Quality Assurance Project Plan
Brazos River Authority

4600 Cobbs Dr.
Waco, TX 76710

Clean Rivers Program

Water Quality Planning Division

Texas Commission on Environmental Quality

P.O. Box 13087, MC 234

Austin, Texas 78711-3087

Effective Period: FY 2016 to FY 2017

Questions concerning this QAPP should be directed to:

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A1 Approval Page

Texas Commission on Environmental Quality

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ES Laboratory

Ahmed Kadry 8-18-15
Ahmed Kadry, PhD Date
BRA ES Laboratory Manager

Mike Quackenbush 8-18-15
Mike Quackenbush Date
BRA ES Deputy Quality Assurance Officer

Jack R. Davis 20 Aug 15
Jack Davis Date
BRA Field Operations Manager

Sub-tier participants (e.g., subcontractors, subparticipants, or other units of government) will sign the QAPP, indicating the organization's awareness of, and commitment to requirements contained in this quality assurance project plan and any amendments or added appendices of this plan. Signatures in section A1 will eliminate the need for adherence letters to be maintained.

A2 Table of Contents

List of Acronyms

AWRL	Ambient Water Reporting Limit
BMP	Best Management Practices
BRA	Brazos River Authority
CAP	Corrective Action Plan
CFR	Code of Federal Regulations
CMS	Coordinated Monitoring Schedule
COC	Chain of Custody
CRP	Clean Rivers Program
DMRG	Surface Water Quality Monitoring Data Management Reference Guide, August 2015, or most recent version
DM&A	Data Management and Analysis
DQAO	Deputy Quality Assurance Officer
EPA	United States Environmental Protection Agency
ES	Environmental Services
FY	Fiscal Year
GIS	Geographical Information System
GPS	Global Positioning System
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LIMS	Laboratory Information Management System
LOD	Limit of Detection
LOQ	Limit of Quantitation
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NELAP	National Environmental Lab Accreditation Program
PT	Proficiency Testing
QA	Quality Assurance
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QAS	Quality Assurance Specialist
QC	Quality Control
QM	Quality Manual
QMP	Quality Management Plan
RPD	Relative Percent Difference
SB	Senate Bill
SLOC	Station Location
SM	Standard Methods
SOP	Standard Operating Procedure
SWQM	Surface Water Quality Monitoring
SWQMIS	Surface Water Quality Monitoring Information System
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality

TDS	Total Dissolved Solids
TKN	Total Kjeldahl Nitrogen
TMDL	Total Maximum Daily Load
TNI	The NELAC Institute
TP	Total Phosphorus
TSS	Total Suspended Solids
TSWQS	Texas Surface Water Quality Standards
TWC	Texas Water Code
TWDP	Texas Water Development Board
USACOE	United States Army Corps of Engineers
USGS	United States Geological Survey
WPP	Watershed Protection Plan
WQ	Water Quality

A3 Distribution List

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Mike Quackenbush, Deputy Quality Assurance Officer
(254) 761-3243

The Brazos River Authority will provide copies of this project plan and any amendments or appendices of this plan to each person on this list and to each sub-tier project participant, e.g., subcontractors, subparticipant, or other units of government. The Brazos River Authority will document distribution of the plan and any amendments and appendices, maintain this documentation as part of the project's quality assurance records, and will ensure the documentation is available for review.

A4 PROJECT / TASK ORGANIZATION

Description of Responsibilities

TCEQ

Sarah Eagle

CRP Work Leader

Responsible for Texas Commission on Environmental Quality (TCEQ) activities supporting the development and implementation of the Texas Clean Rivers Program (CRP). Responsible for verifying that the TCEQ Quality Management Plan (QMP) is followed by CRP staff. Supervises TCEQ CRP staff. Reviews and responds to any deficiencies, corrective actions, or findings related to the area of responsibility. Oversees the development of Quality Assurance (QA) guidance for the CRP. Reviews and approves all QA audits, corrective actions, reviews, reports, work plans, contracts, QAPPs, and TCEQ Quality Management Plan. Enforces corrective action, as required, where QA protocols are not met. Ensures CRP personnel are fully trained.

Daniel R. Burke

CRP Lead Quality Assurance Specialist

Participates in the development, approval, implementation, and maintenance of written QA standards (e.g., Program Guidance, SOPs, QAPPs, QMP). Assists program and project manager in developing and implementing quality system. Serves on planning team for CRP special projects. Coordinates the review and approval of CRP QAPPs. Prepares and distributes annual audit plans. Conducts monitoring systems audits of Planning Agencies. Concurs with and monitors implementation of corrective actions. Conveys QA problems to appropriate management. Recommends that work be stopped in order to safeguard programmatic objectives, worker safety, public health, or environmental protection. Ensures maintenance of QAPPs and audit records for the CRP.

Alexandra Smith

CRP Project Manager

Responsible for the development, implementation, and maintenance of CRP contracts. Tracks, reviews, and approves deliverables. Participates in the development, approval, implementation, and maintenance of written QA standards (e.g., Program Guidance, SOPs, QAPPs, QMP). Assists CRP Lead QA Specialist in conducting BRA audits. Verifies QAPPs are being followed by contractors and that projects are producing data of known quality. Coordinates project planning with the BRA Project Manager. Reviews and approves data and reports produced by contractors. Notifies QA Specialists of circumstances which may adversely affect the quality of data derived from the collection and analysis of samples. Develops, enforces, and monitors corrective action measures to ensure contractors meet deadlines and scheduled commitments.

Cathy Anderson

Team Leader, Data Management and Analysis (DM&A) Team

Participates in the development, approval, implementation, and maintenance of written QA standards (e.g., Program Guidance, SOPs, QAPPs, QMP). Ensures DM&A staff perform data management related tasks, including coordination and tracking of CRP data sets from initial submittal through CRP Project Manager review and approval; ensuring that data are reported following instructions in the Surface Water Quality Monitoring Data Management Reference Guide, August 2015, or most current version (DMRG); running automated data validation checks in Surface Water Quality Monitoring Information System (SWQMIS) and coordinating data verification and error correction with CRP Project Managers; generating SWQMIS summary reports to assist CRP Project Managers' data review; identifying data anomalies and inconsistencies; providing training and guidance to CRP and Planning Agencies on technical data issues to ensure that data are submitted according to documented procedures; reviewing QAPPs for valid stream monitoring stations, validity of parameter codes, submitting entity code(s), collecting entity code(s), and monitoring type code(s); developing and maintaining data management-related standard operating procedures (SOPs) for CRP data management; and coordinating and processing data correction requests.

Peter Bohls

CRP Data Manager, DM&A Team

Responsible for coordination and tracking of CRP data sets from initial submittal through CRP Project Manager review and approval. Ensures that data are reported following instructions in the DMRG. Runs automated data validation checks in SWQMIS and coordinates data verification and error correction with CRP Project Managers. Generates SWQMIS summary reports to assist CRP Project Managers' data review. Identifies data anomalies and inconsistencies. Provides training and guidance to CRP and Planning Agencies on technical data issues to ensure that data are submitted according to documented procedures. Reviews QAPPs for valid stream monitoring stations. Checks validity of parameter codes, submitting entity code(s), collecting entity code(s), and monitoring type code(s). Develops and maintains data management-related SOPs for CRP data management. Coordinates and processes data correction requests. Participates in the development, implementation, and maintenance of written QA standards (e.g., Program Guidance, SOPs, QAPPs, QMP).

Allison Fischer

CRP Project Quality Assurance Specialist

Serves as liaison between CRP management and TCEQ QA management. Participates in the development, approval, implementation, and maintenance of written QA standards (e.g., Program Guidance, SOPs, QAPPs, QMP). Serves on planning team for CRP special projects and reviews QAPPs in coordination with other CRP staff. Coordinates documentation and implementation of corrective action for the CRP.

Brazos River Authority

Jenna Olson

BRA Project Manager

Responsible for implementing and monitoring CRP requirements in contracts, QAPPs, and QAPP amendments and appendices. Coordinates basin planning activities and work of basin partners. Ensures monitoring systems audits are conducted to ensure QAPPs are followed by BRA participants and that projects are producing data of known quality. Ensures CRP project managers and/or QA Specialists are notified of deficiencies and corrective actions, and that issues are resolved. Responsible for validating that data collected are acceptable for reporting to the TCEQ.

Kay Barnes

BRA Quality Assurance Officer

Responsible for coordinating the implementation of the QA program. Responsible for writing and maintaining the QAPP and monitoring its implementation. Responsible for maintaining records of QAPP distribution, including appendices and amendments. Responsible for identifying, receiving, and maintaining project QA records. Responsible for coordinating with the TCEQ QAS to resolve QA-related issues. Notifies the BRA Project Manager of particular circumstances which may adversely affect the quality of data. Coordinates and monitors deficiencies and corrective action. Coordinates and maintains records of data verification and validation. Coordinates the research and review of technical QA material and data related to water quality monitoring system design and analytical techniques. Conducts monitoring systems audits on project participants to determine compliance with project and program specifications, issues written reports, and follows through on findings. Ensures that field staff is properly trained and that training records are maintained.

Kay Barnes

BRA Data Manager

Responsible for ensuring that field data are properly reviewed and verified. Responsible for the transfer of basin quality-assured water quality data to the TCEQ in a format compatible with SWQMIS. Maintains quality-assured data on BRA internet sites.

Mike Quackenbush

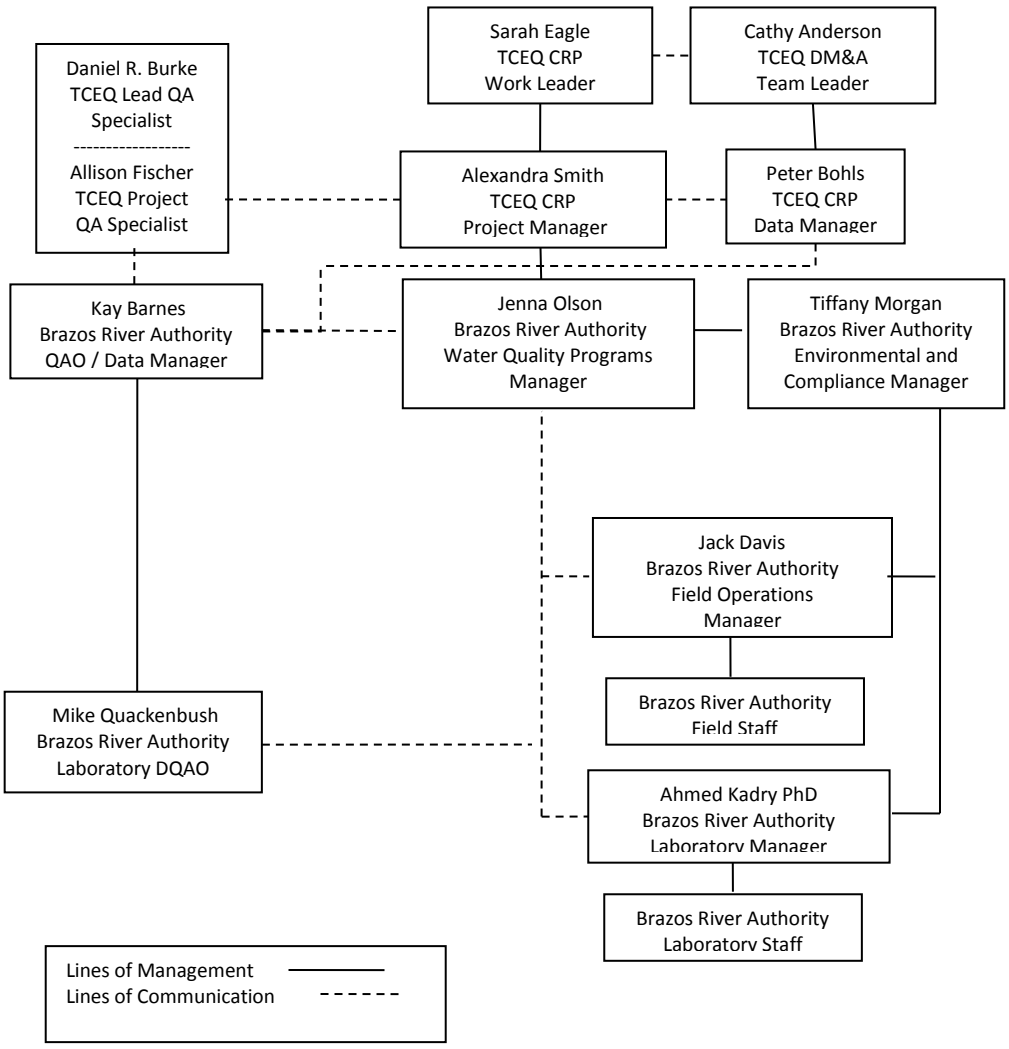
BRA Environmental Services Deputy Quality Assurance Officer Assists with the coordinating and implementation of the QA program. Responsible for ensuring that field and lab test data from the BRA Environmental Services Laboratory are properly reviewed and verified. Coordinates and maintains records of data verification and validation. Maintains the daily corrective action process. Assists with writing and maintaining the QAPP. Responsible for the transfer of basin quality-assured water quality data to the TCEQ in a format compatible with SWQMIS.

Ahmed Kadry
BRA Environmental Services Laboratory Manager
Responsible for initial review and verification of lab test data for compliance, correctness, completeness and consistency with project goals. Coordinates daily lab function.

Jack Davis
BRA Field Operations Manager
Responsible for coordinating field activities to ensure compliance, correctness, completeness and consistency with project goals.

Project Organization Chart

Figure A4.1. Organization Chart - Lines of Communication



A5 Problem Definition / Background

In 1991, the Texas Legislature passed the Texas Clean River Act (Senate Bill 818) in response to growing concerns that water resource issues were not being pursued in an integrated, systematic manner. The act requires that ongoing water quality assessments be conducted for each river basin in Texas, an approach that integrates water quality issues within the watershed. The CRP legislation mandates that each river authority (or local governing entity) shall submit quality-assured data collected in the river basin to the commission. Quality-assured data in the context of the legislation means data that comply with TCEQ rules for surface water quality monitoring (SWQM) programs, including rules governing the methods under which water samples are collected and analyzed and data from those samples are assessed and maintained. This QAPP addresses the program developed between the BRA and the TCEQ to carry out the activities mandated by the legislation. The QAPP was developed and will be implemented in accordance with provisions of the TCEQ Quality Management Plan, January 2013 or most recent version (QMP).

The purpose of this QAPP is to clearly delineate BRA QA policy, management structure, and procedures which will be used to implement the QA requirements necessary to verify and validate the surface water quality data collected. The QAPP is reviewed by the TCEQ to help ensure that data generated for the purposes described above are scientifically valid and legally defensible. This process will ensure that data collected under this QAPP and submitted to SWQMIS have been collected and managed in a way that guarantees its reliability and therefore can be used in water quality assessments, total maximum daily load (TMDL) development, establishing water quality standards, making permit decisions and used by other programs deemed appropriate by the TCEQ. Project results will be used to support the achievement of CRP objectives, as contained in the *Clean Rivers Program Guidance and Reference Guide FY 2016 -2017*.

In 1995, the Brazos River Authority designed the Basin Monitoring Program as the major water quality data collection effort in the Brazos River basin. The Program provides a basin-wide approach to the collection of water quality data that encourages input from local Steering Committee members. The Program is designed to provide specific types of water quality data, while providing flexibility to address dynamic water quality issues throughout the basin.

A6 Project / Task Description

This QAPP applies to routine monitoring throughout the Brazos River basin and biological/habitat assessments on selected sites.

The Clean Rivers Program for the Brazos River Basin is designed to collect water quality samples in each designated segment of the basin in concert with the TCEQ Regional personnel. The sampling is conducted on a periodic basis for water quality constituents that the TCEQ and Brazos River Authority use to assess the status of water quality. The information collected through this program is communicated to stakeholders who assist in setting priorities for monitoring locations. When the data show possible water quality concern or stakeholders indicate a concern, the CRP will focus more resources on those areas to collect water quality data and better define the water quality issue.

See Appendix B for the project-related work plan tasks and schedule of deliverables for a description of work defined in this QAPP. Attach work plan tasks pertaining to this QAPP.

See Appendix B for sampling design and monitoring pertaining to this QAPP.

Amendments to the QAPP

Revisions to the QAPP may be necessary to address incorrectly documented information or to reflect changes in project organization, tasks, schedules, objectives, and methods. Requests for amendments will be directed from the BRA Project Manager to the CRP Project Manager electronically. The BRA will submit a completed QAPP Amendment document, including a justification of the amendment, a table of changes, and all pages, sections or attachments affected by the amendment. Amendments are effective immediately upon approval by the BRA Project Manager, the BRA QAO, the CRP Project Manager, the TCEQ QA Manager or designee, the CRP Project QA Specialist, and additional parties affected by the amendment. Amendments are not retroactive. No work shall be implemented without an approved QAPP or amendment prior to the start of work. Any activities under this contract that commence prior to the approval of the governing QA document constitute a deficiency and are subject to corrective action as described in section C1 of this QAPP. Any deviation or deficiency from this QAPP which occurs after the execution of this QAPP should be addressed through a Corrective Action Plan (CAP). An Amendment may be a component of a CAP to prevent future recurrence of a deviation. Amendments will be incorporated into the QAPP by way of attachment and distributed to personnel on the distribution list by the BRA Project Manager.

Special Project Appendices

Projects requiring QAPP appendices will be planned in consultation with the BRA and the TCEQ Project Manager and TCEQ technical staff. Appendices will be written in an abbreviated format and will reference the Basin QAPP where appropriate. Appendices will be approved by the BRA Project Manager, the BRA QAO, the Laboratory (as applicable), and the CRP Project Manager, the CRP Project QA Specialist, the CRP Lead QA Specialist and other TCEQ personnel, as appropriate. Copies of approved QAPP appendices will be distributed by the BRA to project participants before data collection activities commence.

A7 Quality Objectives and Criteria

The purpose of routine water quality monitoring is to collect surface water quality data that can be used to characterize water quality conditions, identify significant long-term water quality trends, support water quality standards development, support the permitting process, and conduct water quality assessments in accordance with TCEQ's Guidance for Assessing and Reporting Surface Water Quality in Texas, August 2012 or most recent version (https://www.tceq.texas.gov/assets/public/waterquality/swqm/assess/12twqi/2012_guidance.pdf). These water quality data, and data collected by other organizations (e.g., USGS, TCEQ, etc.), will be subsequently reconciled for use and assessed by the TCEQ.

Systematic watershed monitoring is defined as sampling that is planned for a short duration (1 to 2 years), and is designed to; screen waters that would not normally be included in the routine

monitoring program, investigate areas of potential concern, and investigate possible sources of water quality impairments or concerns. Due to the limitations regarding these data (e.g., not temporally representative, limited number of samples, biological sampling does not meet the specimen vouchering requirements), the data will be used to determine whether any locations have values exceeding the TCEQ's water quality criteria and/or screening levels (or in some cases values elevated above normal). The BRA will use this information to determine future monitoring priorities. These water quality data and data collected by other organizations (e.g., USGS, TCEQ, etc.), will be subsequently reconciled for use and assessed by the TCEQ.

Brazos River Authority will conduct biological monitoring using specifications found in TCEQ SOP, V1 – Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods, 2012 (RG-415) and TCEQ SOP, V2 – Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data, 2014 (RG-416).

The Brazos River Authority will conduct diel water quality monitoring using a systematic approach. The diel monitoring will adhere to the specifications described in the TCEQ SOP V1 – *TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods,* 2012 (RG-415).

The measurement performance specifications to support the project purpose for a minimum data set are specified in Appendix A: Table A7.1 and in the text following.

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 Appendix A Table A7.1 are the program-defined reporting specifications for each analyte and yield data acceptable for the TCEQ's water quality assessment. A full listing of AWRLs can be found at http://www.tceq.state.tx.us/assets/public/waterquality/crp/QA/awrlmaster.pdf.

