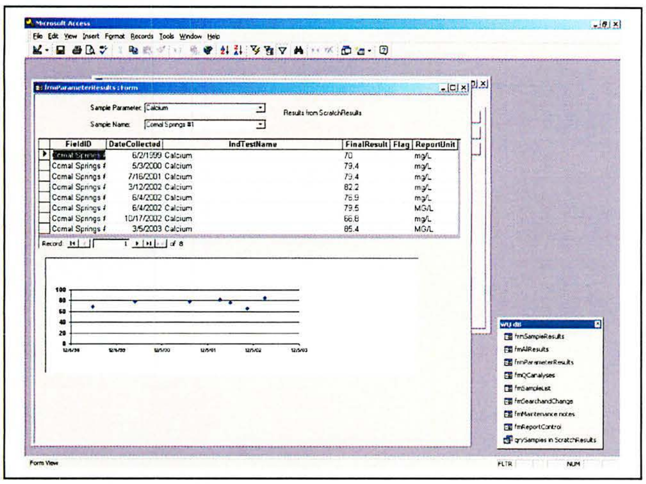
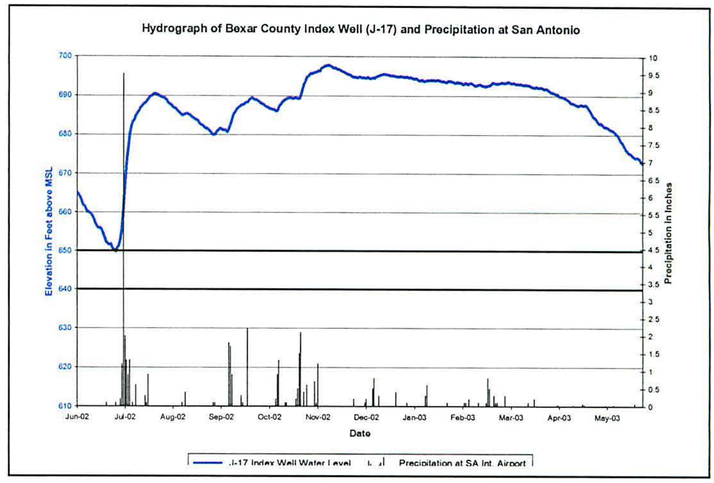
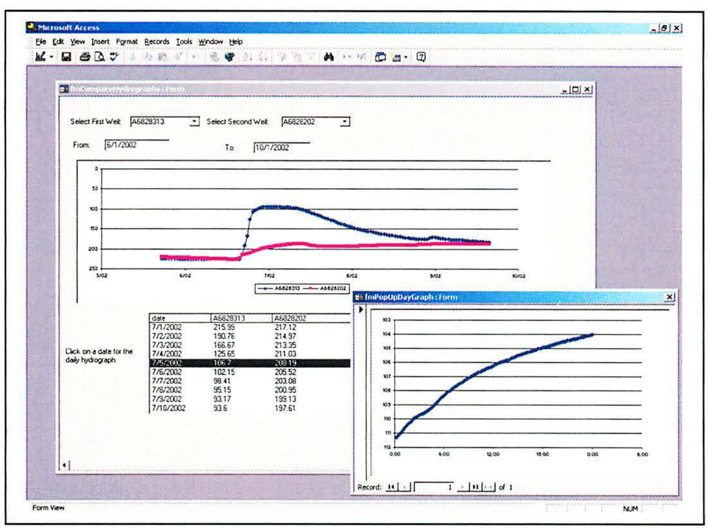
Edwards Aquifer Authority
Data Management Plan







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EDWARDS AQUIFER
AUTHORITY

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Edwards Aquifer Authority
Draft Data Management Plan

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1. Introduction

The Edwards Aquifer Authority (Authority), its predecessor agency (the Edwards Underground Water District; EUWD), and their contractors maintain an extensive data collection program that generates a large volume of data. The program has generated data such as water levels, water quality analyses, elevation survey measurements, rainfall measurements, and other information related to the Edwards Aquifer. Early data were stored in paper files and reports, and subsequent data were stored in spreadsheets. Currently, there is no single repository for data collected by the Authority. This plan was written to design and implement a data management system that will be used by the Authority in the future. It includes historical as well as current data. The scope of the system includes both hard copy files and computerized data storage and retrieval. The system fulfills one of the requirements of the *Strategic Plan 2002-2006* that was adopted by the Authority in 2002. In addition, it will reflect requirements generated by the Data Management team.

This plan describes the objective, tasks, and database structure for the data management system.

2. Objective

The objective of the data management system is to collect, store, and retrieve data with a known level of quality for use by the Authority and its constituents.

To meet this objective, this plan presents the results of the following tasks:

A. Needs Assessment — The needs assessment consists of identifying the types, uses, and data quality objectives (DQOs) for all data that the Authority collects. DQOs are specifications that the data must meet in order to be useful, representative, and reliable for the end user. Other items such as training and equipment are developed by determining how to meet the DQOs.

B. Identify Data Streams — Data streams are the routes and processes that data follows from collection to its final use, including storage and retrieval. For example, synoptic water levels can be traced from the field measurements to a database to groundwater elevation maps. Each organizational team will have its own data streams. This plan is mainly concerned with data streams in the Aquifer Science and Investigation and Monitoring teams with a link to permitted wells.

