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

Regional Agricultural BMP Planning Database

TSSWCB Project # 22-52

Quality Assurance Project Plan

Texas State Soil and Water Conservation Board

Revision #1

prepared by

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Texas A&M AgriLife Research
Texas Water Resources Institute

Effective Period: Upon final approval through February 29, 2024

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

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College Station, Texas 77840

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Section A1: Approval Sheet

Quality Assurance Project Plan (QAPP) for *Regional Agricultural BMP Planning Database*

Texas State Soil and Water Conservation Board (TSSWCB)

Name: Dakota Massey
Title: TSSWCB Project Manager (PM)

Signature:_____ Date:_____

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

Signature:_____ Date:_____

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

Name: Michael Schramm
Title: TWRI Project Manager

Signature:_____ Date:_____

Name: Stephanie DeVilleneuve
Title: TWRI QAO

Signature:_____ Date:_____

Name: Duncan Kikoyo
Title: TWRI DM

Signature:_____ Date:_____

Section A2: Table of Contents

Section: Title

List of Acronyms and Abbreviations

BMP	Best Management Practice
CAR	Corrective Action Report
DEM	Digital Elevation Model
DM	Data Manager
GIS	Geographic Information System
LDC	Load Duration Curve
NRCS	Natural Resources Conservation Service
PM	Project Manager
QA	Quality Assurance
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	Quality Control
QPR	Quarterly Progress Report
SELECT	Spatially Explicit Load Estimation Calculation
SWAT	Soil and Water Assessment Tool
TCEQ	Texas Commission on Environmental Quality
TMDL	Total Maximum Daily Load
TNRIS	Texas Natural Resources Information System
TPWD	Texas Parks and Wildlife Department
TSSWCB	Texas State Soil and Water Conservation Board
TWRI	Texas AgriLife Research, Texas Water Resources Institute
USDA	United States Department of Agriculture
USGS	United States Geological Survey
WPP	Watershed Protection Plan

Section A3: Distribution List

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

Texas State Soil and Water Conservation Board

1497 Country View Lane
Temple, TX 76504

Name: Dakota Massey
Title: TSSWCB PM

Name: Mitch Conine
Title: TSSWCB QAO

Texas A&M AgriLife Research - Texas Water Resources Institute

578 John Kimbrough Blvd.
2118 TAMU
College Station, TX 77845

Name: Michael Schramm
Title: TWRI Project Manager

Name: Stephanie DeVilleneuve
Title: TWRI QAO

Name: Duncan Kikoyo
Title: TWRI DM

Section A4: Project/Task Organization

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

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

Dakota Massey, TSSWCB PM

Responsible for ensuring that the project delivers data of known quality, quantity, and type on schedule to achieve project objectives. Provides the primary point of contact between TSSWCB and TWRI. Tracks and reviews deliverables to ensure that tasks in the work plan are completed as specified. Reviews and approves QAPP and any amendments or revisions and ensures distribution of approved/revised QAPPs to TSSWCB participants. Notifies TSSWCB QAO of any project non-conformances or corrective actions reported or taken by TWRI.

Mitch Conine; TSSWCB QAO

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

TWRI – Texas Water Resources Institute, College Station, Texas. Responsible for general project oversight, coordination and administration, project reporting, data acquisition, development of project database and meta-analysis.

Michael Schramm, TWRI; PM

The TWRI PM is responsible for ensuring that all tasks and other requirements in the contract are executed on time and with the quality assurance/quality control (QA/QC) requirements as defined by the contract and in the project QAPP: assessing the quality of subcontractor/participant work; submitting accurate and timely deliverables to the TSSWCB PM; and coordinating attendance at conference calls, training, meetings, and related project activities. Responsible for verifying that the QAPP is distributed and followed by TWRI and the project is producing products of known and acceptable quality. Responsible for ensuring adequate training and supervision of all activities involved in the project, including facilitation of audits and the implementation, documentation, verification, and reporting of corrective actions. Ensure work satisfies project objectives as well as contract and work plan requirements. Works with the TWRI Data Manager (DM) and project staff to acquire data and perform analysis work.

