TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
COW CREEK GROUNDWATER CONSERVATION DISTRICT
CONTINUOUS GROUND WATER MONITORING NETWORK

QUALITY ASSURANCE PROJECT PLAN

EFFECTIVE DATE: June 16, 2011

A1 APPROVAL PAGE

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CCGCD, Project Lead

6/16/2011
Date

Heath Hoffman
CCGCD, Site Operator

6/16/2011
Date

A1 APPROVAL PAGE

Lee Gudgell

Lee Gudgell, GBRA
Quality Control Officer

05/31/11
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Debbie Magin

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Data Validation

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06-02-2011
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Date

The Cow Creek Groundwater Conservation District (CCGCD) CWQMN Quality Assurance Project Plan documents specific details for this particular project.

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A.3 DISTRIBUTION LIST

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
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Mr. Tommy Matthews, President

GUADALUPE-BLANCO RIVER AUTHORITY (GBRA)
Mr. Tommy Hill, Chief Engineer
Ms. Debbie Magin, Water Quality Services
Mr. Lee Gudgell, Water Quality Technician

A4 PROJECT/TASK ORGANIZATION

This section is intended to identify individuals and organizations that will be responsible for developing and/or supporting the CCGCD Project.

The Project Lead is responsible for the development of the Quality Assurance Project Plan.

A4.1 TCEQ CGMN Network Coordinator (Charles Dvorsky)

- Responsible for establishing new monitoring stations and integrating stations into the existing monitoring network.
- Coordinates development of the Quality Assurance Project Plan.
- Provides overall support for the ingestion of data into LEADS

A4.2 CCGCD Project Lead (Micah Voulgaris)

X Develops Quality Assurance Project Plans
X Responsible for coordination of the overall project
X Plans and participates in site reconnaissance; coordinates with appropriate internal and external parties to accomplish objectives of site visits
X Participate in deployment of station as appropriate

A4.3 TCEQ Systems Planning and Implementation Team (Mike Peltier)

X Provides overall support and logistics for deployment of monitoring stations
X Provides training to operate and maintain station infrastructure

A4.4 TCEQ Quality Assurance Officer (Sharon Coleman)

- Provides oversight of all QA activities.
- Determines conformance with program quality system requirements.
- Recommends to division directors and project managers and through them to deputy directors, that work be stopped in order to safeguard programmatic objectives, worker safety, public health, or environmental protection.
- Assists program and project managers in developing and implementing quality systems.
- Provides technical expertise and/or consultation on quality services.

A4.5 GBRA Quality Control Officer (Lee Gudgell)

- Participates and/or conducts project technical system audits.
- Trains operators on monitoring equipment and QC procedures.
- Assists program and project managers in developing and implementing quality systems.
- Assesses the effectiveness of program quality systems.
- Ensures maintenance of records will demonstrate defensibility of data.

- Monitors the implementation of corrective actions.
- Provides technical expertise and/or consultation on quality service.
- Ensures that QAPP requirements related to the activities within their tasks are met.

A4.6 CCGCD Operator (Heath Hoffman)

X Site Operation and Maintenance
X Participate in station development

A4.7 GBRA Data Validation (Debbie Magin)

X Provides data validation for three field parameter sites.
X Contacts Site Operator and Project Lead ~~to~~ when potential data issues arise.

A5 PROBLEM DEFINITION/BACKGROUND

The Texas Hill Country Area, which includes Kendall County, was declared a Critical Groundwater Area by the then Texas Water Commission in 1990. This declaration, now known as the Hill Country Priority Groundwater Management Area (PGMA), gave notice to the residents of the area that water availability and quality will be at risk within the next 50 years. The Cow Creek Groundwater Conservation District (CCGCD or District) acknowledges that groundwater is a limited resource within the District. Balancing the allocation of water among competing uses such as domestic, municipal, agricultural, and industrial, while ensuring adequate groundwater to maintain spring flow, riparian rights, and wildlife needs is beneficial to all residents within the District. Continuing population growth within the District and surrounding areas will place increasing demands on groundwater resources within the District. A web of real-time monitoring wells is needed to enable the District to make critical decisions regarding water availability and drought contingency planning.

A6 PROJECT/TASK DESCRIPTION

The Cow Creek Groundwater Conservation District Project is an experimental design developed to provide data for groundwater resource management decisions. Six existing monitoring wells are equipped with real-time monitoring equipment and telemetry. Monitoring began on March 16, 2009.

The six sites are equipped with probes that monitor depth to water, specific conductivity, and temperature. The six sites were selected due to their lack of a pump column and their proximity to the pumping centers in the Cow Creek GCD service area. Total Dissolved Solids (TDS) will be calculated from the generally accepted conversion (SC*0.65=TDS). The TDS data will allow the District to determine what, if any measures need to be taken to address the influence of surface water on groundwater quality and if non-point source pollution is occurring. This data set will help the Cow Creek GCD make management decisions related to desired future conditions of the aquifer, drought management issues, and groundwater availability issues. This project enables Cow Creek GCD, TCEQ, Guadalupe Blanco River Authority, Kendall County, and The City of Boerne to make real-time observations of the depth to water in and around the

rapidly developing Hill Country Area. The LEADS data set will be one of the deciding factors when the District implements drought stages. (See Appendix B –current rules re: drought stages)

A7 QUALITY OBJECTIVES AND CRITERIA

InSitu AquaTROLL 200 Performance Specifications are described in Table A7.1. The measurement performance specifications to support the project objectives are specified in Table A7.2. Methods used are based on *Standard Methods for the Examination of Water and Wastewater*, 20th Edition, 1998 unless otherwise noted.