The limit of quantitation (LOQ) is the minimum level, concentration, or quantity of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. Analytical results shall be reported down to the laboratory's LOQ (i.e., the laboratory's LOQ for a given parameter is its reporting limit).

The following requirements must be met in order to report results to the CRP:

- The laboratory's LOQ for each analyte must be at or below the AWRL as a matter of routine practice
- The laboratory must demonstrate its ability to quantitate at its LOQ for each analyte by running an LOQ check sample for each analytical batch of CRP samples analyzed.
- Control limits for LOQ check samples are found in Appendix A.

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

Precision

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

Laboratory precision is assessed by comparing replicate analyses of laboratory control samples (LCS) in the sample matrix (e.g. deionized water, sand, commercially available tissue) or sample/duplicate pairs in the case of bacterial analysis. Precision results are compared against measurement performance specifications and used during evaluation of analytical performance. Program-defined measurement performance specifications for precision are defined in Appendix A.

Bias

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

Representativeness

Site selection, the appropriate sampling regime, the sampling of all pertinent media according to TCEQ SOPs, and use of only approved analytical methods will assure that the measurement data represents the conditions at the site. Routine data collected under CRP for water quality assessment are considered to be spatially and temporally representative of routine water quality conditions. Water Quality data are collected on a routine frequency and are separated by approximately even time intervals. At a minimum, samples are collected over at least two seasons (to include inter-seasonal variation) and over two years (to include inter-year variation) and include some data collected during an index period (March 15- October 15). Although data may be collected during varying regimes of weather and flow, the data sets will not be biased toward unusual conditions of flow, runoff, or season. The goal for meeting total representation of the water body will be tempered by the potential funding for complete representativeness.

Comparability

Confidence in the comparability of routine data sets for this project and for water quality assessments is based on the commitment of project staff to use only approved sampling and analysis

methods and QA/QC protocols in accordance with quality system requirements and as described in this QAPP and in TCEQ 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 are available for use compared to the total potential data. Ideally, 100% of the data should be available. However, the possibility of unavailable data due to accidents, insufficient sample volume, broken or lost samples, etc. is to be expected. Therefore, it will be a general goal of the project(s) that 90% data completion is achieved.

A8 Special Training / Certification

Before new field personnel independently conduct field work senior field staff trains him/her in proper instrument calibration, field sampling techniques, and field analysis procedures. The Field Operations Manager will document the successful field demonstration. The DQA Officer (or designee) will retain documentation of training and the successful field demonstration in the employee's personnel file (or other designated location, and will be available during monitoring systems audits.

The requirements for Global Positioning System (GPS) certification are located in Section B10, Data Management.

Contractors and subcontractors must ensure that laboratories analyzing samples under this QAPP meet the requirements contained in section The NELAC Institute (TNI) Volume 1 Module 2, Section 4.5.5 (concerning Subcontracting of Environmental Tests).

A9 Documents and Records

The documents and records that describe, specify, report, or certify activities are listed. The list below is limited to documents and records that may be requested for review during a monitoring systems audit. Add other types of project documents and records as appropriate.

Table A9.1 Project Documents and Records

Document/Record	Location	Retention (yrs)	Format
QAPPs, amendments and appendices	BRA	7	Paper and electronic (pdf)
Field SOPs	BRA	7	Paper and electronic (pdf)
Laboratory Quality Manuals	BRA	7	Paper and electronic (pdf)

Document/Record	Location	Retention (yrs)	Format
Laboratory SOPs	BRA	7	Paper and electronic (pdf)
QAPP distribution documentation	BRA	5	Paper and electronic (pdf)
Field staff training records	BRA	5	Paper
Field equipment calibration/maintenance logs	BRA	5	Paper
Field instrument printouts	BRA	5	Paper
Field notebooks or data sheets	BRA	5	Paper
Chain of custody records	BRA	5	Paper and electronic (pdf)
Laboratory calibration records	BRA	5	Paper and electronic (pdf)
Laboratory instrument printouts	BRA	5	Paper and electronic (pdf)
Laboratory data reports/results	BRA	5	Paper and electronic (pdf)
Laboratory equipment maintenance logs	BRA	5	Paper and electronic (pdf)
Corrective Action Documentation	BRA	5	Paper and electronic (pdf)

Laboratory Test Reports

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

When a formal report is required by CRP the Laboratory reports of analytical results performed by the Environmental Services Laboratory will include the following elements:

- Sample Number (LIMS number)
- Site Number
- Date and time of collection
- Sample depth
- Sample Matrix
- Parameter (Storet Code)
- Sample results
- Units of measurement
- Holding time for SM9223-B

- LOQ and LOD (formerly referred to as the reporting limit and the method detection limit, respectively), and qualification of results outside the working range (if applicable)
- Certification of NELAP compliance
- QC Results
- Comments related to sample collection or analysis

Electronic Data

Data will be submitted electronically to the TCEQ in the Event/Result file format described in the most current version of the DMRG, which can be found at (http://www.tceq.state.tx.us/compliance/monitoring/water/quality/data/wdma/dmrg_index.html). A completed Data Review Checklist and Data Summary (see Appendix F) will be submitted with each data submittal.

B1 Sampling Process Design

See Appendix B for sampling process design information and monitoring tables associated with data collected under this QAPP.

B2 Sampling Methods

Field Sampling Procedures

Field sampling will be conducted in accordance with the latest versions of the TCEQ Surface Water Quality Monitoring Procedures Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue, 2012.(RG-415) and Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data, 2014 (RG-416), collectively referred to as "SWQM Procedures". Updates to SWQM Procedures are posted to the Surface Water Quality Monitoring Procedures website (https://www.tceq.texas.gov/waterquality/monitoring/swqm_guides.html), and shall be incorporated into the BRA's procedures, QAPP, SOPs, etc., within 60 days of any final published update. Additional aspects outlined in Section B below reflect specific requirements for sampling under CRP and/or provide additional clarification.

Table B2.1 Sample Storage, Preservation and Handling Requirements

Parameter	Matrix	Container	Preservation	Sample Volume	Holding Time
Chloride	Water	Nalgene Bottle	Ice, cool >0 to 6° C	125 mL*	28 days
Nitrate nitrogen	Water	Nalgene Bottle	Ice, cool >0 to 6° C	125 mL*	48 hours
Ortho-phosphate Phosphorus	Water	Nalgene Bottle	Ice, cool >0 to 6° C	125 mL*	Filter within 15 minutes of collection**/48 hours use Storet code 00671
Ortho-phosphate Phosphorus Lab Filtered	Water	Nalgene Bottle	Ice, cool >0 to 6° C	125 mL*	48 hours, if not filtered within 15 minutes use Storet code 70507
Sulfate	Water	Nalgene Bottle	Ice, cool >0 to 6° C	125 mL*	28 days
E. coli	Water	100 ml sterile IDEXX bottle with Sodium Thiosulfate	Sodium Thiosulfate, Ice, cool >0 to 6° C	100 mL	8 hours#
Enterococcus	Water	100 ml sterile IDEXX bottle with Sodium Thiosulfate	Sodium Thiosulfate, Ice, cool >0 to 6° C	100 mL	8 hours
TDS	Water	Brown Nalgene Bottle	Ice, cool >0 to 6° C	500 mL‡	7 days
TSS	Water	LDPE Cubitainer	Ice, cool >0 to 6° C	1 L cubitainer	7 days
Turbidity	Water	Brown Nalgene Bottle	Ice, cool >0 to 6° C	500 mL‡	48 hours
Chlorophyll *a*	Water	Brown Nalgene Bottle	Dark Ice, cool >0 to 6° C before filtration: dark frozen after filtration	500 mL‡	48 hours to filter/24 days frozen after filtration
Total Phosphorus	Water	Nalgene Bottle	Ice, cool >0 to 6° C H_2SO_4 to pH 2	250 mL?	28 days
Total Kjeldahl Nitrogen	Water	Nalgene Bottle	Ice, cool >0 to 6° C H_2SO_4 to pH 2	250 mL?	28 days
Ammonia	Water	Nalgene Bottle	Ice, cool >0 to 6° C H_2SO_4 to pH 2	250 mL?	28 days
Benthic Macro invertebrates	Water	Glass	5% formalin in field, 70% ethanol after washing	å¢	Permanent preservation in ethanol
Fish	Water	Glass	10% formalin in field, 70%	å¢	7 days in formalin,

Parameter	Matrix	Container	Preservation	Sample Volume	Holding Time
			ethanol		permanent preservation in ethanol

*Ion chromatograph analytes (chloride, nitrate, orthophosphate-phosphorus and sulfate) will be taken from the same 250mL sample after filtration of orthophosphate phosphorus.
** Preservation of Orthophosphate Phosphorus is performed immediately upon collection or within 15 minutes of collection by filtration in the field.
#E.coli samples should always be processed as soon as possible and within 8 hours. When transport conditions necessitate delays in delivery, the holding time may be extended and samples must be processed as soon as possible and within 30 hours.
‡TDS, Turbidity, and Chl *a* are analyzed from a single 500 mL sample for a given monitoring location.
ʔTKN, TP, and Ammonia are analyzed from a single 500 mL sample for each monitoring location.
ĉSample volume is dependent on number of organisms collected.

Sample Containers

Certificates from sample container manufacturers are maintained in a notebook by the BRA. Sample containers used for conventional parameters are purchased pre-cleaned and are disposable from Quality Environmental Containers.

- IDEXX sterile 120 and 290 mL bottles are used for bacteria sampling.
- 1 Quart LDPE Cubitainers are used for TSS sampling.
- 16 oz Brown HDPE bottles are used for chlorophyll *a*, TDS, and Turbidity sampling.
- 8 oz White HDPE bottles are used for TKN, TP, and NH3-N sampling.
- 4 oz White HDPE bottles are used for Cl, SO4, NO3-N, and OPO4-P sampling.

Processes to Prevent Contamination

Procedures outlined in SWQM Procedures outline the necessary steps to prevent contamination of samples. These include: direct collection into sample containers, when possible; use of certified containers for organics; and clean sampling techniques for metals. Field QC samples (identified in Section B5) are collected to verify that contamination has not occurred.

Documentation of Field Sampling Activities

Field sampling activities are documented on field data sheets (or actual name of the documents used to record field data) as presented in Appendix D. Flow worksheets, aquatic life use monitoring checklists, habitat assessment forms, field biological assessment forms, and records of bacteriological analyses (if applicable) are part of the field data record. Parameters which are preferred by the SWQM and Water Quality Standards Programs are highlighted in the shell A7 document. The following will be recorded for all visits:

Station ID
Sampling Date
Location
Sampling Depth
Sampling Time
Sample Collector's name and signature
Preservation for samples collected
Sample Type (Grab or Composite)

Sample unique identification
Requested tests
Values for all field parameters
    Water temperature
    Dissolved oxygen
    Specific conductance
    pH
    Flow

Notes containing detailed observational data not captured by field parameters, including;
    Water appearance
    Weather
    Biological activity
    Recreational activity
    Unusual odors
    Pertinent observations related to water quality or stream uses
    Watershed or instream activities
    Specific sample information
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:

- Write legibly, in indelible ink
- Changes are made by crossing out original entries with a single line strike-out, entering the changes, and initialing and dating the corrections.
- Close-out incomplete pages with an initialed and dated diagonal line.

Sampling Method Requirements or Sampling Process Design Deficiencies, and Corrective Action

Examples of sampling method requirements or sample design deficiencies include but are not limited to such things as inadequate sample volume due to spillage or container leaks, failure to preserve samples appropriately, contamination of a sample bottle during collection, storage temperature and holding time exceedance, sampling at the wrong site, etc. Any deviations from the QAPP, SWQM Procedures, or appropriate sampling procedures may invalidate data, and require documented corrective action. Corrective action may include for samples to be discarded and re-collected. It is the responsibility of the BRA Project Manager, in consultation with the BRA QAO, to ensure that the actions and resolutions to the problems are documented and that records are maintained in accordance with this QAPP. In addition, these actions and resolutions will be conveyed to the CRP Project Manager both verbally and in writing in the project progress reports and by completion of a CAP.

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

B3 Sample Handling and Custody

Sample Tracking

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

A sample is in custody if it is in actual physical possession or in a secured area that is restricted to authorized personnel. The Chain of Custody (COC) form is a record that documents the possession of the samples from the time of collection to receipt in the laboratory. BRA uses the field data sheet as the COC for routine sampling (See Appendix C). The following list of items matches the field datasheets in Appendix C.

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

Sample Labeling

Samples from the field are labeled on the container, or on a label; with an indelible marker. Label information includes:

Sample Number
Site Number
Date and time of collection
Initials of Collector
Sample Depth

Sample Handling

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

Samples are collected in the field, filtered or acid preserved as necessary, and stored in coolers on ice. Samples are delivered to the Authority's water quality laboratory in coolers with field data sheets (COC Forms) attached. The laboratory staff examines each sample container for anomalies and ensures that all container information matches the information on the appropriate field data sheet. If the information is present and correct, the lab staff will receive the samples by signing the field data sheet "received by" block and entering the samples into the laboratory sample log book. At this instant, the samples become the responsibility of the Authority's water quality laboratory.

Internal sample handling, custody, and storage procedures for laboratory are described in the Brazos River Authority's Environmental Laboratory Quality Manual.

Sample Tracking Procedure Deficiencies and Corrective Action

All deficiencies associated with COC procedures, as described in this QAPP, are immediately reported to the BRA Project Manager. These include such items as delays in transfer resulting in holding time violations; violations of sample preservation requirements; incomplete documentation, including signatures; possible tampering of samples; broken or spilled samples, etc. The BRA Project Manager in consultation with the BRA QAO will determine if the procedural violation may have compromised the validity of the resulting data. Any failures that have reasonable potential to compromise data validity will invalidate data and the sampling event should be repeated. The resolution of the situation will be reported to the TCEQ CRP Project Manager in the project progress report. CAPs will be prepared by the Lead Organization QAO and submitted to TCEQ CRP Project Manager along with project progress report.

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

B4 Analytical Methods

The analytical methods, associated matrices, and performing laboratories are listed in Appendix A. The authority for analysis methodologies under CRP is derived from the 30 Tex. Admin. Code ch. 307, in that data generally are generated for comparison to those standards and/or criteria. The Standards state "Procedures for laboratory analysis must be in accordance with the most recently published edition of the book entitled Standard Methods for the Examination of Water and Wastewater, the TCEQ Surface Water Quality Monitoring Procedures as amended, 40 CFR 136, or other reliable procedures acceptable to the TCEQ, and in accordance with chapter 25 of this title."

Laboratories collecting data under this QAPP must be NELAP accredited in accordance with 30 TAC Chapter 25. Copies of laboratory QMs and SOPs are available for review by the TCEQ.

Standards Traceability

All standards used in the field and laboratory are traceable to certified reference materials. Standards preparation is fully documented and maintained in a standards log book or an electronic log. 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.

Analytical Method Deficiencies and Corrective Actions

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

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

The TCEQ has determined that analyses associated with the qualifier codes (e.g., "holding time exceedance", "sample received unpreserved", "estimated value") may have unacceptable measurement uncertainty associated with them. This will immediately disqualify analyses from submittal to SWQMIS. Therefore, data with these types of problems should not be reported to the TCEQ. Additionally, any data collected or analyzed by means other than those stated in the QAPP, or data suspect for any reason should not be submitted for loading and storage in SWQMIS. However, when data is lost, its absence will be described in the data summary report submitted with the corresponding data set, and a corrective action plan (as described in section C1) may be necessary.

B5 Quality Control

Sampling Quality Control Requirements and Acceptability Criteria

The minimum field QC requirements, and program-specific laboratory QC requirements, are outlined in SWQM Procedures. Specific requirements are outlined below. Field QC sample results are submitted with the laboratory data report (see Section A9.).

Laboratory Measurement Quality Control Requirements and Acceptability Criteria

Batch

A batch is defined as environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A preparation batch is composed of one to 20 environmental samples of the same NELAP-defined matrix, meeting the above mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 25 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates, or concentrates) which are analyzed together as a group. An analytical batch can include prepared samples originating from various environmental matrices and can exceed 20 samples.

Method Specific QC requirements

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

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

Comparison Counting

For routine bacteriological samples, repeat counts on one or more positive samples are required, at least monthly. If possible, compare counts with an analyst who also performs the analysis. Replicate counts by the same analyst should agree within 5 percent, and those between analysts should agree within 10 percent. Record the results.

Limit of Quantitation (LOQ)

The laboratory will analyze a calibration standard (if applicable) at the LOQ published in Appendix A, Table A7, on each day calibrations are performed. In addition, an LOQ check sample will be analyzed with each analytical batch. Calibrations including the standard at the LOQ listed in Appendix A 7.1 will meet the calibration requirements of the analytical method or corrective action will be implemented.

LOQ Check Sample

An LOQ check sample consists of a sample matrix (e.g., deionized water, sand, commercially available tissue) free from the analytes of interest spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes. It is used to establish intra-laboratory bias to assess the performance of the measurement system at the lower limits of analysis. The LOQ check sample is spiked into the sample matrix at a level less than or near the LOQ published in Appendix A, Table A7, for each analyte for each analytical batch of CRP samples run. If it is determined that samples have exceeded the high range of the calibration curve, samples should be diluted or run on another curve. For samples run on batches with calibration curves that do not include the LOQ published in Appendix A, Table A7, a check sample will be run at the low end of the

calibration curve.

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

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

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

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

Laboratory Control Sample (LCS)

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

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

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

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

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

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

Laboratory Duplicates

A laboratory duplicate is an aliquot taken from the same container as an original sample under laboratory conditions and processed and analyzed independently. Duplicates are prepared in the laboratory by splitting aliquots of an LCS, splitting aliquots of one sample, and preparing two matrix spike samples(where applicable). Both aliquots are carried through the entire preparation and

analytical process. Laboratory duplicates are used to assess method precision, the effect of sample matrix on precision, and are performed at a rate of one per preparation batch.

For most parameters except bacteria, precision is evaluated using the relative percent difference (RPD) between duplicate LCS 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: (If other formulas apply, adjust appropriately.)

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

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

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

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

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

Matrix spike (MS) – Matrix spikes (performed as a matrix spike and matrix spike duplicate pair) are prepared by adding a known quantity of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available.

Matrix spikes indicate the effect of the sample on the precision and accuracy of the results generated using the selected method. The frequency of matrix spikes is specified by the analytical method, or a minimum of one per preparation batch, whichever is greater. To the extent possible, matrix spikes prepared and analyzed over the course of the project should be performed on samples from different sites.

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

The percent recovery of the matrix spike is calculated using the following equation, where %R is percent recovery, S_{SR} is the concentration measured in the matrix spike, S_R is the concentration in the

parent sample, and S_A is the concentration of analyte that was added:

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

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

Method blank

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

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

Quality Control or Acceptability Requirements Deficiencies and Corrective Actions

Sampling QC excursions are evaluated by the Lead Organization Project Manager, in consultation with the Lead Organization QAO. In that differences in sample results are used to assess the entire sampling process, including environmental variability, the arbitrary rejection of results based on pre-

determined limits is not practical. Therefore, the professional judgment of the BRA Project Manager and QAO will be relied upon in evaluating results. Rejecting sample results based on wide variability is a possibility. Field blanks for trace elements and trace organics are scrutinized very closely. Field blank values exceeding the acceptability criteria will automatically invalidate the sample. Notations of blank contamination are noted in the quarterly report and the final QC Report. Equipment blanks for metals analysis are also scrutinized very closely.

Laboratory measurement quality control failures are evaluated by the laboratory staff. The disposition of such failures and the nature and disposition of the problem is reported to the BRA Laboratory QAO. The Laboratory QAO will discuss with the BRA Project Manager. If applicable, the BRA Project Manager will include this information in the CAP and submit with the Progress Report which is sent to the TCEQ CRP Project Manager.