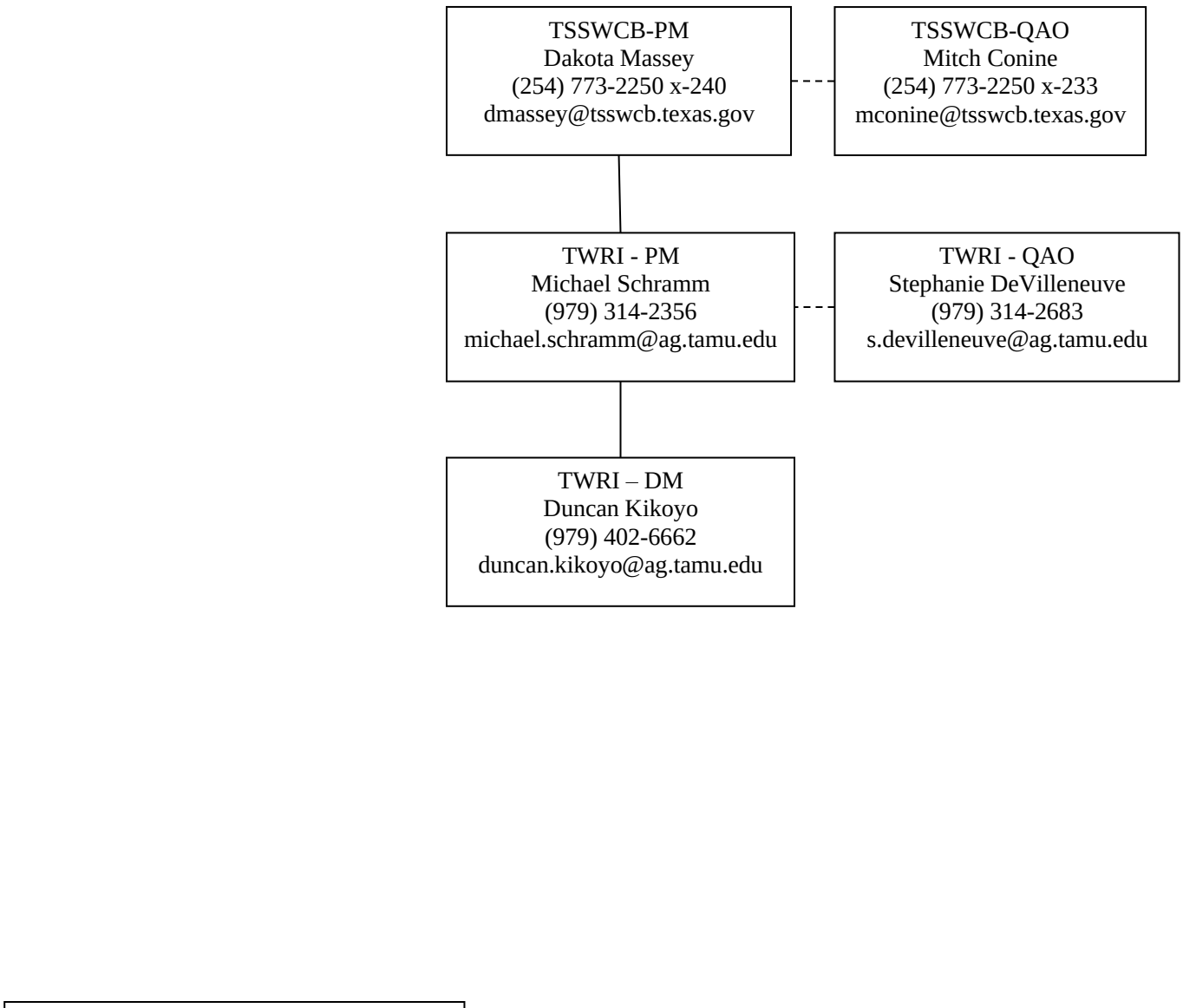
Stephanie DeVilleneuve, TWRI; QAO

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

Duncan Kikoyo, TWRI; DM

Responsible for the acquisition and verification of data. Oversees data management for the project. Performs data quality assurances prior to use of data. Provides point of contact for the TWRI PM to resolve issues related to the data and assumes responsibility for the correction of any data errors.