Table A7.1 - In-Situ AQUA TROLL 200 Performance Specifications

Temperature	
Material	Titanium
Range	-20°C to 65°C (-4°F to 149°F)
Unit of Measure	Celsius or Fahrenheit
Accuracy	+/- 0.1°C
Resolution	0.01°C
Conductivity	
Sensor Type	Balanced 4-electrode cell
Sensor Material	PVC, Titanium
Range	5µS/cm – 100,000µS/cm
Accuracy	+/- 0.5% of reading plus 1 µS/cm from 5 µS/cm to 80,000 µS/cm +/- 1.0% of reading from 80,000 µS/cm to 100,000 µS/cm
Resolution	0.1µS/cm
Pressure Transducer	
Sensor Type	Silicon Strain Gauge
Material	Titanium
Range, Vented	35 ft and 231 ft
Unit of Measure	PSI, KPa, mm, cm, m, in., ft., Bar, mBar, mmHg
Accuracy**	
@ 15°C	+/- 0.05% Full Scale (FS)
0°C to 50°C	+/- 0.1% FS
-20°C to -1°C and 51°C to 80°C	+/- 0.25% FS
Resolution	+/- 0.005% FS or better
Max. Pressure	2X Range
Burst Pressure	3X range

* Real time Level compensation for density

** Accuracy with 4-20 mA output option: +/- 0.25% FS.

Table A7.2 DQOs for InSitu AquaTROLL 200

Parameter	LEADS Parameter Code	Units	Measurement Equipment	Method	Calibration Verification Sample Acceptance Limit (CVS)
Specific Conductance	10094	µS/cm	In-Situ Aqua TROLL 200	Conductivity cell, Standard Method 2510B	±5.0% RPE
Temperature	10010	□C	In-Situ Aqua TROLL 200	Standard Method 2550 B	±0.50 °C
Depth to water	10079	Feet	In-Situ Aqua TROLL 200	Pressure Transducer	±1.00 Feet
TDS	10294	mg/L	In-Situ Aqua TROLL 200	Calculated by LEADS. SC measurements are multiplied by 0.65	5.0% RPE (SC CVS)

Calibration Verification Samples (CVS)

Calibration verification samples are analyzed during each service interval, typically every 60 days consistent with **TCEQ SOP AMPM-009 Title: Analysis of Electrical Conductivity (EC), Temperature, Water Level, and Sample Depth in Ambient Surface Water using the In-Situ Aqua TROLL 200 Multiprobes**.

Representativeness

The CCGCD Project measures depth to water and water quality in greater temporal detail and resolution than is possible with grab samples or short term deployments of monitoring instrumentation. In general, monitoring locations are chosen by the CCGCD to be representative based on the locations being representative of the Trinity Aquifer for the area based on the professional judgment of the CCGCD hydrologists. See map Appendix C.

Comparability

CCGCD Project water quality measurements are based on Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, unless otherwise noted. Comparability is also achieved by using manufacturer provided operation and maintenance manual, reporting data in standard units, by using accepted rules for significant figures, and by reporting data in standard formats.

Completeness

A general requirement for data completeness has been set at 75 percent return. Periods when water levels are below the fully extended communication cable length or other conditions necessitate shutdown of some instrumentation and these times are not considered in the goal for data completeness. Calculation method for data completeness is discussed in Section C1.

A8 SPECIAL TRAINING/CERTIFICATION

CCGCD staff will be the lead for site operation and maintenance for the CGMN stations. CCGCD staff received initial training for sonde setup and calibration of the InSitu AquaTROLL 200 multi-parameter sonde by the manufacturer's representative. A follow-up training including the sonde and In-situ AquaTROLL 200 will be conducted by the manufacturer's representative upon instrument installation at the stations. Training on the Coastal Zeno datalogger and wireless IP modem was conducted by TCEQ Ambient Monitoring staff upon installation of the equipment at the stations.

CCGCD and GBRA staffs have completed LEADS Data management training.

A9 DOCUMENTS AND RECORDS

Each project participant is expected to maintain records that include sufficient information to reconstruct each final reported measurement from the variables originally gathered in the measurement process. This includes, but is not limited to, information (raw data, electronic files, and/or hard copy printouts) related to sample collection, measurement instrument calibration, quality control (QC) checks of sampling or measurement equipment, "as collected" measurement values, an audit trail for any modifications made to the "as collected" measurement values and traceability documentation for reference standards.

Difficulties encountered during sampling or analysis is documented in operator logs to clearly indicate the affected measurements.

A9.1 Documentation of Procedures and Objectives

1. Published guidance (*Code of Federal Regulations*, U.S. Environmental Protection Agency [EPA], and EPA *Quality Assurance Handbook*)
2. Manufacturer's Operation and Maintenance Manual
3. Instrument manufacturer's technical support manuals
4. *Texas Commission on Environmental Quality (TCEQ) Quality Management Plan*

A9.2 Record Keeping

Cow Creek Groundwater Conservation District Project written records are kept for five years. Electronic records are kept indefinitely or for a life of a project. Please see Table A9.1 for type of record and location.

Table A9.1 CCGCD Record Location

Record	Location
Sampling Information	TCEQ Website
Instrument calibration data forms	CCGCD Central Office
Instrument and equipment logbooks	Should be located with instrumentation if possible
LEADS electronic Validator logs and Calibration Verification Page	Comms Front-End Processor computer
Validators notes	Data Validators office
CCGCD QAPP	CCGCD Central Office
Finding Summary Reports	CCGCD Central Office
TSAs and PEA	CCGCD Central Office

A9.3 Data Reporting

Cow Creek Groundwater Conservation District Project environmental data is stored electronically in the MeteoStar/LEADS System. See Section B10 and Section D for more details.

A9.4 Documentation Control Plan

This section describes the procedure and responsibilities for document control used by the TCEQ Cow Creek Groundwater Conservation District Project for environmental sample collection and analysis.

It is the responsibility of each Cow Creek Groundwater Conservation District Project participant to ensure they are properly following Manufacturer's Operation and Maintenance Manual, Instrument manufacturer's technical support manuals, and other applicable portions of TCEQ SOPs.