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

B6 Instrument/Equipment Testing, Inspection, and Maintenance

All sampling equipment testing and maintenance requirements are detailed in the SWQM Procedures. Sampling equipment is inspected and tested upon receipt and is assured appropriate for use. Equipment records are kept on all field equipment and a supply of critical spare parts is maintained.

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

B7 Instrument Calibration and Frequency

Field equipment calibration requirements are contained in the SWQM Procedures. Post-calibration error limits and the disposition resulting from error are adhered to. Data collected from field instruments that do not meet the post-calibration error limits specified in the SWQM Procedures will not be submitted for inclusion into SWQMIS.

Detailed laboratory calibrations are contained within the QM(s) or SOP(s).

B8 Inspection/Acceptance of Supplies and Consumables

No special requirements for acceptance are specified for field sampling supplies and consumables. Reference to the laboratory QM may be appropriate for laboratory-related supplies and consumables. Field and Laboratory supplies are received according to procedures in the BRA Laboratory Quality Manual.

B9 Acquired Data

Non-directly measured data, secondary data, or acquired data involves the use of data collected under another project, and collected with a different intended use than this project. The acquired data still meets the quality requirements of this project, and is defined below. The following data source(s) will be used for this project:

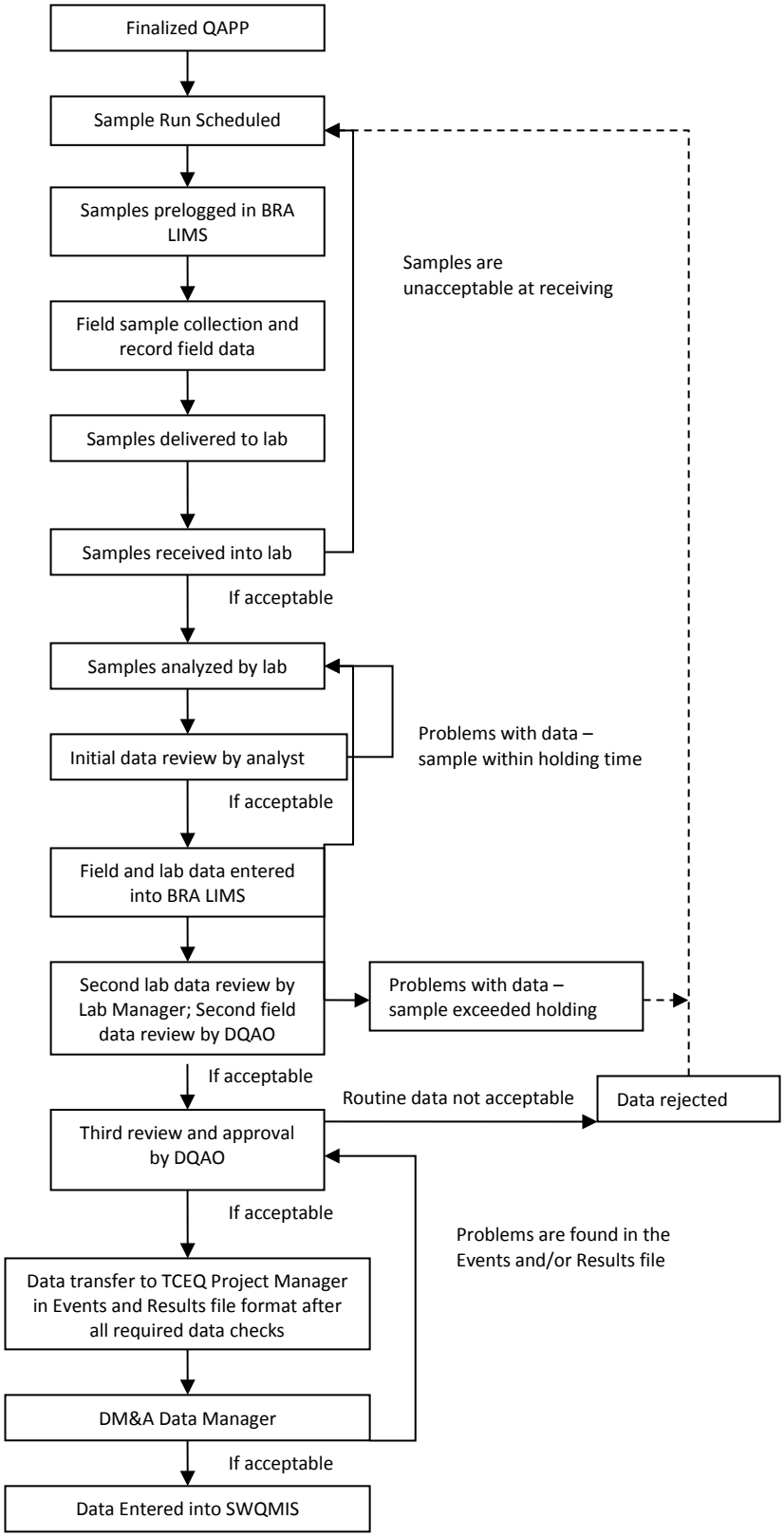
USGS gage station data will be used throughout this project to aid in determining gage height and flow. Rigorous QA checks are completed on gage data by the USGS and the data are approved by the USGS and permanently stored at the USGS. This data will be submitted to the TCEQ under parameter code 00061 Flow, Instantaneous or parameter code 74069 Flow Estimate depending on the proximity of the monitoring station to the USGS gage station.

Reservoir stage data are collected every day from the Unites States Geological Survey (USGS), International Boundary and Water Commission (IBWC), and the Unites States Army Corps of Engineers (USACE) websites. These data are preliminary and subject to revision. The Texas Water Development Board (TWDB) derives reservoir storage (in acre-feet) from these stage data (elevation in feet above mean sea level), by using the latest rating curve datasets available. These data are published at the TWDB website at http://waterdatafortexas.org/reservoirs/statewide. The web application uses real time gaged observations 7 AM reading each day (or closest reading available) from 119 major reservoirs to approximate daily storage for each reservoir, as well as daily total storage for water planning regions, river basins and the state of Texas. These instantaneous data are updated to mean daily data for all previous days. These data will be submitted to the TCEQ under parameter code 00052 Reservoir Stage and parameter code 00053 Reservoir Percent Full.
Insert additional sources of non-direct measurements as needed.

B10 Data Management

Data Management Process

Figure 1 B10.0 Data Flow Path



Data Dictionary

Terminology and field descriptions are included in the DMRG. A table outlining the entities that will be used when submitting data under this QAPP is included below for the purpose of verifying which entity codes are included in this QAPP.

Name of Entity	Tag Prefix	Submitting Entity	Collecting Entity
Brazos River Authority	BR	BR	BR

Data Errors and Loss

Laboratory technicians review all data before finalizing data reports. If needed and the sample is still within holding time, the technician will reanalyze samples not meeting QA requirements. The Laboratory Manager reviews all laboratory data following analysis and checks for calculation errors or data entry errors. The Deputy Quality Assurance Officer performs the second review of field data and a third review of all data to determine validity within this QAPP. The three reviews are recorded on the appropriate QA/QC Review form. Examples of forms or checklists are provided in Appendix E.

Record Keeping and Data Storage

All electronic records are backed-up weekly. Access to protected records is limited to Quality Assurance Manager or their designee to prevent unauthorized access or amendment.

Procedure for Records Management

- Identification: Records are uniquely identified.
- Collection: Observations, data and calculations are recorded at the time they are made. When mistakes are made in technical records, each mistake is crossed out with a single line (not erased, made illegible, or deleted) and the correct value entered alongside. Corrections are signed or initialed by the person making the correction. For electronic systems, all changes are tracked by the audit trail or by added notes. When changes are made to technical records for reasons other than for correction of transcription errors, the reason for the change is recorded on the document.
- Storage: All records stored on electronic media are supported by the hardware and software required for retrieval and have hard-copy or write-protected backup copies.
- Filing: Records are filed promptly and in an organized fashion.
- Access: Access to archived information is documented with an access log.
- Disposal: Records are disposed of according to applicable regulation, client request, or after seven years.

Water Quality Laboratory Database (LIMS) – Data migration and transfer of database contents is provided by chain-of-custody procedures, oversight of the Quality Assurance Officer and DQAO, passwording, and the three-tiered quality assurance process.

Backup/Disaster Recovery

In the event of failure of the data management system, the network can be restored in a matter of a few hours by reloading the archives from the tapes. Instrument programs and electronic data are saved to the BRA network servers.

Archives/Data Retention

The BRA IT Department does two different types of backups, SQL Server Database Backups and Tape Backups of all systems. Full backups of each database from SQL Server are done daily and two full backups are kept on the server at all times. During business hours Transaction log backups of each database are done every 15 minutes from 7:00 am to 6:00 pm. A daily incremental tape backup is run nightly, with full tape backups done on weekends. Tapes are rotated out daily and we maintain at least two months' worth of backups of all IT systems on tape before a tape is recycled.

Data Handling, Hardware, and Software Requirements

Water Quality Database (LIMS) - The Authority's laboratory database serves as a repository of water sample tracking and water quality analysis data until all appropriate tests and analyses have been performed and the results have undergone quality control review. The database resides on the Authority's network server, as described above, and is maintained through third party software application named SampleMaster by Accelerated Technology Laboratories, Inc. Information Technology staff maintains the database through Dell Power R620 based computers provided with Microsoft Access® as the front end and Microsoft SQL® as the back end. Data input and access to the laboratory water quality database are restricted by password and network access to the Laboratory Manager, Laboratory Staff, Field Operations Staff, Quality Assurance Officer, Deputy Quality Assurance Officer, and the IT Project Administrator/Database Analyst.

Information Resource Management Requirements

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

In lieu of entering certified GPS coordinates, positional data may be acquired with a GPS and verified with photo interpolation using a certified source, such as Google Earth or Google Maps. The verified coordinates and map interface can then be used to develop a new SLOC.

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

Assessment Activity	Approximate Schedule	Responsible Party	Scope	Response Requirements
Status Monitoring Oversight, etc.	Continuous	BRA	Monitoring of the project status and records to ensure requirements are being fulfilled	Report to TCEQ in Quarterly Report
Monitoring Systems Audit of BRA	Dates to be determined by TCEQ CRP	TCEQ	Field sampling, handling and measurement; facility review; and data management as they relate to CRP	30 days to respond in writing to the TCEQ to address corrective actions
Laboratory Inspection	Dates to be determined by TCEQ	TCEQ Laboratory Inspector	Analytical and quality control procedures employed at the laboratory and the contract laboratory	30 days to respond in writing to the TCEQ to address corrective actions
Proficiency Testing	Semi-annually	Brazos River Authority	Analyze a blind sample from an authorized PT provider for all accredited analyses	Submit results to PT provider before closing date

Corrective Action Process for Deficiencies

Deficiencies are any deviation from the QAPP, *SWQM Procedures*, SOPs, or the DMRG. Deficiencies may invalidate resulting data and require corrective action. Repeated deficiencies should initiate a CAP. Corrective action for deficiencies may include for samples to be discarded and re-collected. Deficiencies are documented in logbooks, field data sheets, etc. by field or laboratory staff, are communicated to Lead Organization Project Manager (or other appropriate staff), and should be subject to periodic review so their responses can be uniform, and their frequency tracked. It is the responsibility of the Lead Organization Project Manager, in consultation with the Lead Organization QAO, to ensure that the actions and resolutions to the problems are documented and that records are maintained in accordance with this QAPP. In addition, these actions and resolutions will be conveyed to the CRP Project Manager both verbally and in writing in the project progress reports and by completion of a CAP.

Corrective Action

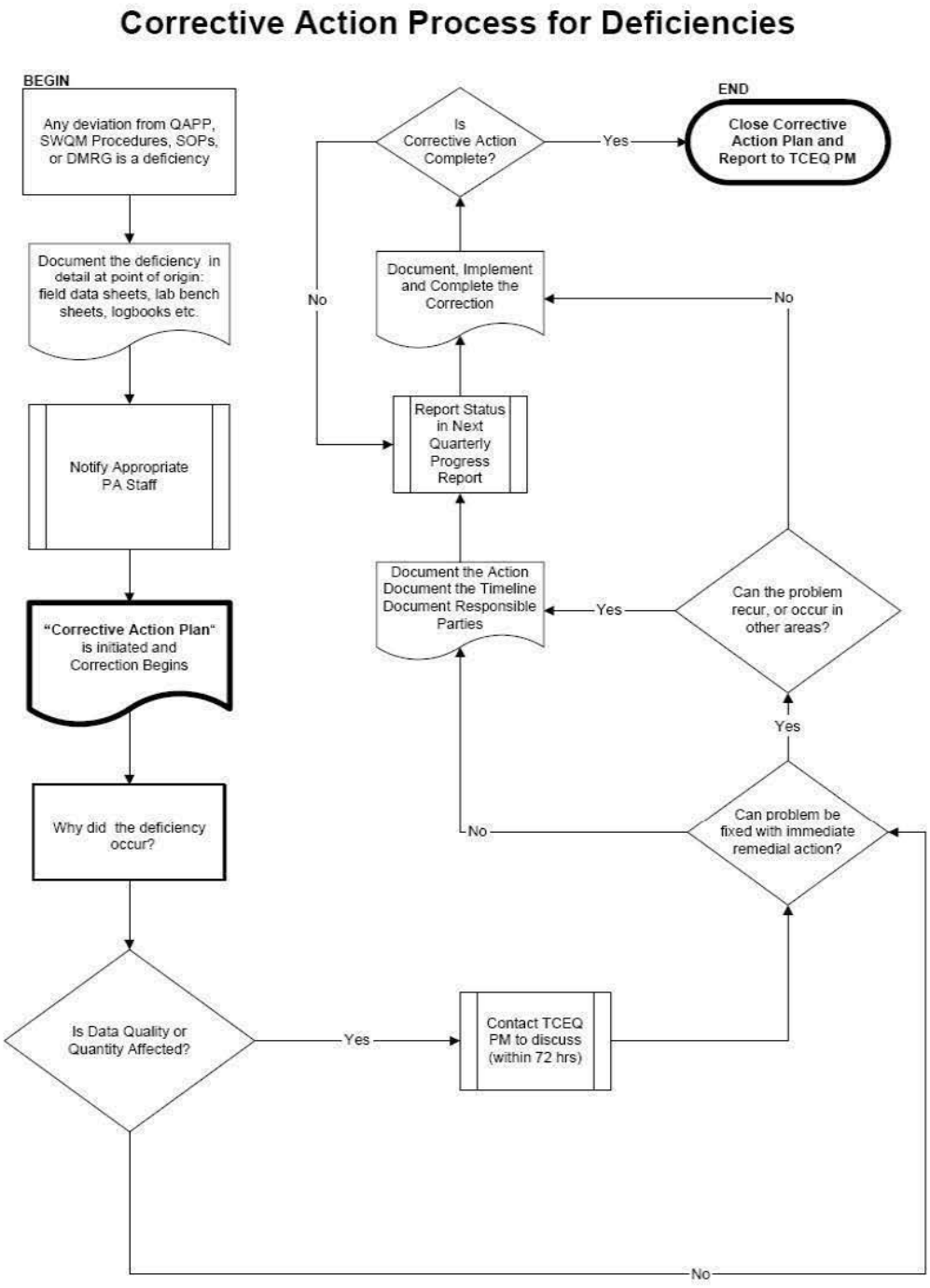
CAPs should:

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

Brazos River Authority has designed and implemented an electronic corrective action system that incorporates the items above.

To facilitate the process a flow chart has been developed (see figure C1.1: Corrective Action Process for Deficiencies).

Figure C1.1 Corrective Action Process for Deficiencies



Status of CAPs will be included with quarterly progress reports. In addition, significant conditions which, if uncorrected, could have a serious effect on safety or on the validity or integrity of data will be reported to the TCEQ immediately.

The BRA QAO is responsible for implementing corrective actions and tracking deficiencies and corrective actions in a pre-CAP log. Records of audit findings and corrective actions are maintained by the BRA QAO. Audit reports and corrective action documentation will be submitted to the TCEQ with the Progress Report.

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

C2 Reports to Management

Table C2.1 QA Management Reports

Type of Report	Frequency	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation	Report Recipients
Data Completion Report	Monthly	1 week following end of month	DQAO	BRA Project Mgr
Management Review	Bimonthly	Bimonthly	QAO/ DQAO	E&C Mgr
Corrective Action Reports	As required	When closed	Laboratory Manager	E&C Mgr QAO DQAO
ES Laboratory Internal Audit Reports	Quarterly	First week of following quarter	DQAO	QAO E&C Mgr Lab Mgr

Reports to BRA Project Management

A number of Basin Planning Agencies have processes in place to report project status, results of oversight activities, deficiencies, corrective action reports, and significant QA issues to management. They may or may not be written reports. Please list and describe as appropriate. Also include the schedule for submission.

No reports from outside, non-BRA entities are anticipated for the FY 16-17 biennium.

Reports to TCEQ Project Management

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

Progress Report
Summarizes the BRA's activities for each task; reports monitoring status, problems, delays, deficiencies, status of open CAPs, and documentation for completed CAPs; and outlines the status of each task's deliverables.

Monitoring Systems Audit Report and Response
Following any audit performed by the BRA, a report of findings, recommendations and response is sent to the TCEQ in the quarterly progress report.

Data Summary
Contains basic identifying information about the data set and comments regarding inconsistencies and errors identified during data verification and validation steps or problems with data collection efforts (e.g. Deficiencies).

Reports by TCEQ Project Management

Contractor Evaluation
The BRA participates in a Contractor Evaluation by the TCEQ annually for compliance with administrative and programmatic standards. Results of the evaluation are submitted to the TCEQ Financial Administration Division, Procurement and Contracts Section.

D1 Data Review, Verification, and Validation

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 to the TCEQ for entry into SWQMIS.

D2 Verification and Validation Methods

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, verification, and validation will be performed using self-assessments and peer and management review as appropriate to the project task as described in BRA SOPs. The data review tasks to be performed by field and laboratory staff is listed in the first two columns of Table D2.1, respectively. Potential errors are identified by examination of documentation and by manual, examination of corollary or unreasonable data, or computer-assisted. If a question arises or an error is identified, the manager of the task responsible for generating the data is contacted to resolve the issue. Issues which can be corrected are corrected and documented. If an issue cannot be corrected, the task manager consults with the higher level project management to establish the appropriate course of action, or the data associated with the issue are rejected and not reported to the TCEQ for storage in SWQMIS. 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. This review step as specified in Table D2.1 is performed by the BRA Data Manager and QAO. Data review, verification, and validation tasks to be performed on the data set include, but are not limited to, the confirmation of laboratory and field data review, evaluation of field QC results, additional evaluation of anomalies and outliers, analysis of sampling and analytical gaps, and confirmation that all parameters and sampling sites are included in the QAPP.

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

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

If any requirements or specifications of the CRP are not met, based on any part of the data review, the responsible party should document the nonconforming activities and submit the information to the BRA Data Manager with the data in the Data Summary (See Appendix F). All failed QC checks, missing samples, missing analytes, missing parameters, and suspect results should be discussed in the Data Summary.

