quality samples.

Table B2.1 - Min. Sample Vol., Container Types, and Preservation & Holding Requirements

Parameter	Matrix	Container	Preservation	Sample Mass Required for Analysis	Holding Time
<i>E. Coli</i> **	Water	Autoclaved, amber glass bottle, thiosulfate	Ice to 4°C	250 mL	8 hours
Enterococcus	Water	Autoclaved, amber glass bottle, thiosulfate	Ice to 4°C	250 mL	8 hours
TSS	Water	250 mL polyethylene bottle	Ice to 4°C	250 mL	180 days
NO <sub>3</sub> -N + NO <sub>2</sub> -N (filtered)	Water	125-mL brown polyethylene bottle	Ice to 4°C	125 mL	28 days*
O-PO <sub>4</sub> (field filtered < 15 min.)	Water	125-mL brown polyethylene bottle	Ice to 4°C	125 mL	28 days*
NH <sub>3</sub> (filtered)	Water	125-mL brown polyethylene bottle	Ice to 4°C	125 mL	28 days*
NH <sub>3</sub> (unfiltered)	Water	125-mL clear polyethylene bottle	Ice to 4°C, 1 mL of 4.5N H <sub>2</sub> SO <sub>4</sub>	100 mL	28 days*
Phosphorous	Water	125-mL clear polyethylene bottle	Ice to 4°C, 1 mL of 4.5N H <sub>2</sub> SO <sub>4</sub>	100 mL	28 days*
TKN	Water	125-mL clear polyethylene bottle	Ice to 4°C, 1 mL of 4.5N H <sub>2</sub> SO <sub>4</sub>	100 mL	28 days*
Chloride	Water	250 mL polyethylene bottle	Ice to 4°C	50 mL	28 days
Sulfate	Water	250 mL polyethylene bottle	Ice to 4°C	50 mL	28 days

\* The USGS NWQL has a 28-day holding time for all nutrients. Documentation that differences in analytical results from samples that were analyzed within 48 hours and samples analyzed at intervals up to 30 days were not statistically significant when the sample was filtered and treated with sulfuric acid. Documentation can be accessed at: <http://nwql.usgs.gov/Public/pubs/WRIR98-4118-new.pdf>

\*\* *E.coli* samples analyzed by SM 9223-B 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 24 hours; if held over 8 hours the data would be flagged as such.

### *Processes to Prevent Cross-Contamination*

Procedures to prevent contamination of samples as outlined in the TCEQ SWQM Procedures (2012) will be followed. Preservation procedures for chloride, sulfate, and “suspended sediment concentration” are based on the National Field Manual for the Collection of Water-Quality Data: United States Geological Survey Techniques of Water-Resources Investigations, available online at <https://www.usgs.gov/mission-areas/water-resources/science/national-field-manual-collection-water-quality-data-nfm><sup>10</sup> Field QC samples, as discussed in Section B5, are collected to verify that contamination of samples during collection or processing has not occurred.

### *Documentation of Field Sampling Activities*

Documentation of USGS field activities and water-quality sample collection will be conducted as described in the TCEQ SWQM Procedures (2012) and the USGS National Field Manual (variously dated<sup>11</sup>).

Sampling information (e.g., site location, date, time, etc.) and field data will be recorded using an Excel based application known as Superfly. The Superfly application acts as an electronic field sheet and is treated as original record and archived accordingly.

Field sampling activities are documented on electronic field data sheets as presented in Appendix A1. The following will be recorded for all site visits:

1. Station ID
2. Sampling date
3. Location
4. Sampling depth
5. Sampling time
6. Sample collector’s name/signature
7. Values for all field parameters
8. Detailed observational data, including:
  - Water appearance
  - Weather
  - Biological activity
  - Unusual odors
  - Pertinent observations related to water quality or stream uses (e.g., exceptionally poor water-quality conditions/standards not met; stream uses such as swimming, boating, fishing, irrigation pumps, etc.)
  - Watershed or in-stream activities (events impacting water quality (e.g., bridge construction, livestock watering upstream, etc.)
  - Missing parameters (i.e., when a scheduled parameter or group of parameters is not collected)

### *Recording Data*

For the purposes of this section and subsequent sections, all field and laboratory personnel follow the basic rules for recording information as documented below:

1. Legible writing in indelible ink with no modifications, write-overs, or cross-outs;
2. Correction of errors with a single line followed by initials and the date;
3. Close-out all incomplete pages using a diagonal line with initials and the date.

*Deficiencies, Nonconformances, and Corrective Action Related to Sampling Requirements*

Deficiencies are defined as unauthorized deviations from procedures documented in the QAPP or other applicable documents. Nonconformances are deficiencies that affect data quantity and/or quality and render the data unacceptable or indeterminate. Deficiencies related to sampling methods requirements include, but are not limited to, such things as sample container, volume, and preservation variations, improper/inadequate storage temperature, holding-time exceedances, and sampling site adjustments.

Deficiencies are documented in logbooks, on field data sheets, etc. by field or laboratory staff and reported to the correct field or laboratory supervisor or USGS Project Chief who will notify the QAO. The USGS QAO will initiate a Corrective Action Report (CAR) to document the deficiency if needed (Appendix C).

GTRI, USGS Project Chief, and USGS QAO will determine if the deficiency constitutes a nonconformance. If it is determined the activity or item in question does not affect data quality and therefore, is not a valid nonconformance, the CAR will be completed accordingly and the CAR closed. If it is determined a nonconformance does exist, GTRI and the USGS Project Chief will determine the disposition of the nonconforming activity or item and necessary corrective actions(s); results of the disposition (completed Corrective Action Report) will be maintained by the USGS QAO.