Figure A4.1. Project Organization Chart



Section A5: Problem Definition/Background

Limited resources are available for watershed planners and stakeholders to assess the location and scale of agricultural best management practices (BMPs) required to obtain pollutant load reductions needed to achieve state water quality standards. Scenario planning with mechanistic models such as the Soil and Water Assessment Tool (SWAT) can be used to estimate resulting instream water quality based on placement and amount of BMPs in a watershed. The accuracy and effectiveness of these modelling approaches are contingent on the modelling technician and can be prone to over- or underestimation of load reductions depending on the effectiveness of the model parameter calibration process. In order to balance cost, complexity, and uncertainty, the Bacteria Total Maximum Daily Load (TMDL) Taskforce suggested the use of simpler tools as a first step where appropriate to assess needed load reduction (Jones et al. 2007). As a result, many watershed protection plans (WPPs) and TMDL I-Plans use a combination of Load Duration Curves (LDC) and the Spatially Explicit Load Estimate Calculation Tool (SELECT) to estimate needed loading reductions and prioritize BMP and management measure placement. This approach is appealing because it is easily communicated with stakeholders and efficiently moves the planning process forward towards implementation.

The use of LDCs and SELECT are reliable and replicable ways of estimating needed load reductions and spatially allocating loads and practices. However, the planning of the number of agricultural BMPs required to achieve load reductions can be biased based on the studies selected or information available to the planner and stakeholder group. Furthermore, the estimated percent load reductions from agricultural BMPs are typically re-estimated (or likely copy-pasted) with each new WPP. A centralized and updated database of potential pollutant load reductions resulting from agricultural BMPs would provide an unbiased source of reference and streamline work effort for future WPPs and TMDL I-Plans.

Section A6: Project Goals and Task Description

The goal of this project is to develop a reference database that catalogues different BMPs implemented in Texas and their performance in improving water quality. To accomplish this, TWRI will identify agricultural BMPs implemented in Texas and neighboring states (in cases where climatic and ecological sites/soils are similar) by carrying out a comprehensive assessment of peer-reviewed scientific literature and results of field experimental investigations on the impacts of management measures in reducing nutrient, sediment, and pathogen loads. Published studies for potential inclusion will be found by searching leading academic databases such as Google scholar, Web of Science, and Scopus. Results from experimental trials will be collated from agricultural research stations in the state such as those at Riesel and Vernon, TX, among others. Study inclusion criteria will adhere to TCEQ protocols for acquired data, as well as standards that govern systematic reviews and meta-analyses. To evaluate the relative effectiveness of different practices in reducing pollutant loads, the quality assured pooled data will be meta-analyzed to develop representative statistics of typical load reductions attributed to agricultural BMPs. Results of the statistical analysis will be inventoried in an easy-to-use database. Outreach aimed at popularizing the database amongst potential users will involve sharing results of the analysis and applications of the database in webinars, or other related public forums and publishing findings of the analysis in a peer-reviewed journal that has a wide reach in Texas and in neighboring states.

The project shall consist of:

1. QAPP – describe general method and sources of acquired data (Google scholar, Web of Science, keywords used, etc.). Define parameters of interest (nutrients, sediment, pathogens).
2. Data gathering and database development.
3. Published database (e.g., Excel workbook). Will be shared on an open access system such as the Texas Data Repository (https://data.tdl.org/).
4. Meta-analysis of gathered research.
5. Produce summary statistics for all the identified BMPs and regression equations as appropriate.
6. Produce technical report on data/methods to estimate load reductions from practices. Include walk through for how a user would use database.
7. Publish results of meta-analysis in a peer-reviewed scientific journal (e.g., Texas Water Journal or another applicable journal).
8. Share results via press release and public presentations (e.g., Texas Watershed Coordinator Roundtable, Annual SWCD meeting).

This QAPP covers activities in Task 3 of the work plan (Database Development and Publication) (Table A6.1).

Table A6.1. Project Plan Milestones

Task	Project Milestones	Agency	Start Month	End Month
3.1	TWRI will use academic literature searches (with Google Scholar and other available academic search tools) to develop and deliver a database of studies on agricultural BMP effectiveness. The database will be shared via a project website for watershed planners and implementers to use.	TWRI	1	8
3.2	TWRI will conduct a meta-analysis of studies in the database to summarize pollutant load reduction statistics for common pasture, range, and crop practices. The data and statistics for watershed planning pollutant load reductions will be published in a technical report.	TWRI	1	12

Section A7: Quality Objectives and Criteria for Data Quality

No data will be collected specifically for this project. Existing data from other sources will be acquired and used as described in Section B9. Section B9 also describes by what criteria the data are qualified for use in this project. These data will be used to conduct a meta-analysis of the performance of various water quality management BMPs for addressing non-point source pollution. A meta-analysis is a retrospective analysis of multiple studies that ask similar research questions. The aim is to use statistical approaches (typically regression analysis) to develop pooled estimates of effect size across different studies.