Table D2.1: Data Review Tasks

Data to be Verified	Field Task	Laboratory Task	Lead Organization Data Manager Task
Sample documentation complete; samples labeled, sites identified	Aquatic Scientist	Lab Mgr	DQAO
Field QC samples collected for all analytes as prescribed in the TCEQ SWQM Procedures Manual	Aquatic Scientist		DQAO
Standards and reagents traceable		Lab Mgr	DQAO
Chain of custody complete/acceptable	Aquatic Scientist	Lab Mgr	DQAO
NELAP Accreditation is current		Lab Mgr	QAO
Sample preservation and handling acceptable		Lab Tech	DQAO
Holding times not exceeded		Lab Mgr	DQAO
Collection, preparation, and analysis consistent with SOPs and QAPP	Aquatic Scientist	Lab Mgr	DQAO
Field documentation (e.g., biological, stream habitat) complete	Aquatic Scientist	Lab Mgr	DQAO
Instrument calibration data complete	Aquatic Scientist		DQAO
QC samples analyzed at required frequency		Lab Mgr	DQAO
QC results meet performance and program specifications		Lab Mgr	DQAO
Analytical sensitivity (LOQ/AWRL) consistent with QAPP		Lab Mgr	DQAO
Results, calculations, transcriptions checked		Lab Mgr	DQAO
Laboratory bench-level review performed		Lab Analyst / Lab Mgr	DQAO
All laboratory samples analyzed for all scheduled parameters		Lab Mgr	DQAO
Corollary data agree		Lab Mgr	DQAO
Nonconforming activities documented	Aquatic Scientist /	Lab Analyst / Lab Mgr	DQAO

Data to be Verified	Field Task	Laboratory Task	Lead Organization Data Manager Task
	Field Supervisor		
Outliers confirmed and documented; reasonableness check performed			DQAO / QAO
Dates formatted correctly			DQAO / QAO
Depth reported correctly and in correct units			DQAO / QAO
TAG IDs correct			DQAO / QAO
TCEQ Station ID number assigned			DQAO / QAO
Valid parameter codes			DQAO / QAO
Codes for submitting entity(ies), collecting entity(ies), and monitoring type(s) used correctly			DQAO / QAO
Time based on 24-hour clock			DQAO
Check for transcription errors		Lab Mgr	DQAO / QAO
Sampling and analytical data gaps checked (e.g., all sites for which data are reported are on the coordinated monitoring schedule)			QAO
Field instrument pre- and post-calibration results within limits	Aquatic Scientist		DQAO
10% of data manually reviewed			DQAO

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 will be used by the TCEQ for the Texas Water Quality Integrated Report in accordance with TCEQ's Guidance for Assessing and Reporting Surface Water Quality in Texas, August 2010 or most recent version, and for TMDL development, water quality standards development, and permit decisions, as appropriate. Data which do not meet requirements will not be submitted to SWQMIS nor will be considered appropriate for any of the uses noted above.

Appendix A: Measurement Performance Specifications (Table A7.1)

See accompanying Excel file BRA_CRP_QAPP_TblA7_FY1617.xls

Measurement performance specifications define the data quality needed to satisfy project objectives. To this end, measurement performance specifications are qualitative and quantitative statements that:

- clarify the intended use of the data
- define the type of data needed to support the end use
- identify the conditions under which the data should be collected

Appendix A of the QAPP addresses measurement performance specifications, including:

- analytical methodologies
- AWRLs
- limits of quantitation
- bias limits for LCSs
- precision limits for LCSDs
- completeness goals
- qualitative statements regarding representativeness and comparability

The items identified above need to be considered for each type of monitoring activity. The CRP emphasizes that data should be collected to address multiple objectives, if possible, thereby maximizing the expenditure of resources. Caution should be applied when attempting to collect data for multiple purposes because measurement performance specifications may vary according to the purpose. For example, limits of quantitation may differ for data used to assess standards attainment and for trend analysis. When planning projects, first priority should be given to the main use of the project data and the data quality needed to support that use, then secondary goals should be considered.

Table A7.1 should be modified to reflect actual parameters, methods, etc. employed by the BRA and its participants. Alternative methods than those listed in the following table may be used. Procedures for laboratory analysis must be in accordance with the most recently published edition of Standard Methods for the Examination of Water and Wastewater, 40 CFR 136, or otherwise approved independently. Only data collected that have a valid TCEQ parameter code assigned in Table A7.1 are stored in SWQMIS. Any parameters listed in Table A7.1 that do not have a valid TCEQ parameter code assigned will not be stored in SWQMIS.

Table A7.1 - Measurement Performance Specifications

TABLE A7.1 Measurement Performance Specifications for DIEL Parameters in Water					
24 HourParameters in Water					
Parameter	**Units**	**Matrix**	**Method**	**Parameter Code**	**Lab**
TEMPERATURE, WATER (DEGREES CENTIGRADE), 24HR AVG	DEG C	Water	TCEQ SOP V1	00209	field
WATER TEMPERATURE, DEGREES CENTIGRADE, 24HR MAX	DEG C	Water	TCEQ SOP V1	00210	field
TEMPERATURE, WATER (DEGREES CENTIGRADE) 24HR MIN	DEG C	Water	TCEQ SOP V1	00211	field
SPECIFIC CONDUCTANCE, US/CM, FIELD, 24HR AVG	uS/cm	Water	TCEQ SOP V1	00212	field
SPECIFIC CONDUCTANCE, US/CM, FIELD, 24HR MAX	uS/cm	Water	TCEQ SOP V1	00213	field
SPECIFIC CONDUCTANCE, US/CM, FIELD, 24HR MIN	uS/cm	Water	TCEQ SOP V1	00214	field
PH, S.U., 24HR MAXIMUM VALUE	std. units	Water	TCEQ SOP V1	00215	field
PH, S.U., 24HR, MINIMUM VALUE	std. units	Water	TCEQ SOP V1	00216	field
SALINITY, 24-HR, MAXIMUM, PPT	ppt	Water	TCEQ SOP V1	00217	field
SALINITY, 24-HR, AVERAGE, PPT	ppt	Water	TCEQ SOP V1	00218	field
SALINITY, 24-HR, MINIMUM, PPT	ppt	Water	TCEQ SOP V1	00219	field
SALINITY, # OF MEASUREMENTS IN 24-HRS	NU	Water	TCEQ SOP V1	00220	field
WATER TEMPERATURE, # OF MEASUREMENTS IN 24-HRS	NU	Water	TCEQ SOP V1	00221	field
SPECIFIC CONDUCTANCE, # OF MEASUREMENTS IN 24-HRS	NU	Water	TCEQ SOP V1	00222	field
pH, # OF MEASUREMENTS IN 24-HRS	NU	Water	TCEQ SOP V1	00223	field
DISSOLVED OXYGEN, 24-HOUR MIN. (MG/L) MIN. 4 MEA	mg/l	Water	TCEQ SOP V1	89855	field
DISSOLVED OXYGEN, 24-HOUR MAX. (MG/L) MIN. 4 MEA	mg/l	Water	TCEQ SOP V1	89856	field
DISSOLVED OXYGEN, 24-HOUR AVG. (MG/L) MIN. 4 MEA	mg/l	Water	TCEQ SOP V1	89857	field
DISSOLVED OXYGEN, # OF MEASUREMENTS IN 24-HRS	NU	Water	TCEQ SOP V1	89858	field

References:
United States Environmental Protection Agency (USEPA) Methods for Chemical Analysis of Water and Wastes, Manual #EPA-600/4-79-020
American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998. (Note: The 21st edition may be cited if it becomes available.)
TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods, 2012 (RG-415).
TCEQ SOP, V2 - TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data, 2014 (RG-416)

TABLE A7.2 Measurement Performance Specifications for Biological Habitat					
Biological - Habitat					
Parameter	**Units**	**Matrix**	**Method**	**Parameter Code**	**Lab**
FLOW STREAM, INSTANTANEOUS (CUBIC FEET PER SEC)	cfs	Water	TCEQ SOP V2	00061	BRA
BIOLOGICAL DATA	NS	Other	NA/Calculation	89888	BRA
STREAM TYPE; 1=PERENNIAL 2=INTERMITTENT S/PERENNIAL POOLS 3=INTERMITTENT 4=UNKNOWN	NU	Other	NA/Calculation	89821	BRA
STREAMBED SLOPE (M/KM)	M/KM	Other	NA/Calculation	72051	BRA
AVERAGE PERCENTAGE INSTREAM COVER	%	Other	TCEQ SOP V2	84159	BRA
STREAM ORDER	NU	Water	TCEQ SOP V2	84161	BRA
NUMBER OF LATERAL TRANSECTS MADE	NU	Other	TCEQ SOP V2	89832	BRA
FLOW MTH 1=GAGE 2=ELEC 3=MECH 4=WEIR/FLU 5=DOPPLER	NU	Other	TCEQ SOP V2	89835	BRA
TOTAL NUMBER OF STREAM BENDS	NU	Other	TCEQ SOP V2	89839	BRA
NUMBER OF WELL DEFINED STREAM BENDS	NU	Other	TCEQ SOP V2	89840	BRA
NUMBER OF MODERATELY DEFINED STREAM BENDS	NU	Other	TCEQ SOP V2	89841	BRA
NUMBER OF POORLY DEFINED STREAM BENDS	NU	Other	TCEQ SOP V2	89842	BRA
TOTAL NUMBER OF RIFFLES	NU	Other	TCEQ SOP V2	89843	BRA
DOMINANT SUBSTRATE TYPE(1=CLAY,2=SILT,3=SAND,4=GRAVEL,5=COBBLE,6=BOULDER,7=BEDROCK,8=OTHER)	NU	Sediment	TCEQ SOP V2	89844	BRA
AVERAGE PERCENT OF SUBSTRATE GRAVEL SIZE OR LARGER	%	Other	TCEQ SOP V2	89845	BRA
AVERAGE STREAM BANK EROSION (%)	%	Other	TCEQ SOP V2	89846	BRA
AVERAGE STREAM BANK SLOPE (DEGREES)	deg	Other	TCEQ SOP V2	89847	BRA
HABITAT FLOW STATUS, 1=NO FLOW, 2=LOW,3=MOD,4=HIGH	NU	Other	TCEQ SOP V2	89848	BRA
AVERAGE PERCENT TREES AS RIPARIAN VEGETATION	%	Other	TCEQ SOP V2	89849	BRA
AVERAGE PERCENT SHRUBS AS RIPARIAN VEGETATION	%	Other	TCEQ SOP V2	89850	BRA
AVERAGE PERCENT GRASS AS RIPARIAN VEGETATION	%	Other	TCEQ SOP V2	89851	BRA
AVERAGE PERCENT CULTIVATED FIELDS AS RIPARIAN VEGETATION	%	Other	TCEQ SOP V2	89852	BRA
AVERAGE PERCENT OTHER AS RIPARIAN VEGETATION	%	Other	TCEQ SOP V2	89853	BRA
AVERAGE PERCENTAGE OF TREE CANOPY COVERAGE	%	Other	TCEQ SOP V2	89854	BRA
DRAINAGE AREA ABOVE MOST DOWNSTREAM TRANSECT*	km2	Other	TCEQ SOP V2	89859	BRA
REACH LENGTH OF STREAM EVALUATED (M)	m	Other	NA/Calculation	89884	BRA
AVERAGE STREAM WIDTH (METERS)	M	Other	TCEQ SOP V2	89861	BRA
AVERAGE STREAM DEPTH (METERS)	M	Other	TCEQ SOP V2	89862	BRA
MAXIMUM POOL WIDTH AT TIME OF STUDY (METERS)	M	Other	TCEQ SOP V2	89864	BRA
MAXIMUM POOL DEPTH AT TIME OF STUDY(METERS)	M	Other	TCEQ SOP V2	89865	BRA
AVERAGE WIDTH OF NATURAL RIPARIAN VEGETATION (M)	M	Other	TCEQ SOP V2	89866	BRA
AVERAGE WIDTH OF NATURAL RIPARIAN BUFFER ON LEFT BANK (M)	M	Other	NA/Calculation	89872	BRA
AVERAGE WIDTH OF NATURAL RIPARIAN BUFFER ON RIGHT BANK (M)	m	Other	NA/Calculation	89873	BRA
AESTHETICS OF REACH(1=WILD 2=NAT. 3=COMM. 4=OFF.)	NU	Other	TCEQ SOP V2	89867	BRA
NUMBER OF STREAM COVER TYPES	NU	Other	TCEQ SOP V2	89929	BRA
LAND DEVELOP IMPACT (1=UNIMP,2=LOW,3=MOD,4=HIGH)	NU	Other	TCEQ SOP V2	89962	BRA
RIPARIAN VEGETATION %; LEFT BANK - TREES	%	Other	NA/Calculation	89822	BRA
RIPARIAN VEGETATION %; RIGHT BANK - TREES	%	Other	NA/Calculation	89823	BRA
RIPARIAN VEGETATION %; LEFT BANK SHRUBS	%	Other	NA/Calculation	89824	BRA
RIPARIAN VEGETATION %; RIGHT BANK - SHRUBS	%	Other	NA/Calculation	89825	BRA
RIPARIAN VEGETATION %: LEFT BANK - GRASSES OR FORBS	%	Other	NA/Calculation	89826	BRA
RIPARIAN VEGETATION %; RIGHT BANK - GRASSES OR FORBS	%	Other	NA/Calculation	89827	BRA
RIPARIAN VEGETATION %: LEFT BANK - CULTIVATED FIELDS	%	Other	NA/Calculation	89828	BRA
RIPARIAN VEGETATION %: RIGHT BANK - CULTIVATED FIELDS	%	Other	NA/Calculation	89829	BRA
RIPARIAN VEGETATION %: LEFT BANK - OTHER	%	Other	NA/Calculation	89830	BRA
RIPARIAN VEGETATION %: RIGHT BANK - OTHER	%	Other	NA/Calculation	89871	BRA
AVAILABLE INSTREAM COVER HQI SCORE: 4=ABUNDANT 3=COMMON 2=RARE 1=ABSENT	NU	Other	NA/Calculation	89874	BRA

TABLE A7.2 Measurement Performance Specifications for Biological Habitat					
Biological - Habitat					
Parameter	**Units**	**Matrix**	**Method**	**Parameter Code**	**Lab**
BOTTOM SUBSTRATE STABILITY HQI SCORE: 4=STABLE 3=MODERATELY STABLE 2=MODERATELY UNSTABLE 1=UNSTABLE	NU	Other	NA/Calculation	89875	BRA
NUMBER OF RIFFLES HQI SCORE: 4=ABUNDANT 3=COMMON 2=RARE 1=ABSENT	NS	Other	NA/Calculation	89876	BRA
DIMENSIONS OF LARGEST POOL HQI SCORE: 4=LARGE 3=MODERATE 2=SMALL 1=ABSENT	NU	Other	NA/Calculation	89877	BRA
CHANNEL FLOW STATUS HQI SCORE: 3=HIGH 2=MODERATE 1=LOW 0=NO FLOW	NU	Other	NA/Calculation	89878	BRA
BANK STABILITY HQI SCORE: 3=STABLE 2=MODERATELY STABLE 1=MODERATELY UNSTABLE 0=UNSTABLE	NU	Other	NA/Calculation	89879	BRA
CHANNEL SINUOSITY HQI SCORE: 3=HIGH 2=MODERATE 1=LOW 0=NONE	NU	Other	NA/Calculation	89880	BRA
RIPARIAN BUFFER VEGETATION HQI SCORE: 3=EXTENSIVE 2=WIDE 1=MODERATE 0=NARROW	NU	Other	NA/Calculation	89881	BRA
AESTHETICS OF REACH HQI SCORE: 3=WILDERNESS 2=NATURAL AREA 1=COMMON SETTING 0=OFFENSIVE	NU	Other	NA/Calculation	89882	BRA
HQI TOTAL SCORE	NU	Other	NA/Calculation	89883	BRA
NO FLOW ISOLATED POOL: LARGEST POOL MAX WIDTH (M	M	Other	NA/Calculation	89908	BRA
NO FLOW ISOLATED POOL: LARGEST POOL MAX LENGTH (	M	Other	NA/Calculation	89909	BRA
NO FLOW ISOLATED POOL: LARGEST POOL MAX DEPTH (M	M	Other	NA/Calculation	89910	BRA
NO FLOW ISOLATED POOL: SMALLEST POOL MAX DEPTH (	M	Other	NA/Calculation	89911	BRA
NO FLOW ISOLATED POOL: SMALLEST POOL MAX WIDTH (	M	Other	NA/Calculation	89912	BRA
NO FLOW ISOLATED POOL: SMALLEST POOL MAX LENGTH	M	Other	NA/Calculation	89913	BRA
NO FLOW ISOLATED POOLS: NUMBER OF POOLS EVALUATED	NU	Other	NA/Calculation	89914	BRA

* From USGS map.

References:

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

American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), Standard Methods for the Examination o Water and Wastewater, 20th Edition, 1998. (Note: The 21st edition may be cited if it becomes available.)

TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods, 2012 (RG-415).

TCEQ SOP, V2 - TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data, 2014 (RG-416)

TABLE A7.3 Measurement Performance Specifications for Biological Benthic Parameters					
Biological - Benthics (Qualitative)					
Parameter	Units	Matrix	Method	Parameter Code	Lab
STREAM ORDER	NU	Water	TCEQ SOP, V1	84161	BRA
BIOLOGICAL DATA	NS	Other	NA/Calculation	89888	BRA
RAPID BIOASSESSMENT PROTOCOLS BENTHIC MACROINVERTEBRATE IBI SCORE	NS	Other	NA/Calculation	90081	BRA
BENTHIC DATA REPORTING UNITS (1=NUMBER OF INDIVIDUALS IN SUB-SAMPLE, 2=NUMBER OF INDIVIDUALS/FT2, 3=NUMBER OF INDIVIDUALS/M2, 4=TOTAL NUMBER OF INDIVIDUALS IN	NU	Other	TCEQ SOP V2	89899	BRA
DIP NET EFFORT,AREA SWEPT (SQ.METER)	m2	Other	TCEQ SOP V2	89902	BRA
KICKNET EFFORT,AREA KICKED (SQ.METER)	m2	Other	TCEQ SOP V2	89903	BRA
KICKNET EFFORT,MINUTES KICKED (MIN.)	min.	Other	TCEQ SOP V2	89904	BRA
DEBRIS/SHORELINE SAMPLING EFFORT, MINUTES	min.	Other	TCEQ SOP V2	89905	BRA
NUMBER OF INDIVIDUALS IN BENTHIC SAMPLE	NU	Other	TCEQ SOP V2	89906	BRA
UNDERCUT BANK AT COLLECTION POINT (%)	%	Other	TCEQ SOP V2	89921	BRA
OVERHANGING BRUSH AT COLLECTION POINT (%)	%	Other	TCEQ SOP V2	89922	BRA
GRAVEL BOTTOM AT COLLECTION POINT (%)	%	Sediment	TCEQ SOP V2	89923	BRA
SAND BOTTOM AT COLLECTION POINT (%)	%	Sediment	TCEQ SOP V2	89924	BRA
SOFT BOTTOM AT COLLECTION POINT (%)	%	Sediment	TCEQ SOP V2	89925	BRA
MACROPHYTE BED AT COLLECTION POINT (%)	%	Other	TCEQ SOP V2	89926	BRA
SNAGS AND BRUSH AT COLLECTION POINT (%)	%	Other	TCEQ SOP V2	89927	BRA
BEDROCK STREAMBED AT COLLECTION POINT (%)	%	Sediment	TCEQ SOP V2	89928	BRA
PETERSEN SAMPLER EFFORT, AREA SAMPLED (SQ. MTR.)	m2	Other	TCEQ SOP V2	89934	BRA
EKMAN SAMPLER EFFORT, AREA SAMPLED (SQ.METER)	m2	Other	TCEQ SOP V2	89935	BRA
MESH SIZE, ANY NET OR SIEVE, AVERAGE BAR (CM)	cm	Other	TCEQ SOP V2	89946	BRA
BENTHIC SAMPLE COLLECTION METHOD (1=SURBER, 2=EKMAN, 3=KICKNET, 4=PETERSON, 5=HESTER DENDY, 6=SNAG, 7=HESS)	NU	Other	TCEQ SOP V2	89950	BRA
ECOREGION LEVEL III (TEXAS ECOREGION CODE)	NU	Other	TCEQ SOP V1	89961	BRA
AREA OF SNAG SURFACE SAMPLED (SQ.MT)	m2	Other	TCEQ SOP V2	89975	BRA
BENTHOS ORGANISMS -NONE PRESENT (0=None Present)	NS	Other	TCEQ SOP V2	90005	BRA
HILSENHOFF BIOTIC INDEX (HBI)	NU	Other	TCEQ SOP V2	90007	BRA
NUMBER OF EPT INDEX	NU	Other	TCEQ SOP V2	90008	BRA
DOMINANT BENTHIC FUNCTIONAL FEEDING GRP, % OF INDIVIDUALS	%	Other	TCEQ SOP V2	90010	BRA
BENTHIC GRAZERS, PERCENT OF INDIVIDUALS	%	Other	TCEQ SOP V2	90020	BRA
BENTHIC GATHERERS, PERCENT OF INDIVIDUALS	%	Other	TCEQ SOP V2	90025	BRA
BENTHIC FILTERERS, PERCENT OF INDIVIDUALS	%	Other	TCEQ SOP V2	90030	BRA
BENTHIC PREDATORS, PERCENT OF INDIVIDUALS	%	Other	TCEQ SOP V2	90036	BRA
DOMINANT TAXON, BENTHOS PERCENT OF INDIVIDUALS	%	Other	TCEQ SOP V2	90042	BRA
RATIO OF INTOLERANT TO TOLERANT TAXA, BENTHOS	NU	Other	TCEQ SOP V2	90050	BRA
NUMBER OF NON-INSECT TAXA	NU	Other	TCEQ SOP V2	90052	BRA
ELMIDAE, PERCENT OF INDIVIDUALS	%	Other	TCEQ SOP V2	90054	BRA
TOTAL TAXA RICHNESS, BENTHOS	NU	Other	TCEQ SOP V2	90055	BRA
NUMBER OF EPHEMEROPTERA TAXA	NU	Other	TCEQ SOP V2	90057	BRA
TOTAL NUMBER OF INTOLERANT TAXA, BENTHOS	NU	Other	TCEQ SOP V2	90058	BRA
EPT, PERCENT OF INDIVIDUALS	%	Other	TCEQ SOP V2	90060	BRA
CHIRONOMIDAE, PERCENT OF INDIVIDUALS	%	Other	TCEQ SOP V2	90062	BRA
TOLERANT BENTHOS, PERCENT OF INDIVIDUALS	%	Other	TCEQ SOP V2	90066	BRA
PERCENT OF TOTAL TRICHOPTERA INDIVIDUALS AS HYDROPSYCHIDAE	%	Other	TCEQ SOP V2	90069	BRA

References:

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

American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998. (Note: The 21st edition may be cited if it becomes available.)

