2014 Basin Summary Report

A Summary of Water Quality within the Canadian and Red River Basins

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ACRONYM LIST

ALA ..... Aquatic Life Assessment
ALU ..... Aquatic Life Use
AMSL ..... Above Mean Sea Level
AU ..... Assessment Unit
BAC ..... Basin Advisory Committee
BMP ..... Best Management Practice
CAFO ..... Concentrated Animal Feeding Operation
CFS ..... Cubic Feet per Second
CFU ..... Colony Forming Unit
CMM ..... Coordinated Monitoring Meeting
CRIT ..... Criteria
CRMWA ..... Canadian River Municipal Water Authority
CRP ..... Clean Rivers Program
CWA ..... Clean Water Act
EPA ..... U.S. Environmental Protection Agency
ESD ..... RRA Environmental Services Division
FM ..... Farm to Market Road
HUA ..... Hydrologic Unit Area
IR ..... Integrated Report
LPDTF ..... Lower Prairie Dog Town Fork
MAX ..... Maximum
MG/L ..... Milligrams per Liter
MIN ..... Minimum
MPN ..... Most Probable Number
N ..... Number of Measurements
N/A ..... Not Applicable
NPS ..... Non-Point Source
NTMWD ..... North Texas Municipal Water District
PDTF ..... Prairie Dog Town Fork
QA ..... Quality Assurance
QAPP ..... Quality Assurance Project Plan
RRA ..... Red River Authority of Texas
RRC ..... Texas Railroad Commission
RUAA ..... Recreational Use Attainability Analysis
SH ..... State Highway
SWQM ..... Surface Water Quality Monitoring
SWQMIS ..... Surface Water Quality Monitoring Information System
TCEQ ..... Texas Commission on Environmental Quality
TMDL ..... Total Maximum Daily Load
TPWD ..... Texas Parks and Wildlife Department
TSSWCB ..... Texas State Soil and Water Conservation Board
TSWQS ..... Texas Surface Water Quality Standards
TWDB ..... Texas Water Development Board
UG/L ..... Micrograms per Liter
USGS ..... United States Geological Survey
VSS ..... Volatile Suspended Solids
WPP ..... Watershed Protection Plan
WQS ..... Water Quality Standards
WTP ..... Water Treatment Plant
WWTP ..... Wastewater Treatment Plant

ACTIVITIES AND ACCOMPLISHMENTS

The Clean Rivers Program, or CRP, began in 1991 with one goal or mission. Today, that same basic goal expressed in *The Long Term Plan of the Clean Rivers Program* is:

> *To maintain and improve the quality of water within each river basin in Texas through an ongoing partnership involving the Texas Commission on Environmental Quality (TCEQ), river authorities, other agencies, regional entities, local governments, industry, and citizens. The program's watershed management approach will identify and evaluate water quality issues, establish priorities for corrective action, work to implement those actions, and adapt to changing priorities.*

In the Clean River Program's infancy, the watershed management approach was selected as the best method to manage the state's diverse surface water resources. Over twenty-three years later, the energy and motivation that helped start the program is still the driving force of the CRP today.

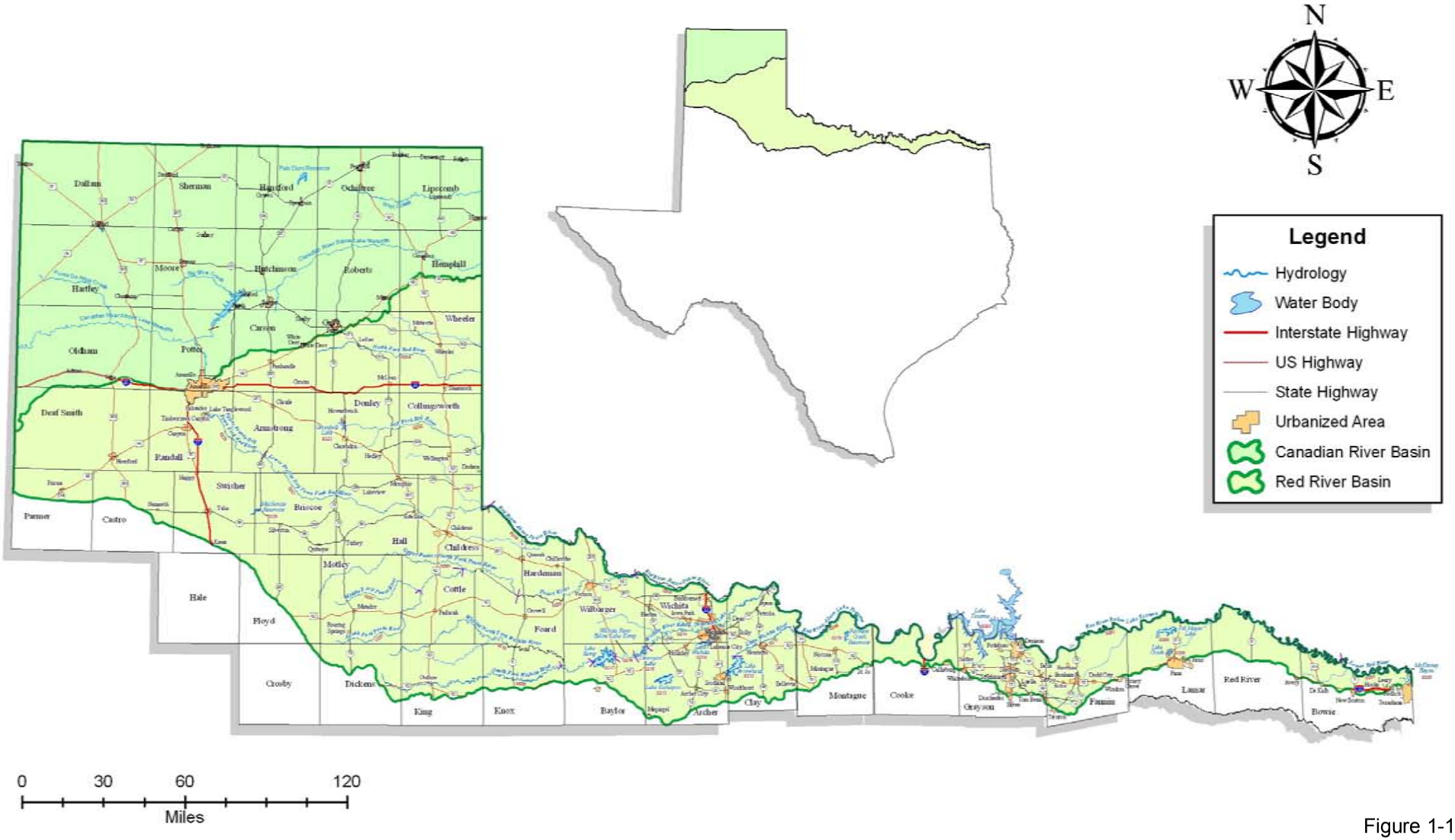
The Clean Rivers Program has proven to be a success with the cooperation of watershed planning efforts in the Canadian and Red River Basins. A very successful component of the CRP for both basins is the annual Coordinated Monitoring Meeting. At this meeting, monitoring partners gather to plan and coordinate monitoring efforts for the next fiscal year. This ensures that the maximum number of sites are selected, without duplication of efforts, thereby insuring the efficient use of available financial resources. Another important ingredient of the Clean Rivers Program is the Basin Advisory Committee meetings. These meetings are held annually to provide opportunities for you, the stakeholder, to offer your opinion and make a difference. The Authority is very appreciative of all of the time and effort that is invested in these meetings.

The Authority's mission is the orderly conservation, reclamation, protection and development of the water resources throughout the Red River Basin for the benefit of the public. The Authority also contracts with the state to conduct water quality monitoring via the Clean Rivers Program within the Texas portion of the Canadian River Basin, as well. The Authority is proud of its commitment between federal, state, and local agencies. Common goals are expressed and pursued by all parties involved in the basins' future.

The Authority always welcomes and encourages stakeholder participation and involvement in the planning of the Canadian and Red River Basins' watershed management. For information on how you can be on the Basin Advisory Committee or other public outreach activities, please contact the Authority or refer to the Authority's website at **www.rra.texas.gov.**

To facilitate assessment of the Canadian and Red River Basins, the Authority subdivided each basin into five reaches, also known as sub-watersheds. These reaches, divided by natural hydrology, are composed of classified and unclassified stream or water body segments and are identified by the TCEQ in the Texas Surface Water Quality Standards (TSWQS). Refer to the **Vicinity Map** on **page 7** for a visual presentation of the Canadian and Red River Basins. The following paragraphs present a summation, by basin reach, of the Authority's findings during this assessment and data review process.

Red and Canadian River Basins
Vicinity Map



0 30 60 120
Miles

Figure 1-1

SIGNIFICANT FINDINGS

Canadian River Basin Overview

The Canadian River Basin includes all or parts of 15 counties in the Texas Panhandle. The headwaters of the Canadian River begin in northeastern New Mexico as a tributary to the Arkansas River and eventually flows into the Mississippi River. The basin was divided into five reaches in order to design the most effective sampling methodology within the limited funds and personnel available. There are five classified stream segments and eight unclassified stream segments in the Canadian River Basin.

From a basin-wide perspective, the waters of the Canadian River Basin are generally good in quality. Water quality throughout the vast majority of the basin supports aquatic life and recreational uses. There are two major issues that affect the Canadian River Basin. One is the ongoing drought, while the other is elevated salt concentrations (including chloride, sulfate, and total dissolved solids). There are no quick solutions or remediation strategies to alleviate either issue, but the Authority and its stakeholders are working toward the effective management of these ongoing issues.

Canadian River Basin – Reach I

In **Reach I** of the Canadian River Basin there are four (one classified and three unclassified) identified segments, all of which were assessed in the *2012 IR*. The *2012 Texas Integrated Report (2012 IR)* lists one portion of the classified stream segment, the Canadian River below Lake Meredith (Segment 0101), with a **bacteriological** impairment and concerns for both **ammonia** and **chlorophyll-*a***. The three unclassified segments, Dixon Creek (Segment 0101A), Rock Creek (Segment 0101B), and White Deer Creek (Segment 0101C) are in the *2012 IR* as well. Dixon Creek is listed with **bacteriological**, **depressed dissolved oxygen**, and **selenium in water** impairments. Additionally, the segment has also been identified with concerns for both **chlorophyll-*a*** and **nitrate**. Rock Creek was delisted for **bacteria** during the 2012 assessment, but still has concerns for water quality based on screening levels for **nitrate**, **orthophosphorus**, and **total phosphorus**. White Deer Creek has never been listed with a concern or impairment and continues to be utilized by the Authority as a reference station for this region of the Panhandle.

The primary overall concerns in **Reach I** are **nutrients** and **bacteria**. The elevated **nutrient** levels may be the result of wildlife and livestock remaining near water to drink and keep cool in the summer. This increases the likelihood of bacteria spikes when there is runoff. Sources of the elevated **nutrients** and **bacteria** vary by segment, but wildlife and agricultural runoff are the most likely causes. Although most **nutrient** nonpoint sources cannot be ascribed to a particular source(s) in most cases, the development of a watershed protection plan will aid in identifying and managing water quality concerns like these. Watershed protection plans are developed locally and are stakeholder driven. For more detailed analyses of these water bodies within **Reach I** of the Canadian River Basin, please refer to the Watershed Summaries located in **Chapter 4**.

Canadian River Basin – Reach II

Reach II of the Canadian River Basin includes six identified stream segments, five (2 classified and three unclassified) of which were assessed in the *2012 IR*. Lake Meredith (Segment 0102), a classified water body, is the largest reservoir in the Canadian River Basin. It is managed by the Canadian River Municipal Water Authority (CRMWA). Lake Meredith (Segment 0102) is on the *2012 IR* with a single impairment for **mercury in edible fish tissue** (walleye). During the 2002 study, twenty-five (25) fish (9 species) were analyzed for mercury, four (4) of which were Walleye. Results showed the average concentration of mercury in these four samples to be 0.804 mg/kg, which exceeds the Health-Based Assessment Comparison Value of 0.700 mg/kg. Additionally, a single White Bass had a mercury value of 0.677 mg/kg. Since a large enough population of this species was not tested, an intermediate public health hazard was issued for White Bass. No additional data has been collected since the initial assessment and subsequent listing to determine whether or not this impairment still exists today. Big Blue Creek (Segment 0102A) was assessed in the *2012 IR* and found to have no impairments or concerns.

The Canadian River above Lake Meredith (Segment 0103) is listed with a single impairment for elevated levels of **chloride**. There is no quick solution to curb the elevated **chloride** concentrations found in the upper portion of the Canadian River.

However, the CRMWA has two ongoing projects taking preventative measures to remove sources of **chloride** in and along the Canadian River before they eventually end up in Lake Meredith. The first method is a deep-well injection process, which focuses on geographic locations identified as having elevated concentration of **chloride** and pumping the highly saline water deep into the earth, similar to processes used in the oil and gas industry. In addition to this, CRMWA implemented a Salt Cedar Management Program in 2004 to help reduce the amount of this highly invasive ornamental shrub (Salt Cedar) along portions of the Canadian River, reducing their negative impact not only on water quality, but also on native species they have successfully outcompeted. This project is scheduled to enter its last year in the summer of 2014, and to date has treated approximately 26,528 acres. The ongoing benefit of these two projects is apparent in **Reach II** of the Canadian River Basin, as evidenced by three 303(d) impairment delistings in the *2012 IR* for **chloride**, **sulfate**, and **total dissolved solids** in Segment 0102.

East Amarillo Creek (Segment 0103A) and the Unnamed Tributary to West Amarillo Creek (Segment 0103C) share concerns for water quality based on screening levels for **chlorophyll-*a***, while East Amarillo Creek also has an additional concern for **nitrate**. Finding the sources of these elevated **nutrients** is going to be difficult because of the urbanization along the creek. However, both unclassified segments have small ponds above the monitoring stations where data is collected. Due to the ongoing drought, it is likely these ponds supply these streams with **nutrient-rich** water, increasing **nutrient** concentrations that support elevated concentrations of **chlorophyll-*a***.

For more detailed analyses of the water bodies within **Reach II** of the Canadian River Basin, please refer to the Watershed Summaries located in **Chapter 4**.

Canadian River Basin – Reach III

There is only one identified segment in **Reach III**, Rita Blanca Lake (Segment 0105). Although

called a lake, Rita Blanca is more comparable to a marsh or wetland. Migratory waterfowl use Rita Blanca Lake as a stopover during migration. It is on the *2012 303(d) List* for **pH** and has concerns for elevated levels of **ammonia**, **chlorophyll-*a***, **orthophosphorus**, **total phosphorus** and **nitrate**. Trend analyses revealed statistically significant upward trends for both **chloride** and **sulfate (See Appendix A)**, along with some interesting seasonal variability, which coincides with the increase of migratory waterfowl using Rita Blanca Lake during the winter months. The TCEQ has identified Rita Blanca Lake as a waterfowl habitat in *Appendix A - Site Specific Uses and Criteria for Classified Segments*, *30 TAC §307.10(1)*, however, alternative criteria has not been allotted. Due to the waterfowl use, it is unlikely that this segment would benefit from a TMDL or watershed protection plan. Additional consideration with regard to water quality standards should be given to Rita Blanca Lake and other water bodies utilized by migratory waterfowl, as the impact this has on water quality is very apparent.

Canadian River Basin – Reach IV

Reach IV has two unclassified segments, and both were assessed in the *2012 IR*. Palo Duro Reservoir (Segment 0199A) has concerns for exceeding the **nutrient** screening levels for **orthophosphorus** and **total phosphorus**. While both elevated and lower values were observed for **total phosphorus**, trend analyses was not possible due to the insufficient number of data points. The ongoing drought, combined with the naturally arid nature of this part of the Canadian River Basin, continue to affect the filling of Palo Duro Reservoir. According to the Palo Duro River Authority, the five year average capacity was 8.06%, while the ten year capacity was 5.86%. Kiowa Creek (Segment 0199B) was not identified as having any impairments or concerns.

Canadian River Basin – Reach V

Like Reach III, **Reach V** has only one classified segment, Wolf Creek (Segment 0104). Wolf Creek was delisted for a previous **bacteria** impairment, but retains a single concern for water quality based on screening levels for **chlorophyll-*a***. This concern was found only in the Lake Fryer portion of Segment 0104, a small impoundment located in the upper portions of the watershed. Exceedances were observed sporadically in the middle portion of segment, while there were no exceedances in the lower portion of the segment. Based on this information, it is likely the concern originates from runoff into the lake after rainfall events, and/or from animal and human activity in the recreation area surrounding the lake. Monitoring above Lake Fryer could be beneficial to aid in the determination of a nonpoint source for **chlorophyll-*a***. The additional information collected may shed light on whether this is a problem in the watershed surrounding the lake or within the watershed above the lake. Trend analysis revealed statistically significant upward trends in the Lake Fryer portion of Segment 0104; **TSS**, **VSS**, **chloride**, and **TKN**, most likely attributed to the ongoing drought within the area.

Red River Basin Overview

As the second longest river in the State of Texas, the Red River Basin includes all or parts of 43 counties across North Texas. The Red River is an interstate water body that originates in Curry County, New Mexico as Tierra Blanca Creek and flows across the Texas Panhandle carving the spectacular Palo Duro Canyon of the High Plains. It then leaves the Caprock Escarpment near the eastern boundary of Childress County, where the south bank of the river becomes the boundary between Texas and Oklahoma. It continues its southeasterly direction

across Texas into southwestern Arkansas, then turns south into Louisiana, where it discharges into the Mississippi River near Simmesport, Louisiana.

Water resources within the Red River Basin are generally good and meet stream standards. There are continuing issues with the exceptionally high levels of salts, which originate in the western portions of the watershed and affect all water downstream. Only 12 of the 30 classified stream segments have been designated as useable for public water supply due to naturally high occurring concentrations of salt, according to water quality standards. As stated earlier, the basin was divided into five reaches in order to design the most effective sampling methodology within the limited funds and personnel available.

As the State Sponsor of the Red River Chloride Control Project, the Authority will continue to support the Chloride Control Project with trustworthy, reliable scientific methodologies to improve the water quality in the Red River and its tributaries. For more information on the Chloride Control Project and/or the Wichita River Basin Chloride Control Project, please review the Authority's website at **www.rra.texas.gov** or the U.S. Army Corps of Engineer's website at **www.swt.usace.army.mil**. The Chloride Control Project has removed more than 405 tons of **chloride** per day entering the river system, without harming the environment.

Red River Basin – Reach I

Reach I of the Red River Basin has thirty-three (eight classified and twenty-five unclassified) identified segments, twenty-seven (ten classified and seventeen unclassified) of which were assessed in the *2012 IR*. Eighteen segments are either on the *2012 303(d)* and/or *305(b) Report.* There are ten concerns for elevated **chlorophyll-*a*** levels, four concerns for elevated **orthophosphorus** levels (will be removed beginning with the *2014 IR*), three concerns for **depressed dissolved oxygen**, two concerns for elevated **ammonia**, four concerns for both elevated **nitrate** and **total phosphorus**, and one concern for both **harmful algal blooms** and **manganese in sediment**. Mud Creek (Segment 0201A) is on the *2012 303(d) List* for elevated **bacteria** levels and **depressed dissolved oxygen**. In addition, Smith Creek (Segment 0202G) is on the *2012 303(d) List* for elevated **bacteria** levels. Specifically, Pat Mayse Lake (Segment 0209) has a concern for **manganese in sediment**. The *2012 Texas Integrated Report* shows the remaining nine segments as either not having any impairments and/or concerns, or were not assessed due to having insufficient data.

Although segments with concerns for **nutrients** are increasing in **Reach I**, **chlorophyll-*a*** is a common concern that can be found up and down the main stem of the Red River. Since Texas and Oklahoma share responsibility for portions of the Red River, it would be useful and advantageous for both states to share data so that each can better manage not only the Red River, but their own resources, as well. In most segments with elevated **nutrients**, attributing the concern(s) to a particular source(s) can be very difficult, due the extensive list of **nutrient-related** nonpoint sources. However, there are some situations where point source influence, a permitted discharger for example, may be the cause. In either case, additional monitoring locations may be required to best determine the location of such sources.

For those segments with **bacteria** impairments or concerns, methods have been developed that allow the **bacteria** to be grouped into human and non-human sources, also known as bacteriological source tracking. This new technology tracks bacterial sources and has successfully differentiated between human and non-human varieties of **bacteria**. Once the source of the bacteria is identified, more comprehensive management plans can be implemented.

In Pat Mayse Lake, the extent of the elevated **manganese** levels could be determined by increasing the number of sediment sampling sites. The results would show if the concern is uniformly distributed or localized, and perhaps a pattern of deposition across the bottom of the lake. Elevated **chloride** and **total dissolved solid** concentrations are a continuous issue due to their natural occurrence in the Red River Basin, and are best addressed through continued monitoring and the Chloride Control Project. For more detailed analyses of all of the segments in **Reach I** of the Red River Basin, please refer to the Watershed Summaries in **Chapter 4**.

Red River Basin – Reach II

Reach II of the Red River Basin has twenty-one (eleven classified and ten unclassified) identified segments, seventeen (ten classified and seven unclassified) of which were assessed in the *2012 IR*. **Reach II** is a diverse area with the majority of the population located in the eastern half of the reach, while the western half is home to some of the largest ranches in the state. Petroleum production is very prominent in this reach. Major sources of naturally occurring **chloride** are also present in **Reach II**.

In **Reach II**, eleven segments are either in the *2012 303(d)* and/or the *305(b) Report*. There are six concerns for elevated **chlorophyll-*a*** and **orthophosphorus** (will be removed beginning with the *2014 IR*, as the TCEQ will begin strictly assessing on **total phosphorus** concentrations) and **total phosphorus** levels. There are two concerns for **depressed dissolved oxygen** levels, and two concerns for **ammonia**, **harmful algal blooms**, **nitrate**, and **selenium in water**. The Little Wichita River (Segment 0211) is on the *2012 303(d) List* for **depressed dissolved oxygen**, **chloride**, **sulfate**, and **total dissolved solids**. In addition, the Wichita River below Lake Diversion Dam (Segment 0214), Beaver Creek (Segment 0214A), and Buffalo Creek (Segment 0214B) are also on the *2012 303(d) List* for elevated **bacteria** levels.

Additionally, Lake Wichita and Diversion Lake were both plagued over the previous two years with occurrences of **harmful algal blooms** as defined by the Texas Parks and Wildlife Department. Specifically, *Prymnesium parvum*, or Golden Algae, as it is more commonly known, led to fish kills in both water bodies, leading to their concern for near non-attainment of the water quality standard for **harmful algal blooms** in the *2012 IR*.

The sources of the concerns on Segments 0214 and 0214A vary almost by assessment unit. They may range from runoff from a small CAFO and/or farming and ranching operations located along the flood plain of the river. Other possible sources could range from increased wildlife and birds (such as large flocks of wild turkeys) in the more rural sections of the segment to runoff and municipal discharge from large cities located along the river. In Segment 0226, the elevated **ammonia** levels could be due to a variety of nonpoint sources, which will require additional monitoring to determine a specific cause.

The North Fork and Middle Fork Wichita River (Segments 0218 and 0218A) have been designated with concerns for near non-attainment of the water quality standard for **selenium in water**. Since **selenium** is a naturally occurring pollutant that cannot be managed, there are no requirements for the development of TMDLs. For more detailed analyses of the segments in **Reach II** of the Red River Basin, please refer to the Watershed Summaries in **Chapter 4**.

Red River Basin – Reach III

Reach III contains ten (five classified and five unclassified) identified segments; eight (five

classified and three unclassified) were assessed in the *2012 IR*. Like most of the western half of the basin, **Reach III** is predominately a rural area, consisting of farming, ranching and oil and gas business. The farms are prime land for grazing and hunters also value the area for its natural resources.

Of the eight identified segments, three are either on the *2012 303(d) List* and/or *305(b) Report*. The Red River below the Pease River (Segment 0205) is shown in the *2012 IR* as having a **bacteriological** impairment and a concern for elevated **chlorophyll-*a*** levels. South Groesbeck Creek (Segment 0206B) is on the *2012 303(d) List* for elevated **bacteria** levels, and have concerns for both **chlorophyll-*a*** and **nitrate**. Sources of the elevated **bacteria** and **chlorophyll-*a*** levels in these segments could be from livestock, birds, and other wildlife that have unrestricted access to these water bodies. The animals remain near water to drink and keep cool in the summer. This increases the likelihood of spikes in **bacteria** levels when there is runoff from a rainfall event.

Paradise Creek (Segment 0230A) is on the *2012 303(d) List* for elevated **bacteria** levels and has concerns for elevated **chlorophyll-*a*** and **nitrate** levels. Using new technologies, such as bacterial source tracking, to determine if the **bacteria** levels have human or animal origins is necessary, since most **nutrient** and **bacteria** sources cannot be attributed to one source. Paradise Creek has been dry during routine monitoring events for all but one event since August 2011. Until regular rainfall returns to the area, it is likely the creek will continue to remain dry, preventing the collection and analysis of water quality. With this in mind, it is likely the listed impairments/concerns will not be able to be removed until current data can determine whether or not these issues still exist. The remaining segments in **Reach III** did not have any concerns or there were insufficient data for assessment. For a more detailed analysis of the segments in **Reach III** of the Red River Basin, please refer to the Watershed Summaries in **Chapter 4**.

Red River Basin – Reach IV

Reach IV of the Red River Basin includes six (three classified and three unclassified) identified segments, all of which were assessed in the *2012 IR*. Of the six identified water bodies in **Reach IV**, four are either in the *2012 303(d)* and/or *2012 305(b) Report*. Lower Prairie Dog Town Fork of the Red River (Segment 0207) has a concern for elevated **bacteria** levels. It also has a concern for elevated **chlorophyll-*a*** levels. Buck Creek (Segment 0207A) is in the *2012 305(b) Report* for **nitrate** values exceeding the **nutrient** screening level. The TCEQ has indicated that additional data and information are needed before a TMDL can be scheduled. However, the Texas State Soil and Water Conservation Board (TSSWCB) is currently working on a Watershed Protection Plan for Buck Creek. The Upper Prairie Dog Town Fork of the Red River (Segment 0229) is on the *2012 303(d) List* for elevated **pH** levels, the only **pH** impairment within the entire Red River Basin. In addition, (Segment 0229) and Lake Tanglewood (Segment 0229A) are in the *2012 Integrated Report* with concerns for elevated levels of **chlorophyll-*a***, **nitrate**, **orthophosphorus**, and **total phosphorus**. Segment 0229A also has concerns for **ammonia** and **depressed dissolved oxygen**. The sources of these concerns are most likely runoff from agricultural fields and grazing pastures. Continued monitoring is recommended for Buck Creek and the Lower Prairie Dog Town Fork of the Red River for these concerns. However, Lake Tanglewood's elevated **nutrient** levels, combined with the effects of possible septic system by-products, would require a special study. For more detailed analyses of the segments located in **Reach IV** of the Red River Basin, please refer to the Watershed Summaries located in **Chapter 4**.

Red River Basin – Reach V

Reach V of the Red River Basin includes six (three classified and three unclassified) identified segments, all of which were assessed in the *2012 IR*. Of the six water bodies in this reach, three; Salt Fork Red River (Segment 0222), McClellan Creek (Segment 0224A), and Sweetwater Creek (Segment 0299A), are on the *2012 303(d) List* for elevated **bacteria** levels. The remaining segments did not reveal any concerns or did not have sufficient data to be assessed.

Nutrients and **bacteria** may become issues for this reach in the near future, as increased levels have been observed. Therefore, continued monitoring is the most effective approach for the determination of the water quality issues for this area. For more detailed analyses of the segments located in **Reach V** of the Red River Basin, please refer to the Watershed Summaries in **Chapter 4**.

RECOMMENDATIONS

Based on the Authority's review and assessment of the water quality data in the Canadian and Red River Basins, the following recommendations are made. These recommendations are presented from a basin wide perspective:

- **Continue with the successful annual Coordinated Monitoring Meeting to develop strategic monitoring plans for both basins;**
- **Continue to educate the general public about water quality, conservation and protection of our natural resources through annual Basin Advisory Committee Meetings;**
- **Continue to work with agriculture/ranching, industry, and municipal entities toward the improvement of water quality through effective planning strategies by encouraging their involvement with Regional Water Planning;**
- **Continue to invite the State of Oklahoma environmental and water quality agencies to attend the Coordinated Monitoring and Basin Advisory Committee Meetings in order to further a cooperative effort in the improvement of water quality for both basins;**
- **Continue to be the state sponsor of the Red River Chloride Control Project, pressing for the project's completion and funding so that previously unusable water sources can be used without excessive treatment costs;**
- **Encourage data collected by the USGS within the Canadian and Red River Basins to be included in the TCEQ's SWQMIS database to aid in in future assessments;**
- **Increase the number of monitoring partners in order for non-monitored locations to receive coverage, thereby increasing the**

amount of data available for future water quality inventories;

- **Research new and alternative conservation measures, such as brush control and implement field trials;**
- **Support the development of an economical method of bacterial source tracking; and**
- **Support the installation of real-time monitors to allow for quicker responses to abnormal occurrences.**

Over the past five years, the Canadian and Red River Basins have experienced varied extremes in weather conditions. Conditions have ranged from prolonged drought, to the scorching heat of hot dry summers, to wildfires that burned thousands and thousands of acres all across the state. In addition, lake levels have declined to some of the lowest values ever recorded.

In spite of these extremes, the water quality in the Canadian and Red River Basins remains good overall. The primary parameters which have impairments or concerns for use attainment or screening levels, respectively in both basins are **bacteria**, **chloride**, **depressed dissolved oxygen**, **chlorophyll-*a***, and **nutrients**. As the sources of these pollutants are discovered, action plans can be developed and implemented. The Authority's recommendations by segment have been summarized and can be found in **Chapter 4 (Watershed Summaries)** of this report. Although monitoring efforts do not answer all of the causes for water quality concerns and impairments, they are the most effective method for raising awareness and discovering pollutants. As additional water bodies appear in the *Texas Integrated Report*, the data collected through the CRP is imperative to aiding in the ongoing effort to remediate and restore Texas water bodies to a healthy status. With continuous increases in expenses and funding amounts decreasing, the Authority is working more efficiently than ever, and like many of its partner agencies, does more with less every year.

The Authority is very proud of the level of coordination, cooperation and respect that it maintains with its partners. Assistance from entities like the TCEQ, USGS, and other cooperating partners, as well as input from the Basin Advisory Committees, results in positive planning for the basins' future.

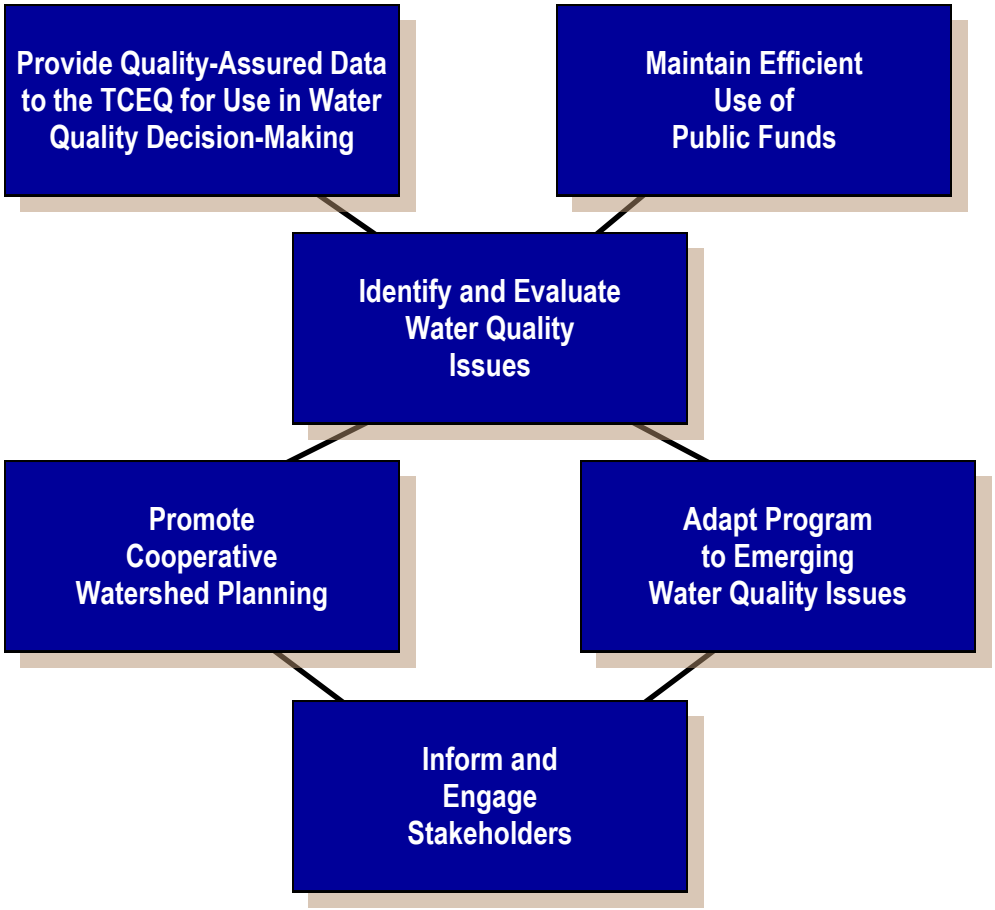
The Authority, as a fee paying stakeholder and steward of the Canadian and Red River Basins' water resources, hopes that the Clean Rivers Program is maintained and funding sources are protected so the original purpose of the program continues.

INTRODUCTION

In 1991, the Texas Legislature passed the Texas Clean Rivers Act (Senate Bill 818), which required basin-wide water quality assessments for each river basin in the state. As a result, the Clean Rivers Program (CRP) was implemented. Since the beginning, the Authority has partnered with the Texas Commission on Environmental Quality (TCEQ) to ensure this charge is carried out for the Canadian and Red River Basins in Texas. One of the main objectives of the CRP is to conduct water quality assessments using a watershed approach. This allows for integration and evaluation of the water quality issues in order to establish methodologies for corrective actions and work toward the implementation of those actions. This summary report provides the reader with a comprehensive scientific overview of the water quality in both river basins.

1.1 — CLEAN RIVERS PROGRAM GOALS AND OBJECTIVES

The primary goal of the CRP is to maintain and improve the quality of water within each river basin in Texas through an ongoing partnership involving the TCEQ, river authorities, other agencies, regional entities, local governments, industry, and citizens. In order to accomplish the goals of the CRP, the following objectives were developed:



1.2 — DESCRIPTIVE OVERVIEW OF THE CANADIAN RIVER BASIN'S CHARACTERISTICS

East Amarillo Creek at US 287

The **Canadian River Basin** includes all or parts of 15 counties in the Texas Panhandle. The headwaters of the Canadian River begin in northeastern New Mexico as a tributary to the Arkansas River and eventually flows into the Mississippi River. The basin was divided into **five reaches** in an attempt to design the most effective sampling plan, with the limited budget available. There are five classified stream segments and eight unclassified stream segments in the Canadian River Basin.

The largest city in the Texas Panhandle is Amarillo. The relatively flat land gives way to Palo Duro Canyon, the second largest canyon in the United States, southeast of the city. North of Amarillo lies Lake Meredith, an artificial reservoir created by the Sanford Dam on the Canadian River. The lake, and the Ogallala Aquifer provide drinking water and irrigation for this moderately dry area of the high plains.

The Canadian River Basin encompasses approximately 47,705 square miles, of which 12,865 square miles are in Texas. The basin's largest river, the Canadian River, begins in the northeastern slopes of the Sangre de Cristo Mountains in New Mexico, where it decreases in elevation from 9,000 feet above mean sea level to 3,600 feet above mean sea level at its lowest point.

In Texas, the Canadian River crosses a relatively flat prairie with a gradual slope to an elevation of 2,870 feet above mean sea level at the Oklahoma border. Average annual precipitation varies from 25 inches in the mountainous upper reaches to 15 inches in eastern New Mexico, and 22 inches near the Texas-Oklahoma border. There are three major reservoirs and four major aquifers in the Texas portion of the Canadian River Basin. More than 250,000 people in the Canadian River Basin in Texas rely on its water resources.

1.3 — SUMMARY OF THE CANADIAN RIVER BASIN'S WATER QUALITY CHARACTERISTICS

Public drinking water supplies occur in two predominant categories: surface water and ground water. Surface water originates from such sources as manmade lakes and perennial rivers, while ground water has historically been used to provide a consistently clean, pure water supply. In some areas of the basin one or both supplies are used as sources for urban, farming, industry, and agriculture use. Current drought conditions and diminishing water supplies are at an extremely critical point. Water conservation has become a normal way of life in the Canadian River Basin.

From a basin-wide perspective, the waters of the Canadian River Basin are generally *good* in quality. Water quality throughout the vast majority of the basin supports aquatic life and recreational uses. There are two major issues that affect the Canadian River Basin. One is the ongoing drought, while the other is excessive chloride levels. There are no quick fixes for either issue, but the Authority and its stakeholders are working toward the management of these ongoing issues.

Drought

The Canadian River Basin in Texas has experienced drought conditions since the mid 1990's and still struggles today. Many area lakes have not been at full capacity for several years and most remain uncomfortably lower than normal, with no end to the drought in sight. In fact, Lake Meredith, the major drinking water reservoir for the region, showed a steady decline beginning in 2000 and ultimately went "dry," according to levels set by the Texas Water Development Board (TWDB) in early 2011. Today, Lake Meredith remains "dry" and alternative ground water supplies are now used to supplement the region's strained resources. A return of normal rainfall would be beneficial and significantly improve many problems caused by the continued drought. Until weather patterns stabilize, the development of water resources must persist to ensure a sufficient supply of good, quality water to serve the needs of the people within the Canadian River Basin, both now and in the future.

Before Salt Cedar Treatment

Chloride

Elevated chloride levels in the Canadian River Basin originate from dissolution of Permian salt deposits. The chloride flows upward to the Canadian River from a shallow artesian "brine aquifer" near Logan, New Mexico. Lake Meredith is in the course of this brine, and serves as a public water supply - more than 500,000 people in the Texas Panhandle. In an effort to combat these elevated levels, the Canadian River Municipal Water Authority (CRMWA), has implemented two different management strategies.

After Salt Cedar Treatment

The first is through a process known as deep-well injection. It has been calculated that approximately 70% of the chloride entering the lake originate from a specific area, and are then transported via the Canadian River into Lake Meredith. The most effective way to manage this chloride is to remove it from the stream channel, ultimately prohibiting it from ever reaching Lake Meredith. Deep-well injection works by removing the chloride through one proc-

ess and subsequently pumping the resulting salt water deep into the earth, similar to oil/gas related processes. This has been in place since 2001.

Secondly, the Salt Cedar Management Program has been in place since 2004 to reduce the chloride in the river system before it enters Lake Meredith. The project centers around the control of Salt Cedar, a highly invasive ornamental plant species. The CRMWA has shown great reductions in the number of bushes lining the Canadian River and its tributaries. However, it is difficult to quantify the impact this has and will have on the water quality in both the Canadian River and Lake Meredith at this time. The persistence of the drought and continually decreasing water levels have not allowed for an accurate determination of the project's overall impact. For more information on CRMWA's Salt Cedar Management Program, please visit: **http://crmwa.com/salt-cedar-management-program**.

1.4 – DESCRIPTIVE OVERVIEW OF THE RED RIVER BASIN'S CHARACTERISTICS

Prarie Dog Town Fork at SH 207

As the fourth largest river basin in the Texas, the Red River Basin includes all or parts of 43 counties across North Texas. The Red River is an interstate water body that originates in Curry County, New Mexico, as Tierra Blanca Creek and flows across the Texas Panhandle carving the spectacular Palo Duro Canyon of the High Plains. It then leaves the Caprock Escarpment near the eastern boundary of Childress County, where the south bank of the river becomes the boundary between Texas and Oklahoma. From this point, the Red River continues its southeasterly direction across Texas into southwestern Arkansas, then turns south into Louisiana, where it discharges into the Mississippi River near Simmesport, Louisiana.

The main stem of the Red River has a total length of 1,217 river miles. The North Fork of the Red River starts near Pampa, Texas, while the Salt Fork of the Red River begins about 26 miles east of Amarillo. Both forks exit Texas into Oklahoma and individually rejoin the Red River main stem about 17 miles north of Vernon, Texas. Palo Duro Creek forms near Canyon, Texas and becomes Prairie Dog Town Fork to the east, which in turn becomes the Red River at the 100th meridian. The Red River covers a drainage area of 94,450 square miles and 1,616 stream miles. It crosses through six major eco-regions and contrasting elevations from 495 feet to 4,835 feet above sea level to shape this diverse area. The Red River Basin contains one of the largest capacity reservoir in Texas, Lake Texoma, along with 31 other reservoirs that provide water to a growing population of more than 900,000 people.

The Red River Basin includes parts of the Llano Estacado of the High Plains, which is a nearly level, high tableland with slow to moderate surface drainage and many small, shallow lakes or "playas". The area east of the High Plains is a broad, nearly level to rolling grass and brush-

Salt Deposits Along PDTF

covered plain with moderate to rapid surface drainage and entrenched streams.

The upper area or the High Plains of the Red River Basin are underlain by sand, silt, and clay of the Ogallala Formation of Pliocene and Pleistocene Epochs. East of the High Plains are westward-dipping sandstone and shale beds of the Triassic Period Dockum Group (*Osage Plains*). Throughout the Osage Plains, the outcropping rocks are westward-dipping Permian Period and Pennsylvanian Epoch sandstone, shale, limestone, dolomite, and gypsum. The Uplands in this area are capped by alluvial gravel and sand of the Quaternary Period Seymour Formation. Approximately 70 million years ago, the western reaches of the Red River watershed were covered with a shallow salty sea. From Montague County to Arkansas, the basin is underlain by limestone, clay and sand of the Cretaceous Period.

The Red River Basin has 75 stream segments, of which 30 are classified and 45 are unclassified, totaling 1,616 stream miles with 32 significant reservoirs. It contains parts of six ecoregions: the Western High Plains, Southwestern Tablelands, Central Great Plains, Central Oklahoma-Texas Plains, Texas Blackland Prairies, and South Central Plains. The topography of the basin ranges from flat prairies in the western reach at an elevation of approximately 4,835 feet above mean sea level, to rolling hills in eastern Texas with a mean elevation of 495 feet above mean sea level.

The watershed receives an average annual precipitation varying from 15 inches in eastern New Mexico to 55 inches near the Texas-Arkansas border. The average annual runoff in the basin is about 159 acre-feet per square mile of contributing drainage area. Stream flow at the Texas-Arkansas state line averages 11,490 cubic feet per second (CFS) or 8.3 million acre-feet per year.

1.5 — SUMMARY OF THE RED RIVER BASIN'S WATER QUALITY CHARACTERISTICS

Water resources within the Red River Basin are generally good and support a hearty and robust aquatic life with respect to stream standards. However, only 12 of the 30 classified stream segments have been designated as useable for public water supply due to naturally high occurring concentrations of salt, according to water quality standards.

Historically, the Red River Basin was once part of an ancient inland sea. Through geologic processes, this ancient sea became isolated and slowly evaporated over time. The salts from this prehistoric sea continue to plague the basin today. These salts occur naturally either through salt springs and seeps or from artificial or manmade issues such as oil field byproducts. The waters of the Wichita, Pease, and Red Rivers contain excessive concentrations

of chloride and sulfate, which are particularly evident in the shallow rivers beds.

CCP Dam on the Middle Fork Wichita River

As the State Sponsor of the **Red River Chloride Control Project**, the Authority will continue to back the Chloride Control Project with good solid science to improve the quality of the water in the Red River and its tributaries. The Red River Chloride Control Project (CCP) is an ongoing project through the United States Army Corps of Engineers aimed at identifying and implementing measures to reduce naturally occurring brine emissions into several watersheds within the Red River Basin. It has been estimated that roughly 3,450 tons of chloride entered the Red River prior to the CCP, making the annual chloride load within the Red River greater than the amount of salt consumed by humans and animals within the United States annually. Successful removal of brine contaminants improves water quality for various uses, including municipal, industrial and agricultural. Since its approval, the CCP has implemented various preventative structures at strategic project areas. Hopefully, funds will eventually become available leading to the completion of this project. Notable accomplishments include:

CCP Low Flow Dam

Area V, Estelline Springs
Has prevented approximately 240 tons of chloride per day from entering the Red River since January of 1964, bringing the year-to-date total to an estimated 4,380,000 tons.

Area VIII, Bateman Pump Station
Has stopped approximately 165 tons of chloride per day from entering the Wichita River and subsequently the Red River since May of 1987, bringing the year-to-date total to an estimated 1,626,075 tons.

For additional information on the Wichita River Basin portion of the Red River Chloride Control Project, please review the **Water Resource Section** of the Authority's website at **www.rra.texas.gov**. Maintaining and improving the quality of water within the Canadian and Red River Basins is an ongoing process. To ensure the continued success of the Clean Rivers Program, **Public Involvement** is vital in locating concerns, setting priorities and seeking solutions. The subsequent paragraphs describe components of public involvement and ways to participate.

PUBLIC INVOLVEMENT

2.1 — BASIN ADVISORY COMMITTEE

Wichita Falls BAC Meeting

The Steering Committee, also known as the **Basin Advisory Committee (BAC)**, has been the cement that has bonded and guided the CRP in the Canadian and Red River Basins. BAC Members include representatives from the public, municipal, county, state and federal government, industry, business, agriculture, fee payers, environmental, education, civic organizations, and others.

Basin Advisory Committee Meetings are held in Amarillo and Wichita Falls at least once per year. The meetings are purposely set up to be open, friendly, casual, and informative. They include in depth technical discussions regarding project work plans, monitoring schedules, reports, and any other relevant topics presented by committee members. BAC members are encouraged to bring guests and provide input, not only at the meetings, but throughout the year.

2.2 — ENVIRONMENTAL OUTREACH

An important program sponsored by the Authority is the distribution of the ***Major Rivers*** educational program to schools within the Canadian and Red River Basins. *Major Rivers* is a water education curriculum designed by the Texas Water Development Board and the Lower Colorado River Authority. It teaches students about Texas' major water resources, how water is treated and delivered to their homes and schools, how to care for their water resources, and how to use them wisely. The program's host, Major Rivers (named for the major rivers of Texas), and his horse Aquifer cover lessons that include a variety of activities in science, math, language arts, social studies and other subjects. Since 2004, the Authority has provided this curriculum to over 1,000 students in the Canadian and Red River Basins. Authority personnel also provide presentations to various organizations, clubs, and civic groups to spark interest and awareness in our local natural resource issues.

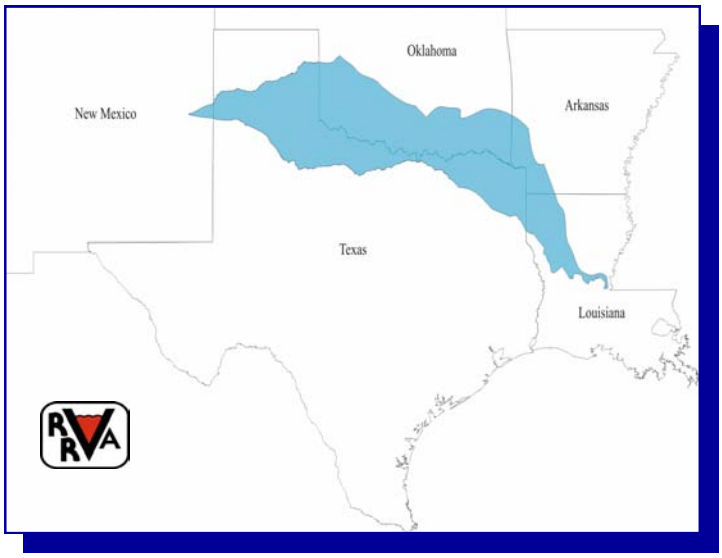
Students at Annual Earth Day Event

Discussing Water Quality at Earth Day

The Authority has also begun to offer internships to interested environmental science majors from Midwestern State University. As of January 2014, the Authority has hosted five interns, all of which have gone onto pursue careers in the environmental field. The Authority has also hosted several class field trips, helping to educate students on all aspects of water quality, and how the CRP helps provide data to the state to help maintain and protect water quality for future generations.

Since 2000, the Authority has partnered with the Texas A&M AgriLife Extension in Wichita County, along with several other local entities to participate in Earth Day. The event provides elementary-age children with the opportunity to learn about a wide variety of environmental-related topics, including, but not limited to fish and wildlife, composting, recycling, flora and fauna, water quality and conservation, and more. Authority staff promote water quality awareness and pollution prevention by allowing students to interact with a 3D model of a watershed. This not only allows students to learn about several point and non-point sources of pollution, but also how these sources can contribute to the degradation of water quality.

2.3 — RED RIVER VALLEY WATER RESOURCE CONFERENCE



A very successful public outreach program pertaining to the Red River Basin is the **Red River Valley Water Resource Conference**. Hosted by the Authority, in cooperation with the Red River Valley Association, the conference typically comprises representatives from Texas, Oklahoma, Arkansas and Louisiana.

Held in the fall of each year, the focus of the conference is water quality and quantity issues that affect everyone within the Red River Basin, in all four states. Presentations are given by various entities such as the U.S. Army Corps of Engineers, the Texas Water Development Board, the U.S. Bureau of Reclamation, the Natural Resources Conservation Service, the Texas Parks and Wildlife, the Oklahoma Water Resources Board, the TCEQ's Total Maximum Daily Load (TMDL) and Surface Water Quality Monitoring (SWQM) staff, the Authority's Environmental Services Division staff and others. More information on the Red River Valley Water Resource Conference can be found at **www.rrva.org**.

2.4 — COORDINATED MONITORING

Annual Coordinated Monitoring Meeting

Water quality is important and requires an extensive amount of resources. To best ensure these resources are used in a manner to maximize the amount of water quality data, the Authority coordinates monitoring efforts with other basin entities by holding annual Coordinated Monitoring Meetings (CMM). Entities that have participated include; the Canadian River Municipal Water Authority, the City of Sherman, the North Texas Municipal Water District, Texas A&M AgriLife, the Texas Commission on Environmental Quality, the Texas Institute of Applied Environmental Research, the Texas Parks and Wildlife Department, the Texas State Soil and Water Conservation Board, the United States Geological Survey, and several others. Goals of this meeting are to coordinate monitoring locations, parameters of concern including 303(d) listings and 305(b) concerns, and data collection frequency. The meeting is set-up to be more like a workshop and input from all participants is encouraged to help develop the most comprehensive monitoring plan possible.

Photo Courtesy of NTMWD

Additionally, 2012 marked the inaugural year for Watershed Action Planning (WAP). This new process was created to help promote a more focused effort on certain water bodies during the annual CMM. Sites identified for WAP discussions are generally those having impairments for several years with no definitive solution or source of impairment identified. The WAP process promotes a more focused approach when consideration is given to monitoring frequency and strategies to be utilized within a segment identified for WAP. The Authority is entering the third year of WAP discussion at the annual CMM and to date, several water bodies have

Photo Courtesy of the City of Sherman

been identified for Recreational Use Attainability Analyses (RUAA). These analyses determine if a particular water body is, or can actually be used for primary contact recreation. If it is determined that it is not, the TCEQ may seek approval from the EPA to change the use designation, thus raising the allowable limit for bacteria, which in some instances would lead to 303(d) delistings.

Coordinated efforts facilitate water quality monitoring for everyone by preventing duplication of efforts and ensuring the maximization of funds allocated for water quality analysis. Additionally, the CMM provides a forum for professionals, organizations, and stakeholders alike to voice concerns or distribute useful information. If you are interested in attending a CMM, please contact the Authority or visit **www.rra.texas.gov** to find information on future meeting dates and information from previous years.

2.5 – RED RIVER AUTHORITY OF TEXAS ON THE WEB

The Authority maintains an enthusiastic commitment to provide up-to-date quality assured water quality information on its website, **www.rra.texas.gov** or on Facebook at **www.facebook.com/RedRiverAuthorityOfTexas.** The website provides a wealth of information covering all aspects of Authority operations.

The **About Us** tab provides an overview of the Authority and its operations, including its Mission Statement, governing body, scope of services and contact information.

The **Public Services** tab provides access to information regarding the General and Financial Services, Utility Operations and the Authority's NELAP Accredited Environmental Laboratory.

An entire section of the website, accessible via the **Water Quality & Planning** tab, is devoted to the Texas Clean Rivers Program. This section provides quick and easy access to all publications, data and information relating to the Authority's participation in the Clean Rivers Program. Additionally, information regarding Regional Water Planning and the Chloride Control Project can be found in this section.

The Authority also maintains an online library under the **Publications** tab that includes reports and studies prepared by the Authority, data inventories, digital mapping, general information, links to environmental studies, historical weather data, and more.

The **Public Notices** tab lists all public meetings and events scheduled by the Authority, such as the Basin Advisory Committee Meetings, the Coordinated Monitoring Meeting, etc. The calendar also provides meeting agendas, directions to, and detailed maps of meeting locations.

WATER QUALITY ANALYSIS

3.1 – AN INTRODUCTION TO WATER QUALITY COLLECTION

Preparing to Monitor on the Wichita River

To ensure that data collected is technically sound and of good quality, all parameters are collected under the guidance of a **Quality Assurance Project Plan (QAPP)**. A QAPP describes the collection, acquisition and documentation guidelines of the data to ensure that the quality objectives are achieved prior to its submittal to TCEQ or entry into the Authority's database. The QAPP also includes a sampling process design and monitoring schedule, which is based on results from previous Water Quality Assessment Reports conducted under the CRP, specific constituents taken from the ***Texas Integrated Report***, the ***303(d) List***, or ***305(b) Report***, and specific requests from TCEQ and the Canadian and Red River Basin Advisory Committees.

3.2 – MONITORING TYPE CODES

In order to ensure enough data is collected for assessment purposes, the monitoring type at each location must be established. The monitoring type code, a four digit code assigned by the data collector, is used by TCEQ to readily assess the intent and bias of all monitoring. TCEQ defines the following monitoring type codes:

Characters one and two convey information regarding the bias of the sampling to end data users. Possible codes for characters one and two include the following:

- **RT Routine Sampling** scheduled in advance without intentionally trying to target any certain environmental condition; samples are collected regardless of the conditions encountered
- **BS Biased Season** scheduled for a certain time of year because the sample means to capture the conditions characteristic of that time of year; samples are collected regardless of flow condition encountered
- **BF Biased Flow** not precisely scheduled in advance because they target a certain flow condition that must be present in order for the sample collection to occur
- **BE Biased Event** not typically scheduled in advance; monitoring is reactive to an emergency condition
- **CD Continuous Data** LEADS data generated by the CEWMN monitoring intent not characterized
- **CE Continuous Event** individual measurements from continuous monitoring target toward a specific event code summary statistics "BE"

- **CF Continuous Flow** individual measurements from continuous monitoring targeted toward certain flow conditions - code summary statistics "BF"
- **CS Continuous Season** individual measurements from continuous monitoring targeted toward a certain time of year - code summary statistics "BS"
- **CT Continuous Routine** individual measurements from continuous monitoring not intentionally targeted toward any environmental condition - code summary statistics "RT"

Characters three and four determine the intent or objective of the monitoring activity and include the following codes:

- **UA Use Attainability Analysis** a structured scientific assessment of the factors affecting the attainment of uses of a water body
- **SI Source Identification** monitoring intended to establish the origin of a recognized impairment or degradation of the water body the project is monitoring
- **RW Receiving Water** a structured scientific water quality characterization of a water body that is or will be receiving runoff or discharge from a permitted entity
- **LF Load Contributions** intended to define or quantify the amount of loading of a certain parameter or parameters a water body is receiving
- **PD Permit Development** related to permit actions not covered by another monitoring type code
- **SD Standards Development** related to standards development and is not covered by another code
- **BA BMP Effectiveness** related to BMP effectiveness monitoring and is not covered by another code
- **TF Model Calibration/Verification** related to calibrating or verifying an environmental model and is not covered by another code
- **WD Watershed Characterization** solely intended to understand the basic physical, environment, and human elements of the watershed

Note: It is permissible to utilize characters RT and BS independent of a third and fourth character so long as the sampling is intended to establish baseline conditions of the monitoring station.

Since 2009, the Authority has characterized all routine monitoring as RT.

3.3 – SEGMENTS, ASSESSMENT UNITS, AND MONITORING STATIONS

Every two years, the TCEQ reviews and assesses water quality across the entire state. The entire process requires several months and hundreds of hours to complete. In order to successfully and accurately assess all water bodies, a systematic approach much be taken to ensure all water bodies are evaluated fairly and in a similar methodical fashion. In order to do this, water bodies must be divided and split into comparable units which can be assigned specific water quality standards, and subsequently assessed against those standards to determine whether or not water quality impairments or concerns exist.

A water body, or segment, can be either classified or unclassified. The main difference between the two is usually size. Classified water bodies are major rivers and streams, like the Wichita or Red River. These streams are assigned four digit codes based on their basin (first two digits) and on their geographic location within that basin (last two digits). For example, every segment, classified or unclassified within the Canadian River Basin will begin with "01", which identifies that segment as being located within the Canadian River Basin. All Red River Basin segments begin with "02." Unclassified water bodies are smaller tributaries that flow into a classified segment. These water bodies maintain the classified segment's four digit code, but have a letter at the end (for a total of five characters) to denote them as unclassified segments. The letters correspond to the order in which they were identified and recognized as individual segments by the TCEQ. For example, Lake Texoma is identified as Segment 0203. Big Mineral Creek is an unclassified segment flowing into Lake Texoma, which is identified as Segment 0203A.

Within these segments are assessment units. Assessment units are smaller "portions" of a classified or unclassified segment that are used during the actual assessment. The number of assessment units, or AUs, is determined by significant differences in water quality which may be present due to a permitted discharge in a portion of the stream, or the number of tributaries that flow into the stream and where those tributaries enter the stream. The TCEQ decides the quantity of AUs per segment and their boundaries. Entities like the Authority periodically review these and submit comments to the TCEQ, which can lead to additional AUs or a correction in the AU's boundary. AUs are the smallest body of water a 303(d) or 305(b) impairment or concern can be assigned to. For example, Lake Texoma (Segment 0203) has a concern for water quality based on screening levels for chlorophyll-*a* in AU_04 (0203_04). This means that for that particular portion of Segment 0203, chlorophyll-*a* did not meet the screening level criteria for chlorophyll-*a* and thus, a concern was identified.

Within AUs are monitoring stations, which in a sense are the smallest parts of the segment. Segments are assessed for impairments and concerns by AUs. The data for the AUs comes from monitoring stations located within a particular AU. Like AUs, there can be one or several monitoring stations within a particular AU. In rare and unique instances, there could even be an AU which does not have a monitoring station in it, for example, Lake Texoma, Segment 0203_05.

In conclusion, entities like the Authority attempt to monitor at least one station within every assessment unit of every segment. However, due to the size of the Red River Basin, this is not always possible. At a minimum, the Authority attempts to monitor within each of the 30 identified classified segments. Unclassified segments are monitored as needed to help identify 303 (d) and 305(b) listings and concerns in classified segments.

3.4 — MONITORING CATEGORIES

Data generated under the Clean Rivers Program has the potential to be used for a variety of programs by the TCEQ. In order to balance the needs of multiple programs, monitoring is divided into the following categories:

Routine Monitoring is the traditional type of monitoring designed to delineate overall water quality throughout a river basin. Monitoring should continue for at least five years. This includes water bodies with parameters that do not support standards or exceeds screening criteria.

Systematic Watershed Monitoring is similar to Routine Monitoring, but with a shorter duration (1-2 years) designed to screen water quality in smaller, unclassified water bodies that are not routinely monitored.

Permit Support Monitoring - The TCEQ may identify specific areas where additional information on water quality is needed for the permitting process.

Special Project Monitoring involves a data collection effort to better characterize non attainment of water quality standards, NPS, and/or pollution loading in a watershed and stakeholder concerns.

Trend and Statistically-Based Monitoring involves the completion of both Basin Highlights Reports (BHR) and Basin Summary Reports (BSR) by Clean Rivers Program Partners. This information is used by TCEQ in decision-making processes and helps facilitate the determination of monitoring priorities.

3.5 — IMPAIRMENTS AND CONCERNS

When the TCEQ conducts an assessment of water quality across the state, they may classify segments (specifically AU's within these segments) as either having impairments or concerns. When an assessment unit is said to be impaired, it has consistently exceeded the segment standard for water quality, as outlined in the most current applicable version of the *Texas Water Quality Standards*. Standards are defined for **chloride**, **sulfate**, **total dissolved solids**, **dissolved oxygen**, **pH**, **bacteria** (*E. coli* and/or *Enterococcus*), and **temperature**.

There are not standards for every parameter. For example, **nutrients** have screening criteria which they are assessed by. Nutrient parameters include; **ammonia**, **chlorophyll-*a***, **nitrate**, **orthophosphorus**, and **total phosphorus**. Nutrient screening levels are delineated into four categories; freshwater stream, reservoir, tidal stream, and estuary, each having specific thresholds. With the exception of **chlorophyll-*a*** (where a numeric criteria has been established for select water bodies), nutrient parameters can only be identified as concerns and not as impaired.

AUs can have concerns, of which there are two types; concerns for water quality based on screening levels (CS) and concerns for near non-attainment of the water quality standard (CN). Only parameters with established water quality standards can be identified as having a CN. For additional information on water quality standards, please refer to the TCEQ's *2010 Texas Water Quality Standards* at: **www.tceq.texas.gov/waterquality/standards/eq_swqs.html**.

3.6 – WATER QUALITY PARAMETERS

The following table list the parameters collected by the Authority, the potential impacts to a water body if the water quality standard is not met, and the possible causes of the pollutants.

PARAMETER	IMPACT	POTENTIAL CAUSE(S)
Ammonia	Naturally occurring in surface and wastewater, and is produced by the breakdown of compounds containing organic nitrogen. Elevated ammonia levels are a good indicator of organic pollution and can adversely affect fish and invertebrate reproductive capacity and reduced growth of the young.	Ammonia is excreted by animals and is produced during the decomposition of plants and animals. It is an ingredient in many fertilizers and is also present in sewage, storm water runoff, certain industrial wastewaters, and runoff from animal feedlots.
Alkalinity	A measure of the acid-neutralizing or buffering capacity of water. The presence of calcium carbonate ions to the buffering system. Alkalinity is a measure of how much acid can be added to a liquid without causing a large change in pH. Alkalinity is important for fish and aquatic life because it protects or buffers against rapid pH changes. Living organisms, especially aquatic life, function best in a pH range of 6.0 to 9.0. Higher alkalinity levels in surface waters will buffer acid rain and other acid wastes and prevent pH changes that are harmful to aquatic life.	Alkalinity is often related to hardness because the main source of alkalinity is usually the result from dissolved carbonate rock formation.
Chloride	One of the major inorganic ions in water and wastewater. Chloride is an essential element for maintaining normal physiological functions in all organisms. Elevated chloride concentrations can disrupt osmotic pressure, water balance, and acid/base balances in aquatic organisms which can adversely affect survival, growth, and/or reproduction.	Chloride compounds, often known as salts, can be an indicator of natural or manmade pollution, as in the case of oil field brines. Natural weathering and leaching of sedimentary rocks, soils, and salt deposits can release chloride in to the environment. Other sources can be attributed to oil exploration and storage, sewage and industrial discharges, runoff from dumps and landfills, and saltwater intrusion.
Chlorophyll-*a*	Increased nutrients in water bodies create diurnal swings that can stress aquatic life. In the presence of sunlight and abundant food sources photosynthesis increases, DO levels rise and pH levels fall. At night respiration begins and oxygen is consumed. DO levels fall and then pH levels rise.	Chlorophyll-a, is a photosynthetic pigment, that is found in all green plants and algae. The concentration of chlorophyll *a* is used to estimate phytoplankton biomass in surface water. Results are expressed in µg/L (micrograms per liter).
Chemical Oxygen Demand (COD)	A measure of the amount of oxygen required to oxidize all compounds in the water.	COD is an indicator of how much organic load is placed on the oxygen in a water body.
Conductivity	A measurement of the electrical current carrying capacity of water. Dissolved substances, such as salts, have the ability to conduct electrical current. Salty water has a high conductivity. This can be used as an indicator of how much dissolved solids are polluting the water.	Causes are basically the same as the causes for TDS.
Dissolved Oxygen (DO)	The amount of oxygen that is freely available in water. Aquatic life needs oxygen to live. DO is vital to fish and other aquatic life. Acceptable ranges of dissolved oxygen levels have been accepted as the single most important indicator of a water body's ability to support desirable aquatic life.	Excessive or unusual quantities of organic material combined with bacteria and large algal blooms may cause DO levels to fluctuate. In some segments where DO can fluctuate, aquatic life may not have sufficient oxygen to survive.
***Escherichia coli* (*E. coli*)**	The current indicator bacteria to determine if the water body is suitable for contact recreation. Potentially harmful to human health. Their presence, expressed in MPN (most probable number) per 100 mL of water, is an indicator of fecal matter contamination which may contain other pathogens.	High number of *E. coli* can indicate a potential pollution problem. Although *E. coli* is used as an indicator, it can be potentially harmful. Present in all warm bodied animals and comes from poorly maintained or ineffective septic systems, overflow of domestic wastewater plants and/or runoff from feedlots.
Enterococcus	Along with *E. coli*, *Enterococcus* is one of the best indicators for health risks from recreational water contact. *Enterococcus* results are useful for watching long-term trends in water quality.	High results of *Enterococcus* over time can indicate a pollution problem. Present in the intestine of all warm-blooded animals, *Enterococcus* is a good indicator of pollution coming from the same sources as *E. coli*.
Flow	The volume of water that moves over a designated point over a fixed period of time, often expressed in CFS (cubic feet per second). Flow, combined with other parameters, can be a good indicator of water quality.	Changes in flow can be natural or man made. Natural changes include beavers building dams, overgrowth of vegetation in times of low flow. Manmade changes include new bridges restricting flow, new construction altering landscapes and runoff.

PARAMETER	IMPACT	POTENTIAL CAUSE(S)
Nitrates	Nitrate additions to surface waters can lead to excessive growth of aquatic plants. High ground water nitrate levels can be toxic to human health, especially in infants and young children. In elevated concentrations can be used as an indicator of human caused pollution.	Nitrates are used as fertilizers to supply a nitrogen source for plant growth. The presence of nitrates in ground water occurs from the conversion of nitrogenous matter into nitrates by bacteria and represents the process whereby ammonia in wastewater, is oxidized to nitrite and then to nitrate by bacterial or chemical reactions.
Nitrites	High levels of nitrates and nitrites can produce Nitrite Toxicity, or "brown blood disease," in fish. This disease reduces the ability of blood to transport oxygen throughout the body.	Nitrites are found in effluent released from wastewater treatment plants, fertilizers, and agricultural runoff carrying animal waste from farms and ranches.
Ortho-phosphorus	Is a soluble form of phosphorus (PO_4) that is applied to urban and agricultural land as fertilizers and is often found in storm water runoff. Is considered the limiting factor of plant growth in a water body.	An element that is essential to plant life but contributes to an increased trophic level (*Eutrophication*) of water bodies. Phosphorus is commonly known as a man-made pollutant. It is an ingredient found in soaps and detergents and is also present in sewage and runoff from animal feedlots.
pH	The pH determines whether a water body is acidic, neutral, or basic. The pH of the water can affect the toxicity of many substances. Most aquatic life is adapted to live within a specific pH range. Changes in the pH can control toxic effects of other substances that may be in runoff.	The pH of natural waters hovers between 6.5-9.0 standard units. Industrial and wastewater discharge, runoff, accidental spills, nonpoint sources and human activity that causes increases in organic matter and bacteria, and over abundant algae can alter the pH.
Sulfate	Usually dissolved into waters from rocks and soils containing gypsum, iron sulfides, and other sulfur compounds. Sulfides are widely distributed in nature and in high concentrations, sulfate can affect drinking water.	Due to abundance of elemental and organic sulfur; and sulfide mineral, soluble sulfate occurs in almost all natural water. Other sources are the burning of sulfur containing fossil fuels, steel mills, and fertilizers.
Temperature	The temperature of water at the time of collection. An important physical relationship exists between the amount of dissolved oxygen in a body of water and its temperature.	Changes in water temperature can be caused by alteration of the riparian zone encroachment of invasive species (plant and/or animal), drought, soil erosion, or changes in ambient temperatures in lakes, as a result of industrial byproducts such as electrical generation.
Total Organic Carbon (TOC)	A measure of the amount of organic materials suspended or dissolved in water. It represents an estimation of the strength or potential damage that effluent or runoff can cause in a body of water if the *Dissolved Oxygen* was organically removed from the water. The measurement of TOC yields more reproducible results than the measurement of oxygen demand tests. Can be used as a pollution indicator.	Comes from decaying matter. Also from detergents, pesticides, fertilizers, herbicides, industrial chemicals and chlorinated organics.
Total Dissolved Solids (TDS)	An important use of the measure of the quality of drinking water. TDS is a quantification of the material dissolved in water, typically the chloride, and sulfate anions which form salts.	TDS is present to some extent in all water bodies. However, primary sources of excess TDS include agricultural, storm water runoff, leaching of soil contamination, and point source water pollution from industrial or sewage treatment plants. Certain naturally occurring TDS arise from weathering and dissolution of rocks and soils.
Total Phosphorus	An essential nutrient to the growth of organisms and can be the nutrient that limits the primary productivity of water.	In excessive amounts from wastewater, agricultural drainage, and certain industrial wastes, it also contributes to the eutrophication of lakes and other water bodies. Phosphorus is commonly known as a man-made pollutant.
Total Suspended Solids (TSS)	Total Suspended Solids (TSS) is the measure of the total suspended solids in water (organic and inorganic). Increased turbidity can reduce the amount of light to plants, which decreases the oxygen production. Additionally, too much sediment can cover habitat, smother benthic organisms, eggs or even clog fish gills.	TSS can have origins from multiple point and nonpoint sources, but the most common source is soil erosion. A good measure of the upstream land use conditions is how much TSS rises after a heavy rainfall.
Turbidity	A measure of clarity of a water sample expressed in NTU's (Nephalometric Turbidity Units). The higher the turbidity, the less clear the water. Water that is turbid can adversely affect plant and fish.	Erosion of soil in riparian zone, point source water pollution from industrial or sewage treatment plants, and stormwater runoff can adversely affect turbidity.
Volatile Suspended Solids (VSS)	Volatile Suspended Solids (VSS) is similar to TSS. The main difference between the two is that VSS is specific to the suspended materials which volatize between 500-550°C.	Please refer to TSS.

3.7 — DATA REVIEW METHODOLOGY

For the Authority's data review, the water quality standards and screening criteria from the TCEQ's ***2012 Guidance for Assessing and Reporting Surface Water Quality in Texas*** were utilized. Quality assured data were extracted from the TCEQ's Surface Water Quality Monitoring Information System (SWQMIS) database. These data were then loaded into Excel spreadsheets and divided by stream segments. The TCEQ analyzes and reports both segments and sub areas of segments known as assessment units (AU). The Authority reviewed the data by stream segment, assessment unit and by individual monitoring stations, as needed, to ensure the most accurate water quality issues were identified. Screening was conducted for each parameter against segment-specific standards and/or nutrient screening level, as defined by the ***Texas Surface Water Quality Standards (TSWQS)***. A list of these parameters and their segment specific standard and/or nutrient screening level can be found in **Appendix A** (Canadian River Basin) and **Appendix B** (Red River Basin).

To properly review the data, a sufficient number of samples were needed to provide a sound base population for analysis. The 2012 assessment performed by the TCEQ included data covering the nine year period of December 1, 2003 through November 30, 2012. The Authority's data review and trend analyses included data covering the period of August 1, 2003 to August 30, 2013. Water Quality Statistics are broken down by basin, reach, segment, and station and can be found in **Appendix A** (Canadian River Basin) and **Appendix B** (Red River Basin).

Results from the Authority's data review were compared against the TCEQ's assessment results. The TCEQ's assessment results include the following integrated documents:

- *2012 Texas 303(d) List*
- *2012 Texas Integrated Report - Basin Assessment Data by Segment*
- *2012 Texas Index of Water Quality Impairments*
- *2012 Texas Water Quality Inventory Water Bodies with Concerns for Use Attainment and Screening Levels*
- *2012 Texas Water Quality Inventory - Sources of Impairments and Concerns*
- *2012 Water Bodies and Impairments Added to the Texas 303(d) List*
- *2012 Texas Water Bodies and Parameters Removed from the 303(d) List*

These reports describe the status of the state's waters, as required by Sections 305(b) and 303(d) of the Federal Clean Water Act. They also summarize the status of the state's surface waters, including concerns for public health, fitness for use by aquatic species and other wildlife, and specific pollutants and their possible sources. These reports can be accessed on the TCEQ's website at **www.tceq.texas.gov/waterquality/assessment/12twqi/twqi12**.

3.8 – TREND ANALYSIS METHODOLOGY

Analysis Procedure

The Authority utilized Microsoft Excel® and Statistica® as the primary software applications to analyze possible trends for this report. Templates were designed to automatically calculate and list, by parameter, the following descriptive statistics: mean, median, minimum, maximum, 25th and 75th percentiles, t-score, and p-value. Sample sizes for trends varied by parameter and minimum sample sizes were observed when setting up trend charts.

All data was imported into the templates by segment and/or assessment unit, and then sorted by parameter. When the descriptive statistics indicated a potential trend, regression charts were created to visually aid in the verification of these possible trends. Each chart was checked for date continuity and outliers. Outliers were flagged and removed using Statistica®. Data sets containing outliers were reconfigured to exclude those flagged outliers, and the regression and descriptive statistics were recalculated to provide a more accurate representation of that specific parameter in the water body. Whenever an analyte within a river or stream was believed to be influenced by changes in flow, flow was graphed alongside the analyte on a second y-axis. For reservoirs, the reservoir capacity (percent full) was utilized.

Appendices A and **B** provide the descriptive statistics used for trend analyses in a tabular format.

Data Source

Data utilized for water quality analysis of the Canadian and Red River Basins were obtained from the TCEQ's SWQMIS database.

Data Size and Selection Criteria

All data utilized for water quality analysis of the Canadian and Red River Basin was collected under a TCEQ approved QAPP. This ensures all data is of a minimum standard and of high analytical quality. In order to conduct trend analysis, at least twenty (20) data points were required. Since analytical methods and reporting limits change, only the most recent ten (10) years worth of water quality data was analyzed (August 2003 – August 2013). **This helps ensure that all data for every analyte is comparable to one another**.