Systematic Review and Meta-Analysis of BMP Performance

TWRI will develop a systematic review and meta-analysis that utilizes published peer-reviewed and technical reports of water quality constituent reductions resulting from the application of agricultural best management practices. Systematic reviews aim to answer specific questions in unbiased fashion by collating, critically appraising, and synthesizing all available evidence relevant to the question. Pre-defined methods minimize risk of bias to provide reliable findings. Meta-analysis has become the standard way of summarizing empirical studies in many scientific fields. A meta-analysis is conducted similar to a systematic review but in addition to a narrative description, the meta-analysis pools results of studies together to arrive at a summary estimate of effect size. The main goal of this meta-analysis is to find the mean effect of various agricultural BMPs on water quality. To develop the meta-analysis the following steps are performed:

- Identifying studies: Peer-reviewed and technical reports are identified using research databases.
- Extract information: From each study, treatment effect sizes are recorded, along with additional data including sample size, statistical score, information pertinent to interpreting results.
- Meta-analysis: Calculate weighted averages of differences in means, slopes, or other statistics across different studies.

Meta-analysis will focus on the impact of agricultural BMPs on water quality parameters, including but not limited to fecal indicator bacteria, nitrogen, phosphorus, and sediment. Additional guidance for conducting systematic reviews is provided in Collaboration for Environmental Evidence (2018).

Section A8: Special Training Requirements/Certification

All personnel involved in this project will have appropriate education and training required to adequately perform their duties. No special certifications are required.

Section A9: Documentation and Records

The document and records that describe, specify, report, or certify activities, requirements, procedures, or results for this project are provided below.

Combined Project Documentation

Quarterly progress reports disseminated to the individuals listed in section A3 will note activities conducted in connection with the project, items or areas identified as potential problems, and any variations or supplements to the QAPP. Final reports on the updated LDC analysis will be developed.

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

All electronic data are backed up routinely. A blank CAR is presented in Appendix A. The TSSWCB may elect to take possession of records at the conclusion of the specified retention period.

Meta-analysis database and files- All records, including electronic files, will be archived by TWRI for three years. Electronic data on the project computers and the network server are backed up daily to the network drive and weekly to an external hard drive and the PI's computer. In the event of a catastrophic systems failure, the tapes can be used to restore the data in less than one day's time. Data generated on the day of the failure may be lost, but can be reproduced from raw data in most cases.

Table A9.1. Project documents and records

Document/Record	Location	Retention	Form
QAPP, amendments, and appendices	TWRI	5 years	Electronic
QAPP distribution documentation	TWRI	5 years	Paper/Electronic
Corrective Action Reports (CARs)	TWRI	5 years	Paper/Electronic
Progress Reports/Final Reports	TWRI/TSSWCB	3 years	Electronic
Meta-analysis database and files	TWRI	3 years	Electronic

Data Transfer between Entities

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

QAPP Revision and Amendments

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

Amendments to the QAPP may be necessary to reflect changes in project organization, tasks, schedules, objectives and methods; address deficiencies and non-conformances; improve

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

Section B1: Sampling Process Design (Experimental Design)

Does not apply to this QAPP.

Section B2: Sampling Method Requirements / Data Collection Method

Does not apply to this QAPP.

Section B3: Sample Handling and Custody Requirements

Does not apply to this QAPP.

Section B4: Analytical Methods

Does not apply to this QAPP.

Section B5: Quality Control Requirements

Does not apply to this QAPP.

Section B6: Equipment Testing, Inspection, & Maintenance Requirements

Does not apply to this QAPP.

Section B7: Instrument Calibration and Frequency

Does not apply to this QAPP.

Section B8: Inspection/Acceptance Requirements for Supplies and Consumables

Does not apply to this QAPP.

