Hollywood Park Water Quality Monitoring Site
Salado Creek Watershed
Quality Assurance Project Plan

Edwards Aquifer Authority
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San Antonio, TX 78215

Prepared in cooperation with the Texas Commission on Environmental Quality

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

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A1 Approval Page

Edwards Aquifer Authority

4/15/13 | 4/15/2013

Ronald H. Vaughn, P.G. — Date
Project Manager

Steven Johnson — Date
QA Officer

TestAmerica Laboratory Inc.

5/16/2013 | 5/16/2013

Tim Kellogg — Date
Laboratory Director

Corinna Hoyle — Date
Quality Assurance Officer

San Antonio River Authority

5/20/13 | 5/20/13

David Hernandez — Date
Laboratory Operations Supervisor

Patricia Carvajal — Date
Laboratory QA Officer

The Edwards Aquifer Authority will secure written documentation from additional project participants (e.g., subcontractors, laboratories) stating the organization's awareness of and commitment to requirements contained in this quality assurance project plan and any amendments or revisions of this plan. The Edwards Aquifer Authority will maintain this documentation as part of the project's quality assurance records. This documentation will be available for review.

A3 Table of Contents

A4 Distribution List

The Edwards Aquifer Authority will provide copies of this project plan and any amendments or revisions of this plan to each project participant defined in the list below. This documentation will be available for review.

Texas Commission on Environmental Quality
P.O. Box 13087
Austin, Texas 78711-3087

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Water Quality Planning/Monitoring and Assessment
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Rebecca S. Reeves, Laboratory Deputy Quality Assurance Officer
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Patricia Carvajal, Laboratory Quality Assurance Officer
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List of Acronyms

AWRL	Ambient Water Reporting Limit
BMP	Best Management Practice
CAR	Corrective Action Report
COC	Chain of Custody
CWA	Clean Water Act
DOC	Demonstration of Capability
DMRG	Data Management Reference Guide
EPA	Environmental Protection Agency
LCS	Laboratory Control Sample (formerly Laboratory Control Standard)
LCSD	Laboratory Control Sample Duplicate (formerly Laboratory Control Standard Duplicate)
LOQ	Limit of Quantitation (formerly reporting limit)
NPS	Nonpoint Source
QA/QC	Quality Assurance/Quality Control
QAM	Quality Assurance Manual
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QAS	Quality Assurance Specialist
QMP	Quality Management Plan
RPD	Relative Percent Difference
SOP	Standard Operating Procedure
SWQM	Surface Water Quality Monitoring
SWQMIS	Surface Water Quality Monitoring Information System
TA	TestAmerica laboratory, Inc.
TCEQ	Texas Commission on Environmental Quality
WQMS	Water Quality Monitoring Site

A5 Project/Task Organization

Texas Commission on Environmental Quality (TCEQ)

Water Quality Planning/Monitoring Assessment
Chuck Dvorsky
CWQMN network coordinator, water quality planning/monitoring and assessment and develops lines of communication and working relationships between the contractor and TCEQ.

Edwards Aquifer Authority (EAA)

Ronald H. Vaughn
EAA Project Manager
Responsible for ensuring tasks and requirements are executed on time and are of acceptable quality. Monitors and assesses the quality of work. Responsible for verifying the QAPP is followed and the project is producing data of known and acceptable quality. Complies with corrective action requirements.

Jon Cradit
EAA Project Coordinator and Field Supervisor
Project Coordinator--Coordinates attendance at conference calls, training, meetings, and related project activities with the TCEQ. Assist the EAA Project Manager to verify the QAPP is followed and the project is producing data of known and acceptable quality. Ensures adequate training and supervision of all monitoring and data collection activities.

Field Supervisor--Responsible for supervising all aspects of the sampling and measurement of surface waters and other parameters in the field. Responsible for the acquisition of water samples and field data measurements in a timely manner that meet the quality objectives specified in Section A8 (Table A.1), as well as the requirements of Sections B1 through B8. Responsible for field scheduling, staffing, and ensuring that staff are appropriately trained as specified in Sections A6 and A8.

Steve Johnson
EAA QAO
Responsible for coordinating and implementation of the QA program. Responsible for identifying, receiving, and maintaining project quality assurance records. Notifies the Edwards Aquifer Authority Project Manager of particular circumstances which may adversely affect the quality of data. Responsible for validation and verification of all data collected according with Table 4 procedures and acquired data procedures after each task is performed. Conducts laboratory inspections. Develops, facilitates, and conducts monitoring systems audits.

Steve Johnson
EAA Data Manager
Responsible for the acquisition, verification, and transfer of data to the TCEQ. Oversees data management for the study. Performs data quality assurances prior to transfer of data to TCEQ. Responsible for transferring data to the TCEQ in the acceptable format. Ensures data are submitted according to workplan specifications.

TestAmerica Laboratory, Inc. (TA)

Tim Kellogg
TestAmerica Laboratory Director
Responsible for supervision of laboratory personnel involved in generating analytical data for this project. Responsible for ensuring that laboratory personnel involved in generating analytical data have adequate training and a thorough knowledge of the QAPP and all SOPs specific to the analyses or task performed and/or supervised. Responsible for oversight of all operations, ensuring that all QA/QC requirements are met, and documentation related to the analysis is completely and accurately reported. Enforces corrective action, as required. Develops and facilitates monitoring systems audits.

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

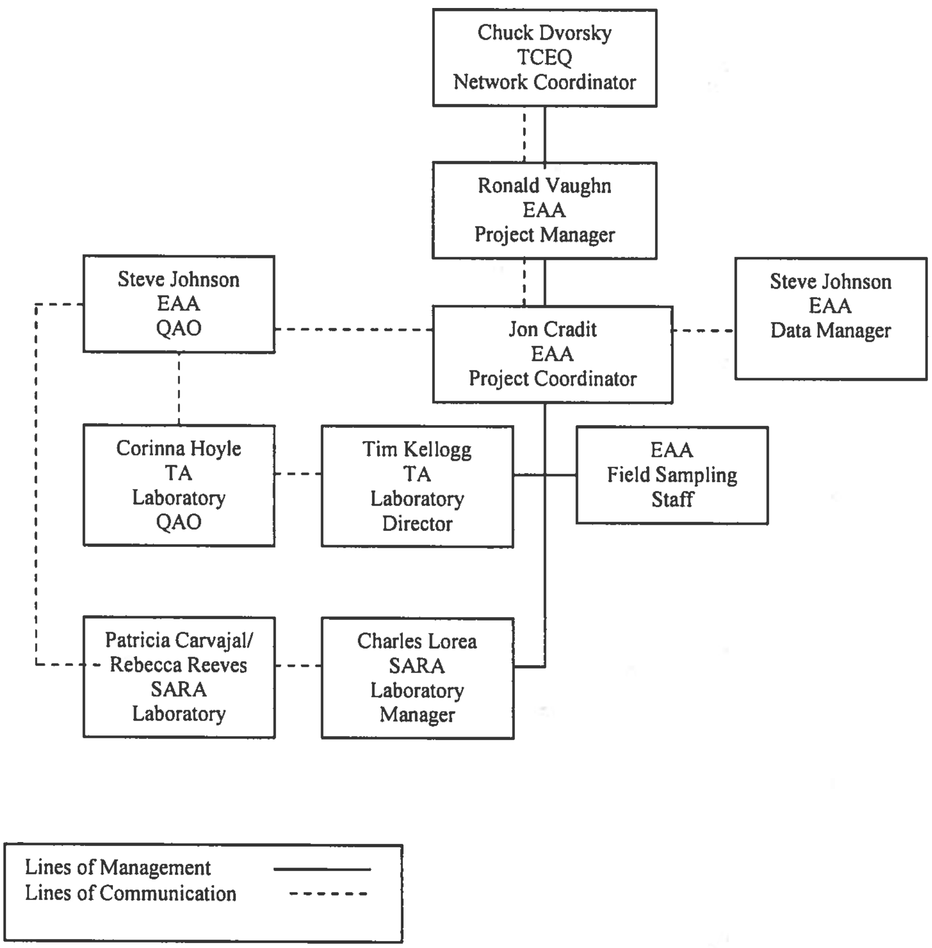
San Antonio River Authority (SARA)

Charles Lorea IV
SARA Laboratory Operations Supervisor
Responsible for supervision of laboratory personnel involved in generating analytical data for this project. Responsible for ensuring that laboratory personnel involved in generating analytical data have adequate training and a thorough knowledge of the QAPP and all SOPs specific to the analyses or task performed and/or supervised. Responsible for oversight of all operations, ensuring that all QA/QC requirements are met, and documentation related to the analysis is completely and accurately reported. Enforces corrective action, as required. Develops and facilitates quality systems audits.