Censored Data

In an effort to prevent trends based on changes in analyte reporting limits, every identified trend was manually reviewed to confirm that the trend was present due to actual values and not based on censored data.

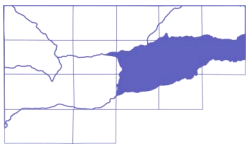
Additionally, since reservoirs are profiled for field parameters, which include temperature, specific conductivity, dissolved oxygen and pH, only the field measurement from the surface, collected at a depth of 0.30 m below the water's surface, was utilized to compute all statistics in the following tables.

Statistical Significance

Simple linear regression was used to display significant trends in water quality. The following criteria had to be met to classify a trend as significant:

t-statistic: > | 2.00 |
p –value: < 0.10

Canadian River Basin — Reach I



Reach I of the Canadian River Basin encompasses an area approximately 90 miles long and 40 miles wide. It includes the northern portion of Hemphill County and the southernmost section of Lipscomb County to Hutchinson County and the northern portion of Carson County. It is located on the main stem of the Canadian River and represents a watershed from the Texas-Oklahoma state line to the Sanford Dam on the Canadian River. **Reach I** contains two subwatersheds totaling 4,790 square miles of contributing drainage with 2,831 square miles in Texas. A map of **Reach I** of the Canadian River Basin is included on **page 39.**

The largest cities within the reach include Pampa and Borger. Other towns include Canadian, Stinnett, Skellytown, Miami and Sanford, with a total reach population of approximately 50,000.

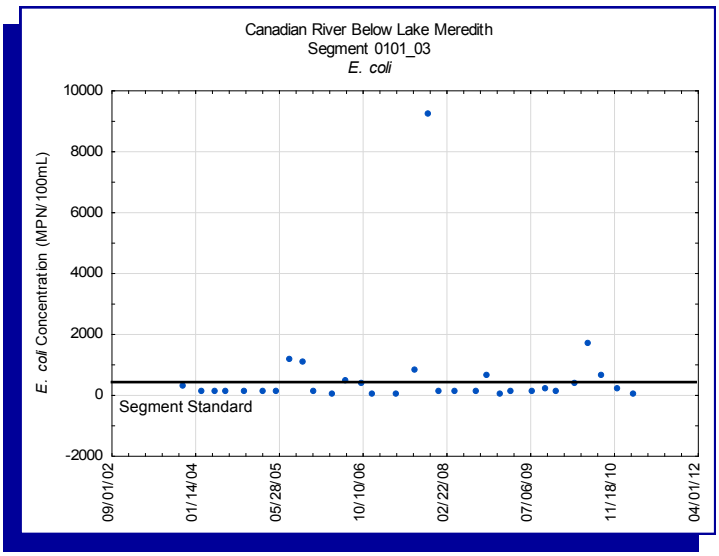
Permits included in **Reach I** are 24 municipal and industrial discharges, 18 solid waste disposal sites and 14 concentrated animal feeding operations (CAFOs).

More than 1,200 farms and ranches cover more than 2,600,000 acres of land. Production from these farms and ranches include cattle, swine, poultry, wheat, oats, corn, sorghum, hay, barley, alfalfa, and soybeans. Approximately 55,000 acres are irrigated farm land, while the remainder is devoted to either dry land farming or pasture land for cattle. The soils range from sandy alluvial, to dark, reddish clay loams that extend over flat plains, to steep and broken rocky ravines, where the plains break into the Canadian River Valley. Rainfall averages from 19 inches to 21 inches annually.

Reach I includes one classified water body, the Canadian River below Lake Meredith (Segment 0101), which runs from the Texas-Oklahoma state line up to the Sanford Dam of Lake Meredith. The three unclassified water bodies (both located near the City of Borger) are Dixon Creek (Segment 0101A), Rock Creek (Segment 0101B), and White Deer Creek (Segment 0101C). All three creeks, which drain into the Canadian River north of Borger, contribute to provide the majority of the flow in the Canadian River in this portion of the reach.

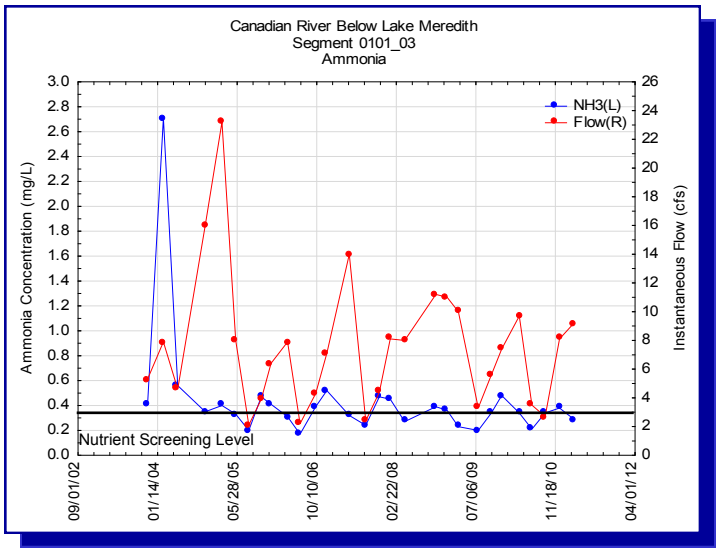
Table 1-1: Canadian Reach I – *2012 Integrated Report* – Impairments and Concerns

Segment / AU	Description	Parameter	Status
0101_03	Canadian River Below Lake Meredith	Bacteria	Impairment
0101_03	Canadian River Below Lake Meredith	Ammonia	Concern-CS
0101_04	Canadian River Below Lake Meredith	Ammonia	Concern-CS
0101_04	Canadian River Below Lake Meredith	Chlorophyll-*a*	Concern-CS
0101A_01	Dixon Creek	Bacteria	Impairment
0101A_01	Dixon Creek	Dissolved Oxygen	Impairment
0101A_01	Dixon Creek	Selenium in water	Impairment
0101A_01	Dixon Creek	Nitrate	Concern-CS
0101A_02	Dixon Creek	Chlorophyll-*a*	Concern-CS
0101B_01	Rock Creek	Nitrate	Concern-CS
0101B_01	Rock Creek	Orthophosphorus	Concern-CS
0101B_01	Rock Creek	Total Phosphorus	Concern-CS

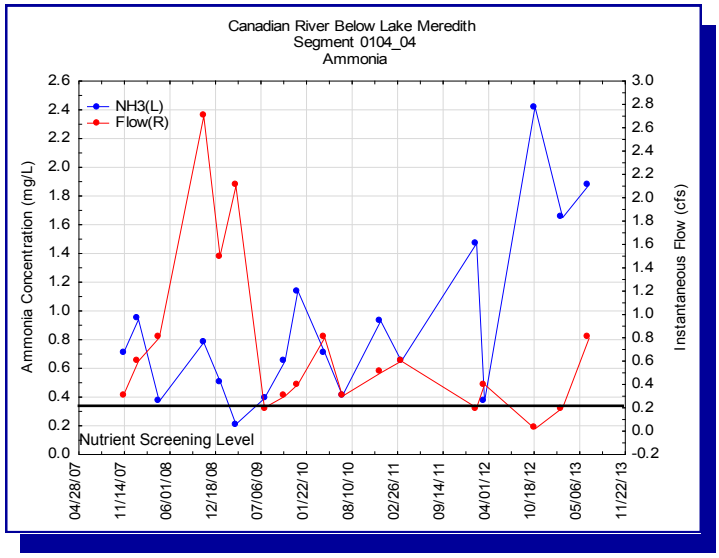


Segment 0101-Canadian River Below Lake Meredith

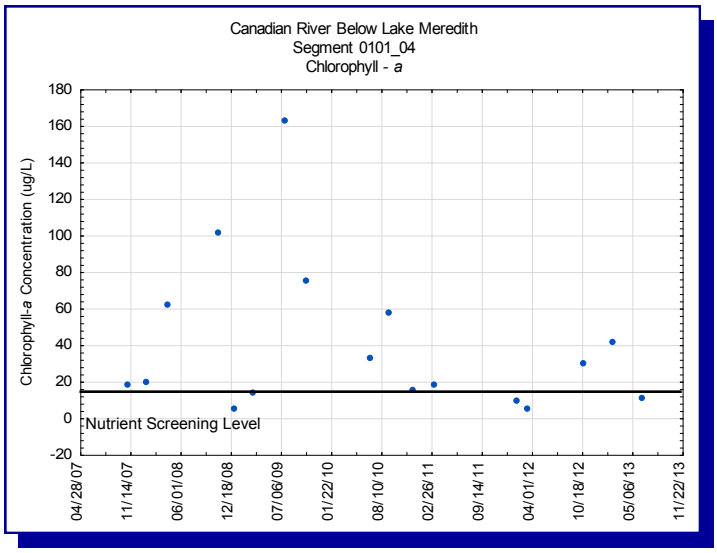
Segment 0101 is on the *2012 IR 303(d) list* with a **bacteriological** impairment and *concerns for water quality based on screening levels* for **ammonia** and **chlorophyll-a**. Analyses of the data by the Authority agreed with this assessment. The portion of the river located in Hutchinson County displayed elevated **ammonia levels**. This whole region is primarily rural with the predominant usage of the land being dependent on location and availability of water. If irrigation is available and the lay of the land is accessible and mostly level, it is likely that some type of cultivation will predominate. However, as the terrain becomes more rugged and/or water availability becomes scarce, the usage of the land turns toward open pasture grazing. Interspersed throughout this reach, and the Canadian Basin as a whole, is the presence of oil and/or gas production. With the scarcity of open water and the rural open range nature of the surrounding area, it is likely the elevated **ammonia** levels are the result of birds and animals staying near water not only to drink, but also to keep cool in the heat of the summers. Also because of the availability of water, grazing animals are able to find more food in the low plains close to the creeks and rivers.



A significant trend was observed during the analysis of **ammonia (see charts)**. In fact, the two plots actually contradict one another, the station further downstream of Lake Meredith actually showing a slight decreasing trend, while the site representing the portion of the Canadian River immediately below the lake showing a more pronounced upward trend. This could possibly be attributed to the significant decrease in flow observed at this monitoring station, allowing **nutrients** to assimilate and amass a higher concentration in a



slower moving stream. Downward trends were present in portions of Segment 0101 for **total dissolved solids**, **chloride**, and **sulfate**.



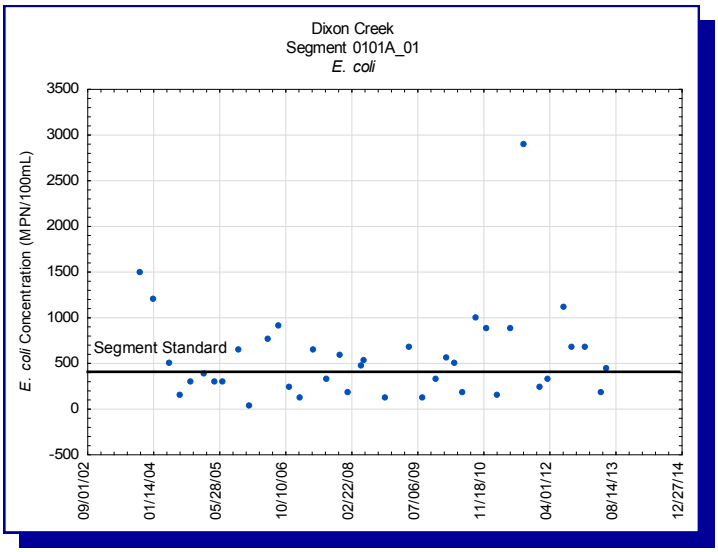
The three major contributors to this classified segment of the Canadian River Basin are Dixon Creek (Segment 0101A), Rock Creek (Segment 0101B), and White Deer Creek (Segment 0101C).

Segment 0101A-Dixon Creek

Dixon Creek makes its way through the center of the Borger Oilfield, where many of the early oil strikes that touched off the Panhandle Boom of the late 1920s took place. Dixon Creek is typically dry in its upper reaches with only the lowest portions actually having water in the creek , it then goes from dry, to perennial with pools and then to perennial after receiving a discharge from a large industrial discharger located on the creek. This industrial discharger provides a consistent flow into the creek, allowing local ranchers to rely on the creek as a water source for their livestock. If this discharge were to stop, Dixon Creek would be, at best, intermittent with perennial pools.

Dixon Creek at SH 152

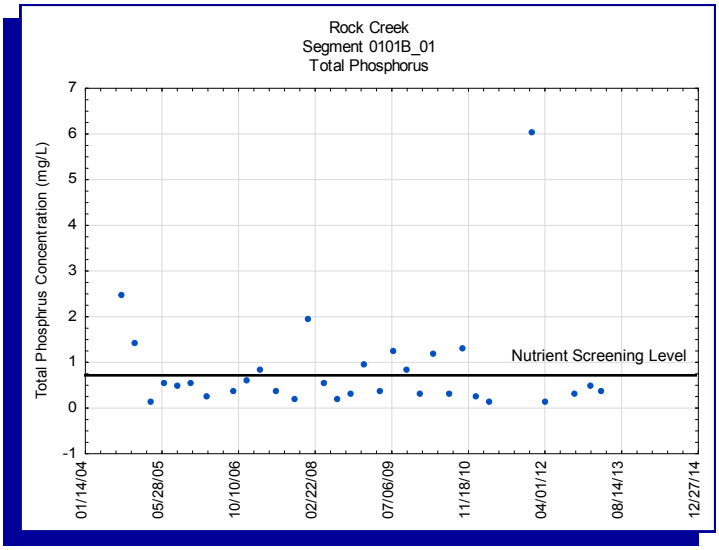
Dixon Creek is currently on the *2012 303(d) List* with impairments for **bacteria**, **depressed dissolved oxygen**, and **selenium in water**. Dixon Creek is also on the *2012 305(b) Report with concerns for use attainment and screening levels* for **nitrate** and **chlorophyll-*a***. The Authority's analyses of the data agreed with the TCEQ's assessment for **bacteria**, but did not agree with the TCEQ's assessment for **dissolved oxygen**. Several years ago, an Aquatic Life Assessment (ALA) was conducted on Dixon Creek by the TCEQ to fully examine the dissolved

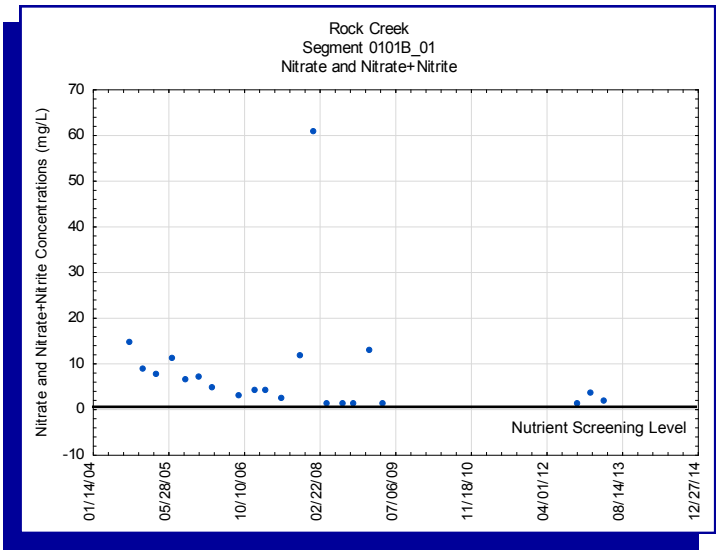


oxygen situation and to ascertain the full health of the water body. The assessment has been completed, but has not yet been published.

No statistically significant trend was found for **bacteria**. However, **chloride** and **total dissolved solids** concentrations did show a downward trend **(See Appendix A)**. Much of the data during this assessment period originated from the monitoring station furthest downstream (Station 10016), since the upstream station above the permitted discharger's outfall (Station 17045) was dry 85.7% of the time (six out of seven monitoring events since October 2011).

Rock Creek near Electric City

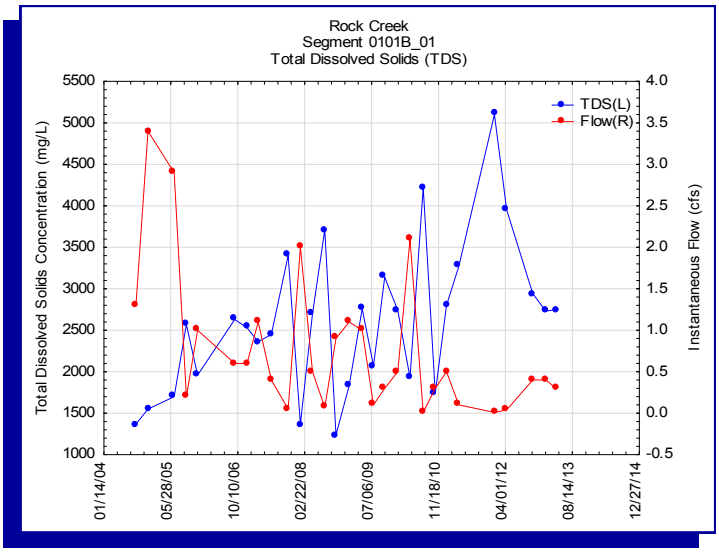


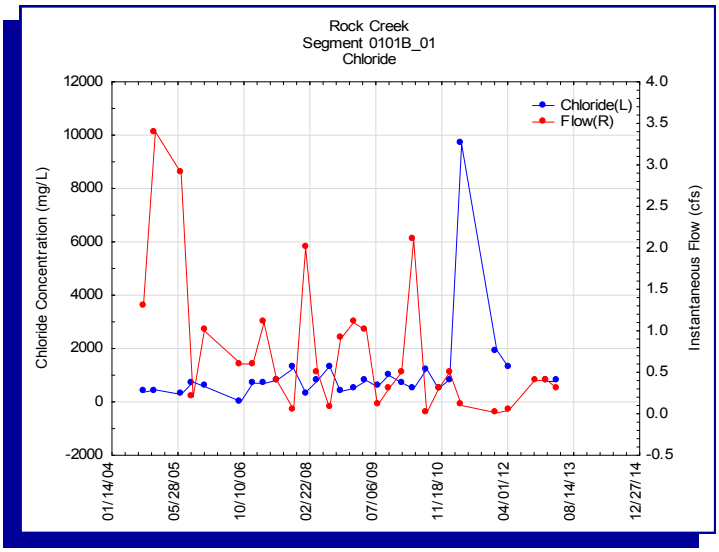


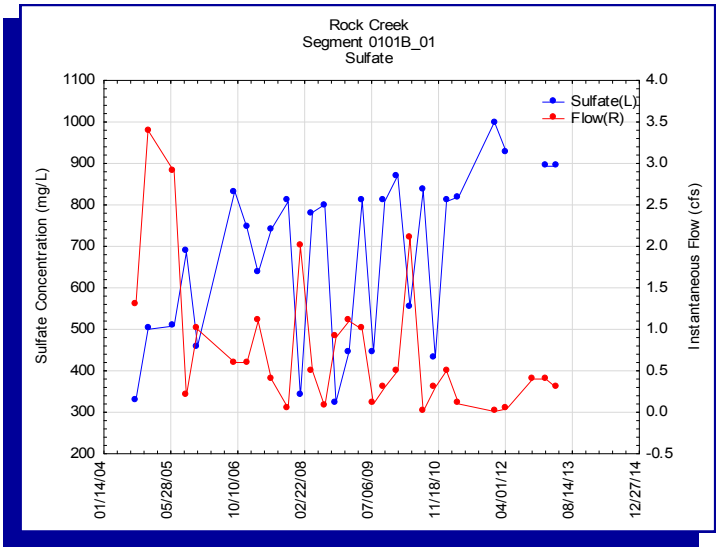
It is likely the outfall created a buffer of sorts, preventing an accumulation of most analytes. It is also a very reliable source of drinking water for livestock and wildlife, which may be contributing to the elevated **bacteria** concentrations.

Segment 0101B-Rock Creek

Rock Creek is an unclassified water body with origins in northern Carson County. The upper intermittent portions of the creek remain dry, only having some flow following significant rainfall events. The creek continues northerly through the suburb community of Bunavista, and the center of the Pantex Oilfield, where the terrain begins to change as it approaches the Canadian River. Rock Creek skirts the northwest side of the City of Borger, which discharges treated wastewater effluent into the creek. It is at this point that the creek becomes perennial, except in the driest of times. After skirting the city, Rock Creek meanders through the countryside before finally confluencing with the Canadian River. Rock Creek was removed from the *2012 IR's 303(d) List* for **bacteria**, but still has *concerns for water quality based on screening levels* for **nitrate**, **orthophosphorus**, and **total phosphorus**.







The Authority's data review found 8 out of 26 samples exceeded the screening criteria for **chlorophyll-*a***, and 10 out of 31 samples exceed the screening criteria for **total phosphorus**. In review of the data, there does not appear to be any correlation whatsoever for **nitrate**. While nitrogen-based compounds do have very high means (**nitrate** mean - 4.69 mg/L / **nitrate+nitrite** mean - 8.20 mg/L), there has not been enough consistent sampling to determine whether or not a trend exists. Since **orthophosphorus** is being phased out by the TCEQ, beginning with the *2014 IR*, the Authority centered its analysis around **total phosphorus**. Statistical results show no significant trend for **total phosphorus** during the period of analysis. Samples used for assessment in this segment are collected downstream of the City of Borger's wastewater treatment plant outfall (Station 10024). Most wastewater outfalls have elevated levels of nutrients because of the nature of the discharge, which could lead to the number of **nitrate** and **phosphorus** exceedances observed within this segment. Lastly, it is important to note that even amidst one of the most persistent droughts this particular area has seen, concentrations of **TDS**, **chloride**, and **sulfate** have not risen significantly. This is likely due to the consistent flow of treated effluent into Rock Creek.

Segment 0104C-White Deer Creek

White Deer Creek is not listed in the *2012 IR* and has no impairments or concerns. The segment has historically been monitored and assessed by the Authority as a reference site for the area. The low concentrations of analytes found in the water body and consistent flow year-round have led the Authority to believe White Deer Creek may be spring fed. The Authority's data analyses did not reveal any significant trends for any of the water quality parameters reviewed.

Canadian River Basin
Reach I

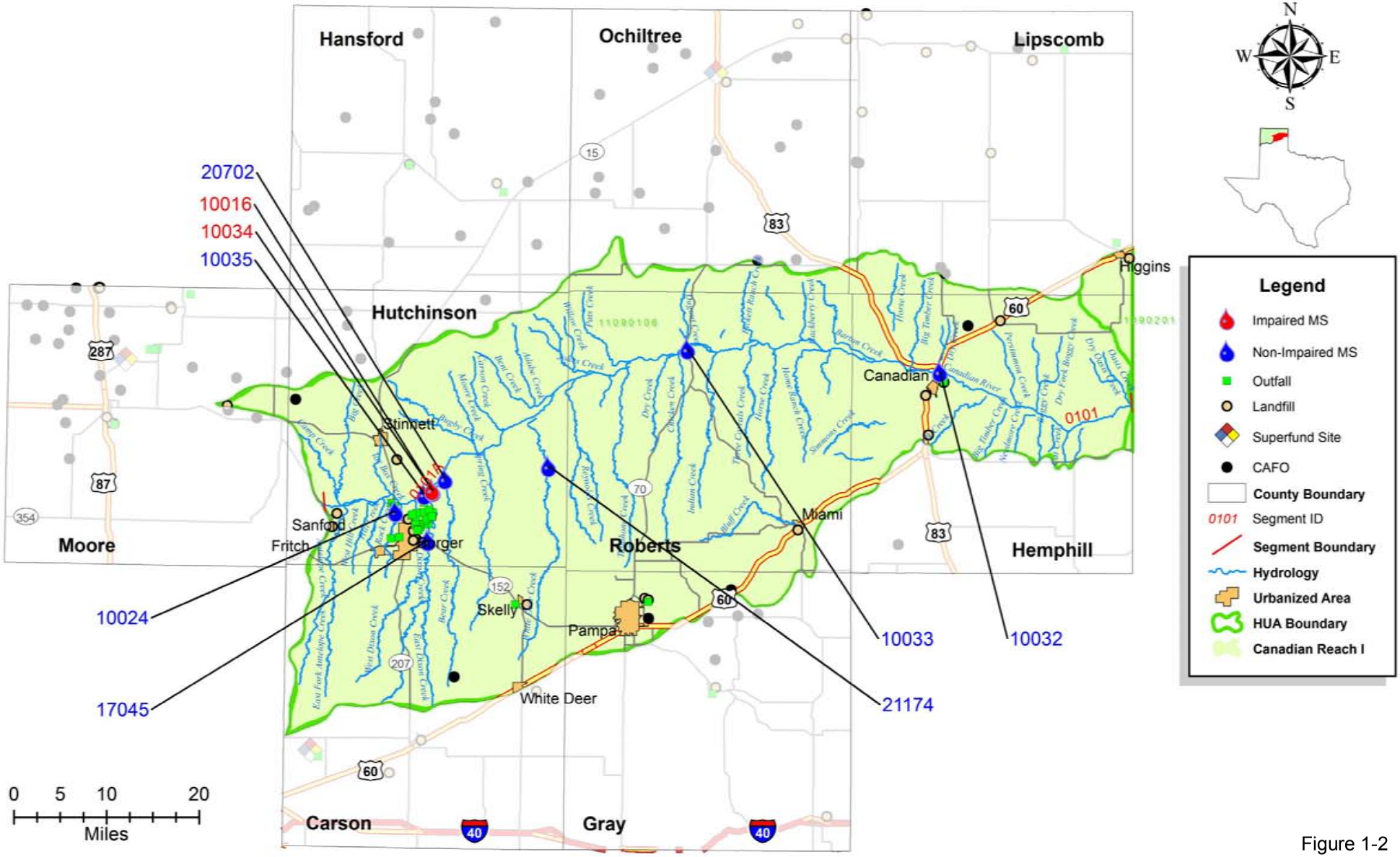


Figure 1-2

Canadian River Basin — Reach II

Reach II of the Canadian River Basin is located from the Sanford Dam at Lake Meredith to the Texas-New Mexico State Line and up to Oldham and Hartley Counties. The city of Amarillo, which is the largest city in both the Canadian and the Red River Basins, has a total population of over 190,695 and is divided by both river basins. **Reach II** makes up about a fourth of the northwestern portion of the city, making the total population of the reach approximately 120,000. A map of **Reach II** of the Canadian River Basin can be found on **page 46**.

The economics of the majority of the reach consist of livestock, agribusiness and oil and gas production. Amarillo is also home to a large refinery that produces copper, selenium, nickel, and tellurium. Also found only in this reach is the unique resource of gaseous helium.

The reach has 13 permitted municipal and industrial dischargers, 14 permitted solid waste disposal sites, and 20 concentrated animal feeding operations.

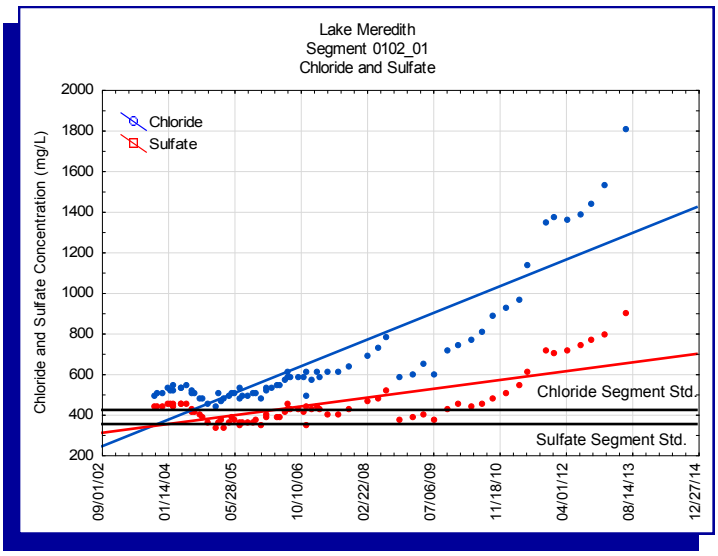
Agriculture in **Reach II** is composed of ranching and farming, producing cattle, wheat, oats, corn, sorghum, hay, barley, alfalfa, and soybeans. The majority of the area utilizes ground water to meet its demands.

Table 1-2: Canadian Reach II – *2012 Integrated Report* – Impairments and Concerns

Segment / AU	Description	Parameter	Status
0102_01	Lake Meredith	Chloride	Impairment
0102_02	Lake Meredith	Chloride	Impairment
0102_01	Lake Meredith	Mercury in fish tissue	Impairment
0102_02	Lake Meredith	Mercury in fish tissue	Impairment
0102_01	Lake Meredith	Sulfate	Impairment
0102_02	Lake Meredith	Sulfate	Impairment
0102_01	Lake Meredith	TDS	Impairment
0102_02	Lake Meredith	TDS	Impairment
0103_01	Canadian River Above Lk Meredith	Chloride	Impairment
0103_02	Canadian River Above Lk Meredith	Chloride	Impairment
0103_03	Canadian River Above Lk Meredith	Chloride	Impairment
0103A_01	East Amarillo Creek	Chlorophyll-*a*	Concern-CS
0103A_02	East Amarillo Creek	Chlorophyll-*a*	Concern-CS
0103A_01	East Amarillo Creek	Nitrate	Concern-CS
0103C_01	Unnamed Trib to West Amarillo Cr	Chlorophyll-*a*	Concern-CS

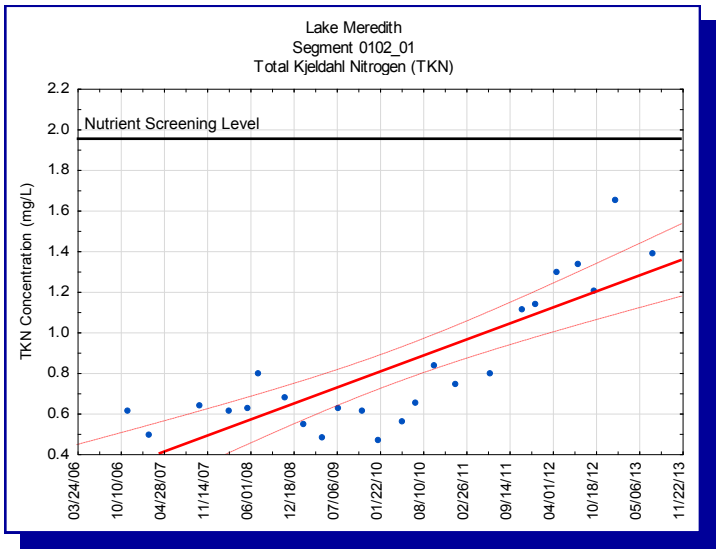
Segment 0102-Lake Meredith

Lake Meredith is the largest reservoir in the Canadian River Basin. Total conservation storage capacity of Lake Meredith is approximately 780,000 acre-feet, with an elevation of 3,011 feet above mean sea level. Managed by the Canadian River Municipal Water Authority (CRMWA), water from Lake Meredith is distributed to eleven area cities located within parts of the Canadian, Red, Colorado and Brazos River Basins. Because of the elevated **chloride** and **sulfate** levels, the water from Lake Meredith is blended with high quality ground water. This blending is designed to maximize yield and improve both quality and quantity of the water delivery to all



of its member cities. Due to the prolonged drought and intense summer temperatures, Lake Meredith has been considered "dry" by the TWDB since early 2011, forcing CRMWA to rely much more heavily on ground water than it had previously.

Lake Meredith continues to be listed with impairments for **chloride**, **sulfate**, and **total dissolved solids**, despite CRMWA having implemented two methods to aid in the reduction of "salts" entering the lake. The first method involved the drilling of shallow wells which would intercept the upward moving brine before it entered the river system. Deep well injection was then used to dispose of the highly saline water that is collected by the shallow wells. This has decreased the amount of **chloride** within the river. The second method that CRMWA implemented to reduce the **chloride** in this area involved the control of the highly invasive ornamental Salt Cedar bush. A Salt Cedar bush outcompetes naturally occurring vegetation using "salts" to its advantage. The bush will actually accumulate and "drop" salt from its leaves creating highly saline soil that native vegetation cannot grow in. Since there is no other vegetation competing for **nutrients**, and more importantly, water, the Salt Cedar bush is then free to grow with little interference. In 2004, the CRMWA began the Salt Cedar Control Program in a effort to reduce the presence of this invasive species along the Canadian River and its tributaries. Since its inception, approximately 26,528 acres have been treated at a cost totaling $3,470,890. CRMWA anticipates 2014 will be the last year of this project.



Despite CRMWA's efforts to reduce the concentration of salts entering Lake Meredith, the Authority's analyses of water quality data for Segment 0102 did agree with TCEQ's assessment, identifying statistically significant upward trends for **chloride**, **sulfate**, and **total dissolved solids**. Since 2011, Lake Meredith has been at "dead pool" elevation, with an average capacity of 0.00% accordingly to data maintained by the Texas Water Development Board. **Chloride** and **sulfate** concentrations averaged significantly higher during 2011-2013, in comparison to data collected between 2003-2010. The median **chloride** concentration rose 135.1% to 1,325 mg/L between 2011-2013, while **sulfate** concentrations rose 71.0% to 697.1 mg/L, respectively. The tremendous increase during this three year period correlates with the declining lake levels observed during the same time. Decreasing lake levels, compounded

with the persistence of record low annual rainfall and drought conditions have severely impacted water quality within the segment. Trend analyses also revealed upward trends for **volatile suspended solids** and **total kjeldahl nitrogen** levels **(See Appendix A)**.

Lake Meredith is also listed on the *2012 303(d) List* for **mercury** in edible tissue. The mercuric compound (methyl-mercury) was found in tissue samples collected from walleye. Walleye is a large cool-water predator sport fish that predominates the food chain in Lake Meredith. Being a longer living creature, the walleye consumes contaminated prey species, accumulating the methyl mercury in its tissues over time. According to health authorities, consuming contaminated species has the potential to cause health problems in pregnant women, infants, and young children. The source of the mercury is questionable; however, the U.S. Environmental Protection Agency has speculated that such sources may include atmospheric depositions from unknown origins. An intense survey of possible sources and a long-term action plan is recommended to reduce this problem in Lake Meredith. Since water levels in Lake Meredith have reached "dead pool" elevation, recreation, including fishing has decreased. At this time, TCEQ has not scheduled another survey of Lake Meredith to determine if **mercury** is still present in edible fish tissue.

Segment 0102A-Big Blue Creek

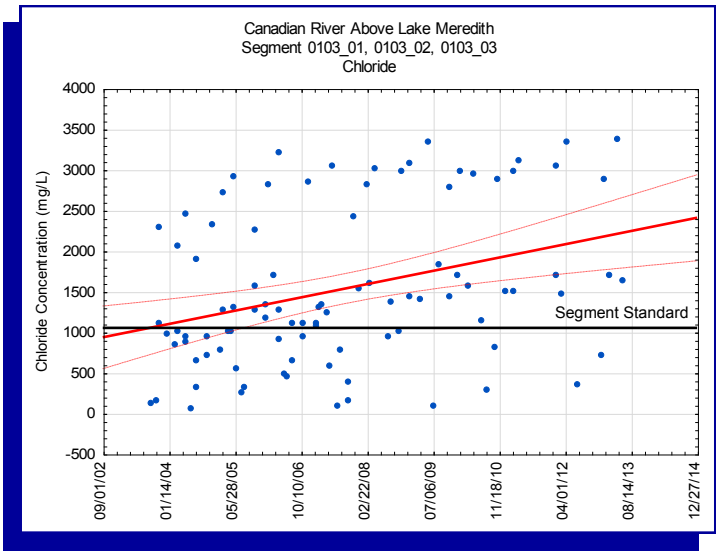
Big Blue Creek is an unclassified segment located between the confluence of Lake Meredith in Carson County and the upstream perennial portion of the stream in Moore County. The creek traverses landscapes similar to that of the rest of the Canadian River Basin. Like most of the area around Lake Meredith, the majority of Big Blue Creek is part of the National Parks Service, Lake Meredith Recreation Area. It is a minor tributary to Lake Meredith. The creek is usually perennial and is spring fed, but will dry up during long periods without rain. When Big Blue Creek is flowing, it is very shallow in depth, usually less than one foot, and meanders from one bank to the other. According to the TCEQ, Big Blue Creek is meeting all uses that were assessed and is not listed with any impairments or concerns. The Authority's analyses of the data agreed with their assessment.

Big Blue Creek at FM 1913

Canadian River at US 287

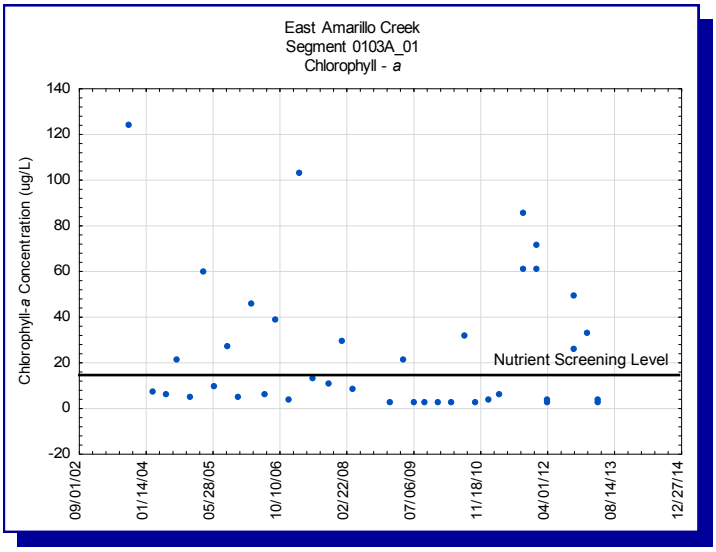
Segment 0103-Canadian River Above Lake Meredith

The Canadian River Above Lake Meredith is a classified water body located from a point immediately upstream of the confluence of Camp Creek in Potter County to the New Mexico State Line in



Oldham County. This part of the Canadian River runs through cattle grazing land. Gravel mines can be found in areas along the river, as well. Typical flow values in this segment are primarily near or below 50 cubic feet per second (cfs); however, during periods of heavy rainfall, flows do exceed values greater than 1,000 cfs. Conversely, during periods of little or no rainfall, flow values are as low as less than 10 cfs.

The Canadian River above Lake Meredith is on the *2012 303(d) List* for exceeding the standard for **chloride**. The Authority's analysis of the data agreed with this assessment. Trend analyses revealed upward trends for **chloride** and **total dissolved solids (See Appendix A)**. These parameters are naturally occurring and are also influenced by antiquated drilling practices. The CRMWA is utilizing two methods along the Canadian River to reduce the amount of chloride entering the lake **(refer to page 18 for additional information)**.

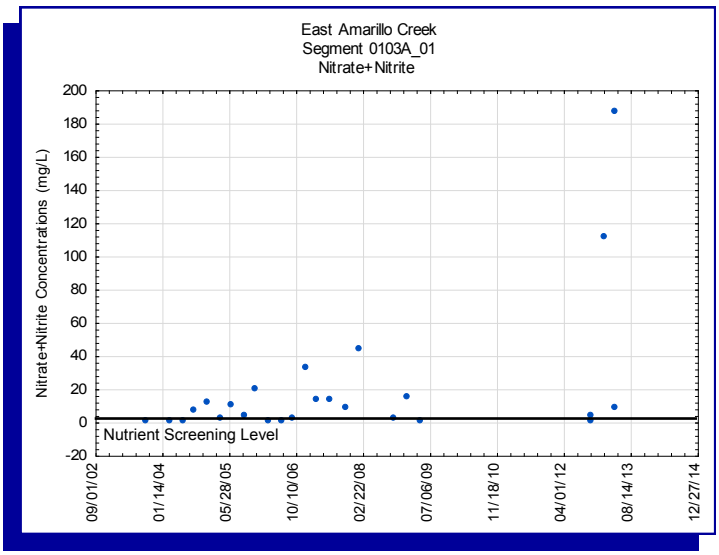


Segment 0103A-East Amarillo Creek

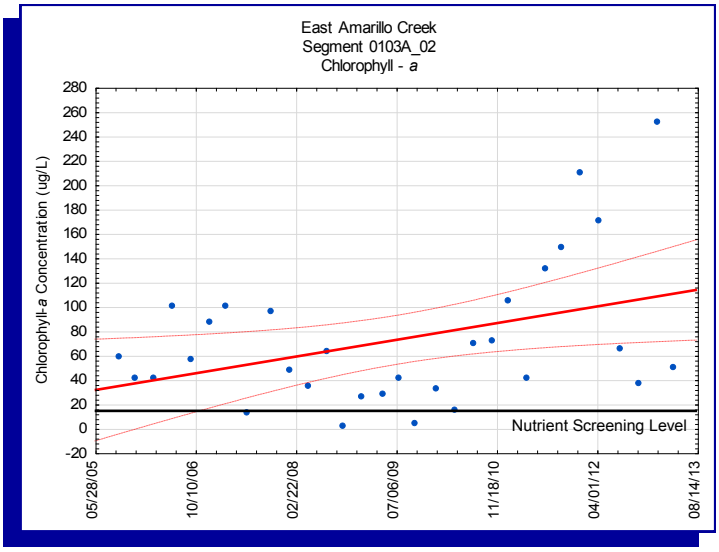
East Amarillo Creek is an unclassified stream segment. It originates in northern Amarillo, where the city has impounded the headwaters of the creek into what is known as Thompson Park Lake. Storm water runoff and natural drainage in Amarillo supply the creek with flow. From there, the creek meanders through the moderately populated portions of Amarillo's northern suburban subdivisions. It then traverses through low-rolling to relatively flat pasture land, surfaced by clay and sandy loam. At the stream's mouth, the soil is loose sand. Vegetation along the creek bed includes scrub brush, native grasses, and salt cedars.

East Amarillo Creek at Loop 335

East Amarillo Creek has been identified as a perennial (always-flowing) stream. However, consideration should be given



to reclassifying it as intermittent with perennial pools, as it can go dry during the hot summer months, especially when water is not flowing over the spillway at Thompson Park Lake. During the past five years, Authority monitoring staff observed little to no flow at the upmost monitoring station (Station 21024) when no water was leaving Thompson Park Lake. The creek has one permitted municipal wastewater treatment plant that will occasionally discharge excess effluent. Most of the flow in the creek comes from natural seeps and springs, urban runoff, and Thompson Park Lake in the upper portions of the creek.



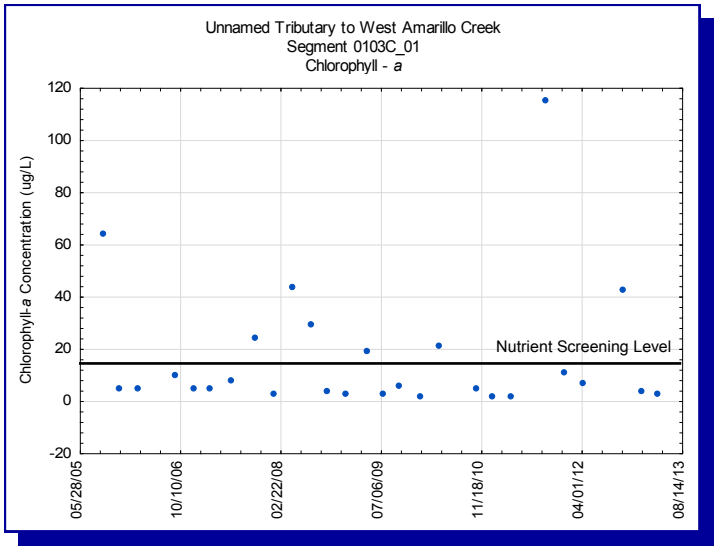
East Amarillo Creek is listed in the *2012 Integrated Report* with concerns for both **chlorophyll-*a*** and **nitrate**. The Authority's analyses of water quality data agreed with this assessment. The most likely sources of these problems are runoff from the urbanized areas that flow into the creek. As the creek exits the City of Amarillo, many small fenced properties can be found bordering the creek. Some of these properties have various types of livestock, which may inadvertently contaminate the creek. Another possibility is the contribution of nutrient-rich water from Thompson Park Lake into East Amarillo Creek. Samples collected at Thompson Park Lake typically have elevated concentrations of nutrients, especially **chlorophyll-*a***. It is possible that this could account for a significant portion of the **chlorophyll-*a*** observed at monitoring stations along East Amarillo Creek. It is important to note that the mean value for **nitrate+nitrite** samples collected at Station 10017 was well above the screening criteria. At this time, there is no explanation for the elevated results, however, routine monitoring will continue at all three monitoring stations in an effort to better characterize potential sources of these high concentrations.

Thompson Park Lake

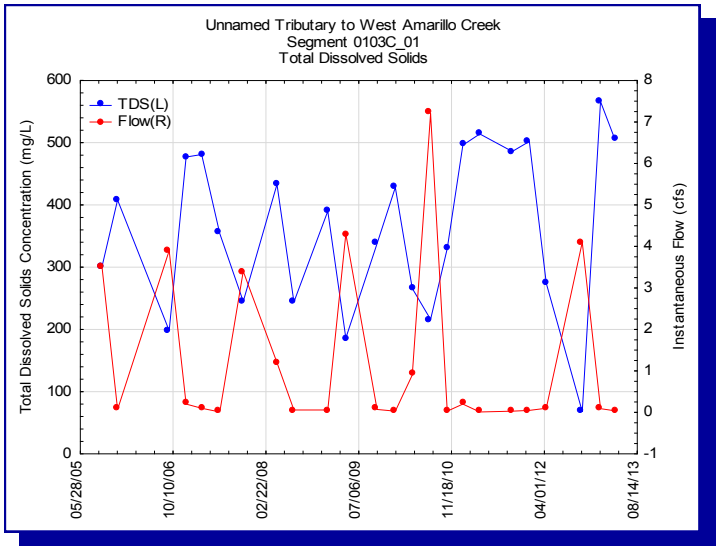
Segment 0103C-Unnamed Tributary to West Amarillo Creek

Unnamed Tributary to West Amarillo Creek is an unclassified stream originating in the northwestern portion of Amarillo. The creek is predominately located on private property with very few access points along its meandering path prior to its confluence with West Amarillo Creek. Segment 0103C had its bacteriological impairment removed during the 2012 assessment. However, it still appears in the *2012 IR* with a single concern for **chlorophyll-*a***.

The Authority's analyses of water quality data agreed with TCEQ's assessment. Flow at this monitoring station has decreased over the recent years, most likely as a result of the prolonged extreme drought conditions in the area. Conversations with local landowners has revealed that the portion of the creek located above the current monitoring station (Station 17056) has been altered to create a large stock pond currently being utilized to water livestock Attempts have been made by Authority staff to gain access to this portion of the creek with no success. If this is the case, it is very likely that little to no flow makes it past this barrier, hence the decreased flow values observed at the current monitoring station.



Beginning in September of 2013, the TCEQ Regional Office in Amarillo, Texas began sampling at a location near the headwaters of the Unnamed Tributary to West Amarillo Creek. This new location (Station 10021) will provide data needed for a comparison of the data collected at the opposite end (Station 17056) of Segment 0103C. Comparison of the data may yield useful information as to where contamination could be occurring. However, at this time, no potential source has been identified in connection with the **chlorophyll-*a*** concern.



Canadian River Basin
Reach II

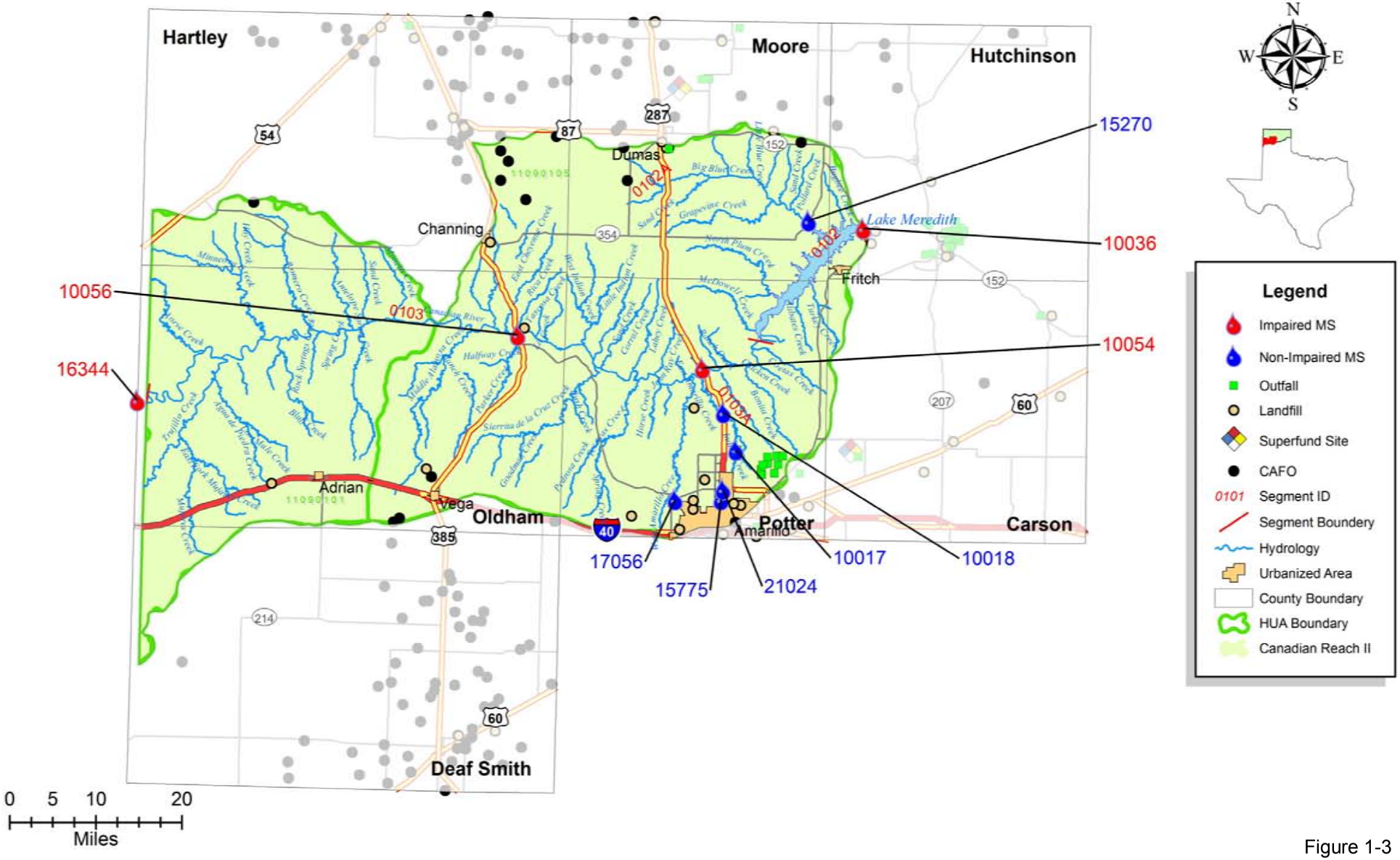


Figure 1-3

Canadian River Basin — Reach III

Reach III of the Canadian River Basin represents the Rita Blanca Creek Watershed upstream to the Texas-New Mexico State Line encompassing Hartley and Dallam Counties. A map of the reach can be found on **page 49**.

The three sub-watersheds contained in this reach include approximately 3,600 square miles, of which an estimated 1,500 square miles are contributing drainage. Within the reach are 53 CAFO permits and three permitted solid waste disposal sites. The City of Dalhart is the only permitted wastewater discharger in this reach.

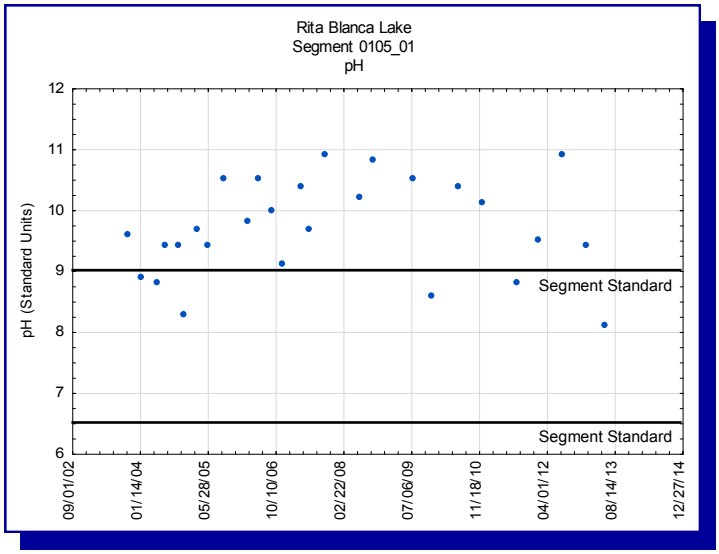
There are more than 600 farms and ranches that cover about 1,750,000 acres of land. These farms and ranches produce cattle, wheat, oats, corn, sorghum, hay, barley, alfalfa, and soybeans. As described in the preceding reaches, only a small portion is irrigated farmland. The soils range from sandy alluvial soils to dark and reddish clay loams over flat plain to broken rocky valleys where the plains break into the Canadian River Valley. Dalhart is the largest city in **Reach III** with a population of more than 8,245. The economy of the reach is basically agribusiness, oil and gas production, and hunting. In addition Dalhart is home to a California-based cheese processing facility. Rainfall averages from 16 inches to a little more than 17 inches, with less than that in recent years.

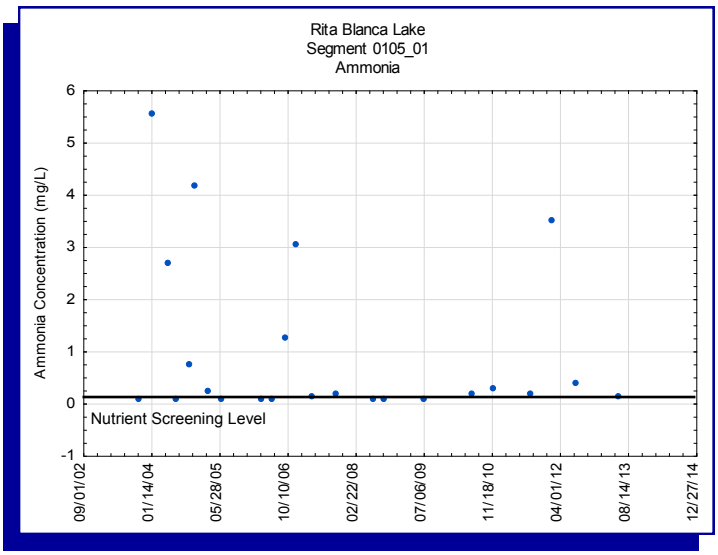
Table 1-3: Canadian Reach III – *2012 Integrated Report* – Impairments and Concerns

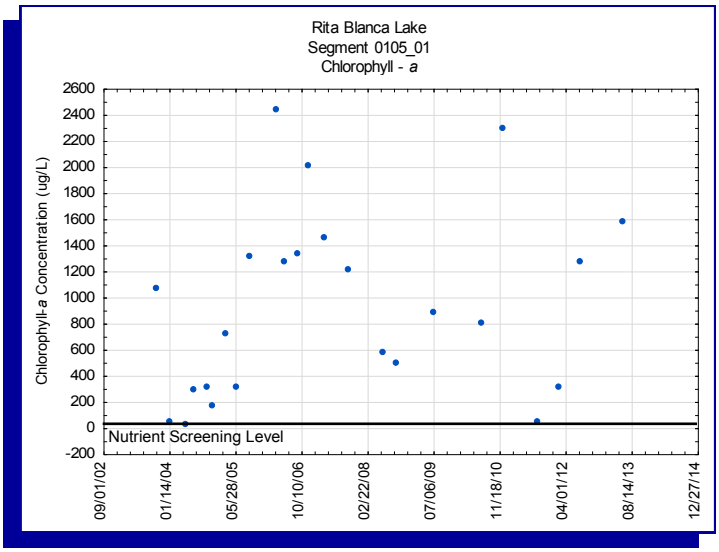
Segment / AU	Description	Parameter	Status
0105_01	Rita Blanca Lake	pH	Impairment
0105_01	Rita Blanca Lake	Ammonia-Nitrogen	Concern-CS
0105_01	Rita Blanca Lake	Chlorophyll-*a*	Concern-CS
0105_01	Rita Blanca Lake	Nitrate	Concern-CS
0105_01	Rita Blanca Lake	Orthophosphorus	Concern-CS
0105_01	Rita Blanca Lake	Total Phosphorus	Concern-CS

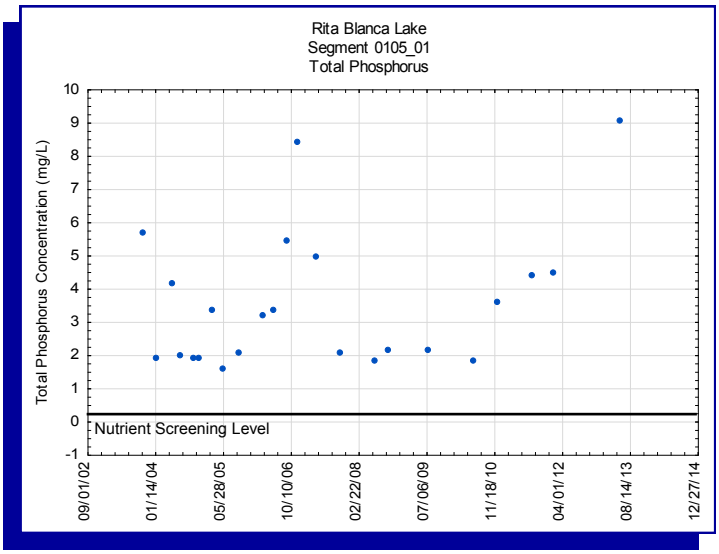
Segment 0105-Rita Blanca Lake

Rita Blanca Lake comprises the only segment within **Reach III**. It was completed in 1938 for flood control of the Rita Blanca Creek, a tributary to the Canadian River, drainage area and by May 1941 it had filled to 75%. Heavy rains that same year damaged the spillway. Since then the lake has only filled a handful of times. Rita Blanca has a potential capacity of 12,100 acre-feet and an elevation of 3,860 feet above mean sea level. Although the drainage area above the lake is 1,062 square miles, the ongoing drought has dried up almost the entire lake.







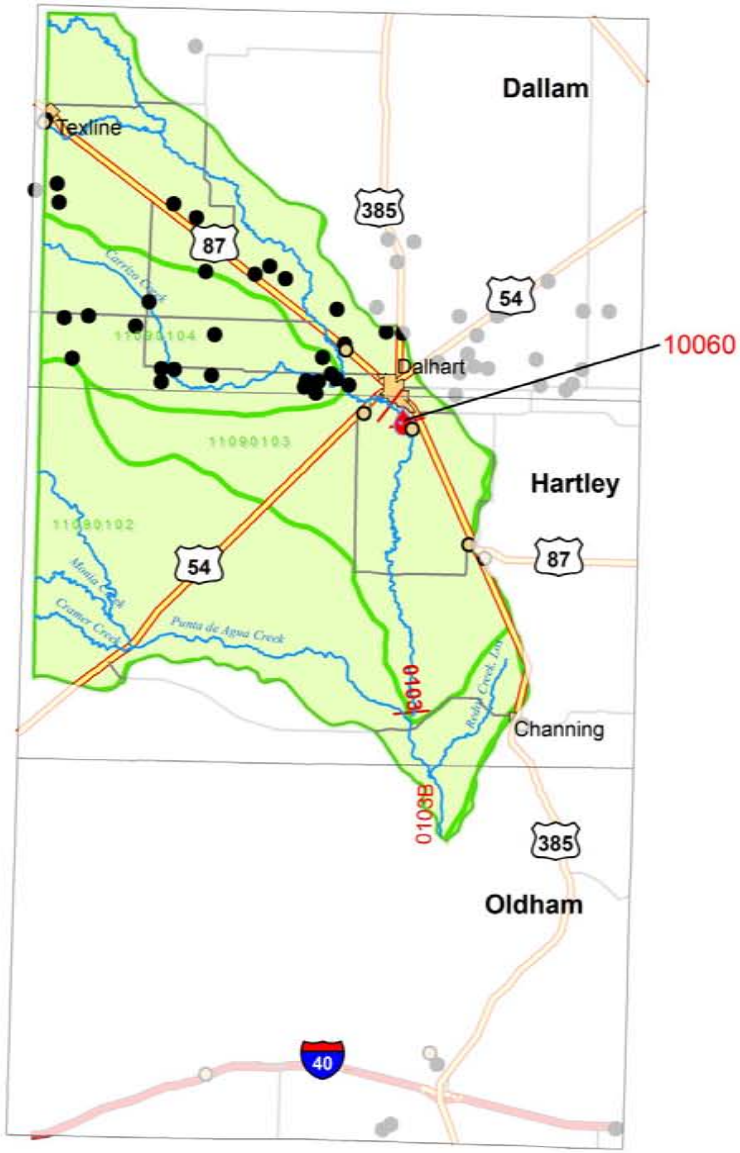


Rita Blanca Lake is unique in that it is the only segment within the Canadian River Basin to be classified as a **Non-contact Recreation** segment. It is on the *2012 303(d) List* for **pH**. The only **pH** impairment within the entire basin. There are *concerns for use attainment and screening levels* for several nutrients, including **chlorophyll-*a***, **ammonia**, **nitrate** and **ortho/total phosphorus**. The Authority's analyses of the data agreed with this assessment, and upward trends for **chloride** and **sulfate** were observed.

A visual and subsequent statistical review of the data revealed some interesting seasonal correlations between **nutrient** constituents. During cold-weather months (October through February), the concentration of both **ammonia** (1.94 mg/L) and **total phosphorus** (3.72 mg/L) were higher than both the non-winter months (**ammonia** - 0.38 mg/L and **total phosphorus** - 3.01 mg/L) and cumulative averages (**ammonia** - 1.01 mg/L and **total phosphorus** - 3.52 mg/L), respectively. **Chlorophyll-*a*** during the winter months actually averaged approximately 13.0% less than during the non-winter months and cumulative averages. No significant trends or exceedances were notated for any additional parameters during the Authority's data review.

The most likely source of the **pH** impairment and **nutrient concerns** is the large number of migratory waterfowl using the lake as a stop over. This may be especially true during the winter months, as data does show a significant increase in the concentration of both **ammonia** and **total phosphorus**. There is not a good resolution to the problems in Rita Blanca. Until rainfall return to levels that are more normal and the lake begins to receive inflow from the watershed, Rita Blanca Lake will to continue to experience similar problems for the foreseeable future.

Canadian River Basin
Reach III



Legend

- Impaired MS
- Non-Impaired MS
- Outfall
- Landfill
- Superfund Site
- CAFO
- 0101 Segment ID
- Segment Boundary
- Hydrology
- Urbanized Area
- County Boundary
- HUA Boundary
- Canadian Reach III

0 5 10 20
Miles

Figure 1-4

Canadian River Basin — Reach IV

Reach IV of the Canadian River Basin includes **Palo Duro Creek (Segment 0199),** a classified water body, from the northern Texas-Oklahoma state line upstream to its headwaters, including portions of Coldwater Creek, Frisco Creek, and Lower Beaver River. It contains three sub watersheds with 6,500 square miles, of which 3,500 are contributing drainage in Texas. It was not assessed in 2008 and data was not available. A map of **Reach IV** can be found on **page 51**.

Major cities located in **Reach IV** include Dumas, Spearman, Cactus, Stratford, Sunray, and Gruver. Rainfall averages from 19 to 20 inches annually. More than 580 farms and ranches encompassing 1,100,000 acres of land produce cattle, wheat, oats, corn, sorghum, hay, barley, alfalfa, and soybeans. Soils range from sandy alluvial to dark and reddish clay loams over flat plain to broken rocky valleys.

There are 9 permitted municipal and industrial dischargers, 13 permitted solid waste disposal sites and 118 concentrated animal feeding operations.

Table 1-4: Canadian Reach IV – *2012 Integrated Report* – Impairments and Concerns

Segment / AU	Description	Parameter	Status
0199A_01	Palo Duro Reservoir	Orthophosphorus	Concern-CS
0199A_01	Palo Duro Reservoir	Total Phosphorus	Concern-CS

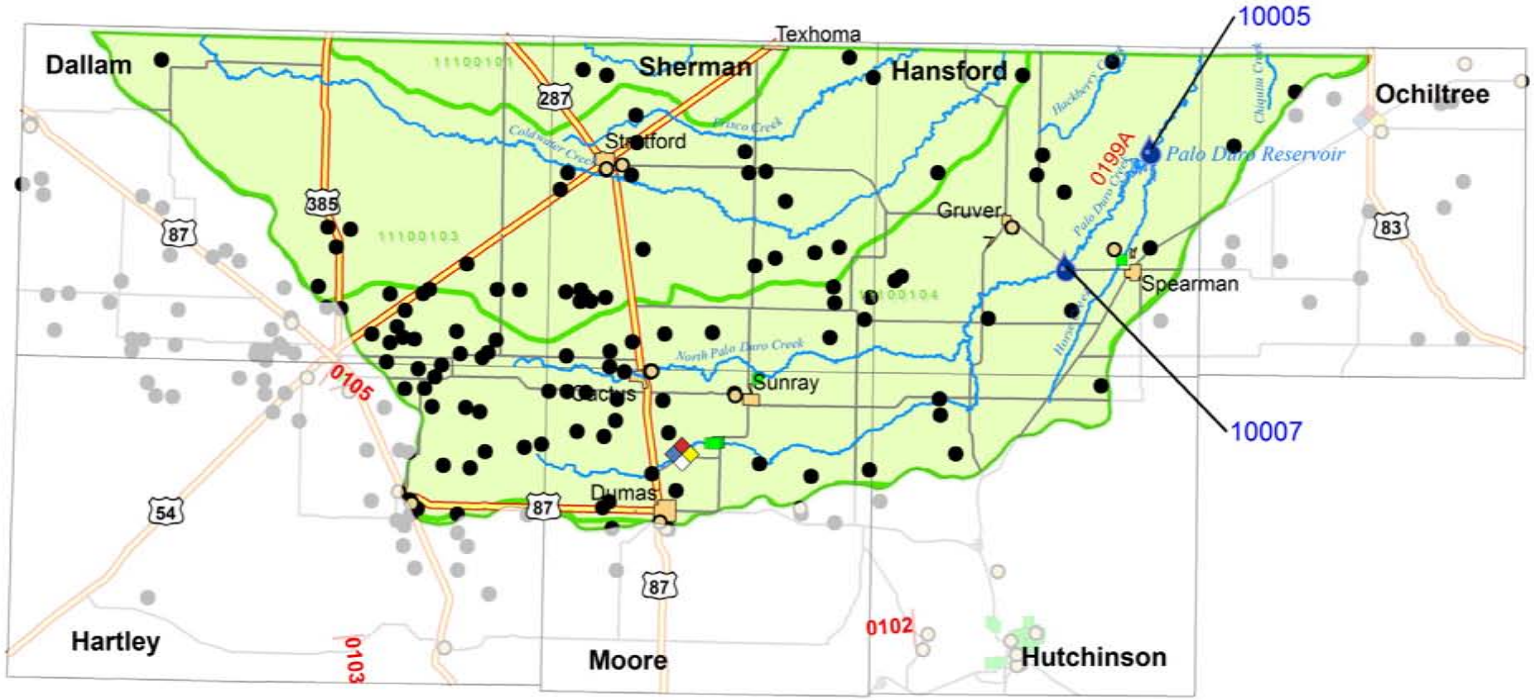
Segment 0199A-Palo Duro Reservoir

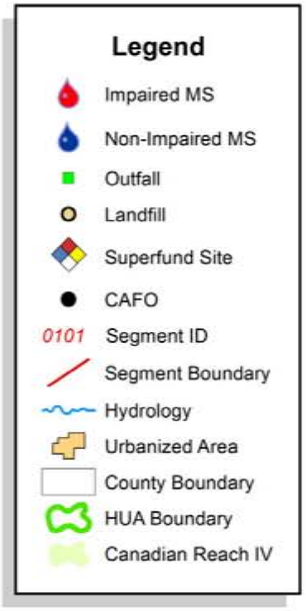
The construction of Palo Duro Reservoir was completed in 1991, with a total storage capacity of 60,900 acre feet (ac/ft), and drainage area of about 614 square miles. The naturally arid nature of this region continues to plague the filling of Palo Duro Reservoir. According to the Palo Duro River Authority, the five year average capacity was 8.06%, while the ten year capacity was 5.86%. This is not surprising considering Lake Meredith has been reported "dry" by the TWDB since early 2011.

While Segment 0199A has been removed from the *303(d) List* (previously listed for **depressed dissolved oxygen),** it does remain listed with *concerns for water quality based on screening levels* for both **orthophosphorus** and **total phosphorus** in the *2012 IR*. The Authority's analyses of **total phosphorus** data agreed with the 2012 assessment. The Authority reviewed 19 data **total phosphorus** results yielding a maximum value of 0.73 mg/L, minimum value of 0.09 mg/L, with an average of 0.23 mg/L. While trend analyses was not possible due to the insufficient number of data points, a visual inspection of the data showed no inclination of a shift in water quality constituents positively or negatively.

Palo Duro Reservoir, like Rita Blanca Lake, is one of very few water bodies in the Panhandle of Texas. It is also relatively shallow and attracts large numbers of migratory waterfowl. Only when and if the lake begins to fill, will these problems begin to show signs of improvement. However, the likelihood of this is minimal based on historical data. Data from the Texas Water Development Board shows that over the past several years, the Palo Duro Reservoir has consistently measured less than 10% of its total capacity. Continued monitoring is essential to generate data allowing for future assessments of water quality.

Canadian River Basin
Reach IV

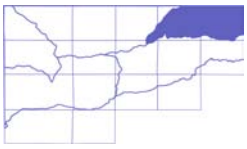




0 5 10 20
Miles

Figure 1-5

Canadian River Basin — Reach V



Reach V of the Canadian River Basin comprises the Wolf Creek segment. It includes the upper eastern section of the Panhandle in Lipscomb and Ochiltree Counties, which is about sixty-five (65) miles long and thirty-five (35) miles wide. It consists of three sub-watersheds with 3,589 square miles of contributing drainage. A map of **Reach V** of the Canadian River Basin can be found on **page 54**.

Rainfall averages from 19 inches to 23 inches annually. More than 660 farms and ranches encompass about 1,150,000 acres of land that produce cattle, wheat, oats, corn, sorghum, hay, and barley with dry land farming. Economics of the area are based on agribusiness, oil and gas production, and hunting. The largest city in **Reach V** is Perryton, which has a population of 8,994 Other towns include Booker, Higgins, Follett, and Darrouzett. The total population of the reach is approximately 12,000. Additionally, **Reach V** contains two (2) municipal wastewater discharges, six permitted solid waste disposal sites and 29 concentrated animal feeding operations.

Table 1-5: Canadian Reach V – *2012 Integrated Report* – Impairments and Concerns

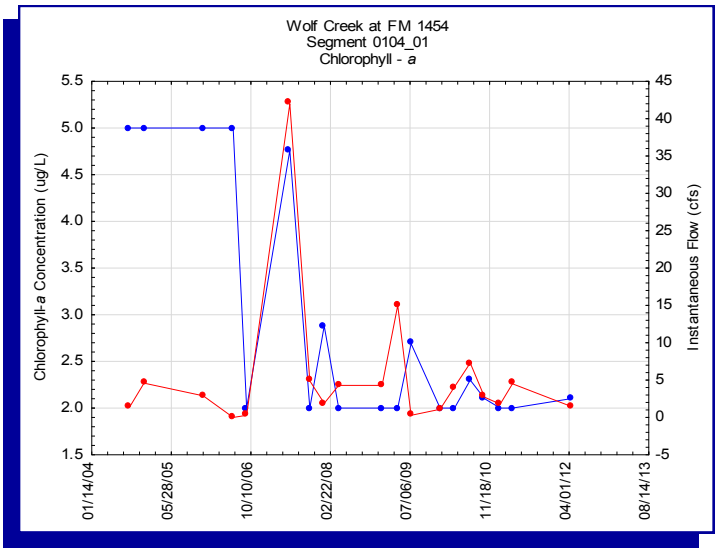
Segment / AU	Description	Parameter	Status
0104_03	Wolf Creek	Chlorophyll-*a*	Concern-CS

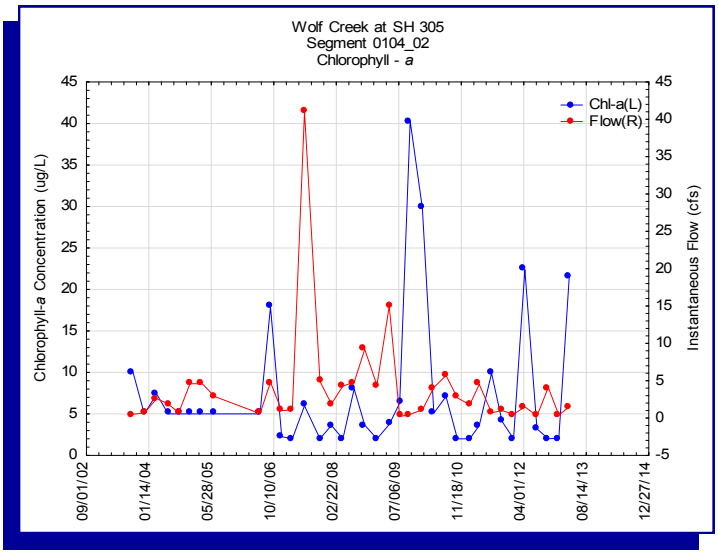
Wolf Creek at SH 305 North of Lipscomb

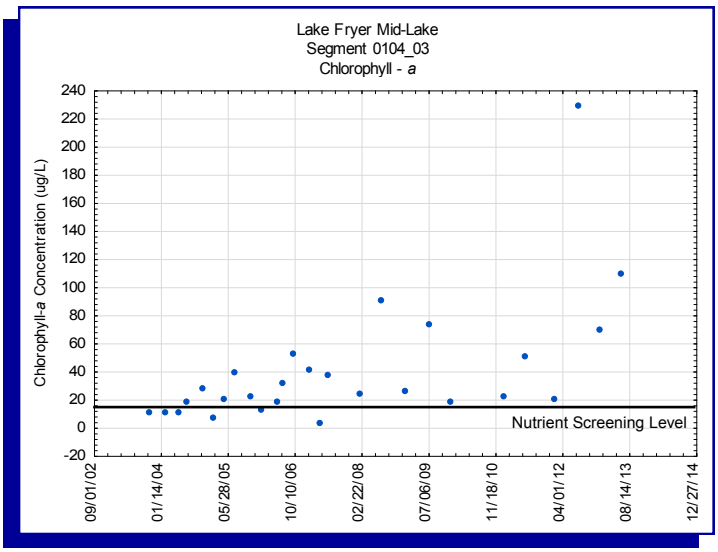
Segment 0104-Wolf Creek

Segment 0104, Wolf Creek, extends from the Oklahoma state line in Lipscomb County to a point 2.0 kilometers (1.2 miles) upstream of FM 3045 in Ochiltree County. The entire length of the segment runs through both Ochiltree and Lipscomb counties prior to leaving the state and entering Oklahoma. The Authority maintains two (2) monitoring stations in Segment 0104; the first monitoring station, 10058, is located at SH 305 just north of the City of Lipscomb. The second monitoring Station, 10059, is on FM 1454 just east of the City of Lipscomb, prior to the water body exiting the state. The Authority has maintained both stations for a combined eighteen (18) years (10058 since 1998 and 10059 since 2003), respectively. Additionally, the USGS provides continuous discharge measurements at Station 10058, while the Region 1 TCEQ Field Office out of Amarillo provides monitoring data at the headwaters of the segment on Lake Fryer, Station 17465.