All logbooks containing data or sample information are uniquely identified with a logbook number. Each site operator has the responsibility of maintaining the logbooks for a minimum of five years or until all sample information contained within is no longer required to be kept. Analytical data records are stored at the Center for Water Research, University of Texas at San Antonio (UTSA) for a minimum of five years, unless otherwise required by a project or regulation. Revisions to documents or records are indicated on the records; obsolete documents are removed from use and archived. Archival material will be maintained by the Center for Water Research, UTSA. Contact: Dr. Weldon W. Hammond

B1 SAMPLING PROCESS DESIGN

Site Selection Criteria

CCGCD selected the six stations to characterize aquifer levels at various locations across the district based on the availability of wells, well characteristics, and accessibility. For this project, all wells must be completed in the Trinity Aquifer, be cased with a minimum inside diameter of 3", and be free from pumps, debris or other obstacles to deployment of the monitoring instrument.

Monitoring Station Design

Monitoring and Support Equipment

Water quality monitoring equipment at each site will include:

- One In-Situ Level AquaTROLL 200 multi-parameter water quality instruments with communication cables and support structure
- Coastal Zeno datalogger
- Wireless IP modem
- Solar panel
- Storage battery and charging system
- A weatherproof metal traffic box containing a Coastal Zeno data logger, wireless IP modem, storage battery and charging system will be mounted on an aluminum pole

Monitoring Equipment Configuration and Measurement Frequencies

The InSitu AquaTROLL 200 multi-parameter instrument will monitor water temperature, specific conductance, and depth to water using the methods detailed in Table A7.2. Water quality measurements and depth to water will be logged once every 15-minutes by the data logger.

B2 SAMPLING METHODS

Sondes or Multi-probes measure water quality parameters *in situ*. The six well sites are as follows:

CAMS 775	68-12-206	Rio Cordillera MW (Middle Trinity—Hensell; Cow Creek)
CAMS 776	68-11-509	Spring Creek MW (Middle Trinity—Hensell)
CAMS 777	68-11-418	Twin Canyon MW (Middle Trinity—Cow Creek)
CAMS 778	68-02-807	TWDB @ Rust Road (Lower Trinity—lower than Hosston)
CAMS 779	68-11-708	TWDB @ City of Boerne (Middle Trinity-Hensell; Cow Creek)
CAMS 780	68-10-616	TWDB @ Kendall County Utility Company (Middle Trinity—Hensell, Cow Creek)

Specific Conductance, Total Dissolved Solids, Depth to water, and Sample Depth measurements are logged once every 15 minutes by the data logger. The data are then transmitted to the IPS MeteoStar/LEADS system in Austin, Texas, where the data are ingested, archived, and averaged into one-hour averages for postings to the TCEQ Internet site. Monitoring procedures will be based **TCEQ SOP AMPM-009 Title: Analysis of Electrical Conductivity (EC), Temperature, Water Level, and Sample Depth in Ambient Surface Water using the In-Situ Aqua TROLL 200 Multiprobes**.. Calibration Verification Samples will be analyzed during each site service event and the results entered to an electronic Calibration Verification Sample/Operator Log within ten (10) days on the internet server at: http://tceqwatercal.ipsmtx.com. The sondes for CAMS 775 – 780 will be removed from their corresponding well at intervals of no more than 2 months. If the sonde is found to be defective, the sonde will be replaced with a new, freshly calibrated sonde. .

Sampling/Measurement System Corrective Action

The site operator is responsible for monitoring the performance of the measurement and support equipment and identifying problems or potential problems. When problems are identified that cannot be resolved by the site operator, the site operator notifies the CCGCD Project Lead responsible for coordination with appropriate personnel to resolve the problem.

The site operator is responsible for documenting problems and corrective actions in the appropriate logbook(s). When problems could affect data quality, the site operator is also responsible for making entries in the IPS MeteoStar/LEADS Operator Log to provide information to the data validators for data assessment purposes.

The project lead is responsible for coordinating the necessary supply and parts shipments to the site operator. When necessary, personnel from the System Planning and Implementation Team will travel to a particular site to repair or replace support equipment that cannot be repaired or replaced by the site operator. Monitoring equipment that cannot be repaired by TCEQ staff is sent to the manufacturer for repair.

B3 SAMPLING HANDLING AND CUSTODY

See Section B10 for electronic management of continuous water quality and depth to water data measured by *in situ* instruments.

B4 ANALYTICAL METHODS

The methods used by the CCGCD Project are based on the *Standard Methods for the Examination of Water and Wastewater*, 20th Edition, 1998, unless otherwise noted. Data comparability is achieved by following approved standardized analytical methods and operating procedures. Methods must be documented to minimize variation in procedures and results. Method-specific standard operating procedures (SOPs) are used to document exact procedures necessary to perform the method or operate a specific instrument or apparatus. The manufacturers recommended operation and maintenance procedures will be followed until the District establishes a SOP.

CCGCD Project method summaries are presented in Tables A7.2. This table includes methods used, analytical techniques, performance criteria, and manufacturer's instrument-specific operation and maintenance manuals.

Analytical system corrective actions are addressed in Section C1 of this quality assurance plan.

B5 QUALITY CONTROL

For a Quality Assurance (QA)/QC program to be successful, it is essential that specific controls be established and maintained throughout the measurement process. QC includes technical activities that measure the attributes and performance of the sampling and analysis process against defined standards to verify that they meet the needs of the project. Data quality is assessed, controlled, and measured by using manufacturer recommended procedures from instrument-specific manuals, QC samples, and data reviews.

Project-defined measurement performance specifications are specified in **Table A7.2 Sonde (Multi-Probe) Temperature Sensor Checks.**

After every deployment period, network multi-probe temperature sensors are checked against National Institute of Standards and Technology NIST-traceable thermometers and thermistors. The sonde's measured temperature must be within ± 0.50 ° C of the NIST thermometer. If the sonde's temperature sensor does not meet the ± 0.50 ° C criterion the corresponding temperature and specific conductance (SC) data for the deployment is invalidated.

Sonde (Multi-Probe) Specific Conductance Sensor Checks

After every deployment period, network multi-probe electrical conductivity sensors are checked against National Institute of Standards and Technology (NIST)-traceable standard conductivity standards. The sonde's measured electrical conductivity must be within ±5.0% RPE of the NIST-traceable sample. If the sonde's electrical conductivity sensor does not meet the ±5.0% RPE criterion the corresponding specific conductance (SC) and TDS data for the deployment period is invalidated.

