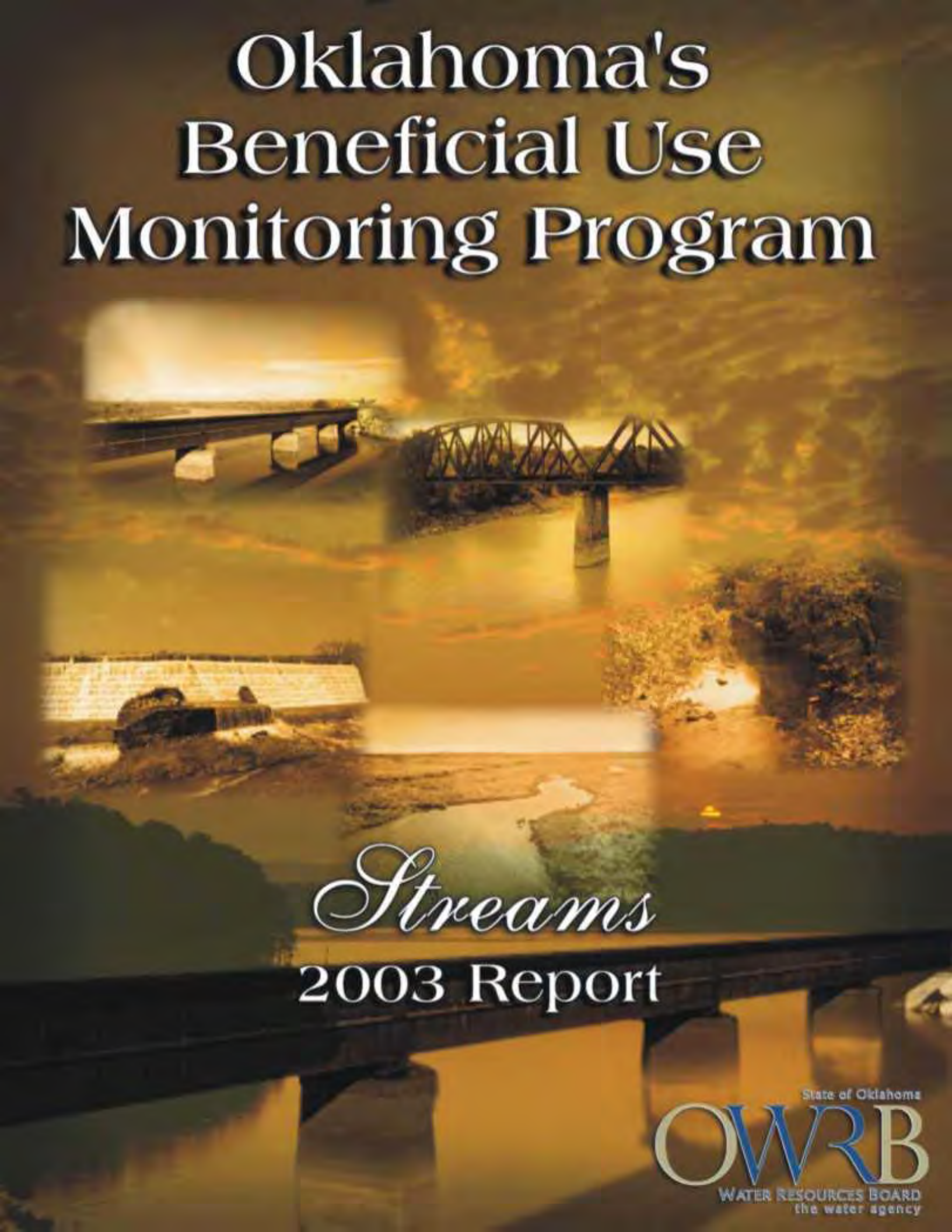
Oklahoma's Beneficial Use Monitoring Program



Streams

2003 Report

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EXECUTIVE SUMMARY

Beneficial Use Monitoring Program Goal:
The goal of the Beneficial Use Monitoring Program is to document beneficial use impairments, identify impairment sources (if possible), detect water quality trends, provide needed information for the OWQS and facilitate the prioritization of pollution control activities.

The Beneficial Use Monitoring Program exists as a result of the vital economic and social importance of Oklahoma's lakes, streams, wetlands,and aquifers and the associated need for their protection and management.The data contained in this report is scientifically defensible and has been collected and analyzed following procedures outlined in Use Support Assessment Protocols (USAP),developed by Oklahoma's environmental agencies. Specifically, USAPs establish a consistent method to determine if beneficial uses assigned for individual waters through Oklahoma Water Quality Standards (OWQS) are being supported. If the BUMP report indicates that a designated beneficial use is impaired, threatened, or otherwise compromised, measures must be taken to mitigate or restore the water quality.

Traditionally,the State of Oklahoma has utilized numerous water monitoring programs conducted by individual state and federal agencies. In general, each environmental agency designs and implements its own program with only limited participation from with other state, municipal, or federal entities. These programs collect information for a specific purpose or project (e.g., development of Total Maximum Daily Loads, OWQS process, lake trophic status determination, water quality impact assessments from nonpoint and point source pollution, stream flow measurement, assessment of best management practices, etc.). Therefore, the information is specific to each project's data quality objectives (DQOs) and is often limited to a very small geographic area.

To synchronize Oklahoma's monitoring efforts related to water quality, the State Legislature appropriated funds in 1998 to create the Beneficial Use Monitoring Program under the direction of the Oklahoma Water Resources Board, which maintains Oklahoma's Water Quality Standards. The BUMP brings the OWRB's overall water quality management program full circle. From the promulgation of OWQS, to permitting and enforcement of permits stemming from OWQS-established criteria, to non-point source controls—all agency water quality management activities are intended to work in concert to restore, protect, and maintain designated beneficial uses.

The specific objectives of the BUMP are to detect and quantify water quality trends, document and quantify impairments of assigned beneficial uses, and identify pollution problems before they become a pollution crisis. This report interprets current Oklahoma Stream data collected as part of the comprehensive long-term program. As the program has matured the BUMP report has become one of the most important documents published annually in Oklahoma.

BENEFICIAL USE MONITORING PROGRAM COMPONENTS

- **Monitoring Rivers & Streams** - The OWRB is currently monitoring approximately 150 stations on a monthly basis. These sites are segregated into two discrete types of monitoring activities. The first monitoring activity is focusing on fixed station monitoring on rivers and streams and the second monitoring activity focuses on a number of sample stations whose location rotate on an annual basis. The two monitoring components are explained below.

    - **Fixed Station Monitoring on Rivers & Streams** - Fixed station monitoring is based largely upon the 67 United States Geological Survey (USGS) eight-digit hydrologic unit code (HUC) basins present in Oklahoma. In general, at least one sample station was located in all of the HUC watersheds with the exception of some of the smaller HUC watersheds adjacent to the state line or in a HUC that does not contain a free flowing stream at some point during the year. After consultation with the other state environmental agencies over time the OWRB has identified 119 fixed stations of which 99 are currently being monitored.

    - **Rotating Station Monitoring on Rivers & Streams** - Over the life of the BUMP, rotational sampling has occurred on over 200 stream segments. Sample stations and variables monitored are based upon Oklahoma's 303(d) list and input from other state environmental agencies on their monitoring needs. Variables monitored as part of this program component are specific for each stream segment monitored.

- **Fixed Station Load Monitoring** -The OWRB is currently working jointly with the USGS to conduct flow monitoring on all of our fixed station sites that do not have an automated flow monitoring USGS gage. This cooperative effort allows for loadings to be calculated and provides much needed data for the Use Support Assessment process.

- **Fixed Station Lakes Monitoring** - Quarterly sampling (approximately once every 90 days) of approximately 55-60 lakes annually is currently occurring. This represents approximately a 40% increase in effort over historical BUMP Lake sampling efforts. In general, a minimum of three stations per reservoir, representing the lacustrine zone, transitional zone, and riverine zone, are designated for sampling at each lake, with additional sites sampled as needed. Additional water quality parameters and lake sites were added to the lake sampling program in 2001 to aid in making use of support determinations.

- **Fixed Station Groundwater Monitoring** - Limited monitoring as part of this task has occurred in the program. Results of monitoring are presented in this report. OWRB staff has made recommendations in this report related to the scope and magnitude of groundwater monitoring activities that the state should pursue in the future. Any proposed groundwater monitoring efforts will be coordinated with the Oklahoma Department of Environmental Quality (ODEQ) program.

- **Intensive Investigation Sampling** - Although no funding was made available for this element of the program, it is important that waters identified as impaired be restored. If routine monitoring identifies impairment then an intensive study will be undertaken to document the source of the impairment and restorative actions, if possible, will be recommended. This task will not be conducted in year one or year two of the program, but,

thereafter, intensive investigations will be conducted as warranted. If water bodies are not identified for intensive study as part of this task then monies will be reallocated to Tasks **one** and **three**. Other entities (i.e. tribal or governmental units outside of Oklahoma) are involved as circumstances dictate or allow.

PROGRAM HISTORY/OVERVIEW

Sampling of the numerous lakes, streams, and rivers across this state was initiated in the summer and fall of 1998. Lake sampling in connection with the Beneficial Use Monitoring Program began in July of 1998. Sampling on numerous streams and rivers began in earnest in November of the same year. For lakes a bare bones statewide sampling network was already in place that was enhanced and built upon. For streams no such comprehensive statewide sampling effort was ongoing at the time the BUMP was funded. Because of this, the OWRB required a number of months to re-allocate staff and implement a monitoring regime on streams. In addition, OWRB staff greatly desired input from the other environmental agencies on the placement of stream monitoring stations. The existence of a previous statewide stream-monitoring network greatly aided in sample site selection. This historical ambient trend stream-monitoring network existed from 1975 until 1993 and was implemented by the Oklahoma State Health Department. Although this program did not evaluate sample results through comparison with the OWQS criteria or determine use support, it did provide a framework upon which to build. The historical sampling network sampled streams on a monthly basis from 1975-1986 and on a semi-annual basis from 1987-1993. Based upon the historical program and input from other agencies, the OWRB has established an ambient monitoring network of 99 active permanent stations and 45-82 rotational sites. The rotational sites are evaluated each year to determine if any should be dropped and others added. The Water Resources Board relies heavily on the other state and federal agencies for input into this process. With continued funding it is the desire of BUMP staff to increase the number of permanent sites to 120 to more effectively monitor our stream resources. In addition, monitoring personnel with the OWRB work closely with the other state environmental agencies to avoid duplication of sampling effort (i.e. the Oklahoma Conservation Commission rotating and data gaps sampling initiatives), except on a very limited basis for quality assurance purposes. A very small number of sites that are duplicative in nature do allow for the comparison of results between sampling programs to ensure that sampling protocols and the Use Support Assessment Protocols (USAP - described below) are working effectively and that decisions on support status are being made in a consistent manner.

The OWRB has developed Use Support Assessment Protocols (USAP) for lakes and streams, which are essential if the state is to be consistent in identifying waters that are not meeting their assigned beneficial uses or are threatened. The Water Resources Board has incorporated the USAP into Oklahoma Administrative Code (OAC) 785:46 to ensure that consistent determinations for impairments are made by all of the monitoring agencies.

The state must follow consistent procedures for listing waters as impaired. Using the OWRB Use Support Assessment Protocols it was possible for OWRB staff to assess whether threats or impairments are present in our waterways. With continued funding-identification of impaired waters will be accomplished on additional waters.

RESULTS OF STREAM SAMPLING EFFORTS

It is essential that Oklahoma quantifies the impacts in a comprehensive and scientific manner and look for trends in water quality to identify waters that are not meeting their assigned beneficial uses. As a state, we must manage our water resources effectively and direct money to areas in most need of protection or remediation to ensure that we continue to have good quality and sufficient quantity of water to meet our needs well into the 21st century. Comprehensive statewide data sets on rivers and streams for accurately assessing beneficial use impairments has not existed since 1993. With the implementation of monitoring on a large scale in October of 1998, this is no longer the case. With the availability of data, it is the desire of the Oklahoma Water Resources Board to provide the legislature and professional water managers with a comprehensive and up-to-date document for their review and approval. Administrative and Technical staff at the OWRB look forward to conducting the Beneficial Use Monitoring Program far into the future and providing the state of Oklahoma with the information it needs to make informed decisions that allow us to effectively manage our precious water resources.

The BUMP permanent ambient trend stream monitoring sites and their associated beneficial uses are listed in Table 1. Beneficial uses that are not being met are shown in **RED**. Listed next to the support code indicating that the beneficial use was not being met is the variable code which indicates which water quality variable violated the OWQS criteria. It is apparent that an inordinate number of water bodies are deemed impaired due to their exceeding the turbidity standard of 10 or 50 nephelometric turbidity units (NTU). The OWQS states that turbidity standards only apply during seasonal base flow conditions. In other words, the criteria should not be applied where normal in-stream conditions exceed the OWQS due to natural processes from a high-flow event. Several “quick” methods are available to assist in the determination of seasonal base flow including the existence of a periphyton line and visual estimation of the degree of flow. However, to reliably determine base flow, a measurement of stream discharge at the time of sampling is needed. This measurement when used in concert with the “quick” methods described above will give a reliable indication of whether the stream is at, below, or above seasonal base flow conditions. Because the BUMP network encompasses the state’s large rivers and streams, discharge is often obtained by comparing stream stage to a continuously updated rating curve. Due to the intense nature of establishing a reliable rating curve, rated discharges are often provisional for a number of months. Therefore, the determination of the previous year’s base flow and eligible turbidity values are also **provisional** at the publication of this report. In 2002, the OWRB began gaging all but 4 permanent station locations. Where permanent water-quality monitoring stations were located near a United States Geological Survey (USGS) stream-flow monitoring station, the information collected by USGS is used to determine if a high-flow event exceeding seasonal base flow had occurred at the time of sampling. All other stations are being rated through a cooperative effort between the OWRB Monitoring Section and the USGS.

Table 1. Permanent Ambient Trend Monitoring Stations and their Beneficial Use Support Status.

STATION NAME	FWP	PBCR	PPWS	AG	AES
Arkansas River, US 64, Moffett	PS (5)	S	S	S	NT
Arkansas River, SH 104, Haskell	PS (5)	NS (8)	N/A	PS (10)	NT
Arkansas River, SH 18, Ralston	NS (5)	NS (8)	S	S	NT
Arkansas River, SH 97, Sand Springs	S	S	N/A	S	NT
Arkansas River, US 62, Muskogee	NS (3)	S	N/A	S	NT
Arkansas River, US 64, Bixby	NS (3)	NS (6, 7, 8)	N/A	S	NT
Barren Fork, SH 51, Eldon	S	NS (8)	S	S	S
Beaver River, off US 64, Guymon	S	NS (7, 8)	S	S	NT
Beaver River, US 83, Turpin	S	NS (6, 7, 8)	N/A	NS (10, 11)	NT
Beaver River, SH 23, Beaver	NS (3)	NS (6, 7, 8)	N/A	NS (10, 11, 12)	NT
Beaver River, CR N1650, Gate	S	NS (8)	N/A	S	NT
Beaver River, US 183, Fort Supply	S	NS (8)	N/A	S	NT
Big Cabin Creek, off US 69, Big Cabin	S	S	S	S	NT
Bird Creek, SH 266, Port of Catoosa	NS (1,3,5)	NS (6, 8)	S	S	NT
Black Bear Creek, SH 18, Pawnee	NS (3, 5)	NS (6, 8)	S	S	NT
Blue River, US 70, Durant	PS (5)	NS (8)	S	S	NT
Brushy Creek, off US 270, Haileyville	NS (1, 3, 5)	NS (8)	S	S	NT
Canadian River, SH 2, Whitefield	S	S	S	S	NT
Canadian River, US 183, Taloga	PS (5)	NS (8)	N/A	NS (10)	NT
Canadian River, US 270, Calvin	NS (5)	NS (8)	S	PS (10, 12)	NT
Canadian River, US 377, Konawa	NS (3, 5)	NS (8)	S	NS (10)	NT
Canadian River, US 66, Bridgeport	NS (5)	NS (8)	N/A	NS (10, 12)	NT
Canadian River, US 77, Purcell	NS (5)	N/A	N/A	NS (10)	NT
Caney Creek, off SH 100, Barber	S	S	S	S	NT
Caney River, off US 75, Ramona	NS (3, 5)	NS (8)	S	S	NT
Chickaskia River, US 177, Blackwell	NS (3, 5)	NS (6, 8)	S	S	NT
Cimarron River, SH 34, Buffalo	S	NS (6, 7, 8)	N/A	PS (11)	NT

STATION NAME	FWP	PBCR	PPWS	AG	AES
Cimarron River, SH 99, Oilton	NS (5)	NS (6)	N/A	S	NT
Cimarron River, US 77, Guthrie	PS (5)	NS (6, 8)	N/A	S	NT
Cimarron River, US 81, Dover	NS (3)	NS (6, 7, 8)	N/A	S	NT
Cimarron River, off US 64, Mocane	NS (3)	NS (6, 8)	S	NS (10, 11)	NT
Cimarron River, US 412, Orienta	NS (5)	NS (7, 8)	N/A	PS (11)	NT
Cimarron River, SH 33, Ripley	NS (5)	NS (8)	N/A	S	NT
Clear Boggy Creek, off US 69, Caney	NS (3, 5)	NS (6, 8)	S	S	NT
Deep Fork River, off SH 16, Beggs	NS (3, 5)	NS (8)	S	S	NT
Deep Fork River, US 377, Stroud	NS (3, 5)	NS (8)	PS (9)	S	NT
East Cache Creek, SH 53, Walters	NS (3, 5)	NS (6, 7, 8)	S	S	NT
Elk Creek, off US 183, Hobart	NS (3, 5)	NS (8)	S	S	NT
Elk River, SH 43, Tiff City (MO)	S	NS (8)	S	S	NT
Elm Fork River, SH 9, Mangum	NS (2, 3)	NS (6, 7, 8)	NS (9)	S	NT
Flint Creek, US 412, Flint	S	NS (8)	S	S	NS (14)
Fourche-Maline Creek, off US 270, Red Oak	NS (1, 3)	NS (8)	S	S	NT
Glover River, SH 3, Glover	NS (1, 3)	NS (8)	S	S	NT
Honey Creek, off SH 25, Grove	S	NS (8)	S	S	T (15)
Illinois River, US 59, Watts	NS (5)	NS (8)	S	S	NS (14)
Illinois River, US 62, Tahlequah	S	NS (8)	S	S	NS (14)
Kiamichi River, off US 271, Tuskahoma	NS (2, 3)	S	S	S	NT
Kiamichi River, SH 63, Big Cedar	NS (3, 4)	S	S	S	NT
Kiamichi River, US 271, Antlers	NS (2, 3)	NS (8)	S	S	NT
Little River, off SH 3, Cloudy	NS (2, 3, 4)	NS (8)	S	S	NT
Little River, SH 56, Sasakwa	NS (3, 5)	NS (6, 8)	S	S	NT
Mountain Fork, SH 4, Smithville	NS (2, 3, 4, 5)	NS (8)	S	S	S
Mountain Fork, US 70, Eagletown	NS (2, 3)	NS (8)	S	S	NT
Mud Creek, SH 32, Courtney	NS (1, 5)	NS (6, 8)	S	S	NT

STATION NAME	FWP	PBCR	PPWS	AG	AES
Muddy Boggy Creek, US 70, Unger	NS (3, 5)	NS (6, 8)	S	S	NT
Muddy Boggy Creek, US 69, Atoka	NS (1, 3, 5)	NS (6, 8)	S	S	NT
Neosho River, off US 66, Commerce	NS (5)	S	S	S	NT
Neosho River, off SH 137, Connor Bridge	S	S	S	S	NT
Neosho River, SH 82, Langley	PS (1)	S	S	S	NT
Neosho River, US 412, Chouteau	S	S	S	S	NT
North Canadian River, Indian Nations Turnpike, Dustin	NS (3, 5)	NS (6, 8)	S	S	NT
North Canadian River, SH 3E, Shawnee	NS (3, 5)	NS (8)	N/A	S	T (13)
North Canadian River, off US 62, Harrah	NS (4, 5)	NS (8)	N/A	S	NT
North Canadian River, US 281, Seiling	PS (5)	NS (8)	S	S	NT
North Canadian River, US 75, Wetumka	NS (3, 5)	NS (6, 8)	S	S	T (13)
North Canadian River, US 412, Woodward	S	NS (8)	N/A	S	NT
North Canadian River, US 81, El Reno	S	NS (8)	S	S	NT
North Fork of the Red River, US 62, Headrick	NS (3, 5)	NS (8)	PS (9)	NS (10, 11)	NT
North Fork of the Red River, SH 34, Carter	S	NS (8)	S	S	NT
Poteau River, off SH 112, Pocola	NS (3, 5)	NS (8)	S	S	NT
Poteau River, US 59, Heavener	S	S	S	S	NT
Red River, SH 79, Waurika	NS (3, 5)	NS (8)	PS (9)	NS (10, 11, 12)	NT
Red River, US 183, Davidson	NS (3, 5)	NS (6, 8)	N/A	NS (10, 11, 12)	NT
Red River, US 259, Harris	PS (5)	S	S	NS (10)	NT
Red River, US 271, Hugo	PS (5)	NS (6, 8)	S	NS (10, 11, 12)	NT
Red River, US 81, Terral	NS (3, 5)	NS (8)	S	NS (11, 12)	NT
Sager Creek, off US 412, West Siloam Springs	S	NS (8)	PS (nitrates)	S	T (13, 15)
Salt Fork of the Arkansas, SH 58, Ingersoll	NS (3, 5)	NS (6, 7, 8)	S	S	NT
Salt Fork of the Arkansas, US 77, Tonkawa	PS (1, 5)	NS (8)	S	S	NT
Salt Fork of the Red River, SH 34, Mangum	S	NS (6, 8)	S	S	NT
Salt Fork of the Red River, off US 283, Elmer	NS (2, 3)	NS (6, 8)	PS (9)	S	NT

STATION NAME	FWP	PBCR	PPWS	AG	AES
Sandy Creek, SH 6, Eldorado	NS (2, 3, 5)	N/A	N/A	NS (10, 11, 12)	NT
Skeleton Creek, SH 74, Lovell	NS (5)	NS (6, 8)	S	S	NT
Spring Creek, off US 412, Murphy	S	S	S	S	NT
Spring River, off SH 137, Quapaw	NS (2. 3, 5)	NS (8)	S	S	NT
Verdigris River, US 412, Inola	NS (3, 5)	S	S	S	NT
Verdigris River, SH 10, Lenepah	NS (3, 5)	NS (8)	S	S	NT
Verdigris River, SH 20, Keetonville	NS (3, 5)	NS (8)	S	S	NT
Verdigris River, SH 51, Wagoner	NS (2, 3, 5)	NS (8)	S	S	NT
Washita River, SH 152, Cordell	NS (5)	NS (6, 8)	S	S	NT
Washita River, SH 19, Pauls Valley	NS (5)	NS (6, 8)	S	NS (10)	NT
Washita River, SH 33, Hammon	PS (5)	NS (6, 8)	S	S	NT
Washita River, US 177, Durwood	NS (3, 5)	NS (6, 8)	S	S	NT
Washita River, US 281, Anadarko	NS (5)	NS (6, 8)	S	S	NT
West Cache Creek, SH 5B, Taylor	NS (3, 5)	NS (6, 7, 8)	S	PS (10)	NT
Wolf Creek, off US 270, Fort Supply	S	NS (8)	S	S	NT

ASSIGNED OWQS BENEFICIAL USES	
FWP = FISH & WILDLIFE PROPAGATION	PBCR = PRIMARY BODY CONTACT RECREATION
PPWS = PUBLIC AND PRIVATE WATER SUPPLY	AG = AGRICULTURE
AES = AESTHETICS	

SUPPORT CODES		
S—FULLY SUPPORTING	PS—PARTIALLY SUPPORTING	NS—NOT SUPPORTING
N/A—NOT APPLICABLE	NT-NOT THREATENED (NUTRIENTS)	T-THREATENED (NUTRIENTS)

WATER QUALITY VARIABLES		
1—DISSOLVED OXYGEN	2—METALS (ACUTE)	3—METALS (CHRONIC)
4—pH	5—TURBIDITY	6—FECAL COLIFORM
7— *Escherichia coli*	8— ENTEROCOCCI	9—METALS
10— TOTAL DISSOLVED SOLIDS	11— CHLORIDES	12— SULFATES
13— TOTAL PHOSPHORUS (TP)	14—TP OK SCENIC RIVER CRITERION	15— NITRITE + NITRATE

INTRODUCTION

Protecting Oklahoma's valuable water resources is essential to maintaining the quality of life for all Oklahomans. Used for a myriad of purposes—such as irrigation, hydropower, public/private water supply, navigation, and a variety of recreational activities—the state's surface and ground waters provide enormous benefits to Oklahoma from both an economic and recreational standpoint.

The National Recreation Lakes Study Commission (NRLSC) estimates that 32,100 people in Oklahoma are employed in support of activities related to our numerous man-made lakes. Also according to the NRLSC, 18,718,000 visitor days are spent on Oklahoma lakes each year and recreation in and around these lakes contributes approximately $2.2 billion each year to Oklahoma's economy. Of additional value are the recreational benefits associated with our smaller municipal/watershed projects, Oklahoma Department of Wildlife lakes, and rivers and streams throughout the state, which infuse millions of dollars into state coffers through fishing, hunting, camping and related activities. For example in 1987, the Oklahoma Comprehensive Outdoor Recreation Plan estimated that approximately $10.7 million was realized through camping and $15.2 million through hunting/fishing.[1] According to a 2001 federal study, fishing activities alone contribute $476,019 dollars to Oklahoma's economy, not including the substantial ancillary costs associated with that extremely popular sport.[2]

In addition to surface waters, abundant ground water also fuels the state's economy by serving as supply for thousands of municipalities, rural water districts, industrial facilities, and agricultural operations. According to the 1995 update of the *Oklahoma Comprehensive Water Plan*, groundwater represents the primary water supply for approximately 300 cities and towns and comprises 60 percent of the total water used in the state each year.[3] Groundwater resources also supply approximately 90 percent of the state's irrigation needs.

Oklahoma works to protect and manage its water resources through a number of initiatives with the Oklahoma Water Quality Standards (OWQS) serving as the cornerstone of the state's water quality management programs. The Oklahoma Water Resources Board (OWRB) is designated by state statute as the agency responsible for promulgating water quality standards and developing or assisting the other environmental agencies with implementation framework. State agencies are responsible for implementing the OWQS as outlined by the OWRB through development of Implementation plans. Protecting our waters is a cooperative effort between many state agencies and because the OWQS are utilized by all agencies and represent a melding of both science and policy, they are an ideal mechanism to assess the effectiveness of our diverse water quality management activities.

The OWQS are housed in OAC 785:45 and consist of three main components: beneficial uses, criteria to protect beneficial uses, and an anti-degradation policy. An additional component, which is not directly part of the OWQS but necessary to water resource protection, is a monitoring program. A monitoring program is required in order to ensure that beneficial uses are maintained and protected. If uses are not being maintained the cause of impairment must

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[1] Oklahoma Statewide Comprehensive Outdoor Recreation Plan (SCORP), 1987.
[2] U.S. Department of Interior, Fish and Wildlife Service, and U.S. Department of Commerce, U.S. Census Bureau. *2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation.*
[3] Oklahoma Water Resources Board, *Update of the Oklahoma Comprehensive Water Plan, 1995*.

be identified and restoration activities should be implemented to improve water quality so that it(unclear) can meet it's(unclear and no contractions) assigned beneficial uses.

All state agencies are currently required to implement Oklahoma's Water Quality Standards within the scope of their jurisdiction through the development of an Implementation Plan specific for their agency. This process, called OWQS Implementation, allows the OWQS to be utilized by other state agencies in the performance of their regulatory (statutory) responsibilities to manage water quality or to facilitate best management practice initiatives.

In the late 1990's the need for a protocol to determine beneficial use impairment was identified. An establishment of such protocol would facilitate state agencies in directing their time and money to the areas in most need of protection or remediation. The OWRB working in close concert with other state environmental agencies and other concerned parties developed Use Support Assessment Protocols (USAP) to be used by all parties for assessing if a body of water was meeting it's assigned beneficial uses. In addition, protocols were developed which could be coupled with a trend monitoring system to detect threatened waters before they become seriously impaired. Data collection efforts connected with protocol development and/or implementation also serves a vital purpose in refining numerical criteria currently included in the OWQS and in developing appropriate numerical and narrative criteria for future OWQS documents. It is essential that our waters meet their assigned uses and that OWQS implementation protocols are appropriate. Please see APPENDIX A for the applicable Oklahoma Administrative Code (OAC) 785:46 related to the USAP. Final approval of the USAP occurred in 2000 and the OWRB has constantly worked to refine the existing protocols and pursue the addition or modification of USAP protocols to further enhance its utility and effectiveness every year since then.

Work to be performed towards development and implementation of the critical fourth component of the OWQS program, monitoring, is the subject of this report. All sampling activities described and conducted as part of this program were consistent with the Oklahoma USAP. It is also important to note that they are consistent with Environmental Protection Agency (EPA) reporting requirements for the "*Integrated Water Quality Monitoring and Assessment Report*", §319 Nonpoint Source (NPS) Assessment, and the §314 Lake Water Quality Assessment (LWQA).

BACKGROUND & PROBLEM DEFINITION

The State of Oklahoma has historically had numerous monitoring programs conducted by several state and federal agencies. In general, each environmental agency conducts their monitoring programs with some degree of integration and coordination with other state, municipal, or federal programs. Most water quality monitoring programs in Oklahoma are designed and implemented by each agency to collect information for one specific purpose or project (i.e. development of Total Maximum Daily Loads, OWQS process, lake trophic status determination, water quality impacts from point source dischargers, stream flow measurements, document success of best management practices, etc.). Information of this type is very specific to each individual project's data quality objectives (DQOs) and is often limited to a very small geographic area. This document describes sampling activities the OWRB has historically conducted on lakes and efforts that are currently on going on lakes and streams across Oklahoma as part of a comprehensive, long-term, statewide Beneficial Use Monitoring Program (BUMP). The goal of the BUMP is to detect and quantify water quality trends, document and quantify impairments of assigned beneficial uses, and identify pollution problems before they become a pollution crisis.

The state has taken a major step towards coordinating sampling activities with the creation of a "Water Quality Monitoring Council," comprised of representatives from state, local, and federal agencies as well as universities, industries, volunteer groups, Indian tribes, and environmental organizations. The Council serves a useful purpose in providing an avenue for communication between the various groups and allows the state to coordinate water quality monitoring in a more effective manner. The Council focuses on coordinating agency activities to help the state avoid duplication of effort. Coordination between all concerned parties is obviously essential, but a comprehensive basic monitoring initiative to support the OWQS implementation process must be supported in order to identify waters that are not meeting their assigned beneficial uses and thus ensure that Oklahoma's water resources are protected from water quality degradation. The Council is pivotal in ensuring consistency between data collection efforts. The Monitoring Council functions informally in a coordinating capacity, which helps maximize monitoring efforts.

BENEFICIAL USE MONITORING PROGRAM (BUMP) OVERVIEW

The overall goal of the Beneficial Use Monitoring Program is to document beneficial use impairments, identify impairment sources (if possible), detect water quality trends, provide needed information for the OWQS, and facilitate the prioritization of pollution control activities.

BENEFICIAL USE MONITORING PROGRAM COMPONENTS

- **Monitoring Rivers & Streams** - The OWRB is currently monitoring approximately 180 stations on a monthly basis. These sites are segregated into two discrete types of monitoring activities. The first monitoring activity is focusing on fixed station monitoring on rivers and streams and the second monitoring activity focuses on a number of sample stations whose locations rotate on an annual basis. The two monitoring components are explained below.

    - **Fixed Station Monitoring on Rivers & Streams** - Fixed station monitoring is based largely upon the 67 United States Geological Survey (USGS) eight-digit hydrologic unit code (HUC) basins present in Oklahoma. In general, at least 1 sample station was located in all of the HUC watersheds with the exception of some of the smaller HUC watersheds adjacent to the state line or in a HUC that does not contain a free flowing stream at some point during the year. After consultation with the other state environmental agencies and over time the OWRB has identified 119 fixed stations of which 99 are currently being monitored.

    - **Rotating Station Monitoring on Rivers & Streams** - Over the life of the BUMP, rotational sampling has occurred on 200 stream segments. Sample stations and variables monitored are based upon Oklahoma's 303(d) list and input from other state environmental agencies on their monitoring needs. Variables monitored as part of this program component are specific for each stream segment monitored

- **Fixed Station Load Monitoring** - The OWRB is currently engaged in a cooperative effort with the USGS to conduct flow monitoring at fixed station BUMP sites that do not currently have an existing USGS flow gage. This effort focuses on collecting both water quality and quantity information in order to calculate pollutant loads and provides OWRB staff with the data necessary to make a use support determination. This initiative is facilitated through the

OWRB's Cooperative Agreement with USGS and various Compact Commission activities. The USGS cost share program, Oklahoma's §319 program, Oklahoma's §314 program and the Oklahoma Integrated Report/303(d) process drive sample site locations.

- **Fixed Station Lakes Monitoring** - Fixed station lakes monitoring goal is designed to facilitate sampling on the 130 largest lakes in Oklahoma every other year. To accomplish this task, the OWRB is sampling approximately 55 to 60 lakes currently on a quarterly basis. Under this scenario repeat sampling on a lake will occur approximately every other year, with the inclusion of lakes data collected by other sources, such as the Corps of Engineers, to meet the goal of 130 lakes every two years. Data collected consists primarily of water chemistry, nutrients, and chlorophyll-a information. In general, sampling of three stations per reservoir, representing the lacustrine zone, transitional zone, and riverine zone occurs. On many reservoirs, additional sites are monitored, including major arms of the reservoir as appropriate. Water quality parameters have been added to the lakes sampling effort over the years to enhance our ability to make use of support determinations.

- **Fixed Station Groundwater Monitoring** - Limited monitoring as part of this task has occurred in the program. Results of monitoring are presented in this report. OWRB staff has made recommendations in this report related to the scope and magnitude of groundwater monitoring activities that the state should pursue in the future. Any proposed groundwater monitoring efforts will be coordinated with the Oklahoma Department of Environmental Quality (ODEQ) program.

- **Intensive Investigations** - If beneficial use impairment is identified or suspected all appropriate state agencies will be alerted and an investigation will be initiated to confirm these suspicions. If routine monitoring cannot definitively identify impairments, then an intensive study will be undertaken and, if impairment is present, the source of the impairment will be identified if possible. One potential use for the intensive studies envisioned was identified during the data analysis phase of this reporting process. For example, monies could be spent to identify if high turbidity readings in rivers and streams are due to natural processes or do to human activities in the watershed of concern. Some potential causes of beneficial use impairment are: improper beneficial use or criteria (Oklahoma Water Resources Board jurisdiction), point source problems (Oklahoma Department of Environmental Quality or Oklahoma Department of Agriculture), non-point source problems (Oklahoma Conservation Commission, Oklahoma Department of Agriculture, Oklahoma Corporation Commission, or Oklahoma Department of Environmental Quality), oil and gas contamination (Oklahoma Corporation Commission), agricultural activities (Oklahoma Department of Agriculture), or mining activities (Oklahoma Department of Mines). All monitoring activities will be cooperative in nature, with the agency with statutory authority assuming the lead role for intensive monitoring. If water bodies are not identified for intensive study as part of this task the monies will be reallocated for routine monitoring of beneficial use attainment. Other entities (i.e. tribal or governmental units outside of Oklahoma) will be involved as appropriate. All intensive-monitoring activities will be consistent with the OWQS and the USAP. If no protocols exist, the best professional judgment or State/Environmental Protection Agency guidance will be used as appropriate.

STREAM MONITORING PROGRAM

The Stream Beneficial Use Monitoring Program was initiated in November of 1998. Implementation of the program was delayed due to the relocation of the ODEQ State Environmental Laboratory to a new building and the fact that the OWRB required a few months to assemble the necessary infrastructure to implement stream sampling (purchase of equipment, database development, assignment of personnel, etc.). The BUMP streams staff has been collecting monthly information since November of 1998 and a summary of the data results for the period of record through early October of 2003 is presented in this section. Results of stream sampling are organized by 4-digit USGS HUC with streams discussed in alphabetical order for each HUC. Each stream station is described individually with a brief narrative outlining the site location and other pertinent information followed by a brief synopsis of data results. Additional graphical representations of the data are included for each station. Toxicant or bacteria data used to determine a status of non-support are located in tables near the beginning of each section. All of the permanent monitoring sites are listed and discussed very briefly.

RIVER AND STREAM MONITORING OVERVIEW

Historically, data on rivers and streams across the state has been very sketchy. Over the years, various local, tribal, state, and federal agencies have managed a number of sampling programs. These programs have varied in nature ranging from short-term, site-specific sampling to the former Oklahoma State Department of Health (OSDH) statewide sampling program. However, a comprehensive, statewide ambient trend-monitoring program had not existed since 1989, the last year that the OSDH conducted monthly sampling. Furthermore, a program with the specific intent of documenting statewide beneficial use impairments on a long-term basis had never existed until the Beneficial Use Monitoring Program (BUMP) was started in September of 1998 with subsequent sampling begun in November of the same year. By establishing a monitoring network that evaluates general water quality through the use of an existing framework like the Oklahoma Water Quality Standards, the state of Oklahoma initiated a progressive phase in the long-term assessment of the overall health of our state's streams and rivers.

MATERIALS & METHODS

The Monitoring Network. The BUMP rivers and streams network consists of two major station classifications — permanent ambient trend sites and rotating sites. Permanent ambient trend monitoring stations are relatively static within the program. In general, they do not change from year to year and have been chosen to allow for long-term assessment of beneficial uses and water quality trends. Since program inception a small number of sites have been dropped from the program and new sites added to more effectively assess the water quality of our major stream basins. Rotating stations are only actively monitored for a predetermined period of time and for a specific purpose.

With the creation of the permanent monitoring network in September of 1998, OWRB staff established three overarching objectives for the program. First, the network must encompass

the entire state. To accomplish this, a commitment was made to locate at least one site in each of the 8-digit USGS hydrologic units (HUC) (see Table 2).

Table 2. Eight Digit United States Geological Survey HUC Watersheds.

8 Digit HUC Number	Description	8 Digit HUC Number	Description
11040001	Cimarron Headwaters	**11100301**	Middle North Canadian
11040002	Upper Cimarron	**11100302**	Lower North Canadian
11040006	Upper Cimarron – Liberal	**11100303**	Deep Fork
11040007	Crooked	**11110101**	Polecat – Snake
11040008	Upper Cimarron – Bluff	**11110102**	Dirty – Greenleaf
11050001	Lower Cimarron – Eagle Chief	**11110103**	Illinois
11050002	Lower Cimarron – Skeleton	**11110104**	Robert S. Kerr Reservoir
11050003	Lower Cimarron	**11110105**	Poteau
11060001	Kaw Lake	**11120105**	Lower Prairie Dog Town Fk., Red
11060002	Upper Salt Fork – Arkansas	**11120202**	Lower Salt Fork – Red
11060003	Medicine Lodge	**11120302**	Middle North Fork – Red
11060004	Lower Salt Fork – Arkansas	**11120303**	Lower North Fork – Red
11060005	Chickaskia	**11120304**	Elm Fork – Red
11060006	Black Bear – Red Rock	**11130101**	Groesbeck – Sandy
11070103	Middle Verdigris	**11130102**	Blue – China
11070105	Lower Verdigris	**11130201**	Farmers – Mud
11070106	Caney	**11130202**	Cache
11070107	Bird	**11130203**	West Cache
11070205	Middle Neosho	**11130208**	Northern Beaver
11070206	Grand Lake	**11130210**	Lake Texoma
11070207	Spring	**11130301**	Washita Headwaters
11070208	Elk	**11130302**	Upper Washita
11070209	Lower Neosho	**11130303**	Middle Washita
11090103	Rita Blanca	**11130304**	Lower Washita
11090201	Lower Canadian – Deer	**11140101**	Bois D'Arc – Island
11090202	Lower Canadian – Walnut	**11140102**	Blue
11090203	Little	**11140103**	Muddy Boggy
11090204	Lower Canadian	**11140104**	Clear Boggy
11100101	Upper Beaver	**11140105**	Kiamichi
11100102	Middle Beaver	**11140106**	Pecan – Waterhole
11100103	Coldwater	**11140107**	Upper Little
11100104	Palo Duro	**11140108**	Mountain Fork
11100201	Lower Beaver	**11140109**	Lower Little
11100203	Lower Wolf		

Currently, all but four of these 8-digit HUCs have at least one sampling station. A map of the 8-digit USGS HUCs is included as Figure 1. The second objective was that the foundation of the monitoring network should be principally the state's largest rivers, the Arkansas River and the Red River, and their major tributaries, such as the Canadian River and the Washita River. Currently, 57 of the 99 stations currently being monitored (57%) meet this criterion. These sites are dispersed over 20 different rivers and streams with the majority located on the Arkansas River and several tributaries including the Cimarron River, the Canadian River, the Verdigris River, and Neosho River as well as the Red River and several tributaries including the Washita River, the Kiamichi River, and the Little River. Secondary consideration was given to the major tributaries of rivers such as Canadian River and the Little River. Currently, 36 of the 99 sites (36%) meet this criterion. Further consideration was given to areas of the state (e.g., the Panhandle) that were underrepresented as well as rivers and streams (e.g., The Deep Fork River) that were conspicuously missing from the network. Currently, 7 of the 100 stations (7%) meet one of these criteria. The third and last objective was to seek the advice and input of other state environmental agencies and professionals before making a final determination of permanent monitoring station locations. In particular, the ODEQ and OCC continue to be very helpful in assisting with locating permanent stations.

Operating within these overarching objectives, the staff of the OWRB has selected and performed monitoring on 119 permanent ambient trend-monitoring sites since September of 1998 and is currently monitoring 102 permanent stations (Table 3). The placement of a site location necessitates several considerations. Above all, a site must be accessible by vehicle and be safe for sampling personnel and other motorists. It is also essential that a site be located in an area where representative data can be acquired. The OWQS Use Support Assessment Protocols (USAP) set spatial limitations on the data that is collected. In summary, a site can only represent 25 stream miles for non-wadable streams and 10 stream miles for wadable streams (with some exceptions). Furthermore, a site can only be representative of the waterbody identification number (12 digit HUC number) in which it is located and the site cannot be located within a regulatory mixing zone. This requires that monitoring sites be selected so that they represent as long a stream reach as possible while maintaining the spatial integrity outlined in USAP. Thirdly, it is important that historical data be considered. Many of the current BUMP permanent monitoring sites were selected from a set of historical monitoring stations that were a part of the OSDH (the environmental Division that conducted the Ambient Program later became part of the ODEQ) Ambient Trend Monitoring Program. Before initial sampling began in 1998, OWRB staff worked closely with the ODEQ to integrate many of the historical sites into the BUMP. Although the historical data from these sites can not be used to assess beneficial uses (USAP sets a temporal limitation of five years), the historical data set benefits the state in assessing long-term water quality trends. Lastly, it is imperative that rivers and streams which have been designated in the OWQS as Outstanding Resource Waters (ORW), High Quality Waters (HQW), or Sensitive Water Supplies (SWS) be given unique consideration even if they do not meet the objectives as outlined. For example, Sager Creek is not a tributary of a major tributary of a major river. However, it is listed as an ORW and therefore is sampled as part of the BUMP. The water quality status of each site is discussed in more detail in the individual HUC narrative sections that follow this section of the report.

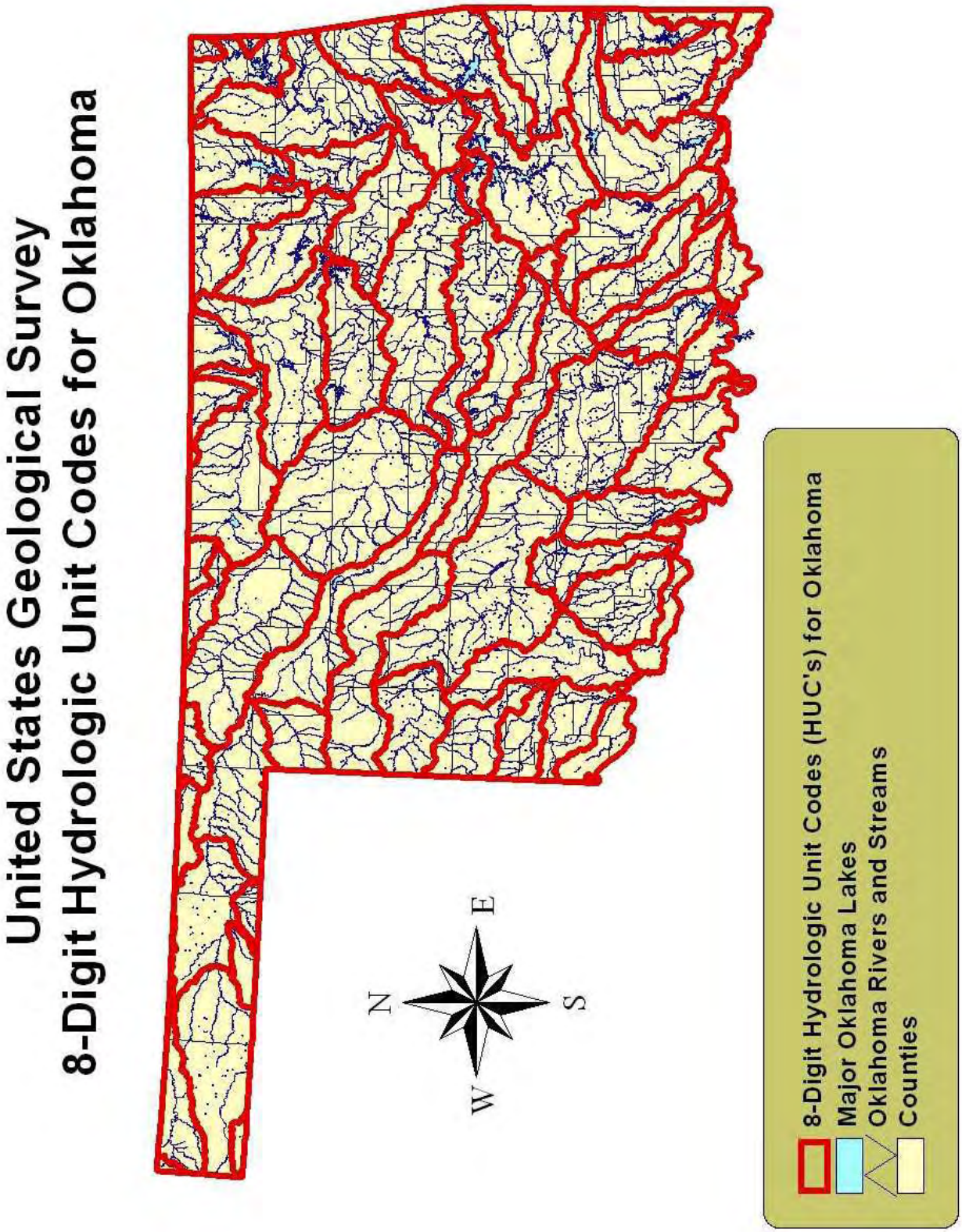


Figure 1. USGS 8-digit Hydrologic Unit Codes for Oklahoma.

Table 3. Permanent Ambient Trend Monitoring Stations.

	4-DIGIT USGS #	WBID #	STATION NAME	COUNTY	STATUS
1	1111	220200010010	Arkansas River, US 64, Moffett	Sequoyah	Active 11/98-P
2	1106	621210000030	Arkansas River, off US 77, Newkirk	Kay	Inactive 09/99-10/02
3	1111	120410010080	Arkansas River, SH 104, Haskell	Muskogee	Active 11/98-P
4	1106	621200010200	Arkansas River, SH 18, Ralston	Osage	Active 11/98-P
5	1111	120420010130	Arkansas River, SH 97, Sand Springs	Tulsa	Active 09/99-P
6	1111	121400010260	Arkansas River, US 62, Muskogee	Muskogee	Active 09/99-P
7	1111	120420010010	Arkansas River, US 64, Bixby	Tulsa	Active 11/98-P
8	1111	120400010260	Arkansas River, US 69, Muskogee	Muskogee	Inactive 11/98-12/99
9	1111	121700050010	Barren Fork, SH 51, Eldon	Cherokee	Active 11/98-P
10	1110	720500020010	Beaver River, US 183, Fort Supply	Harper	Active 10/00-P
11	1110	720500020140	Beaver River, CR N1650, Gate	Beaver	Active 10/00-P
12	1110	720510000150	Beaver River, off US 64, Guymon	Texas	Active 11/98-P
13	1110	720500020290	Beaver River, SH 23, Beaver	Beaver	Active 11/98-P
14	1110	720500020010	Beaver River, US 283, Laverne	Harper	Active 01/03-P
15	1110	720500020450	Beaver River, US 83, Turpin	Texas	Active 10/00-P
16	1107	121600060060	Big Cabin Creek, off US 69, Big Cabin	Craig	Active 09/99-P
17	1107	121600060010	Big Cabin Creek, SH 28, Pensacola	Mayes	Inactive 11/98-08/99
18	1107	121300010010	Bird Creek, SH 266, Port of Catoosa	Tulsa	Active 11/98-P
19	1106	621200030010	Black Bear Creek, SH 18, Pawnee	Pawnee	Active 11/98-P
20	1114	410600010010	Blue River, US 70, Durant	Bryan	Active 11/98-P
21	1109	220600030020	Brushy Creek, off US 270, Haileyville	Pittsburg	Active 11/98-P
22	1109	220600010120	Canadian River, Ind. Nat. Tpk., Hanna	McIntosh	Inactive 11/98-09/99
23	1109	220300000010	Canadian River, SH 2, Whitefield	Haskell	Active 09/99-P
24	1109	520620020120	Canadian River, US 183, Taloga	Dewey	Active 11/98-P
25	1109	220600010119	Canadian River, US 270, Calvin	Hughes	Active 11/98-P
26	1109	520600010010	Canadian River, US 377, Konawa	Seminole	Active 11/98-P
27	1109	520620010050	Canadian River, US 66, Bridgeport	Blain	Active 11/98-P
28	1109	520610010010	Canadian River, US 77, Purcell	McClain	Active 11/98-P
29	1111	121700040010	Caney Creek, off SH 100, Barber	Cherokee	Active 09/99-P

	4-DIGIT USGS #	WBID #	STATION NAME	COUNTY	STATUS
30	1107	121400010010	Caney River, off US 75, Ramona	Washington	Active 11/98-P
31	1106	621100000010	Chickaskia River, US 177, Blackwell	Kay	Active 11/98-P
32	1104	620930000010	Cimarron River, off US 64, Mocane	Beaver	Active 10/99-P
33	1105	620910020010	Cimarron River, SH 34, Buffalo	Woods	Active 11/98-P
34	1105	620900010170	Cimarron River, SH 99, Oilton	Creek	Active 11/98-P
35	1105	620920010010	Cimarron River, US 412, Orienta	Major	Active 11/98-P
36	1105	620910030010	Cimarron River, US 77, Guthrie	Logan	Active 11/98-P
37	1105	620910010010	Cimarron River, US 81, Dover	Kingfisher	Active 11/98-P
38	1105	620900030010	Cimarron River, SH 33, Ripley	Payne	Active 10/00-P
39	1114	410400030020	Clear Boggy Creek, off US 69, Caney	Atoka	Active 11/98-P
40	1110	720500020070	Clear Creek, US 283, May	Ellis	Inactive 11/98-09/00
41	1113	311200000030	Cow Creek, SH 5, Waurika	Jefferson	Inactive 11/98-09/02
42	1110	520700020010	Deep Fork River, off SH 16, Beggs	Okmulgee	Active 11/98-P
43	1110	520700040180	Deep Fork River, US 377, Stroud	Lincoln	Active 11/98-P
44	1113	311300010020	East Cache Creek, SH 53, Walters	Cotton	Active 11/98-P
45	1112	311500030010	Elk Creek, off US 183, Hobart	Kiowa	Active 11/98-P
46	1107	121600030440	Elk River, SH 43, Tiff City (MO)	McDonald	Active 05/99-P
47	1112	311800000010	Elm Fork River, SH 9, Mangum	Greer	Active 11/98-P
48	1111	121700060010	Flint Creek, US 412, Kansas	Delaware	Active 11/98-P
49	1111	220100040020	Fourche-Maline Creek, off US 270, Red Oak	Latimer	Active 11/98-P
50	1114	410210080010	Glover River, SH 3, Glover	McCurtain	Active 11/98-P
51	1113	311100020010	Hickory Creek, off SH 32, Marietta	Love	Inactive 11/98-09/00
52	1107	121600030440	Honey Creek, off SH 25, Grove	Delaware	Active 11/98-P
53	1111	121700030350	Illinois River, US 59, Watts	Adair	Active 11/98-P
54	1111	121700030010	Illinois River, US 62, Tahlequah	Cherokee	Active 11/98-P
55	1114	410310010010	Kiamichi River, off US 271, Tuskahoma	Pushmataha	Active 11/98-P
56	1114	410310020010	Kiamichi River, SH 63, Big Cedar	LeFlore	Active 11/98-P
57	1114	410300030010	Kiamichi River, US 271, Antlers	Pushmataha	Active 11/98-P
58	1114	410300010010	Kiamichi River, SH 109, Fort Towson	Bryan	Active 10/02-P
59	1110	720500020130	Kiowa Creek, off US 283, Laverne	Harper	Inactive 11/98-09/00

	4-DIGIT USGS #	WBID #	STATION NAME	COUNTY	STATUS
60	1111	220200050010	Lee Creek, SH 101, near Short	Sequoyah	Active 01/03-P
61	1114	410210020140	Little River, off SH 3, Cloudy	Pushmataha	Active 11/98-P
62	1109	520800010010	Little River, SH 56, Sasakwa	Seminole	Active 11/98-P
63	1114	410200010200	Little River, off US 70, near Holly Creek	McCurtain	Active 10/02-P
64	1114	410200010200	Little River, US 70, Idabel	McCurtain	Inactive 11/98-09/02
65	1114	410210060020	Mountain Fork, SH 4, Smithville	McCurtain	Active 11/98-P
66	1114	410210040010	Mountain Fork, US 70, Eagletown	McCurtain	Active 11/98-P
67	1113	311100040010	Mud Creek, SH 32, Courtney	Love	Active 11/98-P
68	1114	410400050270	Muddy Boggy Creek, SH 3, Farris	Atoka	Inactive 11/98-06/99
69	1114	410400050270	Muddy Boggy Creek, US 69, Atoka	Atoka	Active 09/99-P
70	1114	410400010070	Muddy Boggy Creek, US 70, Unger	Choctaw	Active 07/99-P
71	1107	121600040220	Neosho River, off US 66 , Commerce	Ottawa	Active 10/00-P
72	1107	121600040010	Neosho River, off SH 137, Connor Bridge	Ottawa	Active 11/98-P
73	1107	121600020170	Neosho River, SH 82, Langley	Mayes	Active 11/98-P
74	1107	121600010280	Neosho River, US 412, Chouteau	Mayes	Active 11/98-P
75	1110	520510000110	North Canadian River, US 377, Centerview	Pottawatomie	Active 10/00-P
76	1110	520500010110	North Canadian River, Ind. Nat. Tpk., Dustin	McIntosh	Active 11/98-P
77	1110	520510000110	North Canadian River, off US 62, Harrah	Oklahoma	Active 11/98-P
78	1110	720500010010	North Canadian River, US 281, Seiling	Dewey	Active 11/98-P
79	1110	520510000010	North Canadian River, US 75, Wetumka	Hughes	Active 09/99-P
80	1110	520530000010	North Canadian River, US 81, El Reno	Canadian	Active 11/98-P
81	1110	720500010140	North Canadian River, US 412, Woodward	Woodward	Active 10/00-P
82	1112	311510010010	North Fork of the Red River, SH 34, Carter	Beckham	Active 11/98-P
83	1112	311500010020	North Fork of the Red River, US 62, Headrick	Tillman	Active 11/98-P
84	1110	720500020500	Palo Duro Creek, SH 3, Bryan's Corner	Texas	Inactive 11/98-09/00
85	1111	220100010010	Poteau River, off SH 112, Pocola	LeFlore	Active 11/98-P
86	1111	220100020010	Poteau River, US 59, Heavener	LeFlore	Active 11/98-P
86	1107	121610000010	Pryor Creek, US 69A, Sportsman Acres	Mayes	Inactive 09/99-09/00
87	1113	311100010190	Red River, I-35, Gainsville	Love	Inactive 11/98-08/99
88	1113	311200000010	Red River, SH 79, Waurika	Jefferson	Inactive 11/98-10/03

	4-DIGIT USGS #	WBID #	STATION NAME	COUNTY	STATUS
89	1113	311310010010	Red River, US 183, Davidson	Tillman	Active 11/98-P
90	1114	410100010010	Red River, US 259, Harris	McCurtain	Active 11/98-P
91	1114	410400010010	Red River, US 271, Hugo	Choctaw	Active 11/98-P
92	1113	311100010190	Red River, US 81, Terral	Jefferson	Active 11/98-P
93	1111	121700060080	Sager Creek, off US 412, West Siloam Springs	Delaware	Active 11/98-P
94	1106	621010010160	Salt Fork of the Arkansas, SH 58, Ingersoll	Alfalfa	Active 11/98-P
95	1106	621000010010	Salt Fork of the Arkansas, US 77, Tonkawa	Kay	Active 10/00-P
96	1106	621000010010	Salt Fork of the Arkansas, US 177, White Eagle	Noble	Inactive 11/98-09/00
97	1112	311600020010	Salt Fork of the Red River, off US 283, Elmer	Jackson	Active 11/98-P
98	1112	311600020010	Salt Fork of the Red River, off SH 34, Mangum	Greer	Active 10/00-P
99	1113	311600010040	Sandy Creek, SH 6, Eldorado	Jackson	Active 11/98-P
100	1105	620910030010	Skeleton Creek, SH 74, Lovell	Logan	Active 11/98-P
101	1107	121600010290	Spring Creek, off US 412, Murphy	Mayes	Active 11/98-P
102	1107	121600070010	Spring River, off SH 137, Quapaw	Ottawa	Active 11/98-P
103	1107	121500020260	Verdigris River, US 412, Inola	Rogers	Active 10/00-P
104	1107	121510010010	Verdigris River, US 60, Nowata	Nowata	Inactive 02/99-09/99
105	1107	121510020010	Verdigris River, SH 10, Lenepah	Nowata	Active 11/98-P
106	1107	121500030010	Verdigris River, SH 20, Keetonville	Rogers	Active 11/98-P
107	1107	121500010200	Verdigris River, SH 51, Wagoner	Wagoner	Active 09/99-P
108	1113	311100030010	Walnut Bayou, SH 32, Burneyville	Love	Inactive 09/99-09/00
109	1113	310810020010	Washita River, off SH 19, near Alex	Grady	Active 01/03-P
110	1113	310830030060	Washita River, SH 152, Cordell	Washita	Active 11/98-P
111	1113	310810010010	Washita River, SH 19, Pauls Valley	Garvin	Active 11/98-P
112	1113	310840010010	Washita River, SH 33, Hammon	Custer	Active 11/98-P
113	1113	310800020010	Washita River, US 177, Durwood	Carter	Active 11/98-P
114	1113	310830010010	Washita River, US 281, Anadarko	Caddo	Active 11/98-P
115	1113	311310020010	West Cache Creek, SH 5B, Taylor	Cotton	Active 11/98-P
116	1110	720500030040	Wolf Creek, off US 270, Fort Supply	Woodward	Active 11/98-P

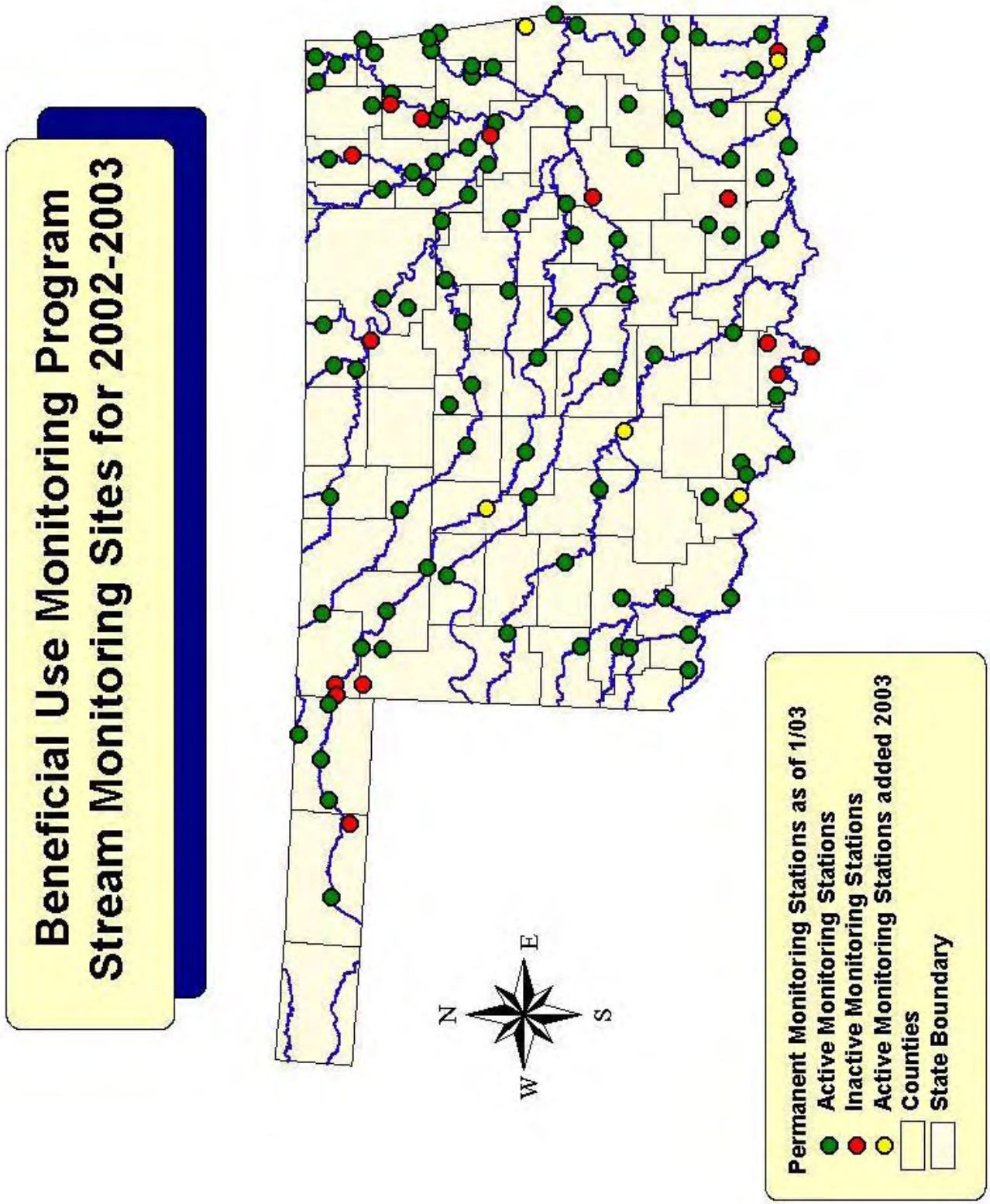


Figure 2. Beneficial Use Monitoring Program permanent ambient trend monitoring sites.

Rotating site selection is not as simple of a process. The goal of the rotating portion of the program is to provide short-term assessments on priority waters as identified by a state agency or other party. Two over-arching objectives were identified to aid in the determination of what would qualify as a rotating site. First of all, it was determined that data collection at a particular site should be short-term in nature and not extend past one sampling year, although some stations do remain in the network for up to two years. Data collected within that year should allow water quality managers to make the appropriate decisions regarding the segment being monitored. For instance, if a stream reach is listed as impaired due to pH on the 303(d) list, measuring pH throughout one year should allow the requesting agency or entity to either de-list the segment or determine what other monitoring efforts are necessary. Secondly, the monitoring should fall within the framework of the USAP. Since the inception of the program, the staff of the OWRB has met individually with representatives of other state agencies to identify their priority short-term monitoring needs. Once the OWRB receives a list of waters for monitoring from the interested agencies, staff evaluates the nominations and notifies the nominating agency of which waters would be monitored (all of the waters requested for monitoring have been accommodated since program inception). In all, two hundred (200) monitoring stations have been or are currently being monitored. In most instances, the segments were listed for one or more variables on the state's 303d list. For a comprehensive list of historic and/or current rotational monitoring stations, **please contact the Oklahoma Water Resources Board/Water Quality Programs Division at (405) 530-8800.**

Stream Monitoring Variables. The variables that are monitored were chosen to reflect both objectives of the programs — assessment of beneficial uses within the framework of USAP as well as the assessment of general water quality. Even though a variable may not be listed in the OWQS with a specific criterion (e.g., hardness), the variable is an important constituent in analyzing and understanding the general water quality of a particular segment. See Table 4 for a list of monitoring variables.

Table 4. Variables Monitored by the BUMP Stream Sampling Program.

SAMPLE VARIABLES		
General Water Quality Variables – Sampled 10 times annually		
Dissolved Oxygen (D. O.)	pH	Specific Conductance
Temperature	Oxidation/Reduction Potential	% D. O. Saturation
Salinity	Total Alkalinity	Total Hardness
Chloride	Nephelometric Turbidity	Sulfate
Total Dissolved Solids		
Nutrients – Sampled 10 times annually		
*Kjeldahl Nitrogen	Ortho-Phosphorus	Total Phosphorus
*Nitrate Nitrogen	*Nitrite Nitrogen	Ammonia Nitrogen
Metals – Sampled 4 times biannually at a minimum with some site-specific sampling		
Arsenic	Cadmium	Chromium
Copper	Lead	Mercury
Nickel	Selenium	Silver
Zinc	Thallium	

SAMPLE VARIABLES		
Organics – Site specific sampling		
Analysis of Pesticides, Herbicides, Fungicides, and other organics		
Bacteriological Communities – Sampled 5 times annually at a minimum (during recreational season)		
Fecal Coliform	*Escherichia coli*	Enterococci

***Total nitrogen is calculated by OWRB staff, based upon concentrations for these compounds.

Data for water quality variables is collected in one of two ways. Some variables are monitored in-situ utilizing a Hydrolab® Minisonde or YSI multi-probe instrument. The measurement is taken at the deepest point of the channel at a depth of at least 0.1 meters and no greater than one-half of the total depth. The data are uploaded from the instrument to a data recorder, transferred manually to a field log sheet, and downloaded to the OWRB monitoring database. These variables include dissolved oxygen (D. O.), %D. O. saturation, water temperature, pH, salinity, oxidation-reduction potential, total dissolved solids, and specific conductance. Data for all other variables are gathered from water quality samples collected at the station. Samples are collected either by suspending a modified DH-81 hand-line depth-integrating sampler (polyethylene collection bottle) from a bridge or by wading the stream with a DH-81 wadable depth-integrating sampler (polyethylene collection bottle). If sampling occurs from a bridge, the sampling is done on the down-stream side of the bridge spanning the stream of interest. Samples are collected using a combination of the depth-integration method and the equal-width increment method. The depth-integration method involves collection of samples from the surface of the water to the bottom of the water column with water collected at a consistent rate on both the descent and the ascent. The equal-width-increments-method allows for collection of a composite sample by sampling with depth-integration at 5 to 10 equal widths across the stream. As each increment is sampled, the water is added to a polyethylene churn splitter. From this composite water sample, water quality variables are monitored in several ways. For laboratory analysis of general water quality variables and nutrients, water is aliquotted from the churn splitter to 2 1-liter bottles (one for sulfuric acid/ice preservation and one for ice preservation). If a sample is needed for metals analysis, water is aliquotted into a 1-liter acid washed bottle, preserved with nitric acid, and placed on ice. Sample water for the determination of nephelometric turbidity, total hardness, and total alkalinity is also aliquotted from the splitter churn. Nephelometric turbidity is determined through use of a HACH Portable turbidimeter. Total hardness and alkalinity are determined using HACH test kits. All instruments and test kits are calibrated and used according to manufacturer's instructions. Samples for organics analysis are collected separately using Teflon and glass containers as opposed to polypropylene. Because organics have an increased affinity for polypropylene, allowing a sample to contact polypropylene sample bottles or churn splitters may cause concentrations to be significantly underestimated. Therefore, a composite sample for organics analysis is collected by using a 1-liter Teflon collection bottle. At each increment, water is added to a 3-gallon glass bottle. The laboratory sample is aliquotted by inverting the glass bottle 10 times and dispensing to one-quart or one-pint clear or amber glass jars depending on the type of organic analysis. The samples are placed on ice for preservation. For a more detailed discussion of sampling procedures, please contact the OWRB for copy of the BUMP Standard Operating Procedures (SOP). The SOP document can be obtained by contacting the Oklahoma Water Resources Board/Water Quality Programs Division at (405) 530-8800 or access the web address http://www.owrb.state.ok.us/studies/reports/reports_pdf/bump_sopfy01.pdf to download a copy of the SOP document.

OWRB stream sampling personnel collect water quality data for all variables on permanent ambient trend monitoring stations (Table 3). In all cases, the rotating stations have been derived from stream segments listed on Oklahoma's 303(d) list and on streams submitted for monitoring by other state agencies. Therefore, the water quality variables analyzed are determined from the 303(d) listed cause code or by the requesting agency, with concurrence by OWRB staff. The stations monitored for the OCC are located on stream segments designated for salinity on the 303(d) list. Each station is sampled monthly for a variety of cations and anions. Methods used at rotating sites are identical to methods described for the permanent sites.

Quality Assurance/Quality Control (QA/QC). QA/QC will not be discussed in detail in this report. However, for a comprehensive description of field QA/QC methods, please contact the Oklahoma Water Resources Board/Water Quality Programs Division at (405) 530-8800. For laboratory QA/QC methods please contact the Oklahoma Department of Environmental Quality/Customer Services Division at (405) 702-6100. Comprehensive QA/QC has been performed on all data collected and utilized for this report.

STREAM DATA ANALYSIS PROTOCOLS

BUMP data collection on streams began in November of 1998. In order to provide a structural framework for data analysis and interpretation within the confines of the OWQS, the program uses the Use Support Assessment Protocols (USAP) promulgated into rule in Oklahoma Administrative Code (OAC) 785:46-15. A detailed explanation of the relationship between the USAP and the data collected on streams and rivers as part of the BUMP is presented below. This explanation is broken down into 8 subsections: Data Requirements, Default Protocols, Assessment of Fish and Wildlife Propagation Support, Assessment of Primary Body Contact Recreation Support, Assessment of Public and Private Water Supply Support, Assessment of Agriculture Support, Assessment of Aesthetics Support, and Assessment of Human Health Support (fish consumption). The latest USAP is included with this document as Appendix A and should provide greater insight into exactly how use support determinations were made for this report. In addition, OAC 785:45 (Oklahoma Water Quality Standards) and the justification document for the USAP can be obtained by contacting the OWRB/Water Quality Programs Division at (405) 530-8800 or through accessing the documents on the OWRB web page at: http://www.owrb.state.ok.us/util/rules/pdf_rul/Chap45.pdf.

Data Requirements. USAP divides the number of stream miles that can be represented by a single site/station (or spatial coverage) into two categories—non-wadable and wadable streams. Sites/stations can be representative of no more than 25 stream miles on non-wadable streams and 10 stream miles on wadable streams. These limitations can be adjusted based upon existing data, distance between monitoring sites, sources of pollution, and the influence of major hydrological features, such as major tributaries and dams (delineated by 12-digit waterbody identification segments). A definition of what constitutes a wadable and non-wadable stream is not outlined in the USAP, so OWRB staff use federal guidance as well as best professional judgment. Federal 305 (b) guidelines say that no monitoring site/station can be representative of more than 25 stream miles on large streams and rivers. Furthermore, in areas where topography and land use are relatively homogeneous and there are no other significant influences, a single monitoring station can be representative up to 50 to 75 stream miles. Therefore, only two firm guidelines are currently available for determining the spatial coverage of a monitoring site/station:

1) The spatial coverage can not extend outside the 12-digit segment in which the monitoring site/station is located except in those instances where it is determined that it is reasonable to do so (e.g., the segment break is not caused by a major hydrological influence).
2) No monitoring site/station can be representative of more than 25 stream miles (in some instances, monitoring sites/stations may be representative of up to 50 stream miles with a scientifically defensible justification).

Accordingly, spatial coverage for the 2002-2003 BUMP report on streams will be limited to these two guidelines. The spatial coverage is subject to change dependent upon the language of the latest version of USAP.

USAP sets two limitations on temporal coverage. First, data used in assessments must be collected such that decisions are not biased towards either critical-flow, base-flow, or high-flow conditions. This report uses data collected during all seasons. Secondly, stream data that is more than five years old cannot be used to assess support unless no other data exists or a scientifically defensible reason can be brought forth justifying the use of older data. This report uses no data collected before November of 1998.

USAP also sets data requirements on the number of samples needed and the magnitude of criteria exceedance for toxicants and dissolved oxygen before a use support determination can be made. The minimum number of samples required to assess use support for all general water quality variables is 10. This minimum number of samples is not applicable if data from samples already collected ensures that the use will not be supported. In other words, if a 25% exceedance is required to designate a use as not supporting and 3 of the first 5 samples collected were in exceedance of the criteria, then sampling can discontinue because you are assured of having >25% of the minimum number of samples exceeding the criteria. The BUMP program collects at least ten samples per year on all general water quality parameters with the exception of bacteria, organics and metals. Toxicants (metals and organics) require a minimum of 5 samples to determine use support, however, less than 5 samples can be used to determine if a use is partially supported or not supported. Furthermore, if at least 2 sample concentrations of a toxicant exceed the criteria prescribed in the OWQS by two or more orders of magnitude, then the use is determined to be "not supporting".

Finally, USAP gives guidance on the treatment of practical quantification limits (PQL), or detection limits. A PQL is the minimum value that a particular test or instrument can "read-to" with an acceptable level of confidence. If a value is determined to be less than the PQL, then it is generally reported as a "less than value" (e.g., variable data point "x" = <2.0 mg/L). In other words, the test or the instrument cannot deliver a value less than the PQL without introducing statistically significant uncertainty to the data. Moreover, when analyzing the data, data point "x" cannot be assigned a value of 2.0 mg/L or 0.0 mg/L because staff would be making an arbitrary determination that would assuredly be either an under estimation or an over estimation of the "true" value. Consequently, the OWRB staff assigns a value that is fifty percent of the PQL ("x" would equal 1.0 mg/L).

Default Protocols. USAP outlines the procedures for determining whether a set of data points for a particular variable **support**, **partially support**, or **do not support** a particular beneficial use. These protocols are constructed around two distinct types of numerical variables — short term averages and long term averages. In each case, samples collected for the range of water quality parameters are analyzed and aggregated in different ways.

Short-term average numerical variables measure variables with exposure periods of less than seven days (e.g., turbidity or a sample standard for chlorides). In other words, the set of samples that is being analyzed considers each sample as a separate entity. For example, **each** turbidity sample collected monthly from January through December is considered a unique sample, and consequently, every sample is not aggregated into a single sample for analysis but is considered a fraction of the whole. Use support determination for short-term numerical variables requires a three-step process:

1. Each sample exceeding the prescribed criterion or screening level for a particular variable is identified,
2. The number of samples exceeding the prescribed criterion or screening level is divided by the total number of samples collected to obtain a percent exceedance, and
3. The percent exceedance is compared to a range of prescribed percent exceedances to determine use support. The prescribed percent exceedances are:
    - **i)** Supporting — less than or equal to ten percent (10%),
    - **ii)** Partially supporting — greater than 10% but less than twenty-five percent (25%),
    - **iii)** Not supporting — greater than or equal to 25%.

Long-term average numerical variables measure variables with exposure periods of greater than or equal to seven days (e.g., yearly mean standard for chlorides). In other words, the **entire** set of samples that is being analyzed is considered a unique entity. For example, chloride samples collected monthly from January through December are aggregated through the calculation of a geometric mean. Use support determination for long-term numerical variables requires a three-step process:

1) Samples for a particular variable are aggregated into a geometric mean
2) The geometric mean is compared to the prescribed criterion or screening level
3) Use support is determined to be supporting if the mean is less than the prescribed criterion or screening level or not supporting if the mean is greater than the prescribed criterion or screening level.

Because the long-term average compares only one value (the geometric mean) to the prescribed criterion or screening level, it cannot be considered partially supporting. In most instances, at least ten samples are required to calculate a geometric mean. Furthermore, geometric means are calculated on a two-year rolling average using the most recent data available.

So that the reader will fully understand how use support was determined for our rivers and streams for the various beneficial uses assigned to them a short discussion of the OWQS beneficial uses and the Use Support Assessment Protocols (USAP) is included below.

Assessment of Fish and Wildlife Propagation (FWP) Support. The FWP beneficial use utilizes five different water quality variables to assess use support: dissolved oxygen (D.O.) concentration, toxicants, hydrogen ion activity (pH), biological criteria, and turbidity. For purposes of this report, only D.O., metals concentrations in the water column, pH, and turbidity will be used in the assessment. Only one variable needs to exceed the assessment protocol for the beneficial use to be partially supported or not supported. Collection of organic samples was intitiated in 2002-2003.

Biological criteria have been promulgated into rule for several ecoregions and more ecoregions will follow in 2003-2004. During the summer of 2003, the BUMP began collecting biological data for those ecoregions currently in rule to assess FWP use support.

The OWQS 785:45-5-12(g)(1) in a table entitled "Dissolved Oxygen Criteria" prescribes three screening levels for D.O. in streams. Streams are categorized in Appendix C of the OWQS as habitat limited aquatic communities (HLAC), warm water aquatic communities (WWAC), cool water aquatic communities (CWAC), and trout fisheries (TF). The prescribed screening level for each of the categories is: HLAC—4.0mg/l (April 1—June 15) and 3.0 mg/L (June 16—May 31); WWAC—4.0mg/l (June 16—October 15) and 5.0 mg/L (October 16—June 15); and CWAC and TF—5.0mg/l (June 1—October 15) and 6.0 mg/L (October 16—May 31). The protocol for short-term average numerical parameters is used to assess the level of support.

Numerical criteria is prescribed for toxicants in OWQS 785:45-5-12(g)(6)(G) in a table entitled "Numerical Criteria for Toxic Substances". To determine use support, the protocol for short-term average numerical parameters is used. Sample values must be compared to both acute and chronic criterion. Both criterions need not be exceeded for the variable to be partially supported or not supported.

A numerical range for pH of 6.5 to 9.0 units is prescribed in 785:45-5-12(g)(3) for all aquatic classifications. The protocol for short-term average numerical parameters is used to assess the level of support.

Screening limits are established for turbidity in OWQS 785:45-5-12(g)(7)(A)(i) and (iii). CWAC are assigned a criterion of 10 Nephelometric Turbidity Units (NTU), and all other stream communities are assigned a criterion of 50 NTU. The protocol for short-term average numerical parameters is used to assess the level of support. In OWQS 785:45-5-12(g)(7)(C), it is stated that numerical criteria for turbidity "apply only to seasonal base flow conditions". Therefore, those measurements that are taken above seasonal base flow are not included in determining support. To determine seasonal base flow, the average discharge for the sampling day is compared to the median flow of the three months surrounding the sampling day. If the station is not part of the USGS stream-flow monitoring program but has an upstream or downstream stream-flow station in close proximity, that station is used to determine whether the station in question is at seasonal base flow. If no proximal stream-flow station exists, stream-flow monitoring stations on other waterbodies that are in close geographical proximity were used to determine whether the station in question is at seasonal base flow. Use support determinations based on turbidity data are provisional and assessments related to turbidity may be subject to change. Furthermore, to assist staff in the determination of seasonal base flow at stations that do not have continuous discharge measurements, the OWRB is now collecting discharge measurements at all but four of the permanent monitoring stations. To supplement base flow determination staff uses several anecdotal methods. These methods are only used in concert with another method when determining if base flow conditions existed when the sample was taken. In one method, staff determines flow condition visually by noting whether the flow is minimal, light, moderate, high, or stormwater. Also, beginning in 2002, staff began noting the presence or absence of a periphyton line as well as the color and texture of the periphyton. In most instances, if a periphyton line has been established, flow has not exceeded that level in at least seven days.

Assessment of Primary Body Contact Recreation (PBCR) Support. The PBCR beneficial use utilizes 2 different bacteriological classes and one bacteriological species to assess use support: fecal coliform (FC), *Escherichia coli* (*E. coli*), and enterococci (Ent.). The assessment

is performed by using the long-term average numerical protocol to compare to a prescribed geometric mean and by using a modified version of the short-term average numerical protocol to compare each sample to a prescribed screening level. The prescribed geometric means (GM) and screening levels (SL) are: FC—GM of 400 colony forming units/mL (cfu/mL) and SL of 400 cfu/mL; *E. coli*—GM of 126 cfu/mL and SL of 235 cfu/mL in scenic rivers and 406 cfu/mL in all other waters; and Ent. —GM of 33 cfu/mL and SL of 61 cfu/mL in scenic rivers and 406 cfu/mL in all other waters. For *E. coli* and Ent., both the SL (only one sample exceedance is necessary) and the GM must be exceeded for the use to not be supported. If all of the samples meet the SL or the GM is met, the use is supported. In the case of FC, the use may only be supported if the GM is met and no greater than 25% of the sample concentrations exceed the SL. If either the GM is exceeded or greater than 25% of the sample concentrations exceed the SL, the use is not supported for FC. In no instance is the PBCR beneficial use partially supported. Furthermore, PBCR support is only determined from samples collected during the recreational season from May 1 through September 30 of each year. Only one variable needs to violate the assessment protocol for the beneficial use to be not supported.

Assessment of Public and Private Water Supply (PPWS) Support. The PPWS beneficial use utilizes toxicant concentrations to assess use support. For purposes of this report, only metals are considered in the toxicant category. Only one variable needs to violate the assessment protocol for the beneficial use to be partially supported or not supported. Organics are currently being collected at some stations. In previous reporting years, total coliform bacteria were used to determine use support. This was done in error. The criterion of 5,000 cfu/mL in the OWQS is only applied at the water supply intake point and is not applied throughout the waterbody.

Numerical criteria for metals is established in OWQS 785:45-5-10(1) and (6). The short-term numerical average protocol is used to determine use support for both sets of criterion. If a substance has different numerical criteria listed in both tables, the most stringent criterion takes precedence. Furthermore, criteria in both tables need not be exceeded for the use to be partially supported or not supported.

Assessment of Agriculture (AG) Support. The AG beneficial use utilizes three variables to assess use support: total dissolved solids, chlorides, and sulfates. Numerical criteria for both yearly mean standards and sample standards are located in Appendix F of OAC 785:45. The yearly mean standard for each variable is compared to the geometric mean of the samples using a long-term average numerical protocol. The sample standard for each variable is compared to the each sample using a short-term average numerical protocol. Use support assessment for each variable requires a three-step process:

1) The sample standard and yearly mean standard for the six digit management segment which encompasses the monitoring must be located in Appendix F of OAC 785:45;
2) The geometric mean of the samples is compared to the yearly mean standard (if the geometric mean exceeds the yearly mean standard, the use is not supported and no further analysis is necessary);
3) If the geometric mean meets the yearly mean standard, the sample standard is compared to each sample and percent exceedance is calculated (depending on the percent exceedance, the variable is supporting, partially supporting, or not supporting). Regardless of the criteria in Appendix F of OAC 785:45, if all TDS samples are less than 750 mg/L and all chloride and sulfate samples are less than 250 mg/L, the AG beneficial use is supported. Only one variable needs to

violate the assessment protocol for the beneficial use to be partially supported or not supported.

Assessment of Aesthetics Support. With the exception of the numerical criterion of 0.037 mg/L of total phosphorus for Oklahoma scenic rivers and 70 Platinum-cobalt units for true color, the OWQS includes only narrative criteria for the aesthetics beneficial use. Furthermore, the USAP only addresses the effect of nutrients and true color. However, narrative criteria in OAC 785:45-3-2(c) requires that nutrients related water quality degradation cannot interfere with the maintenance of any beneficial use protected under OAC 785:46-13-3(a)(1). Because numerical nutrient criteria exists only for scenic rivers, assessments of nutrients on all other rivers and streams do not determine beneficial use support but whether a particular stretch of stream is nutrient-threatened. Therefore, these assessments of nutrients do not utilize any of the default protocols, but revolve around the use of a dichotomous key. The use of the key is a rather involved process and will not be verbally outlined in this report. Please refer to OAC 785:46-15-10 for a detailed discussion of the dichotomous key and how it is apllied for use support determination.

The impact of nutrients on streams is related to the growth of phytoplankton. Phytoplankton is autotrophic which means that when light and consumables such as nutrients are available they can convert energy and grow. The available nutrients are total phosphorus and nitrite and nitrate (utilized as a combined nitrogen concentration). Several factors determine if the level of these compounds pose a threat to the health of the stream. Foremost, the size of the stream must be considered. Smaller streams (3rd order or less) tend to be more susceptible to nutrient impacts and, therefore, smaller concentrations have similar effects as larger concentrations in larger streams (greater than 3rd order). Depending on stream order, USAP has established preset threshold values for total phosphorus and nitrate/nitrite. If the two-year rolling median of the sample values exceeds the threshold, the following confounding factors are considered to determine if the excessive nutrients are threatening the health of the stream. The amount of time the nutrient is resident in the stream is proportional to the impact. Therefore, the slope of the topography around the station must be considered. Furthermore, phytoplankton is light dependent for growth. Consequently, light must be able to able to penetrate the surface of the water. For this reason, water clarity must be measured by either using a nephelometric turbidity meter or a Secchi disk. Only turbidity readings taken at seasonal base flow are included when calculating the geometric mean. Logic would suggest that low clarity will limit the impact of phytoplankton on the stream and that high clarity will increase the impact of phytoplankton. On smaller streams, available light is also measured by percent canopy shading.

In 2002, a numerical criterion of 0.037 mg/L of total phosphorus was set for all waterbodies designated as Oklahoma Scenic Rivers. These rivers include the Barren Fork River, Flint Creek, the Illinois River, Lee Creek, Little Lee Creek, and the Mountain Fork River above Broken Bow Reservoir. The two-year rolling geometric mean is used to assess the level of support and can only be supporting or not supporting.

Assessment of Human Health Support. A new beneficial use was created in 1999 dealing with fish consumption and is housed under the Human Health criteria. The new use deals with fish consumption bans and states that waters that the DEQ has issued a fish consumption ban on will be considered as not supporting it's fish consumption use. Currently the BUMP has sampled several waters to determine fish consumption use support.

PERMANENT STREAM MONITORING STATION RESULTS & DISCUSSION

The results for the permanent monitoring stations are grouped alphabetically within their home 4-digit USGS sub-basin (Table 3). A map of the state with all of the 4-digit HUC basins is included as to aid the reader in finding a particular water body (Figure 3). Each of these sections has a similar arrangement. Immediately following the tab for a particular sub-basin, there is a 1 or 2-page synopsis of the physical, geographical, and hydrological attributes of the HUC. Included in this description will be a tabular listing of the stations located within the sub-basin.

Following the HUC description will be a detailed 1-3-page analysis of each station. The analysis includes a physical, geographical, and hydrological description of the site. Directly following the descriptive information, a short narrative is included that verifies that monitoring at the site complied with the data requirements outlined in USAP, or, in some instances, an explanation is offered as to why certain data requirements were not followed. For example, several stations in western Oklahoma go dry during the late spring or early summer. Therefore, the assessments for these stations may not be seasonally representative. Next, a comprehensive assessment of each of the prescribed beneficial uses will be done both in a narrative format and graphically. An all-inclusive assessment of the stations can be found in Table 5. Under certain circumstances, a beneficial use may not be assessed for a variety of reasons. The station may be new or inactivated before adequate data was collected for assessment, data may not be available due to laboratory, field, or equipment error, or sometimes data may not be collected due to monetary or personnel constraints.

Table 5 lists the BUMP permanent ambient trend stream monitoring sites and their associated beneficial uses. Beneficial uses that are not being met are shown in **RED**. Listed next to the support code indicating that the beneficial use was not being met is the variable code which indicates which water quality variable violated the OWQS criteria. When reviewing Table 5 it is apparent that an inordinate number of water bodies are deemed impaired due to turbidity and bacteria.

Many waterbodies exceed the turbidity standard of 10 or 50 nephelometric turbidity units. The OWQS states that turbidity standards only apply during seasonal base flow conditions. Several "quick" methods are available to assist in the determination of seasonal base flow including the existence of a periphyton line and visual estimation of the degree of flow. However, to reliably determine base flow, a measurement of stream discharge at the time of sampling is needed. This measurement when used in concert with the "quick" methods described above will give a reliable indication of whether the stream is at, below, or above seasonal base flow conditions. Because the BUMP network encompasses the state's large rivers and streams, discharge is often obtained by comparing stream stage to a continuously updated rating curve. Due to the intense nature of establishing a reliable rating curve, rated discharges are often provisional for a number of months. Therefore, the determination of the previous year's base flow and consequently turbidity values available for use support analysis are **provisional** at the publication of this report. The OWRB is gauging all but 4 permanent station locations. Where permanent water-quality monitoring stations were located near a United States Geological Survey (USGS) stream-flow monitoring station, the information collected by USGS is used to determine if a high-flow event exceeding seasonal base flow had occurred at the time of sampling. All other stations are being rated through a cooperative effort between the OWRB Monitoring Section and the USGS. To supplement base flow determination staff use several anecdotal methods. These methods are only used in concert with another method when

determining if base flow conditions existed when the sample was taken. In one method, staff determines flow condition visually by noting whether the flow is minimal, light, moderate, high, or stormwater. Also, beginning in 2002 and continuing, staff notes the presence or absence of a periphyton line as well as the color and texture of the periphyton. In most instances, if a periphyton line has been established, flow has not exceeded that level in at least seven days.

Of the 97 stations assessed for Primary Body Contact Recreation (PBCR) in this report, 81 stations (or 84%) are listed as not supporting due to the exceedance of one or more variable. Several explanations may address this inordinate number of non-supporting stations. Primarily, a valid assumption may be that the assessment of data is reflective of reality in many listings. Of the 81 non-supporting stations, 35 (or 43%), have multi-variable exceedances. Furthermore, a pattern of consistency can be seen for certain variables at some stations. In other words, exceedances of the applicable screening limits are present in each recreational season during the period of record. Secondly, the high percentage of non-supporting stations may be an artifact of either the OWQS criteria and/or the USAP decision-making process. The criteria used to assess PBCR are protective of human health. However, are all waterbodies assigned PBCR recreated to the same extent? In other words, should the same amount of protection apply to all waterbodies? Currently, Oklahoma has a two-tiered system—lakes/scenic rivers and all others—with more stringent criteria applied to lakes and scenic rivers. It may be prudent to investigate subdividing the “all other” tier into several categories. Additionally, the decision-making process in USAP may be producing some type I errors—assigning non-support status incorrectly. While maintaining the need for protection of human health, the process for assignment and assessment of the PBCR beneficial use needs to be looked over carefully so that water quality management will be become more precise and accurate.

It is also imperative that the state begins refining the minerals criteria found in OAC 45: Appendix F. Many of these management segment values were extrapolated from minimum data and from stations not necessarily representative of the entire management segment. The OWRB has developed a protocol for the development of site-specific minerals criteria. With the data available from the BUMP and other water quality monitoring programs, many of these inconsistent criteria could begin to be refined.

It is essential that Oklahoma quantify impacts in a comprehensive and scientific manner and look for trends in water quality to identify waters which are not meeting their assigned beneficial uses. As a state, we must manage our water resources effectively and direct money to areas in most need of protection or remediation to ensure that we continue to have good quality and sufficient quantity of water to meet our needs well into the 21st century. It is the desire of the Oklahoma Water Resources Board to provide the legislature, the general public and professional water managers with a comprehensive and up-to-date document for their review and approval. Administrative and Technical staff at the OWRB look forward to conducting the Beneficial Use Monitoring Program far into the future and providing the state of Oklahoma with the information it needs to make informed decisions related to the effective management of it’s precious water resources.

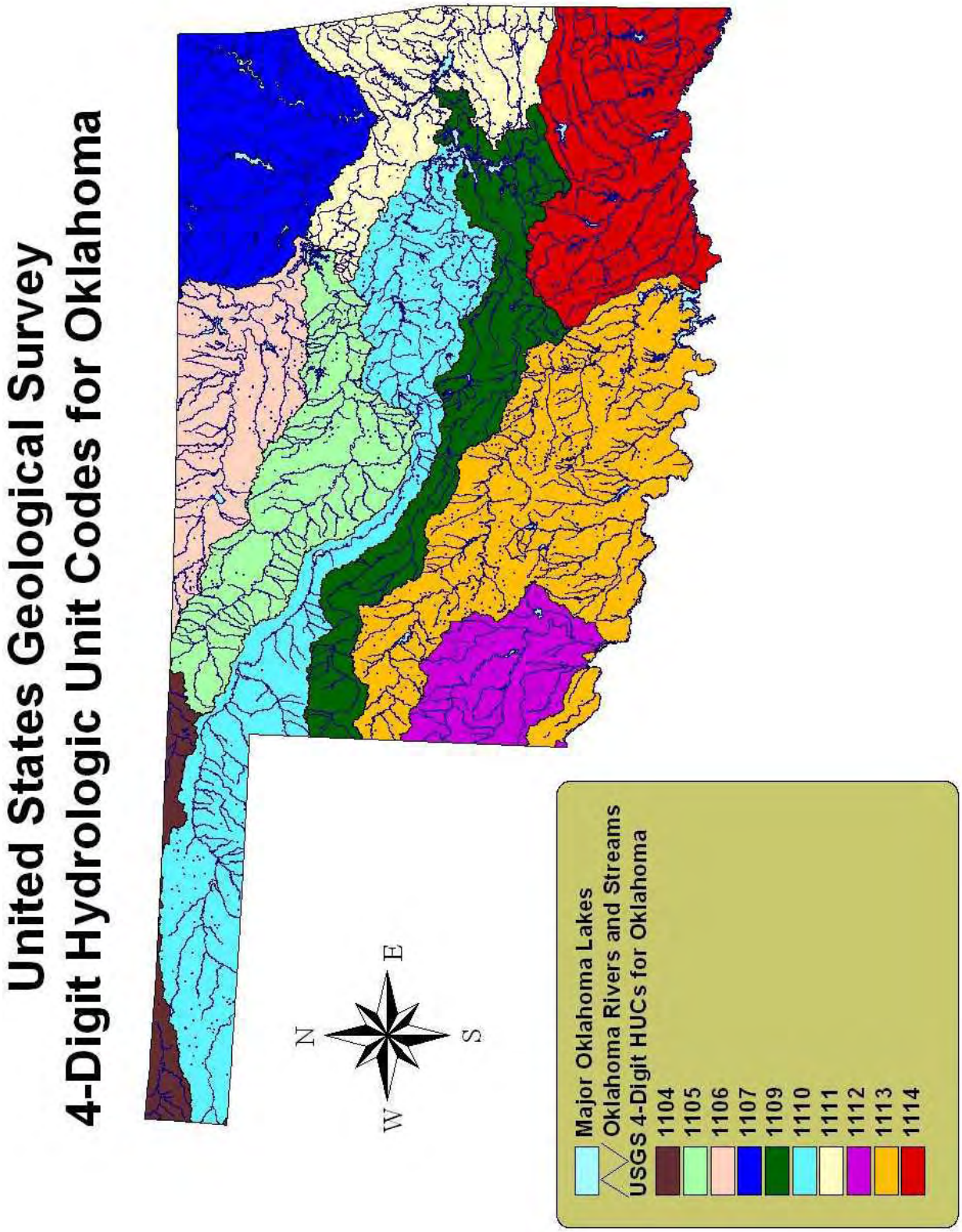


Figure 3. USGS 4-digit HUC basins.

Table 5. Permanent Ambient Trend Monitoring Stations and their Beneficial Use Support Status.