Rebecca S. Reeves
SARA, Deputy QAO
Acts as a reserve project and laboratory QAO, in the event that the primary QAO is unavailable. This position will insure that any quality assurance issues are handled in a timely fashion, thus preventing repetitive errors from occurring when the primary QAO is unavailable. This person is kept apprised of all correspondence, nonconformance reports, corrective actions reports, inspections for the project, the laboratory and field. This will insure consistency and compliance of all elements of the quality assurance program and specific elements of this project.

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

Figure A5.1. Organization Chart - Lines of Communication



A6 Problem Definition/Background

The Edwards Aquifer, located in south-central Texas, is one of the most prolific karst aquifers in the United States and is an important groundwater resource for municipal, industrial, domestic, agricultural, recreational, and ecological needs. The aquifer extends about 270 miles from the Rio Grande River along the Mexico/United States border at Del Rio, east to San Antonio, then northeast through Austin to Salado. Hydrologic divides separate the Edwards Aquifer into three major segments: the San Antonio (southern unit), Barton Springs, and Northern segments.

The southern unit of the Edwards Aquifer is the sole source of drinking water for over 1.5 million people, including the City of San Antonio. The Edwards Aquifer is a karst aquifer with numerous direct recharge features including sinkholes and caves which provide the conduit for high volumes of rainfall runoff to enter the aquifer. Owing to the rapid recharge, the Edwards Aquifer is highly susceptible to nonpoint source pollution during rainfall runoff events.

Up to 85 percent of recharge to the aquifer is derived from streams originating on the contributing zone, located up gradient and west of the recharge zone. Water flowing onto the recharge zone sinks into numerous caves, sinkholes, and fractures recharging the aquifer.

EPA identifies karst aquifers as one of the most vulnerable to pollution because of their rapid groundwater velocities and limited ability to filter contaminants. Numerous tracer tests have been performed on Edwards Aquifer demonstrating rapid groundwater flow occurs in a well-integrated network of conduits discharging at wells and springs. A portion of groundwater flows from the conduits into the diffuse matrix of the aquifer building up storage in the aquifer. Water from storage flows diffusely to wells or back into the conduit network. This dual flow system results in contamination having the potential to rapidly impact wells and springs, as well as slowly accumulate and move within the matrix of the aquifer.

The TCEQ lists the Edwards Aquifer on a list of impaired groundwater resources. Salado Creek is listed on the 303(d) list of impaired streams. Increases in sediment, bacteria, and other contaminants in groundwater as a result of storm-flow events in the Edwards Aquifer has been documented by analysis of water samples from monitor and water-supply wells.

This project's goal is to improve water quality in the Edwards Aquifer by facilitating timely and efficient responses to recharge events by monitoring water quality in the Salado Creek Watershed, excluding "first flush" flows of contaminated storm water into recharge features on Salado Creek by closing automated valves on a flow exclusion structure, and opening the valves when the "first flush" storm water pulse has passed to allow continued recharge of surface water (after first flush has past) into the aquifer.

A7 Project/Task Description

This project's goal is to improve water quality in the Edwards Aquifer by facilitating timely and efficient responses to recharge events by continuously monitoring water quality in the Salado Creek Watershed and excluding "first flush" flows of contaminated storm water into recharge features on Lorence Creek. This will be accomplished using best management practices (BMPs) with valves that will be installed, and automatically opening the valves when the storm water pulse has passed to allow continued recharge of clean surface water into the aquifer. The valves will be triggered based on data recoded by onsite water quality turbidity data. The valves will close when turbidity is determined to be high. The valves will reopen when turbidity lowers to acceptable concentrations.

This project will include a retrofitted existing storm water exclusion structural BMP at the Hollywood Park Sinkhole with continuous water quality monitoring instruments and an automated valve system to open and close the structure, and operation and maintenance of the automated remote water-quality monitoring equipment and the BMP for the duration of the contract based on availability of resources. The Hollywood Park sinkhole is located at: 29° 35' 46"N, 98° 28' 35"W, WGS84/NAD83, USGS Longhorn Quadrangle. The instrumented and automated site in the Salado Creek Watershed within Lorence Creek will analyze ambient water and storm water for temperature, turbidity, temperature and conductivity. Continuous water-quality monitoring will be conducted in accordance with TCEQ's established quality assurance project plan (QAPP). Data will be transmitted to TCEQ electronically to be uploaded into the LEADS system. The recharge flows into the BMP will be monitored with in-situ flow instruments.

Automated stormwater grab sample laboratory analyses will be performed for samples collected by automatic samplers in Lorence Creek under selected and various selected flow conditions. The Automated stormwater grab samples will typically be analyzed for total dissolved solids (TDS), total suspended solids (TSS), biological oxygen demand (BOD), chemical oxygen demand (COD), ammonia (NH_3), nitrate (NO_3) as N, nitrite (NO_2) as N, total Kjeldahl Nitrogen and phosphorus (PO_4).

Water quality data from automatic samplers will be used to monitor the water quality of water excluded from direct recharge to the Aquifer and the water quality of water recharged directly the Aquifer.

See Section B1 and B2 for monitoring to be conducted under this QAPP.

Revisions to the QAPP

Until the work described is completed, this QAPP shall be revised as necessary and reissued annually on the anniversary date, or revised and reissued within 120 days of significant changes, whichever is sooner. The most recently approved QAPPs shall remain in effect until revisions have been fully approved; reissuances (i.e., annual updates) must be submitted to the TCEQ before the last version has expired. If the entire QAPP is current, valid, and accurately reflects the project goals and organization's policy, the annual reissuance 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

Amendments to the QAPP may be necessary to reflect changes in project organization, tasks, schedules, objectives, and methods; address deficiencies and nonconformances; improve operational efficiency; and/or accommodate unique or unanticipated circumstances. Requests for amendments are directed from the Edwards Aquifer Authority Project Manager to the TCEQ using the QAPP Amendment shell. The changes are effective immediately upon approval by the TCEQ, or their designees.

Amendments to the QAPP and the reasons for the changes will be documented, and revised pages will be forwarded-to all persons on the QAPP distribution list by the Edwards Aquifer Authority QAO. Amendments shall be reviewed, approved, and incorporated into a revised QAPP during the annual revision process or within 120 days of the initial approval in cases of significant changes.

A8 Quality Objectives and Criteria

The objectives of the data collection efforts of this project are as follows:

Water quality monitoring will be conducted to operate BMP with a valve over a recharge feature for the San Antonio (southern unit) segment of the Edwards Aquifer. In-Situ water quality monitoring will also obtain information about water quality in Lorence Creek and water quality entering the aquifer. WQMS Data will be telemetered to TCEQ to be uploaded into the LEADS system.

Data from automatic samplers will be used to calculate the pollutant loads associated with stormwater runoff events in Lorence Creek.