Corrective Action Reports (CARs) document: root cause(s); impact(s); specific corrective action(s) to address the deficiency; action(s) to prevent recurrence; individual(s) responsible for each action; the timetable for completion of each action; and how completion of each corrective action will be documented. CARs will be included in quarterly progress reports. In addition, significant conditions (i.e., situations which, if uncorrected, could have a serious effect on safety or the validity or integrity of data) will be reported to the TSSWCB immediately both verbally and in writing.

## B3 SAMPLE HANDLING AND CUSTODY

### *Chain-of-Custody*

USGS sample handling and custody procedures will follow those outlined by Shelton (1994<sup>10</sup>). The purpose of sample custody is to document and maintain the integrity of all samples during collection, transportation, analysis, and reporting of analytical results.

A sample is “in custody” if it is in actual physical possession or in a secured area that is restricted to authorized personnel. The Chain-of-Custody (COC) form is used to document sample handling during the transfer from the field to the laboratory and among subcontract laboratories.

Immediately after collection and until shipment, samples are in the custody of USGS personnel. Samples are returned to the USGS Houston Water Science Center where they are processed and packed for shipment. The USGS Houston facility is secured and only accessed by a key card. Samples are usually shipped via Fed Ex the same day as collection. When this is not possible, samples are maintained at appropriate holding temperatures. Information including site ID, date and time of sampling, sampling method, and field parameters are entered into the USGS water-quality database (QWDATA), at which time a unique record number is assigned to the site visit. Water-quality samples are shipped to NWQL packed in ice in sealed containers. The NWQL is a secured laboratory at the US Federal Center in Denver, Colorado. Access to the Federal Center is controlled by guards; access to the NWQL is by key card only.

All samples are sent with Analytical Services Request (ASR) forms, which also serve as a COC. The ASR form is provided in Appendix A1 and includes the following information:

1. Date and time of collection
2. Site identification
3. Sample medium (water)
4. Number of containers
5. Preservative used or if the sample was filtered
6. Analyses required – Lab Schedule or Lab Code
7. Name of collector
8. Date of sample shipment and person who shipped sample(s)
9. Name of laboratory admitting the sample

Upon arrival, an email is sent to the USGS Project Chief, documenting sample receipt and condition. This notification is maintained as part of the project records.

NWDLS laboratory’s COC form is provided in Appendix B.

### *Sample Labeling*

Pre-printed, waterproof labels that are adhesive-backed, and capable of being attached directly to the sample container are used. An indelible marker is used to write all information. Label information includes:

1. Station Identification Number
2. Station Name
3. Date and Time (of sample collection)
4. Sample Type (i.e., analysis to be performed)
5. Sample processing or preservation

### *Sample Handling*

Upon collection, samples are immediately put in coolers containing ice. All samples, except for suspended sediment, are maintained at 4°C until analysis.

USGS sample handling and custody procedures follow NWQL Technical Memoranda. Samples and their containers are kept under the surveillance of the sampling team or in a secure storage area until transfer to the shipper's agent. The sample containers are sealed before delivery to the shipper. The shipper (Fed Ex) logs samples into a tracking system when taking custody. At the receiving laboratory, the laboratory carefully examines the sample container to ensure that it is intact before the shipper is released from custody of the samples.

Sample handling procedures at the NWQL are described in the NWQL QMS plan (Maloney, 2005<sup>9</sup>). When received at the NWQL, samples are removed from coolers, examined, sample temperature is verified, matched with the record created in Houston, logged into the Laboratory Information Management System (LIMS) database at the laboratory, labeled with a unique bar code number, and transferred to refrigerators until analysis.

All samples are sent with Analytical Services Request (ASR) forms to NWQL, which also serve as USGS COCs.

NWDLS sample handling will follow procedures as described in NWDLS AD004, Rev. 1.

### *Deficiencies, Nonconformances, and Corrective Action Related to Chain-of-Custody*

Deficiencies are defined as unauthorized deviation from procedures documented in the QAPP. Nonconformances are deficiencies that affect the quality and render the data unacceptable or indeterminate. All deficiencies associated with chain-of-custody procedures as described by this QAPP are immediately reported to the USGS Project Chief. 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.

Deficiencies are documented in logbooks and field data sheets by field or laboratory staff and reported to the pertinent field or laboratory supervisor who will notify the USGS Project Chief.

The USGS Project Chief will notify the USGS QAO of the potential nonconformance. The USGS QAO will initiate the CAR to document the deficiency.

The USGS QAO, in consultation with the USGS Project Chief (and other affected individuals/organizations), will determine if the deficiency constitutes a non-conformance. If it is determined the activity or item in question does not affect data quality and therefore is not a valid nonconformance, the CAR will be completed accordingly and closed. If it is determined that a nonconformance does exist, the USGS Project Chief in consultation with USGS QAO will determine the disposition of the nonconforming activity or item and necessary corrective action(s); results will be documented by completion of a CAR, which is retained by the USGS QAO.

CARs document: root cause(s); programmatic impact(s); specific corrective action(s) to address the deficiency, action(s) to prevent recurrence, individual(s) responsible for each action, the timetable for completion of each action; and the means by which completion of each corrective action will be documented. The TSSWCB will be notified of inconsistencies that affect data quality with quarterly progress reports. In addition, significant conditions (i.e., situations that, if uncorrected, could have a serious effect on safety or validity or integrity of data) will be reported to TSSWCB immediately.

## B4 ANALYTICAL METHODS

The analytical methods, associated matrices, and performing laboratories are listed in Table A7.1. All analyses cited in the Table A7.1 that are performed by the USGS laboratory are approved methods that are either published by the U.S. Environmental Protection Agency (designated “EPA”), the American Society for Testing and Materials Annual Book of ASTM Standards (designated “ASTM”), in Standard Methods for the Examination of Water and Wastewater (American Public Health Association, 1998)<sup>3</sup> (designated “SM”), or in USGS Techniques of Water-Resources Investigations Reports, Open-File Reports, and Methods and Techniques. References for specific analytical methods are provided as footnotes to Table A7.1.