STATION NAME	FWP	PBCR	PPWS	AG	AES
Arkansas River, US 64, Moffett	PS (5)	S	S	S	NT
Arkansas River, SH 104, Haskell	PS (5)	NS (8)	N/A	PS (10)	NT
Arkansas River, SH 18, Ralston	NS (5)	NS (8)	S	S	NT
Arkansas River, SH 97, Sand Springs	S	S	N/A	S	NT
Arkansas River, US 62, Muskogee	NS (3)	S	N/A	S	NT
Arkansas River, US 64, Bixby	NS (3)	NS (6, 7, 8)	N/A	S	NT
Barren Fork, SH 51, Eldon	S	NS (8)	S	S	S
Beaver River, off US 64, Guymon	S	NS (7, 8)	S	S	NT
Beaver River, US 83, Turpin	S	NS (6, 7, 8)	N/A	NS (10, 11)	NT
Beaver River, SH 23, Beaver	NS (3)	NS (6, 7, 8)	N/A	NS (10, 11, 12)	NT
Beaver River, CR N1650, Gate	S	NS (8)	N/A	S	NT
Beaver River, US 183, Fort Supply	S	NS (8)	N/A	S	NT
Big Cabin Creek, off US 69, Big Cabin	S	S	S	S	NT
Bird Creek, SH 266, Port of Catoosa	NS (1,3,5)	NS (6, 8)	S	S	NT
Black Bear Creek, SH 18, Pawnee	NS (3, 5)	NS (6, 8)	S	S	NT
Blue River, US 70, Durant	PS (5)	NS (8)	S	S	NT
Brushy Creek, off US 270, Haileyville	NS (1, 3, 5)	NS (8)	S	S	NT
Canadian River, SH 2, Whitefield	S	S	S	S	NT
Canadian River, US 183, Taloga	PS (5)	NS (8)	N/A	NS (10)	NT
Canadian River, US 270, Calvin	NS (5)	NS (8)	S	PS (10, 12)	NT
Canadian River, US 377, Konawa	NS (3, 5)	NS (8)	S	NS (10)	NT
Canadian River, US 66, Bridgeport	NS (5)	NS (8)	N/A	NS (10, 12)	NT
Canadian River, US 77, Purcell	NS (5)	N/A	N/A	NS (10)	NT
Caney Creek, off SH 100, Barber	S	S	S	S	NT
Caney River, off US 75, Ramona	NS (3, 5)	NS (8)	S	S	NT
Chickaskia River, US 177, Blackwell	NS (3, 5)	NS (6, 8)	S	S	NT
Cimarron River, SH 34, Buffalo	S	NS (6, 7, 8)	N/A	PS (11)	NT
Cimarron River, SH 99, Oilton	NS (5)	NS (6)	N/A	S	NT

STATION NAME	FWP	PBCR	PPWS	AG	AES
Cimarron River, US 77, Guthrie	PS (5)	NS (6, 8)	N/A	S	NT
Cimarron River, US 81, Dover	NS (3)	NS (6, 7, 8)	N/A	S	NT
Cimarron River, off US 64, Mocane	NS (3)	NS (6, 8)	S	NS (10, 11)	NT
Cimarron River, US 412, Orienta	NS (5)	NS (7, 8)	N/A	PS (11)	NT
Cimarron River, SH 33, Ripley	NS (5)	NS (8)	N/A	S	NT
Clear Boggy Creek, off US 69, Caney	NS (3, 5)	NS (6, 8)	S	S	NT
Deep Fork River, off SH 16, Beggs	NS (3, 5)	NS (8)	S	S	NT
Deep Fork River, US 377, Stroud	NS (3, 5)	NS (8)	PS (9)	S	NT
East Cache Creek, SH 53, Walters	NS (3, 5)	NS (6, 7, 8)	S	S	NT
Elk Creek, off US 183, Hobart	NS (3, 5)	NS (8)	S	S	NT
Elk River, SH 43, Tiff City (MO)	S	NS (8)	S	S	NT
Elm Fork River, SH 9, Mangum	NS (2, 3)	NS (6, 7, 8)	NS (9)	S	NT
Flint Creek, US 412, Flint	S	NS (8)	S	S	NS (14)
Fourche-Maline Creek, off US 270, Red Oak	NS (1, 3)	NS (8)	S	S	NT
Glover River, SH 3, Glover	NS (1, 3)	NS (8)	S	S	NT
Honey Creek, off SH 25, Grove	S	NS (8)	S	S	T (15)
Illinois River, US 59, Watts	NS (5)	NS (8)	S	S	NS (14)
Illinois River, US 62, Tahlequah	S	NS (8)	S	S	NS (14)
Kiamichi River, off US 271, Tuskahoma	NS (2, 3)	S	S	S	NT
Kiamichi River, SH 63, Big Cedar	NS (3, 4)	S	S	S	NT
Kiamichi River, US 271, Antlers	NS (2, 3)	NS (8)	S	S	NT
Little River, off SH 3, Cloudy	NS (2, 3, 4)	NS (8)	S	S	NT
Little River, SH 56, Sasakwa	NS (3, 5)	NS (6, 8)	S	S	NT
Mountain Fork, SH 4, Smithville	NS (2, 3, 4, 5)	NS (8)	S	S	S
Mountain Fork, US 70, Eagletown	NS (2, 3)	NS (8)	S	S	NT
Mud Creek, SH 32, Courtney	NS (1, 5)	NS (6, 8)	S	S	NT
Muddy Boggy Creek, US 70, Unger	NS (3, 5)	NS (6, 8)	S	S	NT
Muddy Boggy Creek, US 69, Atoka	NS (1, 3, 5)	NS (6, 8)	S	S	NT
Neosho River, off US 66, Commerce	NS (5)	S	S	S	NT

STATION NAME	FWP	PBCR	PPWS	AG	AES
Neosho River, off SH 137, Connor Bridge	S	S	S	S	NT
Neosho River, SH 82, Langley	PS (1)	S	S	S	NT
Neosho River, US 412, Chouteau	S	S	S	S	NT
North Canadian River, Indian Nations Turnpike, Dustin	NS (3, 5)	NS (6, 8)	S	S	NT
North Canadian River, SH 3E, Shawnee	NS (3, 5)	NS (8)	N/A	S	T (13)
North Canadian River, off US 62, Harrah	NS (4, 5)	NS (8)	N/A	S	NT
North Canadian River, US 281, Seiling	PS (5)	NS (8)	S	S	NT
North Canadian River, US 75, Wetumka	NS (3, 5)	NS (6, 8)	S	S	T (13)
North Canadian River, US 412, Woodward	S	NS (8)	N/A	S	NT
North Canadian River, US 81, El Reno	S	NS (8)	S	S	NT
North Fork of the Red River, US 62, Headrick	NS (3, 5)	NS (8)	PS (9)	NS (10, 11)	NT
North Fork of the Red River, SH 34, Carter	S	NS (8)	S	S	NT
Poteau River, off SH 112, Pocola	NS (3, 5)	NS (8)	S	S	NT
Poteau River, US 59, Heavener	S	S	S	S	NT
Red River, SH 79, Waurika	NS (3, 5)	NS (8)	PS (9)	NS (10, 11, 12)	NT
Red River, US 183, Davidson	NS (3, 5)	NS (6, 8)	N/A	NS (10, 11, 12)	NT
Red River, US 259, Harris	PS (5)	S	S	NS (10)	NT
Red River, US 271, Hugo	PS (5)	NS (6, 8)	S	NS (10, 11, 12)	NT
Red River, US 81, Terral	NS (3, 5)	NS (8)	S	NS (11, 12)	NT
Sager Creek, off US 412, West Siloam Springs	S	NS (8)	PS (nitrates)	S	T (13, 15)
Salt Fork of the Arkansas, SH 58, Ingersoll	NS (3, 5)	NS (6, 7, 8)	S	S	NT
Salt Fork of the Arkansas, US 77, Tonkawa	PS (1, 5)	NS (8)	S	S	NT
Salt Fork of the Red River, SH 34, Mangum	S	NS (6, 8)	S	S	NT
Salt Fork of the Red River, off US 283, Elmer	NS (2, 3)	NS (6, 8)	PS (9)	S	NT
Sandy Creek, SH 6, Eldorado	NS (2, 3, 5)	N/A	N/A	NS (10, 11, 12)	NT
Skeleton Creek, SH 74, Lovell	NS (5)	NS (6, 8)	S	S	NT
Spring Creek, off US 412, Murphy	S	S	S	S	NT
Spring River, off SH 137, Quapaw	NS (2. 3, 5)	NS (8)	S	S	NT
Verdigris River, US 412, Inola	NS (3, 5)	S	S	S	NT

STATION NAME	FWP	PBCR	PPWS	AG	AES
VERDIGRIS RIVER, SH 10, LENEPAH	NS (3, 5)	NS (8)	S	S	NT
VERDIGRIS RIVER, SH 20, KEETONVILLE	NS (3, 5)	NS (8)	S	S	NT
VERDIGRIS RIVER, SH 51, WAGONER	NS (2, 3, 5)	NS (8)	S	S	NT
WASHITA RIVER, SH 152, CORDELL	NS (5)	NS (6, 8)	S	S	NT
WASHITA RIVER, SH 19, PAULS VALLEY	NS (5)	NS (6, 8)	S	NS (10)	NT
WASHITA RIVER, SH 33, HAMMON	PS (5)	NS (6, 8)	S	S	NT
WASHITA RIVER, US 177, DURWOOD	NS (3, 5)	NS (6, 8)	S	S	NT
WASHITA RIVER, US 281, ANADARKO	NS (5)	NS (6, 8)	S	S	NT
WEST CACHE CREEK, SH 5B, TAYLOR	NS (3, 5)	NS (6, 7, 8)	S	PS (10)	NT
WOLF CREEK, OFF US 270, FORT SUPPLY	S	NS (8)	S	S	NT
WASHITA RIVER, US 281, ANADARKO	NS (5)	NS (6, 8)	S	S	NT
WEST CACHE CREEK, SH 5B, TAYLOR	NS (3, 5)	NS (6, 8)	S	PS (10)	NT
WOLF CREEK, OFF US 270, FORT SUPPLY	S	NS (8)	S	S	NT

ASSIGNED OWQS BENEFICIAL USES	
FWP = FISH & WILDLIFE PROPAGATION	PBCR = PRIMARY BODY CONTACT RECREATION
PPWS = PUBLIC AND PRIVATE WATER SUPPLY	AG = AGRICULTURE
AES = AESTHETICS	

SUPPORT CODES		
S—FULLY SUPPORTING	PS—PARTIALLY SUPPORTING	NS—NOT SUPPORTING
N/A—NOT APPLICABLE	NT-NOT THREATENED (NUTRIENTS)	T-THREATENED (NUTRIENTS)

WATER QUALITY VARIABLES		
1—DISSOLVED OXYGEN	2—METALS (ACUTE)	3—METALS (CHRONIC)
4—pH	5—TURBIDITY	6—FECAL COLIFORM
7— *Escherichia coli*	8— ENTEROCOCCI	9—METALS
10— TOTAL DISSOLVED SOLIDS	11— CHLORIDES	12— SULFATES
13— TOTAL PHOSPHORUS (TP)	14—TP OK SCENIC RIVER CRITERION	15— NITRITE + NITRATE

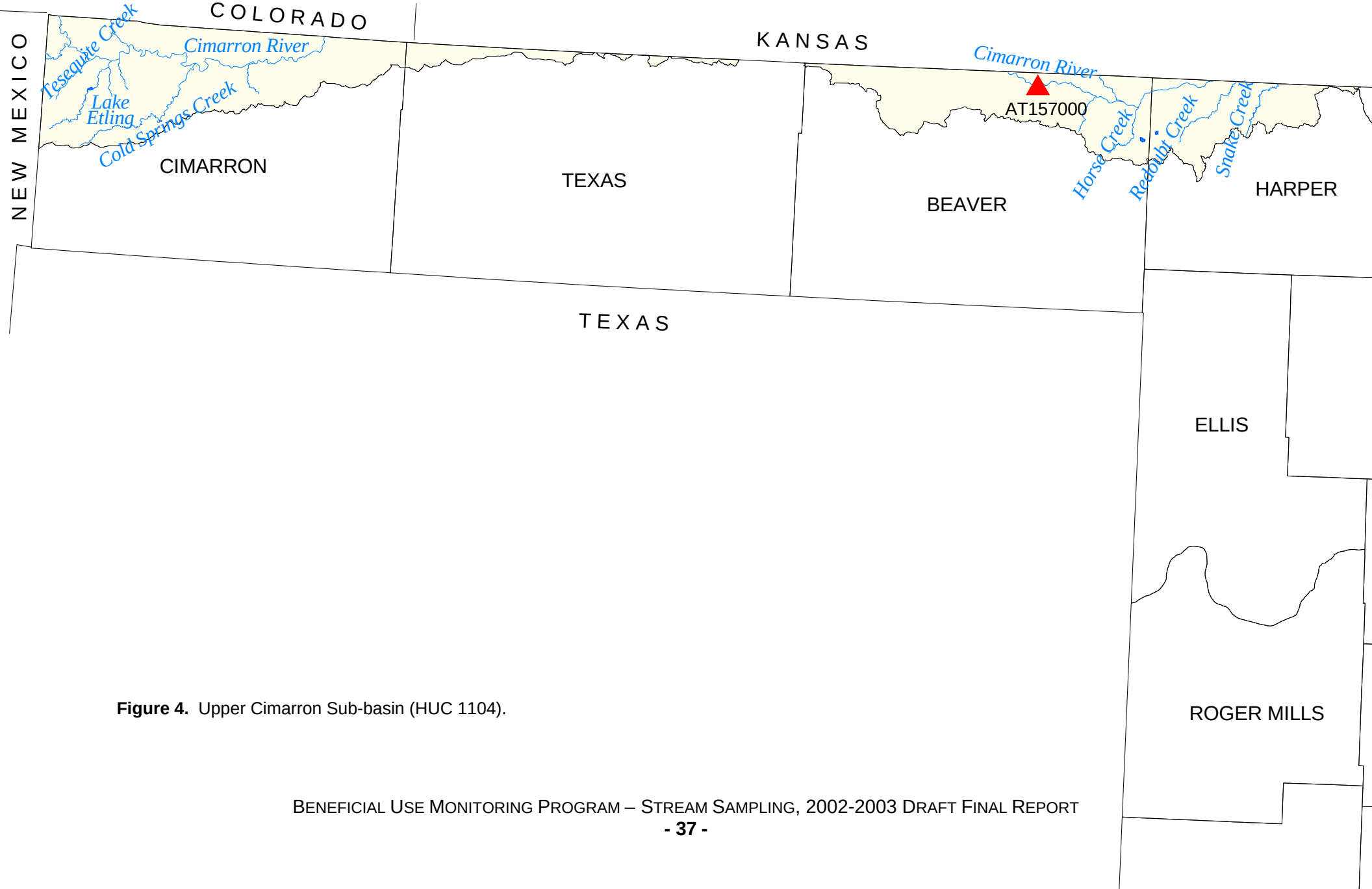


Figure 4. Upper Cimarron Sub-basin (HUC 1104).

HUC 1104

UPPER CIMARRON SUB-BASIN

The Upper Cimarron sub-basin (4-digit hydrologic unit 1104) is situated in the far northwest portion of the state. It originates in the northwestern portion of Cimarron County and continues along the northern third of the county until exiting at the northwest corner of Texas County. The sub-basin reenters Oklahoma in the upper reaches of Beaver County and terminates in the northwest section of Harper County. No major cities or County seats are located within the sub-basin. Minor cities of note include Kenton and Knowles.

The sub-basin is subdivided into four 8-digit hydrologic units (HUC) within the state. These HUC's are the Cimarron Headwaters (11040001), the Upper Cimarron (11040002), the Upper Cimarron-Liberal (11040006), and the Upper Cimarron-Bluff (11040008). The Cimarron River dominates the sub-basin. Near the headwaters of the Cimarron River, Lake Carl Etling is formed by South Carrizo Creek. The only water quality monitoring station in the sub-basin is AT157000 (Table 6).

The sub-basin is dominated by two major ecoregions. The Southwestern Tablelands are prominent in the far west and appear in portions of Beaver County while the Western High Plains are foremost in the near west, central and eastern portions of the sub-basin. The Central Great Plains touches the sub-basin in the far eastern reaches of Harper County. The primary land usage in the sub-basin is rangeland with open grasslands to the west and east and sand sagebrush in portions of Beaver County. Irrigated croplands are scattered throughout the sub-basin. Other land uses of note include pastureland, woodlands, large farmsteads, and bare exposed rock.

Table 6. Permanent Ambient Trend Monitoring Stations Located in HUC 1104.

WBID #	STATION #	STATION NAME	STATUS	FS	PS	NS/T	CBD
620930000010	AT157000	CIMARRON RIVER, OFF US 64, MOCANE	ACTIVE 10/99- P	PPWS, AES	NONE	FWP, AG, PBCR	NONE

ASSIGNED OWQS BENEFICIAL USES AND SUPPORT CODES	
PPWS = PUBLIC AND PRIVATE WATER SUPPLY	EWS = EMERGENCY WATER SUPPLY
FWP = FISH & WILDLIFE PROPAGATION	PBCR = PRIMARY BODY CONTACT RECREATION
AG = AGRICULTURE	AES = AESTHETICS
FS = FULLY SUPPORTING	PS = PARTIALLY SUPPORTING
NS/T = NOT SUPPORTING/THREATENED	CBD = CANNOT BE DETERMINED

Table 7. Toxicant exceedances in HUC 1104.

STATION #	STATION NAME	DATE	Selenium (µg/L)
AT157000	CIMARRON RIVER, OFF US 64, MOCANE	01/04/2000	7.00
		05/01/2000	6.00
		06/05/2000	7.00

Table 8. Exceedances of fecal coliform, enterococci, and *E. coli* screening limits in HUC 1104. Only values leading to a determination of not supporting for the Public and Private Water Supply and the Primary Body Contact Recreation beneficial uses are in included.

STATION #	STATION NAME	DATE	Fecal Coliform (cfu/mL)	Enterococci (cfu/mL)	*E. coli* (cfu/mL)
AT157000	CIMARRON RIVER, OFF US 64, MOCANE	06/07/2000		440	
		07/12/2000	3100	6100	489
		08/09/2000	1800	1300	
		09/07/2000	3900	500	
		06/05/2001	800	500	
		07/10/2001	2000	4000	
		08/07/2001	700		
		07/16/2002	600		
		08/13/2002	11000	9000	

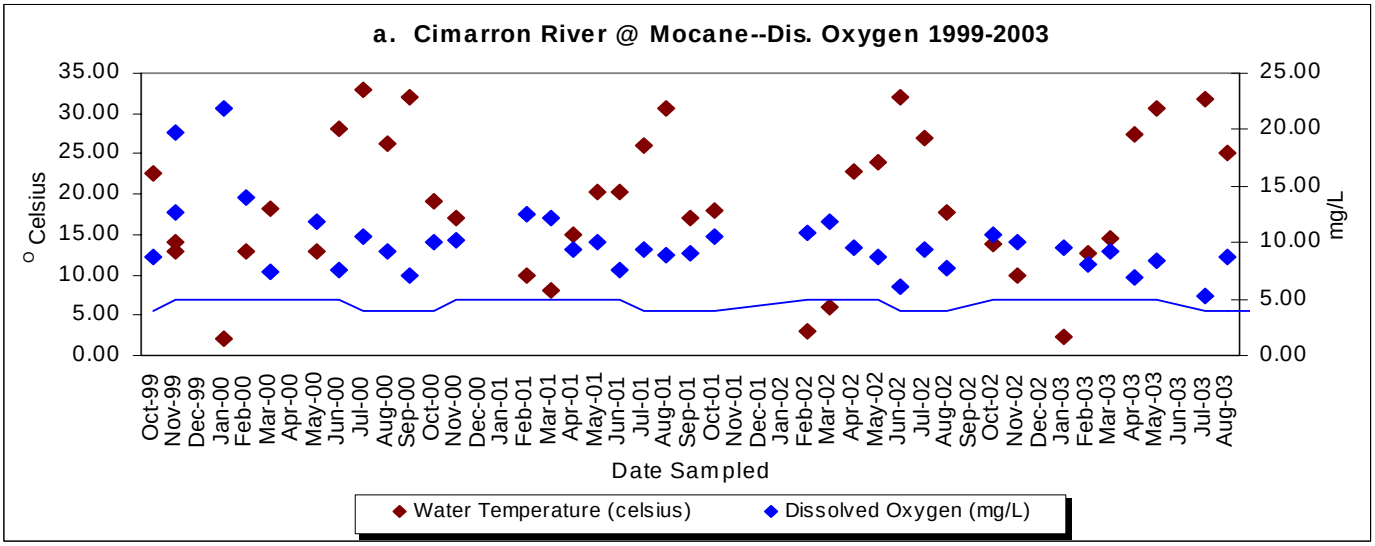
Cimarron River near Mocane

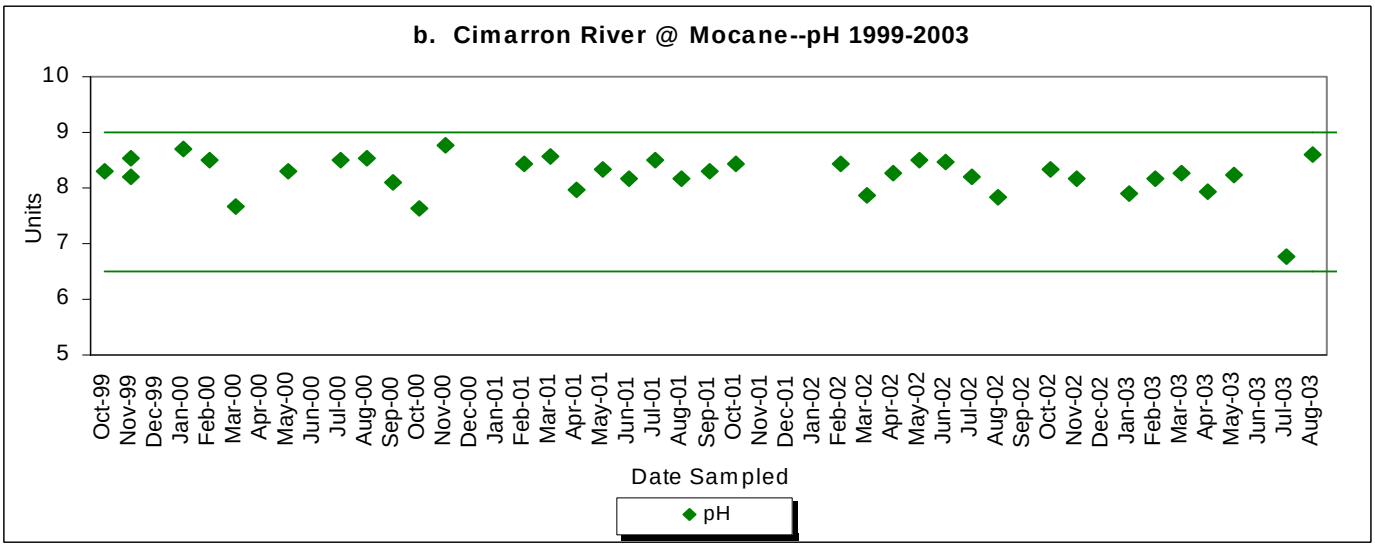
Station AT157000 (620930000010-001AT) is a permanent ambient trend monitoring station located on the Cimarron River in Oklahoma. Situated in the northeastern portion of Beaver County, the site was established northeast of the Town of Mocane off of US Highway 64 on County Road 1510. The station is positioned near the upper end of stream segment 620930000010 and is classified within the Upper Cimarron River – Liberal 8-digit HUC watershed (11040006). Water enters the stream system from Kansas and from several tributaries including Cottonwood Creek, Crooked Creek, and Horse Creek, among others.

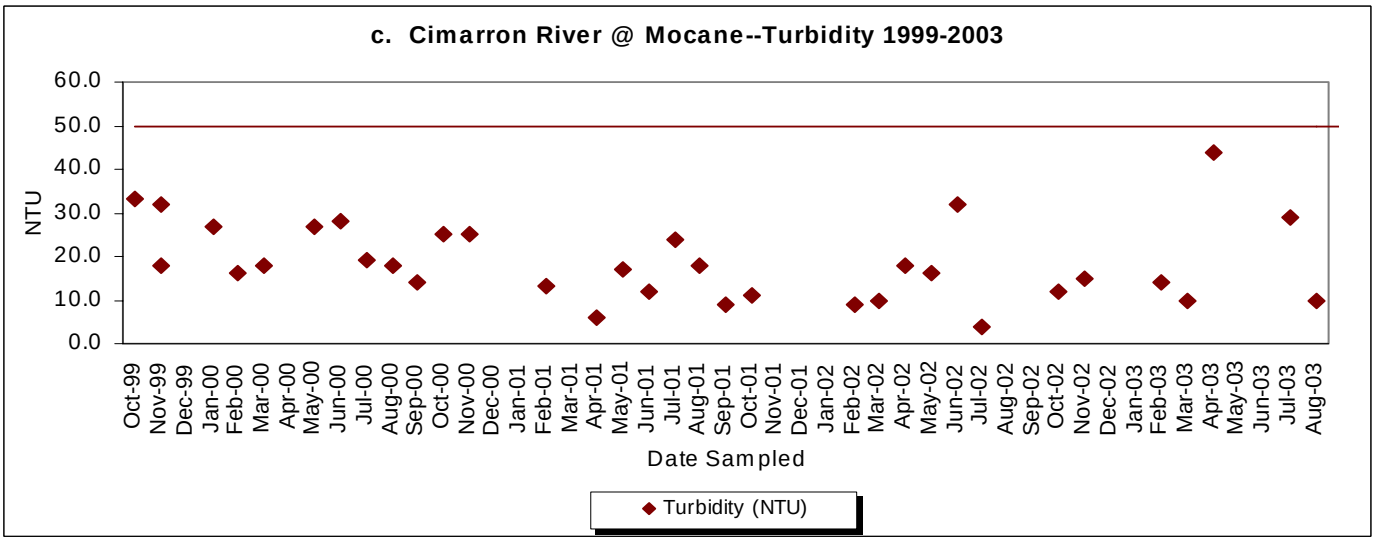
This station on the Cimarron River has been active for all water quality variables since October of 1999. The following assessment of beneficial uses is based on data collected from October of 1999 through October of 2003. For purposes of reporting, this station is representative of the Cimarron River from its entrance into Oklahoma near Mocane, Oklahoma (97.3276, 36.9679) downstream to its exit from Oklahoma near Englewood, Kansas (97.1739, 36.6243). As per Appendix A, Table 6 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR) and 5) Aesthetics.

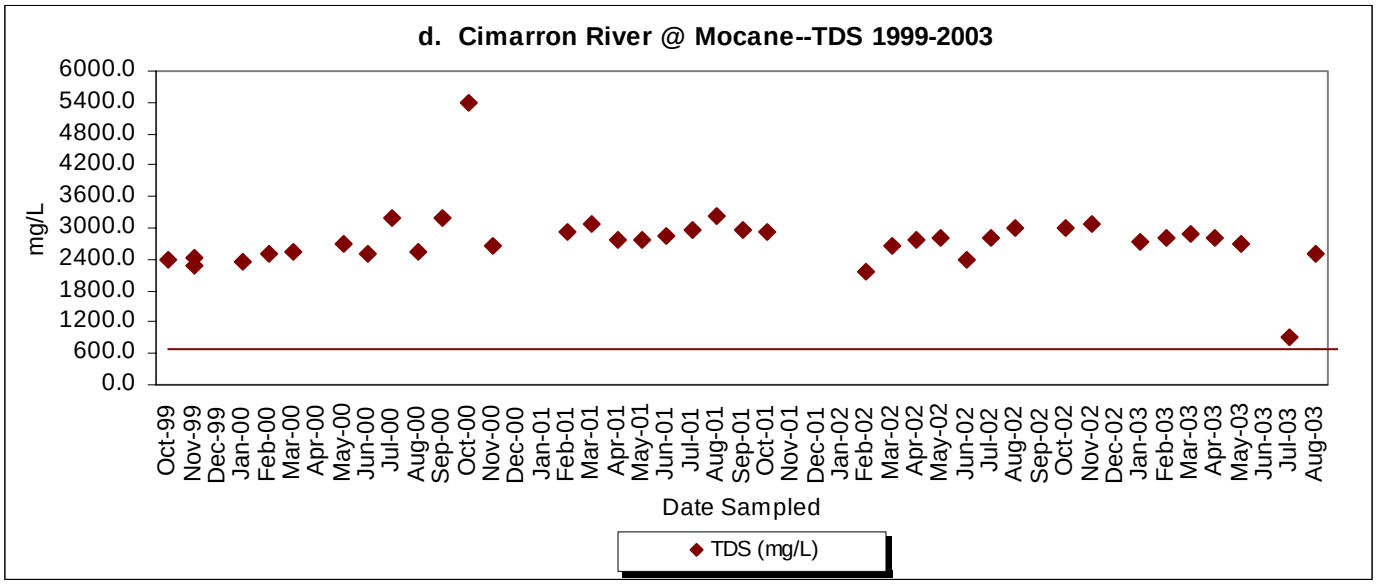
The PPWS beneficial use support is supported. The WWAC beneficial use is not supported. Of the 13 toxicant samples collected, 3 of the selenium concentrations (or 23%) exceeded the prescribed chronic criteria of 5 µg/L (Table 7). Dissolved oxygen (Figure 5a), pH (Figure 80b), and turbidity (Figure 5b) data met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is not supported (Figure 5d and Figure 5e). Of the 40 total dissolved solids concentrations, 40 samples (or 100%) exceeded the prescribed sample standard of 700 mg/L, and the geometric mean (2600.8 mg/L) exceeded the yearly mean standard (700 mg/L). Of the 35 chloride concentrations, 34 samples (or 97%) exceeded the prescribed sample standard of 250 mg/L, and the geometric mean (1031.3 mg/L) exceeded the yearly mean standard (250 mg/L). The PBCR beneficial use is not supported (Table 8). Of the 13 fecal coliform concentrations, 8 samples (or 62%) exceeded the prescribed screening level of 400 cfu/mL. Of the 13 enterococci concentrations, 7 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (270.2 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Cimarron River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 1.0 mg/L and 4.65 mg/L, respectively (Figure 5f).

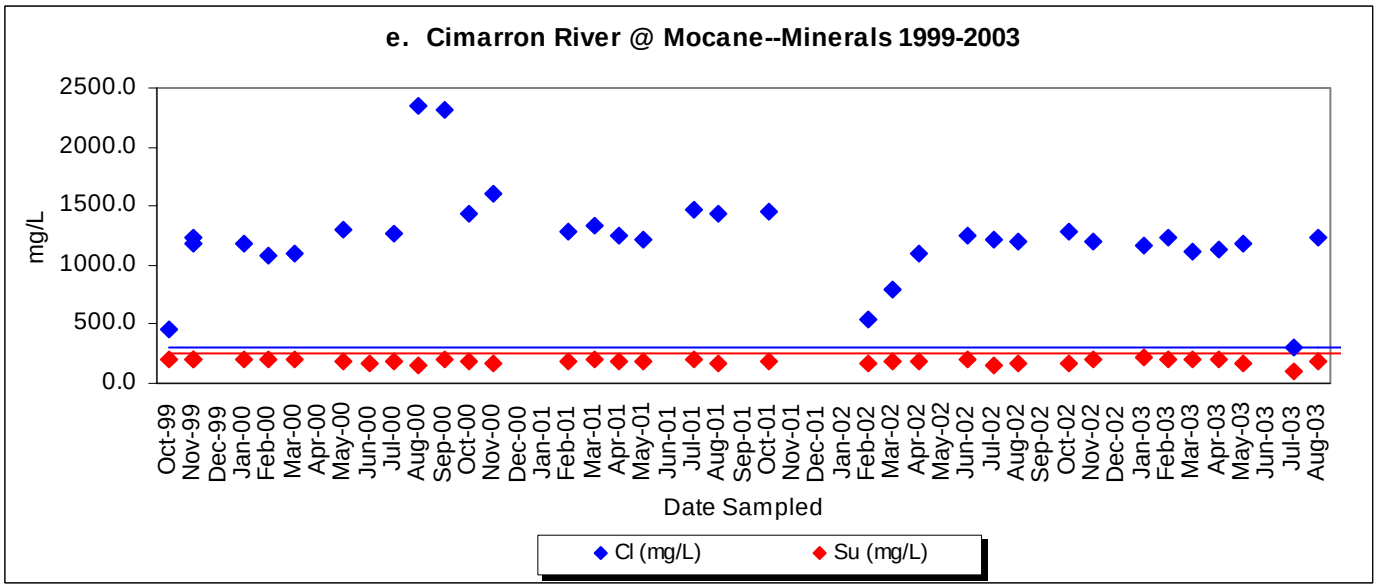
Figure 5a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) for the Cimarron River at Mocane (AT157000), 1999-2003.

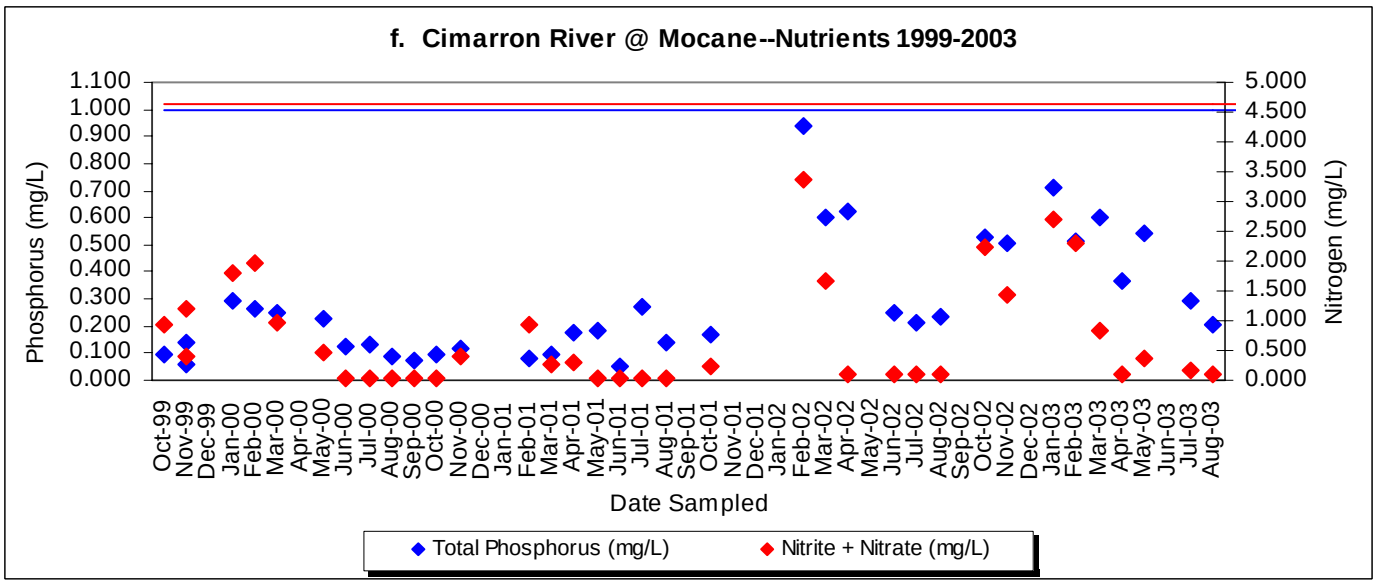







d. Cimarron River @ Mocane--TDS 1999-2003
mg/L
6000.0
5400.0
4800.0
4200.0
3600.0
3000.0
2400.0
1800.0
1200.0
600.0
0.0
Oct-99 Nov-99 Dec-99 Jan-00 Feb-00 Mar-00 Apr-00 May-00 Jun-00 Jul-00 Aug-00 Sep-00 Oct-00 Nov-00 Dec-00 Jan-01 Feb-01 Mar-01 Apr-01 May-01 Jun-01 Jul-01 Aug-01 Sep-01 Oct-01 Nov-01 Dec-01 Jan-02 Feb-02 Mar-02 Apr-02 May-02 Jun-02 Jul-02 Aug-02 Sep-02 Oct-02 Nov-02 Dec-02 Jan-03 Feb-03 Mar-03 Apr-03 May-03 Jun-03 Jul-03 Aug-03
Date Sampled
TDS (mg/L)


e. Cimarron River @ Mocane--Minerals 1999-2003
mg/L
2500.0
2000.0
1500.0
1000.0
500.0
0.0
Oct-99 Nov-99 Dec-99 Jan-00 Feb-00 Mar-00 Apr-00 May-00 Jun-00 Jul-00 Aug-00 Sep-00 Oct-00 Nov-00 Dec-00 Jan-01 Feb-01 Mar-01 Apr-01 May-01 Jun-01 Jul-01 Aug-01 Sep-01 Oct-01 Nov-01 Dec-01 Jan-02 Feb-02 Mar-02 Apr-02 May-02 Jun-02 Jul-02 Aug-02 Sep-02 Oct-02 Nov-02 Dec-02 Jan-03 Feb-03 Mar-03 Apr-03 May-03 Jun-03 Jul-03 Aug-03
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Cimarron River @ Mocane--Nutrients 1999-2003
Phosphorus (mg/L)
1.100
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Nitrogen (mg/L)
5.000
4.500
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
Oct-99 Nov-99 Dec-99 Jan-00 Feb-00 Mar-00 Apr-00 May-00 Jun-00 Jul-00 Aug-00 Sep-00 Oct-00 Nov-00 Dec-00 Jan-01 Feb-01 Mar-01 Apr-01 May-01 Jun-01 Jul-01 Aug-01 Sep-01 Oct-01 Nov-01 Dec-01 Jan-02 Feb-02 Mar-02 Apr-02 May-02 Jun-02 Jul-02 Aug-02 Sep-02 Oct-02 Nov-02 Dec-02 Jan-03 Feb-03 Mar-03 Apr-03 May-03 Jun-03 Jul-03 Aug-03
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

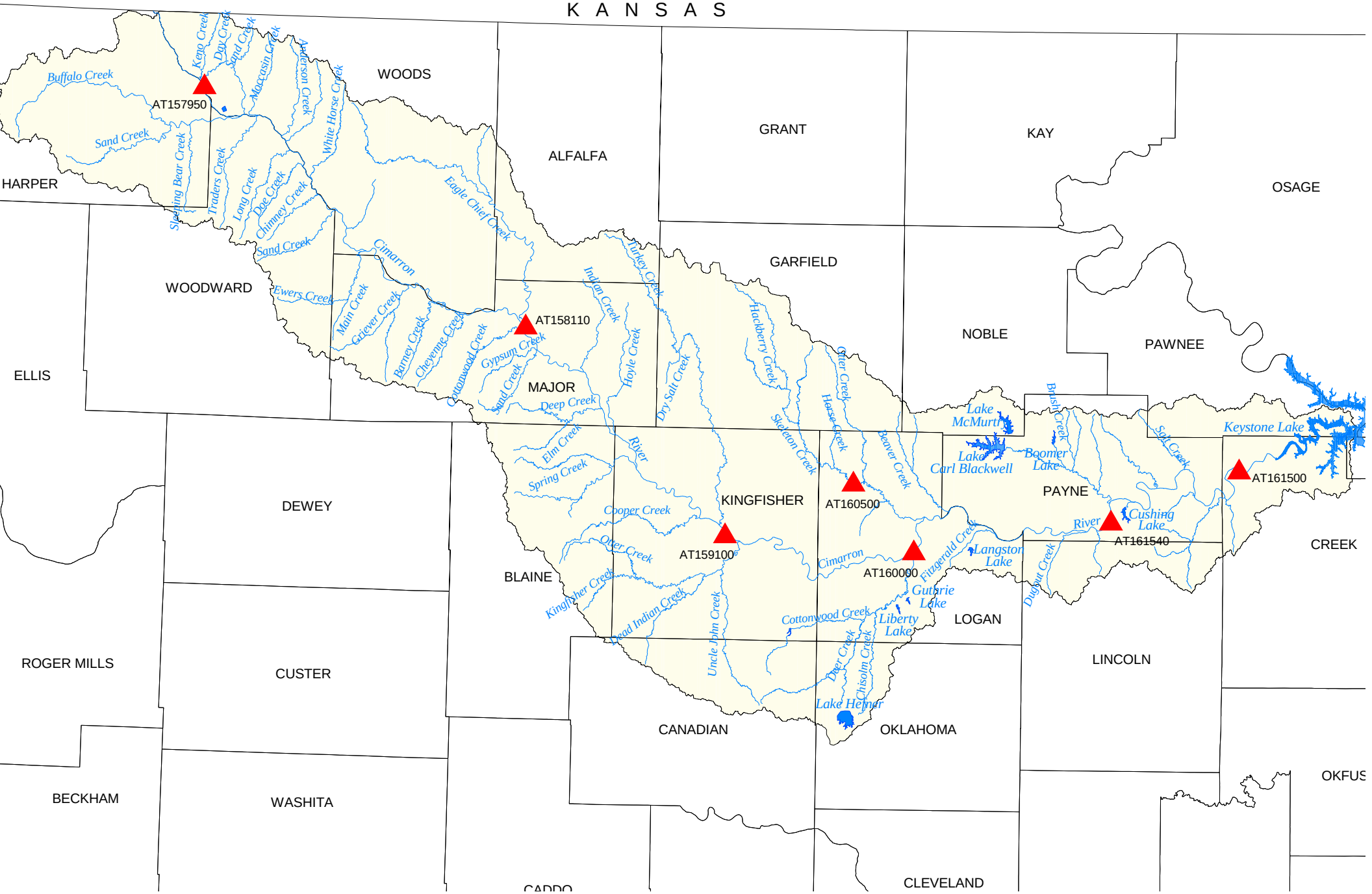


Figure 6. Lower Cimarron Sub-basin (HUC 1105).

HUC 1105

LOWER CIMARRON SUB-BASIN

The Lower Cimarron sub-basin (4-digit hydrologic unit 1105) is situated in the near northwest and north central portions of the state. It originates in the eastern portion of Harper County, continues eastward through portions of Woodward, Woods, Alfalfa, Major, Garfield, Blaine, Kingfisher, Logan, Noble, Payne, Lincoln, and Pawnee Counties and terminates in the northern part of Creek County. Major cities and county seats located within the sub-basin include Enid, Kingfisher, Guthrie, Stillwater, and north Edmond. Minor cities of note include Buffalo, Fairview, Hennessey, Langston, Cushing, and Drumright.

The sub-basin is subdivided into three 8-digit hydrologic units (HUC) within the state. These HUC's are the Lower Cimarron – Eagle Chief (11050001), the Lower Cimarron – Skeleton (11050002), and the Lower Cimarron (11050003). The major surface water in the sub-basin is the lower Cimarron River. Major tributaries include Buffalo Creek, Eagle Chief Creek, Turkey Creek, Kingfisher Creek, Cottonwood Creek, Skeleton Creek, and Stillwater Creek. Three major lakes are located in the sub-basin—Lake Carl Blackwell formed by Stillwater Creek, Lake McMurtry formed by a tributary of Stillwater Creek, and the Cimarron River Arm of Lake Keystone. Seven permanent water quality-monitoring stations (Table 9) are located in the sub-basin—AT157950, AT158110, AT159100, AT160500, AT160000, AT161450, and AT161500.

The sub-basin is characterized by three ecoregions. The Central Great Plains is the primary ecoregion beginning in the far eastern portion and continuing through the central part of the sub-basin. The Central Oklahoma/Texas Plains represent the eastern quarter (¼) of the sub-basin. The Southwestern Tablelands typify portions of Woodward and Woods Counties. The primary land usage in the sub-basin is rangeland (open grasslands). It dominates the southern portion of the sub-basin from the far western portions through Kingfisher County and is further interspersed throughout the northern portion and in parts of Payne, Creek, and Noble Counties to the east. The secondary land use is cropland, which dominates the north central portion of the sub-basin and is further interspersed in areas to the western, central, and eastern portions. The tertiary land use is pastureland (brushy or mixed) that covers much of Creek Logan, Lincoln and Payne Counties and is further interspersed throughout each of the remaining counties in the sub-basin. Other land uses of note are forestland, rangeland, farmsteads, major urban areas, wetlands, and bare sand channels.

Table 9. Permanent Ambient Trend Monitoring Stations Located in HUC 1105.

WBID #	STATION #	STATION NAME	STATUS	FS	PS	NS/T	CBD
620920030010	AT157950	CIMARRON RIVER, SH 34, BUFFALO	ACTIVE 11/98-P	FWP, AES	AG	PBCR	NONE
620910020010	AT159100	CIMARRON RIVER, US 81, DOVER	ACTIVE 11/98-P	AG, AES	NONE	FWP, PBCR	NONE
620920010010	AT160000	CIMARRON RIVER, US 77, GUTHRIE	ACTIVE 11/98-P	AG, AES	FWP	PBCR	NONE
620900010170	AT161500	CIMARRON RIVER, SH 99, OILTON	ACTIVE 11/98-P	AG, AES	NONE	FWP, PBCR	NONE
620920010010	AT158110	CIMARRON RIVER, US 412, ORIENTA	ACTIVE 11/98-P	AES	AG	FWP, PBCR	NONE
620900030010	AT161450	CIMARRON RIVER, SH 33, RIPLEY	ACTIVE 10/00-P	AG, AES	NONE	FWP, PBCR	NONE
620910030010	AT160500	SKELETON CREEK, SH 74, LOVELL	ACTIVE 11/98-P	PPWS, AG, AES	NONE	FWP, PBCR	NONE

ASSIGNED OWQS BENEFICIAL USES AND SUPPORT CODES

PPWS = PUBLIC AND PRIVATE WATER SUPPLY	EWS = EMERGENCY WATER SUPPLY
FWP = FISH & WILDLIFE PROPAGATION	PBCR = PRIMARY BODY CONTACT RECREATION
AG = AGRICULTURE	AES = AESTHETICS
FS = FULLY SUPPORTING	PS = PARTIALLY SUPPORTING
NS/T = NOT SUPPORTING/THREATENED	CBD = CANNOT BE DETERMINED

Table 10. Toxicant exceedances in HUC 1105.

STATION #	STATION NAME	DATE	Selenium (µg/L)
AT159100	CIMARRON RIVER, US 81, DOVER	12/13/1999	11.00
		05/15/2000	13.00

Table 11. Exceedances of fecal coliform, enterococci, and *E. coli* screening limits in HUC 1105. Only values leading to a determination of not supporting for the Public and Private Water Supply and the Primary Body Contact Recreation beneficial uses are in included.

STATION #	STATION NAME	DATE	Fecal Coliform (cfu/mL)	Enterococci (cfu/mL)	*E. coli* (cfu/mL)
AT157950	CIMARRON RIVER, SH 34, BUFFALO	06/14/1999			435
		08/23/1999	560		669
		09/07/1999	970	480	4880
		05/17/2000		620	
		08/23/2000			2187
		09/15/2000	970	480	4880
		05/08/2001	1500		
		06/05/2001	6000	11000	617
		07/10/2001			426
		08/07/2001			24199
		09/25/2001			2143

STATION #	STATION NAME	DATE	Fecal Coliform (cfu/mL)	Enterococci (cfu/mL)	*E. coli* (cfu/mL)
		05/14/2002	1800	2000	
		06/11/2002		700	4611
		07/16/2002	500	1500	6131
		08/13/2002	1000	800	4884
		09/17/2002	7000		3873
AT161500	CIMARRON RIVER, SH 99, OILTON	09/08/1999	670		
		06/21/2000	19000		
		07/26/2000	530		
		05/07/2001	4000		
		06/04/2001	600		
		05/22/2002	4000		
		08/26/2002	600		
		09/23/2002	27000		
AT160000	CIMARRON RIVER, US 77, GUTHRIE	06/07/1999	430		
		06/20/2000	630	1000	
		07/26/2000	1500		
		05/08/2001		6000	
		06/05/2001		9000	
		07/11/2001		3000	
		09/24/2001	1000	11000	
		06/05/2002	1800	1700	
		08/27/2002	2000		
		09/24/2002	4000	2000	
		09/30/2003	1300		
AT159100	CIMARRON RIVER, US 81, DOVER	06/07/1999			435
		08/02/1999	560		669
		09/07/1999	970	480	4880
		07/26/2000	1600	900	
		05/08/2001		5000	
		06/05/2001		1200	
		08/07/2001		1600	
		09/24/2001	500	1000	
		08/27/2002	11000	7000	
		09/24/2002		500	
		06/11/2003	18000	87000	9208
		07/01/2003			703
		08/12/2003		1100	
		09/09/2003			1989
		09/30/2003	4200	600	
AT158110	CIMARRON RIVER, US 412, ORIENTA	06/07/1999		680	419
		08/02/1999			556
		05/08/2001		500	

STATION #	STATION NAME	DATE	Fecal Coliform (cfu/mL)	Enterococci (cfu/mL)	*E. coli* (cfu/mL)
		06/05/2001		630	
		08/07/2001		900	
		09/24/2001			408
		06/05/2002		2500	933
		07/10/2002			512
		08/27/2002		4000	475
		06/10/2003			1112
		09/09/2003		600	
		09/16/2003		900	
AT161450	CIMARRON RIVER, SH 33, RIPLEY	05/07/2001		1000	
		06/04/2001		3000	
		08/26/2002		600	
		09/23/2002		3000	
		06/09/2003		4000	
AT160500	SKELETON CREEK, SH 74, LOVELL	06/07/1999		470	
		08/02/1999			
		09/07/1999		1100	
		06/21/2000	410	122000	
		07/26/2000	1600	1400	
		05/08/2001		800	
		06/05/2001	600	5000	
		07/10/2001			
		08/07/2001		27000	
		09/24/2001	900	7000	
		06/05/2002	3000	41000	
		09/25/2002	700	2000	

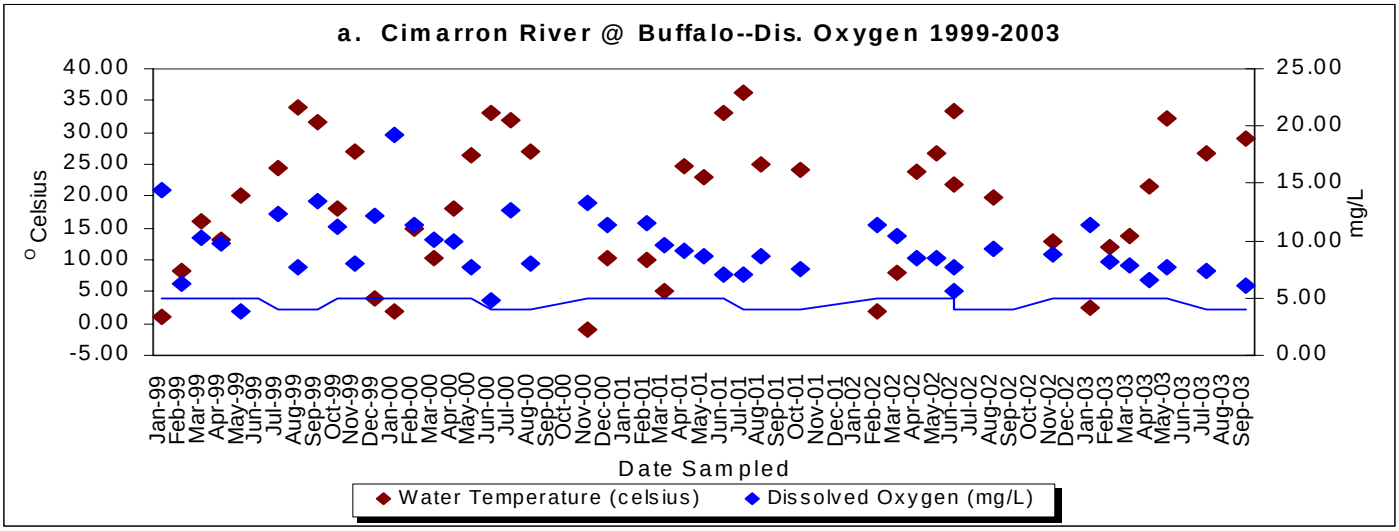
Cimarron River Near Buffalo

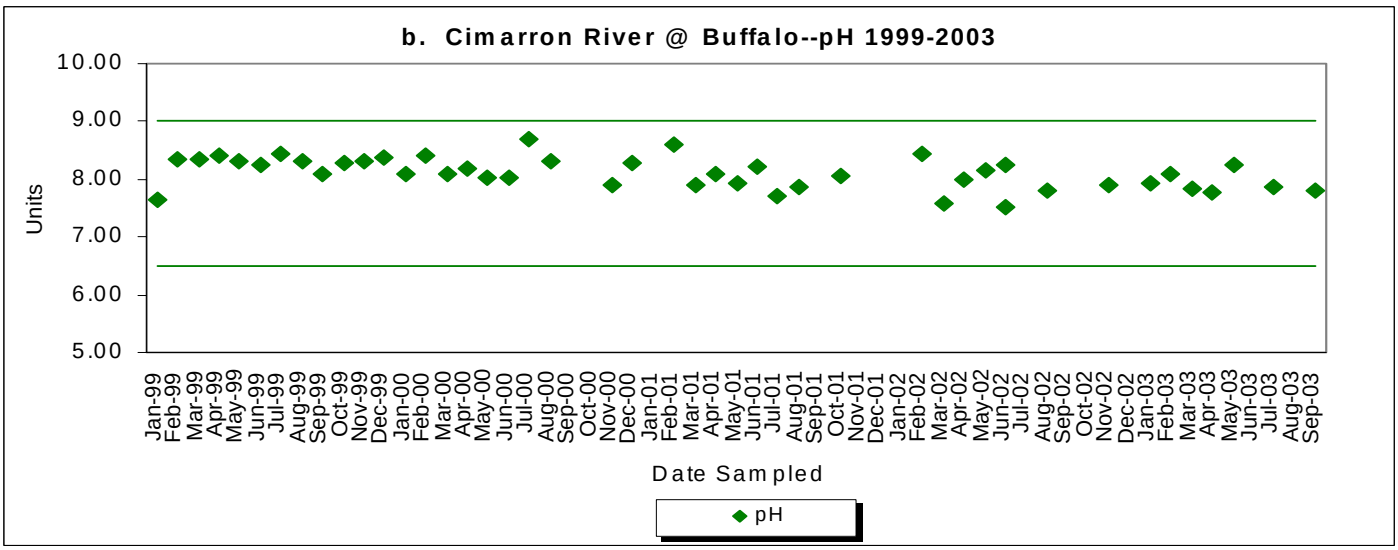
Station AT157950 (620920030010-001AT) is a permanent ambient trend monitoring station located on the Cimarron River in Oklahoma. Situated in the northwestern portion of Woods County, the site was established east of the Town of Buffalo on State Highway 34. The station is positioned near the midpoint of stream segment 620920030010 and is classified within the Lower Cimarron River - Eagle Chief Creek 8-digit HUC watershed (11050001). Water enters the stream system from Kansas and from several tributaries including Keno Creek, Day Creek, Buffalo Creek, and Sand Creek, among others.

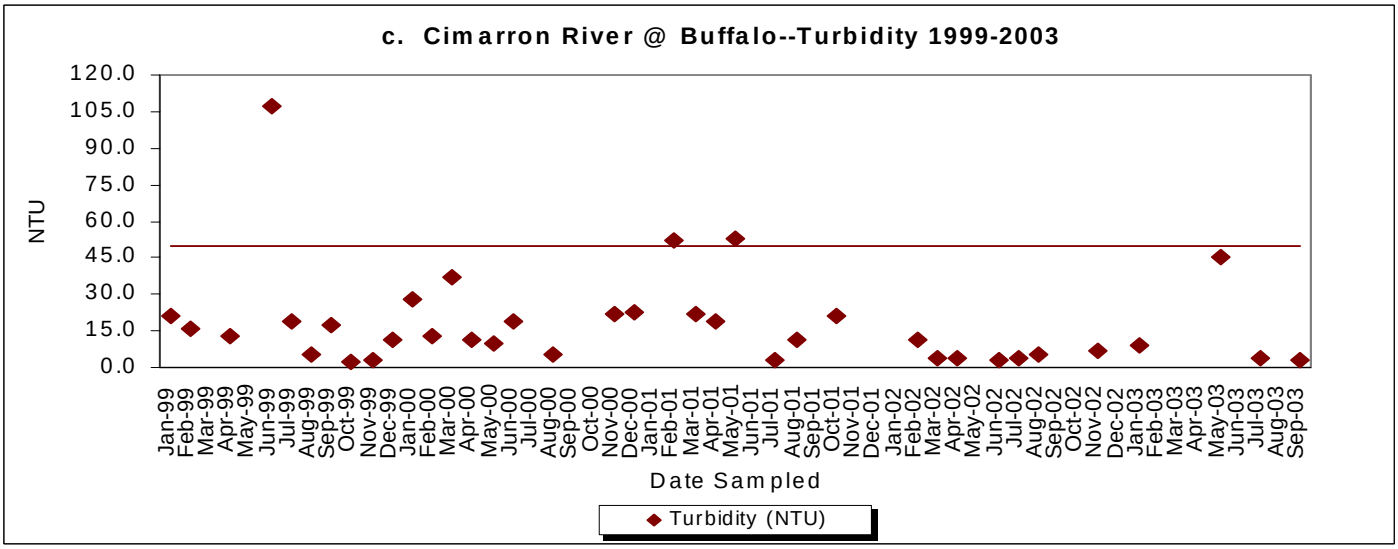
This station on the Cimarron River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from January 1999 through September of 2003. For purposes of reporting, this station is representative of the Cimarron River from entrance into Oklahoma near Buffalo, Oklahoma (99.4562, 36.9996 downstream to confluence of the Cimarron River with Buffalo Creek (99.2166, 36.7869). As per Appendix A, Table 6 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Emergency Water Supply (EWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class III Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

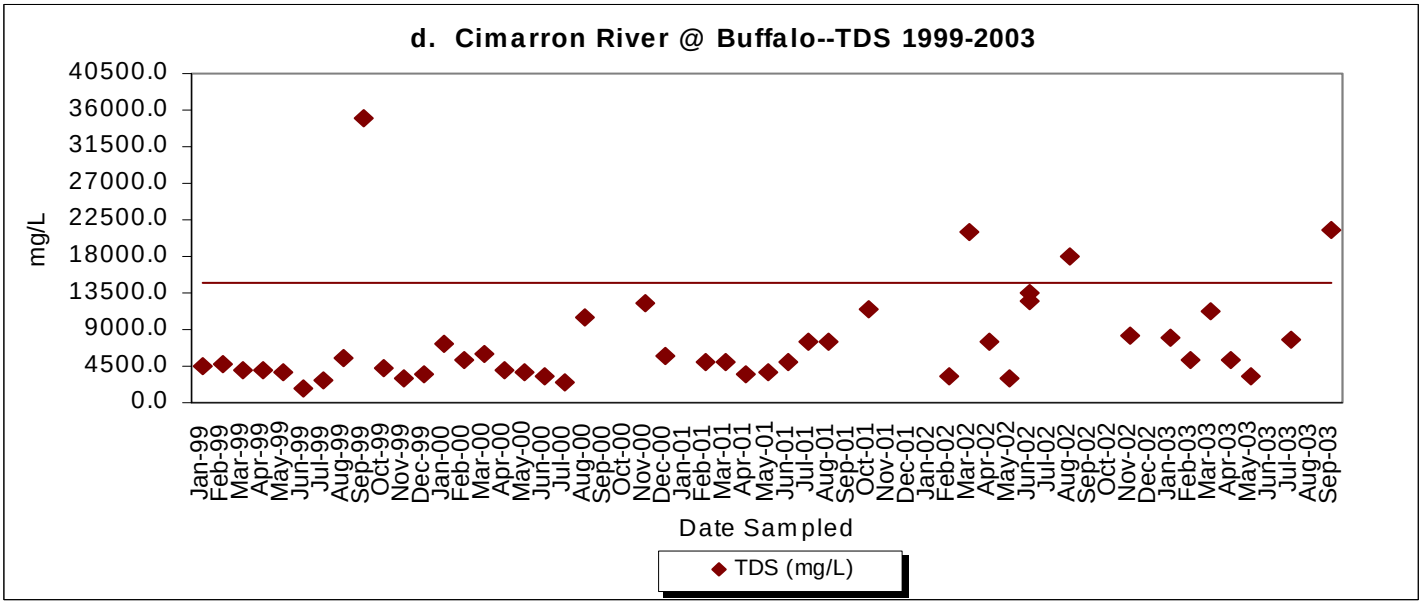
The WWAC beneficial use is supported. Dissolved oxygen (Figure 7a), pH (Figure 7b), turbidity (Figure 7c), and toxicant samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is partially supported (Figure 7d and Figure 7e). Of the 45 chloride concentrations, 10 samples (or 22%) exceeded the sample standard of 5131.0 mg/L. Total dissolved solid and sulfate concentrations met the prescribed segment-specific criteria. The PBCR beneficial use is not supported (Table 11). Of the 20 fecal coliform concentrations, 9 samples (or 45%) exceeded the prescribed screening level of 400 cfu/mL, and the geometric mean (310.3 cfu/mL) exceeded the prescribed mean standard of 400 cfu/mL. Of the 20 enterococci concentrations, 8 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (221.1 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. Of the 20 *E. coli* concentrations, 13 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (970.0 cfu/mL) exceeded the prescribed mean standard of 126 cfu/mL. This segment of the Cimarron River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 1.0 mg/L and 4.65 mg/L, respectively (Figure 7f).

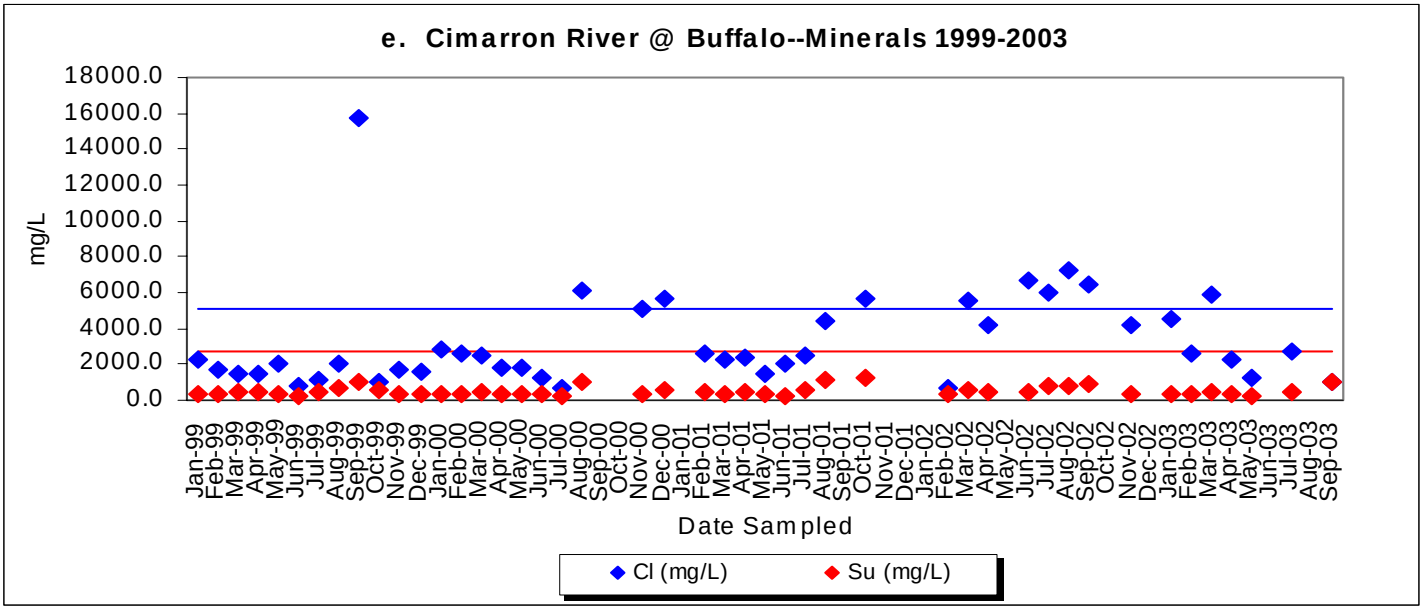
Figure 7a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) for the Cimarron River at Buffalo (AT157950), 1999-2003.

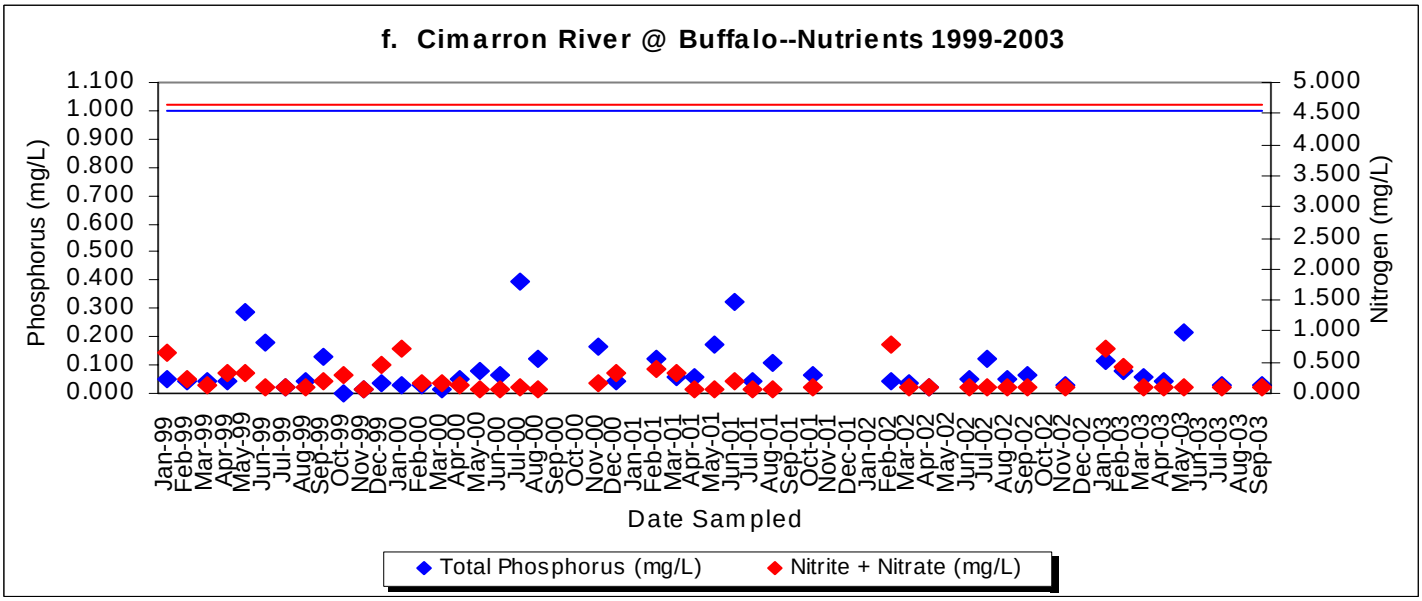







d. Cimarron River @ Buffalo--TDS 1999-2003
mg/L
Date Sampled
TDS (mg/L)


e. Cimarron River @ Buffalo--Minerals 1999-2003
mg/L
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Cimarron River @ Buffalo--Nutrients 1999-2003
Phosphorus (mg/L)
Nitrogen (mg/L)
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

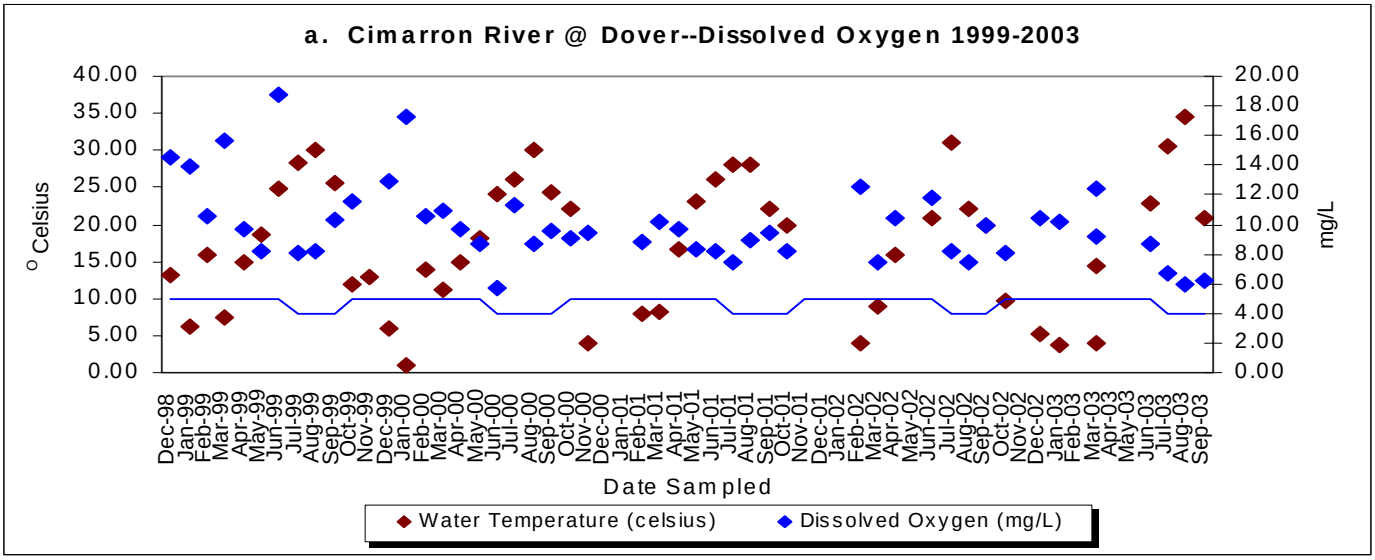
Cimarron River near Dover

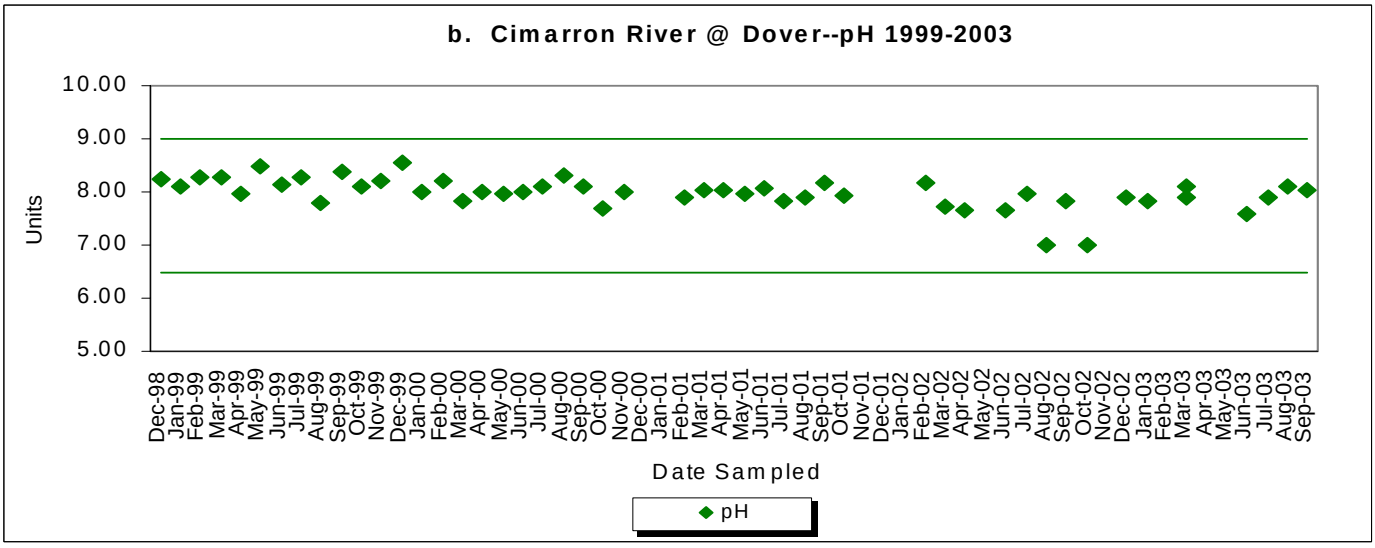
Station AT159100 (620910020010-001AT) is a permanent ambient trend monitoring station located on the Cimarron River in Oklahoma. Situated in the central portion of Kingfisher County, the site was established south of the Town of Dover on US Highway 81. The station is positioned near the midpoint of stream segment 620910020010 and is classified within the Lower Cimarron River - Skeleton Creek 8-digit HUC watershed (11050002). Water enters the stream system from and from several tributaries including Indian Creek, Deep Creek, Hoyle Creek, Salt Creek, Cooper Creek, Turkey Creek, and Kingfisher Creek, among others.

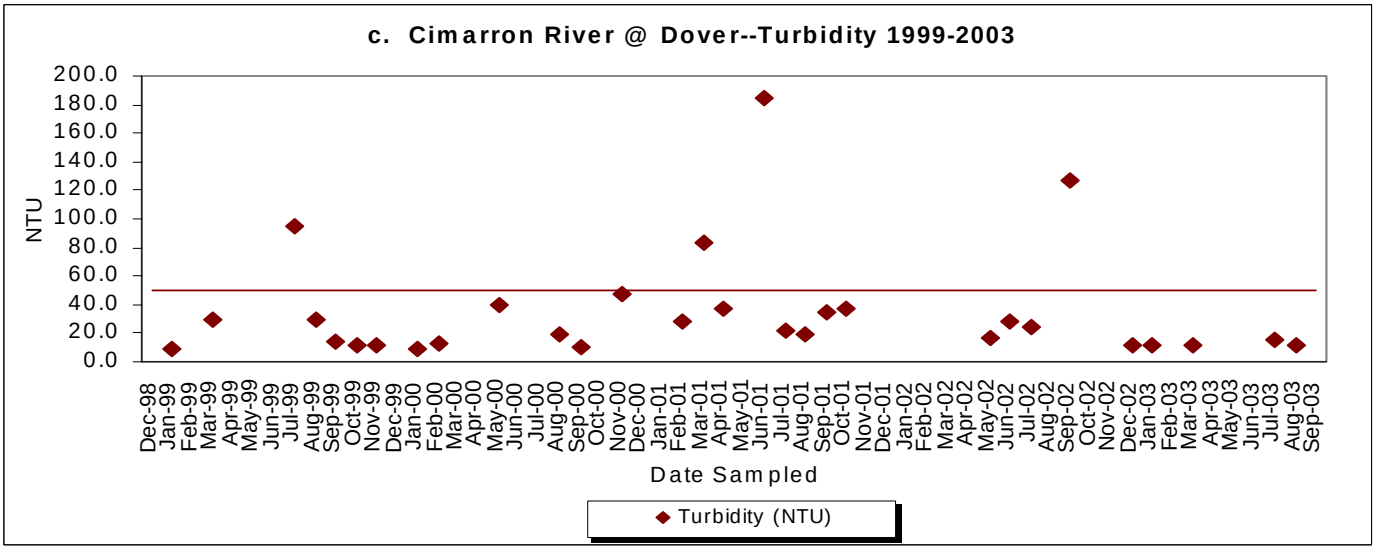
This station on the Cimarron River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through September of 2003. For purposes of reporting, this station is representative of the Cimarron River from the confluence of Indian Creek (98.2968, 36.2762) downstream to confluence of the Cimarron River with Kingfisher Creek (97.8787, 35.9308). As per Appendix A, Table 6 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Emergency Water Supply (EWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class III Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

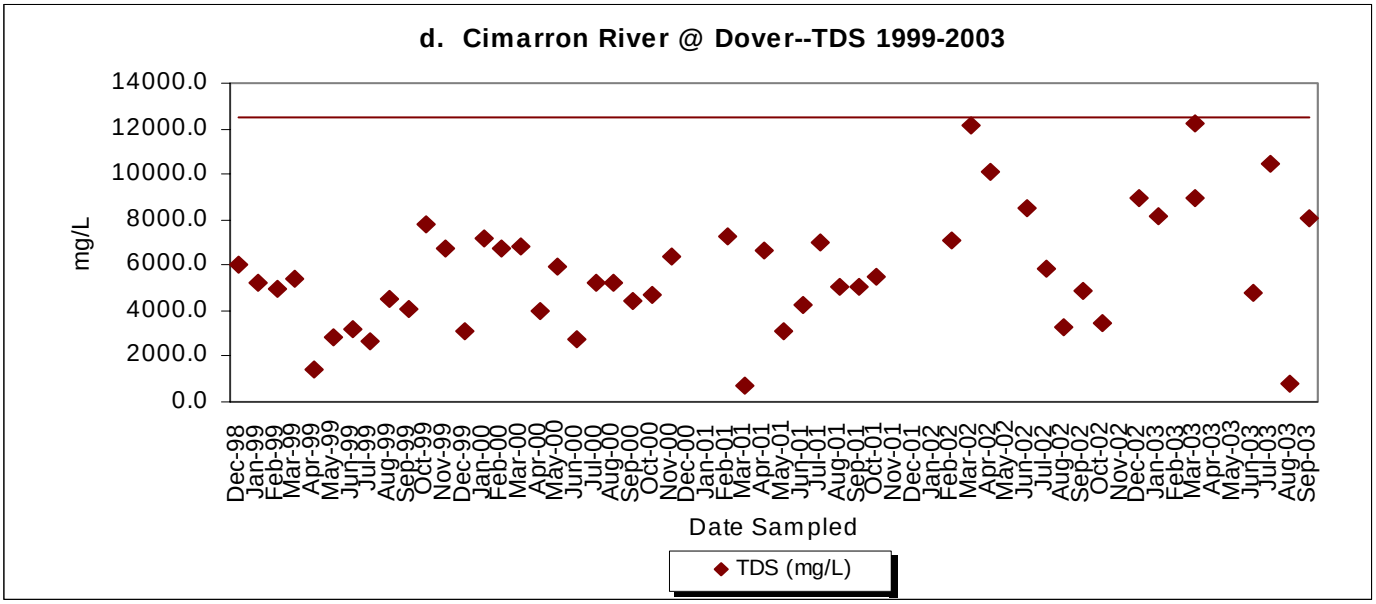
The WWAC beneficial use is not supported. Of the 14 toxicant samples collected, 2 of the selenium concentrations (or 14%) exceeded the prescribed chronic criteria of 5 µg/L (Table 10). Dissolved oxygen (Figure 8a), pH (Figure 8b), and turbidity (Figure 8c) samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 8d and Figure 8e). The PBCR beneficial use is not supported (Table 11). Of the 27 fecal coliform concentrations, 7 samples (or 26%) exceeded the prescribed screening level of 400 cfu/mL. Of the 28 *E. coli* concentrations, 7 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (338.6 cfu/mL) exceeded the prescribed mean standard of 126 cfu/mL. Of the 28 enterococci concentrations, 11 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (178.6 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Cimarron River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 1.0 mg/L and 4.65 mg/L, respectively (Figure 8f).

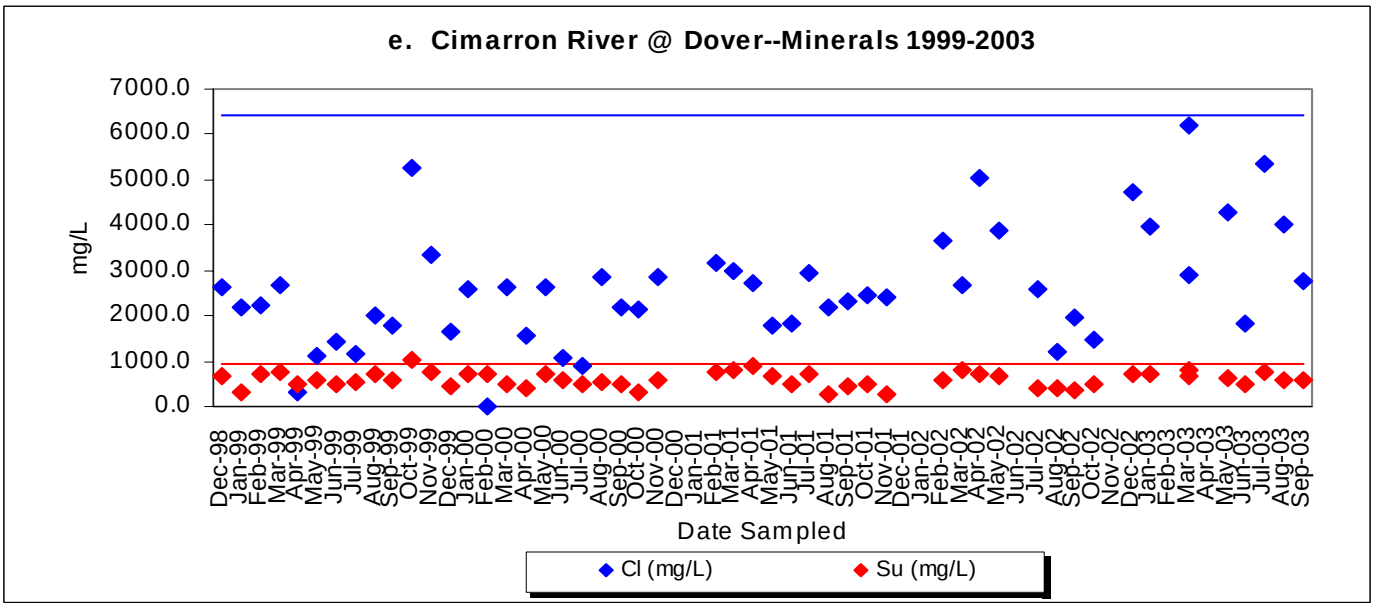
Figure 8a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) for the Cimarron River at Dover (AT159100), 1999-2003.

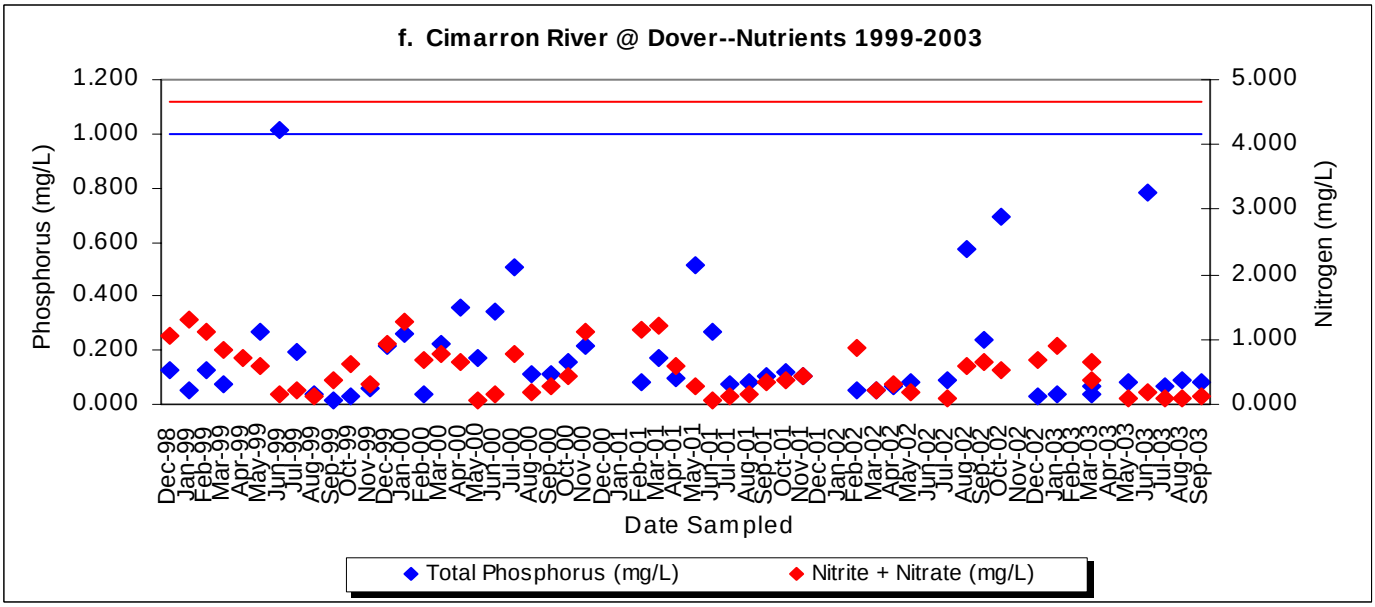







d. Cimarron River @ Dover--TDS 1999-2003
mg/L
Date Sampled
TDS (mg/L)


e. Cimarron River @ Dover--Minerals 1999-2003
mg/L
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Cimarron River @ Dover--Nutrients 1999-2003
Phosphorus (mg/L)
Nitrogen (mg/L)
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

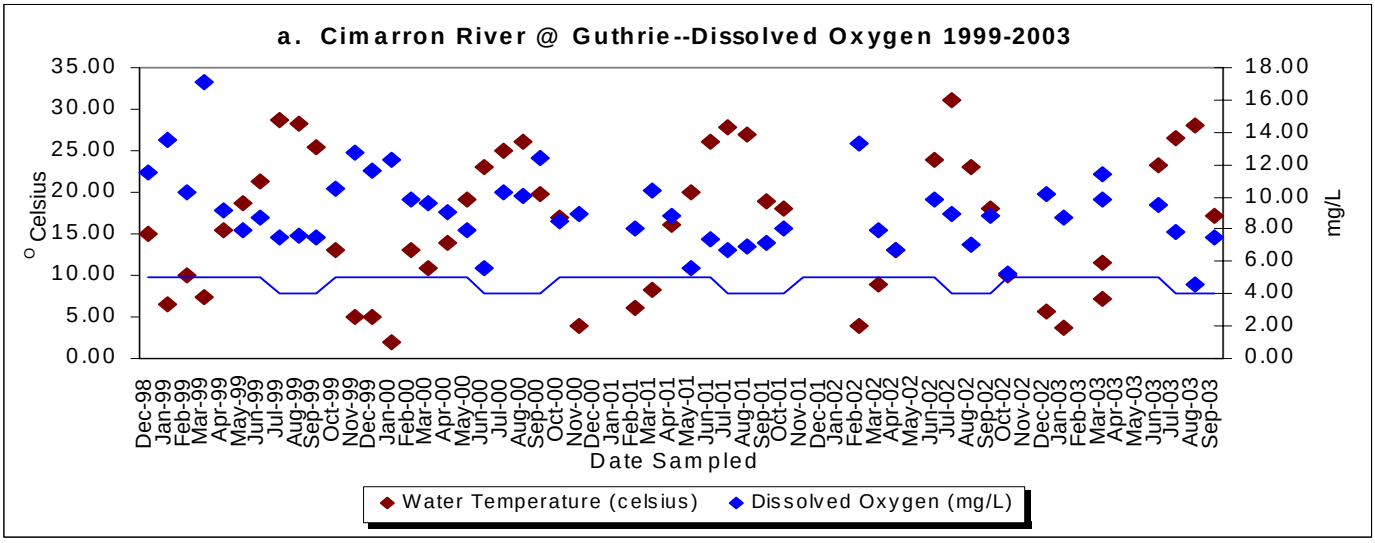
Cimarron River near Guthrie

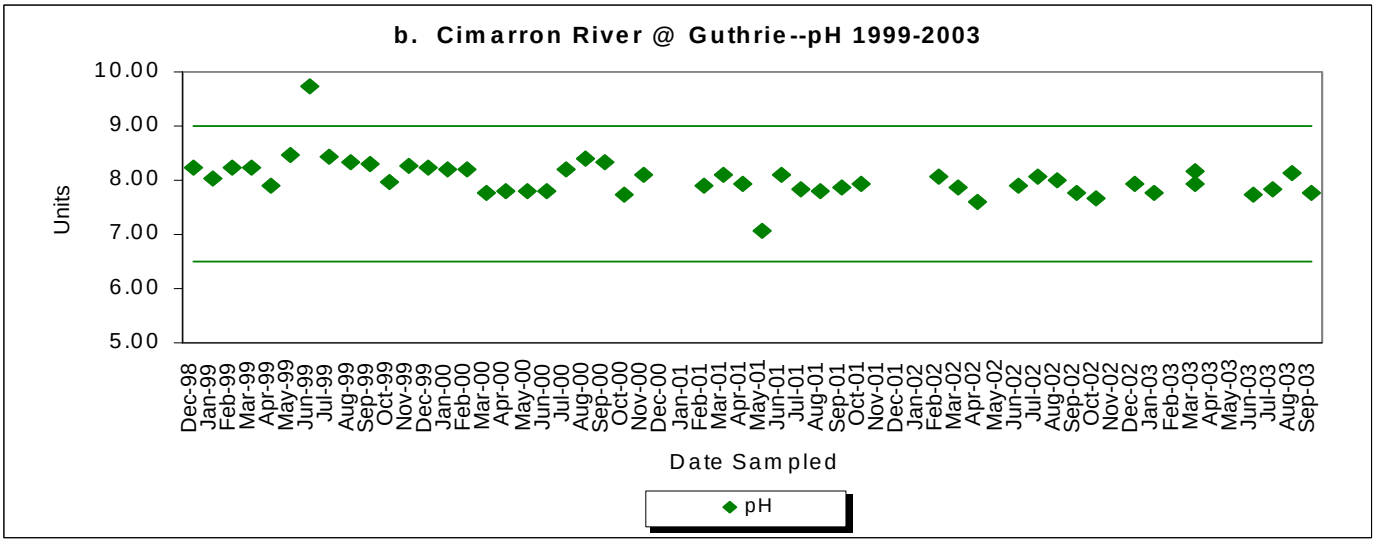
Station AT160000 (620910010010-001AT) is a permanent ambient trend monitoring station located on the Cimarron River in Oklahoma. Situated in the central portion of Logan County, the site was established north of the City of Guthrie on US Highway 77. The station is positioned near the upper end of stream segment 620910010010 and is classified within the Lower Cimarron River - Skeleton Creek 8-digit HUC watershed (11050002). Water enters the stream system from several tributaries including Kingfisher Creek, Cottonwood Creek, and Skeleton Creek, among others.

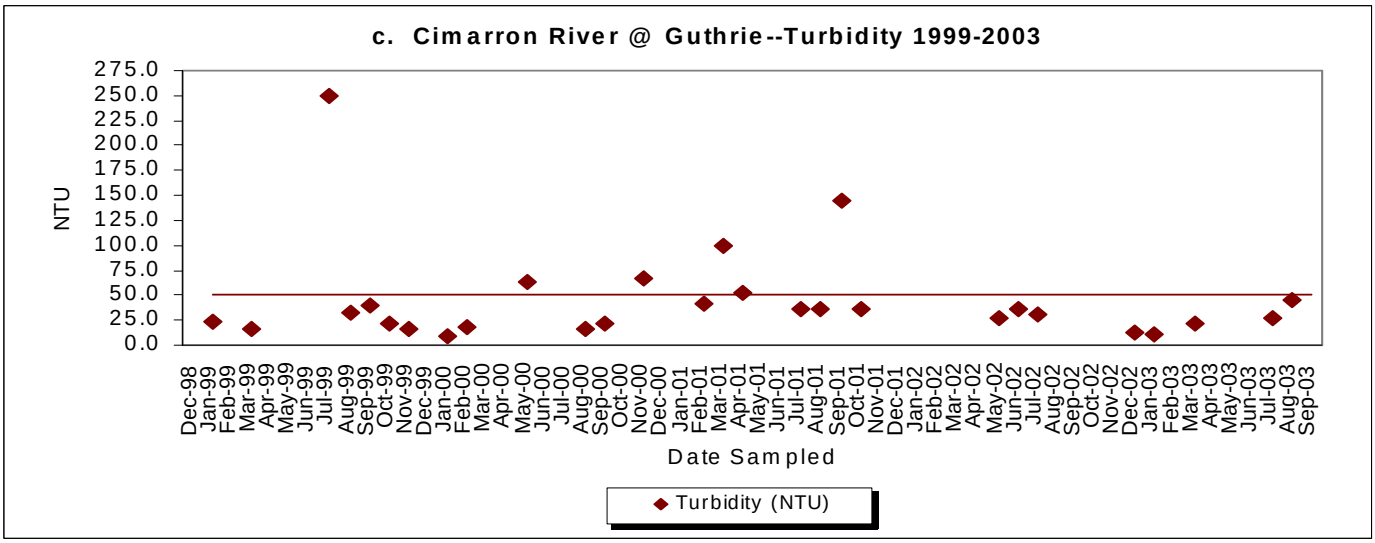
This station on the Cimarron River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through September of 2003. For purposes of reporting, this station is representative of the Cimarron River from the confluence of Kingfisher Creek (97.8787, 35.9308) downstream to confluence of the Cimarron River with Skeleton Creek (97.3975, 35.9875). As per Appendix A, Table 6 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Emergency Water Supply (EWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class III Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

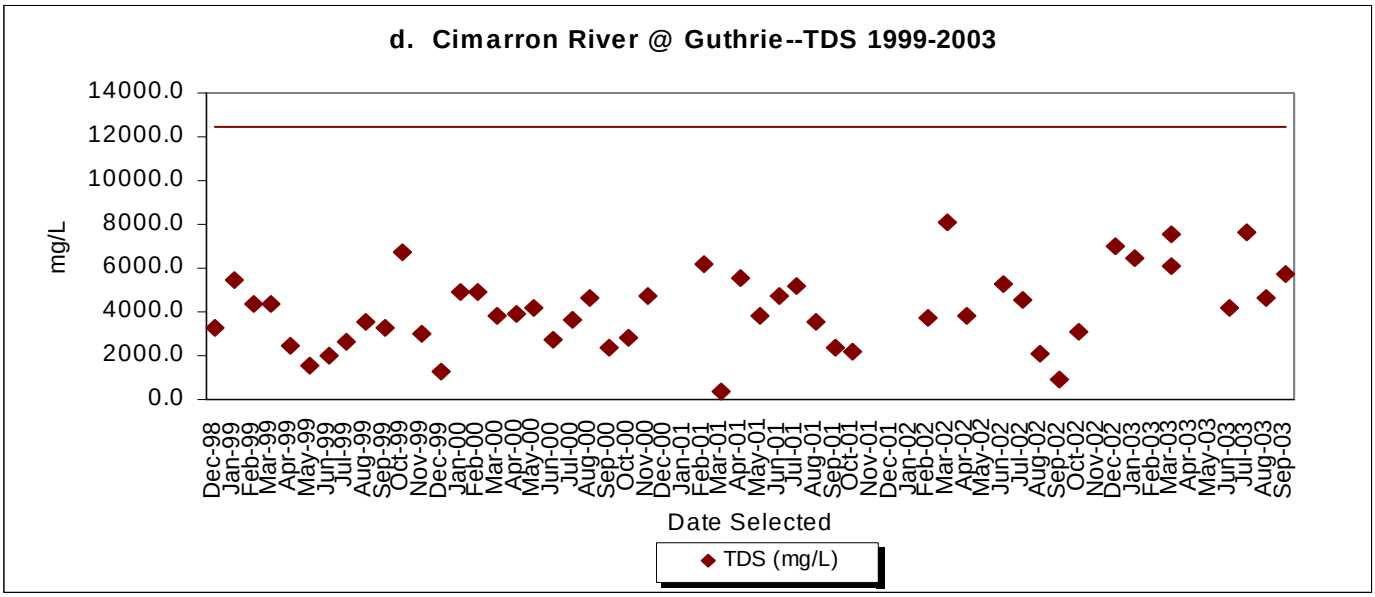
The WWAC beneficial use is partially supported. Of the 29 turbidity samples (Figure 9c), 6 samples (or 21%) exceeded the numerical criteria of 50. Dissolved oxygen (Figure 9a), pH (Figure 9b), and toxicant samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 9d and Figure 9e). The PBCR beneficial use is not supported (Table 11). Of the 26 fecal coliform concentrations, 8 samples (or 31%) exceeded the prescribed screening level of 400 cfu/mL. Of the 27 enterococci concentrations, 7 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (55.1 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Cimarron River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 1.0 mg/L and 4.65 mg/L, respectively (Figure 9f).

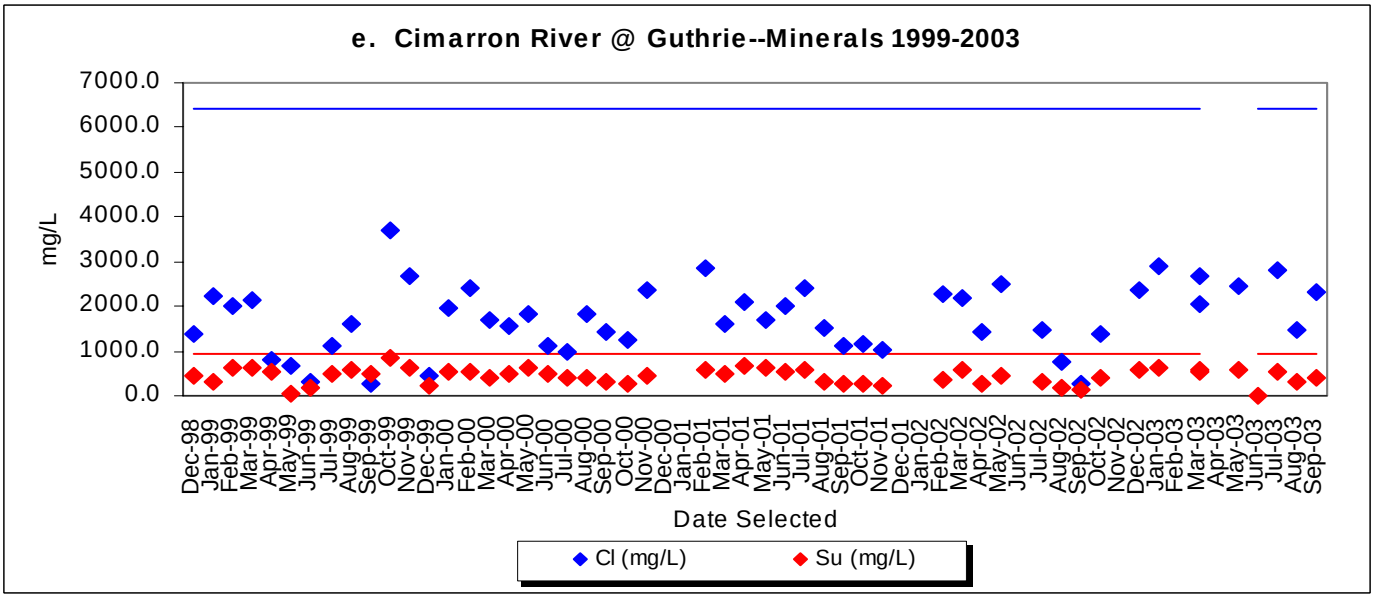
Figure 9a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) for the Cimarron River at Guthrie (AT160000), 1999-2003.

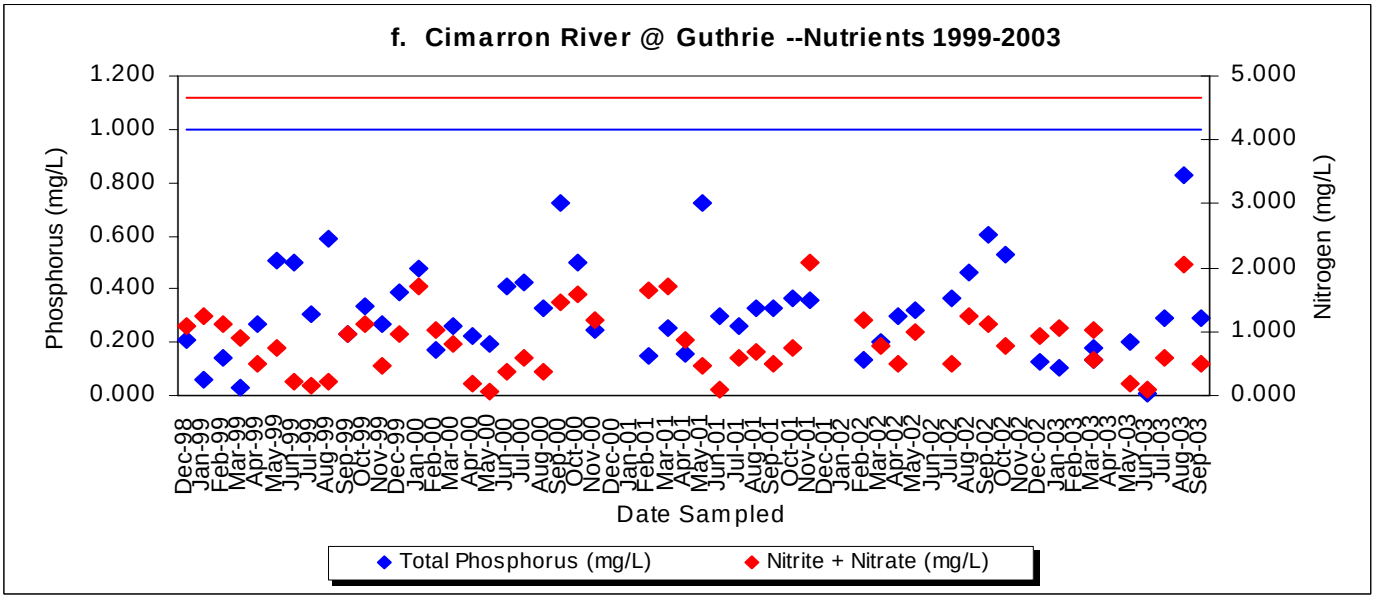







d. Cimarron River @ Guthrie--TDS 1999-2003
mg/L
Date Selected
TDS (mg/L)


e. Cimarron River @ Guthrie--Minerals 1999-2003
mg/L
Date Selected
Cl (mg/L)
Su (mg/L)


f. Cimarron River @ Guthrie --Nutrients 1999-2003
Phosphorus (mg/L)
Nitrogen (mg/L)
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

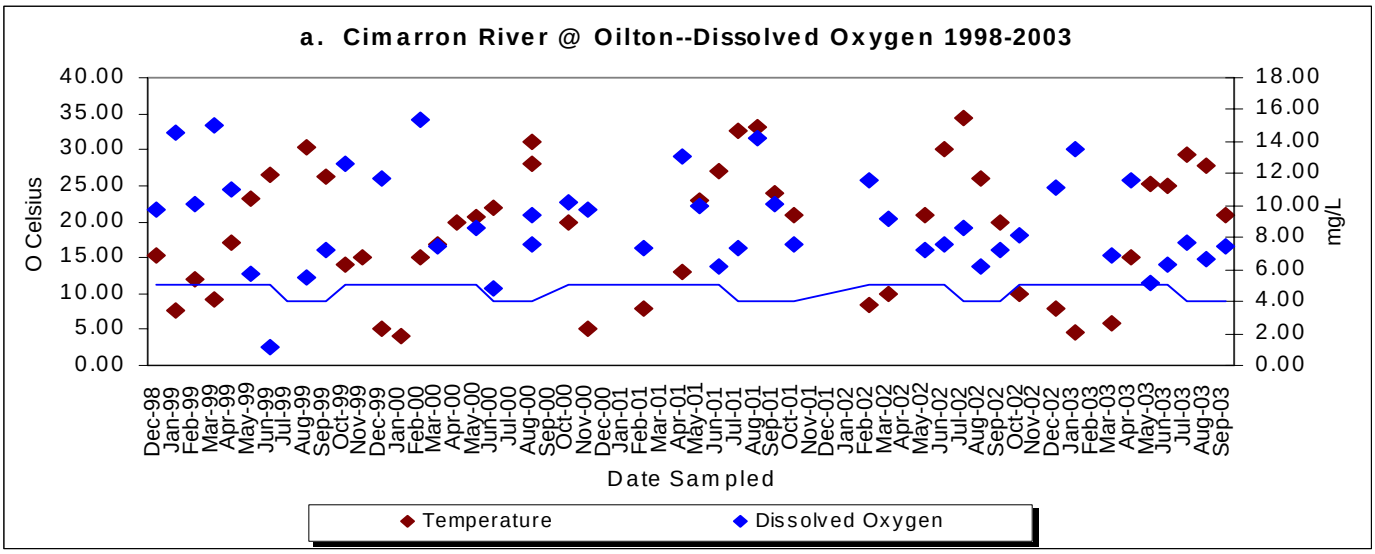
Cimarron River near Oilton

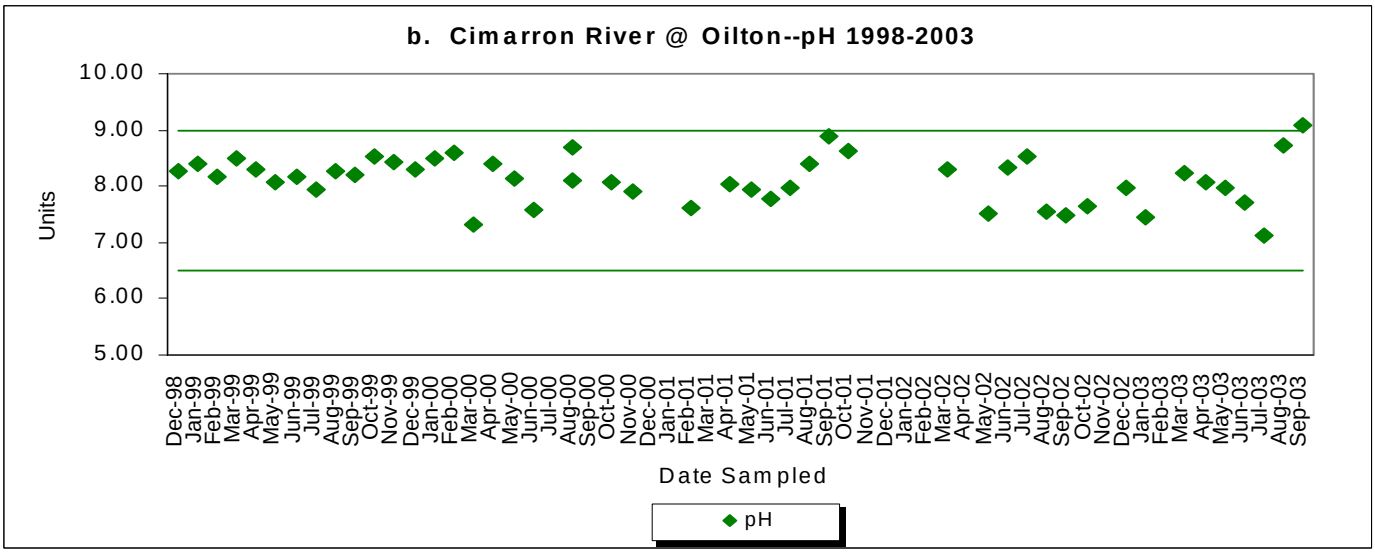
Station AT161500 (620900010170-001AT) is a permanent ambient trend monitoring station near the terminal end of the Cimarron River in Oklahoma. Situated in the northwestern portion of Creek County, the site was established north of the Town of Oilton on State Highway 99. The station is positioned near the midpoint of stream segment 620900010170 and is classified within the Lower Cimarron River 8-digit HUC watershed (11050003). Water enters the stream system from several tributaries including Salt Creek, Skull Creek, Euchee Creek, and Tiger Creek, among others.