Lorence Creek Recharge Project will employ only methods and techniques which have been determined to produce measurement data of a known and verifiable quality and which are sufficient to meet the objectives of the project.

Data Quality Objectives for automatic sampling data are in table A8.1. Measurement Quality Objectives (MQOs) and Data Quality Objectives (DQOs) to support the Water Quality Monitoring Site (WQMS) are specified in Tables A8.2 and A8.3, respectively. The quality control (QC) program has been developed with these objectives in mind. Methods used for water-quality measurements in the WQMS are based on *Standard Methods used for the Examination of Water and Wastewater*, 21[th] Edition, 2005 unless otherwise specified.

Quantitative and qualitative information regarding measurement data needed to measure water quality are provided in Table A8.1.

Table A8.1 Measurement Performance Specifications for Automatic Monitoring

Parameter	Units	Matrix	Method	Parameter Code	AWRL	Limit of Quantitation (LOQ)	Recovery at LOQ (%)	Precision (RPD of LCS/LCSD)	BIAS %Rec of LCS	Complete %	Field / Lab
Conductivity	uS/cm	Water	EPA 120.1and TCEQ SOP V1	00094 00095	NA	NA	NA	NA	NA	90	Field and TestAmerica
Temperature	°C	Water	TCEQ SOP V1	00010	NA	NA	NA	NA	NA	90	Field
Turbidity	NTU	Water	ISO 7027 EPA 180.0	82079	NA	NA	NA	NA	NA	90	Field and TestAmerica
TSS	mg/L	Water	EPA 160.2	00530	4	4	NA	20	NA	90	TestAmerica
TDS, calculated	mg/L	Water	TCEQ SOP V1	70294	NA	NA	NA	NA	NA	90	TestAmerica
Ammonia –N (NH_3)	mg/L	Water	EPA 350.3	00610	0.1	0.02	70-130%	20	80-120	90	TestAmerica
Biological Oxygen Demand (BOD-5-day)	mg/L	Water	SM 5210B	00310	2	NA	NA	NA	NA	90	SARA
Nitrate, nitrogen total (NO_3)	mg/L	Water	EPA 300.0	00620	0.05	0.05	70-130	20	80-120	90	SARA

Parameter	Units	Matrix	Method	Parameter Code	AWRL	Limit of Quantitation (LOQ)	Recovery at LOQ (%)	Precision (RPD of LCS/LCSD)	BIAS %Rec of LCS	Complete %	Field / Lab
Nitrite, nitrogen (NO_2)	Mg/L	Water	EPA 300.0	00615	0.05	0.05	70-130	20	80-120	90	SARA
Chemical Oxygen Demand (COD Low Level)	mg/L	Water	EPA 410.4	00335	10	0.02	70-130	20	80-120	90	TestAmerica
Total kjeldahl nitrogen	mg/L	Water	EPA 351.2	00625	0.2	0.2	70-130	20	80-120	90	TestAmerica
Total Phosphorus (PO_4)	mg/L	Water	EPA 365.2	00665	0.06	0.06	70-130	20	80-120	90	TestAmerica

References:
***American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), "Standard Methods for the Examination of Water and Wastewater," 18th Edition, 1992.
American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), "Standard Methods (SM) for the Examination of Water and Wastewater," 21th Edition, 2005.
TCEQ SOP - Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue, 2003.
United States Environmental Protection Agency (USEPA) "Methods for Chemical Analysis of Water and Wastes," Manual #EPA-600/4-79-020
SARA = San Antonio River Authority
TestAmerica = TestAmerica Laboratory Inc.

Table A8.2 DQOs for Water-Quality Monitoring Sondes (Multi-Probes)

Parameter	Parameter Code	Units	Measurement Equipment	Method	Calibration Verification Sample (CVS)**
SC	00094	US/cm	In-Situ MP Troll 9500	Std. Mthds. 2510, EPA 120.1	≤5.0% RPE
Depth	NA	Feet @ 30psi	In-Situ MP Troll 9500	NA	NA
Turbidity	NA	NTU	In-Situ MP Troll 9500	Optical	NA
Temperature	00010	Celsius	In-Situ MP Troll 9500	EPA 170.1	NA

**CVS criteria for use in the 305(b) and 303(d) Lists per SWQM DQOs.
NA = Not Applicable

Table A8.3 Acoustic Doppler Current Profiler (ADCP) Flow Meters

Parameter	SOP	Flow Meter	Units	Method	Range[1]	Range[2]	Resolution	Accuracy
Volumetric Flow Rate Water Velocity	00094	Shallow Water (Intermittent Streams)	CFS	Doppler Ultrasonic, frequency 500kHz	0.033 to 5.0 ft	-5 to 20 ft/s	+0.01 ft + 0.1 ft/s	TBD

1- vertical beam
2- water velocity
cfs = cubic feet per second
TBD = To be determined. This information will be provided in an amendment to the QAPP.

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

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

Laboratory precision is assessed by comparing replicate analyses of laboratory control samples in the sample matrix (e.g. deioinized water, sand, commercially available tissue). Precision results are compared against measurement performance specifications and used during evaluation of analytical performance. Program-defined measurement performance specifications for precision are defined in Table A8.1.

Bias

Bias is a statistical measurement of correctness and includes multiple components of systematic error. A measurement is considered unbiased when the value reported does not differ from the true value. Bias is determined through the analysis of laboratory control samples and LOQ Check Standards prepared with verified and known amounts of all target analytes in the sample matrix (e.g. deioinized water and matrix spikes) and by calculating percent recovery. Results are compared against measurement performance specifications and used during evaluation of analytical performance. Program-defined measurement performance specifications for bias are specified in Table A8.1.

Representativeness

Representativeness is the degree to which data accurately and precisely represents a characteristic of a population, a process condition, or an environmental condition. The data will be considered representative of the target population or phenomenon to be studied. Site selection, the appropriate sampling regime, the use of only approved analytical methods will assure that the measurement data represents the conditions at the site. Data collected for water-quality assessment are considered to be spatially and temporally representative of the full range of water quality conditions over time. Water-quality data are collected on a routine frequency and are separated by even time intervals. Depending on data storage capabilities, readings will be made between every 1 to 10 minutes. The intent of the stormwater sampling component is to define the water-quality profile(s) of stormwater events within the Salado Creek watershed with the parameters listed in Table A8.1 by measuring at Lorence Creek. Stormwater samples will be collected by an automatic sampling device for the duration of the stormwater event. For a single stormwater event within the Salado Creek watershed, four to seven samples will accurately represent the over-all water quality of that storm event. Although data may be collected during varying regimes of weather and flow, the continuous water-quality data sets will not be biased toward unusual conditions of flow, runoff, or season. Stormwater samples will be representative of water quality during storm events or of base-flow (non-storm) conditions. The goal for meeting total representation of Salado Creek will be tempered by the potential funding for complete representativeness. The goal of the water quality monitoring will be to characterize the potential contaminants entering the aquifer via recharge at the sinkhole.

Completeness

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

Comparability

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

QA/QC protocols in accordance with quality system requirements and as described in this QAPP. Comparability is also guaranteed by reporting data in standard units, by using accepted rules for rounding figures, and by reporting data in a standard format as specified in Section B10.

Limit of Quantitation

AWRLs (Table A8.1 and A8.2) are used in this project as the *limit of quantitation* specification, so the Water Quality Standards can be used as the benchmarks to compare data against. Laboratory *limits of quantitation* (Table A8.1 and A8.2) must be at or below the AWRL for each applicable parameter.

Analytical Quantitation

To demonstrate the ability to recover at the limit of quantitation, the laboratory will analyze an LOQ check standard on each day samples are run.

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

DQOs for WQMS

Additional DQOs for the WQMS portion of this project are provided in Section A8 of the Water Quality Monitoring Site (WQMS) QAPP.