According to the *2012 Texas Integrated Report*, Wolf Creek has been removed from the *303(d) List* for **bacteria**, but still has a single concern for **chlorophyll-*a***. This is for the portion of the segment that includes Lake Fryer to the upper end of the segment. With the ongoing drought,





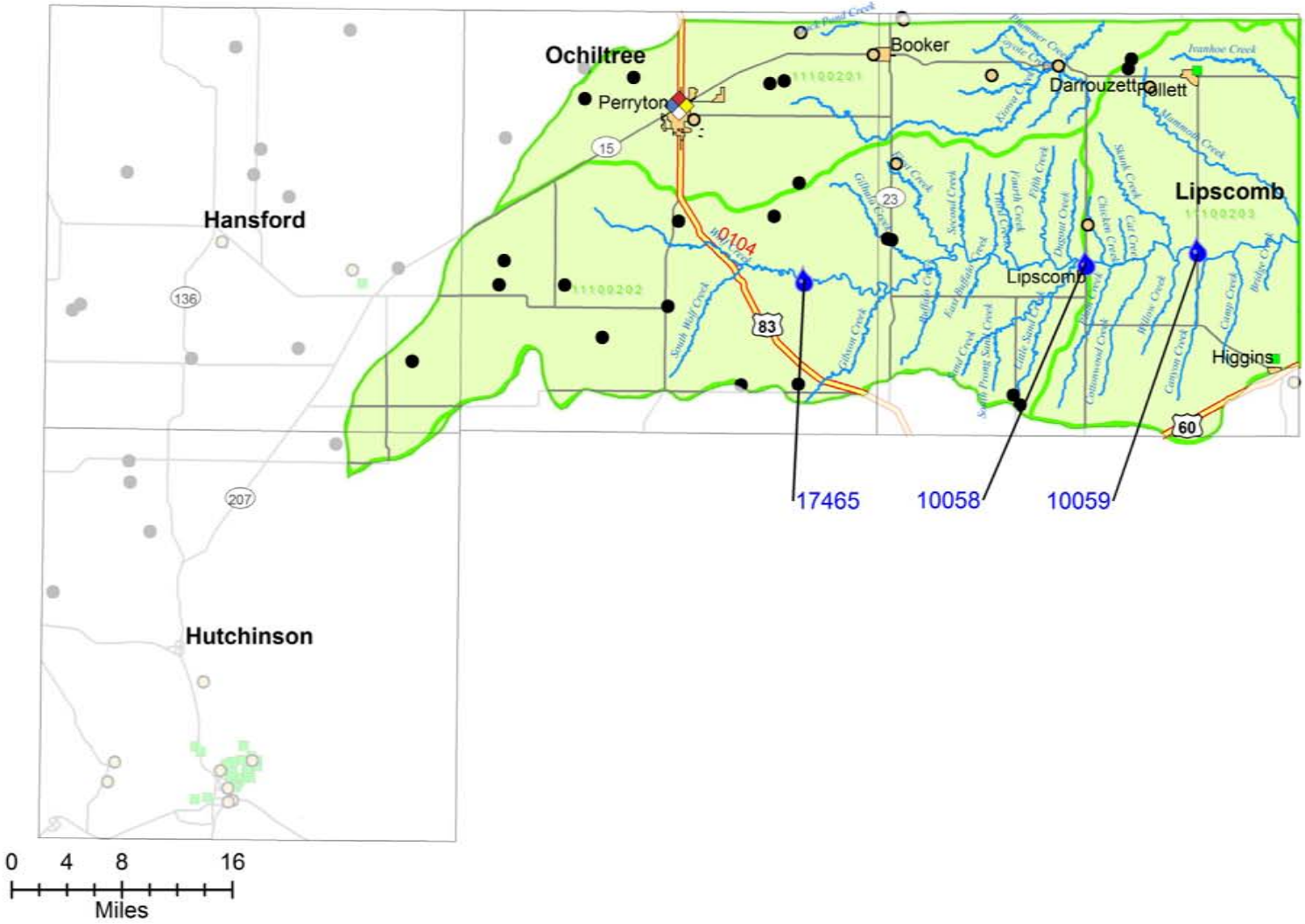


the creek has been consistently dry at Station 10059 during routine monitoring events. In fact, between January 2011 and April 2013, Station 10059 was dry approximately 70% of the time during routine monitoring events. Thus, the only water quality data for the segment comes from the upper and middle portions of Wolf Creek.

Water quality data from Stations 10058 and 17465 have some very interesting **chlorophyll-*a*** data. Between January 2003 and April of 2013, only 15.4% of data collected at Station 10058 exceeded the specified screening level for **chlorophyll-*a***. However, at Station 17465, approximately 73% of the data exceeded the screening level.

There are a number of reasons that could be contributing to the elevated concentrations of **chlorophyll-*a*** in the upper portion of Wolf Creek. The Texas Panhandle, like most other portions of the state, has been experiencing severe drought conditions for quite some time. Without regular rainfall, the primary input of water into Lake Fryer comes in the form of runoff from the nutrient-rich cropland surrounding the reservoir. Increasing concentrations of nutrients, such as **total phosphorus** and nitrogen **(TKN)** display trends mimicking that of **chlorophyll-*a***, lending credibility to this theory. While flows observed at Station 10058 have been lower than the computed historic averages, Wolf Creek is still flowing north of Lipscomb. This flow, albeit very low flow, does help prevent the accumulation of nutrients and could be the reason why **chlorophyll-*a*** values have not exceeded the water quality standard as often, in comparison to the Lake Fryer monitoring station. Additional monitoring above Lake Fryer may provide useful information in determining the source of **chlorophyll-*a*** observed in this segment.

Canadian River Basin
Reach V

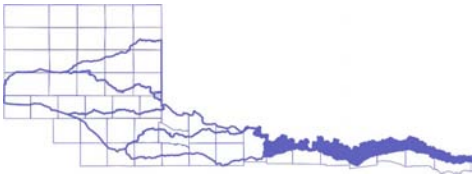


Legend

- Impaired MS
- Non-Impaired MS
- Outfall
- Landfill
- Superfund Site
- CAFO
- 0101 Segment ID
- Segment Boundary
- Hydrology
- Urbanized Area
- County Boundary
- HUA Boundary
- Canadian Reach V

Figure 1-6

Red River Basin Reach I



Reach I of the Red River Basin is the easternmost reach of the Texas portion of the Red River Basin. It is approximately 230 miles long by 35 miles wide. Beginning at Texarkana in Bowie County and ending upstream just inside Clay County, the reach encompasses approximately 6,588 square miles. Maps of the lower and upper portions of **Reach I** can be found on **pages 67** and **68**, respectively.

Numerous small communities and rural areas are characteristic of much of the easternmost areas. Cities within the basin with populations more than 10,000 include Texarkana, Paris, Sherman, Denison, and Gainesville. Smaller cities in these counties include Bonham, Bowie, Clarksville, New Boston, and Nocona. The populations of more than 260 towns and communities account for less than 10,000 people. However, total population of **Reach I** is approximately 350,000.

One of the fastest growing areas in this region is the Sherman-Denison metropolitan area, likely a result of the Dallas/Fort Worth Metroplex's continued growth northward along the Highway 75 corridor. This population growth is also driving the growth of the infrastructure of the suburban areas. This, in turn, affects water quality from the influences of runoff from these newly populated areas.

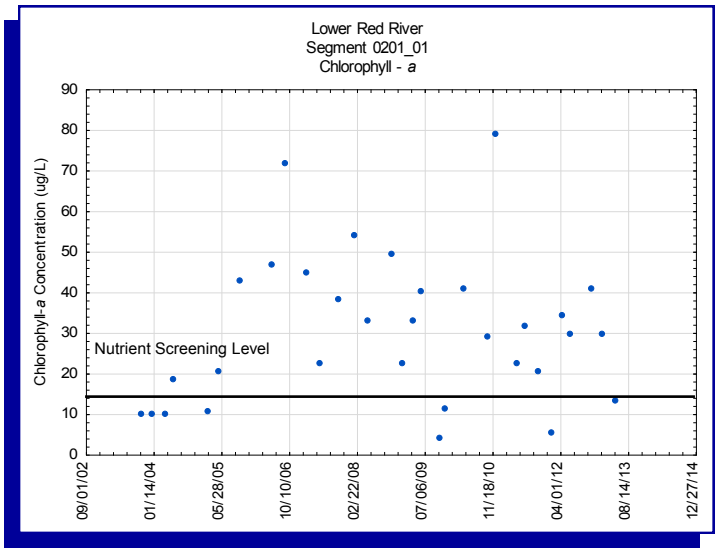
The major reservoirs of **Reach I** of the Red River Basin include: Pat Mayse Lake, Lake Bonham, Lake Texoma, Moss Lake, and Lake Nocona. Annual rainfall amounts average from 32 inches to 50 inches.

The seven counties located within **Reach I** contain three classified river or stream segments (**0201, 0202,** and **0204**) and five classified water body segments (lakes and/or reservoirs - **0203**, **0208**, **0209**, **0210**, and **0225**). Nine unclassified water bodies are also in **Reach I** and include: **0201A**, **0202A**, **0202C**, **0202D**, **0202E**, **0202F**, **0202G**, **0203A**, and **0204B**. There are 40 permitted municipal and industrial dischargers, 43 permitted solid waste disposal sites and six concentrated animal feeding operations.

There are approximately 10,000 farms covering three million acres of land that produce mainly wheat, hay, soybeans, corn, milo, cotton, sorghum, turf grasses, wholesale nursery greenery, pecans, peaches, melons, peanuts, and fruits. The farms also raise beef cattle, poultry, goats, dairy cattle, and horses. Soils vary within the reach to more than 40 different types. A variety of trees such as pine and oaks contribute natural resources for the lumber and paper mill industries.

Table 1-6 Red Reach I – *2012 Integrated Report* – Impairments and Concerns

Segment / AU	Description	Parameter	Status
0201_01	Lower Red River	Chlorophyll-*a*	Concern-CS
0201A_01	Mud Creek	Bacteria	Impairment
0201A_01	Mud Creek	Dissolved Oxygen	Impairment
0201A_01	Mud Creek	Ammonia	Concern-CS
0201A_01	Mud Creek	Chlorophyll-*a*	Concern-CS
0201A_01	Mud Creek	Dissolved Oxygen	Concern-CS
0202_01-04	Red River Below Lake Texoma	Chlorophyll-*a*	Concern-CS
0202A_02	Bois D' Arc Creek	Bacteria	Impairment
0202C_01	Pecan Bayou	Dissolved Oxygen	Concern-CS
0202E_01	Post Oak Creek	Total Phosphorus	Concern-CS
0202F_01/02	Choctaw Creek	Bacteria	Impairment
0202F_01	Choctaw Creek	Nitrate	Concern-CS
0202F_01	Choctaw Creek	Orthophosphorus	Concern-CS
0202F_01	Choctaw Creek	Total Phosphorus	Concern-CS
0202G_01	Smith Creek	Bacteria	Impairment
0202G_01	Smith Creek	Ammonia	Concern-CS
0202G_01	Smith Creek	Orthophosphorus	Concern-CS
0202G_01	Smith Creek	Total Phosphorus	Concern-CS
0202I_01	Little Pine Creek	Chlorophyll-*a*	Concern-CS
0202I_01	Little Pine Creek	Dissolved Oxygen	Concern-CN
0202K_01	Iron Ore Creek	Bacteria	Impairment
0203_04	Lake Texoma	Chlorophyll-*a*	Concern-CS
0203_01-05	Lake Texoma	Harmful Algal Bloom	Concern-CN
0203_01/04	Lake Texoma	Orthophosphorus	Concern-CS
0203A_01	Big Mineral Creek	Nitrate	Concern-CS
0203A_01	Big Mineral Creek	Orthophosphorus	Concern-CS
0203A_01	Big Mineral Creek	Total Phosphorus	Concern-CS
0204_01-03	Red River Above Lake Texoma	Chlorophyll-*a*	Concern-CS
0209_01/02	Pat Mayse Lake	Manganese in Sediment	Concern-CS
0209_01/02	Pat Mayse Lake	Chlorophyll-*a*	Concern-CS



Segment 0201 - Lower Red River

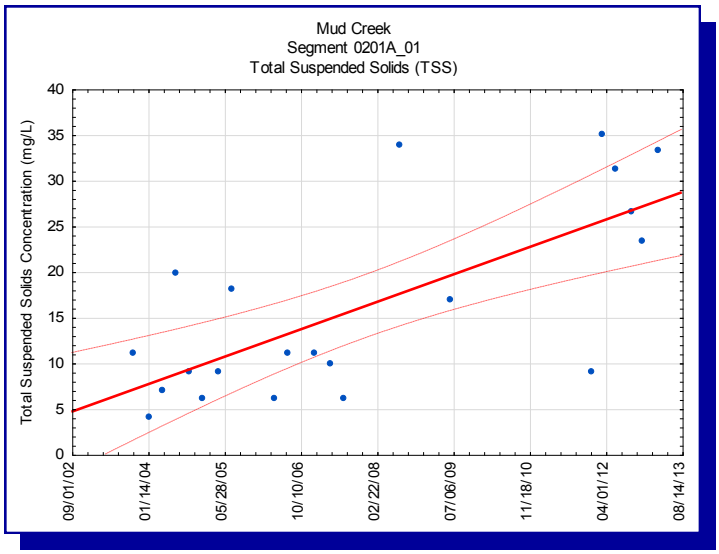
The Lower Red River (Segment 0201) is the lowest segment of the Red River and runs from the Arkansas state line in Bowie County to the Arkansas-Oklahoma state line in Bowie County. This segment is on the *2012 IR* with a single concern for **chlorophyll-*a***. The Authority's analysis of the data agreed with this assessment.

Chlorophyll-*a*, an indicator of nutrient levels, is a concern present up and down the main stem of the Red River. Run-off and discharges from both sides of the watershed (Texas and Oklahoma), along with the different methods

Texas and Oklahoma utilize in their approach to water quality monitoring, affect the interpretation of this issue.

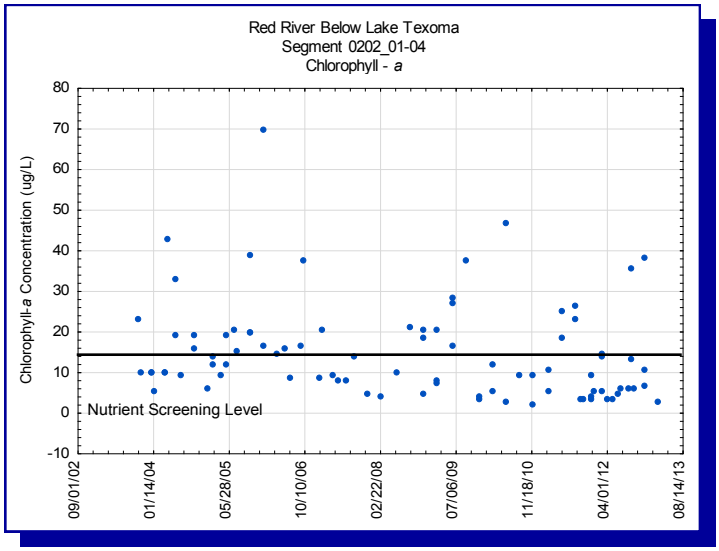
Segment 0201A - Mud Creek

Mud Creek (Segment 0201A) is an unclassified segment that begins eight and one half miles northwest of DeKalb in northwestern Bowie County and runs southeast to a point just above DeKalb. It then turns northeast to its mouth on the Red River north of New Boston. It is on the *2012 303(d) List* for **depressed dissolved oxygen** and elevated **bacteria** levels. It also has concerns for **chlorophyll-*a*** and **depressed dissolved oxygen**. The Authority's analyses of the data agreed with this assessment. Upward trends for both **turbidity** and **TSS** were observed **(See Appendix B)**. **Total phosphorus** also exceeded the nutrient screening level of 0.69 mg/L 19.0% of the time (4/21 events) during the period of review. In most water bodies in their natural state, **total phosphorus** is the limiting factor driving how much growth that water body can sustain and support. When **total phosphorus** concentrations rise in a water body increased growth affects everything up the food chain. One of the first indications that some kind of pollutant has been introduced into a water body, is increased levels of algal growth. Mud Creek rarely flows due to beaver dams along the water body. The exception is during and after heavy rainfall events. With the persistence of these two factors, the **depressed dissolved oxygen** levels will likely remain well below required levels.



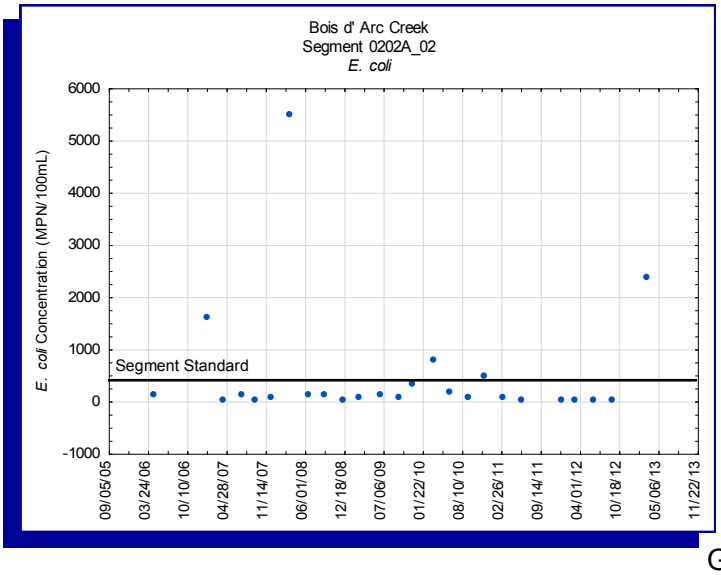
Mud Creek is a typical East Texas creek from all appearances. However, somewhere upstream there is something that is causing these problems. Some possible sources that could be contaminating the creek include runoff from fields, animals concentrating near the creek using it as a water source, birds roosting in trees over the creeks and/or the discharge of untreated household waste into the creek. In the future, it may be beneficial to determine if Mud Creek would be a suitable candidate for bacterial source tracking, the analytical methodology used to aid in the removal of Buck Creek (Segment 0207A) from the 303(d) list. Additionally, a change in the segment's recreational use category would raise the permissible threshold for bacteria, potentially reducing the number of exceedances, eventually leading to its delisting. The TSSWCB is contracting with TIAER to conduct a Recreational Use Attainability Analysis

(RUAA) to determine if this is feasible.



Segment 0202 - Red River Below Lake Texoma

Red River below Lake Texoma (Segment 0202) is a classified segment located from the Arkansas-Oklahoma state line in Bowie County to Denison Dam in Grayson County. It is on the *2012 IR* with a single concern for **chlorophyll-*a*** throughout the entire segment, with the exception of the portion extending from the confluence of Choctaw Creek up to the Denison Dam. The Authority's analyses of the data agreed with this assessment, finding values exceeding the nutrient screening level for **chlorophyll-*a*** 48.8% of the time (41/84 events). Trend analyses by the Authority also revealed a subtle downward trend for **chloride**, **sulfate** and **TDS** levels at Station 21031, the most upstream station within the segment. The downward trend for these three analytes has been consistent, however, there is not enough data at this time (approximately 15 data points) to definitively confirm the trend. Like most of **Reach I** of the Red River Basin, it receives runoff and flow from Oklahoma, as well as Texas. As stated earlier, since both Texas and Oklahoma contribute to these issues in the Red River, a cooperative effort between the states will be necessary to fully understand and characterize the impairments and concerns. Monitoring should continue throughout this segment. No other nutrients were shown to exceed the nutrient screening criteria.



Segment 0202A - Bois D' Arc Creek

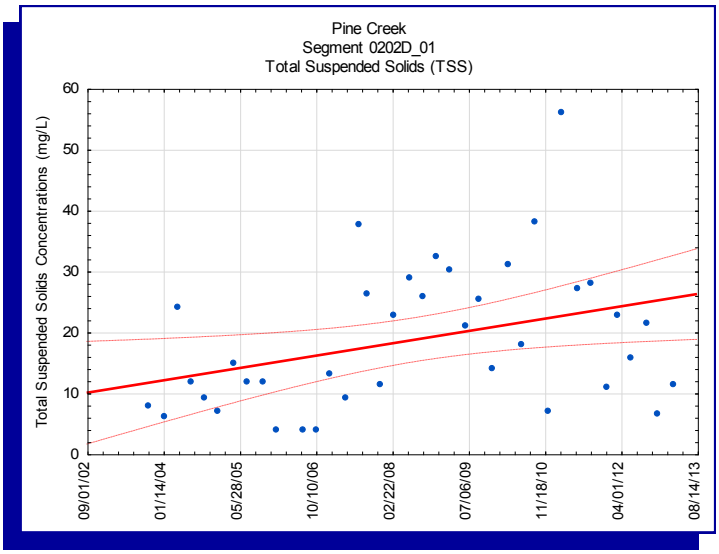
Bois D' Arc Creek (Segment 0202A) is an unclassified water body that runs from its confluence with the Red River to the upstream perennial portion of the stream southwest of Bonham in Fannin County, Texas. Bois D' Arc Creek rises two miles northwest of Whitewright in southeastern Grayson County, runs northeast across Fannin County, and eventually forms a natural boundary between Fannin and Lamar Counties, before its confluence with the Red River. The stream, intermittent in its upper reaches, is 60 miles long. It flows over the permeable, clay soils of Grayson County, and the highly calcareous catalpa clay of Fannin County. South of Bois D' Arc Creek in Fannin County is a cove that is part of a chalk escarpment. Bois D' Arc Creek is listed in the *2012 IR* with a **bacteria** impairment. Ironically, Segment 0202A was delisted for **bacteria** (Segment 0202A_01) and listed for **bacteria** (Segment 0202A_02) in the same year (2012). At this time, Bois D' Arc Creek is monitored at three stations monthly by the North Texas Municipal Water District (NTMWD) and two stations quarterly by the Authority. Analysis of the **bacteriological** data within AU 02 re-

vealed exceedances 23.1% of the time (6/26 events), with a calculated geomean of 141 MPN, which exceeds the geomean standard of 126 MPN. However, if you remove the single outlier from the data set, the calculated geomean falls to 115 MPN, which does meet the segment standard. There were no other significant trends. Continued routine monitoring by the Authority and NTMWD will aid in isolating potential sources of **bacteria**.

Segment 0202C - Pecan Bayou

Pecan Bayou (Segment 0202C) is an unclassified water body with origins south of Woodland in the northwestern corner of Red River County. It is intermittent at places in its upper and middle reaches. The stream meanders for 40 miles to its mouth on the Red River in northeastern Red River County, approximately one mile west of the Bowie County line. The soils along the creek are loam and clay, and the area is primarily agricultural. Fields and pastures are interspersed with heavily wooded areas of pines and various hardwood trees.

Pecan Bayou is on the *2012 IR* with a concern for **depressed dissolved oxygen**. The Authority's analysis of the data agreed with this assessment. While no trends were evident, screening analyses confirmed the concern for **depressed dissolved oxygen** levels **(See Appendix B)**. **Chlorophyll-*a*** levels have increased, most likely from nutrient levels increasing from runoff after rain fall events. **Depressed dissolved oxygen** levels have been recorded during these recent years. One possibility that could cause the creek to slow down and/or even stop is the presence of beaver dams. To help better assess water quality within this segment, the Authority added an additional monitoring station north of the City of Bagwell (Station 14472) in September 2012, several miles upstream from the historically utilized station at FM 1159.

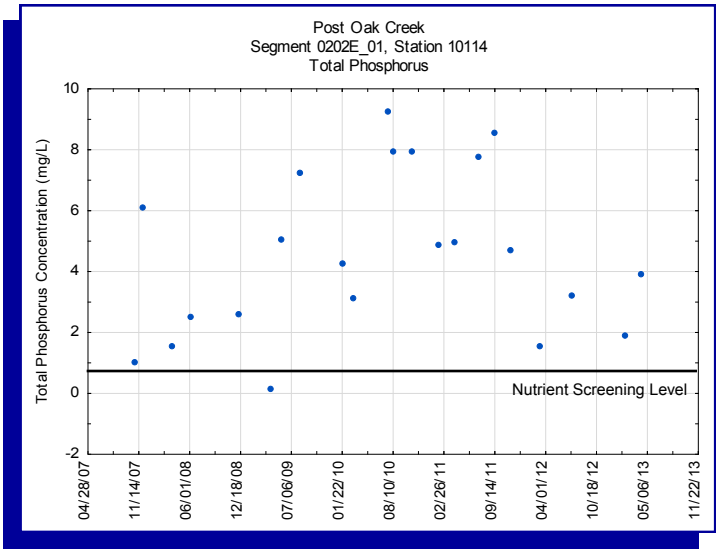


Segment 0202D - Pine Creek

Pine Creek (Segment 0202D), an unclassified segment, begins in western Lamar County, two miles north of Brookston and runs northeast for 25 miles to its mouth on the Red River, north of Paris. The upper tributaries of Pine Creek have been impounded to form Lake Crook, a water supply lake for the City of Paris. The stream initially traverses flat to gently sloping terrain with some locally steep scarps, surfaced by soils that vary from dark clays to deep loams over clay. Vegetation in this area is mainly hardwoods and grasses. Toward its mouth, the stream

descends to low-lying flood plains, surfaced by sands and gravels. The area supports all categories of agribusiness.

Pine Creek is not listed for any impairments or concerns in the *2012 IR*. The Authority's analyses of the data agreed with this assessment. The Authority's trend analyses revealed an upward trend for **TSS** and downward trends for **chloride** and **total phosphorus (See Appendix B)**. Further analyses also revealed exceedances in screening criteria for **chlorophyll-*a*** and **dissolved oxygen**. Until the TCEQ's 2006 Assessment, Pine Creek data was assessed with data from Smith Creek, a tributary that flows into Pine Creek and affects the water quality of Pine Creek. Both monitoring sites are less than a quarter of a mile from each other on US 271, just north of the City of Paris. The Pine Creek monitoring site is a few hundred feet upstream of the confluence of Smith Creek and does not have a sustainable flow unless water is flowing over the spillway of Lake Crook. However, Smith Creek does have a fairly consistent flow, the result of a permitted waste water outfall upstream, and generally backs up into Pine Creek. Authority monitoring staff have documented reverse flow at this site due to Smith Creek overrunning and blocking Pine Creek. Water quality concerns on Pine Creek are most likely attributed to the Smith Creek influences. Runoff from local fields and possible leakage of some type of untreated effluent may be adding to the issues in Pine Creek. Permanent changes and improvements will only be effective when problems in Smith Creek are resolved. Refer to **Smith Creek**, **page 62** for additional information on this water body.



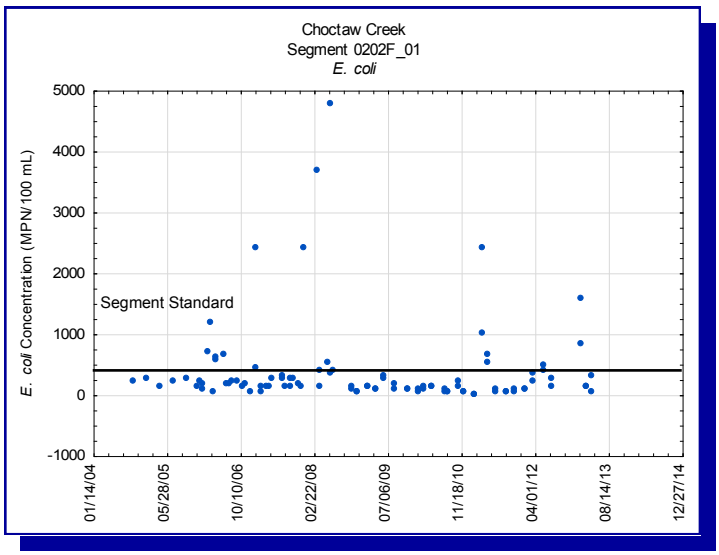
Segment 0202E - Post Oak Creek

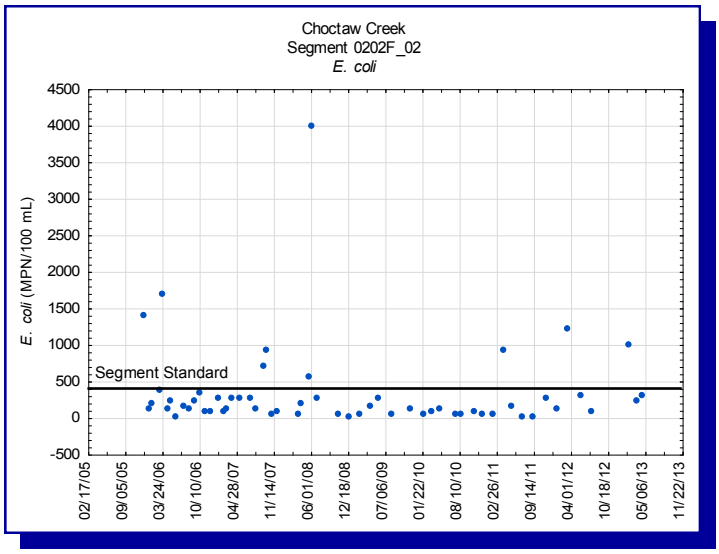
Post Oak Creek (Segment 0202E), an unclassified segment, originates in north central Grayson County, two and a half miles northwest of the City of Sherman. From there it runs southeasterly for twelve miles to its mouth on Choctaw Creek, two miles southeast of Sherman. It then runs through the City of Sherman, from the northwest to the southeast and is primarily used as storm drainage for a large part of the city.

Post Oak Creek is in the *2012 IR* with a single concern for **total phosphorus**. The Authority's analysis of the data agreed with the elevated levels of **total phosphorus**. Trend analyses indicated a downward trend for **ammonia** which was determined to be the result of a change in method detection level and not water quality **(See Appendix B)**. Since Post Oak Creek flows through the City of Sherman, and most runoff from the city runs into the creek, there is the possibility that the **total phosphorus** source may come from specific points somewhere along the creek. However, exceedances in **total phosphorus** only appear at one of three monitoring locations along the creek (Station 10114). Station 10114 exceeds the **total phosphorus** nutrient screening level of 0.69 mg/L 95.5% of the time, while the other monitoring locations have exceeded the same criteria a combined 5.56% of the time. A point source discharge is located upstream of Station 10114 and could potentially be the source of the elevated **total phosphorus** concentrations observed during routine monitoring events. Additional monitoring will be required to determine if there are other contributing factors contributing to the elevated nutrient levels.

Segment 0202F - Choctaw Creek

Choctaw Creek (Segment 0202F) is an unclassified segment that originates three and a half miles southwest of Sherman in central Grayson County and runs northeast for 38 miles to its mouth on the Red River, two and a half miles northwest of Anthony in western Fannin County. The surrounding flat terrain with local shallow depressions is surfaced by clay and sandy loams that support hardwoods, pines, junipers, and native grasses. Choctaw Creek receives runoff from a moderately populated countryside. The area around the creek also supports cattle and other agribusiness in the watershed. A major tributary to Choctaw Creek is Post Oak Creek.





Choctaw Creek is on the *2012 IR* with a **bacteria** impairment and concerns for **orthophosphorus**, **total phosphorus**, and **nitrate**. The Authority's analyses of the data agreed with this assessment and no trends were evident for these three parameters. Data analyses revealed interesting coincidences between the monitoring stations where the data was obtained. The upmost station within the segment (Station 10112) only exceeded the specified nutrient screening levels for **total phosphorus** (0.69 mg/L) and **nitrate** (1.95 mg/L) one time during the period of review. The station located just after the confluence with Post Oak Creek (Segment 0202E) exceeded the **total phosphorus** criteria 95.5% (21/22) and **nitrate** 100% (13/13) of the time. The most downstream station within the segment (Station 18370) exhibited similar exceedances (29/34 (85.3%) **total phosphorus** / 13/13 (100%) **nitrate** exceedances). This may be significant to note considering the similar issues observed just below the permitted discharge above Station 10114, especially since these exceedances are not observed at the most upstream station

Choctaw Creek at US 82

Smith Creek - Station 17044

Smith Creek - Station 21026

Smith Creek - Station 21027

(Station 10112) within this segment. Additional causes, or sources of pollutants of these exceedances could be livestock and wildlife grazing in the fields along the creek, and/or runoff from agricultural uses. Fortunately, the elevated nutrients are not adversely impacting **dissolved oxygen**, aquatic life, or algae growth.

Segment 0202G - Smith Creek

Smith Creek (Segment 0202G), a tributary to Pine Creek, is an unclassified water body located from the confluence with Pine Creek north of the City of Paris to its upstream portion south of the City of Paris in Lamar County. The Smith Creek watershed is home to a large permitted industrial discharger, which is the primary source of consistent flow in Smith Creek. This permitted discharger utilizes an aerial spray field (overland flow permit) type of discharge over a series of large fields. Improving water quality in this segment may prove to be difficult, but not impossible.

Smith Creek is on the *2012 303(d) List* for a **bacteria** impairment. It also has concerns for **ammonia**, **orthophosphorus**, and **total phosphorus**. The Authority's analyses of the data agreed with the TCEQ's assessment of this segment. Trend analyses revealed no statistically significant trends in water quality **(See Appendix B)**. Authority monitoring staff have recorded **dissolved oxygen** readings that ranged from less than 0.5 mg/L to over 10.0 mg/L and recorded **bacteria** levels that ranged from just less than 32 MPN to greater than 24,000 MPN. Due to the wide variability observed by Authority field staff during routine monitoring events, the decision was made in 2011 to add two additional stations within Segment 0202G; one above the historical monitoring location (Station 17044), but much closer to the permitted dischargers outfall (Station 21026), and another above the permitted discharger

(Station 21027), in an effort to better characterize the source of **bacteria** and **nutrients**. Preliminary analytical values confirm that the water quality parameters of interest (Segment 0202G impairments and concerns) are elevated at both locations below the permitted discharger, yet well below both segment and nutrient screening levels above the discharge. TCEQ is currently working with the permittee to modify the existing permit, which may lead to a reduction in nutrient loading, and a subsequent reduction of in-stream analyte concentrations.

Segment 0202I - Little Pine Creek

Little Pine Creek currently appears in the *2012 IR* with concerns for **chlorophyll-*a*** and **depressed dissolved oxygen**. Trend analysis also showed a subtle upward trend for **VSS**, however, the number of data points in the data set does not meet the minimum required for trend analysis. The trend can technically not be confirmed, but it is something that should be watched closely over the next year. Additional monitoring will be required to identify a potential source of the contaminants.

Segment 0202K - Iron Ore Creek

Iron Ore Creek is listed with a single **bacteria** impairment in the *2012 IR*. The creek meanders through privately owned property for much of its length. Additional monitoring will be required to determine the origin of the **bacteria** found in this segment. This water body is currently being evaluated by the Texas State Soil and Water Conservation Board to determine the benefit of a RUAA. If a RUAA is conducted and it is determined that the likelihood of primary contact recreation activities is low enough, the threshold for permissible **bacteria** could be elevated, potentially leading to a delisting. The RUAA is not scheduled to be completed before the next assessment (*2014 IR*).

Lake Texoma Near Dam

Segment 0203 - Lake Texoma

Lake Texoma (Segment 0203) is a classified water body located on the Red River between Texas and Oklahoma in Grayson and Cooke Counties in Texas, and Marshall, Johnson, Bryan, and Love Counties in Oklahoma. It covers more than 89,000 acres and is impounded by the Denison Dam, located five miles northwest of the City of Denison. The lake's capacity is 4,505,000 acre-feet, while 750,000 cubic feet per second is its discharge capacity. The lake and dam have 1,250 miles of shoreline and 1,127,000 acres of protected land. The drainage area is 39,719 square miles, of which 5,936 square miles is probably non-contributing.

Lake Texoma is on the *2012 IR* with concerns for **orthophosphorus**, **harmful algal blooms**, and **chlorophyll-*a***. The **chlorophyll-*a*** concern was specifically for the area described as the "upper-lake area bounded downstream by a line from East Juniper Point to Cardinal Cove (OK) upstream to headwaters." This area is assessed with data from Station 10131, which did show a subtle downward trend for **VSS**. **Chlorophyll-*a*** values collected at this site ranged from 3.00 - 66.6 ug/L, exceeding the nutrient screening level (26.7 ug/L) approximately 25% of the time

over the past seven years (7/28 events). **Orthophosphorus** was identified as a concern specifically for two portions (AU 01 / AU 04) of Lake Texoma, which encompass four Monitoring Stations (15388, 15440, 20545 and 10131). Since **orthophosphorus** will no longer be utilized by the TCEQ for assessment purposes beginning with the *2014 IR*, the Authority analyzed **total phosphorus** data. AU 01 includes data from Stations 15388, 15440, and 20545 shows no **total phosphorus** nutrient screening level (0.20 mg/L) exceedances within the past seven years. AU 04, which is assessed with data from Station 10131, also shows no nutrient screening level exceedances for **total phosphorus**. As for the **harmful algal bloom** concern, which was determined to be present for the entire water body, not much can be done. Several entities, including the United States Army Corps of Engineers, monitor the lake regularly to ensure the water is safe for recreation. Potential sources of the **chlorophyll-*a*** concerns may be attributed to upstream sources like the Red River, as similar concerns are present in most segments above Lake Texoma. With the shift from **orthophosphorus** to **total phosphorus**, this concern will hopefully be dropped, as no assessment units exhibited any exceedances at the nutrient screening level for **orthophosphorus**, and there is currently no concern for **total phosphorus**.

Zebra Mussel Warning at Lake Texoma

Aside from the water quality problems outlined above, Lake Texoma is also facing another threat in the form of a highly invasive species, the Zebra Mussel. Zebra Mussels are originally believed to have found their way into the United States via the ballasts of boats several years ago. First discovered at Lake Texoma in April 2009, the highly invasive mussel has expanded its range to include several reservoirs in and around the Dallas-Fort Worth Metroplex. The USGS, in cooperation with the North Texas Municipal Water District, are monitoring concentrations of Zebra Mussels in Lake Texoma. Additionally, the TPWD has passed legislation requiring all boats entering waters with known Zebra Mussel populations to clean and dry their equipment before transporting it into another lake. Currently, there has not been a proven chemical or biological control to help eradicate the mussel from water bodies it has established in. For more information visit: **www.tpwd.state.tx.us/fishboat/boat/protect_water**.

Segment 0203A - Big Mineral Creek

Big Mineral Creek (Segment 0203A) is an unclassified stream segment that originates at the junction of its northern and southern branches, two miles north of Whitesboro in western Grayson County. It runs east for ten miles to its mouth on the Big Mineral Arm of Lake Texoma. The surrounding terrain is generally flat with occasional shallow depressions, surfaced by clay and sandy loams that support hardwoods, conifers, and various native grasses. The region serves as range and crop land.

Big Mineral Creek is on the *2012 IR* with concerns for **orthophosphorus**, **total phosphorus**, and **nitrate**. The Authority's analyses of the data agreed with the assessment for **orthophosphorus** (exceeds nutrient screening level of 0.37 mg/L 60% of the time over the past seven

years) and **total phosphorus** (exceeds the nutrient screening level of 0.69 mg/L 66.7% of the time over the past seven years). The Authority also agreed with the listing of **nitrate** as a concern based on results for an alternative parameter, **nitrate+nitrite**. Possible causes for the elevated concentrations of **orthophosphorus** and **total phosphorus** could be attributed to the runoff from agricultural uses. As previously stated, the concern for **orthophosphorus** should be dropped in the *Draft 2014 IR*, as TCEQ will move to strictly evaluating water bodies based on **total phosphorus** data.

Segment 0204 - Red River Above Lake Texoma

Red River at FM 677

Red River above Lake Texoma (Segment 0204) is a classified segment located from a point immediately upstream of the confluence of Sycamore Creek in Cooke County to the confluence of the Wichita River in Clay County. The countryside is by and large flat with occasional shallow depressions, surfaced by clay and sandy loams that support hardwoods, conifers, and various native grasses and serves as pasture and crop land. It is also on the *2012 IR* with a concern for **chlorophyll-*a***. The Authority's analyses of the data agreed with the TCEQ assessment. No statistically significant trends were identified during the Authority's analysis of water quality data for Segment 0204. Screening analyses revealed exceedances in every assessment unit of the segment, with 90% (45/50 events) of all events exceeding the **chlorophyll-*a*** nutrient screening level (14.1 ug/L).

As with other areas of the main stem of the Red River, **chlorophyll-*a*** is an ongoing issue. Until a cooperative effort to improve the water quality in this segment is made by both Texas and Oklahoma, these conditions and issues will continue to cause concerns. Since both states are responsible for issues in the Red River, finding a resolution will be necessary. Monitoring should continue throughout this segment.

Segment 0204B - Moss Lake

Moss Lake (Segment 0204B) is an unclassified reservoir impounding Fish Creek. Completed in 1966, its primary purpose was to serve as a water supply for the City of Gainesville. It has 380 surface acres and is impounded by a 1,500 foot dam. Moss Lake is not currently listed with any impairments or concerns. The Authority's trend analyses of the data revealed downward trends in both **sulfate** and **chlorophyll-*a*** and upward trends in both **VSS** and **TKN**. The trend identified for **total phosphorus** is superficial, as it is the result of a change in method detection level and not water quality. However, since the data set did not meet the minimum number of samples required for analysis, these trends cannot be viewed as true trends in water quality at this time. Screening analyses revealed no exceedances for any water quality parameter.

Segment 0208 - Lake Crook

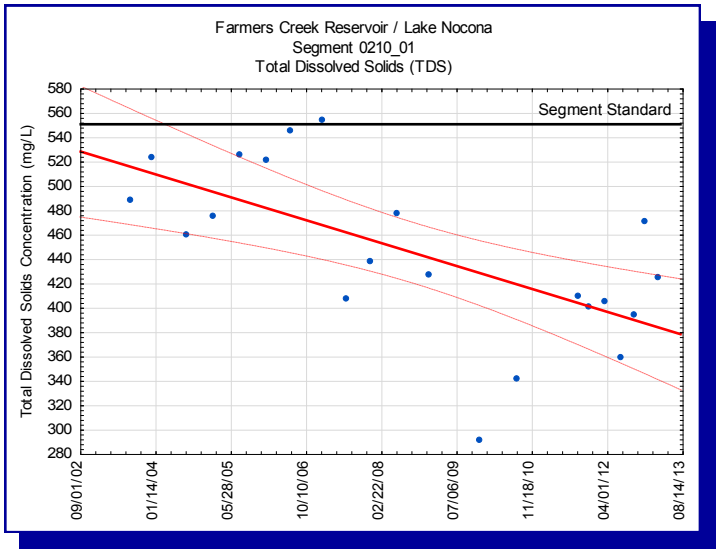
Lake Crook is not listed with any impairments nor concerns in the *2012 IR.* The segment is cur-

rently being monitored by the TCEQ. Monitoring within this station will most likely end in August 2014, as current assessments have found no water quality issues.

Segment 0209 - Pat Mayse Lake

Pat Mayse Lake (Segment 0209) is a classified water body located in north central Lamar County, ten miles north of the City of Paris. The lake was built in 1967 by the U. S. Army Corps of Engineers by impounding the waters of Sanders Creek. The primary uses for the lake are municipal and domestic water supply, flood control, and recreation. Normal capacity is 124,000 acre-feet, with a maximum capacity of 517,000 acre-feet.

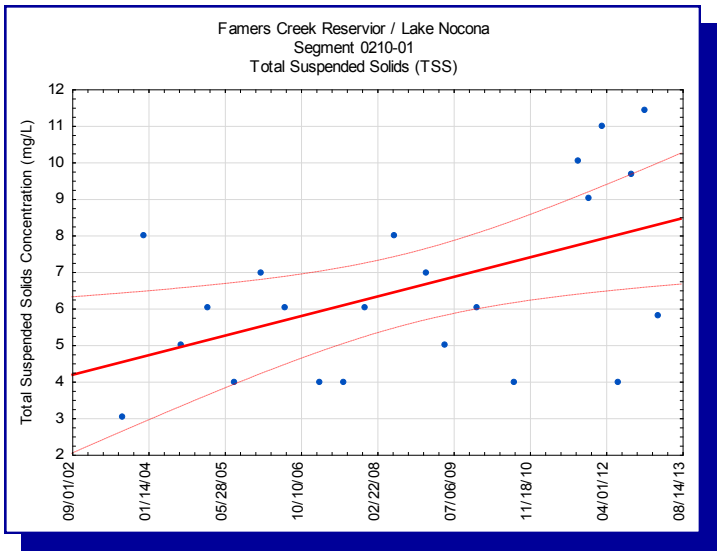
Pat Mayse is on the *2012 IR* with concerns for **manganese in sediment** and **chlorophyll-*a***. Possible causes for the **manganese** include nonpoint sources, such as natural sources or pollution from military facilities. Continued monitoring is necessary to determine the exact source. Current monitoring data has revealed **manganese in sediment** concentrations below the standard and will hopefully lead to a delisting during the TCEQ's 2014 assessment. The Authority's trend analyses revealed subtle downward trends for **VSS** and **chloride**. The trend identified for **VSS** does not appear to be relevant, as it is most likely associated with a modification to the method reporting limit and not an actual change in water quality. It is important to note that while there is downward trend for **chloride**, values are well below the segment standard (100 mg/L) for this analyte and no data point has exceeded the standard **(See Appendix B)**. As stated earlier, continued monitoring is the best approach in determining the cause for these concerns.



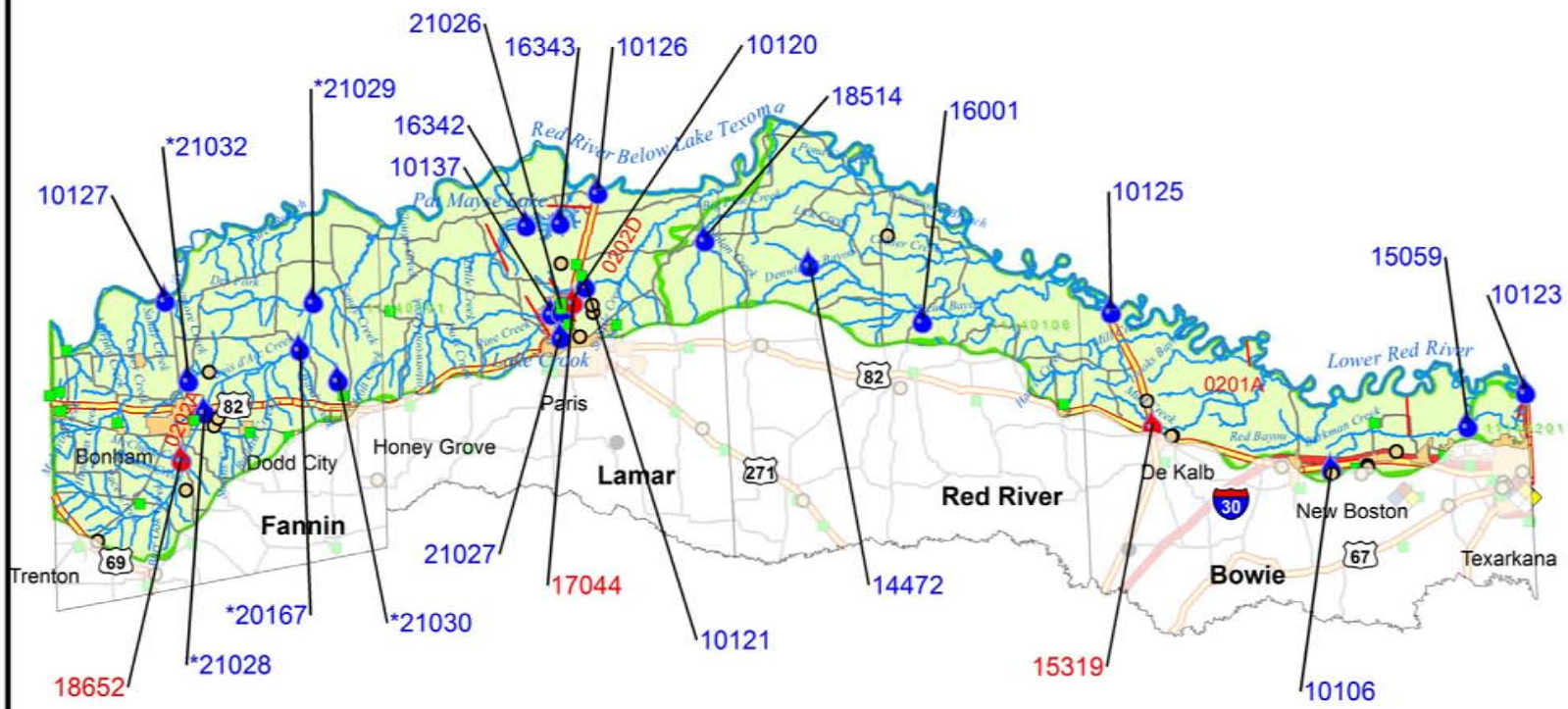
Segment 0210 - Farmers Creek Reservoir

Farmers Creek Reservoir (Segment 0210), or Lake Nocona as it is locally known, is a classified segment that was formed by a dam on Farmers Creek, about six miles northeast of Nocona in northeastern Montague County. It is owned and operated by the North Montague County Water Supply District.

The TCEQ did not identify any impairments or concerns in the *2012 IR*. The Authority's analyses did reveal an upward trend for **TSS** and a downward trend for **TDS,** which is very good news, considering the prolonged drought and increased salinity observed throughout much of the Red River Basin. In fact, since August 2003 there has only been a single exceedance of the water quality standard for TDS (1/21 - 4.76%).



Red River Basin
Lower Reach I



Legend

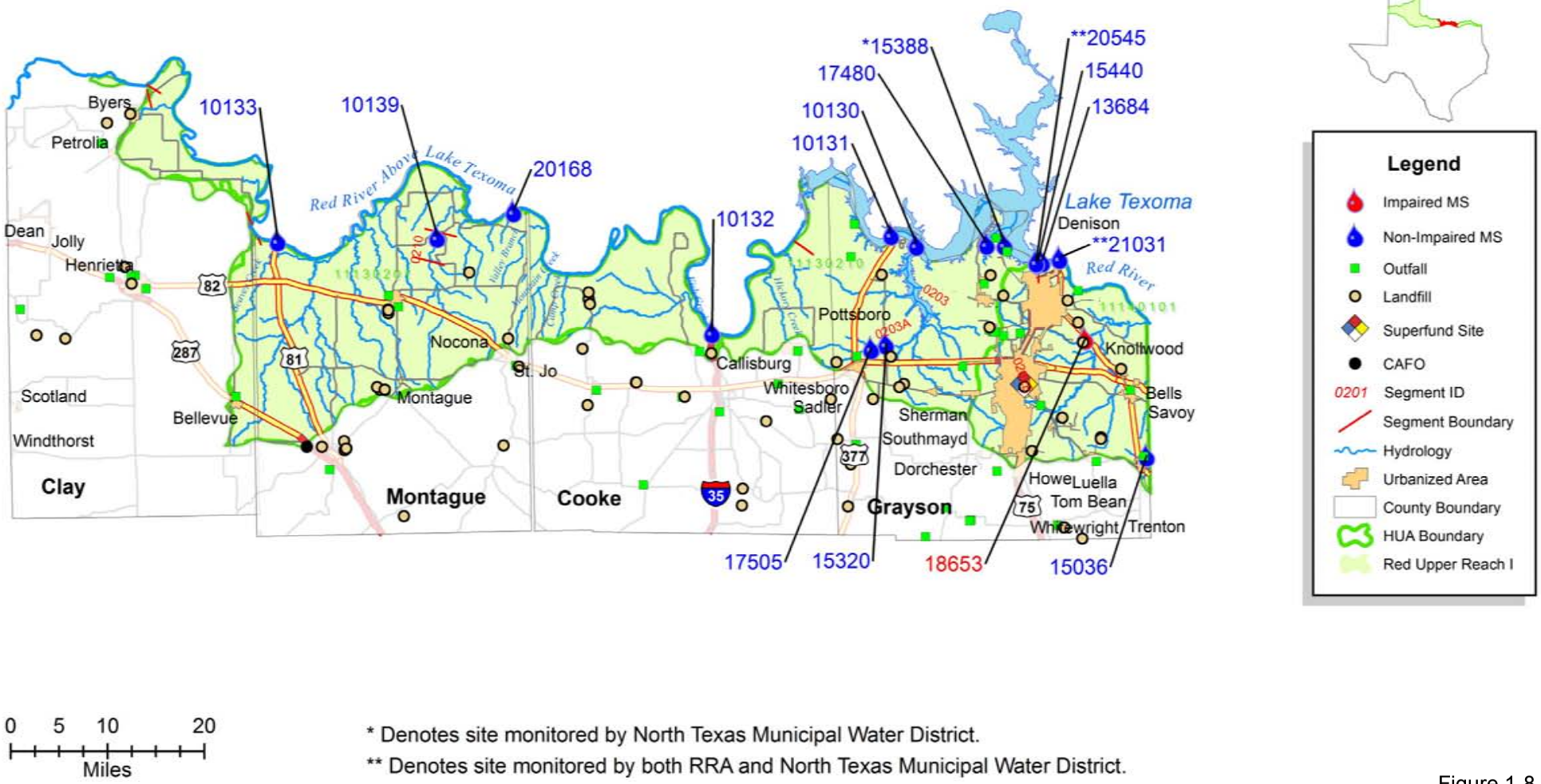
- Impaired MS
- Non-Impaired MS
- Outfall
- Landfill
- Superfund Site
- CAFO
- 0201 Segment ID
- Segment Boundary
- Hydrology
- Urbanized Area
- County Boundary
- HUA Boundary
- Red Lower Reach I

0 5 10 20
Miles

* Denotes site monitored by North Texas Municipal Water District.

Figure 1-7

Red River Basin
Upper Reach I

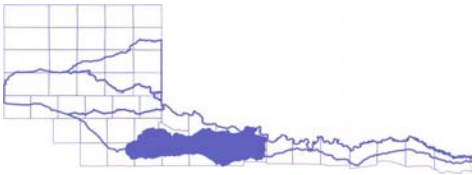


* Denotes site monitored by North Texas Municipal Water District.

** Denotes site monitored by both RRA and North Texas Municipal Water District.

Figure 1-8

Red River Basin — Reach II



Reach II of the Red River Basin represents the Wichita River and Little Wichita River watersheds from the confluence of the Red River in Clay County, west to their headwaters in Dickens County. The area is approximately 170 miles in length and 50 miles wide, or approximately 8,892 square miles. A map of **Reach II** can be found on **page 80**.

The largest city within this reach is Wichita Falls with a population of 104,197. There are 105 cities, towns, and communities found within the reach with Iowa Park, Henrietta, Electra, Seymour, Archer City, and Holliday leading the list. The county population within **Reach II** is approximately 180,000, equating to 26.2 people per square mile. Without Wichita County, there would only be an estimated 5.8 people per square mile. Major reservoirs include: Lake Arrowhead, Lake Diversion, Lake Kemp, Lake Kickapoo, and Santa Rosa Lake. Annual average rainfall for this reach ranges from 19 to 32 inches.

Reach II is a large, diverse area with most of the large population centers located in the eastern portion, while the western portion contains some of the largest ranches in the state, including the W.T. Waggoner Estate, Four Sixes Ranch, Pitchfork Ranch, and several others. The reach contains approximately 3,800 farms covering more than 5,230,000 acres. These farms raise wheat, grains, hay, alfalfa, sorghum, cotton, pecans, peanuts, peaches, and watermelons. Beef cattle, cow/calf operations, dairies, horses, and some swine and goats are also raised on these ranches. The soil types run the gamut from black, red, gray, chocolate, rich loams to sandy and rough pasture land. There are mesquite trees, juniper, post oaks, cottonwood, native pecan, elm, hackberry, and a wide assortment of other trees. Several species of cacti grow abundantly in some areas.

As early as the first half of the 1900's, **Reach II** has been inundated by oil and gas well activities. Early oilfield practices of dumping brine from the well field onto surrounding soils has contributed to salt scalds, which are areas of bare, heavily eroded soils. Although this type of brine disposal was stopped decades ago, some areas continue to experience the after effects of this type of pollution. Mining in this area includes building stone, sand, gravel, volcanic ash, and bituminous coal. Years ago the area was mined for copper.

There are ten classified stream segments and five unclassified stream segments that total 4,951 square miles of contributing drainage in the reach. There are also 18 permitted municipal and industrial dischargers, 43 permitted solid waste disposal sites and ten CAFOs in this reach.

Table 1-7: Red Reach II – *2012 Integrated Report* – Impairments and Concerns

Segment / AU	Description	Parameter	Status
0211_01/02	Little Wichita River	Chloride	Impairment
0211_02	Little Wichita River	Dissolved Oxygen	Impairment
0211_01/02	Little Wichita River	Sulfate	Impairment
0211_01/02	Little Wichita River	TDS	Impairment
0211_02	Little Wichita River	Chlorophyll-*a*	Concern-CS
0212_01	Lake Arrowhead	Orthophosphorus	Concern-CS
0214_02/05	Wichita River Below Diversion Lake	Bacteria	Impairment
0214_01-05	Wichita River Below Diversion Lake	Chlorophyll-*a*	Concern-CS
0214_01/02	Wichita River Below Diversion Lake	Nitrate	Concern-CS
0214_01/02	Wichita River Below Diversion Lake	Orthophosphorus	Concern-CS
0214_01/02	Wichita River Below Diversion Lake	Total Phosphorus	Concern-CS
0214A_01/02	Beaver Creek	Bacteria	Impairment
0214A_02	Beaver Creek	Chlorophyll-*a*	Concern-CS
0214A_01/02	Beaver Creek	Dissolved Oxygen	Concern-CN
0214B_01	Buffalo Creek	Bacteria	Impairment
0214B_01	Buffalo Creek	Ammonia	Concern-CS
0214B_01	Buffalo Creek	Chlorophyll-*a*	Concern-CS
0214B_01	Buffalo Creek	Nitrate	Concern-CS
0214B_01	Buffalo Creek	Orthophosphorus	Concern-CS
0214B_01	Buffalo Creek	Total Phosphorus	Concern-CS
0214E_01	Wichita Valley Irrigation Project	Chlorophyll-*a*	Concern-CS
0215_01	Diversion Lake	Harmful Algal Bloom	Concern-CN
0218_04/05	Wichita/North Fork Wichita River	Selenium in Water	Concern-CN
0218A_01	Middle Fork Wichita River	Selenium in Water	Concern-CN
0219_01	Lake Wichita	Chlorophyll-*a*	Concern-CS
0219_01	Lake Wichita	Harmful Algal Bloom	Concern-CN
0219_01	Lake Wichita	Total Phosphorus	Concern-CS
0226_02/03	South Fork Wichita River	Ammonia	Concern-CS

Segment 0211 - Little Wichita River

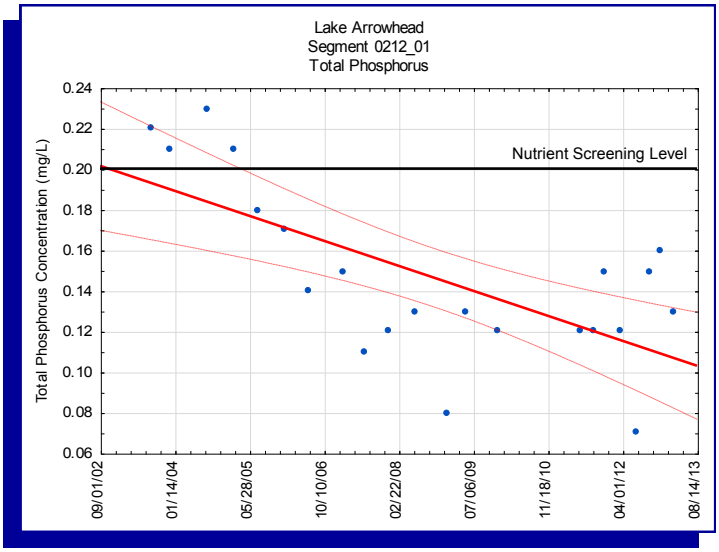
The Little Wichita River (Segment 0211) is a classified segment located from the dam at Lake Arrowhead to its confluence with the Red River in extreme northeastern Clay County, near Terral, Oklahoma. The river traverses across generally flat terrain with local shallow depressions, surfaced by clay and sandy loam that supports mesquites, salt cedar, cottonwoods, elms, junipers, and native grasses.

The Little Wichita River is on the *2012 303(d) List* for **depressed dissolved oxygen**, **chloride**, **sulfate**, and **TDS**, along with a single concern for **chlorophyll-*a***. The Authority's analyses of the data agreed with the TCEQ's assessment. Upward trends were present for **TSS**, **VSS**, **TKN**, and **total phosphorus** at Station 13633, while only **sulfate** exhibited an upward trend at Station 10140. The increasing concentrations of **sulfate** can be primarily attributed to the ongoing drought and subsequent decreasing flows at both monitoring stations. Historically, flow is rarely observed at Station 10140. However, beginning in 2012, flow at Station 13633 has ceased, aiding in the concentration of water quality analytes like **sulfate**.

For years, **depressed dissolved oxygen** and elevated **chlorophyll-*a*** concentrations have been an ongoing problem in the portion of this segment below the Lake Arrowhead Dam. The

physical nature of this segment is in part the source of the problems. When construction began to create Lake Arrowhead in May of 1965, continuous flow into the Little Wichita River below the dam ceased.

The City of Wichita Falls owns the water rights to Lake Arrowhead and controls all releases from the reservoir and other water-related operations. The only time the river flows naturally is after rainfall events or when the City of Henrietta requests that the City of Wichita Falls release water from Lake Arrowhead to flow downstream. This is done so the City of Henrietta can take measures to refill its drinking water supply lake. Because of this faucet like condition "on and off", the river maintains two levels; the low level where the river channel holds a shallow layer of water and the other level, where the river channel is full and flowing, or occasionally flooded by precipitation. The drastic change in water levels is likely the cause of the **depressed dissolved oxygen** levels and **chlorophyll-*a*** issues. When there is no flow, the water in the river becomes stagnant and pooled, thus reducing the **dissolved oxygen** levels. Moreover, any activity or minor runoff into the river will contribute **nutrients** that could affect the **chlorophyll-*a*** levels, which in turn could also affect the **dissolved oxygen** levels. Consideration should be given to revising the **dissolved oxygen** standard for this segment to reflect its actual conditions.



Segment 0212 - Lake Arrowhead

On June 1, 1962, a permit was granted to the City of Wichita Falls to begin the construction of Lake Arrowhead (Segment 0212), a classified segment located from Lake Arrowhead Dam in Clay County up to the normal pool elevation of 926 feet. Deliberate impoundment began in October of 1966. Lake Arrowhead is a municipal water supply reservoir that provides a maximum 228,000 acre-feet of water with a 13,500 acre surface area. It has an elevation of 926 feet above mean sea level and a drainage area above the dam of 832 square miles, as well as a 106 mile-long shoreline.

Lake Arrowhead Near Dam

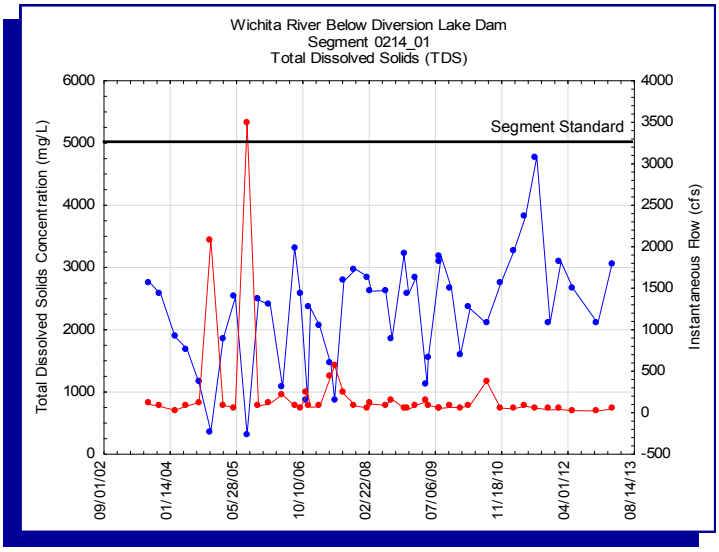
Lake Arrowhead is in the *2012 IR* with a single concern for **orthophosphorus**. The Authority's analyses of the data agreed with this assessment, however, it is important to note that the collection of **orthophosphorus** has stopped. TCEQ has made the decision to discontinue analyses for **orthophosphorus** and focus collection and analyses efforts on **total phosphorus**, since the holding time is considerably longer (28 days compared to 48 hours). Results of

the Authority's trend analyses revealed a downward trend for **total phosphorus (See Appendix B)**. Based on this information, it is hopeful that once water quality standards are revised to reflect the discontinuation of **orthophosphorus**, Lake Arrowhead will drop its **orthophosphorus** concern.

Segment 0213 - Lake Kickapoo

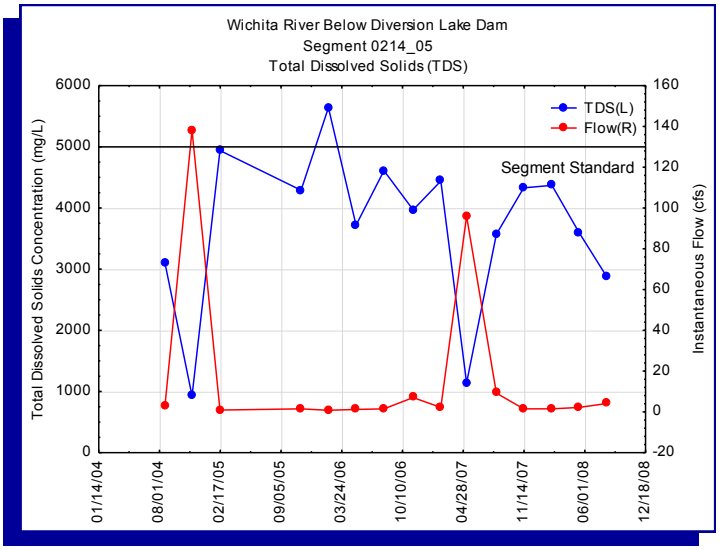
Lake Kickapoo (Segment 0213) is a classified stream segment located from Kickapoo Dam in Archer County up to the normal pool elevation of 1,045 feet. It impounds the North Fork of the Little Wichita River and has a drainage area of 275 square miles. With its capacity of 106,000 acre-feet and with 6,200 surface acre coverage, Lake Kickapoo serves as a municipal water supply for the City of Wichita Falls.

The TCEQ's assessment of Lake Kickapoo revealed no impairments or concerns. The Authority's analyses of the data agreed with this assessment. Trend analyses was not possible due to the insufficient number and the large amount of time between data points. A minimum of 20 data points is necessary to develop the degree of confidence needed for trend analyses **(See Section 3.7 - 3.8 for Data/Trend Analysis Methodology)**.



Segment 0214 - Wichita River Below Diversion Lake Dam

The Wichita River below Lake Diversion Dam (Segment 0214) is a classified segment located from the dam at Lake Diversion flowing northeast across northwestern Archer County, southern Wichita County, and northwestern Clay County, where it joins the Red River just west of the Byers Bend in northern Clay County. It passes through the City of Wichita Falls, then through predominantly flat terrain, where mesquite, salt cedar, cottonwoods, elm, junipers, other low brush, and native grasses cover clay and sandy loam soils.



The Wichita River below Lake Diversion Dam is on the *2012 IR's 303(d) List* for **bacteria** in the lower and upper portions of the segment. It also shows concerns for **chlorophyll-*a***, **orthophosphorus**, **total phosphorus**, and **nitrate** in the two lowest portions of the segment. The Authority's review of the data agreed with TCEQ's assessment. Trend analyses revealed upward trends for **sulfate** and **TDS** in the lowest portion of the segment (AU 01) and upward trends for **chloride**, **sulfate**, and **TDS** in the uppermost portion of the segment (AU 05) **(See Appendix B)**.

Wichita River Below Diversion Lake

The **bacteria** impairment and **nutrient** concerns are most likely associated with the effluent discharge from the River Road Municipal Wastewater Treatment Plant, which is affecting the portion of the segment from FM 2393 to one mile above Eastland Lane. One of the two assessment units (AU 02) that are on the *303(d) List* for **bacteria** is the same portion below the wastewater treatment plant, and the other is located from the dam at Lake Diversion to the Beaver Creek confluence (AU 05). The problems in this portion of the segment could be related to a large number of cattle that are pastured in this area. In addition, a small CAFO and fields that are fertilized with manure are also possible sources of contamination. Additionally, wildlife and birds cannot be ruled out, as feral hogs have been seen in the area and large flocks of wild turkeys roost in the larger trees found closer to the river. Although most of these issues are non-point source in nature, there are various Best Management Practices or BMPs that could be implemented in this and similar areas. They include working with state agencies to control feral hogs and working with local landowners to manage wildlife and riparian habitats. Additionally, cross fencing pastures along riparian areas would allow landowners to move livestock to various selected fenced areas, which would restrict over grazing and give the landowner control over the type and amount of vegetative growth.

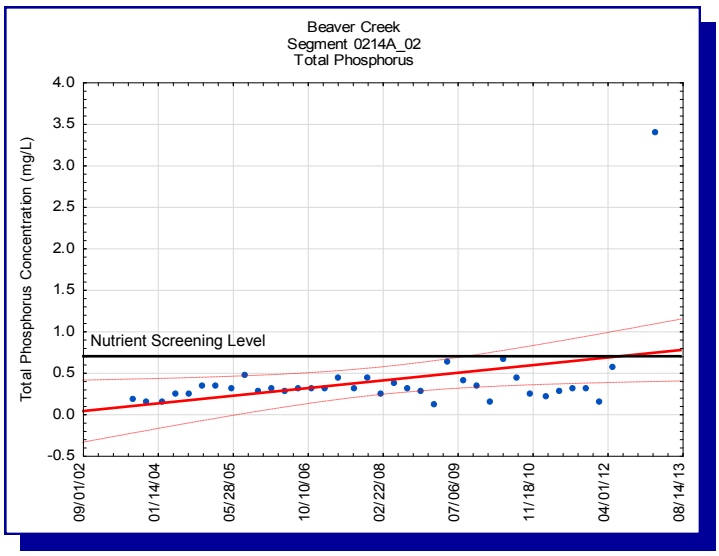
The City of Wichita Falls is currently pursuing a permit from TCEQ, which would allow them to pump treated effluent from the River Road WWTP to a reverse osmosis plant and utilize this as a source of drinking water. When this permit is approved, and the project is implemented, it will drastically reduce stream flow in the lower portion of this segment, adversely affecting water quality, especially **chloride**, **sulfate**, and **TDS** concentrations. As for the upper portion of the segment, the Wichita River is drastically influenced by the water quality of Lake Kemp and Diversion. As **dissolved solids** values continue to increase in these segments, so will they in this portion of the Wichita River.

Beaver Creek at US 283

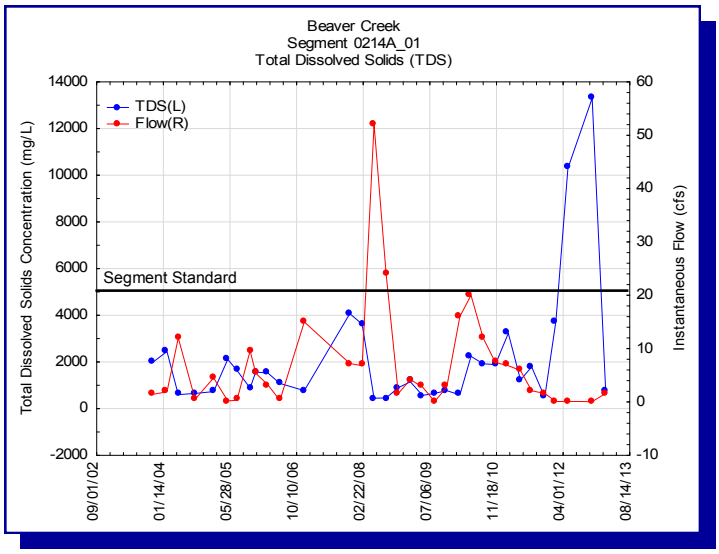
Segment 0214A - Beaver Creek

Beaver Creek (Segment 0214A) is an unclassified segment that begins two miles southwest of Dixie Mound and five miles west of Crowell in western Foard County. It runs southeast through Wilbarger County to its mouth on the Wichita River, north of Kadane Corner in Wichita County. The creek is impounded in southwest Wilbarger County to form the Santa Rosa Lake. The flow of Beaver Creek is intermittent in its up-

per reaches above Santa Rosa Lake. It crosses an area of steeply to moderately sloping hills and flat to rolling terrain with local escarpments, surfaced by shallow and stony to deep sandy and clay loams that support mesquite, salt cedars, elms, cottonwood, junipers, and brush.



Beaver Creek is on the *2012 303(d) List* for **bacteria**. It is also listed with concerns for **chlorophyll-*a*** and **depressed dissolved oxygen**. The Authority's analyses of the data agreed with this assessment. Trend analyses indicated upward trends for **TDS** and **TSS** in the lower portion of this segment and an upward trend in **total phosphorus** in the upper portion of the segment **(see Appendix B)**. This is most likely a combination of drought conditions and reduced flows, leading to the accumulation of salt constituents within the water body.



