CONCHO RIVER BASIN
Non-Point Source Abatement Project
WATERSHED PROTECTION PLAN DEVELOPMENT

Contract No. 04-13

QAPP Category Use II

Quality Assurance Project Plan

Prepared by the
Upper Colorado River Authority
OCTOBER 2004
Contact: Fred Teagarden, 512 Orient, San Angelo, TX 76903
325-655-0565

CONCHO RIVER BASIN WATERSHED PROTECTION PLAN
Quality Assurance Project Plan
Revision: #0

Prepared by the Upper Colorado River Authority
in cooperation With the Texas State Soil and Water Conservation Board

Upper Colorado River Authority
512 Orient Street
San Angelo, TX 76903

Non-Point Source Program
Texas State Soil and Water Conservation Board

Effective Period September 1, 2004 through August 31, 2007

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

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A1 APPROVAL PAGE
CONCHO RIVER Quality Assurance Project Plan

Upper Colorado River Authority

Jeffie H. Roberts, UCRA Board Chairperson	6.6.06 *Date*
Fred Teagarden, UCRA Project Coordinator/ Manager	6-6-06 *Date*
Chuck Brown, UCRA Project Quality Assurance Officer	6/6/06 *Date*
Larry Hauck, PhD, P.E. Texas Institute of Applied Environmental Research	6/9/06 *Date*
Ed Drake, SKG Laboratories	6/6/06 *Date*

Texas State Soil and Water Conservation Board

Aaron Wendt, Project Manager	6/12/06 *Date*
Donna Long, Quality Assurance Officer	6/12/06 *Date*

U.S. Environmental Protection Agency

Ellen Caldwell, NPS *Project Officer, USEPA R6*	8-9-06 *Date*
Donna Miller, State/Tribal Programs Section Chief, USEPA R6	8-9-06 *Date*

Note: The Planning Agency will secure documentation from each sub-tier project participant (e.g., subcontractors, other units of government, laboratories) stating the organization's awareness of and commitment to requirements contained in this quality assurance project plan and any amendments or revisions to this plan. The Planning Agency will maintain this documentation as part of the project quality assurance records, and will ensure that the document is available for review.

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LIST OF ACRONYMS

ACS	American Chemical Society
AWRL	Ambient Water Reporting Limits
BMP	Best Management Practices
BOD_5	5-Day Biological Oxygen Demand
CFS	Cubic Feet/Second
COC	Chain-of Custody
COSA	City of San Angelo
CRP	Clean Rivers Program
DMP	Data Management Plan
DQO	Data Quality Objective
EPA	Environmental Protection Agency
FY	Fiscal Year
LAN	Local Area Network
LCRA	Lower Colorado River Authority
MDL	Minimum Detection Limit
MDMA	Monitoring Data Management and Analysis
MGD	Million Gallons/Day
ml	milliliter
NIST	National Institute of Standards and Technology
NPS/UR	Non-Point Source Pollution Urban Runoff
N	Nitrogen
NH_3	Ammonia
NO_3	Nitrate
P	Phosphorus
QA	Quality Assurance
QAM	Quality Assurance Manuel
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QAS	Quality Assurance Specialist
QC	Quality Control
QMP	Quality Management Plan
RBP	Rapid Bio-assessment Protocol
RWA	Receiving Water Assessment
SOP	Standard Operating Procedure
SU	Standard Units (pH)
SWQM	Surface Water Quality Monitoring
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
TCEQ	Texas Commission on Environmental Quality
TPDES	Texas Pollution Discharge Elimination System
TPH	Total Petroleum Hydrocarbons
TRACS	Texas Regulatory and Compliance System
TSS	Total Suspended Solids
TSSWCB	Texas State Soil and Water Conservation Board

TSWQS	**Texas Surface water Quality Standards.**
UCRA	**Upper Colorado River Authority**
UR	**Urban Runoff**
USGS	**United States Geological Survey**
WMT	**Watershed Management Team**

A3 DISTRIBUTION LIST

1. Randall Rush
   EPA Project Officer
   Environmental Protection Agency
   NPS Program (6WQ-A)
   1445 Ross Avenue
   Dallas, TX 75202-2733

2. Kevin Wagner
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3. Fred Teagarden
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   San Angelo, TX 76903

4. Fred Campbell
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5. Chuck Brown
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   1122 S. Bryant
   San Angelo, TX 76903

7. Larry Hauck, PhD, P.E.
   Assistant Director of Environmental Sciences
   Texas Institute for Applied Environmental Research
   Tarleton University, Box T0410, Tarleton Station
   Stephenville, TX 76402

A4 PROJECT/TASK ORGANIZATION

1. Name: Randall Rush
   Title: EPA Project Officer
   Responsibilities: Overall administration of contract between TSSWCB and EPA specific of this project.

2. Name: Kevin Wagner
   Title: Project and Quality Assurance Manager, NPS Team
   Responsibilities: Oversight and management of TSSWCB NPS Program. Oversees the development of QA guidance for the NPS Team to be sure it is within pertinent frameworks of the TSSWCB. Reviews and approves all NPS Projects, Internal QA audits, corrective actions, reports, work plans, and contracts. Enforces corrective action, as required, where QA protocols are not met. Ensures that all TSSWCB NPS personnel are fully trained, and NPS projects are adequately staffed. Responsible for ensuring that the projects delivers data of known quality, quantity, and type on schedule to achieve project objectives. Provides the primary point of contact between the Lead Organization and the TSSWCB. Tracks deliverables to ensure tasks in the work plan are completed as specified in the contract. Performs technical review of the QAPP. Responsible for verifying that the Lead Organization follows the QAPP.

4. Name: Fred Teagarden
   Title: UCRA Project Coordinator/ Manager
   Responsibilities: Responsible for ensuring that tasks and other requirements in the contract are executed on time and with the quality assurance/ quality control requirements in the system as defined by the contract and in the QAPP; assessing the quality of subcontractor/participant work; submitting accurate and timely deliverables to the TSSWCB Project Manager; and coordinating attendance at conference calls, training, meetings, and related project activities with the TSSWCB. Responsible for verifying that the QAPP is followed by the Lead Organization and that the project is producing data of known and acceptable quality. Responsible for ensuring adequate training and supervision of all activities involved in generating analytical data, corrective action taken as well as facilitating internal audits

5. Name: Chuck Brown

Title: Lead Organization QA Officer; Data Manager

Responsibilities: Maintains official copy of QAPP with lead organization to include all current revisions/additions. Responsible for compliance of all sampling and field procedures to QAPP. Monitor the implementation of the QAM/QAPP within the laboratory to ensure complete compliance with QA objectives as defined by the contract and in the QAPP. Conduct in-house audits to identify potential problems and ensure compliance with written SOPs. Responsible for supervising and verifying all aspects of the QA/QC in the laboratory. Perform validation and verification of data before the report is sent to the contractor. Insures that all QA reviews are conducted in a timely manner from real-time review at the bench during analysis to final pass-off of data to the QA officer. Responsible for the acquisition, verification, and transfer of data to the TSSWCB. Oversees data management for the study. Performs data quality assurances prior to transfer of data to TSSWCB and project reports. Responsible for transferring data to the TSSWCB in the acceptable format. Ensures that the **database** management checklist is filled out and data submitted with appropriate codes and data. Provides the point of contact for the TSSWCB Project Manager to resolve issues related to the data.

7. Name: Ed Drake, SKG Labs

Title: SKG Organization Laboratory QA Officer

Responsibilities: Monitor the implementation of the QAM/QAPP within the laboratory to ensure complete compliance with QA objectives as defined by the contract and in the QAPP. Conduct in-house audits to identify potential problems and ensure compliance with written SOPs. Responsible for supervising and verifying all aspects of the QA/QC in the laboratory. Perform validation and verification of data before the report is sent to the contractor. Insures that all QA reviews are conducted in a timely manner from real-time review at the bench during analysis to final pass-off of data to the QA officer.

8. Name: Larry Hauck, PhD, P.E.

Title: TIAER, Director of Research

Responsibilities: Dr. Hauck will supervise TIAER contributions to the project, including WQ and hydrologic data review and analysis, assistance with paired watershed data collections and interim and final reporting preparation. Dr. Hauck will ensure that the tasks and other requirements in the contract are executed on time and with the quality assurance/quality control requirements in the system as defined by the contract and the QAPP.

A5 PROBLEM DEFINITION

The Concho River basin (*see Figures 1 & 2*) is currently experiencing a severe drought, as is most of West Texas. The four major reservoirs in the region are all currently below 20% of their designed total capacity. As the availably of water resources in this region declines, it is important to continue to conserve and protect the quality of this limited supply.

The Concho River basin lies within thirteen West Texas Counties and encompasses a watershed of approximately 4.5 million acres. Four major reservoirs, O.H. Ivie, O.C. Fisher, Twin Buttes and Lake Nasworthy, are located within the watershed boundaries. These reservoirs provide potable water (either wholly or in part), to approximately 500,000 residents. The streams and reservoirs of the Concho basin are also used for agricultural production and in power generation. The Concho River lies below San Angelo and enters O.H. Ivie Reservoir near Paint Rock, Texas. Several major streams converge above San Angelo to form the Concho River, which includes the North, South and Middle Concho Rivers, Spring Creek and Dove Creek *(see Figures 1 & 2)*. Many historical springs feed into the tributaries of the Concho River. The more environmentally sensitive aquatic habitats are commonly found at these locations. The Concho River (segment 1421) was placed on the 303(d) list (category 5c) for having impaired macro benthos communities in 2002. The O.C. Fisher Reservoir (segment 1425) was also listed for total dissolved solids and chlorides (also category 5c).

Numerous existing and potential sources of non-point source water pollution can be identified within the Concho River Basin. These include: urban runoff, feedlot waste, erosion from irrigated and non-irrigated cropland, on-site wastewater disposal, perennial stream flow loss, and rangeland/pastureland management. Stream segment 1421, (within the urban areas of San Angelo - primarily the North Concho River portion), has been the subject of a ten year BMP implementation program. Funding for this project has been provided by the EPA NPS/UR 319(h) program. Following the adoption of a NPS Urban Runoff Water Pollution Abatement Master Plan for the 4.75 mile stream reach of the North Concho through San Angelo the project has been highly successful in improving water quality and creating public education and outreach opportunities for the community. However, much of the San Angelo urban watershed (including the heavily industrialized Pulliam Draw portion) remains uncontrolled and it is suspected that substantial water quality impacts could occur downstream of San Angelo. Within the proposed project, the 1994 Master Plan will be updated and expanded to include additional high risk urban areas in San Angelo. Water quality complaint investigations and routine monitoring conducted through the Texas Clean Rivers Program in recent years have identified existing and potential water quality problems within the basin. These include diffuse salinity sources more than likely created by oil production facilities near the South Concho River, Dove Creek and in the North Concho River sub-basin. Confined animal operations and extensive cultivation in the watershed (segment1421) have been the focus of numerous special studies and investigations regarding nutrient enrichment and water quality degradation. An extensive and growing rural development within the basin, particularly areas of sensitive aquatic habitats near source springs, has also been recognized as posing considerable risk to the basin water resources. Other areas of extensive development have been documented as having impact on groundwater resources through poorly designed and aging on-site disposal systems. Two completed watershed restoration feasibility studies within the basin have provided considerable data and information regarding the influences of poor range management on basin water resources. A third study is currently underway on the Kickapoo Creek sub-basin and is being conducted by the United States Corp of Engineers under its' watershed restoration (206) program. It is apparent that the basin requires a comprehensive assessment and development of a non-point source pollution abatement plan to coordinate and prioritize efforts to address the problem.

A6 PROJECT/TASK ORGANIZATION

The project as described in *Appendix "A"* (workplan) is designed to evaluate and assess the potential cause of non-point source water pollution on a basin wide basis and to provide for the development of control strategies through a planning process. This will occur through the integration of water quality monitoring in addition to existing and on-going water quality monitoring programs, the development of additional surface and groundwater monitoring activities and the coordination of assessment activities with other entities in the region. The program will coordinate program elements with other entities, which includes the Texas State Soil and Water Conservation Board, Texas Water Development Board, Sterling County Underground Water Conservation District, U.S Geological Survey, Texas Institute for Applied Environmental Research and the City of San Angelo.

The Texas Clean Rivers Program and Colorado River Basin CRP partners (through the Upper Colorado River Basin Steering Committee and Coordinated Monitoring Program) will also be participants in the project through utilization of this forum in an advisory role. The proposed project contains the following elements:

1. Monitoring and Assessment
    - Continue North Concho Watershed Monitoring Program
    - Continue Paired Watershed Monitoring
    - Develop Surface and Groundwater monitoring within remaining basins
    - Integration and assessment of all other approved water quality data collected within the basin (from TCEQ)
    - Development and maintenance of approved QAPP

2. Public Information and Involvement
    - Press Releases, Public Meetings, etc.
    - Area agency coordination
    - Upper Colorado River Basin CRP Steering Committee
    - Upper Colorado River Basin Coordinated Monitoring

- Dissemination of project reports, etc.

3. Water Quality Assessment and Planning
    - Maintenance and analysis of accumulated water quality, hydrologic and hydrogeological data.
    - Assess existing and potential sources of Non-point source water pollution within basin
    - Identify, develop and evaluate alternative control strategies

4. Reporting
    - Provide Quarterly Project Reporting
    - Provide Watershed Protection Plan

The planning project will utilize all existing and previous water resource programs and develop additional data collection programs specifically designed to supplement these programs as related to non-point source issues within the basin. This includes all monitoring within the basin conducted under the coordinated monitoring protocols of the Texas Clean Rivers Program and/or previous data collections conducted under 319(h) approved QAPP's. Agencies involved in this program include the Texas Commission on Environmental Quality, United States Geological Survey, Lower Colorado River Authority, Colorado River Municipal Water District and Upper Colorado River Authority and all data collected under the program is found in the TCEQ water quality data base and 319(h) project files. All new data collections proposed will be developed under QAPP requirements of the program.

The analysis of water quality data and completion of field investigations will allow the creation of an inventory of existing and highly potential sources of NPS water pollution within the basin to include the location of "at risk" stream segments, potential and existing pollutant(s), existing effects and water quality conditions, and potential short term and long term effects. Utilizing the Upper Colorado River Basin Clean Rivers Program Steering Committee (made up primarily of basin stake holders), alternative structural and non-structural BMP's will be identified for each of the at risk stream segments. These alternatives will be screened with "best fit" solutions identified and prioritized on a basin wide basis. Following completion of this process, a watershed protection plan will be prepared which will include discussion and presentation of all project data collected and/or utilized, presentation of all output and processes involved in the identification of at risk stream segments and presentation of all output and processes involved in the identification and prioritization of NPS BMP's.

The schedule of project deliverables in shown *Appendix "A"* (workplan). It is anticipated that water quality data collection will begin immediately after January 1, 2005 and be completed by June 1, 2007.

Expedited Changes to the QAPP

Expedited changes to the QAPP may be necessary to reflect modifications in project organization, tasks, schedules, objectives, and methods; to improve operational efficiency; and to accommodate unique or unanticipated circumstances. Requests for expedited changes are directed in writing from the Upper Colorado River Authority Project Manager to the TSSWCB Project Officer. They are effective immediately upon approval by the TSSWCB Project Manager and the TSSWCB Quality Assurance Officer. Reasons for the changes will be documented and revised pages will be initialed by the TSSWCB Project Manager and Quality Assurance Officer and UCRA Project Manager. They will be distributed by the UCRA Project Manager and incorporated into the QAPP by way of attachment. Expedited changes to the QAPP will be made without a new signature page.

A7 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

The objectives of this project includes the collection and utilization of water quality data and other hydrologic information pursuant to the development of a watershed protection plan to mitigate existing and potential sources of non-point water pollution within the Concho River system. The majority of the monitoring represented by the QAPP is categorized as fixed and/or routine monitoring. The purpose of fixed and/or routine monitoring is to collect surface water quality data necessary for conducting water quality assessments. The proposed groundwater monitoring is also necessary for conducting water quality assessments. While sampling protocols differ, analytical and all other QAPP sample procedures are identical. Groundwater sampling protocols utilized in this QAPP requires the purging of three (3) well volumes prior to sampling. Appendix F identifies sample handling requirements and the measurement performance specifications to support project objectives and includes all water quality data currently collected by the UCRA. This includes all of the water quality data currently collected by the UCRA (as well as the current proposed parameters of this project). Appendix G includes the Laboratory Quality Assurance Manual (QAM).

Precision

The precision of data is a measure of the reproducibility of a measurement when an analysis is repeated. It is strictly defined as the degree of mutual agreement among independent measurements as the result of repeated application of the same process under similar conditions.

TIAER laboratory precision is assessed by comparing replicate analyses of laboratory control standards (LCS/LCSD) and/or sample/duplicate pairs. Performance limits for laboratory duplicates are defined in the Appendix F.

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

Bias

Bias is a statistical measurement of correctness and includes components of systemic error. A measurement is considered unbiased when the value reported does not differ from the true value. Bias is verified through the analysis of laboratory control standards and blank samples. Performance limits for the mean results of laboratory control standards (LCS/LCSD) and results of calibration control standards at laboratory reporting limits (RL's), the lowest concentration at which the laboratory will report quantitative data within a specified recovery range, are specified in Appendix F. Performance limits for blank analyses are discussed in Section B5.

Representativeness

Site selection and sampling of all pertinent media (liquid, slurry, and solids) and use of only approved analytical methods will assure that the measurement data represents the conditions at the site. Representativeness also depends on the number of samples taken to accurately reflect the technological effectiveness at a given site. The goal for meeting total representation for effectiveness of each technology is tempered by the potential funding for complete representativeness.

Comparability

Confidence in the comparability of data sets from this project to those for similar uses is based on the commitment of project staff to use only approved sampling and analysis methods and QA/QC protocols in accordance with quality system requirements and as described in this QAPP and project SOPs. Comparability is also guaranteed by reporting data in standard units, by using accepted rules for rounding figures, and by reporting data in a standard format.

Completeness

The completeness of the data is basically a relationship of how much of the data is available for use compared to the total potential data. Ideally, 100% of the data should be available. However, the possibility of unavailable data due to accidents, insufficient sample volume, broken or lost samples, etc. is to be expected. Therefore, it will be a general goal of this project that 90% data completion is achieved. Should less than 90 percent data completeness occur, the Laboratory Manager will initiate corrective action. Data completeness will be calculated as a percent value.

A8 SPECIAL TRAINING REQUIREMENTS/CERTIFICATIONS

Existing UCRA field staff are trained and periodically updated in the proper techniques. Any new field personnel utilized will receive training in proper sampling and field analysis. Before actual sampling or field analysis occurs, they will demonstrate to the QA officer (in the field), their ability to properly calibrate analysis equipment and perform field sampling and analysis procedures. The QA officer will sign off each sample in their field logbooks. Laboratory analysis will be performed by SKG Laboratories. that participates in a comprehensive quality assurance program and is periodically audited.

A9 DOCUMENTATION AND RECORDS

Documentation of this project will consist of quarterly progress reports, the Concho River Watershed Protection Plan, and a final report that includes a summary of all accumulated data, project activities, and findings and a formal technical summary of the project for technology transfer distribution. Chain of custody and sample data report sheets are included Appendix C & D of this report. Field data will be recorded on the sample data report sheet (including observations) that will accompany samples from the field to the laboratory.

All formal documents prepared during this project are considered project deliverables and include the following: Quarterly reports, meeting records, QAPP, Watershed Protection Plan, news releases, and final reports.

Technical documents retained include all laboratory records, field journals, sample forms, COC and including any photographic records.

All major documents and records relevant to this QAPP will be retained in the offices of the Upper Colorado River Authority for a minimum of ten (10) years. Retention times for other documents and records may vary. See the following chart:

Document/Record	Location	Retention	Form
QAPP, Amendments & Appendices	TSSWCB/Contractor	10 years	Paper & Electronic
QAPP Distribution Documentation	Contractor	5 years	Paper
Field Notebooks or Data Sheets	Contractor	5 years	Paper
Field Equipment calibration/maint. logs	Contractor	5 years	Paper
Chain of Custody Records	Contractor	5 years	Paper
Laboratory Records & Reports	Contractor	5 years	Paper

Back-up Plan for Electronic Plans – Distribution of QAPP

All electronically stored water quality data is transmitted to a minimum of two (2) UCRAW computes and immediately placed on disk for storage in a secure location. In addition all water quality data as processed will be placed on the UCRA website. The UCRA Quality Assurance Officer (Chuck Brown) is responsible for QAPP distribution to the identified parties.

B1 SAMPLING PROCESS DESIGN

See "*Appendix B*" for sampling process design information and monitoring tables associated with data collected under this QAPP. See *Figures 1-8* for location of all sampling and investigative activities.

B2 SAMPLING METHODS

Field Sampling Procedures
Field sampling will be conducted according to procedures documented in the TCEQ Surface Water Quality Monitoring Procedures Manual and consistent with appendix B of this document. Groundwater monitoring will occur consistent with the documents cited and descriptions contained in section A7 above.

Matrix, Container Types, Preservation, Sample Volume and Holding Times
Requirements for individual parameters or groups of constituents are shown on table in Appendix F. Preservation of samples is performed within 15 minutes of sample collection.

Sample Containers
Disposable sample containers are purchased for conventional parameters and are used for sampling by the UCRA (*see Appendix "G")*

Processes to Prevent Contamination
Procedures outlined in the TCEQ Surface Water Quality Procedures Manual outline the steps necessary to prevent contamination of samples. The include direct collection into sampling containers, when possible; clean sampling techniques for metals; and certified containers for organics. Field QC samples are collected to verify that contamination has not occurred.