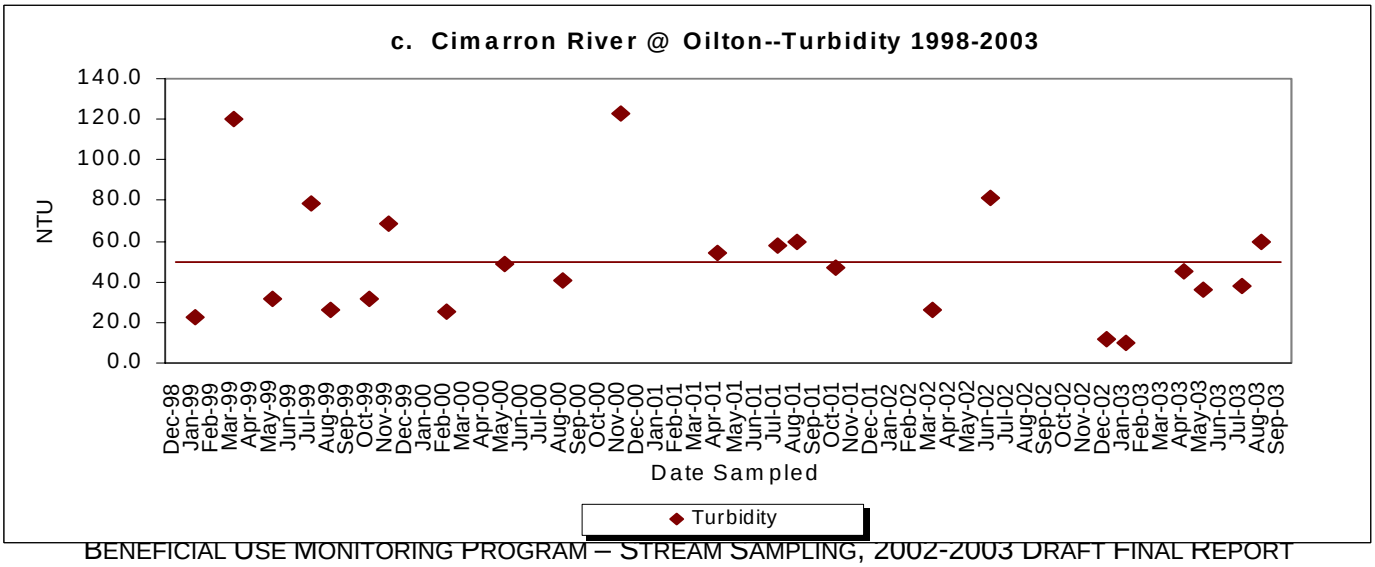
This station on the Cimarron River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through September of 2003. For purposes of reporting, this station is representative of the Cimarron River from the confluence of Salt Creek (96.7212, 36.0928) downstream to confluence of the Cimarron River with Keystone Reservoir (96.4829, 36.1160). As per Appendix A, Table 6 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Emergency Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class III Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

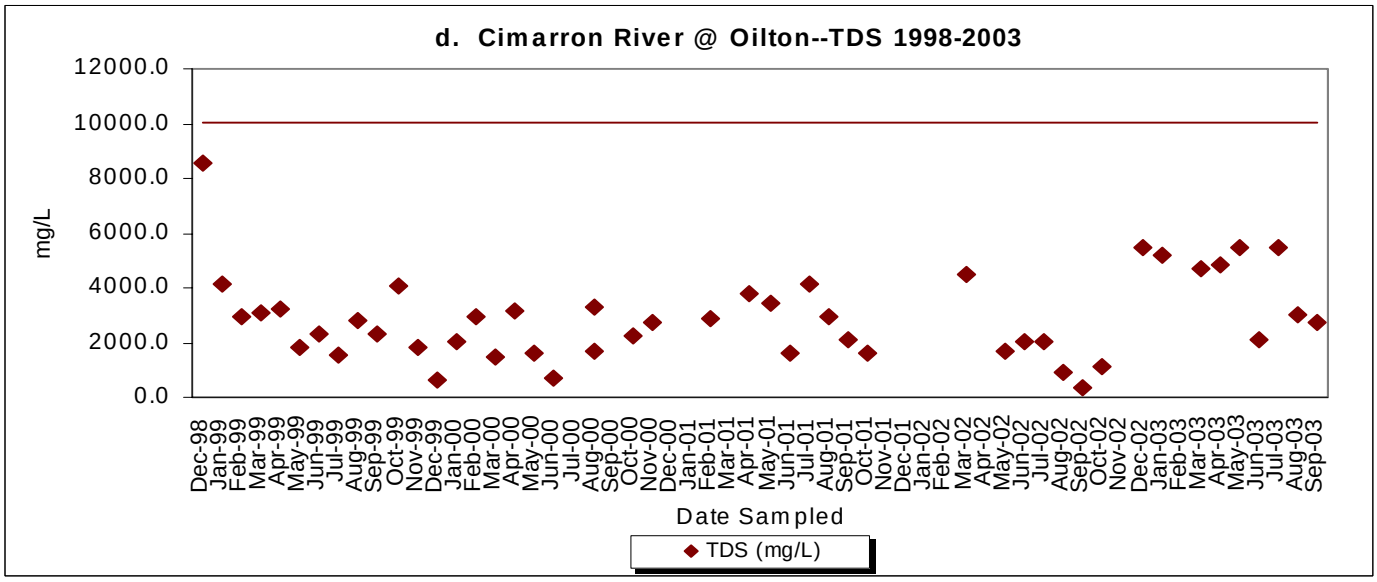
The WWAC beneficial use is not supported. Of the 24 turbidity samples (Figure 10c), 9 samples (or 38%) exceeded the numerical criteria of 50. Dissolved oxygen (Figure 10a), pH (Figure 10b), and toxicant samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 10d and Figure 10e). The PBCR beneficial use is not supported (Table 11). Of the 19 fecal coliform concentrations, 8 samples (or 42%) exceeded the prescribed screening level of 400 cfu/mL. This segment of the Cimarron River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 1.0 mg/L and 4.65 mg/L, respectively (Figure 10f).

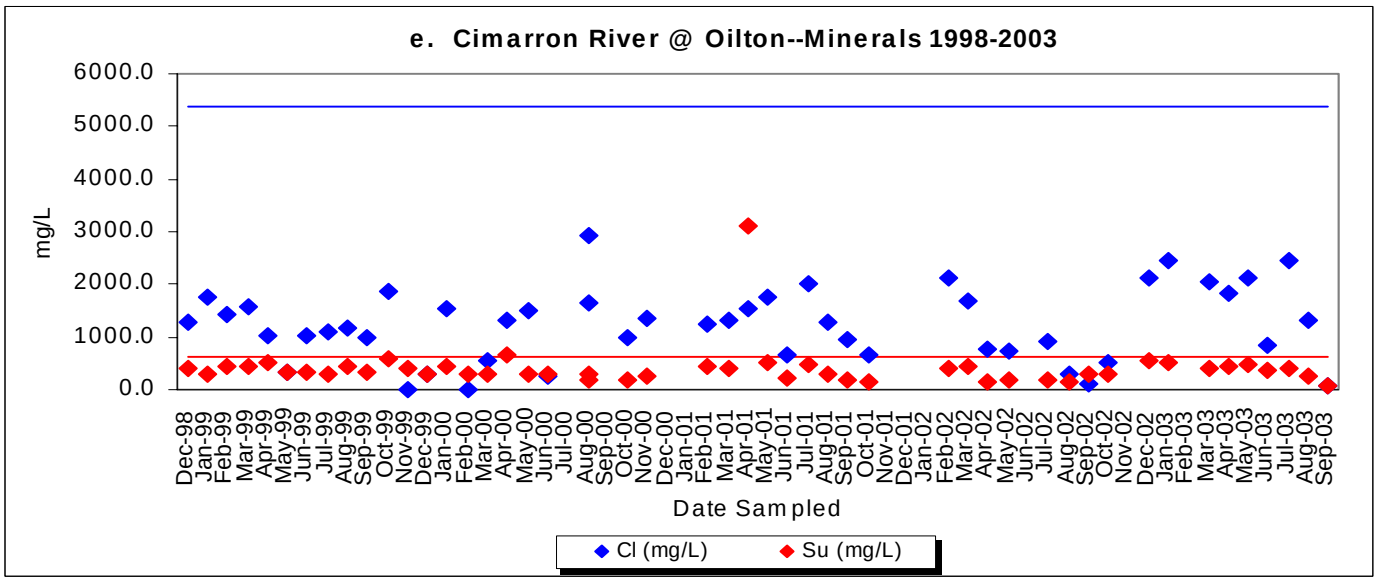
Figure 10a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) for the Cimarron River at Oilton (AT161500), 1998-2003.

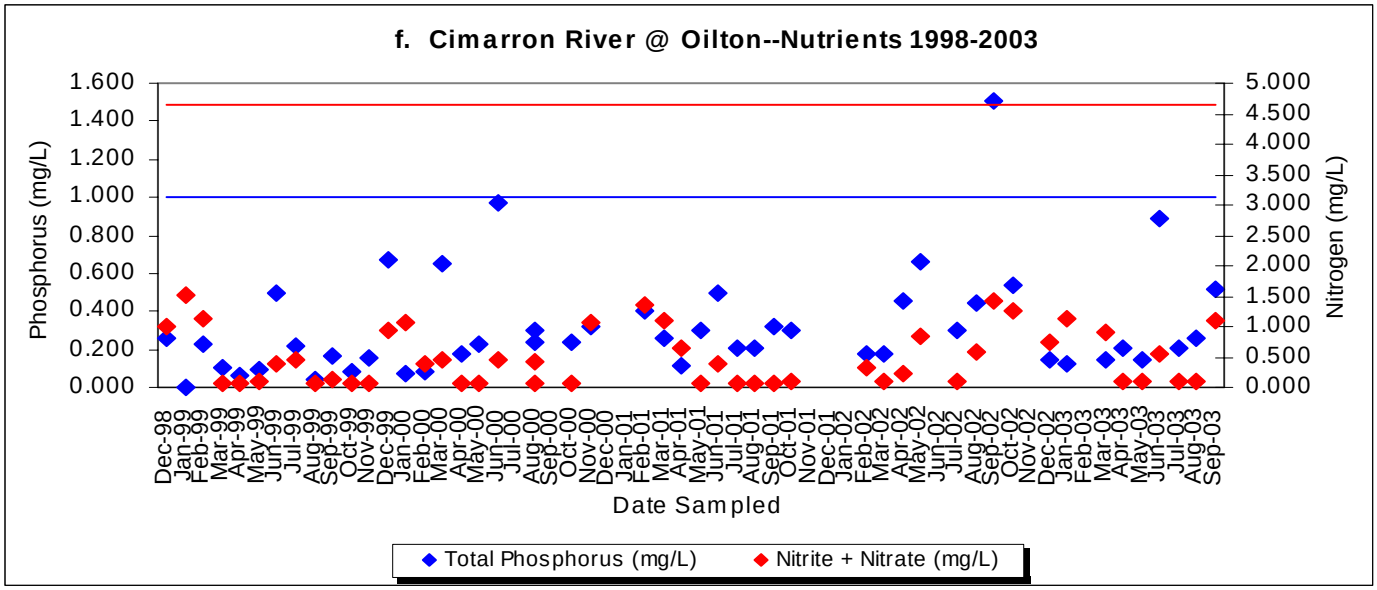







d. Cimarron River @ Oilton--TDS 1998-2003
mg/L
Date Sampled
TDS (mg/L)


e. Cimarron River @ Oilton--Minerals 1998-2003
mg/L
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Cimarron River @ Oilton--Nutrients 1998-2003
Phosphorus (mg/L)
Nitrogen (mg/L)
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

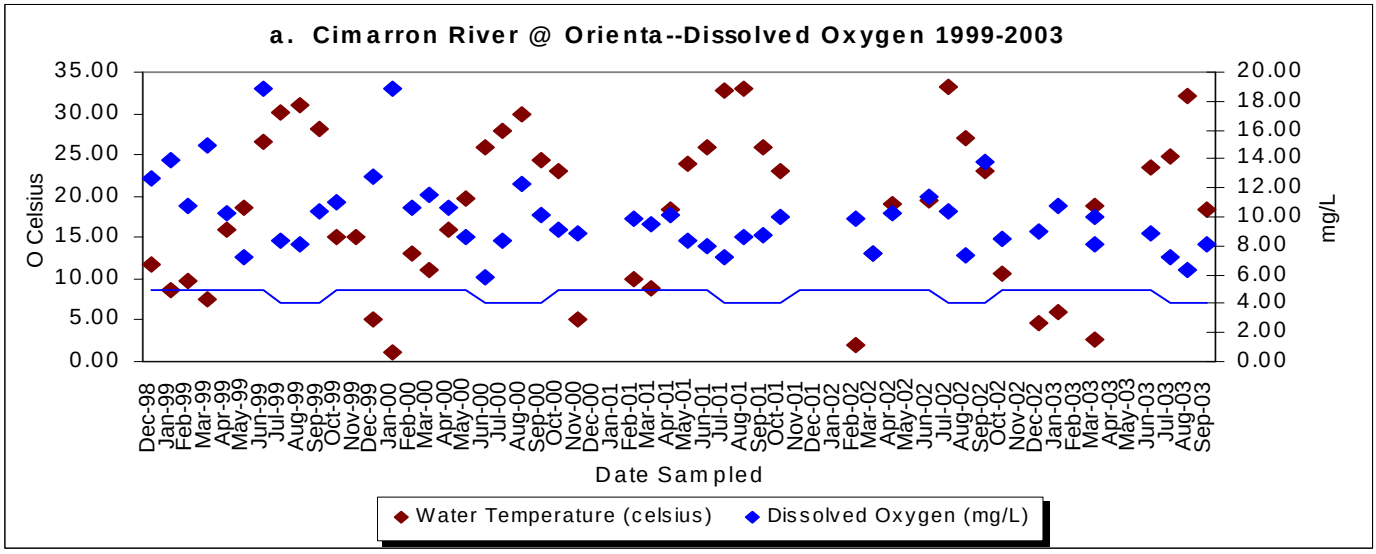
Cimarron River near Orienta

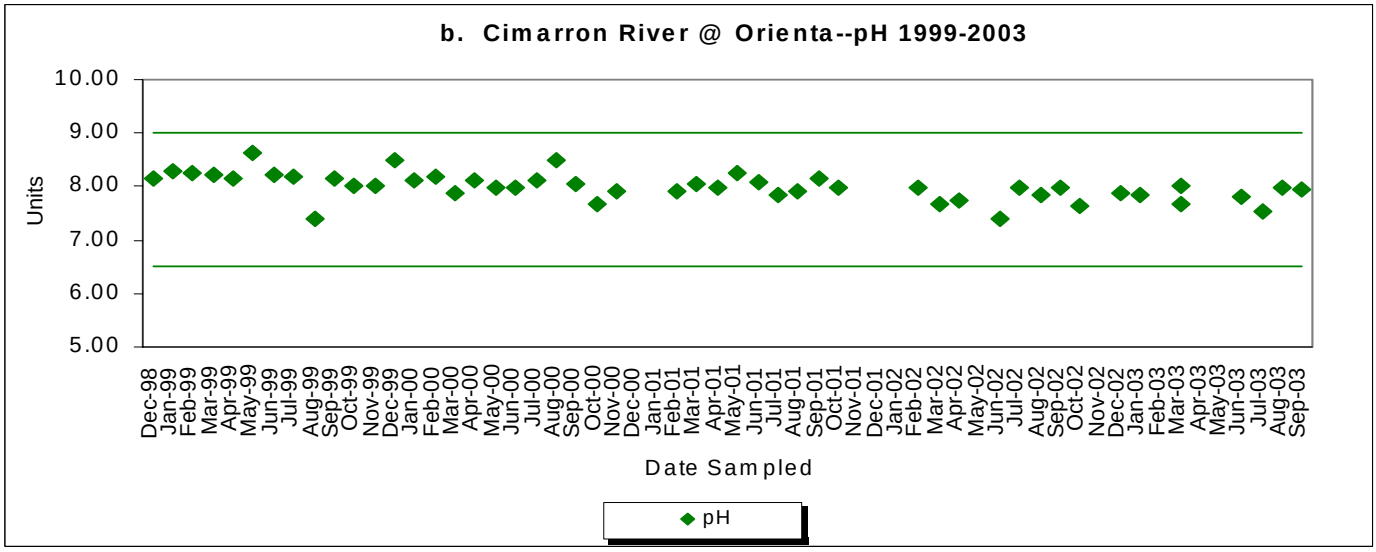
Station AT158110 (620920010010-001AT) is a permanent ambient trend monitoring station located on the Cimarron River in Oklahoma. Situated in the north central portion of Major County, the site was established northeast of the City of Orienta on US Highway 412. The station is positioned near the lower end of stream segment 620920010010 and is classified within the Lower Cimarron River - Eagle Chief Creek 8-digit HUC watershed (11050001). Water enters the stream system from several tributaries including Main Creek, Griever Creek, Cheyenne Creek, Eagle Chief Creek, and Sand Creek, among others.

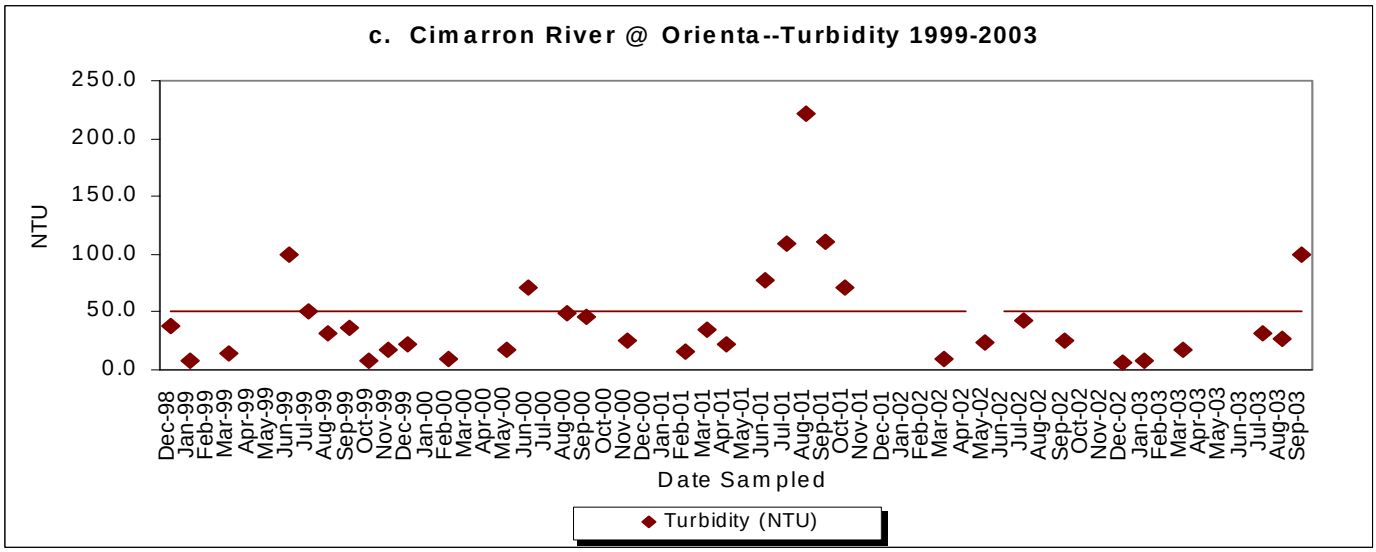
This station on the Cimarron River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December 1998 through September of 2003. For purposes of reporting, this station is representative of the Cimarron River from the confluence of Main Creek (98.8753, 36.5154) downstream to confluence of the Cimarron River with Sand Creek (-98.4192, 36.3194). As per Appendix A, Table 6 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Emergency Water Supply (EWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class III Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

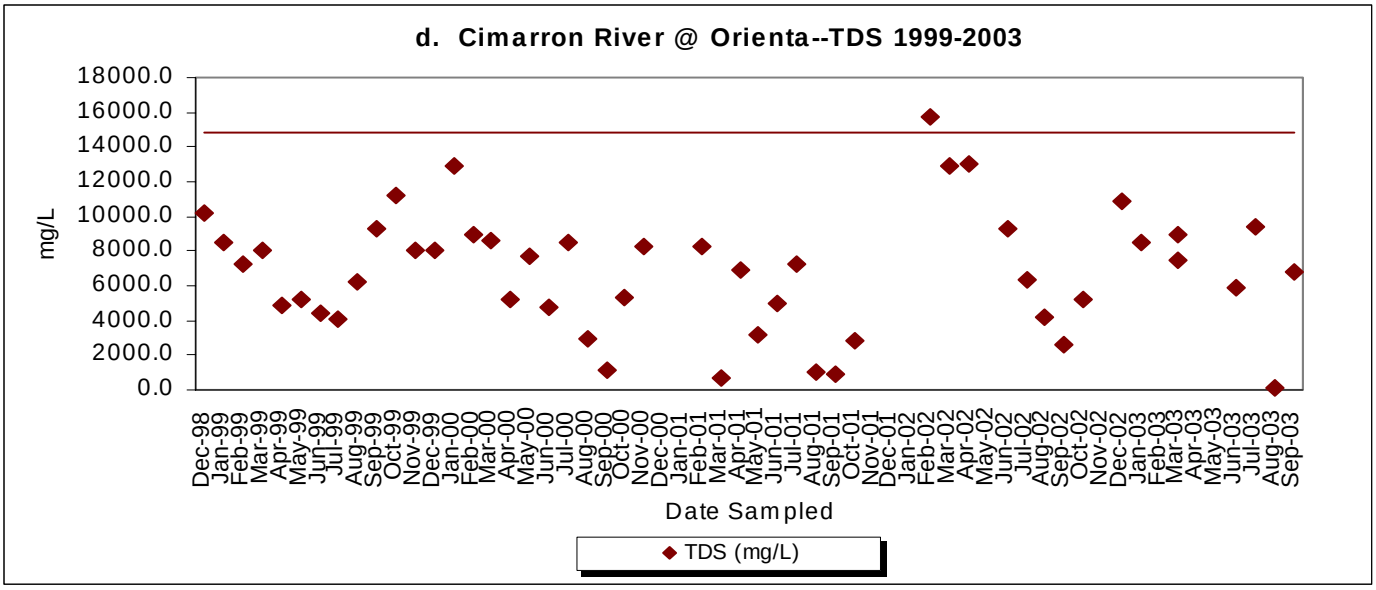
The WWAC beneficial use is not supported. Of the 34 turbidity samples (Figure 11c), 9 samples (or 26%) exceeded the numerical criteria of 50. Dissolved oxygen (Figure 11a), pH (Figure 11b), and toxicant samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is partially supported (Figure 11d and Figure 11e). Of the 49 chloride concentrations, 9 samples (or 18%) exceeded the prescribed sample standard of 5131.0 mg/L. Total dissolved solids and sulfates met the prescribed, site-specific criteria. The PBCR beneficial use is not supported (Table 11). Of the 27 *E. coli* concentrations, 7 exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (159.2 cfu/mL) exceeded the prescribed mean standard of 126 cfu/mL. Of the 27 enterococci concentrations, 8 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (96.8 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Cimarron River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 1.0 mg/L and 4.65 mg/L, respectively (Figure 11f).

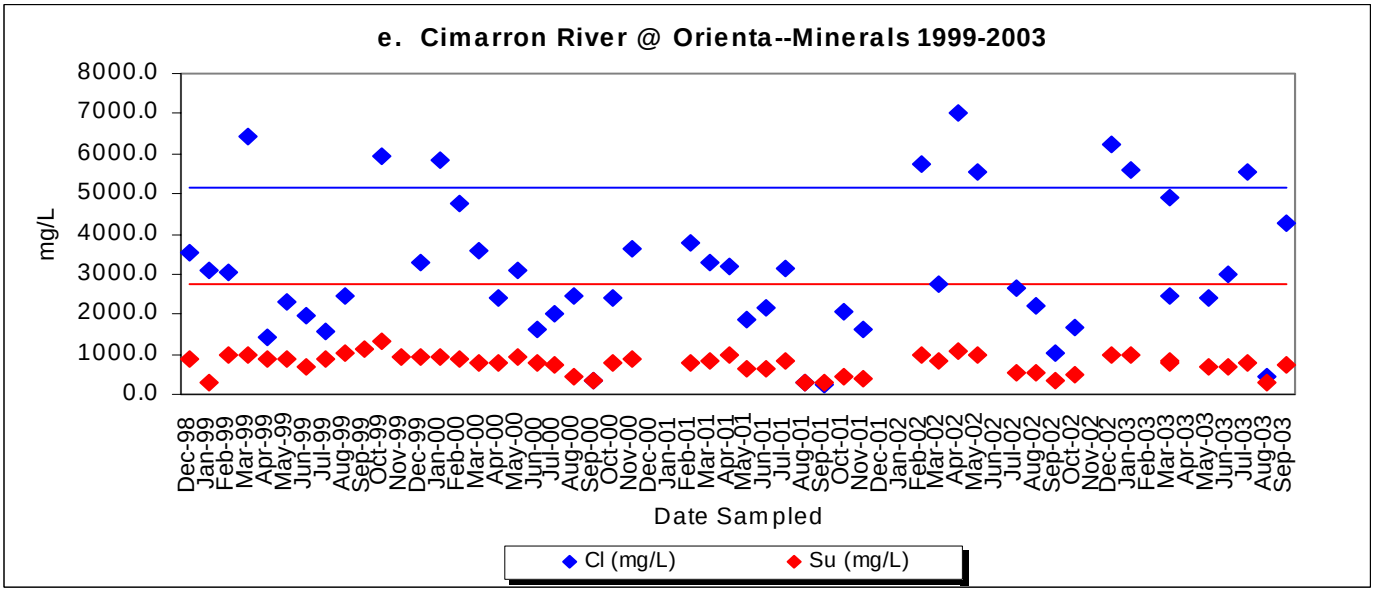
Figure 11a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) for the Cimarron River at Orienta (AT158110), 1999-2003.

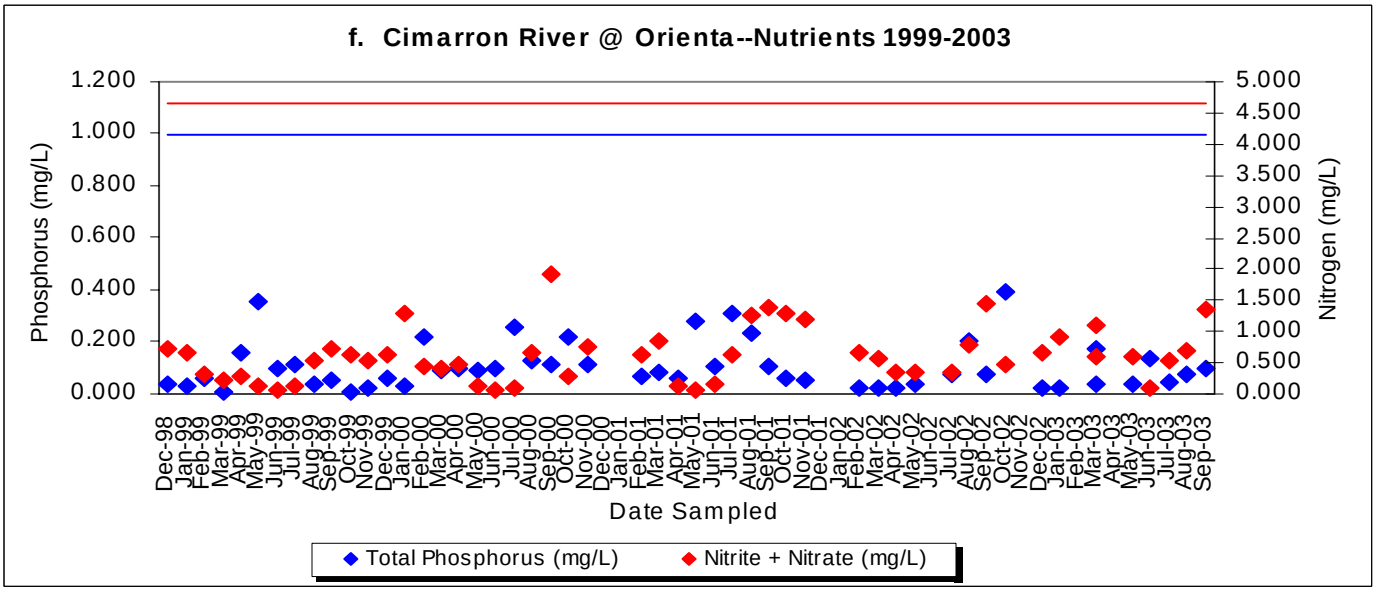







d. Cimarron River @ Orienta--TDS 1999-2003
mg/L
Date Sampled
TDS (mg/L)


e. Cimarron River @ Orienta--Minerals 1999-2003
mg/L
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Cimarron River @ Orienta--Nutrients 1999-2003
Phosphorus (mg/L)
Nitrogen (mg/L)
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

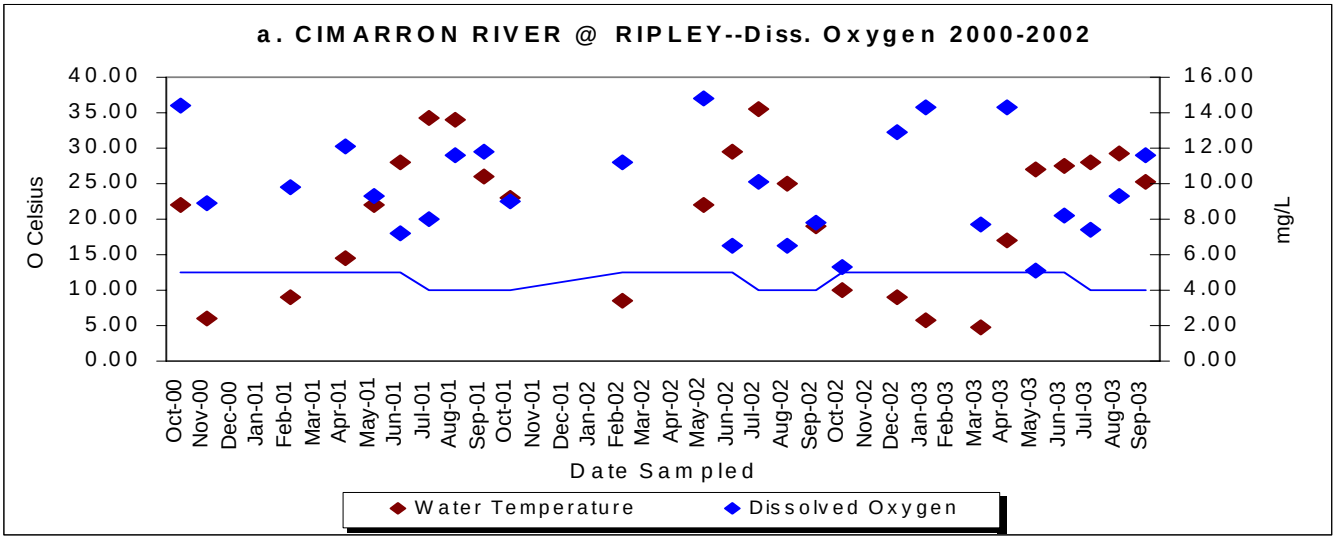
Cimarron River near Ripley

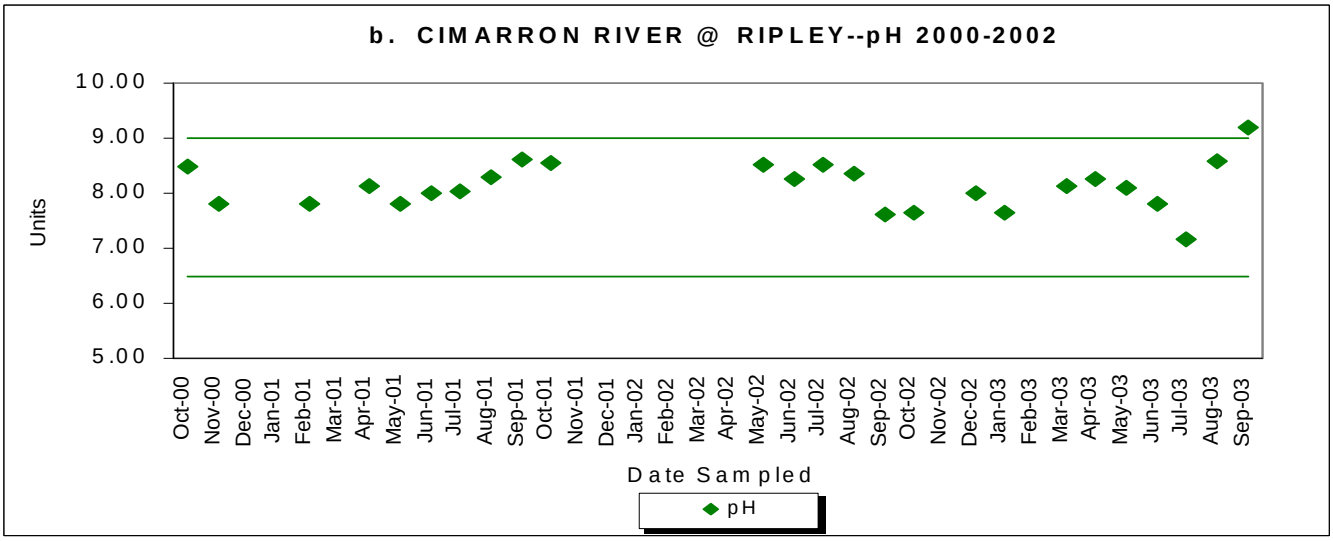
Station AT161450 (620900030010-001AT) is a permanent ambient trend monitoring station located on the Cimarron River in Oklahoma. Situated in the south central portion of Payne County, the site was established south of the Town of Ripley on State Highway 33. The station is positioned near the terminal end of stream segment 620900030010 and is classified within the Lower Cimarron River 8-digit HUC watershed (11050003). Water enters the stream system from Skeleton Creek, Beaver Creek, Fitzgerald Creek (Langston Lake), Dugout Creek, and Sand Creek, among others.

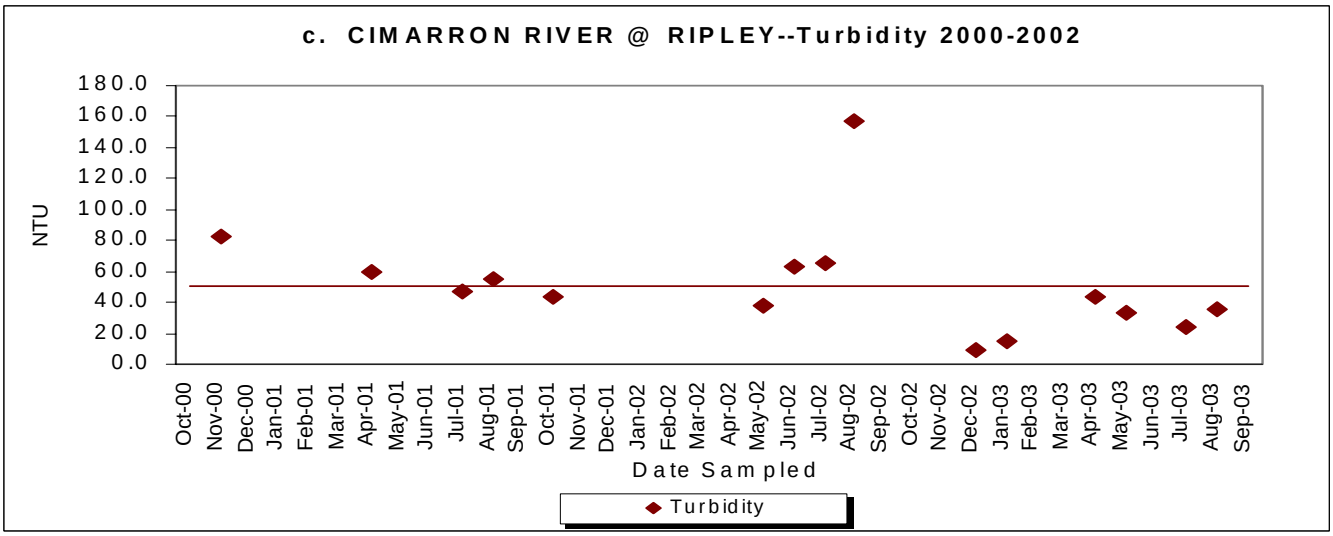
This station on the Cimarron River has been active for all water quality variables since October of 2000. The following assessment of beneficial uses is based on data collected from October of 2000 through September of 2003. For purposes of reporting, this station is representative of the Cimarron River from the confluence of Skeleton Creek (97.3975, 35.9875) downstream to the confluence of the Cimarron River with Stillwater Creek (-96.9149, 36.0230). As per Appendix A, Table 6 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Emergency Water Supply (EWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class III Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

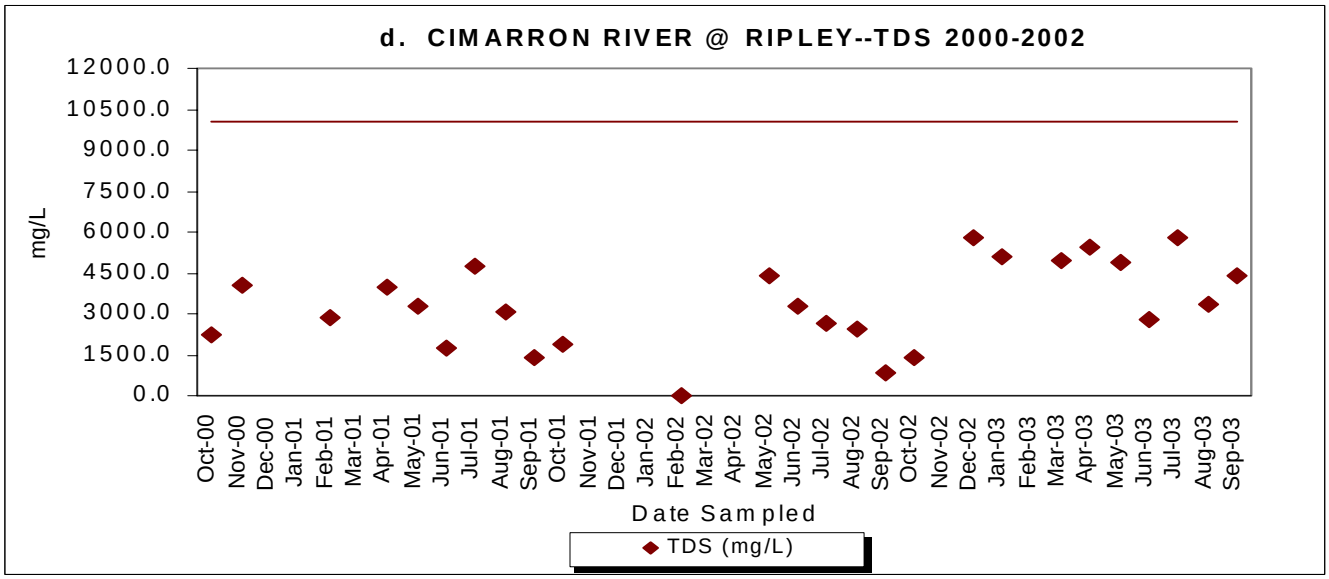
The WWAC beneficial use is not supported. Of the 15 turbidity samples (Figure 12c), 6 samples (or 40%) exceeded the numerical criteria of 50. Dissolved oxygen (Figure 12a), pH (Figure 12b), and toxicant samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 12d and Figure 12e). The PBCR beneficial use is not supported (Table 11). Of the 20 enterococci concentrations, 5 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (67.8 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Cimarron River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 1.0 mg/L and 4.65 mg/L, respectively (Figure 12f).

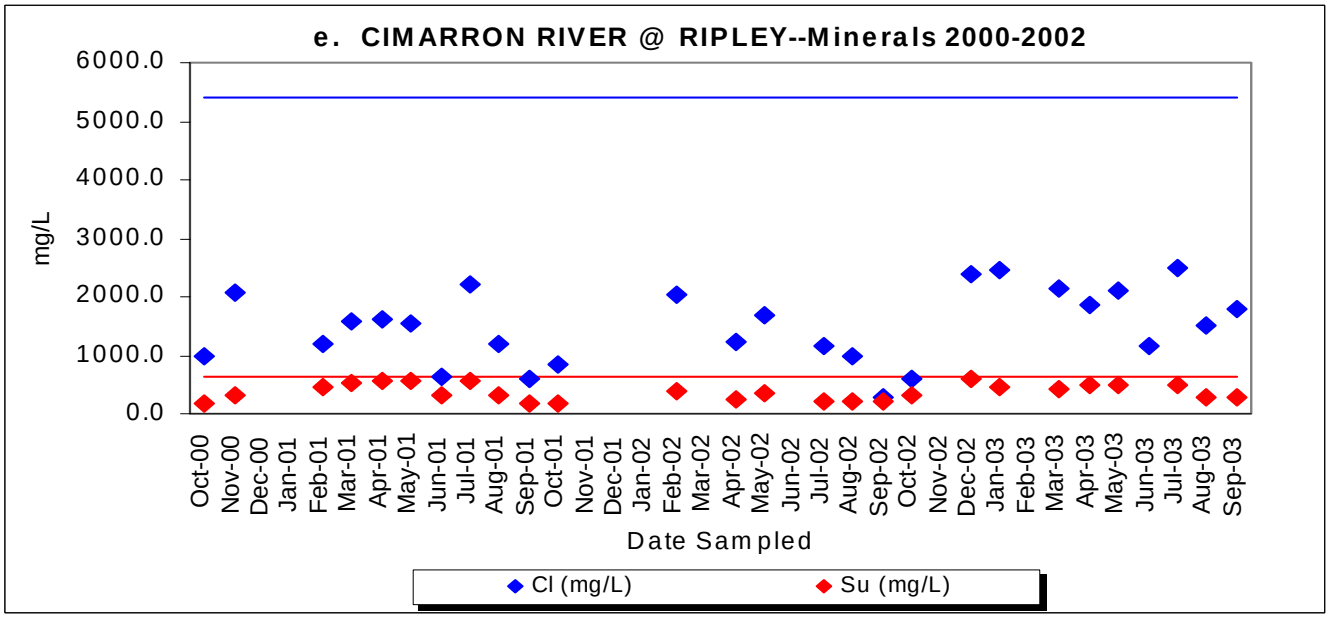
Figure 12a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) for the Cimarron River at Ripley (AT161450), 2000-2003.

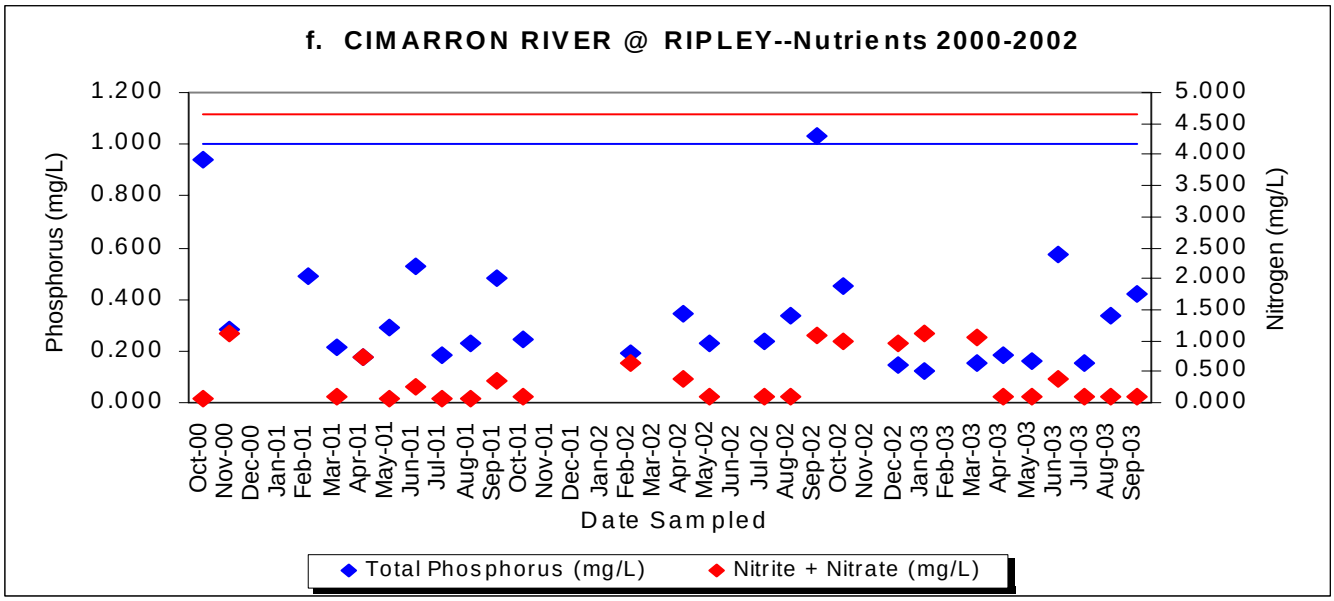







d. CIMARRON RIVER @ RIPLEY--TDS 2000-2002
mg/L
12000.0
10500.0
9000.0
7500.0
6000.0
4500.0
3000.0
1500.0
0.0
Oct-00 Nov-00 Dec-00 Jan-01 Feb-01 Mar-01 Apr-01 May-01 Jun-01 Jul-01 Aug-01 Sep-01 Oct-01 Nov-01 Dec-01 Jan-02 Feb-02 Mar-02 Apr-02 May-02 Jun-02 Jul-02 Aug-02 Sep-02 Oct-02 Nov-02 Dec-02 Jan-03 Feb-03 Mar-03 Apr-03 May-03 Jun-03 Jul-03 Aug-03 Sep-03
Date Sampled
TDS (mg/L)


e. CIMARRON RIVER @ RIPLEY--Minerals 2000-2002
mg/L
6000.0
5000.0
4000.0
3000.0
2000.0
1000.0
0.0
Oct-00 Nov-00 Dec-00 Jan-01 Feb-01 Mar-01 Apr-01 May-01 Jun-01 Jul-01 Aug-01 Sep-01 Oct-01 Nov-01 Dec-01 Jan-02 Feb-02 Mar-02 Apr-02 May-02 Jun-02 Jul-02 Aug-02 Sep-02 Oct-02 Nov-02 Dec-02 Jan-03 Feb-03 Mar-03 Apr-03 May-03 Jun-03 Jul-03 Aug-03 Sep-03
Date Sampled
Cl (mg/L)
Su (mg/L)


f. CIMARRON RIVER @ RIPLEY--Nutrients 2000-2002
Phosphorus (mg/L)
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Nitrogen (mg/L)
5.000
4.500
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
Oct-00 Nov-00 Dec-00 Jan-01 Feb-01 Mar-01 Apr-01 May-01 Jun-01 Jul-01 Aug-01 Sep-01 Oct-01 Nov-01 Dec-01 Jan-02 Feb-02 Mar-02 Apr-02 May-02 Jun-02 Jul-02 Aug-02 Sep-02 Oct-02 Nov-02 Dec-02 Jan-03 Feb-03 Mar-03 Apr-03 May-03 Jun-03 Jul-03 Aug-03 Sep-03
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

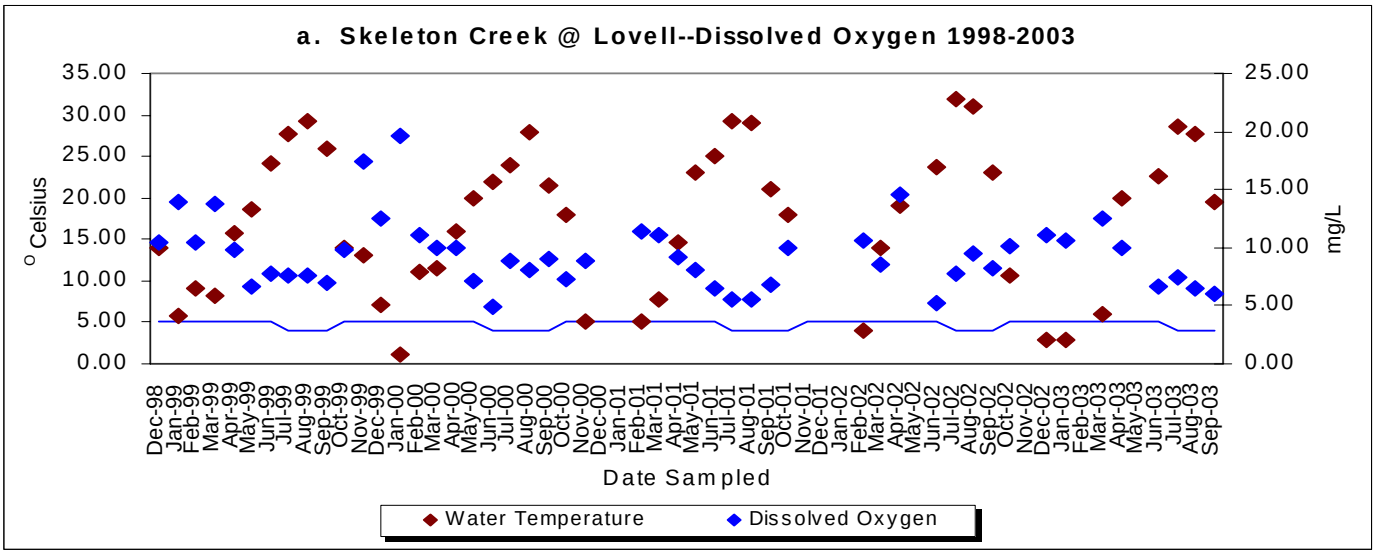
Skeleton Creek near Lovell

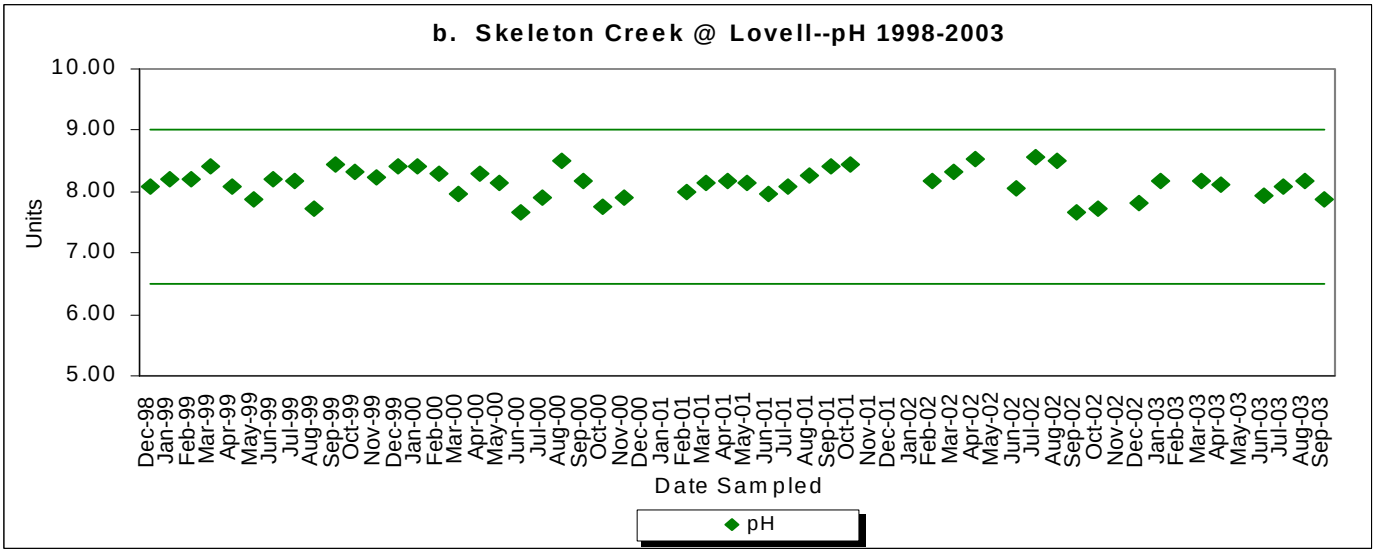
Station AT160500 (620910030010-001AT) is a permanent ambient trend monitoring station located on Skeleton Creek. Situated in the northwestern portion of Logan County, the site was established east northeast of the City of Lovell on State Highway 74. The station is positioned near the upper end of stream segment 620910030010 and is classified within the Lower Cimarron River - Skeleton Creek 8-digit HUC watershed (11050002). Water enters the stream system from several tributaries including Horse Creek, Otter Creek, and Wolf Creek, among others.

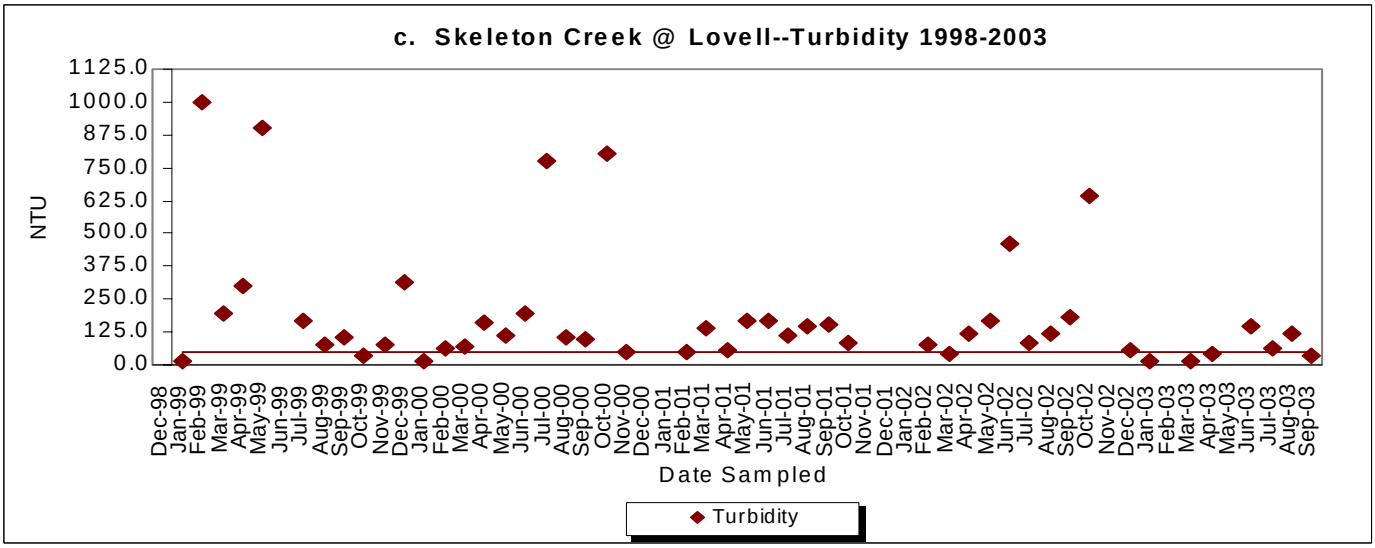
This station on Skeleton Creek has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December 1998 through September of 2003. For purposes of reporting, this station is representative of Skeleton Creek from the confluence of Spring Creek (-97.7067, 36.1194) downstream to confluence of Skeleton Creek with the Cimarron River (97.3975, 35.9875). As per Appendix A, Table 6 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class II Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

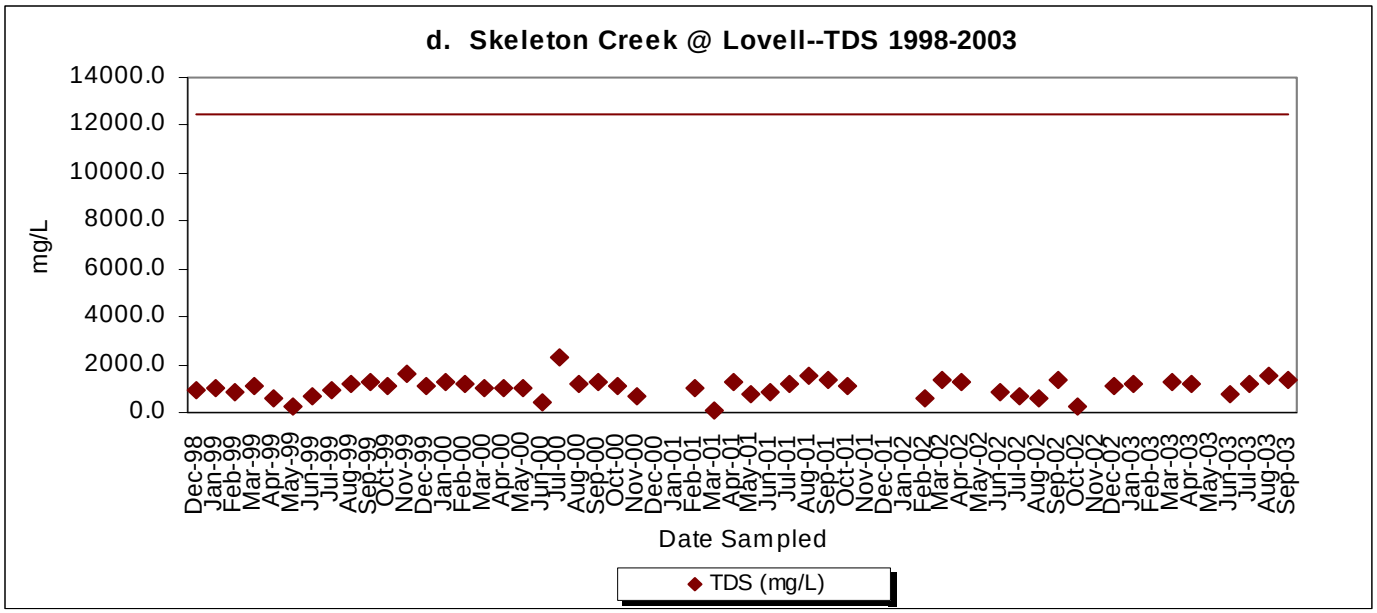
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 32 turbidity samples (Figure 13c), 23 samples (or 72%) exceeded the numerical criteria of 50. Dissolved oxygen (Figure 13a), pH (Figure 13b), and toxicant samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 13d and Figure 13e). The PBCR beneficial use is not supported (Table 11). Of the 19 fecal coliform concentrations, 6 samples (or 32%) exceeded the prescribed screening level of 400 cfu/mL. Of the 19 enterococci concentrations, 10 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (2503.2 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of Skeleton Creek is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 1.0 mg/L and 4.65 mg/L, respectively (Figure 13f).

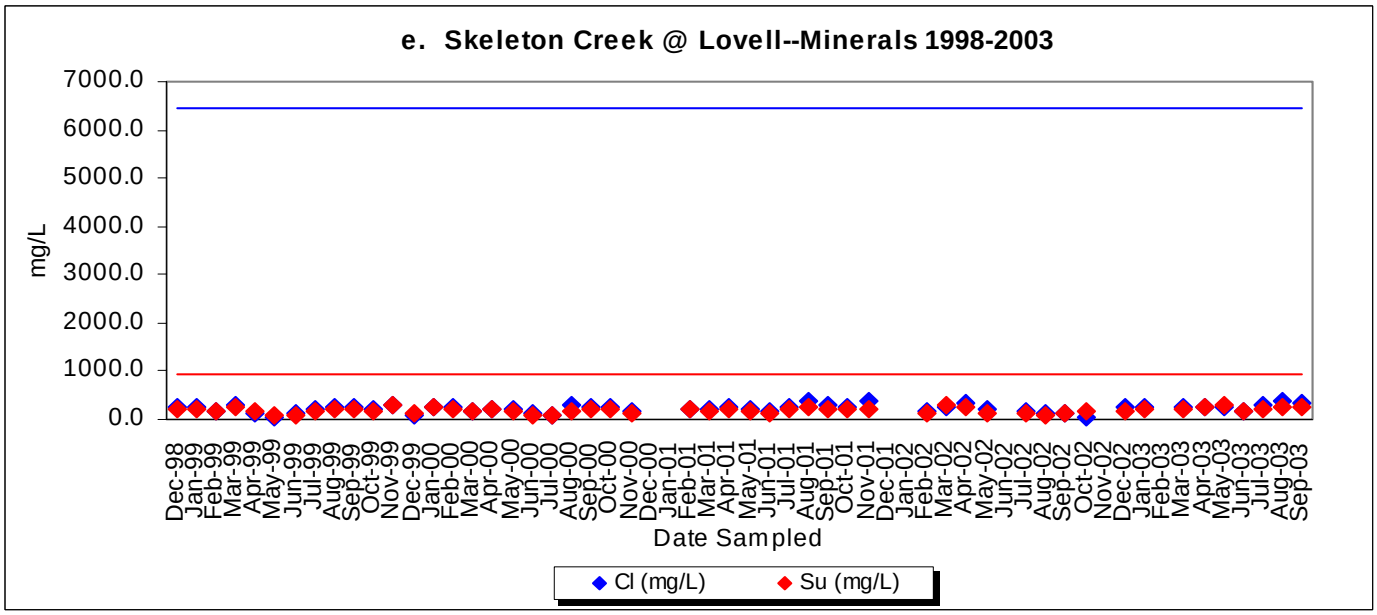
Figure 13a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) for the Skeleton Creek at Lovell (AT160500), 1998-2003.

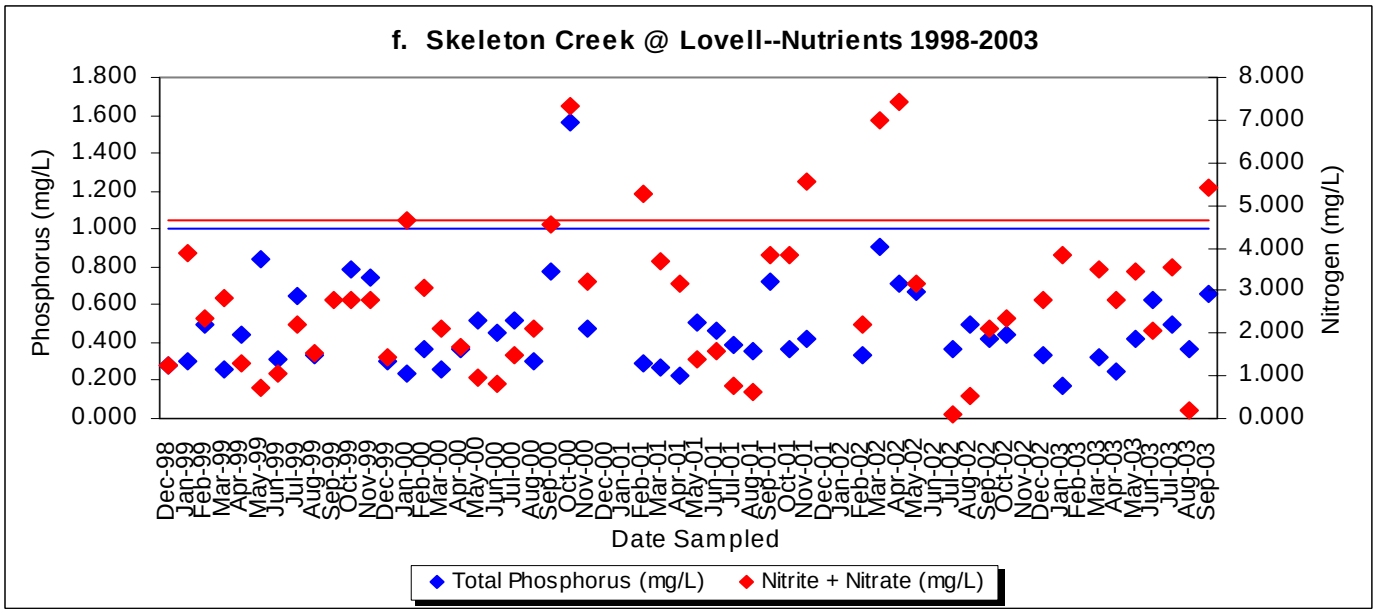







d. Skeleton Creek @ Lovell--TDS 1998-2003
mg/L
14000.0
12000.0
10000.0
8000.0
6000.0
4000.0
2000.0
0.0
Date Sampled
TDS (mg/L)


e. Skeleton Creek @ Lovell--Minerals 1998-2003
mg/L
7000.0
6000.0
5000.0
4000.0
3000.0
2000.0
1000.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Skeleton Creek @ Lovell--Nutrients 1998-2003
Phosphorus (mg/L)
1.800
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Nitrogen (mg/L)
8.000
7.000
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

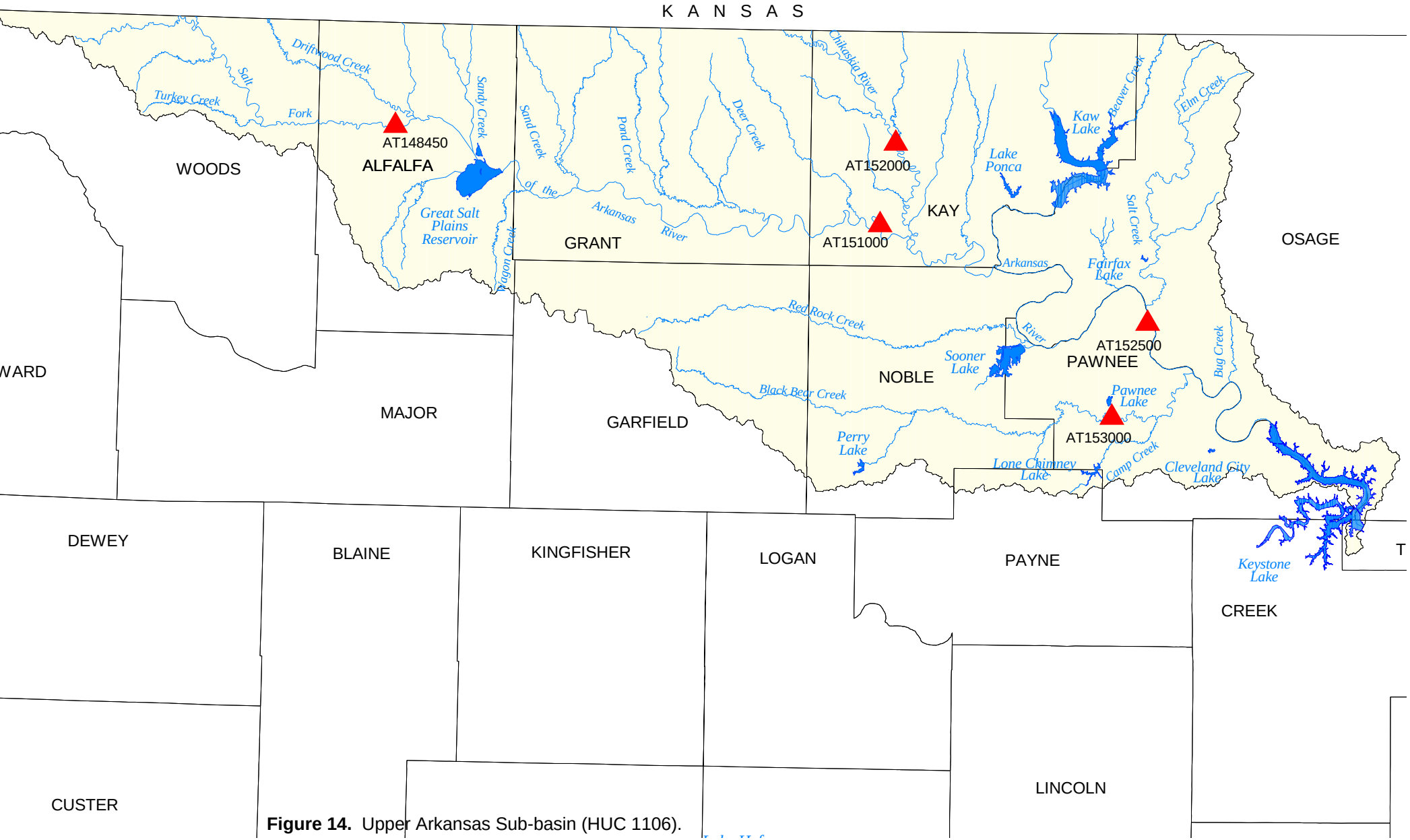


Figure 14. Upper Arkansas Sub-basin (HUC 1106).

HUC 1106

UPPER ARKANSAS SUB-BASIN

The Upper Arkansas sub-basin (4-digit hydrologic unit 1106) is situated in the north central portion of the state. It originates in the northeast portion of Woods County, continues eastward through portions of Alfalfa, Grant, Garfield, Kay, Noble, and Payne Counties and terminates in the western part of Osage County and northern one-half (½) of Pawnee County. Major cities and County seats located within the sub-basin include Alva, Ponca City, Perry, Pawnee, Tonkawa, Blackwell, and Cleveland. Minor cities of note include Cherokee, Medford, and Ralston.

The sub-basin is subdivided into six 8-digit hydrologic units (HUC) within the state. These HUC's are the Kaw Lake (11060001), the Upper Salt Fork of the Arkansas (11060002), the Medicine Lodge (11060003), the Lower Salt Fork of the Arkansas (11060004), the Chickaskia (11060005), and the Black Bear–Red Rock (11060006). The major surface water in the sub-basin is the upper Arkansas River. Major tributaries include the Salt Fork of the Arkansas River, the Chickaskia River, Black Bear Creek, Beaver Creek, Salt Creek, Sand Creek, Pond Creek, Deer Creek, Bois d'Arc Creek, and Red Rock Creek. Three major lakes are located in the sub-basin— the Great Salt Plains Lake formed by the Salt Fork of the Arkansas River, Kaw Lake formed by the Arkansas River and Beaver Creek, Sooner Lake formed by Greasy Creek, and the Arkansas River arm of Keystone Lake. Five active permanent water quality-monitoring stations (Table 12) are located in the sub-basin—AT148450, AT152000, AT151000, AT152500, and AT153000. Two inactive water quality-monitoring stations (AT152260 and AT148120) are located in the sub-basin. These stations were last assessed in the 2001 and 2003 BUMP reports, respectively.

The sub-basin is characterized by four ecoregions. The Central Great Plains is the primary ecoregion beginning in the far western portion and continuing through the east part of the sub-basin. The Central Oklahoma/Texas Plains represent the eastern quarter (¼) of the sub-basin. The Flint Hills characterize the northeast portion of Kay County and part of Osage County. The Southwestern Tablelands typify portions of Woods County. The primary land usage in the sub-basin is cropland. It dominates the central part of the sub-basin from eastern Woods County to the east central parts of Kay and Noble Counties. Cropland is further interspersed through the far western and eastern portions. The secondary land use is rangeland (open grasslands, sand sagebrush, upland shrubs, eastern red cedar, and post oak–blackjack oak). Rangeland dominates the far western and eastern portions of the sub-basin as well the northeastern portion of Alfalfa County and the southern portion of Payne and Pawnee Counties. It is further interspersed throughout the sub-basin. The tertiary land use is forestland (bottomland hardwoods and post oak–blackjack oak) that dominates the eastern portion of Payne County and the north and eastern portions of Pawnee County. Forestland is also present in portions of Kay and Osage Counties. Other land uses of note are pastureland, woodlands, farmsteads, major urban areas, wetlands, and confined animal feeding operations.

Table 12. Permanent Ambient Trend Monitoring Stations Located in HUC 1106.

WBID #	STATION #	STATION NAME	STATUS	FS	PS	NS/T	CBD
621200010200	AT152500	Arkansas River, SH 18, Ralston	Active 11/98-P	AG, AES, PPWS	NONE	FWP, PBCR	NONE
621200030010	AT153000	Black Bear Creek, SH 18, Pawnee	Active 11/98-P	AG, AES, PPWS	NONE	FWP, PBCR	NONE
621100000010	AT152000	Chickaskia River, US 177, Blackwell	Active 11/98-P	AG, AES, PPWS	NONE	FWP, PBCR	NONE
621010010160	AT148450	Salt Fork of Arkansas River, SH 58, Ingersoll	Active 11/98-P	AG, AES, PPWS	NONE	FWP, PBCR	NONE
621000010010	AT151000	Salt Fork of Arkansas River, US 77, Tonkawa	Active 10/00-P	AG, AES, PPWS	FWP	PBCR	NONE

ASSIGNED OWQS BENEFICIAL USES AND SUPPORT CODES	
PPWS = PUBLIC AND PRIVATE WATER SUPPLY	EWS = EMERGENCY WATER SUPPLY
FWP = FISH & WILDLIFE PROPAGATION	PBCR = PRIMARY BODY CONTACT RECREATION
AG = AGRICULTURE	AES = AESTHETICS
FS = FULLY SUPPORTING	PS = PARTIALLY SUPPORTING
NS/T = NOT SUPPORTING/THREATENED	CBD = CANNOT BE DETERMINED

Table 13. Toxicant exceedances in HUC 1106.

STATION #	STATION NAME	DATE	Lead (µg/L)	Selenium (µg/L)
AT153000	Black Bear Creek, SH 18, Pawnee	06/21/2000	15.00	
		04/04/2001	15.00	
AT152000	Chickaskia River, US 177, Blackwell	11/14/2000	15.00	
		04/04/2001	27.00	
		01/22/2003	14.00	
AT148450	Salt Fork of Arkansas River, SH 58, Ingersoll	12/13/1999		11.00
		05/15/2000		6.00

Table 14. Exceedances of fecal coliform, enterococci, and *E. coli* screening limits in HUC 1106. Only values leading to a determination of not supporting for the Public and Private Water Supply and the Primary Body Contact Recreation beneficial uses are in included.

STATION #	STATION NAME	DATE	Fecal Coliform (cfu/mL)	Enterococci (cfu/mL)	*E. coli* (cfu/mL)
AT152500	ARKANSAS RIVER, SH 18, RALSTON	07/26/2000		2200	
		05/09/2001		1000	
		06/06/2001		1600	
		05/08/2002		500	
		08/26/2002		1300	
AT153000	BLACK BEAR CREEK, SH 18, PAWNEE	08/03/1999	7100		
		09/08/1999	2600	1400	
		06/21/2000		3000	
		05/09/2001		500	
		06/06/2001		1100	
		09/24/2001	2000		
		08/26/2002	9000	19000	
		09/23/2002	1000	2000	
AT152000	CHICKASKIA RIVER, US 177, BLACKWELL	06/07/1999		410	
		08/25/1999	14000	500	
		06/21/2000	1030	2300	
		07/26/2000	2700	3800	
		06/06/2001	500	7000	
		09/24/2001	5100	11000	
		05/15/2002	1000	800	
		08/28/2002		1100	
		09/25/2002		1600	
AT148450	SALT FORK OF ARKANSAS RIVER, SH 58, INGERSOLL	06/01/1999	1900	900	4611
		07/06/1999	540		
		09/07/1999	520		6630
		07/26/2000	2600		
		08/23/2000	730	480	
		09/20/2000	1600	9000	865
		05/08/2001	1700	4000	
		06/05/2001	700	1500	
		08/07/2001	700		
		09/24/2001	2000	3000	
		05/14/2002	15000	18000	4884
		06/05/2002	1800	8000	1222
		07/10/2002	1400	15000	823
		08/27/2002	2000	13000	
		09/24/2002	4000	5000	581
		05/26/2003	500	5000	
		06/10/2003	800	11000	

STATION #	STATION NAME	DATE	Fecal Coliform (cfu/mL)	Enterococci (cfu/mL)	*E. coli* (cfu/mL)
		07/01/2003	900	600	422
		08/05/2003	3000	17000	1497
		08/12/2003	1100	1500	520
		09/02/2003	500	1900	
		09/16/2003	600	1000	
		10/01/2003		600	
AT151000	SALT FORK OF ARKANSAS RIVER, US 77, TONKAWA	05/09/2001		3000	
		06/04/2001		2000	
		07/09/2001		600	
		08/06/2001		1000	
		09/10/2001		700	
		05/15/2002		1500	
		07/10/2002		1900	
		09/25/2002		500	

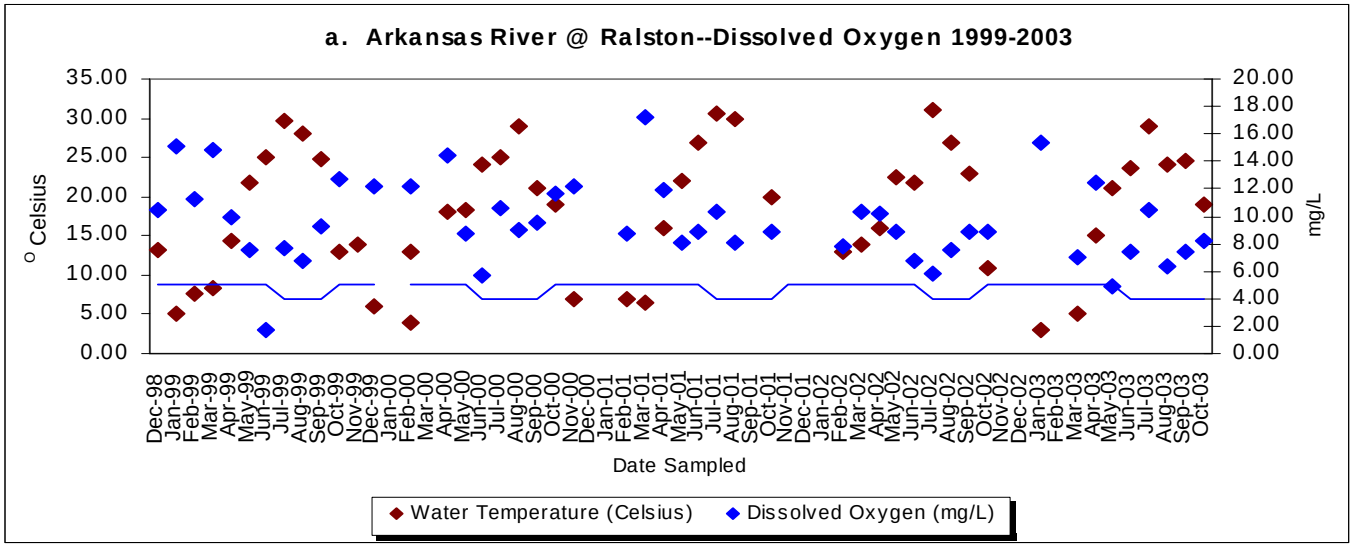
Arkansas River near Ralston

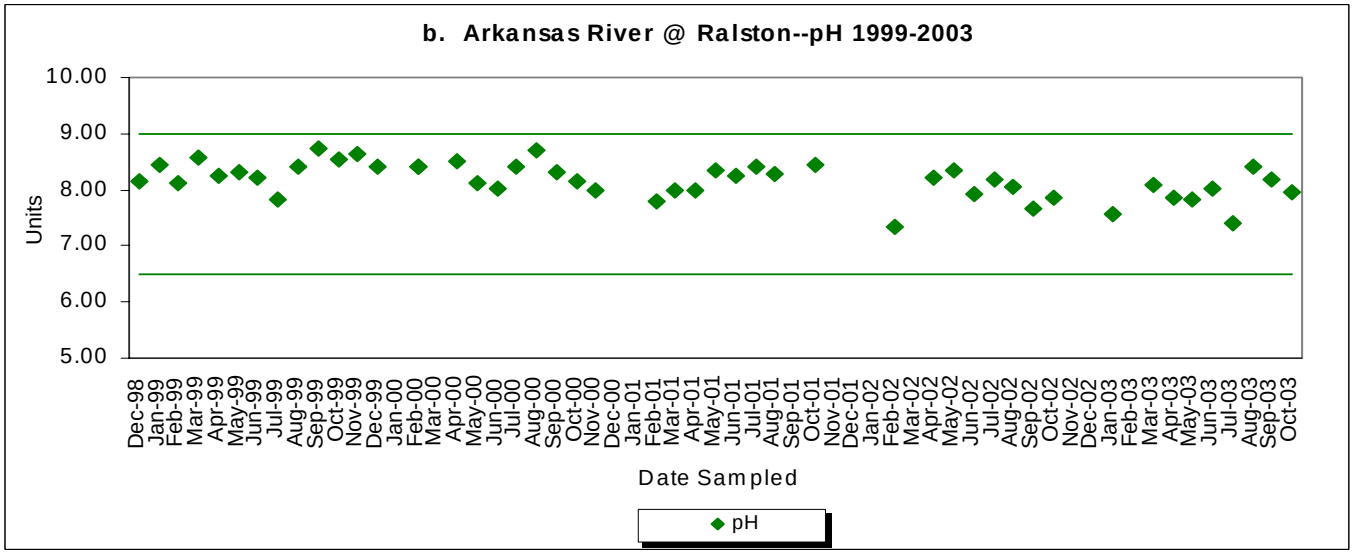
Station AT152500 (621200010200-001AT) is a permanent ambient trend monitoring station located on the Arkansas River in Oklahoma. Situated in the west central portion of Osage County, the site was established east of the Town of Ralston on State Highway 18. The station is positioned near the upper end of stream segment 621200010200 and is classified within the Black Bear - Red Rock Creek 8-digit HUC watershed (11060006). Water enters the stream system from several tributaries including Salt Creek (Fairfax Lake), Black Bear Creek (Pawnee Lake), and Bug Creek, among others.

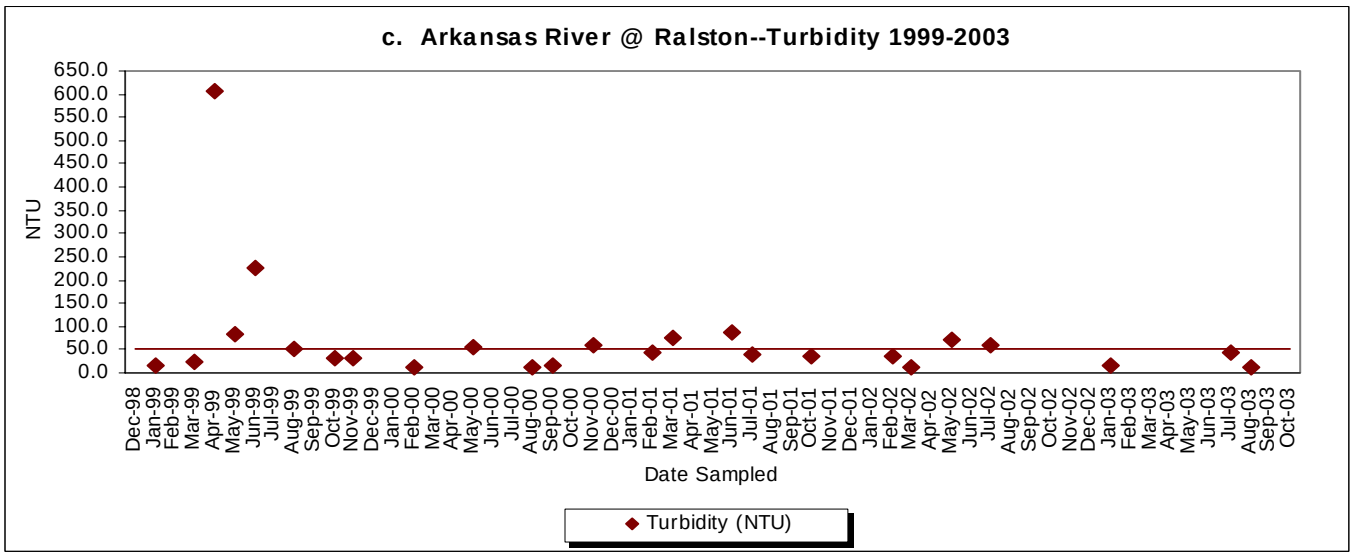
This station on the Arkansas River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through October of 2003. For purposes of reporting, this station is representative of the Arkansas River from the confluence of Salt Creek (97.3276, 36.9679) downstream to confluence of the Arkansas River with Keystone Reservoir (97.1739, 36.6243). As per Appendix A, Table 6 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class II Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

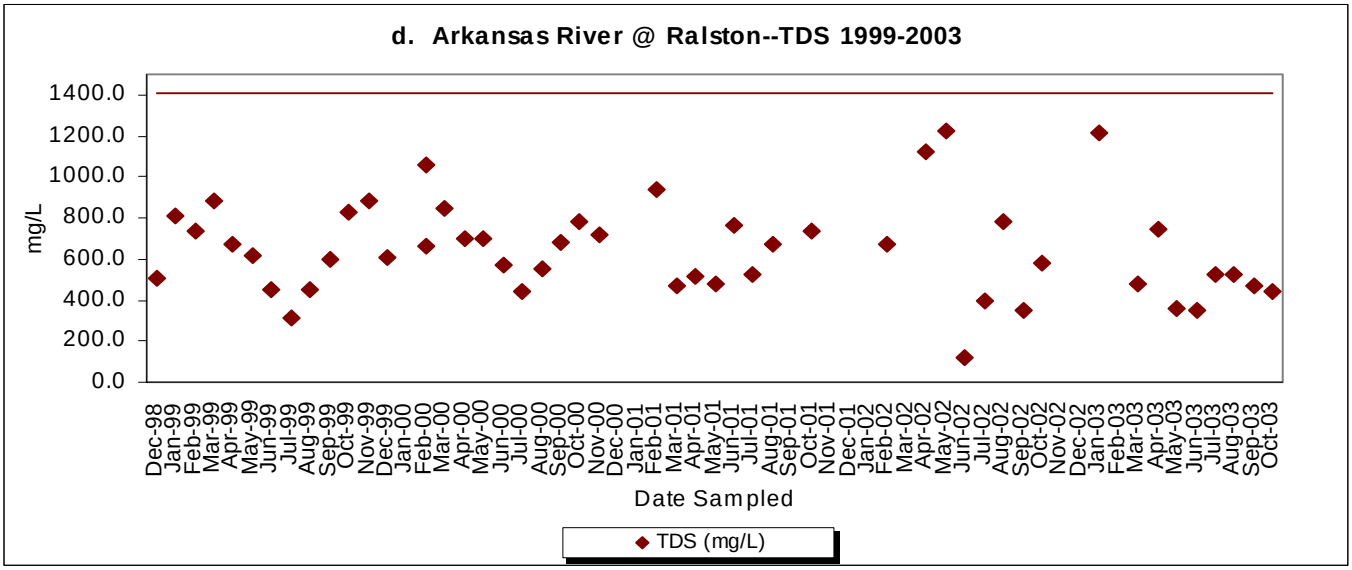
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 25 turbidity samples (Figure 15c), 10 samples (or 40%) exceeded the numerical criteria of 50. Dissolved oxygen (Figure 15a), pH (Figure 15b), and toxicant data collected during the same period met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 15d and Figure 15e). Although 21% of the sulfate concentrations exceeded the sample standard of 153.0 mg/L, the values are below the prescribed minimum standard of 250 mg/L. The PBCR beneficial use is not supported (Table 14). Of the 14 enterococci concentrations, 5 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (219.7 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Arkansas River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 1.0 mg/L and 4.65 mg/L, respectively (Figure 15f).

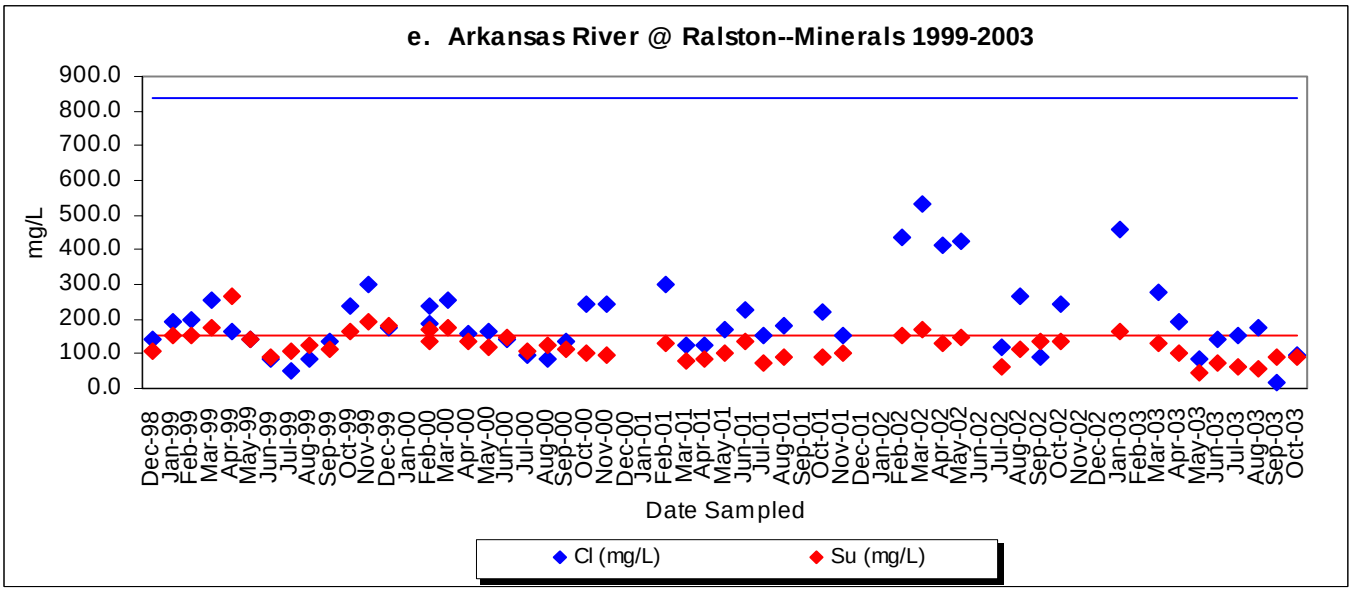
Figure 15a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) for the Arkansas River at Ralston (AT152500), 1999-2003.

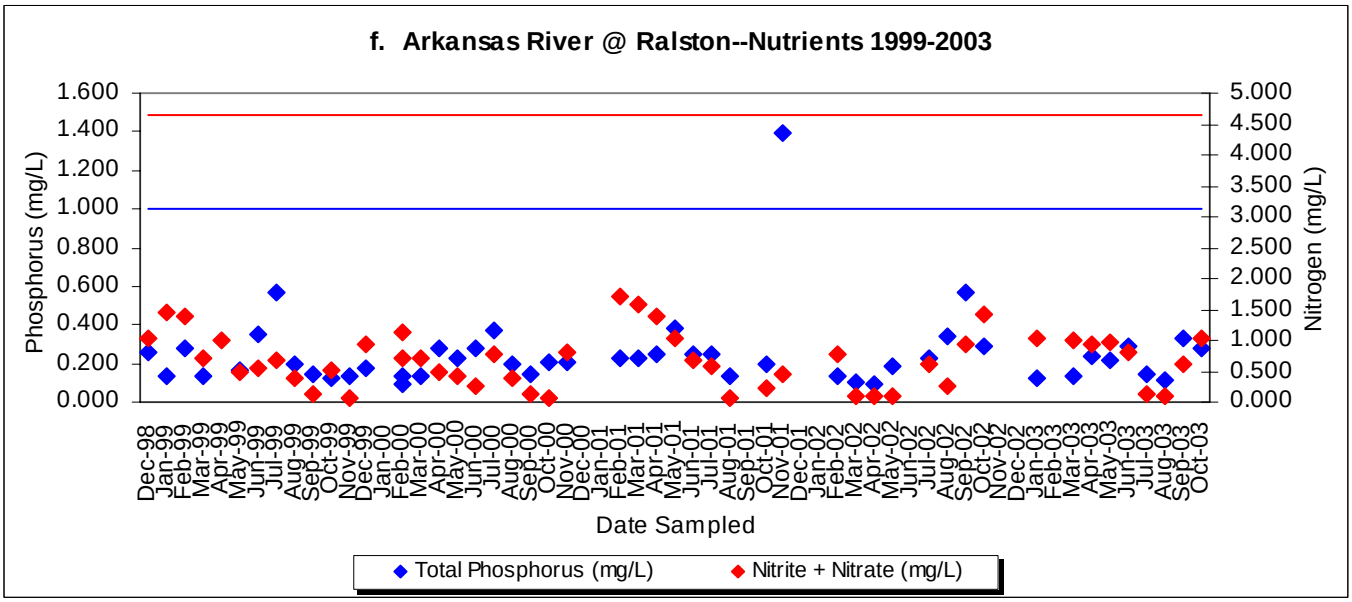







d. Arkansas River @ Ralston--TDS 1999-2003
mg/L
1400.0
1200.0
1000.0
800.0
600.0
400.0
200.0
0.0
Date Sampled
TDS (mg/L)


e. Arkansas River @ Ralston--Minerals 1999-2003
mg/L
900.0
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Arkansas River @ Ralston--Nutrients 1999-2003
Phosphorus (mg/L)
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Nitrogen (mg/L)
5.000
4.500
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

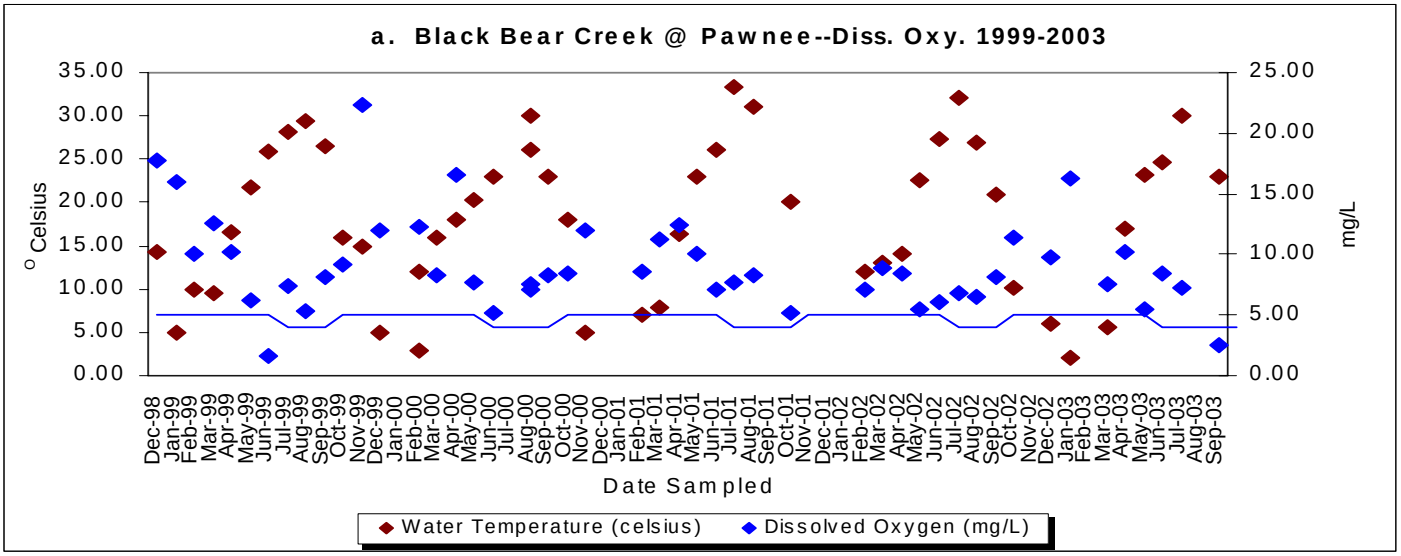
Black Bear Creek at Pawnee

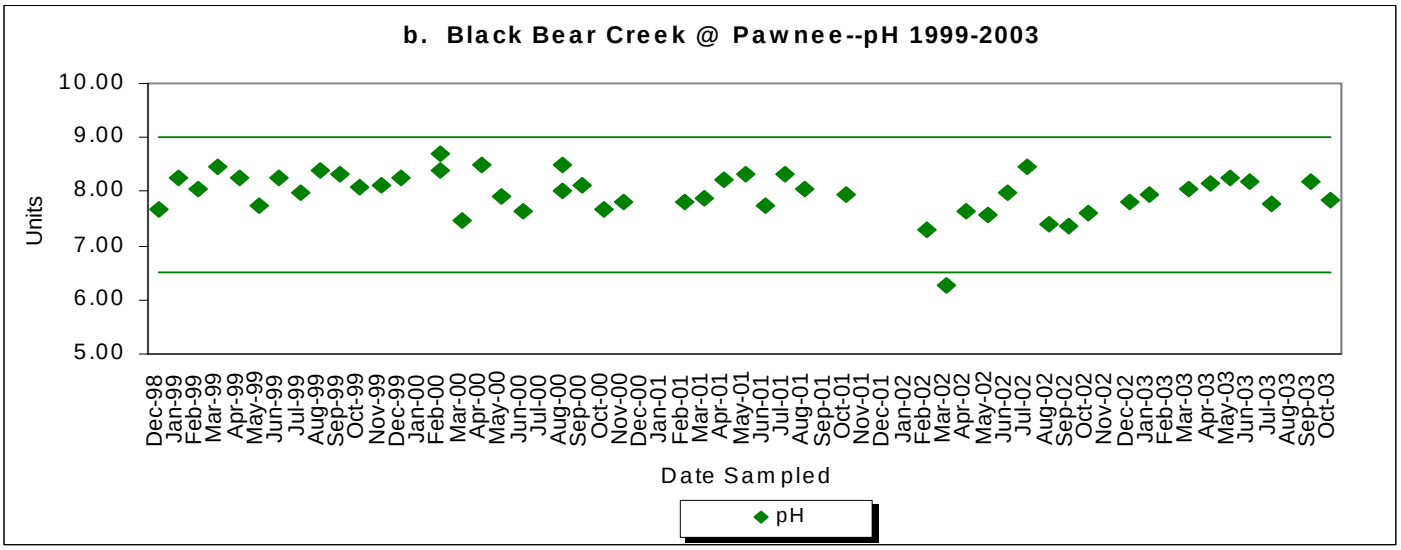
Station AT153000 (621200030010-001AT) is a permanent ambient trend monitoring station located on Black Bear Creek. Situated in the west central portion of Pawnee County, the site was established north of the City of Pawnee on State Highway 18. The station is positioned near the terminal end of stream segment 621200030010 and is classified within the Black Bear - Red Rock Creek 8-digit HUC watershed (11060006). Water enters the stream system from Pawnee Lake and from several tributaries including Cow Creek, Oak Creek, and Camp Creek (Lone Chimney Lake), among others.