C. Design Data Flow	Data flowpaths are defined by the requirements of the data users. They can be characterized as follows: 1) Identify users both inside and outside of the Authority 2) Translate DQOs into processes 3) Create flowpaths for each type of data 4) Design forms, identify equipment needs, and training 5) Design data entry processes 6) Incorporate QA/QC systems into each data type 7) Document the data flow in standard operating procedures
D. Design Databases	Designing the database consists of the following steps: 1) Identify the forms and reports that are required by the users 2) Segregate information for the forms and reports into tables, avoiding redundant data 3) Establish relationships among tables (key fields) 4) Assess compatibility with databases outside of the Authority 5) Create fields (data types) and indexes 6) Design server setup 7) Identify spatial data needs and GIS interface 8) Determine levels of access
E. Create and Test Databases	1) Write software 2) Configure hardware 3) Enter and check historical and new data
F. Create Filing System for Hard Copy	1) Setup files 2) Regular submittals 3) Archive
G. Periodic Audits	1) Database (compare with hard copy) 2) Central files (find specific data) 3) Sample collection (observe field procedures) 4) Laboratory (observe analytical procedures)

3. Needs Assessment

The purpose of the needs assessment is to identify the data types, data uses, and data quality objectives (DQOs) that are used by the Authority. The needs assessment specifies the universe of data that the Authority collects and defines the scope of the data management system. Table 1 lists the types and uses of data collected by the Authority. The DQOs specify the level of quality that the end user requires for the data. In other words, they were developed based on the expectations of the end users. EPA defines DQOs in terms of the following elements:

Precision measures the reproducibility of measurements under a given set of conditions.

Accuracy is a measure of the closeness (bias) of the measured value to the true value.

Representativeness is a qualitative measure of how closely the data reflect the actual concentration or measurement.
Completeness is defined as the percentage of measurements judged to be valid.
Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another.

When all of the DQO specifications are met, then the data are useable without qualification. If one or more of the DQOs are not met, then the data may be useable under certain conditions or for semi-quantitative purposes only.

The needs assessment also reveals the specifications for the user interfaces for all phases of the data management system, such as data entry, queries, and report generation. This will be considered in the future revisions of the plan. While the database is being designed and built, screens will be created for entering field data and other tasks as needed.

Table 1. Data Types Collected by the Authority

Data Types	**Data Uses**	**Data Quality Objective**
Water Levels (Electronic and Tapedown)	• Groundwater elevation contours • Interpretation of flowpaths • Interpretations of fluctuations • Critical period	• Precision: ±0.01 ft • Accuracy • Representativeness • Completeness • Comparability
Laboratory Water Quality Analyses	• Create water type fingerprint • Trace flowpaths • Investigate spills • Determine risk based on water quality	• DQOs defined for each analytical method or parameter • Precision • Accuracy • Representativeness • Completeness • Comparability
Field Water Quality Analyses	• Determine sampling conditions • Measure parameters with short holding times	• Precision • Accuracy • Representativeness • Completeness • Comparability
Water Use	• Compare water volume with permit • Support enforcement	• Accuracy

Data Types	Data Uses	Data Quality Objective
Precipitation	• Calculate recharge • Anticipate aquifer response • Analysis of cloud seeding program	• Precision: ±0.1 inch • Accuracy: • Representativeness • Completeness • Comparability
GPS measurements (sport, submeter, surveyor grade)	• Determine locations	• Precision: 2 ft vertical 20 ft horizontal
Pump discharges	• Water usage	• ±10%
Well inspections	• Determine well use • Verify permit application data • Check flow meters • Verify location	• Accurate
Geophysical logs	• Determine stratigraphy • Correlate with other boreholes • Determine well conditions	• Precision adequate to see contrasts • Comparability
WPAP data	• Identify recharge features • Monitor BMPs	• Accurate locations
Permit data	• Assign water use • Monitor compliance • Aid enforcement	• Defensible • Accurate
Streamflow or springflow discharge and stage	• Measure streamflow • Estimate recharge • Evaluate habitat conditions • Trigger statutory requirements • Estimate recharge and discharge	• Precision: ±0.01 ft for stage; ±10% for discharge • Accuracy: • Representativeness • Completeness • Comparability
Recharge from recharge dams	• Report recharge to the TCEQ • Hydrogeologic Report	• Precision: ±10% amount recharged
Domestic water use	• Estimate aquifer discharge	• Nearest 1,000 gal/yr.
Biological data	• Evaluate habitat conditions • Support T&E species	• Defensible
Underground storage tanks	• Recharge zone protection • UST compliance	• Accurate • Defensible

4. Authority Data Streams

Table 2 is a summary of the data streams in the Authority. A data stream is a collection, storage, and retrieval sequence that can be defined for each data type. A data stream traces each data type from collection to end users. The largest data streams are water levels, water quality analyses, precipitation measurements, and permit information.

Table 2. Summary of Data Streams

Origin	Data Reduction	Storage	Retrieval	End Users	Archive
Water Levels (Electronic) Data collected from continuous recorders	Adjusted for tapedown Calculate elevation	Monitoring database	Monitoring database Internet	Authority staff, public	Central files
Water Levels (Tapedown) Data collected by hand	Calculate elevation	Monitoring database	Monitoring database Internet	Authority staff, public	Central files
Water Level Charts Data water level measurements	Data validation	Monitoring database	Monitoring database	Board of directors, Authority staff, public	Central files
Laboratory Water Quality Analyses Data provided by lab	Data validation	Water quality database	Water quality database	Authority staff, public	Central files
Field Water Quality Analyses Data measured with field instruments	Data validation	Water quality database	Water quality database	Authority staff, public	Central files
Water Use Data provided by permittee	Check by staff	Groundwater withdrawal database	Groundwater withdrawal database	Authority staff, public	Central files

Table 2. Summary of Data Streams

Origin	Data Reduction	Storage	Retrieval	End Users	Archive
Precipitation Data collected by remote system	Check for errors Compare to NEXRAD	MTU database	MTU database Internet	Authority staff, public, NWS	Central files
GPS measurements Data collected from GPS device	Check for errors	Master well database	Master well database	Authority staff, public	Central files
Pump discharges Measurements by hand or from a gauge	Calculate discharge	Database	Database	Authority staff, public	Central files
Well inspections Observations collected by individuals	Check for completeness	Central files	Central files	Authority staff, public	Central files
Geophysical logs Logs collected by governmental entities and logging company	Check for errors	Central files	Central files	Authority staff, public	Central files
WPAP data Information taken from WPAPs	Record in database	WPAP database	WPAP database	Authority staff, public	Central files
Permit data Information taken from applications and in the field	Check for accuracy	Permitting database	Permitting database	Authority staff, public	Central files