Documentation of Field Sampling Activities
Field sampling activities are documented on field data sheets as presented in appendix C. Flow worksheets, field books and records of bacteriological analysis are also a part of the field record. The following will be recorded for all site visits: Station ID; Location; Sample time and date; depth; Collectors name & signature; values for all field parameters; sample preservatives; detailed observational data (weather, water appearance, days since rainfall, flow severity); other observational data.

Deficiencies, Nonconformance and Corrective Action Related to Sampling
Deficiencies are defined as unauthorized deviations from procedures documented in the QAPP or other applicable documents. Non-conformances are deficiencies, which affect quality and render the data unacceptable or indeterminate. Deficiencies related to sampling method requirements include, but are not limited to, such things as improper

sample container, volume and preservation variances, improper/inadequate storage temperature, holding time excursions, and sample site adjustments.

Deficiencies are documented in logbooks, field data sheets, etc. by field or laboratory staff and properly reported. The QAO will initiate a Nonconformance Report (NCR) to document the deficiency. The QAO in consultation with the project manager and the TSSWCB QAO will determine if the deficiency constitutes a nonconformance. If it is determined the activity or item does not affect data quality, and therefore, is not a valid nonconformance, the NCR will be completed appropriately and closed. If it is determined that a nonconformance does exist, the project manager and QAO will determine the disposition of the nonconforming activity or item and the necessary corrective actions. The results will be documented by the QAO by completion of a Corrective Action Report.

B3 SAMPLING HANDLING AND CUSTODY PROCEDURES

Chain-of-Custody

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

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

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

Sample Labeling

Samples are marked on a label with an indelible marker. Label information includes site identification, the date and time of sampling, and preservatives added if applicable. An example is included in *Appendix C*.

Sample Handling

Samples will be taken from various water body types.. Bottles will be clearly labeled at the site and information entered in a field log of samples collected per event. Samples will be kept on ice during sample events. Samples will be refrigerated and ammonia samples will be acidified as soon as possible. Since BOD_5 is the most time-sensitive parameter to be tested, samples for BOD_5 analysis will be transported to the laboratory the same day as collected and analyzed as soon as possible (recommended within six (6) hours, but at least within forty-eight (48) hours which is the regulatory maximum holding time). Samples will be logged into the laboratory with a unique sample number, date and time of collection, name of collector, and collection location. The laboratory director shall be responsible for ensuring analysis within acceptable holding times.

- **Field measurements (no sample required):**
  Samples analyzed by direct measurement will be identified by location, time, date, and analyst in a field logbook. Conductivity, pH, Dissolved Oxygen, and Temperature will be taken. Flow will be calculated from depth, stream profile and velocity measurements and/or pipe/weir calculations.

- **Laboratory Samples:**
  Samples taken for laboratory analysis will be identified by location, time, date and sampler's initials in a field log book. Samples will be accompanied by a chain-of custody form detailing sample identifying information, signature blocks for sample receipt and delivery, and analysis parameters for each sample. Sample containers will also be labeled (please see COC and sample labels in Appendix C & D).

Failures in Chain-of-Custody and Corrective Action
All failures associated with chain-of-custody procedures are immediately reported to the UCRA Project Manager. These include such items as delays in transfer resulting in holding time violations; violations of sample preservation requirements; incomplete documentation, including signatures; possible tampering of samples; broken or spilled samples, etc. The UCRA Project Manager will determine if the procedural violation may have compromised the validity of the resulting data. The UCRA Project Manager, in consultation with the UCRA QAO, will decide how the issue will be resolved based on best professional judgment and inform the staff. Possible courses of action include, document and proceed; redo the entire sampling event; or selectively analyze the samples. The resolution of the situation will be transmitted to the TSSWCB in the quarterly progress report. If data quality is compromised, affected data will not be reported to TSSWCB.

B4 ANALYTICAL METHODS REQUIREMENTS

The analytical methods and associated matrices are listed in Appendix F. The analyses cited in the table are EPA approved methods as cited in the CRP Program Guidance and in 40 Code of Federal Regulations, Section 136, Part B. Copies of laboratory SOP's are retained by the UCRA and are available for review by the TSSWCB. Laboratory SOP's are consistent with EPA requirements as specified in the method.

Field monitoring and laboratory equipment to be utilized by the UCRA staff involves the following:

1. Field WQ monitor – HydroLab Quanta, multi-probe, w/100' cable
2. Field WQ monitor – HydroLab Mini-Sonde, multi-probe (capable of un-attended monitoring)
3. Flow measurement – Marsh McBirney, Inc Flow Mate
4. Idexx – E Coli Enumeration System
5. Bacteriological Incubator – Precision Serial No. 604051796

All equipment used by the Contract laboratory is consistent with the analytical methods identified in *Appendix "F"*

Standards Traceability

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

Alternative Methodologies

Only data collected under approved analytical methodologies as specified in this QAPP will be submitted to the TSSWCB. Requests for alternative methodologies (modifications of EPA approved methods, new methods, etc.) will be submitted in writing for approval to the UCRA Project Manager. Approval by the TSSWCB will be denied or granted based on notification and consultation with U.S.E.P.A. Project staff and may involve equivalency testing, etc. Amended work will only begin after the modified procedures have been approved.

Failures or Deviations in Analytical Method Requirements and Corrective Actions

Failures in field and laboratory measurement systems involve but are not limited to such things as instrument malfunctions, failures in calibration, blank contamination, QC sample problems, etc. In many cases, the field technician or lab analyst will be able to correct the problem. If the problem is resolvable by the field technician or lab analyst, then they will document the problem on the field data sheet or laboratory record and complete the analysis. If the problem is not resolvable, then it is conveyed to the respective supervisor, who will make the determination. If the analytical system failure compromises the sample results, the data will not be reported to the TSSWCB as part of this study. The nature and disposition of the problem is reported on the data report, which is sent to the UCRA Project Manager. The UCRA Project Manager will include this information on the Quarterly Report, which is sent to the TSSWCB.

B5 QUALITY CONTROL REQUIREMENTS

Internal quality control consists of at least seven elements:

1) Certification of Operator Competence – For this study, demonstration of acceptable single-operator precision and bias is sufficient. Make a minimum of four replicate analyses of an independently prepared check sample having a concentration between 5 and 50 times the method detection limit (MDL) for the analysis. The precision of low-level duplicates should be plus or minus 25%, high level duplicates should be plus or minus 10%.

2) Recovery of Matrix Spikes – recovery of matrix spikes will be used to verify the absence of matrix effects. Make the known addition between 5 and 50 times the MDL or between 1 and 10 times ambient level which ever is greater. If duplicates are also being analyzed, the sum of the duplicates and known additions should equal at least 10% of the samples (see percent recovery calculations in this section).

3) Analysis of Externally Supplied Standards – As a minimum, analyze externally supplied standards whenever analysis of known additions does not result in acceptable recovery or once each day, whichever is more frequent. Use laboratory control standards with a concentration between 5 and 50 times the MDL or near sample ambient levels whichever is greater. Where possible, use certified reference materials as laboratory control standards. National Institute of Standards and Technology (NIST) Standard Reference Materials are preferred, if available. If internal reference materials are used, prepare high level standard should be within plus or minus 10%.

4) Analysis of Reagent Blanks – Analyze reagent blanks whenever new reagents are used and as often as required in specific methods. Analyze a minimum of 5% of the sample load as reagent blanks; this monitors purity of reagents and the overall procedural blank. Analyze a reagent blank after any sample with a concentration greater than that of the highest standard that might result in carryover from one sample to the next.

5) Calibration with Standards – As a minimum, measure three different dilutions of the standard when an analysis is initiated. Subsequently, verify the standard curve daily by analyzing one or more standards within the linear range, as specified in the individual method. Reportable analytical results are those within the range of the standard dilutions used. Do not report values above the highest standard unless an initial demonstration of greater linear range has been make, no instrument parameters have been changed, and the value is less than 1.5 times the highest standard. The lowest reportable value is the MDL, provided that the lowest calibration standard is less than 10 times the MDL. If a blank is subtracted, report the result even if it is negative.

6) Analysis of Duplicates (field splits) – When most samples have measurable levels of the constituent being determined, analysis of duplicate samples is effective for assessing precision. Analyze 10% or more of the samples in duplicate. Analyze duplicates and known additions in matrices representative of the samples analyzed in the laboratory. Precision of low level duplicates should be within plus or minus 25%, high level duplicates should be plus or minus 10%.

7) Control Charts – Control charts should be kept which includes a means chart for laboratory control standards or calibration check standards, a means chart for background or reagent blank results, and a range chart for replicate analyses.

8) Field Blanks – Field blanks will be analysed to assess potential bias of field samples. One field blank per 10% of the total samples collected will be delivered to the laboratory for analysis. Analytical results indicating constituient concentrations in excess of detection limits will determine excursion from acceptable limits.

The laboratory employs a continuous evaluation of its performance for each method and matrix. Precision of analyses will be determined by repeating the entire analysis of a sample per batch. If the method requires more stringent quality control procedures the method requirements will be followed. If X1 and X2 are the values determined by the duplicate analyses, then the percent deviation is calculated using the formula:

$$\% \text{ Deviation} = [\text{Absolute Value } (X_1 - X_2)/(X_1 + X_2)]*100$$

Accuracy of an analysis process will be monitored by determining the percent recovery of a spike quantity of the parameter in question added to a portion of an actual sample and then determined by analysis. This will be performed at a rate of 10%. If the method requires more stringent quality control procedures, the method requirements will be followed. If SSR is the spiked sample result, SR is the sample un-spiked result, and SA is the spike added, then the percent recovery is calculated using the formula:

$$\% \text{ Recovery} = [(SSR - SR)/SA]*100$$

The percent deviation and the percent recovery of individual analyses have only limited value. The laboratory will combine the information of 20 or more determinations of precision and accuracy and establish quality control charts with upper and lower control limits (±3 Standard Deviation) for each parameter. Completeness is calculated as a percent value. In the following equation, ST is the total number of samples collected and SV is the number of samples with a valid analytical report.

$$\% \text{ Completeness} = 100\ (SV/ST)$$

The QA/QC program will be used as the quality control guideline for analytical performance, equipment maintenance, sample handling, data generation, documentation, records and reporting and will be updated as analytical performance and procedures change in order to keep current with actual laboratory practices.

For description of AWRL, please see *Appendix "F"*.

B6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION AND MAINTENANCE REQUIREMENTS

All sampling equipment testing and maintenance requirements are detailed in the *TCEQ Surface Water Quality Monitoring Procedures Manual, Most Recent Revision.* Sampling equipment is inspected and tested upon receipt and is assured appropriate for use. Equipment records are kept on all field equipment and a supply of critical spare parts is maintained.

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

B7 INSTRUMENT CALIBRATION AND FREQUENCY

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

Detailed laboratory calibrations are contained within the QAM(s). The laboratory QAM identifies all tools, gauges, instruments, and other sampling, measuring, and test equipment used for data collection activities affecting quality that must be controlled and, at specified periods, calibrated to maintain bias within specified limits. Calibration records are maintained and are available for inspection by the TSSWCB. Equipment requiring periodic calibrations includes, but is not limited to, thermometers, pH meters, balances, incubators, turbidity meters, and analytical instruments. Calibration records are available to the TSSWCB for review.

B8 INSPECTION/ACCEPTANCE REQUIREMENT FOR SUPPLIES AND CONSUMABLES

Sample bottles shall be new and appropriately sized to meet analytical needs. Sample container types shall be consistent with the parameter analysis and standard methods. Reagents for analysis and calibration shall be at least ACS grade. The UCRA QAO is responsible for inspection /acceptance of supplies and consumables.

B9 DATA ACQUISITION REQUIREMENTS

Non-direct measurement data that will be used in this study include TCEQ stream monitoring data, stream flow data from USGS, and other data obtained from government funded studies conducted under approved work plans. Each of these data sets was collected in accordance with the particular agency's QA procedures and meets the acceptance criteria of this study. It is likely that any public input will be subjective in nature and will not be used as critical decision criteria. The UCRA is a Colorado River Basin Clean Rivers Program partner and has been involved in the collection and screening of water quality data that is available for the Concho River Basin.

B10 DATA MANAGEMENT

Data Management Protocols are addressed in the Data Management Plan, which is in *Appendix E* of the document.

C1 ASSESSMENTS AND RESPONSE ACTIONS

Assessments will be conducted at the end of each monitoring session. The QA/QC Officer will interview sample collections staff to ensure acceptance of the data collected and that the monitoring plan was properly conducted. Any non-conforming conditions that are discovered will be reported to Mr. Chuck Brown who will be responsible for the determination, implementation, and documentation of the proper response action. The TSSWCB may also conduct a field review to confirm procedures. All documentation is subject to review by the TSSWCB at any time applicable to the QAPP.

This table may not be all-inclusive of assessment activities being conducted. The types of assessments detailed in this section are generally not considered to be internal QA functions, such as data validation.

Assessment Activity	Approximate Schedule	Responsible Party	Scope	Response Requirements
Status Monitoring Oversight, etc.	**Continuous**	***Planning Agency***	**Monitoring of the project status and records to ensure requirements are being fulfilled**	**Report to TSSWCB in Quarterly Report**
Monitoring Systems Audit	***Dates to be determined by TSSWCB***	**TSSWCB**	**Field sampling, handling and measurement; facility review; and data management as they relate to project**	**30 days to respond in writing to the TSSWCB to address corrective actions**
Monitoring Systems Audit/Lab Inspection (on participants as applicable)	***Dates to be determined by the Planning Agency***	***Planning Agency***	**Field sampling, handling and measurement; facility review; and data management as they relate to project**	***Fill in as appropriate***
Lab Performance Evaluation Samples	**Annually**	**EPA *(these samples may also be supplied commercially)***	**Check competency of the laboratory to perform analyses**	**Report problems to the TSSWCB in Progress Report**

Corrective Action

UCRA Project Manager is responsible for implementing and tracking corrective action procedures as a result of audit findings. Both TSSWCB and UCRA Project Managers maintain records of audit findings and corrective actions.

Sources of Corrective Actions:

Corrective actions procedures could come about from several sources including the following:

a) Planning agency (UCRA) review of field activities, laboratory performance or internal practice.
b) TSSWCB records review or annual project audit of planning agency.
c) EPA performance evaluation samples to check competency of the Laboratory to perform analysis.

Documentation:

Corrective action procedures will be documented by correspondence from agency initiating procedures to all parties identified under A3 Distribution List.

Line of Communication:

Corrective action requests and procedures verification will follow general lines of communication consistent with the project organizational chart.

Follow-up:

Corrective action requests should include instructions, descriptions, and deadline pertinent to the request. These deadlines will be established by the planning agency (UCRA) into a project "tickle" system for immediate follow-up.

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

C2 REPORTS TO MANAGEMENT

Documentation of the project will consist of quarterly progress reports, the Watershed Protection Plan, a final report that will include a summary of all accumulated data, project activities, and findings, and a formal technical summary of the project for technology transfer distribution.

D1 DATA REVIEW, VERIFICATION, AND VALIDATION

All data obtained from field and laboratory measurements will be reviewed and verified for integrity and continuity, reasonableness, and conformance to project requirements, and then validated against the data quality objectives are listed in Section A7. Only those data supported by appropriate quality control data and meet the data quality objectives defined for this project will be considered acceptable.

The procedures for verification and validation of data are described in Section D2, below. Chuck Brown is responsible for ensuring that field data are properly reviewed, verified, and submitted in the required format to the project database. Likewise, the Laboratory Manager of SKG Laboratories, San Angelo is responsible for insuring that laboratory data is reviewed, verified, and submitted in the required format to the project database. Finally, Mr. Fred Teagarden is responsible for validating that all data collected meet the data quality objectives of the project and are suitable for reporting to TSSWCB.

D2 VERIFICATION AND VALIDATION METHODS.

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

Verification of data will be performed using self-assessments and peer review, as appropriate to the project task, followed by technical review by the manager of the task. The data to be verified (listed by task in Table D.1) is evaluated against project specifications and are checked for errors, especially errors in transcription, calculations, and data input. Potential outliers are identified by examination for unreasonable data, or identified using computer-based statistical software. If a question arises or an error or potential outlier is identified, the manager of the task responsible for generating the data is contacted to resolve the issue. Issues that can be corrected are corrected and documented electronically or by initialing and dating the associated paperwork. If an issue cannot be corrected, the task manager consults with higher level project management to establish the appropriate course of action, or the data associated with the issue are rejected.

The Planning Agency Project Manager is responsible for validating that the verified data are usable and reportable to TSSWCB. One element of the validation process involves evaluating the data again for anomalies. The manager of the task associated with the data, before data validation can be completed must address any suspected errors or anomalous data.

A second element of the validation process is consideration of any findings identified during the annual monitoring systems audit conducted by the TSSWCB Quality Assurance Specialist assigned to the project. Any issues requiring corrective action must be addressed, and the potential impact of these issues on previously collected data will be assessed. Finally, Mr. Fred Teagarden validates that the data meet the data quality objectives of the project and are suitable for reporting to TSSWCB.

Table D.1

Data to Be Verified	Field Task	Laboratory Task	Database Task
Collection and analysis techniques consistent with SOPs and QAPP	✓	✓	
Sample documentation complete	✓	✓	
QC samples collected and analyzed at required frequencies	✓	✓	
QC samples within acceptance limits	✓	✓	
Chain of Custody	✓	✓	
Sample preservation and handling	✓	✓	
Sample identifications	✓	✓	✓
Holding Times	✓	✓	
MAL's		✓	
Instrument calibration data	✓	✓	✓
Measurement Results	✓	✓	
Calculations	✓	✓	
Data entered in required format	✓	✓	✓
TNRCC ID number assigned			✓
Valid STORET codes			✓
Absence of Transcription Error	✓	✓	✓
Source Codes, 1, 2, & 3 used correctly			✓
Reasonableness of Data		✓	✓
Electronic Submittal Errors			✓
Sampling & analytical data gaps	✓	✓	✓

D3 RECONCILIATION WITH DATA QUALITY OBJECTIVES

No decisions will be made by the project team based on the data collected. These data, and data collected by other organizations (e.g., USGS, TCEQ, etc.), will be subsequently analyzed and used by the UCRA in preparation of the Concho River Watershed Protection Plan.

FIGURES

Figure A-4
ORGANIZATIONAL CHART

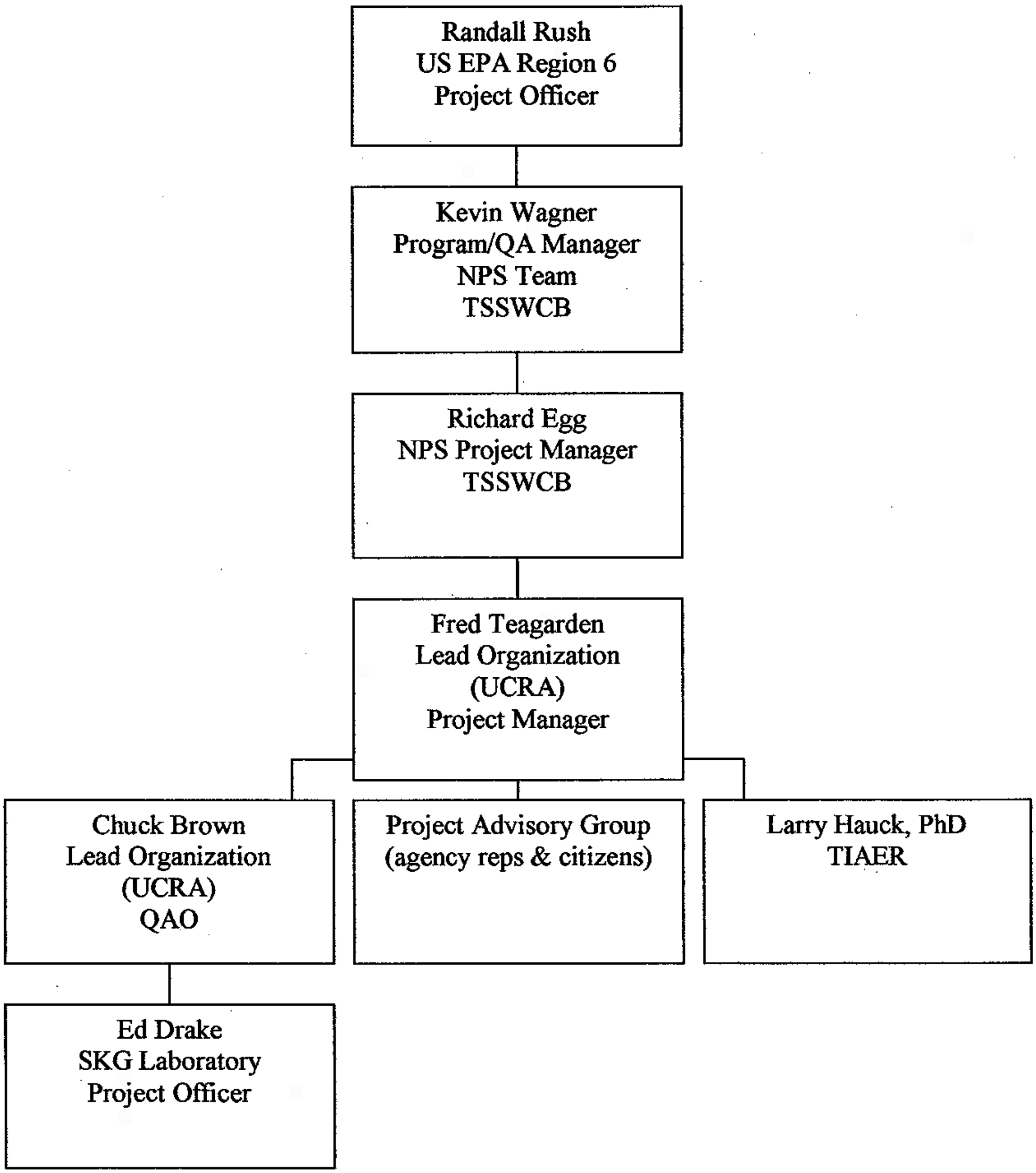


Figure 1

Basin Location Map

Concho Basin within Colorado Basin.