Sonde (Multi-Probe) Depth to water Sensor Checks

At the time of retrieval after every deployment period, network multi-probe pressure transducer sensors are checked against a manually collected depth to water reading made with an electrical tape measure or E-Line. The manual reading will be compared to the last reading taken by the multiprobe pressure transducer sensors. The sonde's reported depth to water must be within ± 1.00' of the manually measured depth to water. If the sonde's reported depth to water does not meet the ± 1.00' criterion, the corresponding depth to water data for the deployment period is invalidated.

Corrective Action Related to QC

Any deviation from the procedures documented in this QAPP, or in the manufacturer's instrument-specific operation and maintenance manual should be documented in the operators log by the site operator. The log entry should contain a description of the exception, the cause (if possible), the affected data, and the impact on the data record. Any affected data should be qualified by a data validator accordingly.

B6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION AND MAINTENANCE

CCGCD operation and maintenance for this project is consistent with the **TCEQ SOP AMPM-009 Title: Analysis of Electrical Conductivity (EC), Temperature, Water Level, and Sample Depth in Ambient Surface Water using the In-Situ Aqua TROLL 200 Multiprobes** Instrument maintenance activities are documented in equipment dedicated logbooks. Preventative maintenance records contain information on periodic routine maintenance, symptoms, troubleshooting effort descriptions, results and follow-up observations. Records should include the date, time, and the name or initials of the site operator performing the maintenance. These records are vital tools in historic instrument performance and are an aid to future troubleshooting. Texas Commission on Environmental Quality (TCEQ) maintenance documents are based on manufacturers' recommendations.

B7 INSTRUMENT CALIBRATION AND FREQUENCY

At a minimum, the site operator will service each sonde and analyze Calibration Verification Samples every two months and record the results in sonde-specific log books and electronically in the Calibration Verification Sample/Operator Log at: http://tceqwatercal.ipsmtx.com/. .

B8 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

FOSD Mobile Monitoring and Deployment Section (MMDS) keeps an inventory of common spare parts. Parts can be mailed via United Parcels Service and will usually arrive the next day (if mailed before noon on the mailing day). The project lead will be responsible for the coordination of parts replacement.

Common sonde spare parts are stocked by FOSD.

The site operator will coordinate with the GBRA laboratory to obtain specific conductance calibration standards.

B9 NON-DIRECT MEASUREMENTS

There are no non-direct measurements used in this project.

B10 DATA MANAGEMENT

Water quality data, flow rate, depth to water data and operator logs (containing quality control (QC) results and other information) from the sites in the CCGCD Project are transferred to the Texas Commission on Environmental Quality (TCEQ) Headquarters (Austin, Texas) Comms Front-End Processor (CFEP) computer through Regional Hewlett Packard 712/60 computers that automatically download-data every 15 minutes by wireless modem or over standard phone lines.

The measurement instrumentation (stations that are equipped with modems) is connected to a Zeno data logger system. The data loggers system records the analog output voltage of each instrument once a second, digitizes it, and stores the data sequentially as five-minute averages into a record. A record consists of sequential fields of data for as many channels as are activated for each monitoring station. Every 15 minutes, the Hub computer collects the previous data from each monitoring station's Zeno data logger by modem. The data are secured from tampering or corruption over the carrier line through an unlisted telephone number, pass code protection, and error checking protocol.

If the telemetry method fails at a given site, the data loggers are capable of recording and storing data until the data are overwritten with newly generated data. The duration of the recording and storing of data is dependent upon the parameters monitored at the site. Once communications are re-established the data are automatically downloaded to the CFEP computer. The site operator should check the operational status of the station every business day via the TCEQ website. If communication problems are detected, the site operator needs to initiate corrective action in a timely manner or data can be lost. The site operator should alert MMDS staff and the project lead to initiate corrective action. Once System Planning and Implementation has been notified, its staff will ensure that corrective action was taken and that the action was effective.

The IPS MeteoStar/LEADS processing program checks for correct date, time, sampling site number, and proper formatting of raw data fields. It then calculates five-minute and hourly averages, converting voltages to engineering units. The data are stored in a temporary disk file. Data validation will be performed by the Guadalupe-Blanco River Authority (GBRA) staff as noted in Section A4.4. GBRA data validators work from the temporary disk file through their personal computer on a graphical interface. The data validators obtain Sonde QC information from the IPS MeteoStar/LEADS operator log and/or Calibration Verification, which is typically entered by the site operators and cooperators. Site cooperators who have obtained authorization can access the IPS MeteoStar/LEADS TCEQ web page operator log via the Virtual Private Network to enter operator logs and calibration verifications at http://rhone.tceq.state.tx.us.

The District will establish triggers for each of the Drought stages for each of the six wells. The TCEQ will configure the LEADS database to notify the CCGCD Project Lead, the CCGCD Board of Directors, and other interested parties when water levels drop below a trigger point.

After data validation, the data are coded in the file. The coded data in this file are considered "validated data" and are archived on optical disk indefinitely.

Currently, data from the CCGCD Project are not currently being stored in the TCEQ Surface Water Quality Monitoring System (SWQMIS).

Data Users

Data stored in the IPS MeteoStar/LEADS system may be provided to internal users (TCEQ data analyst, etc.) by email, on disk, on printouts, or through TCEQ web page reports. Other internal customers have read-only access. Public requests for CCGCD Project data are made through the Monitoring and Assessment Section. Non-validated data may be released to the public with disclaimers regarding the validity of the data.

C1 ASSESSMENTS AND RESPONSE ACTIONS

Technical System (TSA) and Performance Evaluation (PEA) Audits

TSAs will include procedures for a thorough systematic, on-site qualitative audit of station operation, equipment, training, personnel, documentation, sampling and measurement systems, quality control (QC) procedures, maintenance procedures, and safety of a system. They focus on conformance to procedures. Important parameters are checked either visually or by measurements and are documented on checklists and other forms or spreadsheets. TSAs will be performed by the project Quality Control Officer.