A9 Special Training/Certification

Staff responsible for operating the automated samplers and flow meters will undergo a training session by the project equipment vendor.

Field personnel will receive training in proper sampling and field analysis. Before actual sampling or field analysis occurs, they will demonstrate to the QA officer (in the field), their ability to properly operate the automatic samplers and retrieve the samples.

EAA and subcontractors must ensure that laboratories analyzing samples under this QAPP meet the requirements contained in Section 5.4.4 of the NELAC standards (concerning Review of Requests, Tenders and Contracts).

The EAA will follow and adhere to Section A8 of the WQMS QAPP.

A10 Documents and Records

Laboratory Test Reports

Test/data reports from the laboratory must document the test results clearly and accurately. Routine data reports will be consistent with the NELAC standards (Section 5.5.10) and include the information necessary for the interpretation and validation of data. The requirements for reporting data and the procedures are provided below.

- Report title
- Name and address of laboratory
- Name and address of client and project name
- Sample results
- Units of measurement
- Sample matrix
- Dry weight or wet weight (as applicabl125e)

- Station information
- Date and time of collection
- 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, i.e. SARA and/or TA utilizes NELAP and will not be reporting LOQ and LOD for BOD, NO_2, and NO_3).
- An explanation of failed QC and any non-standard conditions that may have affected quality
- A signature and title of laboratory director or designee

Electronic Data

Only electronic WQMS data will be reported electronically to TCEQ through the LEADS system. Automatic sampler data will be submitted to the TCEQ in a format specified by the TCEQ Project Manger.

In-situ water quality and water level measurements are logged once every 15 minutes by the data logger. The data is then transmitted to the MeteoStar/LEADS system in Austin, Texas where the data is ingested, archived, and posted to the appropriate TCEQ internet site.

Records and Documents Retention Requirements

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

B1 Sampling Process Design (Experimental Design)

Sample Design Rationale

<u>WQMS</u>

In situ Water Quality Data collected by the WQMS system will be used to trigger the opening and closing of the valve on the BMP. As a storm pulse is recognized by high turbidity readings on the WQMS instruments, a signal will be sent automatically to the valve control mechanism for the valve to close. As turbidity readings drop below a pre-set level that indicates approach to base flow conditions, the valve will be opened to allow the cleaner water in Lorence Creek to recharge the aquifer. Additional sample design rationales for the WQMS portion of this project are described in Section B1 of the WQMS QAPP.

Automatic Sampling (Stormwater)

The sample design rationale for stormwater sampling for this study is based on the intent to reduce contaminants from entering the Edwards Aquifer by the automated operation of a BMP situated over Hollywood Park Sinkhole. Monitoring sites are specified in section B1. Since the valves on the BMPs will be closed during initial period of high storm flow, the amount of sediment and other contaminants in the surface water during this period needs to be determined. The stormwater sampling program will focus on the collection of samples that represent the highest amount of flow from a given storm and the collection of samples as the storm pulse subsides to develop a water-quality profile of the stormwater event. It is anticipated that between three to five storm events will be sampled at the BMP for the duration of the project. For each of these events, between four to seven samples will be collected. One to three samples will be collected near the maximum stream flow, one or two samples will be collected as the storm pulse is rapidly subsiding, and another one or two samples will be collected when turbidity levels of the water are close to stabilizing. It is estimated that the number of days between peak flow and the time at which sediment load and turbidity have decreased to the point that the valve on the BMP should be opened could vary between 2 to 6 days. The sampling schedule will be set to cover this amount of time initially. As data are collected from the first storm events, the sampling schedule will be refined.

An ISCO automatic sampler and an ISCO flow meter have been installed. The flow meter will measure the water level (stage) and velocity of the water in Lorence Creek at the BMP. The flow meter will be programmed to log water level every 5 minutes to trigger the automatic sampler to start sampling and be used to pace the sample intervals based on water level.

The automatic sampler will be programmed to collect samples starting when the increase in water level indicates that the beginning of storm flow has reached the BMP. The actual amount of water-level rise indicative of a storm event will be determined once a flow meter or other water-level measurement instrument is installed at the BMP. Samples will be collected every 2 to 6 hours depending on the anticipated duration of the storm flow. Sampling will continue until the water level drops below 75 percent of the peak flow compared to flow at the start of sampling, or until 10 days after start of sampling, whichever comes first. The cutoff for sample collection will also be evaluated once the BMP is instrumented for water-level measurements. The cutoff point is likely to vary considerably for each storm event.

Each sample will be acidified as appropriate, iced and transported to the laboratory where they will be stored at $<4\,^{0}$C prior to analysis.

Monitoring and Support Equipment

In addition to the sampling equipment mentioned above, the monitoring site will include the following equipment:

- In-Situ Troll 9500 multi-parameter water quality probe (temperature, conductivity, turbidity)
- In-Situ Level Troll 500 (or equivalent) (temperature, pressure)
- Zeno data logger 3200
- Modem and cellular telephone telecommunication equipment
- ISCO 2150 flow meter with area velocity/pressure
- Air compressor and tank (to operate BMP valve)

This equipment will be part of Water Quality Monitoring Site (WQMS). The automated sampling equipment, Zeno data logger and telemetry communication equipment are installed in a rented storage locker above flood stage adjacent to the BMP. In-situ water quality equipment and flow measuring equipment such as the Troll 9500 and Troll 500 are installed in the BMP structure. Cables to connect the data logger to the probes are run through a PVC conduit that are buried in a trench for a portion of the distance between the BMP and the storage locker.

Data collected with the above equipment (temperature, conductivity, turbidity, pressure, and stream flow) is be telemetered to the TCEQ LEADS System with a cellular telephone.

Table B1.1 Monitoring Sites

TCEQ Station ID	Site Description	Latitude Longitude	Start Date	End Date	Sample Matrix	Monitoring Frequencies (per year)		
						Field (In-situ)	Lab	Comments
CAMS 774	Hollywood Park Creek Sink	29° 35' 46"N 98° 28' 35"W	15 days from QAPP approval	TBD	water	9	9	It is assumed there will be three stormwater events per year to be collected. A minimum of 3 sample intervals will be collected for each event. The actual number collected will depend on the duration of the storm events.

B2 Sampling Methods

The EAA will follow and adhere to Section B2 of the WQMS QAPP, excluding the Continuous Monitoring Auto Analyzer or equivalent equipment.

Field Sampling Procedures

EAA staff will follow the Manufacturer's Operator Manuals for the automated flow meter, multi-parameter probe, and automated sampler data collection.

Methods and Equipment for Water-Quality Monitoring are specified in Table B2.1.

Storm-water sample collection will follow the field sampling procedures for conventional parameters documented in the TCEQ Surface Water Quality Monitoring Procedures Manual (most recent addition).

The sample volumes, container types, minimum sample volume, preservation requirements, and holding time requirements are specified in Table B2.2.