At a minimum, laboratories producing data under this QAPP are compliant with ISO/IEC Standard 17025. NWDLS and the USGS NWQL policies and procedures comply with the National Environmental Laboratory Accreditation Program (NELAP) standards of 2016. Documentation of NWQL policies and procedures is found in the NWQL QMS plan (Maloney, 2005<sup>9</sup>).

### *Standards Traceability*

All standards used in the field and laboratory are traceable to certified reference materials. Standards preparation is fully documented, maintained, and are available upon request. Each documentation includes information concerning the standard identification, starting materials, including concentration, amount used, and lot number; date prepared, expiration date, and preparer’s initials/signature. The reagent bottle is labeled in a way that will trace the reagent back to preparation.

### *Deficiencies, Nonconformances, and Corrective Action Related to Analytical Methods*

Deficiencies are defined as unauthorized deviations from procedures documented in the QAPP or other applicable documents. Nonconformances are deficiencies that affect the quantity and/or quality and render the data unacceptable or indeterminate. 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.

Deficiencies are documented in logbooks and field data sheets by field or laboratory staff and reported to the pertinent field or laboratory supervisor who will notify the USGS Project Chief. The USGS Project Chief will notify the USGS QAO of the potential non-conformance. The USGS QAO will initiate the CAR to document the deficiency.

The USGS QAO, in consultation with the USGS Project Chief (and other affected individuals/organizations), will determine if the deficiency constitutes a non-conformance. If it is determined the activity or item in question does not affect data quality and therefore is not a valid nonconformance, the CAR will be completed accordingly and closed. If it is determined that a nonconformance does exist, the USGS Project Chief in consultation with USGS QAO will determine the disposition of the nonconforming activity or item and necessary corrective



action(s); results will be documented by completion of a CAR, which is retained by the USGS QAO.

CARs document: root cause(s); programmatic impact(s); specific corrective action(s) to address the deficiency, action(s) to prevent recurrence, individual(s) responsible for each action, the timetable for completion of each action; and the means by which completion of each corrective action will be documented. The TSSWCB will be notified of inconsistencies that affect data quality with quarterly progress reports. In addition, significant conditions (i.e., situations that, if uncorrected, could have a serious effect on safety or validity or integrity of data) will be reported to TSSWCB immediately.

## B5 QUALITY CONTROL

### *Sampling Quality Control Requirements and Acceptability Criteria*

Field quality-control samples are submitted as separate samples to the laboratory and reported accordingly, on the data reports. Table B5.1 lists QC samples for water chemistry that will be collected as part of this project.

Table B5.1 - Number and type of field quality-control samples<sup>1</sup>

<b>Constituent</b>	<b>Number of Analyses</b>	<b>Method Blank</b>	<b>Field Blank</b>	<b>Field Split</b>
<i>E. coli</i>	64	0	2	4
Enterococcus	64	0	2	4
TSS	64	1	2	4
Nutrients	64	1	2	4
Chloride	64	1	2	4
Sulfate	64	1	2	4

### *Equipment Blanks*

An equipment blank tests the amount of potential contamination to water samples from equipment used to collect or process the samples. It consists of a sample of reagent water that is poured into or over a sampling device, compositing container, or filtering apparatus. The equipment blank is collected in the same type of container as the environmental sample, preserved in the same manner, and analyzed for the same parameter. The analysis of equipment blanks should yield values lower than the reporting limit, or, when target analyte concentrations are very high, blank values must be less than 5% of the lowest value of the batch or corrective action will be implemented.

### *Field Blanks*

Field blanks are required for water samples when collected without sample equipment (i.e., as grab samples). A field blank consists of deionized water that is taken to the field and poured into the sample container. Field blanks are not routinely required but are used to assess the contamination from field sources such as airborne materials, containers, and preservatives. The analysis of field blanks should yield values lower than the reporting limit. When target analyte concentrations are high, blank values should be less than 5% of the lowest value of the batch. Field blanks will be collected during the study to provide this information.”

### *Field Split*

---

<sup>1</sup> For chemical analyses, one equipment blank is run at the beginning of the study. If any of the analytes are above acceptable levels, appropriate measures are taken to identify the possible source(s) of the contaminants. Once these measures have been undertaken, an additional equipment blank is processed and analyzed to test their effectiveness. For biological and bacteriological analyses, periodic equipment blanks test for organic growth in the deionized water system.

A field split is a single sample subdivided by field staff immediately following collection and submitted to the laboratory as two separately identified samples according to procedures specified in the TCEQ SWQM Procedures. Split samples are preserved, handled, shipped, and analyzed identically and are used to assess variability in all of these processes. Field splits apply to conventional samples only and are collected at a minimum frequency of 10%. The precision of field split results is calculated by relative percent difference (RPD) using the following equation:

$$RPD = (X1-X2)/((X1+X2)/2)*100$$

A 30% RPD criteria will be used to screen field split results as a possible indicator of excessive variability in the collection and analytical system. If it is determined that meaningful quantities of constituent (i.e., >AWRL) were measured and analytical variability can be eliminated as a factor, then variability in the field split results will primarily be used as a trigger for discussion with field staff to ensure samples are being handled in the field correctly. Some sample results or batches of samples may be invalidated based on the examination of all extenuating information. Professional judgment during data validation will be relied upon to interpret the results and take appropriate action. The qualification (i.e., invalidation) of data will be documented in the Data Summary. Deficiencies will be addressed as specified in this section under Deficiencies, Nonconformances, and Correction Action related to Quality Control. If the RPD of the field splits exceeds 30%, the Project Chief will identify possible sources of error and corrective measures will be taken before the next sampling event.