Performance Evaluation Audits

PEA audit procedures test the ability of measurement systems to obtain acceptable results. Audit results will be compared against applicable QC acceptance criteria. Audit results are documented on forms and spreadsheets. PEAs will be performed by the project Quality Control Officer.

Data Completeness Assessment

Data completeness is calculated as follows for CCGCD Project sites:

$$\% \text{ Completeness} = \frac{\text{Number of valid measurements}}{\text{Total possible measurements}} \times 100$$

Data Completeness reports will be generated and distributed by the CCGCD Site Operator quarterly.

Corrective Action

When problems are identified at a monitoring site, the site operator shall initiate corrective action as soon as possible. Corrective action is accomplished at the lowest level and shall be documented in the MeteoStar/LEADS operator log. For complex problems that cannot be readily resolved, the individual discovering the problem notifies the appropriate project lead for resolution. If the problem cannot be resolved by the project lead, the network coordinator is notified and coordinates a resolution to the problem with the appropriate project personnel. For complex problems, verbal and written communication between the affected parties is started and continues until the issue is resolved.

It is expected that any individual in the CCGCD Project who discovers a problem will initiate corrective action appropriate to the situation. A formal corrective action plan is in development and will be conducted in accordance with the TCEQ *Quality Management Plan.*

Audit Reports

An audit report is generated for each CCGCD Project audit. The recipient of the audit report is the District's Board of Directors. The TCEQ CWQMN Coordinator and the TCEQ Quality Assurance Officer will each receive a copy of all project audit reports. Each audit report is individually numbered, dated, and identifies the auditor, auditee, and nonconformity (findings and observations). The audit report may suggest recommended corrective action to nonconformities

If an audit report contains findings a written response to the findings from the network coordinator is required within thirty days with proposed corrective action or action to be taken. The written response is used to track and verify the proposed corrective action initiated by the finding. If a finding or proposed corrective action is disputed and cannot be readily resolved, the recommendation is pushed to successively higher management levels for resolution. The network coordinator is responsible for managing this process. Corrective actions can be verified during future inspections.

Based on audit reports the network coordinator may recommend to the division director and project manager to stop work if necessary in order to safeguard programmatic objectives, worker safety, public health, or environmental protection.

C2 REPORTS TO MANAGEMENT

The District will send a quarterly report to the District's Board of Directors. The TCEQ CWQMN Coordinator will also receive a copy of the quarterly report. The data generated from

the real time monitoring equipment will be reviewed on a bi-monthly basis by, the Site Operator for the Cow Creek Groundwater Conservation District (CCGCD). If any problems arise the Site Operator will report them immediately to the CCGCD Project Lead who will in turn report them to the appropriate member of TCEQ project management.

Reports to CCGCD Board of Directors

After every technical system audit (TSA) and performance evaluation audit, the field auditor prepares a report that describes the results. The report includes audit findings, observations, suggested corrective actions, etc., if appropriate. The quality control (QC) officer or auditor assesses proposed corrective actions and makes technical recommendations to management.

Final reports are submitted to the auditee and the CCGCD Board of Directors and copies are provided to the TCEQ CWQMN Coordinator and to the TCEQ Quality Assurance Officer. Individual reports may specify required responses, method of response (written, verbal, etc.) and response deadlines.

D1 DATA REVIEW, VERIFICATION, AND VALIDATION

Data validation will be conducted by Guadalupe-Blanco River Authority (GBRA) staff in Seguin, Texas. Data verification will be performed by GBRA and CCGCD staff.

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

Ambient measurement and quality control (QC) data are accessed, verified, and validated by personnel from GBRA. All continuous water quality monitoring data are reviewed and verified for integrity and continuity, reasonableness, and conformance to project requirements. Data validators perform data review using the IPS MeteoStar/LEADS to graphically display the data. Collection and transmission of the data are confirmed, and communications with site operators and/or project leads are initiated if problems are detected. Only those data which are supported by appropriate QC samples and meet the measurement performance specifications defined for this project will be considered acceptable. Data that have been validated and have been designated as acceptable will be identified as validated data in the IPS MeteoStar/LEADS system.

Table A7.2 lists the criteria for QC sample results for sonde measurement data. Verification of specific conductance (SC) includes the analysis of a calibration verification sample (CVS) performed after instrument deployment. The site operator analyzes the CVSs monthly. The site operator then records in the Operators Log whether the CVS passed or failed on a parameter specific basis. The data validator manually verifies the sonde CVS data that is accessed from the Operators Log via an internal TCEQ web page. The log notes are reviewed for a given batch of

ambient measurements. The log contains CVS information, as well as any other site observations. Any failed CVSs will result in all data back to the last calibration (usually a month) and/or CVS of that parameter being qualified as invalid. All data within one hour after any preventive maintenance (PMA flag) will also be qualified as invalid, in order for the sonde to stabilize.

D2 VERIFICATION AND VALIDATION METHODS

D2.1 Data Validation

Any data deemed questionable by the data validator due inexplicable extreme values, data dropouts, flat-lined data, etc. may be qualified as invalid. During data validation, certain issues or questions may arise about particular data point(s). In this case, the data validator refers to the operator logs. If no logs exist, or the log does not identify a source for the questionable data, the validator will contact the site operator via phone or email to try to resolve any issues and verify any data involved. Additionally, sonde sample depth and depth to water measurement data can be used as a source of additional information for data validation decisions.

After validating any data, and for MeteoStar/LEADS to consider the data as being validated, the data validator must enter validator notes. These notes document and explain any data qualifications made, other than valid (VAL flag) and why the qualification was made. In addition to the electronic validator notes, each validator also keeps a hard copy Validator Notebook that has the same information. These notebooks are stored in the Data Validator's office at the Guadalupe-Blanco River Authority (GBRA) in Seguin, Texas. Notebooks will be kept on file in the Validator's office for five years. A groundwater data validation SOP will be developed by the CCGCD within 90 days of execution of this QAPP.