The upper portion of Beaver Creek is extremely turbid. Collecting samples for **chlorophyll-*a*** is difficult because the high turbidity creates a tremendous interference during **chlorophyll-*a*** analysis. The low **dissolved oxygen** is probably a result of the extreme **turbidity** in the creek and a sluggish flow. However, the water quality changes from the upstream site to the downstream site. The differences between **chloride**, **sulfate** and **turbidity** are apparent, with the downstream site averaging higher levels of these constituents than the upstream site. These differences may be a result of oilfield brine encroachment into the creek as it flows downstream. Additionally, it is likely that historic low flows may be contributing to the increasing **TSS** values observed at the downstream location. Continued monitoring on Beaver Creek is recommended.

Beaver Creek is crossed several times by farm-to-market and county roads. This would make it a favorable candidate for a special study to observe the **chloride**, **sulfate**, and **field measurement** changes from the upper end to the lower end of the creek, in order to determine where these changes occur and what could be causing them.

Segment 0214B - Buffalo Creek

Buffalo Creek (Segment 0214B) is an unclassified segment that originates in two forks; North Buffalo Creek and South Buffalo Creek in northwest central Wichita County. The South Fork

Buffalo Creek at FM 1814

rises near Electra and runs southeast to join the North Fork. The North Fork begins northeast of Electra and runs southeast before joining the South Fork. In 1964 the North Fork was impounded by the construction of Buffalo Creek Reservoir, just over one mile from its juncture with the South Fork. The consolidated Buffalo Creek runs southeast to its mouth on the Wichita River, southeast of Iowa Park in Wichita County.

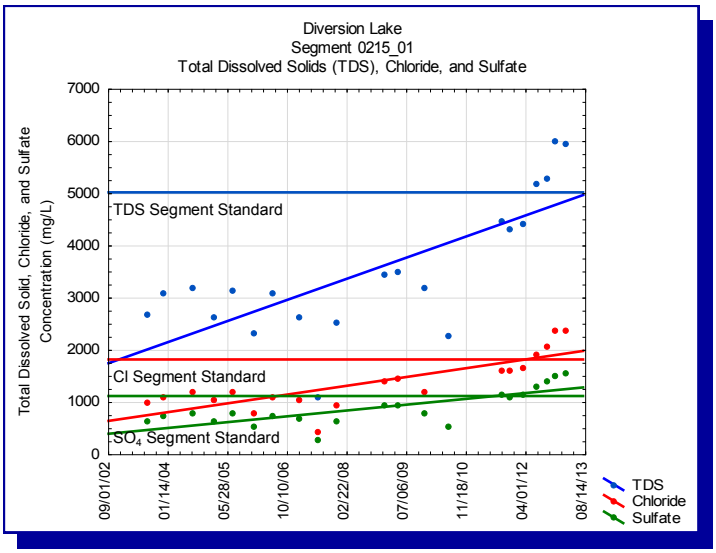
Buffalo Creek is in the *2012 IR* with a **bacteria** impairment and concerns for **ammonia**, **chlorophyll-*a***, **nitrate**, **orthophosphorus**, and **total phosphorus**. The Authority's analyses of the data agreed with TCEQ's. It had previously been hypothesized that runoff from agriculture-related industry and property along the lower portion of Buffalo Creek was the source for its nutrient-related problems. However, in September 2011, the Authority began monthly sampling at two locations along Buffalo Creek and one on a tributary to the creek and discovered that the tributary was the sole source of flow observed in Buffalo Creek, with the exception of heavy rainfall events. Additional monitoring is currently underway to determine the extent of the influence the unnamed tributary has on **Segment 0214B**. It should be notated that concentrations measured at the unnamed tributary for **bacteria**, **ammonia**, **chlorophyll-*a***, and **total phosphorus** are usually higher than those measured at Buffalo Creek.

Segment 0214E - Wichita Valley Irrigation Project

The Wichita Valley Irrigation Canal originates just below the Lake Diversion Spillway. The segment appears in the *2012 IR* with a single concern for **chlorophyll-*a***. Ironically, this concern is not found in Diversion Lake, the source of water in the canal. Additional monitoring will be required to evaluate this concern.

Segment 0215 - Diversion Lake

Lake Diversion (Segment 0215) is a classified water body that impounds the Wichita River. It was constructed in 1922 to work, in conjunction with Lake Kemp, as a flood control impoundment and as a source of water for irrigation. It serves a vast network of irrigation canals and ditches that criss-cross Archer and Wichita Counties. The Wichita County Water Improvement District Number Two (WCWID #2) and the City of Wichita Falls operate and maintain Diversion Lake. When first constructed, the irrigation system was able to supply water to nearly every landowner located downstream in its watershed. Today,



the primary use is still irrigation, but increasing population growth has caused many of the canals to become abandoned and fall into disrepair. These outdated and forgotten canals are, for the most part, no longer utilized. In addition, the City of Wichita Falls has constructed a pipeline that extends from the main supply canal at Headquarters Road to the new reverse osmosis plant on the western side of Wichita Falls. This has been accomplished in order to provide additional supplies for potable water uses.

Lake Diversion Boat Ramp

The TCEQ assessed Diversion Lake and listed it in the *2012 IR* with a concern (CN) for **Harmful Algal Bloom**. This is due to the Golden Algae blooms that have plagued the lake in recent past. Additionally, upward trends were identified for **chloride**, **sulfate**, and **TDS**. **Ammonia** was also identified for meeting the criteria for a statistically significant trend, however, this was due to a change in method detection and not water quality. The increasing concentrations of **chloride**, **sulfate**, and **TDS** can be attributed to reduced stream flow in the portion of the Wichita River above Diversion Lake. Reduced stream flow has led to the accumulation of salts, which are then transported to Diversion Lake. Due to the ongoing drought, water is not being released from Diversion Lake. As the lake level continues to drop, so continues the concentration of these salts. Until regular rainfall returns to the area, it is likely these constituents will continue to increase.

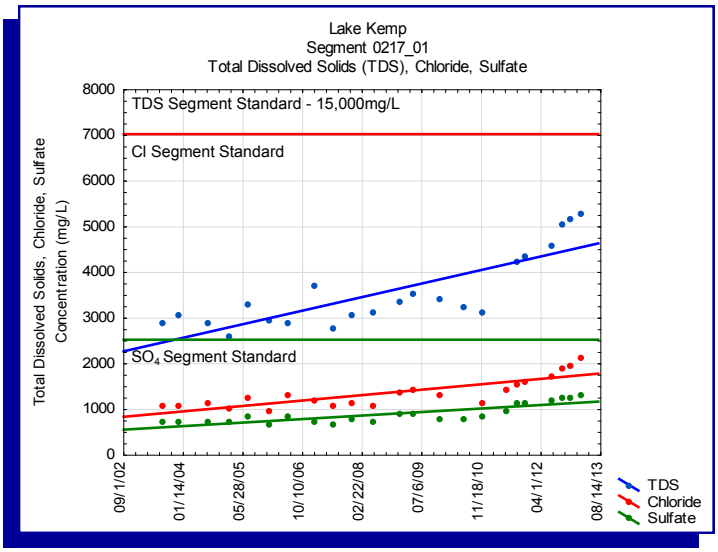
Segment 0216 - Wichita River Below Lake Kemp Dam

The Wichita River below the Lake Kemp Dam (Segment 0216) is a classified segment located between the dam of Lake Kemp and the headwaters of Lake Diversion. There is only one monitoring site on this segment, which is approximately 13 miles in length, and it is located near the dam. The TCEQ assessed the water quality data from this segment and found no impairments or concerns. The Authority's analyses of the data agreed with their assessment and did not reveal any trends.

Lake Kemp Moonshine Boat Ramp

Segment 0217 - Lake Kemp

Lake Kemp (Segment 0217) is a classified water body formed by impounding the Wichita River in north central Baylor County. Like Lake Diversion, it was constructed in 1922 as a flood control and irrigation project. Lake Kemp supplies water to Lake Diversion and has been called on to serve as a supplemental water supply for the City of Wichita Falls. The lake has an elevation of 1,142 feet above mean sea level. The deep loamy soil supports grasses and wild upland plants. Junipers and



mesquite trees can be found all around the lake, while salt cedars can be found primarily around the shoreline and shallow areas of the lake. The TCEQ assessed water quality data from Lake Kemp and found no impairments or concerns. The Authority's analyses of the data agreed with their assessment. Like Diversion Lake, Lake Kemp also exhibited upward trends for **chloride**, **sulfate**, **TDS**, and **TSS**. The trend identified during the assessment period for **ammonia** was superficial, as it was identified as being related to a change in method detection limit. Until regular rainfall returns to the area these constituents will likely continue to increase.

Segment 0218 - Wichita / North Fork Wichita River

Wichita/North Fork Wichita River (Segment 0218) is a classified stream segment that begins more than five miles downstream of the confluence of Crooked Creek in Baylor County to a point a little more than five miles downstream of the most upstream crossing of FM 193 in Dickens County.

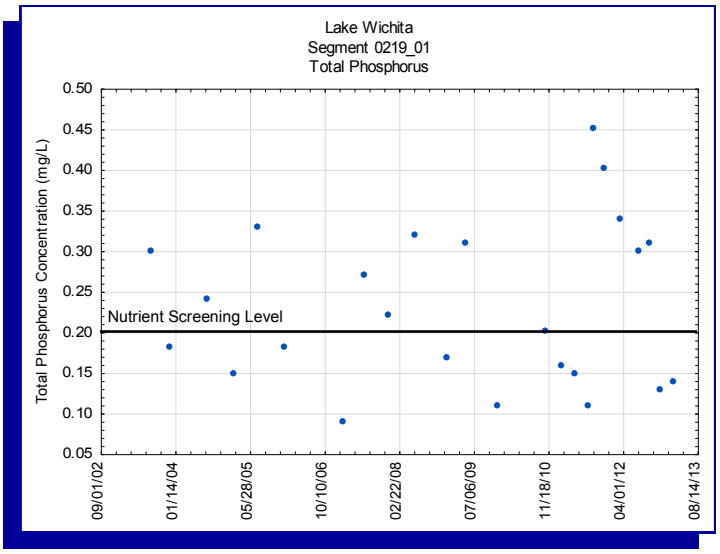
The North Fork (Segment 0218) and Middle Fork (Segment 0218A) of the Wichita River contain elevated concentrations of **selenium**, a naturally occurring chemical element. Since 1959 the U.S. Army Corps of Engineers (USACE) has studied chloride control in the Wichita and Red River Basins. Published environmental studies by the USACE have found that **selenium** occurs naturally in the brine springs found in this area. Although the elevated **selenium** is a chronic condition with little hope of improvement, the current levels have not proven to be toxic to fish and wildlife. The TCEQ has assigned Segment 0218 with a concern for **selenium** in water, in the *2012 IR*. No trends were identified during the Authority's analysis of the data.

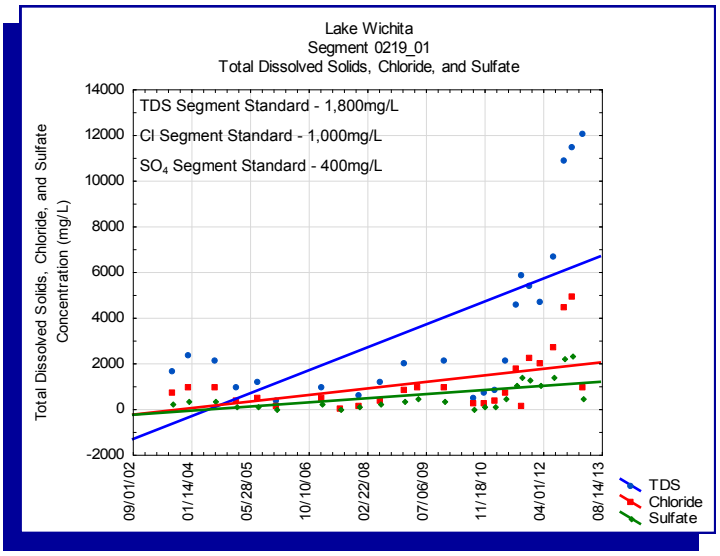
Segment 0218A - Middle Fork Wichita River

The Middle Fork Wichita River (Segment 0218A) is an unclassified segment stretching from the confluence of the North Wichita River, southwest of Crowell in Foard County to the upstream perennial portion of the stream located northeast of Guthrie in King County. Like the North Fork, the Middle Fork Wichita River also contains naturally occurring high levels of **selenium**, which is considered a chronic condition with little hope of improvement. The *2012 IR* assigned Segment 0218A with a single concern for **selenium in water**. As with Segment 0218, this is a naturally occurring trend for this segment.

Middle Fork Wichita River

Lake Wichita at Boat Ramp





Segment 0219 - Lake Wichita

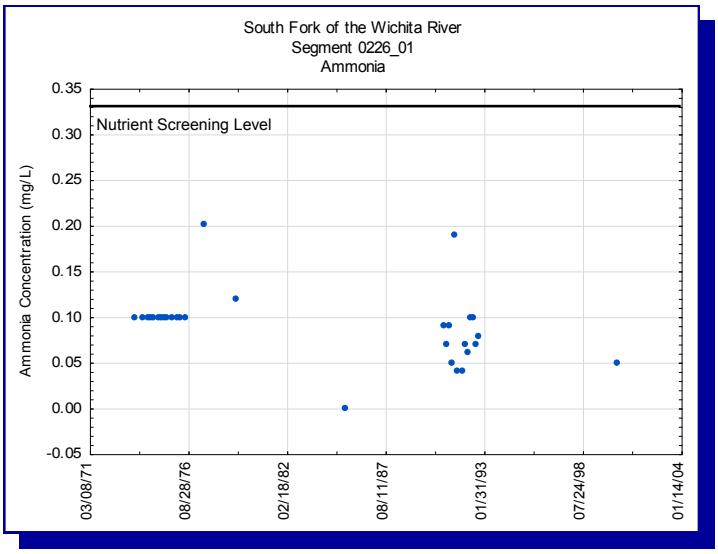
Lake Wichita (Segment 0219) is a water body formed by impounding Holliday Creek. It is located southwest of Wichita Falls in southeastern Wichita County and northeastern Archer County. It has a surface area of 1,224 acres and a capacity of 5,620 acre-feet, with a drainage area of 128.3 square miles above the dam. The *2012 IR* shows Lake Wichita with concerns for **chlorophyll-*a***, **harmful algal bloom**, and **total phosphorus**. The Authority's analyses of the data agreed with this assessment and revealed trends for **chloride**, **sulfate**, and **TDS**. The concerns for both **chlorophyll-*a*** and **total phosphorus** could be attributed to the numerous subdivisions that dot the shoreline around Lake Wichita. Antiquated septic systems could potentially be leaching sewage into the ground, eventually making its way into the lake. **Harmful algal blooms**, specifically Golden Algae, have been a problem in Lake Wichita for the past several years. This is most likely due to the increasing salinity within the water body propagated by the ongoing drought. The drought, and subsequent lack of inflow into Lake Wichita, is concentrating already elevated salts (**chloride**, **sulfate**, and **TDS**) to record highs. The City of Wichita Falls has created a special interest group, *the Lake Wichita Study Committee*, to evaluate potential solutions and/or improvement projects to remediate Lake Wichita. The committee is still evaluating options and no recommendation had been made at the time of this publication.

Segment 0226 - South Fork Wichita River

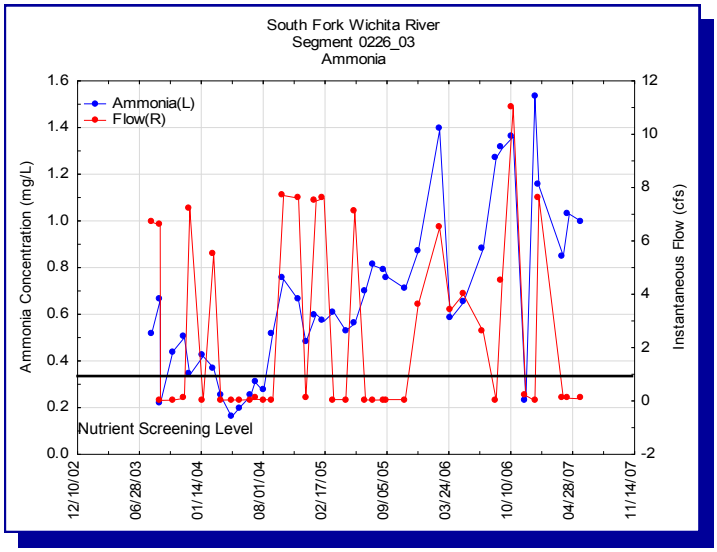
South Fork Wichita River (Segment 0226) is a classified segment located from the confluence with the North Fork Wichita River in Knox County to upstream of U.S. Highway 82 in Dickens County. It is on the *2012 IR* with a con-

cern for **ammonia**. The Authority's review of the data agreed with this assessment. Trend analyses revealed upward trends in **TSS** and **TKN** levels.

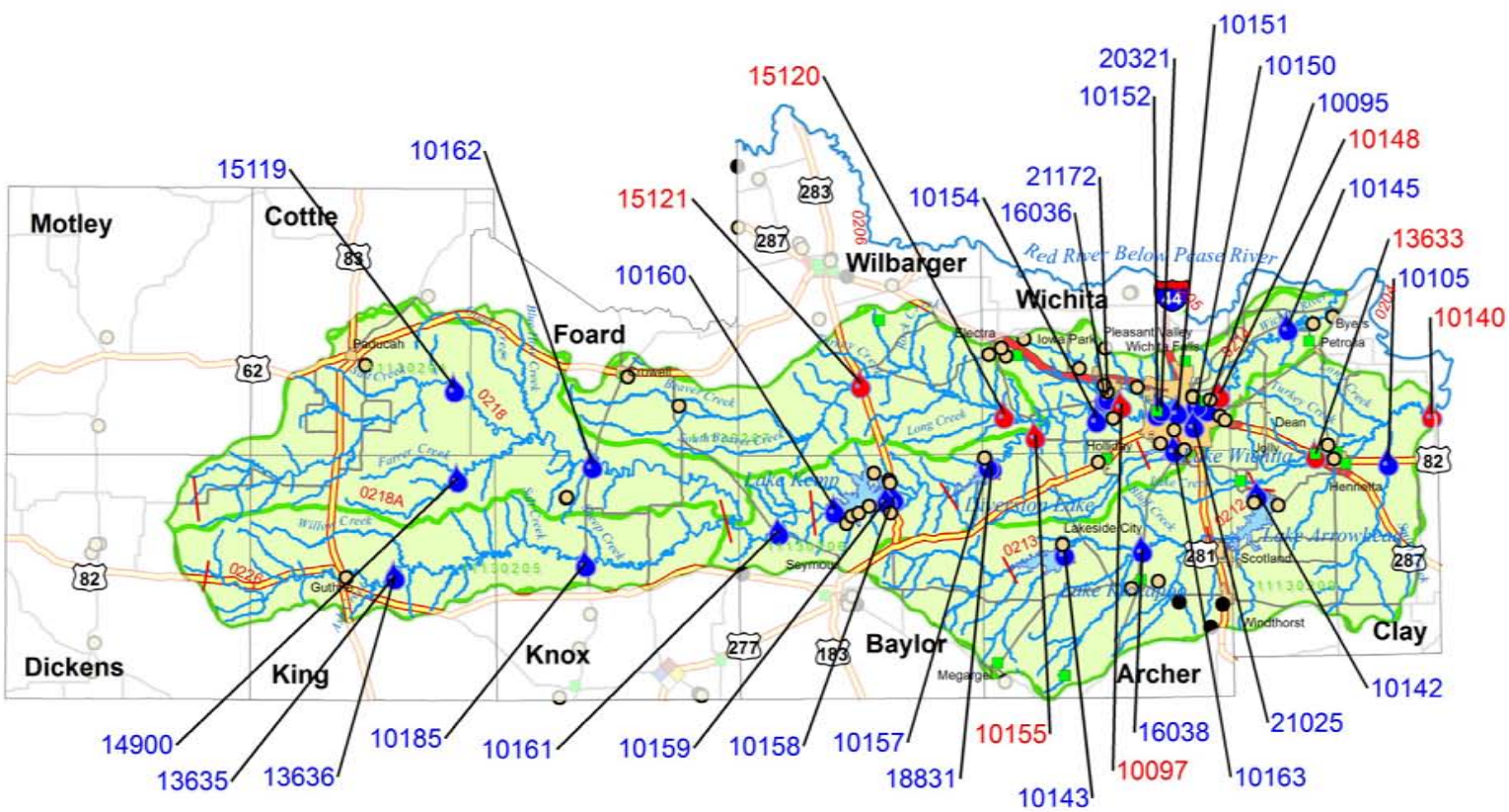
The **ammonia** concern is most likely attributed to livestock, wildlife, or runoff from fertilized agricultural lands after rainfall events. The river is utilized as a local water source for animals. Additional data needs to be collected before a suitable action plan for improvement can be considered. Although most of these issues are nonpoint source in nature, there are various Best Management Practices or BMPs that could be implemented in this and similar areas. They include, but are not limited to, working with local landowners to manage wildlife and riparian habitats. Additionally, cross fencing pastures along riparian areas would allow landowners to move livestock to various selected fenced areas, which would restrict over grazing. This would allow the landowner control over the type and amount of vegetative growth and would also help to safely manage wildlife habitat.



The most interesting aspect of this concern is that it originates in the upper portion of the segment and has not been observed in the lower portion. This is probably attributed to the fact that the lower portion of the segment, monitored at Station 10185, has been dry since September 2011. Therefore, the **ammonia** concentration at this point of the segment is unknown. When more frequent rainfall returns, continued water quality monitoring should reveal whether or not the **ammonia** is linked to a point source pollutant near the upper portion of the segment. This would explain why it has not been observed in the lower portion of the segment. Historical data does not show any exceedances for **ammonia** at Station 10185, lending credit to the belief that the **ammonia** is from a point-source.



Red River Basin
Reach II



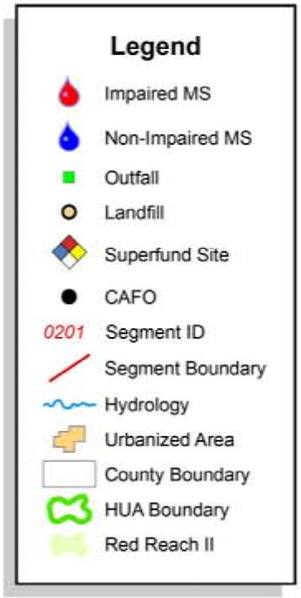


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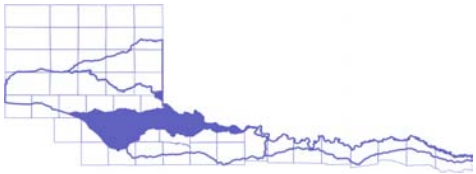
Figure 1-9

Red River Basin — Reach III



Reach III begins in northern Wichita County and extends westward toward Floyd and Briscoe Counties. It includes the Red River main stem from the confluence of Cache Creek upstream to the confluences of Buck Creek and the Red River.

The size of **Reach III** measures about 195 miles long to a maximum of 50 miles wide. The cities of Vernon and Burkburnett with populations of 10,970 and 10,927, respectfully, are the largest within the reach. The total population is about 26,000 with an estimated average of 4.8 people per square mile. Hardeman County is home to the only two reservoirs within the area: Lake Pauline and Lake Copper Breaks. Rainfall averages range from 19 inches to 24 inches annually within this reach.

Reach III contains 5,734 total square miles of drainage in Texas and Oklahoma, of which 4,845 square miles is in Texas. There are 13 permitted municipal and industrial dischargers, 25 permitted solid waste disposal sites and 12 CAFOs in this reach. A map of **Reach III** can be found on **page 86**.

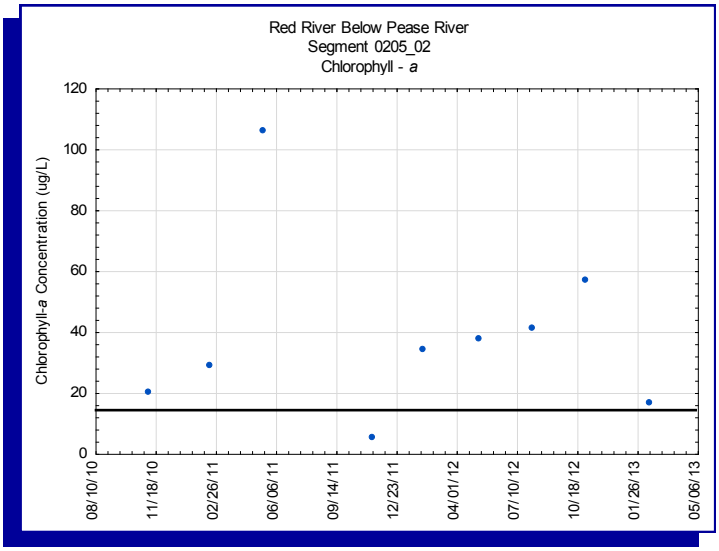
This is predominately a rural area comprising agribusiness and oil and gas production. There are approximately 2,050 farms and ranches covering more than 3,000,000 acres that grow mainly cotton, wheat, hay, feed products, alfalfa, soybeans, sorghum, peanuts, sunflowers, and guar (used in ice-cream and as a food thickener). Soil types range from prime farmland to all types of clay and rough terrain.

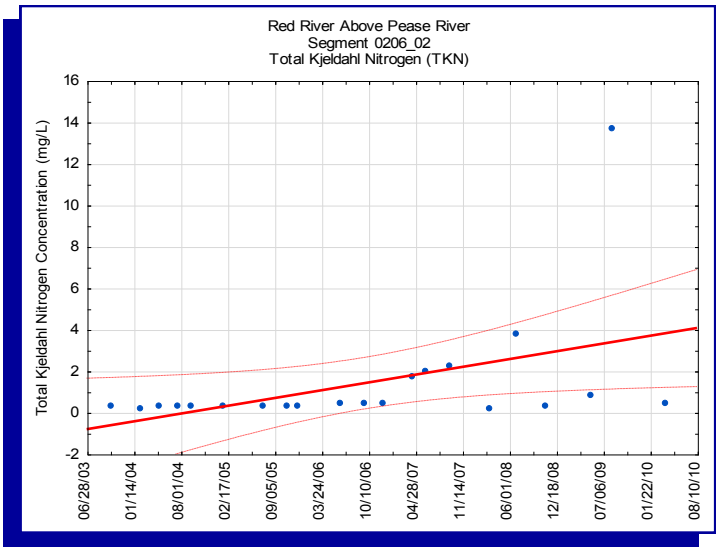
Table 1-8: Red Reach III – *2012 Integrated Report* – Impairments and Concerns

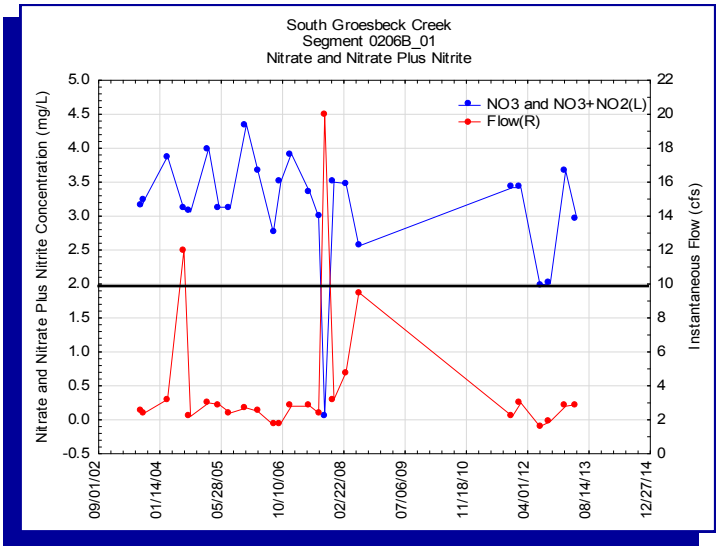
Segment / AU	Description	Parameter	Status
0205_02	Red River Below Pease River	Bacteria	Impairment
0205_01/02	Red River Below Pease River	Chlorophyll-*a*	Concern-CS
0206B_01	South Groesbeck Creek	Bacteria	Impairment
0206B_01	South Groesbeck Creek	Chlorophyll-*a*	Concern-CS
0206B_01	South Groesbeck Creek	Nitrate	Concern-CS
0230A_03	Paradise Creek	Bacteria	Impairment
0230A_03/04	Paradise Creek	Chlorophyll-*a*	Concern-CS
0230A_03/04	Paradise Creek	Nitrate	Concern-CS

The Red River below the Pease River (Segment 0205) is a classified segment that runs from the confluence of the Wichita River in Clay County to the confluence of the Pease River in Wilbarger County. It is newly listed in the *2012 IR* with a **bacteria** impairment and a single concern for **chlorophyll-*a***. The Authority's analyses of the data agreed with the assessment of both **bacteria** and **chlorophyll-*a***. No statistically significant trends were identified. This portion of the Red River meanders through a countryside made up of small farms and cattle operations. Like most of the western half of the basin, it is rural in nature with few cities and roads. Many of the people who live in this area still utilize septic tanks as their primary means of household waste disposal.

Runoff from cultivated fields and an outfall from a wastewater treatment plant are the most







likely contributors to the elevated concentrations of both **bacteria** and **chlorophyll-*a***. As stated earlier, the Red River receives contributions from both Texas and Oklahoma, and as such, both states are responsible for environmental issues in the Red River. Hopefully, coordinated monitoring efforts will help identify potential sources of **nutrient** and **bacteria** loading in the near future.

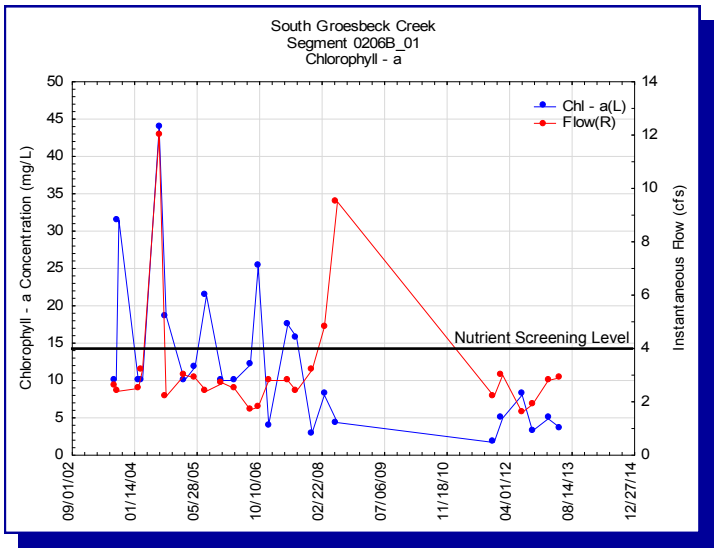
Segment 0206 - Red River Above Pease River

The Red River above the Pease River (Segment 0206) is a classified segment located from the confluence of the Pease River in Wilbarger County to a point immediately upstream of the confluence of Buck Creek in Hardeman County.

Screening analyses conducted by the Authority revealed exceedances for **chlorophyll-*a*** (6.9% - 2/29 events), **chloride** (6.7% - 2/30 events) and **total phosphorus** (13.3% - 4/30 events) within this segment. Trend analyses of the data revealed an upward trend for **TKN** and **nitrate** levels (insignificant due to a significant gap in the data) **(See Appendix B)**. Decreased annual rainfall leading to a reduction in stream flow has likely concentrated nutrient parameters, creating an upward trend for some. Flow data is lacking in this segment making it difficult to determine the presence, or absence, of a correlation between water quality analytes and flow. Additional flow data will need to be collected to validate this theory, and benefit future assessments.

Segment 0206B - South Groesbeck Creek

South Groesbeck Creek (Segment 0206B) is an unclassified segment that extends from the confluence of the Prairie Dog Town Fork of the Red River in Hardeman County to the upstream

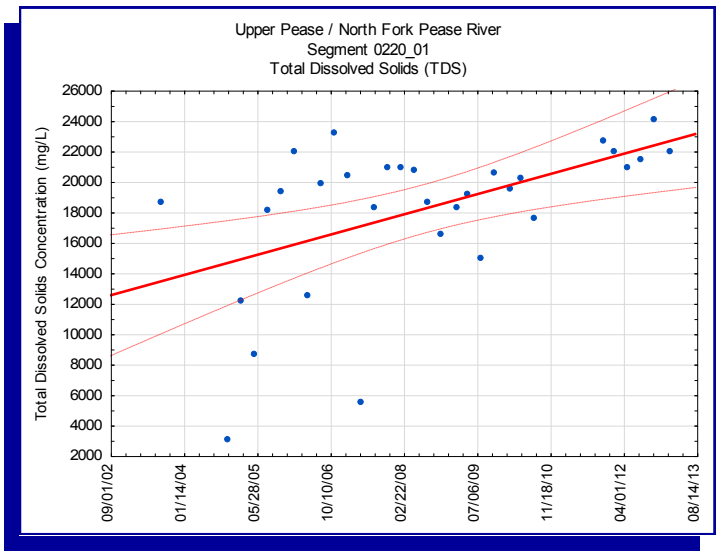


perennial portion of the stream east of Childress in Childress County. Deposits of gypsum were discovered in this area in 1890 and is still mined today. South Groesbeck Creek is on the *2012 IR* with a **bacteria** impairment and concerns for both **nitrate** and **chlorophyll-*a***. The Authority's analyses of the data agreed with this assessment. Trend analyses flagged **TSS**, **total phosphorus** and **chlorophyll-*a*** as having statistically significant trends. **TSS** did show a slight downward trend. The trend for **total phosphorus** was not indicative of a change in water quality, as it was the result of a method detection limit change. **Chlorophyll-*a*** did show a slight downward trend, but still managed to exceed the nutrient screening level 25.9% of the time (7/27).

The source of the **nitrate** in South Groesbeck Creek is not exactly known, but the Creek does flow year round, which gives the indication that the creek is spring fed. The watershed of Groesbeck Creek is mostly underlain by the Seymour Aquifer, which is well documented as containing high levels of **nitrate** and has been known to produce seeps and springs. One factor which may support the theory that the source of **nitrate** observed in Segment 0206B as having come from an underground seep/spring is the fact that the values within the data set are so similar, having an average of 3.09 mg/L and standard deviation of 0.59 mg/L, respectively. The Authority is continuing to closely monitor **nitrate** concentrations by analyzing for **nitrate+nitrite**. Comparatively, **nitrate+nitrite** has a significantly longer holding time than **nitrate** (28 days as compared to 48 hours), which provides laboratories more time for analysis.

The source of the **bacteria** impairment is likely attributed to property owners who utilize the creek as a convenient water source for cattle or other livestock. Authority personnel have documented cattle in or around the creek during monitoring visits at this site.

Segment 0206B is just one portion of the Groesbeck Creek Watershed, which is actually broken down into three separate unclassified segments: Groesbeck Creek (0206A), South Groesbeck Creek (0206B), and North Groesbeck Creek (0206C). Historically, the TCEQ has monitored Segment 0206B. When water quality issues began to arise, the Authority began monitoring Groesbeck Creek at Station 20166 (November 2011) and North Groesbeck Creek at Station 21297 (November 2013). While neither of these unclassified segments had enough data



for the 2012 assessment, the data collected thus far will aid in future assessments and help determine if similar water quality issues are present throughout the Groesbeck Creek Watershed.

Segment 0220 - Upper Pease / North Fork of the Pease River

The Upper Pease/North Fork of the Pease River (Segment 0220) is a classified stream segment extending from the confluence with Canal Creek at the Hardeman-Foard County line to more than three miles upstream of the confluence of Dick Moore Canyon in Floyd County. The TCEQ did not find any impairments or concerns for Segment 0220 during the 2012 assessment. Trend analyses by the Authority revealed upward trends for **chloride**, **sulfate**, and **TDS (See Appendix B)** in the upper portion of the segment. The trends identified for **ammonia**, **nitrate**, and **total phosphorus** were not significant, as they were influenced by a change in method detection limits and not water quality. The lower portion of the segment flagged **TKN** for having a statistically significant trend. However, there was not enough data to accurately make this determination. Unlike the upper portion of the segment, no trends for "salt" constituents were noted. Like most of Texas, this rugged region suffered through the effects of drought and naturally drier conditions, leaving many of the perennial water sources, such as stock tanks, creeks and springs, dry or almost dry, and concentrating water quality parameters, especially salts.

Segment 0221 - Middle Fork Pease River

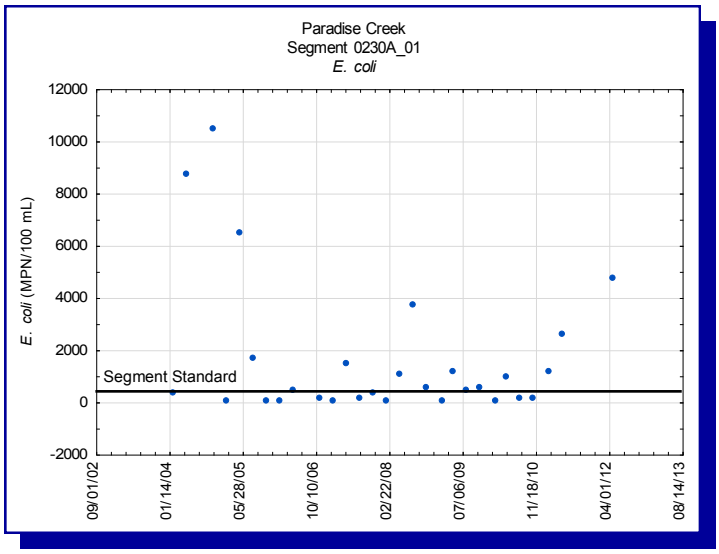
The Middle Fork of the Pease River (Segment 0221) is a classified segment extending from the confluence of the North Fork Pease River in Cottle County to the confluence with Boggy Creek and Mott Creek in Motley County. The TCEQ did not find any exceedances in this segment during the 2012 assessment. There was not enough data for the Authority to conduct a review of water quality within the segment. Based on the water quality data within Segment 0220, it is possible that consideration may be given to monitoring a station within Segment 0221 at a CMM in the next few years.

Pease River at US 287

Segment 0227 - South Fork Pease River

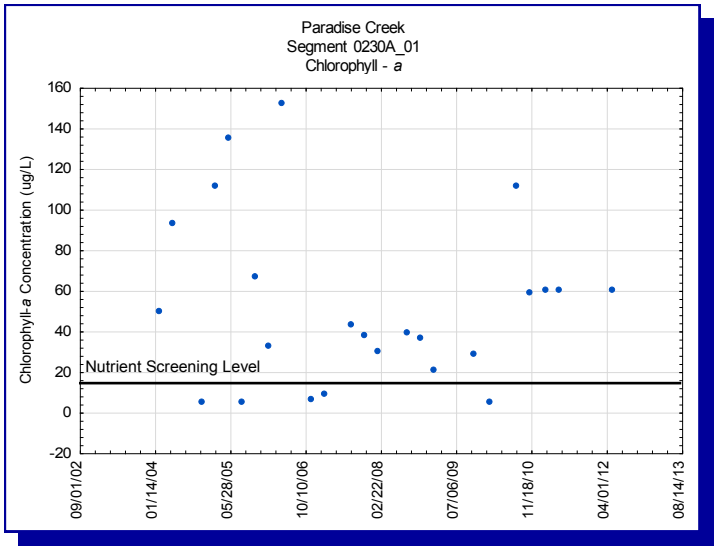
The South Fork of the Pease River (Segment 0227) is a classified segment near Vernon, Texas. The prolonged drought in the area has prevented collection of routine water quality data. As

a result, the TCEQ did not assess Segment 0227 in 2012, as insufficient data was available within the assessment period.



Segment 0230 - Pease River

The Pease River (Segment 0230) is a classified segment extending from the confluence with the Red River in Wilbarger County upstream to the confluence with Canal Creek at the Hardeman-Foard County line. The TCEQ did not find any impairments or concerns within this segment during the 2012 assessment. The Authority's analyses of the data agreed with this assessment. There were several gaps in the data, which prevented trend analyses. However, a visual inspection of recent data indicated increasing concentrations of **chloride**, **sulfate**, and **TDS**. This can most likely be attributed to the ongoing drought and reduced stream-flows observed at both monitoring stations within this segment. To better assess water quality in this segment, the Authority added an additional monitoring station at the US 283 crossing (Station 10165) in September 2013.



Segment 0230A - Paradise Creek

Paradise Creek is an unclassified water body east of the City of Vernon. This small perennial creek is in the *2012 IR* for a **bacteria** impairment, along with concerns for water quality based on screening levels for both **nitrate** and **chlorophyll-*a***. The Authority's analyses of the data agreed with this assessment, however, it is important to note that water quality data has only been collected during one routine monitoring event since May 2011, making it difficult to evaluate the present condition of Paradise Creek.

Until regular rainfall returns to the area, it will be impossible to evaluate water quality or make data-based assessment decisions regarding Paradise Creek.

Paradise Creek at US 287

Red River Basin
Reach III

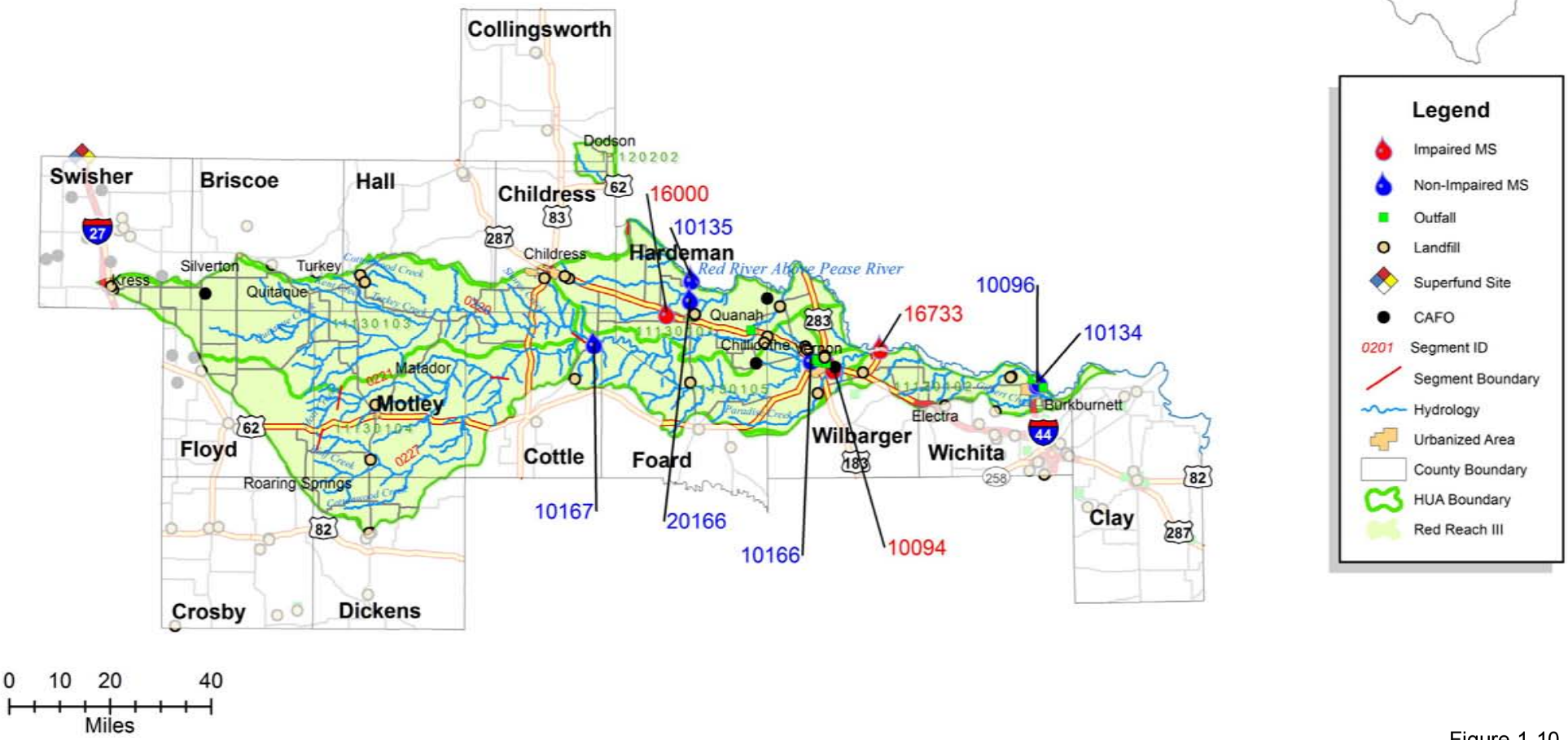
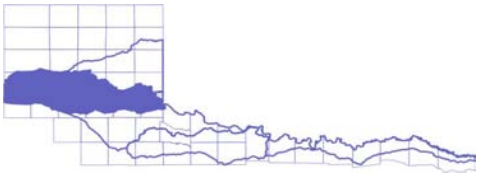


Figure 1-10

Red River Basin — Reach IV



Reach IV of the Red River Basin is one of the most captivating, scenic areas in the state. The landscape changes are surprisingly dramatic, creating beautiful sights, especially where the Caprock drops off to form the canyons. Elevations range from 1,300 to more than 4,200 feet above mean sea level. It begins in Childress County at the Texas/Oklahoma state line and continues through the Texas Panhandle to Deaf Smith and Parmer Counties at the New Mexico state line. It encompasses the Prairie Dog Town Fork of the Red River from the confluence of Buck Creek. The Caprock Escarpment intersects the center of this mostly rural reach, and contains many farms and ranches. Total population for this reach of the Red River Basin is approximately 165,000.

Rainfall is sparse ranging from 10 to 19 inches per year. More than 500 playa lakes (buffalo wallows) are located in the western part of **Reach IV**. There are only six small reservoirs in the entire reach that include: Baylor Lake and Lake Childress in Childress County, Mackenzie Reservoir on the Briscoe/Swisher County line, and Buffalo Lake, Bivins Lake and Lake Tanglewood, all located in Randall County.

The five watersheds in this reach encompass drainage areas totaling 7,626 square miles in Texas and New Mexico, of which 7,084 square miles are in Texas. **Reach IV** contains 8 permitted municipal and industrial discharges, 26 permitted solid waste disposal sites and 120 concentrated animal feeding operations. A map of this reach can be found on **page 92**.

Agriculture plays a significant role in **Reach IV**, as it contains more than 3,900 ranches covering approximately 4,900,000 acres. These ranches produce beef cattle, while farming produces a variety of crops including cotton, wheat, corn, sugar beets, soybeans, sorghum, and potatoes.

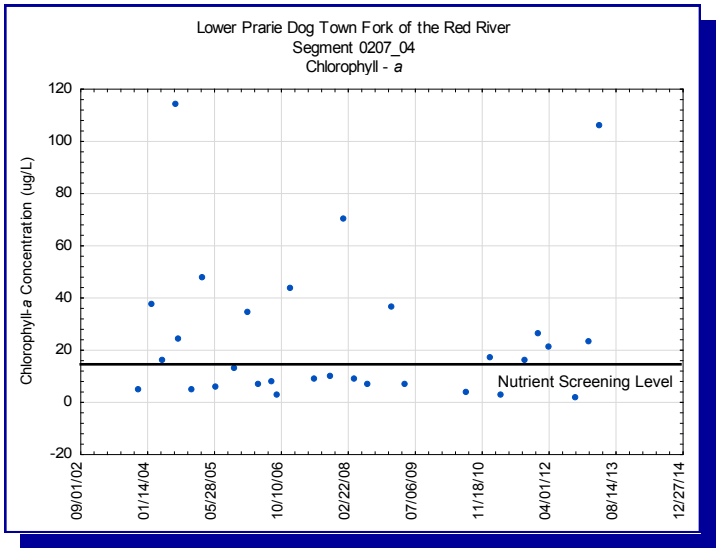
Located in the flood plain of the Prairie Dog Town Fork of the Red River, Estelline Salt Springs is a group of brine springs less than a mile east of Estelline at the Childress County line in east central Hall County. The springs became active in the late 1800's when they washed out a funnel in the alluvium. As part of the Red River Chloride Control Project, in 1964 the U.S. Army Corps of Engineers built a dike around the springs to stop the flow, which prevents more than 240 tons of salt from entering the river system each day. More information on the Estelline Salt Springs and the Red River Chloride Control Project can be found on **pages 20-21** and at: **www.rra.texas.gov**.

The Upper and Lower Prairie Dog Town Forks of the Red River converge and form the main tributary of the Red River. Beginning at the junction of the Palo Duro and Tierra Blanca Creeks in central Randall County, it flows 160 miles southeastward through the Palo Duro Canyon, across southwestern Armstrong and northeastern Briscoe Counties. From there it travels eastward across the broken country of central Hall and Childress Counties to its confluence with the North Fork of the Red River, 12 miles northeast of Vernon. When the Prairie Dog Town Fork crosses the 100th meridian at the eastern line of Childress County, its south bank becomes the state boundary between Texas and Oklahoma, as well as the northern county line of Hardeman and Wilbarger Counties.

Table 1-9: Red Reach IV – *2012 Integrated Report* – Impairments and Concerns

Segment / AU	Description	Parameter	Status
0207_04	LPDTF Red River	Bacteria	Impairment
0207_04	LPDTF Red River	Chlorophyll-*a*	Concern-CS
0207A_01	Buck Creek	Nitrate	Concern-CS
0229_02	UPDTF Red River	pH	Impairment
0229_01/02	UPDTF Red River	Chlorophyll-*a*	Concern-CS
0229_01/02	UPDTF Red River	Nitrate	Concern-CS
0229_01/02	UPDTF Red River	Orthophosphorus	Concern-CS
0229_01/02	UPDTF Red River	Total Phosphorus	Concern-CS
0229A_01	Lake Tanglewood	Ammonia	Concern-CS
0229A_01	Lake Tanglewood	Chlorophyll-*a*	Concern-CS
0229A_01	Lake Tanglewood	Dissolved Oxygen	Concern-CS
0229A_01	Lake Tanglewood	Nitrate	Concern-CS
0229A_01	Lake Tanglewood	Orthophosphorus	Concern-CS
0229A_01	Lake Tanglewood	Total Phosphorus	Concern-CS

Segment 0207 - Lower Prairie Dog Town Fork Red River

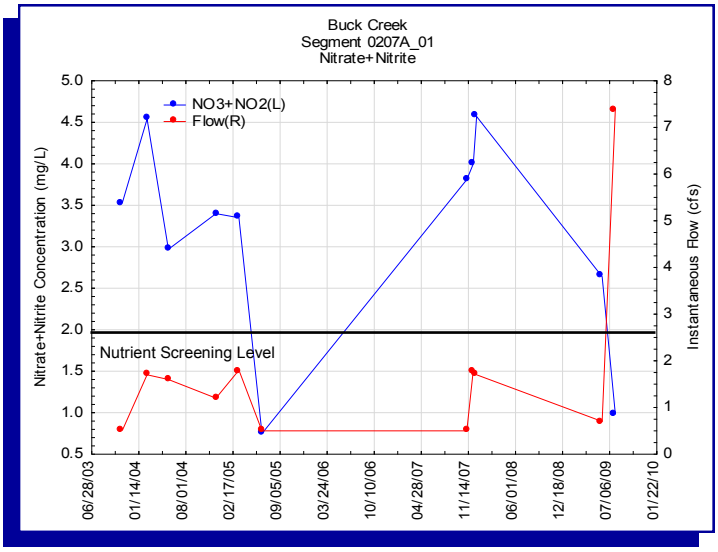


The Lower Prairie Dog Town Fork Red River (LPDTF) (Segment 0207) is a classified segment from a point immediately upstream of the confluence of Buck Creek in Hardeman County to a point upstream of the confluence of Salt Fork Creek in Armstrong County. It is on the *2012 303(d) List* for **bacteria**. LPDTF was first listed with this impairment in 2006, based on exceedances for fecal coliform. Since then, the methodology for **bacteria** assessment has changed for several segments within the Red River Basin. Segment 0207 is now one of nine segments utilizing ***Enterococcus*** (fecal coliform as a back up indicator) as the primary indicator of bacteriological contamination, instead of ***E. coli***. Unfortunately, when the indicator **bacteria** was changed, any previous impairments were carried forward. They will remain until enough new data can be collected with the appropriate indicator **bacteria** to reassess. The Authority has begun collecting ***Enterococcus*** data in an attempt to delist this segment during a future assessment. Preliminary data, collected between February 2013 and February 2014 (5 samples), have a geomean of 1,011 MPN. It also has a single concern for **chlorophyll-*a***. Screening analyses for Station 13637 confirmed **chlorophyll-*a*** concentrations exceeding the **nutrient** standard 43.3% of the time (13/30). Both impairment and concern are present only in the uppermost section of the segment. This is interesting, considering this portion is located in the rugged Palo Duro Canyon area south of the City of Claude, Texas, making public access limited, and leaving the water body virtually undisturbed.

Rangeland grazing, unrestricted access by cattle and agricultural runoff from fertilized fields

LPDTF of the Red River at SH 207

and pastures where livestock have access to the river are probable sources for the elevated **nutrient** levels. Considering how inaccessible this portion of the segment is, wildlife and livestock are able to move freely throughout the area and are likely a major source of the **bacteria**, which has been observed. Establishing an additional monitoring station further upstream of the current monitoring location on SH 207 to gather water quality data could potentially provide additional information needed to determine the location of other potential nonpoint sources for both **bacteria** and **chlorophyll-*a***.



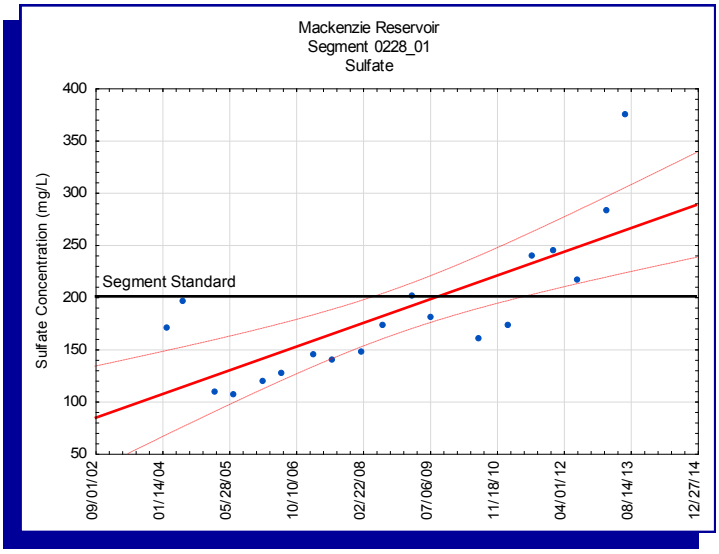
Segment 0207A - Buck Creek

Buck Creek (Segment 0207A) is an unclassified stream segment in Childress County. This perennial stream is located in a rural ranching and farming area, in which ranchers graze cattle in the pastures along the creek bank. Because of drought conditions, wildlife also utilize the natural resources of the segment.

Buck Creek has a single concern for **nitrate**. The Authority's analyses of the data concurred with this assessment. A reliable trend analyses was not possible, due to the lack of data points and lapses in time between collection efforts. However, screening analyses conducted by the Authority did reveal exceedances for **nitrate+nitrite**, an alternate analyte used to assess when **nitrate** data is not available. Although data had not been collected since 2009, the data collected within the ten year period of review did exceed the **nutrient** screening criteria of 1.95 mg/L for **nitrate**, approximately 85.7% of the time (12/14). Per a request from the Texas State Soil and Water Conservation Board, the Authority began monitoring two stations (one in each assessment unit of Buck Creek) in September

Buck Creek at Ranch Road 1547

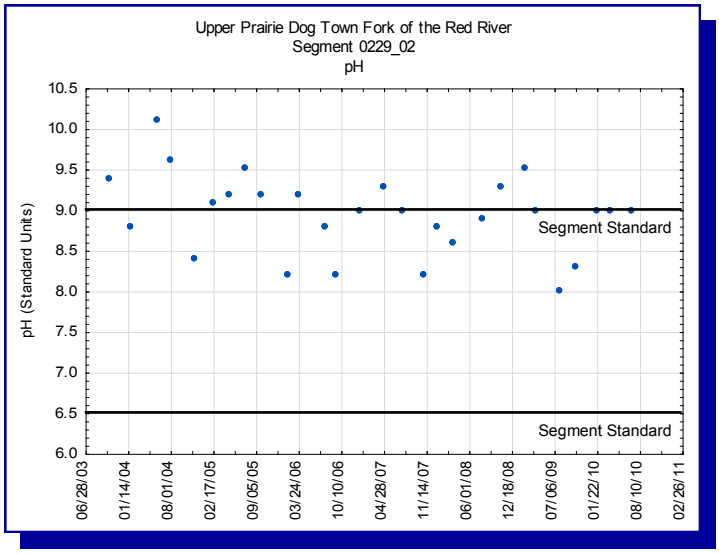
2013 on a quarterly basis. This additional monitoring will provide data to better assess the current status of **nitrate** within Buck Creek. Buck Creek was previously listed for a **bacteria** impairment, but was delisted in 2010, thanks to a three year, 15 station study by the Texas State Soil and Water Conservation Board (TSSWCB), in cooperation with the Texas A&M AgriLife Research Center located in Vernon, Texas. Concluded in 2007, findings from the study revealed that when data were analyzed as individual sites, several of the sites showed exceeding levels of ***E. coli***. However, when the analyses was conducted by grouping sampling sites together by the assessment units that the TCEQ utilizes, standards were not exceeded. Additional information on the Buck Creek Watershed Protection Plan Development can be found at **http://buckcreek.tamu.edu/**.



Segment 0228 - Mackenzie Reservoir

Mackenzie Reservoir (Segment 0228) is a classified segment which impounds Tule Creek. It is located near State Highway 207 in western Briscoe County and eastern Swisher County. When the water was impounded in the 1970s, its purpose was to provide water for the cities of Silverton, Tulia, Floydada, and Lockney. The TCEQ's assessment of the data found no impairments or concerns for Mackenzie Reservoir. Trend analyses revealed an upward trend for **chloride** and a downward trend for **chlorophyll-*a*** concentrations **(See Appendix B)**. This is alarming, as concentrations for **chloride** are nearing the segment standard of 50.0 mg/L. Of equal importance are the concentrations for **sulfate**, which have surpassed the segment standard of 200 mg/L and are continuing to trend in that direction. Both **chloride** and **sulfate** are likely accumulating in Mackenzie Reservoir due to the extreme drought conditions in the area. Based on the data reviewed, a concern for water quality based on screening levels could be assigned during the TCEQ's 2014 assessment.

Sulfate, **TDS**, **Total Phosphorus**, and **VSS** were also flagged as having statistically significant trends, however not enough data was available for proper analysis. Based on the potential for upward trends in several water quality parameters, especially **chloride** and **sulfate**, additional monitoring is recommended in order to obtain a better water quality assessment of Mackenzie Reservoir.

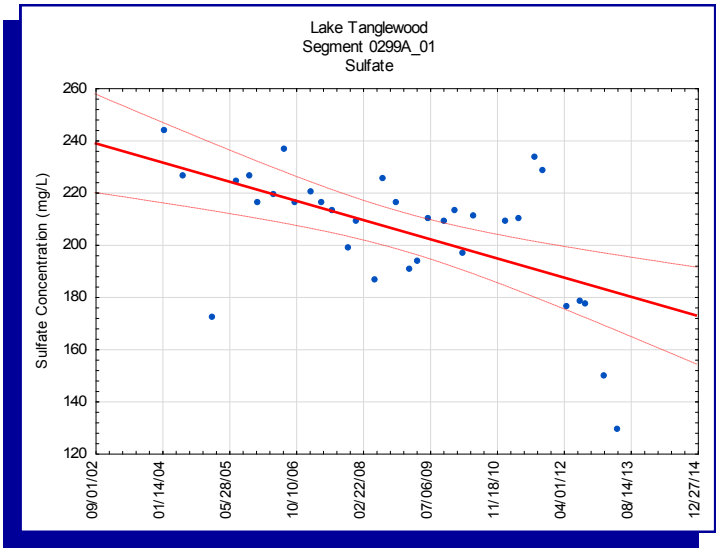


Segment 0229 - Upper Prairie Dog Town Fork Red River

The Upper Prairie Dog Town Fork of the Red River (UPDTF) (Segment

0229) is a classified stream segment. It is located from a point 110 yards upstream of the confluence of Salt Fork Creek in Armstrong County to the Lake Tanglewood Dam in Randall County. It is on the *2012 303(d) List* for **pH** within the portion of the segment closest to Lake Tanglewood Dam; the only **pH** impairment within the entire Red River Basin. During the annual 2010 CMM, it was discussed that there could be potential interference at the current monitoring station below Lake Tanglewood Dam (Station 18317). Following the meeting, a new station was created further downstream of the dam (Station 20801). Monitoring began at the new station in September 2010, and since that time, **pH** has only exceeded the segment standard (6.5 - 9.0) once in thirteen total events. Therefore, it is likely that the original listing for **pH** was simply due to the original monitoring station's proximity to the dam. Continued monitoring will produce enough data to eventually delist Segment 0229 for its **pH** impairment. In addition, Segment 0229 is also listed with concerns for **chlorophyll-*a*, orthophosphorus**, **nitrate**, and **total phosphorus**. The Authority's analyses of the data agreed with this assessment and no statistically significant trends were observed.

This portion of the segment is located below Lake Tanglewood, south of Amarillo. The area upstream of the lake is developing rapidly, as Amarillo grows and expands. Run-off from fields and pastures could be one of several sources causing these nutrient concerns. Another potential nutrient source could be from damaged or failing septic systems located in the small communities in the area. This (see the **Segment 299A - Lake Tanglewood, summary** below), combined with runoff and animals congregating near the water could be potential sources of these problems.



Segment 0229A - Lake Tanglewood

Lake Tanglewood (Segment 0229A) is an unclassified water body. It extends from the Randall County Dam up to normal pool elevation south of Amarillo impounding the PDTF of the Red River.

Lake Tanglewood is in the *2012 IR* with concerns for **ammonia**, **chlorophyll-*a*, depressed dissolved oxygen**, **nitrate**, **orthophosphorus**, and **total phosphorus**. The Authority's analyses of the data agreed with this assessment. Trend analyses indicated a downward trend for sulfate concentrations **(See Appendix B)**. The Authority's review of the data revealed a strong correlation between the concerns listed in the *2012 IR* for both Segments 0229A and 0229. This is unlikely a coincidence, since Lake Tanglewood flows into the UPDTF of the Red River, specifically the portion below the Lake Tanglewood Dam. It is likely that the problems within Segment 0299A are influencing the water quality in the uppermost portions of Segment 0229.

Sources of the **nutrient** concerns could be related to improperly installed septic systems failing due to age. Additionally, fertilizers, wildlife, and permitted dischargers are factors which may be contributing to the heavy **nutrient** load found within Lake Tanglewood. Improvements in water quality would not only benefit Lake Tanglewood, but also the UPDTF of the Red River, as well. A special study would be required for a definitive determination.

Red River Basin
Reach IV

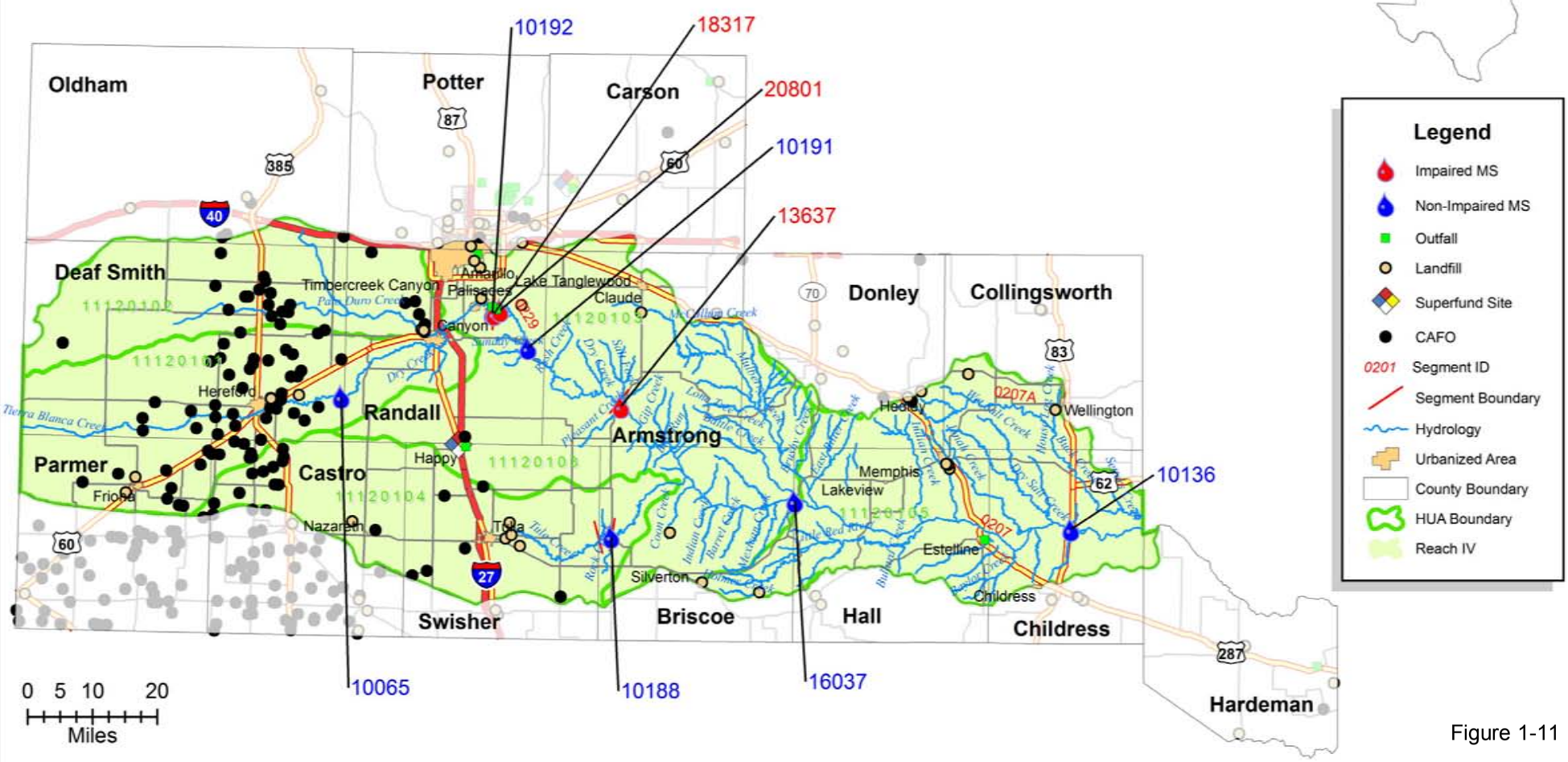
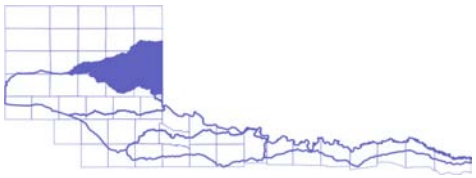


Figure 1-11

Red River Basin — Reach V



Reach V of the Red River Basin begins at the eastern edge of the Panhandle in Hemphill, Wheeler and Swisher Counties, and extends westward to Amarillo for about 100 miles. Its maximum width is about 75 miles. The reach contains the North Fork of the Red River upstream to the headwaters of McClellan Creek, including the headwaters of the Salt Fork of the Red River, Elm Fork of the Red River, and the Washita River. A map of **Reach V** can be found on **page 98**.

Reach V encompasses six sub-watersheds with a contributing drainage of 7,580 square miles in Texas and Oklahoma; 4,124 square miles of the drainage area is in Texas. Predominately farming and ranching are in the area with some oil and gas production. It comprises about 50 small cities below 10,000 people, which include Panhandle, Clarendon, Wheeler, and White Deer. The eastern edge of Amarillo is also located in **Reach V**. Total population in the reach is about 45,000 people. The largest reservoir in this reach is Lake Greenbelt, located in Donley County. Lake McClellan, a small lake, is also in this reach, which is underlain by the Ogallala Aquifer in the northern and western areas.

Ranching dominates this reach, with 2,364 ranches covering more than 3.3 million acres. The ranches primarily raise cattle, cotton, grain sorghum, wheat, corn, oats, barley, and alfalfa.

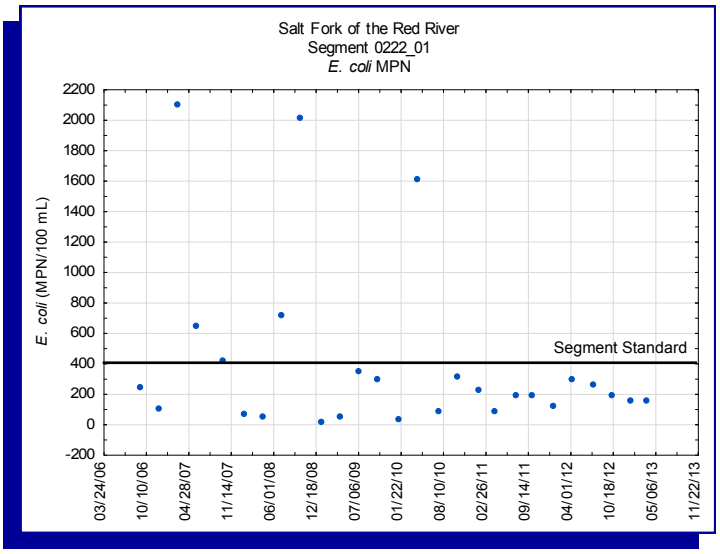
The rolling plains and broken rangeland with sandy clay, dark clay, deep loam, and sandy loam support a variety of native grasses. They also support many varieties of trees such as cottonwood, elm, mesquite, black walnut, chinaberry, willow, hackberry, and oak trees.

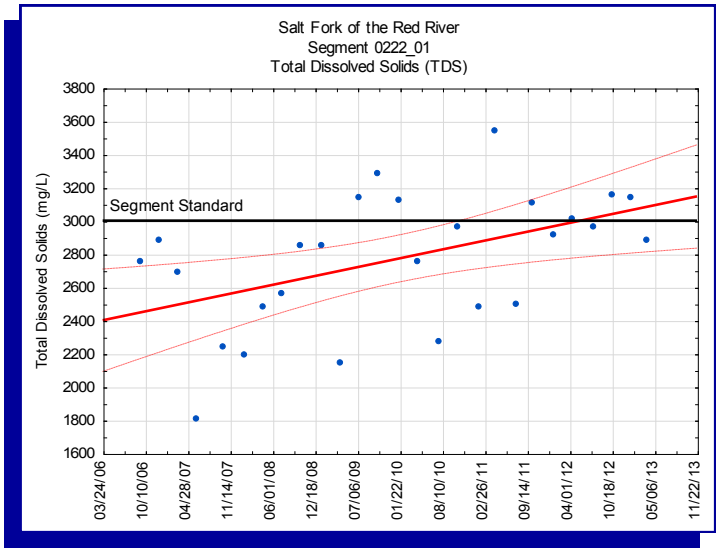
There are 4 permitted municipal and industrial dischargers, 18 permitted solid waste disposal sites and 27 concentrated animal feeding operations in the reach. The Pantex Plant Federal Superfund Site, SUP134, (EPA ID: TX4890110) is located in this reach, 17 miles northeast of Amarillo. The Pantex Plant opened in 1942 as a facility for the production of World War II munitions and explosives. During the following years, state and federal entities have used the facility for various purposes.

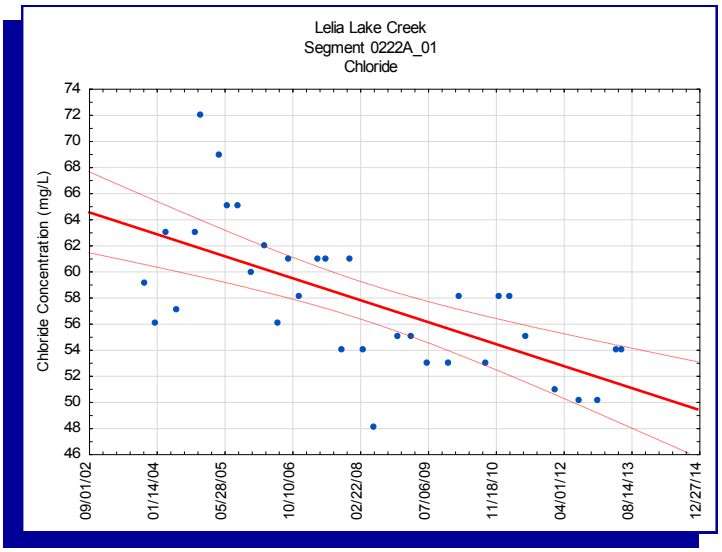
It is currently under the U.S. Department of Energy/National Nuclear Security Administration for the development of high explosive compounds, nuclear weapons assembling/dismantling and interim storage of plutonium/weapon components. Historically, waste management was achieved by the burial or disposal of contaminants in unlined landfills, pits, unlined ditches and playas. These antiquated practices are likely facilitating the release of pollutants into the environment.

Table 1-10: Red Reach V – *2012 Integrated Report* – Impairments and Concerns

Segment / AU	Description	Parameter	Status
0222_01	Salt Fork Red River	Bacteria	Impairment
0224A_01	McClellan Creek	Bacteria	Impairment
0299A_01	Sweetwater Creek	Bacteria	Impairment
0299A_01	Sweetwater Creek	Dissolved Oxygen	Concern-CS







Segment 0222 - Salt Fork Red River

The Salt Fork Red River (Segment 0222) is a classified segment that runs from the Oklahoma State Line in Collingsworth County to Greenbelt Dam in Donley County. Previously unlisted, Segment 0222 appears in the *2010 Integrated Report* with a **bacteria** impairment, which remains with the 2012 assessment. The Authority's data analyses revealed levels of ***E. coli*** exceeding the screening criteria and did agree with the TCEQ's assessment. This is most likely due to the livestock and wildlife population in the area. Trend analyses was conducted for data collected at Station 10171, as there was not enough data from Station 10172 to assess. Trend analyses of this data did reveal a downward trend in **turbidity** and an upward trend in **total dissolved solids**. A review of the data against the segment specific water quality standards revealed minimal exceedances for both **chloride** (3/40) and **total dissolved solids** (7/27). However, **sulfate** did exceed the segment standard of 1,400 mg/L 55% of the time (22/40), during the ten year period of review.