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TCEQ SOP, V2 - TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data, 2014 (RG-416)

TABLE A7.4 Measurement Performance Specifications for Biological Nekton					
Biological - Nekton					
Parameter	**Units**	**Matrix**	**Method**	**Parameter Code**	**Lab**
STREAM ORDER	NU	Water	TCEQ SOP V1	84161	BRA
NEKTON TEXAS REGIONAL IBI SCORE	NS	Other	NA/Calculation	98123	BRA
BIOLOGICAL DATA	NS	Other	NA/Calculation	89888	BRA
SEINE, MINIMUM MESH SIZE, AVERAGE BAR, NEKTON,IN	IN	Other	TCEQ SOP V2	89930	BRA
SEINE, MAXIMUM MESH SIZE, AVG BAR, NEKTON,INCH	IN	Other	TCEQ SOP V2	89931	BRA
NET LENGTH (METERS)	M	Other	TCEQ SOP V2	89941	BRA
ELECTROFISHING METHOD 1=BOAT 2=BACKPACK 3=TOTEBARGE	NU	Other	TCEQ SOP V2	89943	BRA
ELECTROFISH EFFORT, DURATION OF SHOCKING (SEC)	SEC	Other	TCEQ SOP V2	89944	BRA
SEINING EFFORT (# OF SEINE HAULS)	NU	Other	TCEQ SOP V2	89947	BRA
COMBINED LENGTH OF SEINE HAULS (METERS)	M	Other	TCEQ SOP V2	89948	BRA
SEINING EFFORT, DURATION (MINUTES)	MIN	Other	TCEQ SOP V2	89949	BRA
ECOREGION LEVEL III (TEXAS ECOREGION CODE)	NU	Other	TCEQ SOP V1	89961	BRA
AREA SEINED (SQ METERS)	M2	Other	TCEQ SOP V2	89976	BRA
NUMBER OF SPECIES, FISH	NU	Other	TCEQ SOP V2	98003	BRA
NEKTON ORGANISMS-NONE PRESENT (0=None Present)	NS	Other	TCEQ SOP V2	98005	BRA
TOTAL NUMBER OF SUNFISH SPECIES	NU	Other	TCEQ SOP V2	98008	BRA
TOTAL NUMBER OF INTOLERANT SPECIES, FISH	NU	Other	TCEQ SOP V2	98010	BRA
PERCENT OF INDIVIDUALS AS OMNIVORES, FISH	%	Other	TCEQ SOP V2	98017	BRA
PERCENT OF INDIVIDUALS AS INVERTIVORES, FISH	%	Other	TCEQ SOP V2	98021	BRA
PERCENT OF INDIVIDUALS AS PISCIVORES, FISH	%	Other	TCEQ SOP V2	98022	BRA
PERCENT OF INDIVIDUALS WITH DISEASE OR ANOMALY	%	Other	TCEQ SOP V2	98030	BRA
TOTAL NUMBER OF NATIVE CYPRINID SPECIES	NU	Other	TCEQ SOP V2	98032	BRA
PERCENT INDIVIDUALS AS NON-NATIVE FISH SPECIES (% OF COMMUNITY)	%	Other	TCEQ SOP V2	98033	BRA
TOTAL NUMBER OF INDIVIDUALS SEINING	NU	Other	TCEQ SOP V2	98039	BRA
TOTAL NUMBER OF INDIVIDUALS ELECTROFISHING	NU	Other	TCEQ SOP V2	98040	BRA
TOTAL NUMBER OF BENTHIC INVERTIVORE SPECIES	NU	Other	TCEQ SOP V2	98052	BRA
TOTAL NUMBER OF BENTHIC FISH SPECIES	NU	Other	TCEQ SOP V2	98053	BRA
NUMBER OF INDIVIDUALS PER SEINE HAUL	NU	Other	TCEQ SOP V2	98062	BRA
NUMBER OF INDIVIDUALS PER MINUTE ELECTROFISHING	NU	Other	TCEQ SOP V2	98069	BRA
PERCENT INDIVIDUALS AS TOLERANT FISH SPECIES(EXCLUDING WESTERN MOSQUITOFISH)	%	Other	TCEQ SOP V2	98070	BRA

References:
United States Environmental Protection Agency (USEPA) Methods for Chemical Analysis of Water and Wastes, Manual #EPA-600/4-79-020
American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998. (Note: The 21st edition may be cited if it becomes available.)
TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods, 2012 (RG-415).
TCEQ SOP, V2 - TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data, 2014 (RG-416)

TABLE A7.5 Measurement Performance Specifications for Conventional Parameters

Conventional Parameters in Water

Parameter	Units	Matrix	Method	Parameter Code	TCEQ AWRL	LOQ	LOQ Check Sample %Rec	Precision (RPD of LCS/LCSD)	Bias %Rec. of LCS	Lab
RESIDUE, TOTAL NONFILTRABLE (MG/L)	mg/L	water	SM 2540D	00530	5	4	NA	NA	NA	BRA
NITROGEN, AMMONIA, TOTAL (MG/L AS N)	mg/L	water	EPA 350.1 Rev. 2.0 (1993)	00610	0.1	0.05	70-130	20	80-120	BRA
NITRATE NITROGEN, TOTAL (MG/L AS N)	mg/L	water	EPA 300.0 Rev. 2.1 (1993)	00620	0.05	0.04	70-130	20	80-120	BRA
NITROGEN, KJELDAHL, TOTAL (MG/L AS N)	mg/L	water	EPA 351.2	00625	0.2	0.2	70-130	20	80-120	BRA
PHOSPHORUS, TOTAL, WET METHOD (MG/L AS P)	mg/L	water	EPA 365.4	00665	0.06	0.05	70-130	20	80-120	BRA
ORTHOPHOSPHATE PHOSPHORUS,DISS,MG/L,FLDFILT<15MIN	mg/L	water	EPA 300.0 Rev. 2.1 (1993)	00671	0.04	0.04	70-130	20	80-120	BRA
CHLORIDE (MG/L AS CL)	mg/L	water	EPA 300.0 Rev. 2.1 (1993)	00940	5	5	70-130	20	80-120	BRA
SULFATE (MG/L AS SO4)	mg/L	water	EPA 300.0 Rev. 2.1 (1993)	00945	5	5	70-130	20	80-120	BRA
RESIDUE, TOT DISS,UNSPEC CALC BASED ON COND (MG/	mg/L	water	calculation	70294	NA	NA	NA	NA	NA	BRA
RESIDUE,TOTAL FILTRABLE (DRIED AT 180C) (MG/L)	mg/L	water	SM 2540C	70300	10	10	NA	NA	NA	BRA
ORTHOPHOSPHATE PHOSPHORUS,DISS,MG/L,FILTER >15MIN	mg/L	water	EPA 300.0 Rev. 2.1 (1993)	70507	0.04	0.04	70-130	20	80-120	BRA
CHLOROPHYLL-A, FLUOROMETRIC METHOD, UG/L	µg/L	water	EPA 445.0	70953	3	3	70-130	20	80-120	BRA
TURBIDITY,LAB NEPHELOMETRIC TURBIDITY UNITS, NTU	NTU	water	SM 2130B	82079	0.5	0.5	70-130	20	80-120	BRA

*Hardness is not used for regulatory purposes but is used to assess metals in water at inland sites (estuarine sites do not require hardness analysis).

References:

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

American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998. (Note: The 21st edition may be cited if it becomes available.)

TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods, 2012 (RG-415).

TCEQ SOP, V2 - TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data, 2014 (RG-416)

TABLE A7.6 Measurement Performance Specifications for Bacterialogical Parameters

Bacteriological Parameters in Water

Parameter	Units	Matrix	Method	Parameter Code	TCEQ AWRL	LOQ	LOQ Check Sample %Rec	Log Difference of Duplicates	Bias %Rec. of LCS	Lab
E. COLI, COLILERT, IDEXX METHOD, MPN/100ML	MPN/100 mL	water	IDEXX Colilert	31699	1	1	NA	0.50*	NA	BRA
ENTEROCOCCI, ENTEROLERT, IDEXX, (MPN/100 ML)	MPN/100 mL	water	IDEXX Enterolert	31701	10***	10	NA	0.50*	NA	BRA
E.COLI, COLILERT, IDEXX, HOLDING TIME	hours	water	NA	31704	NA	NA	NA	NA	NA	BRA

* This value is not expressed as a relative percent difference. It represents the maximum allowable difference between the logarithm of the result of a sample and the logarithm of the duplicate result. See Section B5.

** E.coli samples analyzed by these methods should always be processed as soon as possible and within 8 hours. When transport conditions necessitate delays in delivery longer than 6 hours, the holding time may be extended and samples must be processed as soon as possible and within 30 hours.

***Enterococcus Samples should be diluted 1:10 for all waters.

References:

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

American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998. (Note: The 21st edition may be cited if it becomes available.)

TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods, 2012 (RG-415).

TCEQ SOP, V2 - TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data, 2014 (RG-416)

TABLE A7.7 Measurement Performance Specifications for Flow

Flow Parameters

Parameter	Units	Matrix	Method	Parameter Code	Lab
FLOW STREAM, INSTANTANEOUS (CUBIC FEET PER SEC)	cfs	water	TCEQ SOP V1	00061	Field
FLOW SEVERITY:1=No Flow,2=Low,3=Normal,4=Flood,5=High,6=Dry	NU	water	TCEQ SOP V1	01351	Field
FLOW MTH 1=GAGE 2=ELEC 3=MECH 4=WEIR/FLU 5=DOPPLER	NU	other	TCEQ SOP V1	89835	Field

References:

United States Environmental Protection Agency (USEPA) Methods for Chemical Analysis of Water and Wastes, Manual #EPA-600/4-79-020
American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998. (Note: The 21st edition may be cited if it becomes available.)
TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods, 2012 (RG-415).
TCEQ SOP, V2 - TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data, 2014 (RG-416)

TABLE A7.8 Measurement Performance Specifications for Field Parameters					
Field Parameters					
Parameter	**Units**	**Matrix**	**Method**	**Parameter Code**	**Lab**
TEMPERATURE, WATER (DEGREES CENTIGRADE)	DEG C	water	TCEQ SOP V1	00010	Field
TRANSPARENCY, SECCHI DISC (METERS)	meters	water	TCEQ SOP V1	00078	Field
SPECIFIC CONDUCTANCE,FIELD (US/CM @ 25C)	us/cm	water	TCEQ SOP, V1	00094	Field
OXYGEN, DISSOLVED (MG/L)	mg/L	water	TCEQ SOP V1	00300	Field
PH (STANDARD UNITS)	s.u	water	TCEQ SOP V1	00400	Field
SALINITY - PARTS PER THOUSAND	PPT	water	TCEQ SOP V1	00480	Field
DAYS SINCE PRECIPITATION EVENT (DAYS)	days	other	TCEQ SOP V1	72053	Field
RESERVOIR STAGE (FEET ABOVE MEAN SEA LEVEL)†	FT ABOVE MSL	water	TWDB	00052	Field
RESERVOIR PERCENT FULL†	% RESERVOIR CAPACITY	water	TWDB	00053	Field
RESERVOIR ACCESS NOT POSSIBLE LEVEL TOO LOW ENTER 1 IF REPORTING	NS	other	TCEQ Drought Guidance	00051	Field
MAXIMUM POOL WIDTH AT TIME OF STUDY (METERS)***	meters	other	TCEQ SOP V2	89864	Field
MAXIMUM POOL DEPTH AT TIME OF STUDY(METERS)***	meters	other	TCEQ SOP V2	89865	Field
POOL LENGTH, METERS***	meters	other	TCEQ SOP V2	89869	Field
% POOL COVERAGE IN 500 METER REACH***	%	other	TCEQ SOP V2	89870	Field
MACROPHYTE BED AT COLLECTION POINT (%)	%	Other	TCEQ SOP V2	89926	Field
WIND INTENSITY (1=CALM,2=SLIGHT,3=MOD.,4=STRONG)	NU	other	NA	89965	Field
PRESENT WEATHER (1=CLEAR,2=PTCLDY,3=CLDY,4=RAIN,5=OTHER)	NU	other	NA	89966	Field
WATER SURFACE(1=CALM,2=RIPPLE,3=WAVE,4=WHITECAP)	NU	water	NA	89968	Field
PRIMARY CONTACT, OBSERVED ACTIVITY (# OF PEOPLE OBSERVED)	# of people observed	other	NA	89978	Field
EVIDENCE OF PRIMARY CONTACT RECREATION (1 = OBSERVED, 0 = NOT OBSERVED)	NU	other	NA	89979	Field

* Reporting to be consistent with SWQM guidance and based on measurement capability.
** Chlorine residual to be collected downstream of chlorinated outfalls.
*** To be routinely reported when collecting data from perennial pools.
† As published by the Texas Water Development Board on their website http://wiid.twdb.state.tx.us/ims/resinfo/BushButton/lakestatus.asp?selcat=3&slbasin=2

References:
United States Environmental Protection Agency (USEPA) Methods for Chemical Analysis of Water and Wastes, Manual #EPA-600/4-79-020
American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998. (Note: The 21st edition may be cited if it becomes available.)
TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods, 2012 (RG-415).
TCEQ SOP, V2 - TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data, 2014 (RG-416)

Appendix B: Task 3 Work Plan & Sampling Process Design and Monitoring Schedule (Plan)

Monitoring Sites for FY 2016
Critical vs. non-critical measurements

All data taken for CRP and entered into SWQMIS are considered critical.

Table B1.1

Site Description	Station ID	Waterbody ID	Basin	Region	SE	CE	MT	Field	Conv	Bacteria	Flow	24 hr DO	AqHab	Benthics	Nekton	Comments
BRAZOS RIVER 70 METERS DOWNSTREAM OF US 90A IN RICHMOND	11846	1202	12	12	BR	BR	RT	12	12	12	12					
BRAZOS RIVER AT FM 1093 NORTHEAST OF WALLIS	11848	1202	12	12	BR	BR	RT	4	4	4						
BRAZOS RIVER AT FM 1462 EAST BANK 4 MILES EAST OF WOODROW AND 7.4 MILES WEST OF ROSHARON	16355	1202	12	12	BR	BR	RT	12	12	12						
BRAZOS RIVER AT US 290 6.5 MILES NORTHWEST OF HEMPSTEAD	11850	1202	12	12	BR	BR	RT	12	12	12	12					
ALLENS CREEK APPROX 480 METERS EAST AND 165 METERS NORTH OF THE INTERSECTION OF SH 36 AND REDEEMER WAY RD AND 4.0 KM NW OF WALLIS	21621	1202H	12	12	BR	BR	BS	2	2		2	2	2	2	2	
ALLENS CREEK AT FM 1458 NORTH OF WALLIS	11577	1202H	12	12	BR	BR	BS	2	2		2	2	2	2	2	
ALLENS CREEK AT FM 1458 NORTH OF WALLIS	11577	1202H	12	12	BR	BR	RT	4	4	4						

BIG CREEK IMMEDIATELY UPSTREAM OF SAWMILL ROAD 7.0 KM UPSTREAM OF WATERS LAKE BAYOU E OF LONG POINT N OF BRAZOS BEND STATE PARK	16353	1202J	12	12	BR	BR	RT	12	12	12						
BRAZOS RIVER 20 M OFF NORTH BANK AT FM 200 NORTHEAST OF GLEN ROSE	20213	1204	12	4	BR	BR	RT	12	12	12	12					
LAKE GRANBURY AT FM 51 NORTH OF GRANBURY 265 METERS WEST AND 69 METERS NORTH OF INTERSECTION OF FM 51 AND SIESTA COURT	11862	1205	12	4	BR	BR	RT	12	12	12						
Lake Granbury immediately upstream of Atchison Topeka and Santa Fe Railroad 110 meters upstream of US377/East Pearl Street East of Granbury	20307	1205	12	4	BR	BR	RT	12	12	12						
LAKE GRANBURY NEAR DAM 102 METERS WEST AND 56 METERS NORTH OF NORTHERN EDGE OF DAM SITE AC USGS 322227097412101	11860	1205	12	4	BR	BR	RT	12	12	12						
UNNAMED CANAL ON LAKE GRANBURY 127 M SOUTH 24 M EAST OF INTERSECTION OF APOLLO COURT AND SKY HARBOUR DRIVE	18015	1205	12	4	BR	BR	RT	12	12	12						In support of Granbury WPP
UNNAMED CANAL ON LAKE GRANBURY 130 M NORTH NORTHWEST OF THE INTERSECTION OF MALLARD WAY AND MALLARD COURT	18018	1205	12	4	BR	BR	RT	12	12	12						In support of Granbury WPP
UNNAMED CANAL ON LAKE GRANBURY 135 M NORTH AND 130 M EAST OF THE INTERSECTION OF DAKOTA TRAIL AND CONEJOS COURT	20216	1205	12	4	BR	BR	RT	12	12	12						In support of Granbury WPP
UNNAMED CANAL ON LAKE GRANBURY 23 M SOUTH 91 M EAST OF INTERSECTION OF HARTWOOD DRIVE AND EAST FERNWOOD COURT	18038	1205	12	4	BR	BR	RT	12	12	12						In support of Granbury WPP
UNNAMED CANAL ON LAKE GRANBURY AT 3709 GREENBROOK DRIVE	18010	1205	12	4	BR	BR	RT	12	12	12						In support of Granbury WPP