Table 2. Summary of Data Streams

Origin	Data Reduction	Storage	Retrieval	End Users	Archive
Compliance/ Enforcement data Data collected to support compliance or enforcement actions	Check for accuracy	Permitting database	Permitting database	Authority staff	Central files
Streamflow or springflow discharge and stage Data collected in the field	Calculate discharge	Central files	Central files	Authority staff	Central files
Recharge from recharge dams Data calculated from field measurements	Calculate recharge Compare with rainfall	Central files	Central files	Authority staff, TCEQ	Central files
Domestic water use Users estimated	Check for reasonable values	Well registration database	Well registration database	Authority staff	Central files
Biological data Data provided by contractors	Compile directly from contractors' reports	Central files	Central files	Authority staff, USFWS, TPWD,	Central files
Underground storage tanks Data taken from permits	Check for accuracy	UST/AST database	UST/AST database	Authority staff, public	Central files

5. Data Flow Design

Data flow is the path from collection to analysis to the end users. For example, laboratory water quality data flow from the wellhead during collection to the laboratory for analysis to data validation to a database and finally to the end user, who may be Authority staff, the media, or the general public. A long data flowpath like laboratory water quality data is composed of several short flowpaths such as a well inspection, a tapedown, field water quality measurements, and analytical procedures.

The end users specify the DQOs for the data, or the Authority specifies the DQOs on the behalf of the users. Each step of the pathway is designed to achieve the DQOs that are specified. For example, the laboratory requires two liters of water to achieve the level of precision required by the Authority for herbicide and pesticide analyses. Consequently, the sampling protocol contains instructions for collecting two liters of water. Each of the sampling protocols is designed to obtain representative samples or measurements and to document the process. Part of each step is an analysis of potential errors and a method for estimating them. For example, synoptic water levels are measured to 0.01 foot, and then two or more measurements are averaged. The accuracy of the resulting number is a function of the standard deviation of the measurements. If the standard deviation is high, then the accuracy is low and vice versa. Finally, each data flowpath has a feedback loop for users to provide comments to the planning process.

For example, the data flow for synoptic water level measurements is shown on Figure 1 below.

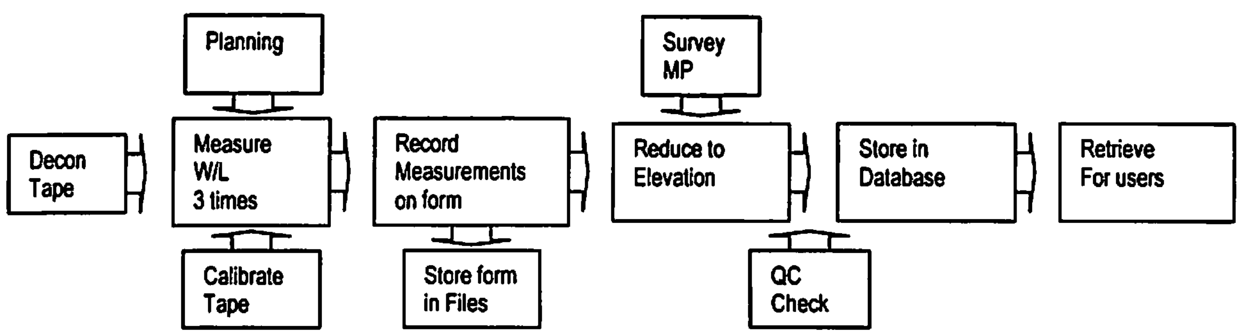

Figure 1. Data Flow for Synoptic Water Levels

Separate plans are being prepared for each of the following data flowpaths:

- Water quality sampling (see Figure 2)
- Water level measurements
- Precipitation measurements

Other plans will be developed for the remaining data streams.

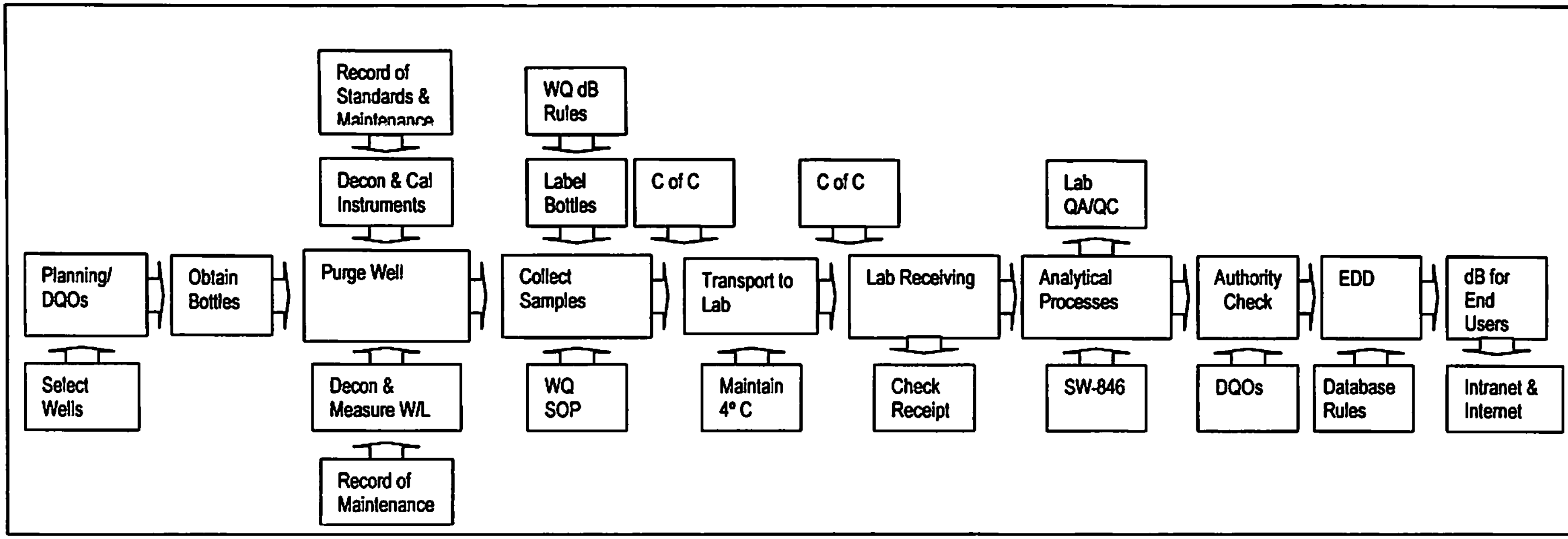

Figure 2. Data Flow for Collecting and Analyzing Water Samples

Notes:

WQ dB = water quality database
WQ SOP = water quality standard operating procedure
C of C = chain of custody
DQOs = data quality objectives
SW-846 = *Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods*, EPA publication SW-846
EDD = electronic data deliverables

6. Database Design

The database is designed for storage and retrieval of all of the data streams that are collected by the Authority. Figure 3 shows a schematic of the database tables and linkages. A database manual will be prepared to describe all parts of the database for users. In general, the state well number is the linkage for groundwater-related tables, and the docket number is the linkage for permitting-related information. Surface water and real-time precipitation data may be retrieved by name or location through latitude and longitude. The three major tables are the Master Well Table, Surface Water Site Table, and the Permits Table. The Master Well Table is the sole repository for wells involved with Authority projects. It is a tabulation of all wells sampled, measured, modeled, or permitted by the Authority. All wells must be in the Master Well Table before analytical results may be entered in the Results Table. Its schema is similar to the Texas Water Development Board (TWDB) database (see *Ground-Water Data Dictionary*, UM-50 by the TWDB) plus a field for the docket number that will serve as the linkage to the Permits Table. The Permits Table actually represents the entire permitting database, which will be a separate database linked to the Master Well Table. The Surface Water Site Table contains records of all streams that the Authority samples. Each table will be designed to restrict write access privileges to prevent accidental errors.

Other tables in the database store water quality results for groundwater and surface water, water-level measurements, aquifer tests, geophysical logs, springflow measurements, information related to TCEQ Chapter 213 compliance, and precipitation measurements. Additional tables may be added as necessary.

The database will be initially created in Microsoft Access and then eventually moved to a Microsoft SQL database with an Access front end when its size starts to diminish its performance. It will reside on the EAADC server where it can be accessed by anyone in the office. Eventually, the database will be accessible through the office Intranet and the Authority's web site.

Each database is described in detail below.

7. Water Quality Database

The water quality database consists of three tables that are related with the state well number for groundwater and spring samples and by the USGS station number for surface water samples. The three tables are as follows:

- Master Well Table: tabulation of all wells used by the Authority
- Surface Water Site Table: tabulation of all surface water sites sampled by the Authority
- Water Quality Results Table: list of all analytical results for all samples collected by the Authority

The analytical results will be delivered to the Authority in electronic data delivery (EDD) format by the laboratory. Each analyte from each well or spring that is sampled will have a separate record in the Results table. The database will create reports through queries either as long lists or in wide crosstab format.