D2.2 Data Tracking

End data users can access validated data via the Internet (TCEQ web pages). Actual measurement values (or averages of these) are shown for data that has been qualified as valid, while the validation flag is shown for data that were qualified as invalid. All data, no matter the qualifier assigned by the system, is manually verified. For a list of validation flags and their definitions, see Table D2.1. After data is verified by the data validator, it is flagged as such in IPS MeteoStar/LEADS.

Table D2.1 Data Validation Flags (Qualifiers)

Flag	Definition
AQI	Ambient Quality Invalid – Flag manually assigned when data point deemed invalid by the data validator.
PMA	Preventive Maintenance – Flag manually assigned when site operator is performing maintenance on analytical equipment.

VAL	Valid – Flag automatically assigned to any data that does not fall above or below pre-defined limits. Valid – Flag manually assigned to any data that was previously automatically assigned a Limit Exceeded (LIM) flag that was later deemed valid by the data validator.
LIM	Limit Exceeded – Flag automatically assigned to any data the fall above or below a pre-defined range.
LST	Lost Data – Flag automatically assigned when data is not retrievable by the data logger because of power outages, equipment malfunction, etc.

D3 RECONCILIATION WITH USER REQUIREMENTS

Problems with potential limitations of the data are handled at three different levels: (1) at the time of audit of the monitoring stations or by the site operators, who have prime responsibility for routine calibrations, maintenance, and analysis of quality control samples; (2) data validators who review verify and validate station data; and, (3) by users of the data. Issues are reconciled at the lowest level and at the earliest time possible. The mechanism for communication between the producers and the users of the data are telephone, e-mail, and the operator's log.

The auditors, validators, site operators, project leads, and managers are empowered to review and question any part of the measurement process and may initiate data reviews and corrective actions to bring the process back into compliance.

To assess the quality of the data produced during the monitoring efforts, the precision, accuracy, and completeness will be assessed in comparison to the measurement quality objectives as discussed in Section A7.

Appendix A

Definitions

Sample/Standards

performance evaluation (PE) sample

Definition - A sample, the composition of which is unknown to the analyst, provided to test whether the analyst/laboratory can produce analytical results within specified performance limits. (NELAC; Glossary of Quality Assurance Terms, QAMS, 8/31/92)

Application - Data from PE samples are used to evaluate method accuracy (and precision if duplicate PE samples are submitted). This is commonly referred to as an audit sample.

calibration standard (CS)

Definition - A mixture prepared from the primary standard mixture or stock standard mixture and, when appropriate, containing the internal standards and surrogates. (Modified NELAC; Glossary of Quality Assurance Terms, QAMS, 8/31/92)

Application - Used to calibrate the instrument response with respect to analyte concentration.

calibration verification standard (CVS)

Definition - An analytical standard analyzed during a batch to ensure acceptable instrument calibration.

Application - Used to verify analytical system calibration.

General Quality Control

chain-of-custody (COC)

Definition - An unbroken trail of accountability that documents the possession of samples, data, and records. (Modified NELAC; Glossary of Quality Assurance Terms, QAMS, 8/31/92)

Application - Provides documentation to establish sample integrity.

General Terminology

audit (quality) - A systematic and independent examination and evaluation to determine whether quality activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve specified objectives. (American National Standard Institute [ANSI]/American Society for Quality Control [ASQC], Standard E4-19)

completeness - A measure of the amount of valid data obtained from a measurement system

compared to the amount that was expected to be obtained under correct, normal conditions. (ANSI/ASQC, Standard E4-19)

data quality objectives (DQOs) - Established quantitative measurements (with associated precision and bias or acceptable uncertainty) that must be obtained from the environmental data operations in order to demonstrate that the desired and expected result has been achieved. (ANSI/ASQC, Standard E4-19)

deficiency - An unauthorized deviation from acceptable procedures or practices, or a defect in an item. (ANSI/ASQC, Standard E4-19).

matrix - Substance being tested.

quality - The sum of features and properties/characteristics of a process, item, or service that bears on its ability to meet the stated needs and expectations of the user. (ANSI/ASQC, Standard E4-19)

Quality Assurance Project Plan (QAPP) - A formal document describing in comprehensive detail the necessary quality assurance, quality control, and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. (ANSI/ASQC, Standard E4-19)

quality assurance (QA) - An integrated system of activities involving planning, implementation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the customer. (ANSI/ASQC, Standard E4-19)

quality control (QC) - The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality. (ANSI/ASQC, Standard E4-19)

representativeness - A measure of the degree to which data accurately and precisely represent a characteristic of a population, parameter, variations at a sampling point, a process condition, or an environmental condition. (ANSI/ASQC, Standard E4-19)

Rule 11.3 Initiation and Determination of Drought Stages

Each of the drought stages shall be initiated by action of the Board utilizing the Palmer Drought Severity Index or other factors as deemed appropriate by the Board and shall remain in effect for a minimum of thirty (30) days. Mandatory percentage reductions in groundwater use under this Rule 11.3 shall not apply to health and safety uses, such as sanitation and firefighting.

A. Stage 1 – Year-Round Conservation - Incipient Dry Spell, Board Determination or PDSI of >-1.0 to -0.5

All well owners and/or users of groundwater are requested to voluntarily minimize the use of groundwater especially for non-essential uses year-round through good water use and water conservation practices. There are no requirements for termination as Stage 1 is a year-round conservation program.

B. Stage 2 - Mild Drought, Board Determination or PDSI of >-2.0 to -1.0

(1) Water Reduction – Mandatory 10% reduction in groundwater use

(2) Mandatory requirements include–

(a) Outdoor lawn and landscape irrigation by hose-end sprinklers, automatic sprinklers, soaker hoses, or drip irrigation is limited to between the hours of 8:00 p.m. to 10:00 a.m. of the following day. Hand-held hoses or hand-held buckets are allowed at any time. Automatic sprinkler systems shall be equipped with rain sensors to prevent operation during periods of rainfall.