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

Geographic Information System (GIS) Data

Geospatial data available from various local, regional, state, and federal organizations may be used for cartographic purposes. Maps developed for reports will be for illustrative purposes. Geospatial data utilized in maps of the study area may include land use, precipitation, soil type, ecoregion, TCEQ monitoring location, TCEQ permitted outfall, gage location, city/county/state boundary, stream hydrology, reservoir, drought, road, watershed, municipal separate storm sewer system, urbanized area, basin, railroad, recreational area, area landmark, aerial photography, and park information. The above data come from the following reliable sources: USGS, Texas Natural Resources Information System (TNRIS), TCEQ, and US Census Bureau. Geospatial data from these sources are accepted for developing project maps based on the reputability of these data sources. Geospatial data will be cited in reports.

Data of known quality compiled and published by other entities may also be used in preparing project reports. This may include ecoregion, hydrology, agricultural census data on livestock. Sources of these data are the USGS, Texas Parks and Wildlife Department (TPWD), TNRIS, and United State Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). Data collected by these entities are assumed to have been verified and validated according to the requirements of the respective programs. Data compilations created for this project will be visually screened for errors. Data will be cited in reports.

Table B9.1 lists the type of measurement, data, units, source, QA documentation use and data range of each acquired data set where applicable.

Because most historical data is of known and acceptable quality and were collected and analyzed in a manner comparable and consistent with needs for this project, no limitations will be placed on their use, except where known deviations have occurred.

Scientific Investigations

Data will be obtained from scientific investigations conducted on agricultural BMP performance. These studies relate performance to variables such as sources, landscape variables, hydrology, location, etc. Peer-reviewed and white-paper reports will be obtained with structured searches using Google Scholar, Web of Science, and other academic search engines as needed. Identified reports will be downloaded and reviewed for scientific quality and data extracted from tables and figures summarize BMP performance. The obtained data will be used to conduct meta-analysis of performance across grouped variables.

Table B9.1. Non-Direct Data Types and Data Sources for planned acquisition

Type of Measurement or Analysis	Type of Data (time series, rate, constant, statistic, taxa, etc.)	Units	Source (weblink when available)	Quality Assurance Documentation	Use	Date Range
County Boundaries	Spatial data, StratMap Boundaries	Shapefile - Polygons	TNRIS Data Search & Download http://www.tnris.org/	Metadata available with download	Map development	N/A
Watershed topography	Spatial GIS data, Digital Elevation Models (DEMs)	Raster- 10 meter resolution	National Elevation Data set from USGS National Map Viewer https://www.usgs.gov/core-science-systems/ngp/tnm-delivery/	Digital Elevation Model Technologies and Applications: The DEM Users Manual 2nd Edition	Delineation of watershed and subwatershed boundaries for maps	N/A
Watershed Boundary Dataset	Spatial GIS data, GIS shapefiles	1:24,000 or better	https://gdg.sc.egov.usda.gov/	https://pubs.usgs.gov/tm/11/a3/pdf/tm11-a3_1ed.pdf	Subwatershed delineation	N/A
Land Use/Land Cover	National Land Cover Data set – GIS raster data set	Raster – 30 m resolution	National Land Cover Database 2019 (NLCD2019) from MRLC Consortium Viewer: https://www.mrlc.gov/data/nlcd-2019-land-cover-conus	Yang, L., Jin, S., Danielson, P., Homer, C., Gass, L., Costello, C., Dewitz, J., Fry, J., Funk, M., Grannemann, B., Rigge, M. and G. Xian. 2018. https://www.mrlc.gov/data/references/national-land-cover-database-2019-landcover-imperviousness-nlcd2019 *A New Generation of the United States National Land Cover Database: Requirements, Research Priorities, Design, and Implementation Strategies*, p. 108 – 123.	Map development	Based on Landsat imagery between 2001 and 2019
Land Use/Land Cover	Crop Data Layer – GIS raster dataset	Raster – 30 m resolution	https://www.nass.usda.gov/Research_and_Science/Cropland/Release/index.php	USDA National Agricultural Statistics Service Cropland Data Layer. 2021. Published crop-specific data layer [Online]. Available at https://nassgeodata.gmu.edu/CropScape/. USDA-NASS, Washington, DC.	Map development	2008-2021