Table B2.1 Methods and Equipment for Water-Quality Monitoring

River Basin	Station Location	MeteoStar /LEADS Data Averaging Time	Sampling Method	Measurement Equipment	Telemetry	Station Parameters
San Antonio River, Salado Creek, Lorence Creek	Hollywood Park, BMP	TBD	Sonde: In situ	Troll 9500 Isco 2150	Wireless Modem	Surface Temperature Surface SC Surface DO Surface Turbidity Stream Stage

Table B2.2 Stormwater Monitoring

Parameter	Matrix	Container	Preservation	Minimum Sample Volume	Holding Time	Lab
TSS	Water	Plastic	Cool to 4°C	250 ml	7 days	TestAmerica
TDS	Water	Plastic	Cool to 4°C	250 ml	7 days	TestAmerica
Biological Oxygen Demand	Water	Amber Glass Or Plastic	Cool to 4°C	>4000 ml	48 hours	SARA
Ammonia-N, total	Water	Plastic	pH<2 (usually 2 ml H_2SO_4/quart) Cool to 4°C	500 ml	28 days	TestAmerica
Nitrate-N, total	Water	Plastic	Cool to 4°C	100 ml	48 hours	SARA
Nitrite-N, total	Water	Plastic	Cool to 4°C	100 ml	48 hours	SARA
Total Kjeldahl Nitrogen	Water	Plastic	pH<2 (usually 2 ml H_2SO_4/quart) Cool to 4°C	500 ml	28 days	TestAmerica
Total phosphorous	Water	Plastic	pH<2 (usually 2 ml H_2SO_4/quart) Cool to 4°C	100 ml	28 days	TestAmerica
Chemical Oxygen Demand	Water	Plastic	2 ml 1:1 H_2SO_4 to pH<2; Cool to 4° C, Dark	110 ml	28 days	TestAmerica

Processes to Prevent Cross Contamination

Procedures outlined in the TCEQ Surface Water Quality Procedures Manual outline the necessary steps to prevent cross-contamination of samples. These include such things as direct collection into sample containers and the use of commercially pre-cleaned sample containers.

Documentation of Field Sampling Activities

Field sampling activities are documented on the Field Data Reporting Form as presented in Appendix E. For all visits, station ID, location, sampling time, sampling date, preservatives added to samples, and sample collector's name/signature are recorded. Values for all measured field parameters are recorded. Detailed observational data are recorded including water appearance, weather, stream uses, unusual odors, specific sample information, missing parameters, and flow severity.

Recording Data

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

1. Legible writing in indelible, waterproof ink with no modifications, write-overs or cross-outs;

2. Correction of errors with a single line followed by an initial and date;
3. Close-outs on incomplete pages with an initialed and dated diagonal line.

Deficiencies, Nonconformances and Corrective Action Related to Sampling Requirements

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

Deficiencies are documented in logbooks, field data sheets, etc. by field or laboratory staff and reported to the cognizant field or laboratory supervisor (or designee) who will notify the EAA QAO. The EAA QAO will notify the EAA Project Manager of the potential nonconformance within 24 hours. The EAA QAO will initiate a Nonconformance Report (NCR) to document the deficiency.

The EAA Project Manager, in consultation with EAA QAO (and other affected individuals/organizations), will determine if the deficiency constitutes a nonconformance. If it is determined the activity or item in question does not affect data quality and therefore is not a valid nonconformance, the NCR will be completed accordingly and the NCR closed. If it is determined a nonconformance does exist, the EAA Project Manager in consultation with EAA QAO will determine the disposition of the nonconforming activity or item and necessary corrective action(s); results will be documented by completion of a Corrective Action Report.

Corrective Action Reports (CARs) document: root cause(s); programmatic impact(s); specific corrective action(s) to address the deficiency; action(s) prevent recurrence; individual(s) responsible for each action; the timetable for completion of each action; and, the means by which completion of each corrective action will be documented. 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 TCEQ immediately both verbally and in writing.

B3 Sampling Handling and Custody

See Section B10 of the WQMS QAPP for electronic managing of Water Quality Monitoring Site data. Water quality is measured *in situ* for the sonde instrumentation.

Sample Labeling
Samples from the field are labeled on the container or label with an indelible marker. Label information includes:

1. Site identification
2. Date and time of collection
3. Preservative added, if applicable
4. Designation of field-filtered@ *(for metals)* as applicable
5. Sample type (i.e., analysis(es)) to be performed

Sample Handling

The following sampling and related equipment will be required for each sampling event:

•Sample bottles for the required analyses, duplicates, field blanks, etc.
•ISCO samplers
•De-ionized water
•Ice chest
•Ice
•Field data sheets and/or field log book
•Chain-of-custody forms
•Sample labels

Immediately after filling, sample bottles will be dried and labeled. Sample-bottle labels that are adhesive backed and capable of being attached directly to the sample containers will be used. The following information will be entered on the sample label as a minimum:

Date
Time
Location
Sample type
Sampler name
Sample identification (ID) number
Preservative (if necessary)

Other information may be entered on the sample label if space permits. However, any information entered on the label will not obscure the required information. Sample labels will be either be preprinted and filled out or may be written directly on sample bottles / containers with waterproof ink.

Samples delivered to the laboratory are either dropped off, picked up by courier, or shipped by a delivery service. To ensure that all sample shipping conditions meet quality assurance standards the samples are stored in the proper containers, samples are properly refrigerated, samples are preserved with appropriate preservatives, and samples are shipping promptly in order to meet holding times.

Some analyses have very short holding times and are thus analyzed immediately as a rule. However, if samples with regular holding times (e.g. 1-2 weeks) are delivered to the lab unreasonably near the holding time expiration date, the Lab Manager may notify the EAA Project Manager that in order to ensure meeting the holding time of the method, a rush must be placed on the sample. If this rush is authorized, then the laboratory will move the sample ahead in the sample stream. If the rush is not approved, the sample will be entered into the sample stream on a routine basis and the laboratory will document that the holding times were exceeded. The documentation of the hold time exceedances(s) will be handled as per Section B2 Sampling Methods (Deficiencies, Nonconformances and Corrective Action Related to Sampling Requirements). The laboratory will make every attempt to meet the holding time whether or not a rush is added, however, if a rush is NOT authorized, the sample will not be allowed to adversely affect any other samples.

Sample Tracking

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

A sample is in custody if it is in actual physical possession or in a secured area that is restricted to authorized personnel. The COC form is used to document sample handling during transfer from the field to the laboratory and among contractors. The following information concerning the sample is recorded on the COC form.

1. Date and time of collection
2. Site identification
3. Sample matrix
4. Number of containers
5. Preservative used
6. Was the sample was filtered
7. Analyses required
8. Name of collector
9. Custody transfer signatures and dates and time of transfer
10. Bill of lading (*if applicable*)

All samples received by the laboratory will be logged in by the sample receiving clerk or other appointed deputy prior to any analyses being performed. Before opening the cooler, the receiving clerk checks for the presence of intact custody seals. The samples themselves are then checked for required temperature, preservation, and several other parameters that are detailed on the Cooler Receipt Form.

After the chain of custody is completed, the clerk will check the sampling dates to determine if any of the samples have already exceeded their holding time limitations. If any samples are received outside of holding time, a note of the expiration is made on the COC and the Lab Manager and the EAA Project Manager is notified.

Once all of the above steps have been successfully completed, the clerk will obtain a signature (if not already present) from the person relinquishing custody of the samples, and will then sign the COC, accepting custody of the samples for the laboratory. The original and a file copy of the COC are retained on file and a copy is given to the EAA Project Manager. The lab's original chain of custody is always returned to the EAA Project Manager as part of the final data package. If the samples are received via FedEx, courier, etc., the airbill or courier receipt is filed in a folder for future reference.

The receiving clerk then assigns a unique Log Number to the project and a unique Lab ID to each separate sample within that project by logging them into the LIMS. This number is also recorded on the COC.

The EAA Project Manager must be contacted immediately if any of the following problems occur:

a. Sample containers are improper, are not intact, or seal is broken

b. Samples received do not match the ones listed on the chain of custody

c. Samples received are outside of holding time

d. Amount of sample submitted to lab is insufficient for the analysis requested

e. Sample turnaround time requested cannot be accommodated by the laboratory

The LIMS produces daily task lists for the various analysts based primarily on due dates and holding times. When a batch of samples is designated as a rush, Management is notified immediately so that the samples can be specially monitored to ensure prompt analytical results and a complete data package within the shortened time period. Samples are then stored in the appropriate storage areas, with those requiring refrigeration remaining in a refrigerator until analysis. Samples are subsequently prepared and analyzed under the direction of the Laboratory Manager.