(b) Washing of automobiles, trucks, trailers, boats, airplanes, and other types of mobile equipment must be done over pervious cover.

(c) Water troughs or any water receptacles with mechanical float controls shall be routinely inspected and properly maintained to prevent leaks and waste of water.

C. Stage 3 - Moderate Drought, Board Determination or PDSI of > -3.0 to -2.0

(1) Water Reduction – Mandatory 20% reduction in groundwater use

(2) Requirements – All requirements in Stage 2 shall remain in effect and mandatory. In addition the following shall also apply:

(a) Outdoor lawn and landscape irrigation shall only be allowed during the following outlined days, between the hours of 8:00 p.m. and 10:00 a.m. of the following day.

Lawn and Landscape Watering Schedule

Day of the Week	Address ends with #
Monday	0 or 1
Tuesday	2 or 3
Wednesday	4 or 5
Thursday	6 or 7
Friday	8 or 9
No Watering on Weekends	

(b) If a new lawn or landscaping has been installed prior to two weeks of or after the initiation of Stage 3, then irrigation of that lawn or landscape may only occur between the hours of 8:00 p.m. to 10:00 a.m. of the following day and in accordance with the following 30-day schedule:

- For the first 10 days after installation, once a day;
- For day 11 through 20 after installation, once every other day; and
- For day 21 through 30 after installation, once every third day.

(c) Washing of automobiles, trucks, trailers, boats, airplanes, and other types of mobile equipment is prohibited unless it is on the premises of a commercial car wash, service station, or a private facility that utilizes a recycled water system. Charity carwashes are prohibited.

(d) Use of water to fill, refill, or add to any indoor or outdoor swimming pools, wading pools, or jacuzzi-type pools is prohibited except on designated watering days during the designated watering hours. When such facilities are not in use, some form of surface cover shall be used to limit the evaporation of water.

(e) Operation of any ornamental fountain or pond for aesthetic or scenic purposes is prohibited except where necessary to support aquatic life or where such fountains or ponds are equipped with a re-circulation system.

(f) Irrigation of a golf course fairway is limited to once per week between the hours of 8:00 p.m. and 10:00 a.m. Irrigation of a golf course green or tee is allowed every day if a plan is filed and approved by the District. These restrictions do not apply if the golf course utilizes an alternate water supply as its only irrigation source, such as reclaimed water, rainwater, surface water or gray water.

(g) Irrigation of athletic fields is limited to no more than twice a week between the hours of 8:00 p.m. and 10:00 a.m. of the following day.

(h) All restaurants are encouraged to serve water to their patrons only upon request.

D. Stage 4 - Severe Drought, Board Determination or PDSI of > -4.0 to -3.0

(1) Water Reduction – Mandatory 30% reduction in groundwater use

(2) Requirements – All requirements of previous stages shall remain in effect during Stage 4 and mandatory. In addition one or more of the following shall be implemented:

(a) All outdoor lawn and landscape irrigation, including the irrigation of new lawns and landscaping is limited to one day a week per the schedule designated in Rule 11.3.C.(2)(a) (Lawn and Landscape Watering Schedule) between the hours of 8:00 p.m. and 10:00 a.m. of the following day.

(b) The use of water for washing sidewalks, driveways, parking areas, streets, tennis courts, or other paved impermeable areas, except to alleviate health or fire hazard is prohibited.

(c) The watering of the ground around foundation to prevent foundation cracking is permitted only during times designated for lawn and landscape irrigation, unless watering is accomplished by a drip system or a hand-held hose, then foundation watering may be done at any time.

(d) Operation of any ornamental fountain or pond for aesthetic or scenic purposes is prohibited. Filling of ponds, lakes, tanks, reservoirs, swimming pools or other surface impoundments with groundwater is prohibited. Water may be added to pools to replace water lost due to use or evaporation during times when landscape irrigation is allowed.

E. Stage 5 - Extreme Drought, Board Determination or PDSI of > -4.0 to -4.5

(1) Water Reduction – Mandatory 40% reduction in groundwater use

(2) Requirements – All requirements of Stage 4 shall remain in effect during Stage 5. In addition one or more of the following shall be implemented:

(a) Irrigation of lawns and landscaped areas shall be limited to once a week on the schedule designated in Rule 11.3.C.(2)(a) (Lawn and Landscape Watering Schedule), and shall be by means of hand-held hoses or hand-held buckets only. No hose-end sprinklers or automatic sprinklers are allowed at any time.

(b) The watering of golf courses is prohibited unless the golf course utilizes treated wastewater effluent or a source other than groundwater as its source of irrigation. These requirements also apply to the irrigation of parks, public properties and athletic fields.

(c) Bulk sales of groundwater from within the District are prohibited.

(d) Use of water from hydrants shall be limited to fire fighting, related activities, or other activities necessary to maintain public health, safety, and welfare.

(e) Irrigation of hay crops is prohibited.

(f) Irrigation of crops designated for human consumption is limited to once a week per the schedule designated in Rule 11.3.C.(2)(a) (Lawn and Landscape Watering Schedule), between the hours of 8:00 pm and 10:00 am of the following day.

(g) Leak-proof troughs shall be used to provide water for livestock.

(h) Use of groundwater for construction activities is prohibited.

(i) The issuance of new well drilling permits may be suspended except to replace an existing well.

F. Stage 6 - Extreme Drought Emergency, Board Determination or PDSI of >-4.5

(1) Water Reduction – Mandatory 50% reduction in groundwater use

(2) Requirements – All requirements of Stage 5 shall remain in effect during Stage 6. In addition one or more of the following shall be implemented:

(a) Irrigation of lawn and landscape areas is prohibited at all times.

(b) Use of water to wash any motor vehicle, motorbike, boat, trailer, airplane, or any other mobile vehicle is prohibited at all times.

(c) The filling, refilling, or adding of potable water to private swimming, or jacuzzi-type pools for any reason is prohibited.

(d) No additional, expanded or increase-in-size water service connections, meters, service lines, pipeline extensions, mains or water service facilities of any kind shall be allowed or approved if groundwater is used.