Overall, concentrations of these analytes appeared to be relatively unaffected, even considering the prolonged drought this particular area has been in. Analyses of several other water quality parameters, including **ammonia**, **chlorophyll-a**, and **total phosphorus**, did not reveal any screening level exceedances at either monitoring location.

Segment 0222A - Lelia Lake Creek

Lelia Lake Creek (Segment 0222A) is an unclassified water body stretching from the confluence of the Salt Fork Red River north of Hedley in Donley County to the upstream perennial portion of the stream west of Hedley. The lake impounds West and East Lelia

Lake Creeks and their tributaries. The TCEQ's assessment did not reveal any impairments or concerns. The Authority's analyses of the data agreed with their assessment. Data review flagged **chlorophyll-*a***, **total phosphorus**, and **VSS** as having statistically significant trends. However, a closer review of this data showed this to be the result of a change to the method detection level of the analytes, and not a true change in water quality. A slight upward trend in **chloride** was observed.

Segment 0223 - Greenbelt Lake

Greenbelt Lake (Segment 0223) is a classified water body on the Salt Fork of the Red River. It was impounded in 1966 by the Greenbelt Dam in Donley County up to the normal pool elevation of 2,664 feet. The reservoir is owned and operated by the Greenbelt Municipal and Industrial Water Authority to supply water for municipal and industrial use. The TCEQ's assessment did not reveal any impairments or concerns. Trend analyses revealed upward trends for **chlorophyll-*a*, chloride**, **sulfate**, **TDS**, **TSS**, and **TKN** levels **(See Appendix B)**. Despite the upward trends in **chloride** and **TDS**, the parameters are still well below segment standards. However, **sulfate** has had two recent exceedances of the standard (201 and 206 mg/L, respectively), which will most likely continue based on trend analysis. **Chlorophyll-*a*** also had a single exceedance during the ten year period of review. Like other areas within the western portion of the Red River Basin, Greenbelt Lake has been severely effected by the ongoing drought. With extended lack of rainfall, farmers, ranchers, and even private individuals who have traditionally used stock ponds or shallow water wells as their source of water, are having to turn to entities like Greenbelt Municipal and Industrial Water Authority for water. The increased demand, coupled with the prolonged lack of normal rainfall, has strained water resources in the area and concentrated certain water quality analytes. Until regular rainfall returns to the region, concentrations of these analytes will likely continue to increase.

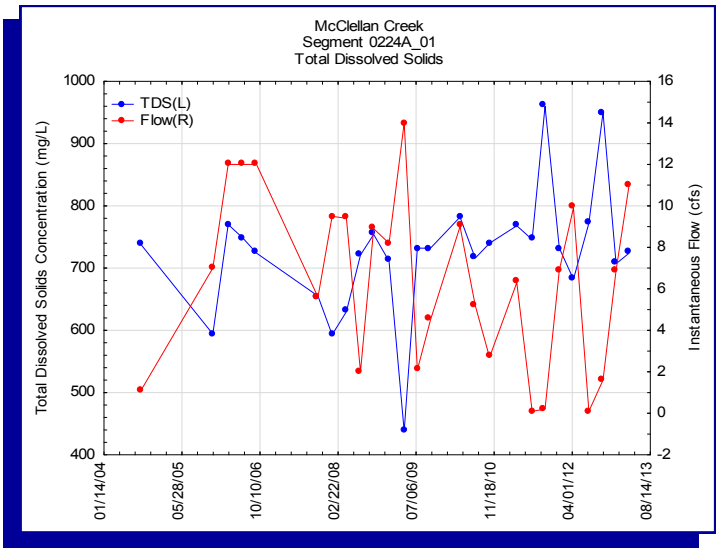
Segment 0224 - North Fork of the Red River

North Fork of the Red River at US 83

North Fork of the Red River (Segment 0224) is a classified water body that begins in west central Gray County and flows eastward across Gray and Wheeler Counties, where it is joined by McClellan Creek. It flows through Oklahoma and joins the Red River northeast of the City of Vernon in Wilbarger County, Texas. The Authority's analyses of the data did not find any exceedances. In addition, the TCEQ's assessment did not reveal any impairments or concerns. Trend analyses flagged **ammonia** as potentially showing an upward trend **(See Appendix B)**. However, the trend was only due to a change in the method detection level and not a true reflection of a change in water quality.

Segment 0224A - McClellan Creek

McClellan Creek, part of Segment 0224A, is a tributary to the North Fork of the Red River and has been selected by the Authority to be used as a reference site. A reference site is one that is considered typical of the area and does not generally have any serious water quality problems. McClellan Creek had previously been listed on the *303(d) List* for a **bacteria** impair-

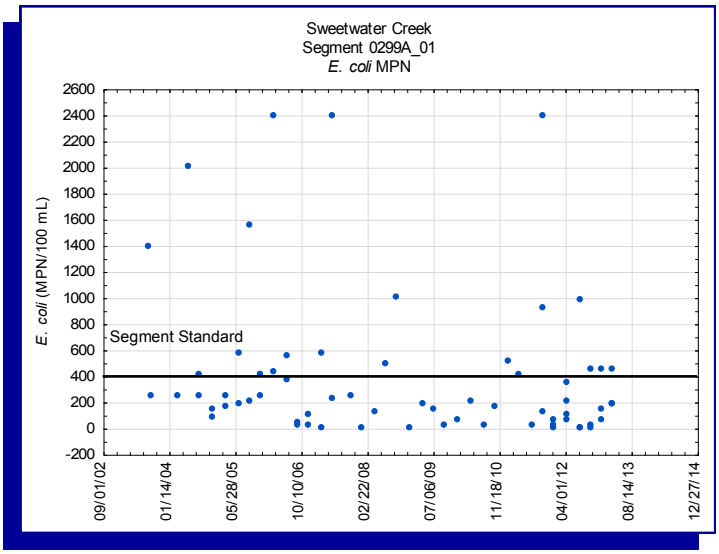


ment, which was ultimately removed. It had been believed that a series of wildfires had caused much of the wildlife in the area to move from their traditional range. As the area has gradually restored itself, wildlife have made their way back and unfortunately, so has the **bacteria**. McClellan Creek was relisted for a **bacteria** impairment in the *2010 IR*, which was confirmed with the *2012 IR*. The Authority's assessment did confirm the geomean exceedance (calculated 147) of the segment standard (126) causing the impairment. Trend analyses showed a subtle upward trend for **TDS**, which can most likely be attributed to the prolonged drought and decreasing flows. **Ammonia**, **chlorophyll-*a***, **TSS**, and **VSS** were also flagged for statistically significant trends, however, these were influenced by changes in the method detection levels and not true changes in water quality.

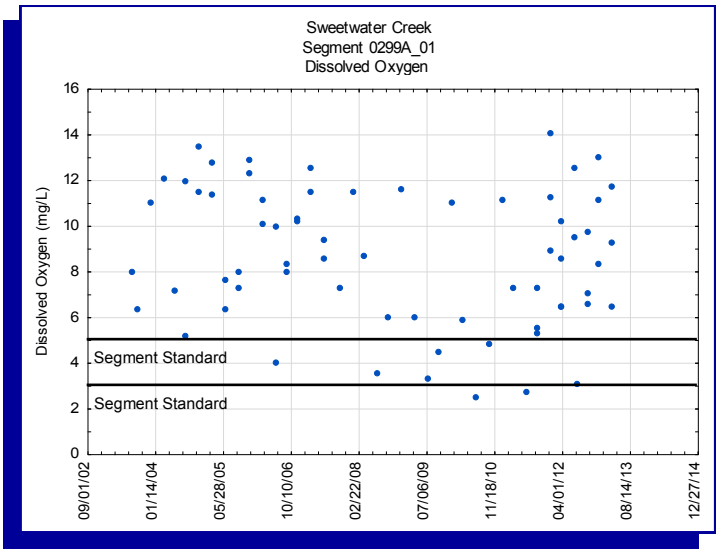
Sweetwater Creek at SH 592

Segment 0299A - Sweetwater Creek

Sweetwater Creek (Segment 0299A) is an unclassified water body located from the Oklahoma state line in Wheeler County to the upstream perennial portion of the stream, northwest of Wheeler in Wheeler County. It is a tributary of the North Fork of the Red River. It was originally on the *303(d) List* in 2002 for **bacteria**, based on fecal coliform exceedances. When the TCEQ changed to ***E. coli*** as the **bacteria** indicator species, the creek continued to exceed standards. The Authority's analyses of the data agreed with this assessment. Sweetwater Creek is monitored at three separate locations, identified as Monitoring Stations 10070 (lower portion), 10072 (middle portion), and 10074 (upper portion). The segment standard for ***E. coli*** is a geomean not to exceed 126. Analyses of the data revealed exceedances at two of the three monitoring stations. Station



Sweetwater Creek at SH 152



Sweetwater Creek at US 83

10070 had a geomean of 238 MPN and Station 10072 had a geomean of 250 MPN. Additionally, analyses of all the data within the segment yielded a geomean of 157 MPN. There are several potential sources which could be contributing to the elevated levels of **bacteria** observed during routine monitoring events. Several large CAFOs can be found in the watershed and large numbers of cattle can be found grazing on pastures and fields. In addition, birds roosting in the trees that line the creek and wildlife could be effecting the water quality.

Segment 0299A was also identified in the *2012 IR* as having a concern for **depressed dissolved oxygen**. A possible explanation could be the extremely low flow that is observed throughout most of the stream. Flow is greatly constricted throughout most of Sweetwater Creek by dense aquatic vegetation.

Continued monitoring on this segment is recommended to aid in the determination of potential **bacteria** sources and reasons for low **dissolved oxygen** levels. Additionally, it may be beneficial to utilize bacterial source tracking within Segment 0299A to aid in the determination of what is contributing the **bacteria** load in the middle and lower portions of Sweetwater Creek. More information about the utilization of this technology can be found in the Red River Basin Reach 1 discussion, located on **page 11**.

It should be noted that a RUAA has been completed within Segment 0299A to help determine if the current bacteria standard is applicable for this segment. Should it be determined that the chance for primary contact recreation is minimal, the bacteria standard could be raised, thus removing Sweetwater Creek's bacteria impairment.

Red River Basin
Reach V

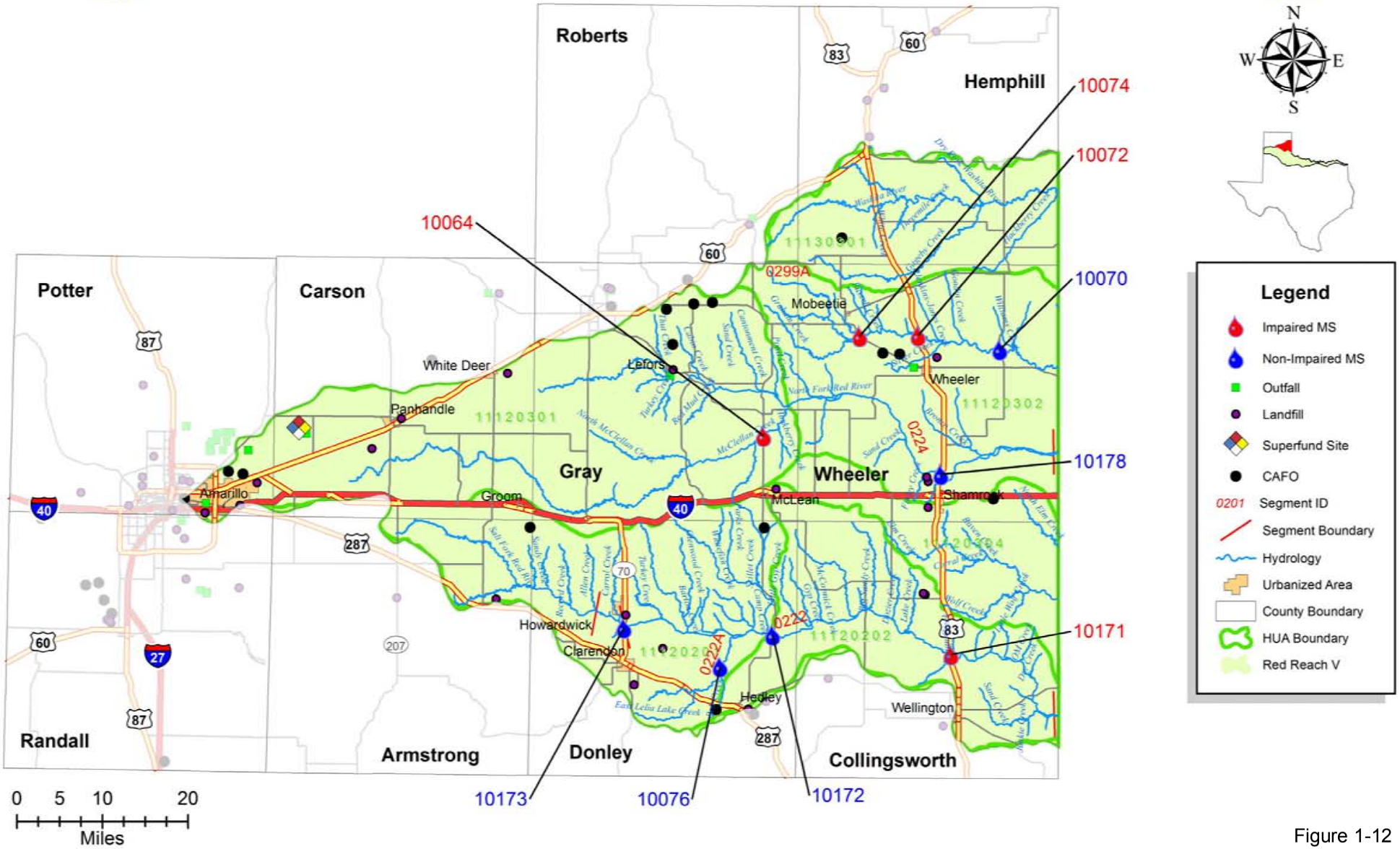


Figure 1-12

RECOMMENDATIONS AND CONCLUSIONS

5.1 — CANADIAN RIVER BASIN SUMMARY

Overall, water quality within the Canadian River Basin tends to be good, with few impairments and concerns. The biggest water-related problem within the Canadian River Basin itself stems from the sheer decrease in annual rainfall, which has concentrated and elevated water quality constituents to levels near water quality standards and screening levels. When normal rainfall returns to the area, it is hopeful that many of these impairments and concerns will begin downward trends until they finally meet designated standards. With this in mind, it is important to note the efforts entities, such as the Canadian River Municipal Water Authority, are making via deep-well injection and the Salt Cedar Management Program to help lower chloride concentrations in portions of the Canadian River to ensure a reliable source of good-quality drinking water for citizens scattered throughout the Texas Panhandle.

5.2 — RED RIVER BASIN SUMMARY

Overall water quality within the Red River Basin tends to be good, with few impairments and concerns. Like the Canadian River Basin, the Red River Basin has faced significant decreases in annual rainfall, increasing the amount of dissolved salts and nutrients in several segments throughout the basin. It is hopeful that when regular rainfall does return, many of these impairments and concerns will begin downward trends until they finally meet designated standards. There are programs in place, such as the Red River Chloride Control Project, which aim to prevent dissolved solids from ever entering portions of the Wichita River, which have and will continue to assist in the improvement of water quality. The completion of this project will tremendously reduce the levels of such salts from entering the watershed. There are also a handful of segments which, should the drought continue, may not be able to be assessed due to a lack of data. Additionally, there are nine segments which have seen changes in the indicator bacteria used for analysis. It is very likely that these segments may be removed from the *IR,* once enough data has been collected with the new indicator, depending on assessment results.

5.3 — RECOMMENDATIONS

The following recommendations and conclusions are based upon the evaluations of water quality for both the Canadian and Red River Basin presented in this report. Comments received through public participation have also influenced these recommendations and conclusions.

- Continue to promote and build upon the already successful Annual Coordinated Monitoring Meeting to develop strategic monitoring plans for both basins. This reduces duplication of efforts, ensures the efficient use of available financial resources, and increases the number of sites to be monitored. In addition, it enables the impairments and concerns, as defined in the *IR*, to be adequately addressed, so that all segments and water quality uses can be assessed;

- Continue to build upon the Watershed Action Planning process. This process emphasizes and promotes a cooperative effort to pursue monitoring based efforts to aid in both the

identification of problems and/or sources of long-time 303(d) impairments and 305(b) concerns and their subsequent delisting and/or removal from such lists;

- Continue to increase the number of monitoring partners, in order for non-monitored locations or locations needing additional monitoring, to receive coverage. Thereby increasing the amount of data available for future water quality assessments. Increased coverage will provide additional data, useful in determining potential cause(s) for both impairments and concerns;

- Continue to promote and collect *Enterococcus* data to better assess the bacteriological quality in high saline water bodies throughout the Red River Basin. Of all the 303(d) impaired water bodies assessed during the *2012 IR*, 22.2% of those have been identified as utilizing *Enterococcus*, in lieu of *E. coli*, as the indicator bacteria for that segment. Once enough data is available, it may be determined that some of the original listings were made in error and those water bodies can be removed from the *IR*;

- Support the development of an economical method of bacterial source tracking. This methodology would greatly aid in identifying bacterial sources on affected segments, which in turn would aid in the resolution of those concerns, as it did within Segment 0207A. Bacteriological impairments account for approximately 20.0% in the Canadian River Basin, and 66.7% in the Red River Basin, of all 303(d) impairments;

- Support the continued development and improvement of the TCEQ's *Drought Monitoring Guidance* in response to the ongoing and severe drought conditions throughout the state. Additional information will provide a means for the public and data providers to readily identify the severity of drought associated with water quality data;

- Support the development of numeric nutrient criteria for the remainder of lakes and reservoirs not previously assigned, and support the future development of numeric criteria for rivers and streams;

- Support the development of a single method for the determination of nitrogenous compounds for the assessment and determination of a water body (water bodies) exceedance with nutrient screening levels;

- Continue to educate the general public about water quality, conservation and protection of natural resources;

- Continue to work with agriculture/ranching, industry, and municipal entities toward the improvement of water quality through effective planning strategies;

- Continue to encourage the USGS to submit their water quality sampling data from the Canadian River at the Texas/New Mexico state line to the TCEQ's SWQMIS database to be used in future assessments;

- Continue to encourage the State of Oklahoma environmental and water quality agencies to take a more active role in both the Coordinated Monitoring and Basin Advisory Committee Meetings, in order to further a cooperative effort in the improvement of water quality for both basins;

- Continue support and installation of real-time monitoring coverage to allow for quicker responses to abnormal occurrences;

- Continue research of new and alternative conservation measures, such as brush control and implement field trials; and

- Continue to be the state sponsor of the Red River Chloride Control Project, pressing for the project's completion and funding so that previously unusable water sources can be utilized without excessive treatment costs.

5.4 — CONCLUSIONS

Over the past five years, the Canadian and Red River Basins have experienced extreme weather conditions that have ranged from prolonged extreme drought conditions combined with the scorching heat of long, hot summers, to wildfires that have burned more square miles than the size of some small states.

In spite of these extremes, the water quality in the Canadian and Red River Basins has stayed the course and remained overall fairly healthy. The primary parameters which have concerns for a use attainment and/or screening levels in both basins; are chlorophyll-*a*, followed by bacteria, then by various nutrients and then depressed dissolved oxygen. As the source or sources of these pollutants are discovered, action plans will be developed and implemented through the best options available.

At first glance, monitoring additional sites each year may give the impression that more sites spread throughout both basins exhibit various concerns such as bacteria, chlorophyll-*a* and nutrients; therefore, the water quality is not as good as it has been in the past. This first impression is not quite true. By increasing the number of sites monitored, a better overall picture of both basins is obtained, which assists in the development of new strategies for improving the water quality of the past. The CRP is actually working more efficiently than ever, and the Authority, like many of its partner agencies are doing more with less every year. Despite increased expenses and reduced CRP budgets, the Authority has increased their monitoring stations every year since 2011, and is currently monitoring almost double the number of stations at this time, in comparison to monitoring performed in 2009.

The understanding of water quality problems and the dynamics of cause and effect have significantly increased, not only through advancing technology, but through first hand knowledge and experience gained by the Authority and its monitoring partners. The Authority is very proud of the level of coordination, cooperation, and respect that it maintains with the TCEQ, the USGS and its other cooperating partners, as well as input from the Basin Advisory Committees to provide feedback that results in planning for the basins' future. This cooperation statewide has led to the development of a proficient, extensive, and dependable database, which is vital in assessing, permitting, and maintaining the water quality within the Canadian and Red River Basins.

The Authority hopes, as both a fee paying stakeholder and custodian of the Canadian and Red River Basins' water resources, that the Clean Rivers Program is maintained and funding sources are protected so that the original purpose of the program continues.

Appendix A - Canadian River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
CI	0101_01	10032	08/01/03	07/31/13	Canadian River Below Lake Meredith	Temperature	00010	95	39	0	0.80	6.95	16.80	23.15	34.90	16.35	1.05	0.30
						Conductivity	00094	-	39	-	1320.00	2300.00	2500.00	2625.00	3220.00	2458.46	-3.06	0.00
						DO	00300	5.0	39	0	7.40	8.50	9.50	11.60	13.10	9.90	0.14	0.89
						pH	00400	6.5 - 9.0	39	0	7.90	8.20	8.30	8.40	8.50	8.28	1.10	0.28
						Ammonia	00610	0.33	39	0	0.02	0.04	0.10	0.10	0.10	0.07	6.71	0.00
						E.coli	31699	394	39	2	1	15	30	98	520	97	-1.61	0.12
						Chloride	00940	1975	38	0	264.00	533.25	602.00	632.25	810.00	581.00	-2.32	0.03
						Chlorophyll-*a*	70953	14.1	39	0	2.00	2.04	3.82	5.00	10.00	4.03	-4.90	0.00
						Nitrate	00610	1.95	13	0	0.02	0.04	0.04	0.04	0.27	0.07	-0.58	0.58
						Nitrate+Nitrite	00630	-	26	-	0.02	0.03	0.05	0.24	1.90	0.23	-0.72	0.48
						Phosphorus, Total	00665	0.69	39	0	0.04	0.06	0.07	0.10	0.19	0.08	-1.16	0.25
						Sulfate	00945	760	38	0	64.30	127.75	160.50	193.75	394.00	166.79	-1.09	0.28
						TDS	70300	5000	38	0	654.00	1300.00	1400.00	1525.00	1930.00	1416.42	-2.62	0.01
						TSS	00530	-	39	-	1.00	4.00	6.00	9.50	29.20	8.03	-0.95	0.35
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	39	-	1.14	2.30	3.80	7.65	67.00	6.84	0.59	0.56
						VSS	00535	-	39	-	1.00	2.50	4.00	4.00	6.00	3.43	-6.04	0.00
CI	0101_02	10033	08/01/03	07/31/13	Canadian River Below Lake Meredith	Temperature	00010	95	39	0	1.60	8.60	13.80	22.75	35.10	15.52	-1.33	0.19
						Conductivity	00094	-	39	-	2290.00	2610.00	2800.00	3085.00	3820.00	2854.36	-3.44	0.00
						DO	00300	5.0	39	0	6.90	8.65	9.30	11.30	12.30	9.71	-1.73	0.09
						pH	00400	6.5 - 9.0	39	0	7.70	8.10	8.30	8.35	8.70	8.24	-2.59	0.01
						Ammonia	00610	0.33	39	0	0.02	0.04	0.10	0.10	0.15	0.08	5.24	0.00
						E.coli	31699	394	38	0	4	16	57	79	214	60	-1.51	0.14
						Chloride	00940	1975	38	0	467.00	606.00	659.00	749.50	997.00	679.63	-2.72	0.01
						Chlorophyll-*a*	70953	14.1	39	3	2.00	3.90	5.00	7.95	20.50	6.78	-2.14	0.04
						Nitrate	00610	1.95	12	0	0.02	0.04	0.04	0.04	0.45	0.09	-0.25	0.80
						Nitrate+Nitrite	00630	-	26	-	0.02	0.03	0.10	0.40	1.90	0.32	-1.04	0.31
						Phosphorus, Total	00665	0.69	39	0	0.06	0.07	0.08	0.12	0.17	0.09	-0.70	0.49
						Sulfate	00945	760	38	0	76.00	170.00	224.00	264.75	450.00	214.58	-3.50	0.00
						TDS	70300	5000	39	0	1240.00	1460.00	1580.00	1820.00	2230.00	1635.13	-2.70	0.01
						TSS	00530	-	39	-	2.00	4.00	5.00	8.00	32.20	7.15	-0.72	0.48
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	39	-	1.00	2.25	2.98	4.64	18.70	3.98	-0.79	0.44
						VSS	00535	-	39		1.00	2.50	4.00	4.00	8.00	3.72	-4.68	0.00
CI	0101_03	10034	08/01/03	07/31/13	Canadian River Below Lake Meredith	Temperature	00010	95	31	0	4.80	10.05	13.90	20.10	25.50	14.54	-0.73	0.47
						Conductivity	00094	-	31	-	2980.00	4935.00	5310.00	6210.00	9560.00	5559.03	-1.61	0.12
						DO	00300	5.0	31	1	4.90	7.45	8.10	8.70	10.40	8.02	0.94	0.35
						pH	00400	6.5 - 9.0	31	0	7.10	7.60	7.70	7.80	8.00	7.69	0.57	0.57
						Ammonia	00610	0.33	29	18	0.17	0.29	0.35	0.41	2.71	0.43	-1.93	0.06
						E.coli	31699	394	31	8	6	72	120	400	9200	594	0.28	0.78
						Chloride	00940	1975	31	3	996.00	1230.00	1380.00	1605.00	2740.00	1477.52	-4.80	0.00
						Chlorophyll-*a*	70953	14.1	28	2	3.00	5.43	10.00	10.05	31.30	9.83	-0.58	0.56
						Nitrate	00610	1.95	5	1	0.20	1.00	1.38	1.95	2.62	1.43	-1.30	0.26
						Nitrate+Nitrite	00630	-	25	-	0.04	0.19	0.49	1.16	4.42	0.88	1.10	0.28
						Phosphorus, Total	00665	0.69	27	0	0.06	0.10	0.11	0.15	0.31	0.13	0.24	0.81
						Sulfate	00945	760	30	0	484.00	536.75	567.00	601.25	718.00	571.37	-4.88	0.00
						TDS	70300	5000	28	0	2700.00	3132.50	3510.00	4015.00	6450.00	3703.57	-5.06	0.00
						TSS	00530	-	31	-	4.00	5.00	7.00	9.50	27.00	8.74	-1.08	0.29
						TKN	00625	-	27	-	0.46	0.79	0.86	1.02	3.36	0.98	-2.42	0.02
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	31	-	2.00	4.00	4.00	4.00	6.00	3.87	1.14	0.26

Appendix A - Canadian River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet Code	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
CI	0101_04	10035	08/01/03	07/31/13	Canadian River Below Lake Meredith	Temperature	00010	95	22	0	7.00	10.40	17.10	21.03	27.20	16.54	1.31	0.20
						Conductivity	00094	-	22	-	2220.00	12150.00	13350.00	16000.00	20500.00	13494.55	0.55	0.59
						DO	00300	5.0	22	5	0.20	5.63	11.65	13.75	16.50	9.97	-3.73	0.00
						pH	00400	6.5 - 9.0	22	0	6.80	7.20	7.30	7.58	8.10	7.36	-1.93	0.07
						Ammonia	00610	0.33	20	18	0.05	0.41	0.71	1.22	2.61	0.94	2.12	0.05
						E.coli	31699	394	4	1	10	51	82	261	750	231	-1.68	0.19
						Chloride	00940	1975	18	18	2980.00	3925.00	4195.00	4967.50	9310.00	4666.67	4.39	0.00
						Chlorophyll-*a*	70953	14.1	18	11	3.00	11.53	18.65	53.13	1510.00	115.93	1.08	0.30
						Nitrate	00610	1.95	0	-	-	-	-	-	-	-	-	-
						Nitrate+Nitrite	00630	-	20	-	0.04	0.04	0.04	0.04	2.40	0.16	1.03	0.32
						Phosphorus, Total	00665	0.69	18	1	0.03	0.07	0.08	0.14	1.54	0.18	1.13	0.27
						Sulfate	00945	760	19	18	509.00	888.50	902.00	994.00	1990.00	1014.11	3.21	0.00
						TDS	70300	5000	13	13	6050.00	7570.00	8240.00	9600.00	12600.00	8513.08	3.19	0.01
						TSS	00530	-	20	-	5.00	7.75	11.50	16.50	189.00	21.75	1.66	0.11
						TKN	00625	-	19	-	0.94	1.13	1.27	2.29	13.80	2.38	1.99	0.06
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	20	-	4.00	4.00	5.00	6.50	123.00	11.55	1.34	0.19
CI	0101	20702	08/01/03	07/31/13	Canadian River Below Lake Meredith	Temperature	00010	95	10	0	6.00	14.55	17.35	22.08	25.10	17.01	-0.52	0.61
						Conductivity	00094	-	10	-	3630.00	4227.50	4510.00	4637.50	5100.00	4447.00	-1.32	0.22
						DO	00300	5.0	10	0	7.60	8.28	8.95	9.75	13.60	9.48	-0.20	0.85
						pH	00400	6.5 - 9.0	10	0	7.70	7.73	7.85	8.10	8.20	7.91	-1.15	0.28
						Ammonia	00610	0.33	8	3	0.13	0.21	0.29	0.39	0.88	0.35	-0.80	0.45
						E.coli	31699	394	8	3	10	31	135	710	6900	1100	-1.55	0.17
						Chloride	00940	1975	8	1	716.00	885.00	963.00	1125.00	6360.00	1722.71	-0.25	0.81
						Chlorophyll-*a*	70953	14.1	8	1	1.91	3.91	6.37	8.18	18.20	7.35	-0.19	0.86
						Nitrate	00610	1.95	0	-	-	-	-	-	-	-	-	-
						Nitrate+Nitrite	00630	-	8	-	0.05	0.13	0.58	2.50	4.21	1.47	0.73	0.49
						Phosphorus, Total	00665	0.69	7	0	0.07	0.13	0.16	0.25	0.46	0.21	2.66	0.04
						Sulfate	00945	760	8	1	412.00	490.00	524.00	580.25	1230.00	604.88	-0.61	0.56
						TDS	70300	5000	0	-	-	-	-	-	-	-	-	-
						TSS	00530	-	8	-	6.00	7.00	8.00	12.25	18.00	9.88	0.88	0.41
						TKN	00625	-	8	-	0.61	0.81	0.86	1.00	1.69	0.97	-0.77	0.47
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	8	-	4.00	4.00	4.00	4.00	5.00	4.13	2.18	0.07
CI	0101A_01	10016	08/01/03	07/31/13	Dixon Creek	Temperature	00010	95	40	0	0.70	5.90	15.50	21.80	25.00	13.89	0.22	0.83
						Conductivity	00094	-	39	-	1650.00	2345.00	2550.00	2770.00	3590.00	2601.28	-4.17	0.00
						DO	00300	5.0	39	1	4.60	8.05	9.70	10.80	14.80	9.42	0.29	0.77
						pH	00400	6.5 - 9.0	40	0	7.30	7.70	7.80	8.00	8.20	7.79	0.24	0.81
						Ammonia	00610	0.33	41	1	0.05	0.05	0.05	0.06	2.34	0.11	-1.80	0.08
						E.coli	31699	394	38	22	31	230	445	668	2900	554	0.57	0.57
						Chloride	00940	-	40	-	223.00	341.75	414.50	480.25	751.00	416.23	-2.92	0.01
						Chlorophyll-*a*	70953	14.1	38	1	2.09	3.36	6.64	10.00	53.00	8.74	-0.48	0.64
						Nitrate	00610	1.95	5	4	0.63	2.76	3.18	3.75	6.81	3.43	0.30	0.78
						Nitrate+Nitrite	00630	-	36	-	0.04	1.04	2.71	4.96	9.12	3.44	-0.18	0.86
						Phosphorus, Total	00665	0.69	36	2	0.11	0.22	0.31	0.39	1.18	0.34	2.52	0.02
						Sulfate	00945	-	41	-	292.00	395.00	430.00	474.00	587.00	430.37	-1.90	0.06
						TDS	70300	-	29	-	1040.00	1480.00	1620.00	1830.00	2200.00	1671.03	-4.56	0.00
						TSS	00530	-	41	-	2.00	4.00	7.00	11.00	48.00	9.27	0.87	0.39
						TKN	00625	-	40	-	0.40	0.67	0.85	1.04	5.08	1.03	-2.09	0.04
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	41	-	1.00	4.00	4.00	4.00	16.00	4.24	-0.30	0.76

Appendix A - Canadian River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet Code	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
CI	0101A_02	17045	08/01/03	07/31/13	Dixon Creek	Temperature	00010	95	1	0	19.60	19.60	19.60	19.60	19.60	19.60	N/A	N/A
						Conductivity	00094	-	1	-	2610.00	2610.00	2610.00	2610.00	2610.00	2610.00	N/A	N/A
						DO	00300	5.0	1	0	5.50	5.50	5.50	5.50	5.50	5.50	N/A	N/A
						pH	00400	6.5 - 9.0	1	0	7.70	7.70	7.70	7.70	7.70	7.70	N/A	N/A
						Ammonia	00610	0.33	1	0	0.10	0.10	0.10	0.10	0.10	0.10	N/A	N/A
						E.coli	31699	394	1	0	20	20	20	20	20	20	N/A	N/A
						Chloride	00940	-	1	-	401.00	401.00	401.00	401.00	401.00	401.00	N/A	N/A
						Chlorophyll-*a*	70953	14.1	1	0	2.80	2.80	2.80	2.80	2.80	2.80	N/A	N/A
						Nitrate	00610	1.95	1	0	0.04	0.04	0.04	0.04	0.04	0.04	N/A	N/A
						Nitrate+Nitrite	00630	-	0	-	-	-	-	-	-	-	-	-
						Phosphorus, Total	00665	0.69	1	0	0.06	0.06	0.06	0.06	0.06	0.06	N/A	N/A
						Sulfate	00945	-	1	-	616.00	616.00	616.00	616.00	616.00	616.00	N/A	N/A
						TDS	70300	-	1	-	1740.00	1740.00	1740.00	1740.00	1740.00	1740.00	N/A	N/A
						TSS	00530	-	1	-	28.00	28.00	28.00	28.00	28.00	28.00	N/A	N/A
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	1	-	24.00	24.00	24.00	24.00	24.00	24.00	N/A	N/A
						VSS	00535	-	1	-	3.00	3.00	3.00	3.00	3.00	3.00	N/A	N/A
CI	0101B_01	10024	08/01/03	07/31/13	Rock Creek	Temperature	00010	95	31	0	4.20	9.10	14.90	20.90	30.90	15.30	0.19	0.85
						Conductivity	00094	-	31	-	1860.00	2630.00	3840.00	4120.00	7490.00	3677.42	3.05	0.00
						DO	00300	5.0	31	0	8.20	10.30	12.40	13.55	17.80	12.19	0.97	0.34
						pH	00400	6.5 - 9.0	31	0	7.40	7.90	8.10	8.25	8.50	8.05	-3.05	0.00
						Ammonia	00610	0.33	31	0	0.02	0.10	0.10	0.10	0.23	0.10	1.43	0.16
						E.coli	31699	394	30	8	6	58	170	448	1100	278	1.58	0.13
						Chloride	00940	-	30	-	10.00	494.50	716.50	835.25	9660.00	1028.63	1.71	0.10
						Chlorophyll-*a*	70953	14.1	31	6	2.00	3.60	5.00	12.20	179.00	13.80	0.70	0.49
						Nitrate	00610	1.95	9	4	0.04	0.21	1.58	8.13	12.70	4.17	-1.19	0.27
						Nitrate+Nitrite	00630	-	21	-	0.92	1.86	4.09	8.50	60.70	8.00	-0.69	0.50
						Phosphorus, Total	00665	0.69	31	9	0.09	0.26	0.45	0.89	6.00	0.80	0.35	0.73
						Sulfate	00945	-	30	-	325.00	470.00	743.00	817.75	1000.00	667.03	3.63	0.00
						TDS	70300	-	31	-	1150.00	1840.00	2570.00	2870.00	5100.00	2532.58	3.64	0.00
						TSS	00530	-	30	-	2.00	4.00	5.00	8.00	37.00	7.31	0.99	0.33
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	31	-	0.80	1.44	2.29	3.95	10.80	3.31	0.35	0.73
						VSS	00535	-	30	-	1.00	2.63	4.00	4.00	12.00	3.78	-1.60	0.12
CI	0101C_01	21174	08/01/03	07/31/13	White Deer Creek	Temperature	00010	95	22	0	3.00	8.00	15.55	17.58	29.30	15.30	-0.47	0.64
						Conductivity	00094	-	22	-	526.00	547.25	555.00	579.00	693.00	569.55	2.32	0.03
						DO	00300	5.0	22	0	5.20	7.25	8.25	10.23	12.30	8.70	-1.21	0.24
						pH	00400	6.5 - 9.0	22	0	7.50	7.90	8.00	8.10	8.50	8.03	-1.75	0.10
						Ammonia	00610	0.33	22	0	0.10	0.10	0.10	0.10	0.10	0.10	-	-
						E.coli	31699	394	22	2	1	35	110	230	690	164	1.81	0.08
						Chloride	00940	-	21	-	27.00	32.70	35.00	38.00	62.00	37.55	0.30	0.76
						Chlorophyll-*a*	70953	14.1	22	2	2.00	2.77	4.70	7.08	32.30	6.66	1.56	0.13
						Nitrate	00610	1.95	11	0	0.02	0.04	0.04	0.07	0.69	0.12	-1.10	0.30
						Nitrate+Nitrite	00630	-	10	-	0.02	0.05	0.09	0.18	1.07	0.20	-1.20	0.26
						Phosphorus, Total	00665	0.69	22	0	0.06	0.06	0.07	0.10	0.13	0.08	-2.33	0.03
						Sulfate	00945	-	21	-	26.40	31.00	33.50	35.60	49.90	34.79	1.30	0.21
						TDS	70300	-	22	-	198.00	297.00	327.50	343.50	400.00	318.77	1.87	0.08
						TSS	00530	-	22	-	4.50	11.03	21.90	32.33	41.00	22.01	0.64	0.53
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	22	-	5.10	11.50	22.10	28.88	35.30	20.23	0.78	0.45
						VSS	00535	-	22	-	2.00	3.85	4.00	5.19	8.20	4.40	0.37	0.71

Appendix A - Canadian River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet Code	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
CII	0102_01	10036	08/01/03	07/31/13	Lake Meredith	Temperature	00010	85	73	0	0.30	8.60	17.30	23.40	28.30	16.02	-0.04	0.97
						Conductivity	00094	-	73	-	15.60	2710.00	2910.00	3250.00	7550.00	3285.42	9.24	0.00
						DO	00300	6.0	35	0	6.70	8.15	9.00	11.45	4220.00	129.79	0.68	0.50
						pH	00400	6.5 - 9.0	73	0	6.50	8.40	8.50	8.60	9.00	8.46	-2.03	0.05
						Ammonia	00610	0.11	32	1	0.05	0.05	0.05	0.05	0.49	0.07	0.84	0.41
						E.coli	31699	394	68	0	1	1	1	1	19	2	2.98	0.00
						Chloride	00940	400	71	71	440.00	506.00	543.00	667.00	1810.00	670.83	15.06	0.00
						Chlorophyll-*a*	70953	26.7	32	4	3.00	5.11	10.00	18.10	48.80	14.61	4.07	0.00
						Nitrate	00610	0.37	33	0	0.02	0.02	0.03	0.06	0.22	0.05	0.43	0.67
						Nitrate+Nitrite	00630	-	30	-	0.04	0.04	0.04	0.04	0.11	0.04	1.26	0.22
						Phosphorus, Total	00665	0.20	29	0	0.02	0.05	0.06	0.06	0.13	0.05	-0.76	0.45
						Sulfate	00945	350	70	66	336.00	381.00	420.50	449.00	899.00	449.04	9.06	0.00
						TDS	70300	1300	24	24	1460.00	1717.50	1860.00	2047.50	2480.00	1881.25	4.05	0.00
						TSS	00530	-	30	-	2.00	4.00	6.50	10.00	19.00	7.40	5.51	0.00
						TKN	00625	-	28	-	0.40	0.56	0.63	0.90	1.65	0.78	6.81	0.00
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	32	-	2.00	4.00	4.00	4.50	11.00	4.55	5.66	0.00
CII	0102A_01	15270	08/01/03	07/31/13	Big Blue Creek	Temperature	00010	85	21	0	0.00	9.30	11.60	16.70	29.00	12.55	3.82	0.00
						Conductivity	00094	-	21	-	603.00	766.00	831.00	913.00	1070.00	827.57	0.96	0.35
						DO	00300	5.0	21	0	6.60	9.10	10.00	10.90	13.70	10.21	-2.97	0.01
						pH	00400	6.5 - 9.0	21	0	8.10	8.30	8.40	8.50	8.60	8.40	2.37	0.03
						Ammonia	00610	0.33	22	0	0.02	0.06	0.10	0.10	0.10	0.08	5.58	0.00
						E.coli	31699	394	21	2	1	5	25	99	920	122	-1.56	0.13
						Chloride	00940	-	20	-	14.10	17.43	20.60	22.78	27.70	20.26	0.25	0.81
						Chlorophyll-*a*	70953	14.1	21	0	2.00	2.00	2.00	2.00	5.00	2.36	-1.90	0.07
						Nitrate	00610	1.95	6	0	0.04	0.04	0.05	0.06	0.09	0.05	-0.33	0.76
						Nitrate+Nitrite	00630	-	14	-	0.02	0.04	0.06	0.14	0.68	0.15	-1.51	0.15
						Phosphorus, Total	00665	0.69	21	0	0.06	0.06	0.06	0.07	0.27	0.08	-0.23	0.82
						Sulfate	00945	-	21	-	72.10	100.60	131.00	186.75	229.00	146.99	2.07	0.05
						TDS	70300	-	21	-	434.00	469.00	526.00	580.00	656.00	530.00	2.70	0.01
						TSS	00530	-	20	-	4.00	4.53	7.49	14.50	38.00	12.10	1.73	0.10
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	21	-	1.07	3.10	5.60	8.92	29.40	8.62	1.35	0.19
						VSS	00535	-	21	-	1.00	2.50	4.00	4.00	4.00	3.28	-4.30	0.00
CII	0103_01	10054	08/01/03	07/31/13	Canadian River Above Lake Meredith	Temperature	00010	95	73	0	0.00	10.60	17.30	22.80	33.50	16.49	0.84	0.41
						Conductivity	00094	-	0	-	-	-	-	-	-	-	-	-
						DO	00300	5.0	73	1	4.20	8.20	9.40	11.30	16.60	9.64	0.47	0.64
						pH	00400	6.5 - 9.0	73	0	7.80	8.10	8.20	8.40	9.00	8.25	2.30	0.02
						Ammonia	00610	0.33	0	-	-	-	-	-	-	-	-	-
						E.coli	31699	394	36	7	10	20	120	333	20000	1044	-0.47	0.64
						Chloride	00940	1050	25	6	47.40	539.00	858.00	1020.00	1710.00	792.91	0.04	0.97
						Chlorophyll-*a*	70953	14.1	0	-	-	-	-	-	-	-	-	-
						Nitrate	00610	1.95	0	-	-	-	-	-	-	-	-	-
						Nitrate+Nitrite	00630	-	0	-	-	-	-	-	-	-	-	-
						Phosphorus, Total	00665	0.69	18	2	0.01	0.02	0.12	0.20	8.13	0.76	2.28	0.04
						Sulfate	00945	540	25	9	34.60	276.00	438.00	615.00	939.00	438.33	0.34	0.74
						TDS	70300	4500	0	-	-	-	-	-	-	-	-	-
						TSS	00530	-	0	-	-	-	-	-	-	-	-	-
						TKN	00625	-	18	-	0.14	0.29	0.44	0.61	10.00	1.19	2.27	0.04
						Turbidity	82079	-	62	-	436.00	2277.50	3865.00	5137.50	8550.00	3758.84	1.59	0.12
						VSS	00535	-	0	-	-	-	-	-	-	-	-	-

Appendix A - Canadian River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet Code	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
CII	0103_02	10056	08/01/03	07/31/13	Canadian River Above Lake Meredith	Temperature	00010	95	37	0	0.20	3.80	11.40	21.60	32.60	12.82	-0.66	0.51
						Conductivity	00094	-	37	-	612.00	3250.00	4510.00	5440.00	6200.00	4153.84	1.65	0.11
						DO	00300	5.0	37	0	3.50	7.70	9.80	11.60	14.40	9.57	0.85	0.40
						pH	00400	6.5 - 9.0	37	0	7.20	7.98	8.15	8.40	8.60	8.11	-0.99	0.33
						Ammonia	00610	0.33	35	0	0.05	0.05	0.05	0.05	0.10	0.05	-0.57	0.57
						E.coli	31699	394	32	3	10	20	75	270	3400	281	-1.77	0.09
						Chloride	00940	1050	36	21	77.00	801.00	1180.00	1457.50	1710.00	1076.19	2.08	0.05
						Chlorophyll-*a*	70953	14.1	33	6	0.69	3.00	3.73	10.00	108.00	15.25	-1.27	0.21
						Nitrate	00610	1.95	5	0	0.10	0.10	0.15	0.43	0.46	0.25	-0.73	0.51
						Nitrate+Nitrite	00630	-	30	-	0.04	0.04	0.04	0.05	1.23	0.13	-0.75	0.46
						Phosphorus, Total	00665	0.69	34	4	0.04	0.06	0.06	0.15	19.00	1.19	-1.08	0.29
						Sulfate	00945	540	36	0	45.00	327.00	400.50	469.00	519.00	371.72	1.13	0.26
						TDS	70300	4500	31	0	852.00	2315.00	2840.00	3170.00	8350.00	2838.13	0.77	0.45
						TSS	00530	-	36	-	4.00	24.00	68.00	157.25	22200.00	1549.72	-0.82	0.42
						TKN	00625	-	33	-	0.20	0.22	0.28	0.37	128.00	4.83	-0.98	0.34
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	36	-	2.00	4.00	7.50	18.00	1750.00	117.81	-0.68	0.50
CII	0103_03	16344	08/01/03	07/31/13	Canadian River Above Lake Meredith	Temperature	00010	95	35	0	0.40	9.45	15.80	22.70	29.20	15.48	-0.23	0.82
						Conductivity	00094	-	35	-	1280.00	8100.00	9660.00	9965.00	11100.00	8635.14	1.15	0.26
						DO	00300	5.0	35	0	7.10	8.40	9.80	10.45	12.40	9.61	0.89	0.38
						pH	00400	6.5 - 9.0	35	0	7.20	8.00	8.20	8.30	8.40	8.10	-0.37	0.72
						Ammonia	00610	0.33	34	0	0.05	0.05	0.05	0.05	0.05	0.05	-	-
						E.coli	31699	394	32	1	4	10	17	62	1100	69	0.92	0.36
						Chloride	00940	1050	34	33	278.00	2260.00	2845.00	3005.00	3370.00	2544.35	1.16	0.25
						Chlorophyll-*a*	70953	14.1	32	1	0.23	3.00	3.40	10.00	16.50	5.92	-2.91	0.01
						Nitrate	00610	1.95	5	0	0.10	0.15	0.20	0.20	0.35	0.20	2.58	0.06
						Nitrate+Nitrite	00630	-	29	-	0.04	0.08	0.16	0.28	0.59	0.19	0.19	0.85
						Phosphorus, Total	00665	0.69	34	1	0.02	0.05	0.06	0.06	1.57	0.10	0.65	0.52
						Sulfate	00945	540	34	0	89.00	425.50	481.00	518.25	617.00	451.68	0.28	0.78
						TDS	70300	4500	26	20	2260.00	4570.00	5440.00	5727.50	6320.00	5001.92	0.39	0.70
						TSS	00530	-	35	-	4.00	9.00	17.00	39.00	8430.00	268.54	0.75	0.46
						TKN	00625	-	31	-	0.16	0.20	0.24	0.32	4.09	0.40	0.83	0.41
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	35	-	2.00	4.00	4.00	5.00	633.00	23.29	0.77	0.44
CII	0103A_01	10017	08/01/03	07/31/13	East Amarillo Creek	Temperature	00010	95	6	0	-0.30	8.95	12.00	13.55	14.90	10.10	0.14	0.90
						Conductivity	00094	-	6	-	254.00	616.25	1099.00	2415.00	3650.00	1568.50	2.26	0.07
						DO	00300	5.0	6	0	7.80	8.00	8.65	9.68	12.70	9.27	-0.51	0.63
						pH	00400	6.5 - 9.0	6	0	7.80	7.85	8.05	8.18	8.30	8.03	-1.51	0.19
						Ammonia	00610	0.33	6	0	0.10	0.10	0.10	0.10	0.10	0.10	-	-
						E.coli	31699	394	6	4	100	285	590	978	2400	828	-0.70	0.52
						Chloride	00940	-	5	-	58.70	145.00	165.00	286.00	458.00	222.54	4.84	0.01
						Chlorophyll-*a*	70953	14.1	6	4	2.50	8.73	29.25	61.78	84.90	36.73	-2.10	0.09
						Nitrate	00610	1.95	1	0	0.07	0.07	0.07	0.07	0.07	0.07	-	-
						Nitrate+Nitrite	00630	-	3	-	0.54	55.77	111.00	149.50	188.00	99.85	29.82	0.00
						Phosphorus, Total	00665	0.69	6	0	0.06	0.07	0.10	0.10	0.17	0.10	-1.66	0.16
						Sulfate	00945	-	5	-	35.90	56.50	86.10	309.00	469.00	191.30	6.67	0.00
						TDS	70300	-	6	-	136.00	340.50	595.00	1656.50	2600.00	1032.00	2.45	0.06
						TSS	00530	-	5	-	3.30	7.00	14.00	44.00	47.10	23.08	-0.28	0.79
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	6	-	2.20	5.33	9.95	24.25	30.30	14.20	-0.74	0.50
						VSS	00535	-	5	-	2.50	6.00	6.20	6.60	10.00	6.26	-0.52	0.63

APPENDIX A - CANADIAN RIVER BASIN DESCRIPTIVE STATISTICS

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet Code	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
CII	0103A_01	10018	08/01/03	07/31/13	East Amarillo Creek	Temperature	00010	95	34	0	0.20	4.60	14.40	17.65	25.40	12.57	-0.49	0.63
						Conductivity	00094	-	34	-	367.00	642.25	982.00	1312.50	1900.00	1001.15	-0.06	0.95
						DO	00300	5.0	34	0	2.20	7.33	9.25	11.53	14.30	9.16	-0.65	0.52
						pH	00400	6.5 - 9.0	34	0	7.40	8.10	8.25	8.30	8.70	8.20	-0.63	0.53
						Ammonia	00610	0.33	33	0	0.04	0.10	0.10	0.12	0.78	0.13	0.30	0.76
						E.coli	31699	394	32	8	3	23	63	424	3448	362	-2.33	0.03
						Chloride	00940	-	32	-	30.90	69.18	148.50	185.75	355.00	149.06	1.06	0.30
						Chlorophyll-*a*	70953	14.1	33	13	2.00	3.70	7.90	31.50	124.00	23.32	-1.00	0.32
						Nitrate	00610	1.95	9	6	0.17	1.19	6.90	11.10	25.70	9.34	-0.45	0.66
						Nitrate+Nitrite	00630	-	22	-	0.24	1.43	5.95	13.10	44.80	9.52	0.61	0.55
						Phosphorus, Total	00665	0.69	33	6	0.06	0.17	0.21	0.55	3.15	0.45	0.09	0.93
						Sulfate	00945	-	32	-	22.60	50.33	84.65	136.25	206.00	91.93	-0.60	0.55
						TDS	70300	-	33	-	192.00	342.00	546.00	746.00	1850.00	608.91	-0.91	0.37
						TSS	00530	-	32	-	4.00	8.75	25.10	44.25	438.00	41.09	-0.11	0.91
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	33	-	6.40	10.90	20.10	43.70	499.00	53.01	-1.57	0.13
						VSS	00535	-	32	-	1.00	4.00	5.50	8.25	46.00	8.14	-1.50	0.14
CII	0103A_02	15775	08/01/03	07/31/13	East Amarillo Creek	Temperature	00010	95	31	0	1.60	7.45	15.00	20.90	26.00	14.64	0.61	0.54
						Conductivity	00094	-	31	-	143.00	372.50	523.00	804.50	1490.00	623.74	-1.65	0.11
						DO	00300	5.0	31	2	3.30	6.45	8.20	10.75	15.70	8.74	0.12	0.91
						pH	00400	6.5 - 9.0	31	1	7.90	8.20	8.50	8.65	9.10	8.46	0.56	0.58
						Ammonia	00610	0.33	31	2	0.02	0.10	0.10	0.15	0.46	0.14	0.96	0.35
						E.coli	31699	394	31	3	3	21	55	170	2400	252	-0.92	0.37
						Chloride	00940	-	30	-	9.92	42.65	68.60	122.75	284.00	94.85	-1.30	0.20
						Chlorophyll-*a*	70953	14.1	31	28	2.65	36.15	57.40	97.50	252.00	72.51	2.31	0.03
						Nitrate	00610	1.95	11	0	0.02	0.04	0.04	0.13	0.17	0.08	-1.41	0.19
						Nitrate+Nitrite	00630	-	18	-	0.02	0.04	0.09	0.26	0.60	0.16	-2.88	0.01
						Phosphorus, Total	00665	0.69	31	0	0.09	0.16	0.19	0.23	0.42	0.20	1.02	0.31
						Sulfate	00945	-	30	-	6.50	23.55	33.95	64.25	141.00	45.47	-1.70	0.10
						TDS	70300	-	31	-	79.00	209.50	284.00	423.50	781.00	328.10	-1.37	0.18
						TSS	00530	-	30	-	8.40	22.10	26.70	31.00	46.00	26.83	1.49	0.15
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	31	-	7.53	17.05	19.20	22.55	37.00	21.10	-0.05	0.96
						VSS	00535	-	31	-	5.00	9.00	11.40	14.00	31.30	12.24	1.49	0.15
CII	0103A	21024	08/01/03	07/31/13	East Amarillo Creek	Temperature	00010	95	4	0	2.00	11.83	15.20	15.60	16.50	12.23	0.33	0.76
						Conductivity	00094	-	4	-	225.00	411.00	595.00	735.75	792.00	551.75	-0.99	0.39
						DO	00300	5.0	4	0	5.40	6.68	7.35	8.55	11.40	7.88	-0.52	0.64
						pH	00400	6.5 - 9.0	4	0	7.60	7.83	8.05	8.23	8.30	8.00	-8.48	0.00
						Ammonia	00610	0.33	4	0	0.10	0.10	0.10	0.13	0.23	0.13	0.11	0.92
						E.coli	31699	394	4	1	65	136	180	253	410	209	0.10	0.92
						Chloride	00940	-	3	-	58.00	81.50	105.00	131.50	158.00	107.00	0.53	0.65
						Chlorophyll-*a*	70953	14.1	4	4	19.20	22.80	64.00	109.75	127.00	68.55	-2.26	0.11
						Nitrate	00610	1.95	1	0	0.04	0.04	0.04	0.04	0.04	0.04	-	-
						Nitrate+Nitrite	00630	-	1	-	0.02	0.02	0.02	0.02	0.02	0.02	-	-
						Phosphorus, Total	00665	0.69	4	0	0.08	0.14	0.17	0.19	0.23	0.16	-1.15	0.33
						Sulfate	00945	-	3	-	29.20	30.20	31.20	32.40	33.60	31.33	-0.65	0.58
						TDS	70300	-	4	-	88.00	220.00	291.00	341.00	410.00	270.00	-1.47	0.24
						TSS	00530	-	3	-	17.00	21.50	26.00	27.50	29.00	24.00	-0.25	0.83
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	4	-	4.10	8.38	10.40	13.25	20.00	11.23	-1.01	0.38
						VSS	00535	-	4	-	5.00	5.23	6.65	9.25	13.00	7.83	-1.95	0.15

Appendix A - Canadian River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet Code	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
CII	0103C_01	17056	08/01/03	07/31/13	Unnamed Tributary to West Amarillo Creek	Temperature	00010	95	29	0	1.90	5.78	12.70	16.65	23.50	12.52	0.92	0.37
						Conductivity	00094	-	28	-	212.00	458.25	722.00	819.25	926.00	635.50	1.06	0.30
						DO	00300	5.0	28	0	4.10	7.03	8.30	9.43	12.50	8.27	-0.18	0.86
						pH	00400	6.5 - 9.0	28	0	7.80	7.90	8.00	8.13	8.80	8.05	1.52	0.14
						Ammonia	00610	0.33	28	0	0.02	0.10	0.10	0.10	0.10	0.09	4.08	0.00
						E.coli	31699	394	28	5	5	21	60	303	2400	338	-0.68	0.50
						Chloride	00940	-	27	-	12.40	45.70	63.40	78.60	136.00	64.69	2.15	0.04
						Chlorophyll-*a*	70953	14.1	27	9	2.00	3.50	6.20	23.90	115.00	21.39	-0.69	0.50
						Nitrate	00610	1.95	9	0	0.04	0.04	0.04	0.17	0.36	0.12	-1.02	0.34
						Nitrate+Nitrite	00630	-	17	-	0.02	0.04	0.12	0.19	0.90	0.20	-2.02	0.06
						Phosphorus, Total	00665	0.69	28	0	0.06	0.06	0.12	0.19	0.35	0.13	-2.78	0.01
						Sulfate	00945	-	27	-	9.45	21.00	29.10	33.65	59.70	28.32	2.61	0.01
						TDS	70300	-	28	-	68.00	260.75	343.00	478.00	566.00	349.36	1.05	0.30
						TSS	00530	-	27	-	3.00	5.00	13.00	35.20	101.00	22.69	-1.55	0.13
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	28	-	2.60	4.18	11.35	33.85	72.70	21.15	-1.57	0.13
						VSS	00535	-	27	-	1.00	4.00	4.00	9.40	27.00	6.71	-0.37	0.71
CIII	0105_01	10060	08/01/03	07/31/13	Rita Blanca Lake	Temperature	00010	85	27	0	2.70	6.75	16.40	22.70	26.50	15.02	0.29	0.78
						Conductivity	00094	-	27	-	946.00	1080.00	1280.00	1435.00	2310.00	1324.07	2.16	0.04
						DO	00300	3.0	26	1	0.00	8.53	10.35	13.70	20.40	11.03	-0.60	0.55
						pH	00400	6.5 - 9.0	27	21	8.10	9.25	9.70	10.40	10.90	9.69	0.35	0.73
						Ammonia	00610	0.11	23	15	0.06	0.09	0.17	1.00	5.54	1.01	-1.21	0.24
						E.coli	31699	394	26	1	2	10	20	63	640	74	-0.33	0.74
						Chloride	00940	200	25	8	127.00	155.00	173.00	214.00	353.00	198.92	2.37	0.03
						Chlorophyll-*a*	70953	26.7	24	23	16.00	306.25	847.00	1325.00	2440.00	926.35	1.11	0.28
						Nitrate	00610	0.37	6	4	0.05	0.21	0.73	1.62	2.02	0.91	0.69	0.52
						Nitrate+Nitrite	00630	-	23	-	1.60	1.94	3.16	4.44	9.08	3.52	1.56	0.13
						Phosphorus, Total	00665	0.20	23	23	1.60	1.94	3.16	4.44	9.08	3.52	1.56	0.13
						Sulfate	00945	200	25	0	49.00	66.00	85.00	94.00	159.00	87.52	2.96	0.01
						TDS	70300	1000	17	3	590.00	764.00	804.00	885.00	1130.00	821.94	0.93	0.36
						TSS	00530	-	25	-	101.00	198.00	268.00	360.00	810.00	300.28	1.01	0.32
						TKN	00625	-	6	-	0.05	0.06	0.13	0.24	0.28	0.15	0.69	0.52
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	24	-	68.00	140.50	204.00	261.25	550.00	227.00	0.38	0.70
CIV	0199A_01	10005	08/01/03	07/31/13	Palo Duro Reservoir	Temperature	00010	85	18	0	2.60	4.55	22.40	26.78	30.10	16.56	0.53	0.60
						Conductivity	00094	-	18	-	214.00	253.25	302.50	337.50	394.00	299.39	0.55	0.59
						DO	00300	3.0	18	0	4.90	6.80	8.00	11.75	12.90	8.89	-0.17	0.87
						pH	00400	6.5 - 9.0	16	0	7.70	8.08	8.30	8.40	8.60	8.20	-0.15	0.88
						Ammonia	00610	0.11	16	0	0.05	0.05	0.07	0.13	0.87	0.17	-0.31	0.76
						E.coli	31699	394	14	1	1	1	5	10	1200	92	1.80	0.09
						Chloride	00940	-	16	-	5.00	15.00	30.00	63.75	169.00	46.63	1.92	0.07
						Chlorophyll-*a*	70953	26.7	18	6	5.11	10.88	19.55	30.25	107.00	28.57	-0.11	0.91
						Nitrate	00610	0.37	2	0	0.05	0.07	0.09	0.10	0.12	0.09	-	-
						Nitrate+Nitrite	00630	-	16	-	0.04	0.04	0.20	0.59	1.27	0.35	-0.49	0.63
						Phosphorus, Total	00665	0.20	17	10	0.09	0.15	0.24	0.47	0.73	0.33	0.21	0.84
						Sulfate	00945	-	18	-	2.00	4.00	7.00	12.75	25.00	8.50	2.22	0.04
						TDS	70300	-	14	-	163.00	197.00	215.00	249.00	401.00	229.86	0.06	0.96
						TSS	00530	-	17	-	5.00	15.00	30.00	62.00	169.00	45.65	1.65	0.12
						TKN	00625	-	16	-	0.75	0.88	1.31	1.57	2.79	1.41	-0.36	0.73
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	17	-	5.00	5.00	7.00	11.00	19.00	8.53	-0.74	0.47

Appendix A - Canadian River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet Code	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
CV	0104_02	10058	08/01/03	07/31/13	Wolf Creek	Temperature	00010	93	36	0	3.60	7.60	17.80	23.93	32.80	16.78	-0.03	0.98
						Conductivity	00094	-	36	-	714.00	821.75	844.50	1597.50	2020.00	1171.67	-0.80	0.43
						DO	00300	5.0	36	0	3.10	8.03	9.55	11.10	14.20	9.36	-0.46	0.65
						pH	00400	6.5 - 9.0	36	0	7.60	7.98	8.00	8.10	8.50	8.03	0.09	0.93
						Ammonia	00610	0.33	36	0	0.02	0.03	0.10	0.10	0.10	0.08	6.21	0.00
						E.coli	31699	394	36	4	5	32	84	184	1300	166	-0.88	0.39
						Chloride	00940	420	35	1	88.10	103.00	125.00	340.00	475.00	214.74	-0.87	0.39
						Chlorophyll-*a*	70953	14.1	36	5	2.00	2.22	5.00	7.18	40.30	7.48	0.77	0.44
						Nitrate	00610	1.95	12	0	0.02	0.04	0.04	0.04	0.08	0.04	3.42	0.01
						Nitrate+Nitrite	00630	-	23	-	0.02	0.02	0.04	0.04	0.19	0.04	0.32	0.75
						Phosphorus, Total	00665	0.69	36	0	0.06	0.06	0.09	0.11	0.39	0.10	-1.23	0.23
						Sulfate	00945	125	35	0	22.70	40.75	48.30	69.20	90.00	54.77	-0.43	0.67
						TDS	70300	1125	36	1	386.00	474.75	532.50	842.25	1150.00	661.69	-0.82	0.42
						TSS	00530	-	36	-	2.00	4.00	6.00	13.70	118.00	12.15	1.18	0.25
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	36	-	1.00	2.17	3.59	7.91	86.40	7.48	1.20	0.24
						VSS	00535	-	36	-	1.00	3.00	4.00	4.00	22.00	4.36	-0.33	0.74
CV	0104_01	10059	08/01/03	07/31/13	Wolf Creek	Temperature	00010	93	31	0	0.40	6.85	17.40	22.30	35.70	16.44	0.22	0.83
						Conductivity	00094	-	31	-	663.00	1100.00	1220.00	1445.00	1650.00	1247.23	1.02	0.31
						DO	00300	5.0	31	0	4.60	8.45	10.20	11.60	13.30	9.98	-0.03	0.98
						pH	00400	6.5 - 9.0	31	0	7.70	8.00	8.30	8.30	8.50	8.19	0.44	0.66
						Ammonia	00610	0.33	39	0	0.02	0.03	0.08	0.10	0.10	0.07	6.05	0.00
						E.coli	31699	394	31	1	2	14	39	101	410	74	-0.08	0.93
						Chloride	00940	420	31	0	78.00	187.00	204.00	285.50	354.00	225.65	1.01	0.32
						Chlorophyll-*a*	70953	14.1	31	0	2.00	2.00	2.30	5.00	10.00	3.48	-6.70	0.00
						Nitrate	00610	1.95	0	0	-	-	-	-	-	-	-	-
						Nitrate+Nitrite	00630	-	31	-	0.02	0.02	0.04	0.05	1.80	0.15	-1.14	0.27
						Phosphorus, Total	00665	0.69	31	0	0.06	0.06	0.08	0.10	0.25	0.09	-0.46	0.65
						Sulfate	00945	125	31	0	20.80	63.48	74.45	78.63	94.00	69.79	-3.29	0.00
						TDS	70300	1125	31	0	480.00	646.50	712.00	785.50	950.00	717.74	1.63	0.11
						TSS	00530	-	31	-	1.00	4.00	4.00	4.00	9.00	4.28	-0.59	0.56
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	31	-	0.60	0.95	1.80	2.85	7.14	2.12	1.54	0.13
						VSS	00535	-	31	-	1.00	4.00	4.00	4.00	4.00	3.37	-5.42	0.00
CV	0104_03	17465	08/01/03	07/31/13	Wolf Creek	Temperature	00010	93	27	0	3.10	5.35	18.50	26.75	28.90	16.72	0.54	0.59
						Conductivity	00094	-	27	0	249.00	409.50	450.00	528.00	716.00	458.96	3.14	0.00
						DO	00300	5.0	27	0	4.90	7.35	8.00	11.55	12.40	9.00	0.87	0.39
						pH	00400	6.5 - 9.0	27	0	7.50	8.10	8.40	8.55	9.00	8.34	2.54	0.02
						Ammonia	00610	0.33	28	0	0.05	0.05	0.05	0.05	0.31	0.06	-0.61	0.55
						E.coli	31699	394	25	0	1	1	4	8	80	8	0.68	0.50
						Chloride	00940	420	27	0	6.00	15.50	21.00	31.50	40.00	22.67	3.46	0.00
						Chlorophyll-*a*	70953	14.1	27	19	3.42	18.50	23.40	45.70	229.00	40.24	3.64	0.00
						Nitrate	00610	1.95	5	0	0.05	0.05	0.05	0.05	0.14	0.07	-0.57	0.60
						Nitrate+Nitrite	00630	-	23	-	0.04	0.04	0.04	0.04	0.28	0.07	-1.41	0.17
						Phosphorus, Total	00665	0.69	25	0	0.05	0.08	0.10	0.27	0.81	0.19	3.36	0.00
						Sulfate	00945	125	27	0	5.00	11.00	13.00	15.00	31.00	13.89	1.45	0.16
						TDS	70300	1125	22	0	202.00	246.00	287.00	309.50	380.00	280.68	1.07	0.30
						TSS	00530	-	26	-	7.00	11.00	20.00	33.00	122.00	27.44	3.02	0.01
						TKN	00625	-	25	-	0.55	0.82	1.02	1.23	3.98	1.23	3.33	0.00
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	27	-	3.00	4.00	6.00	10.00	33.00	8.89	4.45	0.00

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RI	0201_01	10123	08/01/03	07/31/13	Lower Red River	Temperature	00010	93	37	0	6.40	12.60	20.30	24.40	32.80	19.06	-0.07	0.95
						Conductivity	00094	-	37	-	163.00	726.00	984.00	1320.00	1560.00	996.11	-1.97	0.06
						DO	00300	5.0	36	5	6.30	7.55	8.75	9.90	13.30	8.89	-0.17	0.87
						pH	00400	6.5-9.0	37	0	7.10	7.70	7.90	8.10	8.40	7.89	-1.61	0.12
						Ammonia	00610	0.33	35	1	0.05	0.05	0.05	0.10	0.45	0.10	-0.72	0.48
						E.coli	31699	394	35	4	4	12	46	125	2400	236	2.34	0.03
						Chloride	00940	375	34	0	6.00	92.00	141.00	218.75	302.00	151.50	-1.78	0.08
						Chlorophyll-*a*	70953	14.1	32	23	4.10	17.25	29.70	40.63	78.60	30.23	0.55	0.59
						Nitrate	00610	1.95	4	0	0.05	0.05	0.05	0.05	0.05	0.05	-	-
						Nitrate+Nitrite	00630	-	30	-	0.04	0.04	0.04	0.14	0.54	0.12	0.57	0.57
						Phosphorus, Total	00665	0.69	32	0	0.09	0.13	0.14	0.17	0.32	0.15	0.95	0.35
						Sulfate	00945	250	35	0	11.00	98.00	145.00	174.50	229.00	135.40	-1.61	0.12
						TDS	70300	1100	26	0	170.00	492.00	615.00	808.00	938.00	635.08	-1.95	0.06
						TSS	00530	-	35	-	15.00	29.00	42.00	88.50	257.00	68.20	0.20	0.84
						TKN	00625	-	34	-	0.31	0.85	1.08	1.23	1.55	1.04	-0.29	0.77
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	35	-	7.00	9.00	11.00	12.00	27.00	11.43	0.42	0.67
RI	0201A_01	15319	08/01/03	07/31/13	Mud Creek	Temperature	00010	93	20	-	1.80	13.90	18.10	24.23	26.80	17.69	-0.61	0.55
						Conductivity	00094	-	20	-	38.00	112.00	150.50	199.75	316.00	159.25	-0.19	0.85
						DO	00300	5.0	20	12	0.60	1.20	3.60	6.83	12.10	4.30	0.86	0.40
						pH	00400	6.5-9.0	20	0	6.60	6.78	6.95	7.63	8.20	7.18	0.25	0.81
						Ammonia	00610	0.33	22	6	0.02	0.10	0.17	0.40	3.34	0.50	1.92	0.07
						E.coli	31699	394	20	11	4	105	440	1616	3700	966	-0.22	0.83
						Chloride	00940	-	22	-	3.76	10.00	15.00	22.50	50.00	17.06	-0.62	0.54
						Chlorophyll-*a*	70953	14.1	21	9	2.00	4.82	14.30	48.35	90.20	29.41	1.15	0.26
						Nitrate	00610	1.95	3	0	0.04	0.04	0.04	0.08	0.11	0.06	-1.38	0.30
						Nitrate+Nitrite	00630	-	17	-	0.02	0.02	0.04	0.04	0.22	0.05	0.13	0.90
						Phosphorus, Total	00665	0.69	22	3	0.10	0.29	0.37	0.50	1.45	0.48	0.59	0.56
						Sulfate	00945	-	22	-	2.53	10.00	10.00	12.20	35.00	12.95	-0.07	0.94
						TDS	70300	-	21	-	52.00	93.00	115.50	144.50	196.00	119.25	0.80	0.44
						TSS	00530	-	22	-	4.00	9.00	11.00	23.30	35.00	16.06	4.79	0.00
						TKN	00625	-	2	-	1.33	1.40	1.47	1.54	1.61	1.47	-	-
						Turbidity	82079	-	20	-	6.90	12.65	21.20	31.30	70.00	25.28	3.70	0.00
						VSS	00535	-	21	-	2.50	4.00	6.50	7.40	14.00	6.59	1.72	0.10
RI	0201A_01	18515	08/01/03	07/31/13	Mud Creek	Temperature	00010	93	0	-	-	-	-	-	-	-	-	-
						Conductivity	00094	-	0	-	-	-	-	-	-	-	-	-
						DO	00300	5.0	0	-	-	-	-	-	-	-	-	-
						pH	00400	6.5-9.0	0	-	-	-	-	-	-	-	-	-
						Ammonia	00610	0.33	0	-	-	-	-	-	-	-	-	-
						E.coli	31699	394	22	2	11	53	110	178	2400	268	2.18	0.04
						Chloride	00940	-	0	-	-	-	-	-	-	-	-	-
						Chlorophyll-*a*	70953	14.1	0	-	-	-	-	-	-	-	-	-
						Nitrate	00610	1.95	0	-	-	-	-	-	-	-	-	-
						Nitrate+Nitrite	00630	-	0	-	-	-	-	-	-	-	-	-
						Phosphorus, Total	00665	0.69	0	-	-	-	-	-	-	-	-	-
						Sulfate	00945	-	0	-	-	-	-	-	-	-	-	-
						TDS	70300	-	0	-	-	-	-	-	-	-	-	-
						TSS	00530	-	0	-	-	-	-	-	-	-	-	-
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	0	-	-	-	-	-	-	-	-	-