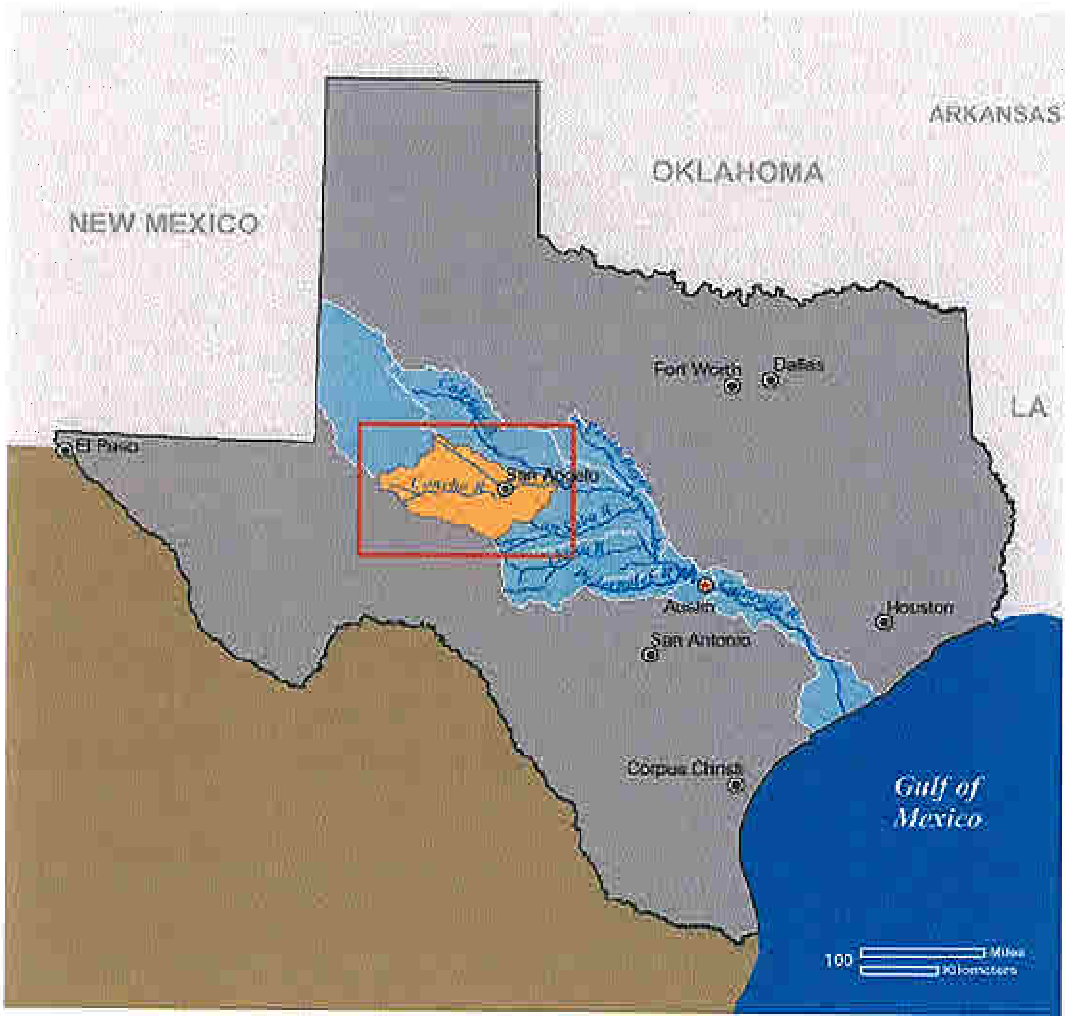


Figure 2

Concho River Basin

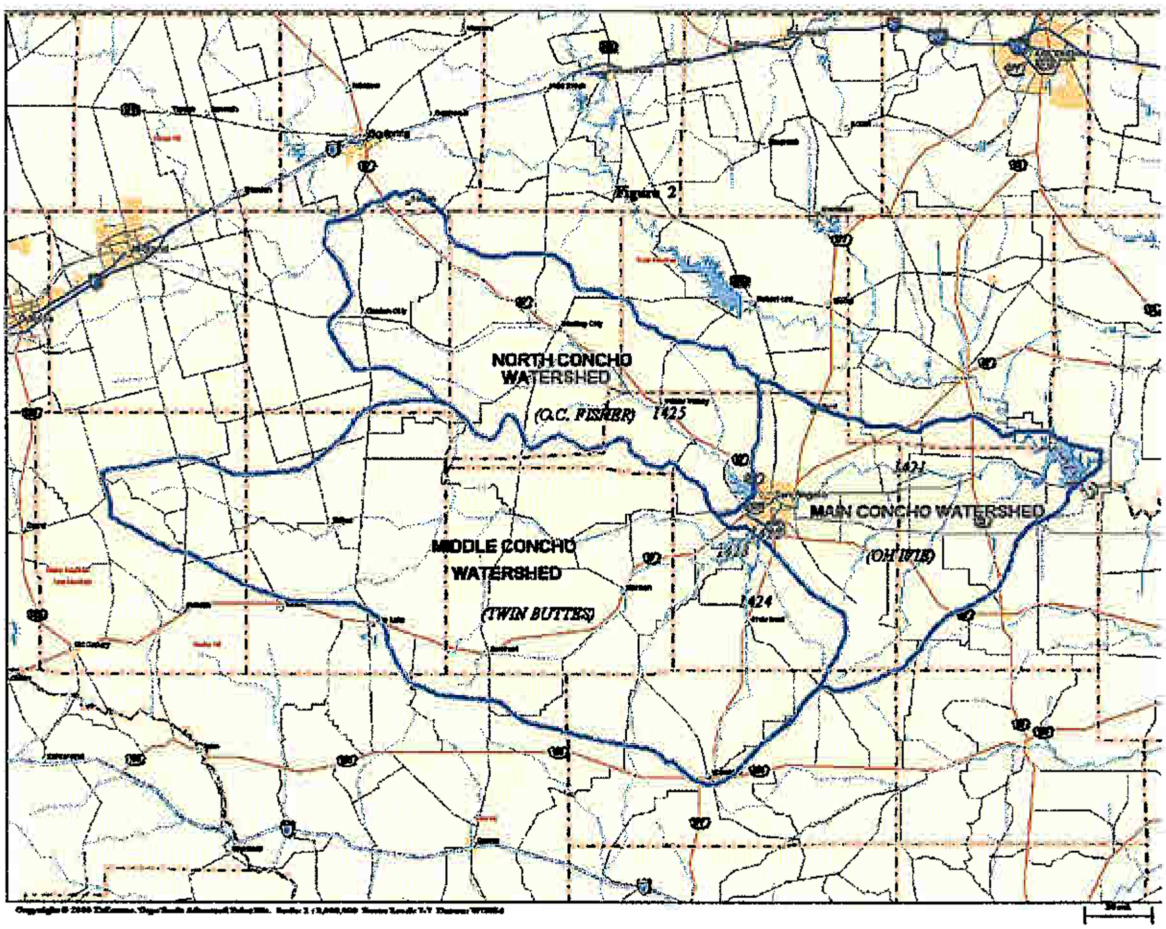


Figure 3

Clean Rivers Program Monitoring Sites

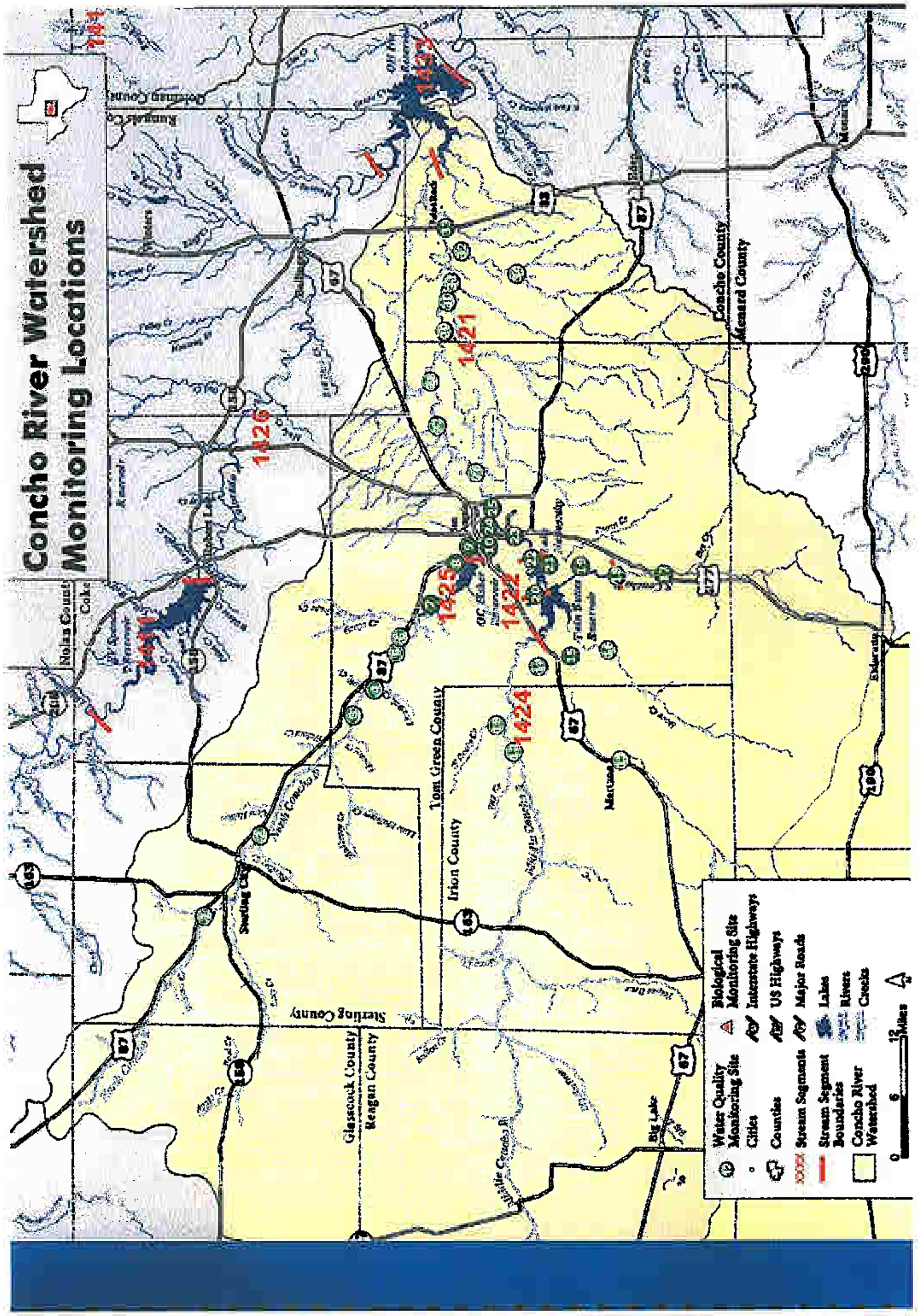


Figure 4

Paired Watershed Sites

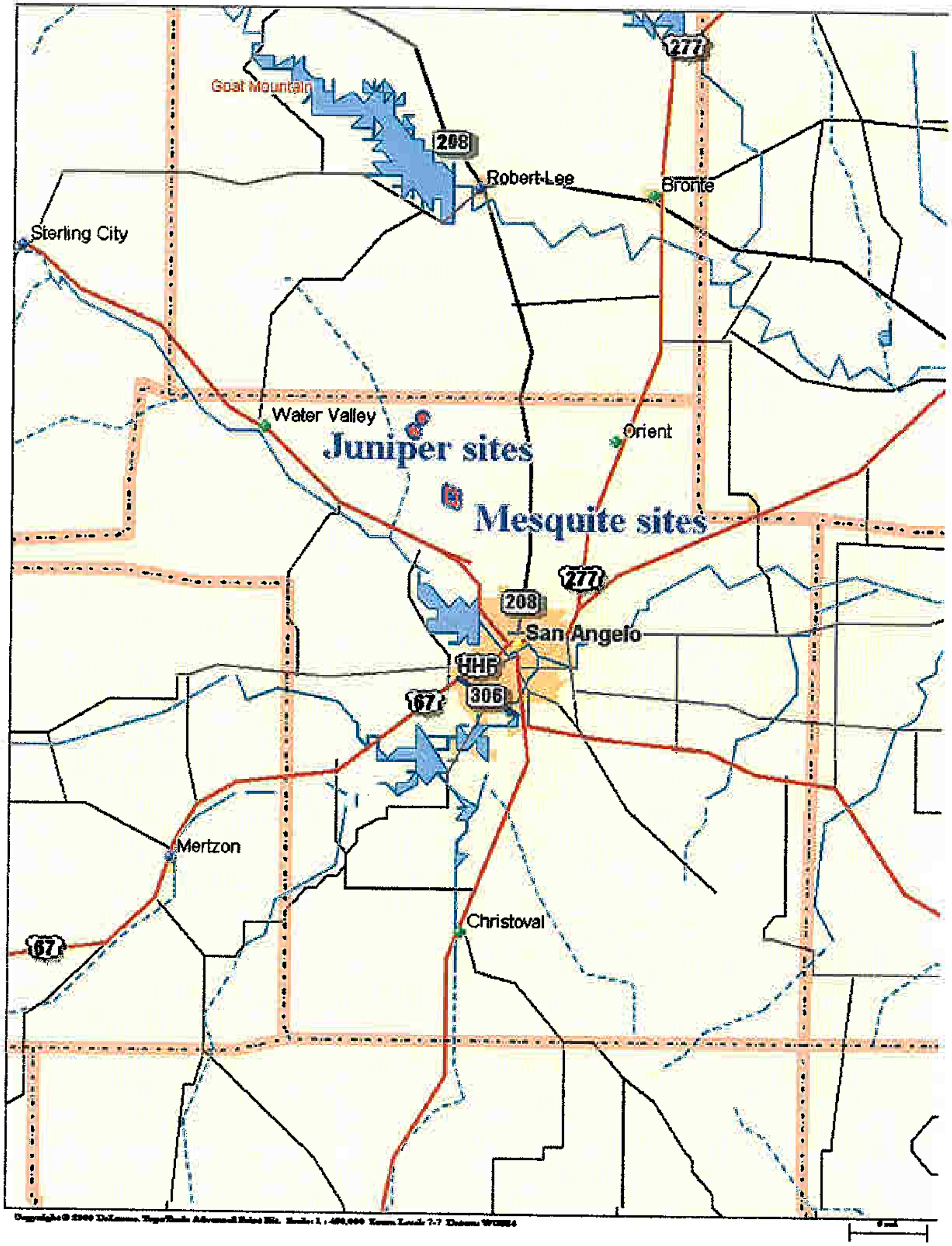


Figure 5

Urban Runoff Sample Sites

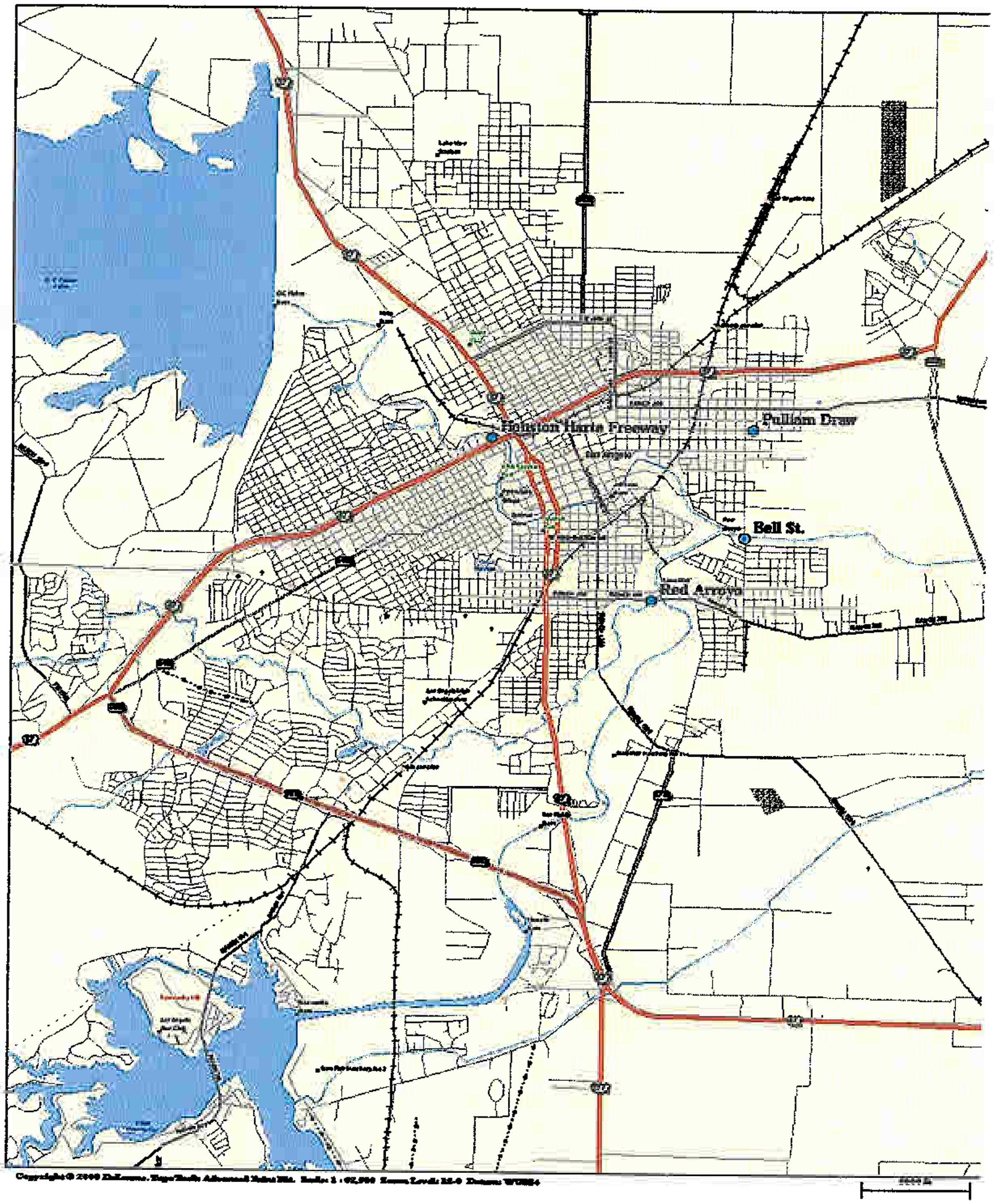


Figure 6

Agricultural NPS Sites

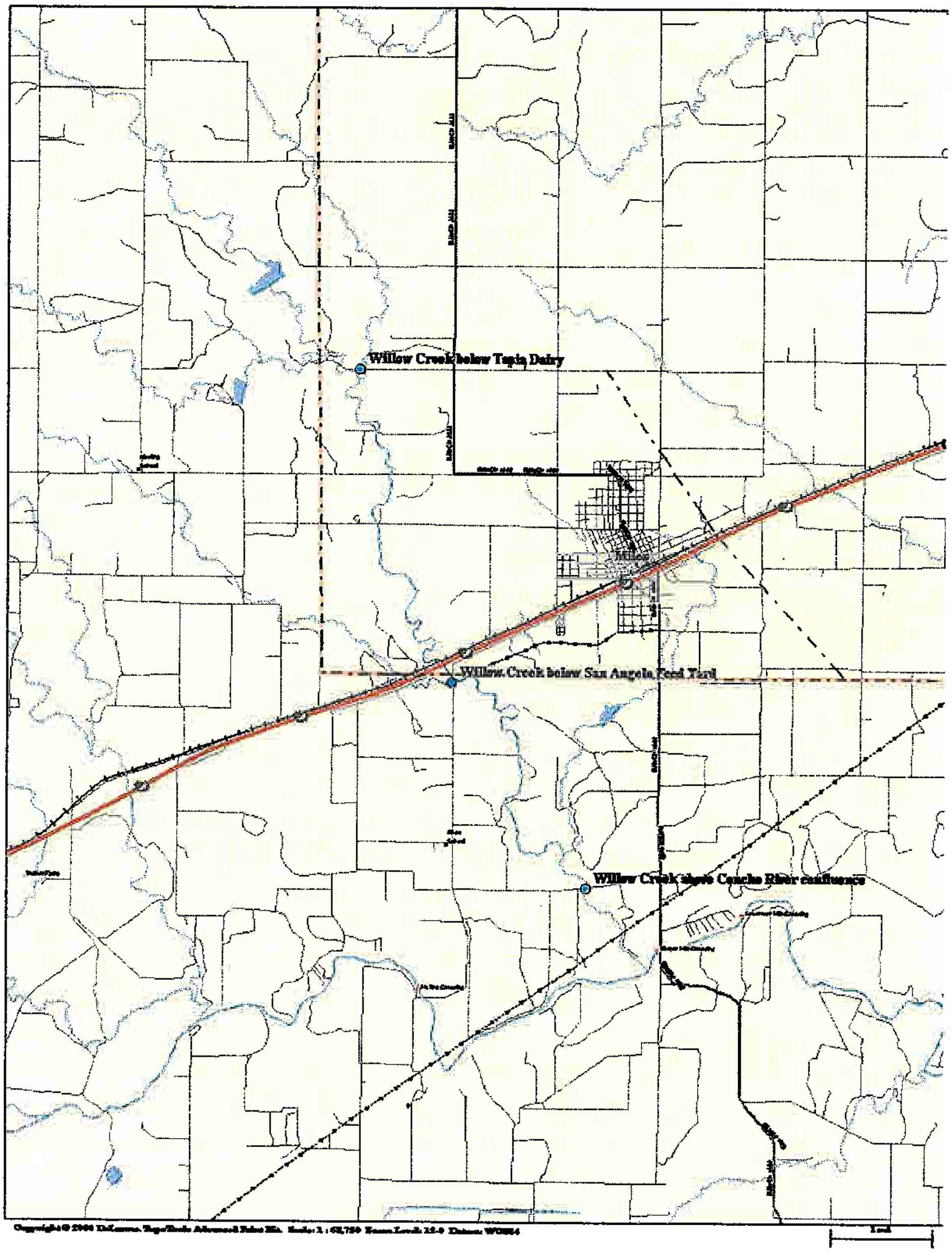


Figure 7

South Concho River Sample Sites

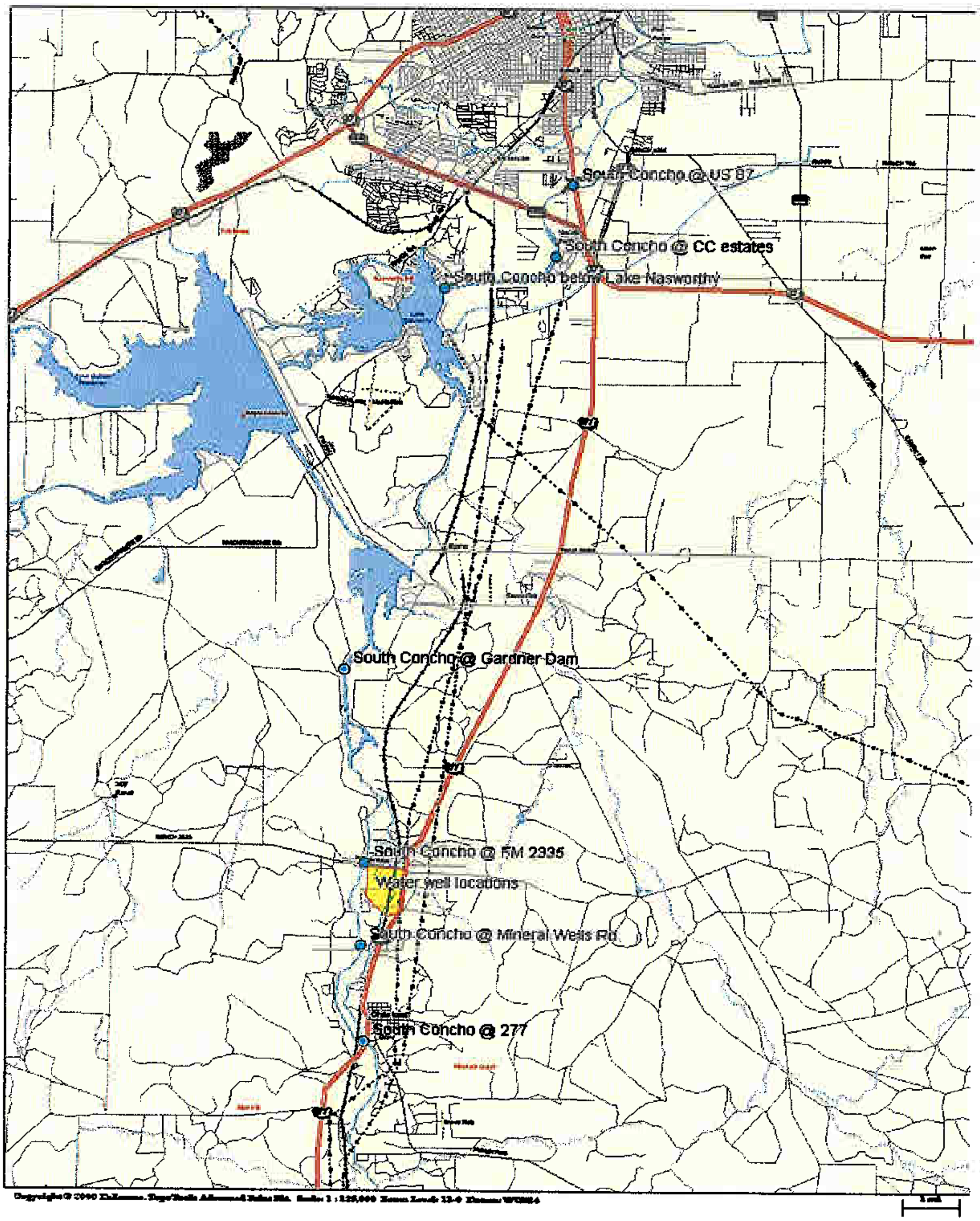
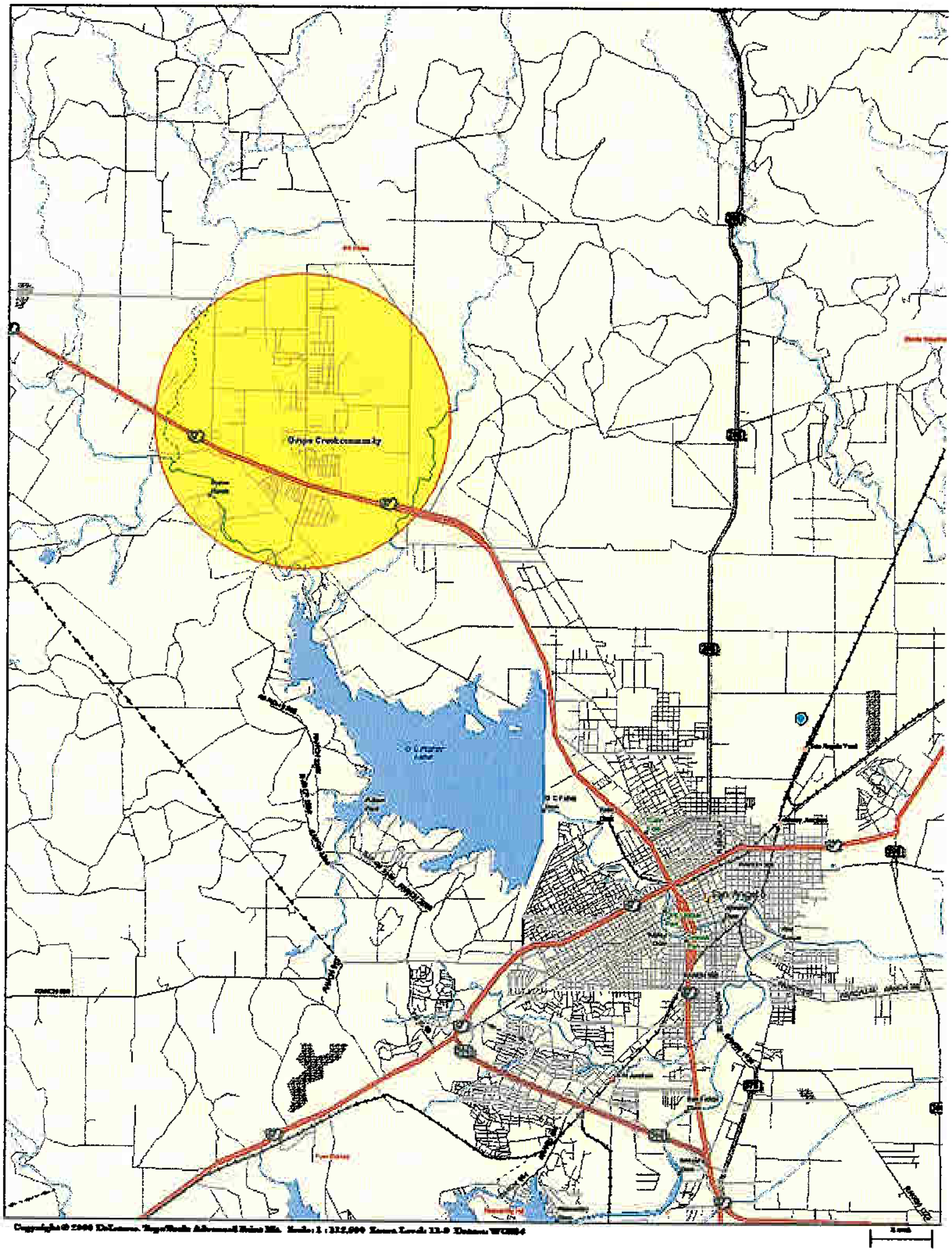


Figure 8

On-Site Disposal Evaluation Area



APPENDIX A
PROJECT WORK PLAN

APPENDIX A - PROJECT WORK PLAN

Development of a Watershed Protection Plan for the Concho River Basin
Texas State Soil and Water Conservation Board
Project #04-4

Nonpoint Source Summary Page

September 1, 2004 – August 31, 2007

1. Title of Project: Development of a Watershed Protection Plan for the Concho River Basin
Project Goals/Objectives: This project will provide an assessment of existing and potential water quality threats related to on-going non-point source (NPS) water pollution within the Concho River basin (located in West Texas) and will also provide a Watershed Protection Plan. Information obtained from this project will be made available to state, federal and local decision makers to promote the orderly restoration of the basin aquatic environment and to prevent additional degradation.

2. Project Tasks: Tasks contained within this workplan include the following: (1) Project Coordination (2) Quality Assurance, Data Collection and Assessment (3) Public Participation (4) Development of a Watershed Protection Plan

3. Measures of Success: The success of this project will be monitored within the specific project deliverables as follows: (1) Quarterly progress reports (2) Annual reports containing the accumulated data collected through approved QAPP protocols and the appropriate analysis of that data (3) Provision of records pertaining to the public participation effort (4) Specific recommendations to state, federal and local agencies regarding NPS issues within the basin based on the developed Watershed Protection Plan.

4. Project Type: Statewide ( ) Watershed (X) Demonstration ( ) Other ( )

5. Waterbody Type: River (X) Groundwater (X) Other ( )

6. Project Location: Concho River Basin to O.H. Ivie Reservoir; including the Concho River (segment 1421) and O.C. Fisher (segment 1425)

7. NPS Management Program Reference: State of Texas Agricultural/Silvicultural Nonpoint Source Management Program approved February 25, 2000.

8. NPS Assessment Report Status: Impaired (X) Impacted (X) Threatened ( ) TMDL ( ) Other (X) -all status designations present in study area.

9. Key Project Activities: Hire staff ( ) Monitoring (X) Regulatory Assistance ( ) Education (X) Implementation ( ) Demonstration (X) Other ( )

10. NPS Management Program Elements: Milestones from the "*Texas Non-point Source Pollution Assessment Report and Management Program,* to be implemented include: (1) Watershed approach to monitoring and assessment of Non-point Source water pollution (2) Coordination with federal, state and local agencies, (3) Committing to technology transfer, technical support, administrative support, and cooperation between agencies and programs for the prevention of NPS water pollution.

11. Project Costs: Federal ($372,055) Non Federal ($248,637) Total Project ($620,092)

12. Project Management: Texas State Soil and Water Conservation Board; *Project Lead:* Upper Colorado River Authority. *Cooperating Entities:*; Texas Water Development Board; Texas Commission on Environmental Quality, Clean Rivers program Upper Basin Steering Committee, all effected Soil and Water Conservation Districts; Natural Resources Conservation Service; United States Geological Survey; Sterling County Underground Water Conservation District; Texas Institute for Applied Environmental Research, City of San Angelo.

13. Project Period: September 1, 2004 through August 31, 2007.

Concho Watershed Protection Plan Development Project
Texas State Soil and Water Conservation Board
Project #04-4
Non-point Source Summary Page
September 1, 2004 – August 31, 2007

Problem/Need Statement:
The Concho River basin is currently experiencing a severe drought, as is most of west Texas. The four major reservoirs in the region are all currently below 20% of their designed, total capacity. As the availably of water resources in this region becomes more and more scarce, it is becoming increasingly important to protect the quality and conserve the usage of this limited resource.

The Concho River basin lies within thirteen West Texas Counties and encompasses a watershed of approximately 4.5 million acres. Four major reservoirs, O.H. Ivie, O.C. Fisher, Twin Buttes and Lake Nasworthy are located within the watershed boundaries. These reservoirs provide potable water, either wholly or in part to approximately 500,000 residents. In addition, the streams and reservoirs of the Concho basin are utilized for agricultural production and in power generation. The Concho River itself, lies below San Angelo and enters O.H. Ivie Reservoir near Paint Rock, Texas. Above San Angelo, several major streams converge to form the Concho River; these include the North, South and Middle Concho Rivers, Spring Creek and Dove Creek *(see Figure 1 and Figure 2)*. Many historical springs feed into the tributaries of the Concho River. It is at these locations that the more environmentally sensitive aquatic habitats are commonly found. In 2002, the Concho River (segment 1421) was placed on the 303(d) List (category 5c) for having impaired macro benthos communities. The O.C. Fisher Reservoir (segment 1425) was also listed for total dissolved solids and chlorides (also category 5c).

Numerous existing and potential sources of non-point source water pollution can be identified within the Concho River Basin. These include: urban runoff, feedlot waste, erosion from irrigated and non-irrigated cropland, on-site wastewater disposal, losses of perennial stream flows, and rangeland and pastureland management. Stream Segment 1421 within urban areas of the City of San Angelo, (primarily the North Concho River portion), have been the subject of a ten year program in implementation of BMP construction within that sub-watershed through the 319 program. This program has been highly successful in improving water quality and providing opportunities for public education. This followed the provision and adoption of a NPS Urban Runoff Water Pollution Abatement Master Plan for a 4.75 mile stream reach of the North Concho through San Angelo. However, much of the urban watershed in San Angelo, including the heavily industrialized Pulliam Draw portion, remains uncontrolled and it is suspected that substantial water quality impacts could occur downstream of San Angelo. Within the proposed project, the 1994 Master Plan will be updated and expanded to include additional high risk urban areas of San Angelo. Water quality complaint investigations and routine monitoring conducted through the Texas Clean Rivers Program in recent years have also identified existing and potential water quality problems within the basin. These include diffuse salinity sources likely from oil production facilities near the South Concho River, near Dove Creek and in the North Concho River sub-basin. Also, confined animal operations and extensive cultivation within the segment 1421 watershed have been the focus of numerous special studies and investigations regarding nutrient enrichment and water quality degradation. Extensive and growing rural development within the basin, particularly areas of sensitive aquatic habitats near source springs, has also been recognized as posing considerable risk to the basin water resources. Other areas of extensive development have been documented as having impact on groundwater resources through poorly designed and aging on-site disposal systems. Two completed watershed restoration feasibility studies completed within the basin have also provided considerable data and information regarding the influences of poor range management on basin water resources. A third study is currently underway on the Kickapoo Creek sub-basin and is being conducted by the United States Corp of Engineers under it's watershed restoration (206) program. It is apparent that the basin requires a comprehensive assessment and development of a non-point source pollution abatement plan to coordinate, and prioritize efforts to address the problem.

General Project Description:
The proposed project is designed to evaluate and assess potential sources of non-point source water pollution on a basin wide basis and to provide for the development of control strategies through a planning process. This will occur through the integration of water quality monitoring in addition to existing, ongoing water quantity monitoring programs, the development of additional surface and groundwater monitoring activities and the coordination of assessment activities with other entities in the region. The proposed program anticipates coordination of program elements with other entities such as the Texas State Soil and Water Conservation Board, Texas Water Development Board, Sterling County Underground Water Conservation District, U.S Geological Survey, Texas Institute for Applied Environmental Research and the City of San Angelo. In addition, the Texas Clean Rivers Program and the Colorado River Basin CRP partners (through it's Upper Colorado River Basin Steering Committee and Coordinated Monitoring Program) will be participants in the project through utilization of this forum in an advisory role. The proposed project contains the following elements:

5. Monitoring and Assessment
    - Continue North Concho Watershed Monitoring Program
    - Continue Paired Watershed Monitoring
    - Develop Surface and Groundwater monitoring within remaining basins
    - Integration and assessment of all other approved water quality data collected within the basin (from TCEQ)
    - Development and maintenance of approved QAPP
6. Public Information and Involvement
    - Press Releases, Public Meetings, etc.
    - Area agency coordination
    - Upper Colorado River Basin CRP Steering Committee
    - Upper Colorado River Basin Coordinated Monitoring
    - Dissemination of project reports, etc.
7. Water Quality Assessment and Planning
    - Maintenance and analysis of accumulated water quality, hydrologic and hydrogeological data.
    - Assess existing and potential sources of Non-point source water pollution within basin
    - Identify, develop and evaluate alternative control strategies
8. Reporting
    - Provide Quarterly Project Reporting
    - Provide Watershed Protection Plan

Discussion:
This proposed planning project will utilize all existing and previous water resource programs and develop additional data collection programs specifically designed to enhance and augment existing programs as related to non-point sources within the basin. This includes all previous and existing monitoring within the basin conducted under the coordinated monitoring protocols of the Texas Clean Rivers Program and/or previous data collections conducted under 319 approved QAPP's. Agencies involved with this program include the Texas Commission on Environmental Quality, United States Geological Survey, Lower Colorado River Authority, Colorado River Municipal Water District and Upper Colorado River Authority and all data collected under the program is found in the TCEQ water quality data base and 319 project files. All new data collections proposed within this project will be developed under QAPP requirements of the program.

The analysis of water quality data and completion of field investigations will allow the creation of an inventory of existing and highly potential sources of NPS water pollution within the basin including the location of at risk stream segments, potential and existing pollutant(s), existing effects and water quality conditions and potential short term and long term effects. Utilizing the Upper Colorado River Basin Clean Rivers Program Steering Committee, which is made up primarily of basin stake holders, alternative structural and non-structural BMP's will be identified for each of the at risk stream segments. These alternatives will be screened and "best fit" solutions identified and prioritized on a basin wide basis. Following completion of this process, a watershed protection plan will be prepared including discussion and presentation of all project data collected and/or utilized, presentation of all output and processes involved in the identification of at risk stream segments and presentation of all output and processes involved in the identification and prioritization of NPS BMP's.

Tasks, Objectives, Schedules, and Estimated Costs:

TASK 1: PROJECT COORDINATION

Cost: $24,000(Federal); $16,000(Non-federal); $40,000(Total)

Objective:

Management of all of the administrative functions required for support of the program.

- Informative and timely progress reports
- Participation in conference calls and planning meetings
- Timely and accurate reimbursement forms and statements
- Proper backup documentation to support allowable costs
- Responsibility for subcontractors, from procurement through oversight
- Participation in any required fiscal monitoring reviews
- Timely & accurate deliverables to meet the intent of the workplan/contract
- Budget monitoring and cost accountability

Task Description:

Work within this task includes the preparation of all quarterly reports, the watershed assessment report, Watershed Protection Plan, coordination of staff and subcontractor efforts, maintenance of financial and technical files, coordination with participating and contracting agency staff, preparation of reimbursement forms and statements and general program supervision. The work will generally be consistent with meeting program objectives as outlined above.

Task Deliverables: September 1, 2004 through August 31, 2007

A. Quarterly Progress Reports to include; Status of deliverables, narrative description of program activities and description of all monitoring. To be submitted to the TSSWCB by the 15th day following the end of the federal FY quarter (January 15, April 15, July 15, October 15).
B. Submittal of Reimbursement forms and statements with quarterly reports.
C. Copies of executed sub-agreements as completed.
D. Attendance at all required coordination or planning meetings with sub-contractors and TSSWCB staff.
E. Printing and submittal of the Watershed Protection Plan containing the nine elements required in the FY 2004 CWA Section 319 Grant Guidelines.

TASK 2: DATA COLLECTIONS AND ASSESSMENT

Cost: $327,041 (Federal); $218,027 (Non-federal); $545,068 (Total)

Objectives:
Conduct monitoring to support a thorough evaluation of NPS issues and aid the development of a Watershed Protection Plan.

***Sub-Task 2.1 Monitoring*:**
The on-going surface and groundwater monitoring programs on the North Concho watershed will be expanded to include the entire Concho River basin, specifically focusing on monitoring and assessment needs that are currently not being achieved to evaluate NPS issues. This will include the characterization of urban runoff loadings to the lower portions of stream segment 1421, evaluation of regulated and unregulated confined animal operations within segment 1421 below San Angelo and assessment of the effects on surface and groundwater quality of on-site wastewater disposal primarily in Northern Tom Green County. The design of these monitoring programs will be developed through the QAPP process and submitted for approval.

***Sub-Task 2.2 Hydrology*:**
This task requires the continued cooperation of the USGS in the operation and maintenance of full telemetry flow stations that were added to the North Concho watershed during the initial program year. These stations are in addition to existing USGS stations financed by other sources. USGS data will be supplementary to data collected by the UCRA at additional quarterly base flow measurement stations. This data will be tabulated, analyzed and prepared for inclusion in the Watershed Protection Plan.

As an added assessment tool, the UCRA proposes to prepare and submit Watershed Run-off Event Reports following every storm event that produces measurable increases in stream flow at any of the stream flow stations. Included in these run-off reports will be detailed analyses of hydrographs and flow data from USGS gaging stations, rainfall amount estimates generated by Doppler Radar from the National Weather Service, volumetric flow estimates at various points on the watershed, channel transmission loss calculations, a narrative description of the storm/run-off event, and the net increase in reservoir contents following the event.

Sub-Task 2.3 Analyze Existing Data:
In addition to monitoring, it is proposed to retrieve and analyze all of the water quality data collected within the Concho basin under an approved QAPP to evaluate all NPS issues within the study area including those that may be attributable to the Texas Brush Control Program.