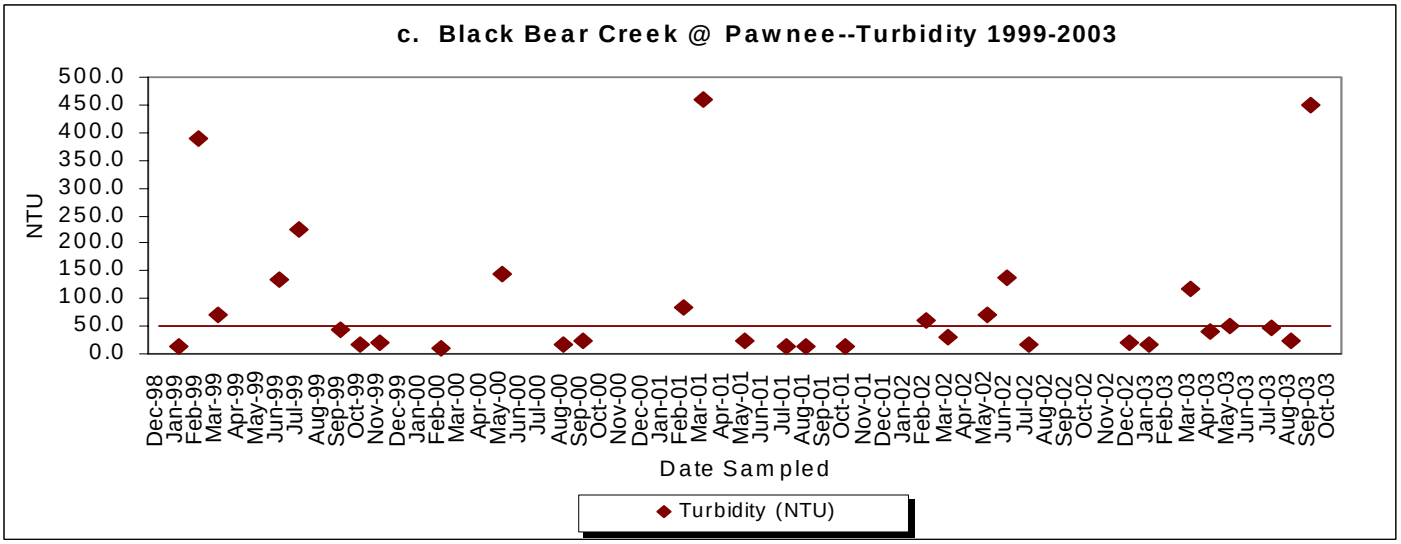
This station on Black Bear Creek has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through October of 2003. For purposes of reporting, this station is representative of Black Bear Creek from the confluence of Cow Creek (97.3276, 36.9679) downstream to confluence of Black Bear Creek with the Arkansas River (97.1739, 36.6243). As per Appendix A, Table 6 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class II Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

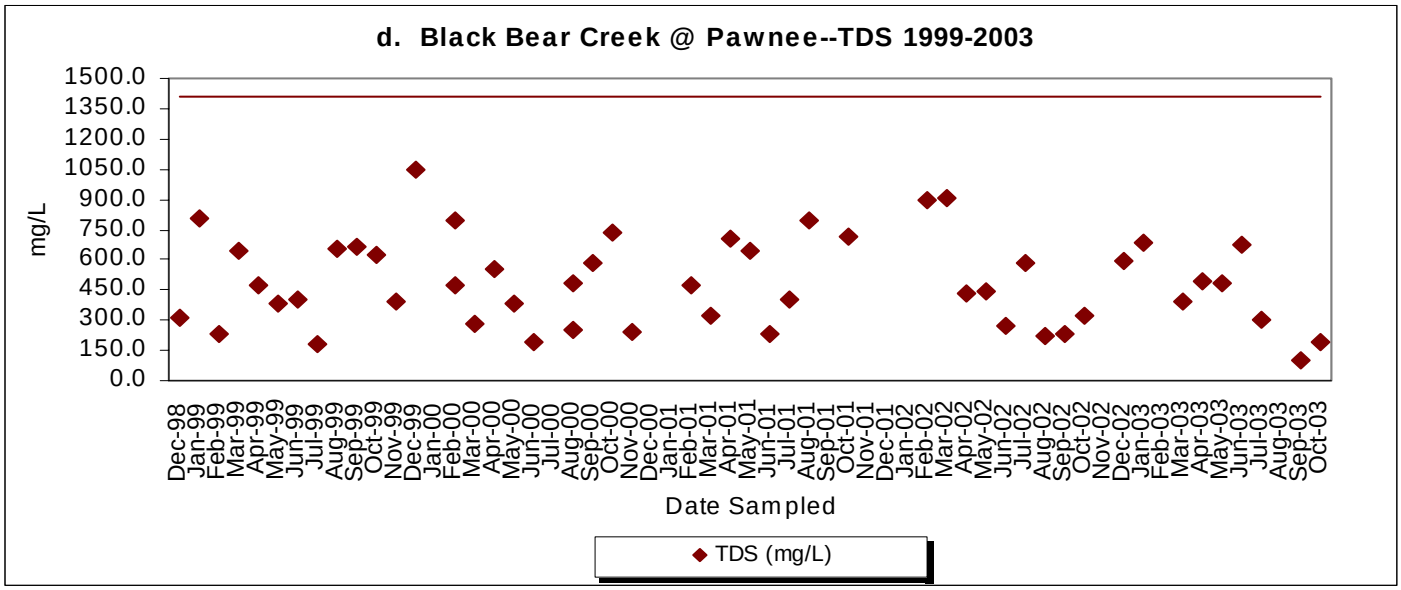
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 31 turbidity samples (Figure 16c), 12 samples (or 39%) exceeded the numerical criteria of 50. Of the 14 toxicant samples collected, 2 of the lead concentrations (or 16%) exceeded the prescribed, hardness-dependent chronic criteria of 8.17 µg/L (Table 13). Dissolved oxygen (Figure 16a) and pH (Figure 16b) data met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 16d and Figure 16e). The PBCR beneficial use is not supported (Table 14). Of the 18 fecal coliform concentrations, 5 samples (or 28%) exceeded the prescribed screening level of 400 cfu/mL. Of the 17 enterococci concentrations, 6 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (293.5 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of Black Bear Creek is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 1.0 mg/L and 4.65 mg/L, respectively (Figure 16f).

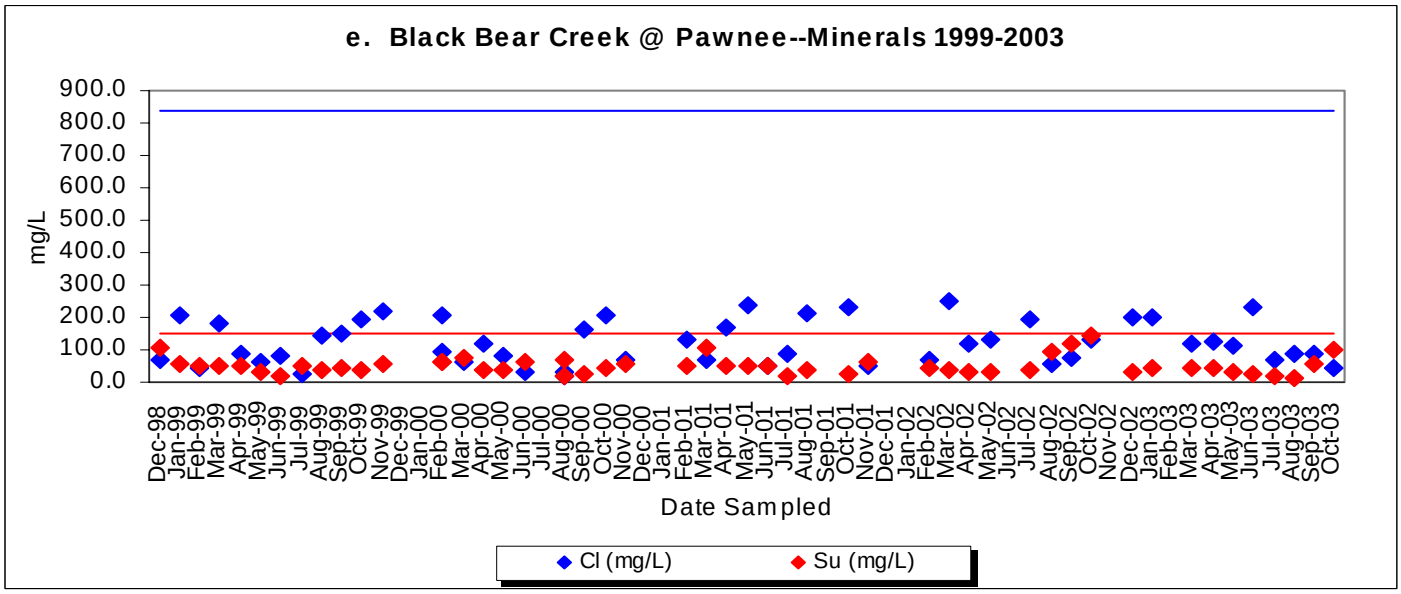
Figure 16a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) for the Black Bear Creek at Pawnee (AT153000), 1999-2003.

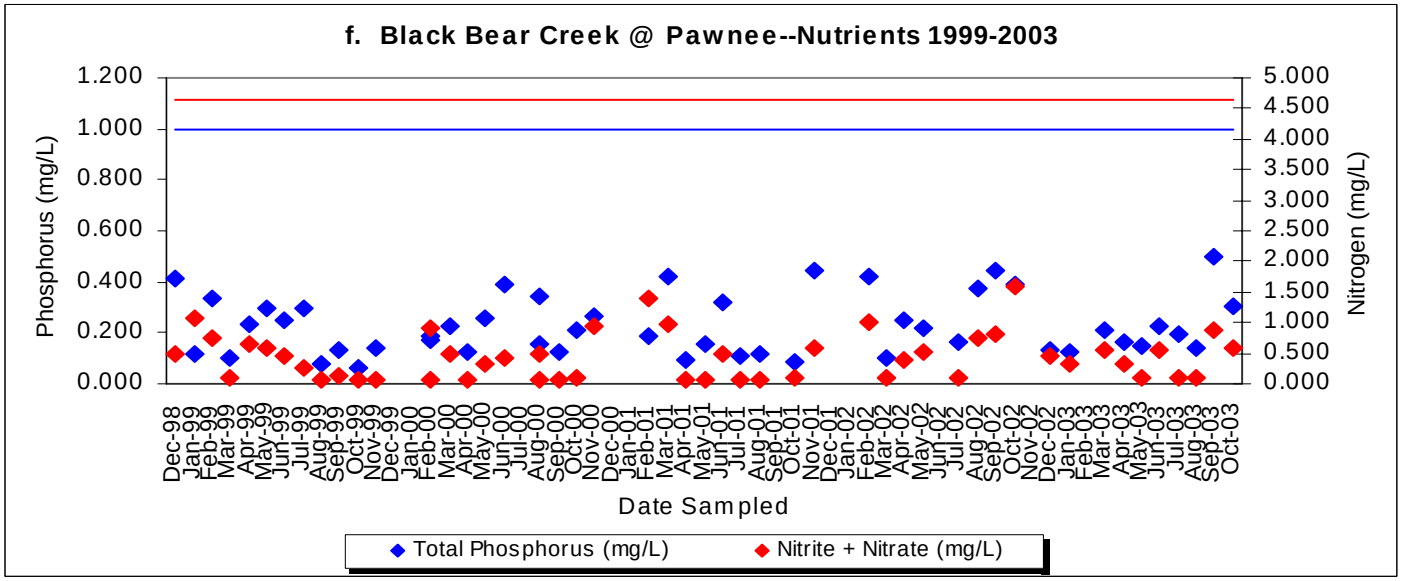







d. Black Bear Creek @ Pawnee--TDS 1999-2003
mg/L
1500.0
1350.0
1200.0
1050.0
900.0
750.0
600.0
450.0
300.0
150.0
0.0
Date Sampled
TDS (mg/L)


e. Black Bear Creek @ Pawnee--Minerals 1999-2003
mg/L
900.0
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Black Bear Creek @ Pawnee--Nutrients 1999-2003
Phosphorus (mg/L)
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Nitrogen (mg/L)
5.000
4.500
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

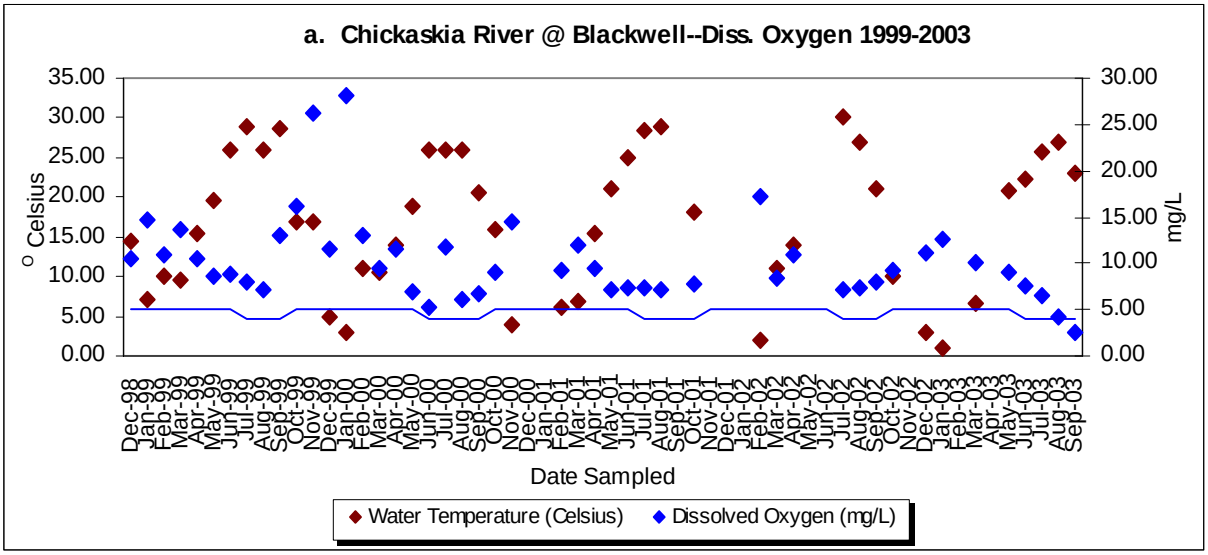
Chickaskia River near Blackwell

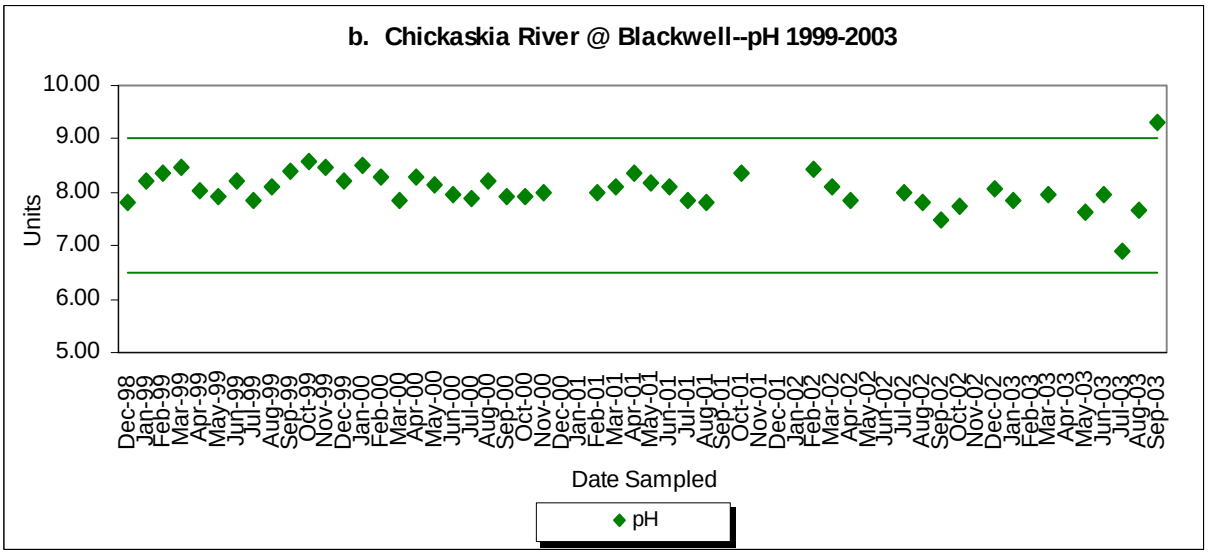
Station AT152000 (621100000010-001AT) is a permanent ambient trend monitoring station located on the Chickaskia River in Oklahoma. Situated in the west central portion of Kay County, the site was established north of the City of Blackwell on US Highway 177. The station is positioned near the midpoint of stream segment 621100000010 and is classified within the Chickaskia River 8-digit HUC watershed (11060005). Water enters the stream system from Lake Blackwell and from several tributaries including Bluff Creek, Shoo Fly Creek, Doe Creek, Bitter Creek, Stink Creek, and Duck Creek, among others.

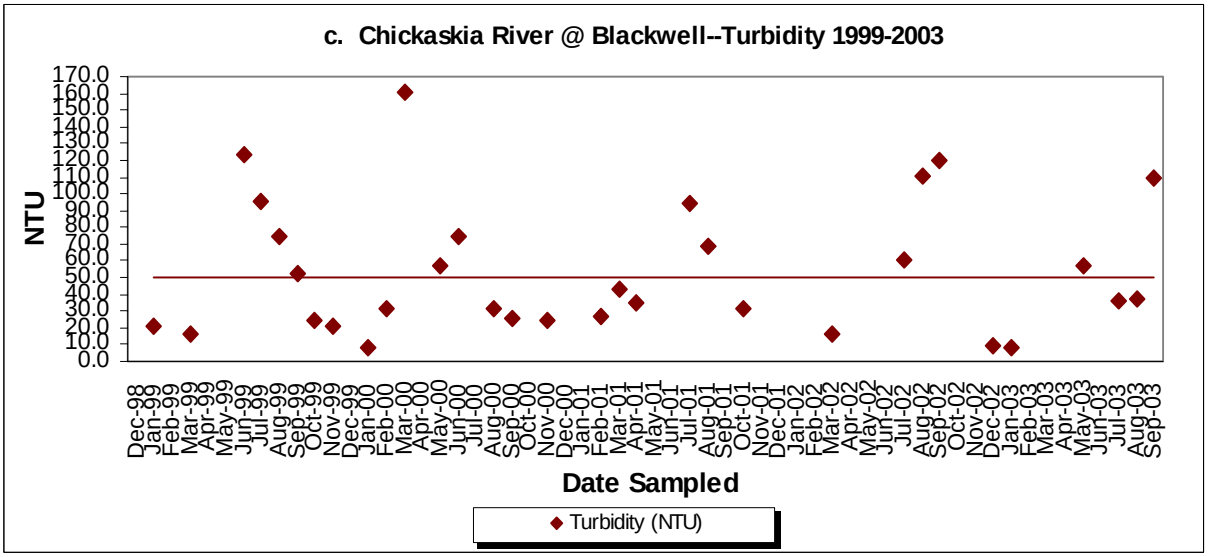
This station on the Chickaskia River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through September of 2003. For purposes of reporting, this station is representative of the Chickaskia River from the confluence of Bluff Creek (97.3276, 36.9679) downstream to confluence of the Chickaskia River with the Salt Fork of the Arkansas River (97.2442, 36.6233). As per Appendix A, Table 6 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

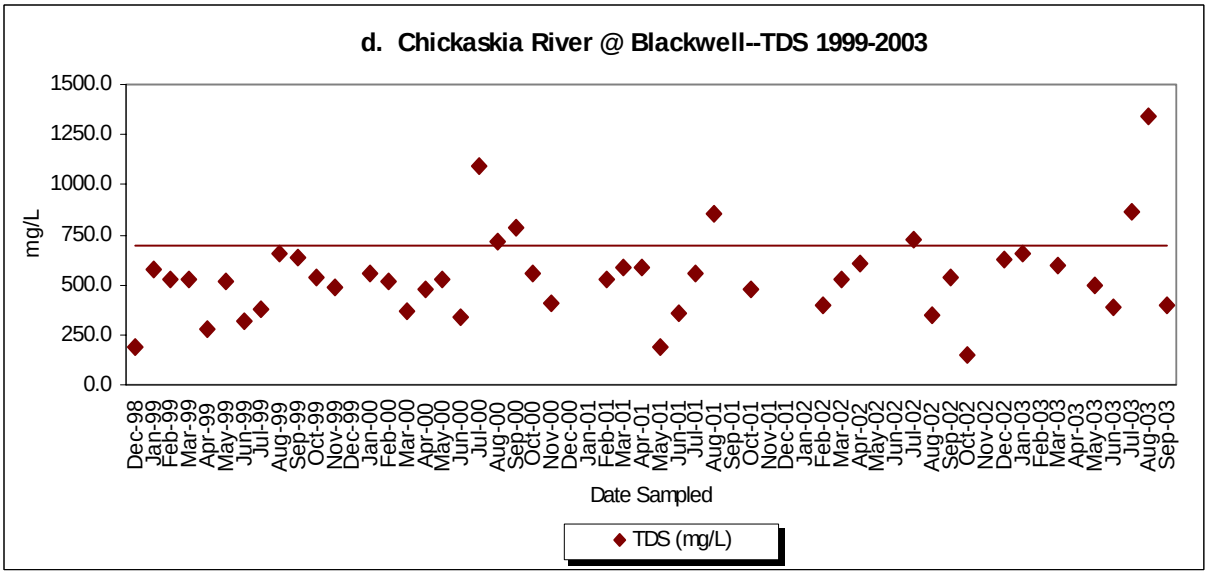
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 32 turbidity samples (Figure 17c), 14 samples (or 44%) exceeded the numerical criteria of 50. Of the 14 toxicant samples collected, 3 of the lead concentrations (or 24%) exceeded the prescribed, hardness-dependent chronic criteria of 11.91 µg/L (Table 13). Dissolved oxygen (Figure 17a) and pH (Figure 17b) data met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids (TDS), chlorides, and sulfates (Figure 17d and Figure 17e). The PBCR beneficial use is not supported (Table 14). Of the 18 fecal coliform concentrations, 6 samples (or 33%) exceeded the prescribed screening level of 400 cfu/mL. Of the 18 enterococci concentrations, 9 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (827.5 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Chickaskia River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 17f).

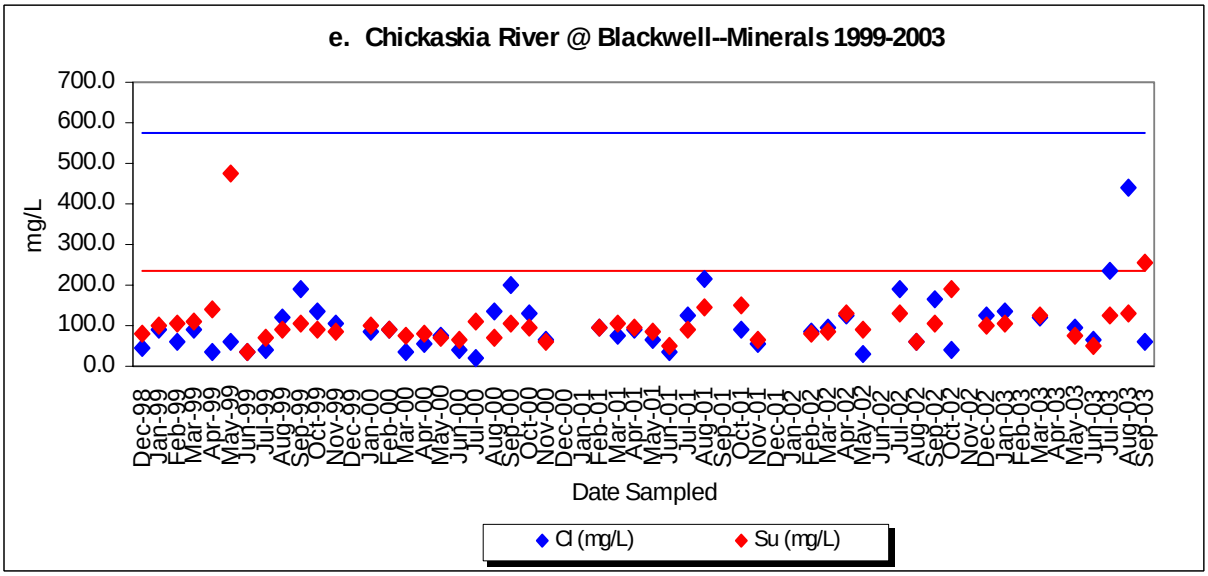
Figure 17a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) for the Chickaskia River at Blackwell (AT152000), 1999-2003.

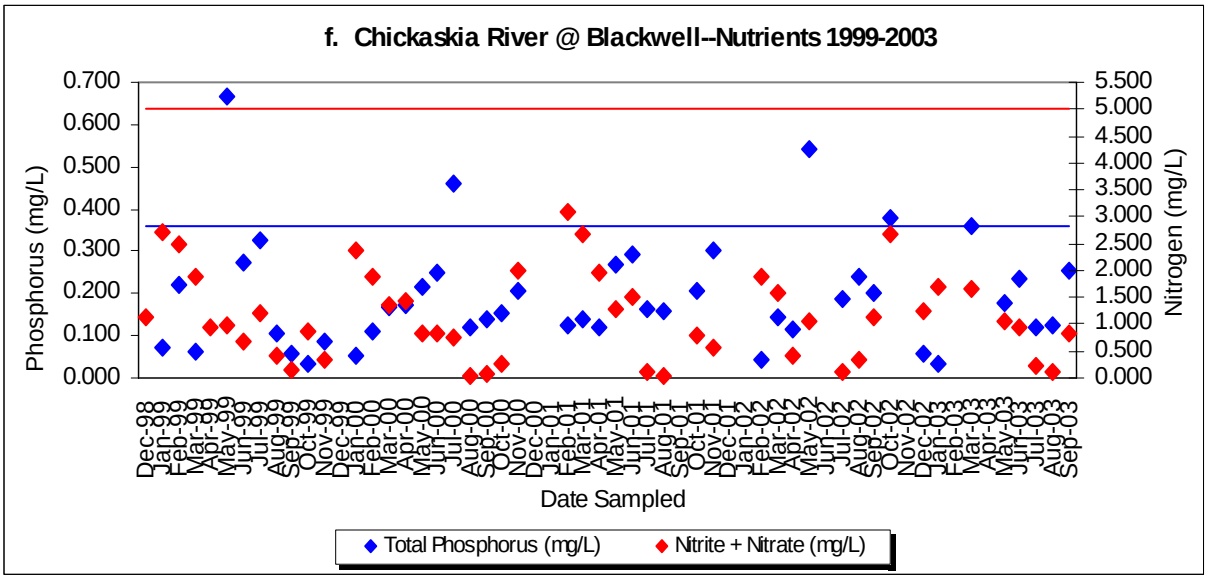







d. Chickaskia River @ Blackwell--TDS 1999-2003
mg/L
1500.0
1250.0
1000.0
750.0
500.0
250.0
0.0
Date Sampled
TDS (mg/L)


e. Chickaskia River @ Blackwell--Minerals 1999-2003
mg/L
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Chickaskia River @ Blackwell--Nutrients 1999-2003
Phosphorus (mg/L)
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Nitrogen (mg/L)
5.500
5.000
4.500
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

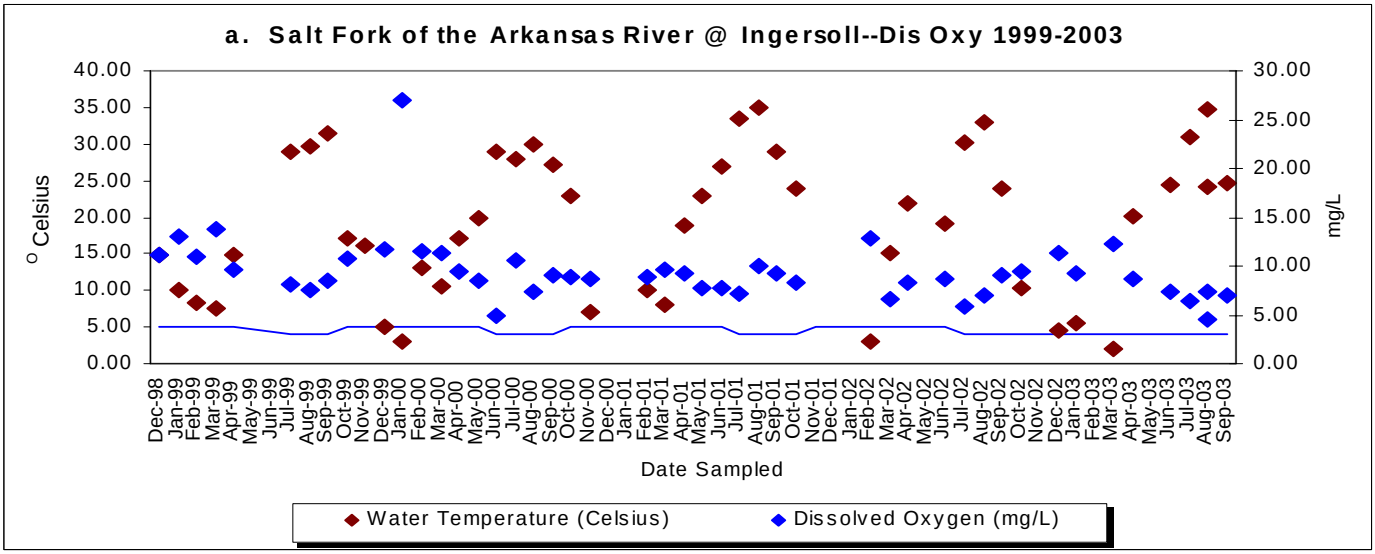
Salt Fork of the Arkansas near Ingersoll

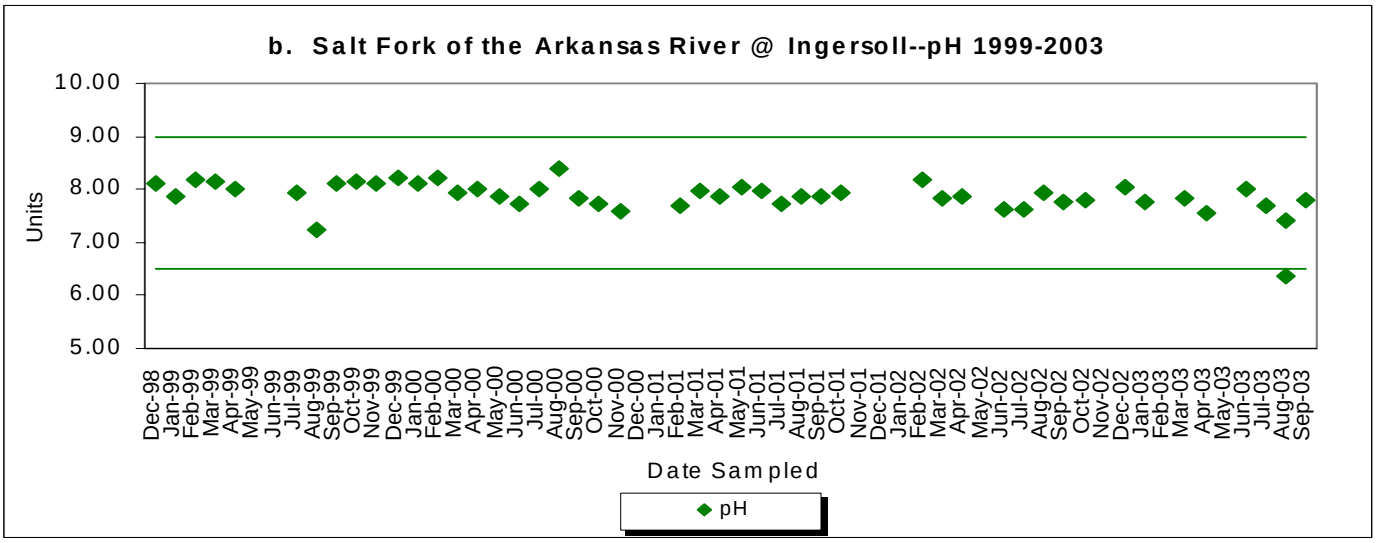
Station AT148450 (621010010160-001AT) is a permanent ambient trend monitoring station located on the Salt Fork of the Arkansas River in Oklahoma. Situated in the north central portion of Alfalfa County, the site was established north of the Town of Ingersoll on State Highway 58. The station is positioned near the midpoint of stream segment 621010010160 and is classified within the Upper Salt Fork of the Arkansas River 8-digit HUC watershed (11120302). Water enters the stream system from Kansas and from several tributaries including Yellowstone Creek, Greenleaf Creek, and Turkey Creek, among others.

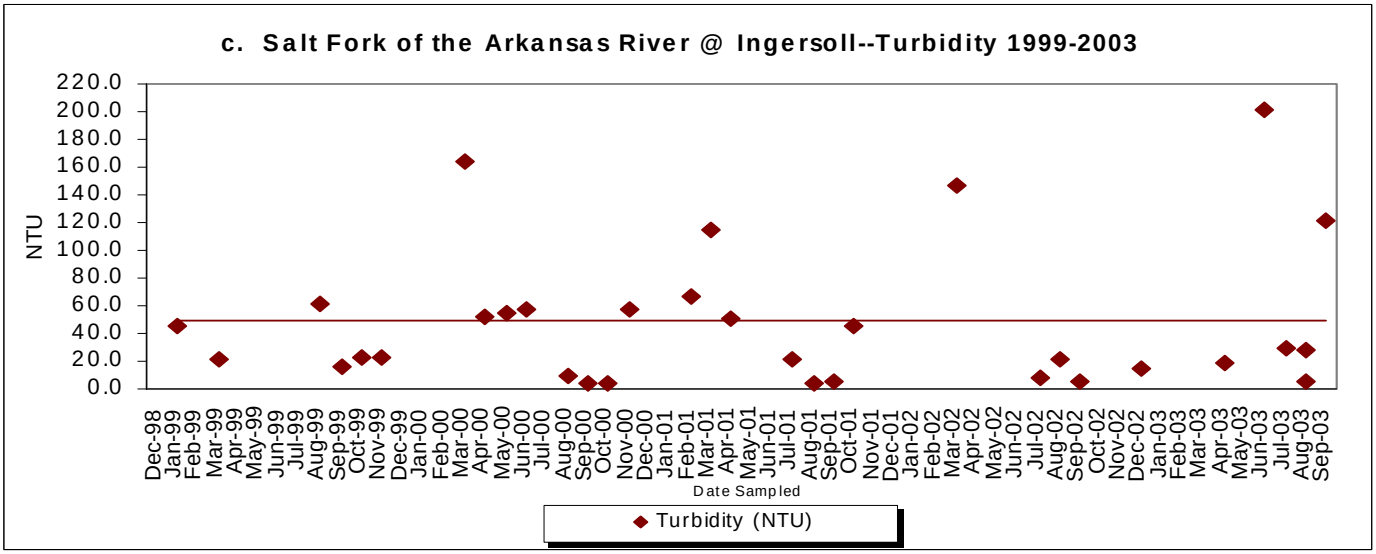
This station on the Salt Fork of the Arkansas River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through September of 2003. For purposes of reporting, this station is representative of the Salt Fork River from the confluence of Turkey Creek (98.6673, 36.8149) downstream to confluence of the Salt Fork River with the Medicine Lodge River (98.3265, 36.8333). As per Appendix A, Table 6 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class III Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

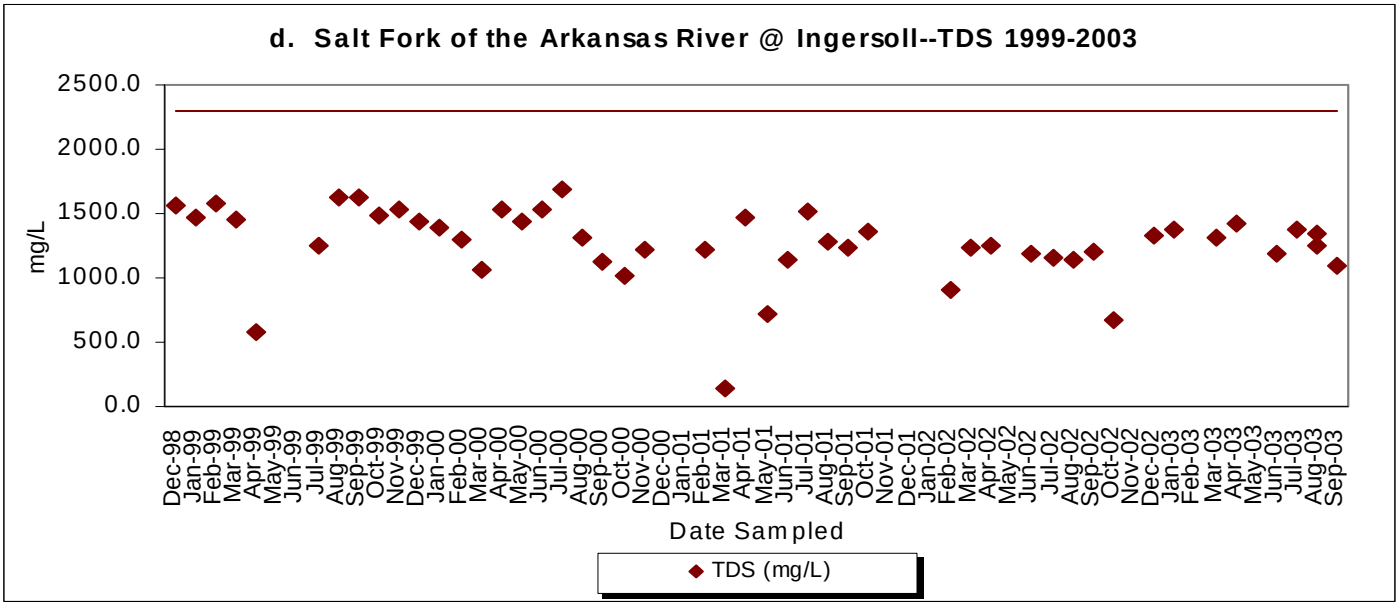
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 13 toxicant samples collected, 2 of the selenium concentrations (or 15%) exceeded the prescribed chronic criteria of 5 µg/L (Table 13). Of the 33 turbidity samples (Figure 18c), 13 samples (or 39%) exceeded the numerical criteria of 50. Dissolved oxygen (Figure 18a) and pH (Figure 18b) data collected during the same period met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 18d and Figure 18e). The PBCR beneficial use is not supported (Table 14). Of the 29 fecal coliform concentrations, 22 samples (or 76%) exceeded the prescribed screening level of 400 cfu/mL, and the geometric mean (484.5 cfu/mL) exceeded the prescribed mean standard of 400 cfu/mL. Of the 29 enterococci concentrations, 19 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (1440.1 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. Of the 29 *E. coli* concentrations, 10 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (155.5 cfu/mL) exceeded the prescribed mean standard of 126 cfu/mL. This segment of the Salt Fork River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 18f).

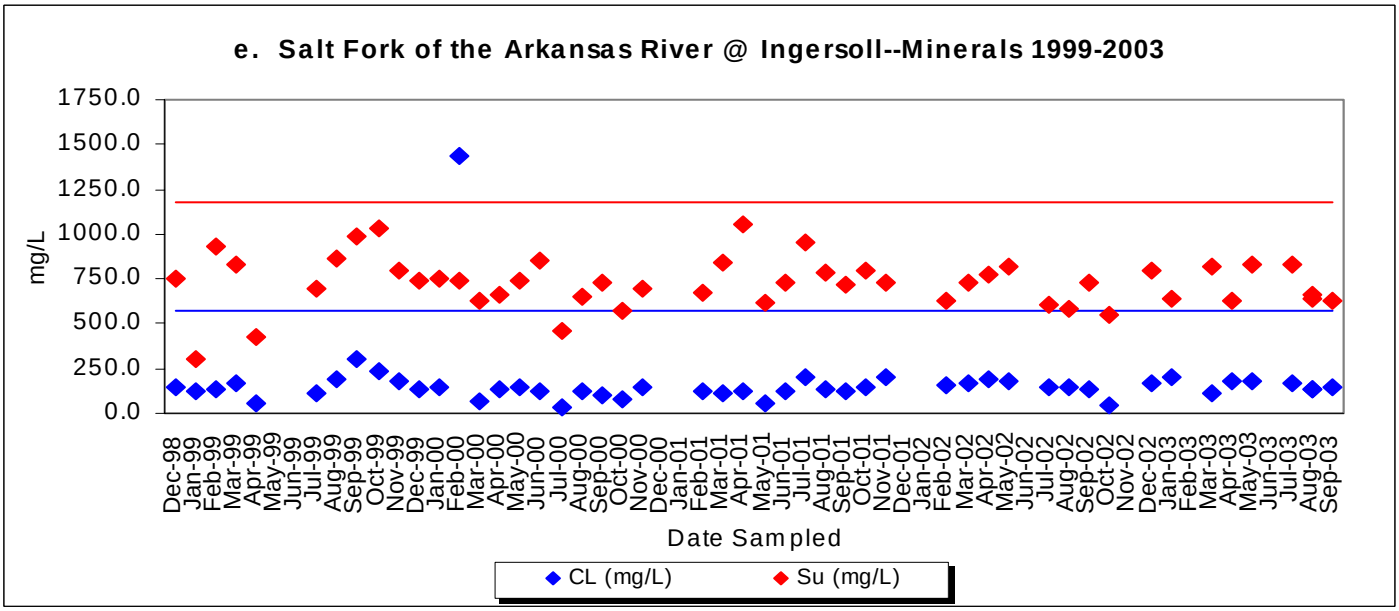
Figure 18a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) for the Salt Fork of the Arkansas River at Ingersoll (AT148450), 1999-2003.

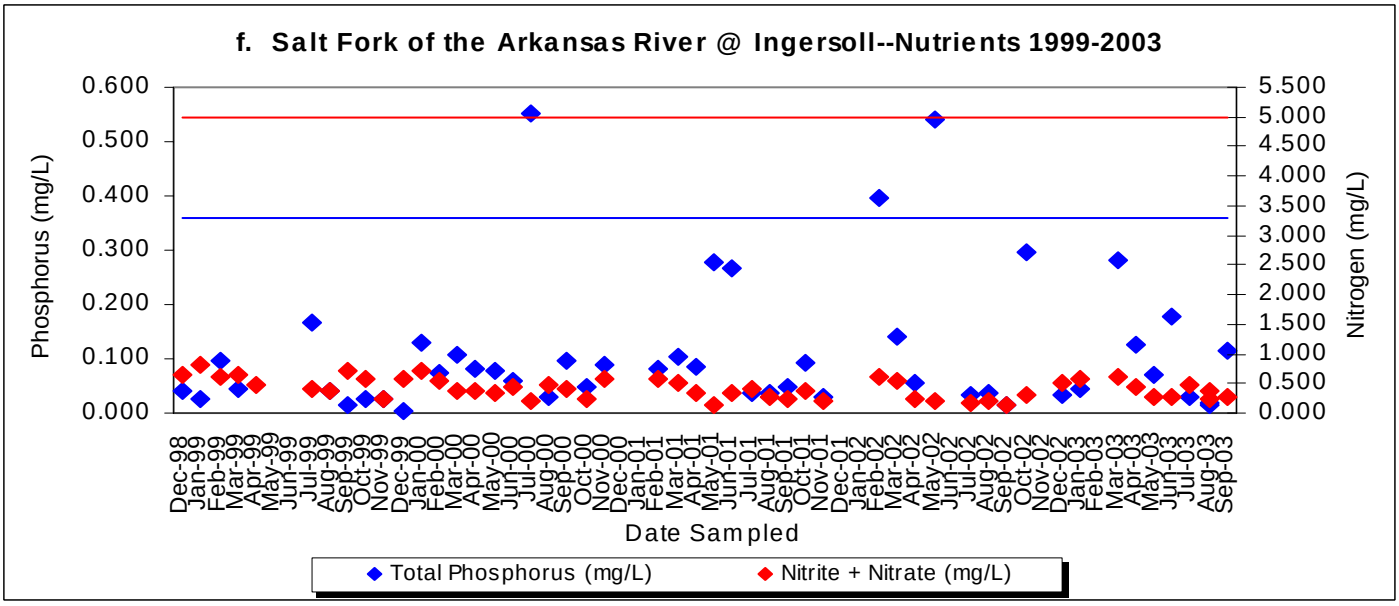







d. Salt Fork of the Arkansas River @ Ingersoll--TDS 1999-2003
mg/L
2500.0
2000.0
1500.0
1000.0
500.0
0.0
Date Sampled
TDS (mg/L)


e. Salt Fork of the Arkansas River @ Ingersoll--Minerals 1999-2003
mg/L
1750.0
1500.0
1250.0
1000.0
750.0
500.0
250.0
0.0
Date Sampled
CL (mg/L)
Su (mg/L)


f. Salt Fork of the Arkansas River @ Ingersoll--Nutrients 1999-2003
Phosphorus (mg/L)
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Nitrogen (mg/L)
5.500
5.000
4.500
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

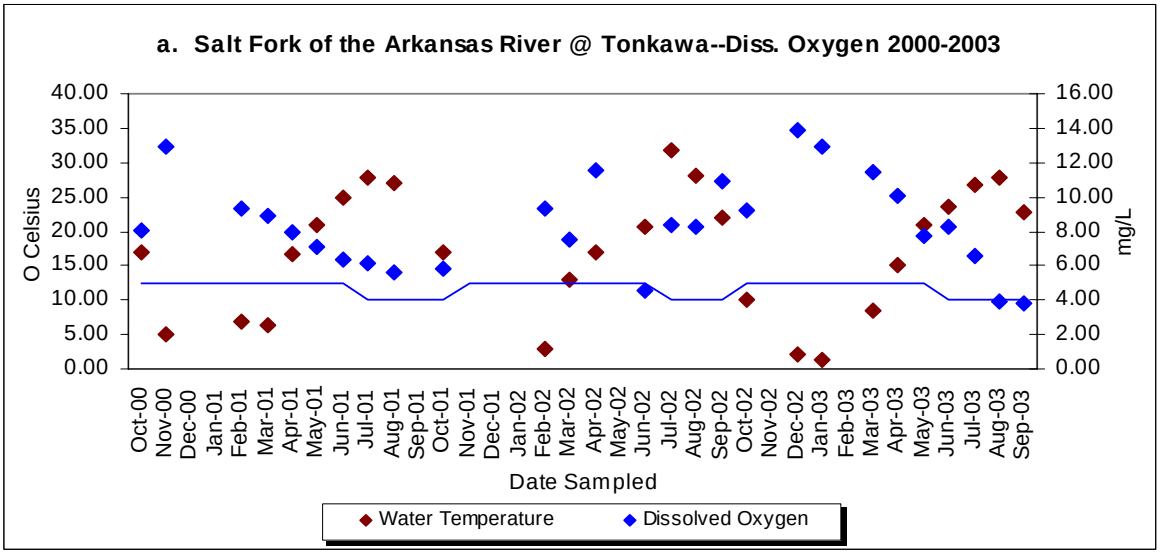
Salt Fork of the Arkansas River near Tonkawa

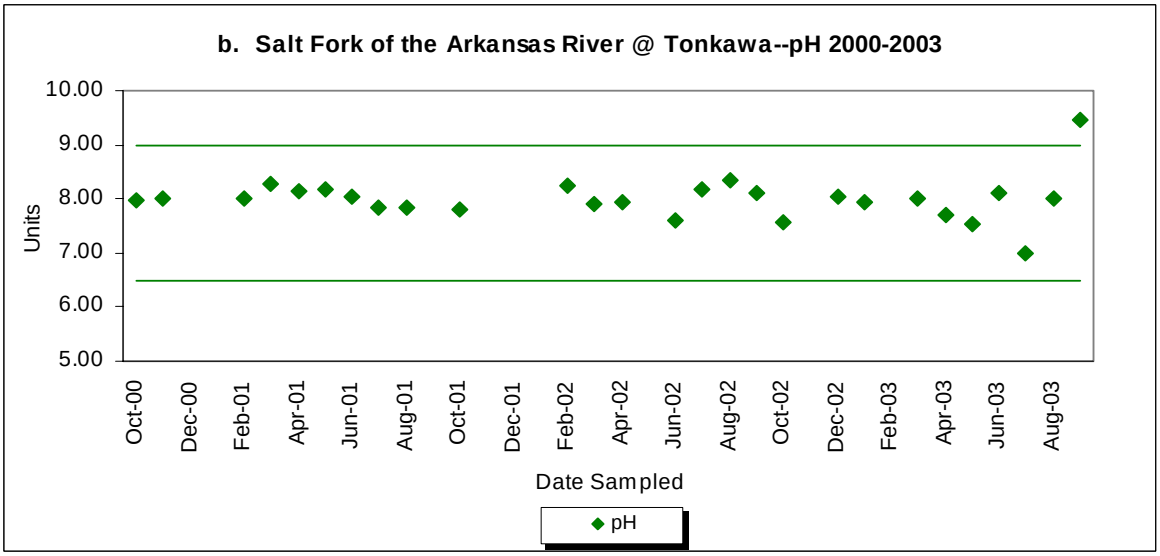
Station AT151000 (621000010010-001AT) is a permanent ambient trend monitoring station located on the Salt Fork of the Arkansas River in Oklahoma. Situated in the southwest portion of Kay County, the site was established south of the Town of Tonkawa on US Highway 77. The station is positioned near the midpoint of stream segment 621000010010 and is classified within the Lower Salt Fork – Arkansas River 8-digit HUC watershed (11060004). Water enters the stream system from Sand Creek, Pond Creek, and Deer Creek, among others.

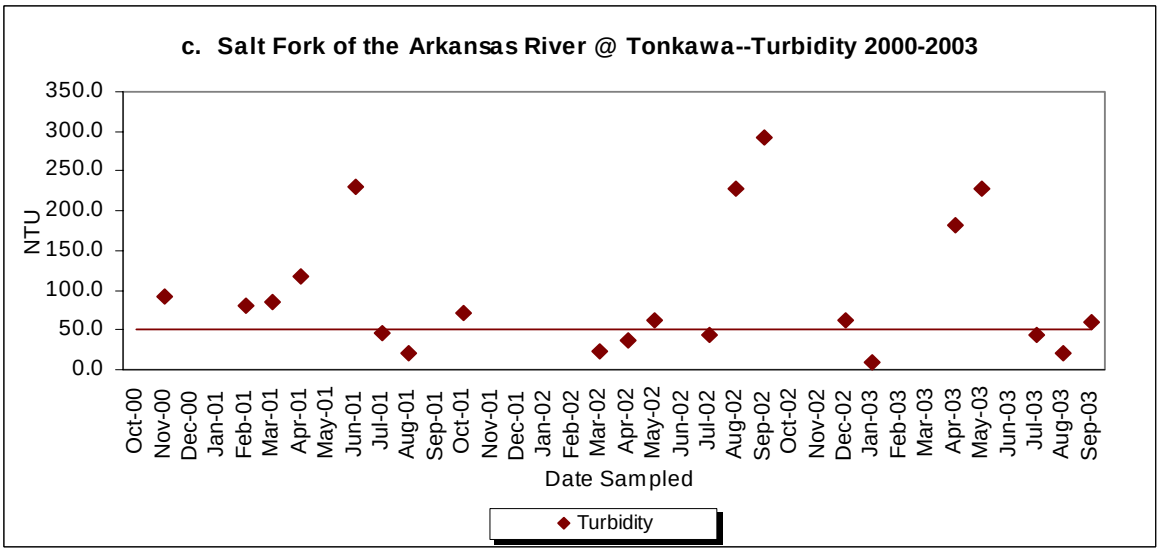
This station on the Salt Fork of the Arkansas River has been active for all water quality variables since October of 2000. The following assessment of beneficial uses is based on data collected from October of 2000 through September of 2003. For purposes of reporting, this station is representative of the Salt Fork of the Arkansas River from the confluence of Sand Creek (97.9700, 36.7194) downstream to the confluence of the Salt Fork of the Arkansas River with the Chickaskia River (97.2442, 36.6233). As per Appendix A, Table 6 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class III Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

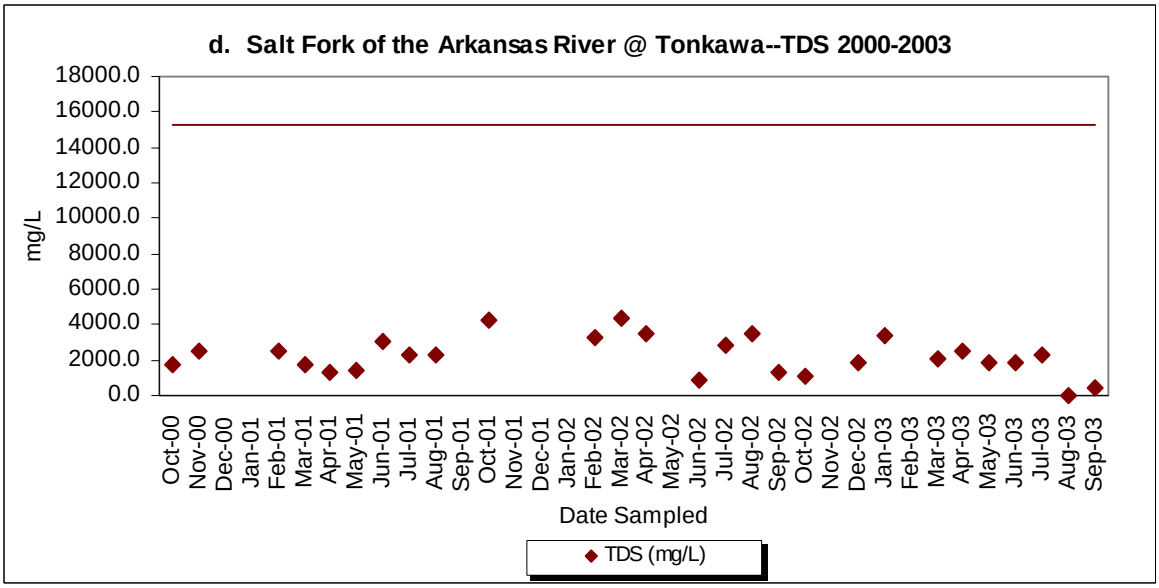
The PPWS beneficial use is supported. The WWAC beneficial use is partially supported. Of the 21 turbidity samples (Figure 19c), 13 samples (or 62%) exceeded the numerical criteria of 50. Of the 27 dissolved oxygen samples (Figure 19a), 3 samples (or 11%) were below the screening level. The pH (Figure 19b), and toxicant data collected during the same period met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 19d and Figure 19e). The PBCR beneficial use is not supported (Table 14). Of the 9 enterococci concentrations, 8 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (1203.0 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Salt Fork River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 1.0 mg/L and 4.65 mg/L, respectively (Figure 19f).

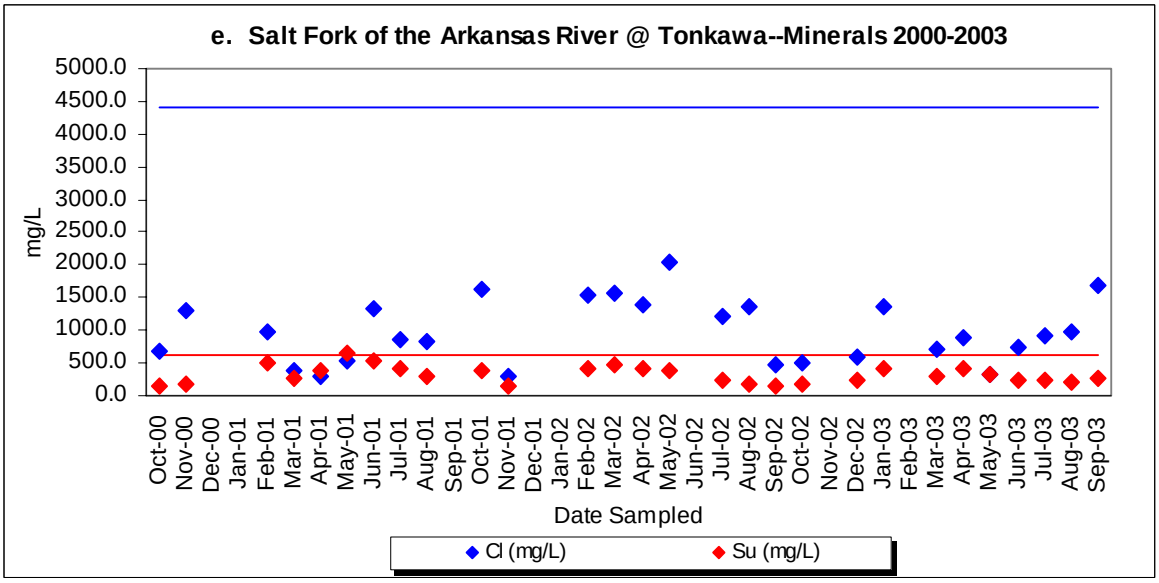
Figure 19a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) for the Salt Fork of the Arkansas River near Tonkawa (AT151000), 2000-2003.

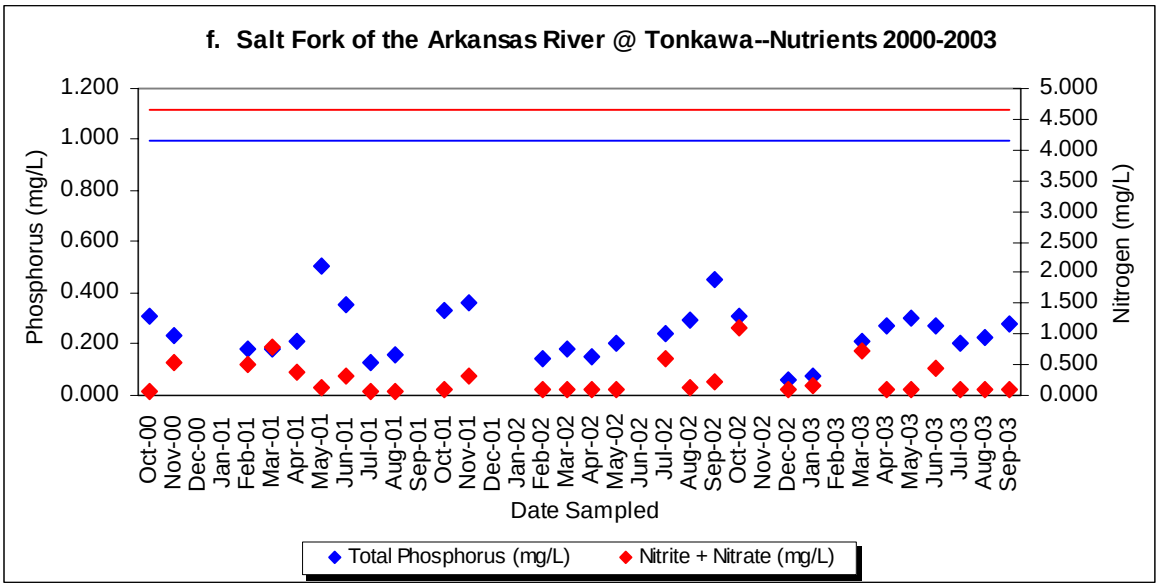







d. Salt Fork of the Arkansas River @ Tonkawa--TDS 2000-2003
mg/L
18000.0
16000.0
14000.0
12000.0
10000.0
8000.0
6000.0
4000.0
2000.0
0.0
Oct-00 Nov-00 Dec-00 Jan-01 Feb-01 Mar-01 Apr-01 May-01 Jun-01 Jul-01 Aug-01 Sep-01 Oct-01 Nov-01 Dec-01 Jan-02 Feb-02 Mar-02 Apr-02 May-02 Jun-02 Jul-02 Aug-02 Sep-02 Oct-02 Nov-02 Dec-02 Jan-03 Feb-03 Mar-03 Apr-03 May-03 Jun-03 Jul-03 Aug-03 Sep-03
Date Sampled
TDS (mg/L)


e. Salt Fork of the Arkansas River @ Tonkawa--Minerals 2000-2003
mg/L
5000.0
4500.0
4000.0
3500.0
3000.0
2500.0
2000.0
1500.0
1000.0
500.0
0.0
Oct-00 Nov-00 Dec-00 Jan-01 Feb-01 Mar-01 Apr-01 May-01 Jun-01 Jul-01 Aug-01 Sep-01 Oct-01 Nov-01 Dec-01 Jan-02 Feb-02 Mar-02 Apr-02 May-02 Jun-02 Jul-02 Aug-02 Sep-02 Oct-02 Nov-02 Dec-02 Jan-03 Feb-03 Mar-03 Apr-03 May-03 Jun-03 Jul-03 Aug-03 Sep-03
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Salt Fork of the Arkansas River @ Tonkawa--Nutrients 2000-2003
Phosphorus (mg/L)
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Nitrogen (mg/L)
5.000
4.500
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
Oct-00 Nov-00 Dec-00 Jan-01 Feb-01 Mar-01 Apr-01 May-01 Jun-01 Jul-01 Aug-01 Sep-01 Oct-01 Nov-01 Dec-01 Jan-02 Feb-02 Mar-02 Apr-02 May-02 Jun-02 Jul-02 Aug-02 Sep-02 Oct-02 Nov-02 Dec-02 Jan-03 Feb-03 Mar-03 Apr-03 May-03 Jun-03 Jul-03 Aug-03 Sep-03
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

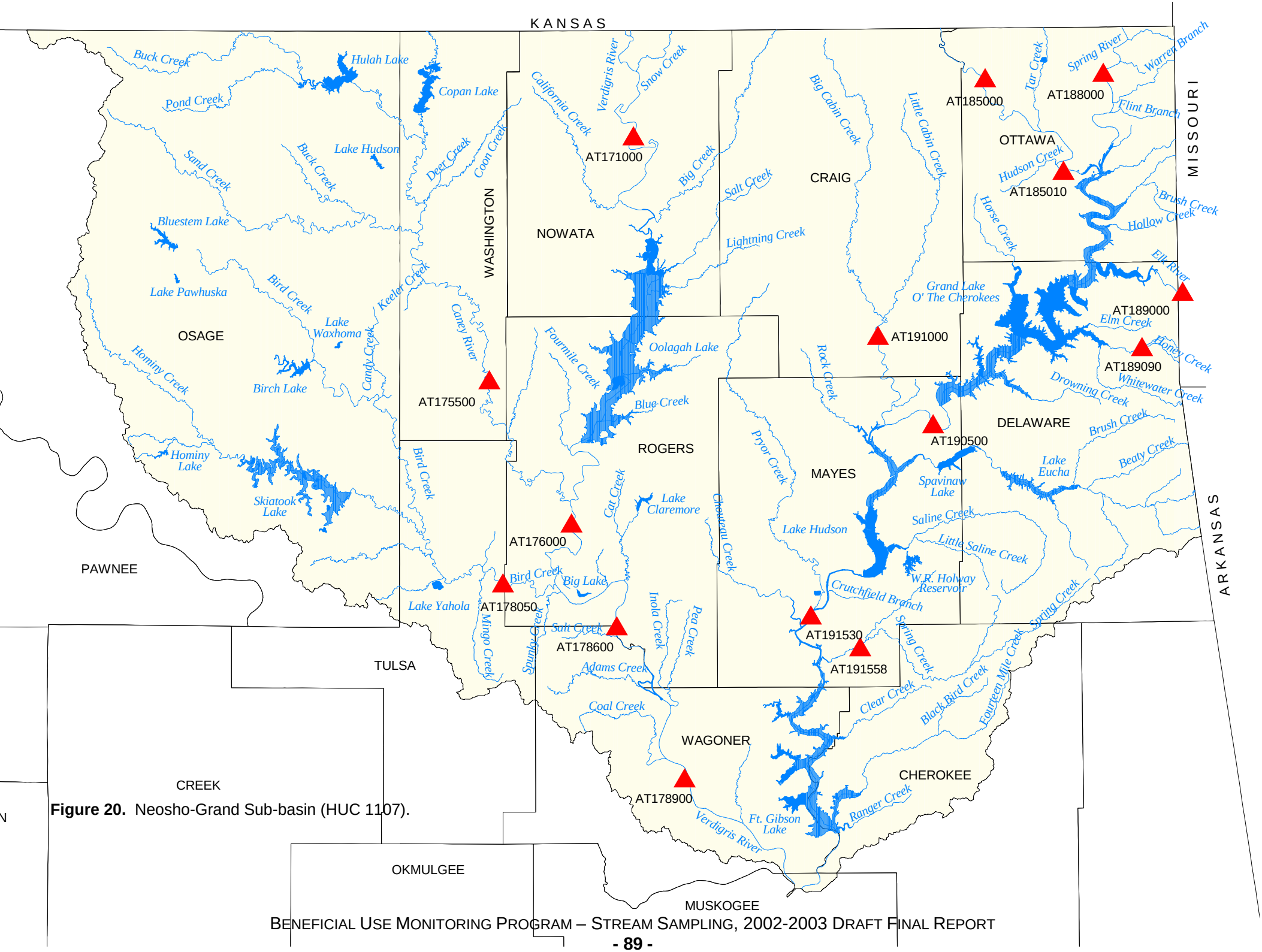


Figure 20. Neosho-Grand Sub-basin (HUC 1107).

HUC 1107

NEOSHO/GRAND SUB-BASIN

The Neosho/Grand sub-basin (4-digit hydrologic unit 1107) is situated in the northeast portion of the state. It originates in the west central portion of Osage County, continues eastward through portions of Washington, Tulsa, Nowata, Rogers, Wagoner, Muskogee, Craig, Mayes, and Cherokee Counties and terminates in Ottawa and Delaware Counties. Major cities and County seats located within the basin include Pawhuska, Dewey, Bartlesville, Skiatook, Collinsville, Sperry, Owasso, Tulsa, Nowata, Oologah, Port of Catoosa, Claremore, Pryor, Chouteau, Locust Grove, Wagoner, Fort Gibson, Vinita, Langley, Miami, Grove, and Jay. Minor cities of note include South Coffeyville, Adair, Quapaw, Afton, and Ketchum.

The sub-basin is subdivided into nine 8-digit hydrologic units (HUC) within the state. These HUC's are the Middle Verdigris (11070103), the Lower Verdigris (11070103), the Caney (11070106), the Bird (11070107), the Middle Neosho (11070205), Grand Lake (11070206), the Spring (11070207), the Elk (11070208), and the Lower Neosho (11070209). The major surface waters in the basin are the Verdigris and Grand/Neosho Rivers. Major tributaries include Caney River, Little Caney River, Spring River, Elk River, Sand Creek, Bird Creek, Big Creek, Dog Creek, Tar Creek, Honey Creek, Big Cabin Creek, Spavinaw Creek, Pryor Creek, and Spring Creek. Nine major lakes are located in the basin—Hulah Lake formed by the Caney River, Copan Lake formed the Little Caney River, Bluestem Lake formed by the headwaters of Bird Creek, Skiatook Lake formed by Hominy Creek, Oologah Lake formed by the Verdigris River, Grand Lake formed by the Neosho, Spring, and Elk Rivers (among other creeks), Lake Eucha formed by Spavinaw Creek, Spavinaw Lake formed by Spavinaw Creek, Lake Hudson formed by the Neosho River and Spavinaw, Rock, and Saline Creek, and Fort Gibson Lake formed by the Neosho River and Clear and Fourteen Mile Creek. Fifteen active permanent water quality-monitoring stations (Table 15) are located in the basin— AT171000, AT175500, AT176000, AT178050, AT178600, AT178900, AT185000, AT185010, AT188000, AT189000, AT189090, AT190500, AT191000, AT191530, and AT191558. Three inactive water quality-monitoring stations (AT171100, AT191050, AT191560) are located in the sub-basin. Stations 171100 and 191050 were last assessed in the 1999 BUMP report while station 191560 was last assessed in the 2000 BUMP report.

The sub-basin is characterized by four ecoregions. The Central Irregular Plains is the primary ecoregion covering the central portion of the sub-basin, the majority of Ottawa and Cherokee Counties, and part of Delaware County. The Central Oklahoma/Texas Plains covers the majority of Osage County and parts of Tulsa and Washington Counties. The Ozark Highlands typify the majority of Delaware County, one-quarter (¼) of Ottawa County, and a small part of western Mayes County. The Boston Mountains ecoregion is represented in a small part of eastern Cherokee County. The primary land usage in the sub-basin is rangeland (open grasslands and woody areas). It dominates the western and north central portions of the sub-basin and is further interspersed throughout the southern, central and east central portions of the sub-basin. The secondary land uses are pastureland and forestland. Pastureland is interspersed throughout the eastern, central, and southern portions of the sub-basin with concentrations in Ottawa, Cherokee, Delaware, Craig, Rogers, Tulsa, and Washington Counties. Forestland (post oak–blackjack oak, hickory, and bottomland hardwoods) is interspersed throughout the entire sub-basin with heavy concentrations in Cherokee and

Delaware Counties. The tertiary land use is cropland with heaviest concentrations in the central and east central portions of the sub-basin. Other land uses of note include farmsteads, major urban areas, wetlands, and confined animal feeding operations.

Table 15. Permanent Ambient Trend Monitoring Stations Located in HUC 1107.

WBID #	STATION #	STATION NAME	STATUS	FS	PS	NS/T	CBD
121600060060	AT191000	Big Cabin Creek, off US 69, Big Cabin	Active 9/99-P	AG, FWP, AES, PBCR. PPWS	NONE	NONE	NONE
121300010010	AT178050	Bird Creek, SH 266, Port of Catoosa	Active 11/98-P	AG, AES, PPWS	NONE	FWP, PBCR	NONE
121400010010	AT175500	Caney River, off US 75, Ramona	Active 11/98-P	AG, AES, PPWS	NONE	FWP, PBCR	NONE
121600030440	AT189000	Elk River, SH 43, Tiff City (MO)	Active 5/99-P	AG, FWP, AES, PPWS	NONE	PBCR	NONE
121600030445	AT189090	Honey Creek, off SH 25, Grove	Active 11/98-P	AG, FWP, PPWS	NONE	AES, PBCR	NONE
121600010280	AT191530	Neosho River, US 412, Chouteau	Active 11/98-P	AG, FWP, AES, PBCR, PPWS	NONE	NONE	NONE
121600040220	AT185000	Neosho River, off US 66, Commerce	Active 10/00-P	AG, AES, PBCR, PPWS	NONE	FWP	NONE
121600040010	AT185010	Neosho River, off SH 137, Connor Bridge	Active 11/98-P	AG, FWP, AES, PBCR, PPWS	NONE	NONE	NONE
121600020170	AT190500	Neosho River, SH 82, Langley	Active 11/98-P	AG, AES, PBCR, PPWS	FWP	NONE	NONE
121600010290	AT191558	Spring Creek, off US 412, Murphy	Active 11/98-P	AG, AES, FWP, PBCR, PPWS	NONE	NONE	NONE
121600070010	AT188000	Spring River, off SH 137, Quapaw	Active 11/98-P	AG, AES, PPWS	NONE	FWP, PBCR	NONE
121500020260	AT178600	Verdigris River, US 412, Inola	Active 10/00-P	AG, AES, PBCR, PPWS	NONE	FWP	NONE
121500030010	AT176000	Verdigris River, SH 20, Keetonville	Active 11/98-P	AG, AES, PPWS	NONE	FWP, PBCR	NONE
121510020010	AT171000	Verdigris River, SH 10, Lenepah	Active 11/98-P	AG, AES, PPWS	NONE	FWP, PBCR	NONE
121500010200	AT178900	Verdigris River, SH 51, Wagoner	Active 9/99-P	AG, AES, PPWS	NONE	FWP, PBCR	NONE

ASSIGNED OWQS BENEFICIAL USES AND SUPPORT CODES

PPWS = PUBLIC AND PRIVATE WATER SUPPLY	EWS = EMERGENCY WATER SUPPLY
FWP = FISH & WILDLIFE PROPAGATION	PBCR = PRIMARY BODY CONTACT RECREATION
AG = AGRICULTURE	AES = AESTHETICS
FS = FULLY SUPPORTING	PS = PARTIALLY SUPPORTING
NS/T = NOT SUPPORTING/THREATENED	CBD = CANNOT BE DETERMINED

Table 16. Toxicant exceedances in HUC 1107.

STATION #	STATION NAME	DATE	Lead (µg/L)	Zinc (µg/L)
AT178050	Bird Creek, SH 266, Port of Catoosa	05/24/1999	12.00	
		05/10/2000	26.00	
		06/28/2000	10.00	
		11/05/2001	4.84	
AT175500	Caney River, off US 75, Ramona	05/24/1999	17.00	
		05/10/2000	22.00	
		06/28/2000	9.00	
		05/07/2001	8.04	
		04/07/2003	19.77	

STATION #	STATION NAME	DATE	Lead (µg/L)	Zinc (µg/L)
AT188000	SPRING RIVER, OFF SH 137, QUAPAW	05/24/1999	8.00	178.00
		12/20/1999		222.00
		06/28/2000	6.00	186.00
		10/24/2000		157.00
		1/29/2003		168.00
		04/07/2003	11.00	221.00
AT178600	VERDIGRIS RIVER, US 412, INOLA	05/30/2001	47.00	
		06/26/2001	12.14	
		09/17/2001	10.37	
		11/27/2001	8.57	
		04/01/2003	6.20	
AT176000	VERDIGRIS RIVER, SH 20, KEETONVILLE	05/24/1999	10.00	
		05/10/2000	32.00	
AT171000	VERDIGRIS RIVER, SH 10, LENEPAH	05/24/1999	7.00	
		05/10/2000	12.00	
		06/28/2000	18.00	
		06/04/2001	21.60	
		04/09/2002	9.78	
AT178900	VERDIGRIS RIVER, SH 51, WAGONER	05/02/2001	5.85	
		05/30/2001	108.00	
		06/26/2001	23.21	
		09/17/2001	13.08	
		10/29/2001	43.36	
		11/27/2001	16.56	
		03/31/2003	5.62	

Table 17. Exceedances of fecal coliform, enterococci, and *E. coli* screening limits in HUC 1107. Only values leading to a determination of not supporting for the Public and Private Water Supply and the Primary Body Contact Recreation beneficial uses are in included.

STATION #	STATION NAME	DATE	Fecal Coliform (cfu/mL)	Enterococci (cfu/mL)	*E. coli* (cfu/mL)
AT178050	BIRD CREEK, SH 266, PORT OF CATOOSA	06/22/1999	760	470	
		07/27/1999	2800		
		09/28/1999	1000	4700	
		06/28/2000	690		
		08/02/2000	1200		
		09/27/2000	2100	900	
		05/07/2001		31000	
		06/04/2001		800	
		05/07/2002	3700	38000	
		07/09/2002	1800	1200	

STATION #	STATION NAME	DATE	Fecal Coliform (cfu/mL)	Enterococci (cfu/mL)	*E. coli* (cfu/mL)
		06/02/2003		73000	
		08/11/2003	5700	700	
		09/15/2003	500	700	
AT175500	Caney River, off US 75, Ramona	06/22/1999		470	
		09/28/1999		1100	
		05/08/2002		2000	
		06/02/2003		700	
		10/01/2003		500	
AT189000	Elk River, SH 43, Tiff City (MO)	05/24/2000		440	
		06/28/2000		1100	
		06/05/2001		1300	
AT189090	Honey Creek, off SH 25, Grove	06/28/2000		1090	
		08/07/2001		600	
		07/09/2002		800	
		09/04/2002		7000	
		10/01/2002		900	
		07/22/2003		9000	
		08/26/2003		700	
		09/30/2003		700	
AT188000	Spring River, off SH 137, Quapaw	06/28/2000		430	
		05/12/2003		33000	
AT176000	Verdigris River, SH 20, Keetonville	09/28/1999		630	
		06/28/2000		2000	
		06/04/2001		430	
		09/04/2002		2000	
AT171000	Verdigris River, SH 10, Lenepah	06/22/1999		430	
		09/28/1999		900	
		05/07/2001		7000	
		09/26/2001		500	
AT178900	Verdigris River, SH 51, Wagoner	05/28/2002		500	

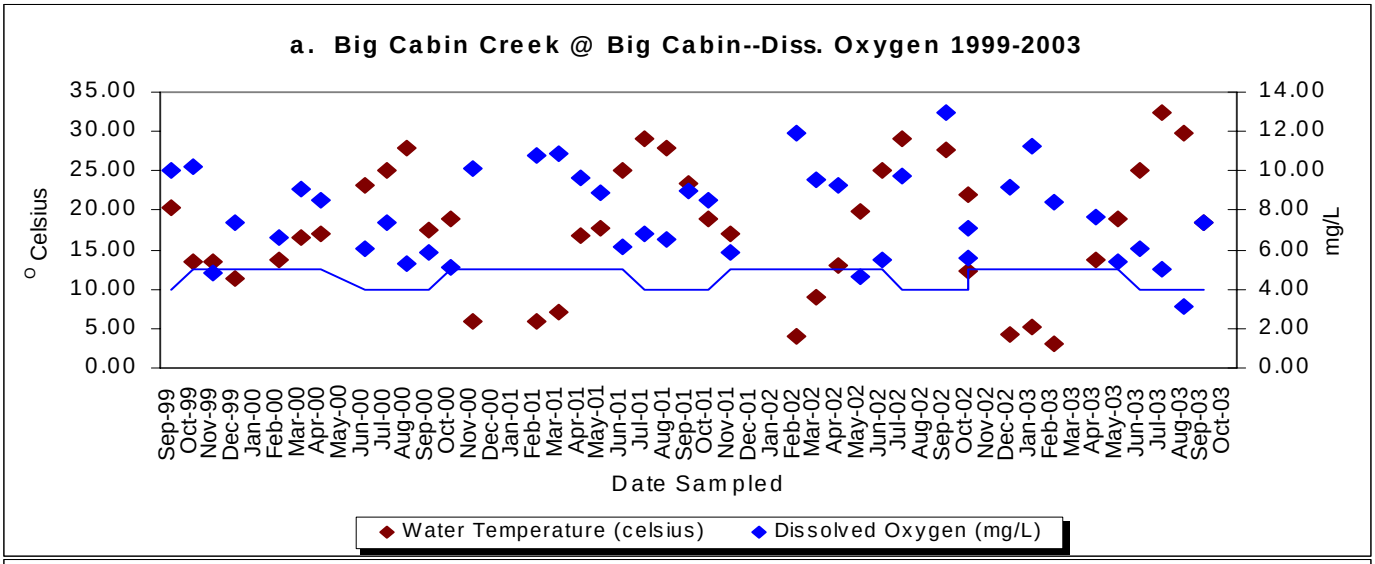
Big Cabin Creek near Big Cabin

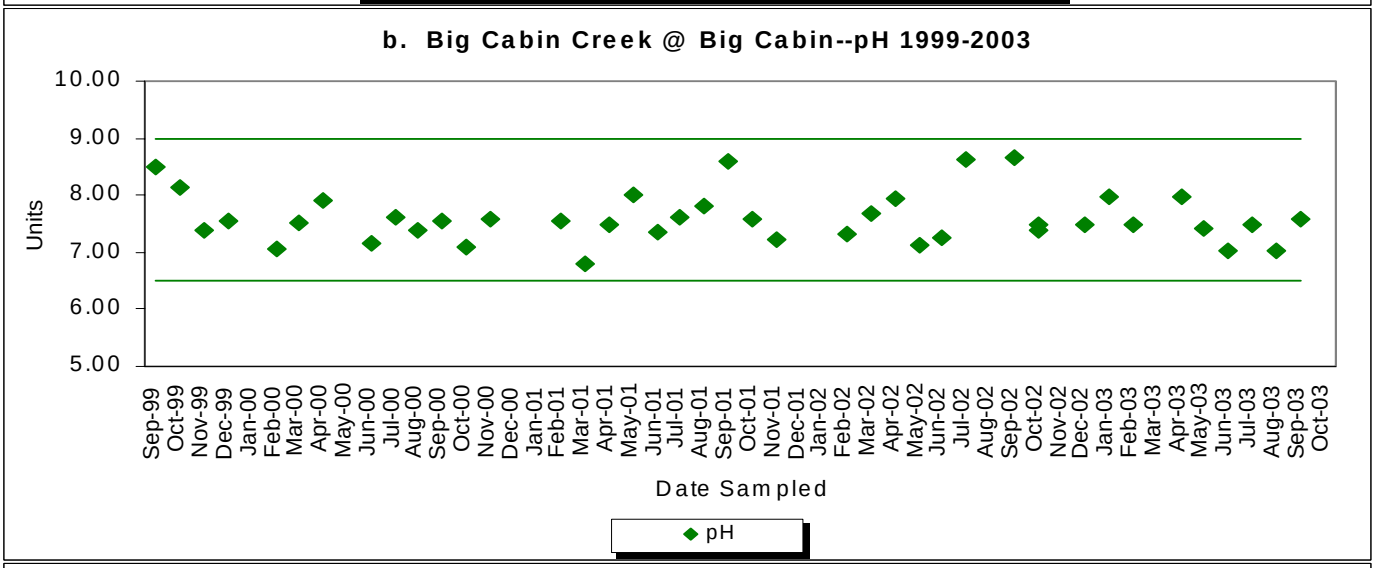
Station AT191000 (121600060060-001AT) is a permanent ambient trend monitoring station located on Big Cabin Creek. Situated in the south central portion of Craig County, the site was established northeast of the Town of Big Cabin off of US Highway 69 on County Road 310. The station is positioned near the upper end of stream segment 121600060060 and is classified within the Lower Neosho River 8-digit HUC watershed (11070209). Water enters the stream system from several tributaries including Bull Creek, Little Cabin Creek, and White Oak Creek, among others.

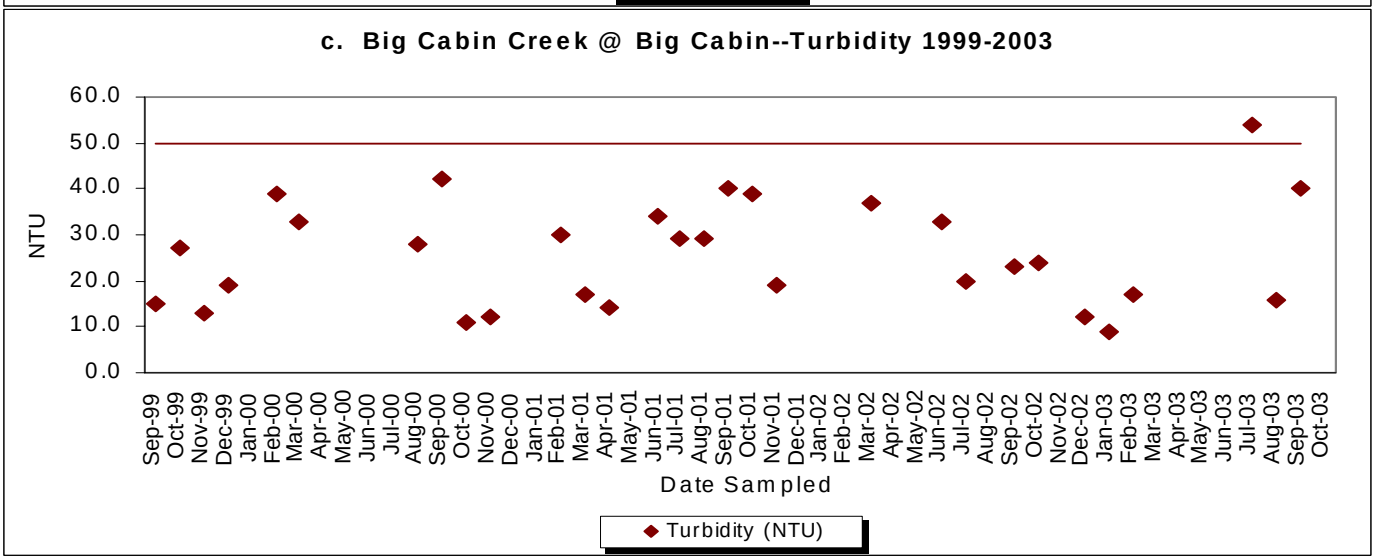
This station on Big Cabin Creek has been active for all water quality variables since September of 1999. The following assessment of beneficial uses is based on data collected from September of 1999 through September of 2003. For purposes of reporting, this station is representative of Big Cabin Creek from the confluence of Bull Creek (95.1416, 36.5875) downstream to the confluence of an unnamed tributary at the Mayes County line (95.143, 36.5094). As per Appendix A, Table 1 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

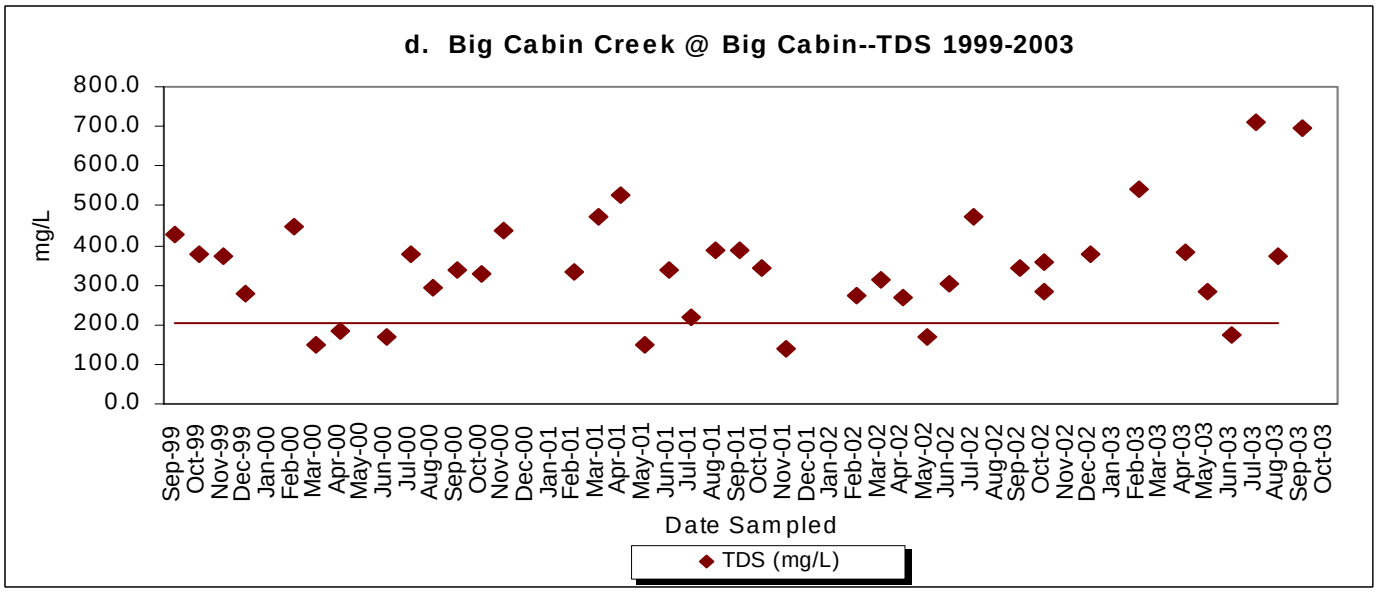
The PPWS beneficial use is supported. The WWAC beneficial use is supported. Dissolved oxygen (Figure 21a), pH (Figure 21b), turbidity (Figure 21c), and toxicant samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids (TDS), chlorides, and sulfates (Figure 21d and Figure 21e). Although 80% of the TDS concentrations exceeded the sample standard of 206.0 mg/L and the geometric mean (370.8 mg/L) exceeded the yearly mean standard of 187.0 mg/L, these values are below the prescribed minimum values of 750mg/L and 700 mg/L, respectively. Although 74% of the sulfate concentrations exceeded the sample standard of 96.0 mg/L and the geometric mean (139.1 mg/L) exceeded the yearly mean standard of 67.0 mg/L, the values are below the minimum standard of 250 mg/L. The PBCR beneficial use is supported for fecal coliform, *E. coli* and enterococci. This segment of Big Cabin Creek is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 21f).

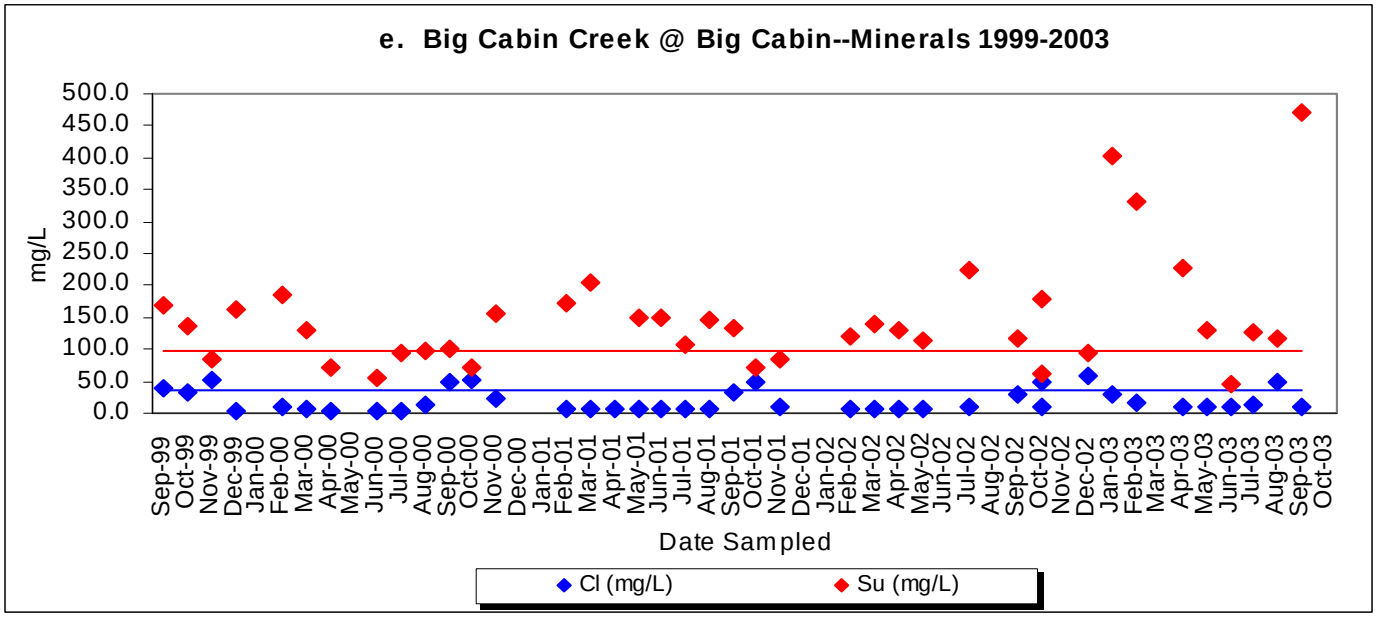
Figure 21a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) for Big Cabin Creek at Big Cabin (AT191000), 1999-2003.

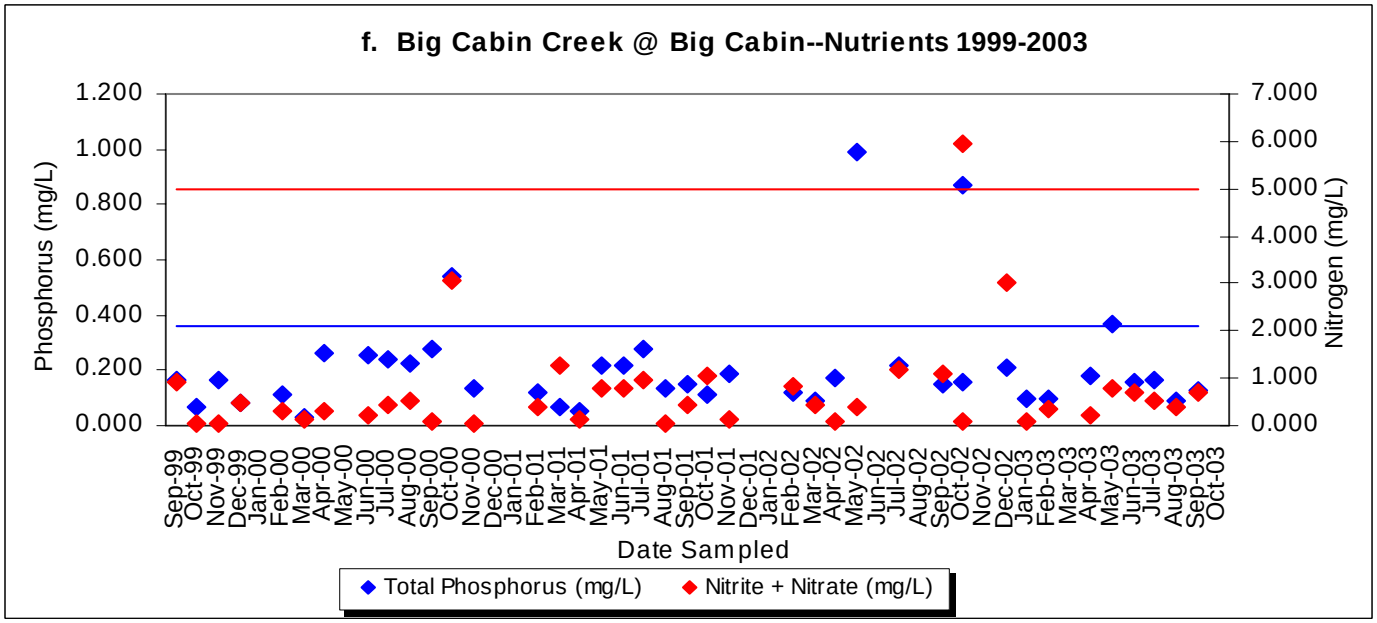







d. Big Cabin Creek @ Big Cabin--TDS 1999-2003
mg/L
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Date Sampled
TDS (mg/L)


e. Big Cabin Creek @ Big Cabin--Minerals 1999-2003
mg/L
500.0
450.0
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Big Cabin Creek @ Big Cabin--Nutrients 1999-2003
Phosphorus (mg/L)
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Nitrogen (mg/L)
7.000
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

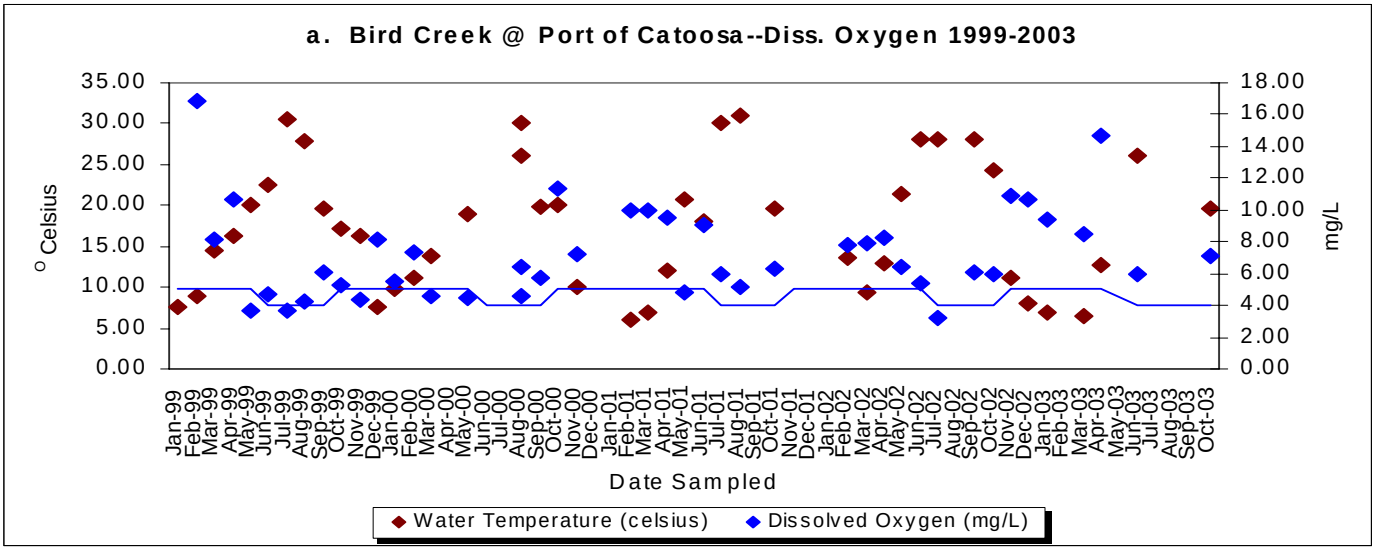
Bird Creek near Catoosa

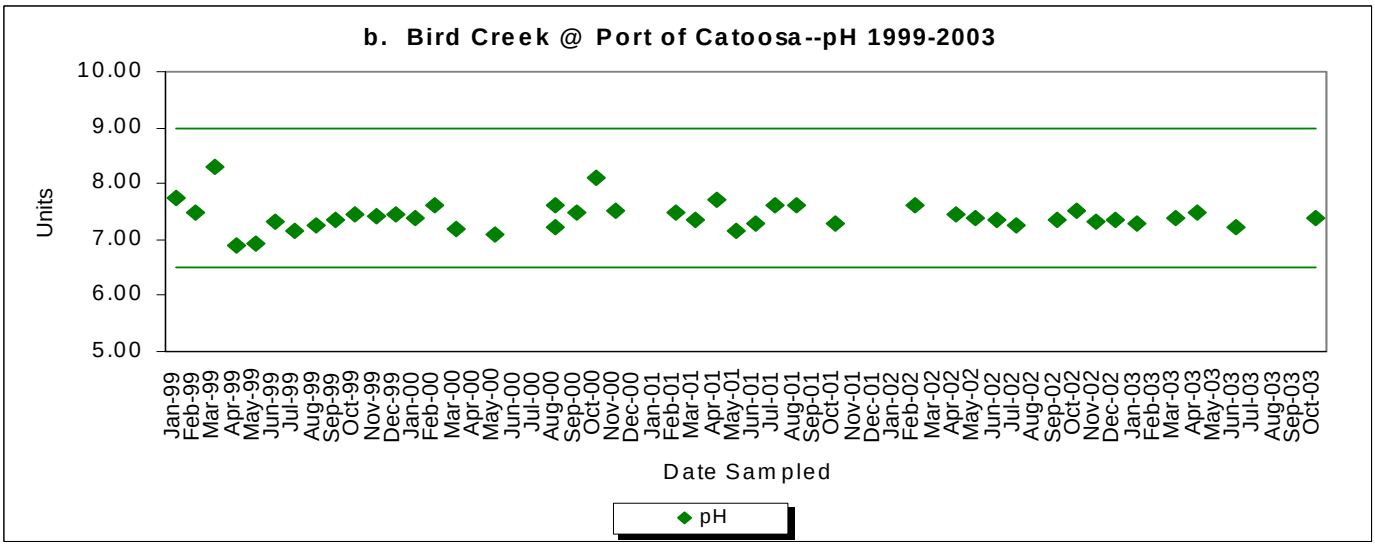
Station AT178050 (121300010010-001AT) is a permanent ambient trend monitoring station located on Bird Creek. Situated in the northeastern portion of Tulsa County, the site was established west of the Port of Catoosa on State Highway 266. The station is positioned near the terminal end of stream segment 121300010010 and is classified within the Bird Creek 8-digit HUC watershed (11070107). Water enters the stream system from Lake Yahola, Delaware Creek, Flat Rock Creek, Owasso Creek, and Mingo Creek, among others.

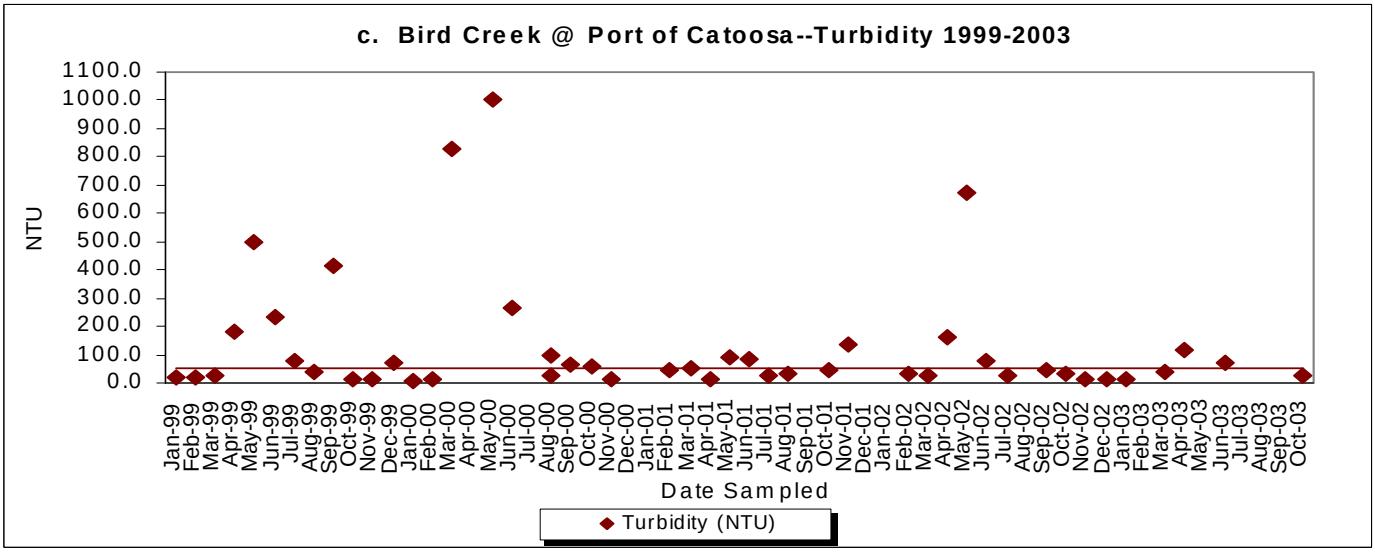
This station on Bird Creek has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from January of 1999 through October of 2003. For purposes of reporting, this station is representative of Bird Creek from the confluence of Delaware Creek (95.9453, 36.2639) downstream to confluence of Bird Creek with the Verdigris River (95.7261, 36.2210). As per Appendix A, Table 1 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

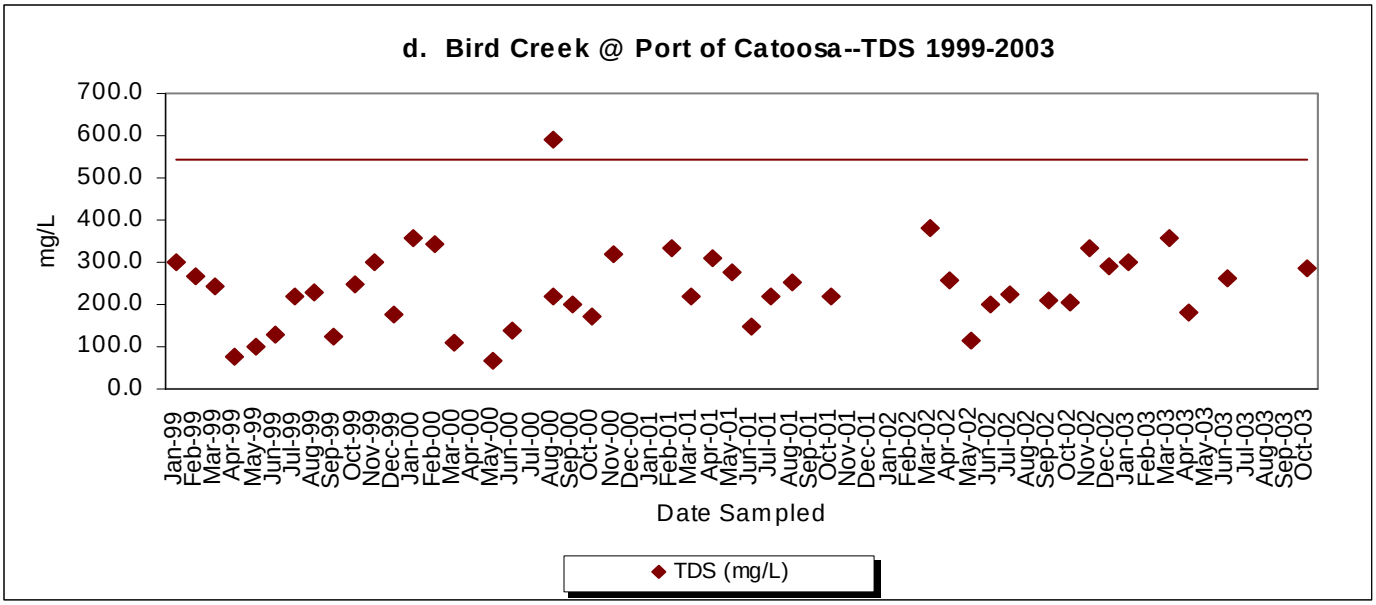
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 14 toxicant samples collected, 4 of the lead concentrations (or 29%) exceeded the prescribed hardness-dependant chronic criteria of 4.78 µg/L (Table 16). Of the 43 dissolved oxygen samples collected (Figure 22a), 7 samples (or 16%) were below the prescribed screening level. Of the 30 turbidity samples collected (Figure 22c), 7 samples (or 23%) exceeded the numerical criteria of 50. The pH (Figure 22b) samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 22d and Figure 22e). Although 12% of the sulfate concentrations exceeded the sample standard of 67.0 mg/L, the values are below the minimum standard of 250 mg/L. The PBCR beneficial use is not supported (Table 17). Of the 24 fecal coliform concentrations, 10 samples (or 42%) exceeded the prescribed screening level of 400 cfu/mL. Of the 25 enterococci concentrations, 10 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (234.8 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of Bird Creek is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 22f).