BRAZOS RIVER AT FM 4 NORTH OF PALO PINTO	11864	1206	12	4	BR	BR	RT	12	12	12	12					
BRAZOS RIVER AT US 281 SOUTH OF MINERAL WELLS	11863	1206	12	4	BR	BR	RT	2	2	2						In support of SB 1345
BRAZOS RIVER IMMEDIATELY DOWNSTREAM OF SOUTH SH 16	18748	1206	12	4	BR	BR	RT	2	2	2	2					In support of SB 1345
BRAZOS RIVER IMMEDIATELY UPSTREAM FM 1189 SOUTH OF DENNIS	13543	1206	12	4	BR	BR	RT	12	12	12	12					
BRAZOS RIVER SOUTH BANK 1.74 KM DOWNSTREAM OF US 281 IN PALO PINTO COUNTY	18745	1206	12	4	BR	BR	RT	2	2	2						In support of SB 1345
PALO PINTO CREEK IMMEDIATELY DOWNSTREAM OF FM 129 SOUTH OF BRAZOS	11074	1206D	12	4	BR	BR	RT	2	2	2						In support of SB 1345
POSSUM KINGDOM RESERVOIR DEEP ELM CREEK ARM 597 METERS NORTH AND 880 METERS WEST OF INTERSECTION OF ANTHONY LOOP AND LEFTYS COURT	11868	1207	12	4	BR	BR	RT	12	12	12						
POSSUM KINGDOM RESERVOIR NEAR DAM 696 METERS WEST AND 221 METERS SOUTH OF NORTHERN EDGE OF DAM	11865	1207	12	4	BR	BR	RT	12	12	12						
POSSUM KINGDOM RESERVOIR NEAR END OF FM 2951 67 METERS NORTH AND 864 METERS WEST OF INTERSECTION OF FM 2951 AND SANBAR ROAD	11867	1207	12	4	BR	BR	RT	12	12	12						
POSSUM KINGDOM RESERVOIR NEAR JOHNSON BEND 437 METERS NORTH AND 429 METERS WEST OF INTERSECTION OF HELLS GATE LOOP AND HELLS POINT RD	11866	1207	12	4	BR	BR	RT	12	12	12						
BRAZOS RIVER 72 METERS DOWNSTREAM OF SH 67 2.0 MILES NE OF SOUTH BEND 2.81 KM DOWNSTREAM FROM THE CONFLUENCE WITH CLEAR FORK BRAZOS R	13641	1208	12	3	BR	BR	RT	12	12	12	12					

BRAZOS RIVER AT US 183/US 277 AT SEYMOUR	11871	1208	12	3	BR	BR	RT	12	12	12	12					
NAVASOTA RIVER IMMEDIATELY DOWNSTREAM OF SH 30 EAST OF COLLEGE STATION	11875	1209	12	9	BR	BR	RT	4	4	4						
NAVASOTA RIVER IMMEDIATELY DOWNSTREAM OF SH 6 NORTH OF NAVASOTA	11873	1209	12	9	BR	BR	RT	4	4	4						
NAVASOTA RIVER IMMEDIATELY DOWNSTREAM OF US 79 BETWEEN EASTERLY AND MARQUEZ	11877	1209	12	9	BR	BR	RT	4	4	4	4					
CARTERS CREEK 44 METERS DOWNSTREAM OF BIRD POND ROAD SOUTHEAST OF COLLEGE STATION 2 MILES SOUTH OF SH 30	11785	1209C	12	9	BR	BR	RT	4	4	4						
DUCK CREEK AT SH 79 IN THE TOWN OF EASTERLY	16389	1209H	12	9	BR	BR	BS	2	2		2	5	2	2	2	
GIBBONS CREEK EAST 25 M UPSTREAM OF FM 244	18800	1209I	12	9	BR	BR	RT	4	4	4						
LAKE MEXIA 152 METERS NORTH AND 261 METERS WEST OF SOUTHWESTERN EDGE OF DAM 11 KILOMETERS WEST OF MEXIA	17586	1210	12	9	BR	BR	BS					5				
LAKE MEXIA 67 METERS SOUTH AND 264 METERS EAST OF INTERSECTION OFFM 3437 AND REDBUD 11 KILOMETERS WEST OF MEXIA	17587	1210	12	9	BR	BR	BS					5				
LAKE MEXIA SOUTH OF US 84 515 METERS SOUTH AND 1.03 KILOMETERS EAST OF INTERSECTION OF US 84 AND FM 2310 11 KILOMETERS WEST OF MEXIA	17588	1210	12	9	BR	BR	BS					5				
YEGUA CREEK 377 METERS DOWNSTREAM OF FM 50 SOUTH OF CLAY	11880	1211	12	9	BR	BR	RT	4	4	4						
LITTLE RIVER AT US 77 BRIDGE SOUTHEAST OF CAMERON	11888	1213	12	9	BR	BR	RT	12	12	12	12					

LITTLE RIVER IMMEDIATELY DOWNSTREAM OF SH 95 NEAR LITTLE RIVER ACADEMY	13546	1213	12	9	BR	BR	RT	4	4	4	4					
STILLHOUSE HOLLOW LAKE IN PLEASANT BRANCH COVE 4.28 KM DOWNSTREAM OF CHAPARRAL ROAD CROSSING	20051	1216	12	9	BR	BR	RT	4	4	4						
STILLHOUSE HOLLOW LAKE IN TRIMMIER CREEK COVE NEAR CONFLUENCE OF LITTLE TRIMMIER CREEK 310 M S AND 462 E OF SCHRADER DR END	18753	1216	12	9	BR	BR	RT	4	4	4						
STILLHOUSE HOLLOW LAKE MID-LAKE AT LAMPASAS RIVER ARM APPROX 60 METERS UPSTREAM OF STILLHOUSE HOLLOW ROAD/FM 3481	11895	1216	12	9	BR	BR	RT	4	4	4						
STILLHOUSE HOLLOW LAKE NEAR DAM 441 METERS SOUTH AND 302 METERS WEST OF NORTHERN EDGE OF DAM SITE AC USGS 310129097315901	11894	1216	12	9	BR	BR	RT	4	4	4						
PLEASANT BRANCH AT FOOTBRIDGE IN PURSER PARK APPROX 63 METERS DOWNSTREAM OF MOUNTAIN LION RD CROSSING IN HARKER HEIGHTS	21689	1216A	12	9	BR	BR	RT	4		4						
TRIMMIER CREEK IMMEDIATELY UPSTREAM OF CHAPARRAL ROAD WEST OF FM 3481	18754	1216A	12	9	BR	BR	RT	4	4	4						
UNNAMED TRIBUTARY OF TRIMMIER CREEK APPROX 60 METERS EAST OF PROSPECTOR TRAIL AND MUSTANG TRAIL INTERSECTION IN HARKER HEIGHTS	21690	1216A	12	9	BR	BR	RT	4		4						
ROCKY CREEK AT FM 963 AND APPROXIMATELY 1.26 KM UPSTREAM OF LAMPASAS RIVER NEAR OAKALLA	11724	1217A	12	11	BR	BR	RT	4	4	4						

NOLAN CREEK IMMEDIATELY UPSTREAM OF US 190 EAST OF NOLANVILLE	11907	1218	12	9	BR	BR	RT	4	4	4						
BELTON LAKE 1.11 KILOMETERS NORTH AND 265 METERS WEST OF INTERSECTION OF FM 2305 AND WOODLAND POINT ROAD USGS SITE EC 310829097294301	15679	1220	12	9	BR	BR	RT	4	4	4						
BELTON LAKE 2.11 KM NORTH AND 1.70 KM EAST OF INTERSECTION OF FORT HOOD MILITARY RES ROAD AND NOLAN ROAD USGS SITE CC 310829097312201	15678	1220	12	9	BR	BR	RT	4	4	4						
BELTON LAKE 629M NORTH AND 157M EAST OF THE BOAT RAMP AT WESTCLIFF PARK	20835	1220	12	9	BR	BR	RT	4	4	4						
BELTON LAKE IN OWL CREEK ARM 313 M NORTH AND 265 M WEST OF BOAT RAMP AT OWL CREEK PARK	18798	1220	12	9	BR	BR	RT	4	4	4						
BELTON RESERVOIR COWHOUSE CREEK ARM 88 METERS NORTH AND 954 METERS EAST OF THE INTERSECTION OF NOLAN CREEK ROAD AND LIBERTY HILL ROAD	11922	1220	12	9	BR	BR	RT	4	4	4						
BELTON RESERVOIR LEON RIVER ARM NEAR HEADWATERS 626 METERS N AND 288 METERS W OF INTERSECTION OF KUIKENDALL RD AND MC GREGOR PARK RD	11923	1220	12	9	BR	BR	RT	4	4	4						
BELTON RESERVOIR NEAR DAM 81 METERS NORTH AND 17 METERS WEST OF SOUTHERN EDGE OF DAM	11921	1220	12	9	BR	BR	RT	4	4	4						
COWHOUSE CREEK 71 METERS DOWNSTREAM OF FM 116 SOUTHWEST OF GATESVILLE	11805	1220A	12	9	BR	BR	RT	4	4	4	4					

LEON RIVER 18 METERS UPSTREAM OF CORYELL CR 183 NORTHEAST OF LEVITA	11929	1221	12	9	BR	BR	RT	4	4	4						
LEON RIVER AT HAMILTON COUNTY ROAD 109	18781	1221	12	9	BR	BR	RT	4	4	4						
LEON RIVER AT HAMILTON CR 203 NORTH OF HAMILTON	20905	1221	12	9	BR	BR	RT	12	12	12						
LEON RIVER AT HAMILTON CR 431 1.6 KM DOWNSTREAM OF SH 36 SOUTHWEST OF JONESBORO	11930	1221	12	9	BR	BR	RT	12	12	12						
LEON RIVER IMMEDIATELY DOWNSTREAM OF FM 1829 SOUTHEAST OF NORTH FORK HOOD	11925	1221	12	9	BR	BR	RT	12	12	12						
LEON RIVER IMMEDIATELY DOWNSTREAM OF US 67/ US 377 DOWNSTREAM LAKE PROCTOR	11934	1221	12	3	BR	BR	RT	12	12	12	12					
RESLEY CREEK AT COMANCE CR 394 740 METERS UPSTREAM OF THE CONFLUENCE WITH THE LEON RIVER	11808	1221A	12	3	BR	BR	RT	4	4	4						
RESLEY CREEK AT FM 2823 WEST OF CARLTON C704	17377	1221A	12	3	BR	BR	RT	4	4	4						
SOUTH LEON RIVER 20 M DOWNSTREAM OF SH 36 EAST OF GUSTINE	11817	1221B	12	3	BR	BR	RT	4	4	4						
PECAN CREEK AT SH 22 EAST OF HAMILTON	17547	1221C	12	9	BR	BR	RT	4	4	4						
PLUM CREEK 10 M DOWNSTREAM OF CORYELL CR 106 NEAR LEVITA	18405	1221E	12	9	BR	BR	RT	4	4	4						
CORYELL CREEK 51 METERS DOWNSTREAM OF FM 107 1.9 KM UPSTREAM OF THE CONFLUENCE WITH THE LEON RIVER	11804	1221G	12	9	BR	BR	RT	4	4	4						
PROCTOR LAKE COPPERAS CREEK ARM 460 METERS NORTH AND 2.04 KILOMETERS EAST OF INTERSECTION OF COMANCE CR 410A AND COMANCHE CR 407	11937	1222	12	3	BR	BR	RT	2	2	2						

PROCTOR LAKE IN LEON AND SABANA RIVER ARM 2.43 KM NORTH AND 1.23 KM EAST OF INTERSECTION OF COMANCHE CR 424 AND FM 2318	11936	1222	12	3	BR	BR	RT	2	2	2						
PROCTOR LAKE NEAR DAM FLOODGATE 911 METERS NORTH AND 940 METERS EAST OF INTERSECTION OF FM 2861 AND COMANCHE CR 418C	11935	1222	12	3	BR	BR	RT	2	2	2						
NORTH BOSQUE RIVER AT COOPERS CROSSING ROAD WEST OF CHINA SPRING	11951	1226	12	9	BR	BR	RT	4	4	4						
MERIDIAN CREEK AT SH 6 2.5 MILES NORTHWEST OF CLIFTON	14908	1226C	12	9	BR	BR	RT	4	4	4						
NOLAN RIVER 75 METERS UPSTREAM OF FM 933 IN BLUM	11967	1227	12	9	BR	BR	RT	4	4	4	4					
NOLAN RIVER IMMEDIATELY UPSTREAM OF FM 916 WEST OF RIO VISTA	11971	1227	12	4	BR	BR	RT	4	4	4						
PALUXY RIVER LOW WATER CROSSING OFF OF VAN ZANDT ROAD NEAR SH 144 IN GLEN ROSE	20232	1229	12	4	BR	BR	RT	4	4	4						
BRAZOS RIVER AT SH 105 WEST OF NAVASOTA	12030	1242	12	9	BR	BR	RT	12	12	12						
BRAZOS RIVER AT SH 21 11 MILES NORTHEAST OF CALDWELL	15767	1242	12	9	BR	BR	RT	12	12	12	12					
BRAZOS RIVER IMMEDIATELY DOWNSTREAM OF FM 413 NORTHEAST OF ROSEBUD	12032	1242	12	9	BR	BR	RT	12	12	12	12					
BRAZOS RIVER IMMEDIATELY UPSTREAM OF SH 6 SOUTHEAST OF WACO	12038	1242	12	9	BR	BR	RT	12	12	12	12					
THOMPSONS CREEK IMMEDIATELY UPSTREAM OF SILVERHILL ROAD 765 METERS UPSTREAM OF SH 47 WEST OF BRYAN	16396	1242D	12	9	BR	BR	RT	4	4	4						
LITTLE BRAZOS RIVER IMMEDIATLEY UPSTREAM OF SH 21 WEST OF BRYAN	11591	1242E	12	9	BR	BR	RT	4	4	4						

SALADO CREEK 75 METERS DOWNSTREAM OF FM 2268 IN SALADO	12051	1243	12	9	BR	BR	RT	4	4	4						
BRUSHY CREEK AT WILLIAMSON CR 129/ENGERMAN LANE	12059	1244	12	11	BR	BR	RT	4	4	4						
BRUSHY CREEK IMMEDIATELY DOWNSTREAM OF CHISHOLM TRAIL ROAD	12068	1244	12	11	BR	BR	RT	4	4	4						
BRUSHY CREEK IMMEDIATELY DOWNSTREAM OF FM 685	12060	1244	12	11	BR	BR	RT	4	4	4						
GRANGER LAKE IN SAN GABRIEL RIVER ARM NEAR HEADWATERS 7.22 KILOMETERS DOWNSTREAM OF SH 95	12096	1247	12	11	BR	BR	RT	4	4	4						
GRANGER LAKE IN WILLIS CREEK ARM 960 METERS NORTH AND 1.91 KM EAST OF INTERSECTION OF WILLIAMSON CR 348 AND CR 389	12097	1247	12	11	BR	BR	RT	4	4	4						
GRANGER LAKE NEAR DAM 1.44 KILOMETERS NORTH AND 190 METERS WEST OF SOUTHERN EDGE OF DAM	12095	1247	12	11	BR	BR	RT	4	4	4						
Willis Creek at Williamson CR 236 west of Granger 635 meters east of the intersection of Williamson CR 335 and Williamson CR 326	20305	1247A	12	11	BR	BR	RT	4	4	4						
SAN GABRIEL/NORTH FORK SAN GABRIEL RIVER AT WILLIAMSON CR 366 4.84 KILOMETERS UPSTREAM OF SH 95	12099	1248	12	11	BR	BR	RT	4	4	4						
SAN GABRIEL/NORTH FORK SAN GABRIEL RIVER IMMEDIATELY DOWNSTREAM OF SH 29 EAST OF GEORGETOWN	12102	1248	12	11	BR	BR	RT	4	4	4						
SAN GABRIEL/NORTH FORK SAN GABRIEL RIVER NORTH FORK IMMEDIATELY DOWNSTREAM OF IH 35 IN GEORGETOWN	12108	1248	12	11	BR	BR	RT	4	4	4						
BERRY CREEK IMMEDIATELY DOWNSTREAM OF FM 971 2 MILES EAST OF IH 35	13496	1248A	12	11	BR	BR	RT	4	4	4						

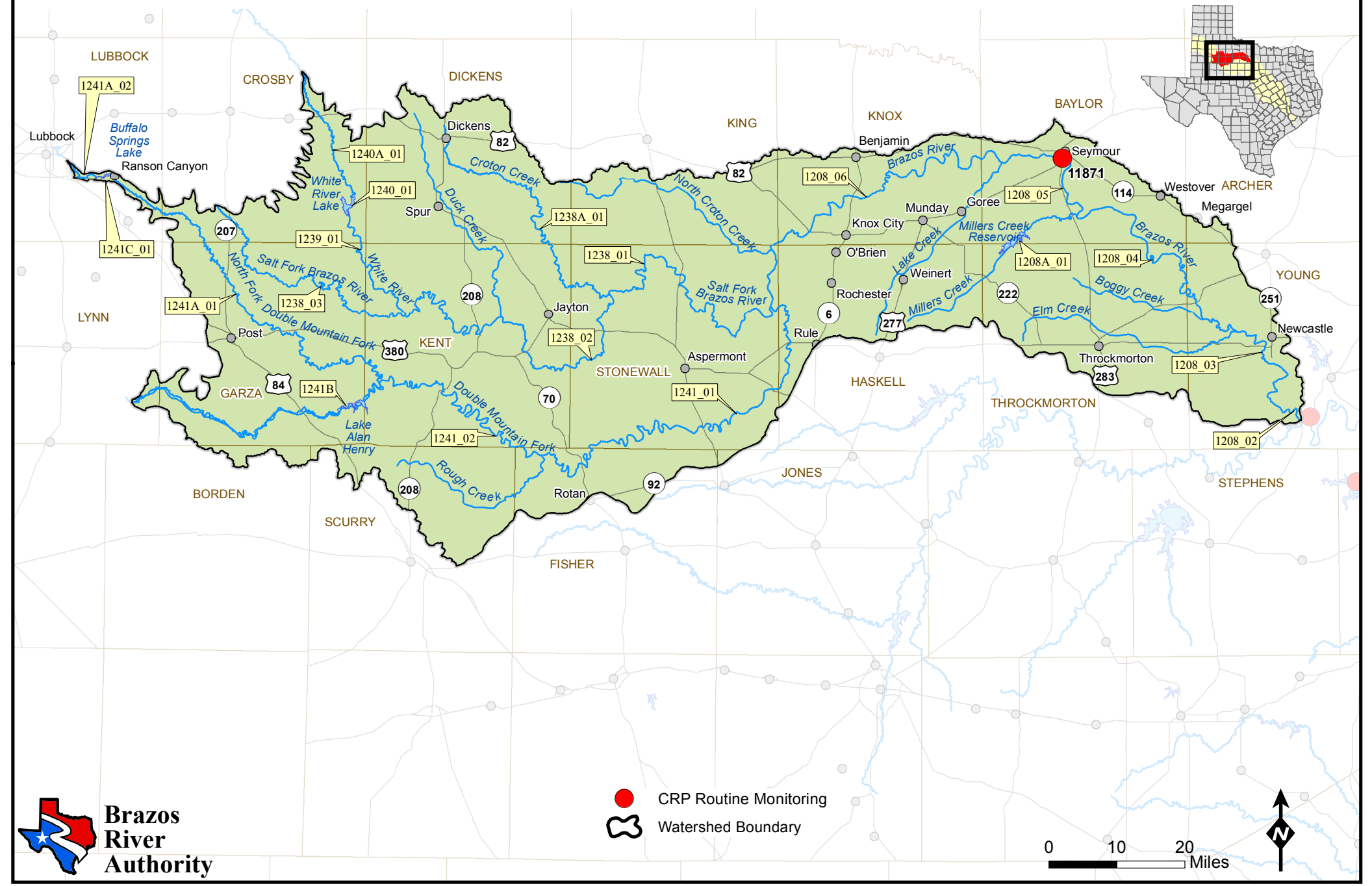
MANKINS BRANCH AT WILLIAMSON CR 100 IMMEDIATELY UPSTREAM OF THE CONFLUENCE WITH THE SAN GABRIEL RIVER	13497	1248C	12	11	BR	BR	RT	4	4	4						
LAKE GEORGETOWN NEAR DAM 68 METERS NORTH AND 88 METERS EAST OF SOUTHWEST EDGE OF DAM	12111	1249	12	11	BR	BR	RT	4	4	4						
LAKE GEORGETOWN NEAR HEADWATERS IN THE NORTH SAN GABRIEL ARM 305 METERS SOUTH AND 1.05 KILOMETERS WEST FROM THE INTERSECTION OF WILLIAMSON CR 262 AND PARK ROAD 8	12113	1249	12	11	BR	BR	RT	4	4	4						
SOUTH FORK SAN GABRIEL RIVER 1.44 KM NORTH AND 1.80 KM WEST OF THE INTERSECTION OF WEIR RANCH ROAD AND LEANDER RANCH ROAD / RR 2243 AT WEIR PIT ROCK QUARRY IN WILLIAMSON COUNTY	20309	1250	12	11	BR	BR	RT	4	4	4	4					
SOUTH FORK SAN GABRIEL RIVER AT US 183	12116	1250	12	11	BR	BR	RT	4	4	4						
LAKE LIMESTONE AT CONFLUENCE OF NAVASOTA RIVER AND BIG CREEK ARMS 1.33 KM S AND 1.39 KM EAST OF INTERSECTION OF LCR 752 AND 3D RCH RD	12125	1252	12	9	BR	BR	RT	12	12	12						
LAKE LIMESTONE AT FM 3371 696 METERS NORTH AND 430 METERS EAST OF INTERSECTION OF FM 3371 AND PARK 2 RD SITE DC USGS 312622096224201	13970	1252	12	9	BR	BR	RT	12	12	12						
LAKE LIMESTONE IN LAMBS CREEK ARM 2.19 KILOMETERS DOWNSTREAM OF FM 1512 NEAR LCR 893	12124	1252	12	9	BR	BR	RT	12	12	12						