B4 Analytical Methods

The analytical methods are listed in Table A.8.1 of Section A8. Laboratories collecting data under this QAPP are compliant with the NELAC Standards.

Copies of laboratory SOPs are retained by the laboratory and are available for review by the TCEQ. Laboratory SOPs are consistent with EPA requirements as specified in the method.

Standards Traceability

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

Deficiencies, Nonconformances and Corrective Action Related to Analytical Methods

Deficiencies are defined as unauthorized deviation from procedures documented in the QAPP. Nonconformances are deficiencies which affect quality and render the data unacceptable or indeterminate. Deficiencies related to field and laboratory measurement systems include but are not limited to instrument malfunctions, blank contamination, quality control sample failures, etc.

Deficiencies are documented in logbooks, field data sheets, etc. by field or laboratory staff and reported to the cognizant field or laboratory supervisor who will notify the Edwards Aquifer Authority Project Manager. The Edwards Aquifer Authority Project Manager will notify the Edwards Aquifer Authority QAO of the potential nonconformance within 24 hours. The Edwards Aquifer Authority QAO will initiate a Nonconformance Report (NCR) to document the deficiency.

The Edwards Aquifer Authority Project Manager, in consultation with Edwards Aquifer Authority QAO (and other affected individuals/organizations), will determine if the deficiency constitutes a nonconformance. If it is determined the activity or item in question does not affect data quality and therefore is not a valid nonconformance, the NCR will be completed accordingly and the NCR closed. If it is determined a nonconformance does exist, the Edwards Aquifer Authority Project Manager in consultation with Edwards Aquifer Authority QAO will determine the disposition of the nonconforming activity or item and necessary corrective action(s); results will be documented by the Edwards Aquifer Authority QAO by completion of a Corrective Action Report.

Corrective Action Reports (CARs) document: root cause(s); programmatic impact(s); specific corrective action(s) to address the deficiency; action(s) to prevent recurrence; individual(s) responsible for each action; the timetable for completion of each action; and, the means by which completion of each corrective action will be documented. 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 TCEQ immediately both verbally and in writing.

B5 Quality Control

Sampling Quality Control Requirements and Acceptability Criteria

Field Split - A field split is a single sample subdivided by field staff immediately following collection and submitted to the laboratory as two separately identified samples according to procedures specified in the SWQM Procedures. Split samples are preserved, handled, shipped, and analyzed identically and are used to assess variability in all of these processes. Field splits apply to conventional samples only. One field split sample will collected from each storm sampling event.

The precision of field split results is calculated by relative percent difference (RPD) using the following equation:

RPD = (X1-X2)/((X1+X2)/2))

A 30% RPD criteria will be used to screen field split results as a possible indicator of excessive variability in the sample handling and analytical system. If it is determined that elevated quantities of analyte (i.e., > 5 times the RL) were measured and analytical variability can be eliminated as a factor, than variability in field split results will primarily be used as a trigger for discussion with field staff to ensure samples are being handled in the field correctly. Some individual sample results may be invalidated based on the examination of all extenuating information. The information derived from field splits is generally considered to be event specific and would not normally be used to determine the validity of an entire batch; however, some batches of samples may be invalidated depending on the situation. Professional judgment during data validation will be relied upon to interpret the results and take appropriate action. The qualification (i.e., invalidation) of data will be documented on the Data Summary. Deficiencies will be addressed as specified in this section under Deficiencies, Nonconformances, and Correction Action related to Quality Control.

Laboratory Measurement Quality Control Requirements and Acceptability Criteria

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

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

Limit of Quantitation (LOQ) – The laboratory will analyze a calibration standard (if applicable) at the LOQ on each day project samples are analyzed. Calibrations including the standard at the LOQ will meet the calibration requirements of the analytical method or corrective action will be implemented.

LOQ Check Standard – An LOQ check standard 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 standard is spiked into the sample matrix at a level less than or near the LOQ for each analyte for each batch samples that are run.

The LOQ check standard is carried through the complete preparation and analytical process. LOQ Check Standards are run at a rate of one per analytical batch. A batch is defined as 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.

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

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

Measurement performance specifications are used to determine the acceptability of LOQ Check Standard analyses as specified in Table A8.1.

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

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

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; SR is the measured result; and SA is the true result:

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

Measurement performance specifications are used to determine the acceptability of LCS analyses as specified in Table A8.1.

Laboratory Duplicates – A laboratory duplicate is prepared by taking aliquots of a sample from the same container under laboratory conditions and processed and analyzed independently. A laboratory control sample duplicate (LCSD) is prepared in the laboratory by splitting aliquots of an LCS. Both samples are carried through the entire preparation and analytical process. LCSDs are used to assess precision and are performed at a rate of one per batch. A batch is defined as 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.

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

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

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

Measurement performance specifications are used to determine the acceptability of duplicate analyses-as specified in Table A8.1. The specifications for bacteriological duplicates in Table A8.1 apply to samples with concentrations > 10 org/100mL.

Laboratory equipment blank - Laboratory equipment blanks are prepared at the laboratory where collection materials for metals sampling equipment are cleaned between uses. These blanks document that the materials provided by the laboratory are free of contamination. The QC check is performed before the metals sampling equipment is sent to the field. The analysis of laboratory equipment blanks should yield values less than the LOQ. Otherwise, the equipment should not be used.

Matrix spike (MS) –Matrix spikes are prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

Percent recovery of the known concentration of added analyte is used to assess accuracy of the analytical process. The spiking occurs prior to sample preparation and analysis. Spiked samples are routinely prepared and analyzed at a rate of 10% of samples processed, or one per batch whichever is greater. A batch is defined as 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. The information from these controls is sample/matrix specific and is not used to determine the validity of the entire batch. The MS is spiked at a level less than or equal to the midpoint of the calibration or analysis range for each analyte. Percent recovery (%R) is defined as 100 times the observed concentration, minus the sample concentration, divided by the true concentration of the spike.

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 laboratory shall document the calculation for %R. The percent recovery of the matrix spike is calculated using the following equation in which %R is percent recovery, SSR is the observed spiked sample concentration, SR is the sample result, and SA is the reference concentration of the spike added:

$$\%R = (SSR - SR)/SA * 100$$

Measurement performance specifications for matrix spikes are not specified in this document.

The results are compared to the acceptance criteria as published in the mandated test method. Where there are no established criteria, the laboratory shall determine the internal criteria and document the method used to establish the limits. For matrix spike results outside established criteria, corrective action shall be documented or the data reported with appropriate data qualifying codes.

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 blank is carried through the complete sample preparation and analytical procedure. The method blank is used to document contamination from the analytical process. The analysis of method blanks should yield values less than the LOQ. For very high-level analyses, the blank value should be less then 5% of the lowest value of the batch, or corrective action will be implemented.

Deficiencies, Nonconformances and Corrective Action Related to Quality Control

Deficiencies are defined as unauthorized deviation from procedures documented in the QAPP. Nonconformances are deficiencies which affect quality and render the data unacceptable or indeterminate. Deficiencies related to Quality Control include but are not limited to quality control sample failures.

Deficiencies are documented in logbooks, field data sheets, etc. by field or laboratory staff and reported to the cognizant field or laboratory supervisor who will notify the Edwards Aquifer Authority Project Manager. The Edwards Aquifer Authority Project Manager will notify the Edwards Aquifer Authority QAO of the potential nonconformance within 24 hours. The Edwards Aquifer Authority QAO will initiate a Nonconformance Report (NCR) to document the deficiency.