Type of Measurement or Analysis	Type of Data (time series, rate, constant, statistic, taxa, etc.)	Units	Source (weblink when available)	Quality Assurance Documentation	Use	Date Range
Land Use/Land Cover	Ecological mapping coverage	Raster – 10 m resolution	https://tpwd.texas.gov/landwater/land/programs/landscape-ecology/ems/	Elliott, Lee F., Amie Treuer-Kuehn, Clayton F. Blodgett, C. Diane True, Duane German, and David D. Diamond. 2009-2014. Ecological Systems of Texas: 391 Mapped Types. Phase 1 – 6, 10-meter resolution Geodatabase, Interpretive Guides, and Technical Type Descriptions. Texas Parks & Wildlife Department and Texas Water Development Board, Austin, Texas. Documents and Data Available at: http://www.tpwd.state.tx.us/gis/data/downloads#EMS-T	Map development	2016 or most recent available
Soil Map Unit Boundaries and Properties	Spatial GIS data, Soils	Shapefile - polygons	NRCS SSURGO databases via Web Soil Survey http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm or Geospatial Data Gateway http://datagateway.nrcs.usda.gov/	SSURGO/STATSGO2 Structural Metadata and Documentation http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcs142p2_053631	Map development	various
Hydrography	Vector GIS data	Geodatabase – points, polylines, polygons	National Hydrography Data set (NHD)Pre-staged Subregions http://nhd.usgs.gov/data.html	NHD Program Documentation http://nhd.usgs.gov/program_documentation.html	Map development	N/A
Livestock population estimates	County-level livestock density	County level individual animals	USDA Census of Agriculture http://www.agcensus.usda.gov/	Regulations Guiding NASS http://www.agcensus.usda.gov/About_the_Census/Regulations_Guiding_NASS/index.php	Map and source development	2007-2017 (when available)

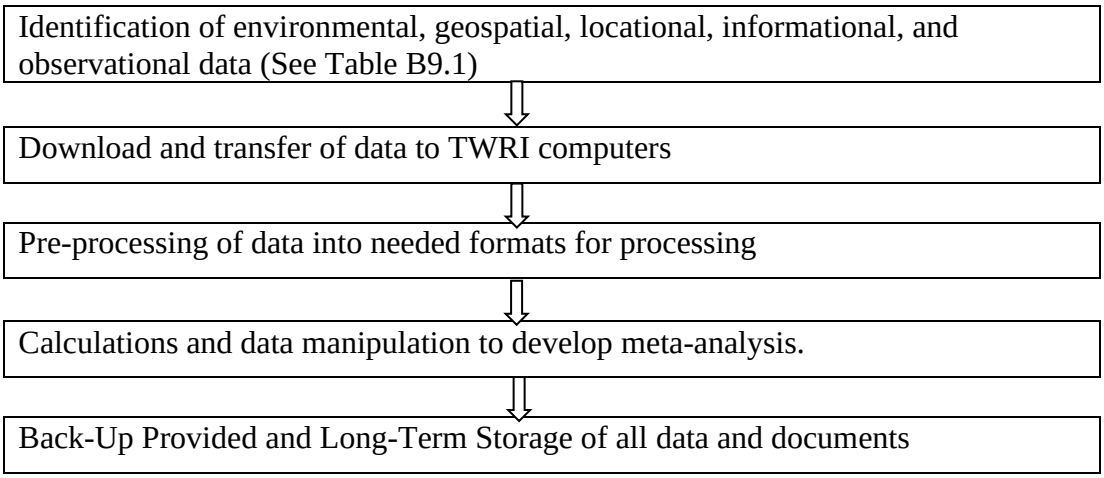
Section B10: Data Management

Data Management Process

The data acquired for this project will be maintained in Microsoft Access database and/or Excel spreadsheet format and visually screened for errors.

The flow chart traces the path of the data from acquisition to final use and storage. Identification of environmental, geospatial, locational, informational, and observational

data (See Table B9.1)



All project data are stored in a unique directory established for the project with additional subdirectories as needed for organization of data and files. Document control if provided by all project staff only using data and files in the project directory and providing different file names along when editing or manipulating the files provide document control. Staff keep older versions of documents and workbooks in the project directory in the event errors are detected, which may necessitate use of earlier versions of the documents and data for expedient correction. Continuous cloud backup provides additional safeguards in this area of document control.

The computations and data in Excel workbooks or R scripts used to develop meta-analysis are checked by the TWRI PM prior to development of draft reports. Any errors detected are noted and appropriate project staff directed to make needed corrections. Tables in reports are checked for accuracy by the TWRI PM prior to submitting the draft report to TSSWCB.

Personnel

Michael Schramm is the TWRI PM and will provide overall project management for TWRI. He is responsible for ensuring that the data are managed according to the data management plan and QAPP. He works with the TWRI DM and TWRI project staff to acquire data and perform analysis.