LAKE LIMESTONE NEAR DAM 572 METERS NORTH AND 2.28 KILOMETERS EAST OF INTERSECTION OF WINDING WAY ROAD AND BRAZOS RIVER AUTHORITY ROAD	12123	1252	12	9	BR	BR	RT	12	12	12						
UPPER NAVASOTA RIVER 81 METERS DOWNSTREAM OF SH 164 EAST OF GROESBECK	12126	1253	12	9	BR	BR	RT	12	12	12						
SPRINGFIELD LAKE 535 M SOUTH AND 600 M EAST OF NAVASOTA RIVER MOUTH AND APPROXIMATELY 1700 M UPSTREAM OF THE DAM	18799	1253A	12	9	BR	BR	BS					5				
SPRINGFIELD LAKE NEAR DAM 69 METERS WEST AND 65 METERS NORTH OF SOUTHERN EDGE OF DAM 5.2 MILES NORTH OF GROESBECK	16247	1253A	12	9	BR	BR	BS					5				
AQUILLA CREEK IMMEDIATELY UPSTREAM OF FM 933 NORTHWEST OF WACO	11593	1256A	12	9	BR	BR	RT	4	4	4						
BRAZOS RIVER IMMEDIATELY UPSTREAM OF FM 2114 SOUTHEAST OF LAGUNA PARK	12044	1257	12	9	BR	BR	RT	12	12	12	12					

Appendix C: Station Location Maps

Maps of stations monitored by the BRA are provided in the accompanying .pdf file BRA_CRP_QAPP_AppendicesB-F_FY1617. The maps were generated by the BRA. This product is for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. It does not represent an on-the-ground survey and represents only the approximate relative location of property boundaries. For more information concerning this map, contact the Brazos River Authority Water Quality Programs Manager, Jenna Olson at 254-761-3149.

Watershed of the Salt and Double Mountain Forks of the Brazos River
FY16 Water Quality Monitoring



CRP Routine Monitoring

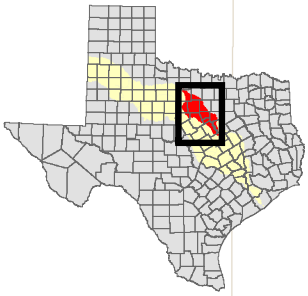
Watershed Boundary

0 10 20 Miles

N

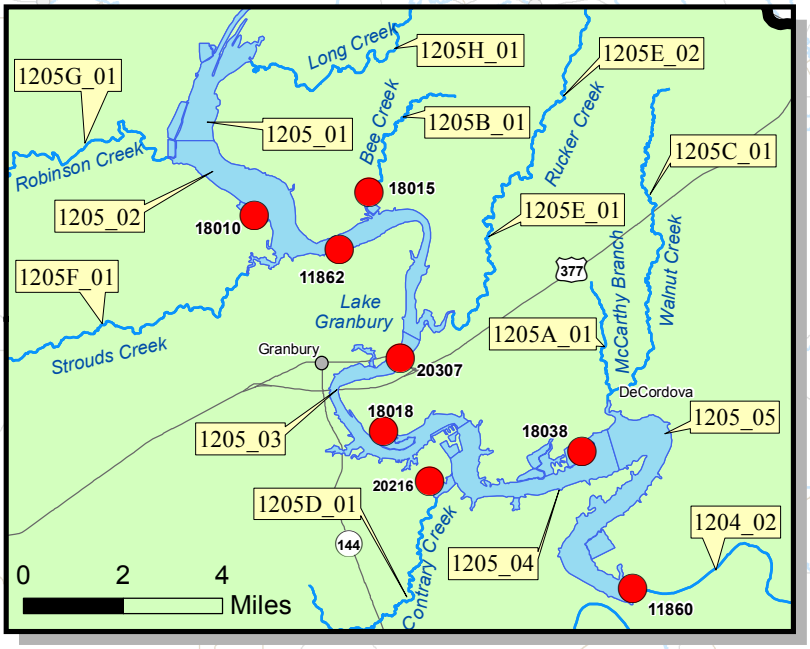
Brazos River Authority

Upper Watershed of the Brazos River
FY16 Water Quality Monitoring



CRP Routine Monitoring
Watershed Boundary

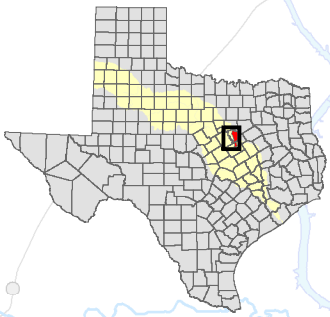
See Inset Map



Brazos River Authority

0 10 20 Miles

Aquilla Creek Watershed
FY16
Water Quality Monitoring



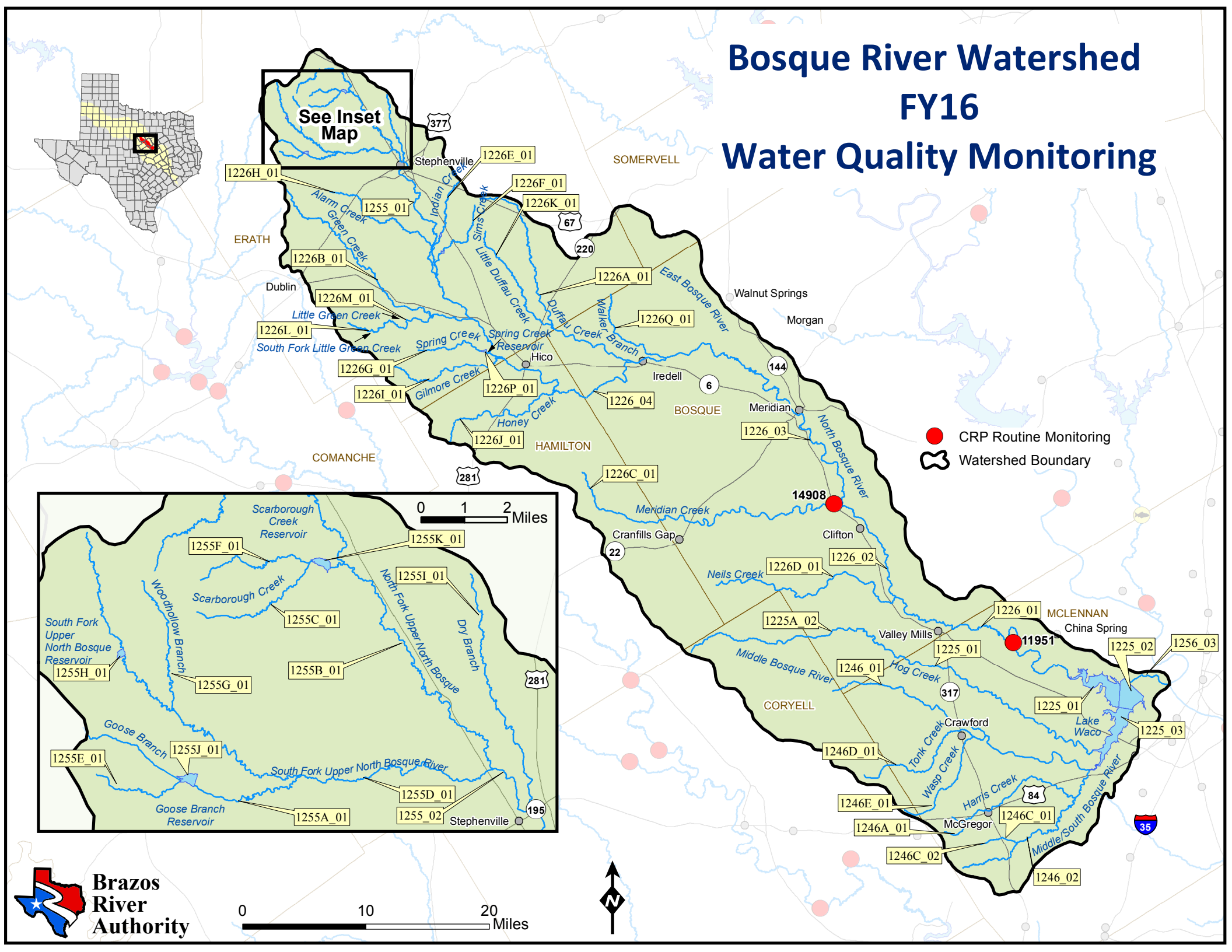
JOHNSON
Covington
Itasca
81
35W
171
Hackberry Creek
1254B_01
Carl's Corner
35E
77
HILL
Aquilla Creek
1254A_02
Hillsboro
171
22
1254A_01
1254_02
Aquilla Reservoir
1254_03
1254_01
Abbott
Aquilla
35
West
1256A_01
Brazos River
MCLENNAN
Aquilla Creek
Ross
Gholson
11593
Elm Mott
1257_01
1256_01
Brazos River

CRP Routine Monitoring
Watershed Boundary

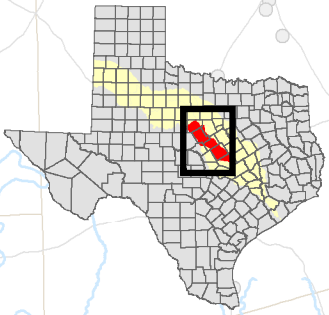
Brazos River Authority

0 5 10 Miles

N


Bosque River Watershed
FY16
Water Quality Monitoring
See Inset Map
CRP Routine Monitoring
Watershed Boundary
14908
11951
1226H_01
1226E_01
1226F_01
1226K_01
1255_01
1226B_01
1226M_01
1226L_01
1226G_01
1226I_01
1226P_01
1226A_01
1226Q_01
1226_04
1226J_01
1226_03
1226C_01
1226D_01
1226_02
1226_01
1225A_02
1225_01
1246_01
1225_02
1256_03
1225_03
1246D_01
1246E_01
1246A_01
1246C_01
1246C_02
1246_02
1255F_01
1255K_01
1255I_01
1255C_01
1255B_01
1255G_01
1255H_01
1255J_01
1255E_01
1255D_01
1255A_01
1255_02
Alarm Creek
Green Creek
Indian Creek
Sims Creek
Little Duffau Creek
Duffau Creek
Walker Branch
East Bosque River
Little Green Creek
South Fork Little Green Creek
Spring Creek
Spring Creek Reservoir
Gilmore Creek
Honey Creek
North Bosque River
Meridian Creek
Neils Creek
Middle Bosque River
Hog Creek
Tonk Creek
Wasp Creek
Harris Creek
Lake Waco
Middle/South Bosque River
Scarborough Creek Reservoir
Scarborough Creek
Woodhollow Branch
South Fork Upper North Bosque Reservoir
North Fork Upper North Bosque
Dry Branch
Goose Branch
Goose Branch Reservoir
South Fork Upper North Bosque River
Stephenville
Dublin
Hico
Iredell
Meridian
Walnut Springs
Morgan
Cranfills Gap
Clifton
Valley Mills
Crawford
McGregor
China Spring
ERATH
SOMERVELL
BOSQUE
HAMILTON
COMANCHE
CORYELL
MCLENNAN
377
67
220
144
6
22
281
317
84
35
195
0 1 2 Miles
0 10 20 Miles
N
Brazos River Authority