Sub-Task 2.4 Paired Watershed Studies:
Under this sub-task, UCRA proposes to operate, maintain and collect/analyze data from the existing two sets (four stations) of experimental sites designed to monitor and determine the effects of brush control on the water balance, water yield and water quality within the watershed. Each of the sites has been instrumented with Campbell Scientific Data Loggers and Sensors that automatically records evapotranspiration using Bowen ratio/energy balance methods, precipitation, wind speed and direction, air temperature, relative humidity and other pertinent data. Surface water flows will also be sampled and monitored at two sites. Brush has been treated in one of the mesquite sites (June, 2002) and will be treated in one of the juniper sites during this contract period.

This sub-task requires weekly site visits to collect data via download into a laptop computer and/or collection of additional data by other means. Data will be transmitted electronically from the UCRA to the Texas Institute for Applied Environmental Research (TIAER) for verification and analysis. If it is deemed beneficial to the project, site visit intervals may be adjusted during the contract period to enhance the quality of data being collected. UCRA staff will perform existing field operation and maintenance programs. UCRA and/or TIAER staff will maintain and repair equipment as required, and will replace equipment units or parts as needed. TIAER staff will also conduct regular monthly site visits. Storm water samples will be collected at the juniper sites following mechanical removal of brush from one of the sites. The controlled environment and similarities of the two sites will allow for a comprehensive evaluation of the water quality impacts of the practice. At a minimum, three (3) storm events will be sampled. Accumulated data will be reviewed, verified and analyzed throughout the contract period. Detailed data reports will be prepared and submitted with the annual program and interim reports. A major portion of the analytical work effort within this task will be provided through the TIAER agreement with the UCRA.

Task Deliverables: September 1, 2004 through August 31, 2007

A. Implementation of an approved basin wide surface and groundwater monitoring program as developed and approved through the QAPP process.
B. The collection, retrieval and reporting of real time full telemetry flow data available from USGS flow stations within the watershed
C. The retrieval, analysis and reporting of all water quality data currently being collected within the basin under approved QAPP.
D. Quarterly base flow stream measurements at selected sites in the watershed.
E. Additional opportunistic stream flow measurements.
F. Hydrologic, hydrogeological and water quality data tabulation, analysis and reporting.
G. Watershed Rainfall & Runoff Event Reports submitted with quarterly reports and included in annual reports.
H. Weekly site visits to collect data from paired watershed sites.
I. Weekly transmittal of data to TIAERS project staff.
J. Preparation and submittal of quarterly and annual data summaries and analysis, consistent with the project reporting requirements.

TASK 3: PUBLIC PARTICIPATION AND OUTREACH

Cost: $10,800 (Federal); $7,200 (Nonfederal);$18,000 (Total)

Objectives:
To follow are objectives included with the implementation of this work task:

- To involve the general public, civic groups, UCRA basin partners and interested governmental entities in assisting the UCRA in project planning and implementation
- To keep the public and other interested entities informed of project progress.
- To inform the public and other interested entities of the monitored hydrologic benefits resulting from the program.
- To involve existing Clean Rivers Program advisory entities (Steering Committee, Coordinated Monitoring processes) as project advisory partners.
- To provide decision makers with a comprehensive assessment and abatement plan to address NPS issues within the Concho River basin.

Task Description:
As a part of this project, a comprehensive public outreach and education effort will be instituted as related to NPS water pollution within the watershed. This effort will include all previously successful activities conducted by the contractor such as, coordination and cooperation with public entities, public awareness and education through press releases, project area tours for officials and members of the press, meetings with civic groups, Soil & Water Conservation Districts, Underground Water Conservation Districts and cooperating organizations and involvement with the UCRA Texas Watch Program. Initially, this program will focus on soliciting input into the planning phase of the project. Following this, the public will be kept informed of project implementation progress. In addition to the above, the UCRA will utilize an existing CRP Upper Basin Steering Committee as an advisory group.

Task Deliverables: September 1, 2004 through August 31, 2007

A. The UCRA will maintain and submit quarterly records of public outreach to the TSSWCB which includes the following:

    - Meeting dates, times, locations, attendee lists, agendas
    - Any curricula, evaluation forms
    - Press releases
    - Media reprints or other records

TASK 4: WATER QUALITY ASSESSMENT AND PLANNING

Cost: $8,400 (Federal); $5,600 (Nonfederal); $14,000 (Total)

Objective:
To assess the water quality implications of existing and potential NPS water pollution within the basin, based on the continuing data collections, and develop control strategies within a basin wide Protection Plan (Watershed Protection Plan).

Task Description:
Work within this task includes the evaluation and analysis of all program data collections and observations and the development of a NPS water quality assessment based on that evaluation and analysis. Utilizing the assessment, potential alternative management strategies will be identified, evaluated and used in the preparation of a Watershed Protection Plan designed to address NPS issues. The prepared Watershed Protection Plan will include a watershed assessment report, the results of all data collections, data analysis, identification of alternatives, a description of the screening process regarding various alternatives and recommended actions.

Task Deliverables: September 1, 2004 – August 31, 2007

A. Data and analysis reporting through quarterly reports.
B. Draft Watershed Protection Plan to TSSWCB 7-15-07
C. Final Watershed Protection Plan to TSSWCB 8-31-07

Project Lead:
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APPENDIX B
SAMPLING PROCESS DESIGN AND MONITORING SCHEDULE FROM WORKPLAN TASK 2

APPENDIX B

SAMPLING PROCESS DESIGN AND MONITORING SCHEDULE

FROM PROJECT WORK PLAN TASK 2

Introduction

A review of *Appendix A*, (the project work plan), reveals that the project is composed of three basic elements:

- A watershed approach to monitoring and the assessment of non-point source water pollution.
- Coordination with federal, state and local agencies.
- Committing to technology transfer, technical support, administrative support and cooperation between agencies and programs for the prevention of non-point source pollution.

Each of these elements results in definable and lasting benefits for the Concho River Basin and area communities. There are several goals and objectives associated with each of these elements (discussion to follow).

Watershed Approach to Monitoring and Assessment - The project proposes utilizing all existing water quality monitoring programs and other water resource entities with new water quality monitoring and reconnaissance initiatives that specifically assess non-point source water pollution problems within the Concho River Basin. Based on this assessment, a watershed protection plan will be prepared to identify existing and potential sources of non-point source water pollution and proposes BMP's to mitigate those sources.

Coordination with Federal, State and Local Agencies – Project planning and implementation has been and will continue to be coordinated with federal, state and local agencies. The project advisory committee (Upper Colorado River Basin Clean Rivers Program Steering Committee) is composed of agency representatives including the U.S. Department of Agriculture, Texas State Soil and Water Conservation Board, Texas Commission on Environmental Quality, Texas Railroad Commission, Several Municipalities, Lower Colorado River Authority, Colorado River Municipal Water District and County Commissioners in addition to other area stakeholders. The project also includes Tarleton State University, an Underground Water Conservation District, the U.S. Geological Survey and the Texas Water Development Board *as active project participants.*

Committing to Technology Transfer, Technical Support, Administrative Support and Cooperation – In addition to post project reporting, technology transfers and other NPS support activities, the UCRA currently works closely with the TSSWCB staff and TCEQ

Regional offices to prioritize and coordinate project work efforts. This enables us to immediately begin to utilize water quality and other data collection efforts to impact on-going agency planning and priorities for the region. Project interim data and/or findings could significantly impact agency monitoring, implementation or enforcement priorities and or funding requirements and should be reviewed as soon as available. The project watershed protection plan, (which requires agency participation and cooperation in implementation) will be a coordinated and prepared with all area stakeholder input.

Project Data Collection Activities

As previously stated, the project utilizes all existing approved water quality data collection activities (CRP Coordinated Monitoring Program). In order to meet all project objectives, additional water quality monitoring will occur, hydrologic and hydrogeological data will be collected and various investigations and reconnaissance efforts conducted as needed. A discussion of each of these data input sources for the project follows:

Existing Water Quality Data Collections - The Colorado River Basin Clean Rivers Partners (LCRA, CRMWD, UCRA, TCEQ) are currently involved in a Coordinated Monitoring program that includes the Concho River Basin. The program is re-evaluated annually through a meeting with all State, Federal and River Authority participants. If necessary, program revisions to meet water quality data requirements are made. This data ultimately becomes a part of the TCEQ water quality database and is collected under the approved Colorado River Basin CRP QAPP. Data is analyzed by the participants and the TCEQ pursuant to the agency data requirements and goals. The data collected within the Concho River Basin will be separately analyzed by the project staff (specifically to identify NPS issues and trends). This analysis will specifically look for trends associated with suspected NPS sites and parameters. Any variances from stream standards by those sites and parameters will also be noted. The table that follows identifies the sample sites, entity and frequency of sampling and parameters collected. Sample sites are also located on *Figure 3*. The table includes the site description, TCEQ station number, TCEQ region, the entity conducting the monitoring (UC – UCRA, FO- TCEQ field office, CW-CRMWD), sample type, Rt.- Routine Sample, DI – Diurnal Sample, SS- Special Sample, frequency (per year) and the parameters tested (conventional chemical, field data, flow, bacteriological). Routine samples are those collected at fixed station sites according to the published schedule determined by the coordinated monitoring protocols. Diurnal samples are those data generally collected by field tests over a 24 hour period consisting of continuous measurements or measurements at predetermined times through the sample period. This data normally consists of dissolved oxygen, pH values and temperature. Special samples are collected in response to unusual conditions such as fish kills, water quality complaint or accidental spills. Conventional chemical parameters include anion-cation balance and plant nutrients. Field data includes D.O., pH value, water temperature and Specific conductance.

Site Description	Station	Region	Entity	Type	Conv	Bacteria	Flow	Field
Segment 1421 |								
LIPAN CREEK APPROX. 9(	12254	8	CW	RT	2	2	2	2
KICKAPOO CREEK AT FM	12255	8	CW	RT	2	2	2	2
DRY HOLLOW CREEK AT I	12257	8	CW	RT	2	2	2	2
CONCHO RIVER BRIDGE (	12401	8	CW	RT	6	2	6	6
CONCHO RIVER BRIDGE (	12401	8	UC	RT	4	4	4	4
CONCHO RIVER AT FM381	12402	8	UC	RT	4	4	4	4
CONCHO RIVER AT FM16?	12403	8	UC	RT	4	4	4	4
CONCHO RIVER AT COUN	12404	8	FO	RT	4	4	4	4
CONCHO RIVER AT VERIB	12405	8	UC	RT	4	4	4	4
CONCHO RIVER AT FM38(	12407	8	UC	RT	4	4	4	4
CONCHO RIVER DOWNST	12408	8	FO	RT	4	4	4	4
CONCHO RIVER 0.4 MI. DC	12409	8	CW	RT	6		6	6
CONCHO RIVER 0.4 MI. DC	12409	8	UC	DI				
CONCHO RIVER 0.4 MI. DC	12409	8	UC	RT	4	4	4	4
NORTH CONCHO RIVER T	12412	8	UC	DI				
NORTH CONCHO RIVER T	12412	8	UC	RT			12	12
NORTH CONCHO RIVER T	12412	8	FO	DI				
NORTH CONCHO RIVER T	12412	8	FO	RT	4	4	4	4
NORTH CONCHO RIVER T	12412	8	FO	SS				
CONCHO RIVER SOUTH F	12416	8	UC	DI				
CONCHO RIVER SOUTH F	12416	8	UC	RT	4	4	4	4
NORTH CONCHO RIVER A	15886	8	UC	DI				
NORTH CONCHO RIVER A	15886	8	UC	RT			12	12
CONCHO RIVER SOUTH F	17348	8	UC	RT	4	4		4
MIDDLE KICKAPOO CREEI	18002	8	UC	RT	4	4	4	4
Segment 1422								
LAKE NASWORTHY NEAR	12418	8	UC	RT				2
LAKE NASWORTHY NEAR	12418	8	FO	RT	4	4		4
LAKE NASWORTHY IN RIV	12419	8	UC	RT	2	2		2
LAKE NASWORTHY IN RIV	12419	8	FO	RT	2	2		2
LAKE NASWORTHY MIDDI	12421	8	UC	RT	2	2		2
LAKE NASWORTHY MIDDI	12421	8	FO	RT	2	2		2
Segment 1423								
SPRING CREEK AT BRIDG	12161	8	UC	RT	4	4	4	4
DOVE CREEK AT BRIDGE	12166	8	UC	RT	4	4	4	4
TWIN BUTTES RESERVOII	12422	8	UC	RT	2	2		2
TWIN BUTTES RESERVOII	12422	8	FO	RT	2	2		2
TWIN BUTTES RESERVOII	12425	8	UC	RT	2	2		2
TWIN BUTTES RESERVOII	12425	8	FO	RT	2	2		2
SPRING CREEK AT LAKE /	17346	8	UC	RT	4	4	4	4
Segment 1424								
WEST ROCKY CREEK AT I	12165	8	UC	RT	4	4	4	4
SOUTH CONCHO RIVER A	12427	8	UC	RT	2	2	2	2
SOUTH CONCHO RIVER A	12427	8	FO	RT	2	2	2	2
MIDDLE CONCHO RIVER A	16903	8	UC	RT	4	4	4	4
CONCHO RIVER SOUTH F	17349	8	UC	RT	4	4	4	4
Segment 1425								
NORTH CONCHO RIVER A	12170	8	UC	RT			4	4
NORTH CONCHO RIVER A	12171	8	UC	RT	4	4	4	4
O.C. FISHER RESERVOIR	12429	8	UC	RT	2	2		2
O.C. FISHER RESERVOIR	12429	8	FO	RT	2	2		2
N. CONCHO RIVER AT SHI	16779	8	UC	RT			4	4
N. CONCHO RIVER, 6.2MI	16780	8	UC	RT	4		4	4
NORTH CONCHO RIVER A	17245	8	UC	RT			4	4
NORTH CONCHO RIVER A	17350	8	UC	RT			4	4
NORTH CONCHO RIVER A	17351	8	UC	RT			4	4

New Water Quality Monitoring Initiatives Under This Project by Category- to follow is an identification and discussion of the proposed new water quality monitoring that will be conducted under the initially proposed project. If additional sites, categories or parameters are planned as this project is implemented, a QAPP revision will be prepared.

I. **Mechanical Brush Removal Sediment Transport Evaluation**: At the location of the *Juniper Paired Watershed Studies*, collect storm water samples from three (3) storm events at the mechanically treated and the untreated watershed sites (see *Figure 4*). Samples to be collected by flow meter activated Isco Model 3600 portable samplers. The units are capable of collecting twenty four (24) 250 ml sub-samples at pre-selected time intervals. Ten (10) minute intervals would result in the capacity to monitor a four (4) hour storm event. Experience to date at these sites would indicate this setting to be appropriate for almost every event. Following the event, the sub-samples will be composited on a flow weighted basis and transported to the laboratory for TSS analysis.

II. **San Angelo Urban Environment Evaluation**: Four (4) sites are proposed that will augment existing data regarding NPS urban runoff problems in the San Angelo urban environment. These sites include; (1) Red Arroyo at the confluence with the South Concho River, (2) Pulliam Draw near the confluence with the Concho River below San Angelo, (3) Discharge from the Bell Street Reservoir and (4) Major stormwater outfall from the East-West Expressway to the North Concho River immediately below the 14^{th} Street bridge (See *Figure 5*). Each site will be monitored during three (3) storm events and sampled for TSS, BOD5, NH3-N, NO3-N, T-PO4, flow and TPH. Field measurements will also be taken and recorded.

The "typical" storm water hydrograph (plotting flow rates vertically and time, horizontally) displaying a rapidly increasing flow rate to the peak and a dwindling flow rate to the end of the episode has been well known for many years. Many factors dictate the dimensions of the hydrograph, such as the storm characteristics, area, slope and configuration of the watershed, the storm water channel or conveyance characteristics and the length of the reach above the point of measurement. Ideally, water quality during a monitored storm event would at a minimum be determined by the collection of five sub-samples; Two (2) sub-samples on the ascending portion of the hydrograph, one (1) sub-sample at the peak, and two (2) sub-samples on the descending portion of the hydrograph. The total number of sub-samples composited and the time interval between sampling will effect the reproduction of the total flow water quality in the sample analytical results. Ideally, the sub-samples would be composited on a flow weighted basis either prior to analysis or mathematically utilizing sub-sample analytical results. Analytical results of this composite sample would then approximate the quality of the entire waste stream, and by analyzing the flow data to determine total flows, the total loading of individual pollutants to the stream can be calculated. Inherent in this "ideal" process is the accurate definition of the storm water hydrograph through continuous or frequent flow measurements during the period.

In planning for the monitoring program, it has been recognized that though automatic samplers will be available for use, flow monitoring equipment will not be available. It has been determined, therefore, to attempt to generally define the storm water hydrograph at each sample site during storm events utilizing manual measurements. Critical elements to be measured are, the approximate time of flow commencement, approximate time and duration of peak flow and approximate time of episode ending. Application of this information to the known characteristics of a "typical" hydrograph will allow considerable definition of the storm event and consequently, guidance in sub-sample disposition. Prior to sample station "on line" status and at each sample site, an appropriate point will be selected to measure channel cross-section, slope and other engineering data to allow calculation of flows based on water surface elevation. Based on this field information, a flow/elevation chart will be prepared for each site. The staff assigned to monitor the automatic samplers will be instructed to record the approximate critical times as described above for each sample site and to note and record the peak flow elevation.

With this information, monitoring staff can quickly approximate the storm hydrograph for each station and then select sub-sample amounts for compositing and sample preparation for shipment to the laboratory from each site. Except for the Bell Street site, it is proposed to collect sub-samples at ten minute intervals through out the storm event and then composite the final sample based on the flow rates at the time of sub-sampling proportional to the total discharge. The Isco Model 3600 can accommodate a four (4) hour total event with this setting. Flow rates and duration of events are greatly influenced by the location of the site and the mitigation by the reservoir volume at Bell Street. It is likely that sample intervals will be increased to 30 minutes with a twelve (12) hour total event planned.

III. **Regulated and Non-Regulated Confined Animal Operations:** The Concho River basin contains numerous Confined Animal Feeding Operations (CAFO's) including dairies, cattle feedlots, sheep feedlots, sales auctions, holding pens, etc. Many of these operations are large regulated commercial facilities and many are small un-regulated commercial and recreation facilities. Among these are numerous support operations which include manure disposal through field application. The UCRA proposes to intensely monitor stormwater quality within one tributary system that contains one large cattle feeding operation, one large dairy and numerous smaller operations. The Willow Creek tributary system lies within Tom Green and Runnels Counties and confluences with the Concho River (segment 1421) below San Angelo (see *Figure 6*). Three storm events will be monitored at three (3) monitoring sites. Isco Model 3600 automatic samplers will be utilized, and sub-samples collected at ten (10) minute intervals for the duration of the event. Sampling, compositing and parameter protocols (except deleting TPH) described in section II will also be utilized in this study.

IV. **Concho River Basin Salinity Issues:** Oil field activities impacting ground and surface water quality has been and continues to be a high priority within the basin. These impacts are often diffuse and not readily traced to point sources. Typically, shallow ground water is impacted and through time a salinity plume moves down gradient to impact surface water. The UCRA proposes to monitor two existing situations, both on the South Concho River, one near Christoval and the other below Lake Nasworthy. In conducting these studies, eight (8) water wells near Christoval will be monitored on a quarterly basis for the contract period. Parameters tested will include field conductance, static levels, and samples for anion-cation balance laboratory analysis. Approved sampling protocols described in this QAPP will be utilized in the testing including purging three well volumes prior to sampling.

Seven (7) fixed station monitoring sites will also be established on the South Concho River at (1) U.S. Hwy 277 bridge (2) Mineral Wells Crossing (3) F.M. 2335 bridge (4) Gardner's Dam (5) Below Lake Nasworthy Dam (6) Country Club Estates boat ramp (7) Ben Ficklin Crossing (See Fig. 7). These sites will be monitored on a quarterly basis during the contract period for field parameters, flow and laboratory samples for anion-cation balance analysis. The above sample sites have been selected to spatially obtain the desired data for analysis. If any of the sites are currently being monitored under CRP or are added to that program during the contract period, those sites will not be duplicated through this program.

V. **On-Site Waste Disposal Issues:** Several areas within the Concho River Basin contain dense residential developments utilizing on-site waste disposal methods. On such area located on the North Concho watershed (*see Figure 8*) is a highly developed area containing large numbers of residential units as well as commercial development. The un-incorporated community of "Grape Creek" is the second largest community in the basin and contains many thousands of residents. Many or most of these are located on small lots (0.25 – 2.0 acres in size) and have both water well and waste disposal facilities on the properties. Most of these residents currently receive potable water from an approved public supply (Concho Rural Water Corp.), but all utilize individual on-site disposal facilities. The almost complete conversion to public water supply by the community was assisted by poor bacteriological quality of the shallow alluvial aquifer.

The UCRA will evaluate the current water quality condition of the aquifer in this area through one time sampling of a minimum of forty (40) water wells. The potentially effected area will be identified, mapped and gridded, with the sample locations determined by random selection of grid and location of one suitable well per grid. The wells will be sampled for NH3-N, NO3-N, bacteriological (e-coli) and static water level. Approved well sampling techniques will be utilized, including the purging of three well volumes prior to sample collection.