#### *Laboratory Measurement Quality Control Requirements and Acceptability*

Analyses for chemical constituents will be performed by USGS laboratories. Because of very short holding times, bacteriological analysis will be performed by NWDLS Environmental Laboratory. A summary of quality control measures at the NWQL, including participation in laboratory evaluation programs, is provided in the NWQL Quality Management System manual (Maloney, 2005<sup>9</sup>).

Detailed laboratory QC requirements and corrective action procedures are contained within the individual laboratory quality assurance manuals (QAMs). The minimum requirements that all participants abide by are stated below. Lab QC sample results are submitted with the data report (see Section C2).

#### *Laboratory Control Standard (LCS)*

A LCS consists of a sample matrix (e.g. deionized water) free from the analyte(s) of interest spiked with verified known amounts of analyte(s). The LCS is spiked into the sample matrix at a level less than or near the mid-point of the calibration curve 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.

The LCS is carried through the complete preparation and analytical process. The LCS is used to document the bias of the analytical process. The number of LCS samples can vary and is either specified in the method or SOP. An LCS is analyzed at a minimum of one per batch of

environmental samples. A batch is defined as a set of environmental samples that are prepared and/or analyzed together within the same process using the same lot of reagents.

Results of LCS 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 the percent recovery of LCS analyses, where %R is percent recovery; SR is the measured result; SA is the spike added:

$$\%R = SR/SA * 100$$

Analyte concentration must be within the calibration range of the methods where possible. An LCS that is determined to be within the acceptance criteria effectively establishes that the analytical system is in control and validates system performance for the samples in the associated batch. Samples analyzed along with an LCS determined to be “out of acceptance limit” are reprocessed and reanalyzed, or the data are reported with appropriate data-qualifying codes.

Performance limits and control charts are used to determine the acceptability of LCS analyses. Project control limits are specified in Table A7.1.

#### *AWRL/Reporting Limit Verification*

The laboratory reporting limit for each parameter will be at or below the AWRL. To demonstrate the ongoing ability to recover at the reporting limit, the laboratory will analyze a calibration standard (if applicable) at or below the reporting limit on each day USGS samples are analyzed. Two acceptance criteria will be met, or corrective action will be implemented. First, calibrations including the standard at the reporting limit will meet the calibration requirements of the analytical method. Second, the instrument response (e.g., absorbance, peak area, etc.) for the standard at the reporting limit will be treated as a response for a sample by use of the calibration equation (e.g., regression curve, etc.) in calculating an apparent concentration of the standard. The calculated and reference concentrations for the standard will then be used to calculate percent recovery (%R) at the reporting limit using the equation:

$$\%R = CR/SCA * 100$$

where CR is the calculated result and SCA is the reference concentration for the standard. Recoveries must be within 75-125% of the reference concentration.

When daily calibration is not required (e.g., EPA Method 624), or a method does not use a calibration curve to calculate results, the laboratory will analyze a check standard at the reporting limit on each day USGS samples are analyzed. The check standard does not have to be taken through sample preparation but must be recovered within 75-125% of the reference concentration for the standard. The percent recovery of the check standard is calculated using the following equation in which %R is percent recovery, SCR is the sample result, and SCA is the reference concentration for the check standard:

$$\%R = SCR/SCA * 100$$

If the calibration (when applicable) or the recovery of the calibration or control standard is not acceptable, corrective actions (e.g., re-calibration) will be taken to meet the specifications before proceeding with analyses of USGS samples.

The NWQL uses Continuing Calibration Verification (CCV) standards as calibration checks. These standards are run at or below the AWRL for each inorganic constituent, on each day. Therefore, this information will be compiled for those days when USGS samples are analyzed and provided to the Project Chief.

#### *Laboratory Duplicates*

A laboratory duplicate is prepared in the laboratory by splitting aliquots of an LCS. Both samples are carried through the entire preparation and analytical process. LCS duplicates are used to assess precision and are performed at a rate of one per batch.

For most parameters, precision is calculated by the relative percent difference (RPD) of LCS 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:

$$RPD = (X_1 - X_2) / \{(X_1 + X_2) / 2\} * 100$$

A bacteriological duplicate is a special type of laboratory duplicate and applies when bacteriological samples are run in the field as well as in the lab. Bacteriological duplicate analyses are performed on samples from the sample bottle on a 10% basis. Results of bacteriological duplicates are evaluated by calculating the logarithm of each result and determining the range of each pair.

Performance limits and control charts are used to determine the acceptability of duplicate analyses. Project control limits are specified in Table A7.1. The specifications for bacteriological duplicates in Table A7.1 apply to samples with concentrations >10 colonies/100mL.

#### *Laboratory equipment blank*

The NWQL prepares blank water for internal use. This is done using the in-house deionized water followed by a final ultrapure deionizing and polishing those results in ASTM Type I reagent water. Certificates of analyses and NWQL documentation of blank water are available from the laboratory website. Blanks are included as an integral part of each set of sample analyses, in conjunction with both spikes and environmental samples. The sequence ensures that instrumentation is appropriately purged between samples. The analysis of laboratory equipment blanks should yield values less than the reporting limit. Otherwise, the equipment will not be used.

#### *Method (Equipment) Blank*

A method blank is an analyte-free matrix to which all reagents are added in the same volumes or proportions as used in the sample processing and analyzed with each batch. The method blank is carried through the complete sample preparation and analytical procedure. The method blank is used to document contamination from the analytical process. The analysis of method blanks should yield values less than the reporting level. 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.

#### *Additional method-specific QC requirements*

Additional QC samples are run (e.g., surrogates, internal standards, continuing calibration samples, interference check samples) as specified in the methods. The requirements for these samples, their acceptance criteria, and corrective actions are method specific.