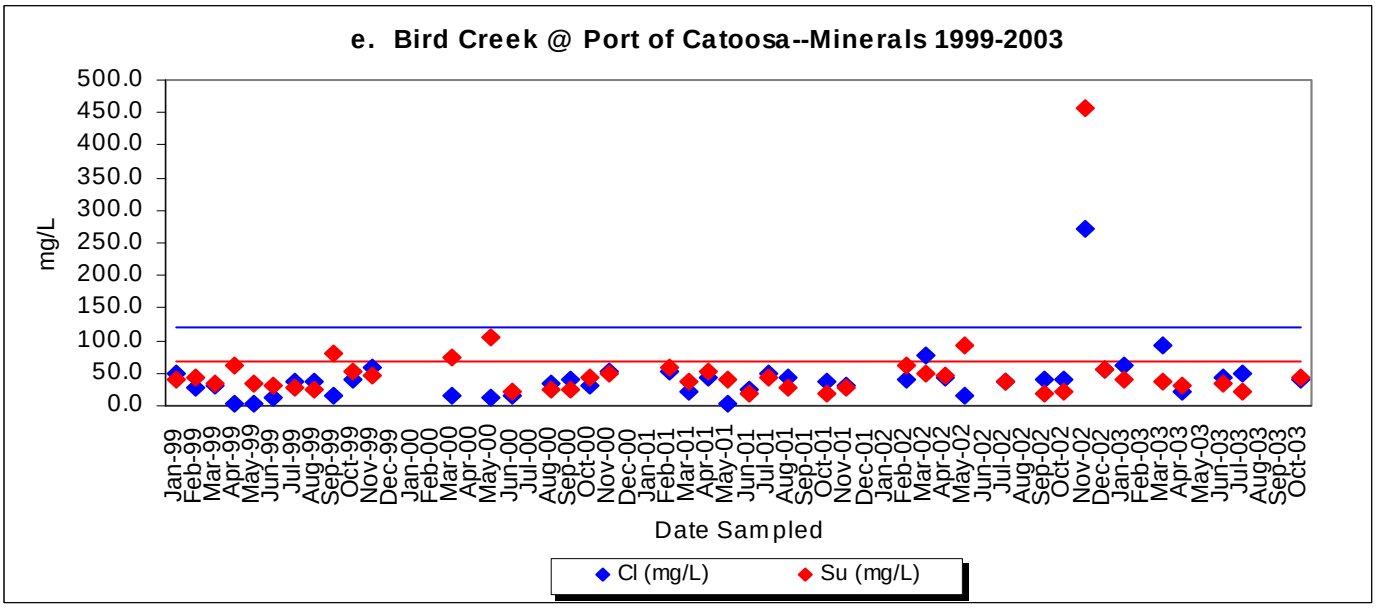
Figure 22a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) for Bird Creek at Catoosa (AT178050), 1999-2003.

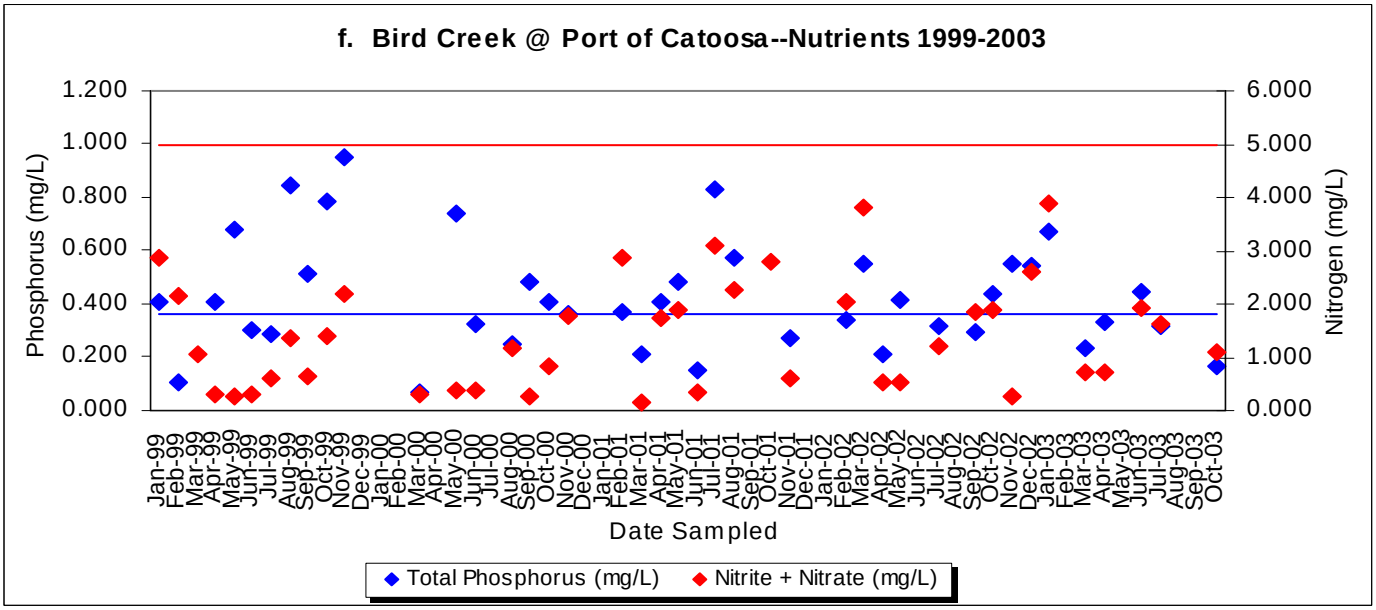







d. Bird Creek @ Port of Catoosa--TDS 1999-2003
mg/L
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Date Sampled
TDS (mg/L)


e. Bird Creek @ Port of Catoosa--Minerals 1999-2003
mg/L
500.0
450.0
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Bird Creek @ Port of Catoosa--Nutrients 1999-2003
Phosphorus (mg/L)
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

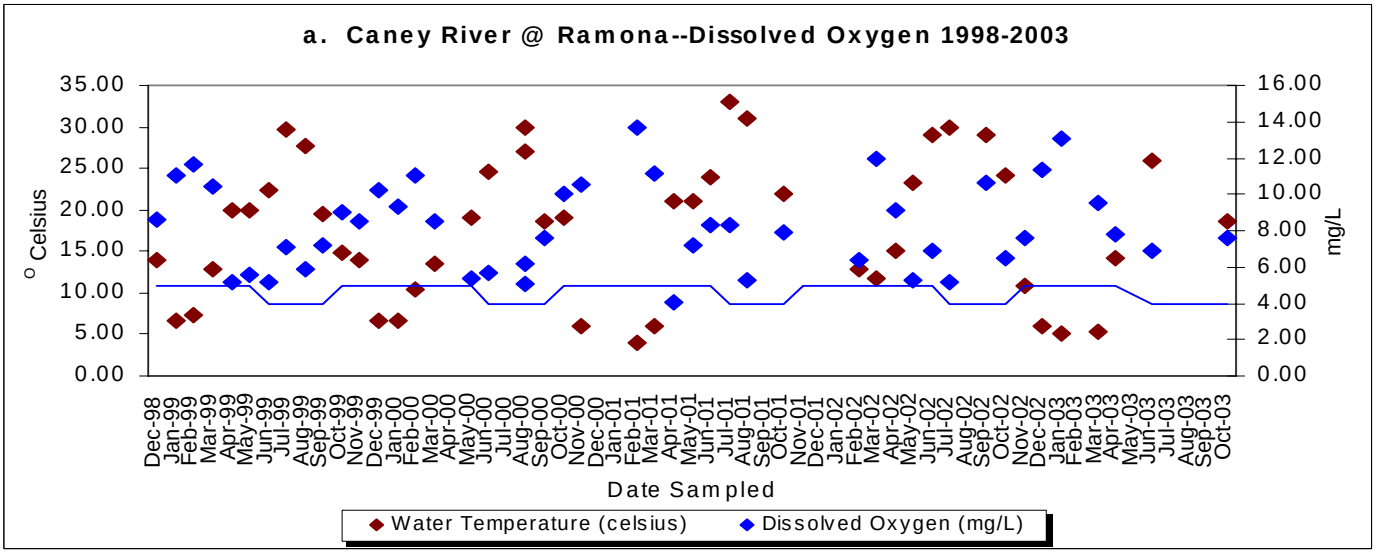
Caney River near Ramona

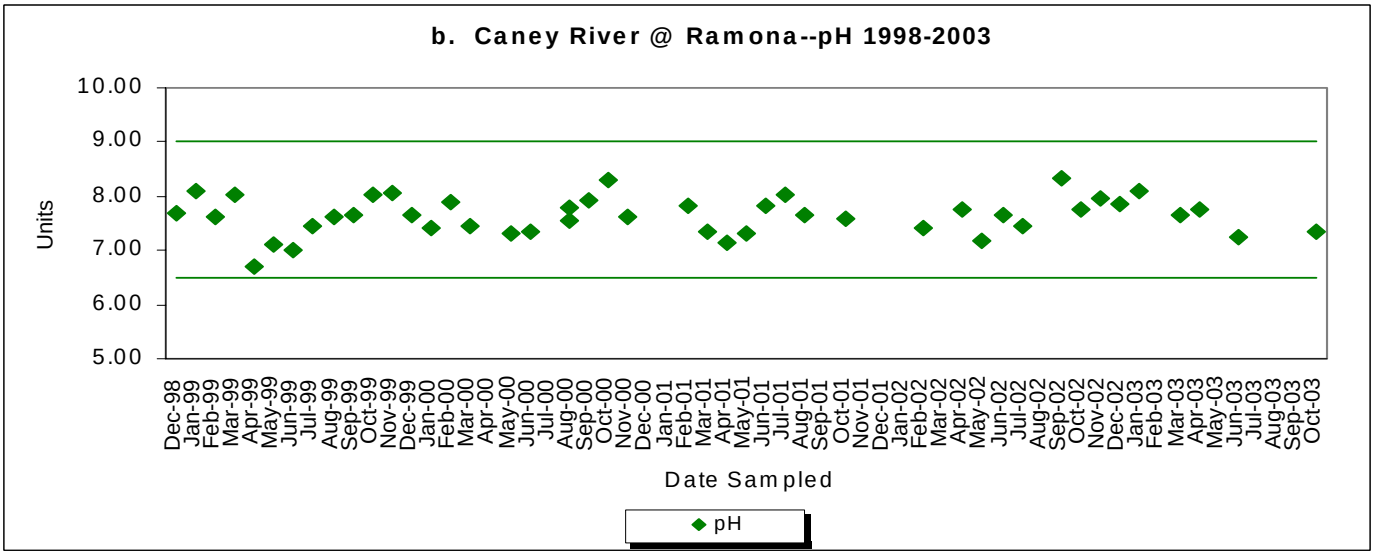
Station AT175500 (121400010010-001AT) is a permanent ambient trend monitoring station located on the Caney River in Oklahoma. Situated in the southeastern portion of Washington County, the site was established southeast of the Town of Ramona off US Highway 75 on County road 390. The station is positioned between the midpoint and the terminal end of stream segment 121400010010 and is classified within the Caney River 8-digit HUC watershed (11070106). Water enters the stream system from Sand Creek, Keeler Creek, and Rabb Creek, among others.

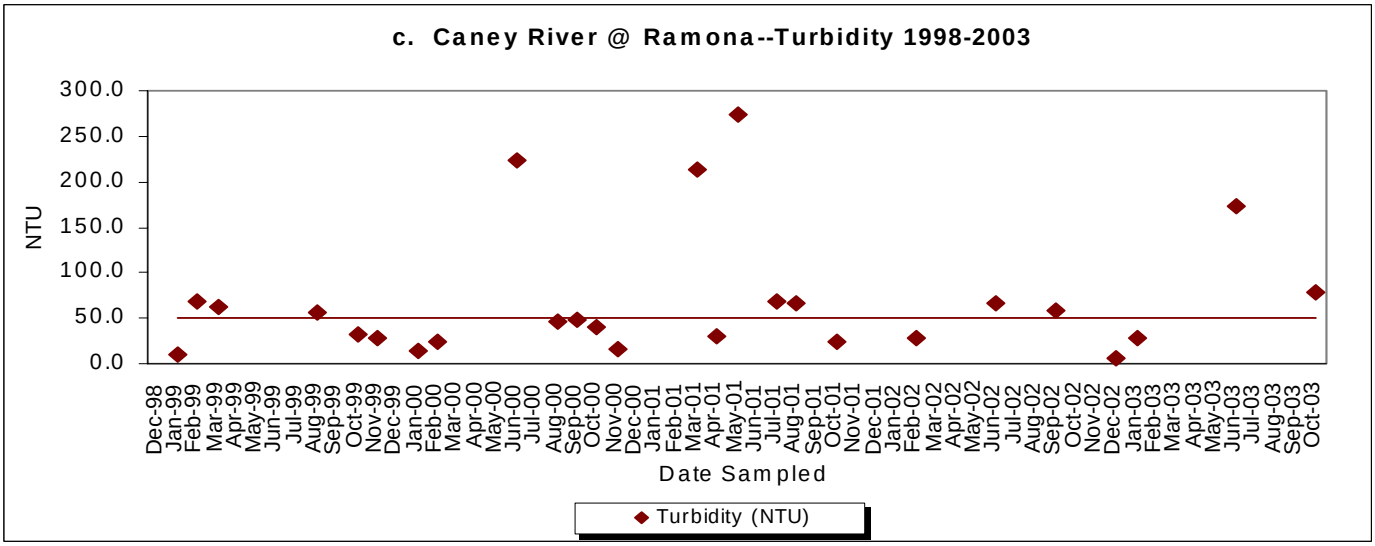
This station on the Caney River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through October of 2003. For purposes of reporting, this station is representative of the Caney River from the confluence of Sand Creek (95.9684, 36.7167) downstream to confluence of the Caney River with Rabb Creek (95.8101, 36.4338). As per Appendix A, Table 6 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

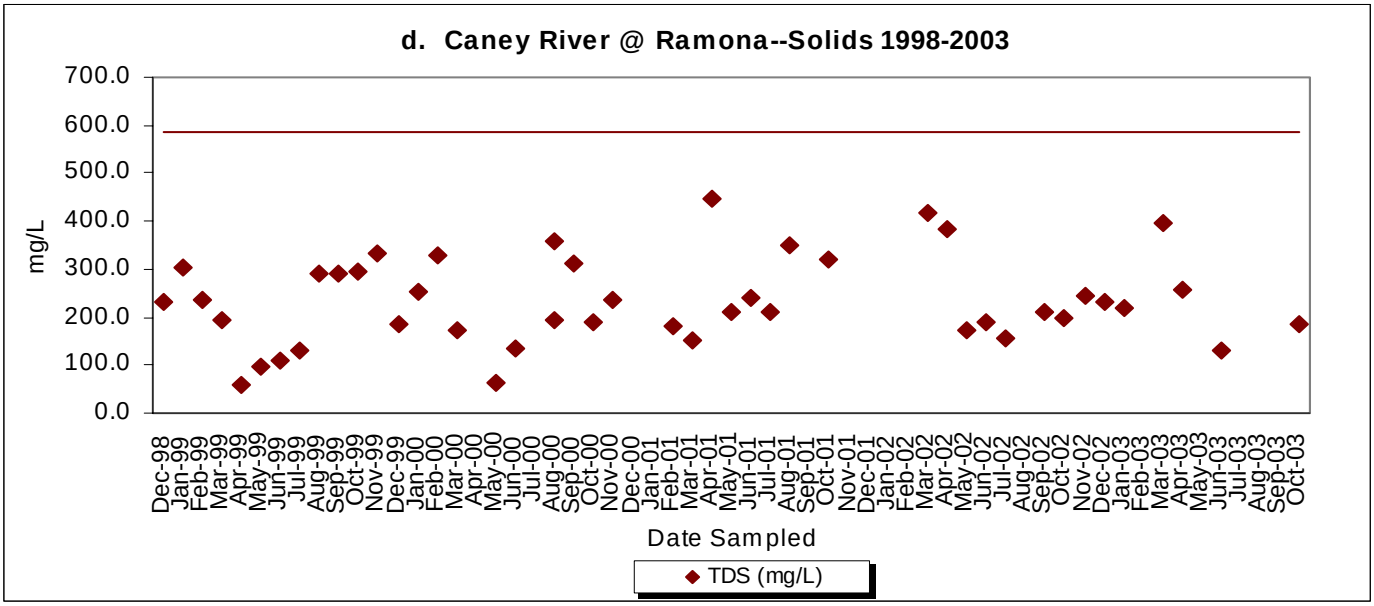
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 26 turbidity samples (Figure 23c), 12 samples (or 46%) exceeded the numerical criteria of 50. Of the 14 toxicant samples collected, 5 of the lead concentrations (or 36%) exceeded the prescribed hardness-dependant chronic criteria of 5.66 µg/L (Table 16). Dissolved oxygen (Figure 23a) and pH (Figure 23b) samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 23d and Figure 23e). The PBCR beneficial use is not supported. Of the 27 enterococci concentrations, 5 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (93.6 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Caney River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 23f).

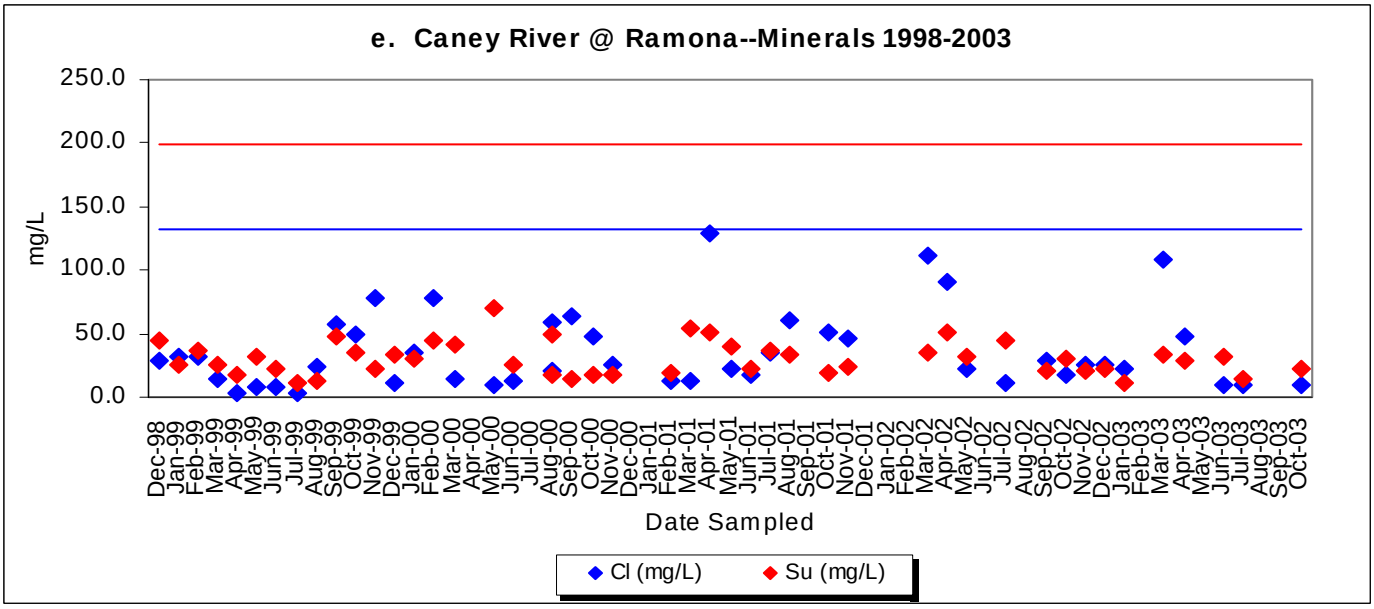
Figure 23a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) for the Caney River at Ramona (AT175500), 1998-2003.

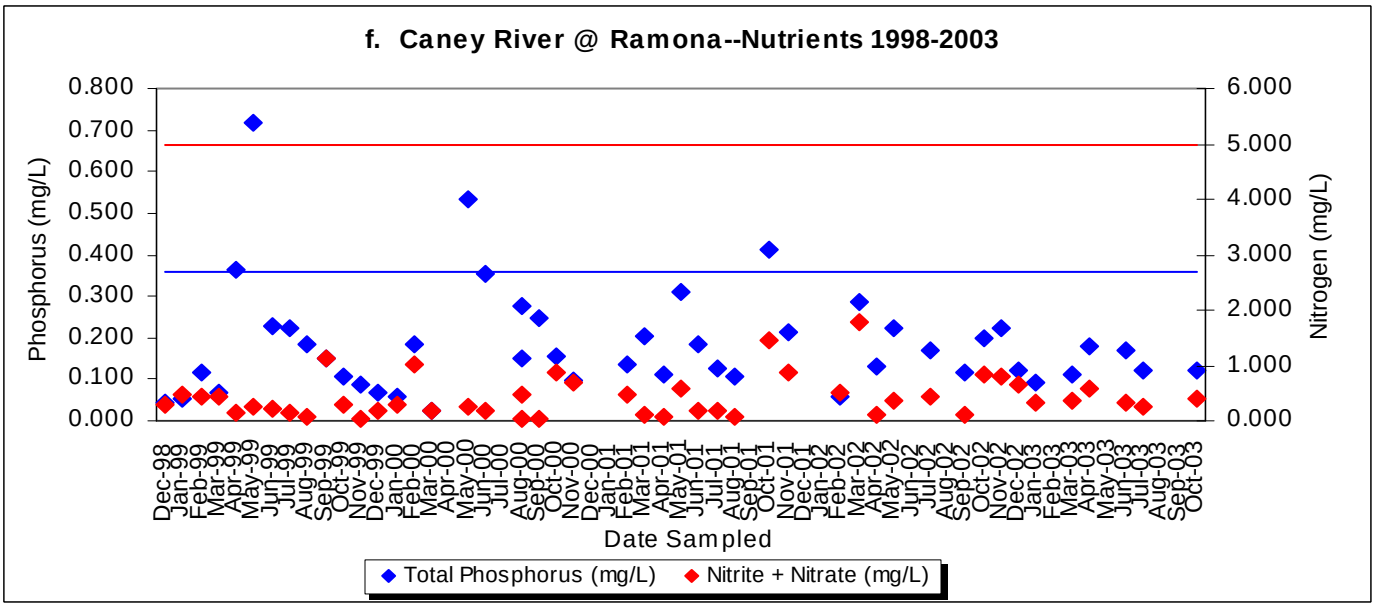







d. Caney River @ Ramona--Solids 1998-2003
mg/L
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Date Sampled
TDS (mg/L)


e. Caney River @ Ramona--Minerals 1998-2003
mg/L
250.0
200.0
150.0
100.0
50.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Caney River @ Ramona--Nutrients 1998-2003
Phosphorus (mg/L)
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

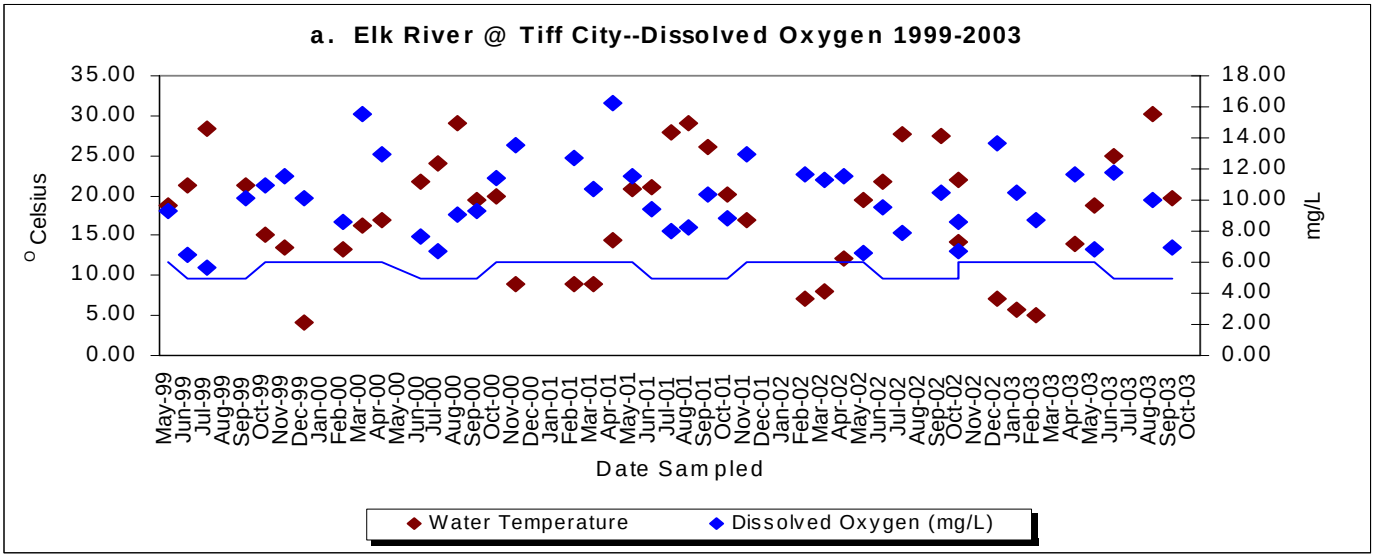
Elk River near Tiff City, Missouri

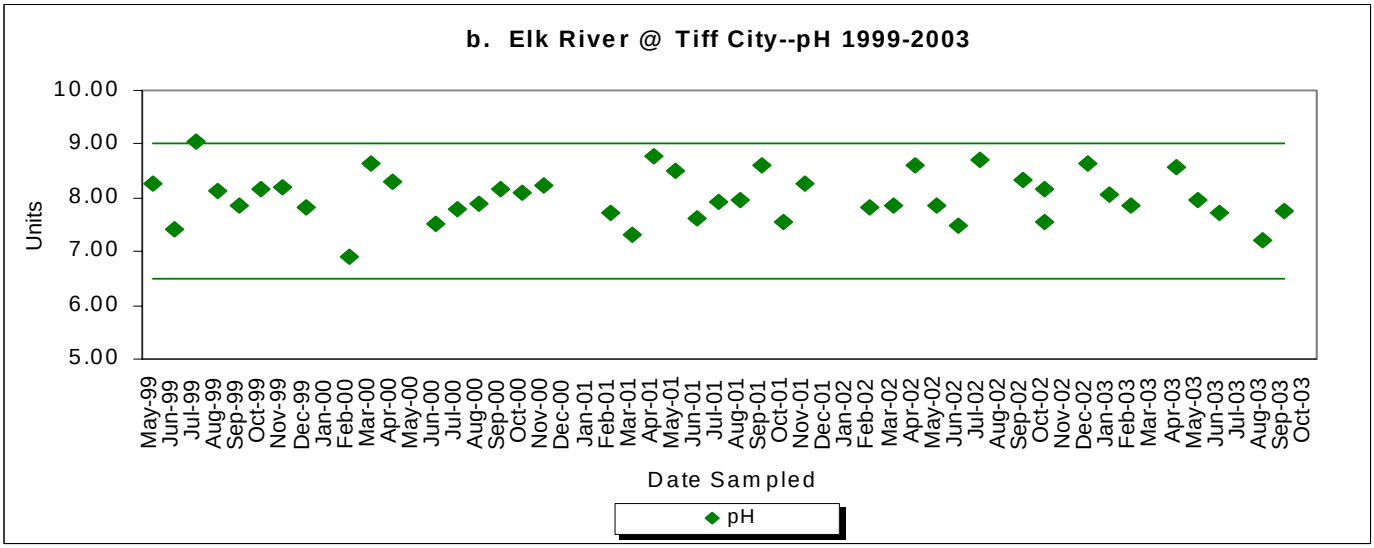
Station AT189000 (121600030440-001AT) is a permanent ambient trend monitoring station located on the Elk River in Missouri. Situated in the west central portion of McDonald County, the site was established south-southeast of the Town of Tiff City on Missouri SH 43. The station is positioned near the midpoint of stream segment 121600030440 and is classified within the Elk River 8-digit HUC watershed (11070208). Water enters the stream system from several tributaries including the Buffalo Creek, among others.

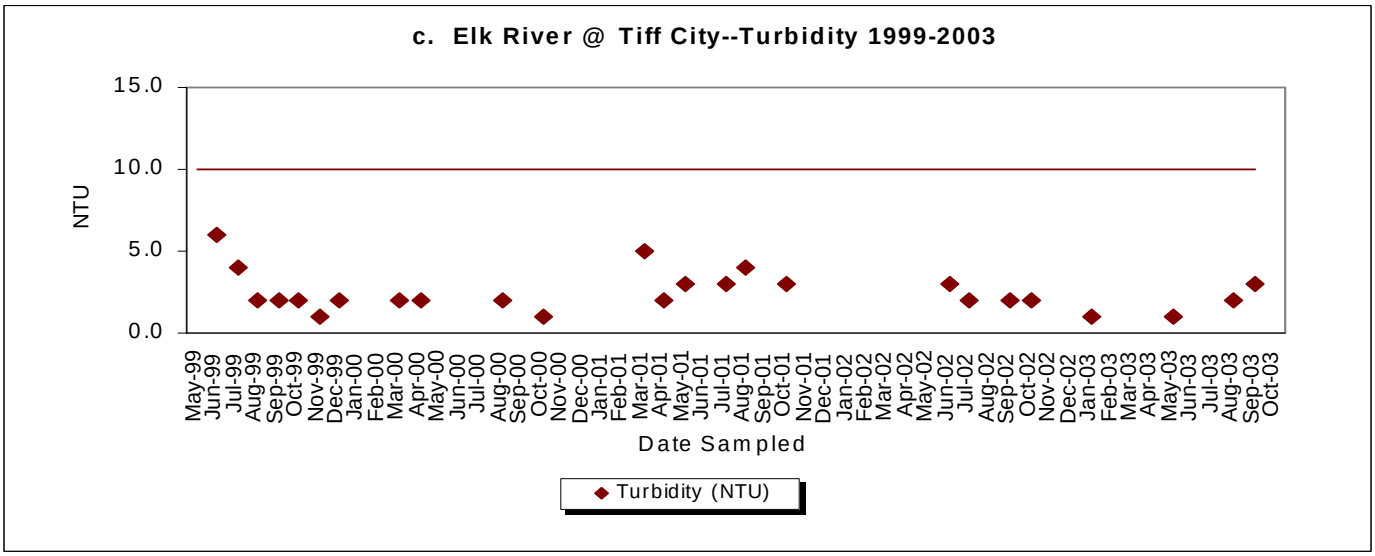
This station on the Elk River has been active for all water quality variables since May of 1999. The following assessment of beneficial uses is based on data collected from May of 1999 through September of 2003. For purposes of reporting, this station is representative of the Elk River from its entrance into Oklahoma near Tiff City, Missouri (94.2950, 36.5510) downstream to confluence of the Elk River with Grand Lake (94.6177, 36.6250). As per Appendix A, Table 1 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Cool Water Aquatic Community—Fish and Wildlife Propagation (CWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

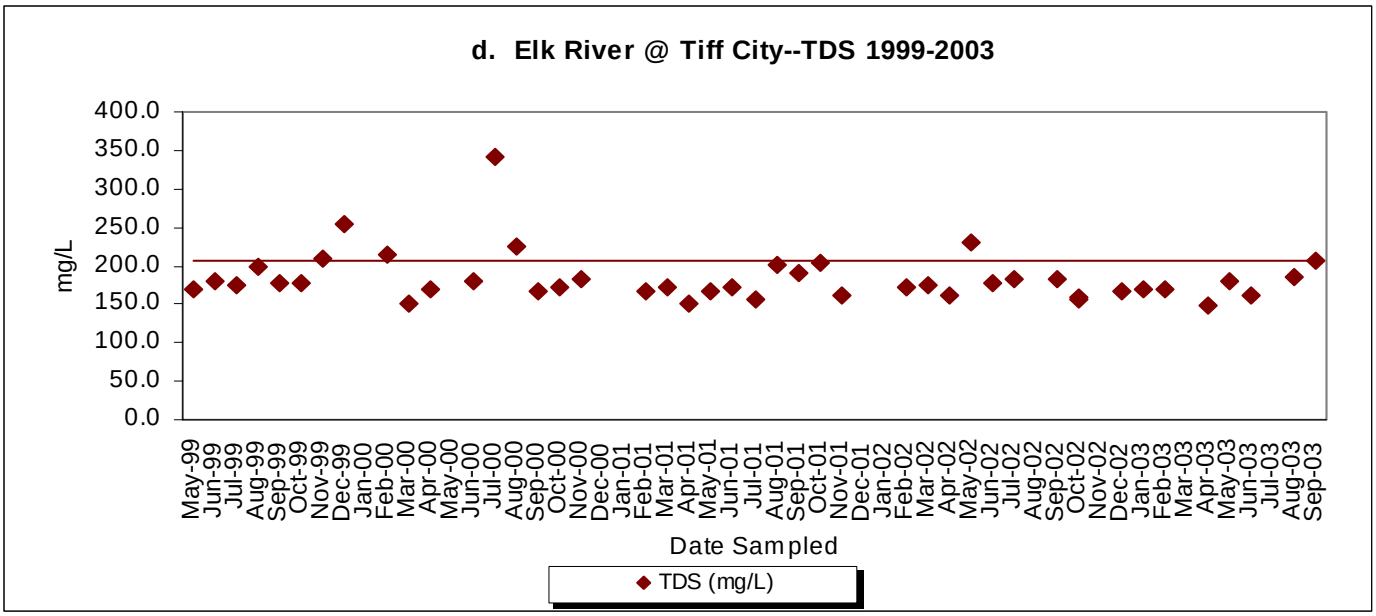
The PPWS beneficial use is supported. The CWAC beneficial use is supported. Dissolved oxygen (Figure 24a), pH (Figure 24b), turbidity (Figure 24c), and toxicants met the criteria prescribed in the CWAC beneficial use. The AG beneficial use is supported for total dissolved solids (TDS), chlorides, and sulfates (Figure 24d and Figure 24e). Although 16% of the TDS concentrations exceeded the sample standard of 206.0 mg/L, the values are below the minimum standard of 750 mg/L. The PBCR beneficial use is not supported (Table 17). Of the 27 enterococci concentrations, 3 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (50.1 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Neosho River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 24f).

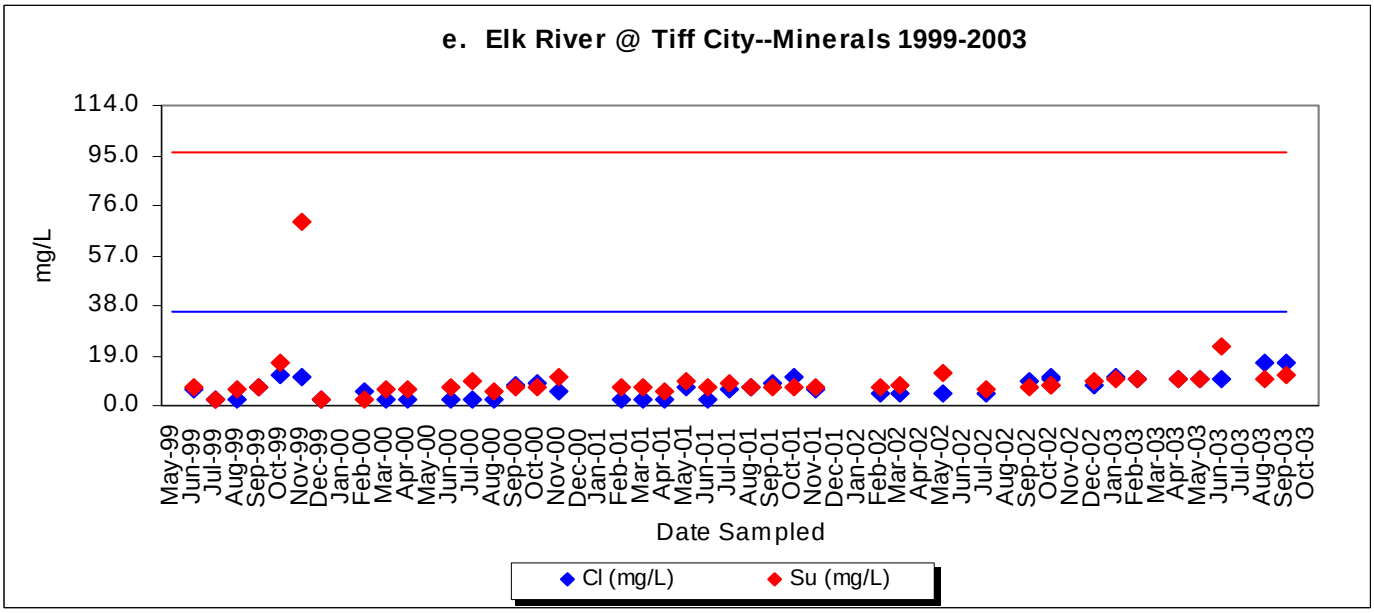
Figure 24a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) for the Elk River at Tiff City (MO) (AT189000), 1999-2003.

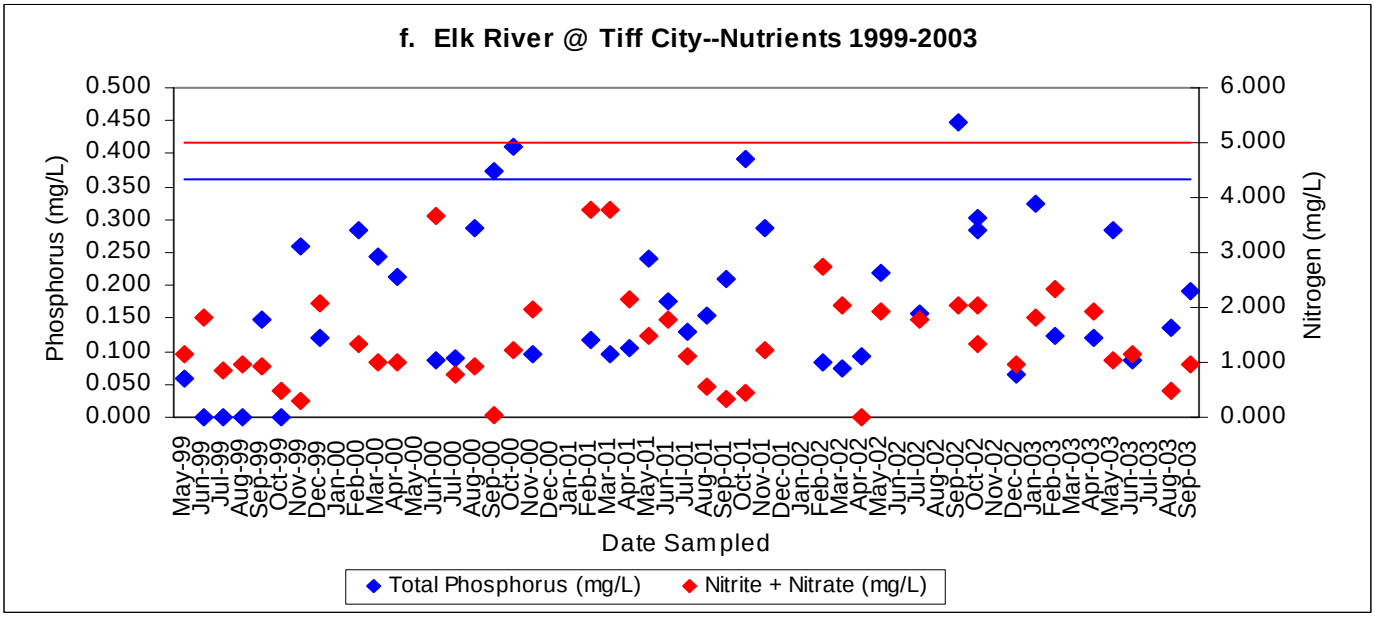







d. Elk River @ Tiff City--TDS 1999-2003
mg/L
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
Date Sampled
TDS (mg/L)


e. Elk River @ Tiff City--Minerals 1999-2003
mg/L
114.0
95.0
76.0
57.0
38.0
19.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Elk River @ Tiff City--Nutrients 1999-2003
Phosphorus (mg/L)
0.500
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

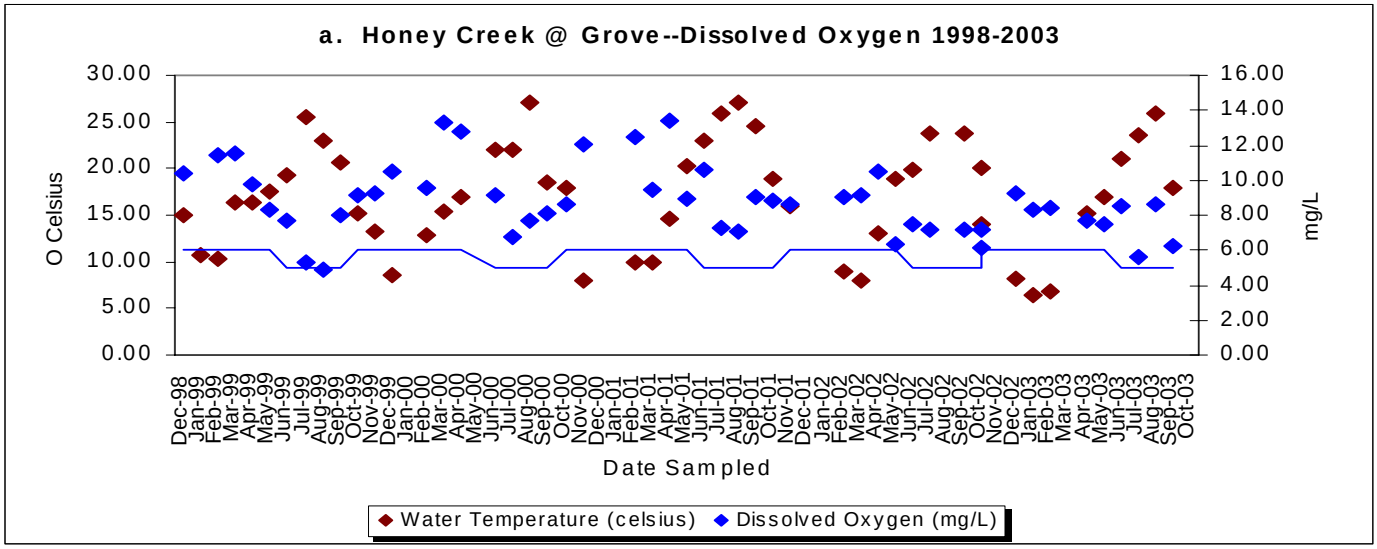
Honey Creek near Grove

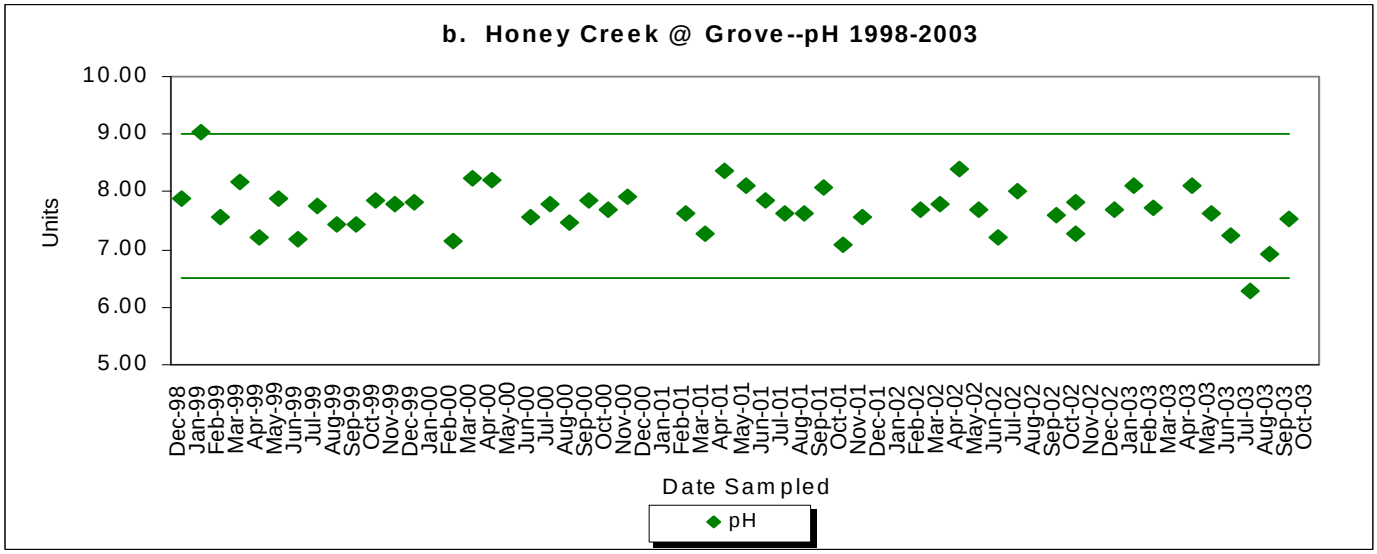
Station AT189090 (121600030290-001AT) is a permanent ambient trend monitoring station located on Honey Creek in Oklahoma. Situated in the northeastern portion of Delaware County, the site was established southeast of the City of Grove off of SH 25 on County Road N4650. The station is positioned near the terminal end of stream segment 121600030445 and is classified within the Grand Lake 8-digit HUC watershed (11070206). Water enters the stream system from Missouri and from several tributaries including the Cave Springs Branch, among others.

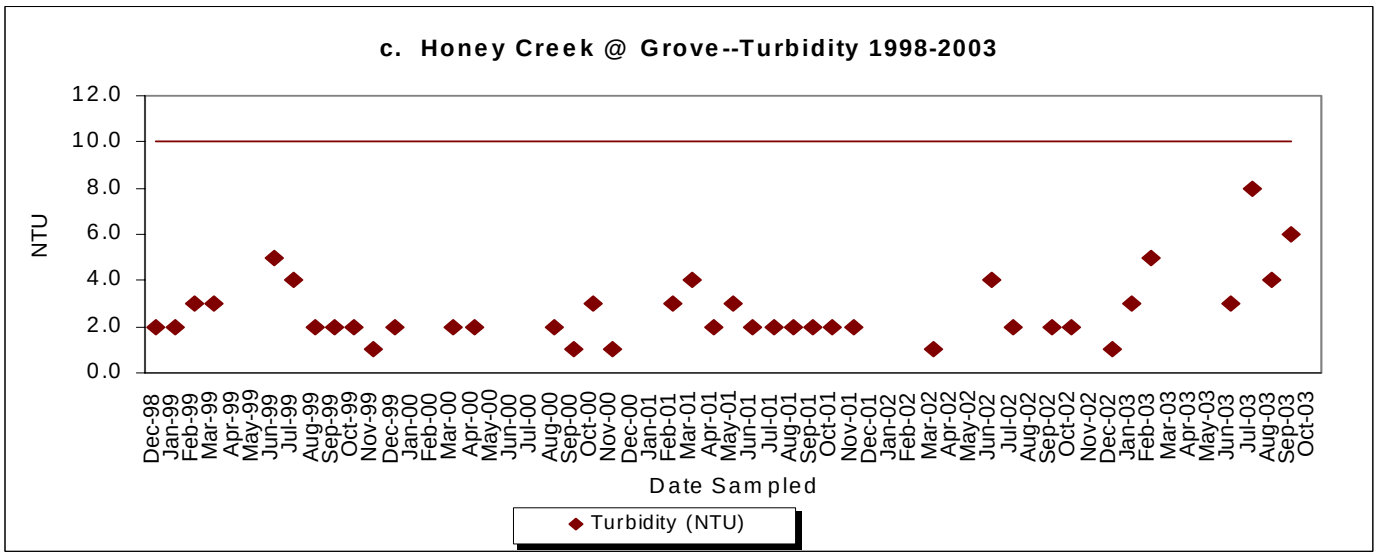
This station on Honey Creek has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through September of 2003. For purposes of reporting, this station is representative of Honey Creek from its entrance into Oklahoma near Southwest City, Missouri (94.6178, 36.5243) downstream to confluence of Honey Creek with Grand Lake (94.7427, 36.5505). As per Appendix A, Table 1 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Cool Water Aquatic Community—Fish and Wildlife Propagation (CWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

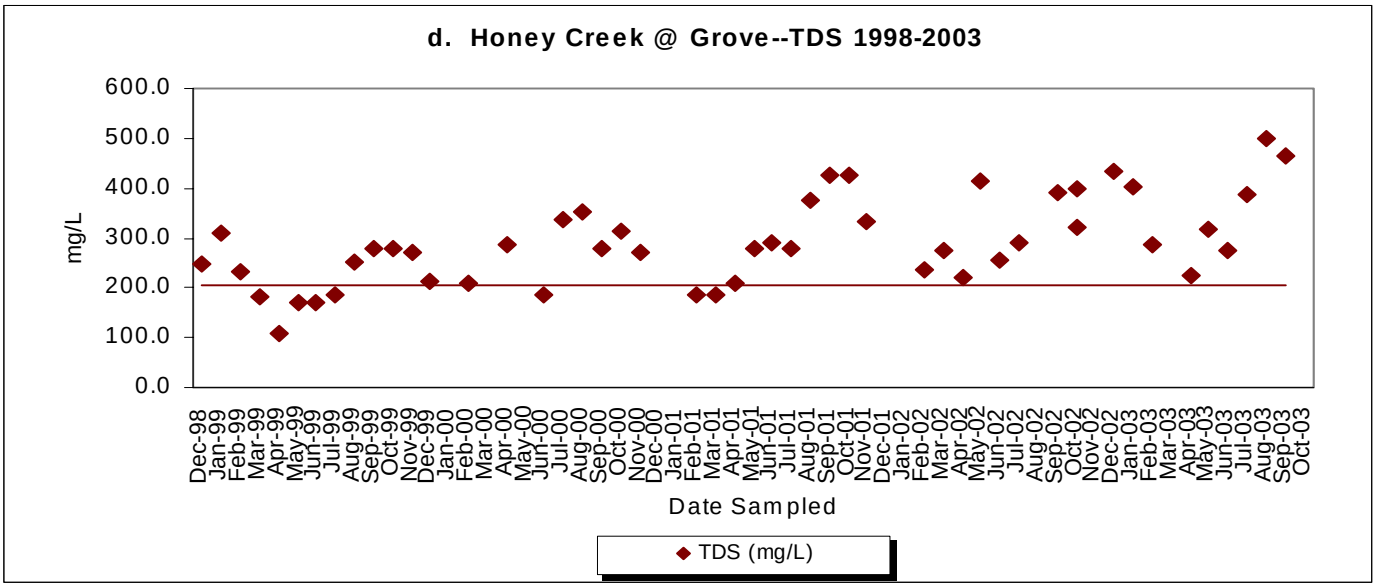
The PPWS beneficial use is supported. The CWAC beneficial use is supported. Dissolved oxygen (Figure 25a), pH (Figure 25b), turbidity (Figure 25c), and toxicant samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids (TDS), chlorides, and sulfates (Figure 25d and Figure 25e). Although 84% of the TDS concentrations exceeded the sample standard of 206.0 mg/L and the geometric mean (332.3 mg/L) exceeded the yearly mean standard of 187.0 mg/L, the values are below the minimum standards of 750 and 700 mg/L, respectively. Although 54% of the chloride concentrations exceeded the sample standard of 80.0 mg/L, the values are below the minimum standard of 250 mg/L. The PBCR beneficial use is not supported (Table 17). Of the 27 enterococci concentrations, 8 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (362.7 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of Honey Creek is nutrient-threatened. The median of the nitrate/nitrite samples (2.54 mg/L) exceeded the prescribed threshold median of 2.40 mg/L (f). The station is not light-limited with a mean turbidity of 3 NTU and less than 80% canopy coverage. The total phosphorus median values were below the threshold median of 0.15 mg/L (Figure 25f).

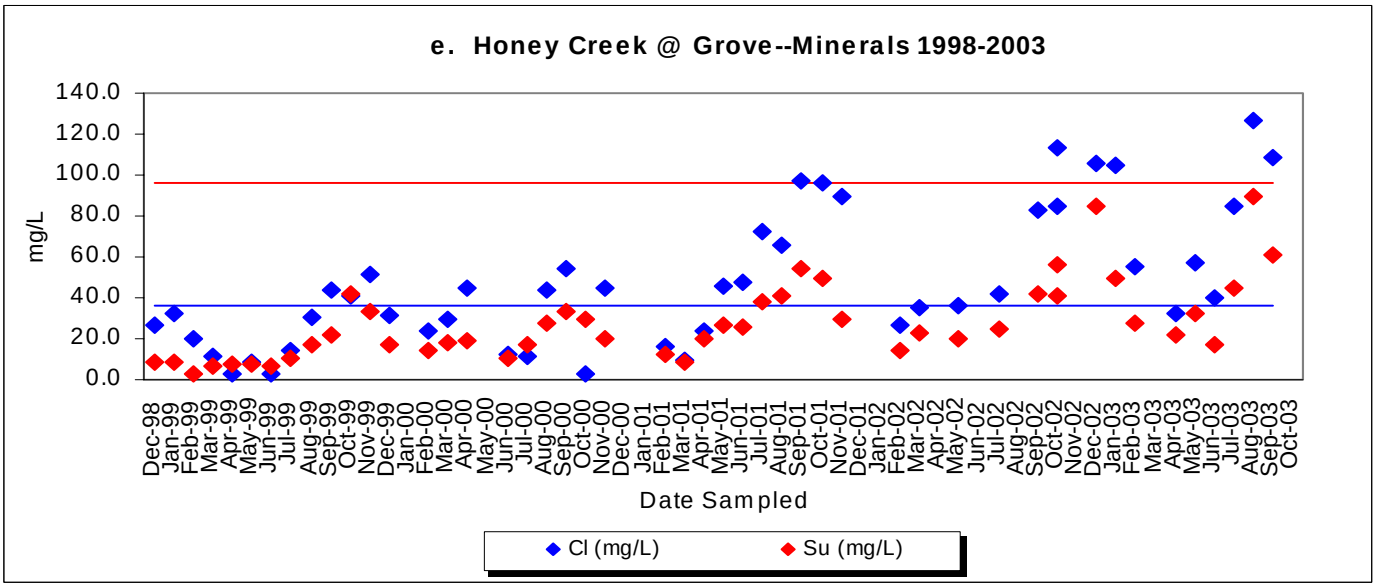
Figure 25a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) for Honey Creek at Grove (AT189090), 1998-2003.

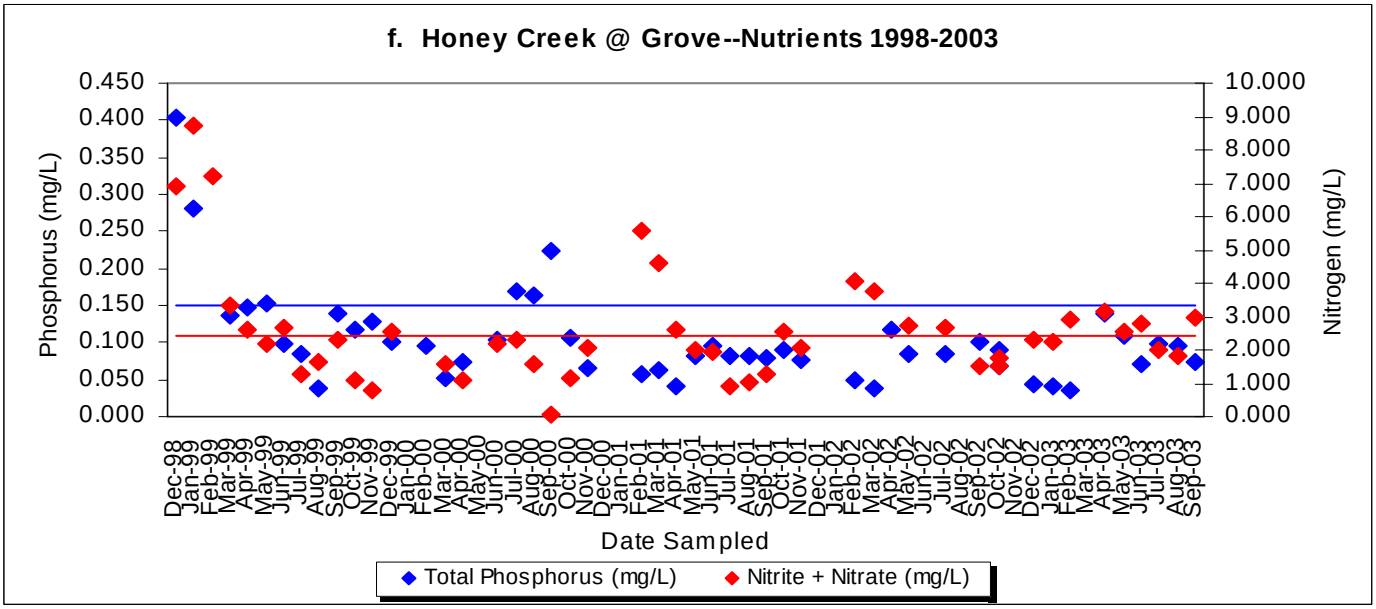







d. Honey Creek @ Grove--TDS 1998-2003
mg/L
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Date Sampled
TDS (mg/L)


e. Honey Creek @ Grove--Minerals 1998-2003
mg/L
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Honey Creek @ Grove--Nutrients 1998-2003
Phosphorus (mg/L)
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
Nitrogen (mg/L)
10.000
9.000
8.000
7.000
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

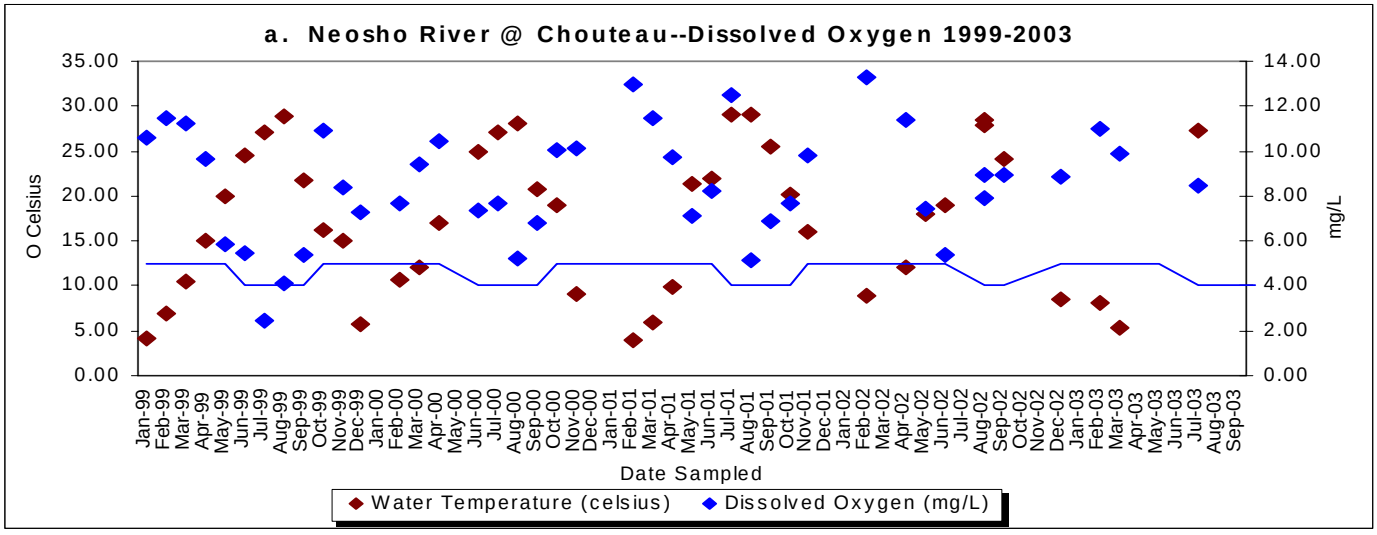
Neosho River near Chouteau

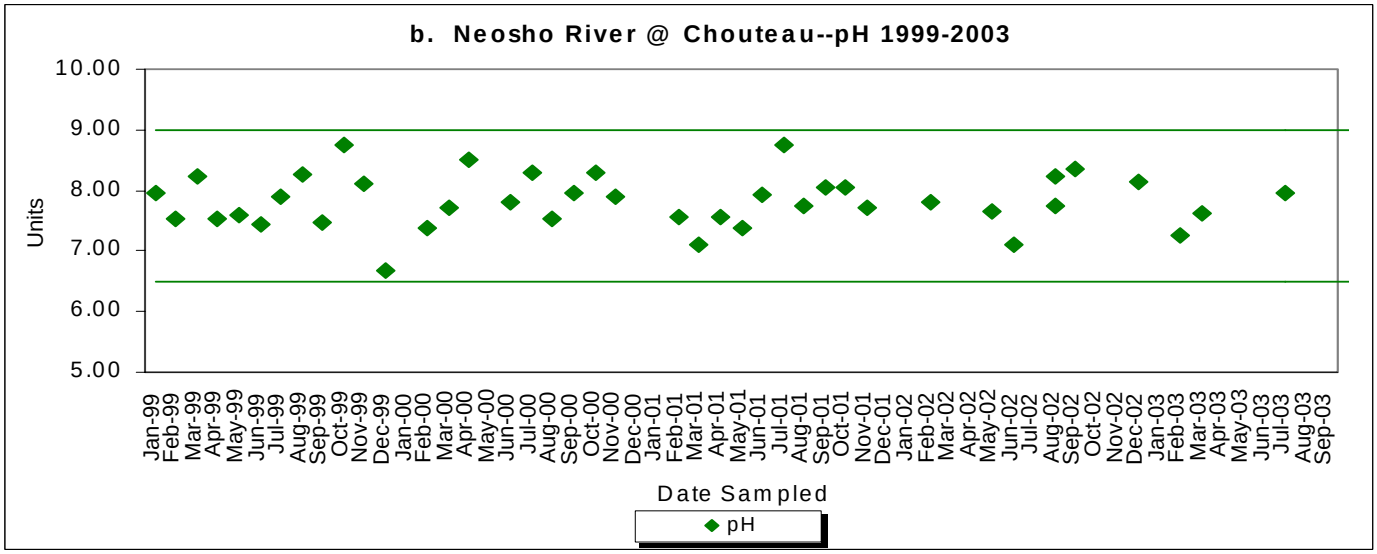
Station AT191530 (121600010280-001AT) is a permanent ambient trend monitoring station on the Neosho River in Oklahoma. Situated in the south central portion of Mayes County, the site was established east of the City of Chouteau on US Highway 412. The station is positioned near the terminal end of stream segment 121600010280 and is classified within the Lower Neosho River 8-digit HUC watershed (11070209). Water enters the stream system from Lake Hudson and from several tributaries including Crutchfield Branch Creek, Pryor Creek, and Chouteau Creek, among others.

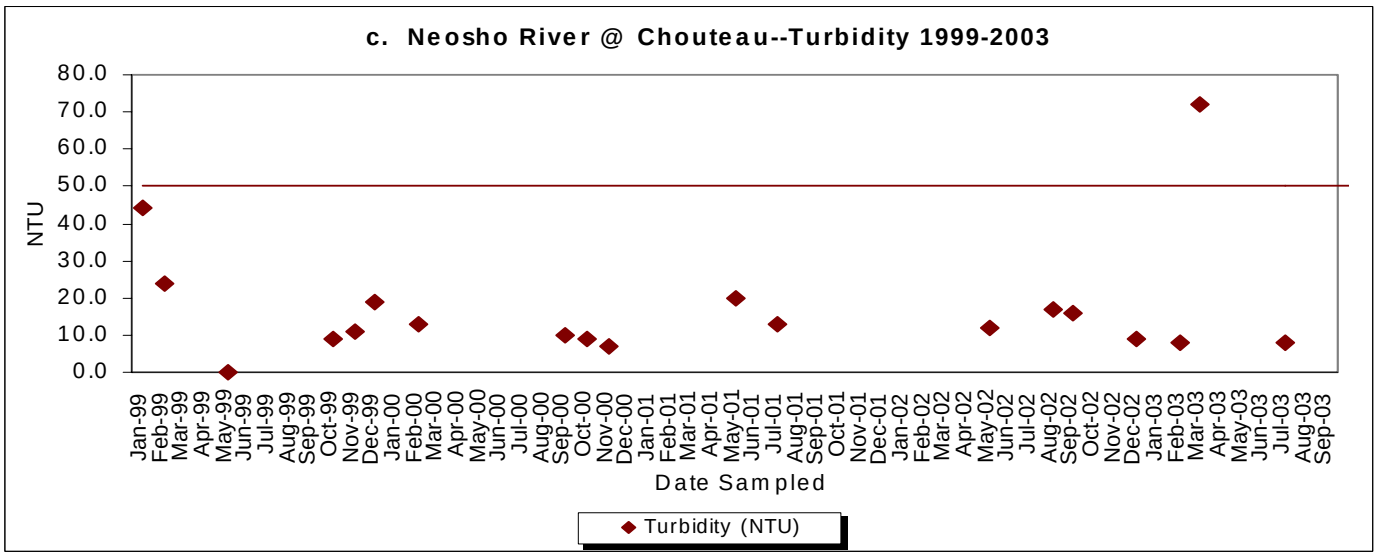
This station on the Neosho River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from January of 1999 through October of 2003. For purposes of reporting, this station is representative of the Neosho River from the confluence of Lake Hudson (95.1815, 36.2307) downstream to confluence of the Neosho River with Fort Gibson Lake (95.3005, 36.1540). As per Appendix A, Table 1 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

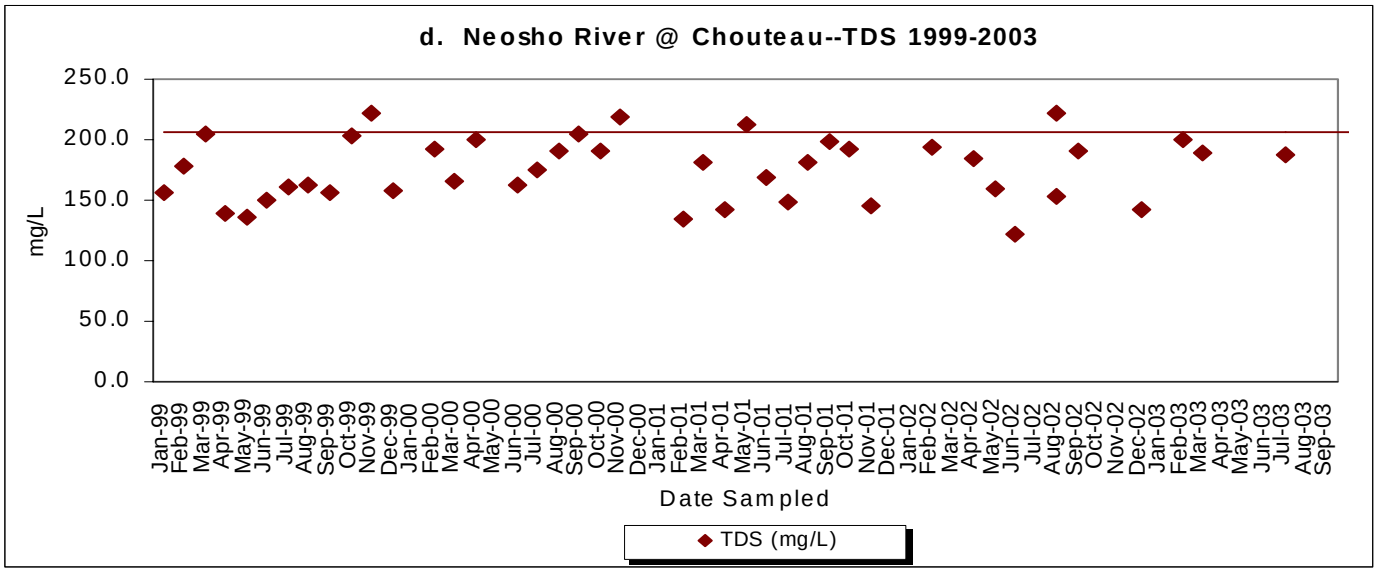
The PPWS beneficial use is supported. The WWAC beneficial use is supported for dissolved oxygen (Figure 26a), pH (Figure 26b) turbidity (Figure 26c), and toxicants. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 26d and Figure 26e). The PBCR beneficial use is supporting for fecal coliform, *E. coli* and enterococci. This segment of the Neosho River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 26f).

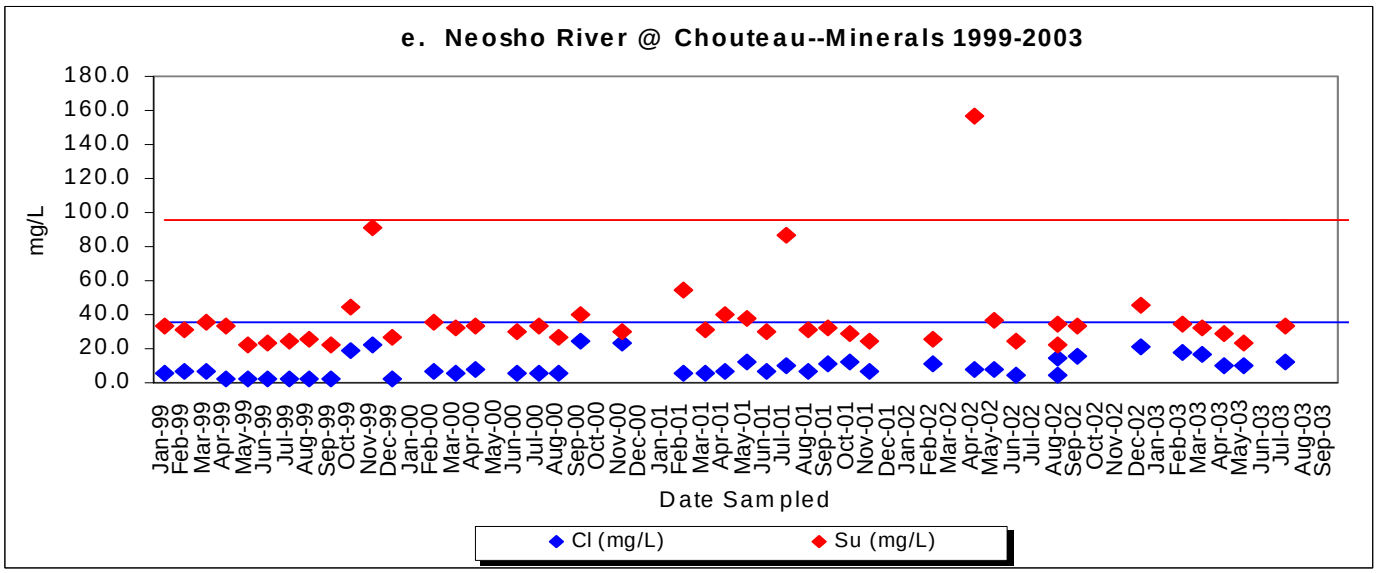
Figure 26a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) for the Neosho River at Chouteau (AT191530), 1999-2003.

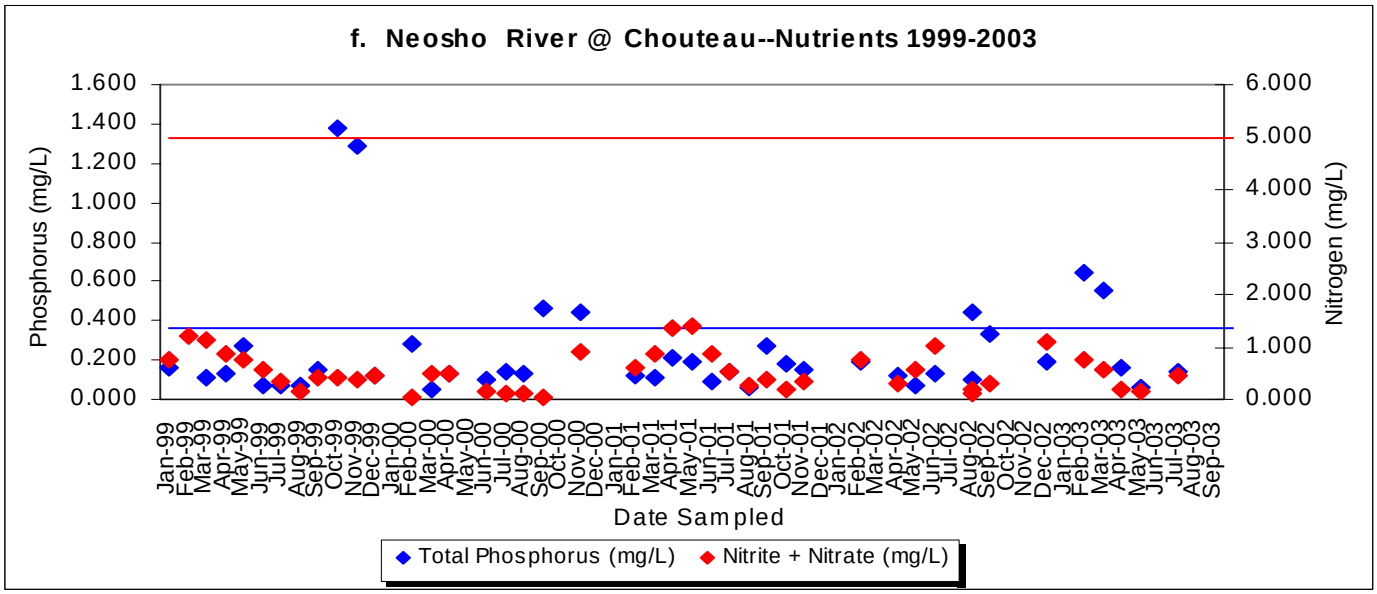







d. Neosho River @ Chouteau--TDS 1999-2003
mg/L
250.0
200.0
150.0
100.0
50.0
0.0
Date Sampled
TDS (mg/L)


e. Neosho River @ Chouteau--Minerals 1999-2003
mg/L
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Neosho River @ Chouteau--Nutrients 1999-2003
Phosphorus (mg/L)
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

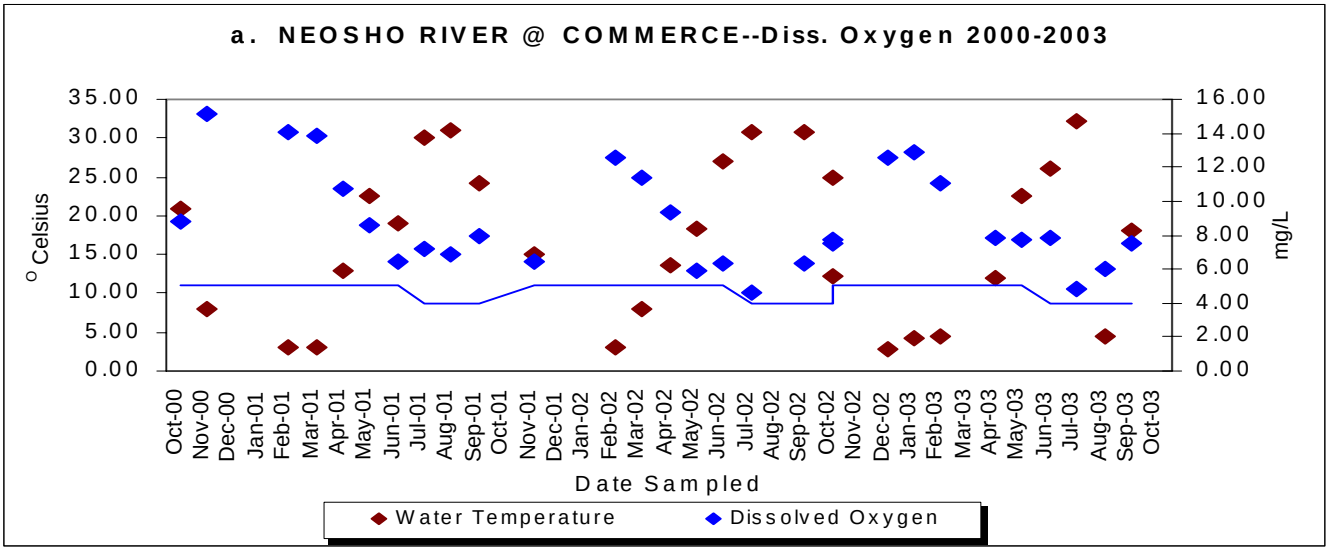
Neosho River near Commerce

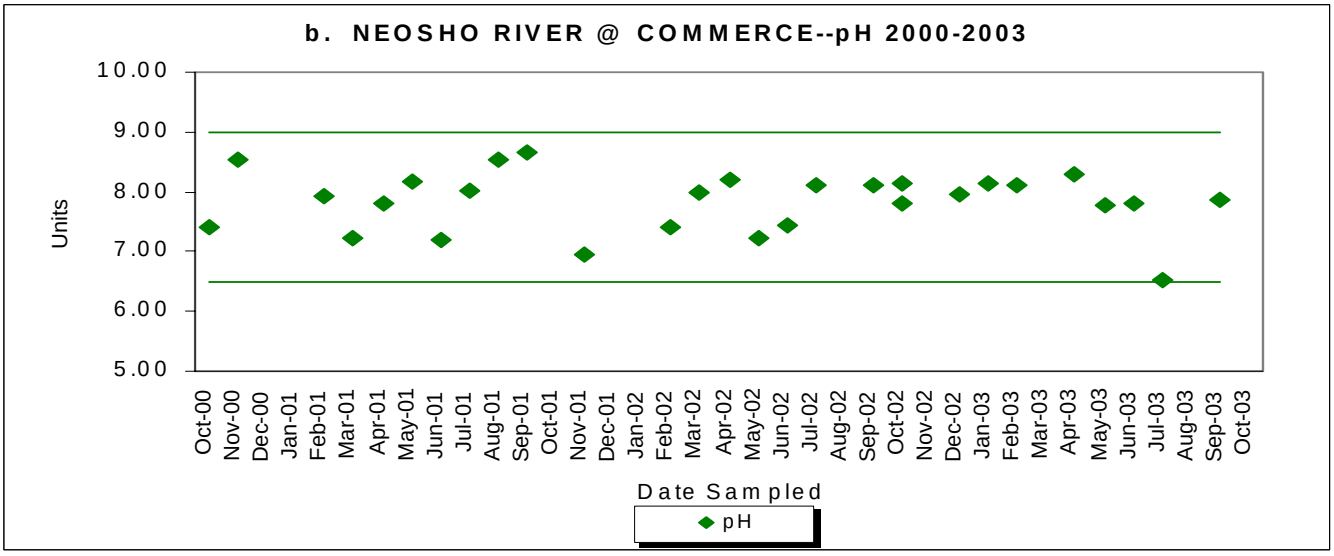
Station AT185000 (121600040220-001AT) is a permanent ambient trend monitoring station located on the Neosho River in Oklahoma. Situated in the northwest portion of Ottawa County, the site was established west of the Town of Commerce off of US Highway 66 on County Road. The station is positioned near the midpoint of stream segment 121600040220 and is classified within the Lower Verdigris River 8-digit HUC watershed (11070206). Water enters the stream system from Bird Creek, Spunky Creek, Chambers Creek, Dog Creek (Claremore Lake), and Salt Creek, among others.

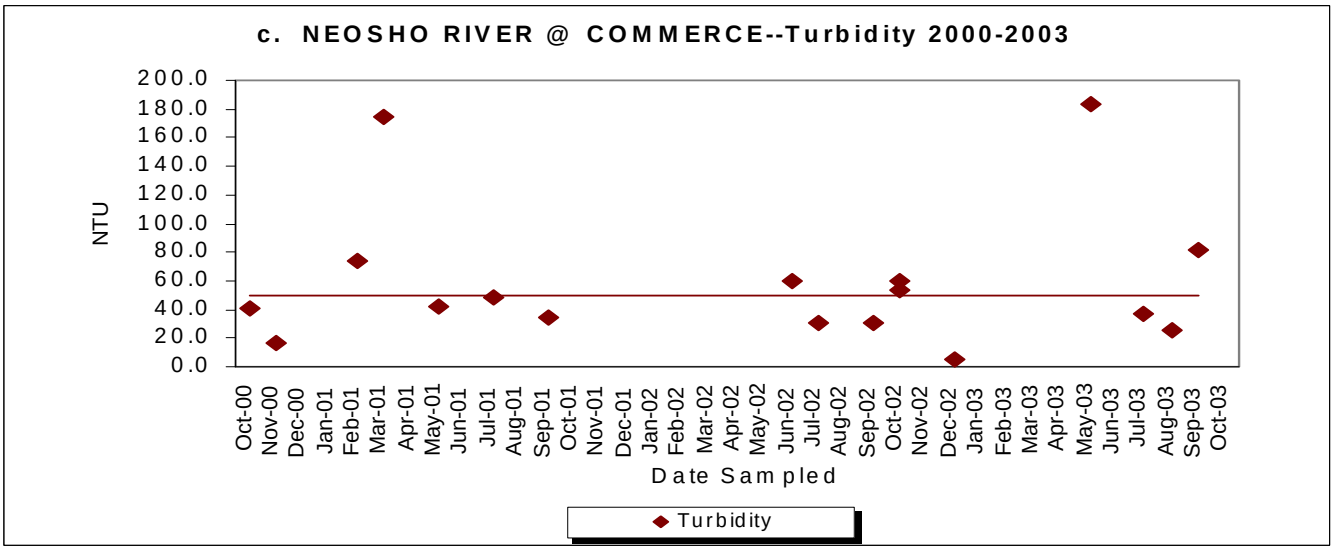
This station on the Neosho River has been active for all water quality variables since October of 2000. The following assessment of beneficial uses is based on data collected from October of 2000 through September of 2003. For purposes of reporting, this station is representative of the Neosho River from its entrance into the Oklahoma (95.0352, 36.9995) downstream to the confluence of the Neosho River with Elm Creek (94.9286, 36.8907). As per Appendix A, Table 1 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

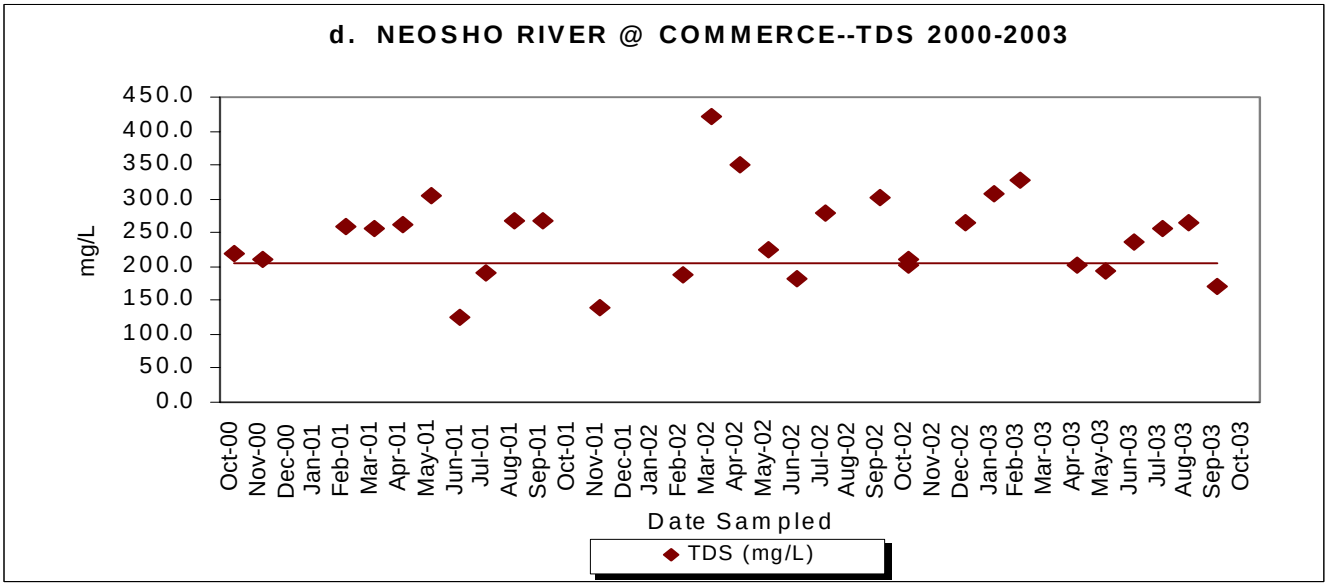
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 17 turbidity samples (Figure 27c), 7 samples (or 41%) exceeded the numerical criterion of 50. Dissolved oxygen (Figure 27a), pH (Figure 27b), and toxicant samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids (TDS), chlorides, and sulfates (Figure 27d and Figure 27e). Although 69% of the TDS concentrations exceeded the sample standard of 206.0 mg/L and the geometric mean (239.5 mg/L) exceeded the prescribed yearly mean standard of 187.0 mg/L, the values are below the minimum standards of 750 and 700 mg/L, respectively. The PBCR beneficial use is supported for fecal coliform, *E. coli* and enterococci. This segment of the Neosho River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 1.0 mg/L and 4.65 mg/L, respectively (Figure 27f).

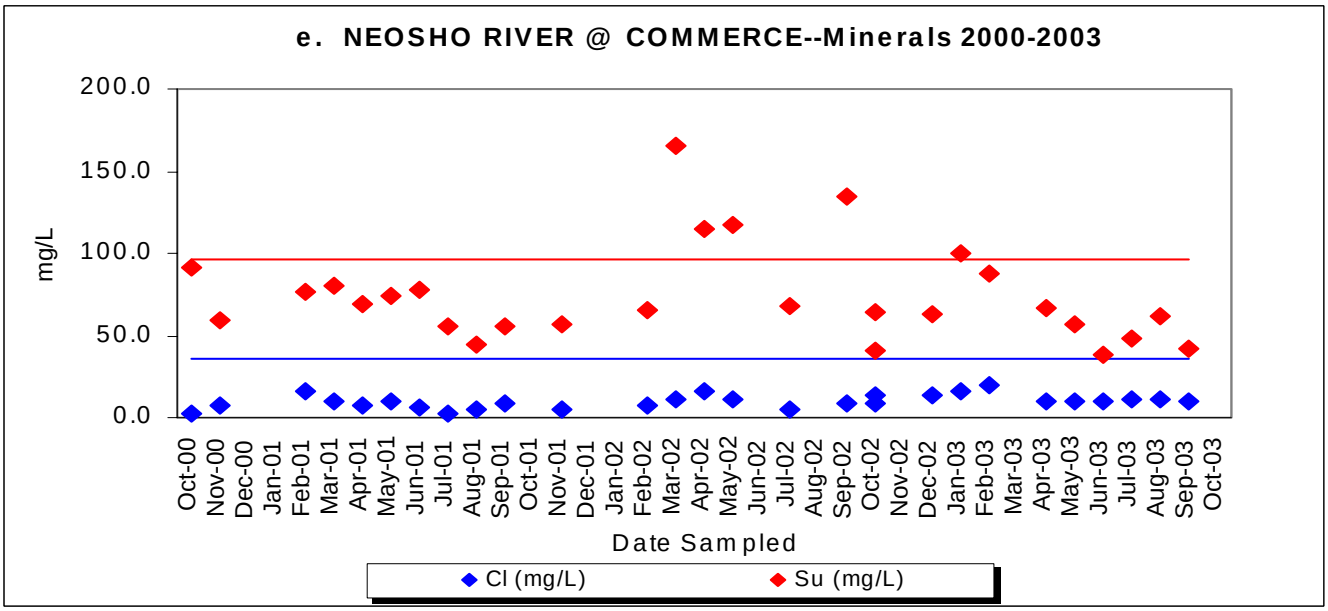
Figure 27a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) for the Neosho River at Commerce (AT185000), 2000-2003.

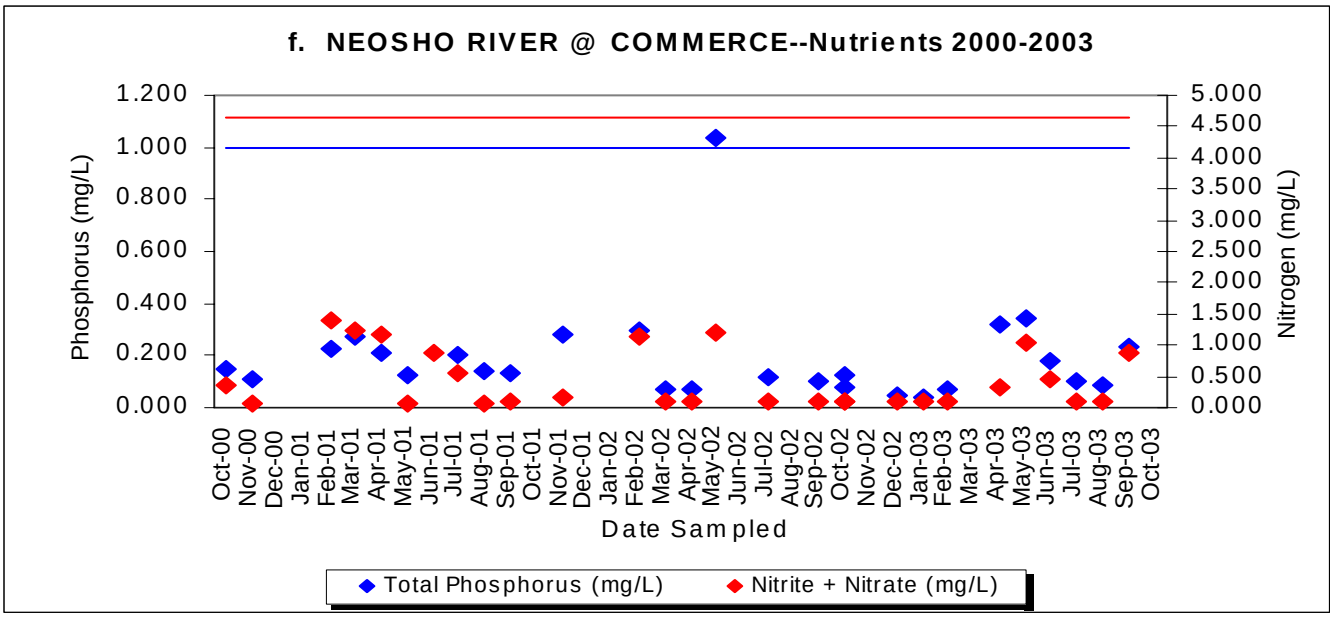







d. NEOSHO RIVER @ COMMERCE--TDS 2000-2003
mg/L
450.0
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
Oct-00 Nov-00 Dec-00 Jan-01 Feb-01 Mar-01 Apr-01 May-01 Jun-01 Jul-01 Aug-01 Sep-01 Oct-01 Nov-01 Dec-01 Jan-02 Feb-02 Mar-02 Apr-02 May-02 Jun-02 Jul-02 Aug-02 Sep-02 Oct-02 Nov-02 Dec-02 Jan-03 Feb-03 Mar-03 Apr-03 May-03 Jun-03 Jul-03 Aug-03 Sep-03 Oct-03
Date Sampled
TDS (mg/L)


e. NEOSHO RIVER @ COMMERCE--Minerals 2000-2003
mg/L
200.0
150.0
100.0
50.0
0.0
Oct-00 Nov-00 Dec-00 Jan-01 Feb-01 Mar-01 Apr-01 May-01 Jun-01 Jul-01 Aug-01 Sep-01 Oct-01 Nov-01 Dec-01 Jan-02 Feb-02 Mar-02 Apr-02 May-02 Jun-02 Jul-02 Aug-02 Sep-02 Oct-02 Nov-02 Dec-02 Jan-03 Feb-03 Mar-03 Apr-03 May-03 Jun-03 Jul-03 Aug-03 Sep-03 Oct-03
Date Sampled
Cl (mg/L)
Su (mg/L)


f. NEOSHO RIVER @ COMMERCE--Nutrients 2000-2003
Phosphorus (mg/L)
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Nitrogen (mg/L)
5.000
4.500
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
Oct-00 Nov-00 Dec-00 Jan-01 Feb-01 Mar-01 Apr-01 May-01 Jun-01 Jul-01 Aug-01 Sep-01 Oct-01 Nov-01 Dec-01 Jan-02 Feb-02 Mar-02 Apr-02 May-02 Jun-02 Jul-02 Aug-02 Sep-02 Oct-02 Nov-02 Dec-02 Jan-03 Feb-03 Mar-03 Apr-03 May-03 Jun-03 Jul-03 Aug-03 Sep-03 Oct-03
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

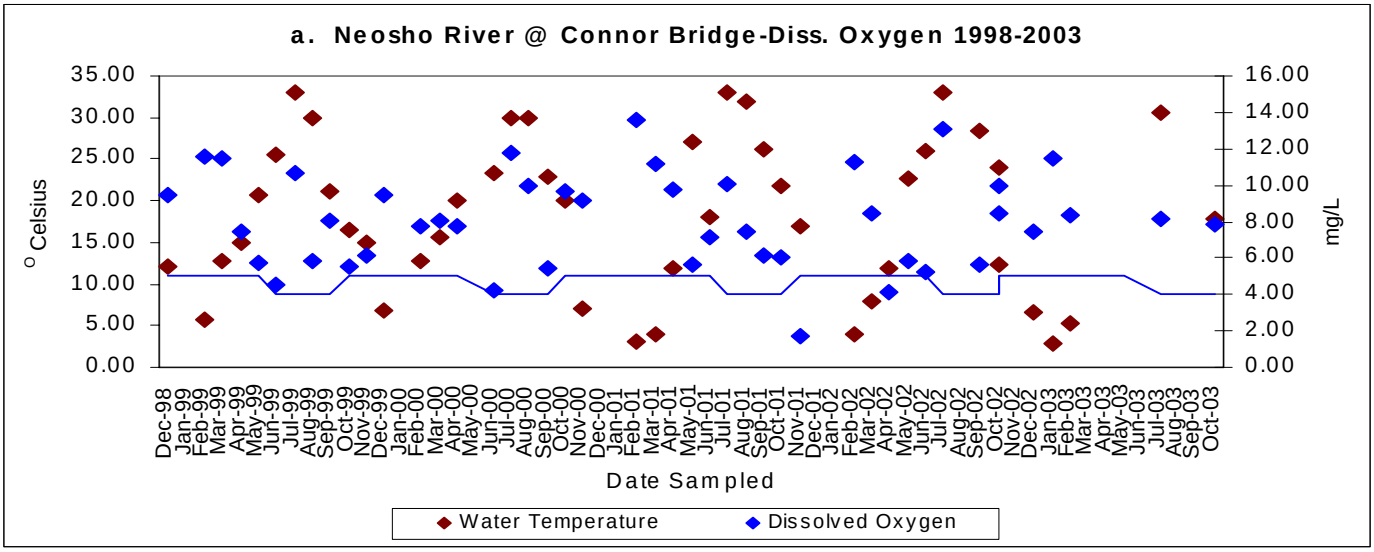
Neosho River near Connor Bridge

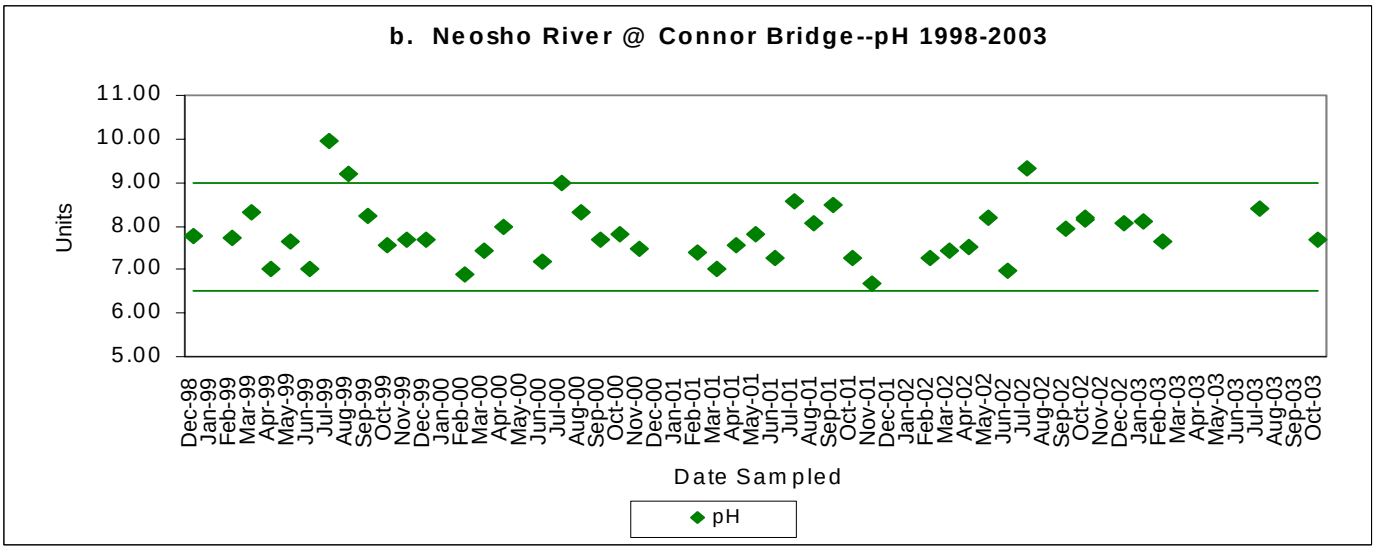
Station AT185010 (121600040010-001AT) is a permanent ambient trend monitoring station located on the Neosho River in Oklahoma. Situated in the central portion of Ottawa County, the site was established south southeast of the City of Miami off of State Highway 137 on County Road E0145 at Connor Bridge. The station is positioned near the terminal end of stream segment 121600040010 and is classified within the Grand Lake 8-digit HUC watershed (11070206). Water enters the stream system from several tributaries including Tar Creek and Hudson Creek, among others.