Stephanie DeVilleneuve is the TWRI QAO and is responsible for ensuring that project data are scientifically valid, legally defensible, of known precision, accuracy, integrity, meet the data quality objectives of the project, and are reportable to TSSWCB.

Duncan Kikoyo is the TWRI DM and is responsible for oversight of all acquired data and confirming that all data were appropriately obtained and documented. He is responsible for overseeing all required data control checks on the data.

TWRI project staff and students work with the TWRI DM to acquire data and perform analysis.

Systems Design

TWRI uses laptop and desktop personal computers. The computers run Windows 10 operating system or newer. Software includes Microsoft® Word, Microsoft® Excel, Microsoft® Access, and Program R Statistical Software. All GIS analysis will be performed using ArcGIS Pro or newer.

TWRI utilizes Microsoft Teams, OneDrive, and SharePoint for enterprise file services. The enterprise file system utilizes the Microsoft Cloud to ensure secure data storage of critical operational and project files, automated and distributed data backup that meets AgriLife system policies, and automated file versioning. Microsoft Cloud services utilize multiple geographic redundancies that ensure 99.99% data availability in the event of data loss. Any information deleted is also recoverable within 93 days of deletion. File versioning is enabled to automatically save the previous 25 versions of a file so they can be rolled back in the event of file corruption or unintended changes. Microsoft Enterprise Cloud services are described in detail at: https://docs.microsoft.com/en-us/office365/Enterprise/office-365-data-resiliency-overview.

Table B10.1. Hardware and Software used to Support Data Processing

Equipment & software name	Type	Specification	Use
Dell/HP PC Computers	Hardware	Intel Core Processor, 8 GB Ram or more, Windows 10 Enterprise	Support data gathering, data analysis, and report generation.
Microsoft Teams and OneDrive	Software	Enterprise managed software	Project file management and data backup.
ArcGIS Pro or higher	Software	Window interface	Development of maps and spatial analyses
Program R 3.5 or higher and R-Studio	Software	Window interface	Statistical analysis and figure development.
Microsoft Office 2013 and 2016 Software (Excel, Word, PowerPoint)	Software	Windows platform	Data preparation, report writing, presentations.

Data Migration/Transfer/Conversion

Data are processed using Microsoft Excel, Microsoft Access, ArcGIS Pro, and/or Program R. The TWRI DM is responsible for the oversight of the transfer of electronic data files from the Internet to the project directory, which is located on the TWRI Intranet. The various types of data to be downloaded from the Internet are included in Table B9.1. GIS data (e.g. shapefiles, raster datasets, DEMs, etc.) will be downloaded into a GIS project directory. All files created from GIS analyses will be stored in the GIS project directory.

Databases on the Internet are stored in a variety of formats. Some data or files required for the project can be downloaded from the Internet into text or Excel files, where they can be manipulated to create text files or other types of data files that can be used directly in a meta-analysis. Data is downloaded into Excel, R and R-Studio for data management, calculations, and statistical tests prior to being moved into Excel workbooks.

Backup/Disaster Recovery

TWRI utilizes Microsoft Teams, OneDrive, and SharePoint for enterprise file services. The enterprise file system utilizes the Microsoft Cloud to ensure secure data storage of critical operational and project files, automated and distributed data backup that meets AgriLife system policies, and automated file versioning. Microsoft Cloud services utilize multiple geographic redundancies that ensure 99.99% data availability in the event of data loss. Any information deleted is also recoverable within 93 days of deletion. File versioning is enabled to automatically save the previous 25 versions of a file so they can be rolled back in the event of file corruption or unintended changes. Microsoft Enterprise Cloud services are described in detail at: https://docs.microsoft.com/en-us/office365/Enterprise/office-365-data-resiliency-overview

Archives/Data Retention

Complete original data sets are archived on permanent media (hard disk drive) and retained on-site by TWRI for a retention period specified in Table A9.1 Project Documents and Records. Additionally, offsite replicates of project files are retained through Microsoft Team and SharePoint cloud servers.

Data Dissemination

Project updates will be provided to the TSSWCB PM in progress reports and the information will be made available through the project website. Data collected through this project will be synthesized into a project final report delivered to TSSWCB at the end of the project. No environmental data collected will be collected as part of the project.