Hydrologic and Hydrogeologic Data Collections – To monitor responses to watershed flow enhancement activities currently underway on the North Concho River, the UCRA is collecting both hydrologic and hydrogeologic data, and this existing program will continue. A summary of the data sources is as follows:

- United States Geologic Survey (USGS) flow measurement stations (6) on the main stem and target tributaries.
- Quarterly field flow measurements at additional sites along the main stem and major tributaries conducted by the UCRA.
- Rainfall runoff reports based on NWS Doppler rainfall estimates and flow measurement stations.
- Quarterly groundwater static levels within the watershed in Sterling County provided by the Sterling County Underground Water Conservation District.
- Quarterly and continuous groundwater static levels from numerous wells in Coke and Tom Green County within the watershed by the UCRA through continuous well level recorders (provided by the TWDB) and direct quarterly measurements.
- Continued operation of two (2) paired watershed studies on one (1) predominately mesquite site and one (1) predominately juniper site ((See figure 4). Instrumentation within the sites are monitoring total hydrologic responses to water supply enhancement efforts including both treated and untreated sites. Project direction and data collections/analysis are being conducted by the Texas Institute for Applied Environmental Research (TIAER) at Tarleton State University.

General Investigations and Reconnaissance - In addition to the data collection activities as described above, the UCRA proposes to enhance this effort to include the following:

- The UCRA will respond to water quality emergencies and water quality complaints originating within the basin that are likely due to NPS issues. Complete investigative reports of these activities will be provided in the project quarterly reports.
- The UCRA will amend this monitoring plan to include any required extensive monitoring in response to active complaints or emergencies.
- The UCRA will conduct a complete aerial inventory of the Concho River Basin including main stem, major tributaries and reservoir basins. This will be accomplished through high quality video taping utilizing contract helicopter service. The video will be accompanied by audio comments and GPS locations of major features such as diversion points, outfalls, suspect adjacent activities, dams,

crossings, locations of invader plant species, pools, etc. This inventory will be made available immediately to other agency use such as the Regional TCEQ office, USGS, Texas Parks and Wildlife Department, TSSWCB and others if requested.

General Assessment Methods – The new water quality monitoring initiatives proposed in this section as described above generally focus on specific areas and specific evaluation parameters. This approach simplifies the assessment methodology in each specific initiative and dictates the examination of collected data to variances from standards and establishing trends toward those variances. This will also include the examination of hydrological, seasonal or other factors effecting those variances and possible calculation of stream loadings or other assessments necessary to document or predict main stem water quality variances. This is not to say that the collected data cannot be utilized to assess potential NPS problems within similar situations within the basin. For example, salinity inflow data collected can be applied to similar situations through out the basin and the documentation of incresed sediment loadings resulting from mechanical brush control in a specific area can be utilized to formulate basin wide recommendations for protocols to mitigate such problems.

APPENDIX C – FIELD DATA SHEETS

RESERVOIR AND STR[illegible]M FIELD DATA SHEET

Date: **Water Body:** **Data File Name:** .dat **File Location:** I:/
Initial Calibration: Date: **Log Book:** **Page:** **Days Since Significant Rainfall:**
Post Calibration: Date: **Within Specifications** **D.O.** **pH** **Sp. Cond.**
Turbidity Calibration: **Last 1° Calibration:** **Gel Standards: 0-10 =** **0-100 =** **0-1000 =**
Data Collected By: **Weather:**

Time	Station Location	Depth* (m)	Secchi (m)	Turb (NTU)	Flow** (cfs)	Flow*** Severity	Notes (clarity, color, odor, biology, wave action, special samples, etc...) **Samples preserved with 1 ml 1:1 H_2SO_4.**

* For stream sites, use average depth of pool
** Use feet ASL at headwaters and dam sites
*** Flow Severity Ratings: 1= No Flow 2= Low Flow 3- Normal Flow 4= High Flow (flood) 5= Above Normal 6 = Dry

UCRA

DISCHARGE MEASUREMENT NOTES

SITE__________________DATE__________

DISTANCE	DEPTH	VELOCITY	AREA	FLOW

ESTIMATED FLOW__________ CALCULATED FLOW__________

COMMENTS / OBSERVATIONS______________________________

UCRA MULTIPROBE SENSOR CALIBRATION AND MAINTENANCE LOG

DATE ____________ TIME ____________ INSTRUMENT ____________ BATTERY VOLTAGE ____________

	Temp of std		Value of std.		Initial reading		Calibrated to	
D.O.								
Cond. High								
Cond. Low								
pH 7								
pH 10								

BP mm/hg: ____________

Comments: ____

Maintence notes: ____

____

Post Calibration? ______

SKG Laboratories

San Angelo, TX
325-658-1986

Client/project		Sample ID	
Matrix	Sampled By	Date	Time
Analysis / Remarks		Preservation	

APPENDIX D – CHAIN OF CUSTODY FORMS

SKG LABORATORY
ENGINEERING • SURVEYING • ENVIRONMENTAL
1122 SOUTH BRYANT BLVD.
SAN ANGELO, TEXAS 76903
PHONE: 325.[illegible]
FAX: 325.[illegible]

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Project No.	Client / Project

Field Sample No./ Identification	Date and Time	Grab	Comp.	No. of Sample Containers	Sample Type (Liquid, Sludge, etc.)	Preservative	Analysis Requested	Laboratory Remarks

Samplers: (Signature)	Relinquished by: (Signature)	Date: Time:	Received by: (Signature)	Date: Time:	COC Seal No.
	Relinquished by: (Signature)	Date: Time:	Received by: (Signature)	Date: Time:	
Affiliation	Relinquished by: (Signature)	Date: Time:	Received by: (Signature)	Date: Time:	Intact:

Remarks:	Data Results To: 1. 2.	Laboratory No.

APPENDIX E – DATA MANAGEMENT PLAN

APPENDIX E - DATA MANAGEMENT PLAN

Personnel –

Chuck Brown – Mr. Brown will provide liaison with other staff members, agency program participants and the contract analytical laboratory. He will receive and review all field notes and calculations utilized in sample preparation and storm event characterization from the sample team following each event, and all fixed station monitoring. He will also review COC procedures and documentation, laboratory records, laboratory QA procedures and analytical results. The laboratory will be asked to provide all analytical data and QA documentation in electronic format (spread sheet) to Mr. Brown. Mr. Brown will also be responsible for the archiving of this data and ultimate organization of the data for use in project reports.
Fred Teagarden- Mr. Teagarden will be responsible for the final review, use and presentation of all project analytical data. Any calculations performed utilizing the data such as constituent loadings to the stream will first be submitted to Mr. Brown for review prior to incorporation into project documents.

Systems Design - Hardware and Software Requirements – As stated above, the contract laboratory will be encouraged to provide analytical document in electronic format and within a spreadsheet. This data and all project data will be reviewed, archived and backed up within the existing UCRA data management system. This system currently consists of pc networking and the archiving of electronic files both by the project officers and the administrative coordinator. Paper copies of all pertinent documents and reports are maintained within the UCRA file system.

Data Dictionary – N/A

Data Management Plan Implementation – The Upper Colorado River Authority has received, maintained, transmitted and stored water quality and other data since entrance into the Clean Rivers Program in 1991. Since that time, procedures and technology has evolved at a fast pace. As a partner in the Clean River Program, the UCRA staff has received considerable and on-going training and monitoring related to data management. The water quality and other data to be collected and handled as a result of this program is minimal and should not require any special management protocols. The route and handling of all project data is described above under, "Personnel".

Quality Assurance/Control - See Section D of this QAPP.

Migration/Transfer/Conversion – N/A, see above.

Backup/Disaster Recovery – The data back up system is described above under "System Design".

Archives/Data Retention – Long term archiving of data and project files is accomplished by the transfer of files to CD-ROM. These files are then placed in fire proof safe.

Information Dissemination – All project documents including final reports and analytical data is provided to the Project Citizen Advisory Committee and to all interested agencies identified by the Public participation effort. In addition all pertinent documents and reports will be posted on the UCRA web site which is linked to the TSSWCB web site. In addition, all project milestones such as report finalization will be the subject of press releases in the local and regional area.

APPENDIX F – SAMPLING HANDLING REQUIREMENTS & MEASUREMENT PERFORAMANCE SPECS

Parameter	Matrix	Container	Preservative	Sample Volume (ml)	Holding Time
Chlorophyll-a	Water	Polyethylene or Glass	Ice, 4 °C, Dark	500	24 hours
Pheophytin	Water	Polyethylene or Glass	Ice, 4 , °C Dark	500	24 hours
Fecal coliform	Water	Sterile, Polyethylene	Ice, 4 °C	125	6 hours
E. coli	Water	Sterile, Polyethylene	Ice, 4 °C	125	6 hours
Enterococci	Water	Sterile, Polyethylene	Ice, 4 °C	125	6 hours
Chloride	Water	Polyethylene or Glass	Ice, 4 °C	100	28 days
Nitrate/Nitrite-N	Water	Polyethylene or Glass	Ice, 4 °C	200	48 hours
Nitrate-N	Water	Polyethylene or Glass	Ice, 4 °C	200	48 hours
Turbidity, lab	Water	Polyethylene or Glass	Ice, 4 °C	100	48 hours
Alkalinity, total	Water	Polyethylene or Glass	Ice, 4 °C	200	14 days
Chemical oxygen demand	Water	Polyethylene or Glass	Ice, 4 , °C H_2SO_4, pH<2	100	28 days
Hardness, Total	Water	Polyethylene or Glass	HNO_3 or H_2SO_4 pH<2	100	6 hours
Metals in Water	Water	Polyethylene or Glass	HNO_3 pH<2	500	28 days
Pesticide (8081)	Water and Sediment	Amber glass	Ice, 4 °C	1000	7/35 days before/after extraction
PCBs (8082)	Water and Sediment	Amber glass	Ice, 4 °C	1000	7/40 days before/after extraction
Org Phos. Pesticides (8141)	Water and Sediment	Amber glass	Ice, 4 °C	1000	7/40 days before/after extraction
Herbicides (8151)	Water and Sediment	Amber Glass	Ice, 4 °C	1000	7/40 days before/after extraction
Semi VOAs (BNAs) (8270C)	Water and Sediment	Amber glass	Ice, 4 °C	1000	7/40 days before/after extraction

UCRA-collected samples

Field, Conventional and Bacteriological Parameters										
PARAMETER	UNITS	MATRIX	METHOD	STORET	AWRL	LAB Reporting Linit	RECOVERY (% rec. of RL)	PRECISION (RPD of LCS/LCS dups)	BIAS (% Rec. of LCS)	LAB
Flow	cfs	water	TCEQ SOP	00061	NA*	NA	NA	NA	NA	Field
Flow, daily average (gage)	cfs	water	TCEQ SOP	00060	NA*	NA	NA	NA	NA	Field
Flow estimate	cfs	water	TCEQ SOP	74069	NA*	NA	NA	NA	NA	Field
Flow measurement method	1-gage 2-electric 3-mechanical 4-weir/flume 5-doppler	water	TCEQ SOP	89835	NA*	NA	NA	NA	NA	Field
Flow severity	1-no flow, 2-low, 3-normal, 4-flood, 5-high, 6-dry	water	TCEQ SOP	01351	NA*	NA	NA	NA	NA	Field
Reservoir surface elevation	Ft. MSL	water	TCEQ SOP	00062	NA*	NA	NA	NA	NA	Field
pH	pH/ units	water	EPA 150.1 and TCEQ SOP	00400	NA*	NA	NA	NA	NA	Field
DO	mg/L	water	EPA 360.1 and TCEQ SOP	00300	NA*	NA	NA	NA	NA	Field
D.O. saturation	%	water	SM 4500 O C	00301	NA*	NA	NA	NA	NA	Field
Conductivity	uS/cm	water	EPA 120.1 and TCEQ SOP	00094	NA*	NA	NA	NA	NA	Field
Temperature	° C	water	EPA 170.1 and TCEQ SOP	00010	NA*	NA	NA	NA	NA	Field
Secchi Depth	meters	water	TCEQ SOP	00078	NA*	NA	NA	NA	NA	Field
Days since last significant rainfall	days	NA	TCEQ SOP	72053	NA*	NA	NA	NA	NA	Field
Maximum pool width**	meters	water	TCEQ RWA SOP	89864	NA*	NA	NA	NA	NA	Field
Maximum pool depth**	meters	water	TCEQ RWA SOP	89865	NA*	NA	NA	NA	NA	Field
Pool length**	meters	water	TCEQ RWA SOP	89869	NA*	NA	NA	NA	NA	Field
% pool coverage**	%	water	TCEQ RWA SOP	89870	NA*	NA	NA	NA	NA	Field
Total water depth	meters	water	TCEQ RWA SOP	82903	NA*	NA	NA	NA	NA	Field
Measurements of DO in 24-hours	#	water	TCEQ SOP/ Calculation	89858	NA*	NA	NA	NA	NA	Field

PARAMETER	UNITS	MATRIX	METHOD	STORET	AWRL	LAB Reporting Limit	RECOVERY (% rec. of RL)	PRECISION (RPD of LCS/LCS dups)	BIAS (% Rec. of LCS)	LAB
24 hour DO average	mg/l	water	TCEQ SOP/ Calculation	89857	NA*	NA	NA	NA	NA	Field
Maximum daily DO	mg/l	water	TCEQ SOP/ Calculation	89856	NA*	NA	NA	NA	NA	Field
Minimum daily DO	mg/l	water	TCEQ SOP/ Calculation	89855	NA*	NA	NA	NA	NA	Field
24-hour average water temperature	° C	water	TCEQ SOP/ Calculation	00209	NA*	NA	NA	NA	NA	Field
Maximum daily water temperature	° C	water	TCEQ SOP/ Calculation	00210	NA*	NA	NA	NA	NA	Field
Minimum daily water temperature	° C	water	TCEQ SOP/ Calculation	00211	NA*	NA	NA	NA	NA	Field
24-hour average conductivity	µS/cm	water	TCEQ SOP/ Calculation	00212	NA*	NA	NA	NA	NA	Field
Maximum daily conductivity	µS/cm	water	TCEQ SOP/ Calculation	00213	NA*	NA	NA	NA	NA	Field
Minimum daily conductivity	µS/cm	water	TCEQ SOP/ Calculation	00214	NA*	NA	NA	NA	NA	Field
Maximum daily pH	s.u.	water	TCEQ SOP/ Calculation	00215	NA*	NA	NA	NA	NA	Field
Minimum daily pH	s.u.	water	TCEQ SOP/ Calculation	00216	NA*	NA	NA	NA	NA	Field
24-hr water temperature # of measurements	° C	water	TCEQ SOP/ Calculation	00221	NA*	NA	NA	NA	NA	Field
24-hr conductivity # of measurements	µS/cm	water	TCEQ SOP/ Calculation	00222	NA*	NA	NA	NA	NA	Field
24-hr pH # of measurements	s.u.	water	TCEQ SOP/ Calculation	00223	NA*	NA	NA	NA	NA	Field
Sulfate	mg/L	water	EPA 375.4	00945	10	5	75-125	20	80-120	SKG
O-phosphate-P	mg/L	water	SM 4500 H+B	00671	.04	0.04	75-125	20	80-120	SKG
Chloride	mg/L	water	SM 4500 Cl	00940	10	10	75-125	20	80-120	SKG
Ammonia-N, total	mg/L	water	EPA 350.3	00610	.02	.01	75-125	20	80-120	SKG
Alkalinity, total	mg/L	water	EPA 310.1	00410	10	10	NA	20	80-120	SKG
Hardness, total (as CaC03)	mg/L	water	EPA 130.2	00900	5	5	NA	20	80-120	SKG
Fecal coliform, membrane filtration	org/100mL	water	Std. Methods 9222-D	31616	1	1	NA	.5***	NA	SKG

* Reporting to be consistent with SWQM guidance and based on measurement capability.

** To be routinely reported when collecting data from perennial pools.

*** Based on a range statistic as described in Standard Methods, 20th Edition, Section 9020-B, Quality Assurance/Quality Control - Intralaboratory Quality Control Guidelines. This criterion applies to bacteriological duplicates with concentrations >10 MPN/100mL or 10 organisms/100mL.

References for Table A7.1:

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

American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), *Standard Methods for the Examination of Water and Wastewater*, 20th Edition, 1998.

TCEQ SOP - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue, 2003.

American Society for Testing and Materials (ASTM) Annual Book of Standards, Vol. 11.02

PARAMETER	UNITS	MATRIX	METHOD	STORET	AWRL	LAB Reporting Linit	RECOVERY (% rec. of RL)	PRECISION (RPD of LCS/LCS dups)	BIAS (% Rec. of LCS)	LAB
TSS	mg/L	water	SM 2540D	00530	4	0.5	NA	20	NA	SKG
VSS	mg/L	water	SM 2540E	00535	4	0.5	NA	20	NA	SKG
Sulfate	mg/L	water	EPA 300.0	00945	10	0.5	75-125	20	80-120	SKG
Ammonia-N	mg/L	water	SM 4500 NH3 D	00610	0.02	0.02	75-125	20	80-120	SKG
Total Kjeldahl Nitrogen	mg/L	water	EPA 351.2	00625	0.2	0.1	75-125	20	80-120	SKG
o-phosphorus, total	mg/L	water	SM 4500 P E	70507	NA	0.02	75-125	20	80-120	SKG
Total phosphorus	mg/L	water	SM 4500 P B&E	00665	0.06	0.02	75-125	20	80-120	SKG
Chlorophyll-a	µg/L	water	SM 10200-H	32211	10	0.5	75-125	20	NA	SKG
Pheophytin	µg/L	water	SM 10200-H	32218	5	0.5	75-125	20	NA	SKG
Fecal coliform	CFU/100mL	water	SM 9222 D	31616	1	1	NA	1***	NA	SKG
E. coli	CFU/100mL	water	SM 9222 G	31700	1	1	NA	1***	NA	SKG
Chloride	mg/L	water	SM4500 Cl B EPA 300	00940	10	0.5	75-125	20	80-120	SKG
Nitrate/nitrite-N	mg/L	water	EPA 353.2	00630	0.04	0.03	75-125	20	80-120	SKG
Alkalinity, total	mg/L	water	SM 2320B	00410	10	1	NA	20	80-120	SKG
Chemical Oxygen Demand	mg/L	water	EPA 410.4 SM 5220D	00335	10	5	75-125	20	70-130	SKG
Total Organic Carbon	mg/L	water	SM 5310 B	00680	2	1	75-125	20	70-130	SKG

Addendum to Appendix F

Sample Handling Requirements

Parameter	**Matrix**	**Container**	**Preservative**	**Sample Volume (ml)**	**Holding Time**
TPH	Water	Glass-40 ml VOA	HCl,pH<2	40 ml	14 days

Data Quality Objectives for Measurement Data

Parameter	**Units**	**Method**	**Parameter Code**	**AWRL**	**Accuracy of AWRL**	**Precision duplicate (%RPD)**
TPH	mg/l	TCEQ 1005**	04720	5*	75-125%	20

Bias LCS (%rec of LCS)	**Completeness %**
75-125%	80

*An AWRL has not been developed for this parameter. The number shown is based on laboratory detection limit.
** TCEQ method 1005, Revision 03, June 1, 2001.

APPENDIX G – LABORATORY QAM

SKG
ENGINEERING
SURVEYING ♦ LABORATORY ♦ ENVIRONMENTAL

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QUALITY ASSURANCE

PROGRAM PLAN

SKG LABORATORY
1122 SOUTH BRYANT BLVD.
SAN ANGELO, TEXAS 76903

JANUARY, 2004

SKG LABORATORY MISSION STATEMENT

THE MISSION OF THE SKG LABORATORY IS TO PROVIDE RELIABLE, EFFICIENT, RESPONSIVE AND QUALITY ANALYTICAL, SAMPLING AND TECHNICAL SERVICES TO OUR CUSTOMERS.

Table of Contents

1. Introduction

SKG Laboratory is committed to providing legally and scientifically defensible analytical data to our customers. The management and staff of SKG Laboratory are committed to maintaining a carefully controlled analytical environment, which assures the consistent generation of accurate data.

Detailed written analytical procedures are used to ensure strict adherence to published analytical methodologies throughout the laboratory. Laboratory management monitors records and quality control data on a regular basis.

1.1_ Purpose

The purposes of this Quality Assurance Program Plan (QAPP) are:

To define the nature and extent of Quality Assurance for all chemical analyses performed by the laboratory.

To establish the requirements for preparation of Quality Assurance procedures and policies.

To provide a description of the methods to be used in carrying out the Quality Assurance Program.

1.2 Objectives

The overall objective of this QAPP is to ensure that SKG Laboratory produces scientifically valid and defensible data of known and acceptable precision and accuracy. In addition, this plan will act as a quality control guideline for analytical performance, sample handling, equipment reliability, data generation, documentation and records, and reporting. It will be updated as analytical performance and procedures change in order to keep current with actual laboratory practices as per standard operating procedure. SKG Labs will accomplish these objectives by:

Verifying that work procedures and practices are adequate and acceptable to the customer and regulatory agencies.

Generating and calculating all data in accordance to published methods that are recognized standards of the environmental laboratory industry.

2.0 Facility

The laboratory facility is located at 1122 South Bryant Boulevard, San Angelo, Texas. The laboratory will furnish any sample collection instructions, sample containers, shipping containers or shipping instructions required for the testing needs of the customer.

2.1 Personnel Qualifications, Duties and Responsibilities

All persons assigned to the positions described in this document receive on-the-job training by working with experienced SKG personnel. All personnel are closely supervised and evaluated. In addition, all personnel are trained for each method performed along with quality assurance procedures and instrumentation prior to being assigned analytical duties. (Appendix A)

Required Education and Experience for Laboratory Staff:

Chemist I B.S. Degree in Chemistry is required with concentration in instrumental analysis. Experience in quantitative analysis procedures and basic computer skills are desirable. Knowledge of laboratory test methods and environmental sampling will be helpful. Ability to effectively communicate with client and customers is essential to position.