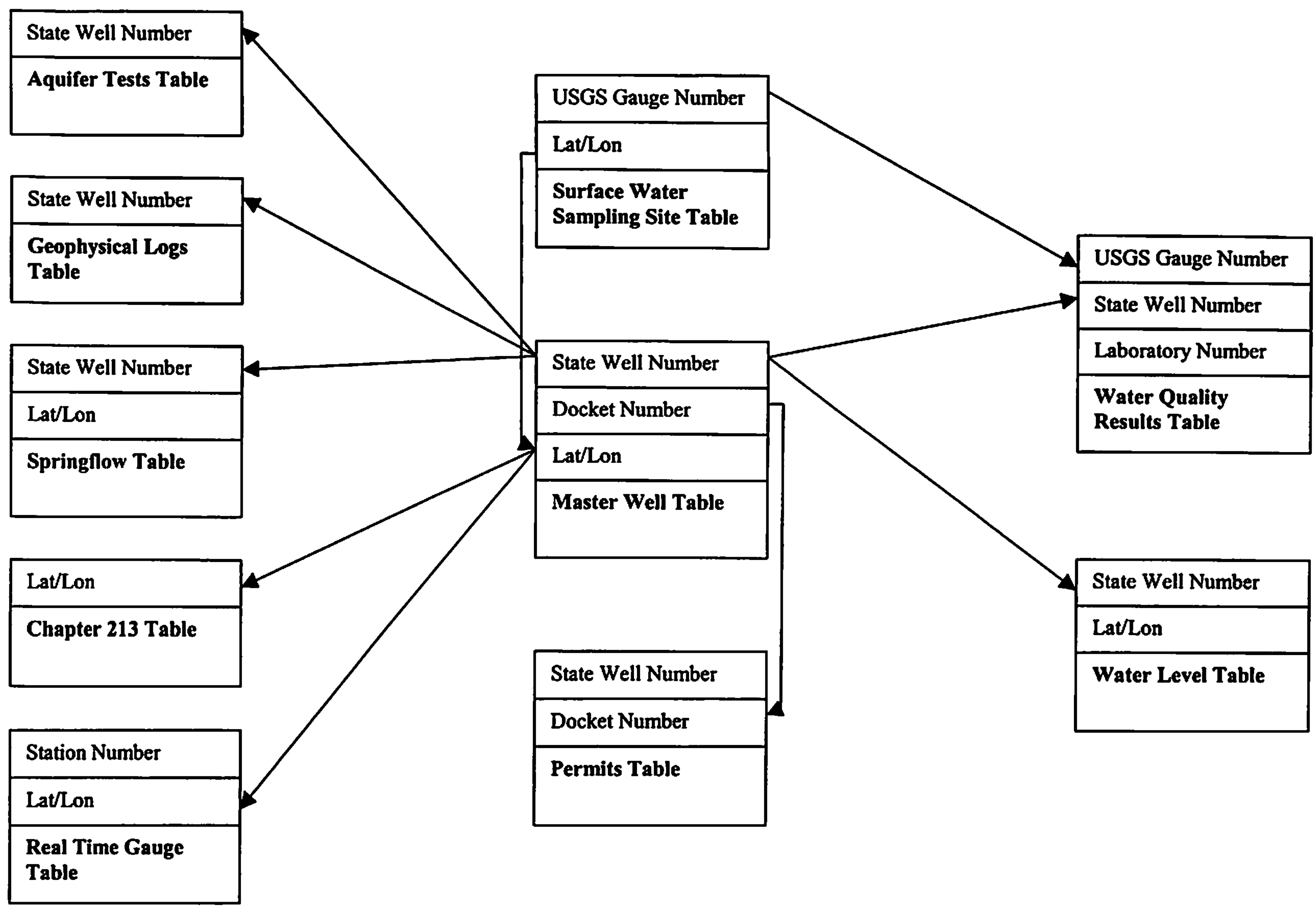

Figure 3. Schematic Diagram of the Database Structure and Linkages

Table 3. Master Well Table Fields

Field Name	Definition	Field Type	Length	Valid Values
State Well Number	State Well Number	Integer	7	Like 6823301
Docket Number	Permit number for well owner	Character	7	Like BE00269
FIPS County Code	3-digit code	Small Integer	3	Atascosa 13 Bexar 29 Comal 91 Guadalupe 187 Hays 311 Kinney 271 Medina 427 Uvalde 463
Basin	River basin	Small Integer	2	Guadalupe River 18 San Antonio River 19 Nueces River 21
Zone	River basin zone	Small Integer	1	1
Region Number	Counties overlying the Edwards Aquifer	Small Integer	2	11
Previous Well Number	Previous Well Number	Character	12	Like DX-68-23-301
Latitude	Latitude	Single		Decimal degrees
Longitude	Longitude	Single		Decimal degrees (negative)
Owner1	Owner's name	Character	22	
Owner2		Character	22	
Driller1	Driller's name	Character	20	
Driller2		Character	20	
Accuracy of Coordinates		Character	1	

Field Name	Definition	Field Type	Length	Valid Values
Aquifer Code	Geologic setting of aquifer. Valid values are listed in descending order of occurrence in TWDB database records for the Authority area.	Character	8	218EBFZA, 218EDRDA, 112LEON, 218GLRS, 218GLRSL, 218EDRD, 124INDO, 124CRRZ, 211ECDD, 218GLRSU, 124WLCX, 218GRHC, 218CCRK, 218GRCCU, 211ASTN, NOT-APPL, 219SLGH, 218TRNT, 217HSTN, 211ANCC, 124CZWX, 100ALVM, 217SLGO, 218GPSH, 218EDDT, 218HSCC, 110ALVM, 211BUDA, 218EDGR, 217HSCC, 110AVGR, 218GLRH, 218HCSH, 218GRLH, 110AVML, 218LGRLH, 218GRUH, 121UVLD, 218TVPK, 112LSRP, 112LNBD, 124RKLW, 218EDGRU, 211AEDD, 218EDAS
Aquifer ID 1	Primary designation of aquifer	Small Integer	2	Edwards (BFZ):11 Trinity: 28 Other: 22 Carrizo-Wilcox 10 Edwards-Trinity Plateau 13 Cenozoic Pecos Allvm.: 3
Aquifer ID 2	Secondary designation of aquifer	Small Integer	2	11, 28, 22, 10, 13, 3
Aquifer ID 3	Tertiary designation of aquifer	Small Integer	2	11, 28, 22, 10, 13, 3
Elevation of LSD	Ground surface elevation in feet above msl	Small Integer	4	500 to 10,000

Field Name	Definition	Field Type	Length	Valid Values
Method of Elevation Measurement	Method of Elevation Measurement	Character	1	A - altimeter G - geographical positioning system (GPS) G1 - Survey grade G2 – Mapping grade G3 – Recreation grade L - level or other surveying method M - interpolated from topographic map Z - other (Blank) - method unknown
Users Code Economics	Unique number for all wells with same owner	Integer	6	970053 to 105600
Date Drilled	Date Drilled	Character	8	mmddyyyy
Well Type	Use of well	Character		A - anode C - repressurize D - drain E - geothermal G - seismic H - heat reservoir M - mine O - observation P - oil or gas R - recharge S - spring T - test hole W - withdrawal of water X - waste disposal Z - other
Well Depth	Depth of well in feet	Small Integer	4	Up to 8000

Field Name	Definition	Field Type	Length	Valid Values
Source of Depth Measurement	Source of Depth Measurement D and A are the most common	Character	1	A - reported by another government agency D - from drillers' log or well report. G - private geologist-consultant or university associate. L - depth interpreted from geophysical log M - memory of owner, operator, driller. O - reported by the owner of the well, where depth is certain or documented. R- reported by person other than the owner, driller, or another government agency. S- measured by personnel of reporting agency. Z- other source (explain in remarks)
Type of Lift	Mechanism for extracting water	Character	1	A - airlift B - bucket C - centrifugal pump J - jet pump N - none P – piston R - rotary pump S - submersible pump T - turbine pump U - unknown Z - other (explain in remarks)

Field Name	Definition	Field Type	Length	Valid Values
Type of Power	Power for extraction device	Character	1	D - diesel engine E - electric motor G - gasoline engine H - hand L - LP gas (propane or butane) engine N - natural-gas engine W - windmill Z - other (explain in remarks) (Blank) - no power source present
Horsepower	Horsepower	Character	7	0.25 to 1000
Primary Water Use	Primary Water Use Usually H, P, S, or U	Character	1	A - air conditioning B - bottling C - commercial D - dewater E - power F - fire H - domestic I - irrigation J - industrial (cooling) K - mining M - medicinal N - industrial P - public supply Q – aquaculture R - recreation S - stock T - institution U - unused Y - desalination Z - other (explaining remarks)
Secondary Water Use	Secondary Water Use Usually S	Character	1	See above
Tertiary Water Use	Tertiary Water Use	Character	1	See above
Water Levels Available	Indicate if water levels are in database	Character	1	Y or N