#### *Deficiencies, Nonconformances, and Corrective Action Related to Quality Control*

Deficiencies related to laboratory measurement systems include, but are not limited to, instrument malfunctions, blank contamination, quality-control sample failures, etc. Procedures the NWQL uses to ensure data quality and corrective actions are described in the NWQL Quality Management System report, Sections 2.6-2.8 (Maloney, 2005<sup>9</sup>). Corrective actions at the NWQL are outlined in the laboratory Quality Management System manual (Maloney, 2005<sup>9</sup>).

Sampling QC excursions are evaluated by the USGS PM, in consultation with the USGS QAS. In that differences in field duplicate sample results are used to assess the sampling process, including environmental variability, the automatic rejection of results based on control chart limits is not practical. Therefore, some professional judgment will be relied upon in evaluating results. Rejecting sample results based on wide variability is a possibility. Blank data are scrutinized very closely. Blank values exceeding the acceptability criteria may automatically invalidate the sample, especially in cases where high blank values may be indicative of contamination which may be causal in putting a value above the standard. Incidences of field duplicate excursions and blank contamination are noted in the quarterly report.

Deficiencies are documented in logbooks and field data sheets by field or laboratory staff and reported to the pertinent field or laboratory supervisor who will notify the USGS Project Chief. The USGS Project Chief will notify the USGS QAO of the potential non-conformance. The USGS QAO will initiate the CAR to document the deficiency.

The USGS QAO, in consultation with the USGS Project Chief (and other affected individuals/organizations), will determine if the deficiency constitutes a non-conformance. If it is determined the activity or item in question does not affect data quality and therefore is not a valid nonconformance, the CAR will be completed accordingly and closed. If it is determined that a nonconformance does exist, the USGS Project Chief in consultation with USGS QAO will determine the disposition of the nonconforming activity or item and necessary corrective action(s); results will be documented by completion of a CAR, which is retained by the USGS QAO.

CARs document: root cause(s); programmatic impact(s); specific corrective action(s) to address the deficiency, action(s) to prevent recurrence, individual(s) responsible for each action, the

timetable for completion of each action; and the means by which completion of each corrective action will be documented. The TSSWCB will be notified of inconsistencies that affect data quality with quarterly progress reports. In addition, significant conditions (i.e., situations that, if uncorrected, could have a serious effect on safety or validity or integrity of data) will be reported to TSSWCB immediately.

## B6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

All sampling equipment testing and maintenance requirements are detailed in the TCEQ Surface Water Quality Monitoring Procedures Volumes 1 and 2. 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.

National Field Manual for the Collection of Water-Quality Data: United States Geological Survey Techniques of Water-Resources Investigations, available online at <https://www.usgs.gov/mission-areas/water-resources/science/national-field-manual-collection-water-quality-data-nfm>.

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



## B7 INSTRUMENT CALIBRATION AND FREQUENCY

A calibration of water-quality meters will take place at the beginning of sampling each day. Post-calibration will be done at the conclusion of sampling on the same day. Both calibration and post-calibration documentation will be photocopied and included with the field form for each site sampled during that day. Post-calibration error limits and the disposition resulting from error are adhered to. Data not meeting post-error limit requirements invalidate associated data collected after the pre-calibration and are not submitted to the TSSWCB. Field equipment calibration requirements are described in the TCEQ Surface Water Quality Monitoring Procedures.

## B8 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

All laboratory-related items will be inspected and accepted for use in this project by the laboratories. Acceptance criteria for such supplies and consumables, to satisfy the technical and quality objectives of this project, are documented in the individual laboratories' QMs.

## B9 NON-DIRECT MEASUREMENTS

A portion of the baseline and routine monitoring data set employed in this project is non-direct because these data sets are obtained from the agencies or organizations that made the direct measurements. Every monitoring program differs in the quantity and quality of procedural documentation, metadata, and Quality Assurance/Quality Control (QA/QC) practices. All data will be accepted from the sources but will be subject to a validation process. Sources may include, depending on the availability of data during the project period, the TCEQ SWQMIS database, the National Weather Service, Trinity Bay Conservation District, USGS, Texas Department of State Health Services, EPA, and the Houston-Galveston Area Council (H-GAC). Limitations will be noted in the final report and all web-based deliverables.

The project will make qualitative statements describing data confidence based on the existence and availability of the following documentation:

- Approved QAPP
- Established QA/QC procedures
- Agency-specific procedural documentation
- Metadata in a standard format

Data sets will fall under one of three qualitative confidence levels: HIGH, MODERATE, and LOW. It should be noted that agency data will not automatically fall in the HIGH level of confidence range, just as volunteer monitoring data will not necessarily be placed within the LOW confidence range. The confidence level will be determined based on the availability of the above documentation. Depending on the availability of the documentation, it is possible that volunteer monitoring data could be classified as being MODERATE or even HIGH, just as the lack of that documentation could cause agency data to fall within the MODERATE or LOW confidence ranges.

Data will be designated as having a HIGH level of confidence if three to four of the following items exist and are made available:

- An approved QAPP
- Established QA/QC procedures
- Agency-specific procedural documentation
- Metadata in a standard format

Data will be designated as having a MODERATE level of confidence if two of the following items exist and are made available:

- An approved QAPP
- Established QA/QC procedures
- Agency-specific procedural documentation
- Metadata in a standard format

Data will be designated as having a LOW level of confidence if one or fewer of the following items exist and are made available:

- An approved QAPP
- Established QA/QC procedures
- Agency-specific procedural documentation
- Metadata in a standard format

## B10 DATA MANAGEMENT

### *Data Management Process*

For data processing and management, the introduction of errors and loss of data will be managed by applying standard procedures for record keeping and auditing. Documentation will describe project personnel that made changes and the time at which the changes were made. Every time a file is changed it is saved in a new version and the old version will be archived. New file names and locations will be recorded in the database documentation. Archival files will be deleted when the data updates are received from the responsible agency and the data processing cycle starts over. Periodic comparisons between recent and early versions will be used to detect problems and quality assurance training will be implemented if problems are detected.