The Edwards Aquifer Authority Project Manager, in consultation with Edwards Aquifer Authority QAO (and other affected individuals/organizations), will determine if the deficiency constitutes a nonconformance. If it is determined the activity or item in question does not affect data quality and therefore is not a valid nonconformance, the NCR will be completed accordingly and the NCR closed. If it is determined a nonconformance does exist, the Edwards Aquifer Authority Project Manager in consultation with Edwards Aquifer Authority QAO will determine the disposition of the nonconforming activity or item and necessary corrective action(s); results will be documented by the Edwards Aquifer Authority QAO by completion of a Corrective Action Report.

Corrective Action Reports (CARs) document: root cause(s); programmatic impact(s); specific corrective action(s) to address the deficiency; action(s) to prevent recurrence; individual(s) responsible for each action; the timetable for completion of each action; and, the means by which completion of each corrective action will be documented. 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 TCEQ immediately both verbally and in writing.

B6 Instrument/Equipment Testing, Inspection and Maintenance

The EAA will follow and adhere to Section B6 of the WQMS QAPP, excluding the Continuous Monitoring Auto Analyzer or equivalent equipment.

All instream sampling equipment testing and maintenance requirements are detailed in the TCEQ Surface Water Quality Monitoring Procedures. Equipment records are kept on all field equipment and a supply of critical spare parts is maintained by the Edwards Aquifer Authority.

All laboratory tools, gauges, instrument, and equipment testing and maintenance requirements are contained within laboratory QAM(s). Testing and maintenance records are maintained and are available for inspection by the TCEQ. Instruments requiring daily or in-use testing may include, but are not limited to, water baths, ovens, autoclaves, incubators, refrigerators, and laboratory pure water. Critical spare parts for essential equipment are maintained to prevent downtime. Maintenance records are available for inspection by the TCEQ.

B7 Instrument/Equipment Calibration and Frequency

Operation and periodic scheduled maintenance will be performed by EAA staff and/or contractor(s). Subject to available parts, consumables, and other supplies, EAA will respond to and correct any equipment failures or malfunctions within 48 hours. Calibration requirements for the automated monitoring equipment will be located at the EAA offices and will be available upon request.

In-situ field Equipment calibration requirements are contained in the TCEQ Surface Water Quality Monitoring Procedures Manual. Post calibration error limits and the disposition resulting from error are adhered to. Data not meeting post-error limit requirements invalidates associated data collected subsequent to the pre-calibration and are not submitted to the TCEQ.

Detailed laboratory calibrations are contained within the QAM(s).

B8 Inspection/Acceptance of Supplies and Consumables

Sample containers will have preservative already added when necessary. In addition, chain of custody documents, sample collection instructions, and coolers will be provided to ensure that samples are handled in compliance with the various EPA protocols and holding times.

B9 Data Management

Data Path

Samples are collected and are transferred to the laboratory for analyses as described in Sections B1 and B2. Analytical data will be sent electronically via email from the laboratory to EAA. Following data verification and validation, the data are exported in a format specified by the TCEQ.

Record-keeping and Data Storage

Edwards Aquifer Authority recordkeeping and document control procedures are contained in the water quality sampling and laboratory standard operating procedures (SOPs) and this QAPP. Original field and laboratory data sheets are stored in the Edwards Aquifer Authority offices in a fireproof file in accordance with the record-retention schedule in Section A9. Two copies of the database are backed up each Friday on magnetic tape. One copy is stored in a fireproof safe in the Edwards Aquifer Authority office, and one copy is stored off-site. If necessary, disaster recovery will be accomplished by information resources staff using the backup database.

Data Verification/Validation

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

Forms and Checklists

See Appendix D for the Field and Laboratory Data Sheets.

Data Handling

Data are processed using the Microsoft Access 2000 suite of tools and applications. Data integrity is maintained by the implementation of password protections which control access to the database and by limiting update rights to a select user group. No data from external sources are maintained in the database. The database administrator is responsible for assigning user rights and assuring database integrity.

Hardware and Software Requirements

Hardware configurations are sufficient to run Microsoft Access 2000 under the Windows NT operating system in a networked environment. Information resources staff are responsible for assuring hardware configurations meet the requirements for running current and future data management/database software as well as providing technical support. Software development and database administration are also the responsibility of the information resources department. Information resources develops applications based on user requests and assures full system compatibility prior to implementation.

Information Resource Management Requirements

Edwards Aquifer Authority information technology (IT) policy is contained in IT SOPs which are available for review at Edwards Aquifer Authority offices.

C1 Assessments and Response Actions

C1.1 Assessments and Response Actions

Assessment Activity	Approximate Schedule	Responsible Party	Scope	Response Requirements
Status Monitoring Oversight, etc.	Continuous	EAA	Monitoring of the project status and records to ensure requirements are being fulfilled.	30 days to respond in writing to the TCEQ to address corrective actions
Laboratory Inspections	Dates to be determined by the TCEQ lab inspector	TCEQ	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
Monitoring Systems Audit	Dates to be determined by TCEQ	TCEQ	The assessment will be tailored in accordance with objectives needed to assure compliance with the QAPP. Field sampling, handling and measurement; facility review; and data management as they relate to the NPS Project	30 days to respond in writing to the TCEQ to address corrective actions
Laboratory Inspection	Based on work plan and or discretion of Edwards Aquifer Authority	EAA	Analytical and quality control procedures employed at the laboratory and the contract laboratory	30 days to respond in writing to the Edwards Aquifer Authority QAO to address corrective actions
Monitoring Systems Audit	Based on work plan and or discretion of Edwards Aquifer Authority	EAA	The assessment will be tailored in accordance with objectives needed to assure compliance with the QAPP.	30 days to respond in writing to the Edwards Aquifer Authority QAO to address corrective actions
Site Visit	Dates to be determined by TCEQ	TCEQ	Status of activities. Overall compliance with work plan and QAPP	As needed

Corrective Action

The Edwards Aquifer Authority Project Manager is responsible for implementing and tracking corrective action procedures as a result of audit findings. Records of audit findings and corrective actions are maintained by both the TCEQ and the Edwards Aquifer Authority QAO.

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

C2 Reports to Management

Reports to TCEQ

All reports required by previous contract have been submitted, there are no other required reports.

Reports to EAA Project Management

All laboratory analytical reports and applicable QA/QC data related to field and laboratory analysis will be collected and archived by the EAA and TestAmerica.

Reports by TCEQ

All reports required by previous contract have been submitted, there are no other required reports.

D1 Data Review, Verification, and Validation

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 obtained from the in-situ field monitoring equipment for the WQMS and laboratory results will be reviewed and verified for conformance to project requirements. The in-situ WQMS field data results and the laboratory results will be validated against the data quality objectives which are listed in Section A8. For the WQMS data the data monitoring and validation will be performed by an EAA contractor that is familiar with TCEQ LEADs system (specifically TCEQ Monitoring Operations Division SOP #DQRP-015) and will include data examined for record completeness, report accuracy, operator logs reviewed, data losses investigated, data manually validated, and validation logs maintained. Only those data which are supported by appropriate quality control data and meet the measurement performance specification defined for this project will be considered acceptable and used in the project.

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

D2 Verification and Validation Methods

All data will be verified to ensure they are representative of the samples analyzed and locations where measurements were made, and that the data and associated quality control data conform to project specifications. The staff and management of the respective field, laboratory, and data management tasks are responsible for the integrity, validation and verification of the data each task generates or handles throughout each process. The field and laboratory tasks ensure the verification of raw data, electronically generated data, and data on chain-of-custody forms and hard copy output from instruments.