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RI	0202_01	10125	08/01/03	07/31/13	Red River Below Lake Texoma	Temperature	00010	93	39	0	4.80	12.45	19.20	27.00	32.40	19.07	1.23	0.22
						Conductivity	00094	-	39	-	190.00	779.00	1270.00	1385.00	1940.00	1101.64	-1.50	0.14
						DO	00300	5.0	37	0	5.50	7.60	9.60	10.80	12.70	9.44	0.24	0.81
						pH	00400	6.5-9.0	39	0	7.40	7.80	8.10	8.20	8.60	8.04	1.18	0.25
						Ammonia	00610	0.33	26	0	0.05	0.05	0.10	0.10	0.10	0.08	11.50	0.00
						E.coli	31699	394	32	1	1	4	13	49	1100	79	0.67	0.51
						Chloride	00940	375	35	1	19.30	90.80	162.00	264.00	400.00	178.75	-1.23	0.23
						Chlorophyll-*a*	70953	14.1	10	5	6.90	18.70	18.70	19.80	28.10	18.62	-0.19	0.85
						Nitrate	00610	1.95	14	0	0.04	0.04	0.10	0.20	0.86	0.20	0.12	0.90
						Nitrate+Nitrite	00630	-	13	-	0.02	0.04	0.04	0.04	0.10	0.04	0.57	0.58
						Phosphorus, Total	00665	0.69	26	0	0.06	0.08	0.11	0.17	0.58	0.15	0.01	0.99
						Sulfate	00945	250	35	0	20.90	83.65	145.00	197.00	250.00	141.67	-0.52	0.61
						TDS	70300	1100	27	0	202.00	410.00	648.00	880.00	1040.00	652.81	-1.18	0.25
						TSS	00530	-	27	-	17.00	28.40	37.00	60.20	371.00	63.15	-0.45	0.66
						TKN	00625	-	8	-	0.72	0.76	0.85	0.97	1.10	0.88	-3.13	0.02
						Turbidity	82079	-	19	-	10.00	20.45	24.00	45.85	534.00	66.34	-0.74	0.47
						VSS	00535	-	26	-	5.00	7.00	8.00	12.05	40.00	10.67	0.01	0.99
RI	0202_03	10126	08/01/03	07/31/13	Red River Below Lake Texoma	Temperature	00010	93	40	0	3.90	12.18	20.60	26.88	31.20	19.40	0.46	0.65
						Conductivity	00094	-	40	-	210.00	964.25	1305.00	1620.00	2030.00	1293.93	-1.63	0.11
						DO	00300	5.0	40	0	5.30	7.45	9.85	11.35	13.90	9.69	0.81	0.43
						pH	00400	6.5-9.0	40	0	7.60	8.00	8.20	8.40	8.60	8.17	1.02	0.32
						Ammonia	00610	0.33	35	0	0.05	0.05	0.10	0.10	0.20	0.08	8.70	0.00
						E.coli	31699	394	30	3	1	6	16	96	4800	243	1.65	0.11
						Chloride	00940	375	44	4	12.90	141.75	238.00	314.75	431.00	235.48	-1.47	0.15
						Chlorophyll-*a*	70953	14.1	30	16	3.20	9.83	15.25	20.95	69.40	19.15	-0.35	0.73
						Nitrate	00610	1.95	17	0	0.04	0.04	0.05	0.20	1.06	0.17	1.28	0.22
						Nitrate+Nitrite	00630	-	19	-	0.02	0.04	0.04	0.25	0.34	0.13	-0.08	0.94
						Phosphorus, Total	00665	0.69	35	1	0.05	0.06	0.09	0.12	1.02	0.14	1.65	0.11
						Sulfate	00945	250	44	1	16.40	115.75	191.00	225.00	277.00	172.85	-1.01	0.32
						TDS	70300	1100	36	2	148.00	553.75	868.00	1022.50	1290.00	790.11	-1.41	0.17
						TSS	00530	-	36	-	6.00	24.25	33.00	54.55	929.00	69.98	1.69	0.10
						TKN	00625	-	17	-	0.41	0.55	0.63	0.77	0.98	0.65	0.59	0.56
						Turbidity	82079	-	19	-	9.50	17.90	25.00	44.70	850.00	88.90	1.43	0.17
						VSS	00535	-	35	-	2.00	5.00	6.60	8.55	87.70	9.53	1.90	0.07
RI	0202_04	10127	08/01/03	07/31/13	Red River Below Lake Texoma	Temperature	00010	93	40	0	5.20	10.90	20.40	26.03	29.20	18.94	-0.43	0.67
						Conductivity	00094	-	40	-	604.00	1235.00	1590.00	1722.50	2090.00	1501.65	-1.13	0.26
						DO	00300	5.0	40	0	6.00	8.48	9.85	11.53	13.50	9.86	1.13	0.27
						pH	00400	6.5-9.0	40	0	7.70	8.00	8.15	8.30	8.60	8.17	1.10	0.28
						Ammonia	00610	0.33	37	0	0.02	0.05	0.10	0.10	0.13	0.08	4.06	0.00
						E.coli	31699	394	40	3	1	15	31	73	24000	732	-0.73	0.47
						Chloride	00940	375	39	4	68.40	215.50	295.00	332.50	435.00	275.14	-1.42	0.16
						Chlorophyll-*a*	70953	14.1	38	12	2.00	7.60	10.10	19.50	42.30	14.11	-0.71	0.48
						Nitrate	00610	1.95	12	0	0.04	0.15	0.29	0.54	0.90	0.36	0.36	0.72
						Nitrate+Nitrite	00630	-	27	-	0.02	0.16	0.25	0.44	2.11	0.40	2.12	0.04
						Phosphorus, Total	00665	0.69	37	0	0.06	0.08	0.11	0.17	0.94	0.15	0.59	0.56
						Sulfate	00945	250	39	10	69.20	165.00	222.00	249.00	290.00	208.52	-0.08	0.93
						TDS	70300	1100	39	6	355.00	714.00	921.00	1060.00	1250.00	883.33	-0.58	0.56
						TSS	00530	-	39	-	3.00	8.50	13.20	24.00	636.00	37.22	1.59	0.12
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	40	-	3.10	6.49	9.00	17.43	550.00	30.60	1.37	0.18
						VSS	00535	-	39	-	1.00	4.00	4.00	6.00	82.90	7.30	1.16	0.26

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RI	0202_05	13684	08/01/03	07/31/13	Red River Below Lake Texoma	Temperature	00010	93	23	0	6.60	10.35	19.00	23.80	27.90	17.26	-0.15	0.88
						Conductivity	00094	-	8	-	780.00	1179.25	1835.00	2130.00	2190.00	1632.13	-6.50	0.00
						DO	00300	5.0	23	1	0.60	7.30	8.20	12.65	14.60	9.60	-0.88	0.39
						pH	00400	6.5-9.0	23	0	7.00	7.70	8.10	8.20	8.60	7.99	-0.01	1.00
						Ammonia	00610	0.33	0	-	-	-	-	-	-	-	-	-
						E.coli	31699	394	0	-	-	-	-	-	-	-	-	-
						Chloride	00940	375	8	5	103.00	198.75	414.50	452.50	464.00	331.13	-5.18	0.00
						Chlorophyll-*a*	70953	14.1	0	-	-	-	-	-	-	-	-	-
						Nitrate	00610	1.95	0	-	-	-	-	-	-	-	-	-
						Nitrate+Nitrite	00630	-	0	-	-	-	-	-	-	-	-	-
						Phosphorus, Total	00665	0.69	0		-	-	-	-	-	-	-	-
						Sulfate	00945	250	8	4	95.10	151.25	254.50	278.50	293.00	216.26	-5.63	0.00
						TDS	70300	1100	0	-	-	-	-	-	-	-	-	-
						TSS	00530	-	0	-	-	-	-	-	-	-	-	-
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	0	-	-	-	-	-	-	-	-	-
RI	0202_05	15779	08/01/03	07/31/13	Red River Below Lake Texoma	Temperature	00010	93	11	0	5.70	13.50	20.90	24.45	31.30	19.29	0.44	0.67
						Conductivity	00094	-	11	-	430.00	1059.00	1260.00	1515.00	1720.00	1253.09	0.72	0.49
						DO	00300	5.0	11	0	5.50	7.90	8.80	9.75	12.10	8.89	-0.96	0.36
						pH	00400	6.5-9.0	11	0	7.60	8.00	8.10	8.20	8.30	8.06	-1.63	0.13
						Ammonia	00610	0.33	11	0	0.05	0.05	0.05	0.05	0.12	0.06	-1.31	0.22
						E.coli	31699	394	9	1	2	10	13	39	2000	239	1.99	0.08
						Chloride	00940	375	11	0	151.00	195.00	237.00	287.00	343.00	242.27	1.46	0.18
						Chlorophyll-*a*	70953	14.1	10	6	10.00	12.55	17.90	24.23	39.80	20.70	3.22	0.01
						Nitrate	00610	1.95	5	0	0.05	0.05	0.05	0.05	0.06	0.05	-0.68	0.54
						Nitrate+Nitrite	00630	-	6	-	0.04	0.04	0.04	0.05	0.26	0.08	-1.50	0.19
						Phosphorus, Total	00665	0.69	11	0	0.08	0.10	0.11	0.15	0.63	0.16	1.65	0.13
						Sulfate	00945	250	11	1	115.00	155.50	188.00	203.50	259.00	181.27	1.08	0.30
						TDS	70300	1100	11	0	554.00	707.00	800.00	945.00	1060.00	815.82	1.16	0.27
						TSS	00530	-	11	-	21.00	29.00	44.00	54.50	465.00	80.27	1.66	0.13
						TKN	00625	-	11	-	0.52	0.78	0.85	0.90	1.95	0.92	2.04	0.07
						Turbidity	82079	-	11	-	0.00	-	-	-	0.00	-	-	-
						VSS	00535	-	11	-	6.00	7.50	8.00	10.50	57.00	12.91	1.76	0.11
RI	0202_02	21031	08/01/03	07/31/13	Red River Below Lake Texoma	Temperature	00010	93	15	0	8.20	11.50	15.80	23.15	25.50	16.70	0.35	0.73
						Conductivity	00094	-	15	-	1390.00	1685.00	1790.00	1960.00	1990.00	1794.00	-3.59	0.00
						DO	00300	5.0	15	2	1.30	6.55	9.40	10.20	11.60	8.19	-0.30	0.77
						pH	00400	6.5-9.0	15	0	7.10	7.45	7.70	7.90	8.20	7.67	-0.35	0.73
						Ammonia	00610	0.33	15	0	0.10	0.10	0.10	0.11	0.29	0.13	-0.07	0.95
						E.coli	31699	394	14	1	1	3	9	20	490	48	0.31	0.76
						Chloride	00940	375	14	7	284.00	315.25	371.50	410.00	442.00	364.50	-4.26	0.00
						Chlorophyll-*a*	70953	14.1	13	0	2.80	3.00	4.80	5.70	6.40	4.39	1.36	0.20
						Nitrate	00610	1.95	8	0	0.05	0.10	0.12	0.16	0.20	0.12	-3.91	0.01
						Nitrate+Nitrite	00630	-	15	-	0.05	0.08	0.15	0.17	0.25	0.13	-0.28	0.79
						Phosphorus, Total	00665	0.69	15	0	0.04	0.04	0.06	0.09	0.13	0.07	0.55	0.59
						Sulfate	00945	250	14	8	221.00	229.25	279.50	304.50	334.00	271.71	-4.68	0.00
						TDS	70300	1100	15	5	870.00	1002.50	1070.00	1170.00	1310.00	1080.80	-4.45	0.00
						TSS	00530	-	15	-	2.50	2.60	2.90	4.95	77.50	9.53	0.18	0.86
						TKN	00625	-	11	-	0.44	0.55	0.60	0.64	0.88	0.61	4.22	0.00
						Turbidity	82079	-	14	-	1.90	2.54	3.15	4.02	70.00	8.61	0.16	0.87
						VSS	00535	-	15	-	2.50	2.50	2.50	2.50	9.50	3.21	0.29	0.78

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RI	0202A_01	15036	08/01/03	07/31/13	Bois D' Arc Creek	Temperature	00010	93	7	-	7.30	12.20	16.90	20.65	24.50	16.34	0.18	0.86
						Conductivity	00094	-	7	-	599.00	683.00	1110.00	1355.00	1400.00	1026.43	-0.10	0.93
						DO	00300	5.0	7	0	6.20	7.10	10.70	11.55	12.60	9.54	0.10	0.92
						pH	00400	6.5-9.0	7	0	7.80	8.05	8.10	8.20	8.30	8.10	-3.05	0.02
						Ammonia	00610	0.33	7	0	0.10	0.10	0.10	0.10	0.23	0.12	1.75	0.13
						E.coli	31699	394	7	3	10	49	270	690	820	368	-0.21	0.84
						Chloride	00940	-	7	-	17.80	28.95	67.10	86.15	183.00	71.16	-1.16	0.29
						Chlorophyll-*a*	70953	14.1	6	1	2.00	2.68	5.75	8.08	14.50	6.42	0.23	0.82
						Nitrate	00610	1.95	4	4	6.59	7.69	12.13	20.25	32.40	15.81	-0.98	0.40
						Nitrate+Nitrite	00630	-	3	-	7.16	19.28	31.40	33.20	35.00	24.52	-2.94	0.10
						Phosphorus, Total	00665	0.69	7	5	0.35	0.78	3.13	5.05	5.40	2.93	-0.05	0.96
						Sulfate	00945	-	7	-	51.30	59.15	100.00	118.50	244.00	107.23	-1.22	0.27
						TDS	70300	-	7	-	368.00	412.00	688.00	868.00	885.00	643.00	-0.15	0.88
						TSS	00530	-	7	-	5.80	7.50	11.00	12.45	25.00	11.67	-2.04	0.09
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	7	-	3.90	6.50	10.00	10.55	13.50	8.79	-0.83	0.44
						VSS	00535	-	6	-	2.50	2.50	2.50	2.50	5.00	2.92	-0.77	0.48
RI	0202A_01	15318	08/01/03	07/31/13	Bois D' Arc Creek	Temperature	00010	93	10	-	2.70	13.80	18.20	25.08	32.40	18.39	-0.42	0.68
						Conductivity	00094	-	10	-	128.00	361.00	440.50	558.75	997.00	483.40	-1.15	0.28
						DO	00300	5.0	10	0	6.90	8.13	8.80	9.98	13.20	9.37	0.67	0.52
						pH	00400	6.5-9.0	10	0	7.90	8.00	8.05	8.18	8.40	8.09	0.26	0.80
						Ammonia	00610	0.33	10	0	0.02	0.02	0.04	0.06	0.11	0.05	0.16	0.87
						E.coli	31699	394	10	2	34	51	104	358	24000	2745	0.74	0.48
						Chloride	00940	-	10	-	10.00	10.00	12.15	28.45	90.00	28.37	-1.26	0.24
						Chlorophyll-*a*	70953	14.1	8	0	2.00	5.00	5.15	10.60	11.00	6.84	1.12	0.30
						Nitrate	00610	1.95	0	-	-	-	-	-	-	-	-	-
						Nitrate+Nitrite	00630	-	10	-	0.02	0.07	0.23	0.36	1.04	0.28	1.18	0.27
						Phosphorus, Total	00665	0.69	10	1	0.06	0.12	0.15	0.27	1.74	0.33	0.80	0.44
						Sulfate	00945	-	10	-	10.00	21.25	27.65	49.10	123.00	44.84	-1.14	0.28
						TDS	70300	-	10	-	72.00	192.50	236.50	295.75	627.00	275.40	-1.04	0.33
						TSS	00530	-	10	-	4.00	12.75	34.00	147.25	1460.00	200.00	0.90	0.39
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	10	-	4.12	19.65	31.40	132.48	1220.00	180.43	0.93	0.38
						VSS	00535	-	10	-	4.00	4.00	7.00	16.48	146.00	22.43	0.90	0.39
RI	0202A_02	18652	08/01/03	07/31/13	Bois D' Arc Creek	Temperature	00010	93	27	-	1.80	9.35	17.40	25.20	28.80	16.97	0.51	0.62
						Conductivity	00094	-	26	-	127.00	463.25	578.50	651.50	1520.00	587.69	0.50	0.62
						DO	00300	5.0	26	0	5.60	6.73	8.10	10.20	13.60	8.57	-0.35	0.73
						pH	00400	6.5-9.0	26	0	7.60	7.73	7.90	7.98	8.20	7.87	-1.57	0.13
						Ammonia	00610	0.33	25	2	0.02	0.10	0.10	0.10	0.39	0.11	0.86	0.40
						E.coli	31699	394	19	6	2	45	96	255	5500	553	-0.86	0.40
						Chloride	00940	-	26	-	5.00	10.10	15.95	25.90	105.00	21.95	0.26	0.80
						Chlorophyll-*a*	70953	14.1	19	0	0.50	2.00	2.00	2.00	2.00	1.92	-0.73	0.47
						Nitrate	00610	1.95	12	2	0.04	0.04	0.31	0.55	2.44	0.61	0.08	0.94
						Nitrate+Nitrite	00630	-	15	-	0.02	0.04	0.07	0.63	3.59	0.58	1.34	0.20
						Phosphorus, Total	00665	0.69	25	1	0.06	0.06	0.08	0.10	1.64	0.17	-1.75	0.09
						Sulfate	00945	-	30	-	1.00	1.00	2.00	5.00	6.00	2.77	-0.64	0.53
						TDS	70300	-	26	-	1.48	3.93	7.73	14.95	1400.00	94.07	-1.72	0.10
						TSS	00530	-	26	-	2.50	4.93	7.00	13.60	1650.00	96.52	-1.71	0.10
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	25	-	1.00	2.00	4.00	4.00	128.00	9.66	-1.78	0.09

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RI	0202A_01	20167	08/01/03	07/31/13	Bois D' Arc Creek	Temperature	00010	93	33	-	2.50	10.00	17.10	26.50	32.70	18.03	-0.78	0.44
						Conductivity	00094	-	33	-	225.00	370.00	443.00	488.00	886.00	438.58	-0.70	0.49
						DO	00300	5.0	33	3	2.60	7.50	8.90	10.20	12.30	8.54	-2.14	0.04
						pH	00400	6.5-9.0	33	0	7.00	7.90	8.00	8.20	8.30	7.98	-2.09	0.04
						Ammonia	00610	0.33	32	1	0.06	0.10	0.10	0.10	0.50	0.12	1.28	0.21
						E.coli	31699	394	30	0	6	8	8	27	29	17	-4.86	0.00
						Chloride	00940	-	33	-	5.00	11.50	16.50	25.60	65.70	20.14	-0.93	0.36
						Chlorophyll-*a*	70953	14.1	33	0	1.00	1.00	3.00	3.00	3.80	2.30	11.44	0.00
						Nitrate	00610	1.95	20	0	0.04	0.05	0.05	0.09	1.02	0.13	0.19	0.85
						Nitrate+Nitrite	00630	-	24	-	0.04	0.05	0.05	0.09	1.39	0.18	0.79	0.44
						Phosphorus, Total	00665	0.69	32	0	0.02	0.06	0.12	0.20	0.62	0.16	-0.29	0.77
						Sulfate	00945	-	36	-	1.00	1.75	2.00	3.00	6.00	2.69	-1.15	0.26
						TDS	70300	-	33	-	3.40	6.50	17.40	55.10	516.00	45.15	-1.08	0.29
						TSS	00530	-	33	-	2.70	6.00	17.60	57.70	396.00	54.35	-0.14	0.89
						TKN	00625	-	17	-	0.57	0.77	0.92	1.00	1.58	0.95	-0.13	0.89
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	33	-	1.00	2.50	4.00	9.00	44.00	7.73	0.37	0.71
RI	0202A_01	21028	08/01/03	07/31/13	Bois D' Arc Creek	Temperature	00010	93	20	-	5.50	11.20	15.30	22.28	27.30	16.47	-0.34	0.74
						Conductivity	00094	-	20	-	175.00	330.50	414.50	511.25	660.00	416.35	-2.94	0.01
						DO	00300	5.0	20	8	0.40	2.53	5.70	8.53	13.00	5.52	0.85	0.41
						pH	00400	6.5-9.0	20	0	6.50	7.20	7.20	7.58	8.30	7.37	-0.19	0.85
						Ammonia	00610	0.33	20	4	0.10	0.10	0.10	0.12	3.07	0.30	-1.46	0.16
						E.coli	31699	394	20	6	27	38	102	523	2400	432	-0.61	0.55
						Chloride	00940	-	19	-	3.04	4.26	9.94	14.50	60.40	15.02	-3.49	0.00
						Chlorophyll-*a*	70953	14.1	18	9	3.00	4.63	16.30	31.80	116.00	24.16	1.65	0.12
						Nitrate	00610	1.95	12	2	0.05	0.05	0.16	0.66	2.39	0.56	-3.19	0.01
						Nitrate+Nitrite	00630	-	19	-	0.05	0.05	0.27	1.32	3.21	0.82	-2.68	0.02
						Phosphorus, Total	00665	0.69	20	4	0.03	0.09	0.12	0.26	2.46	0.45	-2.91	0.01
						Sulfate	00945	-	19	-	5.23	11.04	35.10	56.55	74.70	35.43	-2.80	0.01
						TDS	70300	-	20	-	138.00	217.50	277.50	316.75	430.00	278.50	-2.64	0.02
						TSS	00530	-	20	-	8.80	13.45	16.40	20.20	448.00	43.96	0.31	0.76
						TKN	00625	-	19	-	0.43	0.76	1.12	1.49	3.41	1.20	-1.08	0.29
						Turbidity	82079	-	18	-	10.40	12.25	14.30	31.48	180.00	33.53	0.33	0.74
						VSS	00535	-	20	-	2.50	4.00	5.70	6.91	54.00	8.56	0.29	0.77
RI	0202A_01	21029	08/01/03	07/31/13	Bois D' Arc Creek	Temperature	00010	93	18	-	3.80	10.88	14.45	24.33	28.10	16.69	0.23	0.82
						Conductivity	00094	-	18	-	265.00	366.75	456.50	532.25	1540.00	523.61	-0.55	0.59
						DO	00300	5.0	18	1	4.90	6.68	8.40	9.45	11.90	8.20	-0.95	0.36
						pH	00400	6.5-9.0	18	0	7.10	7.90	8.00	8.00	8.20	7.93	0.61	0.55
						Ammonia	00610	0.33	18	0	0.10	0.10	0.10	0.10	0.28	0.11	1.11	0.28
						E.coli	31699	394	18	4	1	42	89	295	2400	321	-1.38	0.19
						Chloride	00940	-	18	-	8.43	14.35	22.70	43.00	195.00	39.33	-0.57	0.58
						Chlorophyll-*a*	70953	14.1	17	5	3.00	3.00	8.60	20.30	79.60	15.63	0.14	0.89
						Nitrate	00610	1.95	12	0	0.05	0.05	0.05	0.15	0.90	0.17	-1.87	0.09
						Nitrate+Nitrite	00630	-	17	-	0.05	0.05	0.05	0.28	1.37	0.24	-0.42	0.68
						Phosphorus, Total	00665	0.69	18	1	0.03	0.08	0.18	0.21	0.71	0.19	-1.03	0.32
						Sulfate	00945	-	18	-	21.20	33.48	42.90	53.75	353.00	62.11	-1.43	0.17
						TDS	70300	-	18	-	194.00	285.00	299.50	334.50	1010.00	346.44	-0.69	0.50
						TSS	00530	-	18	-	2.50	11.08	19.40	53.05	176.00	46.86	-0.91	0.38
						TKN	00625	-	18	-	0.54	0.73	0.83	0.96	1.64	0.91	0.33	0.75
						Turbidity	82079	-	18	-	2.73	15.08	28.30	45.93	138.00	39.68	0.16	0.88
						VSS	00535	-	18	-	2.50	2.78	6.20	12.10	26.00	9.13	-1.05	0.31

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RI	0202C_01	16001	08/01/03	07/31/13	Pecan Bayou	Temperature	00010	93	36	-	2.40	11.83	18.35	25.53	32.50	18.11	-0.07	0.94
						Conductivity	00094	-	36	-	69.00	176.50	229.00	332.00	549.00	257.36	-0.87	0.39
						DO	00300	5.0	36	11	2.40	4.48	6.55	8.73	12.60	6.74	1.40	0.17
						pH	00400	6.5-9.0	36	0	6.50	7.10	7.40	7.70	8.10	7.41	2.56	0.01
						Ammonia	00610	0.33	34	1	0.02	0.10	0.10	0.10	0.58	0.11	-1.00	0.32
						E.coli	31699	394	36	5	2	25	80	228	3100	310	-0.15	0.88
						Chloride	00940	-	35	-	7.02	10.10	16.90	26.75	57.50	21.97	-2.14	0.04
						Chlorophyll-*a*	70953	14.1	32	6	2.00	3.10	5.00	9.93	60.80	9.75	1.22	0.23
						Nitrate	00610	1.95	11	0	0.04	0.04	0.04	0.04	0.14	0.05	0.79	0.45
						Nitrate+Nitrite	00630	-	24	-	0.02	0.04	0.05	0.14	0.68	0.12	0.15	0.89
						Phosphorus, Total	00665	0.69	34	0	0.06	0.09	0.12	0.16	0.34	0.14	-1.94	0.06
						Sulfate	00945	-	35	-	10.00	25.55	37.30	56.35	140.00	44.07	-0.68	0.50
						TDS	70300	-	35	-	10.00	114.00	154.00	205.00	446.00	169.66	-0.59	0.56
						TSS	00530	-	35	-	4.00	11.50	19.00	25.00	90.00	22.95	1.25	0.22
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	36	-	11.30	26.68	37.60	46.40	166.00	45.24	0.02	0.98
						VSS	00535	-	34	-	2.00	4.00	4.00	5.75	12.40	4.81	-0.24	0.82
RI	0202D_01	10120	08/01/03	07/31/13	Pine Creek	Temperature	00010	93	39	-	6.30	11.60	18.20	26.40	28.90	18.42	-0.50	0.62
						Conductivity	00094	-	39	-	83.00	128.50	243.00	692.00	1467.00	426.28	-2.44	0.02
						DO	00300	5.0	39	15	1.10	4.10	5.80	7.40	12.50	6.01	0.42	0.68
						pH	00400	6.5-9.0	39	0	6.90	7.30	7.40	7.60	8.20	7.49	1.20	0.24
						Ammonia	00610	0.33	37	1	0.02	0.09	0.10	0.10	0.35	0.11	-0.61	0.55
						E.coli	31699	394	39	5	5	39	75	150	830	139	-0.74	0.46
						Chloride	00940	-	38	-	4.62	10.00	13.00	55.68	189.00	37.18	-2.08	0.04
						Chlorophyll-*a*	70953	14.1	31	8	2.00	6.30	10.50	18.25	124.00	18.23	-0.34	0.74
						Nitrate	00610	1.95	12	0	0.02	0.04	0.06	0.20	0.28	0.11	0.49	0.63
						Nitrate+Nitrite	00630	-	25	-	0.02	0.04	0.08	0.17	0.59	0.13	0.10	0.92
						Phosphorus, Total	00665	0.69	37	1	0.06	0.16	0.22	0.32	0.70	0.27	-2.16	0.04
						Sulfate	00945	-	38	-	8.42	16.25	38.35	69.98	510.00	71.61	-1.66	0.11
						TDS	70300	-	38	-	80.00	111.25	179.00	345.25	876.00	251.58	-1.75	0.09
						TSS	00530	-	38	-	4.00	9.50	15.50	26.25	56.00	18.68	2.31	0.03
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	39	-	3.70	11.65	30.00	55.05	157.00	40.51	0.57	0.57
						VSS	00535	-	37	-	2.00	4.00	4.00	5.20	14.00	4.81	0.05	0.96
RI	0202E_01	10114	08/01/03	07/31/13	Post Oak Creek	Temperature	00010	93	58	-	10.50	17.43	20.65	25.98	29.10	21.12	0.10	0.92
						Conductivity	00094	-	58	-	628.00	1350.00	1585.00	1932.50	2870.00	1639.86	-0.50	0.62
						DO	00300	5.0	56	0	6.50	7.80	8.45	9.85	12.20	8.86	-1.17	0.25
						pH	00400	6.5-9.0	58	0	7.00	7.50	7.70	7.78	7.90	7.61	-5.93	0.00
						Ammonia	00610	0.33	22	0	0.10	0.10	0.10	0.10	0.10	0.10	-	-
						E.coli	31699	394	57	7	12	50	120	210	4800	263	-0.34	0.73
						Chloride	00940	-	2	-	149.00	173.75	198.50	223.25	248.00	198.50	-	-
						Chlorophyll-*a*	70953	14.1	6	0	2.00	2.00	2.00	2.08	2.20	2.05	-1.22	0.28
						Nitrate	00610	1.95	13	13	8.27	14.00	19.10	21.50	24.90	17.76	0.30	0.77
						Nitrate+Nitrite	00630	-	7	-	0.07	4.95	7.55	13.10	118.00	23.10	-0.82	0.44
						Phosphorus, Total	00665	0.69	22	21	0.14	2.53	4.45	6.93	9.20	4.51	0.79	0.44
						Sulfate	00945	-	2	-	135.00	154.00	173.00	192.00	211.00	173.00	-	-
						TDS	70300	-	2	-	638.00	738.50	839.00	939.50	1040.00	839.00	-	-
						TSS	00530	-	6	-	3.20	4.23	4.90	10.30	13.00	7.02	-0.76	0.48
						TKN	00625	-	2	-	0.78	0.99	1.19	1.40	1.60	1.19	-	-
						Turbidity	82079	-	57	-	0.79	1.90	2.50	3.93	100.00	5.30	-0.65	0.52
						VSS	00535	-	1	-	2.60	2.60	2.60	2.60	2.60	2.60	-	-

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RI	0202E_01	10115	08/01/03	07/31/13	Post Oak Creek	Temperature	00010	93	76	-	2.60	10.68	18.25	23.38	29.30	17.31	0.41	0.69
						Conductivity	00094	-	76	-	235.00	624.25	809.00	982.75	1650.00	807.86	-0.22	0.83
						DO	00300	5.0	74	5	0.80	6.90	8.45	10.25	15.10	8.55	0.18	0.86
						pH	00400	6.5-9.0	76	0	7.10	7.68	7.80	7.90	8.20	7.80	-2.41	0.02
						Ammonia	00610	0.33	40	0	0.02	0.07	0.10	0.10	0.14	0.08	3.04	0.00
						E.coli	31699	394	76	19	2	78	135	430	11000	653	-0.11	0.91
						Chloride	00940	-	20	-	10.00	29.38	34.10	56.05	475.00	67.92	-0.95	0.35
						Chlorophyll-*a*	70953	14.1	23	1	2.00	2.00	5.00	5.00	23.60	5.04	0.49	0.63
						Nitrate	00610	1.95	13	0	0.04	0.10	0.14	0.18	0.57	0.18	-1.54	0.15
						Nitrate+Nitrite	00630	-	25	-	0.04	0.36	0.44	0.64	21.20	1.42	1.11	0.28
						Phosphorus, Total	00665	0.69	40	2	0.06	0.10	0.15	0.20	5.66	0.31	0.15	0.88
						Sulfate	00945	-	20	-	22.00	83.85	95.00	117.75	171.00	99.49	0.38	0.71
						TDS	70300	-	20	-	170.00	322.50	417.00	507.75	704.00	413.65	-0.40	0.69
						TSS	00530	-	25	-	4.00	4.00	5.00	11.50	404.00	29.08	0.26	0.80
						TKN	00625	-	2	-	0.41	0.43	0.46	0.48	0.50	0.46	-	-
						Turbidity	82079	-	76	-	0.90	2.49	3.45	7.31	478.00	14.84	-0.13	0.89
						VSS	00535	-	19	-	3.00	4.00	4.00	4.00	38.00	6.37	0.70	0.49
RI	0202E_01	17599	08/01/03	07/31/13	Post Oak Creek	Temperature	00010	93	46	-	4.60	11.13	18.20	24.40	31.10	17.88	0.71	0.48
						Conductivity	00094	-	46	-	350.00	531.25	637.00	963.25	2170.00	824.89	-1.17	0.25
						DO	00300	5.0	46	7	2.80	5.50	7.90	11.70	14.30	8.50	0.16	0.87
						pH	00400	6.5-9.0	46	0	7.30	7.70	7.90	8.00	8.70	7.91	-0.43	0.67
						Ammonia	00610	0.33	14	0	0.08	0.10	0.10	0.10	0.11	0.10	2.23	0.04
						E.coli	31699	394	19	0	6	6	6	8	8	7	6.74	0.00
						Chloride	00940	-	2	-	23.00	28.50	34.00	39.50	45.00	34.00	-	-
						Chlorophyll-*a*	70953	14.1	42	0	2.00	2.00	2.00	2.00	2.00	2.00	-	-
						Nitrate	00610	1.95	7	0	0.02	0.04	0.08	0.26	0.30	0.14	0.70	0.51
						Nitrate+Nitrite	00630	-	7	-	0.03	0.04	0.12	0.19	0.58	0.18	0.50	0.64
						Phosphorus, Total	00665	0.69	14	1	0.06	0.11	0.22	0.30	1.20	0.28	-0.42	0.68
						Sulfate	00945	-	54	-	1.00	1.00	1.00	2.75	6.00	2.13	-0.74	0.46
						TDS	70300	-	45	-	2.52	8.70	12.50	19.60	160.00	18.77	-0.75	0.46
						TSS	00530	-	5	-	4.00	7.00	12.00	17.00	20.00	12.00	1.34	0.25
						TKN	00625	-	1	-	0.70	0.70	0.70	0.70	0.70	0.70	-	-
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	2	-	2.50	2.88	3.25	3.63	4.00	3.25	-	-
RI	0202F_01	10111	08/01/03	07/31/13	Choctaw Creek	Temperature	00010	93	58	-	7.30	14.85	20.40	24.98	29.30	20.22	0.65	0.52
						Conductivity	00094	-	58	-	152.00	1062.50	1445.00	1867.50	2870.00	1504.05	-0.55	0.58
						DO	00300	5.0	56	0	6.40	8.08	9.05	10.85	15.40	9.59	0.71	0.48
						pH	00400	6.5-9.0	58	0	7.60	7.80	7.90	8.00	8.20	7.89	1.18	0.24
						Ammonia	00610	0.33	22	0	0.10	0.10	0.10	0.10	0.17	0.11	1.38	0.18
						E.coli	31699	394	57	13	26	99	170	320	4800	343	-0.61	0.54
						Chloride	00940	-	2	-	114.00	138.75	163.50	188.25	213.00	163.50	-	-
						Chlorophyll-*a*	70953	14.1	6	0	2.00	2.75	3.60	4.98	9.00	4.35	-1.40	0.22
						Nitrate	00610	1.95	13	13	4.47	8.36	17.00	21.10	23.90	15.36	0.38	0.71
						Nitrate+Nitrite	00630	-	7	-	2.40	4.61	6.86	15.35	112.00	23.02	-0.82	0.44
						Phosphorus, Total	00665	0.69	22	21	0.60	2.08	3.30	6.30	8.60	3.96	0.45	0.66
						Sulfate	00945	-	2	-	116.00	135.75	155.50	175.25	195.00	155.50	-	-
						TDS	70300	-	2	-	580.00	690.00	800.00	910.00	1020.00	800.00	-	-
						TSS	00530	-	6	-	4.40	5.35	8.80	10.68	14.00	8.58	-0.16	0.88
						TKN	00625	-	2	-	1.44	1.56	1.67	1.79	1.90	1.67	-	-
						Turbidity	82079	-	57	-	1.20	2.80	4.90	6.23	110.00	7.27	-0.74	0.46
						VSS	00535	-	1	-	2.50	2.50	2.50	2.50	2.50	2.50	-	-

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RI	0202F_01	18370	08/01/03	07/31/13	Choctaw Creek	Temperature	00010	93	45	-	3.80	12.40	18.20	24.00	30.00	18.60	0.04	0.97
						Conductivity	00094	-	45	-	381.00	888.00	1230.00	1690.00	2750.00	1358.40	-0.38	0.71
						DO	00300	5.0	43	0	6.10	7.20	8.20	10.20	13.20	8.90	0.97	0.34
						pH	00400	6.5-9.0	45	0	7.40	7.90	8.00	8.10	8.30	7.98	0.36	0.72
						Ammonia	00610	0.33	34	0	0.02	0.06	0.10	0.10	0.11	0.08	5.62	0.00
						E.coli	31699	394	29	0	6	6	8	8	29	8	-0.59	0.56
						Chloride	00940	-	18	-	13.00	47.70	109.00	228.00	401.00	147.70	-0.85	0.40
						Chlorophyll-*a*	70953	14.1	34	0	2.00	2.00	2.00	2.00	5.00	2.09	1.03	0.31
						Nitrate	00610	1.95	13	13	2.66	3.59	10.20	18.90	21.20	11.63	-0.09	0.93
						Nitrate+Nitrite	00630	-	20	-	0.04	2.63	8.42	13.63	90.20	14.33	-0.36	0.72
						Phosphorus, Total	00665	0.69	34	29	0.06	1.10	2.28	5.68	11.13	3.44	-1.87	0.07
						Sulfate	00945	-	45	-	2.00	3.00	3.00	5.00	5.00	3.49	-1.00	0.32
						TDS	70300	-	43	-	2.80	7.85	17.00	40.35	984.00	61.25	-1.26	0.22
						TSS	00530	-	23	-	5.00	24.00	33.00	51.55	926.00	94.98	-0.41	0.68
						TKN	00625	-	2	-	1.02	1.08	1.14	1.20	1.26	1.14	-	-
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	17	-	4.00	4.00	6.00	8.00	76.00	12.78	0.47	0.65
RI	0202F_02	10112	08/01/03	07/31/13	Choctaw Creek	Temperature	00010	93	58	-	3.80	11.25	18.80	23.43	30.80	18.00	1.10	0.28
						Conductivity	00094	-	58	-	325.00	545.25	622.50	743.75	1890.00	692.26	-3.07	0.00
						DO	00300	5.0	56	9	0.60	6.90	8.10	10.03	14.00	8.07	1.45	0.15
						pH	00400	6.5-9.0	58	0	7.60	7.80	7.90	8.00	8.20	7.87	-0.46	0.65
						Ammonia	00610	0.33	22	1	0.10	0.10	0.10	0.10	0.63	0.13	0.89	0.39
						E.coli	31699	394	57	9	5	68	130	280	4000	337	-0.46	0.65
						Chloride	00940	-	2	-	7.16	9.60	12.03	14.47	16.90	12.03	-	-
						Chlorophyll-*a*	70953	14.1	6	0	2.20	2.58	4.50	6.28	10.90	5.15	-3.72	0.01
						Nitrate	00610	1.95	13	0	0.02	0.04	0.04	0.29	0.58	0.17	-0.15	0.88
						Nitrate+Nitrite	00630	-	6	-	0.04	0.07	0.24	0.42	0.47	0.25	0.37	0.73
						Phosphorus, Total	00665	0.69	22	1	0.06	0.06	0.08	0.13	4.50	0.33	0.65	0.52
						Sulfate	00945	-	2	-	58.00	66.10	74.20	82.30	90.40	74.20	-	-
						TDS	70300	-	2	-	278.00	308.00	338.00	368.00	398.00	338.00	-	-
						TSS	00530	-	7	-	4.10	9.75	27.90	48.00	300.00	63.93	-1.71	0.14
						TKN	00625	-	2	-	0.31	0.36	0.41	0.45	0.50	0.41	-	-
						Turbidity	82079	-	57	-	1.10	3.70	6.67	12.00	150.00	14.07	-0.99	0.32
						VSS	00535	-	1	-	3.40	3.40	3.40	3.40	3.40	3.40	-	-
RI	0202G_01	17044	08/01/03	07/31/13	Smith Creek	Temperature	00010	93	39	-	3.30	11.95	18.50	24.85	28.40	18.15	-1.04	0.30
						Conductivity	00094	-	39	-	342.00	690.00	820.00	985.00	2225.00	911.54	-1.38	0.18
						DO	00300	5.0	39	21	0.50	3.05	4.80	6.00	11.30	4.75	0.91	0.37
						pH	00400	6.5-9.0	39	0	6.90	7.30	7.40	7.50	7.70	7.39	0.57	0.57
						Ammonia	00610	0.33	37	14	0.02	0.10	0.27	0.53	2.26	0.41	-0.36	0.72
						E.coli	31699	394	39	28	15	300	687	2000	24000	2776	-1.14	0.26
						Chloride	00940	-	38	-	21.10	81.43	105.00	124.00	243.00	107.50	0.48	0.64
						Chlorophyll-*a*	70953	14.1	33	0	2.00	2.00	2.00	5.00	5.20	3.09	-4.54	0.00
						Nitrate	00610	1.95	12	0	0.04	0.04	0.05	0.28	0.44	0.15	-0.42	0.69
						Nitrate+Nitrite	00630	-	26	-	0.02	0.04	0.15	0.35	0.73	0.20	0.40	0.69
						Phosphorus, Total	00665	0.69	37	24	0.06	0.62	0.87	1.28	4.30	1.17	-0.28	0.78
						Sulfate	00945	-	38	-	25.40	69.63	94.75	208.00	722.00	161.76	-0.48	0.63
						TDS	70300	-	38	-	214.00	414.75	489.50	589.00	1130.00	541.50	-0.20	0.84
						TSS	00530	-	38	-	3.70	8.25	12.00	18.40	48.70	14.72	-0.57	0.58
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	39	-	6.90	9.20	12.00	17.05	59.30	15.49	-0.30	0.76
						VSS	00535	-	37	-	2.00	4.00	4.00	6.00	22.70	5.67	-1.10	0.28

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RI	0202G_01	21026	08/01/03	07/31/13	Smith Creek	Temperature	00010	93	7	-	6.00	10.35	17.90	23.40	25.50	16.70	-0.07	0.95
						Conductivity	00094	-	7	-	240.00	675.00	863.00	895.50	1050.00	756.29	0.02	0.98
						DO	00300	5.0	7	3	1.40	2.75	5.50	7.65	8.90	5.23	-0.65	0.54
						pH	00400	6.5-9.0	7	1	4.30	7.30	7.40	7.60	8.50	7.14	0.46	0.66
						Ammonia	00610	0.33	7	0	0.10	0.10	0.11	0.21	0.33	0.16	2.84	0.03
						E.coli	31699	394	7	6	330	770	1100	2400	2400	1453	-0.82	0.45
						Chloride	00940	-	7	-	55.20	70.25	86.20	111.50	142.00	92.41	-0.04	0.97
						Chlorophyll-*a*	70953	14.1	6	0	2.00	2.00	2.00	3.05	4.00	2.57	-2.87	0.03
						Nitrate	00610	1.95	4	0	0.04	0.04	0.06	0.12	0.22	0.10	-0.59	0.60
						Nitrate+Nitrite	00630	-	3	-	0.02	0.06	0.09	0.32	0.54	0.22	1.56	0.26
						Phosphorus, Total	00665	0.69	7	4	0.32	0.48	1.02	1.13	1.40	0.85	0.53	0.61
						Sulfate	00945	-	7	-	58.90	102.60	145.00	162.50	167.00	128.73	-0.83	0.44
						TDS	70300	-	7	-	278.00	404.00	520.00	526.00	540.00	456.86	0.37	0.72
						TSS	00530	-	7	-	4.80	8.65	14.00	18.30	75.00	21.10	-0.87	0.42
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	7	-	6.85	9.65	11.00	16.00	49.50	16.95	-0.55	0.60
						VSS	00535	-	6	-	2.50	2.50	4.75	9.40	11.00	5.95	-0.80	0.46
RI	0202G_01	21027	08/01/03	07/31/13	Smith Creek	Temperature	00010	93	7	-	7.20	11.15	16.80	21.15	25.60	16.31	-0.29	0.78
						Conductivity	00094	-	7	-	320.00	450.00	578.00	639.00	917.00	570.43	-0.37	0.72
						DO	00300	5.0	7	3	3.30	4.50	5.90	7.55	10.70	6.29	0.36	0.73
						pH	00400	6.5-9.0	7	0	7.30	7.45	7.50	7.70	7.70	7.54	0.38	0.72
						Ammonia	00610	0.33	7	0	0.10	0.10	0.10	0.10	0.10	0.10	-	-
						E.coli	31699	394	7	2	8	12	58	510	2400	501	0.31	0.77
						Chloride	00940	-	7	-	5.44	11.90	16.80	18.10	24.90	15.31	-1.59	0.16
						Chlorophyll-*a*	70953	14.1	6	2	2.00	5.68	10.85	23.30	55.40	18.42	-0.87	0.42
						Nitrate	00610	1.95	4	0	0.04	0.04	0.04	0.08	0.19	0.08	-0.27	0.80
						Nitrate+Nitrite	00630	-	3	-	0.02	0.02	0.02	0.11	0.19	0.08	2.09	0.17
						Phosphorus, Total	00665	0.69	7	0	0.06	0.07	0.09	0.14	0.18	0.11	0.27	0.80
						Sulfate	00945	-	7	-	63.60	74.70	110.00	156.00	306.00	134.43	-0.90	0.40
						TDS	70300	-	7	-	192.00	281.00	332.00	405.50	566.00	351.86	-0.54	0.61
						TSS	00530	-	7	-	4.00	7.05	8.30	16.55	25.10	12.09	0.27	0.80
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	7	-	7.10	8.22	8.70	9.07	31.00	11.62	1.64	0.15
						VSS	00535	-	6	-	2.50	2.63	3.20	4.15	10.00	4.30	-0.95	0.39
RI	0202I_01	18514	08/01/03	07/31/13	Little Pine Creek	Temperature	00010	93	18	-	0.90	9.65	15.25	22.58	27.40	15.97	0.48	0.64
						Conductivity	00094	-	18	-	126.00	220.25	245.00	349.25	508.00	281.83	-1.88	0.08
						DO	00300	5.0	18	8	1.00	2.85	5.60	7.18	10.50	5.28	0.93	0.37
						pH	00400	6.5-9.0	18	1	6.40	6.70	6.90	7.18	7.70	6.93	1.78	0.09
						Ammonia	00610	0.33	18	3	0.05	0.05	0.06	0.20	1.18	0.20	0.03	0.98
						E.coli	31699	394	10	0	24	26	28	29	29	27	-0.43	0.68
						Chloride	00940	-	18	-	6.00	10.25	13.50	16.00	49.00	16.39	-1.31	0.21
						Chlorophyll-*a*	70953	14.1	2	0	5.00	5.00	5.00	5.00	5.00	5.00	-	-
						Nitrate	00610	1.95	0	-	-	-	-	-	-	-	-	-
						Nitrate+Nitrite	00630	-	18	-	0.04	0.04	0.04	0.06	0.41	0.09	1.67	0.11
						Phosphorus, Total	00665	0.69	17	0	0.06	0.09	0.15	0.17	0.22	0.14	1.28	0.22
						Sulfate	00945	-	18	-	1.00	1.00	1.00	1.00	5.00	1.33	0.97	0.35
						TDS	70300	-	0	-	-	-	-	-	-	-	-	-
						TSS	00530	-	18	-	4.00	11.25	21.00	27.75	57.00	23.22	1.99	0.06
						TKN	00625	-	17	-	0.56	1.04	1.22	1.48	2.72	1.29	0.57	0.58
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	18	-	4.00	4.00	5.50	7.00	10.00	5.89	2.11	0.05

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RI	0202J_01	15446	08/01/03	07/31/13	Sand Creek	Temperature	00010	93	47	-	3.30	11.20	19.10	24.15	27.50	18.31	1.06	0.29
						Conductivity	00094	-	47	-	206.00	631.50	752.00	877.50	1190.00	752.17	-0.03	0.98
						DO	00300	5.0	46	14	1.10	4.15	5.65	8.45	15.00	6.53	1.07	0.29
						pH	00400	6.5-9.0	47	0	7.20	7.60	7.70	7.80	8.20	7.69	-0.01	0.99
						Ammonia	00610	0.33	14	0	0.10	0.10	0.10	0.10	0.10	0.10	-	-
						E.coli	31699	394	47	10	3	13	63	255	6500	579	-0.25	0.80
						Chloride	00940	-	1	-	30.80	30.80	30.80	30.80	30.80	30.80	-	-
						Chlorophyll-*a*	70953	14.1	4	1	6.10	6.18	7.40	11.98	22.10	10.75	-1.01	0.39
						Nitrate	00610	1.95	8	0	0.02	0.04	0.04	0.04	0.19	0.06	0.72	0.49
						Nitrate+Nitrite	00630	-	5	-	0.04	0.14	0.15	0.36	0.53	0.24	0.46	0.67
						Phosphorus, Total	00665	0.69	14	0	0.06	0.13	0.25	0.32	0.41	0.23	-1.17	0.26
						Sulfate	00945	-	1	-	93.70	93.70	93.70	93.70	93.70	93.70	-	-
						TDS	70300	-	1	-	374.00	374.00	374.00	374.00	374.00	374.00	-	-
						TSS	00530	-	5	-	5.40	11.00	16.70	30.00	30.00	18.62	-0.07	0.95
						TKN	00625	-	1	-	0.75	0.75	0.75	0.75	0.75	0.75	-	-
						Turbidity	82079	-	46	-	1.72	3.73	6.53	13.00	60.00	10.79	-0.95	0.35
						VSS	00535	-	1	-	3.00	3.00	3.00	3.00	3.00	3.00	-	-
RI	0202K_01	18653	08/01/03	07/31/13	Iron Ore Creek	Temperature	00010	93	18	-	2.30	8.28	14.80	25.03	28.50	16.22	0.04	0.97
						Conductivity	00094	-	18	-	204.00	519.50	636.00	677.00	778.00	586.33	0.29	0.77
						DO	00300	5.0	16	0	6.20	7.50	8.20	11.08	14.20	9.58	0.42	0.68
						pH	00400	6.5-9.0	18	0	7.70	7.90	7.95	8.10	8.40	8.01	3.14	0.01
						Ammonia	00610	0.33	17	0	0.02	0.04	0.05	0.08	0.10	0.06	-0.07	0.94
						E.coli	31699	394	9	0	6	24	26	28	28	24	1.15	0.28
						Chloride	00940	-	20	-	8.45	30.50	49.00	55.90	86.80	44.51	0.45	0.66
						Chlorophyll-*a*	70953	14.1	11	0	2.00	2.00	5.00	5.00	5.00	3.64	10.68	0.00
						Nitrate	00610	1.95	0	-	-	-	-	-	-	-	-	-
						Nitrate+Nitrite	00630	-	17	-	0.04	0.04	0.11	0.28	1.91	0.27	-1.44	0.17
						Phosphorus, Total	00665	0.69	15	1	0.03	0.05	0.06	0.16	0.72	0.14	-1.25	0.23
						Sulfate	00945	-	22	-	1.00	2.00	3.00	5.00	6.00	3.36	-0.44	0.66
						TDS	70300	-	10	-	4.30	7.36	10.80	51.35	1230.00	162.50	1.01	0.34
						TSS	00530	-	18	-	4.00	4.00	7.10	43.75	802.00	64.87	-0.46	0.65
						TKN	00625	-	7	-	0.32	0.33	0.34	0.35	0.48	0.36	2.69	0.04
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	19	-	4.00	4.00	4.00	4.50	72.00	8.88	-0.72	0.48
RI	0202L_01	21030	08/01/03	07/31/13		Temperature	00010	93	20	-	2.40	11.00	14.85	23.20	27.30	15.98	-0.21	0.83
						Conductivity	00094	-	20	-	712.00	945.75	1250.00	1695.00	1990.00	1325.45	-0.19	0.85
						DO	00300	5.0	20	1	3.10	7.55	8.55	10.73	12.10	8.65	-0.10	0.92
						pH	00400	6.5-9.0	20	3	8.30	8.40	8.65	8.90	9.30	8.70	-0.28	0.78
						Ammonia	00610	0.33	20	4	0.10	0.10	0.10	0.27	1.86	0.31	0.34	0.74
						E.coli	31699	394	20	15	51	423	1060	1775	2400	1168	-1.53	0.14
						Chloride	00940	-	19	-	37.00	81.55	108.00	162.00	195.00	114.32	0.69	0.50
						Chlorophyll-*a*	70953	14.1	18	16	4.50	28.00	58.50	75.58	163.00	55.86	0.79	0.44
						Nitrate	00610	1.95	12	1	0.05	0.05	0.05	0.67	2.35	0.41	-1.39	0.19
						Nitrate+Nitrite	00630	-	19	-	0.05	0.05	0.05	1.31	4.36	0.97	0.23	0.82
						Phosphorus, Total	00665	0.69	20	12	0.04	0.53	0.71	1.41	3.00	1.04	-0.49	0.63
						Sulfate	00945	-	19	-	117.00	131.50	147.00	174.00	191.00	151.37	-0.23	0.82
						TDS	70300	-	20	-	495.00	621.00	805.00	1180.00	1510.00	910.90	-0.61	0.55
						TSS	00530	-	20	-	19.00	76.38	103.00	149.00	490.00	134.43	-0.97	0.34
						TKN	00625	-	19	-	0.90	1.79	2.32	2.98	4.54	2.52	0.29	0.78
						Turbidity	82079	-	19	-	14.80	51.70	120.00	235.00	374.00	151.53	-0.32	0.75
						VSS	00535	-	20	-	4.00	16.38	21.00	33.48	74.00	25.74	-0.96	0.35

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RI	0202M_01	21032	08/01/03	07/31/13		Temperature	00010	93	20	-	7.00	12.30	18.05	24.88	32.00	18.72	-0.20	0.84
						Conductivity	00094	-	20	-	97.00	115.75	127.00	139.00	163.00	127.65	-1.96	0.06
						DO	00300	5.0	20	2	3.70	8.45	9.40	10.18	12.30	9.06	0.40	0.69
						pH	00400	6.5-9.0	19	3	6.40	7.80	8.00	8.65	9.50	8.05	0.47	0.65
						Ammonia	00610	0.33	20	0	0.10	0.10	0.10	0.12	0.28	0.13	-0.14	0.89
						E.coli	31699	394	20	0	1	3	8	11	230	20	1.08	0.29
						Chloride	00940	-	19	-	2.86	3.25	3.51	3.77	4.62	3.59	-1.37	0.19
						Chlorophyll-*a*	70953	14.1	19	18	17.60	32.33	47.70	60.30	153.00	53.25	0.74	0.47
						Nitrate	00610	1.95	12	0	0.05	0.05	0.05	0.05	0.25	0.07	1.93	0.08
						Nitrate+Nitrite	00630	-	19	-	0.05	0.05	0.05	0.10	0.83	0.14	-1.09	0.29
						Phosphorus, Total	00665	0.69	20	0	0.02	0.09	0.10	0.11	0.15	0.10	1.36	0.19
						Sulfate	00945	-	19	-	1.71	2.48	3.68	5.08	5.85	3.74	1.21	0.24
						TDS	70300	-	20	-	67.00	80.75	90.50	99.50	118.00	91.75	-0.66	0.52
						TSS	00530	-	20	-	12.00	16.23	18.25	23.58	31.00	19.97	2.38	0.03
						TKN	00625	-	19	-	1.03	1.23	1.44	1.51	2.30	1.45	1.22	0.24
						Turbidity	82079	-	19	-	9.73	12.90	14.00	17.85	25.90	15.80	1.12	0.28
						VSS	00535	-	20	-	6.00	8.70	9.80	11.25	18.00	10.31	-0.36	0.72
RI	0203_01	15388	08/01/03	07/31/13	Lake Texoma	Temperature	00010	92	22	0	7.80	14.10	22.05	26.43	29.30	20.55	-2.38	0.03
						Conductivity	00094	-	19	-	810.00	1640.00	1680.00	1730.00	2010.00	1684.21	2.54	0.02
						DO	00300	5.0	22	0	5.70	7.43	8.65	10.00	11.30	8.71	2.84	0.01
						pH	00400	6.5-9.0	22	0	6.70	7.93	8.10	8.38	8.70	8.09	-0.73	0.47
						Ammonia	00610	0.11	17	1	0.10	0.10	0.10	0.10	0.18	0.10	-0.49	0.63
						E.coli	31699	394	17	0	1	1	1	1	11	2	1.41	0.18
						Chloride	00940	600	18	0	94.70	313.50	345.50	365.00	435.00	336.93	3.03	0.01
						Chlorophyll-*a*	70953	26.7	15	0	3.20	4.55	6.90	9.85	18.70	7.93	-0.20	0.84
						Nitrate	00610	0.37	11	0	0.05	0.05	0.06	0.13	0.18	0.09	-0.94	0.37
						Nitrate+Nitrite	00630	-	17	-	0.05	0.05	0.10	0.15	0.18	0.10	1.30	0.21
						Phosphorus, Total	00665	0.20	17	0	0.02	0.04	0.05	0.05	0.06	0.04	0.56	0.58
						Sulfate	00945	300	18	1	121.00	240.75	258.50	270.25	319.00	255.11	3.37	0.00
						TDS	70300	1500	17	0	957.00	1000.00	1020.00	1050.00	1280.00	1049.71	-3.87	0.00
						TSS	00530	-	17	-	2.50	3.00	4.40	5.20	6.00	4.09	-1.77	0.10
						TKN	00625	-	16	-	0.50	0.55	0.62	0.65	0.67	0.60	-0.38	0.71
						Turbidity	82079	-	16	-	2.00	2.34	3.03	3.84	5.80	3.24	-0.14	0.89
						VSS	00535	-	17	-	2.50	2.50	2.50	2.50	3.60	2.61	-2.01	0.06
RI	0203_01	15440	08/01/03	07/31/13	Lake Texoma	Temperature	00010	92	33	0	6.70	11.50	21.50	26.40	29.70	19.03	-0.24	0.81
						Conductivity	00094	-	33	-	725.00	1290.00	1650.00	1820.00	2170.00	1563.48	-1.87	0.07
						DO	00300	5.0	33	2	3.10	6.90	9.20	11.60	14.50	9.20	0.34	0.74
						pH	00400	6.5-9.0	33	0	7.50	8.00	8.30	8.40	8.50	8.19	-0.78	0.44
						Ammonia	00610	0.11	33	2	0.02	0.04	0.10	0.10	0.21	0.08	2.71	0.01
						E.coli	31699	394	33	0	1	1	1	2	150	6	-0.72	0.47
						Chloride	00940	600	33	0	33.50	213.00	332.00	390.00	454.00	293.66	-0.82	0.42
						Chlorophyll-*a*	70953	26.7	33	2	2.20	4.60	7.18	11.80	155.00	13.20	-0.86	0.40
						Nitrate	00610	0.37	8	0	0.04	0.04	0.09	0.14	0.24	0.11	-2.04	0.08
						Nitrate+Nitrite	00630	-	25	-	0.02	0.04	0.09	0.19	1.23	0.20	0.98	0.34
						Phosphorus, Total	00665	0.20	8	2	0.06	0.06	0.08	0.10	0.46	0.12	-1.46	0.19
						Sulfate	00945	300	33	4	84.30	203.00	247.00	271.00	323.00	235.55	-1.26	0.22
						TDS	70300	1500	33	0	406.00	766.00	980.00	1120.00	1300.00	932.61	-0.67	0.50
						TSS	00530	-	33	-	2.00	4.00	4.00	5.00	105.00	7.83	-0.82	0.42
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	33	-	1.43	2.20	3.30	4.60	56.00	4.96	-0.60	0.56
						VSS	00535	-	33	-	1.00	4.00	4.00	4.00	19.00	4.03	-2.17	0.04

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RI	0203_01	20545	08/01/03	07/31/13	Lake Texoma	Temperature	00010	92	29	0	8.90	10.70	19.00	25.50	28.60	18.72	-2.01	0.05
						Conductivity	00094	-	26	-	820.00	1660.00	1720.00	1945.00	2150.00	1747.69	0.56	0.58
						DO	00300	5.0	29	2	4.40	8.10	9.50	10.60	12.70	9.10	3.27	0.00
						pH	00400	6.5-9.0	29	0	6.60	7.90	8.10	8.20	8.60	8.01	-0.28	0.78
						Ammonia	00610	0.11	23	0	0.10	0.10	0.10	0.10	0.10	0.10	-	-
						E.coli	31699	394	22	0	1	1	1	2	12	2	-1.05	0.31
						Chloride	00940	600	24	0	97.40	320.00	337.50	379.25	445.00	340.23	0.92	0.37
						Chlorophyll-*a*	70953	26.7	21	0	2.10	3.20	4.80	9.10	15.20	6.76	-0.14	0.89
						Nitrate	00610	0.37	12	0	0.05	0.05	0.09	0.15	0.31	0.11	-2.11	0.06
						Nitrate+Nitrite	00630	-	23	-	0.05	0.08	0.12	0.17	0.41	0.14	-1.18	0.25
						Phosphorus, Total	00665	0.20	23	0	0.02	0.04	0.04	0.05	0.07	0.04	0.93	0.36
						Sulfate	00945	300	25	3	121.00	233.00	250.00	276.00	326.00	255.60	1.73	0.10
						TDS	70300	1500	23	0	922.00	994.50	1020.00	1110.00	1290.00	1059.00	-5.17	0.00
						TSS	00530	-	23	-	2.50	2.95	3.50	5.04	7.60	4.02	0.85	0.40
						TKN	00625	-	19	-	0.49	0.55	0.58	0.62	0.66	0.58	0.09	0.93
						Turbidity	82079	-	22	-	1.50	2.07	2.41	2.94	6.23	2.70	0.83	0.42
						VSS	00535	-	23	-	2.50	2.50	2.50	2.50	3.20	2.56	0.14	0.89
RI	0203_02	17480	08/01/03	07/31/13	Lake Texoma	Temperature	00010	92	40	0	6.90	12.05	20.00	26.83	30.50	19.37	-0.65	0.52
						Conductivity	00094	-	40	-	726.00	1412.50	1670.00	1900.00	2130.00	1602.50	-0.49	0.63
						DO	00300	5.0	40	1	4.50	8.65	10.30	11.65	14.00	10.13	0.35	0.73
						pH	00400	6.5-9.0	40	0	7.70	8.30	8.30	8.50	8.70	8.33	0.15	0.88
						Ammonia	00610	0.11	40	1	0.01	0.06	0.10	0.10	0.13	0.08	3.47	0.00
						E.coli	31699	394	21	0	6	6	8	8	26	9	3.17	0.00
						Chloride	00940	600	40	0	34.50	226.00	329.00	387.25	485.00	305.06	-0.17	0.87
						Chlorophyll-*a*	70953	26.7	15	0	2.00	2.00	2.60	3.40	4.20	2.75	1.00	0.33
						Nitrate	00610	0.37	11	0	0.02	0.04	0.04	0.13	0.25	0.08	-0.29	0.78
						Nitrate+Nitrite	00630	-	28	-	0.02	0.04	0.07	0.16	1.00	0.14	0.02	0.99
						Phosphorus, Total	00665	0.20	40	0	0.04	0.06	0.06	0.08	0.15	0.07	-1.21	0.23
						Sulfate	00945	300	40	2	28.00	207.75	237.00	274.25	340.00	231.01	0.51	0.62
						TDS	70300	1500	40	0	1.80	3.58	4.70	6.38	16.20	5.63	-1.23	0.23
						TSS	00530	-	40	-	2.80	5.00	6.00	10.13	55.00	10.08	-0.77	0.45
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	40	-	1.00	3.90	4.00	4.00	9.00	4.03	-3.95	0.00
RI	0203_03	10130	08/01/03	07/31/13	Lake Texoma	Temperature	00010	92	40	0	6.50	11.93	20.45	27.85	30.80	19.68	-0.46	0.65
						Conductivity	00094	-	40	-	880.00	1647.50	1925.00	2105.00	2400.00	1834.40	-0.98	0.33
						DO	00300	5.0	40	0	6.00	9.18	10.20	11.15	13.30	10.03	0.43	0.67
						pH	00400	6.5-9.0	40	0	7.90	8.28	8.35	8.53	8.80	8.36	-0.04	0.97
						Ammonia	00610	0.11	40	3	0.02	0.04	0.10	0.10	0.21	0.08	3.99	0.00
						E.coli	31699	394	40	0	1	1	2	6	96	9	-0.58	0.56
						Chloride	00940	600	40	0	41.50	318.50	400.50	456.25	511.00	374.69	-0.14	0.89
						Chlorophyll-*a*	70953	26.7	40	9	4.46	11.15	18.65	26.45	46.10	19.38	-3.67	0.00
						Nitrate	00610	0.37	11	1	0.02	0.04	0.04	0.14	0.41	0.11	-0.74	0.48
						Nitrate+Nitrite	00630	-	28	-	0.02	0.02	0.04	0.09	0.74	0.10	-0.15	0.88
						Phosphorus, Total	00665	0.20	40	0	0.05	0.06	0.07	0.09	0.18	0.08	-2.22	0.03
						Sulfate	00945	300	40	7	86.40	208.00	262.00	276.25	920.00	260.81	1.15	0.26
						TDS	70300	1500	40	0	484.00	937.25	1115.00	1262.50	1440.00	1075.90	-0.27	0.79
						TSS	00530	-	40	-	4.00	7.80	9.05	11.00	22.00	9.49	1.15	0.26
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	40	-	3.60	6.47	8.66	11.38	14.90	8.92	1.09	0.28
						VSS	00535	-	40	-	2.00	4.00	4.15	5.05	8.00	4.59	-4.74	0.00

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RI	0203_04	10131	08/01/03	07/31/13	Lake Texoma	Temperature	00010	92	40	0	6.60	11.50	20.45	27.90	30.60	19.60	-0.55	0.59
						Conductivity	00094	-	40	-	1040.00	1697.50	1975.00	2165.00	2620.00	1899.75	-0.39	0.70
						DO	00300	5.0	40	0	5.90	8.98	9.80	11.30	12.60	9.92	0.19	0.85
						pH	00400	6.5-9.0	40	0	7.80	8.20	8.30	8.50	8.90	8.32	-0.71	0.48
						Ammonia	00610	0.11	40	4	0.02	0.07	0.10	0.10	0.27	0.09	3.81	0.00
						E.coli	31699	394	40	0	1	1	1	2	135	6	-1.15	0.26
						Chloride	00940	600	40	0	40.00	342.25	408.00	464.25	594.00	392.20	0.11	0.92
						Chlorophyll-*a*	70953	26.7	40	12	3.00	17.35	22.20	28.58	66.60	23.43	-1.61	0.12
						Nitrate	00610	0.37	11	1	0.02	0.04	0.04	0.19	0.42	0.13	-0.58	0.57
						Nitrate+Nitrite	00630	-	28	-	0.02	0.02	0.04	0.16	0.44	0.10	-0.86	0.40
						Phosphorus, Total	00665	0.20	40	1	0.06	0.06	0.08	0.11	0.29	0.09	-3.05	0.00
						Sulfate	00945	300	40	9	108.00	206.25	258.00	298.50	368.00	249.50	0.03	0.98
						TDS	70300	1500	40	3	582.00	974.25	1105.00	1325.00	1640.00	1127.53	0.33	0.75
						TSS	00530	-	40	-	4.00	7.00	9.10	12.00	30.00	10.12	0.31	0.76
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	40	-	2.83	6.39	9.80	12.08	50.70	11.68	-0.55	0.59
						VSS	00535	-	39	-	2.00	4.00	4.00	5.60	11.00	4.58	-3.72	0.00
RI	0203A_01	17505	08/01/03	07/31/13	Big Mineral Creek	Temperature	00010	92	9	-	7.20	9.80	21.50	25.60	25.80	17.41	1.66	0.13
						Conductivity	00094	-	9	-	349.00	694.00	750.00	926.00	1250.00	782.67	2.72	0.03
						DO	00300	5.0	9	0	6.30	8.90	9.00	10.80	11.20	9.40	-1.43	0.19
						pH	00400	6.5-9.0	9	0	7.40	7.40	7.70	8.10	8.20	7.76	1.51	0.17
						Ammonia	00610	0.33	18	2	0.05	0.05	0.05	0.19	0.76	0.17	-0.79	0.44
						E.coli	31699	394	13	0	24	25	26	28	29	26	-6.33	0.00
						Chloride	00940	-	18	-	28.00	55.25	68.50	81.75	98.00	66.94	0.52	0.61
						Chlorophyll-*a*	70953	14.1	0	-	-	-	-	-	-	-	-	-
						Nitrate	00610	1.95	0	-	-	-	-	-	-	-	-	-
						Nitrate+Nitrite	00630	-	18	-	0.04	0.96	2.51	12.58	13.90	6.34	0.03	0.98
						Phosphorus, Total	00665	0.69	11	6	0.45	0.85	1.62	1.86	2.35	1.42	0.30	0.77
						Sulfate	00945	-	38	-	1.00	2.00	3.00	3.00	5.00	2.61	0.05	0.96
						TDS	70300	-	0	-	-	-	-	-	-	-	-	-
						TSS	00530	-	15	-	9.00	10.00	12.00	25.00	59.00	20.47	1.33	0.20
						TKN	00625	-	12	-	0.44	0.71	0.78	1.04	1.40	0.83	0.11	0.92
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	18	-	4.00	4.00	4.00	4.75	7.00	4.50	0.84	0.41
RI	0204_01	10132	08/01/03	07/31/13	Red River Above Lake Texoma	Temperature	00010	93	30	0	5.50	12.43	18.20	25.78	33.70	18.48	0.35	0.73
						Conductivity	00094	-	30	-	337.00	2235.00	3590.00	5365.00	7570.00	3806.17	-0.37	0.72
						DO	00300	5.0	30	3	4.00	6.48	9.15	10.75	14.40	8.90	1.78	0.09
						pH	00400	6.5-9.0	30	0	7.20	7.90	8.10	8.20	8.90	8.07	1.74	0.09
						Ammonia	00610	0.33	28	0	0.02	0.05	0.05	0.05	0.16	0.06	0.53	0.60
						E.coli	31699	33	25	7	1	14	65	470	2400	402	1.29	0.21
						Chloride	00940	2000	27	2	18.00	417.50	1030.00	1425.00	2090.00	977.37	-0.23	0.82
						Chlorophyll-*a*	70953	14.1	25	18	6.04	22.20	39.10	46.60	171.00	41.84	-0.09	0.93
						Nitrate	00610	1.95	0	-	-	-	-	-	-	-	-	-
						Nitrate+Nitrite	00630	-	28	-	0.04	0.04	0.04	0.25	1.26	0.21	0.50	0.62
						Phosphorus, Total	00665	0.69	29	1	0.09	0.14	0.18	0.32	0.81	0.27	-1.31	0.20
						Sulfate	00945	1200	28	0	24.00	245.75	465.50	704.50	1130.00	498.25	-0.41	0.68
						TDS	70300	6000	23	0	666.00	1220.00	2430.00	3625.00	4740.00	2502.52	0.53	0.60
						TSS	00530	-	27	-	19.00	34.50	57.00	224.50	968.00	193.59	-0.55	0.58
						TKN	00625	-	27	-	0.70	0.96	1.14	1.70	2.68	1.38	-1.24	0.23
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	26	-	5.00	10.25	16.00	23.25	76.00	21.62	-0.38	0.71

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RI	0204_02	20168	08/01/03	07/31/13	Red River Above Lake Texoma	Temperature	00010	93	53	0	1.80	8.70	17.00	26.20	30.00	16.91	-0.79	0.43
						Conductivity	00094	-	53	-	820.00	3670.00	5350.00	6250.00	8400.00	4964.34	1.36	0.18
						DO	00300	5.0	53	0	5.10	7.80	9.50	11.60	13.40	9.59	0.48	0.63
						pH	00400	6.5-9.0	53	0	7.60	8.10	8.10	8.30	8.70	8.16	-0.69	0.49
						Ammonia	00610	0.33	22	0	0.10	0.10	0.10	0.10	0.18	0.10	-0.12	0.91
						E.coli	31699	33	49	0	6	6	6	8	8	7	10.38	0.00
						Chloride	00940	2000	21	1	272.00	846.00	1390.00	1620.00	2120.00	1260.19	0.22	0.83
						Chlorophyll-*a*	70953	14.1	12	12	17.00	31.55	45.70	53.75	106.00	46.49	0.38	0.71
						Nitrate	00610	1.95	11	0	0.02	0.04	0.04	0.59	1.04	0.32	0.49	0.64
						Nitrate+Nitrite	00630	-	9	-	0.02	0.04	0.04	0.34	1.68	0.29	2.07	0.07
						Phosphorus, Total	00665	0.69	29	1	0.06	0.17	0.20	0.27	1.25	0.26	-1.00	0.33
						Sulfate	00945	1200	53	0	2.00	2.00	2.00	3.00	5.00	2.75	-1.99	0.05
						TDS	70300	6000	54	0	5.90	23.03	55.30	109.50	910.00	122.11	-0.41	0.68
						TSS	00530	-	22	-	21.00	44.45	74.50	179.75	784.00	146.44	-1.04	0.31
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	22	-	7.00	14.80	19.80	23.68	54.00	21.55	-0.68	0.50
RI	0204_03	10133	08/01/03	07/31/13	Red River Above Lake Texoma	Temperature	00010	93	70	0	1.70	8.60	17.85	25.90	38.50	17.67	-1.96	0.05
						Conductivity	00094	-	70	-	204.00	4210.00	5345.00	6727.50	7970.00	5174.63	-0.20	0.84
						DO	00300	5.0	70	0	6.10	8.20	9.70	12.38	14.20	10.17	1.28	0.21
						pH	00400	6.5-9.0	70	0	7.70	8.13	8.20	8.40	9.00	8.26	0.33	0.74
						Ammonia	00610	0.33	22	0	0.10	0.10	0.10	0.10	0.16	0.10	0.19	0.85
						E.coli	31699	33	54	4	6	20	37	85	3700	151	-0.36	0.72
						Chloride	00940	2000	21	0	302.00	1040.00	1220.00	1500.00	1890.00	1267.62	-0.29	0.78
						Chlorophyll-*a*	70953	14.1	16	15	8.30	33.68	55.35	90.23	329.00	82.33	1.32	0.21
						Nitrate	00610	1.95	11	1	0.02	0.04	0.04	1.10	4.98	0.83	-0.89	0.39
						Nitrate+Nitrite	00630	-	9	-	0.02	0.04	0.04	0.28	0.31	0.12	0.64	0.54
						Phosphorus, Total	00665	0.69	57	2	0.06	0.18	0.24	0.30	1.30	0.28	-1.15	0.26
						Sulfate	00945	1200	21	0	156.00	535.00	699.00	851.00	1200.00	683.67	-0.27	0.79
						TDS	70300	6000	21	0	764.00	2580.00	3090.00	4100.00	5240.00	3258.29	-0.26	0.80
						TSS	00530	-	22	-	11.00	50.80	68.50	131.75	806.00	140.94	-1.13	0.27
						TKN	00625	-	17	-	0.58	1.00	1.30	1.80	2.60	1.38	-0.93	0.37
						Turbidity	82079	-	54	-	5.80	28.70	50.60	137.50	920.00	127.79	-0.67	0.51
						VSS	00535	-	22	-	4.00	15.40	20.70	27.05	64.00	22.87	-0.89	0.38
RI	0204B_01	15447	08/01/03	07/31/13	Moss Lake	Temperature	00010	93	17	-	7.80	14.00	22.70	27.50	30.30	20.22	0.52	0.61
						Conductivity	00094	-	17	-	257.00	265.00	277.00	288.00	325.00	280.88	-0.39	0.70
						DO	00300	5.0	17	0	5.30	7.60	8.30	9.50	11.90	8.58	-0.52	0.61
						pH	00400	6.5-9.0	17	0	7.60	8.00	8.10	8.30	8.50	8.12	-0.26	0.80
						Ammonia	00610	0.11	14	0	0.05	0.05	0.05	0.05	0.06	0.05	1.58	0.14
						E.coli	31699	33	16	0	1	1	3	4	150	12	-0.90	0.38
						Chloride	00940	-	17	-	5.00	5.00	6.00	7.00	8.00	6.18	-1.54	0.14
						Chlorophyll-*a*	70953	26.7	16	0	3.54	6.85	10.00	10.00	12.30	8.76	-2.51	0.02
						Nitrate	00610	0.37	4	0	0.05	0.05	0.08	0.11	0.12	0.08	0.97	0.40
						Nitrate+Nitrite	00630	-	11	-	0.04	0.04	0.04	0.12	0.20	0.08	1.99	0.07
						Phosphorus, Total	00665	0.20	15	0	0.05	0.06	0.06	0.06	0.06	0.06	3.98	0.00
						Sulfate	00945	-	17	-	10.00	12.00	16.00	16.00	18.00	14.65	-2.24	0.04
						TDS	70300	-	16	-	158.00	168.50	178.00	186.75	212.00	178.56	-0.07	0.94
						TSS	00530	-	17	-	2.00	4.00	4.00	4.00	10.00	4.47	1.37	0.19
						TKN	00625	-	15	-	0.27	0.36	0.42	0.49	0.63	0.43	4.21	0.00
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	17	-	1.00	2.00	4.00	4.00	4.00	3.18	4.68	0.00