Field Name	Definition	Field Type	Length	Valid Values
Water Quality Available	Indicate if water quality analyses are in database	Character	1	Y or N
Well Logs Available	Indicate if geophysical logs are available	Character	6	A - drilling time B - casing collar C - caliper D - driller's E - electric F - fluid-conductivity G - geologists or sample H - magnetic I - induction J - gamma ray S - sonic K - dipmeter survey L - lateral log M - microlog N - neutron O - microlateral log P - photographic Q - radioactive tracer T - temperature U - gamma-gamma V - fluid velocity Y - core Z - other
Other Data Available	Indicate if other data are available with appropriate code	Character	1	A - aquifer test B - power-yield test C - specific capacity Z - other
Date Collected or Updated	Enter date	Character	8	Mmddyyyy
Reporting Agency	Enter code for Authority	Character	2	07
Well Schedule in TWDB files	Indicate if well schedule is in TWDB files	Character	1	Y or N

Field Name	Definition	Field Type	Length	Valid Values
Construction Method	Technique used to construct the well Usually A, C, or H	Character	1	A - air rotary B - bored or augured C - cable-tool D - dug H - hydraulic rotary J - jetted P - air percussion R - reverse rotary T - trenching V - driven W - drive and wash Z - other (explain in remarks)
Completion	Well completion Usually X (about 75% of wells in Authority area)	Character	1	C - porous concrete F - gravel pack w/perforations G - gravel pack w/screen H - horizontal gallery O - open end P - perforated or slotted S - screen T - sand W - walled X - open hole Z - other (explain in remarks)
Casing Material	Casing Material Usually S or P	Character	1	B - brick C - concrete D - copper G - galvanized iron I - wrought iron M - other metal N - none P - PVC, fiberglass, other plastic R - rock or stone S - steel T - tile U - coated steel W - wood Z - other material (explain in remarks)

Field Name	Definition	Field Type	Length	Valid Values
Screen Material	Screen Material If any, usually P or S	Character	1	B - brass or bronze C - concrete G - galvanized iron I - wrought iron M - other metals P - PVC, fiberglass, or other plastic R - stainless steel S - steel T - Tile Z - other (explain in remarks
Lithological Log Type		Character	2	
Lithology Interpreter Initials	Initials of geologist	Character	3	XXX
Lithology Interpretation Date	Date	Date	NA	mm/dd/yyyy

8. Surface Water Sites

Table 4 lists the fields for capturing surface water sites that have been sampled by the Authority.

Table 4. Field Definitions for the Surface Water Sample Site Table

Field Name	Definition	Field Type	Length	Valid Values
USGS gauge	USGS gauge number	Character	8	Like 08177700
Station name	USGS name for station	Character	55	Like "Nueces River at Laguna TX"
Description	Description of station	Character	55	Text
Latitude	Latitude in ddmmss format	Character	6	Like 291525
Longitude	Longitude in dddmmss format	Character	7	Like 0995512
Survey datum	NAD27 or NAD83	Character	5	NAD27 or NAD83
County Code	FIPS county code	Integer	3	29
Altitude	Altitude of station	Integer	4	1234

Field Name	Definition	Field Type	Length	Valid Values
Altitude datum	NGVD29	Character	6	NGVD29
HUC	Hydrologic unit code	Character	8	Like 12100302
Drainage area	Drainage area above the station in square miles	Single	5	1.25

9. Water Quality Results Table

Water quality results will be provided to the Authority in a single long table that consists of a record for each analyte along with quality control analyses. Table 5 lists the field definitions for the water quality results table, which is based on the electronic data deliverable (EDD) from Severn-Trent laboratory (STL-Corpus Christi). Future laboratory contracts will specify this format in the scope of work. Each sample is uniquely identified by its state well number and date (and time if necessary). The water sampling program generates about 50,000 records each year. The state well number field links the sample to the master well table and other tables in the database. The date and analytes will be used as a criterion in queries. Soil samples will be stored in a separate table with similar fields.

Table 5. Field Definitions for Water Quality Results Table

Field	Field Type	Description	Valid Value
AnalRunID	Character	Batch number for samples and QC	VL042502-68289
LabID	Character	Laboratory sample ID	212242-001
QCTyp	Character	Type of sample	LCD, LCS, MB, MD, MS, MSD, SB, SBD, SMP
IndTestName	Character	Analyte	Trichloroethene
AnalMethod	Character	Analytical method	SW-846 8260B
QCBatchID	Character	QC batch	QC-68289
ColumnNum	Integer	GC column number	1
Matrix	Character	Water or soil	WATER
OrderNum	Integer	Laboratory job number	212242
AnalDil	Integer	Dilution factor	1
LeachDate	Date	TCLP leach date for soil	4/25/2002
FileName	Character	Instrument file name	VOC GC/MS #4
ReportUnit	Character	Units for results	mg/kG, mg/L, mg/L CACO3, N/A, pH UNITS, ug/L

Field	Field Type	Description	Valid Value
ConcMethod	Character	Concentration method for soil	NONE
ExtractMethod	Character	Extraction method for soil	NONE
%Moist	Single	Moisture content for soil	10.0
FinalResult	Single	Reported result	0.3
Flag	Character	Result qualifier	B, J, U, UB
EPAQual	Character	EPA qualifier	B, J, U, UB
MDL	Single	Method detection limit (lowest level and J flagged)	0.3
PRL	Single	Laboratory reporting limit	1
SpkAmt	Single	Spike amount for MS, MSD, and LCS samples	Any number
%Rec	Single	Percent recovered	Percentage
RPD	Single	Relative percent difference for duplicate analyses	Percentage
UpperLim	Integer	Upper control limit	Percentage
LowerLim	Integer	Lower control limit	Percentage
RPDLim	Integer	Control limit for RPD	Percentage
TestType	Character	Target or surrogate sample	TRG or SUR
FieldID	Character	Sample name or USGS gauge number	AY-68-27-611 for well or 08177700 for stream
State_well_number	Long integer	State well number	6827611
ClientName	Character	Name of client	Edwards Aquifer Authority
DateCollected	Date	Date collected	4/24/2002
TimeCollected	Time	Time collected	1:45:00 PM
DateReceived	Date	Date received	4/25/2002
ClientProjID	Character	Client project ID	Springs
ClientProjName	Character	Client project name	Springs
COCNum	Character	Chain of custody number	12345
RptBasis	Character	Dry or wet weight for soil	NA