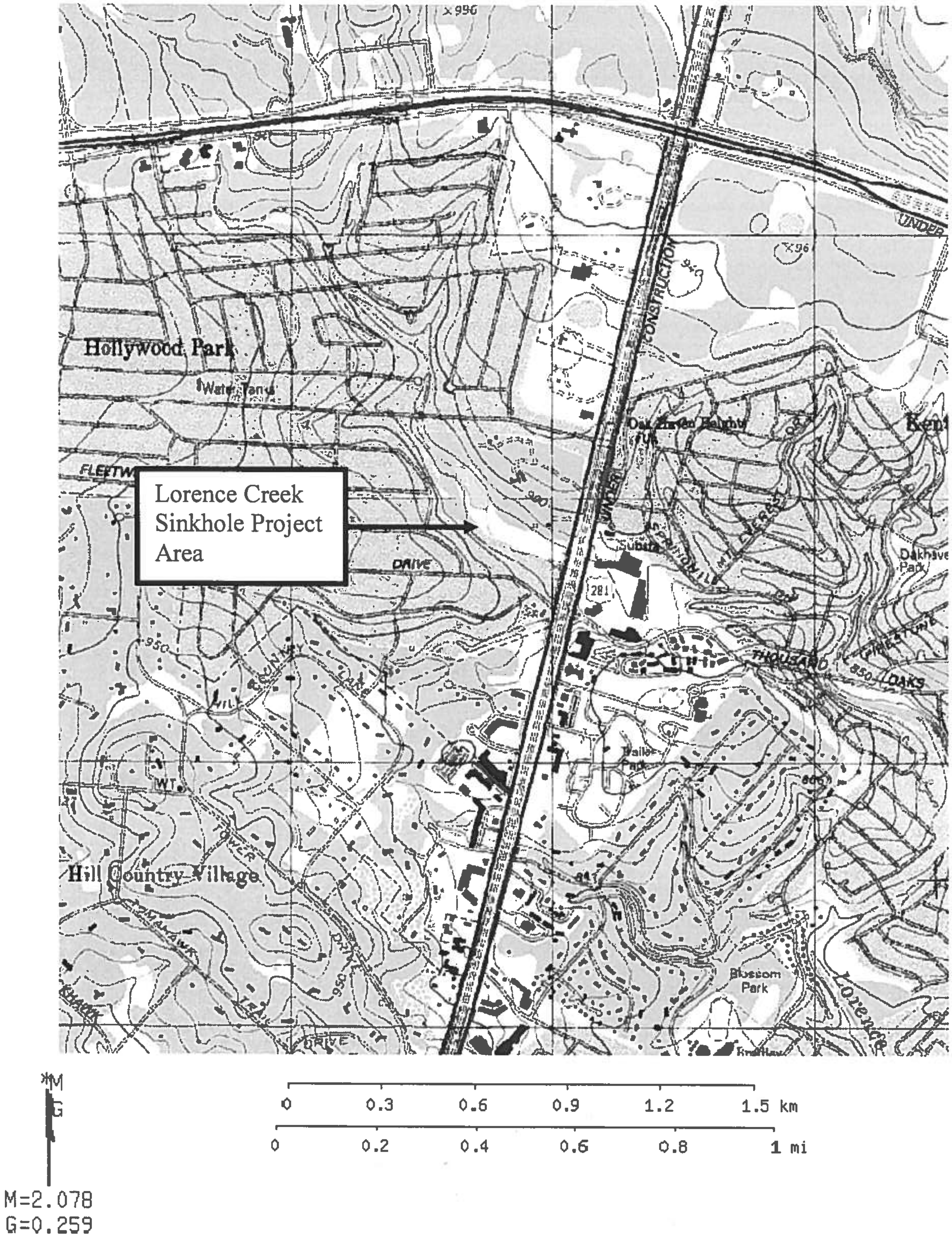
Verification, validation and integrity review of data will be performed using self-assessments and peer review, as appropriate to the project task, followed by technical review by the manager of the task. The data to be verified are evaluated against project performance specifications (Section A8) and are checked for errors, especially errors in transcription, calculations, and data input. 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 electronically or by initialing and dating the associated paperwork. If an issue cannot be corrected, the task manager consults with higher level project management to establish the appropriate course of action, or the data associated with the issue are rejected.

The Edwards Aquifer Authority Project Manager and QAO are each responsible for validating that the verified data are scientifically valid, defensible, of known precision, bias, integrity, meet the data quality objectives of the project, and are reportable to TCEQ. One element of the validation process involves evaluating the data again for anomalies. Any suspected errors or anomalous data must be addressed by the manager of the task associated with the data, before data validation can be completed.

D3 Reconciliation with User Requirements

Data collected from this project will be reviewed by the EAA and used to access the effectiveness of the sinkhole control structure and assist with measured reductions in pollutant loading entering the Edwards Aquifer through the sinkhole. The water quality parameter data (instream monitoring) will be compared to the laboratory data. These comparisons will allow the EAA to adjust the sinkhole control structure water valve gates to better decrease the pollutant loading to the Edwards Aquifer.

Appendix A. Area Location Map



Appendix B. Field Data Reporting Form

Edwards Aquifer Authority
Water Quality
Field Data Sheet
Surface Water

Site Information

Station Name:

Location:

Owner/Contact:

Address:

County:

Point of Collection:

Date: Time:

Ambient Temp. Collector(s):

Weather:

Instrument Calibration

Conductivity Meter #

Standard	Meter Reading
500	
1000	
10000	

pH Meter #

Standard	Meter Reading
Buffer 4.0	
Buffer 7.0	
Buffer 10.0	

DO Meter #

Sampling Conditions

Gage Readings	Time	Level
Before Sampling		
After Sampling		

Hydrologic Event	Hydrologic Condition
Storm	Stable, Low
Drought	Falling
Spill	Stable, High
Regulated Flow	Rising
Routine Sample	Stable, Normal

Alkalinity:

	mL of Sample	pH	mL of Acid	Total Alk.
Rep.1				
Rep.2				

Field Readings

Time Sampled:

pH:

Temperature:

Conductivity:

Dissolved Oxygen:

Turbidity:

Equal-Width-Increment Method

Transect Width:

Number of Verticals:

Flow/Appearance:

Bacteria:

Set up Conditions (circle all that apply)
Field Vehicle Open Field Hotel Lab

Coliform, fecal, Membrane Filter m-FC agar at 44.5 C

mL of Sample	Blank	3	10	30	100
# Colonies					

Reported #: /100mL ideal non ideal

Streptococci, fecal, Membrane Filter KF Streptococcus agar at 35 C

mL of Sample	Blank	1	5	25	100
# Colonies					

Reported #: /100mL ideal non ideal

Type of Analysis: (circle all that apply)
Std. Chem VOC's Herb/Pest BOD TOC TSS
Other:

Data Base Entry: Comments:

Appendix C. Chain-of-Custody Form

CHAIN OF CUSTODY RECORD

Project Name:						Analyses Required											
Station ID	Date	Time (24hr)	Matrix	Descriptio n													Sample ID

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:	Laboratory remarks:
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:	Lab log #
Relinquished by: (Signature)	**Date:**	**Time:**	**Received for lab by: (Signature)**	**Date:**	**Time:**	**Laboratory Name:**

Appendix D. Field and Laboratory Data Sheets

(Original field and laboratory data sheets are stored in the Edwards Aquifer Authority offices)

ATTACHMENT 1
Letter to Document Adherence to the QAPP

TO:

FROM: Ronald H. Vaughn, P.G.
Edwards Aquifer Authority
Environmental Management Officer

Please sign and return this form by June 12, 2013 to:

Ronald H. Vaughn, P.G.
Edwards Aquifer Authority
Environmental Management Officer
1615 N. St. Mary's St.
San Antonio, TX 78215

I acknowledge receipt of the "Water Quality Monitoring Site Quality Assurance Project Plan, April 12, 2013". I understand the document(s) describe quality assurance, quality control, data management and reporting, and other technical activities that must be implemented to ensure the results of work performed will satisfy stated performance criteria.

Signature Date

Copies of the signed forms should be sent by the Contractor to the TCEQ NPS Project Manager within 60 days of TCEQ approval of the QAPP.