For data monitoring and acquisition, all field forms used as part of this study are in Appendix A1.

Review procedures at the NWQL are discussed in the laboratory QMS manual (Maloney, 2005<sup>9</sup>). Analytical results from the NWQL (nutrients, TSS, chloride, sulfate,) are electronically transferred to the USGS NWIS database. In addition, a copy of the analytical results is sent electronically to a directory accessible from the USGS Houston Water Science Center. Each week, personnel from Houston retrieve analytical data from the directory for review by the Project Chief. Standard data checks include ion balance and comparison with historical data from that site. If any anomalies are found during review, the NWQL is notified for re-loads or clarification, if necessary. Analytical results from NWDLS are manually entered into the USGS NWIS database by project personnel. Data from field sheets used to record hydrologic data (discharge, stage) are checked and manually entered into the USGS NWIS database. Similarly, water-quality parameters that are determined during site visits (water temperature, specific conductance, dissolved oxygen, pH, etc.) are verified in the office and entered into the USGS NWIS database. All data entries are ultimately reviewed for accuracy by the Project Chief.

Continuous (24-hour) monitor data (water temperature, specific conductance, dissolved oxygen, pH) are determined at each sampling station of East and West Fork Double Bayou during 24 events. The multi-probe data are recorded electronically by a data logger. Calibration of the monitor is checked and recorded both when it is deployed, and when it is removed from the field. Data are reviewed by the USGS Project Chief for final acceptance. If values exceed calibration criteria, they are not provided.

Verified project data will be retrieved from the USGS NWIS database and provided to GTRI in electronic format. GTRI will provide the data to TSSWCB in electronic format. All data will be submitted to the GTRI and TSSWCB using standard methods. If any discrepancies are found in data that are submitted by the USGS, the Project Chief will be alerted and the extent and source of the discrepancy will be determined and corrected before re-submitting the electronic data.

### *Data Errors and Loss*

Data errors or losses will be documented in logbooks and field data sheets by field or laboratory staff and reported to the pertinent field or laboratory supervisor who will notify the USGS Project Chief. If the USGS Project Chief deems the loss significant they will notify the USGS QAO of the potential non-conformance. The USGS QAO will initiate the CAR to document the deficiency.

The USGS QAO, in consultation with the USGS Project Chief (and other affected individuals/organizations), will determine if the deficiency constitutes a non-conformance. If it is determined the activity or item in question does not affect data quality and therefore is not a valid nonconformance, the CAR will be completed accordingly and closed. If it is determined that a nonconformance does exist, the USGS Project Chief in consultation with USGS QAO will determine the disposition of the nonconforming activity or item and necessary corrective action(s); results will be documented by completion of a CAR, which is retained by the USGS QAO.

#### *Record Keeping and Data Storage*

For data processing and management, this project is built upon the use of computing and electronic communications resources for the transfer, processing, and maintenance of data. GTRI staff will manage the project's computing resources.

Record-keeping and document control procedures are contained in the water quality sampling and laboratory SOPs and this QAPP. GTRI uses three servers with dual processors and high-capacity hard drives. The data servers are backed up nightly to an air-gapped archival system for additional security. Security systems and software to protect data from virus infection and tampering by unauthorized users are integrated. The data servers are equipped with emergency power supplies. Data sets for access by personnel not directly involved in data management or analysis will be provided with read-only permission.

Surface-water and water-quality data will be archived as outlined in the Texas Water Science Center quality assurance and quality-control plan. Field data will be promptly entered into the NWIS database. Monitor data will be uploaded every time measurements are made. A total of three USGS Hydrologic technicians or Hydrologists will be involved in the record finalization process.

#### *Data Handling, Hardware, and Software Requirements*

Data integrity is maintained by the implementation of secured folders that control access to the database limiting update rights to a select user group. No data from external sources are maintained in the database. The GTRI PM/Data Manager is responsible for assigning user rights and assuring database integrity. Data sets processed for access by personnel not directly involved in data management or analysis will be provided with read-only permission.

IT Department 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 GIS department. GIS or IT staff may develop applications based on user requests and assures full

system compatibility prior to implementation. The GTRI PM/Data Manager will coordinate with the IT staff to ensure that server and network maintenance will minimally interfere with project computing, storage, and network connectivity needs.

Microsoft software packages for processing and maintaining data include Microsoft SQL Server, Access, and Excel. Esri geospatial products including ArcGIS Pro, ArcGIS Online, ArcGIS Dashboards, and ArcGIS Experience Builder are used for map production, geodatabase creation and storage, and building public-facing applications. JMP Pro 15.2.0, ArcGIS Pro 2.9.2, Program R version 4.2.1, or the latest available versions, are used to perform statistical analyses.

For data monitoring and acquisition, analytical results from USGS laboratories will be electronically transferred to the USGS NWIS database. Analytical results from NWDLS will be provided to the USGS in an electronic format.

### Electronic Data

Data will be submitted electronically to the TCEQ Data Management and Analysis Team for inclusion in SWQMIS and/or project partner for review in the Event/Result file format described in the most current version of the TCEQ Data Management Reference Guide (DMRG). Until the project begins, and we know the coordination schedule for sampling, lab turnaround time on each parameter, and data QC checks, an exact schedule for SWQMIS submission cannot be determined; at a minimum, annual submissions will occur. A completed Data Summary (see example in Appendix D) will be submitted with each data submittal.

Table B10.1 Codes for Data Submittals

<b>Sample Description</b>	<b>Tag Prefix</b>	<b>Submitting Entity</b>	<b>Collecting Entity</b>	<b>Monitoring Type Code</b>
Routine monitoring to assess ongoing trends	<i>TX</i>	<i>TX</i>	<i>GS</i>	<i>RT</i>
Biased flow monitoring targets flow condition that must be present for sample collection to occur	<i>TX</i>	<i>TX</i>	<i>GS</i>	<i>BF</i>
24-hour DO Monitoring	<i>TX</i>	<i>TX</i>	<i>GS</i>	<i>BS</i>

- 1) RT- Sampling scheduled in advance without intentionally trying to target any certain environmental condition. The sampling seeks to set a baseline for the site. Sample will be collected regardless of the conditions encountered.
- 2) BF - not precisely scheduled in advance because they target a certain flow condition that must be present in order for the sample collection to occur.