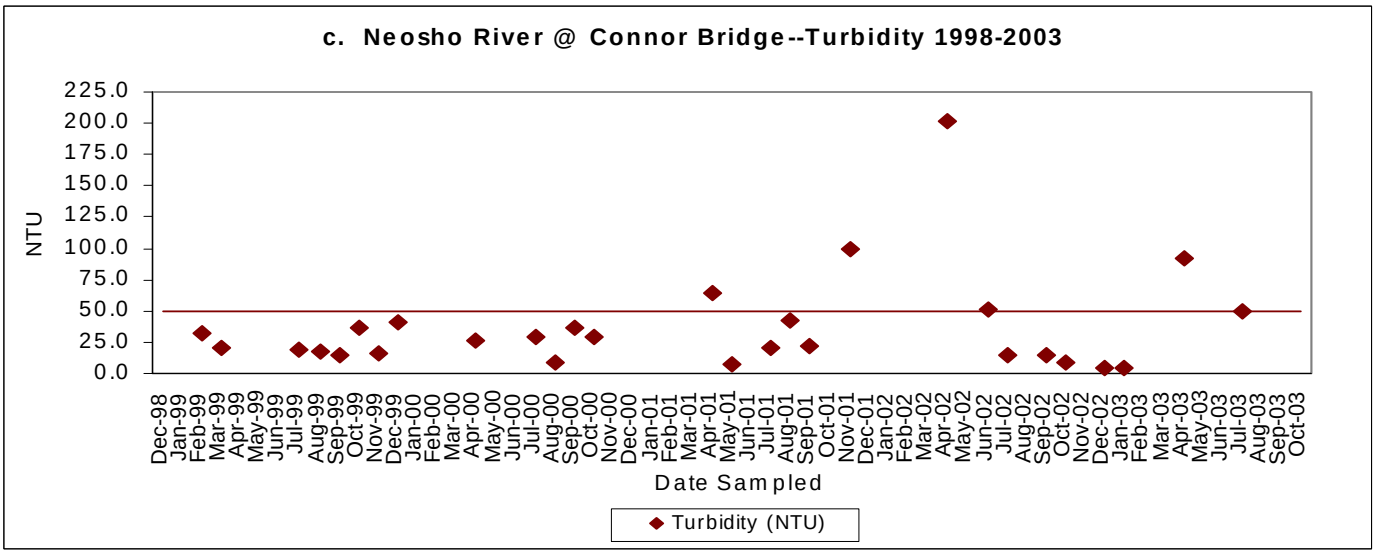
This station on the Neosho River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through October of 2003. For purposes of reporting, this station is representative of the Neosho River from the confluence of an unnamed tributary above the City of Miami, Oklahoma (94.9116, 36.8757) downstream to confluence of the Neosho River with Grand Lake (-94.7866, 36.7919). As per Appendix A, Table 1 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

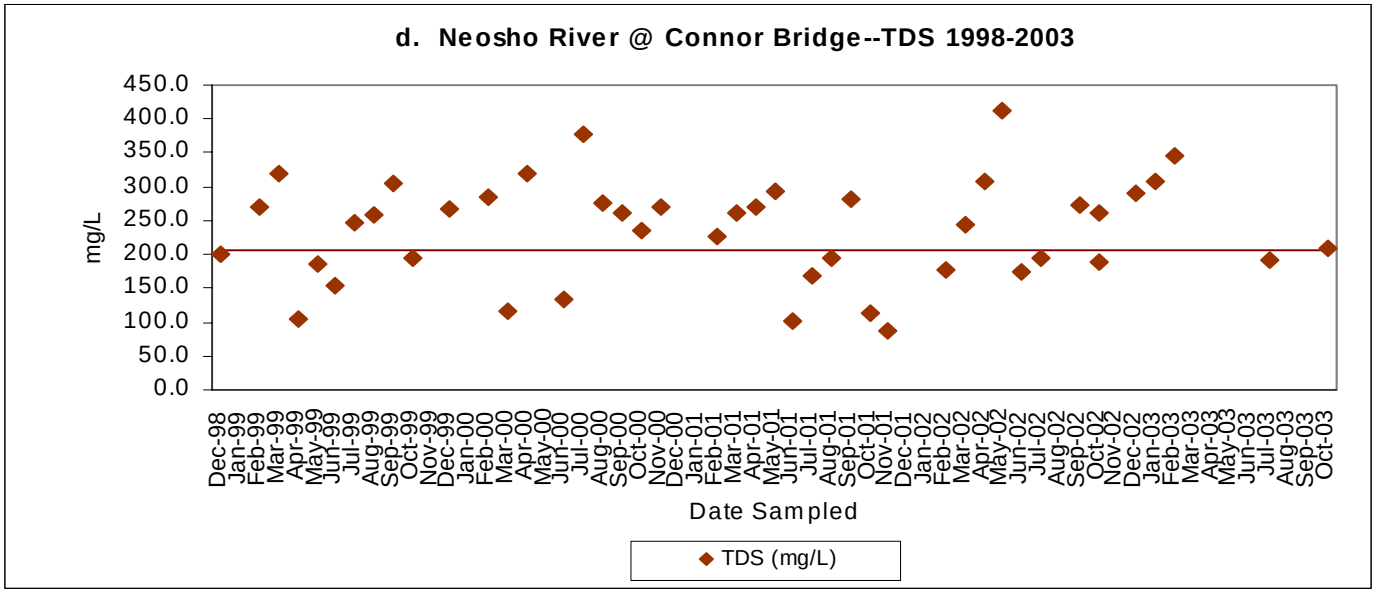
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Dissolved oxygen (Figure 28a), pH (Figure 28b), turbidity (Figure 28c), and toxicant samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids (TDS), chlorides, and sulfates (Figure 28d and Figure 28e). Although 61% of the TDS concentrations exceeded the sample standard of 206.0 mg/L and the geometric mean (220.6 mg/L) exceeded the prescribed yearly mean standard of 187.0 mg/L, the values are below the minimum standards of 750 and 700 mg/L, respectively. The PBCR beneficial use is supported for fecal coliform, *E. coli* and enterococci. This segment of the Neosho River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 28f).

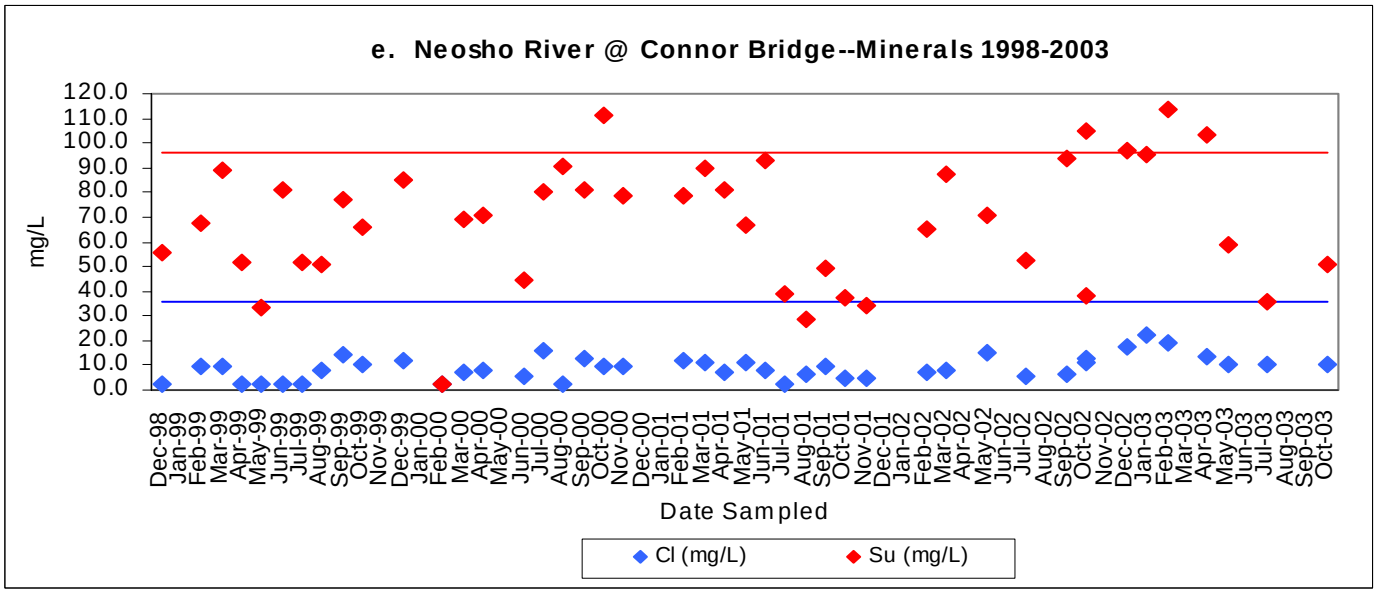
Figure 28a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) for the Neosho River at Connor Bridge (AT185010), 1998-2003.

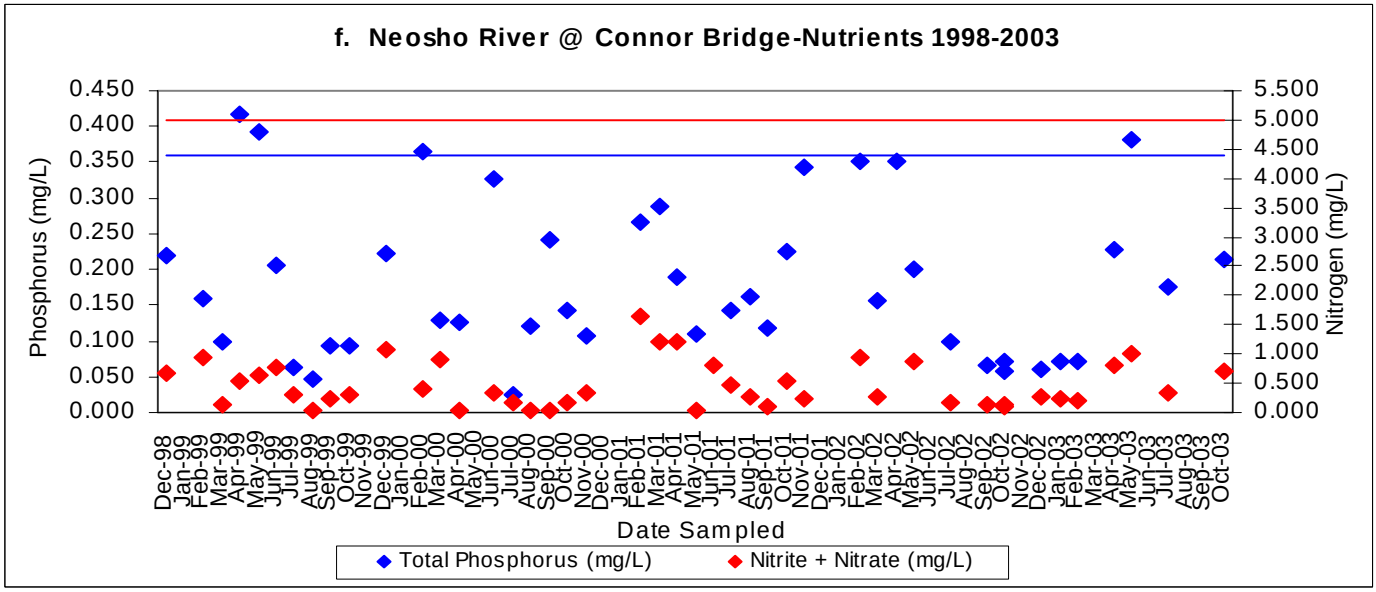







d. Neosho River @ Connor Bridge--TDS 1998-2003
mg/L
450.0
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
Date Sampled
TDS (mg/L)


e. Neosho River @ Connor Bridge--Minerals 1998-2003
mg/L
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Neosho River @ Connor Bridge-Nutrients 1998-2003
Phosphorus (mg/L)
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
Nitrogen (mg/L)
5.500
5.000
4.500
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

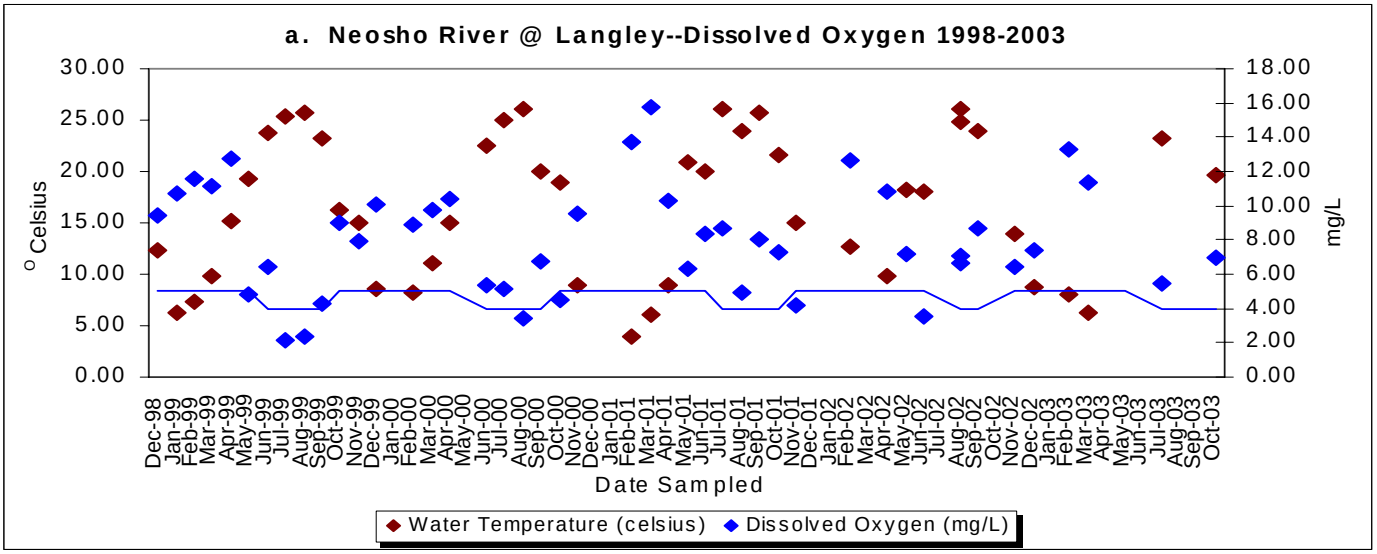
Neosho River near Langley

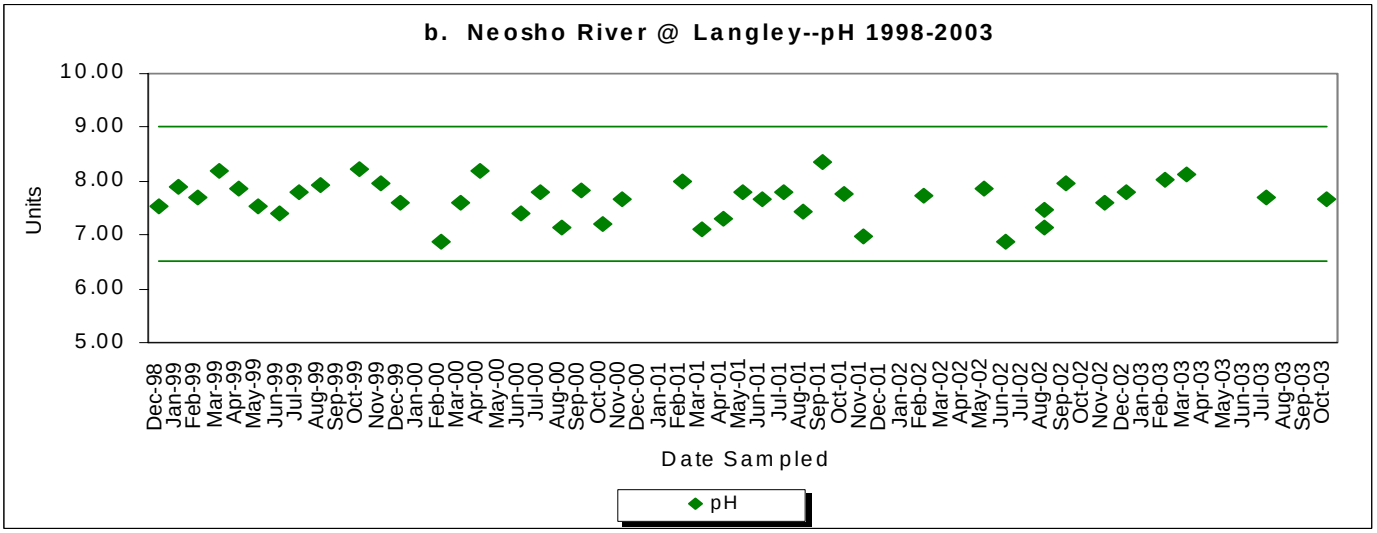
Station AT190500 (121600020170-001AT) is a permanent ambient trend monitoring station on the Neosho River below Grand Lake and above Lake Hudson. Situated in the northeastern portion of Mayes County, the site was established south of the Town of Langley on State Highway 82. The station is positioned near the midpoint of stream segment 121600020170 and is classified within the Lower Neosho River 8-digit HUC watershed (11070209). Water enters the stream system from Grand Lake and several tributaries including Big Cabin Creek, among others.

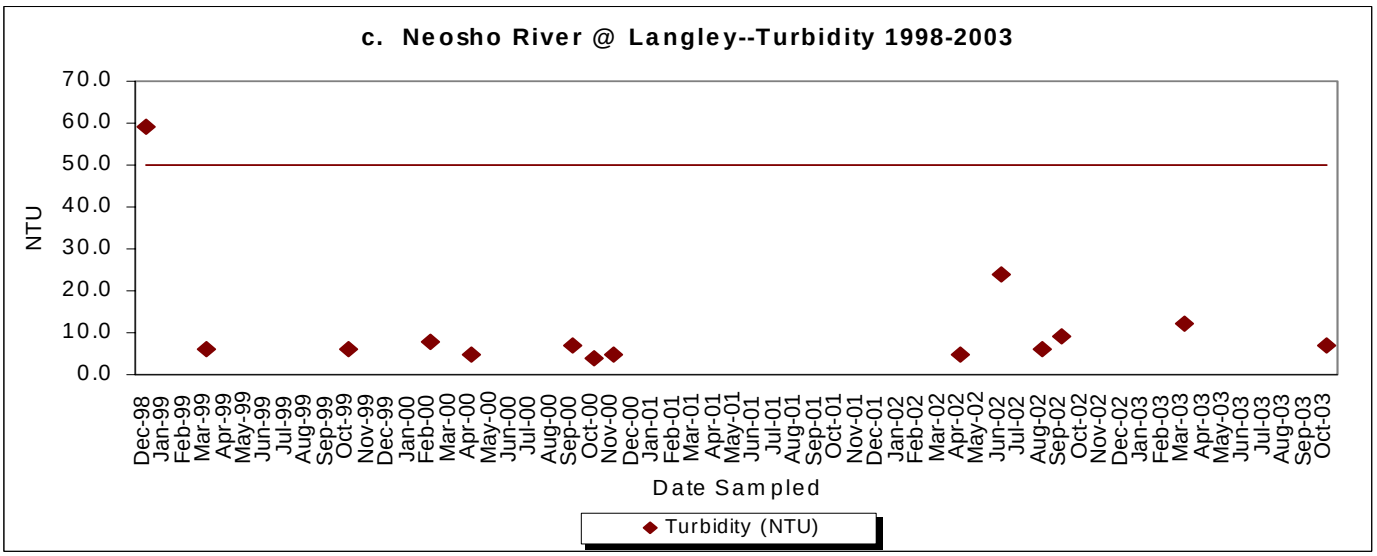
This station on the Neosho River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through October of 2003. For purposes of reporting, this station is representative of the Neosho River from the confluence of Grand Lake (95.1426, 36.4415) downstream to confluence of the Neosho River with Lake Hudson (95.0408, 36.4690). As per Appendix A, Table 1 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

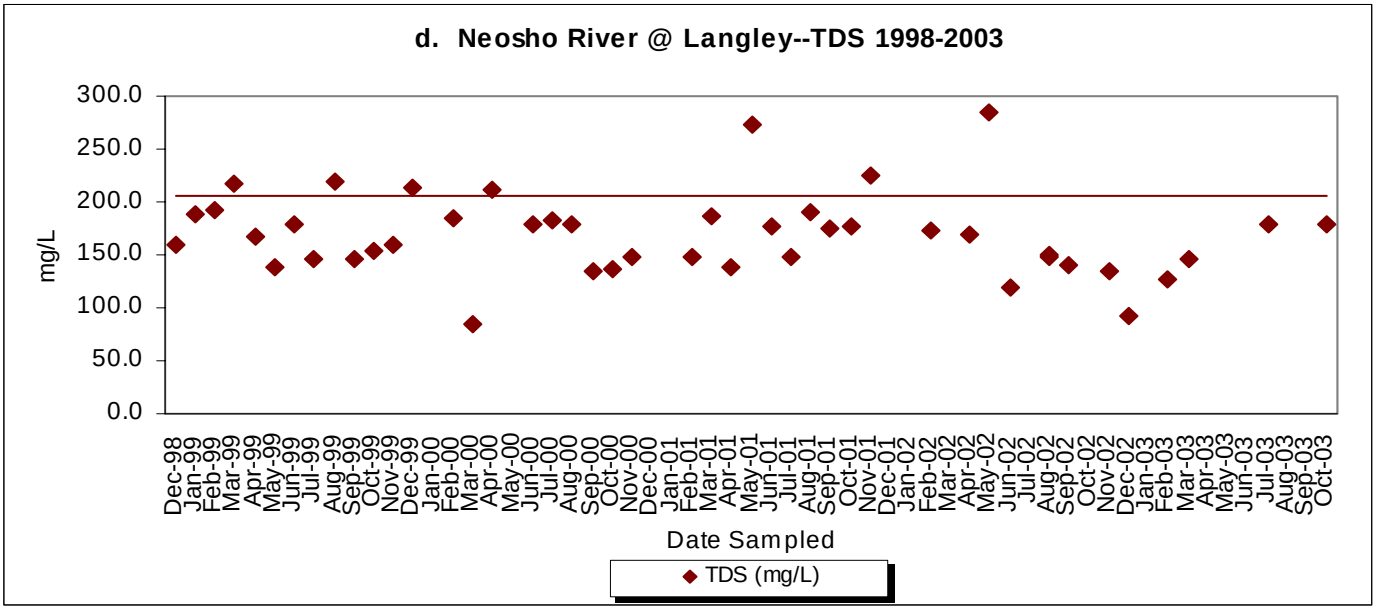
The PPWS beneficial use is supported. The WWAC beneficial use is partially supported. Of the 45 dissolved oxygen samples (Figure 29a), 7 samples (or 16%) were below the screening level. Turbidity (Figure 29c), pH (Figure 29b), and toxicant samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids (TDS), chlorides, and sulfates (Figure 29d and Figure 29e). Although 16% of the TDS concentrations exceeded the sample standard of 206.0 mg/L, the values are below the minimum standard of 750 mg/L. The PBCR beneficial use is supported for fecal coliform, *E. coli* and enterococci samples. This segment of the Neosho River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 29f).

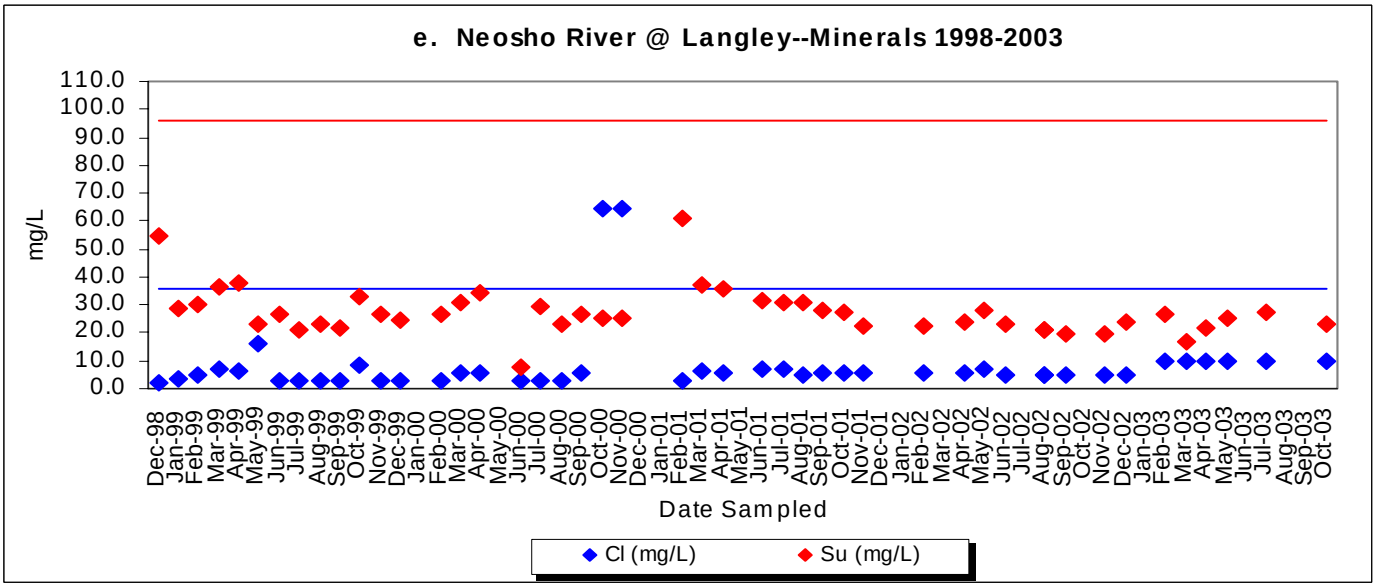
Figure 29a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) for the Neosho River at Langley (AT190500), 1998-2003.

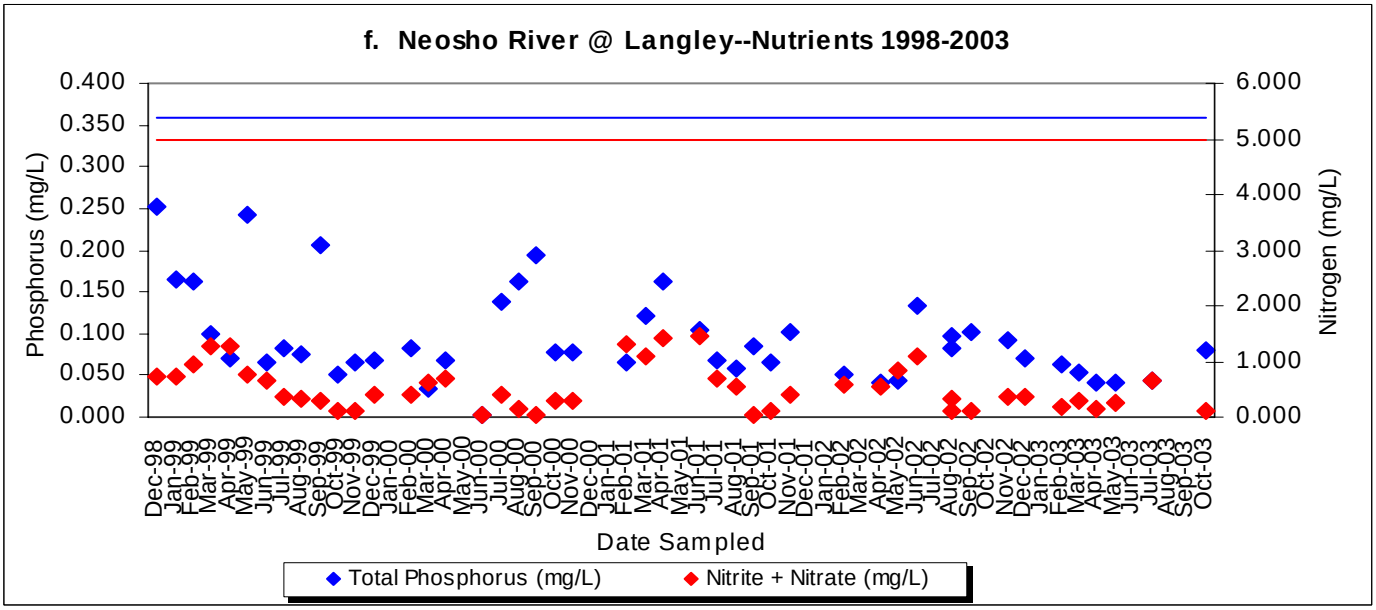







d. Neosho River @ Langley--TDS 1998-2003
mg/L
300.0
250.0
200.0
150.0
100.0
50.0
0.0
Date Sampled
TDS (mg/L)


e. Neosho River @ Langley--Minerals 1998-2003
mg/L
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Neosho River @ Langley--Nutrients 1998-2003
Phosphorus (mg/L)
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

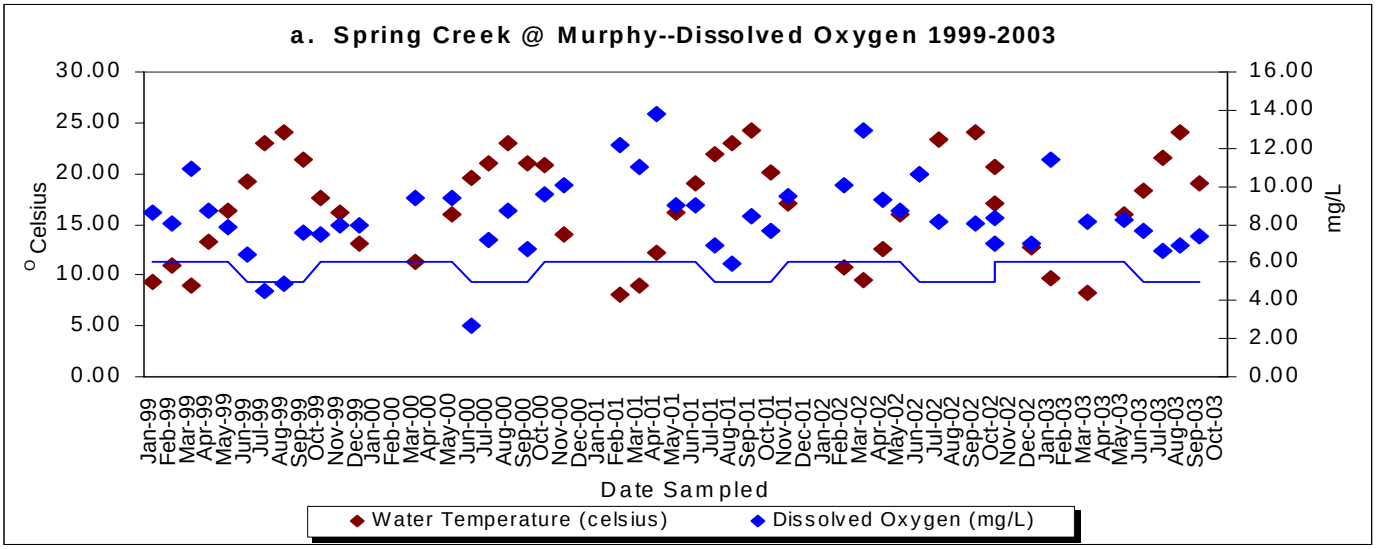
Spring Creek near Murphy

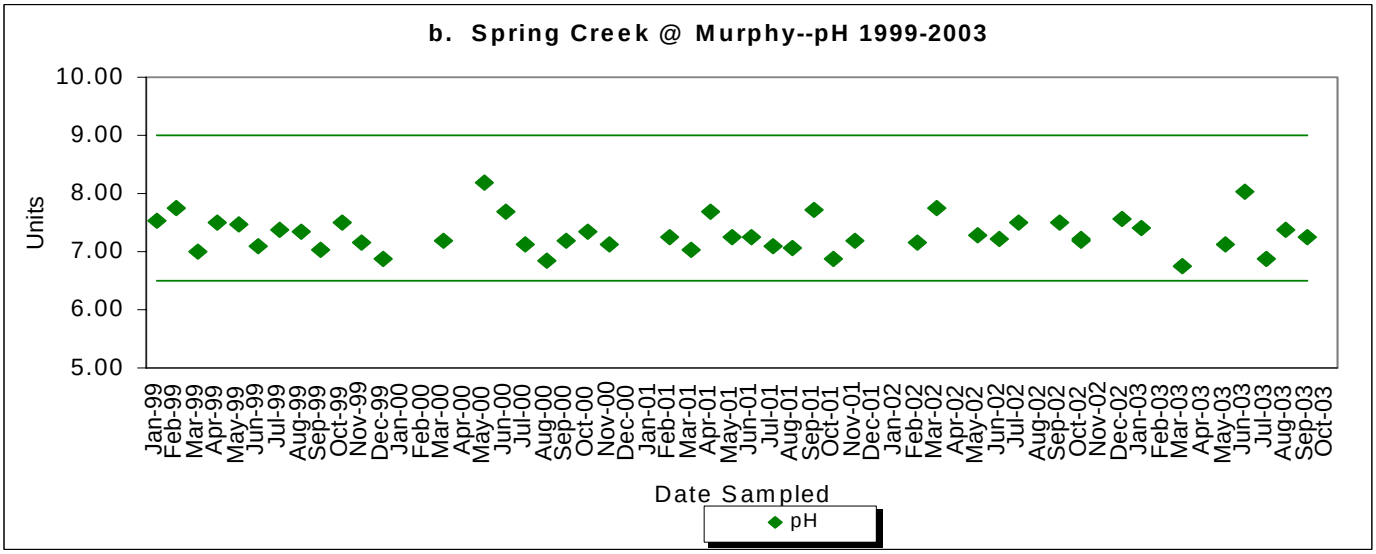
Station AT191558 (121600010290-001AT) is a permanent ambient trend monitoring station located on Spring Creek. Situated in the south central portion of Mayes County, the site was established east-southeast of the Town of Murphy off US Highway 412 near County Road E0610. The station is positioned near the terminal end of stream segment 121600010290 and is classified within the Lower Neosho River 8-digit HUC watershed (11070209). Water enters the stream system from several tributaries including Double Spring Creek and Snake Creek, among others.

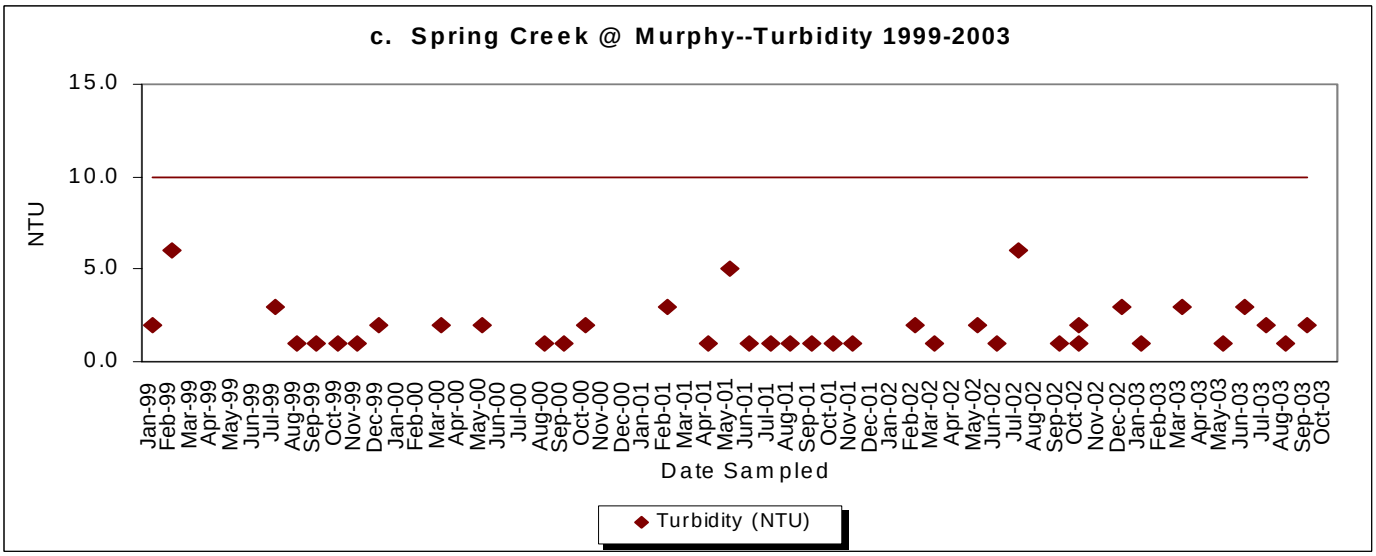
This station on Spring Creek has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from January of 1999 through September of 2003. For purposes of reporting, this station is representative of Spring Creek from the confluence of Double Spring Creek (94.9929, 36.1043) downstream to confluence of Spring Creek River with Cedar Crest Lake (95.2250, 36.1181). As per Appendix A, Table 1 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Cool Water Aquatic Community—Fish and Wildlife Propagation (CWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

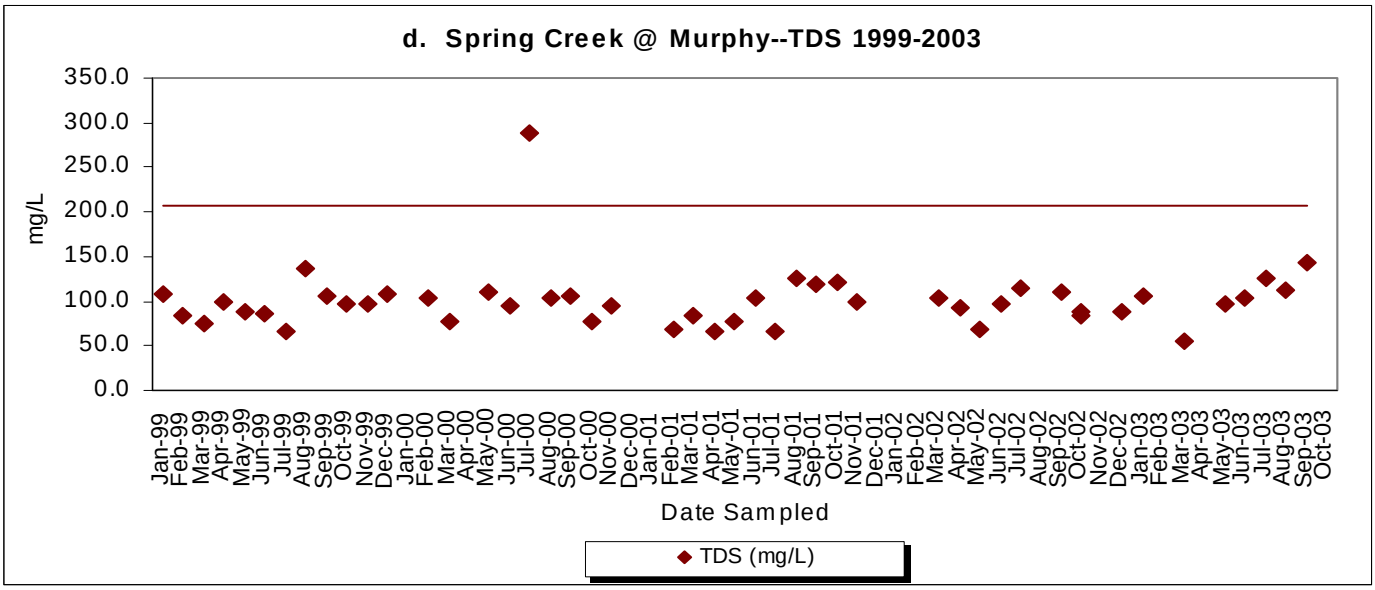
The PPWS beneficial use is supported. The CWAC beneficial use is supported. Dissolved oxygen (Figure 30a), pH (Figure 30b), turbidity (Figure 30c), and toxicant data collected during the same period met the criteria prescribed in the CWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 30d and Figure 30e). The PBCR beneficial use is supported for fecal coliform, *E. coli* and enterococci samples. This segment of Spring Creek is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 30f).

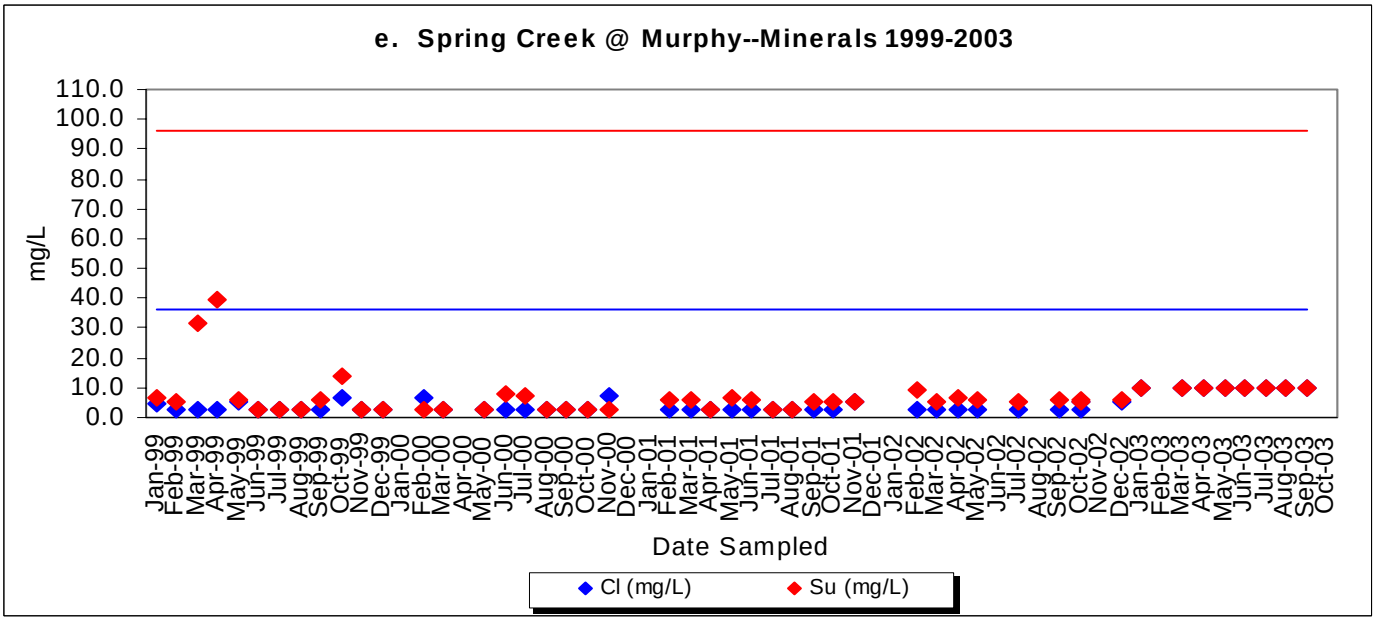
Figure 30a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) for Spring Creek at Murphy (AT191558), 1999-2003.

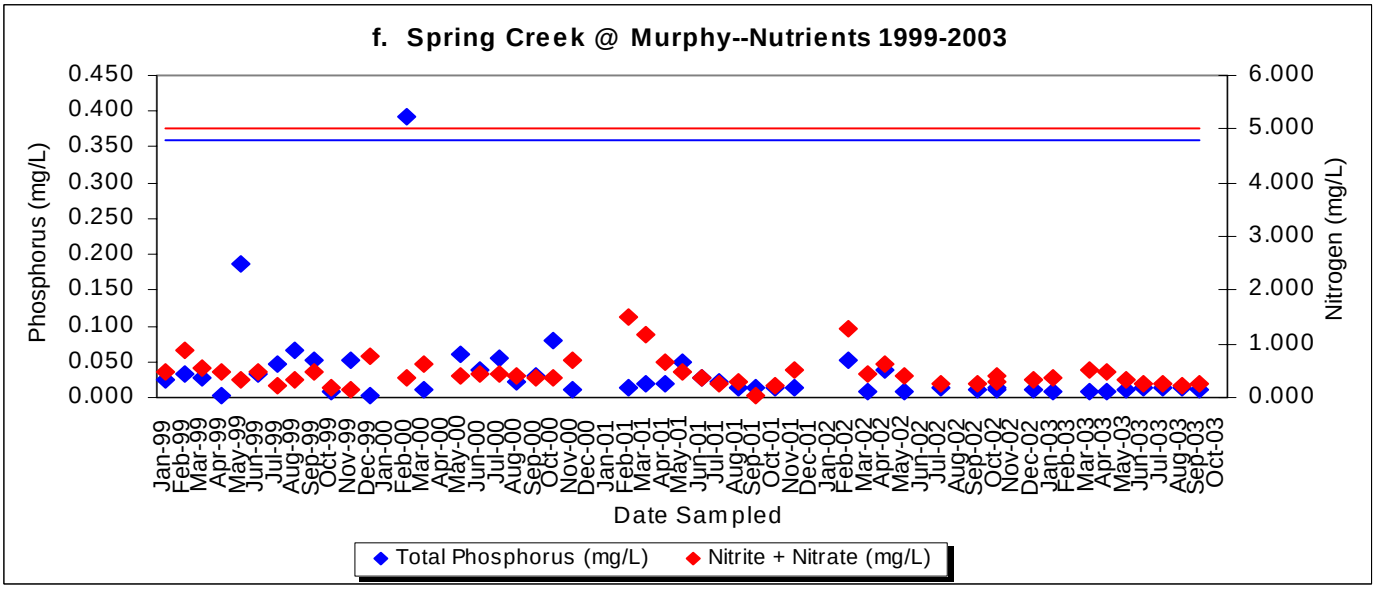







d. Spring Creek @ Murphy--TDS 1999-2003
mg/L
Date Sampled
TDS (mg/L)


e. Spring Creek @ Murphy--Minerals 1999-2003
mg/L
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Spring Creek @ Murphy--Nutrients 1999-2003
Phosphorus (mg/L)
Nitrogen (mg/L)
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

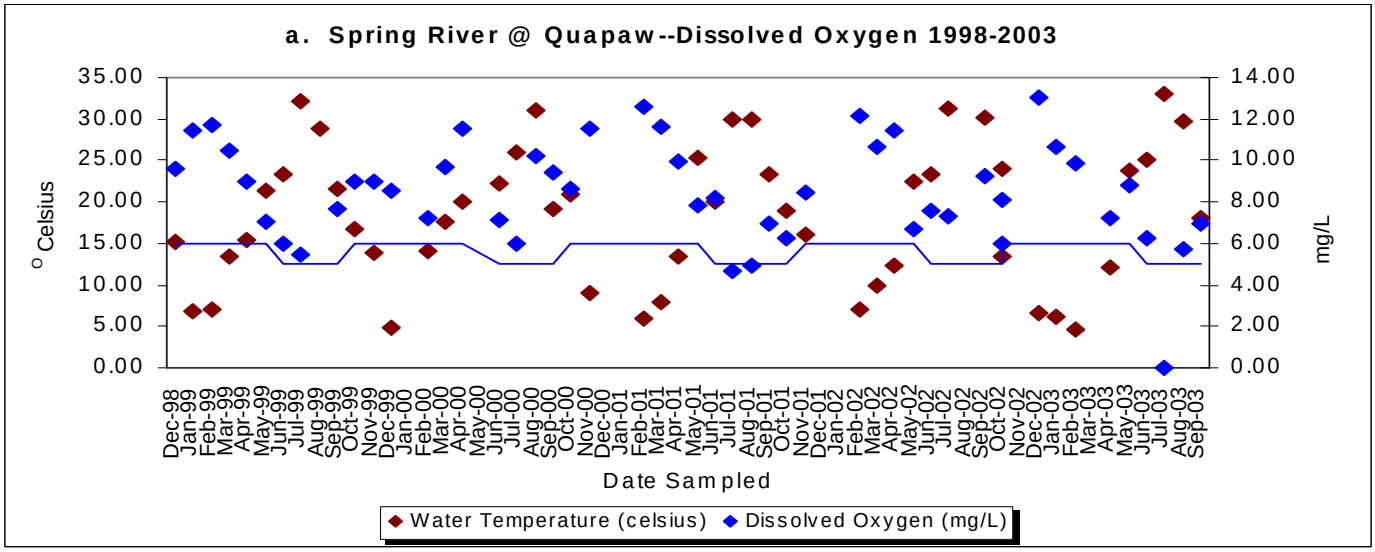
Spring River near Quapaw

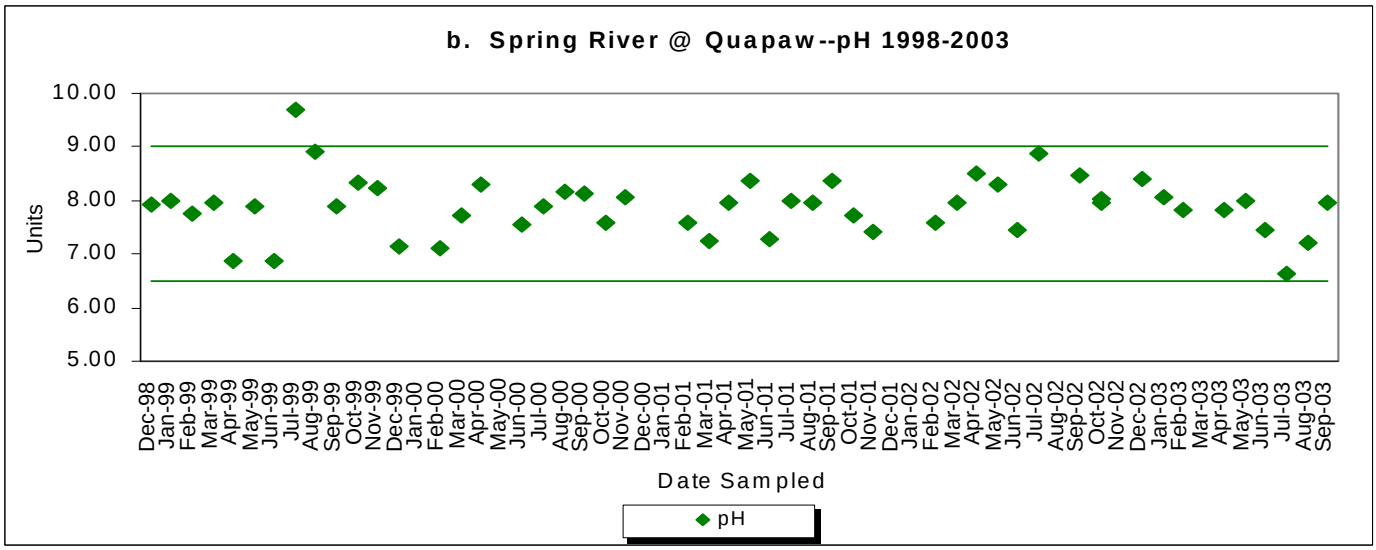
Station AT188000 (121600070010-001AT) is a permanent ambient trend monitoring station located on Spring River in Oklahoma. Situated in the north central portion of Ottawa County, the site was established east-southeast of the City of Quapaw off of State Highway 137 on County Road E0050. The station is positioned near the midpoint of stream segment 121600070010 and is classified within the Spring River 8-digit HUC watershed (11070207). Water enters the stream system from Kansas and from several tributaries including Five Mile Creek, Devil's Hollow Creek, Warren Branch Creek, and Flint Branch Creek, among others.

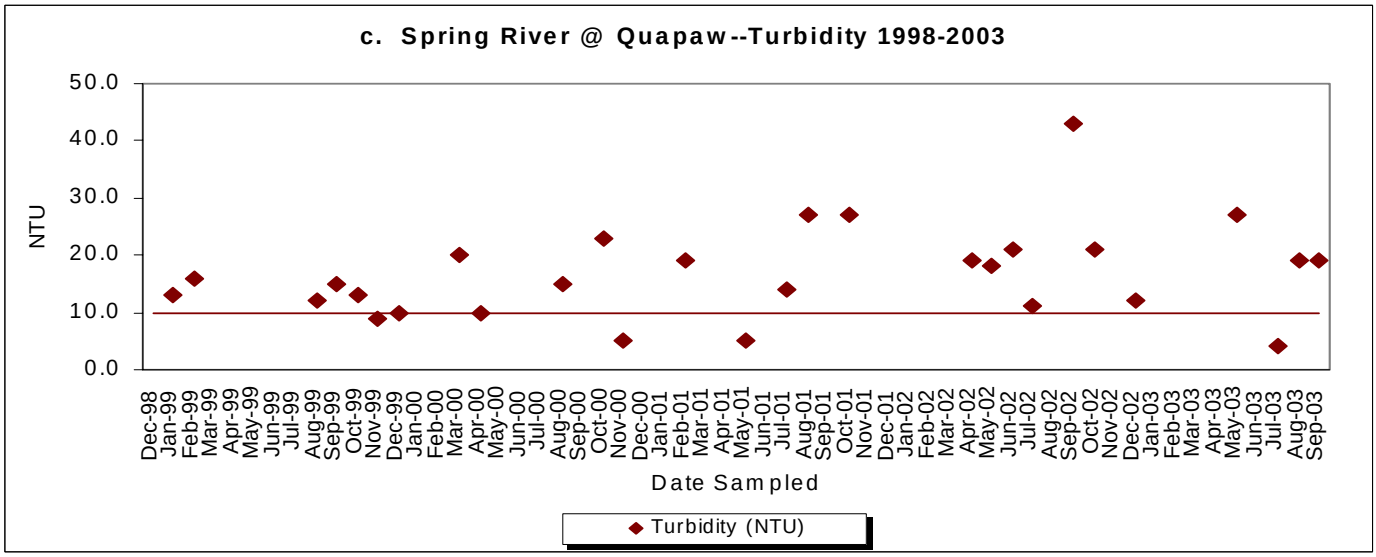
This station on the Spring River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through September of 2003. For purposes of reporting, this station is representative of the Spring River from its entrance into Oklahoma (94.7118, 36.9988) downstream to confluence of the Spring River with Grand Lake (94.7342, 36.8322). As per Appendix A, Table 1 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Cool Water Aquatic Community—Fish and Wildlife Propagation (CWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

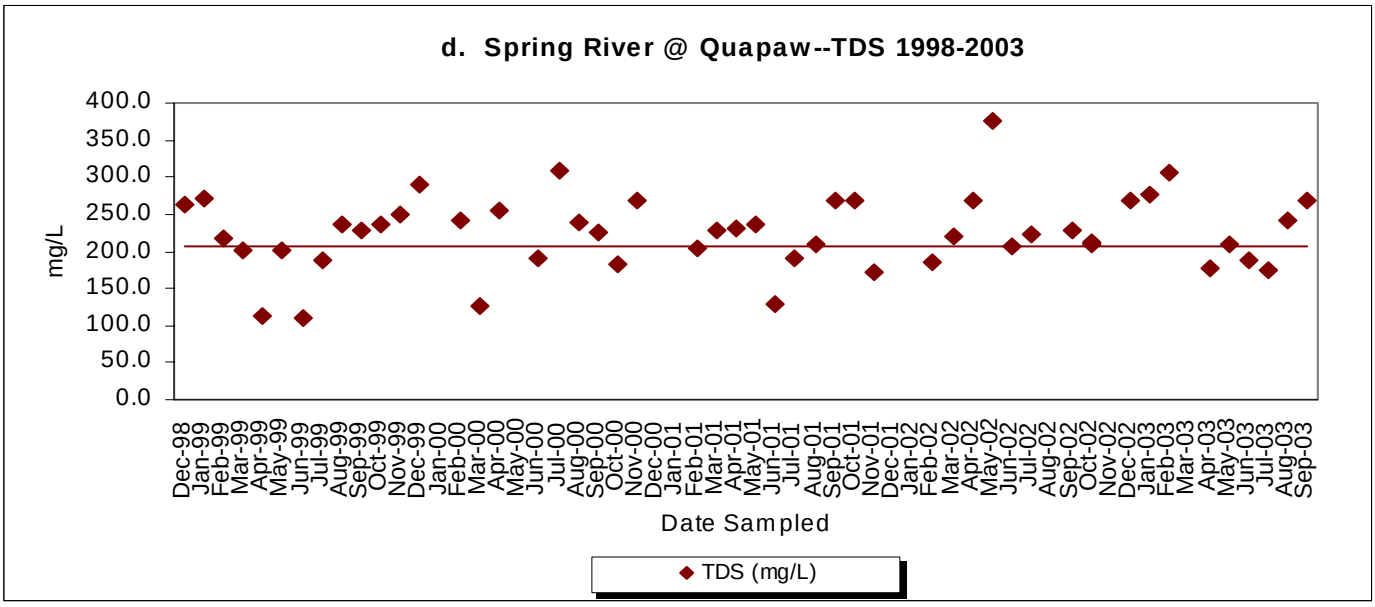
The PPWS beneficial use is supported. The CWAC beneficial use is not supported. Of the 28 turbidity samples (Figure 31c), 22 samples (or 79%) exceeded the numerical criteria of 10. Of the 13 lead samples; 3 of the concentrations (or 23%) exceeded the prescribed hardness-dependant chronic criterion of 5.32 µg/L (Table 16). Of the 14 zinc samples, 6 of the concentrations (or 43%) exceeded the prescribed hardness-dependant chronic criteria of 149.23 µg/L, and 5 of the concentrations (or 36%) exceeded the prescribed hardness-dependant acute criterion of 164.74 µg/L (Table 16). Dissolved oxygen (Figure 31a) and pH (Figure 31b) samples met the criteria prescribed in the CWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 31d and Figure 31e). Although 68% of the TDS concentrations exceeded the sample standard of 206.0 mg/L and the geometric mean (229.1 mg/L) exceed the yearly mean standard of 187.0 mg/L, these numbers are still below the prescribed minimum TDS value of 750 mg/L. The PBCR beneficial use is not supported (Table 17). Of the 25 enterococci concentrations, 2 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (44.7 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Spring River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 31f).

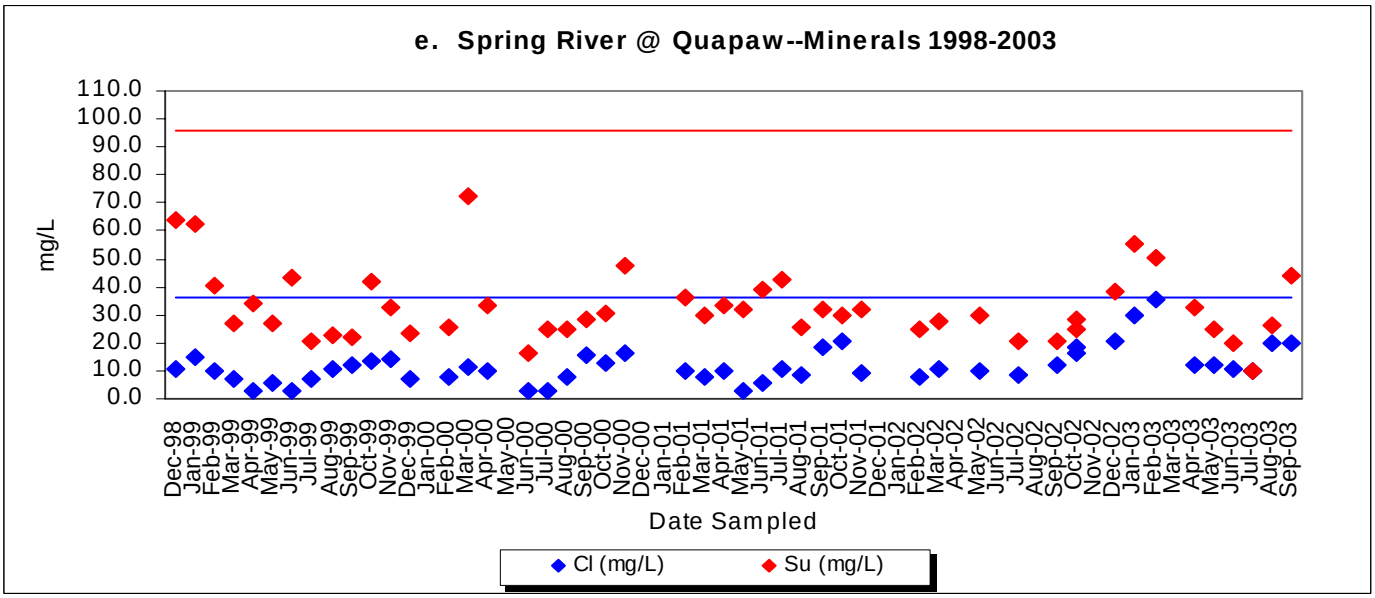
Figure 31a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) for Spring River at Quapaw (AT188000), 1998-2003.

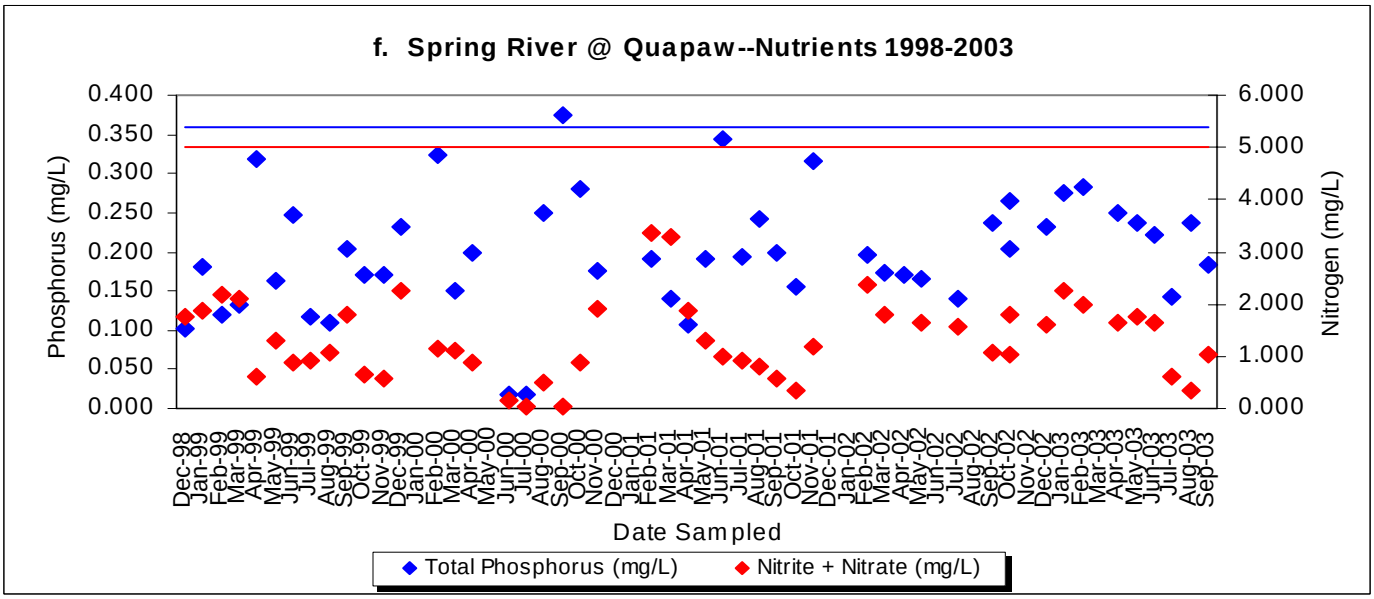







d. Spring River @ Quapaw--TDS 1998-2003
mg/L
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
Date Sampled
TDS (mg/L)


e. Spring River @ Quapaw--Minerals 1998-2003
mg/L
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Spring River @ Quapaw--Nutrients 1998-2003
Phosphorus (mg/L)
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

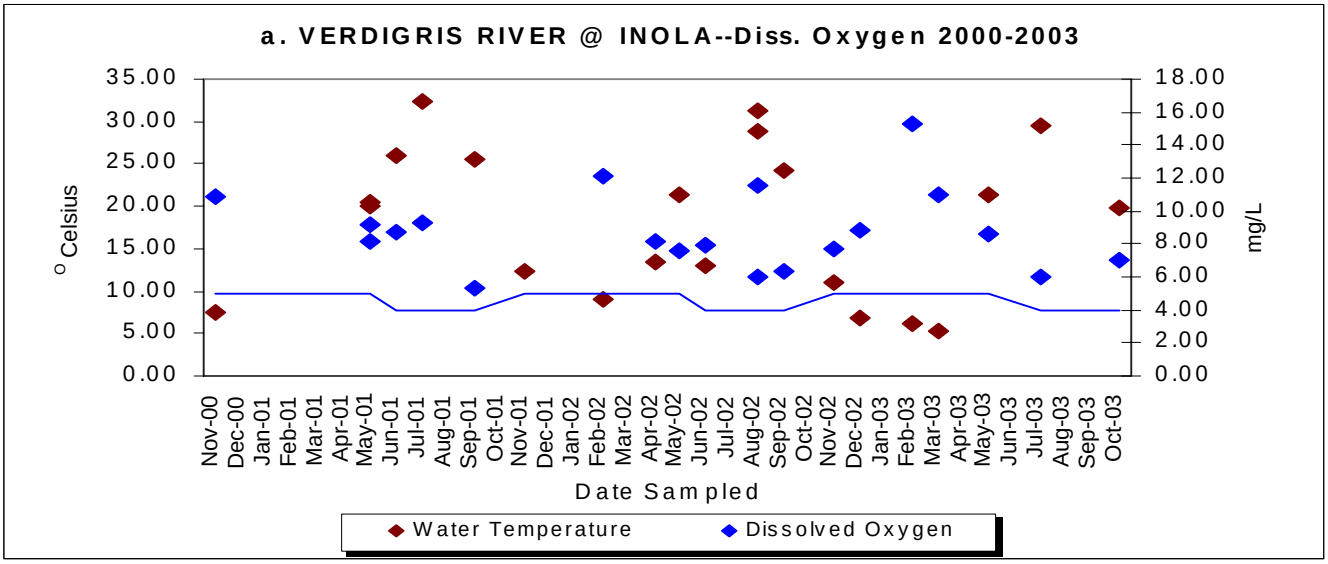
Verdigris River near Inola

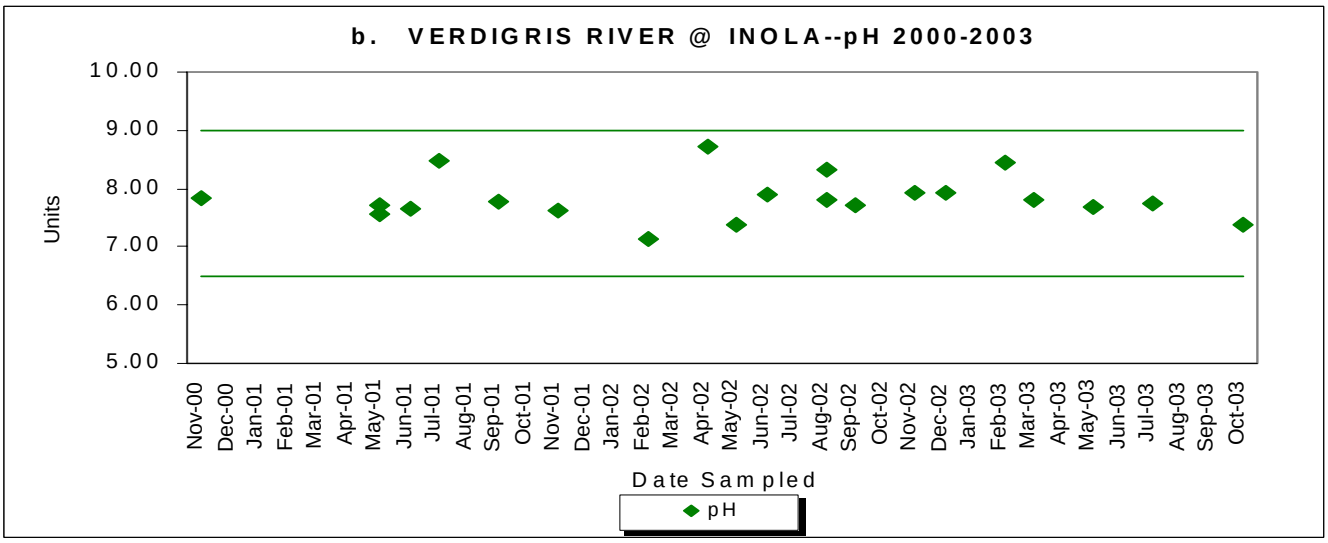
Station AT178600 (121500020260-001AT) is a permanent ambient trend monitoring station located on the Verdigris River (McClellan-Kerr Navigational System) in Oklahoma. Situated in the extreme south central portion of Rogers County, the site was established west of the Town of Inola on US Highway 412. The station is positioned near the midpoint of stream segment 121500020260 and is classified within the Lower Verdigris River 8-digit HUC watershed (11070105). Water enters the stream system from Bird Creek, Spunky Creek, Chambers Creek, Dog Creek (Claremore Lake), and Salt Creek, among others.

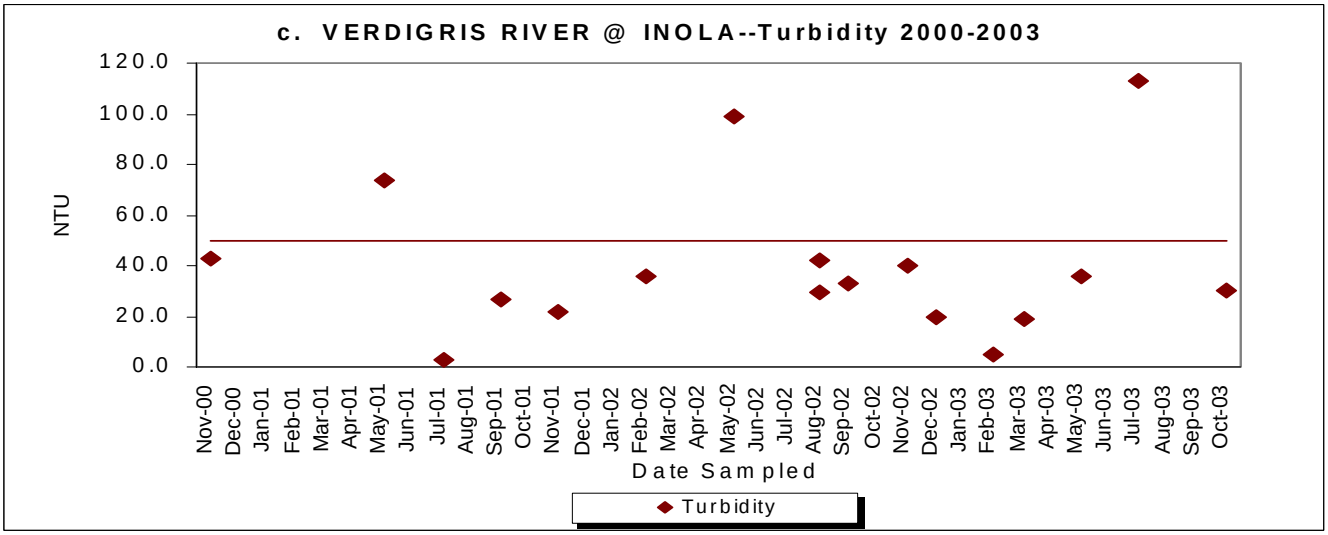
This station on the Verdigris River has been active for all water quality variables since October of 2000. The following assessment of beneficial uses is based on data collected from November of 2000 through October of 2003. For purposes of reporting, this station is representative of the Verdigris River from the confluence of Bird Creek (95.7261, 36.2210) downstream to the confluence of the Verdigris River with Adams Creek (95.5510, 36.0673). As per Appendix A, Table 1 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

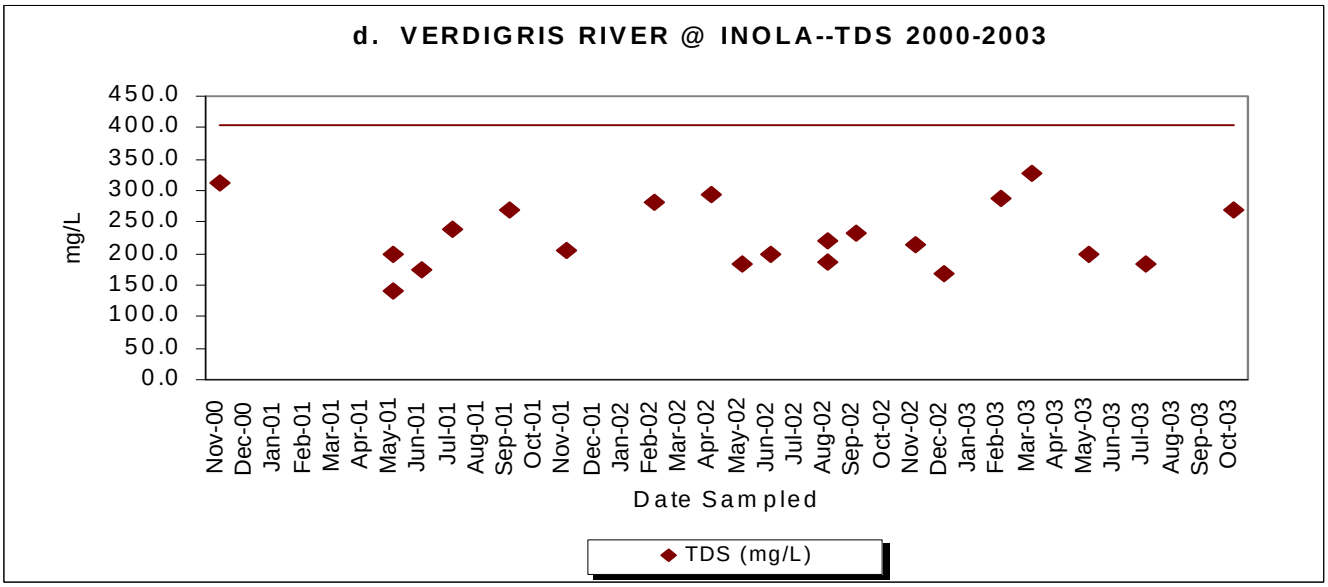
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 9 toxicant samples collected, 5 of the lead concentrations (or 56%) exceeded the prescribed hardness-dependant chronic criteria of 5.42 µg/L (Table 16). Of the 16 turbidity samples (Figure 32c), 3 samples (or 19%) exceeded the numerical criteria of 50. Dissolved oxygen (Figure 32a) and pH (Figure 32b) samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 32d and Figure 32e). The PBCR beneficial use is supported by fecal coliform, *E. coli* and enterococci samples. This segment of the Verdigris River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 1.00 mg/L and 4.65 mg/L, respectively (Figure 32f).

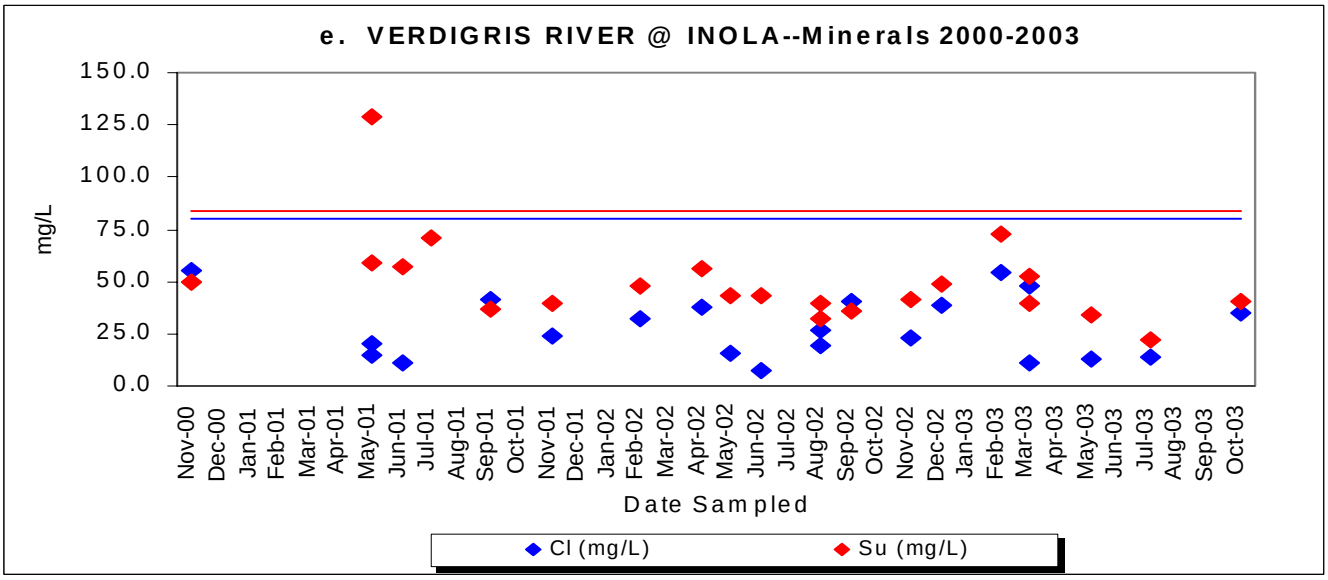
Figure 32a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) for Verdigris River at Inola (AT178600), 2000-2003.

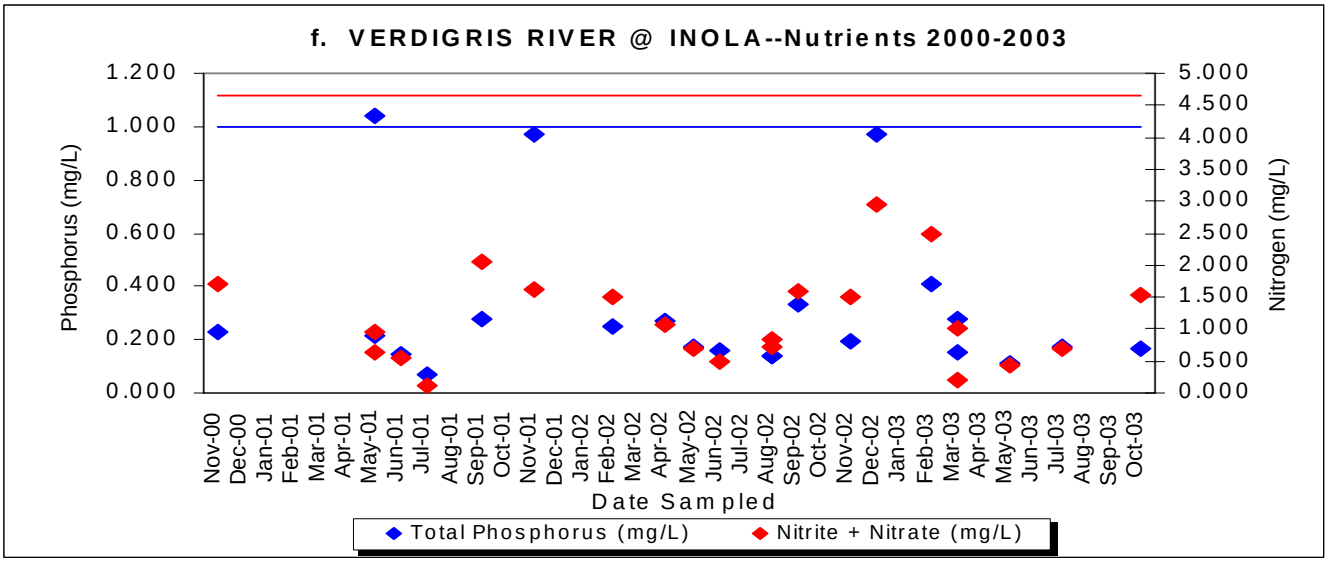







d. VERDIGRIS RIVER @ INOLA--TDS 2000-2003
mg/L
450.0
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
Nov-00 Dec-00 Jan-01 Feb-01 Mar-01 Apr-01 May-01 Jun-01 Jul-01 Aug-01 Sep-01 Oct-01 Nov-01 Dec-01 Jan-02 Feb-02 Mar-02 Apr-02 May-02 Jun-02 Jul-02 Aug-02 Sep-02 Oct-02 Nov-02 Dec-02 Jan-03 Feb-03 Mar-03 Apr-03 May-03 Jun-03 Jul-03 Aug-03 Sep-03 Oct-03
Date Sampled
TDS (mg/L)


e. VERDIGRIS RIVER @ INOLA--Minerals 2000-2003
mg/L
150.0
125.0
100.0
75.0
50.0
25.0
0.0
Nov-00 Dec-00 Jan-01 Feb-01 Mar-01 Apr-01 May-01 Jun-01 Jul-01 Aug-01 Sep-01 Oct-01 Nov-01 Dec-01 Jan-02 Feb-02 Mar-02 Apr-02 May-02 Jun-02 Jul-02 Aug-02 Sep-02 Oct-02 Nov-02 Dec-02 Jan-03 Feb-03 Mar-03 Apr-03 May-03 Jun-03 Jul-03 Aug-03 Sep-03 Oct-03
Date Sampled
Cl (mg/L)
Su (mg/L)


f. VERDIGRIS RIVER @ INOLA--Nutrients 2000-2003
Phosphorus (mg/L)
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Nitrogen (mg/L)
5.000
4.500
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
Nov-00 Dec-00 Jan-01 Feb-01 Mar-01 Apr-01 May-01 Jun-01 Jul-01 Aug-01 Sep-01 Oct-01 Nov-01 Dec-01 Jan-02 Feb-02 Mar-02 Apr-02 May-02 Jun-02 Jul-02 Aug-02 Sep-02 Oct-02 Nov-02 Dec-02 Jan-03 Feb-03 Mar-03 Apr-03 May-03 Jun-03 Jul-03 Aug-03 Sep-03 Oct-03
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

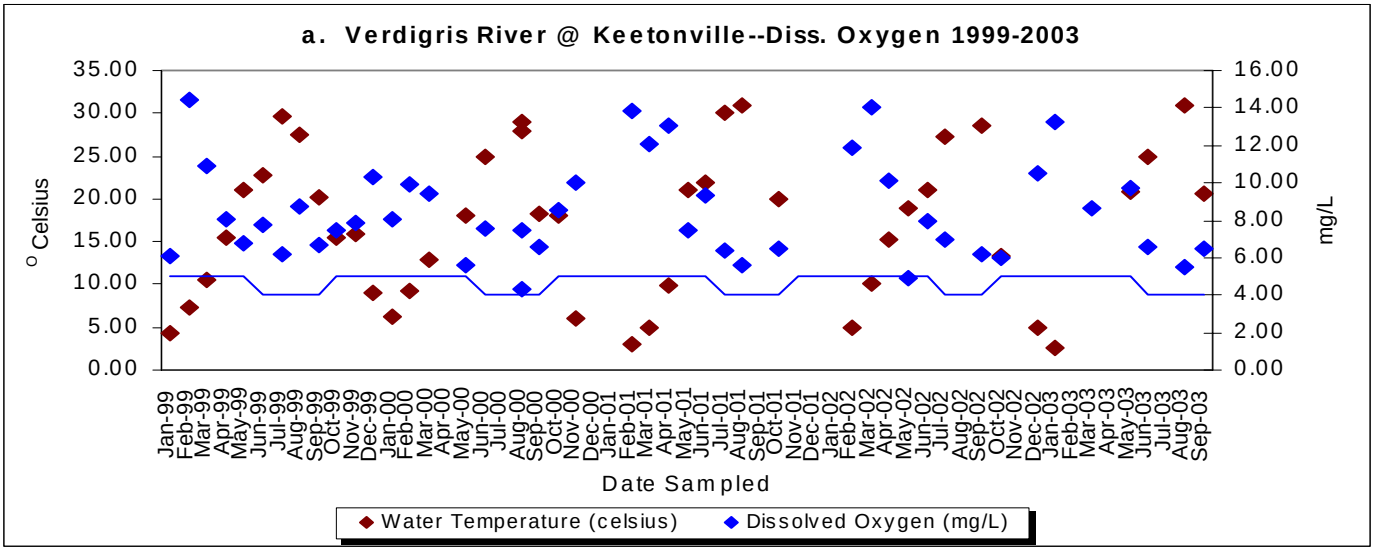
Verdigris River near Keetonville

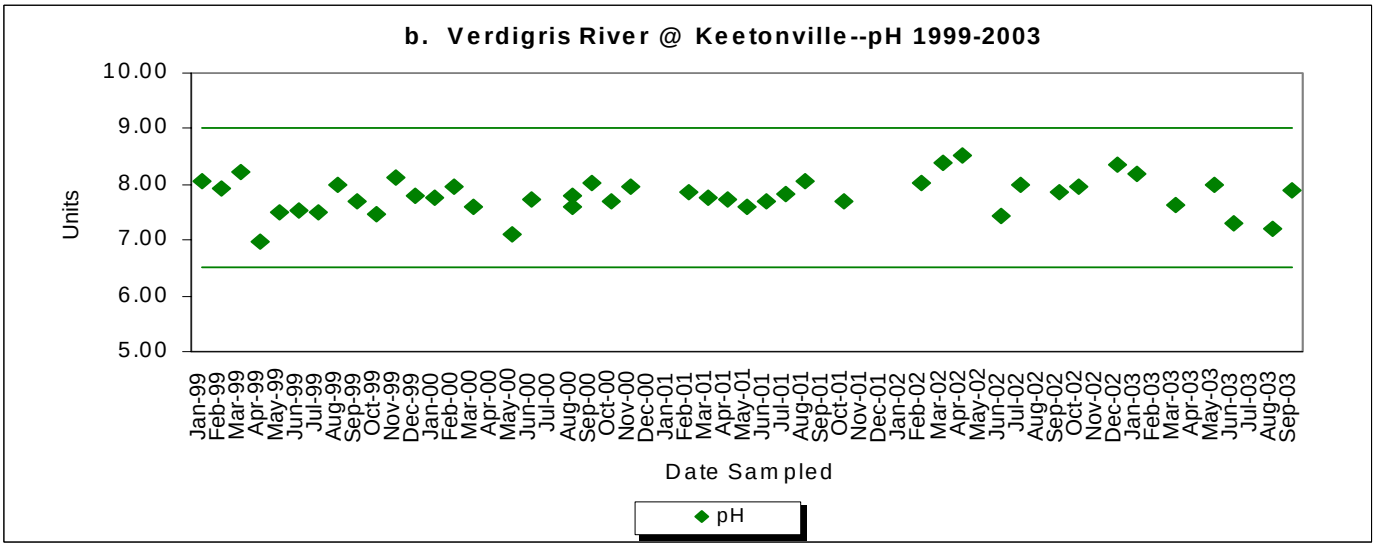
Station AT176000 (121500030010-001AT) is a permanent ambient trend monitoring station located on the Verdigris River in Oklahoma. Situated in the east central portion of Rogers County, the site was established east of the City of Keetonville on State Highway 20. The station is positioned near the midpoint of stream segment 121500030010 and is classified within the Lower Verdigris River 8-digit HUC watershed (11070105). Water enters the stream system from Oologah Lake and from several tributaries including Fourmile Creek, Caney River, and Bird Creek, among others.

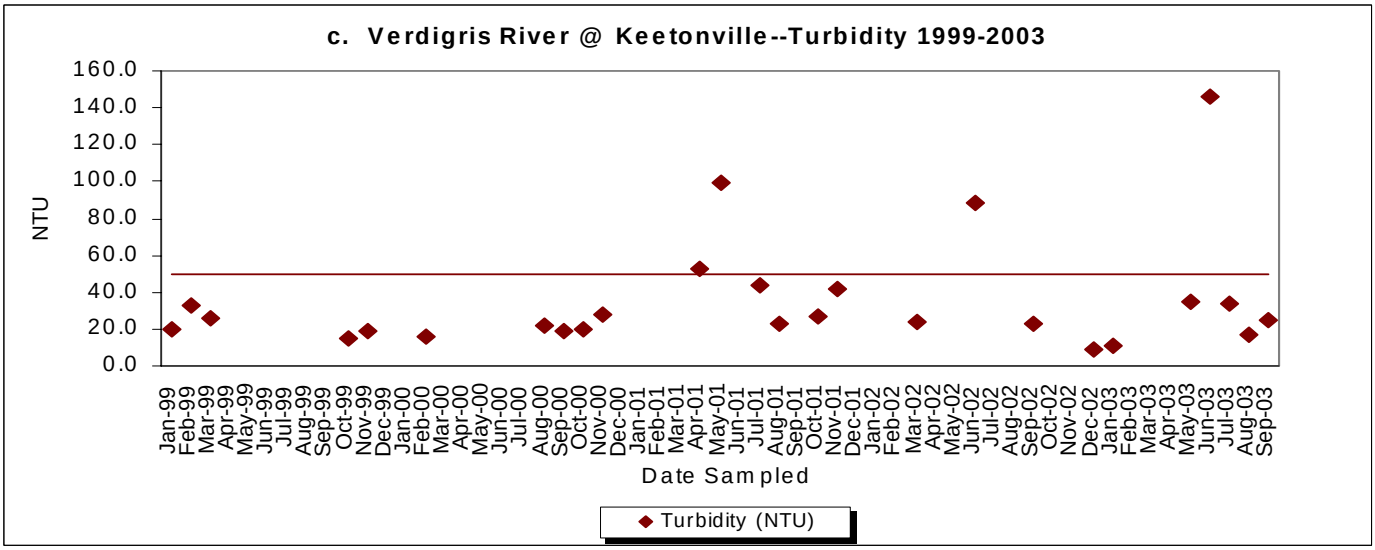
This station on the Verdigris River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from January of 1999 through September of 2003. For purposes of reporting, this station is representative of the Verdigris River from the confluence of Oologah Lake (95.4226, 36.6794) downstream to confluence of the Verdigris River with Bird Creek (95.7261, 36.2210). As per Appendix A, Table 1 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

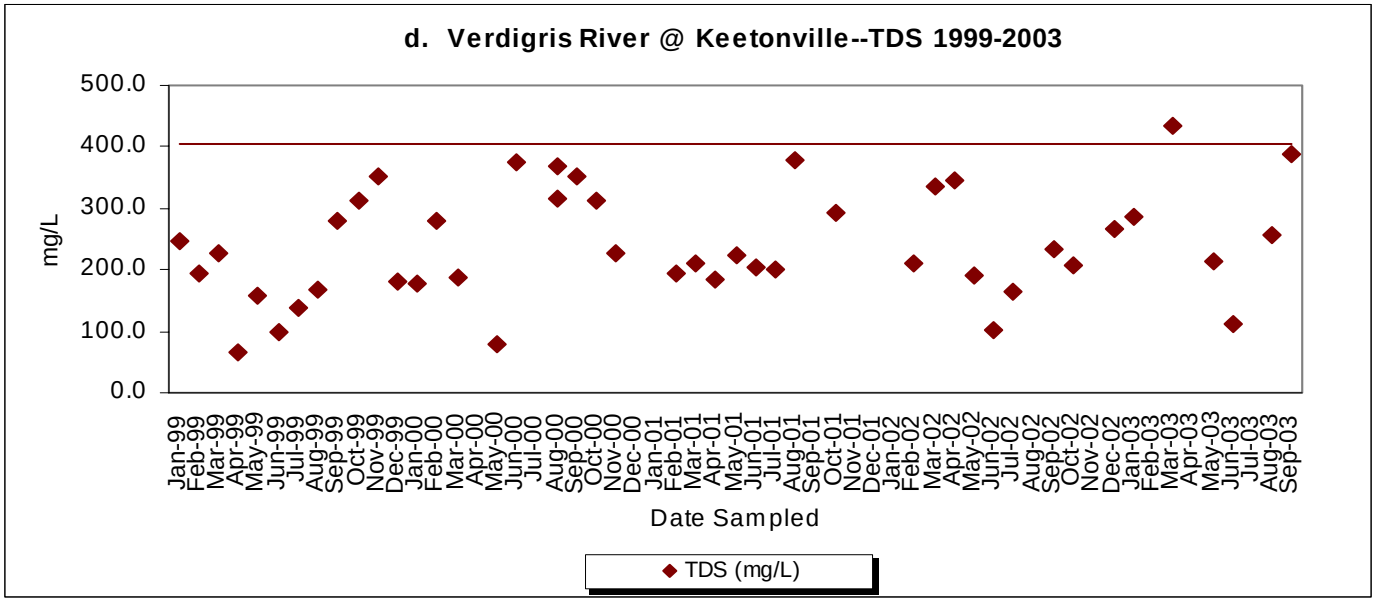
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 13 toxicant samples collected, 2 of the lead concentrations (or 15%) exceeded the prescribed hardness-dependant chronic criteria of 6.04 µg/L (Table 16). Of the 26 turbidity samples (Figure 33c), 4 samples (or 15%) exceeded the numerical criteria of 50. Dissolved oxygen (Figure 33a) and pH (Figure 33b) samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 33d and Figure 33e). The PBCR beneficial use is not supported (Table 17). Of the 16 enterococci concentrations, 4 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (108.3 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Verdigris River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 33f).

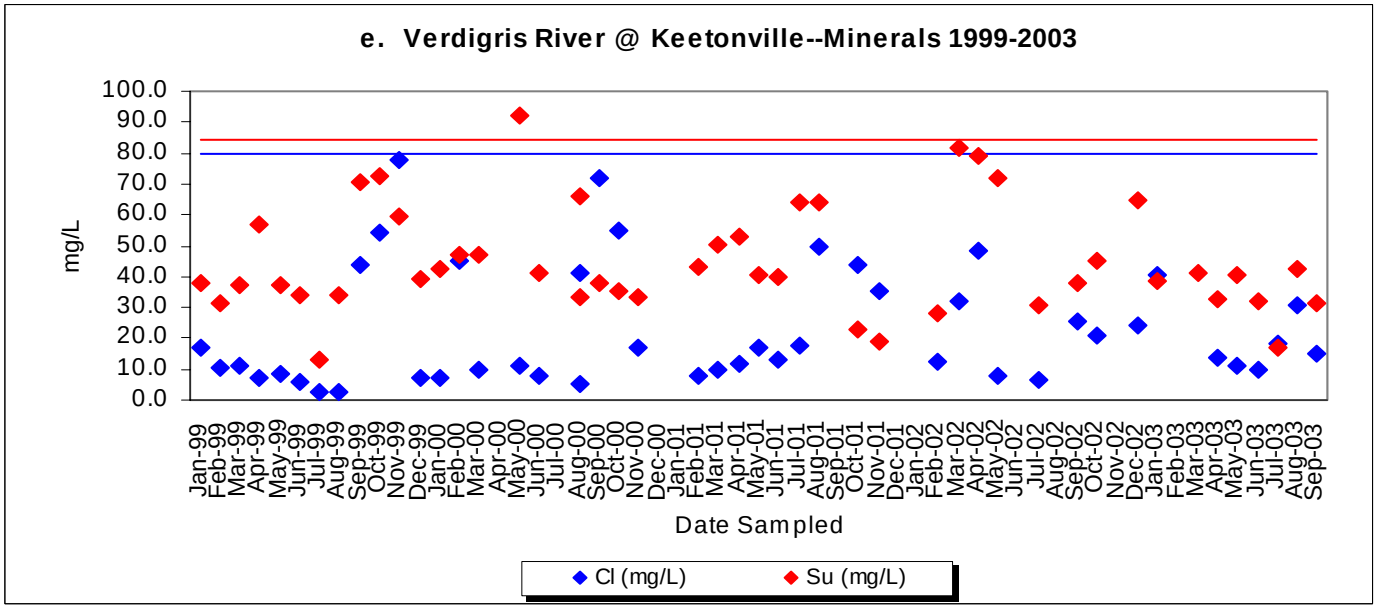
Figure 33a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) for the Verdigris River at Keetonville (AT176000), 1999-2003.

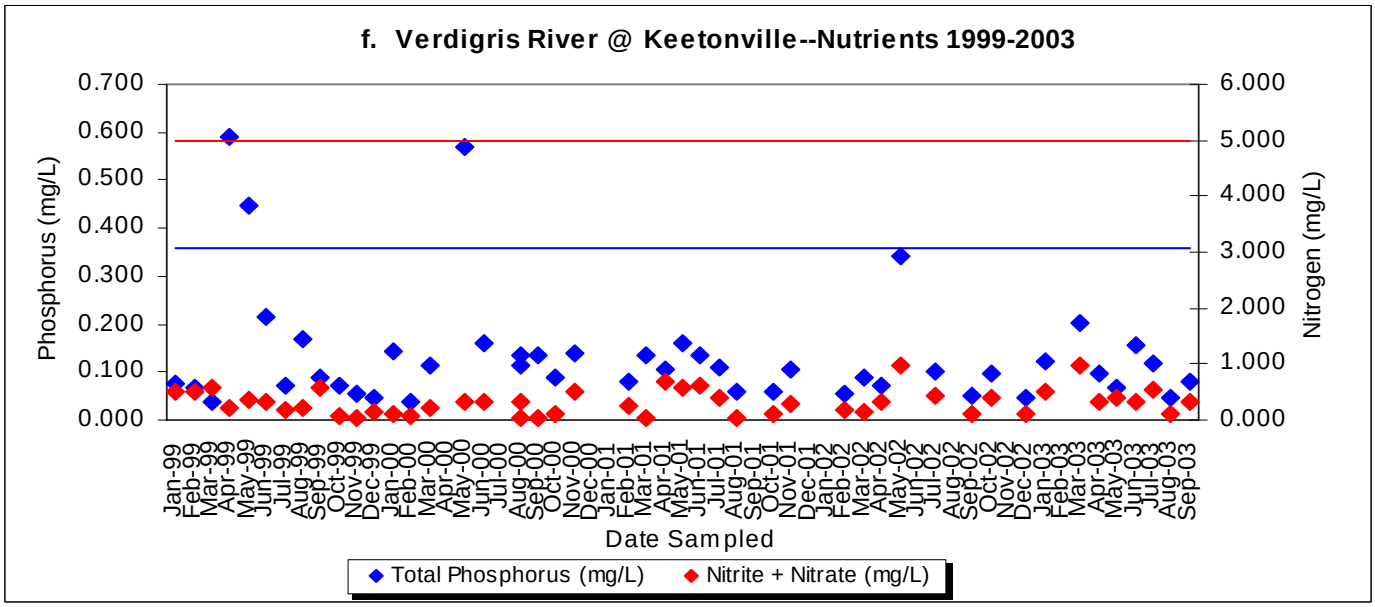







d. Verdigris River @ Keetonville--TDS 1999-2003
mg/L
500.0
400.0
300.0
200.0
100.0
0.0
Date Sampled
TDS (mg/L)


e. Verdigris River @ Keetonville--Minerals 1999-2003
mg/L
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Verdigris River @ Keetonville--Nutrients 1999-2003
Phosphorus (mg/L)
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

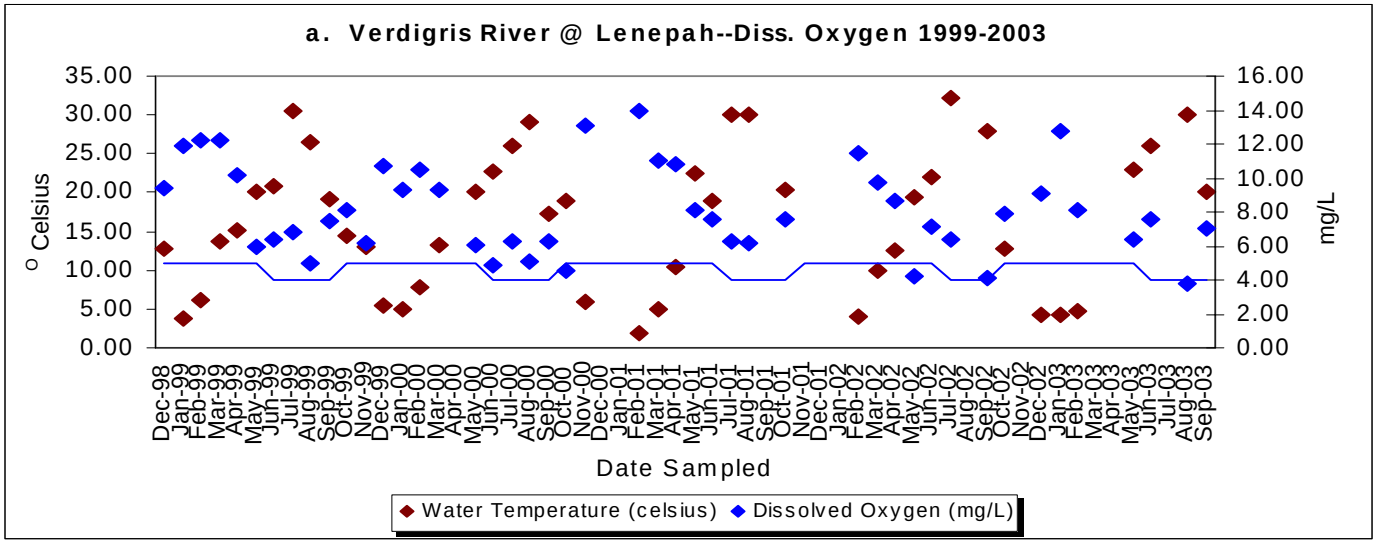
Verdigris River near Lenapah

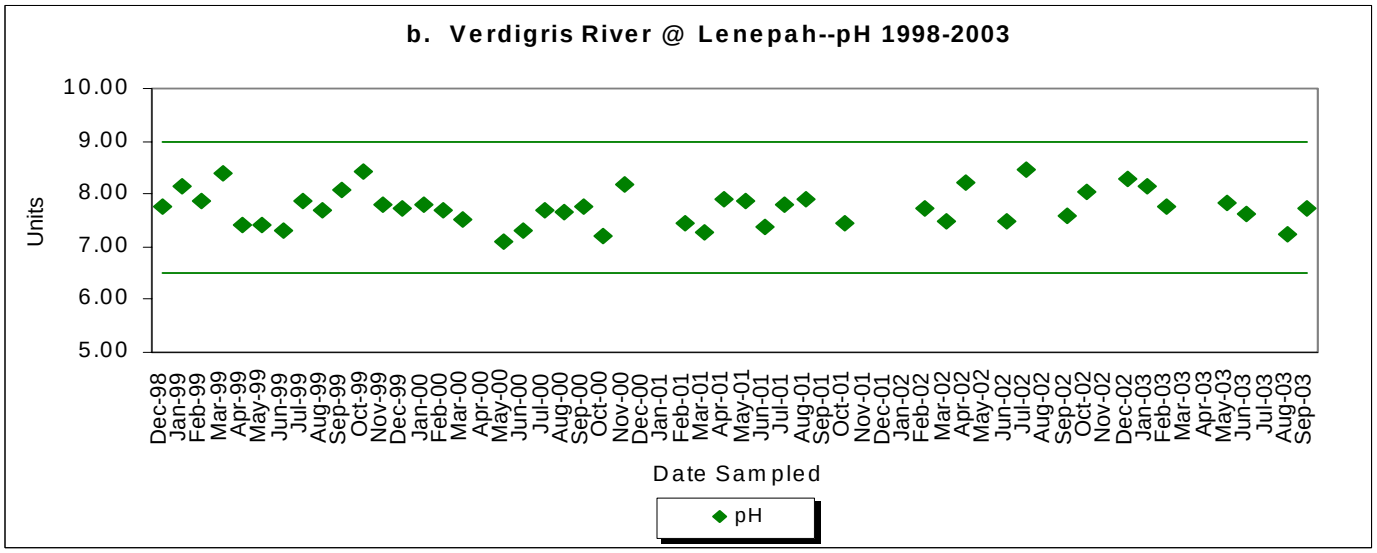
Station AT171000 (121510020010-001AT) is a permanent ambient trend monitoring station near the upper end of the Verdigris River in Oklahoma. Situated in the north central portion of Nowata County, the site was established east of the Town of Lenapah on State Highway 10. The station is positioned near the terminal end of stream segment 121510020010 and is classified within the Middle Verdigris River 8-digit HUC watershed (11070103). Water enters the stream system from Kansas and from several tributaries including Onion Creek, Snow Creek, and California Creek, among others.