Chemist II B.S. Degree in Chemistry is required with course emphasis in the biological sciences and computer sciences. Ten years of progressively responsible experience in governmental or private analytical laboratory is required. Ability to plan and direct laboratory operation with minimum supervision is required. Public and client relation skills and basic computer skills are desirable.

Laboratory Technician I A minimum of 12 semester hours of college level credit in chemistry course work. University extension course completion in laboratory methods or direct analytical laboratory experience may be substituted for college credit. Experience in quantitative analysis procedures desirable. Knowledge of laboratory test methods and environmental sampling will be helpful. Basic computer skills are desirable. Ability to effectively communicate with clients and co-workers is essential.

Laboratory Technician II- A minimum of 12 semester hours of college level credit in chemistry course works. University extension course completion in laboratory methods and/or direct laboratory analytical experience may be substituted for college credit. A minimum of 3 years of responsible direct experience in private or governmental analytical laboratory. Basic computer skills are desirable. Ability to effectively communicate with clients and co-workers is essential.

Laboratory Clerk/Technician High school graduation required. College level course work with science emphasis desirable. Five years responsible work records required. Good communication and public relations skills desirable. General clerical procedure knowledge will be helpful. Some typing and use of laboratory computer system will be required.

Duties and Responsibilities of Key Laboratory Personnel

Chemist I-Under supervision of section chief or laboratory manager, perform routine quantitative analysis procedures on environmental samples including water, wastewater, soils, feeds, natural gas and other materials. Methods utilized will include wet chemistry, calorimetric, gas chromatography, gravimetric and general instrumental. Methods and procedures utilized must include quality assurance compliant with state and federal requirements. Duties will include client consultation and records maintenance. Position will require extended periods at repetitive tasks and work at laboratory bench and computer terminal. Use of acidic, caustic or volatile materials will be required.

Chemist II Under supervision of division director or section chief, direct all routine and special quantitative analysis activities including equipment and supply purchase, test methods, quality assurance, reporting, scheduling of work, client relations and accounting. Laboratory methods utilized will include conventional wet chemistry, bacteriology and instrumental analysis procedures. Position will require direct supervision of analytical staff and providing technical support for other professional staff of the firm.

Laboratory Technician I Under supervision of laboratory manager, perform routine quantitative analysis procedures on environmental samples including water, wastewater, soils, feeds, natural gas and other materials. Methods utilized will include wet chemistry, calorimetric, gas chromatographic, gravimetric and general instrumental. Duties will include general laboratory maintenance and cleaning including glassware. Position will require extended periods at repetitive tasks and work at laboratory bench and sink. Use of acidic, caustic or volatile materials will be required.

Laboratory Technician II Under supervision of laboratory manager, perform routine quantitative analysis procedures on environmental samples including water, wastewater, soils, feeds, natural gas and other materials. Methods utilized will include wet chemistry, calorimetric, gas chromatographic, gravimetric, and general instrumental. Duties will include general laboratory maintenance and cleaning. Laboratory records maintenance and input of data to computer filer and programs for calculation and output will also be required. Position will require extended periods at repetitive tasks and work at laboratory bench and sink. Use of acidic, caustic or volatile materials will be required.

Laboratory Clerk/Technician Under supervision of laboratory manager, receive and log all samples into laboratory records system. Maintain analytical files and prepare analytical reports as original. Assist in quality assurance records maintenance and procedures. Duties will include general laboratory maintenance and cleaning, including glassware and general assistance as required to laboratory analytical staff. Preparation and monitoring of customer billings and statements will be required. Some use of acidic, caustic or volatile materials may be required.

3.0 Standard Operating Procedures

All Standard Operating Procedures (SOP) are to be equivalent to applicable methods in the Standards Methods for the Examination of Water and Wastewater. Copies are available for use in the laboratory and kept in the laboratory bookshelf. The SOPs are reviewed annually and revised as changes are made. Signature pages and revision dates will be found inside the SOPs.

4.0 Records and Record Keeping

Records are maintained of all procedures for processing customer orders, from the specifications of the order to the delivery of the results. All analytical records are kept for a period of 7 years and are stored in a secure building monitored by a professional security firm. Data files are both paper and digital. At this time, digital files are only temporary in nature. All official files on record are papers. These records detail the sample identification, the date of analysis, the results generated, the measure of precision and accuracy achieved, and the identities of those individuals who performed the analysis, reviewed and approved the results. (Appendix C)

SKG Laboratory maintains a Standard Operating Procedure (SOP) manual for all procedures and methodologies utilized in the laboratory operation. SKG Laboratory's records system ensures the following:
All observations and calculations are recorded in a permanent manner (such as laboratory notebook) at the time they are generated, including unit of measurement in which observations are recorded or stated.

All work performed is signed and the date and time is recorded. The documentation included the date, analyst signature, and procedures performed.

Original records are uniquely identified and traceable to the analysis, sample or item to which they reference.

Test records are protected from loss, damage, misuse or deterioration and are retained for an appropriate period in a manner, which permits retrieval when required.

All standards and reagents generated are documented. This procedure is followed whenever standards are used for calibration, analytical control or other purposes in order to establish and maintain traceability of analytical results.

Records are traceable, retrievable, and legible and include sufficient information and explanation such that staff other than those responsible for their generation can readily interpret them.

Records contain sufficient information to allow identification of possible sources of error and to allow satisfactory repetition of the test under the original conditions.
Records contain sufficient details of any significant departures from test specifications or other specified procedures including authorizations for such departures.

Records are checked for data transcription or calculation errors.

Records document the person or persons responsible for their creation and the edit of such creation.

Corrections or amendments to test records are made in a manner, which does not obliterate the original data and are signed and dated by the person responsible.

SKG Laboratory maintains a list of all staff documenting their initials and/or signatures as used in documents such as logbooks or procedures.

For the purpose of this section, all field and laboratory personnel follow the basic rules for recording information as documented below:

Legible writing with no modifications, write-overs or cross-outs;
Correction of errors with a single line followed by an initial and date;
Close-outs on incomplete pages with an initialed and dated diagonal line.

5.0 Field Sampling Procedures

SKG Laboratory follows the Texas Commission On Environmental Quality (TCEQ) guidelines for field sampling according to the procedures found in the TCEQ's *Surface Water Quality Monitoring Procedures Manual*. All field sampling procedures not covered in this manual are to be equivalent to Standard Methods for the Examination of Water and Wastewater. Water quality, location, access, historical sites, designated uses, and representative sites are to be considered when determining where sites are needed to characterize water quality. Sampling is conducted to best fit the requirements of the special study. Special studies may require that sampling be preformed under specific conditions. SKG Laboratory uses the proper containers for collection and follows the correct sample container cleaning procedures. (Appendix D)

A Field Data Logbook is taken into the field on each sampling trip. Station ID, sampling date, location, sampling depth, sampling time, sample collector's initials and record of all measured field parameters and their respective values are recorded in the logbook, and all appropriate forms are legibly filled out in indelible ink. Sampling protocol is written and available to samplers.

6.0 Chain of Custody and Reporting Procedures

The SKG Laboratory utilizes a chain of custody for the receipt and identification of the items to be analyzed. Proper sample handling and custody procedures ensure the custody and integrity of samples beginning at the time of sampling and continuing through transport, sample receipt, preparation, and analysis.

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

- Date and time of collection
- Site identification
- Sample matrix
- Number of containers
- Volume of sample
- Preservative used or if the sample was filtered
- Analyses required
- Name of collector
- Custody transfer signatures and dates and time of transfer
- P.O. or Registration number

All failures associated with chain-of-custody procedures are immediately reported to the Lab Manager. These include delays in transfer, resulting in holding time violations; violations of sample preservation requirements; incomplete documentation, including signatures; possible tampering of samples; broken or spilled samples, etc. The Lab Manager will determine if the procedural violation may have compromised the validity of the resulting data. The Lab Manager will decide how the issue will be resolved based on best professional judgement. Upon identification of any inconsistency, a corrective action report will be completed and all involved parties will be notified of any data that has been compromised. Possible courses of action include, document and proceed; redo the entire sampling event; or selectively analyze the samples.

6.1 Sample Receipt

An integral part of any quality assurance program is the maintenance of sample Integrity by maintaining an accurate and documented listing of the custody of that sample. Upon receiving the samples, proper sample bottles, preservation, temperature, and holding times are checked and verified and the customer is made aware of any discrepancies. SKG Laboratory provides a listing of proper sample bottles, preservatives, and hold times. (Appendix D) The Laboratory Manager verifies that the forms are correctly filled out including any notations regarding sample condition. Then they assign each sample a unique identification number, record the number on the sample bottle, enters the pertinent data in the laboratory logbook. SKG Laboratory uses bound laboratory notebooks, filled out in ink, then dated and signed. Samples are labeled on the container with an indelible marker. Label information includes, site identification; date and time of sampling; preservation added, if applicable; designation of field-filtered as applicable; and sample type. A copy of the completed COC is provided to the customer. The Laboratory Manager then insures that the samples are placed in proper storage in the laboratory. The analysts place a copy of the COC in the laboratory for reference.

6.2 Data Reduction and Validation

All samples are analyzed within Standard Methods holding times, whenever possible. However, SKG Laboratory cannot guarantee holding times will be met for those samples received with less than half the hold time remaining. If holding times cannot be met, the client is contacted for further instructions. All work performed is dated and signed. All digits in a reported result are expected to be known definitely, except for the last digit, which may be in doubt. Therefore, when reporting final data, the proper number of significant figures is used.

Results are not reported when detected lower than the documented sensitivity of an instrument/method, the established limit, or laboratory management approved reliable quantitation limits. Under special circumstances, when lower than normal detection limits are to be reported, the Laboratory Manager must be notified and the limits recorded on the chain-of-custody record for notification on the Final Analysis Report.

Once analytical data is generated by the instrument/analyses, the analyst reviews the data according to the SKG Laboratory Standard Operating Procedures. The data receives a secondary review by another qualified analyst. Upon approval, the analyst signs the runlog/workbook.

7.0 Analytical Instruments and Equipment

SKG Laboratory has invested in state-of-the-art equipment to insure high quality analytical performance and is committed to continuously upgrading its equipment to maintain the laboratory's high standards.

Maintenance and calibrations performed on all equipment are recorded in the proper logbooks. Each analyst is responsible for all preventative maintenance on equipment. Any component of the equipment which has been subjected to overloading or mishandling, or which gives suspect results, or has been shown by verification or otherwise to be defective, is removed from service and evaluated. Once the component or equipment is repaired, calibrated and verified to perform satisfactorily, it will be placed back in service. The laboratory will examine the effect of this defect on the previous analyses by the equipment and notify the customer.

7.1 Reagents

All chemical reagents used in the laboratory meet or exceed the required quality for each particular analysis. All chemicals are stored in their original containers. Reagents requiring preparation is properly labeled with the compound, concentration, analytical parameter, date prepared, preparer's initials, and the expiration date, if applicable. The preparation of each reagent is documented in the designated laboratory notebook. These reagents are retained according to their stability and storage specifications.

7.2 Laboratory Ware

Sample containers are either glass or plastic and are certified clean by the manufacturer. Glass containers include one-liter, narrow-mouth containers, one-liter wide mouth, four ounce wide-mouth, 40 ml vials with Teflon liners in phenolic caps. Plastic containers include 500 ml and one liter polyethylene. All sample containers are disposable. General glassware is washed with detergent, rinsed with tap water and then rinsed with deionized water and allowed to air dry.

8.0 Methodology

Procedures for test methods describe how the analyses are actually performed in the laboratory. Sample preparation and analysis procedures include applicable holding times, and preparation steps; procedures for determining the appropriate dilution to analyze; and other information required to perform the analysis accurately and consistently. Instrumentation standardization includes concentration(s) and frequency of analysis of calibration standards, linear range of the method, and calibration acceptance criteria.

8.1 Analytical Methods

Procedures published by federal agencies, nationally or internationally recognized technical authorities or other validated procedures may be used once the laboratory has demonstrated adequate performance with the method for each particular matrix. SKG Laboratories strictly adheres to approved methods for the particular type of sample to be analyzed. Methods for all matrices are obtained from the following sources:

Surface Water Quality Monitoring Procedures Manual, GI-252, June, 1999.

Standard Methods for Examination of Water and Wastewater APHA, 18th Edition, 1992.

Copies of current methods and instrument instruction manuals are kept in the laboratory for reference. Standard operating procedures for test methods are also used for clarification and documentation of any deviation from the method. Areas that are addressed are:

- Interfaces
- Apparatus and Equipment
- Sample Preservation and Storage
- Instrument Calibration
- Detailed Step-by-Step Procedure
- Method Performance Criteria (accuracy and precision)
- Safety Considerations
- Reagents and Supplies
- Sample Preparation
- Quality Control Procedures
- Sample Calculations

8.2 Calibration Procedures

All measuring and testing equipment which impact the accuracy or validity of tests are calibrated and/or verified before being put into service. Quality control materials and calibration standards are traceable to appropriate national/international measurement standards where available. Standard curves are prepared to adequately cover the expected concentration ranges of the samples using a minimum of three data points for each analyte and one blank, unless otherwise specified by the method employed.

9.0 Internal Laboratory Quality Control Checks

The laboratory has a systematic quality control program for monitoring the reliability and accuracy of its results for each method and matrix. The particular quality-control schemes and statistical techniques vary greatly with the nature and volume of testing. The use of reference materials provides for the monitoring of accuracy performance. Replicate testing of duplicate test items provides for the monitoring of precision performance. Upon identification of any inconsistency, a corrective action report will be completed and all involved parties will be notified of any data that has been compromised.

9.1 Laboratory Water Quality

Ecowater provides a reverse osmosis water system with maintenance and services. The City of San Angelo municipal water is passed through a reverse-phase membrane system with the final polishing accomplished with an activated-carbon filter and two mixed-bed ion-exchange columns. A conductivity meter with a warning light is located between the resin bed tanks. When the warning light goes out, a new tank replaces the used ion resin tank. The deionized water quality is checked continuously by pH and conductivity analysis, which is recorded daily.

9.2 Analytical Limits

A Method Detection Limit (MDL) is a minimum concentration of a substance that can be measured and reported with 95% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix type containing the analyte. MDLs are determined and documented annually or as determined by the method.

Practical Quantitation Limit (PQL), Estimated Quantitation Limit (EQL), and Reporting Limit (RL) are used synonymously in this laboratory and defined as the lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. The value is *generally* three to ten times the MDL. However, it may be nominally chosen within these guidelines to simplify data reporting. For many analytes the PQL analyte concentration is selected as the lower non-zero standard in the calibration curve. Sample PQLs are highly matrix-dependent.

9.3 Precision and Accuracy

The laboratory employs a continuous evaluation of its performance (system process control) for each method and matrix. Precision of analyses will be determined by repeating the entire analysis of a sample per batch. If the method requires more stringent quality control procedures, the method requirements will be followed. If X1 and X2 are the values determined by the duplicate analyses, then the relative percent difference (RPD) is calculated using the formula:

$$RPD = [\text{Absolute value } (X_1 \text{ B } X_2)/((X_1 + X_2)/2)]*100$$

Accuracy of an analysis process will be monitored by determining the percent recovery of a spike quantity of the parameter in question added to a portion of an actual sample and then determined by analysis. This will be performed once per batch. If the method requires more stringent quality control procedures, the method requirements will be followed. If SSR is the spiked sample result, SR is the sample unspiked result, and SA is the spiked added, then the percent recovery is calculated using the formula:

$$\%\ Recovery = [(SSR \text{ B } SR)/SA]*100$$

The relative percent difference and the percent recovery of individual analyses have only limited value. Analytical data generated with control samples that fall within prescribed limits are judged to be generated while the laboratory was in control. Data generated with control samples that fall outside the established control limits are judged to be generated during an out-of-control situation.

9.4 Control Samples

Control samples are QC samples that are introduced into a process to monitor the performance of the system. These samples can be used in different phases of the data collection process, beginning with sampling and continuing through transportation, storage, and analysis and may include, but are not limited to the following:

Field Blank- A sample of media carried to the sampling site, exposed to the sampling conditions (e.g., bottle caps removed), returned to the laboratory, treated as an environmental sample, and carried through all steps of the analysis in order to evaluate possible site contamination sources such as airborne contaminants.

*Trip Blank-*A sample of media taken from the laboratory to the sampling site and returned to the laboratory unopened, to evaluate the integrity of the sample container and its preparation.

Initial Calibration Blank (ICB) - A standard solution that contains no analyte and is used for initial calibration and zeroing instrument response.

Continuing Calibration Blank (CCB) - A standard solution which contains no analyte and is used to verify blank response and freedom from carryover, analyzed after the Continuous Calibration Verification (CCV) and after the Interference Check Standard (ICS).

Method Blank/Matrix Blank - A sample of the matrix without the analytes of interest that goes through the complete analysis including digestion.

Laboratory Control Sample/Laboratory Fortified Blank (LCS/LFB) - A specified amount of Reagent Blank fortified with a known mass of the target analyte(s), usually to determine the recovery efficiency of the method.

Calibration Curve - The graphical relationship between the known values for a series of calibration standards and instrument responses.

Calibration Standard - A substance of reference material used to calibrate an instrument (often called a calibrant).

Initial Calibration Verification (ICV) - A standard solution (or set of solutions) used to verify calibration standard levels with an analyte concentration near mid-range of linear curve and is made from a stock solution having a different manufacturer or manufacturer lot identification than that of the calibration standards.

Continuing Calibration Verification (CCV) - A standard solution (or set of solutions) used to verify freedom of excessive instrumental drift with the concentration near mid-range of linear curve.

Duplicate samples - Two samples taken from and representative of the same population and independently carried through all steps of the sampling and analytical procedures in an identical manner. Laboratory duplicates are used to assess variance of sub-sampling and analysis. Field duplicate samples are used to assess variance of the total method including sampling and analysis.

Interference check standard (ICS) - A standard solution (or set of solutions) used to verify accurate analyte response in the presence of possible interference from other analytes present in samples.

Internal standard (IS) - A standard added to a test portion of a sample in a known amount and carried through the entire demonstration procedures as a reference for calibration and controlling the precision and bias of the applied analytical method.

Matrix Spike (MS) - An aliquot of sample spiked with a known concentration of target analyte(s) prior to sample preparation and analysis in order to document the bias of a method in a given sample matrix.

Matrix Spike Duplicate (MSD) - Intra laboratory split samples spiked with identical concentrations of target analyte(s) prior to sample preparation and analysis in order to document the precision and bias of the method in a given sample matrix.

Secondary standard - A standard with a value based upon comparison with a primary standard.

Surrogate - A organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples.

Quality control samples are evaluated with every batch of samples analyzed. Acceptable limits for analytical instrumentation as well as each method are generated and documented, unless specific minimum acceptance limits are established by the method.

All episodes where the QC data show an out-of-control situation are documented, investigated, and corrective action taken.

Where applicable, the following minimum QC per batch is practiced in the laboratory:

<u>**Inorganics/Classical Chemistry**</u>

1. One calibration checks standard and associate blank. Repeat analysis of all affected samples will be performed if the calibration check standard is outside =10% of the expected value unless the method specifies otherwise. (Broader acceptance ranges must be justified.)

2. One reagent or method blank (carried through preparation).

3. One matrix spike.

4. One duplicate or matrix spiked duplicate.

5. One laboratory control sample (LCS)/laboratory fortified blank (LFB).

<u>**Organics**</u>

6. One calibration check standard (or method-specific frequency). If the calibration check standard is outside the limits, corrective action is taken.

7. One reagent, method or preparation blank (carried through preparation).

8. One matrix spike.

9. One duplicate or matrix spike duplicate.

10. Internal or external standards and surrogates (where available).

11. One laboratory control sample (consists of a representative matrix spiked with a reference standard containing the target analytes) as required by the method.

10.0 Performance and System Audits

A quality audit is an examination to determine whether quality activities and related results comply with planned arrangement and whether these arrangements are implemented effectively and are suitable to achieve objectives; whereas, a management review is a formal evaluation by top management of the status and adequacy of the quality system in relation to quality policy and objectives. The QA Coordinator will conduct quality audits at least once per year.

Audits will determine if:

- Procedures described in the quality system are being followed;
- Objectives (as defined by the quality system) are being achieved;
- Designated duties are being carried out satisfactorily; and
- There are opportunities for improvements.

The Laboratory Manager conducts an annual management review of the quality system to evaluate its status and adequacy. This includes the re-evaluation of the previous review; reports from third-party, client and internal assessments; results of all proficiency tests; details on any internal or external complaints; functionality of the QA Program Plan and Standard Operating Procedures; and laboratory personnel. The evaluation of laboratory personnel will include staff training, discrepancy reports, performance on proficiency tests, and knowledge of laboratory and method specific QA/QC requirements.

In addition to in-house audits, the Texas Commission on Environmental Quality (TCEQ) conducts periodic audits and inspections for quality assurance.

Results of any audit are recorded and brought to the attention of the personnel having responsibility in the area audited. The management personnel responsible for the area will take timely corrective action on deficiencies found during the audit. Follow-up audit activities will verify and record the implementation and effectiveness of the corrective action taken in response to previous audits. The results of audits will be an integral part of the input to management-review activities. Further, the laboratory will notify in writing any customer whose data may have been affected by any noted deficiencies.

In the event of dissatisfaction with SKG performance, a full investigation of the problem along with recommendations to prevent this from recurring and a discussion with the concerned party for complete resolution of the problem. If the quality of data is questionable, an internal audit must be performed.