**C1 ASSESSMENTS AND RESPONSE ACTIONS**

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

Table C1.1 - Assessments and Response Requirements

<b>Assessment Activity</b>	<b>Approximate Schedule</b>	<b>Responsible Party</b>	<b>Scope</b>	<b>Response Requirements</b>
Status Monitoring Oversight, etc.	Continuous	GTRI	Monitoring of the project status and records to ensure requirements are being fulfilled	Report to TSSWCB in Quarterly Progress Report
Monitoring Systems Audit of USGS	Dates to be determined by TSSWCB	TSSWCB	Field sampling, handling and measurement; facility review; and data management as they relate to this project	30 days to respond in writing to the TSSWCB to address corrective actions
Laboratory Inspection	Dates to be determined by TSSWCB	TSSWCB	Analytical and QC procedures employed at the USGS laboratory and the contracted laboratories	30 days to respond in writing to the TSSWCB to address corrective actions

**Corrective Action**

The GTRI PM is responsible for implementing and tracking corrective action resulting from audit findings outlined in the audit report. Records of audit findings and corrective actions are maintained by both GTRI and TSSWCB. Audit reports and corrective action documentation will be submitted to the TSSWCB in the Quarterly Progress Report.

If audit findings and corrective actions cannot be resolved, then the authority and responsibility for terminating work are specified in the agreements in contracts between participating organizations.



## C2 REPORTS TO MANAGEMENT

The results of data audits will be included in quarterly reports to the TSSWCB PM from the GTRI PM. GTRI responses to problems detected by audits will also be summarized in the reports to management. Field water-quality data will be transmitted to the GTRI PM when data are submitted.

### *Reports to TSSWCB*

All reports detailed in this section are contract deliverables and are transferred to the TSSWCB in accordance with contract requirements.

Quarterly Progress Report - Summarizes GTRI's activities for each task; reports monitoring status, problems, delays, and corrective actions; and outlines the status of each task's deliverables.

Monitoring Systems Audit Report and Response - GTRI will respond in writing to the TSSWCB within 30 days upon receipt of a monitoring system audit report to address corrective actions. Response written by the GTRI PM.

## D1 DATA REVIEW, VERIFICATION, AND VALIDATION

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

All field and laboratory data will be reviewed and verified for integrity and continuity, reasonableness, and conformance to project requirements, and then validated against the project objectives and measurement performance specifications which are listed in Section A7. Only those data which are supported by appropriate quality control data and meet the measurement performance specifications defined for this project will be considered acceptable and will be reported.

The procedures for verification and validation of data are described in Section D2 below. The USGS Project Chief is responsible for ensuring that field data are properly reviewed, verified, and submitted in the required format to the project database. Laboratory managers are responsible for ensuring that laboratory data are reviewed, verified, and submitted to the USGS Project Chief.

Data validation will be the focus. The GTRI PM/Data Manager will review all data sets received and validate the values according to the process described below. The sampling and analytical methodology, quality assurance procedures, and associated metadata will be obtained, when available, from agency programs contributing data. Data quality will be described (see Section B9).

If a data error is suspected (e.g. the concentration of a water quality parameter appears to be exceptionally high), the GTRI PM will contact the source agency to verify the data in question. If the data cannot be verified, they will be filtered from the database and not included in analyses. If the data are verified by the source agency, the data will be included in analyses. Regardless of the outcome, the action will be noted in the database documentation.

## D2 VERIFICATION AND VALIDATION METHODS

For data acquisition, data will be reviewed and validated in a stepwise process to exclude from the analysis all values of questionable sampling location, sampling date, sampling method, and value. The first step is to eliminate values that cannot be precisely identified as to the time the sample or information was collected. Values that cannot be precisely located to a latitude and longitude or landmark in the Double Bayou watershed will also be removed. The distribution of values for a particular parameter and method will be reviewed to question the validity of outliers.

Extreme values will be excluded if it is determined that it is physically or biologically impossible for the parameter to arrive at that value. Outliers that pass the test of impossibility but are still an order of magnitude or one standard deviation greater or less than the next closest value will be referred to the submitting agency for determination of inclusion or exclusion.

All field and laboratory data will be reviewed, verified, and validated to ensure they conform to project specifications and meet the conditions of end use as described in Section A7 of this document.

Data review and verification 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 personnel are listed in the first two sections of Table D2.1, respectively. The data to be verified (Table D2.1) are evaluated against project specifications and are checked for errors, especially errors in transcription, calculations, and data input. Data from original field notes will be compared with electronic data to ensure correctness. Potential outliers are identified by graphical examination for unreasonable data or identified using computer-based software embedded in the USGS NWIS database (ADAPS and QWDATA). If a question arises or an error or potential outlier 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 electronically or by initialing and dating the associated paperwork. If an issue cannot be corrected, the task manager consults with higher-level project management to establish the appropriate course of action, or the data associated with the issue are rejected. The USGS Project Chief is responsible for validating that the verified data meet the measurement performance criteria. Field and laboratory reviews, verifications, and validations are documented.

After the field and laboratory data are reviewed, another level of review is performed once the data are combined into a data set. Data review, verification, and validation tasks to be performed on the data set include, but are not limited to, the confirmation of lab 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.