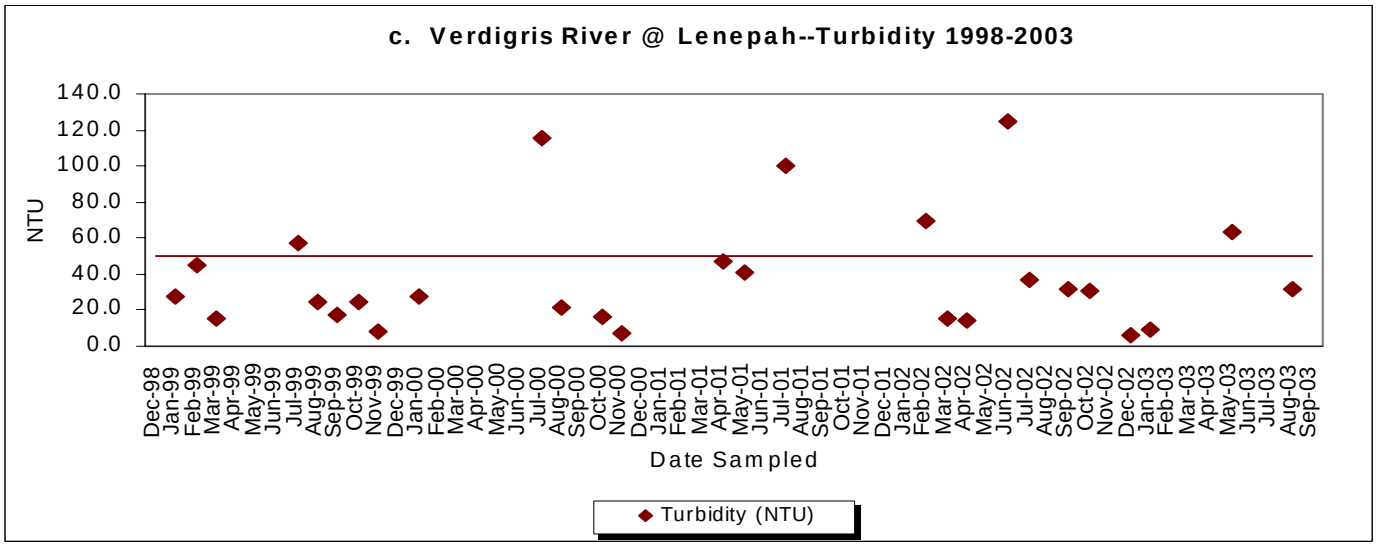
This station on the Verdigris River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through September of 2003. For purposes of reporting, this station is representative of the Verdigris River from entrance into Oklahoma near Coffeyville, Kansas (95.5890, 36.9993) downstream to confluence of the Verdigris River with California Creek (95.6142, 36.7567). As per Appendix A, Table1 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

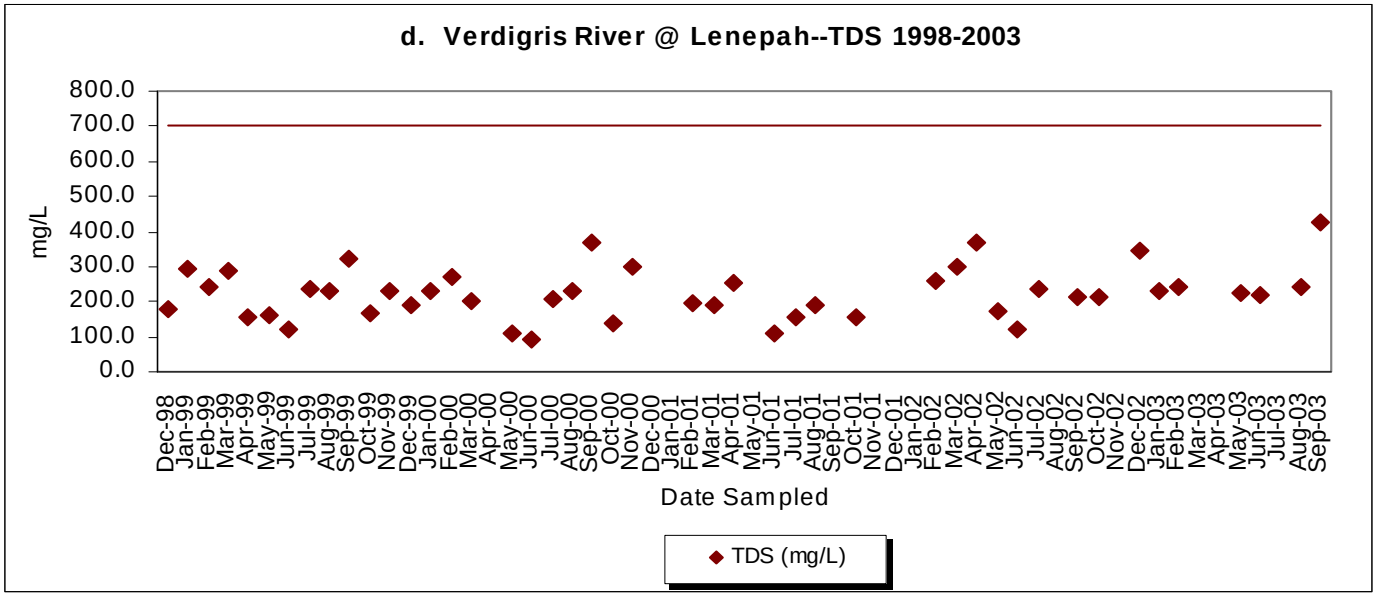
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 15 toxicant samples collected, 5 of the lead concentrations (or 57%) exceeded the prescribed hardness-dependant chronic criteria of 5.89 µg/L (Table 16). Of the 27 turbidity samples (Figure 34c), 6 samples (or 22%) exceeded the numerical criteria of 50. Dissolved oxygen (Figure 34a) and pH (Figure 34b) samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 34d and Figure 34e). The PBCR beneficial use is not supported (Table 17). Of the 16 enterococci concentrations, 4 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (395.6 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Verdigris River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 1.0 mg/L and 4.65 mg/L, respectively (Figure 34f).

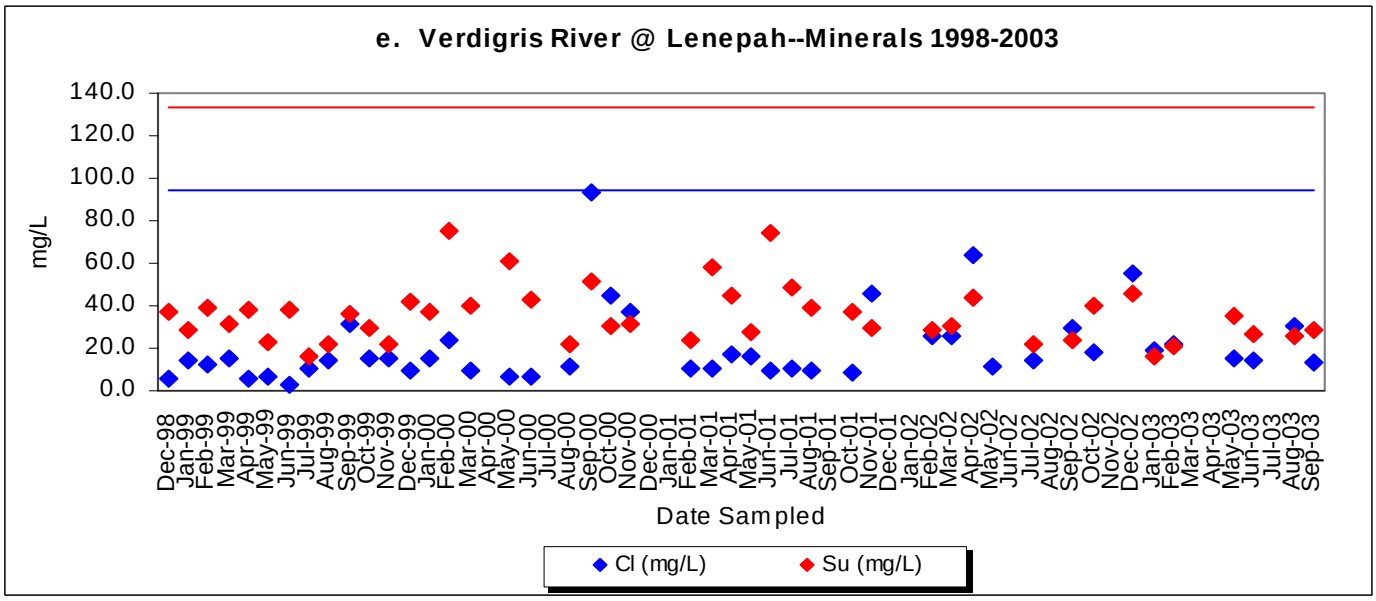
Figure 34a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) for the Verdigris River at Lenepah (AT171000), 1999-2003.

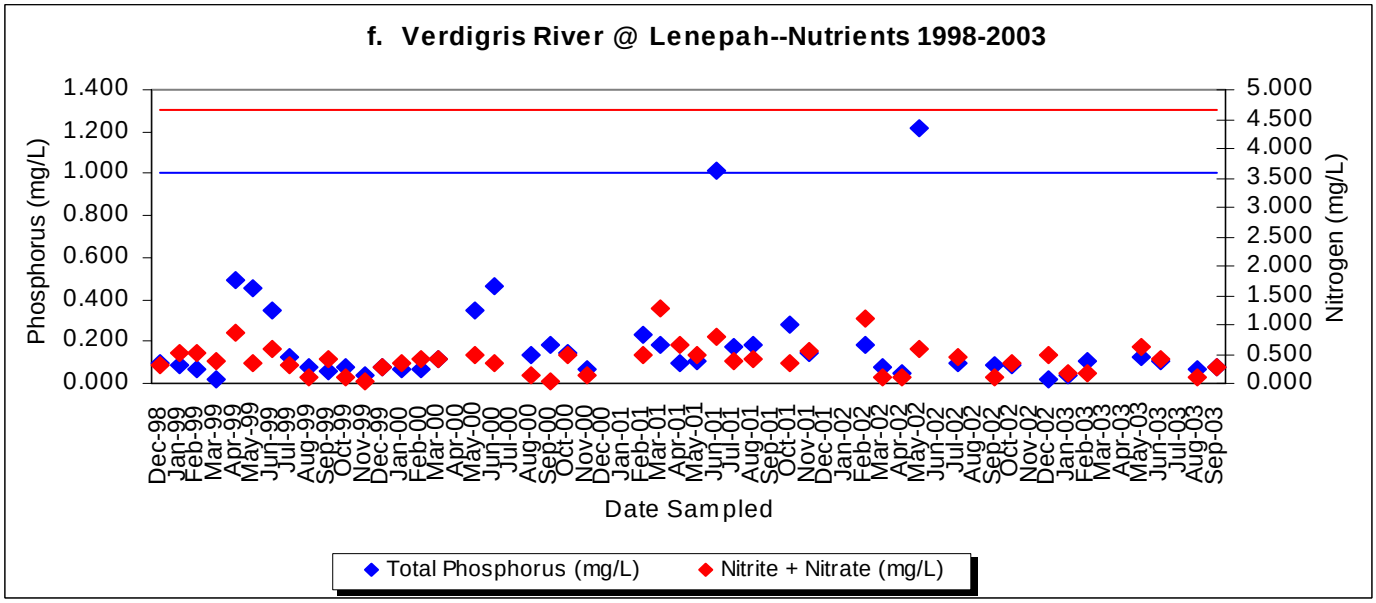







d. Verdigris River @ Lenepah--TDS 1998-2003
mg/L
Date Sampled
TDS (mg/L)


e. Verdigris River @ Lenepah--Minerals 1998-2003
mg/L
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Verdigris River @ Lenepah--Nutrients 1998-2003
Phosphorus (mg/L)
Nitrogen (mg/L)
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

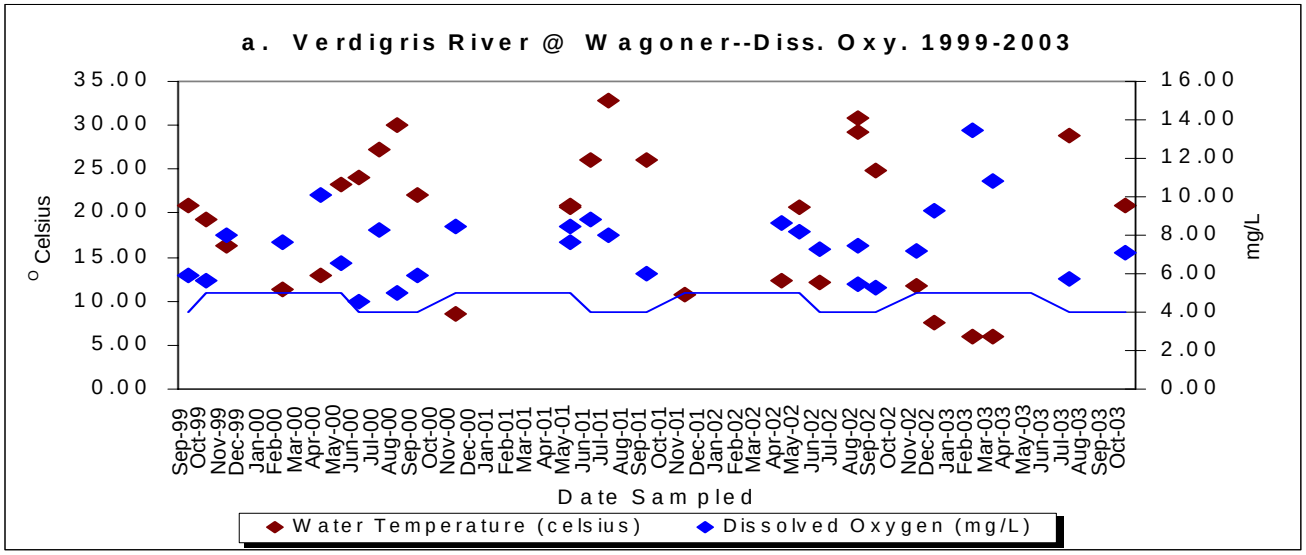
Verdigris River near Wagoner

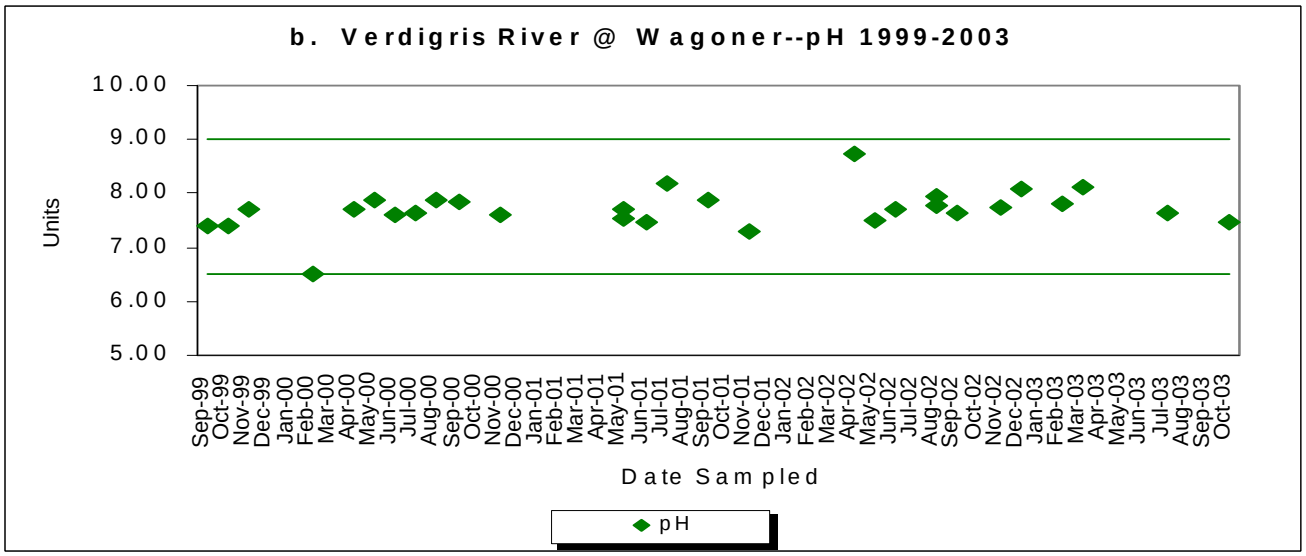
Station AT178900 (121500010200-001AT) is a permanent ambient trend monitoring station near the lower end of the Verdigris River (McClellan-Kerr Navigational System) in Oklahoma. Situated in the central portion of Wagoner County, the site was established west of the City of Wagoner on State Highway 51. The station is positioned near the midpoint of stream segment 121500010200 and is classified within the Lower Verdigris River 8-digit HUC watershed (11070105). Water enters the stream system from several tributaries including Adams Creek (Newt Graham Lake), Inola Creek, Pea Creek, Coal Creek, and Coal Creek near Wagoner, among others.

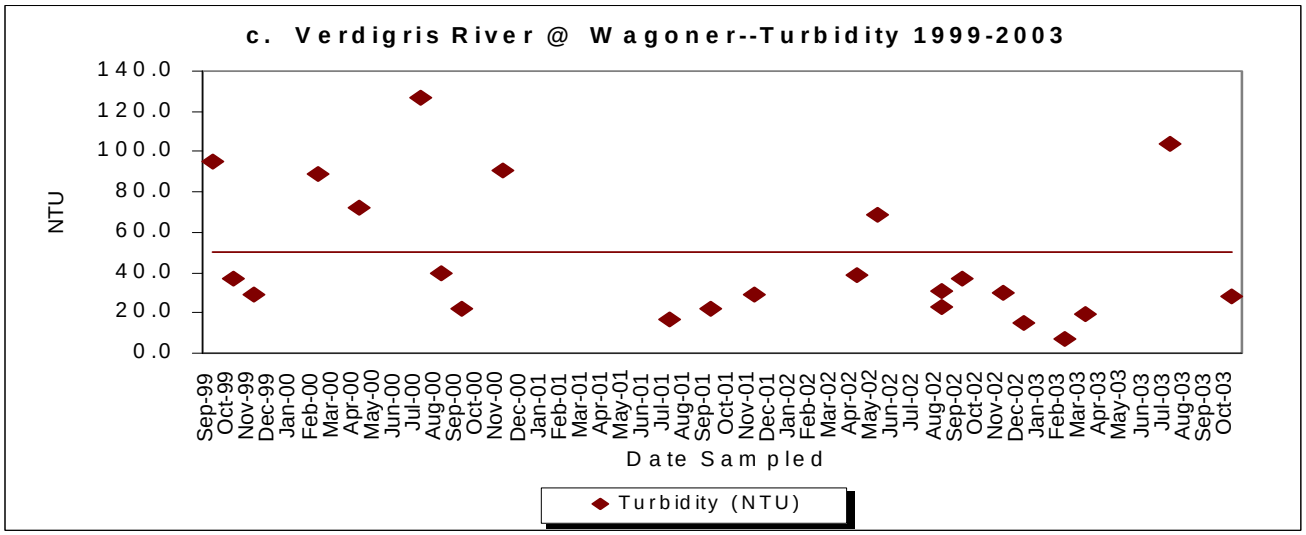
This station on the Verdigris River has been active for all water quality variables since September of 1999. The following assessment of beneficial uses is based on data collected from September of 1999 through October of 2003. For purposes of reporting, this station is representative of the Verdigris River the confluence of Adams Creek (95.5510, 36.0673) downstream to its confluence with the Arkansas River (95.3073, 35.7983). As per Appendix A, Table 1 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

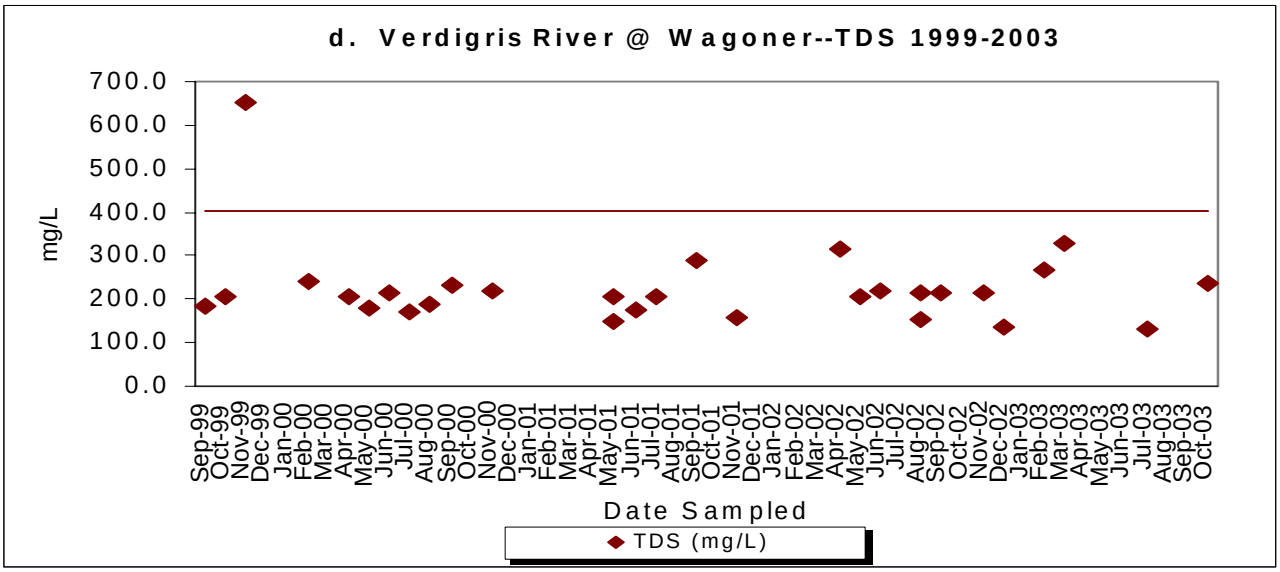
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 10 lead samples collected, 7 of the concentrations (or 70%) exceeded the prescribed hardness-dependant chronic criteria of 4.55 µg/L (Table 16). Of the 10 copper samples, 4 of the concentrations (or 40%) exceeded the prescribed hardness-dependant chronic criteria of 16.26 µg/L, and 2 of the concentrations (or 20%) exceeded the prescribed hardness-dependant acute criterion of 25.00 µg/L (Table 16). Of the 23 turbidity samples (Figure 35c), 7 samples (or 30%) exceeded the numerical criteria 50. Dissolved oxygen (Figure 35a) and pH (Figure 35b) samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 35d and Figure 35e). The PBCR beneficial use is not supported (Table 17). Of the 12 enterococci concentrations, 1 sample exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (38.5 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of Verdigris Creek is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 35f).

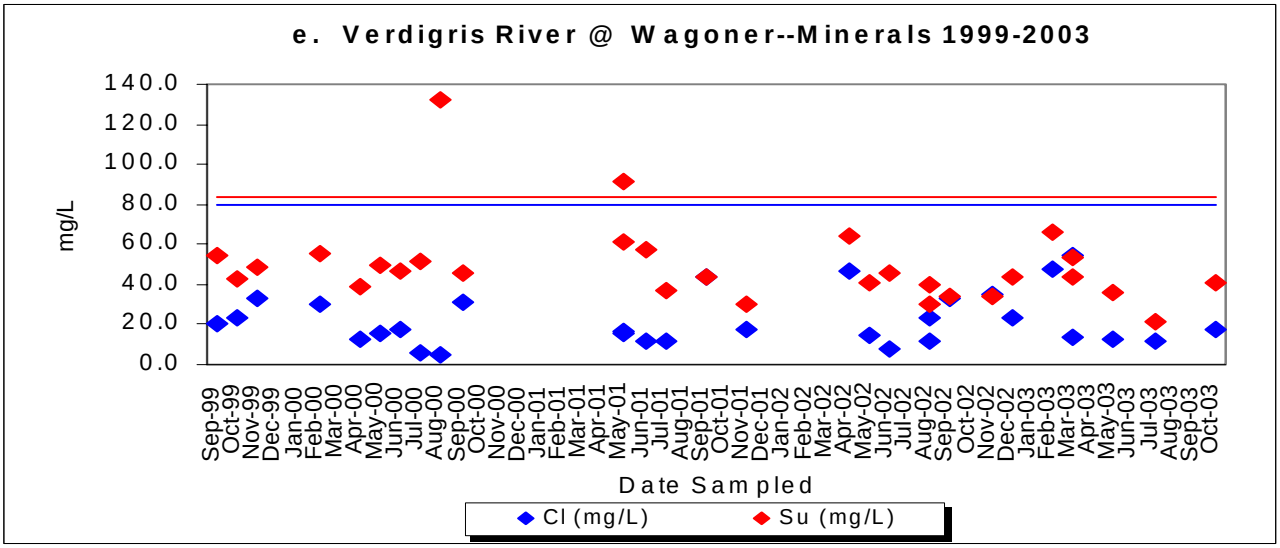
Figure 35a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) for the Verdigris River at Wagoner (AT178900), 1999-2003.

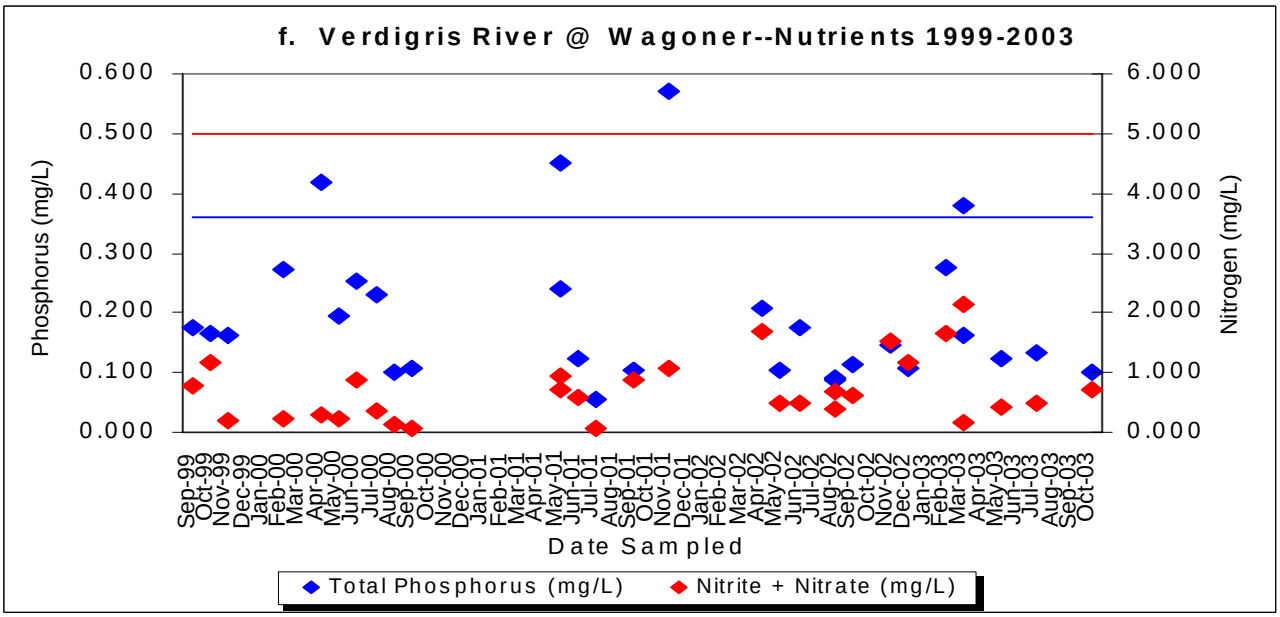







d. Verdigris River @ Wagoner--TDS 1999-2003
mg/L
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Date Sampled
TDS (mg/L)


e. Verdigris River @ Wagoner--Minerals 1999-2003
mg/L
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Verdigris River @ Wagoner--Nutrients 1999-2003
Phosphorus (mg/L)
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

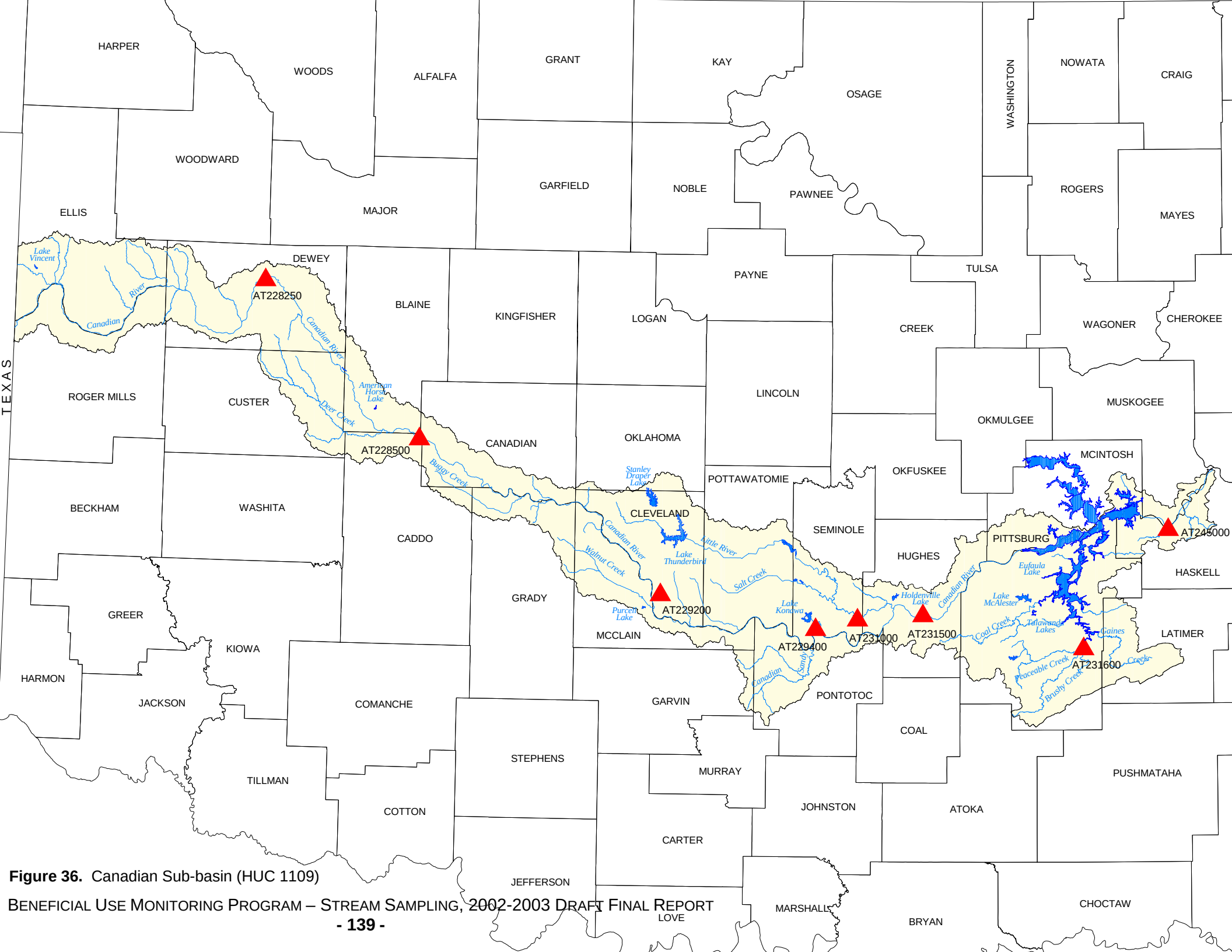


Figure 36. Canadian Sub-basin (HUC 1109)

HUC 1109

CANADIAN SUB-BASIN

The Canadian sub-basin (4-digit hydrologic unit 1109) begins in the central west and runs to the east central portion of the state. It originates in the southern portion of Ellis and the northern portion of Roger-Mills Counties, continues eastward through portions of Ellis, Roger Mills, Dewey, Custer, Blaine, Caddo, Canadian, Grady, Cleveland, McClain, Pottawatomie, Pontotoc, Seminole, Hughes, McIntosh, and Muskogee Counties and terminates in Pittsburg, Haskell, and Latimer Counties. Major cities and County seats located within the basin include Arnett, Taloga, Weatherford, Mustang, Moore, Norman, Noble, Oklahoma City, Purcell, Ada, Tecumseh, Holdenville, McAlester, and Stigler. Minor cities of note include Newcastle, Lexington, Konawa, and Hartshorne.

The basin is subdivided into five 8-digit hydrologic units (HUC) within the state. These HUC's are the Rita Blanca (11090103), the Lower Canadian–Deer (11090201), the Lower Canadian–Walnut (11090202), the Little (11090203), and the Lower Canadian (11090204). The major surface water in the basin is the Canadian River. Major tributaries include Little River, Deer Creek, Walnut Creek, Canadian Sandy Creek, Salt Creek, Coal Creek, Gaines Creek, and Brushy Creek. Five major lakes are located in the basin—Lake Stanley Draper formed by East Elm Creek, Lake Thunderbird formed by the Little River, Lake Konawa formed by Jumper Creek, Lake McAlester formed by a tributary of Coal Creek, and the lower half of Lake Eufaula formed by the Canadian River and Coal, Brushy, and Gaines Creeks (among others). Eight permanent water quality-monitoring stations (Table 18) are located in the basin—AT228250, AT228500, AT229200, AT229400, AT231000, AT231500, AT231600, and AT245000. One inactive water quality-monitoring station (AT231700) is located in the sub-basin. This station was last assessed in the 2000 BUMP report.

The basin is characterized by five ecoregions. The Central Great Plains is one of two primary ecoregions beginning in western Dewey County and continuing to eastern Cleveland and McClain Counties. The other primary ecoregion is the Central Oklahoma/Texas Plains beginning where the Central Great Plains ends and continues through the majority of Pittsburg and McIntosh counties. The Southwestern Tablelands cover an area beginning in the west and ending in the western part of Dewey County. The Arkansas Valley covers the rest of McIntosh, the eastern portions of Pittsburg County, and parts of Haskell and Latimer Counties. The Ouachita Mountains extend over the bottom part of Pittsburg and Latimer Counties. The primary land usage in the sub-basin is rangeland (open grasslands and woody areas). It dominates the western portion of the sub-basin, is prevalent in the central and east central portions, and is further interspersed throughout the remainder of the sub-basin. The secondary land use is pastureland, which is prevalent in the central and eastern portions. The tertiary land uses are cropland and forestland (post oak–blackjack oak and bottomland hardwoods). Cropland is prevalent in the west central portion of the sub-basin and is interspersed throughout the remainder of the sub-basin. Forestland is prevalent in the east central and eastern portions of the sub-basin. Other land uses of note are woodlands, bottom woodlands, farmsteads, major urban areas, and confined animal feeding operations.

Table 18. Permanent Ambient Trend Monitoring Stations Located in HUC 1109.

WBID #	STATION #	STATION NAME	STATUS	FS	PS	NS/T	CBD
220600030010	AT231600	Brushy Creek, off US 270, Haileyville	Active 11/98-P	AG, AES, PPWS	NONE	FWP, PBCR	NONE
520610010050	AT228500	Canadian River, US 66, Bridgeport	Active 11/98-P	AES	NONE	AG, FWP, PBCR	NONE
220600010119	AT231500	Canadian River, US 270, Calvin	Active 11/98-P	AES, PPWS	NONE	AG, FWP, PBCR	NONE
520600010010	AT229400	Canadian River, US 377, Konawa	Active 11/98-P	AES, PPWS	NONE	AG, FWP, PBCR	NONE
520610010010	AT229200	Canadian River, US 77, Purcell	Active 11/98-P	AES	NONE	AG, FWP	NONE
520620020010	AT228250	Canadian River, US 183, Taloga	Active 11/98-P	AES	FWP	AG, PBCR	NONE
220300000010	AT245000	Canadian River, SH 2, Whitefield	Active 9/99-P	AG, FWP, AES, PPWS, PBCR	NONE	NONE	NONE
520800010010	AT231000	Little River, SH 56, Sasakwa	Active 11/98-P	AG, AES, PPWS	NONE	FWP, PBCR	NONE

ASSIGNED OWQS BENEFICIAL USES AND SUPPORT CODES

PPWS = PUBLIC AND PRIVATE WATER SUPPLY	EWS = EMERGENCY WATER SUPPLY
FWP = FISH & WILDLIFE PROPAGATION	PBCR = PRIMARY BODY CONTACT RECREATION
AG = AGRICULTURE	AES = AESTHETICS
FS = FULLY SUPPORTING	PS = PARTIALLY SUPPORTING
NS/T = NOT SUPPORTING/THREATENED	CBD = CANNOT BE DETERMINED

Table 19. Toxicant exceedances in HUC 1109.

STATION #	STATION NAME	DATE	Lead (µg/L)	Selenium (µg/L)
AT231600	Brushy Creek, off US 270, Haileyville	05/15/2000	7.00	
		08/20/2001	2.62	
		4/24/2002	4.03	
		09/03/2003	6.62	
AT229400	Canadian River, US 377, Konawa	06/19/2000	20.00	
		11/07/2000	18.00	
		04/15/2002	16.00	
AT231000	Little River, SH 56, Sasakwa	05/09/2000		7.00
		06/19/2000		7.00
		04/11/2001	17.00	
		03/19/2003	46.00	

Table 20. Exceedances of fecal coliform, enterococci, and E. coli screening limits in HUC 1109. Only values leading to a determination of not supporting for the Public and Private Water Supply and the Primary Body Contact Recreation beneficial uses are in included.

STATION #	STATION NAME	DATE	Fecal Coliform (cfu/mL)	Enterococci (cfu/mL)	*E. coli* (cfu/mL)
AT231600	BRUSHY CREEK, OFF US 270, HAILEYVILLE	05/10/2000		40000	
		06/13/2000		610	
		05/22/2001		73000	
		06/10/2002		900	
		05/05/2003		4000	
		09/03/2003		1300	
AT228500	CANADIAN RIVER, US 66, BRIDGEPORT	05/09/2000		900	
		05/22/2001		7000	
		09/17/2001		900	
		06/16/2003		3000	
		08/25/2003		500	
AT231500	CANADIAN RIVER, US 270, CALVIN	08/13/2002		700	
AT229400	CANADIAN RIVER, US 377, KONAWA	08/15/2001		700	
AT228250	CANADIAN RIVER, US 183, TALOGA	09/15/1999		2300	
		05/02/2001		1000	
		08/14/2002		500	
		06/16/2003		3000	
		07/21/2003		600	
		09/08/2003		600	
AT231000	LITTLE RIVER, SH 56, SASAKWA	07/13/1999	1200		
		09/21/1999	510		
		05/08/2000		500	
		07/24/2000	700	1000	
		09/05/2001	600	700	
		05/20/2002	900		

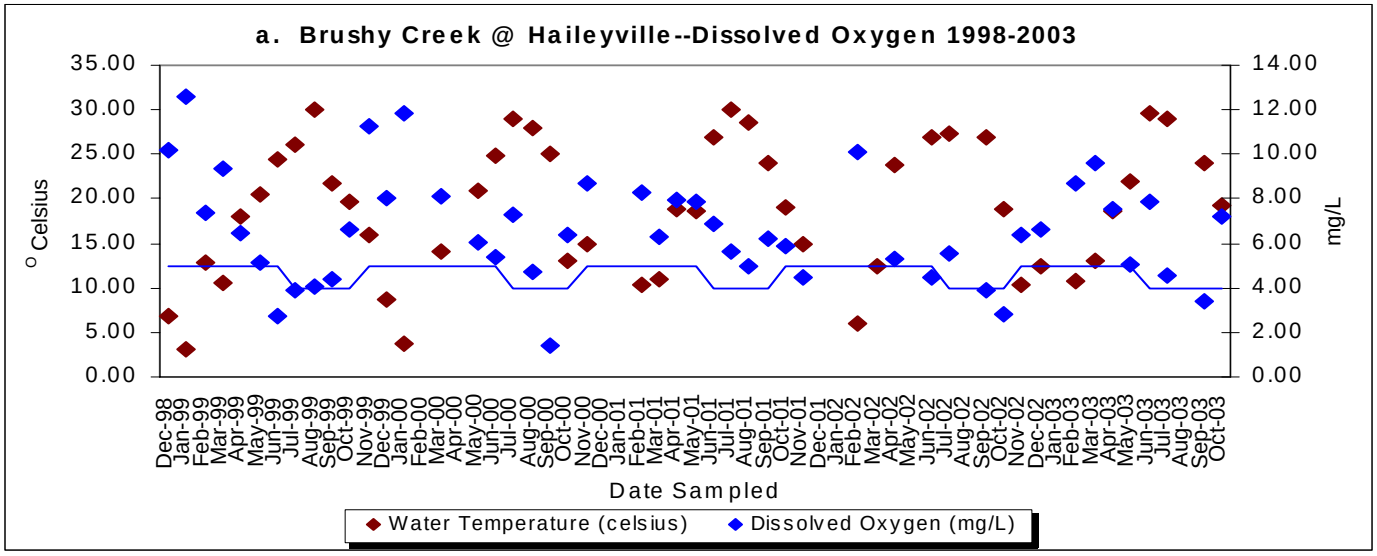
Brushy Creek near Haileyville

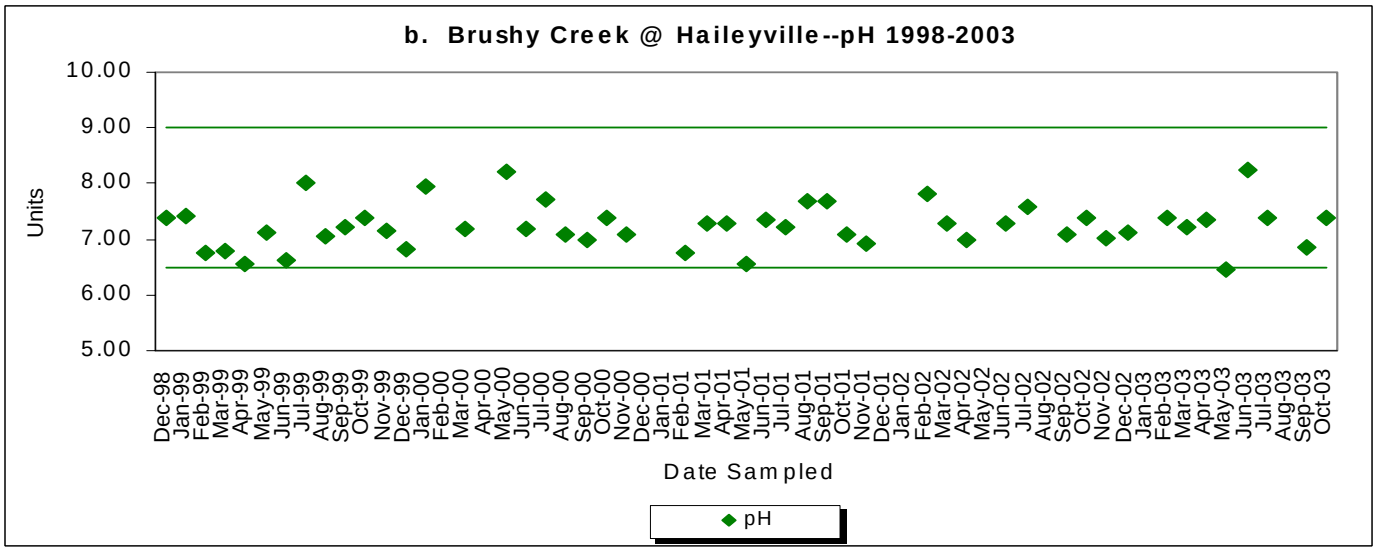
Station AT231600 (220600030010-001AT) is a permanent ambient trend monitoring station located on Brushy Creek. Situated in the east central portion of Pittsburg County, the site was established north of the town of Haileyville off of US Highway 270 on County Road 1480. The station is positioned near the terminal end of stream segment 220600030010 and is classified within the Lower Canadian River 8-digit HUC watershed (11090204). Water enters the stream system from several tributaries including Elm Creek, Peaceable Creek (Brown Lake Watershed) and Blue Creek (Hartshorne Lake), among others.

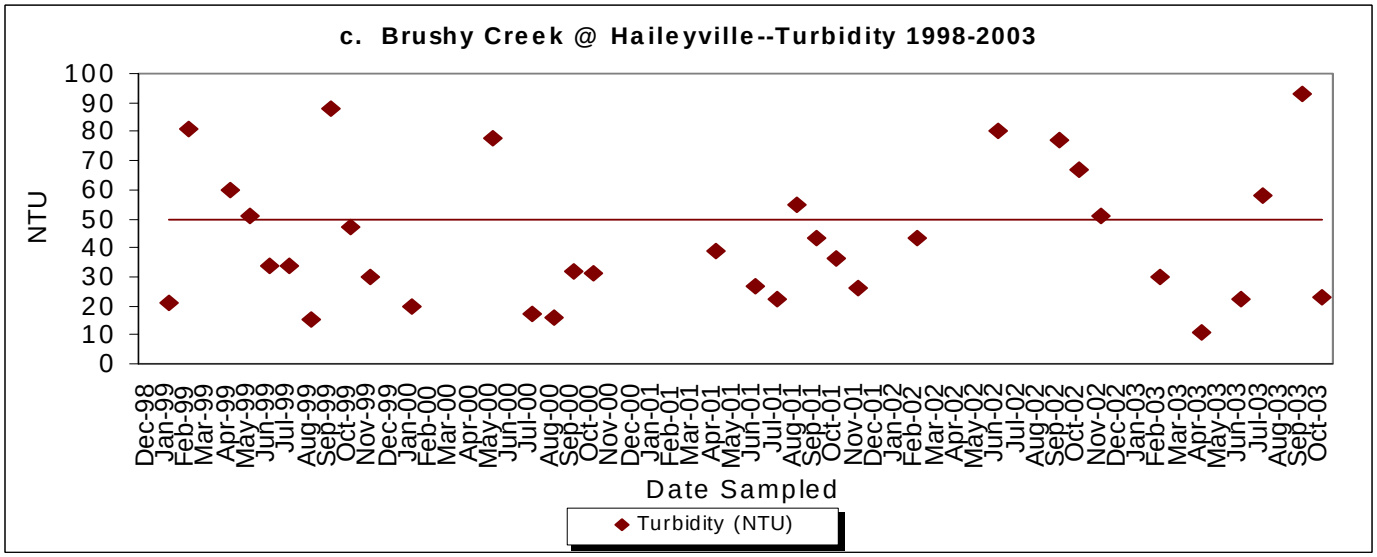
This station on Brushy Creek has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through October of 2003. For purposes of reporting, this station is representative of Brushy Creek from the confluence of Elm Creek (95.7520, 34.6870) downstream to confluence of Brushy Creek with Lake Eufaula (95.5844, 34.8904). As per Appendix A, Table 2 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

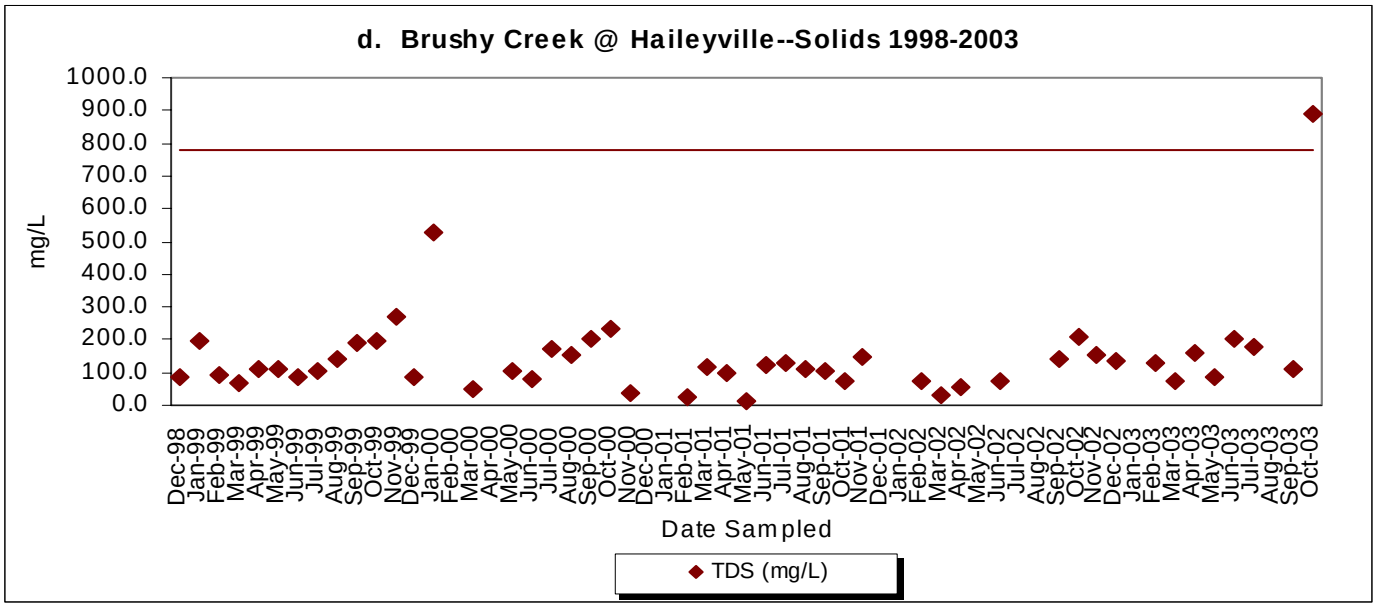
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 34 turbidity samples (Figure 37c), 13 samples (or 38%) exceeded the numerical criteria of 50. Of the 13 toxicant samples collected, 4 of the lead concentrations (or 31%) exceeded the prescribed, hardness-dependent chronic criteria of 2.39 µg/L (Table 19). Of the 48 dissolved oxygen samples (Figure 37a), 8 samples (or 17%) were below the prescribed screening level. The pH (Figure 37b) samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 37d and Figure 37e). The PBCR beneficial use is not supported (Table 20). Of the 26 enterococci concentrations, 6 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (89.3 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of Brushy Creek is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 37f).

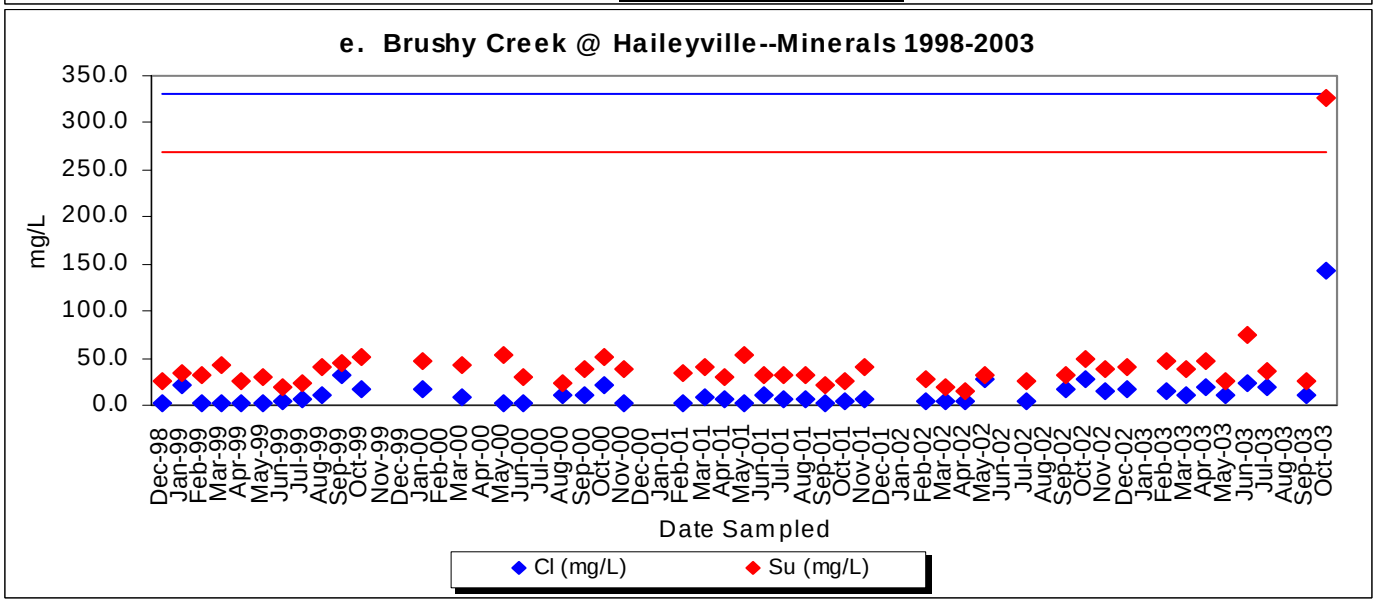
Figure 37a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on Brushy Creek at Haileyville (AT231600), 1998-2003.

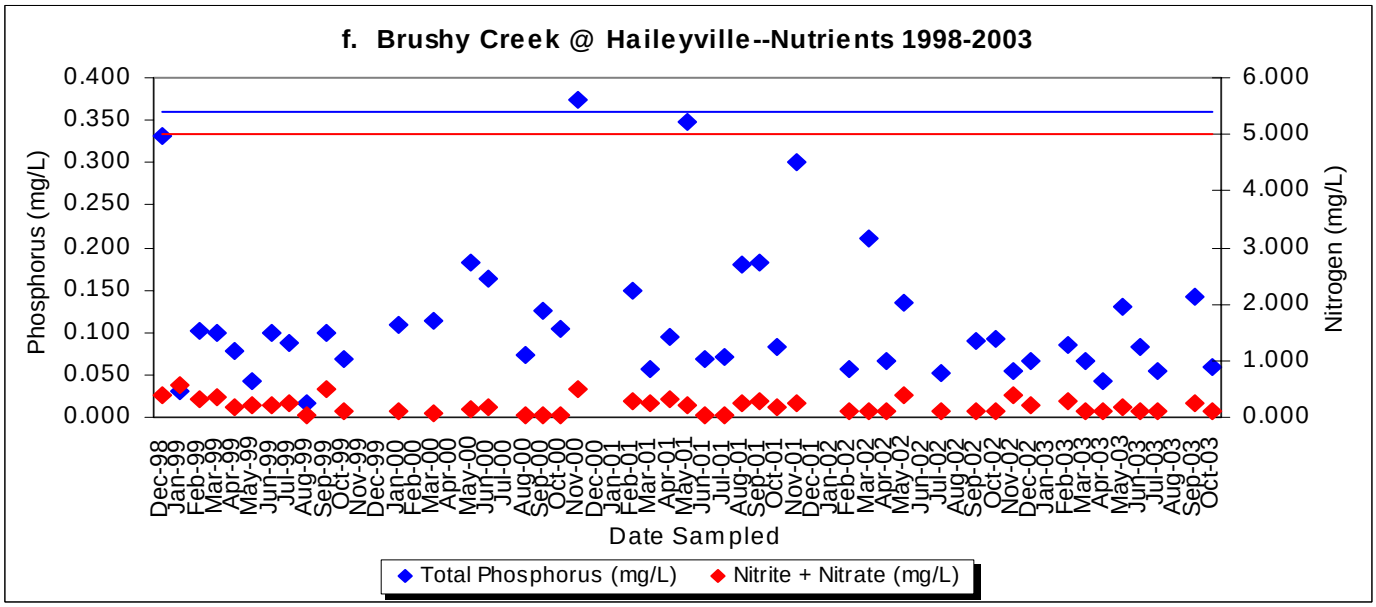







d. Brushy Creek @ Haileyville--Solids 1998-2003
mg/L
1000.0
900.0
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Date Sampled
TDS (mg/L)


e. Brushy Creek @ Haileyville--Minerals 1998-2003
mg/L
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Brushy Creek @ Haileyville--Nutrients 1998-2003
Phosphorus (mg/L)
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

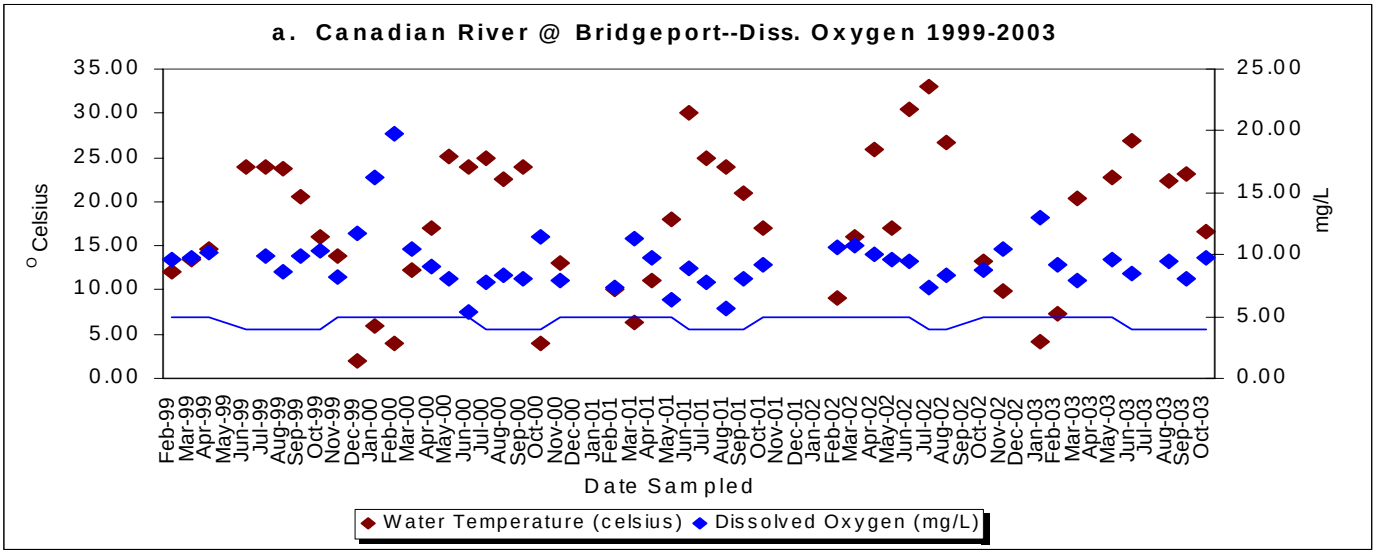
Canadian River near Bridgeport

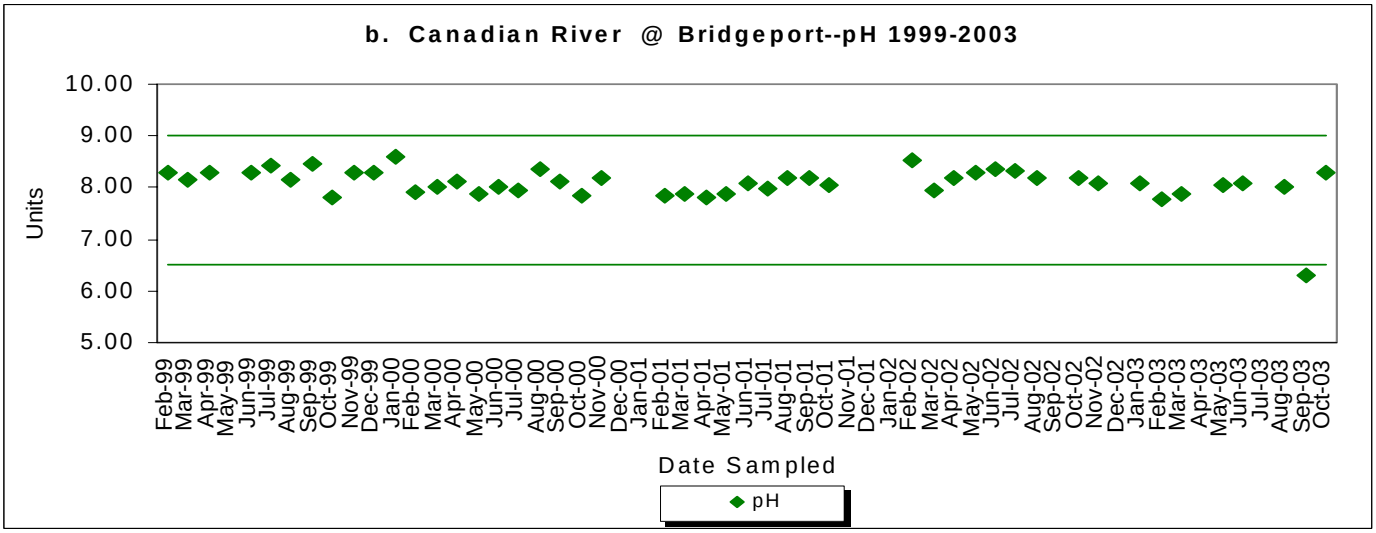
Station AT228500 (520610020150-001AT) is a permanent ambient trend monitoring station located on the Canadian River in Oklahoma. Situated in the northeastern portion of Caddo County, the site was established east of the town of Bridgeport on US Highway 66. The station is positioned near the upper end of stream segment 520610020150 and is classified within the Lower Canadian River - Walnut Creek 8-digit HUC watershed (11090202). Water enters the stream system from several tributaries including Lariat Creek, Canyon View Creek, Powder Face Creek, and Buggy Creek, among others.

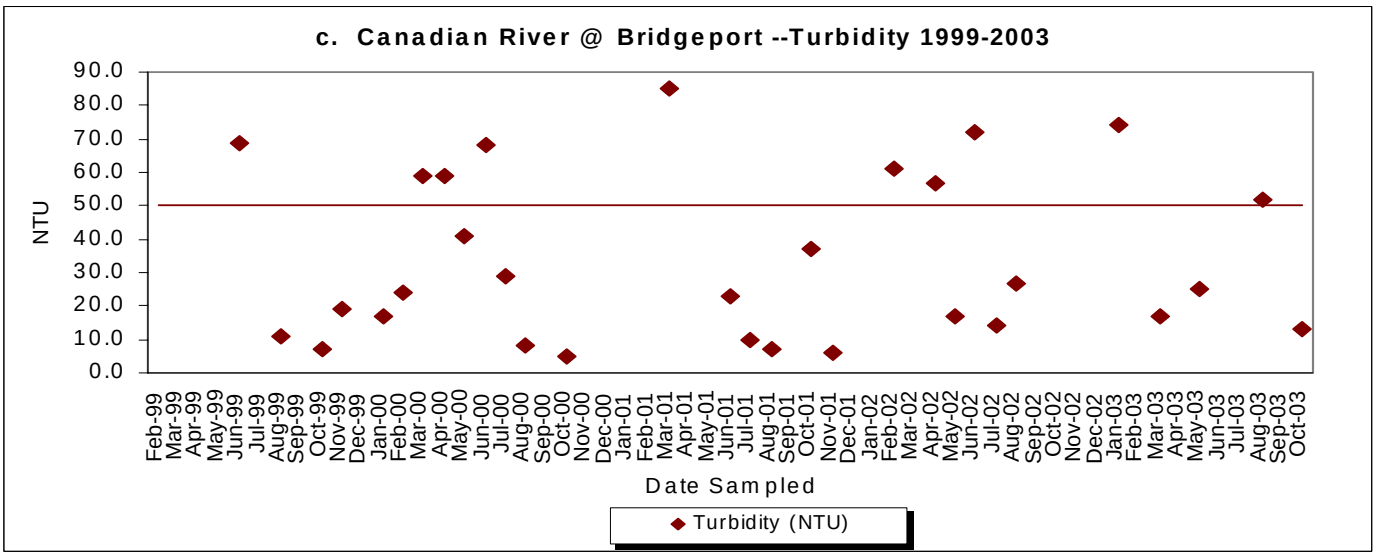
This station on the Canadian River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from February of 1999 through October of 2003. For purposes of reporting, this station is representative of the Canadian River from the confluence of Deer Creek (98.4737, 35.5580) downstream to confluence of the Canadian River with Buggy Creek (97.8950, 35.3450). As per Appendix A, Table 5 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Emergency Water Supply (EWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

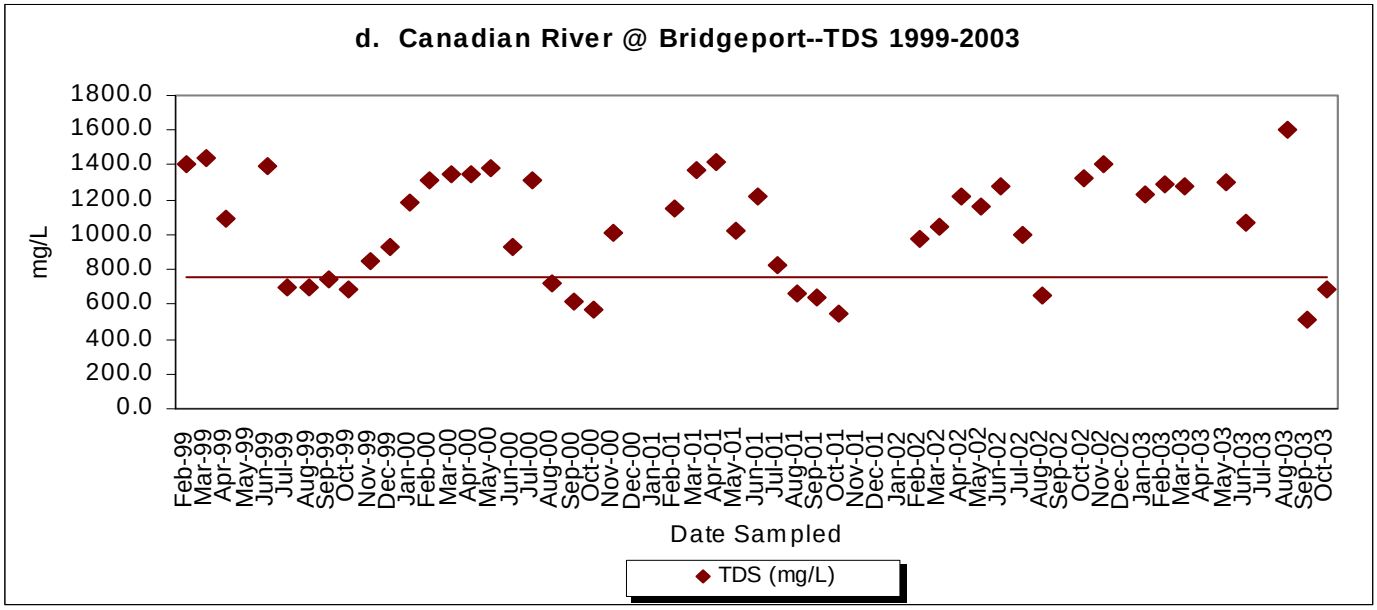
The WWAC beneficial use is partially supported. Of the 30 turbidity samples (Figure 38c), 10 samples (or 33%) exceeded the numerical criteria of 50. Dissolved oxygen (Figure 38a), pH (Figure 38b), and toxicants samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is not supported (Figure 38d and Figure 38e). Of the 47 total dissolved solids concentrations, 34 of the samples (or 72%) exceeded the minimum sample standard of 750 mg/L (Appendix F sample standard is 700 mg/L), and the geometric mean (1035.3 mg/L) exceeded the yearly mean standard of 700 mg/L. Of the 44 sulfate concentrations, 17 samples (or 44%) exceeded the sample standard of 449.0 mg/L. Chloride values met the prescribed segment-specific criterion. The PBCR beneficial use is not supported (Table 20). Of the 26 enterococci concentrations, 5 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (172.9 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Canadian River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 38f).

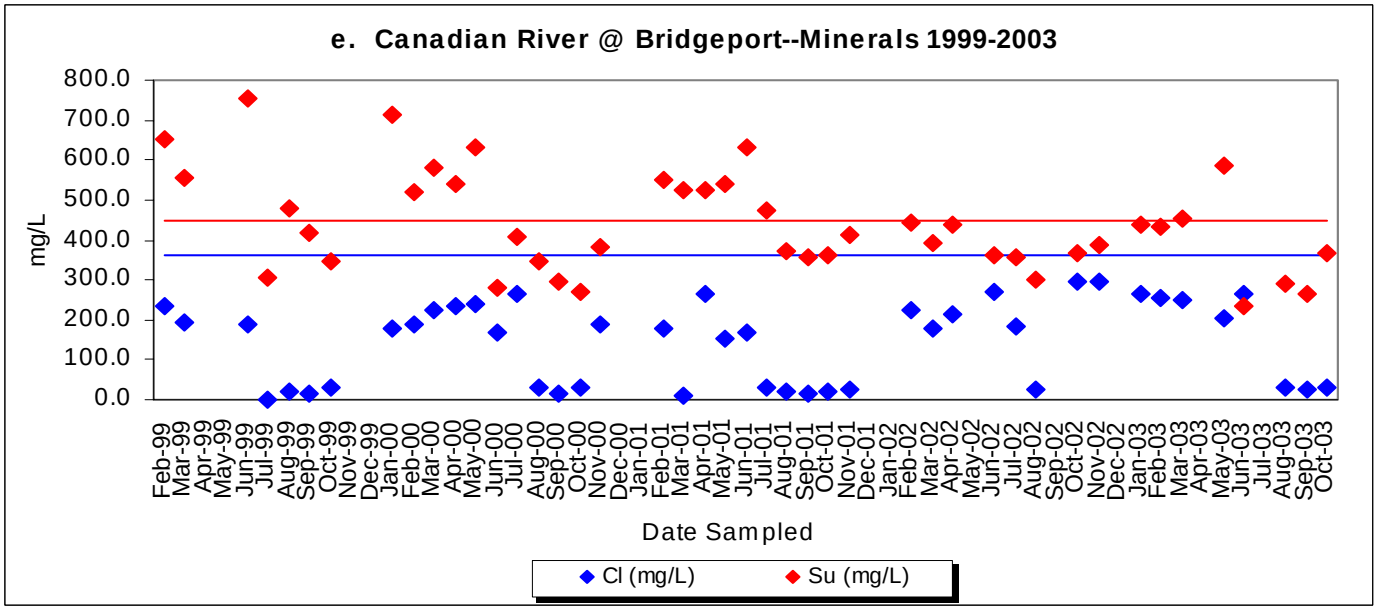
Figure 38a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Canadian River at Bridgeport (AT228500), 1999-2003.

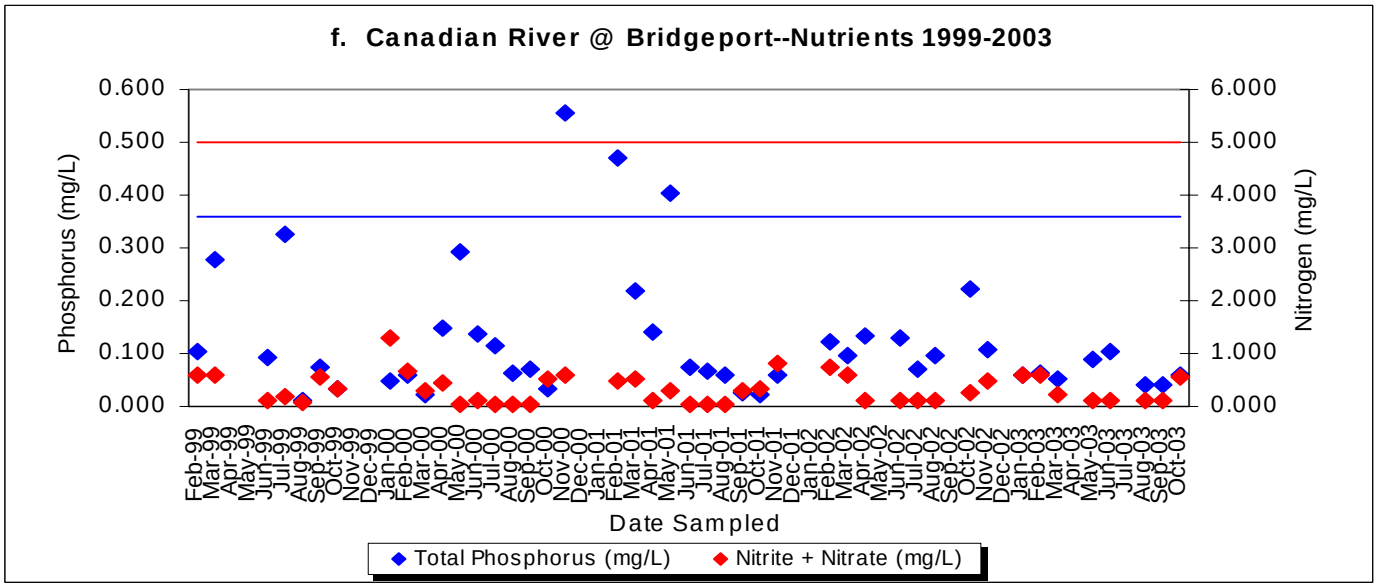







d. Canadian River @ Bridgeport--TDS 1999-2003
mg/L
1800.0
1600.0
1400.0
1200.0
1000.0
800.0
600.0
400.0
200.0
0.0
Date Sampled
TDS (mg/L)


e. Canadian River @ Bridgeport--Minerals 1999-2003
mg/L
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Canadian River @ Bridgeport--Nutrients 1999-2003
Phosphorus (mg/L)
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

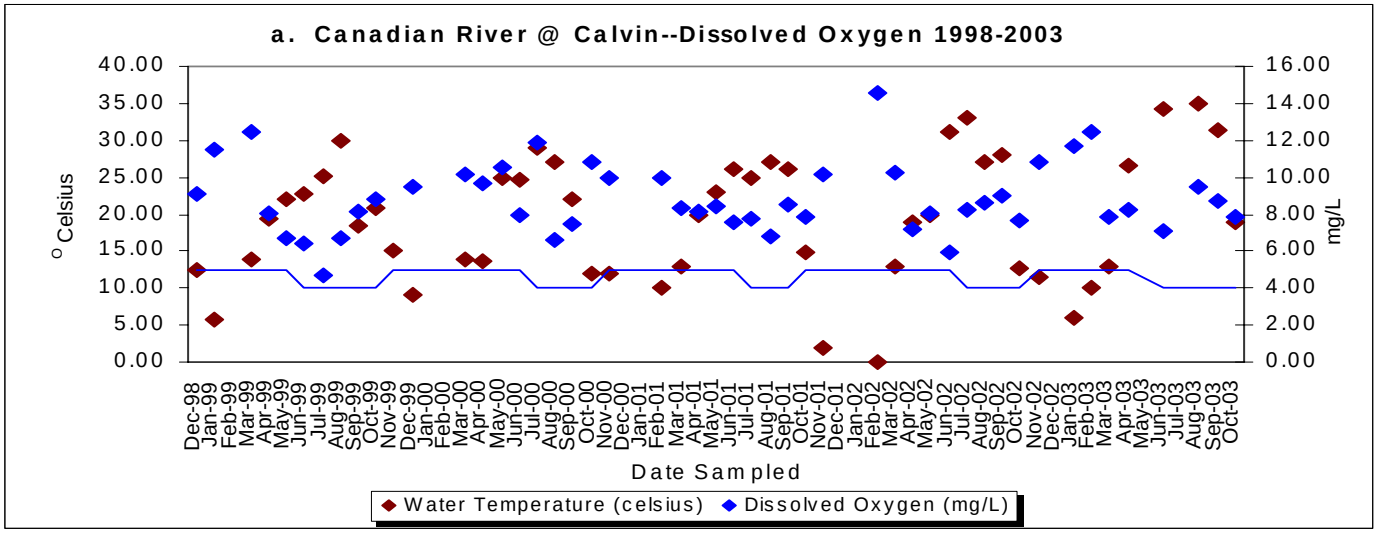
Canadian River near Calvin

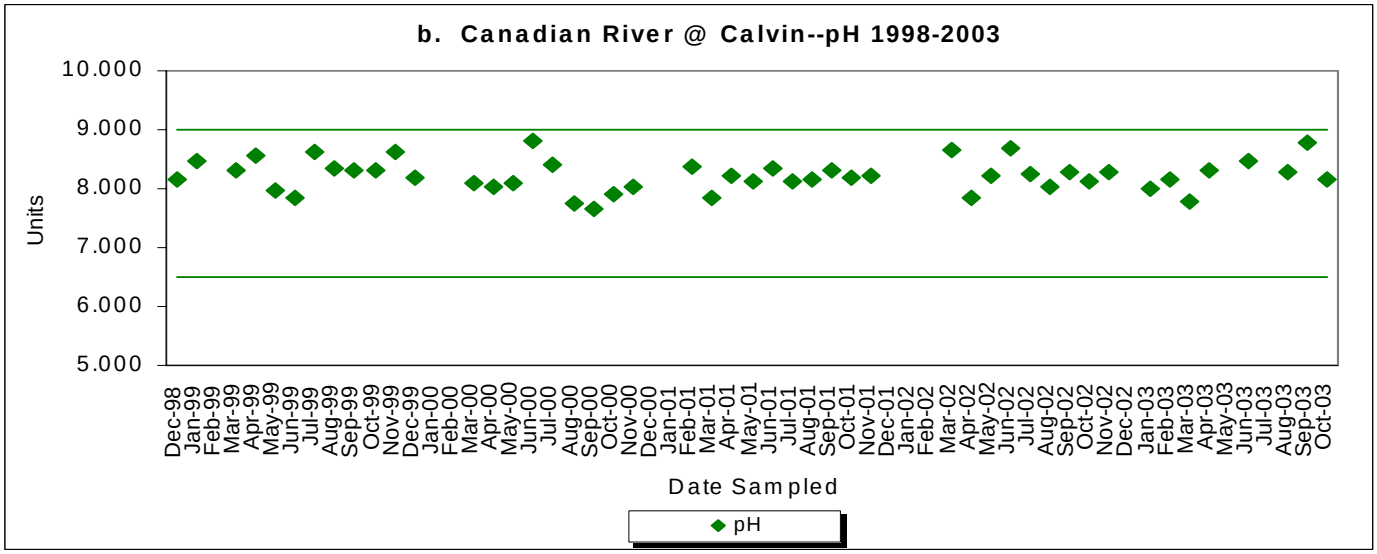
Station AT231500 (220600010119-001AT) is a permanent ambient trend monitoring station between the midpoint and the lower end of the Canadian River in Oklahoma. Situated in the central portion of Hughes County, the site was established north of the town of Calvin on US Highway 270. The station is positioned near the upper end of stream segment 220600010119 and is classified within the Lower Canadian River - Walnut Creek 8-digit HUC watershed (11090202). Water enters the stream system from several tributaries including Big Creek, Salt Creek, Spring Creek, Coal Creek, and Gobbler Creek, among others.

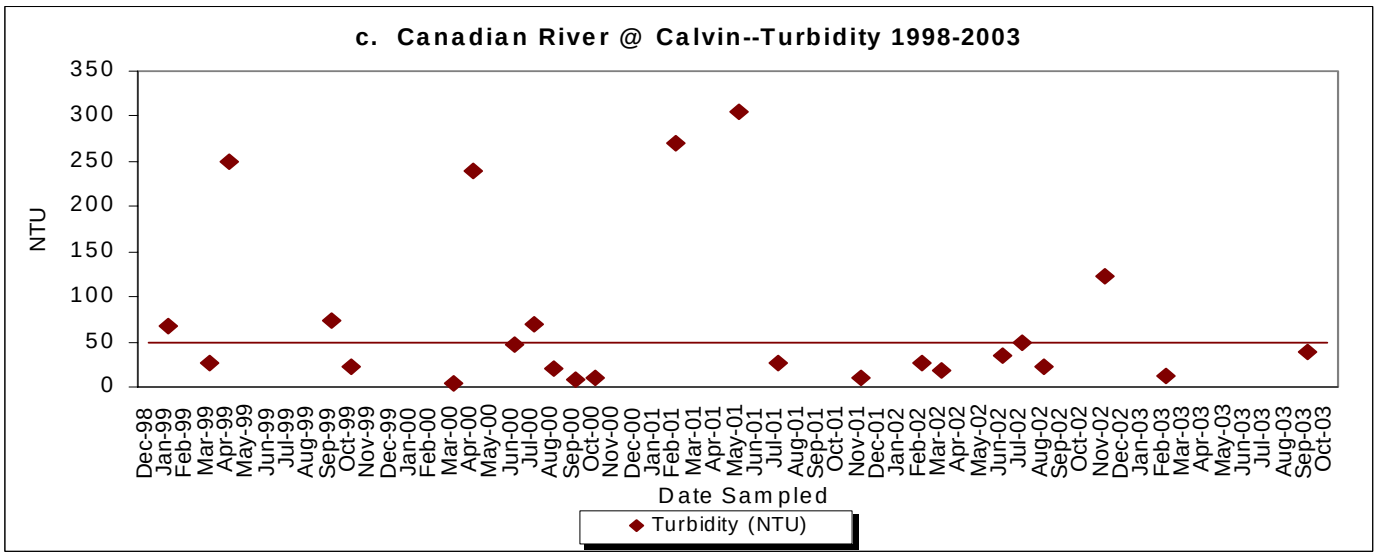
This station on the Canadian River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through October of 2003. For purposes of reporting, this station is representative of the Canadian River from below the confluence of the Little River (96.3637, 34.9962) downstream to confluence of the Canadian River with Eufaula Lake (95.8391, 35.1899). As per Appendix A, Table 2 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

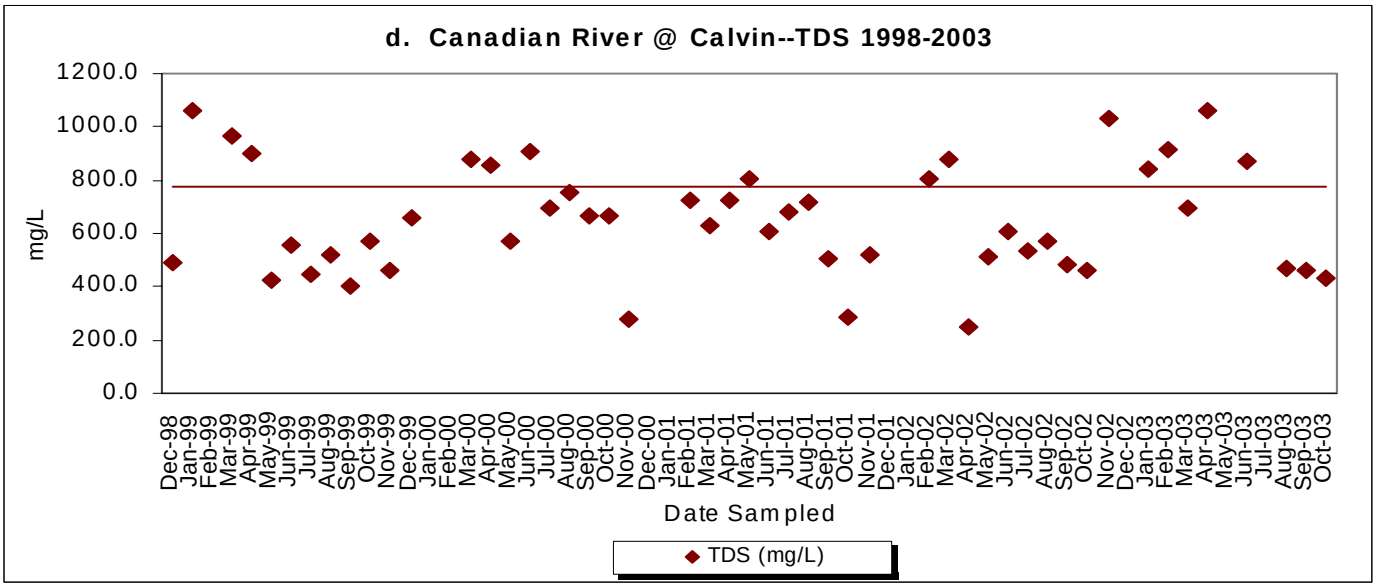
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 24 turbidity samples (Figure 39c), 8 samples (or 33%) exceeded the numerical criteria of 50. Dissolved oxygen (Figure 39a), pH (Figure 39b) and toxicant samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is partially supporting (Figure 39d and Figure 39e). Of the 49 total dissolved solids concentrations, 14 samples (or 29%) exceeded the prescribed sample standard of 777 mg/L. Of the 45 sulfate concentrations, 7 samples (or 16%) exceeded the prescribed sample standard of 268.0 mg/L. The PBCR beneficial use is not supported (Table 20). Of the 19 enterococci concentrations, 1 sample exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (74.6 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Canadian River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 39f).

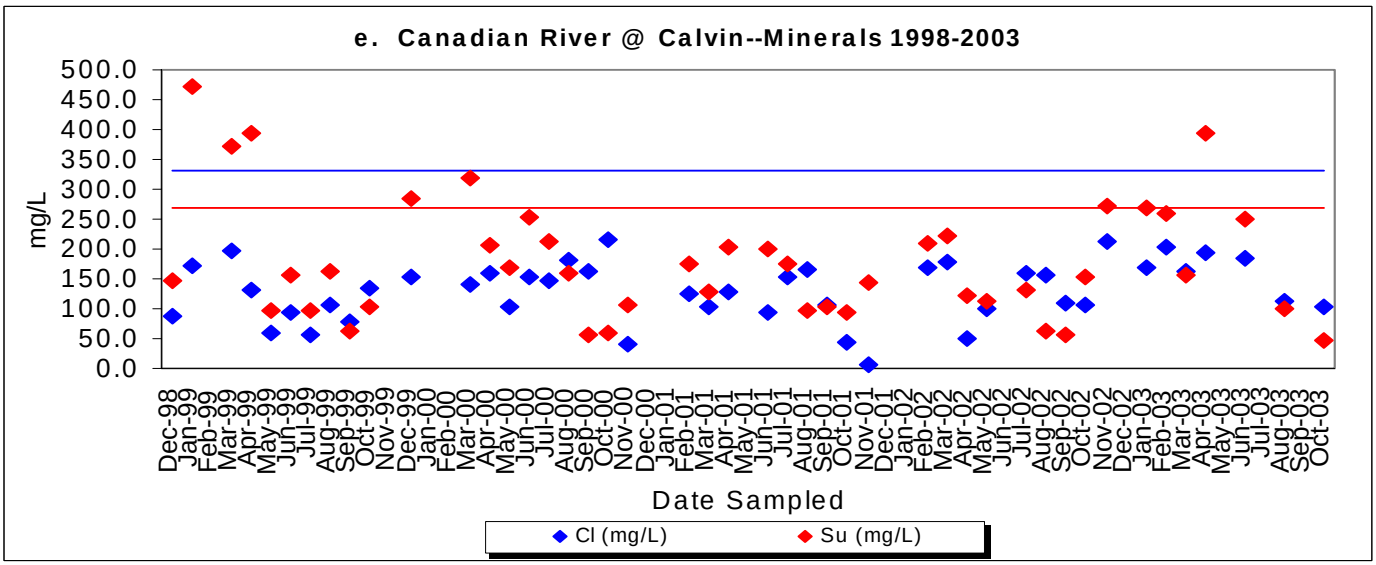
Figure 39a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Canadian River at Calvin (AT231500), 1998-2003.

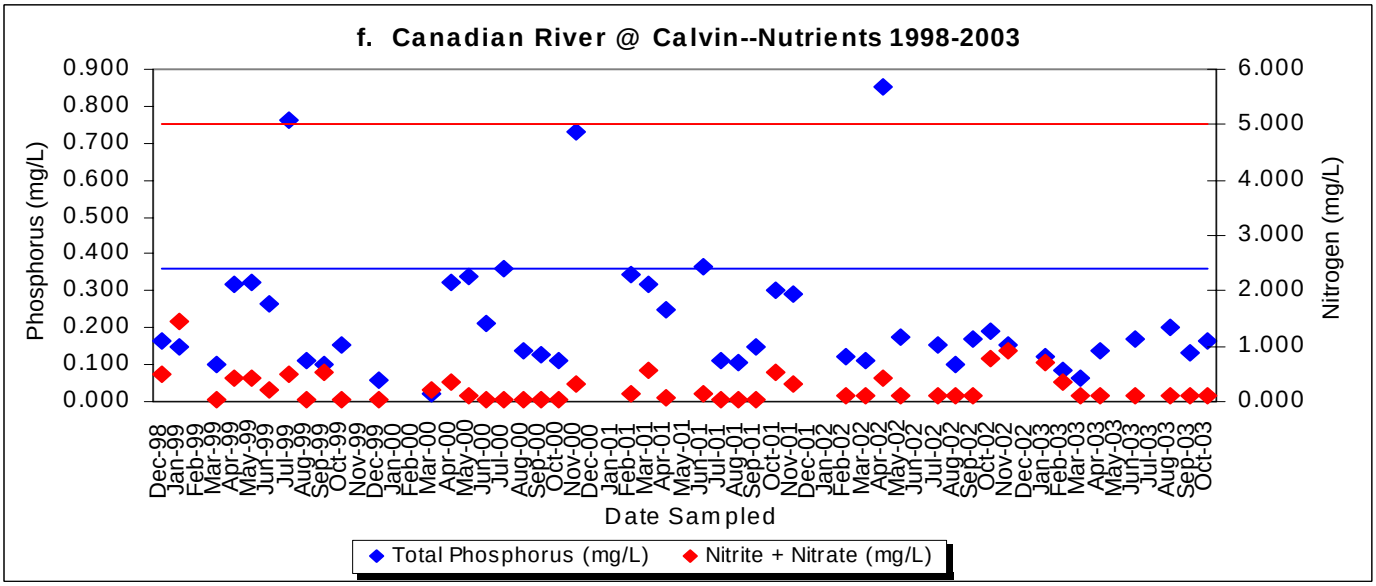







d. Canadian River @ Calvin--TDS 1998-2003
mg/L
1200.0
1000.0
800.0
600.0
400.0
200.0
0.0
Date Sampled
TDS (mg/L)


e. Canadian River @ Calvin--Minerals 1998-2003
mg/L
500.0
450.0
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Canadian River @ Calvin--Nutrients 1998-2003
Phosphorus (mg/L)
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

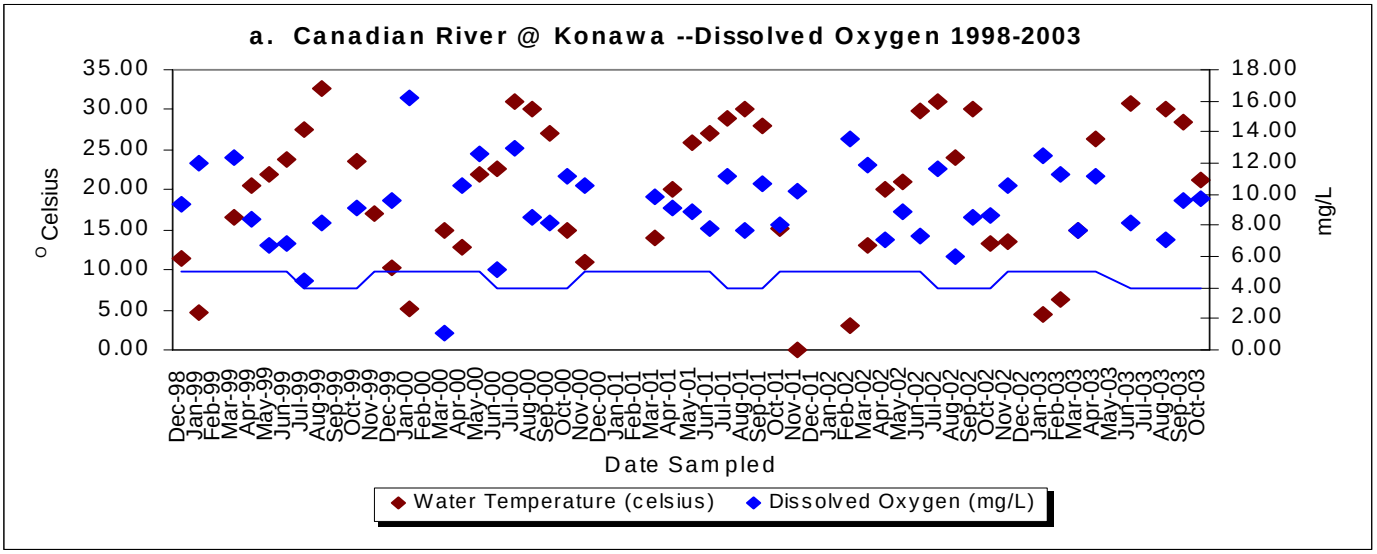
Canadian River near Konawa

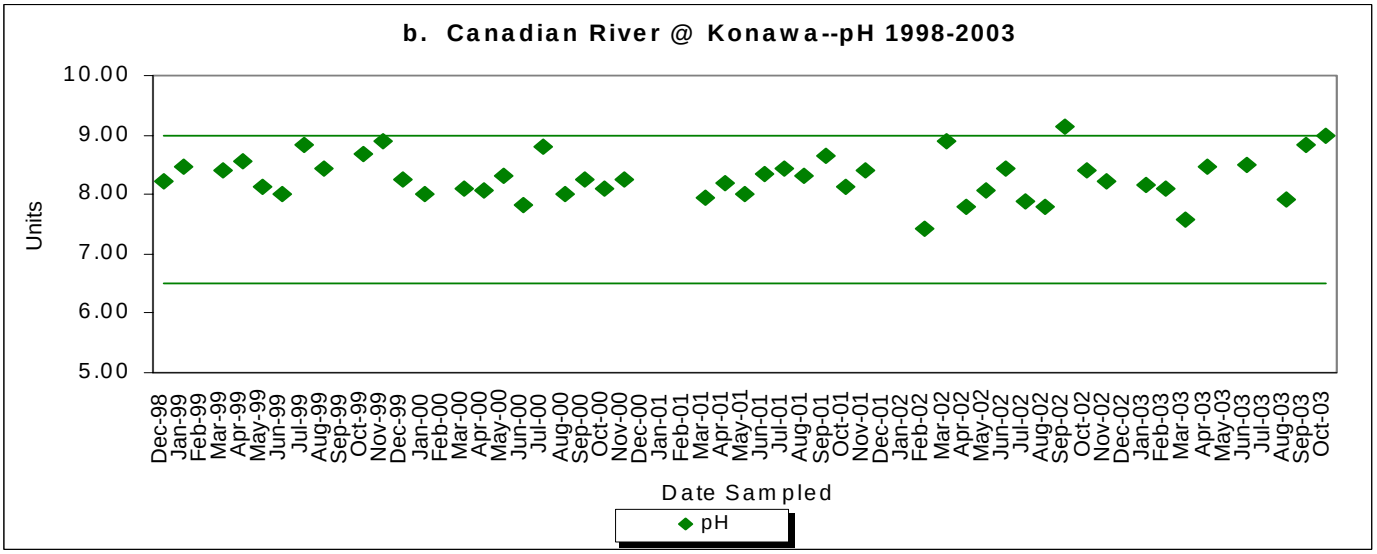
Station AT229400 (520600010010-001AT) is a permanent ambient trend monitoring station located on the Canadian River in Oklahoma. Situated in the southeastern portion of Seminole County, the site was established east of the town of Konawa on US Highway 377. The station is positioned near the upper end of stream segment 520600010010 and is classified within the Lower Canadian River - Walnut Creek 8-digit HUC watershed (11090202). Water enters the stream system from and from several tributaries including Canadian Sandy Creek, Jumper Creek, and the Little River, among others.

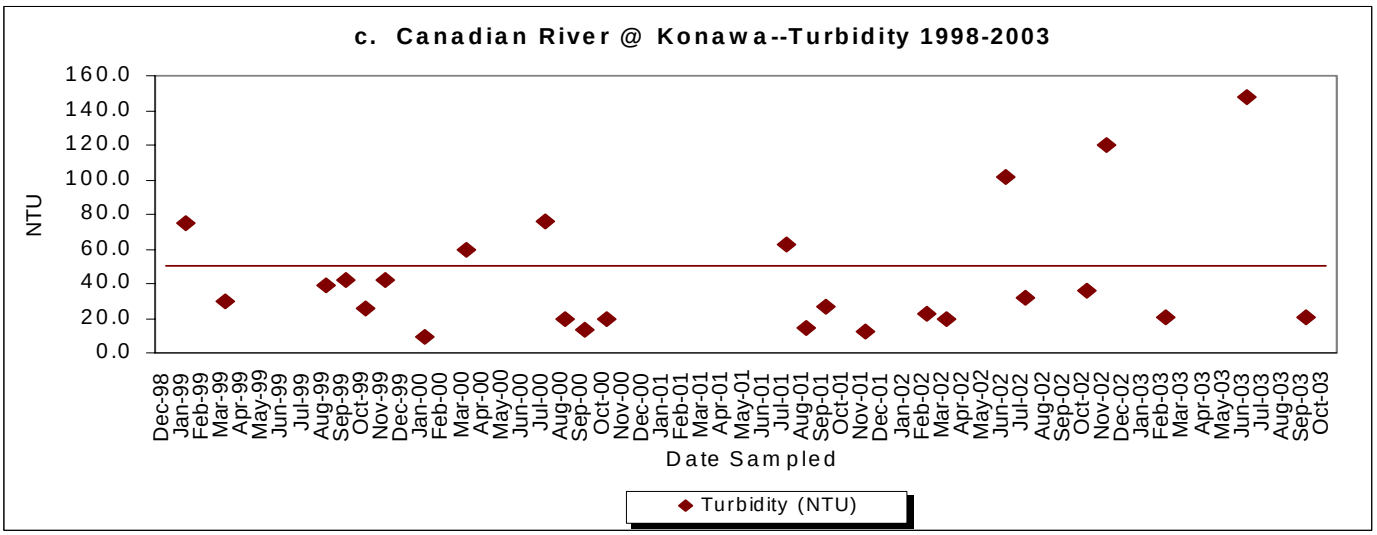
This station on the Canadian River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through October of 2003. For purposes of reporting, this station is representative of the Canadian River from the confluence of Canadian Sandy Creek (96.7007, 34.8651) downstream to confluence of the Little River with the Canadian River (96.3637, 34.9962). As per Appendix A, Table 5 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

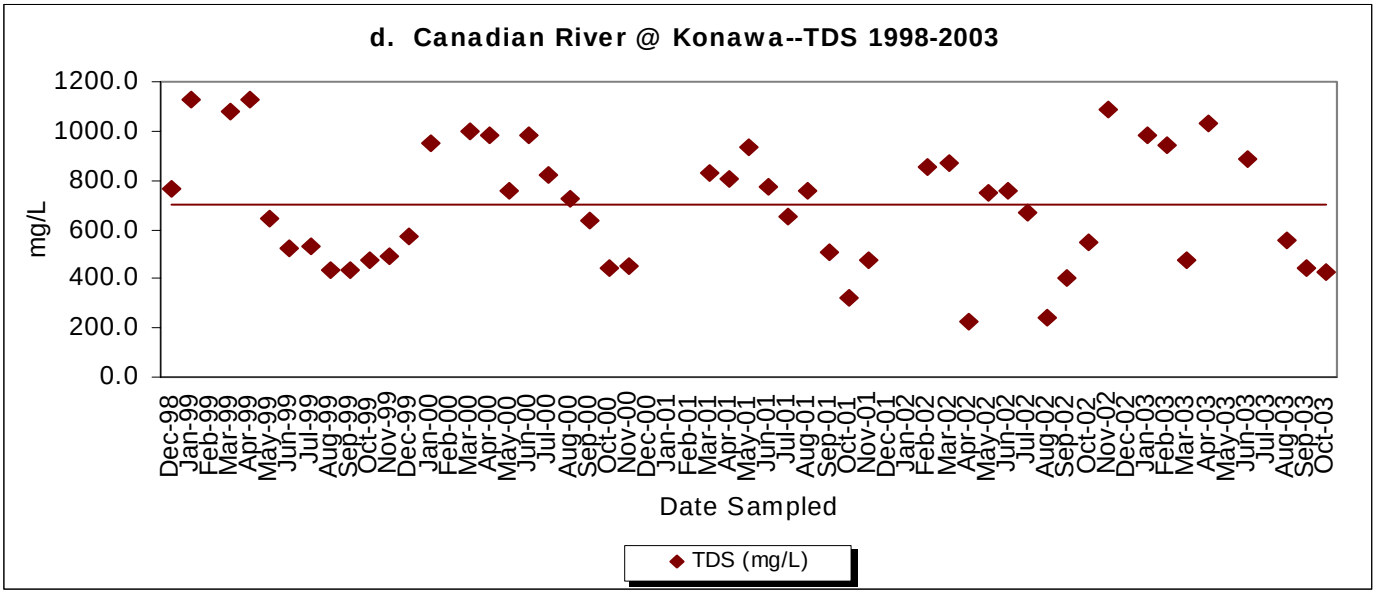
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 25 turbidity samples (Figure 40c), 7 samples (or 28%) exceeded the numerical criteria of 50. Of the 13 toxicant samples collected, 3 of the lead concentrations (or 23%) exceeded the prescribed, hardness-dependent chronic criteria of 15.78 µg/L (Table 19). Dissolved oxygen (Figure 40a) and pH (Figure 40b) samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is not supported (Figure 40d and Figure 40e). Of the 49 total dissolved solids concentrations, 23 samples (or 47%) exceeded the minimum sample standard of 750.0 mg/L (Appendix F sample standard is 700 mg/L). Chloride and sulfate values met the prescribed segment-specific criteria. The PBCR beneficial use is not supported (Table 20). Of the 13 enterococci concentrations, 1 sample exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (180.4 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Canadian River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 40f).