11.0 Subcontractor Policy

When it becomes necessary to subcontract analyses, the laboratory performing the analyses must provide quality data comparable to SKG Labs. To assure this quality, the following criteria are used:

- Any subcontracting laboratory must be inspected by SKG management prior to analyzing any samples and subject to periodic re-inspection.

- SKG will maintain records of a list of approved subcontract laboratories along with a log of when that laboratory was last inspected.

- Once the audit of the subcontracting laboratory is successfully completed, that is, after any noted deficiencies are corrected, a completed copy of the SKG Subcontractor Laboratory Audit Record will be completed and kept on file.

- The subcontracting laboratory will maintain records of EPA Performance Evaluation studies and have those records available for inspection.

- The subcontracting laboratory will provide upon request all quality assurance data relating to the analysis of samples submitted.

- If the subcontracting laboratory has received and maintained certification it will have satisfied all the above requirements for Quality Assurance of a subcontracting laboratory.

APPENDIX A

MANAGEMENT & ADMINISTRATION
Russell T. Gully, P.E., P.L.S.

LABORATORY
Section Chief: Bill Powe
Manager: Ed Drake III

Clerical
Bonnie Evans

SKG
ENGINEERING
SURVEYING • LABORATORY • ENVIRONMENTAL

1122 SOUTH BRYANT BLVD.
SAN ANGELO, TEXAS 76903

PHONE: 325.655.1288
FAX: 325.657.8189

www.skge.com

Bill Powl
Environmental Specialist/Chemist II

Education

B.S. in Chemistry, 1975
Math & Computer Science
Angelo State University
San Angelo, Texas

High School Diploma, 1970
Talpa Centinel High School
Talpa, Texas

Experience Record

1975 – 1977 – San Angelo Labs- Laboratory Manager

1977– Present – SKG Engineering – San Angelo, Texas- Environmental Specialist, Section Chief
Perform ASTM Phase I Environmental Site Assessments, design and perform soil exploration related to environmental and geotechnical projects, perform laboratory analysis when required, designconstruction Storm Water Polution Prevention Plans, and perform Asbestos inspections.

Professional Affiliations

American Chemical Society
Fort Concho Water Utilities Association
American Society for Testing and Materials
Natural Gas Processors Association

Certifications

1999 – Individual Asbestos Management Planner
License No. 205459

Edgar "Scooter" Drake
Laboratory Manager/Techinician

Education

B.S. in Chemistry, 1991
Angelo State University
San Angelo, Texas

High School Diploma, 1983
Cotulla High School
Cotulla, Texas

Experience Record

1992 – Present – SKG Engineering - San Angelo, Texas- Laboratory Manager/Technician

As Manager of SKG Laboratory, Mr. Drake is responsible for the overall management of the laboratory functions, personnel, programs, strategic planning and initiatives and implementation of all department plans. Responsible for directing all routine and special quantitative analysis activities including equipment and supply purchase, test methods, quality assurance, reporting, scheduling of work, client relations, and accounting. Laboratory methods utilized include conventional wet chemistry, bacteriology and instrumental analysis procedures.

Certifications

2001 - Individual Asbestos Management Planner
License No. 205462

APPENDIX B

SKG LABORATORY
ENGINEERING • SURVEYING • ENVIRONMENTAL
1122 SOUTH BRYANT BLVD.
SAN ANGELO, TEXAS 76903
PHONE: 325.655.1255
FAX: 325.657.8189

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Project No.	Client / Project

Field Sample No./ Identification	Date and Time	Grab	Comp.	No. of Sample Containers	Sample Type (Liquid, Sludge, etc.)	Preservative	Analysis Requested	Laboratory Remarks

Samplers: (Signature)	Relinquished by: (Signature)	Date: Time:	Received by: (Signature)	Date: Time:	COC Seal No.
	Relinquished by: (Signature)	Date: Time:	Received by: (Signature)	Date: Time:	
Affiliation	Relinquished by: (Signature)	Date: Time:	Received by: (Signature)	Date: Time:	Intact:
Remarks:			Data Results To: 1. 2.		Laboratory No.

"APPENDIX B"

APPENDIX C

SKG LABS

1122 S. BRYANT SAN ANGELO TEXAS 76903 915-658-1986

WATER ANALYSIS REPORT

CLIENT:
ADDRESS:
SOURCE:

DATE COLLECTED:	COLLECTION POINT:
DATE RECEIVED:	COLLECTED BY:
LAB NUMBER:	DATE REPORTED:
WELL DEPTH:	STATIC LEVEL:
	WELLHEAD ELEV.:

TOTAL ALKALINITY =		mg/L (as CaCO3)
TOTAL HARDNESS =		mg/L (as CaCO3)
CALCIUM HARDNESS =		mg/L (as CaCO3)
pH VALUE =		Std. Units
SP. CONDUCTANCE =		micromhos/cm
IRON =		mg/L (Total)
AMMONIA (as N) =		mg/L (NH3-N)
NITRITES =		mg/L (NO2-N)
PHOSPHATES =		mg/L (Total)
FLUORIDES =		mg/L
NITRATES (AS N) =		mg/L (NO3-N)
NITRATES =	me/L	mg/L (NO3)
CHLORIDES =	me/L	mg/L (Cl)
SULFATES =	me/L	mg/L (SO4)
BICARBONATES =	me/L	mg/L (HCO3)
CALCIUM =	me/L	mg/L (Ca)
MAGNESIUM =	me/L	mg/L (Mg)
SODIUM AND POTASSIUM =	me/L	mg/L (Na & K)
DISSOLVED SOLIDS =	me/L	mg/L (Sum)
TOTAL COLIFORM =	org./100ml	
FECAL COLIFORM =	org./100ml	

**** mg/L = ppm(for fresh water) NR = NOT REPORTED TNTC = Too Numerous To Count
**** The limits noted are State Health Dept. limits for public water supplies.****

Chemist
Ed Drake

"APPENDIX C"

SKG LABORATORY

ENGINEERING ♦ SURVEYING ♦ ENVIRONMENTAL

1122 SOUTH BRYANT BLVD.
SAN ANGELO, TEXAS 76903

PHONE: 325.655.1288
FAX: 325.657.8189

WASTEWATER ANALYSIS REPORT

Pertaining to: ______________________ Permit No.: ______________________________

Date Collected: ______________________ Sample Type: Grab _____ Composite _____ Hr. _____

Flow: ____________________________ Point of Collection: ________________________

Material Sampled: Raw, Primary, Partially Treated, Final, Stream

FIELD DATA

Water Temp: ______________ pH: ______________ Cl_2: ______________

D.O. (mg/L): __________________ (probe, Winkler) Preservative: ____________________

Collected by: __________________________ Date: __________ Time: __________

Relinquished by: _______________________ Date: __________ Time: __________

LABORATORY ANALYSIS

Received by: ____________________ Date: ________________ Time: ____________

Start Date: ____________ Time: _______ Completed: Date: __________ Time: _________

Laboratory No.: __________________ Temperature: ________

		METHOD*			METHOD*
pH (StdUnits)	________	4500 - H^+ B	NH_3-N (mg/L)	________	4500 - NH_3 C
O-PO_4 (mg/L)	________	4500 - P E	NO_2-N (mg/L)	________	4500 - NO_2 B
T-PO_4 (mg/L)	________	4500 - P B5	NO_3-N (mg/L)	________	4500 - NO_3 E
$CBOD_5$ (mg/L)	________	5210 B	Kjeldahl - N (mg/L)	________	4500 - N org B.
BOD_5 (mg/L)	________	5210 B	Sp Cond(umhos/cm)	________	2510 B
TSS (mg/L)	________	2540 D	Fecal Coliform (cfu/100mls)	________	9222 D
VSS (mg/L)	________	2540 E	Oil & Grease (mg/L)	________	5520 B.
Chloride (mg/L)	________	4500 Cl B	Sulfate(mg/L)	________	4500-SO_4 E

* Standard Methods for the Examination of Water & Wastewater 19th Edition

Analyst ____

Remarks: ____

____

"APPENDIX C"

APPENDIX D

Summary of Water Sample Collection, Methods, Preservation, Storage, and Handling Requirements

Parameters	Recommended Containers	Sample Volume (ml)	Preservation	Maximum Holding Time
Routine Conventionals in Water Samples 3 Containers; [illegible] preserved with H_2SO_4				
CONTAINER 1				
Alkalinity, TSS, Cl, SO_4, $NO_3 + NO_2$, OPO_4 See individual volumes and hold times required for parameters taken from Cubitainer 1 listed below	cubitainer or glass	1000	Cool to 4°C, dark	
Alkalinity (00410)		100	Cool to 4°C, dark	14 days
TSS (00530)/VSS (00535)		400	"	7 days
Chloride (Cl) (00940)		100	"	28 days
Sulfate (SO_4) (00945)		100	"	28 days
Orthophosphorus (OPO_4) ① (00671)		150	"	Filter ASAP; 48 hrs until analysis
Nitrate + Nitrite (00630) ($NO_3 + NO_2$) ②		150	"	48 hours
TDS (70300)		250	"	7 days
CONTAINER 2				
NH_3, TPO_4, TOC See individual volumes and hold times required for parameters taken from Cubitainer 2 listed below	cubitainer or glass	1000	1-2 ml conc.H_2SO_4 to pH <2 and cool to 4°C, dark	
Ammonia (NH_3) (00610)		150	"	28 days

Parameters	Recommended Containers	Sample Volume (ml)	Preservation	Maximum Holding Time
Total Phosphorus (TPO_4) (00665)		150	"	28 days
Total Organic Carbon (TOC) (00680)		100	"	28 days
CONTAINER 3				
Chlorophyll *a* ③ (32211) Pheophytin *a* (32218)	quart (or liter) cubitainer	1000	Cool to 4°C, dark	•Filter ≤ 48 hours •Filters may be stored frozen up to 30 days

Routine Conventionals-in-Water Sample Collection Procedure

- Label containers before collection with Tag #, Station Location, Date and Sample Type.
- Place an "X" on the container lid to identify the acidified sample.
- Open cubitainers by pulling apart. Pre-rinsing cubitainers with ambient water is not necessary.
- Fill each container with ambient water by submerging container approximately one foot below the surface mid-stream until filled.
- Place sample on ice immediately. Acidify the "X" container as soon as possible.
- Place on ice and ship as soon as possible.

Non-Routine Water Samples

Parameters	Recommended Containers	Sample Volume (ml)	Preservation	Maximum Holding Time
OIL AND GREASE (00556)	glass jar with teflon lined lid rinsed with hexane or methylene chloride	1000	2 ml conc. H_2SO_4 to pH <2; cool to 4°C, dark	28 days
PHENOLS (34694)	glass jar with teflon lined lid	1000	2 ml conc. H_2SO_4 to pH <2; cool to 4°C, dark	28 days
CYANIDE (00720)	quart (or liter) cubitainer	1000	2 ml 1:1 NaOH added to pH > 12; 0.6g ascorbic acid if residual chlorine present. Cool to 4°C, dark.	14 days
BIOCHEMICAL OXYGEN DEMAND (00310)	gallon cubitainer	> 4000	Cool to 4°C, dark; add 1g FAS crystals per liter if residual chlorine present	48 hours
CHEMICAL OXYGEN DEMAND (00335)	quart cubitainer	110	2 ml conc. H_2SO_4 to pH <2; cool to 4°C, dark	28 days

① It is preferable that samples be filtered in the field or laboratory filter as soon as possible.
② If nitrite and nitrate are analyzed by ion chromatography, then no acidification is required. For other methods of analysis, preserve with H_2SO_4 to pH < 2 for a holding time of 28 days.
③ It is suggested in Standard Methods that samples must be filtered as soon as possible and filters can be stored frozen for 21 to 30 days. Other authorities suggest samples be filtered and can be stored indefinitely.

Parameters	Recommended Containers	Sample Volume (ml)	Preservation	Maximum Holding Time
Metals-In-Water				
DISSOLVED (except Hg)	HNO_3 cleaned plastic bottle	1000	Filter at sample site with 0.45 micron in-line filter into ultra-pure HNO_3 preacidified container to pH<2	6 months
DISSOLVED MERCURY	HNO_3 cleaned glass or Teflon bottle	250	Same as above	28 days
TOTAL (except Hg)	HNO_3 cleaned plastic bottle	1000	Preacidified container with 5 ml ultra-pure HNO_3 to pH<2	6 months
TOTAL MERCURY (Hg)	HNO_3 cleaned glass or Teflon bottle	250	Preacidified with 1-2 ml ultra-pure HNO_3 to pH<2	28 days
HEXAVALENT CHROMIUM (filtered)	plastic or glass	600	Cool to 4°C, dark, no acid	24 hours; must notify lab in advance
HARDNESS (00900)	quart cubitainer	250	Cool to 4°C, dark OR	48 hours
Metals-In-Water				
HARDNESS (00900) (cont)			Filtered and 2 ml conc H_2SO_4 or HNO_3 to pH < 2; Cool to 4°C, dark	6 months

Metals-in-Water Sample Collection Procedures

DISSOLVED METALS (includes Hexavalent Chromium)

- Put on ***powder-free*** latex gloves and using Clean Hands/Dirty Hands technique.
- Assemble pump, tubing, and filter.
- Immerse intake tubing directly into water 1 ft and pump approx. 500 ml of ambient water to flush tubing and filter.
- Fill precleaned, preacidified container with 600-1000 ml of filtrate leaving some head space.

TOTAL METALS

- Put on ***powder-free*** latex gloves and using Clean Hands/Dirty Hands technique.
- Assemble pump, and tubing without filter.
- Immerse intake tubing directly into water 1 ft and pump approx. 500 ml of ambient water to flush tubing.
- Fill precleaned, preacidified container with 600-1000 ml of sample leaving some head space.

Parameters	Recommended Containers	Sample Volume (ml)	Preservation	Maximum Holding Time
Organics/Pesticides-In-Water				
VOLATILE ORGANICS (VOA)	Two-40 ml VOA Vials	80	Cool to 4°C, dark; or 2-4 drops HCL to pH < 2, cool to 4°C, dark for BTEX	14 days
ORGANICS PESTICIDES & HERBICIDES •Organophophorus Pesticides •Organochlorine Pesticides •Chlorinated Herbicides SEMI-VOLATILE ORGANICS	1- qt glass jar with teflon lined lid per sample type; must be prerinsed with hexane, acetone, or methylene chloride	1000 **Each sample type requires 1000 ml in a separate container**	Cool to 4°C, dark If chlorine is present, add 0.1g sodium thiosulfate	7 days until extraction

Organics-in-Water Collection Procedure

- Label each container before collection with Tag #, Station Location, Date, and "ORGANICS-Organophosphorus Pesticides or Organochlorine Pesticides, or Chlorinated Herbicides" or "SEMIVOLATILES" (depending on sample type).
- Fill to the top. Put in the dark and on ice.
- Fill quart jar(s) to the top. Put in the dark and on ice.

Parameters	Recommended Containers	Sample Volume (ml)	Preservation	Maximum Holding Time
Biological				
TOXICITY IN WATER	Two 1-gallon cubitainers	8000 ml	Cool to 4°C, dark	7 days

Toxicity Sample Collection Procedure

WATER

- Label containers before collection with Station Location, Date and Sample Type.
- Open cubitainers by pulling apart. Pre-rinsing cubitainers with ambient water is not necessary.
- Fill each container with ambient water by submerging container approximately one foot below the surface mid-stream until filled.
- Place on ice and ship as soon as possible.

A complete listing of metals, organics, and conventional water parameters are located in Appendix

Summary of Quality Assurance Field Samples

Field Duplicates

- Represent environmental and other variability introduced during sampling, preservation and handling. Field Duplicates are submitted with every tenth sample. If less than 10 samples are collected in a month, submit one set of duplicates per month.
- Collect two sets of routine samples at the same location, sequentially, using the same methods. The samples are handled, stored, shipped and analyzed using identical procedures. This applies to all cases of routine surface water collection procedures, including instream grab samples, bucket grab samples from bridges, pumps, and other water or sediment sampling devices.
- Each set of samples has a separate tag #. Submit both sets of water samples to the same lab for analysis; **Label RFA Tag as a DUPLICATE.**

VOA Trip Blanks

- Trip blanks are run for volatile organic samples <u>only</u>.
- One set of DI water samples is submitted for volatile organics samples for each ice chest of samples.
- VOA trip blanks are samples prepared in the laboratory with pure laboratory water, preserved as required. They are transported to the sampling site, handled like other VOA samples, and returned to the laboratory of analysis. Trip blanks are not opened in the field.
- VOA trip blanks are used to check contamination of the sample through leaching of the septum.

Field Blanks

Conventionals in Water and Organics

- Field Blanks are not routinely required but may be inserted into the sample regime, if needed for a specific reason.
- Blanks are collected at the last station of a sampling trip or sampling day.
- DI water is obtained from the laboratory.
- In the field, fill sample containers with DI water. The samples are handled, stored, shipped and analyzed the same as the ambient water samples.
- Label the container as a BLANK and with a separate (from ambient water sample) tag # (the same RFA Tag is used for all blank samples prepared at a site); **Record BLANK on the RFA Tag station description space.**

Field Equipment Blanks

Dissolved Metals

- If Field Equipment Blanks are consistently less than the reporting limit, a set of Field Equipment Blanks are submitted with every tenth sample. If less than 10 samples are collected in a month, submit one set of blanks per month. *If contamination is detected in field equipment blanks, blanks are required for every metals-in-water sample until the problem is resolved.*
- Blanks are collected at the last station of a sampling trip or sampling day.

Field Equipment Blanks (continued)

Dissolved Metals (continued)

- DI water is obtained from the laboratory.
- 1000 ml of metals-free deionized water that has been drawn through a new filter will be submitted as a blank. Flush the tube and filter with 500 to 1000 ml of metals-free DI water. Routine procedure described for collecting dissolved metals-in-water will be followed.
- Label container as a DISSOLVED METALS BLANK and with a separate (from ambient water sample) tag # (the same RFA Tag is used for all blank samples prepared at a site); **Record BLANK on the RFA Tag station description space.**

Total Metals

- If Field Equipment Blanks are consistently less than the reporting limit, a set of Field Equipment Blanks are submitted with every tenth sample. If less than 10 samples are collected in a month, submit one set of blanks per month. *If contamination is detected in field equipment blanks, blanks are required for every metals-in-water sample until the problem is resolved.*
- Blanks are collected at the last station of a sampling trip or sampling day.
- DI water is obtained from the laboratory.
- 1000 ml of metals-free deionized water that has been drawn through a clean tube will be submitted as a blank. Flush tube with 500 to 1000 ml of metals free DI water. Routine procedure described for collecting total metals-in-water will be followed.
- Label the container with TOTAL METALS BLANK and sample tag # (the same RFA Tag is used for both dissolved and total metals-in-water samples; **Label RFA Tag as a Total Metals BLANK.**

NOTE: Equipment blanks are not routinely collected or analyzed on samples other than metals-in-water. The frequency of these samples is variable and is chosen to address specific quality assurance issues.

Summary of Sediment Sample Collection Methods, Preservation, Storage, and Handling Requirements

Parameters	Recommended Containers	Sample Volume (grams)	Preservation	Maximum Holding Time
Sediment				
Metals	1- pint glass jar with Teflon lined lid; special treatment not required	500 g	Cool to 4°C, dark	28 day ①
Organics	1-pint glass with Teflon lined lid; special treatment not required	500 g	Cool to 4°C, dark	14 days
Conventionals AVS, TOC, Grain Size, % Solids	1-pint glass jar with Teflon lined lid	500 g	Cool to 4°C, dark	14 days ②
Toxicity in Sediment	1-quart glass jars*	Two full jars	Cool to 4°C, dark	7 days

① Holding time for mercury in sediment is 28 days. Other metals in sediment 180 days.
② Holding time for AVS is 14 days; for grain size, TOC, oil and grease, and percent solids (moisture content) 28 days.
* required jar size

Sediment Sample Collection Procedure

- Label containers before collection with Tag #, Station Location, Date and Sample Type.
- Wash dredge pan and bucket with ambient water at start and before next station.
- Slowly lower the dredge into the sediment. Raise closed dredge at approx. 2 ft/s.
- Slowly decant overlying water. Empty sediment grab into a pan.
- Composite a minimum of 3 samples. Sediment needs to be collected directly into the container (specifically organics and conventionals [AVS])
- First grab-put first scoop off top into Container 1; next scoop into Container 2.
- Second grab- put first scoop in Container 2; the second scoop in Container 1.

Parameters	Recommended Containers	Sample Volume (grams)	Preservation	Maximum Holding Time
Sediment Sample Collection Procedure				
• Keep rotating until the jars are full. • Compositing in pan releases volatiles. However, a composite sample may be collected in a pan or bucket for metals in sediment samples. Reject grab if: mud is coming out top of dredge; overlying water leaking out of dredge (removes superficial sediment); and/or sediment sloping in the dredge (surface of sediment bite in dredge should be relatively flat). This may be difficult for flowing water samples. Entire bites from a flowing water site may be used. • Place samples into clean glass jars with Teflon lids. Put samples in dark and on ice. Fill containers to top with no head space. • If sampling for both metals and organics collect three (3) jars of sediment (metals/organics/conventionals) • Record in field notebook the location, sediment description (color, texture, odor, and number of grabs). • Ship to lab.				
• ***For estuarine and reservoir samples***, collect the top aerobic zone (up to 5 cm) from at least three subsamples and composite. • ***For stream samples***, the entire grab may be composited. Otherwise, exclude the bottom-most layer and composite.				
NOTE: If submitting sediment samples for metals, organics and conventionals three (3) separate jars are required. If samples are submitted for metals only, than 2 separate jars are required. Samples for organics only also require 2 separate jars.				
A complete listing of metals, organics and conventional parameters in sediment are located in Appendix E				