Field	Field Type	Description	Valid Value
AnalItemTime	Time	Time of analysis	7:41:00 PM
AnalItemDate	Date	Date of analysis	4/25/2002
Suite	Character	Type of chemical	EXTRACTION, METALS, PESTICIDE, SVOC, VOC, WETCHEM
TIC	Integer	Indicates if TICs were detected	0 for no 1 for yes
CASNO	Character	CAS number for analyte	79-01-6
Source	Character	Name of analytical laboratory	STL-Corpus, STL-Austin, STL-Tallahassee, PCS, TWDB, USGS, document title and date

10. Water Level Table

The Water Level Table stores both tapedowns (manual measurements) and records from continuous recorders. The Authority collects water levels from monthly tapedowns, continuous recorders, synoptic surveys (three times a year), water sampling, and other projects. These programs generate about 300,000 water-level measurements each year based on a 15-minute measurement interval for the continuous recorders. Table 6 describes the fields in the Water-Level Table. Temperature and conductivity measurements may be stored in a separate table.

Table 6. Field Definitions for Water-Level Table

Field	Field Type	Description	Valid Value
State_well_number	Long integer	State well number	6827611
Depth	Single	Depth to water in feet and tenths of feet with up to two decimal places (up to four significant figures)	6.8 51.42 120.2 1,251
Corr_WL	Single	Depth to water corrected by tapedowns when the data were downloaded	6.8 51.42 120.2 1,251
Date	Date/Time	Date of measurement	mm/dd/yyyy

Field	Field Type	Description	Valid Value
Time	Date/Time	Time of measurement Hours and minutes are sufficient; seconds may be retained from continuous recorders.	hh:mm:ss in 24-hour format (13:57:54)
DT	Date/Time	Date + Time; key field with no duplicates	mm/dd/yyyy hh:mm:ss
Well_name	Character	Well name other than state well number	e.g., J-17
Temp	Single	Temperature in degrees Fahrenheit if measured	72.13
Cond	Single	Conductivity in µSiemens/cm if measured	652.27

Correction of Depth Measurements

Electronic drift, temperature changes, battery charge, and other factors affect the accuracy of depth measurements recorded by some continuous recorders. Consequently, the measurements are provisional until they have been corrected by tapedown measurements. The tapedowns are stored in a separate table in the database as shown in Table 7.

The database contains a visual basic program to correct the drift using the slopes of the lines between the tapedowns at the beginning and end of each recording period. At each download, the program calculates the slope between the current and previous tapedown measurements and adjusts the intervening electronic measurements. Spurious measurements taken when the instrument was out of the water or when the battery was weak are deleted. Figure 4 shows the depth correction and tapedowns for the hydrograph for well AY-28-19-806.

Table 7. Field Definitions for Tapedowns Table

Field	Field Type	Description	Valid Value
State_well_number	Long integer	State well number	6827611
Depth	Single	Depth to water in feet and tenths of feet with up to two decimal places (up to four significant figures)	6.8 51.42 120.2 1,251
Date	Date/Time	Date of measurement	mm/dd/yyyy
Time	Date/Time	Time of measurement Hours and minutes are sufficient; seconds may be retained from continuous recorders.	hh:mm:ss in 24-hour format (13:57:54)
Comments	Memo	Comments regarding the tapedown	

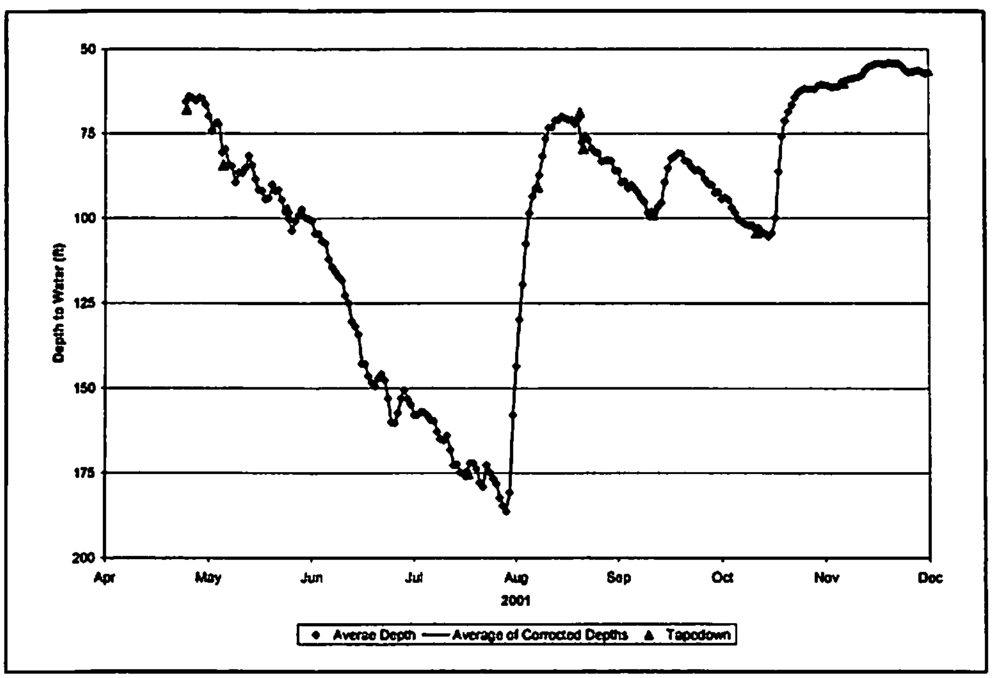

Figure 4. Hydrograph with Corrected Depths and Tapedowns

11. Implementation

This section describes the implementation of the data management plan. It covers the construction of the database, preparation of supporting plans, training, and periodic review and maintenance.