Leon River Watershed
FY16 Water Quality Monitoring



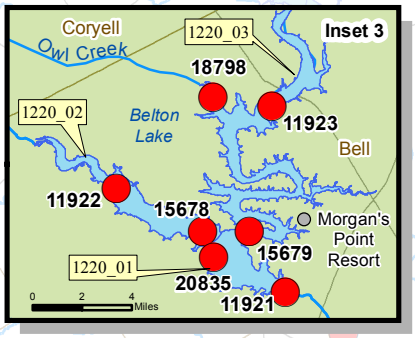
CRP Routine Monitoring

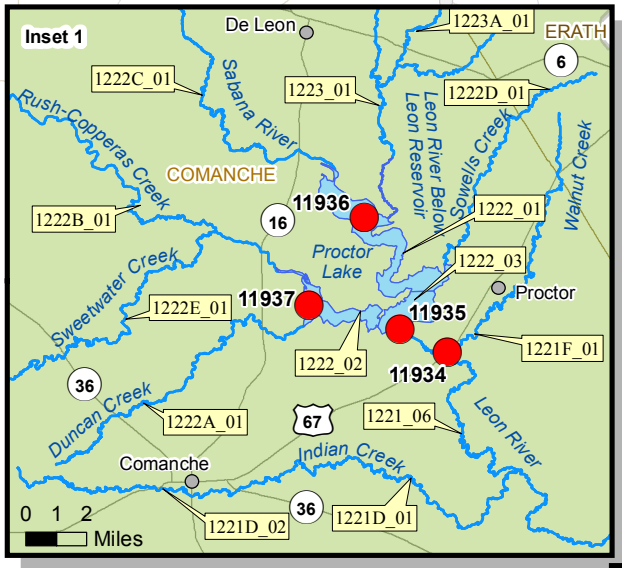
Watershed Boundary

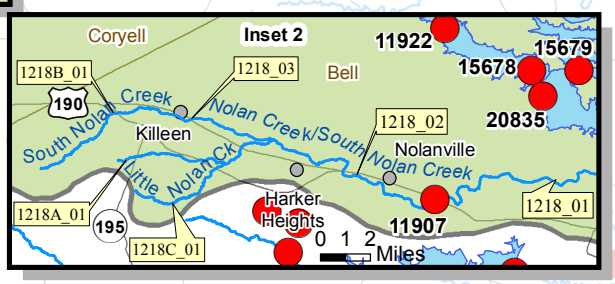
See Inset Map 1

See Inset Map 2

See Inset Map 3



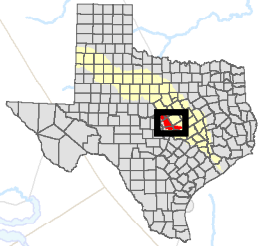




Brazos River Authority

0 10 20 Miles

Lampasas River Watershed
FY16 Water Quality Monitoring



CRP Routine Monitoring

Watershed Boundary

HAMILTON

MILLS

LAMPASAS

CORYELL

BURNET

BELL

WILLIAMSON

1217_05

1217_04

Seg 1217C

1217_03

1217_02

1217B_01

1217B_02

1217D_01

1217A_01

1217_01

1217F_02

1217F_01

1216A_01

1216_01

1216_02

1215_01

1243_01

1243_02

Seg 1217E

Lampasas River

Bennett Creek

Simms Creek

Sulphur Creek

Mesquite Creek

North Rocky Creek

Rocky Creek

South Rocky Creek

Reese Creek

Trimmier Creek

Lake Stillhouse Hollow

Salado Creek

Lometa

Lampasas

Kempner

Salado

Florence

Jarrell

21689

21690

18754

20051

18753

11894

11895

11724

12051

84

281

190

183

195

138

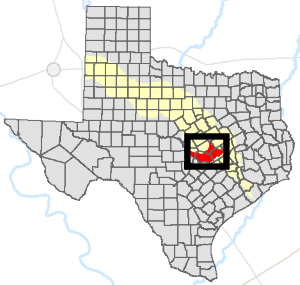
35

0 10 20 Miles

Brazos River Authority

N

Little River Watershed
FY16
Water Quality Monitoring



CRP Routine Monitoring

Watershed Boundary

MCLENNAN

FALLS

BELL

MILAM

WILLIAMSON

BURNET

TRAVIS

BASTROP

Moody

Troy

Temple

Little River

Rogers

Holland

Buckholts

Cameron

Jarrell

Bartlett

Granger

Weir

Georgetown

Liberty Hill

Bertram

Leander

Cedar Park

Round Rock

McNeil

Thrall

Taylor

Hutto

Thorndale

Milano

Little Elm Creek

Big Elm Creek

Little River

North Fork San Gabriel River

South Fork San Gabriel River

Middle Fork San Gabriel

Lake Georgetown

Lake Granger

San Gabriel River

San Gabriel/North San Gabriel River

Willis Creek

Berry Creek

Mankins Branch

Huddleston Branch

Mustang Creek

Brushy Creek

Brushy Creek above South Brushy Creek

South Brushy Creek

Lake Creek

1213B_02

1213A_02

1213C_01

1213B_01

1213A_01

1213_04

1213_01

1213_02

1251_02

1251_01

1248A_01

Seg 1247A

1247_02

1247_01

1214_01

1249_02

1249_01

1250_03

1248C_01

1248_01

1247_03

1214_02

1248D_01

1250_02

1250_01

1248B_01

1244_01

1244A_01

1244_04

1244_03

1244C_01

1244D_01

1244_02

1244B_01

13546

11888

20305

12097

12095

12113

12111

13496

12102

12096

12108

12116

20309

13497

12099

12060

12068

12059

281

138

183

195

35

95

29

320

77

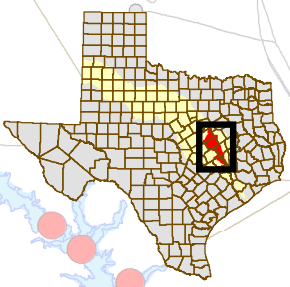
190

79

0 10 20 Miles

Brazos River Authority

Central Watershed of the Brazos River FY16 Water Quality Monitoring



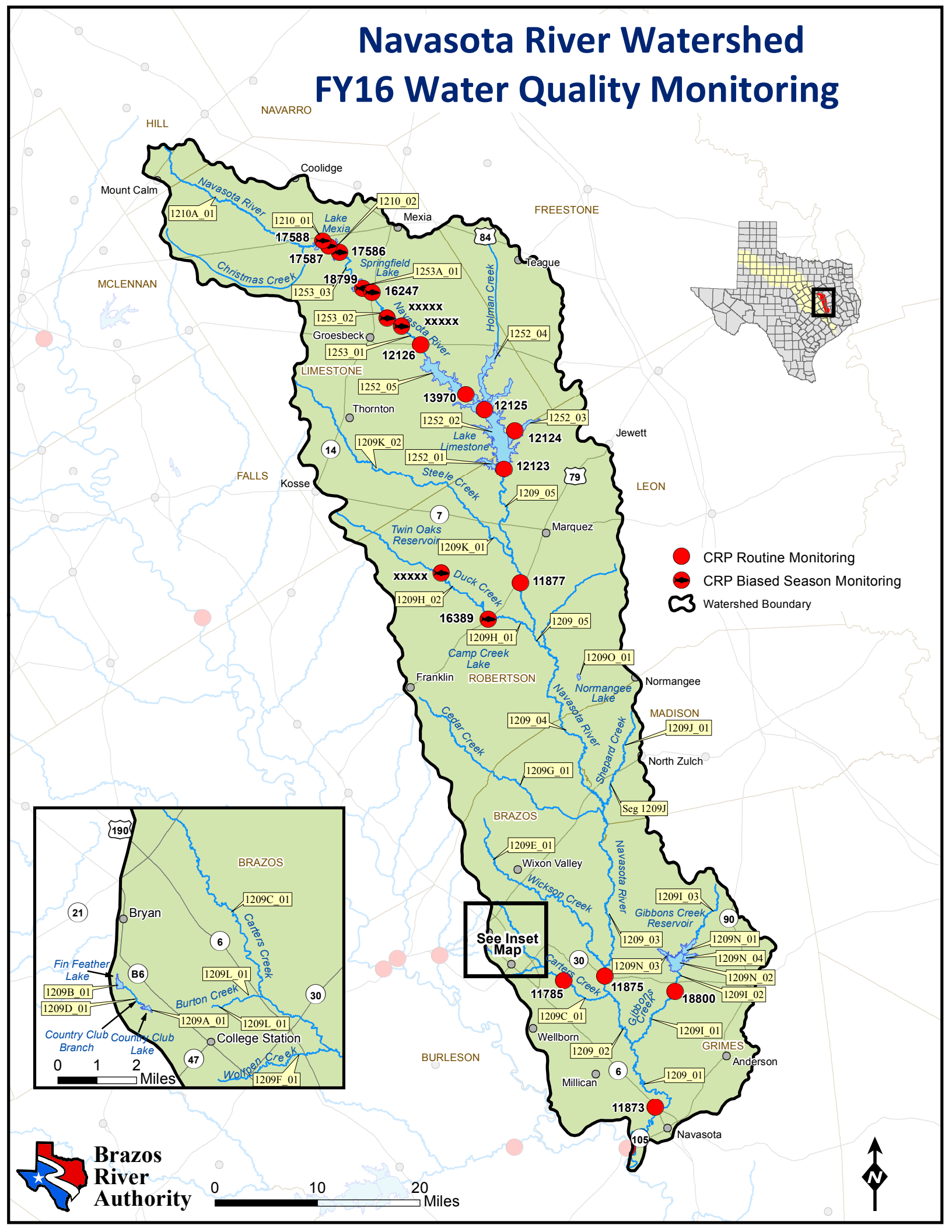
CRP Routine Monitoring

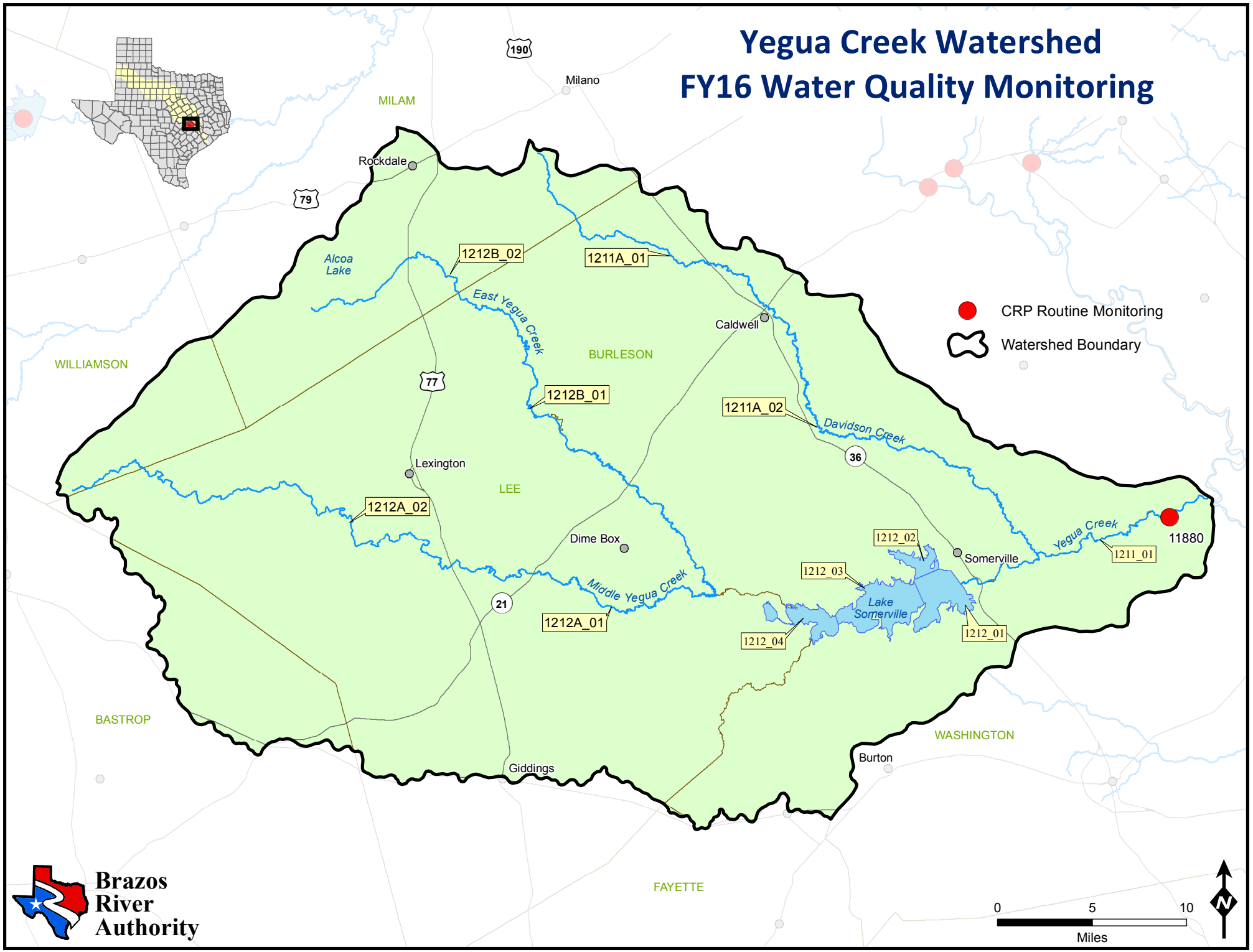
Watershed Boundary

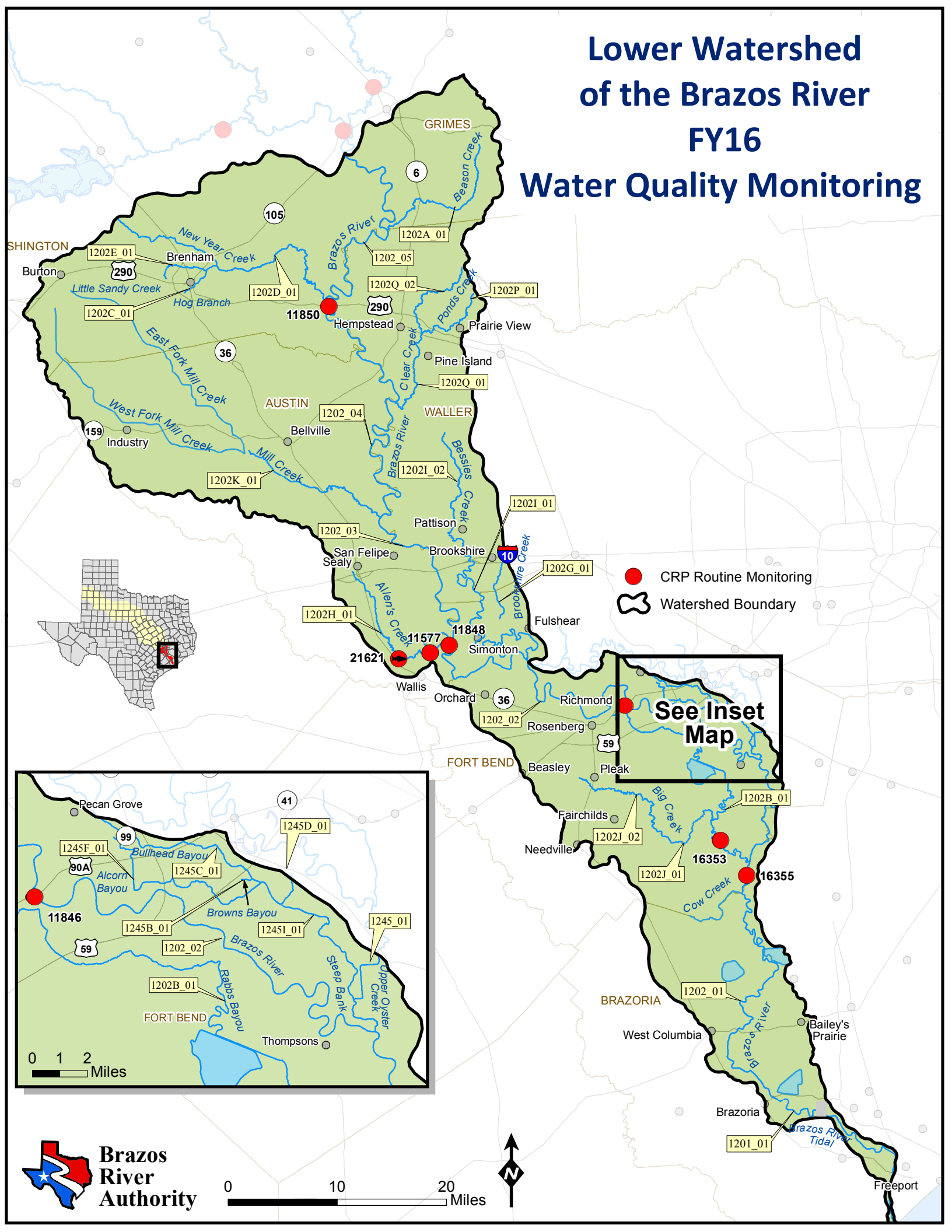
Brazos River Authority

0 10 20 Miles

Navasota River Watershed
FY16 Water Quality Monitoring




Yegua Creek Watershed
FY16 Water Quality Monitoring
CRP Routine Monitoring
Watershed Boundary
Milano
MILAM
Rockdale
190
79
77
36
21
Alcoa Lake
1212B_02
1211A_01
East Yegua Creek
Caldwell
BURLESON
WILLIAMSON
1212B_01
1211A_02
Davidson Creek
Lexington
LEE
1212A_02
Dime Box
Yegua Creek
11880
1211_01
1212_02
Somerville
1212_03
Middle Yegua Creek
Lake Somerville
1212A_01
1212_04
1212_01
BASTROP
WASHINGTON
Giddings
Burton
FAYETTE
Brazos River Authority
0
5
10
Miles
N


Lower Watershed
of the Brazos River
FY16
Water Quality Monitoring
GRIMES
WASHINGTON
AUSTIN
WALLER
FORT BEND
BRAZORIA
Burton
Brenham
Hempstead
Prairie View
Pine Island
Bellville
Industry
Pattison
Brookshire
San Felipe
Sealy
Fulshear
Wallis
Orchard
Simonton
Richmond
Rosenberg
Beasley
Pleak
Fairchilds
Needville
West Columbia
Bailey's Prairie
Brazoria
Freeport
Pecan Grove
Thompsons
Brazos River
New Year Creek
Little Sandy Creek
Hog Branch
East Fork Mill Creek
West Fork Mill Creek
Mill Creek
Beason Creek
Ponds Creek
Clear Creek
Bessies Creek
Brookshire Creek
Allen's Creek
Big Creek
Cow Creek
Bullhead Bayou
Alcorn Bayou
Browns Bayou
Rabbs Bayou
Steep Bank
Upper Oyster Creek
Brazos River Tidal
1202E_01
1202D_01
1202C_01
1202A_01
1202_05
1202Q_02
1202P_01
1202Q_01
1202_04
1202I_02
1202I_01
1202K_01
1202_03
1202G_01
1202H_01
1202_02
1202B_01
1202J_02
1202J_01
1202_01
1245D_01
1245F_01
1245C_01
1245B_01
1245I_01
1245_01
1201_01
11850
11577
11848
21621
16353
16355
11846
See Inset Map
CRP Routine Monitoring
Watershed Boundary
0 1 2 Miles
0 10 20 Miles
N
Brazos River Authority

Appendix D: Field Data Sheets

BRAZOS RIVER AUTHORITY
FIELD DATA SHEETS FOR SAMPLES COLLECTED FOLLOWING SWQM VOL.I

LIMS#/SITE ID _____

SITE NAME: _____

DATE: _____

TIME: _____

COLLECTORS: Baack Balch Davis Grimm Moran Nickolai

RUN: Allens Creek

Hydrolab SN# 12A 12B 349 608 830 831

STORET Code		Description
89966		SKIES: 1=CLEAR, 2=PT/CLOUDY, 3=CLOUDY, 4=RAIN
89965		WIND: 1=CALM, 2=SLIGHT, 3=MOD, 4=STRONG
00078		TRANSPARENCY, SECCHI DISC (METERS)
89861		AVG STREAM WIDTH (METERS)
01351		FLOW SEVERITY: 1=NO FLOW, 2=LOW, 3=NORMAL, 4=FLOOD, 5=HIGH, 6=DRY
89835	-	FLOW METHOD: 1=USGS, 2=MARSH MCBIRNEY, 3=MECH, 4=WEIR/FLUE, 5=DOPPLER
00061		STREAM FLOW INSTANTANEOUS (CFS)
89926		AQUATIC VEGETATION @ COLLECTION SITE (PERCENT)
72053		DAYS SINCE LAST SIGNIFICANT PRECIPITATION (DAYS)
89978		NUMBER OF PEOPLE OBSERVED PERFORMING PRIMARY CONTACT RECREATION
89979		EVIDENCE OF PRIMARY CONTACT RECREATION: OBSERVED (1) NOT OBSERVED (0)

	Temp	D.O.	Specific Conductance	pH	Salinity	DO	Cl Res							
	(ºC)	(mg/L)	(µs/cm)	(s.u.)	(ppt)	(% Sat.)	(mg/L)	Matrix : Surface Water						
DEPTH	00010	00300	00094	00400	00480	00301		Other:	Sample Type: Grab					
Surface 0.3m									Anions Filtered	TSS	Turbidity Chl a	*E. coli*	TKN/TP NH3	
							Bottle ID:		A[1]	B	C	D	E[2]	

COMMENTS

[1] Field Filtered [2]Preserved with H_2SO_4

All Samples collected preserved on ice.

Receiver's Signature **Form Completed by:**

Time of Receipt: **Date of Receipt:**

BRAZOS RIVER AUTHORITY
FIELD DATA SHEETS FOR SAMPLES COLLECTED FOLLOWING SWQM VOL. I

SITE ID # ______________________

SITE NAME: ______________________

DATE: ______________________

TIME: ______________________

COLLECTORS: Baack Balch Davis Grimm Moran Nickolai

RUN: Belton

Hydrolab SN# 12A 12B 349 608 830 831

STORET Code		Description
89966		SKIES: 1=CLEAR, 2=PT/CLOUDY, 3=CLOUDY, 4=RAIN
89965		WIND: 1=CALM, 2=SLIGHT, 3=MOD, 4=STRONG
89968		WATER SURFACE (1=Calm,2=Ripple,3=Wave,4=Whitecaps)
00078		TRANSPARENCY, SECCHI DISC (METERS)
89926		AQUATIC VEGETATION @ COLLECTION SITE (PERCENT)
72053		DAYS SINCE LAST SIGNIFICANT PRECIPITATION (DAYS)
00051		RESERVOIR ACCESS NOT POSSIBLE LEVEL TOO LOW
00052		RESERVOIR STAGE (feet above msl)
00053		RESERVOIR PERCENT FULL

		Temp	**D.O.**	**Specific Conductance**	**pH**	**Salinity**	**DO**	**Cl Res**		Matrix: Surface Water			
	Depth	(ºC)	(mg/L)	(µs/cm)	(s.u.)	(ppt)	(% Sat.)	(mg/L)	Other:	Sample Type: Grab			
LIMS #	(m)	00010	00300	00094	00400	00480	00301	Bottle ID		A[1]	B	C	D
	0.3m									Anions	TSS	Turbidity	*E. coli*

COMMENTS

[1]Field Filtered | All Samples collected preserved on ice. | Feet x 0.3048 = Meters

Receiver's Signature ______________________ **Form Completed by:** ______________________

Time of Receipt: ____________ **Date of Receipt:** ____________

Appendix E: Chain of Custody Forms

ESL LABORATORY
4600 Cobbs Drive
Waco, TEXAS 76710

Brazos River Authority

TELEPHONE: (254) 761-3100
FAX: (254) 761-3102

Run ID:

Client/Project:	Contact:	TX Permit No.:
Address:	Phone No.:	WQ Permit No.:
	FAX No.:	Collected by:

Sample ID	Obs Temp °C	Corr Temp °C	Sample Name, Site Description or Case Number	Collection				Matrix	Container Volume / Type	G / C	Preser-vation	Verified (F1-F8)	Analysis Requested
Laboratory Use Only				Start Date	Start Time	End Date	End Time						

Customer Comments:

If sample is received outside holdtime/s or preservation requirements, initial to authorize analysis:

Date / Time:	Relinquished by:	Received by:

Laboratory Comments:

Thermometer ID:

Matrix : **AQ** -Aqueous **SW** -Stormwater **S**-Sludge/Soil/Sediment **P**-Potable Water
NP-Non-potable surface water **B**-Benthics **PK**-Plankton **F**-Fish **AG**-Algae **O**-Other

Preservation: F -Field, L -Lab **Plus:** (**1**)cool to 4°C (**2**)H_2SO_4 to pH<2 (**3**)HNO_3 to pH<2
(**4**)HCl to pH<2 (**5**)$Na_2S_2O_3$ (**6**)NaOH to pH>12 (**7**)None required (**8**)Other, as noted

Container: **I**-Idexx **P**- Plastic **AP**-Amber Plastic **G** -Clear Glass **AG** -Amber Glass **B** -Bacti **WP** -Whirl Pak **VOA** -40ml vial **C** -Cubitainer

Approved for use by KB on 12May14

Appendix F: Data Review Checklist and Summary Shells

Data Review Checklist

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

Data Summary

Data Source: **Brazos River Authority - MS Access Database**

Date Submitted: _____

Tag ID Ranges: _____

Date Range: _____

- □ I certify that all data in this data set meets the requirements specified in Texas Water Code Chapter 5, Subchapter R (TWC §5.801 et seq) and Title 30 Texas Administrative Code Chapter 25, Subchapters A & B.
- □ This data set has been reviewed using the criteria in the Data Review Checklist.

Brazos River Authority Data Manager: _____ **Date:** _____

This dataset contains data from FY__ QAPP Submitting Entity code BR and collecting entity BR. This is field and lab data that was collected by the Brazos River. Analyses were performed by the BRA Environmental Services Laboratory. The following tables explain discrepancies or missing data as well as calculated data loss.

Discrepancies or missing data:

Test	Parameter	Data Points Expected	Additional Data Points	Stations Dry, Pooled, or inaccessible (no data)	Data Points Rejected	Data Points Submitted

Comments:

Data Loss for the listed tag ID:

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