Section C1: Assessments and Response Actions

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

Table C1.1. Assessments and Response Actions

Assessment Activity	Approximate Schedule	Responsible Party	Scope	Response Requirements
Status Monitoring Oversight, etc.	Continuous	TWRI	Monitor project status and records to ensure requirements are being fulfilled. Monitoring & review performance & data quality	Report to TSSWCB in QPR.
Technical systems audit	As needed	TSSWCB	Assess compliance with QAPP; review facility and data management as they relate to the project	45 days to respond to TSSWCB with corrective actions

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

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

Corrective Action

Corrective Action Reports (CARs) should:

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

- Identify personnel responsible for action
- Establish timelines and provide a schedule
- Document the corrective action
- Evaluate the need for qualification or exclusion of data

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

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

Section C2: Reports to Management

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

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

The final report for this project will include information detailing the results and findings of meta-analysis work conducted under this QAPP. Items in this report will include brief description of methodologies utilized and implications of these finding.

Section D1: Data Review, Validation and Verification

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

Data collected by the TCEQ, the USGS, and the Texas CRP partners have been reviewed, verified, and validated according to the requirements of the respective programs prior to their use in this project. The sources of GIS data for the project, e.g., TCEQ, National Hydrography Dataset, National Land Cover Database, NRCS, and others, undergo review, verification, and validation of the shapefiles and other spatial resources by their respective programs before the data and information are publicly available and prior to use in this project. Non-geospatial data include scientific investigations (peer-reviewed published studies and non peer-reviewed technical reports) are reviewed for consistency to identify potential errors prior to use.

Section D2: Validation Methods

GIS Data

Data for this portion of the project (e.g., land use, urban areas, population projections, digital elevation models, stream layers, and population projections) as provided in Table B9.1 have been collected and made publicly accessible by authoritative sources such as the USGS and USDA. Data from these sources will be considered as verified and validated by the various agencies providing the data. However, data compilations created for this project will be visually screened for errors. Any errors detected by project staff will be reported to the TWRI PM and, if necessary, to the TSSWCB PM for resolution. Issues which can be readily corrected, e.g., removal of outlier data, will be documented and the data either removed, qualified, or corrected prior to further analysis.

Scientific Investigations

Data compilations created for this project will be visually screened for errors. Outputs from systematic reviews and meta-analysis will be reviewed to ensure methods (Collaboration for Environmental Evidence, 2018) for development are followed and verify that data formatting and inputting were done correctly and that outputs were produced error free and appear to be reasonable based on current knowledge.

Section D3: Reconciliation with User Requirements

GIS Data

GIS inventory and maps developed for this project will be used for informational purposes only and will not be used exclusively to make any management decisions. Potential limitations may include accuracy and precision of the land use data and planning documents. The limitations of maps produced will be described in the project final report and conveyed to audiences when discussed.

Scientific Investigations

Outputs from systematic reviews and meta-analysis will ultimately be provided for use by watershed planners for the purpose of estimating load reductions resulting from agricultural BMP implementation. The results will be described in detail in the final report and any publications and used for educational purposes as appropriate. The limitation of the approach will be described in the report and conveyed to audiences when discussed.

References

Collaboration for Environmental Evidence. 2018. Guidelines and Standards for Evidence synthesis in Environmental Management. Version 5.0 (AS Pullin, GK Frampton, B Livoreil & G Petrokofsky, Eds) www.environmentalevidence.org/information-for-authors.

Jones, C., Wagner, K., Di Giovanni, G., Hauck, L., Mott, J., Rifai, H., Srinivasan, R., Ward, G. (2007). Bacteria Total Maximum Daily Load Task Force Final Report. Texas Water Resources Institute for the Texas Commission on Environmental Quality and the Texas State Soil and Water Conservation Board. Technical Report TR-341. https://hdl.handle.net/1969.1/86092

Appendix A: Corrective Action Report

SOP-QA-001
CAR #:_____

Date:_____ Area/Location:_____

Reported by:_____ Activity:_____

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

Possible causes:
_____
_____
_____

Recommended Corrective Actions:
_____
_____
_____

CAR routed to:_____
Received by:_____

Corrective Actions taken:
_____
_____
_____
_____

Has problem been corrected?: YES NO

Immediate Supervisor:_____

Program Manager:_____

TWRI Quality Assurance Officer:_____

TSSWCB Quality Assurance Officer:_____