11.1. Implementation of the Database

The database will consist of commercial software with all current and historical water quality analyses and water level measurements. Acquisition of the database software will include evaluation, purchasing, uploading the Authority's data, periodic updates, and training. Several database software systems will be selected for consideration. They will be evaluated on the basis of the following characteristics in descending order of importance:

- Relevance to Authority data collection programs
- Ease of use
- Reporting capabilities (data tables, charts, maps, etc.)
- Testimonials from other users
- Flexibility of site license
- Price (purchase price, annual maintenance fee, and costs of associated software)
- Availability of help
- Analytical capabilities
- Availability of source code
- Ease of customization

If possible, a demo version of each database system will be obtained for hand-on testing.

After the database software has been acquired, all recent and historical data will be uploaded and checked. The Authority's analytical data resides in a variety of formats including:

- Authority spreadsheets and databases
- TWDB database
- USGS databases
- Laboratory files
- Other electronic or published data

Each data source has its own format of tables, records, and numbers, and they have to be converted to the EDD from STL-Corpus Christi, which will be the format of the commercial software. The principal fields that have to be reconciled are listed in Table 7 along with rules to follow for the conversion.

Table 7. Conversion Rules for Fields

Field	Rule
AnalRunID	If available
LabID	If available
QCTyp	Convert to LCD, LCS, MB, MD, MS, MSD, SB, SBD, or SMP

Field	Rule
IndTestName	Title case; no chemical symbol; isomers for organic compounds in lower case
AnalMethod	SW-846 8260B for SW-846; SM160 for Standard Methods;
QCBatchID	If available; BatchID for STL-Tallahassee
ColumnNum	If available
Matrix	WATER or SOIL
OrderNum	Lab job number
AnalDil	If available
FileName	If available
ReportUnit	mg/Kg, mg/L, MG/L CACO3, N/A, pH UNITS, ug/L
FinalResult	Enter with the same number of significant figures as lab reported
Flag	B, J, U, UB
EPAQual	Add after validation
MDL	Enter with the same number of significant figures as lab reported
PRL	Enter with the same number of significant figures as lab reported
SpkAmt	If available
%Rec	If available
RPD	If available
UpperLim	If available
LowerLim	If available
RPDLim	If available
TestType	If available
FieldID	AY-68-27-611 for well names or 08177700 for stream locations
State_well_number	Six digits or blank if no state well number
ClientName	Edwards Aquifer Authority
DateCollected	mm/dd/yyy format if available
TimeCollected	H:mm PM format
DateReceived	mm/dd/yyy format if available
ClientProjID	Not used
ClientProjName	Springs, Surface Water, Wells, NAWQA
COCNum	From chain of custody
AnalItemTime	If available
AnalItemDate	If available
Suite	METALS, PESTICIDE, SVOC, VOC, WETCHEM

Field	Rule
TIC	If available; 0 for no or 1 for yes
CASNO	Hyphenated format, e.g., 79-01-6
Source	STL-Corpus, STL-Austin, STL-Tallahasse, PCS, TWDB, USGS, or document title and date

Analytical data will be added to the database in a two-stage uploading process in which the data are imported into a temporary table (ScratchResults) for checking and subsequently moved to a permanent table (tblResults) after the data have been corrected. This is a technique to be sure that only data that meet the DQOs are entered into the permanent database.

11.2. Checking the Database Records

Every sample analysis in ScratchResults will be checked against the hard copy of the results from the laboratory. The database will generate a report in a format similar to the original for checking. Text-to-speech software may be used to facilitate checking. Text-to-speech software reads a text file of the sample results while the reviewer checks the original laboratory report. The reviewer will sign, date, and initial each page of the database reports after checking them.

After the database reports have been checked, the database administrator will revise the records with errors and sign and date the database reports. These will be filed to verify the accuracy of the database records.

11.3. Training

Training will be offered to everyone who is assigned to use the database. Preference will be given to server-based software so that everyone will have access to it. Training will consist of one or more sessions.

11.4. Database Access and Security

The database will be designed to facilitate access, while protecting the integrity of the data. Depending on the software, passwords or user identification will be used to grant privileges to users for specific tables and forms. The ability to make changes will be restricted to the database administrator. The following table lists the privileges for each class of user.

Class	Privileges
Public	Browse, run existing queries or forms by specifying dates, well names, or other criteria
Staff Member	As above plus create new queries
Restricted user	As above plus add sampling information to specific forms
Database administrator	As above plus add or change data, create new tables, alter the data schema

Ultimately, portions of the database will be accessible via the Authority's public web page. It will be protected by the Authority's firewall as well as access restrictions built into the database. It will consist of a limited number of forms for retrieving analytical results, time-series data, or other relatively simple queries. Public users will enter a well name, date, or other criteria to obtain the desired results. Eventually, the database also may be accessed through ArcIMS. A user would select an area to obtain a group of wells or sampling locations and then enter other criteria to define the desired data.

11.5. Preparation of Supporting Plans

This Plan will be supported and implemented by the following plans, which are in Appendices:

- Water quality sampling (see Figure 2)
- Water level measurements
- Precipitation measurements
- GPS Measurements
- Other plans may include geophysical logging, well inspection, and site inspections.

Each of the supporting plans will describe the DQOs, methodologies, and equipment required for data collection. For example, the water quality sampling plan will cover all activities in the data stream including preparation, decontamination, sample collection, transport, and documentation. The precipitation measurement plan will present the real-time network layout, instrumentation, and maintenance.

In addition, a Quality Assurance Project Plan (QAPP) will be prepared to cover all of the Authority's data collection programs. The QAPP presents in specific terms the policies, organization, functions, and quality assurance/quality control (QA/QC) requirements designed to achieve the data quality goals described in this Plan. The objective of the QAPP is to ensure all data produced by the Authority and its contractors are scientifically valid and defensible. It establishes the analytical protocols and documentation requirements to ensure the data are collected, reviewed, and analyzed in a consistent manner.

As each plan is completed, the Authority will train everyone who will implement the plans.

11.6. Periodic Revisions of the Plans

Each plan will be reviewed periodically and updated in response to problems, program changes, or technology improvements. For each review, the revisions will be documented, and a new plan will be issued. The revision date will be recorded in the revised plan.