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RI	0208_01	10137	08/01/03	07/31/13	Lake Crook	Temperature	00010	90	7	0	10.00	15.05	19.70	24.10	27.90	19.41	0.04	0.97
						Conductivity	00094	-	7	-	78.00	85.00	104.00	109.50	132.00	100.43	0.13	0.90
						DO	00300	5.0	7	0	7.20	7.75	8.60	9.45	10.40	8.66	0.65	0.54
						pH	00400	6.5-9.0	7	0	6.90	7.15	7.20	7.40	7.50	7.24	2.29	0.06
						Ammonia	00610	0.11	8	1	0.05	0.05	0.05	0.06	0.15	0.07	-1.72	0.13
						E.coli	31699	394	8	1	1	2	10	109	980	175	0.85	0.43
						Chloride	00940	75	7	0	5.00	5.00	5.00	5.00	5.00	5.00	-	-
						Chlorophyll-*a*	70953	26.7	8	0	2.23	4.77	5.25	6.19	7.75	5.39	0.31	0.76
						Nitrate	00610	0.37	0	-	-	-	-	-	-	-	-	-
						Nitrate+Nitrite	00630	-	8	-	0.04	0.24	0.30	0.42	0.51	0.30	2.64	0.03
						Phosphorus, Total	00665	0.20	7	6	0.12	0.25	0.30	0.32	0.39	0.28	0.95	0.38
						Sulfate	00945	150	7	0	9.00	9.00	11.00	13.50	14.00	11.29	4.44	0.00
						TDS	70300	350	0	-	-	-	-	-	-	-	-	-
						TSS	00530	-	8	-	6.00	17.25	22.00	30.00	35.00	22.25	0.55	0.60
						TKN	00625	-	8	-	0.57	0.77	0.88	1.19	3.78	1.25	1.22	0.26
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	8	-	4.00	4.00	4.00	5.50	7.00	4.88	-0.77	0.47
RI	0209_01	16343	08/01/03	07/31/13	Pat Mayse Lake	Temperature	00010	90	36	0	5.20	11.78	21.50	27.18	33.30	20.30	-0.14	0.89
						Conductivity	00094	-	36	-	116.00	133.75	147.00	153.25	166.00	144.28	-2.25	0.03
						DO	00300	5.0	36	1	4.70	7.25	8.75	10.83	13.20	8.96	0.54	0.60
						pH	00400	6.5-9.0	36	1	6.20	7.48	7.90	8.30	9.20	7.89	-0.22	0.83
						Ammonia	00610	0.11	38	3	0.05	0.05	0.05	0.05	0.28	0.06	1.28	0.21
						E.coli	31699	394	32	0	1	1	1	13	41	8	-0.16	0.87
						Chloride	00940	100	37	0	5.00	5.00	6.00	7.00	10.00	6.49	-3.51	0.00
						Chlorophyll-*a*	70953	26.7	37	8	4.61	11.00	18.00	25.10	34.50	18.52	-1.02	0.32
						Nitrate	00610	0.37	6	0	0.05	0.05	0.05	0.05	0.08	0.06	0.24	0.82
						Nitrate+Nitrite	00630	-	32	-	0.04	0.04	0.04	0.08	0.26	0.08	-0.75	0.46
						Phosphorus, Total	00665	0.20	33	0	0.02	0.04	0.06	0.06	0.08	0.05	-4.05	0.00
						Sulfate	00945	175	37	0	6.00	12.00	13.00	13.00	19.00	12.76	-1.55	0.13
						TDS	70300	350	29	0	82.00	95.00	100.00	106.00	132.00	100.83	-1.00	0.33
						TSS	00530	-	37	-	4.00	4.00	6.00	8.00	14.00	6.38	1.13	0.27
						TKN	00625	-	34	-	0.40	0.55	0.62	0.75	1.15	0.66	0.37	0.71
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	37	-	2.00	4.00	4.00	4.00	5.00	3.76	4.99	0.00
RI	0209_02	16342	08/01/03	07/31/13	Pat Mayse Lake	Temperature	00010	90	36	0	5.60	13.63	22.00	27.28	32.70	20.89	-0.36	0.72
						Conductivity	00094	-	36	-	118.00	133.75	146.00	153.75	167.00	144.72	-2.78	0.01
						DO	00300	5.0	36	0	5.80	8.10	9.20	10.43	12.80	9.25	0.82	0.42
						pH	00400	6.5-9.0	36	1	6.10	7.85	8.30	8.50	9.20	8.15	-0.94	0.35
						Ammonia	00610	0.11	37	1	0.05	0.05	0.05	0.05	0.40	0.06	1.37	0.18
						E.coli	31699	394	30	0	1	1	1	10	220	18	0.81	0.42
						Chloride	00940	100	36	0	5.00	5.75	6.00	7.00	9.00	6.44	-4.29	0.00
						Chlorophyll-*a*	70953	26.7	35	9	5.86	14.45	20.10	29.65	41.10	21.42	-0.76	0.45
						Nitrate	00610	0.37	6	0	0.05	0.05	0.05	0.05	0.06	0.05	-0.17	0.87
						Nitrate+Nitrite	00630	-	31	-	0.04	0.04	0.04	0.11	0.22	0.08	-0.86	0.40
						Phosphorus, Total	00665	0.20	33	0	0.02	0.05	0.06	0.06	0.10	0.05	-2.14	0.04
						Sulfate	00945	175	36	0	9.00	12.00	13.00	13.00	18.00	12.78	-1.86	0.07
						TDS	70300	350	28	0	55.00	94.50	103.00	107.00	129.00	101.50	-1.05	0.30
						TSS	00530	-	37	-	4.00	5.00	7.00	11.00	20.00	8.27	0.59	0.56
						TKN	00625	-	33	-	0.50	0.62	0.70	0.89	1.41	0.75	-0.62	0.54
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	37	-	3.00	4.00	4.00	4.00	5.00	4.03	3.25	0.00

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RI	0210_01	10139	08/01/03	07/31/13	Farmers Creek Reservoir	Temperature	00010	93	22	0	6.70	9.13	16.65	27.28	31.10	18.27	-0.28	0.79
						Conductivity	00094	-	22	-	472.00	737.25	800.00	864.75	1000.00	782.45	-1.84	0.08
						DO	00300	5.0	22	0	5.60	7.29	9.60	10.10	12.20	8.93	0.98	0.34
						pH	00400	6.5-9.0	22	0	7.80	8.23	8.30	8.40	8.70	8.33	1.75	0.09
						Ammonia	00610	0.11	22	0	0.05	0.05	0.05	0.10	0.11	0.07	5.24	0.00
						E.coli	31699	394	17	0	1	1	1	5	15	4	0.43	0.68
						Chloride	00940	200	22	2	77.00	130.75	153.00	168.50	344.00	156.95	-0.11	0.91
						Chlorophyll-*a*	70953	26.7	21	1	3.61	8.60	10.00	13.00	35.80	11.75	1.20	0.24
						Nitrate	00610	0.37	7	0	0.04	0.04	0.05	0.05	0.07	0.05	-0.25	0.81
						Nitrate+Nitrite	00630	-	14	-	0.02	0.04	0.04	0.04	0.12	0.05	0.28	0.78
						Phosphorus, Total	00665	0.20	21	0	0.05	0.06	0.06	0.06	0.12	0.06	0.81	0.43
						Sulfate	00945	60	22	1	21.00	32.25	37.50	44.75	85.90	39.13	-0.55	0.59
						TDS	70300	550	21	1	292.00	404.00	438.00	488.00	554.00	444.67	-3.65	0.00
						TSS	00530	-	22	-	3.00	4.25	6.00	8.00	11.40	6.54	2.60	0.02
						TKN	00625	-	14	-	0.50	0.56	0.61	0.65	1.08	0.63	1.50	0.16
						Turbidity	82079	-	7	-	3.40	6.25	6.74	10.18	13.00	8.00	-0.47	0.66
						VSS	00535	-	22	-	1.00	2.85	4.00	4.00	4.90	3.46	1.69	0.11
RII	0211_01	10140	08/01/03	07/31/13	Little Wichita River	Temperature	00010	91	64	0	1.70	10.10	18.05	26.20	31.70	17.87	-0.28	0.78
						Conductivity	00094	-	64	-	144.00	895.75	2445.00	3947.50	7860.00	2637.66	3.82	0.00
						DO	00300	3.0	64	1	1.20	5.00	7.00	9.83	17.00	7.83	2.04	0.05
						pH	00400	6.5-9.0	64	0	7.40	7.80	8.10	8.33	8.90	8.09	2.59	0.01
						Ammonia	00610	0.33	25	2	0.07	0.10	0.10	0.10	0.38	0.13	-1.01	0.32
						E.coli	31699	394	64	11	2	24	96	258	4100	306	-1.13	0.26
						Chloride	00940	250	25	16	10.00	157.00	428.00	643.00	5020.00	676.06	1.98	0.06
						Chlorophyll-*a*	70953	14.1	11	10	11.00	22.85	66.00	158.50	228.00	98.10	1.42	0.19
						Nitrate	00610	1.95	11	0	0.02	0.04	0.08	0.18	0.40	0.14	2.34	0.04
						Nitrate+Nitrite	00630	-	13	-	0.02	0.04	0.04	0.26	0.38	0.14	-1.77	0.10
						Phosphorus, Total	00665	0.69	32	0	0.06	0.17	0.28	0.37	0.50	0.28	-1.63	0.11
						Sulfate	00945	50	25	21	10.00	84.00	232.00	544.00	2500.00	390.90	3.00	0.01
						TDS	70300	500	24	20	172.00	641.75	1180.00	2232.50	5170.00	1595.04	1.75	0.09
						TSS	00530	-	25	-	17.00	44.00	70.40	98.00	184.00	74.15	-0.63	0.53
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	65	-	9.86	44.00	77.00	180.00	784.00	141.37	-2.98	0.00
						VSS	00535	-	25	-	4.40	8.00	12.00	18.00	53.20	14.40	1.62	0.12
RII	0211_02	13633	08/01/03	07/31/13	Little Wichita River	Temperature	00010	91	22	0	3.40	9.75	17.15	24.10	30.80	16.86	-1.12	0.28
						Conductivity	00094	-	21	-	159.00	230.00	280.00	537.00	806.00	399.95	0.00	1.00
						DO	00300	3.0	22	5	1.30	3.80	5.60	8.58	11.40	6.17	0.67	0.51
						pH	00400	6.5-9.0	22	0	7.20	7.50	7.85	8.10	8.30	7.79	1.61	0.12
						Ammonia	00610	0.33	22	0	0.05	0.05	0.05	0.07	0.31	0.07	1.13	0.27
						E.coli	31699	394	19	9	13	134	400	730	20000	1668	1.68	0.11
						Chloride	00940	250	23	0	7.00	14.50	26.00	67.00	148.00	48.04	-1.28	0.21
						Chlorophyll-*a*	70953	14.1	22	8	3.00	10.00	10.00	24.63	59.60	18.40	1.27	0.22
						Nitrate	00610	1.95	7	0	0.05	0.05	0.05	0.05	0.19	0.07	1.23	0.27
						Nitrate+Nitrite	00630	-	15	-	0.04	0.04	0.07	0.16	0.38	0.12	1.51	0.15
						Phosphorus, Total	00665	0.69	22	1	0.08	0.23	0.38	0.50	0.96	0.38	2.42	0.02
						Sulfate	00945	50	23	0	2.00	5.00	5.00	6.00	21.00	7.13	-1.95	0.06
						TDS	70300	500	17	1	152.00	218.00	261.00	329.00	528.00	297.24	-3.37	0.00
						TSS	00530	-	23	-	6.00	24.00	36.00	75.50	583.00	73.48	2.45	0.02
						TKN	00625	-	22	-	0.73	1.09	1.43	1.86	3.00	1.49	3.14	0.00
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	23	-	1.00	4.50	7.00	14.50	73.00	11.26	2.67	0.01

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RII	0211A_01	10105	08/01/03	07/31/13	East Fork Little Wichita River	Temperature	00010	91	5	-	4.40	8.40	16.50	18.80	21.40	13.90	3.26	0.03
						Conductivity	00094	-	5	-	103.00	114.00	190.00	251.00	400.00	211.60	-0.46	0.67
						DO	00300	9.0	5	0	5.10	6.40	6.50	9.00	10.60	7.52	-0.48	0.66
						pH	00400	6.5-9.0	5	0	7.50	7.50	8.00	8.10	8.10	7.84	-4.16	0.01
						Ammonia	00610	0.33	6	1	0.05	0.06	0.08	0.12	0.36	0.12	0.78	0.47
						E.coli	31699	394	5	3	63	130	410	480	2400	697	-0.37	0.73
						Chloride	00940	-	6	-	5.00	6.25	9.50	13.50	101.00	24.17	-11.89	0.00
						Chlorophyll-*a*	70953	14.1	6	1	4.36	5.33	6.42	9.67	29.40	10.39	-7.67	0.00
						Nitrate	00610	1.95	0	-	-	-	-	-	-	-	-	-
						Nitrate+Nitrite	00630	-	6	-	0.04	0.04	0.15	0.32	0.51	0.20	0.85	0.44
						Phosphorus, Total	00665	0.69	6	1	0.17	0.26	0.47	0.60	0.96	0.48	1.20	0.28
						Sulfate	00945	-	6	-	5.00	5.00	5.00	5.00	26.00	8.50	-11.19	0.00
						TDS	70300	-	1	-	390.00	390.00	390.00	390.00	390.00	390.00	-	-
						TSS	00530	-	6	-	22.00	34.25	93.00	181.00	1750.00	363.83	0.44	0.68
						TKN	00625	-	6	-	1.41	1.43	1.64	2.47	3.82	2.10	0.80	0.46
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	6	-	5.00	7.00	13.50	21.50	137.00	33.00	0.49	0.65
RII	0212_01	10142	08/01/03	07/31/13	Lake Arrowhead	Temperature	00010	93	23	0	6.60	9.45	20.50	27.95	32.10	18.73	-0.39	0.70
						Conductivity	00094	-	23	-	500.00	580.00	672.00	710.00	850.00	661.04	0.63	0.54
						DO	00300	5.0	23	0	6.90	8.05	10.00	10.65	11.70	9.55	2.00	0.06
						pH	00400	6.5-9.0	23	0	8.00	8.40	8.50	8.65	8.90	8.51	1.18	0.25
						Ammonia	00610	0.11	24	1	0.05	0.05	0.05	0.10	0.24	0.07	3.40	0.00
						E.coli	31699	394	20	0	1	1	2	5	10	4	0.66	0.52
						Chloride	00940	250	23	1	70.00	89.00	98.00	125.50	297.00	112.22	1.36	0.19
						Chlorophyll-*a*	70953	26.7	23	0	4.80	9.08	12.60	15.65	24.00	12.64	-0.68	0.50
						Nitrate	00610	0.37	7	0	0.04	0.05	0.05	0.08	0.08	0.06	0.23	0.82
						Nitrate+Nitrite	00630	-	16	-	0.02	0.04	0.04	0.04	0.08	0.04	-0.05	0.96
						Phosphorus, Total	00665	0.20	22	4	0.07	0.12	0.14	0.17	0.23	0.15	-4.06	0.00
						Sulfate	00945	50	24	0	8.00	11.00	13.10	15.70	37.60	14.37	0.03	0.98
						TDS	70300	500	23	0	281.00	337.00	352.00	389.00	478.00	368.43	-0.72	0.48
						TSS	00530	-	24	-	4.00	6.30	8.50	12.25	21.00	9.92	0.52	0.61
						TKN	00625	-	17	-	0.64	0.70	0.83	0.85	0.98	0.80	1.89	0.08
						Turbidity	82079	-	7	-	9.60	13.55	22.10	33.00	39.00	23.40	1.09	0.32
						VSS	00535	-	24	-	2.00	2.73	4.00	4.00	5.00	3.47	-0.60	0.55
RII	0212A_01	16038	08/01/03	07/31/13	Little Wichita River Above Lake Arrowhead	Temperature	00010	93	5	-	6.90	7.00	19.40	20.80	26.40	16.10	3.12	0.04
						Conductivity	00094	-	5	-	259.00	417.00	431.00	606.00	670.00	476.60	-1.03	0.36
						DO	00300	5.0	5	1	0.80	3.70	5.40	7.20	8.50	5.12	-1.51	0.20
						pH	00400	6.5-9.0	5	0	7.30	7.50	7.60	7.80	7.90	7.62	-2.72	0.05
						Ammonia	00610	0.33	4	0	0.06	0.08	0.10	0.15	0.26	0.13	-0.27	0.81
						E.coli	31699	394	4	2	20	200	540	940	1300	600	5.34	0.01
						Chloride	00940	-	4	-	22.00	47.50	78.00	107.50	130.00	77.00	-2.04	0.13
						Chlorophyll-*a*	70953	14.1	4	0	1.05	2.60	3.92	4.78	4.94	3.46	0.35	0.75
						Nitrate	00610	1.95	0	-	-	-	-	-	-	-	-	-
						Nitrate+Nitrite	00630	-	4	-	0.10	0.27	0.36	0.45	0.58	0.35	0.91	0.43
						Phosphorus, Total	00665	0.69	4	1	0.16	0.24	0.33	0.51	0.86	0.42	14.38	0.00
						Sulfate	00945	-	4	-	5.00	5.75	10.00	14.00	14.00	9.75	-1.60	0.21
						TDS	70300	-	0	-	-	-	-	-	-	-	-	-
						TSS	00530	-	4	-	6.00	12.00	92.50	318.25	760.00	237.75	5.68	0.01
						TKN	00625	-	4	-	1.17	1.25	1.41	1.71	2.20	1.55	4.33	0.02
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	4	-	4.00	4.00	12.00	30.50	62.00	22.50	6.13	0.01

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RII	0213_01	10143	08/01/03	07/31/13	Lake Kickapoo	Temperature	00010	90	8	0	7.90	10.18	17.60	25.05	28.50	18.01	-1.43	0.20
						Conductivity	00094	-	8	-	400.00	499.50	515.00	542.50	559.00	509.13	6.32	0.00
						DO	00300	5.0	8	0	6.50	7.95	10.05	11.05	11.50	9.51	2.50	0.04
						pH	00400	6.5-9.0	8	0	8.20	8.45	8.50	8.53	8.60	8.46	1.34	0.22
						Ammonia	00610	0.11	8	0	0.05	0.10	0.10	0.10	0.10	0.09	15.59	0.00
						E.coli	31699	394	8	0	1	1	2	3	63	10	0.19	0.86
						Chloride	00940	100	8	1	43.00	51.90	54.35	62.40	532.00	114.21	0.19	0.85
						Chlorophyll-*a*	70953	26.7	8	0	3.30	4.33	6.30	9.63	10.10	6.75	-1.20	0.27
						Nitrate	00610	0.37	5	0	0.04	0.04	0.05	0.05	0.05	0.05	-0.79	0.48
						Nitrate+Nitrite	00630	-	3	-	0.02	0.02	0.02	0.03	0.04	0.03	-0.02	0.98
						Phosphorus, Total	00665	0.20	8	0	0.05	0.06	0.06	0.08	0.13	0.08	0.56	0.59
						Sulfate	00945	50	8	0	14.00	16.55	17.00	17.90	19.70	17.09	2.32	0.05
						TDS	70300	400	8	0	224.00	262.00	278.00	288.00	300.00	271.50	1.31	0.23
						TSS	00530	-	8	-	4.70	9.85	11.20	15.75	26.00	13.21	-0.29	0.78
						TKN	00625	-	1	-	0.52	0.52	0.52	0.52	0.52	0.52	-	-
						Turbidity	82079	-	7	-	14.00	45.00	55.00	70.40	80.00	54.26	1.09	0.32
						VSS	00535	-	8	-	2.00	2.50	2.50	2.50	3.00	2.50	2.58	0.04
RII	0214_01	10145	08/01/03	07/31/13	Wichita River Below Diversion Lake Dam	Temperature	00010	90	87	0	0.30	11.15	18.20	25.65	31.00	17.78	-0.71	0.48
						Conductivity	00094	-	87	-	310.00	3430.00	4220.00	4680.00	7250.00	3922.79	3.98	0.00
						DO	00300	5.0	87	3	4.60	7.50	10.40	12.45	20.00	10.22	1.49	0.14
						pH	00400	6.5-9.0	87	1	6.50	8.00	8.30	8.60	9.10	8.27	1.94	0.06
						Ammonia	00610	0.33	47	0	0.02	0.05	0.10	0.10	0.22	0.08	1.99	0.05
						E.coli	31699	394	85	14	2	26	52	160	24000	761	-1.61	0.11
						Chloride	00940	1800	49	1	92.20	680.00	943.00	1090.00	7700.00	999.58	-0.68	0.50
						Chlorophyll-*a*	70953	14.1	41	35	6.30	20.60	46.50	109.00	314.00	74.99	0.80	0.43
						Nitrate	00610	1.95	7	4	0.29	1.08	2.32	3.96	4.94	2.52	0.96	0.37
						Nitrate+Nitrite	00630	-	40	-	0.04	1.21	1.96	3.04	8.50	2.37	2.47	0.02
						Phosphorus, Total	00665	0.69	55	19	0.09	0.45	0.58	0.79	1.10	0.59	-1.13	0.26
						Sulfate	00945	800	56	1	41.60	346.00	439.00	558.00	1130.00	451.22	3.50	0.00
						TDS	70300	5000	49	0	320.00	1690.00	2390.00	2780.00	4780.00	2257.14	3.21	0.00
						TSS	00530	-	50	-	4.00	33.50	85.40	129.75	1170.00	147.40	-1.42	0.16
						TKN	00625	-	13	-	0.77	0.95	1.10	2.21	2.53	1.46	-0.83	0.42
						Turbidity	82079	-	75	-	2.80	21.50	70.00	145.00	2130.00	194.65	-2.02	0.05
						VSS	00535	-	50	-	4.00	8.00	14.20	22.75	94.00	19.38	-0.14	0.89
RII	0214_02	10148	08/01/03	07/31/13	Wichita River Below Diversion Lake Dam	Temperature	00010	90	35	0	1.90	12.30	18.50	26.50	33.70	19.17	-0.45	0.65
						Conductivity	00094	-	35	-	1950.00	3635.00	4260.00	4615.00	7280.00	4186.29	1.46	0.15
						DO	00300	5.0	35	1	4.90	7.65	10.40	11.90	14.80	9.96	0.04	0.97
						pH	00400	6.5-9.0	35	0	7.40	7.80	7.90	8.20	8.80	8.01	-0.80	0.43
						Ammonia	00610	0.33	30	1	0.05	0.05	0.06	0.10	0.36	0.08	1.15	0.26
						E.coli	31699	394	18	0	8	8	23	27	29	20	-4.31	0.00
						Chloride	00940	1800	31	0	310.00	803.00	931.00	1095.00	1390.00	912.29	0.69	0.50
						Chlorophyll-*a*	70953	14.1	31	25	3.00	15.40	33.70	54.45	222.00	47.55	-0.70	0.49
						Nitrate	00610	1.95	7	7	3.50	4.29	4.77	5.79	7.10	5.08	0.63	0.55
						Nitrate+Nitrite	00630	-	22	-	0.23	2.95	4.17	4.74	10.30	4.13	0.60	0.55
						Phosphorus, Total	00665	0.69	28	32	0.30	0.96	1.09	1.23	2.75	1.12	1.21	0.24
						Sulfate	00945	800	32	3	107.00	394.00	463.50	556.50	5700.00	630.06	1.55	0.13
						TDS	70300	5000	32	0	880.00	2037.50	2460.00	2787.50	3690.00	2379.31	0.73	0.47
						TSS	00530	-	32	-	4.00	22.50	42.00	67.50	800.00	86.27	0.25	0.80
						TKN	00625	-	23	-	0.80	1.02	1.32	1.62	2.12	1.34	-1.34	0.19
						Turbidity	82079	-	6	-	11.00	25.25	32.50	39.75	45.00	31.00	0.96	0.38
						VSS	00535	-	31	-	4.00	5.00	9.00	14.00	80.00	13.17	-0.04	0.97

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RII	0214_03	10151	08/01/03	07/31/13	Wichita River Below Diversion Lake Dam	Temperature	00010	90	29	0	6.10	13.90	19.00	25.50	31.30	19.53	0.60	0.55
						Conductivity	00094	-	17	-	488.00	4130.00	5300.00	5930.00	6920.00	4614.71	-1.58	0.13
						DO	00300	5.0	29	1	4.60	7.30	9.60	10.90	13.80	9.35	-0.27	0.79
						pH	00400	6.5-9.0	29	0	7.40	7.90	8.00	8.10	8.40	7.98	0.33	0.75
						Ammonia	00610	0.33	5	0	0.02	0.03	0.04	0.08	0.08	0.05	0.92	0.41
						E.coli	31699	394	5	2	15	218	369	440	488	306	0.33	0.76
						Chloride	00940	1800	17	1	93.00	1000.00	1290.00	1530.00	1815.00	1144.82	-1.60	0.13
						Chlorophyll-*a*	70953	14.1	5	5	27.50	37.80	42.40	48.10	96.80	50.52	-1.11	0.33
						Nitrate	00610	1.95	0	-	-	-	-	-	-	-	-	-
						Nitrate+Nitrite	00630	-	5	-	0.02	0.02	0.03	0.05	0.13	0.05	0.49	0.65
						Phosphorus, Total	00665	0.69	5	0	0.11	0.12	0.15	0.24	0.24	0.17	2.10	0.10
						Sulfate	00945	800	17	4	34.00	436.00	680.00	787.00	1050.00	586.64	-2.63	0.02
						TDS	70300	5000	5	0	2640.00	2970.00	3360.00	3690.00	4420.00	3416.00	-0.79	0.47
						TSS	00530	-	17	-	14.00	23.00	90.00	173.00	1140.00	187.06	1.03	0.32
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	5	-	17.60	28.40	73.00	165.00	324.00	121.60	1.35	0.25
						VSS	00535	-	5	-	7.00	9.00	15.00	15.00	18.00	12.80	0.73	0.51
RII	0214_03	10152	08/01/03	07/31/13	Wichita River Below Diversion Lake Dam	Temperature	00010	90	14	0	2.80	11.38	16.40	24.70	28.90	16.89	0.27	0.79
						Conductivity	00094	-	14	-	2100.00	4507.50	5500.00	5690.00	6230.00	4991.43	0.15	0.88
						DO	00300	5.0	14	0	7.00	8.73	10.80	11.80	13.10	10.24	-0.59	0.57
						pH	00400	6.5-9.0	14	0	7.80	7.90	7.95	8.08	8.10	7.97	2.02	0.06
						Ammonia	00610	0.33	14	0	0.05	0.05	0.05	0.05	0.24	0.07	1.14	0.27
						E.coli	31699	394	12	0	10	37	69	87	390	90	0.61	0.55
						Chloride	00940	1800	16	0	336.00	893.00	1395.00	1507.50	1590.00	1195.63	0.95	0.36
						Chlorophyll-*a*	70953	14.1	14	8	3.47	12.80	21.45	29.15	64.10	25.24	0.63	0.54
						Nitrate	00610	1.95	0	-	-	-	-	-	-	-	-	-
						Nitrate+Nitrite	00630	-	15	-	0.04	0.04	0.19	0.47	0.92	0.29	-0.69	0.50
						Phosphorus, Total	00665	0.69	14	0	0.07	0.09	0.11	0.17	0.35	0.15	-0.36	0.73
						Sulfate	00945	800	16	1	121.00	439.25	625.00	678.00	874.00	548.44	1.63	0.12
						TDS	70300	5000	16	0	944.00	2355.00	3420.00	3590.00	3810.00	2944.63	0.78	0.45
						TSS	00530	-	16	-	6.00	17.50	54.50	106.75	694.00	122.13	-0.96	0.35
						TKN	00625	-	13	-	0.60	0.74	0.84	1.16	1.84	0.98	-0.55	0.59
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	16	-	4.00	4.00	8.00	18.25	64.00	14.13	-0.76	0.46
RII	0214_03	10153	08/01/03	07/31/13	Wichita River Below Diversion Lake Dam	Temperature	00010	90	40	0	0.90	11.88	20.55	25.43	31.50	19.07	0.75	0.45
						Conductivity	00094	-	40	-	525.00	3900.00	5180.00	5752.50	6870.00	4597.13	0.64	0.52
						DO	00300	5.0	40	2	4.50	7.78	10.80	13.55	18.40	10.77	-1.40	0.17
						pH	00400	6.5-9.0	40	0	7.50	7.80	7.90	8.10	8.40	7.94	-1.33	0.19
						Ammonia	00610	0.33	16	0	0.02	0.03	0.06	0.08	0.10	0.06	4.08	0.00
						E.coli	31699	394	40	7	10	33	69	205	24200	1713	-1.34	0.19
						Chloride	00940	1800	16	1	120.00	331.00	1210.00	1425.00	1890.00	954.06	0.91	0.38
						Chlorophyll-*a*	70953	14.1	12	10	5.00	18.00	35.95	49.80	95.40	37.48	0.55	0.59
						Nitrate	00610	1.95	0	-	-	-	-	-	-	-	-	-
						Nitrate+Nitrite	00630	-	16	-	0.02	0.13	0.43	0.66	1.01	0.44	-1.19	0.25
						Phosphorus, Total	00665	0.69	16	2	0.06	0.14	0.22	0.33	0.97	0.31	-0.75	0.47
						Sulfate	00945	800	16	1	43.50	145.75	507.00	623.50	921.00	449.82	0.48	0.64
						TDS	70300	5000	16	0	424.00	1053.25	3045.00	3530.00	4060.00	2520.56	0.73	0.48
						TSS	00530	-	16	-	10.00	19.75	61.50	269.00	1600.00	307.68	-0.71	0.49
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	40	-	5.10	12.28	49.85	258.75	3980.00	422.52	-0.90	0.37
						VSS	00535	-	16	-	4.00	6.90	12.00	24.00	100.00	24.40	-1.16	0.26

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RII	0214_04	10154	08/01/03	07/31/13	Wichita River Below Diversion Lake Dam	Temperature	00010	90	42	0	1.90	10.80	16.45	26.23	30.10	17.20	1.12	0.27
						Conductivity	00094	-	42	-	2070.00	4837.50	6115.00	7005.00	10500.00	5876.67	2.41	0.02
						DO	00300	5.0	42	0	6.30	7.88	9.40	11.38	13.70	9.70	-0.65	0.52
						pH	00400	6.5-9.0	42	0	7.30	7.80	7.90	7.90	8.10	7.86	-1.06	0.30
						Ammonia	00610	0.33	18	0	0.10	0.10	0.10	0.10	0.10	0.10	-	-
						E.coli	31699	394	41	3	10	41	79	170	2300	210	-0.13	0.90
						Chloride	00940	1800	18	6	58.90	1300.00	1585.00	1985.00	2810.00	1622.49	0.09	0.93
						Chlorophyll-*a*	70953	14.1	15	11	3.50	13.90	19.10	28.55	50.80	23.41	0.40	0.69
						Nitrate	00610	1.95	12	0	0.02	0.04	0.04	0.04	0.30	0.08	0.24	0.81
						Nitrate+Nitrite	00630	-	5	-	0.04	0.04	0.04	0.18	0.21	0.10	0.30	0.78
						Phosphorus, Total	00665	0.69	26	0	0.06	0.06	0.06	0.10	0.24	0.09	-1.93	0.07
						Sulfate	00945	800	18	5	23.70	517.25	663.50	926.00	1250.00	675.43	-0.58	0.57
						TDS	70300	5000	18	4	1620.00	3557.50	4350.00	4970.00	7130.00	4304.44	1.61	0.13
						TSS	00530	-	17	-	18.00	27.80	50.90	83.00	177.00	63.94	-0.47	0.65
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	42	-	5.16	19.85	46.50	115.25	540.00	93.56	-1.01	0.32
						VSS	00535	-	16	-	3.00	5.00	7.40	13.43	21.30	9.58	0.07	0.95
RII	0214_04	10155	08/01/03	07/31/13	Wichita River Below Diversion Lake Dam	Temperature	00010	90	86	0	1.50	10.93	17.00	25.00	30.50	17.33	-1.21	0.23
						Conductivity	00094	-	86	-	722.00	5755.00	6970.00	7957.50	10100.00	6601.36	2.42	0.02
						DO	00300	5.0	86	3	4.30	7.20	9.45	11.40	15.50	9.53	-1.14	0.26
						pH	00400	6.5-9.0	86	0	7.10	7.60	7.70	7.80	8.10	7.68	-1.92	0.06
						Ammonia	00610	0.33	38	0	0.02	0.06	0.10	0.10	0.28	0.10	2.76	0.01
						E.coli	31699	394	85	22	10	74	170	430	24200	1061	-1.10	0.27
						Chloride	00940	1800	38	19	171.00	1377.50	1805.00	2087.50	2740.00	1674.45	2.92	0.01
						Chlorophyll-*a*	70953	14.1	30	19	2.00	10.98	16.40	39.80	93.80	28.09	-0.63	0.54
						Nitrate	00610	1.95	12	0	0.02	0.04	0.11	0.16	0.35	0.13	0.27	0.80
						Nitrate+Nitrite	00630	-	26	-	0.02	0.03	0.11	0.69	1.82	0.42	-0.68	0.50
						Phosphorus, Total	00665	0.69	46	1	0.06	0.06	0.11	0.19	0.82	0.16	-1.14	0.26
						Sulfate	00945	800	38	22	101.00	719.50	860.50	1040.00	1290.00	835.50	2.77	0.01
						TDS	70300	5000	38	11	480.00	3630.00	4350.00	5430.00	6740.00	4263.89	3.67	0.00
						TSS	00530	-	37	-	16.00	35.00	80.40	197.00	636.00	133.44	0.89	0.38
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	86	-	10.10	29.93	74.85	195.00	1770.00	172.16	-0.85	0.40
						VSS	00535	-	36	-	4.00	6.00	12.00	18.25	42.00	14.23	0.94	0.35
RII	0214A_01	15120	08/01/03	07/31/13	Beaver Creek	Temperature	00010	90	67	-	0.70	8.15	16.90	25.00	32.20	16.27	-0.88	0.38
						Conductivity	00094	-	67	-	398.00	1205.00	1990.00	3575.00	16800.00	2919.82	1.82	0.07
						DO	00300	5.0	67	3	2.50	6.60	8.40	10.55	13.30	8.52	0.23	0.82
						pH	00400	6.5-9.0	67	0	7.20	7.80	7.90	8.10	8.70	7.91	-1.08	0.28
						Ammonia	00610	0.33	35	0	0.05	0.05	0.10	0.10	0.30	0.09	0.94	0.35
						E.coli	31699	394	62	13	1	71	140	282	8700	515	0.72	0.48
						Chloride	00940	-	35	-	106.00	259.00	482.00	843.50	6040.00	793.34	1.88	0.07
						Chlorophyll-*a*	70953	14.1	27	6	2.00	3.99	10.00	13.70	67.30	12.29	-1.22	0.23
						Nitrate	00610	1.95	16	0	0.02	0.04	0.05	0.11	0.57	0.11	0.44	0.66
						Nitrate+Nitrite	00630	-	19	-	0.04	0.04	0.05	0.24	0.71	0.16	1.28	0.22
						Phosphorus, Total	00665	0.69	43	1	0.05	0.07	0.11	0.24	1.50	0.22	1.51	0.14
						Sulfate	00945	-	36	-	13.10	49.25	83.75	109.25	436.00	104.32	1.83	0.08
						TDS	70300	-	35	-	449.00	699.00	1230.00	2035.00	13300.00	2060.80	2.33	0.03
						TSS	00530	-	35	-	6.00	42.50	68.00	187.50	1950.00	193.87	2.09	0.04
						TKN	00625	-	13	-	0.68	0.78	0.84	0.91	1.54	0.90	0.46	0.65
						Turbidity	82079	-	54	-	7.20	54.53	179.50	578.25	3900.00	432.76	0.94	0.35
						VSS	00535	-	34	-	2.00	4.10	7.00	15.00	70.00	12.32	0.74	0.46

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RII	0214A_02	15121	08/01/03	07/31/13	Beaver Creek	Temperature	00010	90	53	-	0.50	10.60	18.50	23.90	29.50	16.83	-1.00	0.32
						Conductivity	00094	-	53	-	262.00	500.00	607.00	778.00	1550.00	662.64	-0.63	0.53
						DO	00300	5.0	53	14	2.30	4.90	6.00	8.30	13.00	6.93	-0.99	0.33
						pH	00400	6.5-9.0	53	2	5.20	7.70	7.90	8.00	9.20	7.85	1.58	0.12
						Ammonia	00610	0.33	37	3	0.02	0.10	0.10	0.10	0.80	0.14	0.72	0.48
						E.coli	31699	394	53	23	74	190	360	620	6870	666	-1.09	0.28
						Chloride	00940	-	37	-	21.60	50.70	69.80	93.50	2400.00	146.39	-1.84	0.07
						Chlorophyll-*a*	70953	14.1	20	8	2.61	8.20	13.60	19.20	81.80	17.48	1.61	0.12
						Nitrate	00610	1.95	12	0	0.02	0.06	0.12	0.14	0.23	0.12	0.68	0.51
						Nitrate+Nitrite	00630	-	25	-	0.02	0.16	0.24	0.32	3.59	0.38	0.22	0.83
						Phosphorus, Total	00665	0.69	37	1	0.12	0.24	0.30	0.38	3.40	0.40	2.22	0.03
						Sulfate	00945	-	37	-	18.40	39.10	66.00	99.40	245.00	86.62	-1.16	0.26
						TDS	70300	-	37	-	206.00	388.00	468.00	568.00	1040.00	498.92	-0.92	0.37
						TSS	00530	-	37	-	18.00	68.00	147.00	214.00	760.00	167.26	-0.10	0.92
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	53	-	30.80	300.00	391.00	498.00	21000.00	813.69	2.29	0.03
						VSS	00535	-	36	-	4.00	8.00	11.00	16.00	50.00	13.16	0.73	0.47
RII	0214B_01	10097	08/01/03	07/31/13	Buffalo Creek	Temperature	00010	90	65	-	3.30	9.40	17.90	25.70	30.10	17.31	-0.07	0.95
						Conductivity	00094	-	65	-	380.00	3250.00	3880.00	4350.00	6080.00	3732.92	0.70	0.49
						DO	00300	5.0	65	0	5.20	6.60	8.80	10.40	15.80	8.78	-1.15	0.26
						pH	00400	6.5-9.0	65	0	7.20	7.60	7.70	7.80	8.30	7.68	-1.40	0.17
						Ammonia	00610	0.33	25	13	0.06	0.24	0.35	0.59	3.18	0.55	0.44	0.66
						E.coli	31699	394	65	16	31	98	190	370	12000	683	0.07	0.94
						Chloride	00940	-	25	-	67.00	670.00	891.00	1070.00	1350.00	836.92	0.93	0.36
						Chlorophyll-*a*	70953	14.1	21	6	1.70	4.57	10.10	22.50	57.00	15.26	-2.36	0.03
						Nitrate	00610	1.95	10	9	1.58	3.38	4.98	7.78	10.40	5.60	0.96	0.36
						Nitrate+Nitrite	00630	-	13	-	0.38	3.21	5.88	10.00	70.00	10.86	-0.40	0.70
						Phosphorus, Total	00665	0.69	33	29	0.22	0.92	1.30	1.78	3.20	1.44	0.65	0.52
						Sulfate	00945	-	25	-	19.00	271.00	479.00	566.00	813.00	440.92	0.22	0.83
						TDS	70300	-	25	-	288.00	1750.00	2450.00	2850.00	3800.00	2296.16	0.46	0.65
						TSS	00530	-	24	-	13.00	25.10	35.50	53.40	788.00	71.58	-1.40	0.17
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	65	-	3.30	18.20	33.00	49.10	730.00	60.74	-1.37	0.17
						VSS	00535	-	23	-	3.50	4.00	6.00	8.00	68.00	8.74	-1.74	0.10
RII	0214E_01	18831	08/01/03	07/31/13	Wichita Valley Irrigation Project	Temperature	00010	90	24	-	2.00	10.88	17.95	25.40	29.80	17.73	0.26	0.80
						Conductivity	00094	-	24	-	3400.00	4402.50	5365.00	6132.50	8830.00	5514.58	5.43	0.00
						DO	00300	5.0	24	0	6.60	8.08	9.10	10.75	12.00	9.36	0.29	0.78
						pH	00400	6.5-9.0	24	0	7.70	8.10	8.30	8.40	8.50	8.23	0.20	0.84
						Ammonia	00610	0.33	24	0	0.05	0.05	0.05	0.06	0.10	0.06	5.08	0.00
						E.coli	31699	394	17	0	8	8	25	27	32	20	-4.29	0.00
						Chloride	00940	-	26	-	77.70	916.00	1220.00	1402.50	2270.00	1199.09	1.88	0.07
						Chlorophyll-*a*	70953	14.1	24	10	4.71	10.68	12.60	23.78	40.80	16.76	1.66	0.11
						Nitrate	00610	1.95	3	0	0.04	0.04	0.04	0.04	0.04	0.04	-	-
						Nitrate+Nitrite	00630	-	21	-	0.02	0.04	0.04	0.04	0.04	0.04	-2.20	0.04
						Phosphorus, Total	00665	0.69	26	0	0.02	0.06	0.06	0.06	0.08	0.06	-0.25	0.80
						Sulfate	00945	-	18	-	2.00	2.00	3.00	3.00	5.00	3.00	0.69	0.50
						TDS	70300	-	6	-	3.50	3.98	5.21	9.65	16.00	7.44	1.34	0.24
						TSS	00530	-	25	-	4.00	7.00	9.00	11.00	25.00	9.92	0.47	0.64
						TKN	00625	-	16	-	0.56	0.65	0.76	0.80	0.88	0.73	-0.65	0.53
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	24	-	3.10	4.00	4.00	5.00	6.00	4.38	-1.60	0.12

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RII	0214F	21172	08/01/03	07/31/13	Unnamed Tributary to Buffalo Creek	Temperature	00010	90	8	-	11.30	18.13	18.55	18.80	21.70	17.98	0.87	0.41
						Conductivity	00094	-	8	-	1400.00	1427.50	1530.00	1817.50	1860.00	1602.50	3.54	0.01
						DO	00300	5.0	8	0	5.20	6.28	8.35	8.50	8.50	7.44	1.22	0.26
						pH	00400	6.5-9.0	8	2	6.00	6.48	7.15	7.33	7.50	6.93	-2.47	0.04
						Ammonia	00610	0.33	8	8	2.45	4.36	7.47	10.65	11.50	7.35	-3.92	0.01
						E.coli	31699	394	8	8	690	778	960	1200	1600	1020	0.86	0.42
						Chloride	00940	-	8	-	301.00	324.00	343.00	433.25	739.00	405.38	-0.70	0.51
						Chlorophyll-*a*	70953	14.1	8	1	2.00	2.00	2.00	5.33	24.40	6.24	1.01	0.35
						Nitrate	00610	1.95	0	-	-	-	-	-	-	-	-	-
						Nitrate+Nitrite	00630	-	8	-	8.13	9.42	18.60	22.83	31.40	17.90	4.27	0.00
						Phosphorus, Total	00665	0.69	8	8	3.30	3.49	4.00	4.53	5.90	4.17	2.00	0.09
						Sulfate	00945	-	8	-	57.70	66.20	71.20	75.60	91.30	71.63	2.30	0.06
						TDS	70300	-	8	-	748.00	790.50	832.00	941.25	1060.00	870.13	3.79	0.01
						TSS	00530	-	7	-	3.70	10.90	17.20	30.50	200.00	43.39	0.28	0.79
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	8	-	3.70	5.03	9.15	20.25	110.00	23.36	0.60	0.57
						VSS	00535	-	5	-	2.50	2.50	3.10	3.80	36.30	9.64	0.61	0.57
RII	0215_01	10157	08/01/03	07/31/13	Diversion Lake	Temperature	00010	90	21	0	5.10	7.80	13.70	28.20	31.60	17.04	-0.36	0.72
						Conductivity	00094	-	21	-	2000.00	4140.00	5000.00	6820.00	9200.00	5534.29	4.92	0.00
						DO	00300	5.0	21	0	5.90	7.40	10.00	10.80	12.70	9.27	0.91	0.38
						pH	00400	6.5-9.0	21	0	7.70	8.10	8.30	8.40	8.50	8.22	-1.64	0.12
						Ammonia	00610	0.11	21	1	0.05	0.05	0.05	0.10	0.12	0.07	5.19	0.00
						E.coli	31699	394	18	0	1	1	10	18	200	22	0.78	0.45
						Chloride	00940	1800	20	4	394.00	1020.00	1200.00	1612.50	2350.00	1357.95	5.55	0.00
						Chlorophyll-*a*	70953	26.7	19	1	7.73	9.25	10.20	19.75	34.00	14.58	1.30	0.21
						Nitrate	00610	0.37	6	0	0.04	0.04	0.05	0.09	0.25	0.09	0.59	0.58
						Nitrate+Nitrite	00630	-	13	-	0.02	0.04	0.04	0.04	0.78	0.10	1.38	0.19
						Phosphorus, Total	00665	0.20	21	0	0.05	0.06	0.06	0.06	0.07	0.06	3.24	0.00
						Sulfate	00945	1100	21	6	241.00	630.00	768.00	1120.00	1510.00	870.14	5.15	0.00
						TDS	70300	5000	21	4	1060.00	2630.00	3170.00	4420.00	5990.00	3521.90	4.84	0.00
						TSS	00530	-	21	-	4.00	5.70	8.00	9.00	23.00	8.96	1.87	0.08
						TKN	00625	-	13	-	0.48	0.64	0.67	0.73	0.88	0.68	1.48	0.16
						Turbidity	82079	-	7	-	4.70	5.19	5.30	8.90	18.00	8.03	1.91	0.10
						VSS	00535	-	21	-	1.00	3.00	4.00	4.00	7.00	3.95	1.58	0.13
RII	0216_01	10158	08/01/03	07/31/13	Wichita River Below Lake Kemp Dam	Temperature	00010	90	50	0	8.90	14.60	19.20	26.13	32.60	20.27	0.98	0.33
						Conductivity	00094	-	41	-	986.00	4820.00	4930.00	5000.00	5090.00	4802.34	0.09	0.93
						DO	00300	5.0	50	0	5.00	8.48	10.15	11.28	15.80	10.12	1.28	0.21
						pH	00400	6.5-9.0	50	0	7.30	7.80	7.90	8.10	8.30	7.91	1.16	0.25
						Ammonia	00610	0.33	0	-	-	-	-	-	-	-	-	-
						E.coli	31699	394	0	-	-	-	-	-	-	-	-	-
						Chloride	00940	1925	41	0	233.00	1090.00	1130.00	1150.00	1190.00	1097.59	-0.01	0.99
						Chlorophyll-*a*	70953	14.1	0	-	-	-	-	-	-	-	-	-
						Nitrate	00610	1.95	0	-	-	-	-	-	-	-	-	-
						Nitrate+Nitrite	00630	-	0	-	-	-	-	-	-	-	-	-
						Phosphorus, Total	00665	0.69	50	0	0.02	0.04	0.04	0.04	0.39	0.04	-0.33	0.74
						Sulfate	00945	960	41	0	150.00	666.00	678.00	700.00	755.00	670.41	-0.18	0.85
						TDS	70300	5000	0	-	-	-	-	-	-	-	-	-
						TSS	00530	-	41	-	10.00	10.00	10.00	10.00	500.00	23.17	0.29	0.78
						TKN	00625	-	41	-	0.22	0.31	0.38	0.42	1.40	0.39	-0.36	0.72
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	0	-	-	-	-	-	-	-	-	-

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RII	0217_01	10159	08/01/03	07/31/13	Lake Kemp	Temperature	00010	93	23	0	5.20	8.95	19.10	26.45	28.80	17.40	-0.24	0.81
						Conductivity	00094	-	23	-	4100.00	4700.00	4990.00	6140.00	8100.00	5526.52	6.92	0.00
						DO	00300	5.0	23	0	5.90	7.40	9.90	10.80	12.50	9.16	1.12	0.27
						pH	00400	6.5-9.0	23	0	7.80	8.10	8.10	8.20	8.40	8.13	0.16	0.88
						Ammonia	00610	0.11	23	0	0.05	0.05	0.05	0.08	0.10	0.06	4.84	0.00
						E.coli	31699	33	20	0	1	1	2	10	10	5	2.22	0.04
						Chloride	00940	7000	22	0	949.00	1070.00	1250.00	1520.00	2110.00	1335.86	6.63	0.00
						Chlorophyll-*a*	70953	26.7	20	0	3.20	9.59	11.45	14.75	23.40	12.34	0.93	0.37
						Nitrate	00610	0.37	5	0	0.04	0.05	0.05	0.10	0.25	0.10	0.99	0.38
						Nitrate+Nitrite	00630	-	16	-	0.02	0.04	0.04	0.04	0.06	0.04	-3.48	0.00
						Phosphorus, Total	00665	0.20	22	0	0.03	0.05	0.06	0.06	0.06	0.06	0.72	0.48
						Sulfate	00945	2500	23	0	652.00	706.50	797.00	1014.50	1310.00	876.09	7.00	0.00
						TDS	70300	15000	22	0	2570.00	2967.50	3235.00	4067.50	5230.00	3546.82	6.46	0.00
						TSS	00530	-	23	-	2.00	4.00	4.00	7.35	10.00	5.30	2.99	0.01
						TKN	00625	-	17	-	0.29	0.42	0.46	0.56	0.65	0.48	2.89	0.01
						Turbidity	82079	-	6	-	2.70	5.42	6.04	6.38	10.00	6.08	0.76	0.48
						VSS	00535	-	23	-	1.00	2.95	4.00	4.00	4.00	3.30	1.38	0.18
RII	0217_02	10160	08/01/03	07/31/13	Lake Kemp	Temperature	00010	93	16	0	4.60	7.03	21.50	26.68	28.00	17.19	0.06	0.96
						Conductivity	00094	-	16	-	3760.00	4422.50	4685.00	5032.50	5950.00	4742.50	1.75	0.10
						DO	00300	5.0	16	0	6.20	7.30	8.05	10.90	12.50	9.01	0.11	0.92
						pH	00400	6.5-9.0	16	0	8.00	8.20	8.20	8.30	8.40	8.22	0.35	0.73
						Ammonia	00610	0.11	18	0	0.05	0.05	0.05	0.05	0.10	0.05	-1.60	0.13
						E.coli	31699	33	14	1	1	1	6	10	1700	144	0.13	0.90
						Chloride	00940	7000	16	0	838.00	1052.50	1095.00	1240.00	1510.00	1143.00	1.94	0.07
						Chlorophyll-*a*	70953	26.7	16	0	6.08	9.74	10.30	11.23	18.30	10.93	-0.44	0.66
						Nitrate	00610	0.37	3	0	0.05	0.05	0.05	0.08	0.10	0.07	-0.17	0.88
						Nitrate+Nitrite	00630	-	13	-	0.04	0.04	0.04	0.04	0.15	0.05	0.33	0.75
						Phosphorus, Total	00665	0.20	17	0	0.05	0.05	0.06	0.06	0.14	0.06	1.27	0.22
						Sulfate	00945	2500	18	0	583.00	710.00	727.00	838.25	970.00	760.17	2.73	0.01
						TDS	70300	15000	17	0	2030.00	2730.00	3080.00	3270.00	3600.00	2988.82	1.34	0.20
						TSS	00530	-	18	-	5.00	8.00	13.50	16.00	128.00	20.78	0.94	0.36
						TKN	00625	-	18	-	0.33	0.46	0.56	0.63	1.12	0.58	0.59	0.56
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	18	-	2.00	4.00	4.00	4.00	10.00	4.11	2.10	0.05
RII	0218_01	10161	08/01/03	07/31/13	Wichita / North Fork Wichita River	Temperature	00010	93	51	0	2.60	12.50	20.60	24.90	34.20	19.11	0.21	0.83
						Conductivity	00094	-	42	-	1990.00	7185.00	11750.00	15300.00	30200.00	11771.90	0.56	0.58
						DO	00300	5.0	51	0	5.60	7.45	8.50	10.15	12.90	8.78	-0.04	0.96
						pH	00400	6.5-9.0	51	0	7.40	7.80	7.90	8.00	8.20	7.92	3.13	0.00
						Ammonia	00610	0.33	2	0	0.10	0.10	0.10	0.10	0.10	0.10	-	-
						E.coli	31699	33	2	0	260	260	260	260	260	260	-	-
						Chloride	00940	7500	42	2	310.00	1785.00	2965.00	4182.50	9280.00	3203.02	1.15	0.26
						Chlorophyll-*a*	70953	14.1	1	0	2.00	2.00	2.00	2.00	2.00	2.00	-	-
						Nitrate	00610	1.95	0	-	-	-	-	-	-	-	-	-
						Nitrate+Nitrite	00630	-	2	-	0.02	0.08	0.14	0.20	0.26	0.14	-	-
						Phosphorus, Total	00665	0.69	51	5	0.03	0.04	0.04	0.09	8.88	0.42	1.50	0.14
						Sulfate	00945	2800	42	2	261.00	1080.00	1660.00	2112.50	3490.00	1636.19	0.56	0.58
						TDS	70300	16250	2	1	4460.00	7895.00	11330.00	14765.00	18200.00	11330.00	-	-
						TSS	00530	-	42	-	3.60	20.50	40.50	164.50	3660.00	273.78	0.80	0.43
						TKN	00625	-	40	-	0.07	0.22	0.28	0.40	5.90	0.60	0.41	0.69
						Turbidity	82079	-	2	-	3.60	677.70	1351.80	2025.90	2700.00	1351.80	-	-
						VSS	00535	-	2	-	2.50	14.38	26.25	38.13	50.00	26.25	-	-

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RII	0218_03	10162	08/01/03	07/31/13	Wichita / North Fork Wichita River	Temperature	00010	93	42	0	5.20	11.15	20.25	27.88	36.90	19.51	-0.72	0.47
						Conductivity	00094	-	42	-	1600.00	16250.00	19950.00	22800.00	30900.00	18243.33	0.21	0.83
						DO	00300	5.0	42	0	6.20	7.00	8.65	9.98	11.50	8.49	1.51	0.14
						pH	00400	6.5-9.0	42	0	7.30	7.80	7.90	8.00	8.30	7.88	0.87	0.39
						Ammonia	00610	0.33	2	0	0.10	0.10	0.10	0.10	0.10	0.10	-	-
						E.coli	31699	33	0	-	-	-	-	-	-	-	-	-
						Chloride	00940	7500	42	5	290.00	4577.50	5900.00	6642.50	9660.00	5335.21	0.71	0.48
						Chlorophyll-*a*	70953	14.1	2	0	2.00	2.25	2.50	2.75	3.00	2.50	-	-
						Nitrate	00610	1.95	0	-	-	-	-	-	-	-	-	-
						Nitrate+Nitrite	00630	-	2	-	0.02	0.03	0.03	0.04	0.04	0.03	-	-
						Phosphorus, Total	00665	0.69	41	4	0.02	0.04	0.04	0.06	3.79	0.28	-0.55	0.58
						Sulfate	00945	2800	42	9	226.00	2190.00	2470.00	2722.50	3880.00	2284.62	0.68	0.50
						TDS	70300	16250	2	1	12300.00	14225.00	16150.00	18075.00	20000.00	16150.00	-	-
						TSS	00530	-	42	-	6.50	13.50	31.00	76.75	6070.00	344.43	-0.52	0.60
						TKN	00625	-	38	-	0.10	0.25	0.30	0.56	4.40	0.69	-0.35	0.73
						Turbidity	82079	-	2	-	6.30	8.48	10.65	12.83	15.00	10.65	-	-
						VSS	00535	-	2	-	2.50	2.50	2.50	2.50	2.50	2.50	-	-
RII	0218_04	15119	08/01/03	07/31/13	Wichita / North Fork Wichita River	Temperature	00010	93	44	0	6.70	13.13	19.10	24.93	29.90	18.62	-0.85	0.40
						Conductivity	00094	-	43	-	1580.00	24600.00	26700.00	27900.00	30300.00	24491.86	-0.20	0.84
						DO	00300	5.0	44	1	4.80	7.15	8.10	9.30	13.10	8.33	0.75	0.46
						pH	00400	6.5-9.0	44	0	7.20	7.50	7.70	7.80	8.10	7.65	-1.34	0.19
						Ammonia	00610	0.33	2	0	0.10	0.10	0.10	0.10	0.10	0.10	-	-
						E.coli	31699	33	0	-	-	-	-	-	-	-	-	-
						Chloride	00940	7500	42	28	358.00	7107.50	8215.00	8515.00	11100.00	7462.10	0.54	0.59
						Chlorophyll-*a*	70953	14.1	2	0	2.00	2.00	2.00	2.00	2.00	2.00	-	-
						Nitrate	00610	1.95	0	-	-	-	-	-	-	-	-	-
						Nitrate+Nitrite	00630	-	2	-	0.06	0.08	0.10	0.12	0.14	0.10	-	-
						Phosphorus, Total	00665	0.69	43	0	0.02	0.04	0.04	0.04	0.38	0.06	-0.09	0.93
						Sulfate	00945	2800	42	5	154.00	2375.00	2615.00	2670.00	3310.00	2397.40	0.71	0.48
						TDS	70300	16250	2	2	17400.00	17850.00	18300.00	18750.00	19200.00	18300.00	-	-
						TSS	00530	-	42	-	2.50	10.00	20.00	29.75	377.00	35.29	-0.03	0.97
						TKN	00625	-	41	-	0.06	0.23	0.34	0.49	1.60	0.40	1.03	0.31
						Turbidity	82079	-	2	-	0.40	0.49	0.58	0.66	0.75	0.58	-	-
						VSS	00535	-	2	-	2.50	2.50	2.50	2.50	2.50	2.50	-	-
RII	0218_02	15177	08/01/03	07/31/13	Wichita / North Fork Wichita River	Temperature	00010	93	14	0	5.90	9.95	21.65	26.05	30.40	19.09	-0.12	0.91
						Conductivity	00094	-	14	-	7500.00	11275.00	17650.00	20750.00	29000.00	16864.29	-0.71	0.49
						DO	00300	5.0	14	0	6.70	7.78	9.00	9.70	11.70	9.07	0.02	0.99
						pH	00400	6.5-9.0	14	0	7.70	7.80	8.00	8.08	8.10	7.93	0.52	0.61
						Ammonia	00610	0.33	15	0	0.05	0.05	0.05	0.05	0.08	0.05	1.65	0.12
						E.coli	31699	33	5	1	7	77	200	200	690	235	0.59	0.59
						Chloride	00940	7500	16	1	132.00	2825.00	4930.00	6382.50	8080.00	4603.88	-1.55	0.14
						Chlorophyll-*a*	70953	14.1	16	1	3.00	10.00	10.00	10.00	30.40	10.47	0.31	0.76
						Nitrate	00610	1.95	5	0	0.17	0.25	0.50	0.75	0.75	0.48	0.24	0.82
						Nitrate+Nitrite	00630	-	11	-	0.04	0.04	0.04	0.04	0.21	0.06	1.90	0.09
						Phosphorus, Total	00665	0.69	14	1	0.05	0.06	0.06	0.10	1.54	0.19	1.74	0.11
						Sulfate	00945	2800	16	4	290.00	1382.50	2305.00	2740.00	3510.00	2122.50	-1.52	0.15
						TDS	70300	16250	14	2	932.00	5697.50	9180.00	14350.00	18600.00	10013.71	-1.96	0.07
						TSS	00530	-	16	-	5.00	15.00	33.00	70.75	2030.00	175.75	1.81	0.09
						TKN	00625	-	15	-	0.24	0.38	0.40	0.73	3.13	0.68	2.16	0.05
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	16	-	3.00	4.00	5.00	8.00	150.00	16.06	1.87	0.08

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RII	0218A_01	14900	08/01/03	07/31/13	Middle Fork Wichita River	Temperature	00010	93	44	-	3.30	12.20	18.80	25.70	31.60	18.77	-0.78	0.44
						Conductivity	00094	-	43	-	13000.00	13450.00	13900.00	14200.00	17500.00	13979.07	6.77	0.00
						DO	00300	5.0	43	0	6.90	8.40	9.20	10.20	12.50	9.28	1.74	0.09
						pH	00400	6.5-9.0	44	0	7.40	7.70	7.80	7.90	8.10	7.79	-0.14	0.89
						Ammonia	00610	0.33	2	0	0.10	0.10	0.10	0.10	0.10	0.10	-	-
						E.coli	31699	33	0	-	-	-	-	-	-	-	-	-
						Chloride	00940	-	43	-	3230.00	3435.00	3540.00	3755.00	6430.00	3642.09	6.63	0.00
						Chlorophyll-*a*	70953	14.1	2	0	2.00	2.23	2.45	2.68	2.90	2.45	-	-
						Nitrate	00610	1.95	0	-	-	-	-	-	-	-	-	-
						Nitrate+Nitrite	00630	-	2	-	0.02	0.02	0.02	0.02	0.02	0.02	-	-
						Phosphorus, Total	00665	0.69	43	0	0.02	0.04	0.04	0.04	0.09	0.04	2.97	0.00
						Sulfate	00945	-	43	-	2130.00	2305.00	2350.00	2390.00	3180.00	2362.56	3.93	0.00
						TDS	70300	-	2	-	11000.00	11450.00	11900.00	12350.00	12800.00	11900.00	-	-
						TSS	00530	-	43	-	3.80	10.00	17.00	36.00	218.00	30.54	1.17	0.25
						TKN	00625	-	41	-	0.10	0.18	0.25	0.35	0.57	0.28	0.81	0.43
						Turbidity	82079	-	2	-	1.40	3.45	5.50	7.55	9.60	5.50	-	-
						VSS	00535	-	2	-	2.50	2.75	3.00	3.25	3.50	3.00	-	-
RII	0219_01	10163	08/01/03	07/31/13	Lake Wichita	Temperature	00010	90	26	0	3.30	7.05	19.15	27.75	32.70	17.65	-0.01	1.00
						Conductivity	00094	-	26	-	320.00	1112.50	3015.00	7325.00	17000.00	4610.69	4.18	0.00
						DO	00300	5.0	26	2	2.20	10.13	10.80	11.50	14.70	10.50	-0.88	0.38
						pH	00400	6.5-9.0	26	0	7.80	8.30	8.65	8.80	9.20	8.56	0.53	0.60
						Ammonia	00610	0.11	26	3	0.05	0.05	0.10	0.10	0.33	0.10	0.95	0.35
						E.coli	31699	394	19	4	1	6	28	270	3300	293	0.36	0.72
						Chloride	00940	1000	26	6	48.00	247.00	697.50	923.75	4930.00	1058.35	2.71	0.01
						Chlorophyll-*a*	70953	26.7	21	20	17.40	45.90	89.10	142.00	608.00	125.07	0.90	0.38
						Nitrate	00610	0.37	10	1	0.04	0.04	0.05	0.05	0.50	0.10	0.49	0.64
						Nitrate+Nitrite	00630	-	14	-	0.02	0.04	0.04	0.04	0.06	0.04	-2.66	0.02
						Phosphorus, Total	00665	0.20	24	12	0.09	0.15	0.21	0.31	0.45	0.23	0.36	0.72
						Sulfate	00945	400	26	10	9.00	111.75	327.00	855.00	2340.00	563.32	3.46	0.00
						TDS	70300	1800	24	13	328.00	902.50	2020.00	4870.00	12000.00	3381.50	3.64	0.00
						TSS	00530	-	26	-	15.00	36.00	46.00	58.75	128.00	50.09	0.11	0.92
						TKN	00625	-	13	-	0.92	1.68	2.13	2.90	3.28	2.21	0.36	0.72
						Turbidity	82079	-	11	-	12.00	25.60	38.00	47.35	154.00	45.67	-1.41	0.19
						VSS	00535	-	26	-	6.50	12.25	18.00	26.25	57.00	21.51	1.31	0.20
RII	0226_01	10185	08/01/03	07/31/13	South Fork Wichita River	Temperature	00010	93	45	0	4.00	11.80	18.60	24.80	30.60	18.61	0.62	0.54
						Conductivity	00094	-	36	-	693.00	4627.50	10700.00	15400.00	35200.00	10564.81	1.06	0.30
						DO	00300	5.0	45	0	6.00	7.10	8.20	9.60	11.70	8.30	-0.47	0.64
						pH	00400	6.5-9.0	45	0	7.20	7.70	7.80	8.00	8.20	7.82	4.00	0.00
						Ammonia	00610	0.33	0	-	-	-	-	-	-	-	-	-
						E.coli	31699	394	0	-	-	-	-	-	-	-	-	-
						Chloride	00940	12000	36	0	28.10	909.00	2560.00	4055.00	11000.00	2732.16	1.06	0.30
						Chlorophyll-*a*	70953	14.1	0	-	-	-	-	-	-	-	-	-
						Nitrate	00610	1.95	0	-	-	-	-	-	-	-	-	-
						Nitrate+Nitrite	00630	-	0	-	-	-	-	-	-	-	-	-
						Phosphorus, Total	00665	0.69	45	7	0.02	0.04	0.05	0.12	5.58	0.54	-1.16	0.25
						Sulfate	00945	3650	36	0	263.00	1110.00	2165.00	2520.00	2970.00	1832.08	1.11	0.27
						TDS	70300	31000	0	-	-	-	-	-	-	-	-	-
						TSS	00530	-	36	-	10.00	27.75	58.00	437.75	9250.00	1108.42	0.03	0.97
						TKN	00625	-	36	-	0.14	0.24	0.34	0.63	9.20	1.12	0.41	0.69
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	0	-	-	-	-	-	-	-	-	-

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RII	0226_03	13635	08/01/03	07/31/13	South Fork Wichita River	Temperature	00010	93	14	0	8.00	18.18	22.70	27.08	30.50	22.05	0.58	0.57
						Conductivity	00094	-	14	-	41000.00	43825.00	44650.00	45050.00	45800.00	44378.57	0.20	0.84
						DO	00300	5.0	14	0	3.60	7.83	8.05	9.40	12.40	8.40	-2.09	0.06
						pH	00400	6.5-9.0	14	0	7.10	7.20	7.20	7.48	7.80	7.34	-5.17	0.00
						Ammonia	00610	0.33	14	-	-	-	-	-	-	-	-	-
						E.coli	31699	394	0	-	-	-	-	-	-	-	-	-
						Chloride	00940	12000	14	14	15000.00	15300.00	15400.00	15600.00	16000.00	15428.57	-0.17	0.87
						Chlorophyll-*a*	70953	14.1	0	-	-	-	-	-	-	-	-	-
						Nitrate	00610	1.95	0	-	-	-	-	-	-	-	-	-
						Nitrate+Nitrite	00630	-	0	-	-	-	-	-	-	-	-	-
						Phosphorus, Total	00665	0.69	5	0	0.04	0.04	0.04	0.04	0.04	0.04	-	-
						Sulfate	00945	3650	14	0	2940.00	3050.00	3100.00	3157.50	3430.00	3110.71	0.29	0.77
						TDS	70300	31000	0	-	-	-	-	-	-	-	-	-
						TSS	00530	-	0	-	-	-	-	-	-	-	-	-
						TKN	00625	-	14	-	0.32	0.41	0.48	0.60	0.72	0.51	-0.25	0.81
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	0	-	-	-	-	-	-	-	-	-
RII	0226_03	13636	08/01/03	07/31/13	South Fork Wichita River	Temperature	00010	93	43	0	6.60	14.65	21.30	26.30	29.60	20.04	-0.85	0.40
						Conductivity	00094	-	43	-	22800.00	44250.00	45600.00	59300.00	71800.00	49939.53	0.36	0.72
						DO	00300	5.0	43	4	3.40	7.15	8.40	9.25	12.40	8.05	0.67	0.51
						pH	00400	6.5-9.0	43	0	6.90	7.20	7.40	7.50	8.00	7.39	-0.77	0.44
						Ammonia	00610	0.33	0	-	-	-	-	-	-	-	-	-
						E.coli	31699	394	0	-	-	-	-	-	-	-	-	-
						Chloride	00940	12000	43	42	7040.00	15100.00	15800.00	21450.00	26600.00	17591.63	0.26	0.79
						Chlorophyll-*a*	70953	14.1	0	-	-	-	-	-	-	-	-	-
						Nitrate	00610	1.95	0	-	-	-	-	-	-	-	-	-
						Nitrate+Nitrite	00630	-	0	-	-	-	-	-	-	-	-	-
						Phosphorus, Total	00665	0.69	43	0	0.02	0.03	0.04	0.04	0.05	0.04	0.10	0.92
						Sulfate	00945	3650	43	0	1430.00	3045.00	3110.00	3160.00	3380.00	3037.21	-1.15	0.25
						TDS	70300	31000	0	-	-	-	-	-	-	-	-	-
						TSS	00530	-	43	-	10.00	16.00	30.00	75.50	202.00	46.42	3.18	0.00
						TKN	00625	-	42	-	0.32	0.47	0.57	0.95	2.50	0.85	3.48	0.00
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	0	-	-	-	-	-	-	-	-	-
RIII	0205_01	10134	08/01/03	07/31/13	Red River Below Pease River	Temperature	00010	93	102	0	2.80	10.10	18.25	25.18	35.60	17.71	-0.15	0.88
						Conductivity	00094	-	92	-	1180.00	6807.50	8450.00	9787.50	14500.00	8117.93	1.28	0.21
						DO	00300	5.0	101	1	4.90	8.00	9.80	12.10	14.70	9.99	2.18	0.03
						pH	00400	6.5-9.0	102	0	7.30	8.00	8.15	8.30	8.50	8.11	4.56	0.00
						Ammonia	00610	0.33	21	0	0.10	0.10	0.10	0.10	0.24	0.11	0.17	0.86
						E.coli	31699	394	42	6	7	20	63	235	4600	300	-0.52	0.60
						Chloride	00940	5000	63	1	234.00	1660.00	2190.00	2600.00	5210.00	2177.48	1.61	0.11
						Chlorophyll-*a*	70953	14.1	16	13	19.30	21.48	29.75	56.30	151.00	44.21	0.22	0.83
						Nitrate	00610	1.95	10	0	0.02	0.04	0.07	0.82	1.68	0.43	0.04	0.97
						Nitrate+Nitrite	00630	-	9	-	0.04	0.04	0.04	0.04	0.27	0.06	-0.44	0.67
						Phosphorus, Total	00665	0.69	77	8	0.03	0.10	0.16	0.26	4.26	0.39	-1.45	0.15
						Sulfate	00945	2000	61	0	140.00	889.00	1080.00	1270.00	1720.00	1060.20	1.38	0.17
						TDS	70300	10000	20	0	3120.00	4300.00	5935.00	6642.50	9390.00	5795.00	1.48	0.16
						TSS	00530	-	62	-	10.00	40.75	108.00	247.00	4210.00	425.75	-1.14	0.26
						TKN	00625	-	40	-	0.52	0.73	1.10	1.33	10.00	1.72	1.85	0.07
						Turbidity	82079	-	52	-	5.90	19.83	40.05	99.43	1200.00	104.55	-0.69	0.50
						VSS	00535	-	21	-	6.00	11.00	19.60	24.00	52.00	19.31	-0.89	0.38