(e) In the event of system failure, the water supply will be managed by such measures necessary to maintain public health and safety, including elimination of service to part or all of the water system.

(f) Irrigation of hay crops is prohibited.

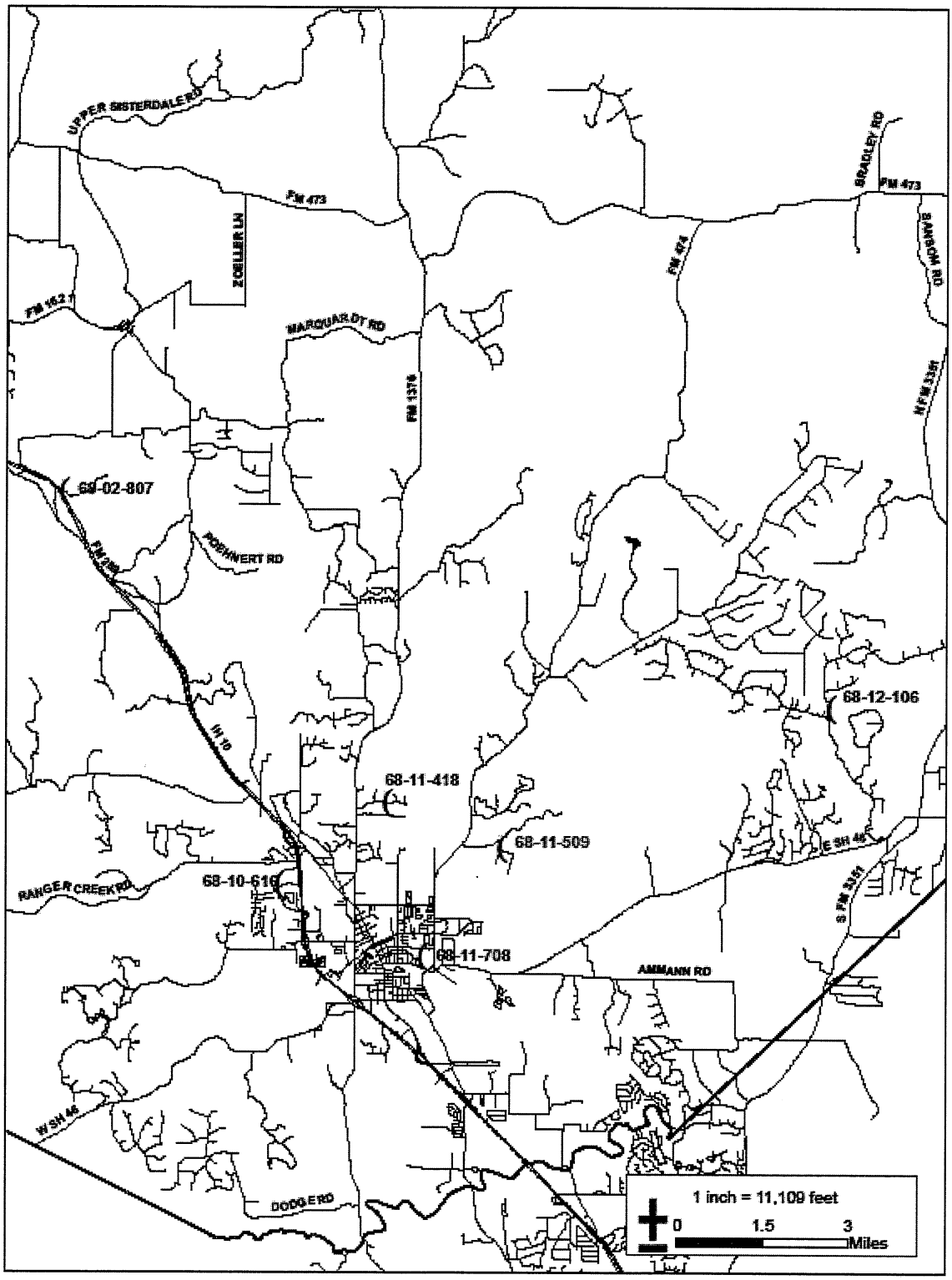
(g) Irrigation of crops designated for human consumption is prohibited.

(h) No new well drilling or operating permits shall be issued except to replace an existing well on an emergency basis.

(i) Other measures deemed necessary by the Board to protect public health and safety.

Adopted January 8, 2007 by Board Order 2007-001; effective January 8, 2007. Amended May 20, 2008 by Board Order 2008-007; effective May 23, 2008.

APPENDIX C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FM 473
ZOELLER LN
FM 1621
MARQUART RD
FM 1376
FM 474
BRADLEY RD
BANDERA RD
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POEHNERT RD
IH 10
68-12-106
68-11-418
68-11-509
E SH 46
RANGER CREEK RD
68-10-516
68-11-708
AMMANN RD
W SH 46
DODGE RD
1 inch = 11,109 feet
0
1.5
3
Miles

Appendix D

List of Acronyms

°C	Degrees Centigrade
CAMS	Continuous Ambient Monitoring Station
CCGCD	Cow Creek Groundwater Conservation District
CVS	Calibration Verification Sample
CGMN	Continuous Groundwater Monitoring Network
EC	Electrical Conductance (Reported as Specific Conductance)
FY	Fiscal Year
GBRA	Guadalupe-Blanco River Authority
LEADS	Leading Environmental Analysis and Display System
Mg/L	Milligram per Liter
FOSD	Field Operations Support Division
NA	Not Applicable
NIST	National Institute of Standards and Technology
QA	Quality Assurance
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	Quality Control
SC	Specific Conductance
SOP	Standard Operating Procedure
SWQM	Surface Water Quality Monitoring Team
T	Temperature
TBD	To Be Determined
TCEQ	Texas Commission on Environmental Quality
TDS	Total Dissolved Solids
RPE	Relative Percent Error
µS/cm	micro Siemens per centimeter
WDM	Water Data Management Team
WQM&A	Water Quality Monitoring & Assessment Section