Table D2.1 - Data Review Tasks

<b>Field Data Review</b>	<b>Responsibility</b>
Field data reviewed for conformance with data collection, sample handling and chain of custody, analytical and QC requirements	USGS Project Chief
Post-calibrations checked to ensure compliance with error limits	USGS Project Chief; USGS QAO
Field data calculated, reduced, and transcribed correctly	USGS Project Chief; USGS QAO
<b>Laboratory Data Review</b>	
Laboratory data reviewed for conformance with data collection, sample handling and chain of custody, analytical and QC requirements to include documentation, holding times, sample receipt, sample preparation, sample analysis, project and program QC results, and reporting	NWQL and NWDLS Laboratory supervisors; USGS Project Chief; USGS Project QAO
Laboratory data calculated, reduced, and transcribed correctly	NWQL and NWDLS Laboratory supervisors; QAO
Reporting limits consistent with requirements for Ambient Water Reporting Limits	USGS Project Chief; USGS QAO
Analytical data documentation evaluated for consistency, reasonableness and/or improper practices	NWQL and NWDLS Laboratory supervisors; QAO
Analytical QC information evaluated to determine impact on individual analyses	USGS Project Chief
All laboratory samples analyzed for all parameters	USGS Project Chief
<b>Data Set Review</b>	
The test report has all required information as described in Section A9 of the QAPP	USGS Project Chief
Confirmation that field and lab data have been reviewed	USGS Project Chief
Data set (to include field and laboratory data) evaluated for reasonableness and if corollary data agree	USGS Project Chief
Outliers confirmed and documented	USGS Project Chief
Field QC acceptable (e.g., field splits and trip, field, and equipment blanks)	USGS Project Chief
Sampling and analytical data gaps checked and documented	USGS Project Chief
Verification and validation confirmed. Data meets conditions of end use and are reportable	USGS Project Chief

### D3 RECONCILIATION WITH USER REQUIREMENTS

Data produced in this project, and data collected by other organizations (e.g., USGS, TCEQ, etc.), will be analyzed and reconciled with project data quality requirements. Data meeting project requirements may be used by the TCEQ in SWQMIS for the use in the development of the biennial *Texas Integrated Report for Clean Water Act Sections 305 (b) and 303(d)* and WPP development as appropriate. Data that do not meet requirements will not be submitted to SWQMIS nor will be considered appropriate for any of the uses noted above.

## References

- <sup>1</sup> Matthes, W.J., Sholar, C.J., and George, J.R., 1992, Quality-assurance plan for the analysis of fluvial sediment by laboratories of the U.S. Geological Survey: U.S. Geological Survey Open-File Report 91-467, 31 p.
- <sup>2</sup> USEPA, 1979, Methods for Chemical analysis of water and wastes, Environmental Protection Agency, Environmental Monitoring Systems Laboratory-Cincinnati (EMSL-CI), EPA-600/4-79-020, revised 1983.
- <sup>3</sup> American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), “Standard Methods for the Examination of Water and Wastewater”, 23<sup>rd</sup> Edition, 2017, accessed May 30, 2019, at <https://doi.org/10.2105/SMWW.2882.180>
- <sup>4</sup> Patton, C.J., and Truitt, E.P., 1992, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory--Determination of total phosphorus by a Kjeldahl digestion method and an automated colorimetric finish that includes dialysis: U.S. Geological Survey Open-File Report 92-146, 39 p.
- <sup>5</sup> Fishman, M.J., 1993, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory--Determination of inorganic and organic constituents in water and fluvial sediments: U.S. Geological Survey Open-File Report 93-125, 217 p.
- <sup>6</sup> USEPA, 1992, Methods for the determination of chemical substances in marine and estuarine environmental samples, EPA Report No. EPA 600/R-92/121.
- <sup>7</sup> TCEQ SOP - Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods, 2012.
- <sup>8</sup> Maloney, T.J. ed., 2005, Quality Management System, U.S. Geological Survey National Water Quality Laboratory: U.S. Geological Survey Open-File Report 2005-1263, 119 p.
- <sup>9</sup> Shelton, LR. 1994, Field guide for collecting and processing stream-water samples for the national water quality assessment program, USGS Open-File Report 94-455.
- <sup>10</sup> U.S. Geological Survey, variously dated, National field manual for the collection of water-quality data: U.S. Geological Survey Techniques of Water-Resources Investigations, available online at <https://www.usgs.gov/mission-areas/water-resources/science/national-field-manual-collection-water-quality-data-nfm>.

<sup>11</sup> Mueller, D.S., Wagner, C.R., Rehm, M.S., Oberg, K.A., and Rainville, Francois, 2013, Measuring discharge with acoustic Doppler current profilers from a moving boat (ver. 2.0, December 2013): U.S. Geological Survey Techniques and Methods, book 3, chap. A22, 95 p., <https://dx.doi.org/10.3133/tm3A22>.







*Appendix C. Corrective Action Report*

**Corrective Action Report**

**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: \_\_\_\_\_

GTRI Quality Assurance Officer: \_\_\_\_\_

TSSWCB Quality Assurance Officer: \_\_\_\_\_

*Appendix D. Data Summary Report*

**Data Summary**

**Data Information**

**Data Source:**

\_\_\_\_\_

**Date Submitted:**

\_\_\_\_\_

**Tag\_id Range:**

\_\_\_\_\_

**Date Range:**

\_\_\_\_\_

**Comments**

**Please explain in the space below any data discrepancies including:**

- Inconsistencies with AWRP specifications;
- Failures in sampling methods and/or laboratory procedures that resulted in data that could not be reported to the TSSWCB or TCEQ; and
- Other discrepancies.

\_\_\_\_\_  
-  
\_\_\_\_\_  
-  
\_\_\_\_\_  
-  
\_\_\_\_\_  
-  
\_\_\_\_\_  
-  
\_\_\_\_\_  
-  
\_\_\_\_\_  
-  
\_\_\_\_\_

**Data Manager:** \_\_\_\_\_

**Date:** \_\_\_\_\_