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RIII	0205_02	16733	08/01/03	07/31/13	Red River Below Pease River	Temperature	00010	93	9	0	4.30	14.30	15.40	21.90	38.20	18.36	0.06	0.95
						Conductivity	00094	-	9	-	3150.00	7720.00	9060.00	9360.00	11800.00	8532.22	-0.52	0.62
						DO	00300	5.0	9	0	8.70	10.70	11.20	11.80	15.30	11.42	-0.33	0.75
						pH	00400	6.5-9.0	9	0	7.70	8.20	8.30	8.30	8.50	8.22	-1.83	0.10
						Ammonia	00610	0.33	9	0	0.10	0.10	0.10	0.10	0.16	0.11	-0.20	0.85
						E.coli	31699	394	7	1	10	44	170	255	1300	297	-0.16	0.88
						Chloride	00940	5000	8	0	755.00	2225.00	2455.00	2620.00	3250.00	2344.38	-0.33	0.75
						Chlorophyll-*a*	70953	14.1	9	8	5.10	20.10	34.50	41.30	106.00	38.52	-0.24	0.81
						Nitrate	00610	1.95	6	0	0.04	0.05	0.41	1.01	1.21	0.54	-1.25	0.27
						Nitrate+Nitrite	00630	-	2	-	0.04	0.31	0.57	0.84	1.10	0.57	-	-
						Phosphorus, Total	00665	0.69	9	0	0.09	0.10	0.14	0.24	0.65	0.23	0.97	0.36
						Sulfate	00945	2000	8	0	137.00	875.75	1165.00	1202.50	1380.00	970.00	0.75	0.48
						TDS	70300	10000	9	0	1930.00	4800.00	5950.00	6370.00	8520.00	5712.22	-1.02	0.34
						TSS	00530	-	9	-	12.00	32.20	61.00	87.00	260.00	77.08	0.25	0.81
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	9	-	6.10	18.00	60.60	70.00	230.00	61.99	0.16	0.88
						VSS	00535	-	8	-	4.00	7.25	13.90	17.15	26.00	13.18	0.88	0.41
RIII	0205A	10096	08/01/03	07/31/13	Wildhorse Creek	Temperature	00010	93	5	-	7.30	7.90	10.40	13.10	22.90	12.32	-0.13	0.91
						Conductivity	00094	-	5	-	1670.00	1730.00	1830.00	1990.00	2060.00	1856.00	1.24	0.28
						DO	00300	5.0	5	0	7.20	9.20	10.20	12.20	12.30	10.22	-0.18	0.87
						pH	00400	6.5-9.0	5	0	7.90	8.00	8.00	8.20	8.30	8.08	-0.81	0.46
						Ammonia	00610	0.33	6	0	0.10	0.10	0.14	0.20	0.23	0.15	0.34	0.75
						E.coli	31699	394	6	2	92	183	195	4400	8700	2527	-0.09	0.93
						Chloride	00940	-	5	-	355.00	428.00	451.00	461.00	666.00	472.20	-1.16	0.31
						Chlorophyll-*a*	70953	14.1	6	2	2.00	5.33	8.85	19.88	46.20	15.60	0.91	0.40
						Nitrate	00610	1.95	2	2	13.30	17.40	21.50	25.60	29.70	21.50	-	-
						Nitrate+Nitrite	00630	-	2	-	15.00	15.38	15.75	16.13	16.50	15.75	-	-
						Phosphorus, Total	00665	0.69	5	5	1.60	1.80	2.18	4.00	4.80	2.88	1.88	0.13
						Sulfate	00945	-	5	-	38.50	44.90	46.30	56.70	710.00	179.28	0.18	0.87
						TDS	70300	-	5	-	882.00	970.00	1050.00	1090.00	1110.00	1020.40	0.68	0.54
						TSS	00530	-	6	-	10.60	14.53	26.05	34.95	54.00	27.55	-0.41	0.70
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	6	-	15.00	17.75	30.20	37.10	65.00	32.23	-0.43	0.69
						VSS	00535	-	6	-	2.50	2.88	5.30	6.90	17.70	6.72	0.30	0.78
RIII	0206_02	10135	08/01/03	07/31/13	Red River Above Pease River	Temperature	00010	93	30	0	3.70	8.35	16.30	24.30	33.00	17.21	-1.12	0.27
						Conductivity	00094	-	30	-	12800.00	19600.00	22050.00	24625.00	34200.00	22930.00	0.40	0.70
						DO	00300	5.0	30	0	6.60	7.45	8.35	10.10	12.10	8.89	0.92	0.36
						pH	00400	6.5-9.0	30	0	7.50	7.90	8.00	8.00	8.20	7.92	0.20	0.84
						Ammonia	00610	0.33	32	0	0.05	0.05	0.05	0.08	0.24	0.07	1.92	0.06
						E.coli	31699	394	4	0	47	68	88	118	170	98	0.88	0.44
						Chloride	00940	12000	31	2	3640.00	5945.00	7130.00	8055.00	12800.00	7436.45	0.21	0.83
						Chlorophyll-*a*	70953	14.1	30	2	2.00	4.38	7.21	10.00	28.40	7.81	-1.51	0.14
						Nitrate	00610	1.95	7	0	0.30	0.45	0.61	0.69	0.75	0.56	-4.22	0.01
						Nitrate+Nitrite	00630	-	23	-	0.11	0.21	0.35	0.40	1.47	0.39	-1.64	0.11
						Phosphorus, Total	00665	0.69	32	4	0.05	0.06	0.06	0.21	8.55	0.56	0.95	0.35
						Sulfate	00945	4000	31	0	1360.00	2130.00	2520.00	2645.00	2820.00	2384.84	-0.07	0.94
						TDS	70300	25000	30	0	7880.00	12650.00	15000.00	17225.00	24100.00	15619.67	0.16	0.87
						TSS	00530	-	32	-	2.00	8.75	22.00	146.50	13800.00	760.90	1.08	0.29
						TKN	00625	-	22	-	0.20	0.28	0.38	0.72	13.70	1.35	2.23	0.04
						Turbidity	82079	-	5	-	1.70	3.62	8.10	15.00	2300.00	465.68	1.80	0.15
						VSS	00535	-	32	-	1.00	3.75	4.00	15.00	1310.00	79.27	1.10	0.28

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RIII	0206B_01	16000	08/01/03	07/31/13	South Groesbeck Creek	Temperature	00010	93	34	-	8.20	14.18	20.30	25.58	30.00	19.67	-0.90	0.37
						Conductivity	00094	-	34	-	4490.00	5937.50	6095.00	6367.50	7025.00	6066.03	-2.68	0.01
						DO	00300	5.0	34	0	5.20	9.40	10.80	11.85	13.00	10.28	-2.82	0.01
						pH	00400	6.5-9.0	34	0	6.90	7.40	7.50	7.70	7.80	7.52	-2.47	0.02
						Ammonia	00610	0.33	29	0	0.05	0.05	0.06	0.08	0.13	0.07	0.68	0.50
						E.coli	31699	394	29	9	38	110	210	480	7900	536	0.30	0.76
						Chloride	00940	-	30	-	762.00	1070.00	1105.00	1247.50	7270.00	1371.30	-0.37	0.72
						Chlorophyll-*a*	70953	14.1	29	7	1.70	4.37	10.00	12.10	43.80	11.28	-2.92	0.01
						Nitrate	00610	1.95	5	5	3.06	3.10	3.14	3.24	3.88	3.28	-0.20	0.85
						Nitrate+Nitrite	00630	-	24	-	0.06	2.92	3.37	3.55	4.35	3.14	-1.51	0.14
						Phosphorus, Total	00665	0.69	29	0	0.02	0.05	0.06	0.06	0.20	0.06	-3.14	0.00
						Sulfate	00945	-	30	-	1330.00	1720.00	1765.00	1797.50	2070.00	1763.67	0.73	0.47
						TDS	70300	-	23	-	4520.00	4640.00	4900.00	5100.00	14800.00	5315.22	1.15	0.26
						TSS	00530	-	30	-	6.00	12.25	25.50	35.75	141.00	32.97	-2.73	0.01
						TKN	00625	-	28	-	0.16	0.30	0.38	0.51	0.81	0.42	-1.63	0.11
						Turbidity	82079	-	7	-	5.80	6.60	7.10	38.25	127.00	32.80	1.30	0.24
						VSS	00535	-	30	-	2.00	4.00	4.00	5.75	15.00	5.37	-1.80	0.08
RIII	0220_01	10167	08/01/03	07/31/13	Upper Pease / North Fork Pease River	Temperature	00010	91	31	0	5.10	12.20	17.80	24.90	35.60	18.73	-1.36	0.18
						Conductivity	00094	-	31	-	4800.00	24750.00	28900.00	32350.00	35500.00	26942.58	2.94	0.01
						DO	00300	5.0	31	0	6.60	7.80	8.80	9.65	12.50	8.89	-0.30	0.76
						pH	00400	6.5-9.0	31	0	7.30	7.70	7.90	7.90	8.10	7.83	-2.44	0.02
						Ammonia	00610	0.33	31	0	0.02	0.02	0.10	0.10	0.17	0.07	4.08	0.00
						E.coli	31699	394	3	3	3898	4689	5480	16740	28000	12459	3.46	0.07
						Chloride	00940	12000	30	1	1148.00	6952.50	9090.00	10800.00	12300.00	8276.60	2.95	0.01
						Chlorophyll-*a*	70953	14.1	29	1	2.00	2.00	2.00	5.00	17.40	3.80	-4.32	0.00
						Nitrate	00610	1.95	7	1	0.02	0.03	0.04	0.34	8.00	1.26	2.92	0.03
						Nitrate+Nitrite	00630	-	22	-	0.02	0.04	0.04	0.35	3.07	0.41	-0.98	0.34
						Phosphorus, Total	00665	0.69	31	2	0.04	0.06	0.06	0.07	4.30	0.25	-0.92	0.36
						Sulfate	00945	3500	30	0	427.00	2265.00	2670.00	3090.00	3500.00	2544.00	2.66	0.01
						TDS	70300	30000	31	0	3080.00	17900.00	19600.00	21000.00	24100.00	18170.65	3.19	0.00
						TSS	00530	-	31	-	3.70	8.10	20.00	25.50	4560.00	222.53	-0.99	0.33
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	31	-	1.40	2.21	3.80	10.01	5820.00	208.90	-0.55	0.58
						VSS	00535	-	31	-	1.00	3.50	4.00	6.00	200.00	13.80	-1.24	0.22
RIII	0220_02	10168	08/01/03	07/31/13	Upper Pease / North Fork Pease River	Temperature	00010	91	18	0	3.30	14.43	24.10	30.83	34.90	22.04	-0.19	0.85
						Conductivity	00094	-	18	-	10100.00	15200.00	17500.00	26850.00	35800.00	20577.11	-0.28	0.78
						DO	00300	5.0	18	0	7.60	8.43	9.50	10.30	11.40	9.41	0.04	0.97
						pH	00400	6.5-9.0	18	0	7.30	7.80	7.85	7.98	8.60	7.87	0.26	0.80
						Ammonia	00610	0.33	18	0	0.05	0.05	0.05	0.05	0.13	0.06	0.73	0.47
						E.coli	31699	394	3	2	4	208	411	1056	1700	705	-0.77	0.52
						Chloride	00940	12000	18	2	933.00	4457.50	5195.00	9692.50	13500.00	6576.28	0.28	0.78
						Chlorophyll-*a*	70953	14.1	17	0	1.00	3.00	10.00	10.00	10.00	7.09	-3.31	0.00
						Nitrate	00610	1.95	5	0	0.25	0.25	0.25	0.40	0.75	0.38	0.38	0.72
						Nitrate+Nitrite	00630	-	13	-	0.04	0.04	0.04	0.16	3.31	0.35	0.79	0.45
						Phosphorus, Total	00665	0.69	18	0	0.05	0.06	0.06	0.06	0.14	0.07	-1.54	0.14
						Sulfate	00945	3500	18	0	1110.00	1950.00	2285.00	2772.50	3330.00	2357.78	-0.15	0.89
						TDS	70300	30000	18	0	4550.00	10600.00	11500.00	18700.00	27100.00	14281.76	-0.03	0.98
						TSS	00530	-	18	-	3.00	4.25	6.50	14.25	68.00	13.39	-0.07	0.94
						TKN	00625	-	17	-	0.24	0.42	0.50	0.61	1.89	0.61	-2.27	0.04
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	18	-	1.00	4.00	4.00	4.00	7.00	4.00	0.36	0.72

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RIII	0221_01	10170	08/01/03	07/31/13	Middle Fork Pease River	Temperature	00010	91	3	0	14.70	14.70	14.70	16.60	18.50	15.97	1.2E+06	0.00
						Conductivity	00094	-	3	-	3830.00	4445.00	5060.00	5060.00	5060.00	4650.00	-1.2E+06	0.00
						DO	00300	5.0	3	0	8.10	8.90	9.70	9.70	9.70	9.17	-1.2E+06	0.00
						pH	00400	6.5-9.0	3	0	8.00	8.05	8.10	8.10	8.10	8.07	-1.0E+06	0.00
						Ammonia	00610	0.33	2	0	0.05	0.05	0.05	0.05	0.05	0.05	-	-
						E.coli	31699	394	3	2	36	36	36	243	450	174	1.2E+06	0.00
						Chloride	00940	870	2	0	624.00	624.00	624.00	624.00	624.00	624.00	-	-
						Chlorophyll-*a*	70953	14.1	2	1	14.20	14.20	14.20	14.20	14.20	14.20	-	-
						Nitrate	00610	1.95	0	-	-	-	-	-	-	-	-	-
						Nitrate+Nitrite	00630	-	2	-	0.04	0.04	0.04	0.04	0.04	0.04	-	-
						Phosphorus, Total	00665	0.69	2	0	0.06	0.06	0.06	0.06	0.06	0.06	-	-
						Sulfate	00945	1400	2	0	949.00	949.00	949.00	949.00	949.00	949.00	-	-
						TDS	70300	2800	2	0	2440.00	2440.00	2440.00	2440.00	2440.00	2440.00	-	-
						TSS	00530	-	2	-	8.00	8.00	8.00	8.00	8.00	8.00	-	-
						TKN	00625	-	2	-	0.44	0.44	0.44	0.44	0.44	0.44	-	-
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	2	-	4.00	4.00	4.00	4.00	4.00	4.00	-	-
RIII	0230_01	10165	08/01/03	07/31/13	Pease River	Temperature	00010	91	15	0	2.10	4.60	14.70	19.70	32.10	14.93	-0.24	0.82
						Conductivity	00094	-	15	-	1430.00	7715.00	12000.00	13250.00	16900.00	10410.67	-0.15	0.89
						DO	00300	4.0	15	0	7.30	9.00	10.70	11.90	12.70	10.36	1.27	0.22
						pH	00400	6.5-9.0	15	0	7.60	7.75	7.80	8.00	8.30	7.87	-1.51	0.15
						Ammonia	00610	0.33	13	2	0.05	0.05	0.11	0.19	0.72	0.19	-0.66	0.52
						E.coli	31699	394	7	0	23	33	86	157	260	107	-0.01	0.99
						Chloride	00940	12000	15	0	156.00	1430.00	3160.00	3910.00	4710.00	2756.60	-0.58	0.57
						Chlorophyll-*a*	70953	14.1	14	0	3.00	10.00	10.00	10.00	13.20	9.25	-1.71	0.11
						Nitrate	00610	1.95	5	0	0.10	0.30	0.46	0.84	1.55	0.65	1.72	0.16
						Nitrate+Nitrite	00630	-	7	-	0.04	0.15	0.26	0.60	13.50	2.18	-0.92	0.39
						Phosphorus, Total	00665	0.69	13	2	0.05	0.05	0.07	0.10	0.99	0.20	2.34	0.04
						Sulfate	00945	3500	15	0	190.00	564.00	1440.00	1830.00	2130.00	1256.60	0.03	0.98
						TDS	70300	30000	14	0	1060.00	3997.50	7240.00	9385.00	11000.00	6521.43	-0.87	0.40
						TSS	00530	-	15	-	8.00	10.50	26.00	98.00	1260.00	199.87	2.61	0.02
						TKN	00625	-	12	-	0.76	1.07	2.27	3.65	14.10	3.42	-1.10	0.29
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	15	-	2.00	4.00	4.00	12.00	97.00	18.60	2.68	0.02
RIII	0230_01	10166	08/01/03	07/31/13	Pease River	Temperature	00010	91	14	0	1.10	11.25	16.00	22.00	30.30	16.21	-0.63	0.54
						Conductivity	00094	-	14	-	5860.00	14125.00	15550.00	16600.00	20100.00	15175.71	-1.59	0.14
						DO	00300	4.0	14	0	7.20	9.23	9.55	11.60	13.40	10.14	0.68	0.51
						pH	00400	6.5-9.0	14	0	7.70	7.90	8.00	8.08	8.10	7.97	-3.24	0.01
						Ammonia	00610	0.33	14	0	0.10	0.10	0.10	0.10	0.10	0.10	-	-
						E.coli	31699	394	1	1	990	990	990	990	990	990	-	-
						Chloride	00940	12000	14	0	1470.00	4002.50	4450.00	4842.50	6450.00	4331.43	-1.46	0.17
						Chlorophyll-*a*	70953	14.1	12	1	2.00	2.25	2.94	7.53	15.50	5.21	1.38	0.20
						Nitrate	00610	1.95	7	0	0.02	0.04	0.04	0.11	0.22	0.08	-0.31	0.77
						Nitrate+Nitrite	00630	-	7	-	0.04	0.05	0.15	0.62	0.96	0.35	-0.40	0.71
						Phosphorus, Total	00665	0.69	14	1	0.06	0.06	0.06	0.08	1.08	0.16	2.39	0.03
						Sulfate	00945	3500	14	0	780.00	1857.50	2060.00	2285.00	2850.00	2002.14	-0.94	0.36
						TDS	70300	30000	14	0	3720.00	9190.00	10450.00	11350.00	14500.00	10337.86	-1.10	0.29
						TSS	00530	-	14	-	5.60	12.70	23.60	47.00	1620.00	154.40	2.65	0.02
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	14	-	2.10	5.39	19.75	38.05	4000.00	321.13	2.76	0.02
						VSS	00535	-	14	-	2.00	4.00	4.00	8.00	84.00	12.00	2.32	0.04

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RIII	0230A_03	10094	08/01/03	07/31/13	Paradise Creek	Temperature	00010	91	29	-	5.80	12.60	18.20	23.10	29.50	17.78	0.20	0.84
						Conductivity	00094	-	29	-	260.00	1750.00	3580.00	5000.00	8750.00	3609.48	-0.25	0.81
						DO	00300	4.0	29	0	4.70	8.60	10.40	12.70	17.10	10.47	-1.82	0.08
						pH	00400	6.5-9.0	29	0	7.80	8.10	8.20	8.40	8.60	8.24	0.58	0.56
						Ammonia	00610	0.33	29	0	0.02	0.04	0.10	0.10	0.28	0.08	2.96	0.01
						E.coli	31699	394	29	15	11	120	480	1500	10500	1652	-1.50	0.14
						Chloride	00940	-	29	-	19.30	254.00	688.00	962.00	2110.00	720.10	-0.16	0.87
						Chlorophyll-*a*	70953	14.1	24	17	5.00	26.93	40.80	62.10	152.00	52.34	-0.54	0.59
						Nitrate	00610	1.95	9	0	0.02	0.04	0.12	0.52	1.65	0.39	-0.56	0.59
						Nitrate+Nitrite	00630	-	20	-	0.04	0.61	1.64	3.36	26.40	3.44	1.10	0.28
						Phosphorus, Total	00665	0.69	29	1	0.06	0.14	0.21	0.29	0.97	0.26	-1.32	0.20
						Sulfate	00945	-	29	-	21.60	210.00	442.00	727.00	1460.00	526.17	-0.29	0.77
						TDS	70300	-	29	-	224.00	1180.00	2380.00	3380.00	6030.00	2449.97	0.23	0.82
						TSS	00530	-	29	-	10.00	25.20	45.00	58.00	184.00	47.85	0.38	0.70
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	29	-	6.90	24.60	44.00	65.00	465.00	68.74	-1.05	0.30
						VSS	00535	-	29	-	4.00	8.00	11.00	13.30	21.00	11.13	-0.15	0.88
RIV	0207_01	10136	08/01/03	07/31/13	Lower Prarie Dog Town Fork Red River	Temperature	00010	93	38	0	1.10	10.18	15.95	24.28	35.40	16.91	-2.03	0.05
						Conductivity	00094	-	38	-	10100.00	42700.00	54200.00	68200.00	96400.00	53911.84	-0.38	0.71
						DO	00300	5.0	38	1	4.00	6.60	7.90	9.23	11.10	7.92	0.80	0.43
						pH	00400	6.5-9.0	38	0	7.10	7.60	7.80	7.90	8.10	7.74	-3.56	0.00
						Ammonia	00610	0.33	37	0	0.02	0.06	0.10	0.10	0.30	0.09	1.97	0.06
						E.coli	31699	394	3	0	3	42	80	204	327	137	-1.08	0.39
						Chloride	00940	37000	35	1	2370.00	13750.00	19300.00	27150.00	42000.00	19475.86	-0.14	0.89
						Chlorophyll-*a*	70953	14.1	33	1	2.00	2.00	5.00	5.00	15.00	4.87	-0.39	0.70
						Nitrate	00610	1.95	11	1	0.02	0.04	0.04	0.06	20.00	1.86	2.34	0.04
						Nitrate+Nitrite	00630	-	24	-	0.02	0.04	0.23	0.83	14.10	1.58	-0.55	0.59
						Phosphorus, Total	00665	0.69	37	5	0.02	0.06	0.06	0.06	4.60	0.40	-0.24	0.81
						Sulfate	00945	5300	36	1	622.00	2835.00	3450.00	3967.50	5800.00	3289.28	-0.22	0.83
						TDS	70300	46200	37	12	7640.00	29400.00	38400.00	51800.00	75800.00	38541.08	-0.32	0.75
						TSS	00530	-	37	-	8.60	18.20	56.00	97.00	7430.00	645.32	-0.41	0.69
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	38	-	1.60	3.93	7.51	59.18	7500.00	594.78	-0.50	0.62
						VSS	00535	-	37	-	2.50	4.00	7.00	13.00	456.00	45.88	-0.43	0.67
RIV	0207_04	13637	08/01/03	07/31/13	Lower Prarie Dog Town Fork Red River	Temperature	00010	93	37	0	5.50	9.20	14.70	25.30	34.20	17.31	-1.12	0.27
						Conductivity	00094	-	37	-	2670.00	4100.00	5600.00	10900.00	37900.00	8895.68	0.38	0.71
						DO	00300	5.0	37	0	6.80	8.50	9.60	12.30	17.60	10.36	0.00	1.00
						pH	00400	6.5-9.0	37	0	7.90	8.10	8.20	8.30	8.60	8.21	0.53	0.60
						Ammonia	00610	0.33	37	0	0.02	0.04	0.10	0.10	0.10	0.07	5.37	0.00
						E.coli	31699	394	29	11	9	24	200	1300	65000	3844	0.56	0.58
						Chloride	00940	37000	36	0	39.80	878.75	1195.00	2890.00	25600.00	2747.27	-0.94	0.35
						Chlorophyll-*a*	70953	14.1	30	15	2.00	6.73	14.25	32.48	114.00	24.16	-0.02	0.98
						Nitrate	00610	1.95	8	4	0.04	0.18	1.54	2.28	5.82	1.77	0.62	0.56
						Nitrate+Nitrite	00630	-	26	-	0.02	0.11	0.69	1.49	7.01	1.57	0.70	0.49
						Phosphorus, Total	00665	0.69	37	5	0.03	0.11	0.21	0.53	3.95	0.44	0.97	0.34
						Sulfate	00945	5300	36	0	135.00	764.25	959.50	1550.00	2700.00	1147.53	-1.79	0.08
						TDS	70300	46200	37	0	392.00	2660.00	3630.00	7190.00	26300.00	5775.19	0.34	0.74
						TSS	00530	-	36	-	4.00	18.00	34.15	117.50	18700.00	734.83	0.28	0.78
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	37	-	0.80	12.30	23.30	106.00	22300.00	1254.94	0.38	0.71
						VSS	00535	-	36	-	1.00	4.00	6.60	13.90	1500.00	61.86	0.24	0.81

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RIV	0228_01	10188	08/01/03	07/31/13	Mackenzie Reservoir	Temperature	00010	90	20	0	3.30	5.58	16.05	25.80	27.30	15.78	0.37	0.71
						Conductivity	00094	-	20	-	547.00	676.25	781.50	858.00	1290.00	811.40	5.50	0.00
						DO	00300	5.0	20	0	6.80	7.60	9.30	11.05	11.90	9.31	-0.26	0.80
						pH	00400	6.5-9.0	20	0	8.00	8.38	8.50	8.60	8.70	8.45	-0.39	0.70
						Ammonia	00610	0.11	20	0	0.05	0.05	0.05	0.05	0.11	0.05	-0.76	0.45
						E.coli	31699	394	19	0	1	1	1	1	10	2	-0.04	0.97
						Chloride	00940	50	20	0	12.00	14.75	17.00	20.50	29.00	17.90	3.28	0.00
						Chlorophyll-*a*	70953	26.7	20	0	3.15	5.28	7.97	11.30	17.10	8.44	-2.73	0.01
						Nitrate	00610	0.37	2	0	0.05	0.05	0.05	0.05	0.05	0.05	-	-
						Nitrate+Nitrite	00630	-	18	-	0.04	0.04	0.04	0.07	0.14	0.06	-0.36	0.72
						Phosphorus, Total	00665	0.20	18	0	0.02	0.05	0.06	0.06	0.16	0.06	-3.92	0.00
						Sulfate	00945	200	19	5	106.00	141.50	172.00	208.00	375.00	184.32	4.76	0.00
						TDS	70300	500	15	5	358.00	423.00	462.00	506.00	536.00	459.67	1.50	0.15
						TSS	00530	-	20	-	4.00	4.00	5.00	5.25	8.00	5.05	1.05	0.31
						TKN	00625	-	20	-	0.39	0.53	0.56	0.60	1.06	0.59	0.68	0.51
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	20	-	1.00	4.00	4.00	4.00	4.00	3.65	3.12	0.01
RIV	0229_01	10191	08/01/03	07/31/13	Upper Prarie Dog Town Fork Red River	Temperature	00010	93	38	0	2.00	5.53	11.30	20.28	30.90	12.84	0.41	0.68
						Conductivity	00094	-	38	-	644.00	1805.00	1930.00	2035.00	3050.00	1917.21	-1.50	0.14
						DO	00300	5.0	38	1	4.00	9.75	11.25	12.18	14.40	10.63	-0.44	0.67
						pH	00400	6.5-9.0	37	1	7.10	8.10	8.30	8.60	9.30	8.30	1.46	0.15
						Ammonia	00610	0.33	34	0	0.05	0.05	0.05	0.05	0.12	0.06	0.63	0.53
						E.coli	31699	394	36	4	10	70	138	253	24000	858	1.45	0.16
						Chloride	00940	350	34	6	25.00	258.00	310.00	336.75	365.00	290.03	-0.24	0.81
						Chlorophyll-*a*	70953	14.1	32	22	4.02	10.00	21.95	65.90	546.00	78.49	0.50	0.62
						Nitrate	00610	1.95	5	5	2.66	3.84	5.65	6.22	6.66	5.01	-1.42	0.23
						Nitrate+Nitrite	00630	-	29	-	0.04	0.54	3.25	5.80	13.70	3.58	0.15	0.88
						Phosphorus, Total	00665	0.69	33	22	0.06	0.34	0.82	1.06	1.54	0.75	-0.44	0.66
						Sulfate	00945	675	34	1	143.00	224.50	258.50	329.00	1140.00	332.24	-1.76	0.09
						TDS	70300	2000	28	2	816.00	1035.00	1210.00	1290.00	2470.00	1275.48	-0.17	0.87
						TSS	00530	-	31	-	5.00	16.50	37.00	67.50	317.00	61.65	0.66	0.52
						TKN	00625	-	33	-	0.37	0.87	1.13	1.82	4.24	1.47	1.58	0.12
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	30	-	3.00	4.00	7.00	11.50	43.00	10.80	0.95	0.35
RIV	0229_02	18317	08/01/03	07/31/13	Upper Prarie Dog Town Fork Red River	Temperature	00010	93	28	0	2.90	9.40	14.70	21.73	27.70	15.26	-0.44	0.67
						Conductivity	00094	-	28	-	1200.00	1667.50	1835.00	1990.00	2430.00	1826.07	0.00	1.00
						DO	00300	5.0	28	1	2.80	7.08	8.90	10.73	11.90	8.54	0.41	0.68
						pH	00400	6.5-9.0	28	11	8.00	8.75	9.00	9.23	10.10	8.95	-1.67	0.11
						Ammonia	00610	0.33	25	4	0.05	0.07	0.17	0.31	0.97	0.23	0.01	0.99
						E.coli	31699	394	7	0	24	27	27	29	30	28	3.02	0.02
						Chloride	00940	350	26	9	181.00	284.25	325.50	374.25	423.00	316.31	-1.07	0.29
						Chlorophyll-*a*	70953	14.1	19	0	2.00	2.00	2.00	2.00	2.00	2.00	-	-
						Nitrate	00610	1.95	4	4	3.41	3.59	5.09	6.75	7.43	5.25	-0.20	0.86
						Nitrate+Nitrite	00630	-	22	-	0.04	0.32	3.30	5.32	9.57	3.55	-2.47	0.02
						Phosphorus, Total	00665	0.69	25	19	0.19	0.73	1.01	1.14	1.39	0.92	-0.22	0.83
						Sulfate	00945	675	28	0	1.00	2.00	3.00	5.00	5.00	3.50	-1.39	0.17
						TDS	70300	2000	0	-	-	-	-	-	-	-	-	-
						TSS	00530	-	26	-	4.00	9.00	12.00	19.25	100.00	17.62	0.10	0.92
						TKN	00625	-	23	-	0.71	1.41	1.94	2.21	4.89	1.92	-0.17	0.87
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	25	-	3.00	4.00	6.00	8.00	39.00	7.72	-0.22	0.83

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RIV	0229_02	20801	08/01/03	07/31/13	Upper Prarie Dog Town Fork Red River	Temperature	00010	93	13	0	5.40	6.90	12.50	21.30	24.20	14.49	0.31	0.76
						Conductivity	00094	-	13	-	1140.00	1550.00	1780.00	1960.00	2050.00	1743.08	-0.44	0.67
						DO	00300	5.0	12	4	1.60	4.53	8.10	10.33	11.80	7.42	-0.07	0.95
						pH	00400	6.5-9.0	13	1	7.50	8.20	8.50	8.70	9.20	8.38	-0.42	0.68
						Ammonia	00610	0.33	12	2	0.05	0.07	0.13	0.19	0.48	0.17	0.77	0.46
						E.coli	31699	394	12	0	4	20	30	58	370	71	-0.19	0.86
						Chloride	00940	350	11	5	147.00	249.50	336.00	393.50	419.00	314.64	-0.10	0.92
						Chlorophyll-*a*	70953	14.1	12	8	4.46	22.34	36.10	45.48	120.00	38.51	0.85	0.41
						Nitrate	00610	1.95	0	-	-	-	-	-	-	-	-	-
						Nitrate+Nitrite	00630	-	12	-	0.61	5.10	6.48	9.81	18.90	7.84	-1.15	0.27
						Phosphorus, Total	00665	0.69	10	10	0.95	1.04	1.26	1.79	2.25	1.41	-1.31	0.22
						Sulfate	00945	675	12	0	48.00	103.50	119.50	161.25	192.00	127.17	-0.96	0.36
						TDS	70300	2000	3	0	888.00	999.00	1110.00	1155.00	1200.00	1066.00	-0.73	0.54
						TSS	00530	-	11	-	5.00	7.50	15.00	20.00	34.00	16.09	-0.11	0.91
						TKN	00625	-	12	-	1.08	1.47	1.62	1.75	2.02	1.60	0.11	0.92
						Turbidity	82079	-	12	-	-	-	-	-	-	-	-	-
						VSS	00535	-	11	-	4.00	4.00	5.00	8.00	10.00	5.91	0.12	0.91
RIV	0229A_01	10192	08/01/03	07/31/13	Lake Tangle-wood	Temperature	00010	93	33	-	3.80	6.20	15.40	22.90	27.50	15.03	-0.19	0.85
						Conductivity	00094	-	33	-	1470.00	1840.00	1990.00	2050.00	2250.00	1952.42	2.07	0.05
						DO	00300	5.0	33	2	0.30	6.90	8.20	11.70	15.70	8.84	-0.62	0.54
						pH	00400	6.5-9.0	33	20	8.50	9.00	9.20	9.50	9.90	9.16	-0.54	0.59
						Ammonia	00610	0.11	31	16	0.05	0.06	0.15	0.50	1.62	0.33	0.91	0.37
						E.coli	31699	394	31	0	1	1	1	2	13	3	1.68	0.10
						Chloride	00940	-	33	-	262.00	322.00	375.00	396.00	455.00	363.94	1.76	0.09
						Chlorophyll-*a*	70953	16.7	32	21	0.93	14.18	61.15	84.63	178.00	60.44	0.64	0.52
						Nitrate	00610	0.37	2	2	6.88	7.18	7.47	7.77	8.06	7.47	-	-
						Nitrate+Nitrite	00630	-	32	-	0.04	2.43	4.34	6.78	11.40	4.45	0.03	0.98
						Phosphorus, Total	00665	0.20	30	30	0.34	0.77	1.13	1.26	1.57	1.03	0.31	0.76
						Sulfate	00945	-	33	-	129.00	194.00	211.00	220.00	244.00	205.42	-3.89	0.00
						TDS	70300	-	27	-	916.00	1035.00	1130.00	1180.00	1320.00	1111.63	-1.07	0.30
						TSS	00530	-	34	-	4.00	4.50	10.00	14.75	28.00	11.03	0.12	0.91
						TKN	00625	-	32	-	1.24	1.89	2.26	2.54	3.47	2.29	1.81	0.08
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	34	-	4.00	4.25	7.00	12.75	26.00	8.85	0.87	0.39
RV	0222_01	10171	08/01/03	07/31/13	Salt Fork Red River	Temperature	00010	93	40	0	0.30	9.73	16.65	25.78	33.00	17.04	-1.48	0.15
						Conductivity	00094	-	40	-	2110.00	2847.50	3165.00	3430.00	3760.00	3131.50	1.47	0.15
						DO	00300	5.0	40	0	6.70	7.78	9.25	11.00	13.80	9.61	2.22	0.03
						pH	00400	6.5-9.0	40	0	7.30	7.80	7.90	8.03	8.40	7.94	-1.08	0.29
						Ammonia	00610	0.33	27	0	0.02	0.10	0.10	0.10	0.10	0.09	4.02	0.00
						E.coli	31699	394	27	5	15	89	190	330	2100	402	-1.60	0.12
						Chloride	00940	400	40	3	169.00	251.75	293.50	336.00	454.00	292.90	1.99	0.05
						Chlorophyll-*a*	70953	14.1	27	0	2.00	2.00	2.00	2.72	10.40	2.72	1.40	0.17
						Nitrate	00610	1.95	13	5	0.44	1.05	1.64	2.12	2.43	1.54	-0.50	0.63
						Nitrate+Nitrite	00630	-	14	-	0.45	0.92	1.13	1.52	5.03	1.52	-0.09	0.93
						Phosphorus, Total	00665	0.69	40	0	0.01	0.01	0.06	0.06	0.14	0.05	5.75	0.00
						Sulfate	00945	1400	40	22	232.00	1207.50	1430.00	1575.00	1770.00	1352.98	1.37	0.18
						TDS	70300	3000	27	7	1810.00	2490.00	2860.00	3060.00	3550.00	2768.89	2.77	0.01
						TSS	00530	-	40	-	2.50	4.00	8.90	10.00	33.00	9.11	-3.74	0.00
						TKN	00625	-	13	-	0.10	0.18	0.18	0.22	1.00	0.25	1.69	0.12
						Turbidity	82079	-	27	-	0.75	1.60	2.30	4.60	14.20	3.81	-2.10	0.05
						VSS	00535	-	27	-	1.00	2.25	2.50	4.00	4.00	2.94	-4.47	0.00

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RV	0222_02	10172	08/01/03	07/31/13	Salt Fork Red River	Temperature	00010	93	13	0	5.80	12.00	16.30	24.00	31.40	17.05	2.20	0.05
						Conductivity	00094	-	13	-	1740.00	1880.00	2000.00	2100.00	3040.00	2087.69	-0.34	0.74
						DO	00300	5.0	13	0	7.00	7.80	10.00	10.50	11.80	9.53	-2.12	0.06
						pH	00400	6.5-9.0	14	0	7.10	7.70	8.10	8.20	8.30	7.91	-0.62	0.54
						Ammonia	00610	0.33	12	0	0.02	0.05	0.05	0.05	0.06	0.05	0.83	0.43
						E.coli	31699	394	13	1	2	25	49	140	1500	177	-0.06	0.95
						Chloride	00940	400	12	1	192.00	242.50	276.00	298.50	415.00	281.08	0.23	0.82
						Chlorophyll-*a*	70953	14.1	13	0	0.33	0.63	3.00	3.00	3.34	2.26	-2.01	0.07
						Nitrate	00610	1.95	0	-	-	-	-	-	-	-	-	-
						Nitrate+Nitrite	00630	-	13	-	0.04	0.04	0.04	0.04	0.04	0.04	1.42	0.18
						Phosphorus, Total	00665	0.69	12	0	0.02	0.02	0.03	0.05	0.06	0.04	-2.05	0.06
						Sulfate	00945	1400	13	0	368.00	448.00	464.00	508.00	832.00	519.46	-0.14	0.89
						TDS	70300	3000	10	0	1110.00	1220.00	1290.00	1337.50	1800.00	1353.00	0.42	0.69
						TSS	00530	-	12	-	1.00	4.00	4.00	6.00	27.00	6.42	-0.16	0.87
						TKN	00625	-	13	-	0.20	0.22	0.26	0.33	0.41	0.28	-1.56	0.14
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	12	-	1.00	4.00	4.00	4.00	4.00	3.75	1.34	0.21
RV	0222A_01	10076	08/01/03	07/31/13	Lelia Lake Creek	Temperature	00010	93	37	-	1.90	7.90	15.80	21.90	26.50	14.85	0.23	0.82
						Conductivity	00094	-	38	-	741.00	954.00	991.00	1020.00	1080.00	979.47	0.53	0.60
						DO	00300	5.0	37	1	0.00	7.00	10.10	11.70	13.90	9.06	-1.72	0.09
						pH	00400	6.5-9.0	38	0	7.30	7.63	7.80	7.98	8.20	7.79	-1.98	0.06
						Ammonia	00610	0.33	35	0	0.05	0.05	0.05	0.05	0.11	0.05	-0.28	0.78
						E.coli	31699	394	37	1	8	30	41	120	460	82	1.13	0.26
						Chloride	00940	-	35	-	48.00	54.00	57.50	61.00	72.00	57.71	-2.73	0.01
						Chlorophyll-*a*	70953	14.1	35	0	0.73	3.00	3.00	10.00	10.00	5.02	-8.09	0.00
						Nitrate	00610	1.95	6	0	0.05	0.10	0.24	1.04	1.50	0.57	0.17	0.87
						Nitrate+Nitrite	00630	-	29	-	0.04	0.05	0.36	1.18	2.28	0.63	-1.25	0.22
						Phosphorus, Total	00665	0.69	36	0	0.02	0.04	0.06	0.06	0.10	0.05	-5.07	0.00
						Sulfate	00945	-	35	-	179.00	194.00	209.00	219.50	244.00	208.09	1.28	0.21
						TDS	70300	-	29	-	590.00	646.00	664.00	716.00	880.00	685.24	-1.85	0.08
						TSS	00530	-	34	-	1.00	4.00	4.00	4.00	8.00	3.82	1.98	0.06
						TKN	00625	-	36	-	0.20	0.31	0.35	0.39	0.52	0.35	-0.72	0.48
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	35	-	1.00	4.00	4.00	4.00	4.00	3.49	4.61	0.00
RV	0223_01	10173	08/01/03	07/31/13	Greenbelt Lake	Temperature	00010	93	35	0	2.20	9.95	18.80	25.10	27.80	16.84	0.71	0.48
						Conductivity	00094	-	35	-	696.00	735.00	796.00	884.00	1180.00	843.74	10.47	0.00
						DO	00300	5.0	35	0	5.00	8.05	8.90	9.90	13.10	9.06	-1.00	0.32
						pH	00400	6.5-9.0	35	0	7.90	8.30	8.40	8.50	8.80	8.39	-1.09	0.28
						Ammonia	00610	0.11	34	1	0.05	0.05	0.05	0.05	0.12	0.05	1.93	0.06
						E.coli	31699	394	32	0	1	1	1	1	28	2	1.92	0.06
						Chloride	00940	250	35	0	54.00	67.00	75.00	84.00	169.00	80.23	5.53	0.00
						Chlorophyll-*a*	70953	26.7	33	1	1.00	3.31	5.87	10.00	39.20	7.78	2.47	0.02
						Nitrate	00610	0.37	2	0	0.05	0.05	0.05	0.05	0.05	0.05	-	-
						Nitrate+Nitrite	00630	-	33	-	0.04	0.04	0.04	0.04	0.10	0.04	1.44	0.16
						Phosphorus, Total	00665	0.20	34	0	0.02	0.05	0.06	0.06	0.08	0.05	-1.32	0.20
						Sulfate	00945	200	35	2	104.00	119.50	135.00	148.00	206.00	139.17	8.46	0.00
						TDS	70300	750	25	0	400.00	428.00	468.00	502.00	578.00	472.20	5.61	0.00
						TSS	00530	-	33	-	2.00	4.00	4.00	6.00	18.00	6.24	5.27	0.00
						TKN	00625	-	33	-	0.24	0.49	0.56	0.69	1.06	0.60	9.24	0.00
						Turbidity	82079	-	0	-	-	-	-	-	-	-	-	-
						VSS	00535	-	35	-	1.00	4.00	4.00	4.00	6.00	3.89	4.46	0.00

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RV	0224_01	10178	08/01/03	07/31/13	North Fork Red River	Temperature	00010	91	35	0	0.10	7.10	16.00	21.50	32.90	15.19	-0.74	0.46
						Conductivity	00094	-	35	-	738.00	2195.00	2330.00	2750.00	3230.00	2370.23	0.28	0.78
						DO	00300	5.0	35	0	6.90	7.90	9.20	11.75	13.40	9.80	1.64	0.11
						pH	00400	6.5-9.0	35	0	7.40	7.90	8.10	8.15	8.20	7.98	-0.23	0.82
						Ammonia	00610	0.33	23	0	0.02	0.10	0.10	0.10	0.10	0.09	3.68	0.00
						E.coli	31699	394	23	2	1	17	50	235	2400	213	-0.58	0.57
						Chloride	00940	800	35	0	71.90	414.00	430.00	453.50	578.00	426.34	0.28	0.78
						Chlorophyll-*a*	70953	14.1	22	1	2.00	2.00	2.00	2.00	33.80	3.60	2.01	0.06
						Nitrate	00610	1.95	10	1	0.04	0.04	0.09	0.13	5.05	0.63	-1.48	0.17
						Nitrate+Nitrite	00630	-	14	-	0.02	0.04	0.04	0.07	0.49	0.08	-0.81	0.43
						Phosphorus, Total	00665	0.69	35	0	0.00	0.01	0.06	0.07	0.40	0.06	1.46	0.15
						Sulfate	00945	1200	35	0	181.00	383.50	439.00	684.00	968.00	513.54	1.33	0.19
						TDS	70300	2500	23	1	1120.00	1425.00	1590.00	1870.00	2700.00	1713.04	0.90	0.38
						TSS	00530	-	35	-	2.00	7.50	10.00	17.55	550.00	30.17	-0.75	0.46
						TKN	00625	-	12	-	0.14	0.18	0.25	0.31	1.90	0.39	1.77	0.10
						Turbidity	82079	-	23	-	1.80	4.01	9.40	12.85	59.20	13.24	-0.68	0.50
						VSS	00535	-	23	-	1.00	1.75	4.00	4.00	8.30	3.14	-1.15	0.26
RV	0224A_01	10064	08/01/03	07/31/13	McClellan Creek	Temperature	00010	91	35	-	0.70	5.85	14.50	20.25	26.20	13.29	-0.12	0.90
						Conductivity	00094	-	35	-	991.00	1125.00	1170.00	1255.00	1540.00	1204.89	1.47	0.15
						DO	00300	5.0	35	0	5.40	7.80	8.60	10.70	12.30	9.02	-0.76	0.45
						pH	00400	6.5-9.0	35	0	7.40	7.90	8.00	8.10	8.70	7.97	-0.09	0.93
						Ammonia	00610	0.33	35	0	0.02	0.02	0.10	0.10	0.10	0.07	7.80	0.00
						E.coli	31699	394	35	7	14	72	130	325	2000	282	-0.63	0.53
						Chloride	00940	-	35	-	10.00	140.50	151.00	173.50	238.00	152.78	1.45	0.16
						Chlorophyll-*a*	70953	14.1	35	0	2.00	2.00	2.00	2.00	5.00	2.69	-6.14	0.00
						Nitrate	00610	1.95	13	0	0.02	0.04	0.04	0.04	0.20	0.05	0.38	0.71
						Nitrate+Nitrite	00630	-	22	-	0.02	0.02	0.04	0.05	1.09	0.11	-1.29	0.21
						Phosphorus, Total	00665	0.69	35	0	0.06	0.06	0.06	0.09	0.18	0.08	-1.04	0.30
						Sulfate	00945	-	35	-	5.00	103.00	117.00	132.00	203.00	115.56	1.66	0.11
						TDS	70300	-	35	-	438.00	668.50	724.00	747.50	960.00	710.03	2.29	0.03
						TSS	00530	-	35	-	1.00	2.50	4.00	4.00	8.00	3.51	-3.99	0.00
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	35	-	0.50	1.15	1.89	2.65	6.40	2.18	0.01	1.00
						VSS	00535	-	35	-	1.00	2.50	4.00	4.00	4.00	3.10	-5.54	0.00
RV	0299A_01	10070	08/01/03	07/31/13	Sweetwater Creek	Temperature	00010	-	8	-	1.00	9.85	14.30	17.80	30.30	13.81	-0.35	0.74
						Conductivity	00094	-	8	-	12.00	887.00	1067.50	1210.00	1490.00	981.38	-1.00	0.35
						DO	00300	5.0	8	-	7.00	9.48	10.95	12.63	14.00	10.74	0.58	0.58
						pH	00400	6.5-9.0	8	-	7.20	7.85	8.20	8.20	8.30	7.99	-1.01	0.34
						Ammonia	00610	0.33	8	0	0.10	0.10	0.10	0.10	0.10	0.10	-	-
						E.coli	31699	-	8	4	61	110	300	575	980	405	-0.25	0.81
						Chloride	00940	394	8	-	45.80	47.23	53.90	76.75	95.60	62.46	-0.99	0.36
						Chlorophyll-*a*	70953	14.1	8	1	2.00	2.40	7.50	9.45	182.00	27.90	-1.63	0.15
						Nitrate	00610	1.95	5	0	0.04	0.04	0.04	0.04	1.20	0.27	-0.54	0.62
						Nitrate+Nitrite	00630	-	3	-	0.02	0.02	0.02	0.64	1.25	0.43	0.00	1.00
						Phosphorus, Total	00665	0.69	8	0	0.06	0.06	0.06	0.07	0.11	0.07	0.57	0.59
						Sulfate	00945	-	8	-	99.00	284.25	316.50	324.00	458.00	294.88	-1.60	0.15
						TDS	70300	-	8	-	530.00	605.00	770.00	838.50	1020.00	745.50	-0.56	0.59
						TSS	00530	-	8	-	2.50	2.50	3.30	8.05	225.00	32.06	-1.73	0.13
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	8	-	2.20	2.58	3.15	4.70	64.20	10.90	-1.72	0.13
						VSS	00535	-	8	-	2.50	2.50	2.50	2.50	32.00	6.19	-1.73	0.13

Appendix B - Red River Basin Descriptive Statistics

Basin Reach	Seg_AU	Station	Date Start	Date End	Site	Parameter	Storet	TWQS / Nutrient SL	N	N Over TWQS / SL	Min	P25	Median	P75	Max	Mean	t-score	p-value
RV	0299A_01	10072	08/01/03	07/31/13	Sweetwater Creek	Temperature	00010	-	24	-	3.50	6.85	16.75	22.45	27.70	15.35	-0.35	0.73
						Conductivity	00094	-	24	-	478.00	539.25	607.50	621.75	731.00	585.54	0.69	0.50
						DO	00300	5.0	24	-	4.00	7.48	8.70	10.40	13.40	8.92	-0.68	0.51
						pH	00400	6.5-9.0	24	-	7.60	7.90	8.10	8.20	8.40	8.04	-2.01	0.06
						Ammonia	00610	0.33	23	0	0.02	0.02	0.05	0.10	0.22	0.06	1.83	0.08
						E.coli	31699	394	23	6	8	168	256	520	2400	599	-0.79	0.44
						Chloride	00940	-	23	-	10.00	16.25	26.20	33.15	200.00	31.37	-1.19	0.25
						Chlorophyll-*a*	70953	14.1	23	3	2.00	3.00	5.00	7.82	98.90	12.48	2.22	0.04
						Nitrate	00610	1.95	4	0	0.04	0.04	0.04	0.04	0.04	0.04	-	-
						Nitrate+Nitrite	00630	-	19	-	0.02	0.02	0.04	0.14	1.50	0.16	-0.48	0.64
						Phosphorus, Total	00665	0.69	23	0	0.06	0.07	0.09	0.14	0.23	0.11	0.12	0.90
						Sulfate	00945	-	23	-	14.60	19.65	25.00	30.15	100.00	29.46	1.75	0.09
						TDS	70300	-	23	-	222.00	288.00	333.00	379.50	1080.00	364.09	0.10	0.92
						TSS	00530	-	23	-	2.50	4.00	9.00	20.50	108.00	18.35	1.89	0.07
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	24	-	1.50	3.48	7.03	11.40	50.00	10.82	1.87	0.07
						VSS	00535	-	23	-	2.50	4.00	4.00	5.00	24.80	6.16	1.75	0.09
RV	0299A_01	10074	08/01/03	07/31/13	Sweetwater Creek	Temperature	00010	-	35	-	0.90	7.05	14.50	21.20	25.80	13.91	-0.06	0.95
						Conductivity	00094	-	35	-	550.00	584.00	600.00	627.00	721.00	607.94	1.25	0.22
						DO	00300	5.0	35	-	2.40	5.95	7.30	11.10	12.80	7.97	-2.92	0.01
						pH	00400	6.5-9.0	35	-	7.60	7.80	8.00	8.10	8.40	7.96	-0.86	0.40
						Ammonia	00610	0.33	35	0	0.02	0.04	0.10	0.10	0.10	0.08	7.50	0.00
						E.coli	31699	394	35	9	1	31	160	380	2400	275	-1.24	0.22
						Chloride	00940	-	35	-	21.80	34.35	37.90	40.75	55.70	37.08	4.02	0.00
						Chlorophyll-*a*	70953	14.1	35	0	2.00	2.00	2.00	3.85	7.64	3.02	-3.49	0.00
						Nitrate	00610	1.95	13	0	0.02	0.04	0.04	0.11	0.26	0.09	-0.95	0.36
						Nitrate+Nitrite	00630	-	22	-	0.02	0.07	0.13	0.25	1.90	0.26	-1.45	0.16
						Phosphorus, Total	00665	0.69	35	0	0.06	0.06	0.07	0.09	0.70	0.10	-1.66	0.11
						Sulfate	00945	-	35	-	10.00	12.90	19.50	23.15	185.00	23.67	-0.17	0.86
						TDS	70300	-	35	-	222.00	318.00	344.00	368.50	436.00	341.14	0.80	0.43
						TSS	00530	-	35	-	1.00	2.80	4.00	4.00	16.30	3.97	-0.39	0.70
						TKN	00625	-	0	-	-	-	-	-	-	-	-	-
						Turbidity	82079	-	35	-	1.15	2.01	2.29	3.70	8.00	2.85	-1.33	0.19
						VSS	00535	-	35	-	1.00	2.50	4.00	4.00	4.00	3.10	-5.54	0.00

Red text - data revealed a statistically significantly trend based on the p-value

TWQS/Nutrient SL - Texas Water Quality Standard/Nutrient Screening Level applicable to segment
N - the number of individual samples which the data set is comprised of
N Over TWQS/SL - Number of samples exceeding the TWQS/Nutrient Screening Level
Min - the least of a set of numbers, specifically the smallest value in the data set
P25 - 25th Percentile
Median - the number located in the middle of the data set when arranged from lowest to highest value
P75 - 75th Percentile
Max - the largest of a set of numbers, specifically the largest value in the data set
Mean - or more specifically the arithmatic mean, or average is calculated by adding up all terms in a data set and dividing by N
t-score - A score utilized in setting up norms for standardized tests
p-value - a measure of uncertainty or the chance that you are observing can be attributed to pure chance alone, occurring in your data set, but not in the general population; for example a p-value of 0.01 would indicate that there is a 1.0% chance the relationship shows up in your data set but not in the general population

APPENDIX C - WATER QUALITY MONITORING STATIONS

Segment	Site	Description
0101	10032	CANADIAN RIVER BRIDGE AT US 60-83 AT CANADIAN
0101	10033	CANADIAN RIVER BRIDGE ON SH 70 NORTH OF PAMPA
0101	10034	CANADIAN RIVER BRIDGE AT PLEMONS ROAD SOUTH OF THE CITY OF PLEMONS
0101	10035	CANADIAN RIVER APPROX 0.6 MI UPSTREAM FROM FM 2277 BRIDGE
0101	20702	CANADIAN RIVER APPROXIMATELY 3.2 KM DOWNSTREAM OF FM 2277 PLEMONS RD BRIDGE NORTHEAST OF BORGER
0101A	10016	DIXON CREEK 150 M UPSTREAM OF HUTCHINSON COUNTY ROAD V UPSTREAM OF CANADIAN RIVER CONFLUENCE NE OF BORGER
0101A	17045	DIXON CREEK AT SH 152 WEST OF RR 2171 EAST OF BORGER
0101B	10024	ROCK CREEK 15 M DOWNSTREAM OF CHICKASAW RD BRIDGE IN ELECTRIC CITY NEAR BORGER
0101C	21174	WHITE DEER CREEK AT JEEP CROSSING APPROX 0.45 KM EAST OF THE DUNCAN RANCH COMPLEX AT THE END OF HUTCHINSON COUNTY ROAD 26
0102	10036	LAKE MEREDITH AT INTAKE TOWER AT DAM NW OF SANFORD
0102A	15270	BIG BLUE CREEK 250 YDS UPSTREAM OF FM 1913 APPROXIMATELY 21 MI SE OF DUMAS
0103	10054	CANADIAN RIVER BRIDGE AT US 87-287 NORTH OF AMARILLO
0103	10056	CANADIAN RIVER BRIDGE ON US 385 NORTH OF TASCOSA
0103	16344	CANADIAN RIVER AT TEXAS / NEW MEXICO STATE LINE 15 MI NORTH OF IH40 IN OLDHAM COUNTY
0103A	10017	EAST AMARILLO CREEK 15 METERS UPSTREAM OF CITY OF AMARILLO ROAD WWTP OUTFALL
0103A	10018	EAST AMARILLO CREEK IMMEDIATELY DOWNSTREAM OF US 287 NORTH OF AMARILLO
0103A	15775	THOMPSON PARK LAKE NORTH END OF NORTH LAKE 213 M W OF US 87 FRONTAGE RD AND 1.34 KM NORTH OF NE 24TH ST IN AMARILLO
0103A	21024	EAST AMARILLO CREEK AT LOOP 335 AND US 287 IN AMARILLO
0103C	17056	UNNAMED TRIBUTARY OF WEST AMARILLO CREEK AT LOOP 335 EASTBOUND ACCESS ROAD 470 M EAST OF ITS INTERSECTION WITH FM / RM 1061
0104	10058	WOLF CREEK BRIDGE AT SH 305 NORTH OF LIPSCOMB
0104	10059	WOLF CREEK 50 M UPSTREAM OF FM 1454 APPROXIMATELY 27.4 KM/17 MI EAST OF LIPSCOMB
0104	17465	LAKE FRYER MID LAKE 75 M UPSTREAM OF DAM SOUTHEAST OF PERRYTON
0105	10060	RITA BLANCA LAKE 331 M W AND 205 M N OF DAM OUTLET SOUTH OF DALHART
0199A	10005	PALO DURO RESERVOIR AT BOAT LAUNCH NEAR DAM 19 KM NORTH OF SPEARMAN
0199A	10007	PALO DURO CREEK SH 207 15 WEST OF SPEARMAN

APPENDIX C - WATER QUALITY MONITORING STATIONS

Segment	Site	Description
0201	10106	PANTHER CREEK AT EASTBOUND US 82 2 KM WEST OF CITY OF HOOKS AT US 82/ST SPUR 86 INTERSECTION
0201	10123	RED RIVER BRIDGE AT SOUTHBOUND US 59 NEAR INDEX ARKANSAS 1.22 KM NORTH OF FM 2320/US 59 INTERSECTION ON TEXAS SHORE SIDE
0201	15059	BARKMAN CREEK 35 M EAST OF RICHMOND RD OVERPASS/FM 559 0.97 KM NW OF FM 559/ HOLLY CREEK ROAD INTERSECTION 115 KM NW OF TEXARKANA
0201A	15319	MUD CREEK AT US 259 3.1 KM NORTH OD FE KALB
0202	10125	RED RIVER DOWNSTREAM LAKE TEXOMA AT US 259 9.3 KM NORTH OF US 259/FM 114 INTERSECTION 21 KM NORTH OF DEKALB
0202	10126	RED RIVER AT NORTHBOUND US 271 IN ARTHUR CITY 0.75 KM NORTH OF FM 197/US 271 INTERSECTION
0202	10127	RED RIVER AT SH 78 355 M NORTHWEST OF FANNIN CR 200/SH 78 INTERSECTION AT TEXAS STATE LINE 10 KM NORTHEAST OF CITY OF RAVENNA
0202	13684	RED RIVER 550 M DOWNSTREAM FROM DENISON DAM POWERHOUSE 7.25 KM NORTH OF DENISON 660 M UPSTREAM OF SHAWNEE CREEK
0202	21031	RED RIVER AT US 75 NORTH OF DENISON
0202A	15036	BOIS D ARC CREEK AT FM 898/OAK HILL ROAD 1.4 KM NORTHEAST OF CITY OF WHITE-WRIGHT/
0202A	21028	BOIS D ARC CREEK AT US 82 NEAR BONHAM
0202A	21029	BOIS D ARC CREEK AT FM 409 NORTHWEST OF HONEY GROVE
0202A	20167	BOIS D ARC CREEK AT FM 1396 NORTHWEST OF HONEY GROVE
0202C	14472	PECAN BAYOU AT BLANTON CREEK CEMETERY ROAD/RED RIVER CR 2235 11.65 KM NORTH OF CITY OF BAGWELL
0202C	16001	PECAN BAYOU AT FM 1159 9.62 KM NORTHEAST OF CLARKSVILLE IN RED RIVER COUNTY
0202D	10120	PINE CREEK AT SOUTHBOUND US 271 APPROX 7.8 KM NORTH OF THE CITY OF PARIS PERMIT WQ001012-000 CAMPBELL SOUP SUPPLY COMPANY
0202D	10121	HICKS CREEK APPROX 400 M UPSTREAM OF PINE CREEK CONFLUENCE AT PRIVATE ROAD 1.55 KM EAST OF US 271 10 KM NNE OF THE CITY OF PARIS
0202E	10114	POST OAK CREEK AT FIRST COUNTY ROAD CROSSING DOWNSTREAM SHERMAN WWTP 0.33 KM SOUT OF E FM 1417/SH 11 INTERSECTION 5.75 KM SE OF SHERMAN
0202E	10115	POST OAK CREEK AT FM 1417 0.25 KM WEST OF SH 11/FM 1417 INTERSECTION 5.3 KM SOUTHEAST OF SHERMAN
0202E	17599	POST OAK CREEK AT FM 1417 0.95 KM SOUTH OF FM 1417/US 82 INTERSECTION 4.75 KM NORTHWEST OF SHERMAN
0202E	21130	DEAN GILBERT LAKE NEAR THE DAM SOUTHWEST OF THE HWY 82 AND FM 1417 INTERSECTION IN SHERMAN TEXAS
0202F	10111	CHOCTAW CREEK AT SH 11 1.6 KM SOUTHEAST OF FM 1417/SH 11 INTERSECTION 7 KM SOUTHEAST OF SHERMAN
0202F	10112	CHOCTAW CREEK AT LUELLA ROAD 7.3 M SSE OF SHERMAN FIRST CROSSING UPSTREAM CONFLUENCE WITH POST OAK CREEK
0202F	18370	CHOCTAW CREEK AT US 82 5.07 KM DOWNSTREAM OF SH 56 EAST OF SHERMAN
0202G	17044	SMITH CREEK AT SOUTHBOUND US 271 385 M UPSTREAM OF THE CONFLUENCE WITH PINE CREEK 7 KM NORTH OF CITY OF PARIS

APPENDIX C - WATER QUALITY MONITORING STATIONS

Segment	Site	Description
0202G	21026	SMITH CREEK AT LAMAR CR 31700 NEAR CITY OF PARIS
0202G	21027	SMITH CREEK AT LOOP 286/US 82 IN THE CITY OF PARIS
0202I	18514	LITTLE PINE CREEK AT FM 195
0202J	15446	SAND CREEK AT SH 56 1.35 KM WEST OF SH 56/US 75 INTERSECTION WEST OF SHERMAN
0202J	16945	PICKENS LAKE MID LAKE AT HERMAN BAKER PARK 1.0 KM EAST OF FM 1417 AND 700 M NORTHEAST OF END OF SOUTHRIDGE LANE SOUTHWEST OF SHERMAN
0202K	18653	IRON ORE CREEK AT US 69 SOUTHEAST OF DENISON
0202L	21030	HONEY GROVE CREEK AT FANNIN CR 2770
0202M	21032	LAKE BONHAM APPROX 265 METERS NORTH AND 165 METERS EAST OF THE INTERSECTION FO FM 273 AND WESTVIEW DRIVE
0203	10130	LAKE TEXOMA NEAR BIG MINERAL ARM 4.1 KM EAST OF US 377/OXFORD DRIVE INTERSECTION 1.5 KM E OF WEST SHORE 15 KM NORTHWEST OF POTTSBORO
0203	10131	LAKE TEXOMA AT US 377 0.42 KM NORTH OF TEXAS BANK ON US 377 8.05 KM NORTH OF GORDONVILLE
0203	15388	LAKE TEXOMA LITTLE MINERAL ARM AT BOAT RAMP AT SIMMONS SHORE IN PRESTON 4.5 KM E OF FM 120 5.5 KM N OR FM 406 12.5 KM NNW OF DENISON
0203	15440	LAKE TEXOMA AT SOUTH END DENISON DAM EAST OF SH 75A NORTH OF DENISON
0203	17480	LAKE TEXOMA LITTLE MINERAL ARM SOUTHEAST OF PRESTON SHORE NEAR INTAKE STRUCTURE EQUIDISTANT BETWEEN SHORELINES 15 KM EAST OF FM 120
0203	20545	LAKE TEXOMA 260 METERS DUE WEST FROM LAKE TEXOMA DAM 282 METERS EAST AND 392 METERS NORTH TO THE INTERSECTION OF FM 1310 AND NORTH SH 91 NORTH OF DENISON
0203A	15320	BIG MINERAL CREEK AT FM 901 NORTH OF SADLER
0203A	17505	SOUTH BRANCH BIG MINERAL CREEK AT RILEY ROAD 1.5 KM NORTH OF RILEY ROAD/ PECAN STREET INTERSECTION 3.0 KM NORTHWEST OF SADLER
0204	10132	RED RIVER AT IH 35 5.25 KM NORTH OF FM 1202/IH 35 INTERSECTION AT TEXAS SHORE 11 KM NORTH NORTHWEST OF GAINESVILLE
0204	10133	RED RIVER AT US 81 2.1 KM NORTH OF US 81/PARR ROAD INTERSECTION 6.5 KM NORTH OF RINGGOLD
0204	20168	RED RIVER AT FM 677 NORTHWEST OF SAINT JO
0205	10134	RED RIVER BRIDGE ON IH 44/US 277/US 281 313 M NORTHEAST OF TEXAS SHORE NEAR MID BRIDGE 4.0 KM NORTHEAST OF CITY OF BURKBURNETT
0205	16733	RED RIVER AT US 183/US 70 N 10.5 KM NORTH NORTHEAST OF OKLAUNION
0205A	10096	WILDHORSE CREEK AT US 281/US 277/IH 44 3.1 KM NORTHEAST OF BURKBURNETT
0206	10135	PRAIRIE DOG TOWN FORK RED RIVER AT SH 6 12.75 KM NORTH OF QUANAH
0206A	20166	GROESBECK CREEK AT SH 6 NORTH OF QUANAH
0206B	16000	SOUTH GROESBECK CREEK AT US 287 7.5 KM WEST NORTHWEST OF WUANAH IN HARDEMAN COUNTY

APPENDIX C - WATER QUALITY MONITORING STATIONS

Segment	Site	Description
0207	10136	LOWER PRAIRIE DOG TOWN FORK RED RIVER AT US 62-82 3.4 KM NORTH OF US 83/RR 2465 INTERSECTION 16 KM NORTH OF CHILDRESS
0207	13637	LOWER PRAIRIE DOG TOWN FORK RED RIVER AT SH 207 10 KM SOUTHWEST OF FM 2272/ SH 207 INTERSECTION 30.45 KM SOUTH OF CLAUDE
0207	16037	LOWER PRAIRIE DOG TOWN FORK RED RIVER AT US 70 70 M SOUTHWEST OF THE NORTHERN TIP OF SOUTHBOUND US 70 BRIDGE 26.4 KM NORTH OF TURKEY
0207	18317	UPPER PRAIRIE DOG TOWN FORK RED RIVER 1.73 KM DOWNSTREAM OF LAKE TANGLEWOOD DAM SOUTHEAST OF AMARILLO
0208	10137	LAKE CROOK MID LAKE 0.88 KM SW OF 19TH STREET/OLD LAKE CROOK ROAD SOUTH INTERSECTION 200 M W OF E SHORE 6.6 KM NNW OF CITY OF PARIS
0209	16342	PAT MAYSE RESERVOIR UPPER LAKE APPROX 1 KM SW OF FOREST POINT RECREATION AREA EQUIDISTANT BETWEEN BOTH SHORELINES
0209	16343	PAT MAYSE RESERVOIR 50 M NORTH OF CITY OF PARIS RAW WATER INTAKE STRUCTURE 3.65 KM SSE FM 197/FM 906 INTERSECTION IN THE CITY OF CHICOTA
0210	10139	FARMERS CREEK RESERVOIR/NOCONA LAKE MID LAKE NEAR DAM 1.3 KM SW OF OAK SHORES ROAD/FM 2953 INTERSECTION 0.36 KM SOUTH OF M ID DAM
0211	10140	LITTLE WICHITA RIVER AT FM 2332 0.63 KM UPSTREAM FROM MOUTH AT RED RIVER CONFLUENCE 9.2 KM NORTHWEST OF RINGGOLD
0211	13633	LITTLE WICHITA RIVER ON RIGHT BANK 25 M DOWNSTREAM OF US82/US 287 1.71 KM DOWNSTREAM OF DUCK CREEK 4 KM WEST NORTHWEST OF HENRIETTA
0211A	10105	EAST FOR LITTLE WICHITA RIVER AT US 82 10.25 KM EAST OF HENRIETTA
0212	10142	LAKE ARROWHEAD MID LAKE NEAR DAM 609 M SOUTH OF MID DAM 765 M SE OF LITTLE WICHITA R INTAKE STRUCTURE 14 KM NE OF SCOTLAND
0212A	16038	LITTLE WICHITA RIVER AT SH 73 7.58 KM NORTH OF ARCHER CITY
0213	10143	LAKE KICKAPOO NEAR MID DAM 521 SOUTH OF NORTH FORK LITTLE WICHITA RIVER INTAKE STRUCTURE 13.8 KM SOUTH OF US 82/SH 25 INTERSECTION
0214	10145	WICHITA RIVER AT FM 810 1.25 KM SOUTH OF FM 1740/FM 810 INTERSECTION 9.65 KM WEST OF BYERS
0214	10148	WICHITA RIVER AT END OF EASTLAND LANE 0.75 KM SE OF RIVER ROAD/EASTLAND LANE INTERSECTION 5.5 KM NORTH NORTHEAST OF WICHITA FALLS
0214	10150	WICHITA RIVER AT SH 240 345 M NORTHWEST OF SH 240/EASTSIDE DRIVE/FRONT STREET INTERSECTION IN WICHITA FALLS
0214	10151	WICHITA RIVER AT ST LOOP 11 237 M NORTH OF US 277/ST LOOP 11 INTERSECTION IN NORTHWESTERN WICHITA FALLS
0214	10152	WICHITA RIVER AT FM 1634
0214	10154	WICHITA RIVER AT FM 368 325 M NORTH OF FM 368/FM 1206 INTERSECTION 7.38 KM SOUTHWEST OF CITY OF IOWA PARK 9.15 KM NORTH OF HOLLIDAY
0214	10155	WICHITA RIVER AT SH 25 1.3 KM NORTH OF SH 258/SH 25 INTERSECTION 14.5 KM NORTHWEST OF CITY OF HOLLIDAY
0214	20321	WICHITA RIVER 1.29 KM DOWNSTREAM OF THE BARNETT ROAD BRIDGE ON LEFT BANK CAMS 746
0214A	15120	BEAVER CREEK AT FM 2326 2.0 KM SOUTHWEST OF SH 25/FM 2326 INTERSECTION 22 KM NORTHWEST OF HOLLIDAY
0214A	15121	BEAVER CREEK AT US 283/US 183 2.23 KM SOUTH OF FM 1763/US 283 INTERSECTION 22.1 KM SOUTH SOUTHEAST OF VERNON
0214B	10097	BUFFALO CREEK AT FM 1814/BELL ROAD 3.6 KM SOUTH OF CITY OF IOWA PARK

APPENDIX C - WATER QUALITY MONITORING STATIONS

Segment	Site	Description
0214B	16036	BUFFALO CREEK AT COLEMAN PARK ROAD 2.95 KM SOUTHWEST OF IOWA PARK 1.7 KM UPSTREAM OF FM 368
0214C	10095	HOLLIDAY CREEK AT HARDING STREET 97 M EAST OF WILLIAMS AVENUE/HARDING STREET INTERSECTION IN WICHITA FALLS
0214C	21025	HOLLIDAY CREEK AT WFCC GOLF COURSE APPROX 120 METERS NORTH AND 10 METERS WEST OF THE INTERSECTION OF BRIDWELL STREET AND 30TH STREET IN WICHITA FALLS
0214E	18831	SOUTH CANAL 80 M DOWNSTREAM OF LAKE DIVERSION SPILLWAY NEAR DUNDEE
0214F	21172	UNNAMED TRIBUTARY OF BUFFALO CREEK AT COLEMAN PARK ROAD DOWNSTREAM OF THE CITY OF IOWA PARK WWTP
0215	10157	DIVERSION LAKE NEAR DAM 0.64 KM NORTHWEST OF SPILLWAY FACE 390 M WEST OF DAM EQUIDISTANT BETWEEN SHORELINES 22.8 KM WEST OF HOLLIDAY
0216	10158	WICHITA RIVER AT US 182/US 283 NEAR LAKE KEMP DAM 10.7 KM NORTH US 82/US 283 INTERSECTION 9.8 KM NORTH OF MABELLE
0217	10159	LAKE KEMP NEAR DAM 0.80 KM SW OF WATER INTAKE STRUCTURE AT WICHITA RIVER 0.72 KM NORTH OF WILLINGHAM LOOP 1.64 KM WEST OF US 283
0217	10160	LAKE KEMP AT HEADWATERS
0218	10161	NORTH WICHITA RIVER AT FM 1919 5.25 KM NORTHWEST OF BAYLOR CR 129/FM 1919 INTERSECTION 16.8 KM NORTHWEST OF SEYMOUR
0218	10162	NORTH WICHITA RIVER AT SH 6 19 KM SOUTH OF CROWELL AND 7.5 KM NORTH OF TRUSCOTT
0218	15119	NORTH FORK WICHITA RIVER 6 KM DOWNSTREAM OF COTTONWOOD CREEK 2.04 KM UPSTREAM OF COTTLE CR 493 NEAR PADUCAH
0218A	14900	MIDDLE WICHITA RIVER 240 M UPSTREAM OF FARRER CREEK 24.25 KM EAST OF US 83/FM 1168 INTERSECTION 30.15 KM NORTHEAST OF GUTHRIE
0219	10163	LAKE WICHITA NEAR MID DAM 376 M SE OF END OF CITY ACCESS RD IN WICHITA FALLS 2.94 KM SW OF SOUTHWEST PKWY/LAKE PARK DR INTERSECTION
0220	10167	PEASE RIVER AT FM 104/RR 104 16.7 KM SOUTH OF KIRKLAND
0222	10171	SALT FORK RED RIVER 80 M DOWNSTREAM OF US 83 AT SOUTH BANK 11 KM NORTH OF WELLINGTON
0222	10172	SALT FORK RED RIVER AT FM 2695/SH 273 15 KM NORTHEAST OF HEDLEY
0222A	10076	LELIA LAKE CREEK AT FM 2471 8.0 KM NORTH NORTHWEST OF HEDLEY
0223	10173	GREENBELT RESERVOIR NEAR INTAKE STRUCTURE AT DAM NEAR SALT FORK RED RIVER 202 M WEST OF SH 70 4 KM SOUTH OF HOWARDWICK
0224	10178	NORTH FORK RED RIVER AT US 83 4.25 KM NORTH OF SHAMROCK
0224A	10064	MCCLELLAN CREEK AT SH 273 0.22 KM SOUTH OF SH 273/HUDGINS ROAD INTERSECTION 10.5 KM NORTH OF CITY OF MCLEAN
0226	10185	SOUTH FORK WICHITA RIVER AT SH 6 6.7 KM NORTH OF BENJAMIN
0226	13635	SOUTH FORK WICHITA RIVER BELOW LOW FLOW DAM 1.1 M DOWNSTREAM FROM RANCH ROAD CROSSING 6.6 M EAST OF GUTHRIE
0226	13636	SOUTH FORK WICHITA RIVER AT LOW FLOW DAM 1.69 KM DOWNSTREAM OF KING CR 274 10.6 KM EAST OF GUTHRIE
0228	10188	LAKE MACKENZIE EAST LAKE NEAR INTAKE TOWER AT DAM 440 M WEST OF FM 284 15 KM NORTHWEST OF SILVERTON

APPENDIX C - WATER QUALITY MONITORING STATIONS

Segment	Site	Description
0229	10191	UPPER PRAIRIE DOG TOWN FORK RED RIVER AT SH PARK ROAD 5/SH 217 IN PALO DURO STATE PARK AT FIRST LOW WATER CROSSING
0229	20801	UPPER PRAIRIE DOG TOWN FORK RED RIVER 5.6 KM DOWNSTREAM OF LAKE TANGLE-WOOD DAM
0229A	10192	LAKE TANGLEWOOD NEAR DAM 0.53 KM SE OF CEDAR LAKE/SHORE DRIVE INTERSEC-TION 200 M N OF EASTERN EDGE OF DAM 16.05 SE OF AMARILLO
0229B	10065	TIERRA BLANCA CREEK AT FLOW GAGING STATION DOWNSTREAM BUFFALO LAKE 0.63 KM SOUTH OF DEAF SMITH CR 8 5.48 KM WEST OF RR 168 NEAR UMBARGER
0230	10166	PEASE RIVER AT US 287 0.91 KM SOUTHEAST OF RR 925/US 287 INTERSECTION 4.6 KM NORTHWEST OF DOWNTOWN VERNON
0230A	10094	PARADISE CREEK AT US 287 3.75 KM EAST OF VERNON
0299A	10070	SWEETWATER CREEK AT RR 592/FM 592 3.33 KM NORTH OF SH 152/RR 592 INTERSECTION 14.15 KM EAST OF WHEELER
0299A	10072	SWEETWATER CREEK AT US 83 6.25 KM NORTH NORTHWEST OF WHEELER
0299A	10074	SWEETWATER CREEK AT SH 152 4.75 KM SOUTHEAST OF MOBEETIE

Red River Authority of Texas
P.O. Box 240
Wichita Falls, Texas 76307
(940) 723-8697
www.rra.texas.gov

North Texas Municipal Water District

Sherman
CLASSIC TOWN. BROAD HORIZON

THE TEXAS CLEAN RIVERS PROGRAM