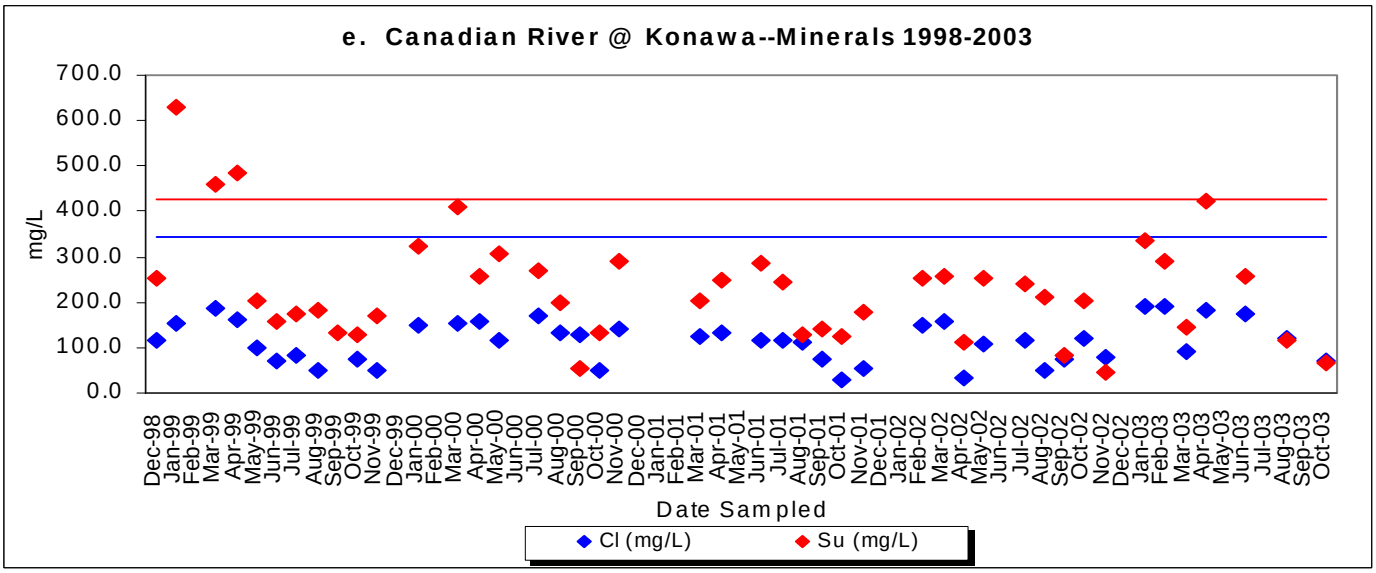
Figure 40a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Canadian River at Konawa (AT229400), 1998-2003.

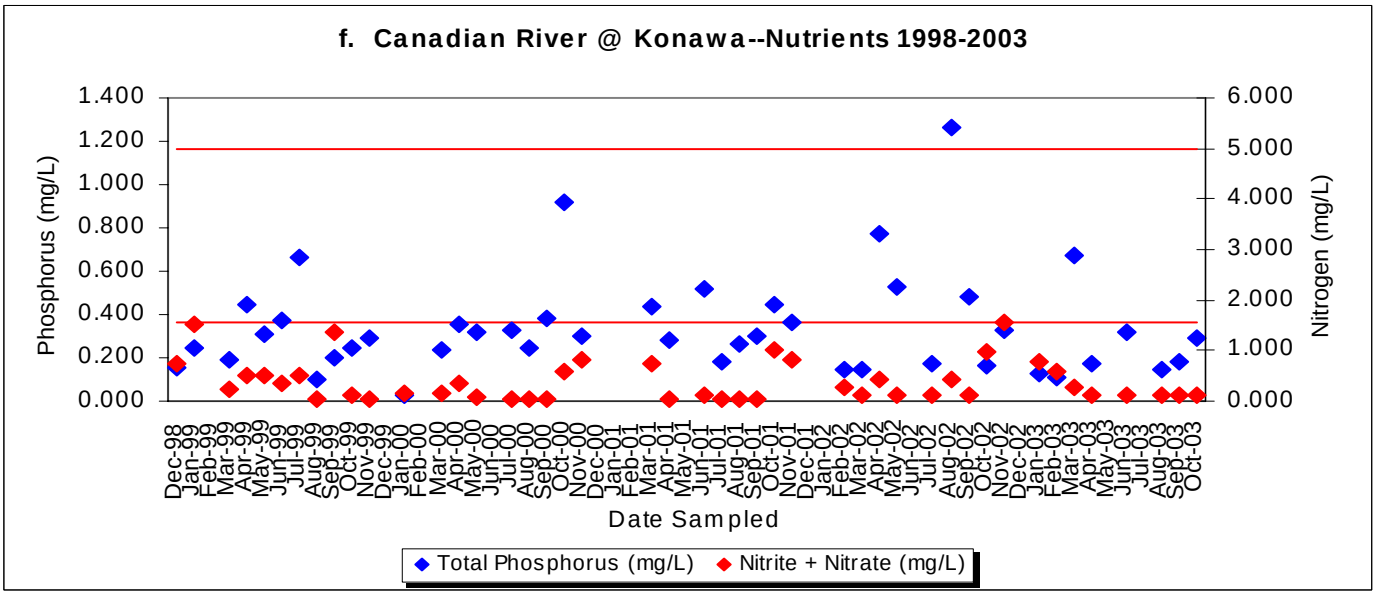







d. Canadian River @ Konawa--TDS 1998-2003
mg/L
Date Sampled
TDS (mg/L)


e. Canadian River @ Konawa--Minerals 1998-2003
mg/L
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Canadian River @ Konawa--Nutrients 1998-2003
Phosphorus (mg/L)
Nitrogen (mg/L)
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

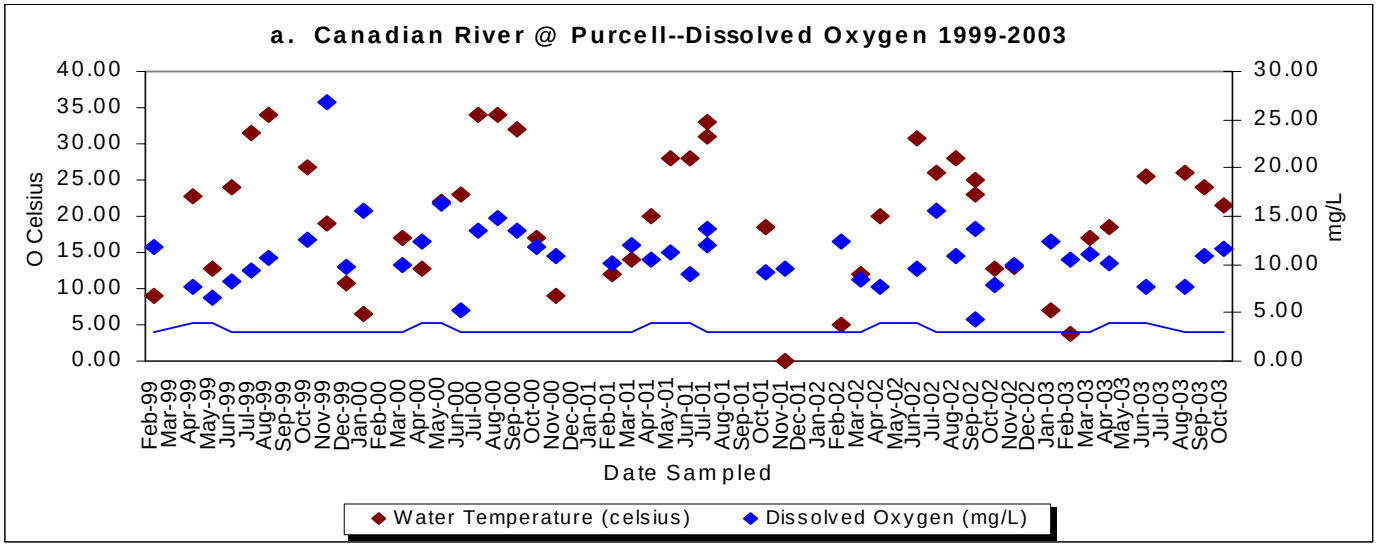
Canadian River near Purcell

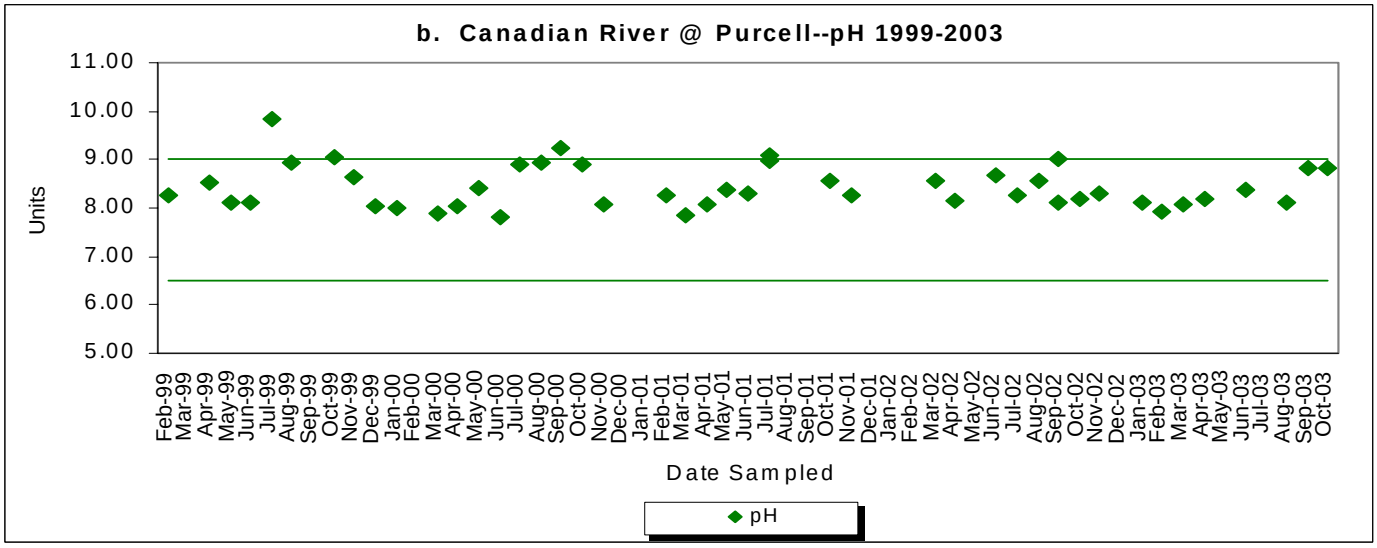
Station AT229200 (520610010010-001AT) is a permanent ambient trend monitoring station located on the Canadian River in Oklahoma. Situated in the east central portion of McClain County, the site was established east of the City of Purcell on US Highway 77. The station is positioned near the midpoint of stream segment 520610010010 and is classified within the Lower Canadian River - Walnut Creek 8-digit HUC watershed (11090202). Water enters the stream system from several tributaries including Cow Creek, Pond Creek, and Walnut Creek, among others.

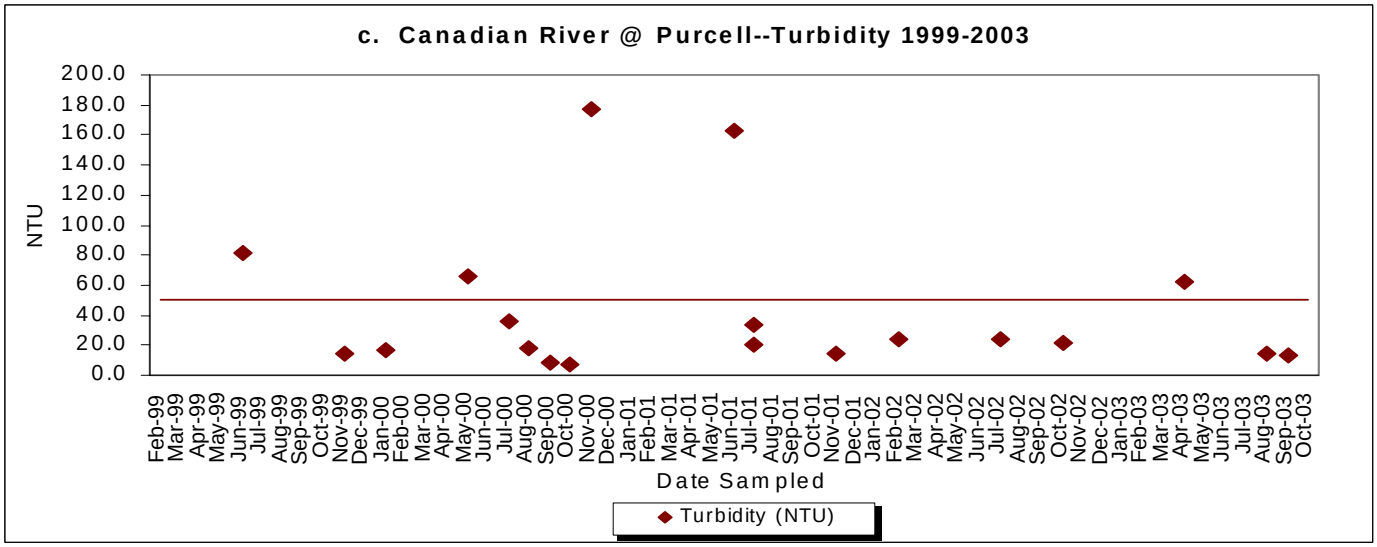
This station on the Canadian River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from February of 1999 through October of 2003. For purposes of reporting, this station is representative of the Canadian River from the confluence of Cow Creek (-97.6291, 35.3154) downstream to confluence of Walnut Creek with the Canadian River (-97.8950, 35.3450). As per Appendix A, Table 5 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Habitat Limited Aquatic Community—Fish and Wildlife Propagation (HLAC), 2) Agriculture—Class II Irrigation (AG), 3) Secondary Body Contact—Recreation (SBCR), and 4) Aesthetics.

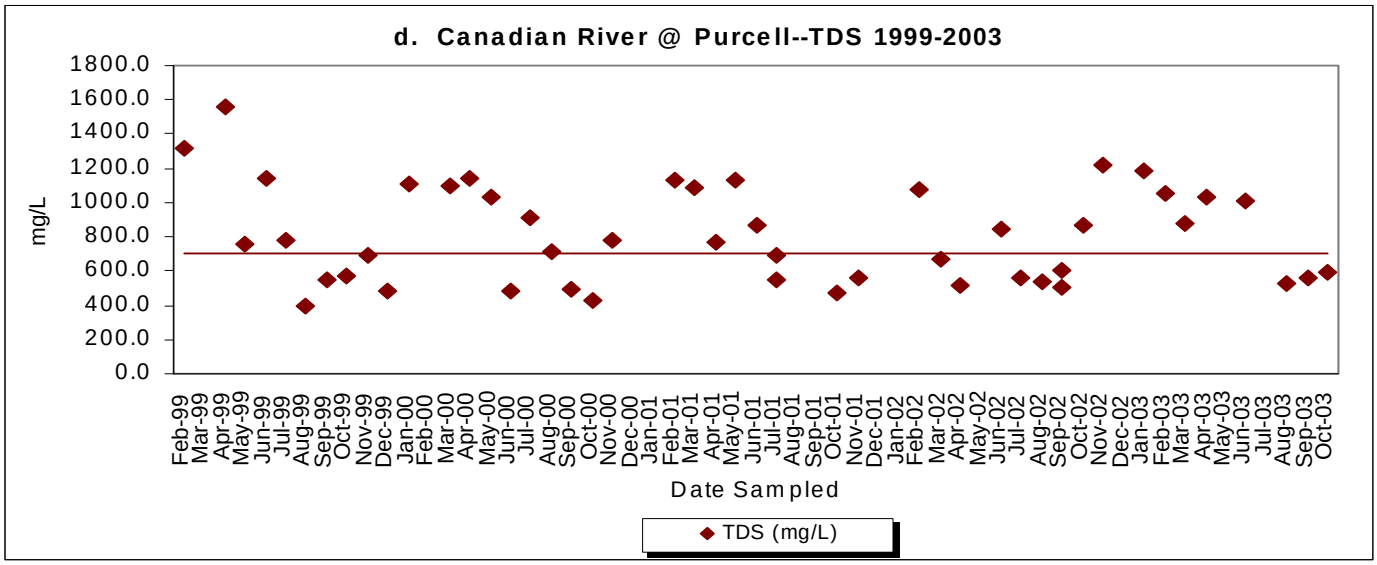
The HLAC beneficial use is not supported. Of the 19 turbidity samples (Figure 41c), 5 samples (or 26%) exceeded the numerical criteria of 50. Dissolved oxygen (Figure 41a), pH (Figure 41b), and toxicant samples met the criteria prescribed in the HLAC beneficial use. The AG beneficial use is not supported (Figure 41d and Figure 41e). Of the 47 total dissolved solids concentrations, 25 samples (or 53%) exceeded the minimum sample standard of 750 mg/L (Appendix F sample standard is 700 mg/L). Chloride and sulfate values met the prescribed segment-specific criteria. This segment of the Canadian River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 41f).

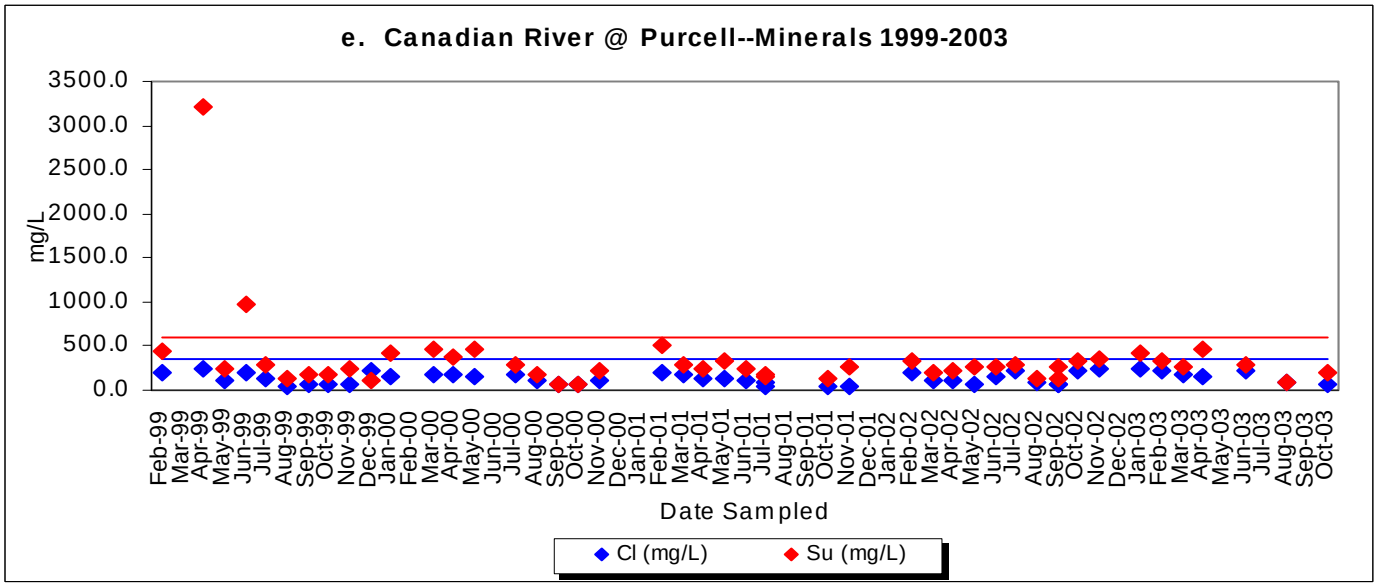
Figure 41a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Canadian River at Purcell (AT229200), 1999-2003.

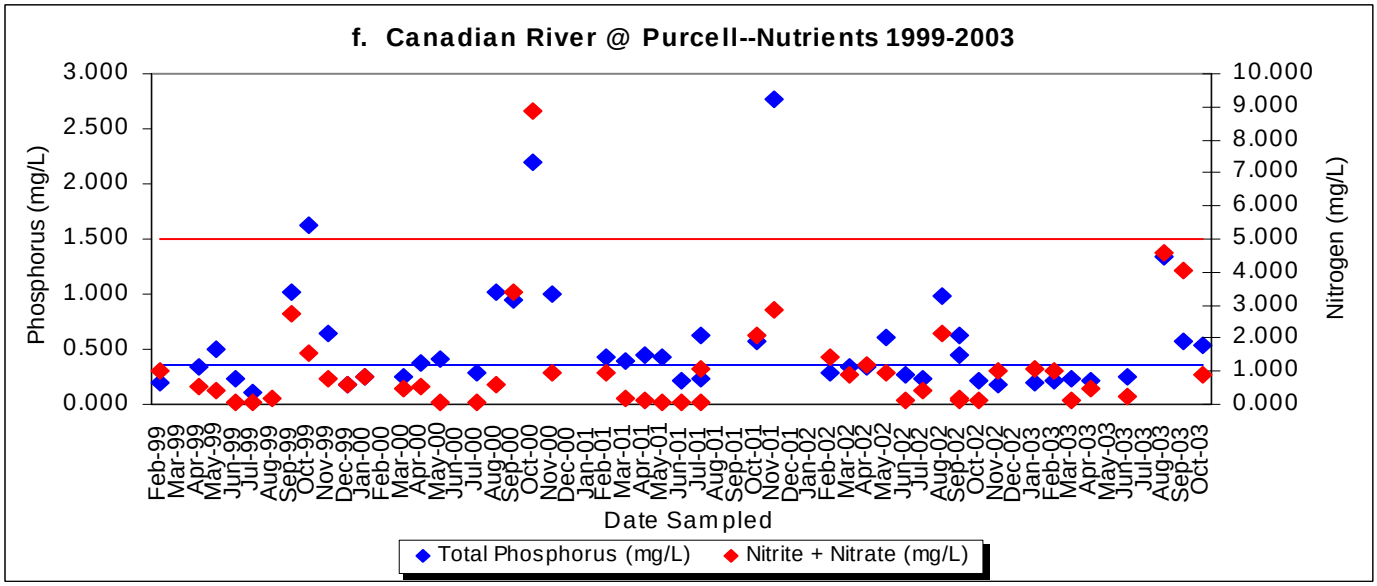







d. Canadian River @ Purcell--TDS 1999-2003
mg/L
Date Sampled
TDS (mg/L)


e. Canadian River @ Purcell--Minerals 1999-2003
mg/L
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Canadian River @ Purcell--Nutrients 1999-2003
Phosphorus (mg/L)
Nitrogen (mg/L)
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

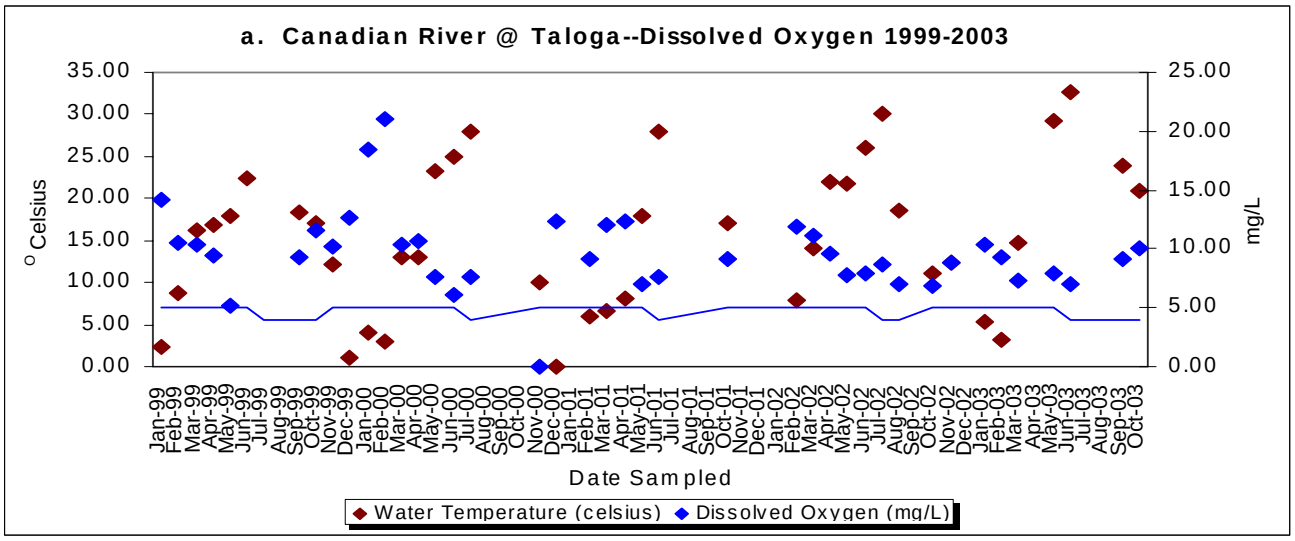
Canadian River near Taloga

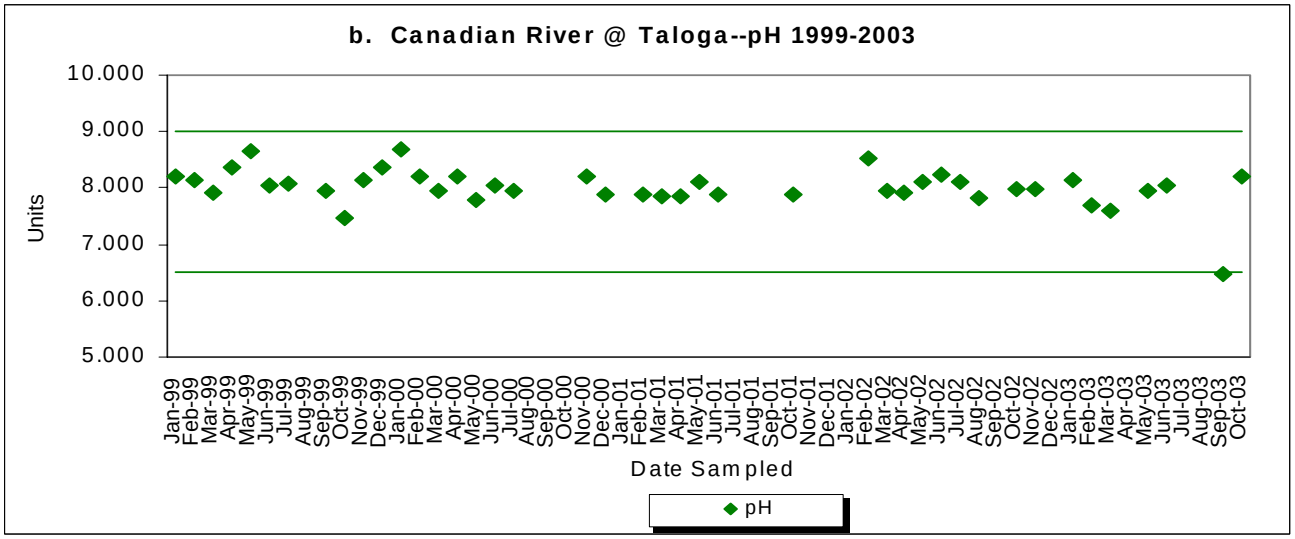
Station AT228250 (520620020010-001AT) is a permanent ambient trend monitoring station located on the Canadian River in Oklahoma. Situated in the north central portion of Dewey County, the site was established north of the town of Taloga on US Highway 183. The station is positioned near the upper end of stream segment 520620020020 and is classified within the Lower Canadian River - Deer Creek 8-digit HUC watershed (11090201). Water enters the stream system from several tributaries including Turkey Creek, Red Creek, Gyp Creek, Trail Creek, Lone Creek, Squirrel Creek, and Deer Creek, among others.

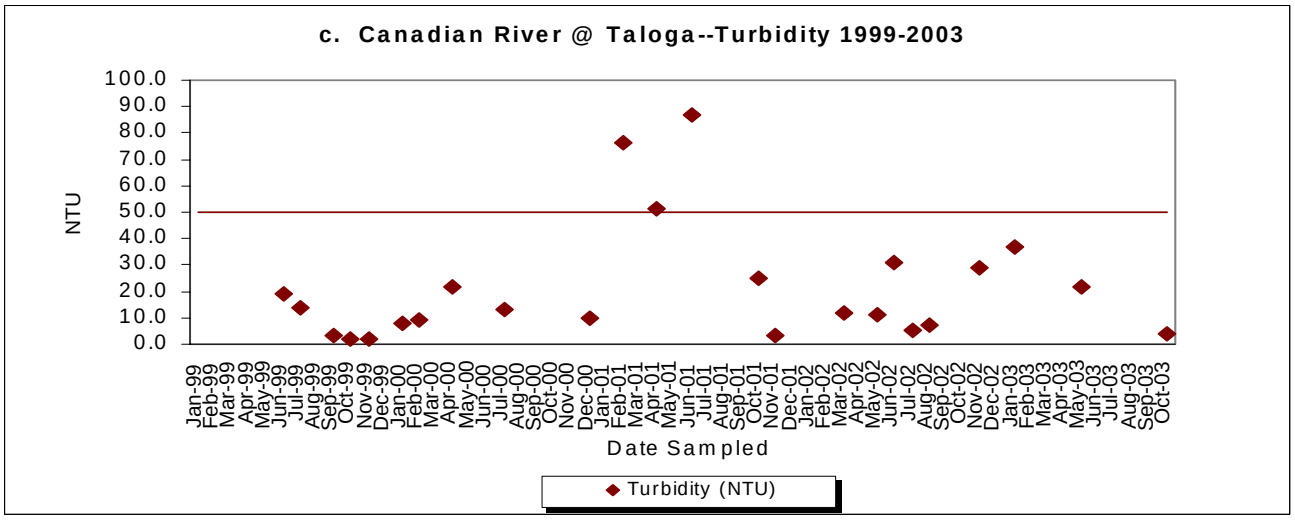
This station on the Canadian River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected January of 1999 through October of 2003. For purposes of reporting, this station is representative of the Canadian River from the confluence of Turkey Creek (99.3783, 36.0127) downstream to confluence of Deer Creek with the Canadian River (98.4737, 35.5580). As per Appendix A, Table 5 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Emergency Water Supply (EWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class II Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

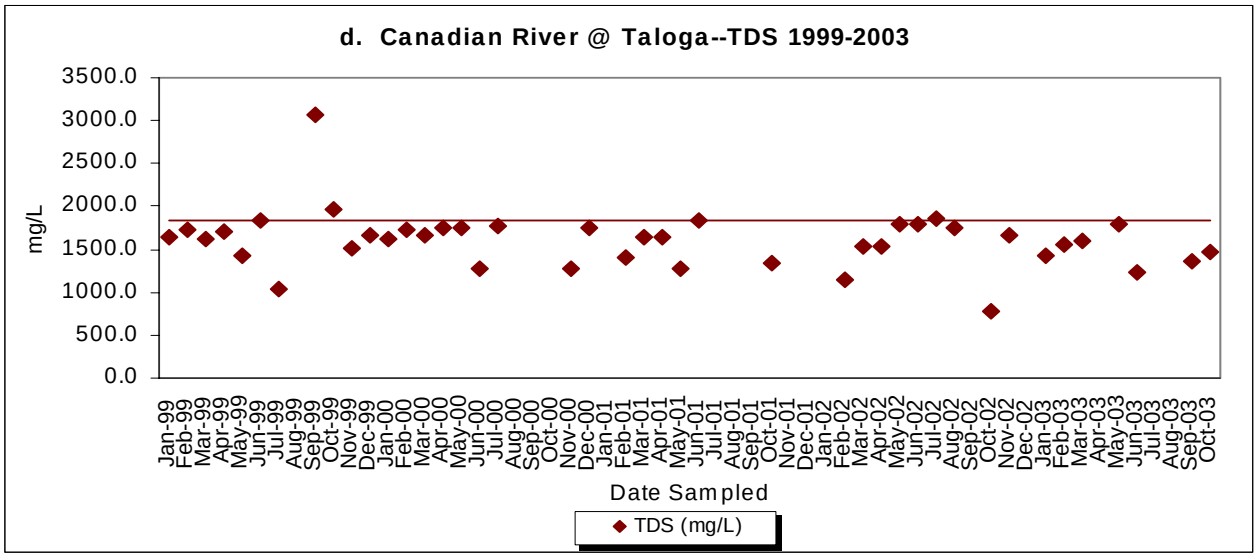
The WWAC beneficial use is partially supported. Of the 24 turbidity samples (Figure 42c), 3 samples (or 13%) exceeded the numerical criteria of 50. Dissolved oxygen (Figure 42a), pH (Figure 42b), and toxicant samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is not supported (Figure 42d and Figure 42e). The geometric mean of the total dissolved solids concentrations (1478.2 mg/L) exceeded the prescribed yearly mean standard of 1463 mg/L. The PBCR beneficial use is not supported (Table 20). Of the 18 enterococci concentrations, 6 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (218.2 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Canadian River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 42f).

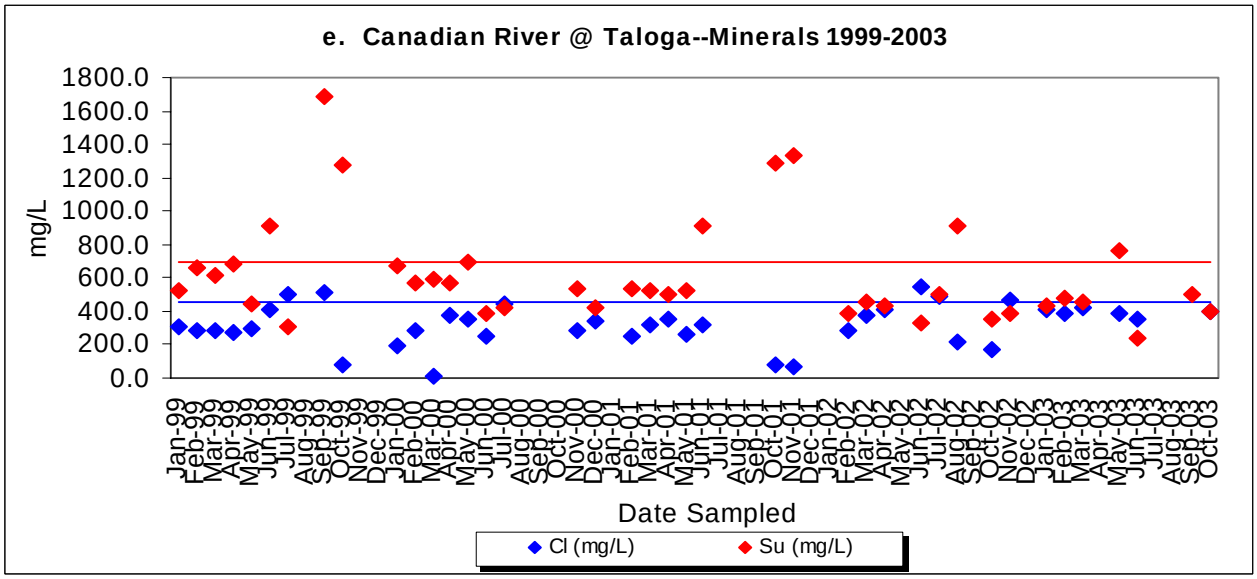
Figure 42a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Canadian River at Taloga (AT228250), 1999-2003.

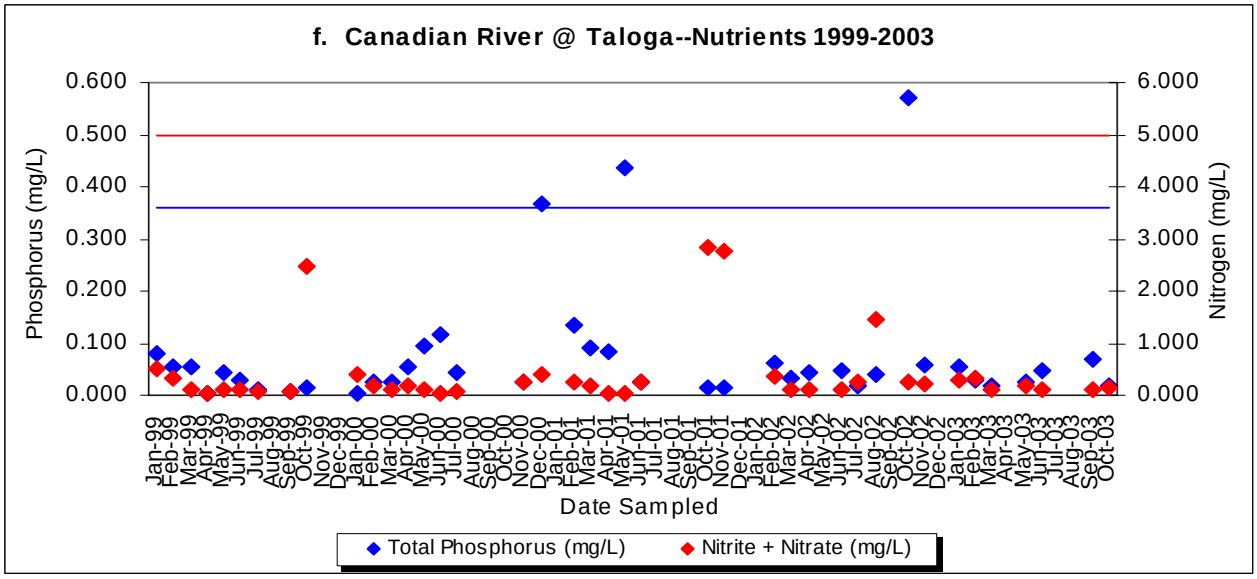







d. Canadian River @ Taloga--TDS 1999-2003
mg/L
3500.0
3000.0
2500.0
2000.0
1500.0
1000.0
500.0
0.0
Date Sampled
TDS (mg/L)


e. Canadian River @ Taloga--Minerals 1999-2003
mg/L
1800.0
1600.0
1400.0
1200.0
1000.0
800.0
600.0
400.0
200.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Canadian River @ Taloga--Nutrients 1999-2003
Phosphorus (mg/L)
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

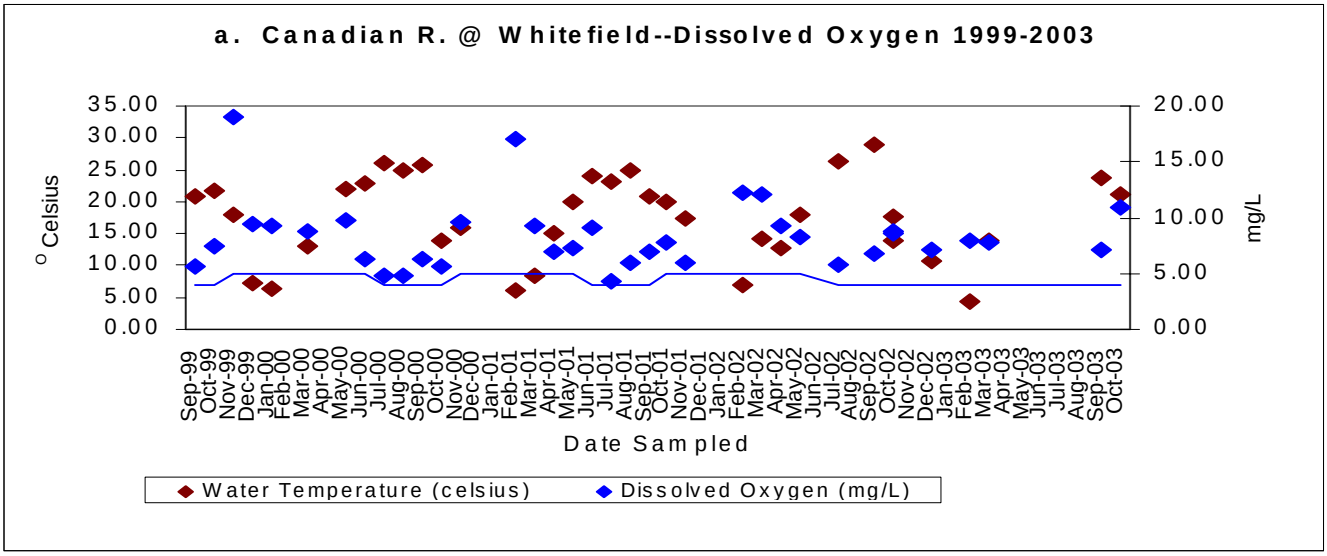
Canadian River near Whitefield

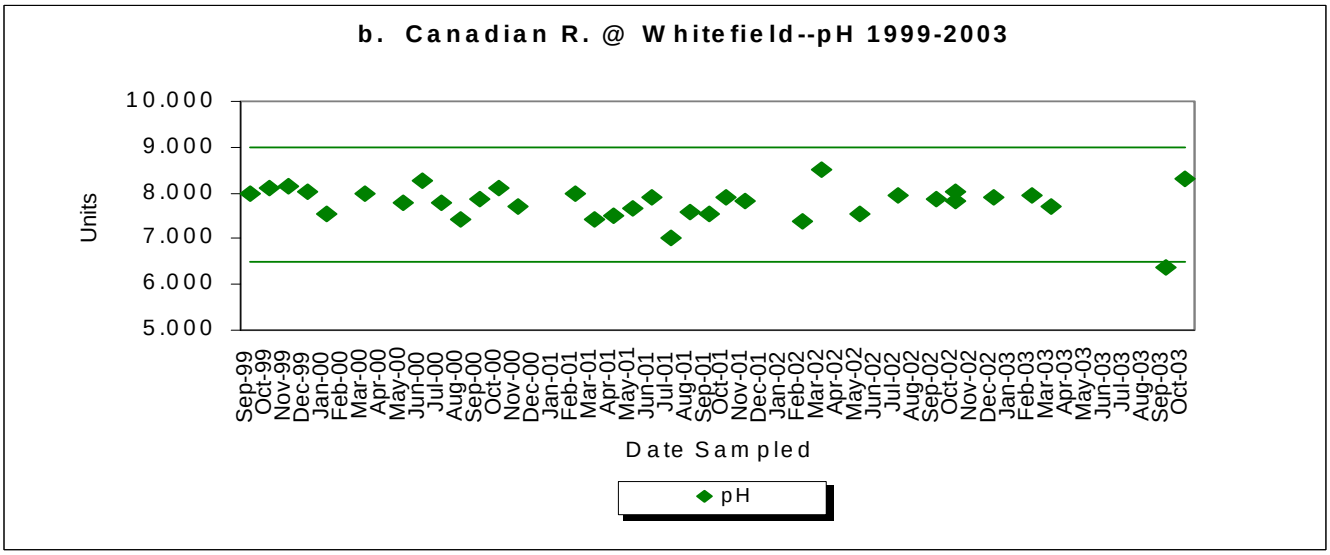
Station AT245000 (220300000010-001AT) is a permanent ambient trend monitoring station near the lower end of the Canadian River in Oklahoma. Situated in the northwestern portion of Haskell County, the site was established north of the town of Whitefield on State Highway 2. The station is positioned between the upper end and the midpoint of stream segment 2203 00000010 and is classified within the Lower Canadian River 8-digit HUC watershed (11090204). Water enters the stream system from Eufaula Lake and several tributaries including Emachaya Creek and Taloka Creek, among others.

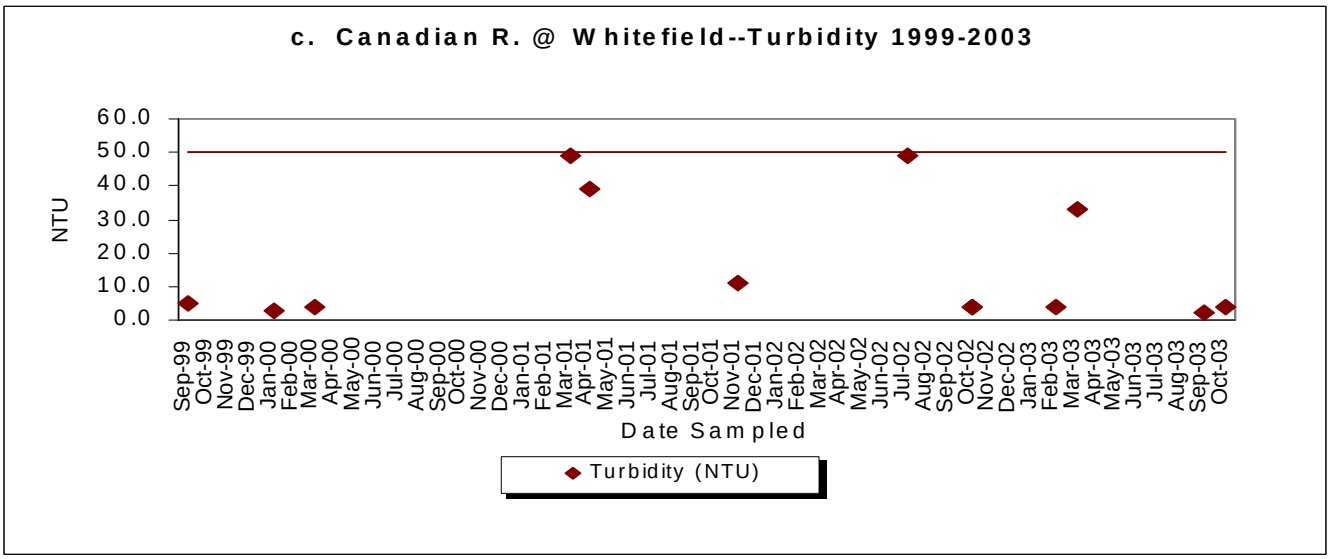
This station on the Canadian River has been active for all water quality variables since September of 1999. The following assessment of beneficial uses is based on data collected from September 1999 through October of 2003. For purposes of reporting, this station is representative of the Canadian River from the confluence with Lake Eufaula (95.3582, 35.3065) downstream to the Canadian River's confluence with Robert S. Kerr Reservoir (95.0776, 35.4325). As per Appendix A, Table 2 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

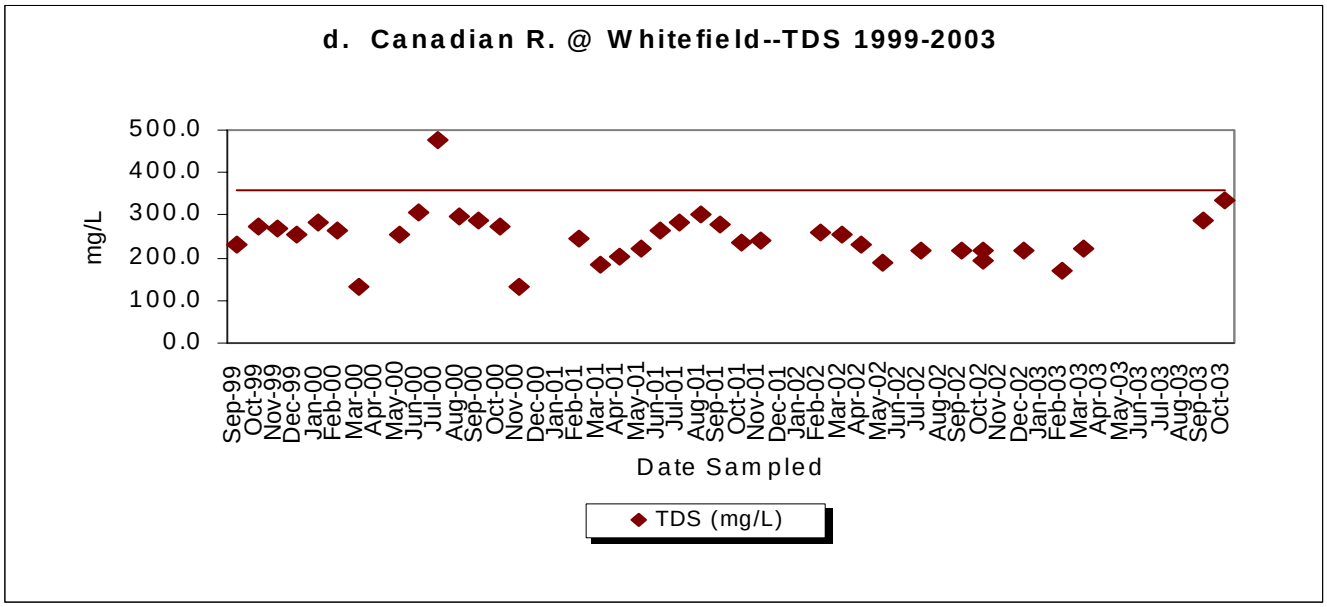
The PPWS beneficial use is supported. The WWAC beneficial use is supported. Dissolved oxygen (Figure 43a), pH (Figure 43b), turbidity (Figure 43c), and toxicant samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 43d and Figure 43e). Although 12% of the sulfate concentrations exceeded the sample standard of 60.0 mg/L, the values are below the minimum value of 250 mg/L. The PBCR beneficial use is supported for fecal coliform, *E. coli* and enterococci. This segment of the Canadian River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 43f).

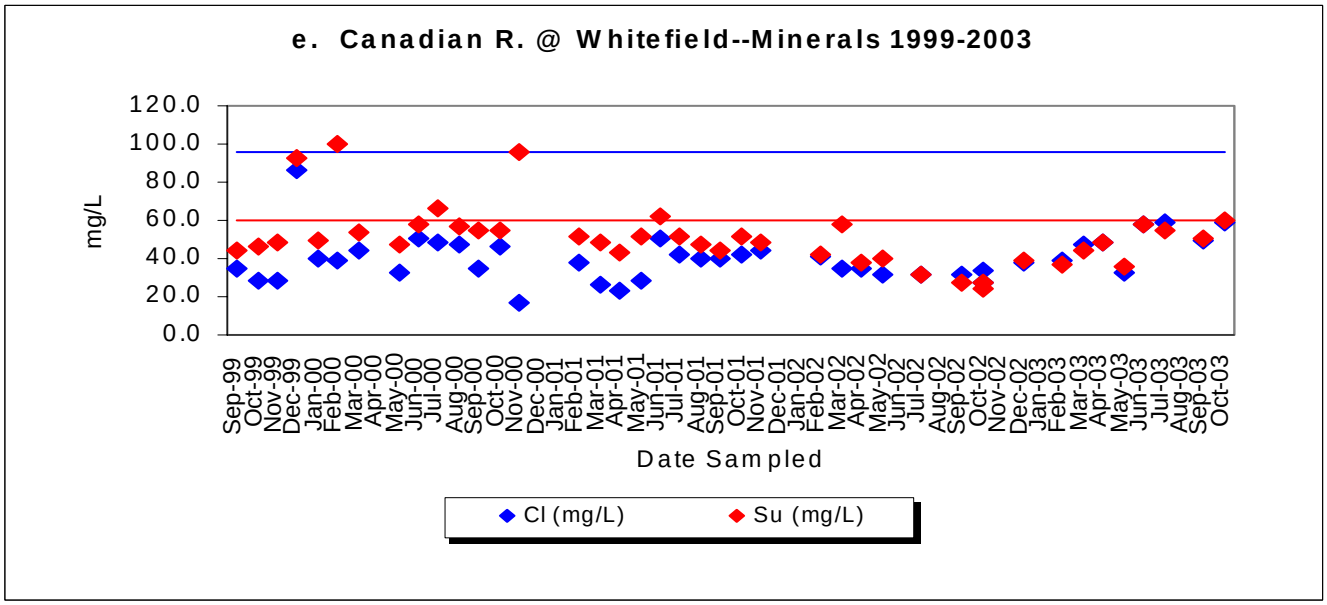
Figure 43a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Canadian River at Whitefield (AT245000), 1999-2003.

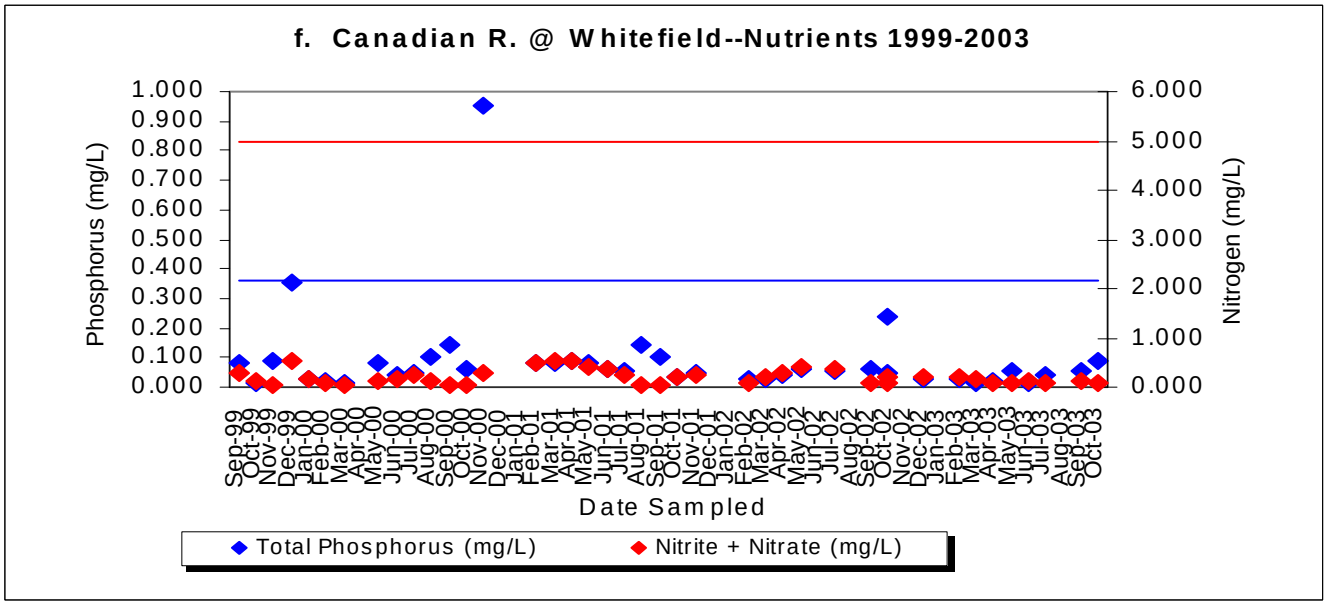







d. Canadian R. @ Whitefield--TDS 1999-2003
mg/L
500.0
400.0
300.0
200.0
100.0
0.0
Date Sampled
TDS (mg/L)


e. Canadian R. @ Whitefield--Minerals 1999-2003
mg/L
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Canadian R. @ Whitefield--Nutrients 1999-2003
Phosphorus (mg/L)
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

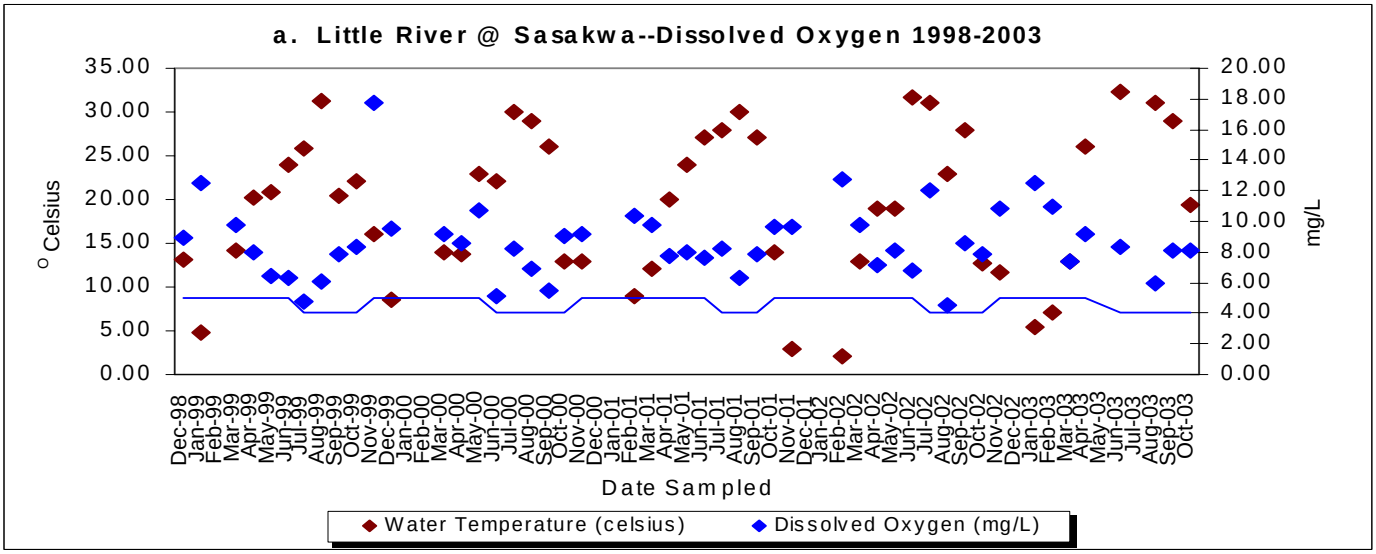
Little River near Sasakwa

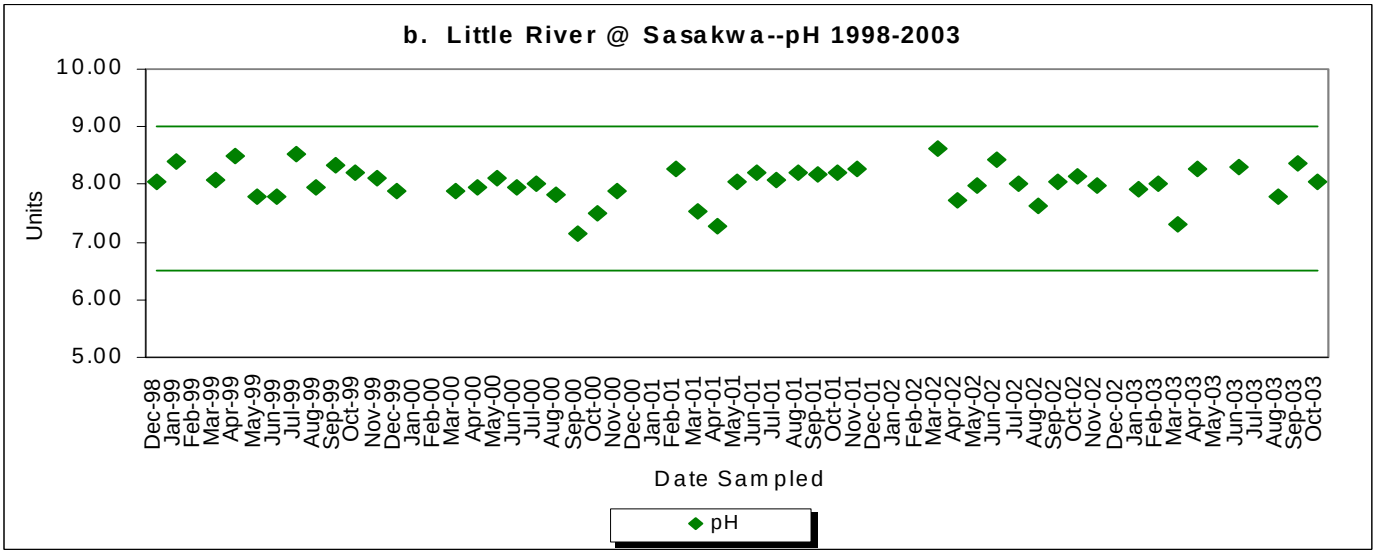
Station AT231000 (520800010010-001AT) is a permanent ambient trend monitoring station located on the Little River. Situated in the southeastern portion of Seminole County, the site was established north-northeast of the town of Sasakwa on State Highway 56. The station is positioned near the midpoint of stream segment 520800010010 and is classified within the Little River 8-digit HUC watershed (11090203). Water enters the stream system from several tributaries including Salt Creek and Bird Creek, among others.

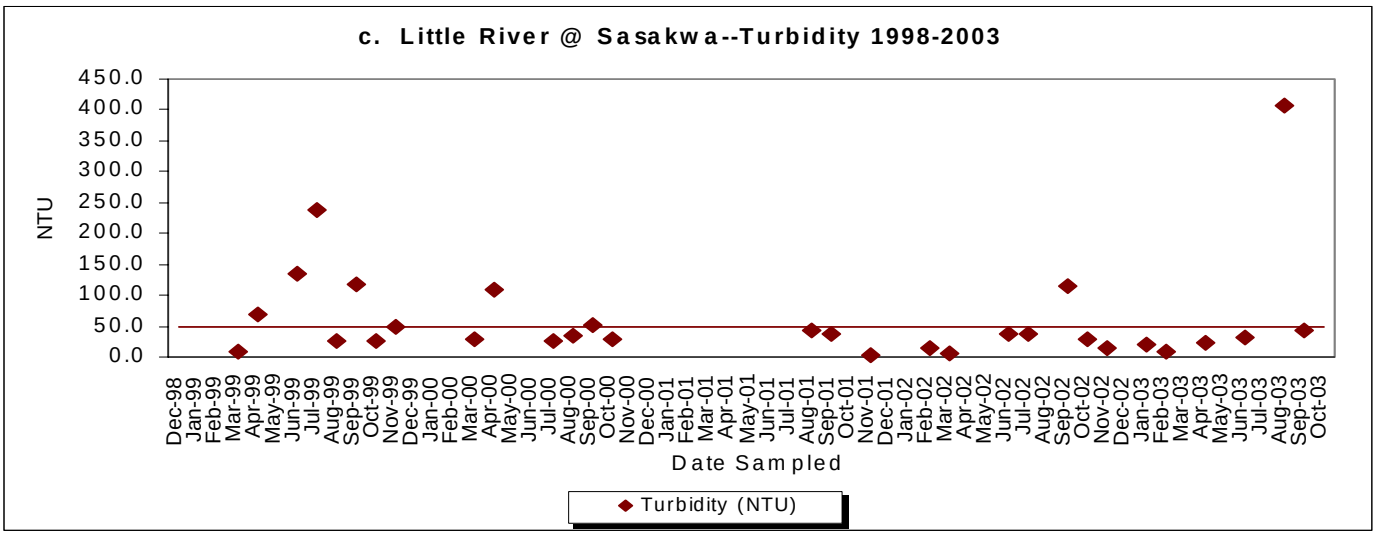
This station on the Little River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through October of 2003. For purposes of reporting, this station is representative of the Little River from the confluence of Salt Creek (96.6130, 35.0213) downstream to confluence of the Little River with the Canadian River (96.3637, 34.9962). As per Appendix A, Table 5 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

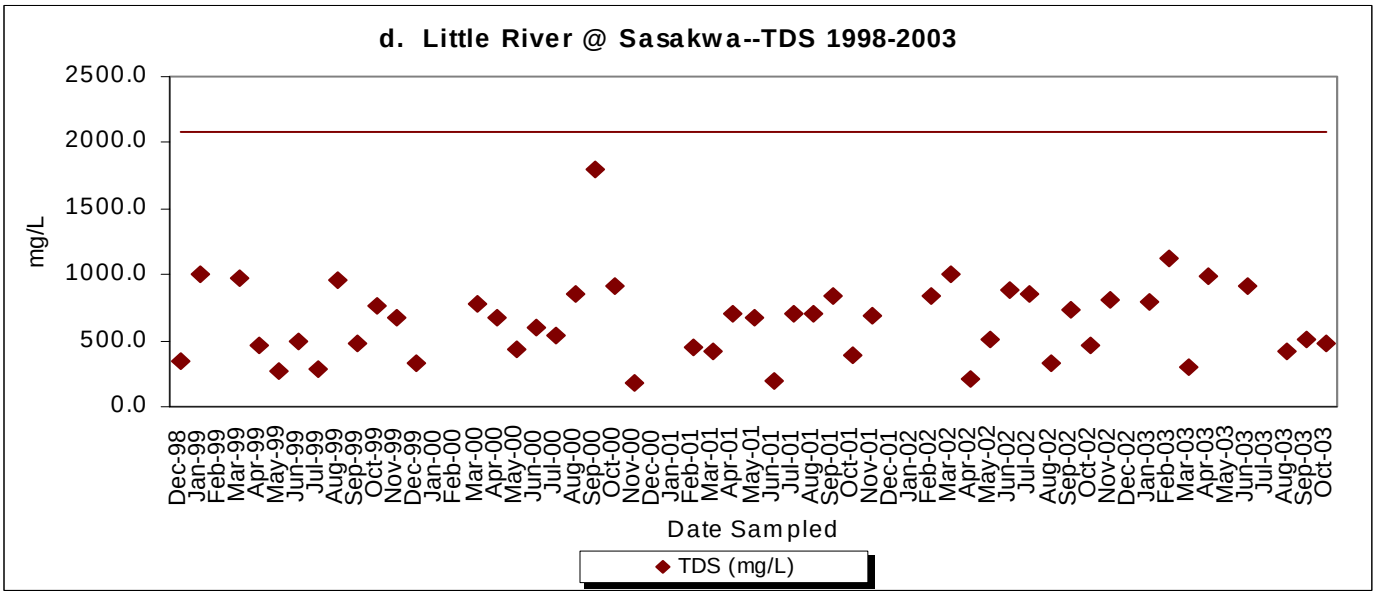
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 30 turbidity samples (Figure 44c), 8 samples (or 27%) exceeded the numerical criteria of 50. Of the 13 selenium samples collected, 2 of the selenium concentrations (or 15%) exceeded the prescribed chronic criteria of 5 µg/L (Table 19). Of the 14 lead samples collected, 2 of the concentrations (or 16%) exceeded the prescribed, hardness-dependent chronic criteria of 11.31 µg/L (Table 19). Dissolved oxygen (Figure 44a) and pH (Figure 44b) samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 44d and Figure 44e). The PBCR beneficial use is not supported (Table 20). Of the 18 fecal coliform concentrations, 5 samples (or 28%) exceeded the prescribed screening level of 400 cfu/mL. Of the 18 enterococci concentrations, 3 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (122.9 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Little River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 44f).

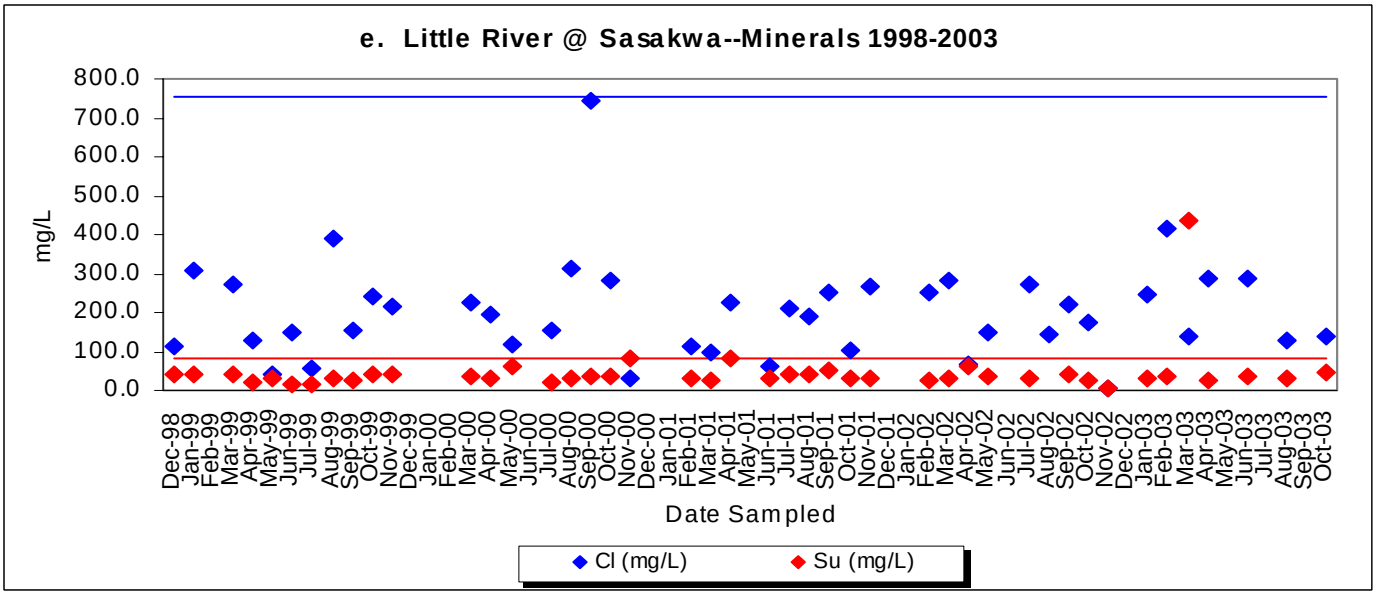
Figure 44a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Little River at Sasakwa (AT231000), 1998-2003.

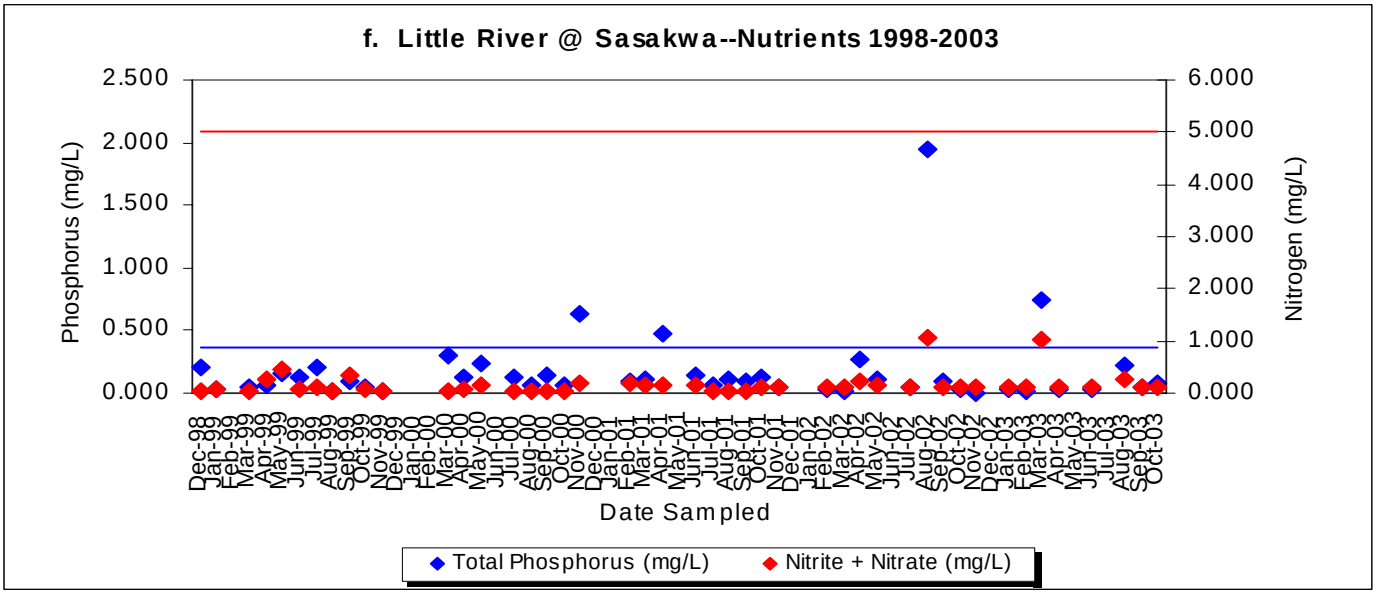







d. Little River @ Sasakwa--TDS 1998-2003
mg/L
2500.0
2000.0
1500.0
1000.0
500.0
0.0
Date Sampled
TDS (mg/L)


e. Little River @ Sasakwa--Minerals 1998-2003
mg/L
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Little River @ Sasakwa--Nutrients 1998-2003
Phosphorus (mg/L)
2.500
2.000
1.500
1.000
0.500
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

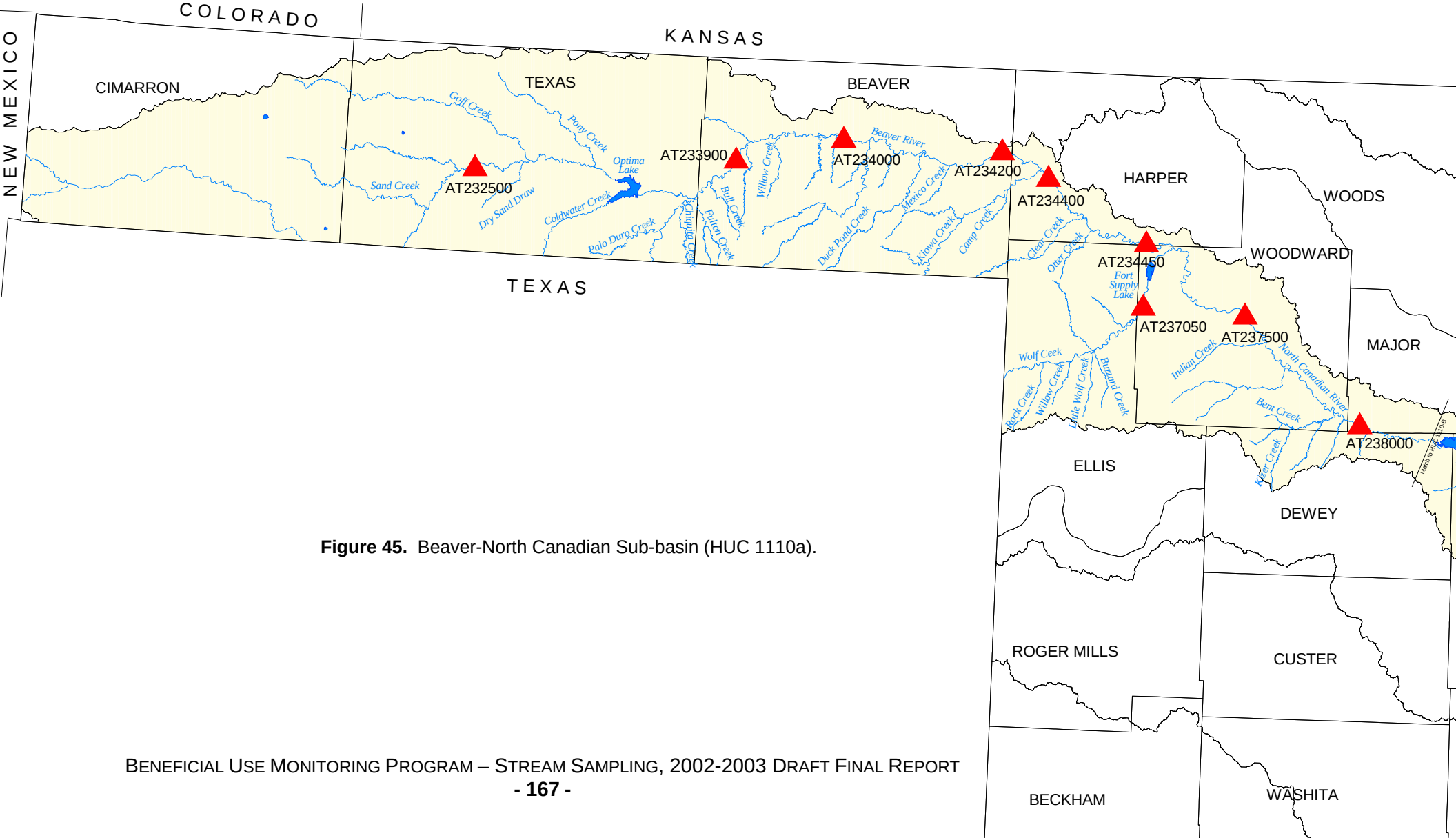


Figure 45. Beaver-North Canadian Sub-basin (HUC 1110a).

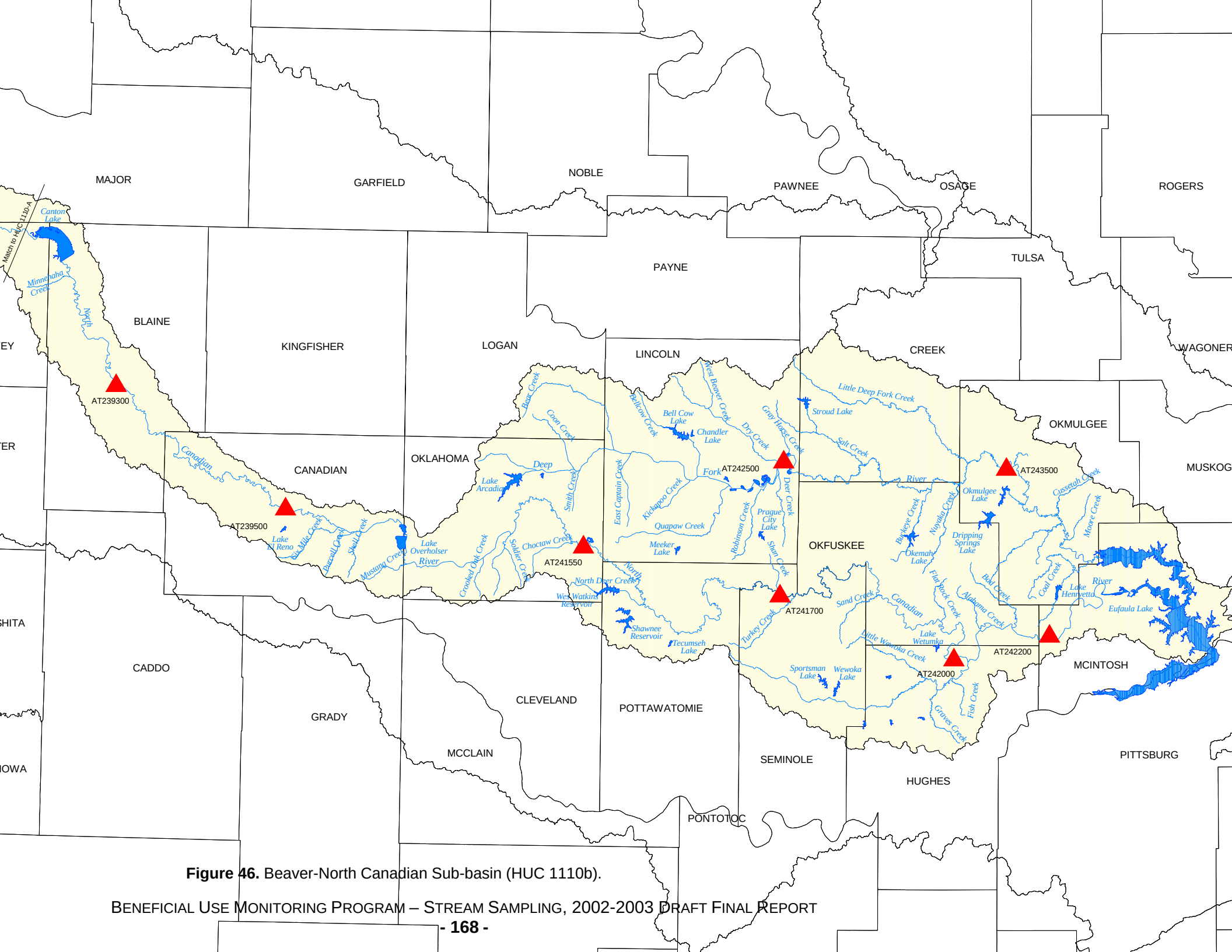


Figure 46. Beaver-North Canadian Sub-basin (HUC 1110b).

HUC 1110

BEAVER/NORTH CANADIAN SUB-BASIN

The Beaver/North Canadian sub-basin (4-digit hydrologic unit 1110) is situated in the Panhandle, northwest, and central portions of the state. It originates in Cimarron County, continues eastward through portions of Texas, Beaver, Harper, Ellis, Woodward, Major, Dewey, Blaine, Canadian, Oklahoma, Logan, Lincoln, Pottawatomie, Seminole, Creek, Okfuskee, Hughes, and Okmulgee Counties and terminates in the central part of McIntosh County. Major cities and County seats located within the basin include Boise City, Guymon, Beaver, Woodward, Watonga, El Reno, Yukon, Oklahoma City, Midwest City, Del City, Choctaw, Harrah, Edmond, Chandler, Shawnee, Tecumseh, Seminole, Bristow, Okemah, Wewoka, Okmulgee, Henryetta, and Eufaula. Minor cities of note include Goodwell, Laverne, Shattuck, Seiling, Meeker, Stroud, Prague, Wetumka, and Beggs.

The sub-basin is subdivided into nine 8-digit hydrologic units (HUC) within the state. These HUC's are the Upper Beaver (11100101), the Middle Beaver (11100102), the Coldwater (11100103), the Palo Duro (11100104), the Lower Beaver (11100201), the Lower Wolf (11100203), the Middle North Canadian (11100301), the Lower North Canadian (11100302), and the Deep Fork (11100303). The major surface water in the sub-basin is the Beaver/North Canadian River. Major tributaries include Goff Creek, Palo Duro Creek, Kiowa Creek, Clear Creek, Wolf Creek, Wewoka Creek, the Deep Fork River, and Little Deep Fork Creek. Ten major lakes are located in the sub-basin—Optima Lake formed by the Beaver River and Coldwater Creek, Fort Supply Lake formed by Wolf Creek, Canton Lake formed by the North Canadian River, Lake Overholser formed by the North Canadian River, Lake Hefner, Lake Arcadia formed by the Deep Fork River, Wes Watkins Lake formed by North Deer Creek, the Shawnee Twin Lakes, Bell Cow Lake formed by Bell Cow Creek, and the upper portion of Eufaula Lake formed by the North Canadian and Deep Fork Rivers. Sixteen active permanent water quality-monitoring stations (Table 21) are located in the basin—AT232500, AT233900, AT234000, AT234200, AT234400 (recently reactivated), AT234450, AT237050, AT237500, AT238000, AT239500, AT241550, AT241700, AT242000, AT242200, AT242500, and AT243500. Three inactive water quality-monitoring stations (AT233750, AT234250, AT234300) are located in the sub-basin and were last assessed in the 2000 BUMP report. The Laverne station will not be assessed in this report due to lack of data.

The basin is characterized by five ecoregions. The Western High Plains cover all Cimarron County, most of Texas County, and half of Beaver County. The Southwestern Tablelands begin in Texas County and terminate in Ellis and Woodward Counties. The Central Great Plains begins in Ellis County and terminates in western Oklahoma County. The Central Oklahoma/Texas Plains begin in eastern Oklahoma County and end in western Okmulgee and McIntosh Counties. The Central Irregular Plains cover eastern Okmulgee and McIntosh Counties. The primary land usage in the sub-basin is rangeland (open grasslands and woody areas). It is prevalent throughout the sub-basin with areas of concentration west central and central portions. The secondary land use is cropland, which is prevalent in the western and central portions and is interspersed throughout the eastern portion. The tertiary land uses is pastureland (brushy or mixed) and forestland (post oak, blackjack oak and bottomland hardwoods). Pastureland is prevalent in the eastern portion and is interspersed through the rest

of the sub-basin. Forestland is prevalent in the eastern part of the sub-basin. Other land uses of note are farmsteads, major urban areas, wetlands, and confined animal feeding operations.

Table 21. Permanent Ambient Trend Monitoring Stations Located in HUC 1110.

WBID #	STATION #	STATION NAME	STATUS	FS	PS	NS/T	CBD
720500020290	AT234000	Beaver River, SH 23, Beaver	Active 11/98-P	AES	NONE	AG, FWP, PBCR	NONE
720500020010	AT234450	Beaver River, US 183, Fort Supply	Active 10/00-P	AG, FWP, AES	NONE	PBCR	NONE
720500020140	AT234200	Beaver River, CR N1650, Gate	Active 10/00-P	AG, FWP, AES	NONE	PBCR	NONE
720510000190	AT232500	Beaver River, off US 64, Guymon	Active 11/98-P	AG, FWP, AES, PPWS	NONE	PBCR	NONE
720500020450	AT233900	Beaver River, US 83, Turpin	Active 10/00-P	FWP, AES	NONE	AG, PBCR	NONE
520700020010	AT243500	Deep Fork River, off SH 16, Beggs	Active 11/98-P	AG, AES, PPWS	NONE	FWP, PBCR	NONE
520700040010	AT242500	Deep Fork River, US 377, Stroud	Active 11/98-P	AG, AES	PPWS	FWP, PBCR	NONE
520500010110	AT242200	North Canadian River, Ind. Nat. Tpk., Dustin	Active 11/98-P	AG, AES, PPWS	NONE	FWP, PBCR	NONE
520530000010	AT239500	North Canadian River, US 81, El Reno	Active 11/98-P	AG, FWP, AES, PPWS	NONE	PBCR	NONE
520520000010	AT241550	North Canadian River, off US 62, Harrah	Active 11/98-P	AG, AES	NONE	FWP, PBCR	NONE
720500010010	AT238000	North Canadian River, US 281, Seiling	Active 11/98-P	AG, AES, PPWS	FWP	PBCR	NONE
520510000110	AT241700	North Canadian River, SH 3E, Shawnee	Active 10/00-P	AG	NONE	FWP, PBCR, AES	NONE
520510000010	AT242000	North Canadian River, US 75, Wetumka	Active 9/99-P	AG, PPWS	NONE	FWP, PBCR, AES	NONE
720500010140	AT237500	North Canadian River, US 412, Woodward	Active 10/00-P	AG, FWP, AES	NONE	PBCR	NONE
720500030010	AT237050	Wolf Creek, off US 270, Fort Supply	Active 11/98-P	AG, FWP, AES, PPWS	NONE	PBCR	NONE

ASSIGNED OWQS BENEFICIAL USES AND SUPPORT CODES

PPWS = PUBLIC AND PRIVATE WATER SUPPLY	EWS = EMERGENCY WATER SUPPLY
FWP = FISH & WILDLIFE PROPAGATION	PBCR = PRIMARY BODY CONTACT RECREATION
AG = AGRICULTURE	AES = AESTHETICS
FS = FULLY SUPPORTING	PS = PARTIALLY SUPPORTING
NS/T = NOT SUPPORTING/THREATENED	CBD = CANNOT BE DETERMINED

Table 22. Toxicant exceedances in HUC 1110.

STATION #	STATION NAME	DATE	Chromium (µg/L)	Copper (µg/L)	Lead (µg/L)	Selenium (µg/L)
AT234000	Beaver River, SH 23, Beaver	06/14/1999				6.00
		01/04/2000				7.00
AT243500	Deep Fork River, off SH 16, Beggs	06/26/2000			13.00	
		10/23/2000			10.00	
AT242500	Deep Fork River, US 377, Stroud	06/26/2000			17.00	
		10/23/2000	165.00		44.00	
		04/08/2002	55.00		25.00	
AT242200	North Canadian River, Indian Nations Turnpike, Dustin	05/25/1999			10.00	
		06/26/2000			13.00	
		10/23/2000			12.00	

STATION #	STATION NAME	DATE	Chromium (µg/L)	Copper (µg/L)	Lead (µg/L)	Selenium (µg/L)
		04/17/2002			20.00	
		03/18/2003			19.00	
AT241700	NORTH CANADIAN RIVER, SH 3E, SHAWNEE	10/23/2000			43.00	
		06/06/2001			15.00	
		04/15/2002			26.00	
		03/18/2003			13.00	
AT242000	NORTH CANADIAN RIVER, US 75, WETUMKA	04/26/2000			10.00	
		06/26/2000		38.00	41.00	
		06/06/2001			32.00	
		04/16/2002		27.00	27.00	
		3/19/2003			15.00	

Table 23. Exceedances of fecal coliform, enterococci, and E. coli screening limits in HUC 1110. Only values leading to a determination of not supporting for the Public and Private Water Supply and the Primary Body Contact Recreation beneficial uses are in included.

STATION #	STATION NAME	DATE	Fecal Coliform (cfu/mL)	Enterococci (cfu/mL)	*E. coli* (cfu/mL)
AT234000	BEAVER RIVER, SH 23, BEAVER	08/10/1999	2700	3200	
		09/15/1999		4300	
		06/07/2000	780	800	1043
		07/12/2000	4200	3000	
		08/09/2000		3700	413
		07/10/2001	2600	4000	2382
		08/07/2001			1199
		09/25/2001	2000		
		05/15/2002	8000	7000	3282
		06/18/2002	500	1100	
AT234450	Beaver River, US 183, Fort Supply	05/09/2001		1200	
		06/06/2001		800	
		07/11/2001		2000	
		05/14/2002		600	
		08/13/2002		3000	
AT234200	Beaver River, CR N1650, Gate	06/05/2001		600	
		09/25/2001		1000	
		05/14/2002		2000	
AT232500	Beaver River, off US 64, Guymon	09/15/1999		2700	428
		07/12/2000		490	
		09/12/2001			935
		06/18/2002		600	
		07/16/2002		6000	
		08/13/2002		21000	500

STATION #	STATION NAME	DATE	Fecal Coliform (cfu/mL)	Enterococci (cfu/mL)	*E. coli* (cfu/mL)
AT233900	Beaver River, US 83, Turpin	05/08/2001	3000		933
		06/05/2001	2100	800	
		07/10/2001	1000		1904
		08/07/2001	500	700	882
		05/15/2002		800	
		06/18/2002	28000	24000	6867
AT243500	Deep Fork River, off SH 16, Beggs	05/25/1999		420	
		06/30/1999		680	
		09/25/2000		1400	
AT242500	Deep Fork River, US 377, Stroud	06/30/1999		269000	
		09/25/2000		156000	
		06/04/2001		1900	
		09/10/2001		3000	
AT239500	North Canadian River, US 81, El Reno	05/03/2000		2300	
		07/12/2000		450	
		09/07/2000		460	
		06/06/2001		500	
		08/14/2002		6000	
		05/27/2003		500	
		07/21/2003		700	
AT241550	North Canadian River, off US 62, Harrah	06/30/1999		80000	
		06/04/2001		5000	
		08/06/2001		1300	
		09/19/2001		33000	
		05/15/2002		12000	
		07/16/2002		500	
AT242200	North Canadian River, Ind. Nat. Tpk., Dustin	06/30/1999	2210	18000	
		07/31/2000	500		
		09/25/2000	9000	34000	
		06/06/2001	700	12000	
		09/19/2001	3000	18000	
		05/15/2002	600	4000	
		08/13/2002	4000		
		06/17/2003		600	
		07/22/2003		500	
		08/06/2003	1900	900	
		09/30/2003		700	
AT238000	North Canadian River, US 281, Seiling	09/07/2000		500	
		05/14/2002		500	
		07/17/2002		900	
		08/14/2002		76000	
AT241700	North Canadian River, SH 3E, Shawnee	06/06/2001		2000	

STATION #	STATION NAME	DATE	Fecal Coliform (cfu/mL)	Enterococci (cfu/mL)	*E. coli* (cfu/mL)
		05/13/2002		5000	
		08/12/2002		5000	
		09/16/2002		1400	
		09/08/2003		500	
		09/30/2003		900	
AT242000	NORTH CANADIAN RIVER, US 75, WETUMKA	09/25/2000	3700	10000	
		05/09/2001	500		
		06/06/2001	1000	6000	
		05/13/2002	7000	34000	
		08/12/2002	900		
		05/13/2003		500	
		06/17/2003	1000	4000	
AT237500	NORTH CANADIAN RIVER, US 412, WOODWARD	07/16/2002		1900	
		08/13/2002		600	
		09/17/2002		3000	
AT237050	WOLF CREEK, OFF US 270, FORT SUPPLY	09/14/1999		410	
		07/12/2000		680	
		09/07/2000		4900	
		08/08/2001		5000	
		08/13/2002		1700	

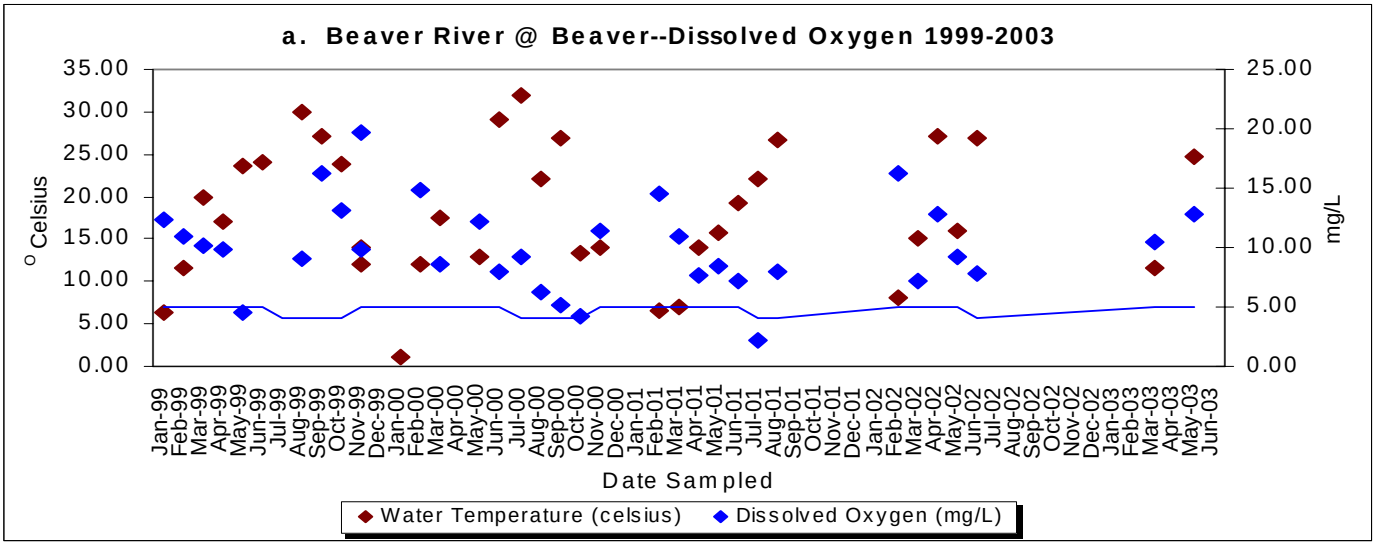
Beaver River near Beaver

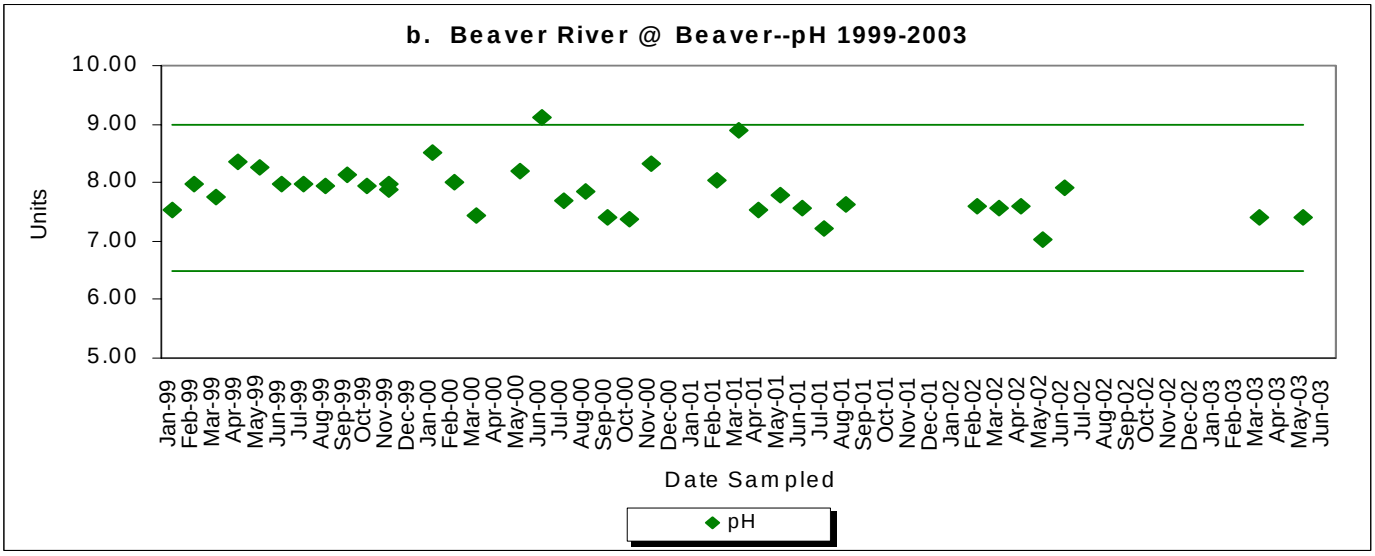
Station AT234000 (720500020290-001AT) is a permanent ambient trend monitoring station located on the Beaver River in Oklahoma. Situated in the north central portion of Beaver County, the site was established north of the City of Beaver on State Highway 23. The station is positioned near the midpoint of stream segment 720500020290 and is classified within the Middle Beaver River 8-digit HUC watershed (11100102). Water enters the stream system from several tributaries including Willow Creek, Six-mile Creek, Home Creek, and Clear Creek, among others.

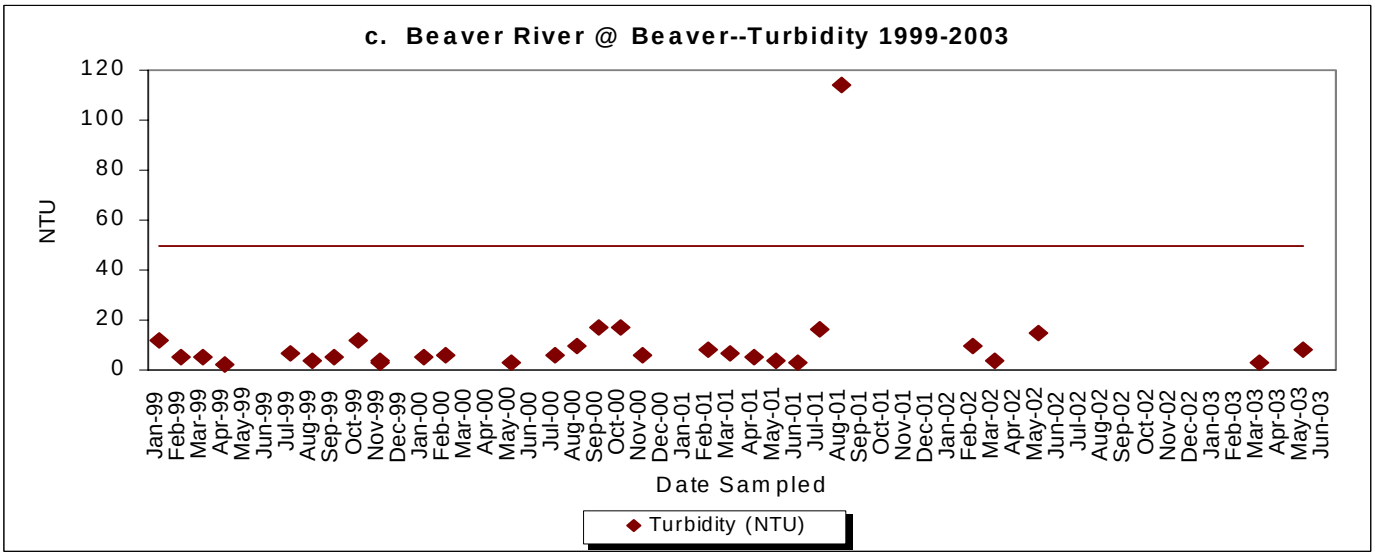
This station on the Beaver River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from January 1999 through May of 2003, when the stream went dry for the season. For purposes of reporting, this station is representative of the Beaver River from below the confluence of Sharp Creek (100.8064, 36.7972) downstream to below the confluence of Clear Creek with the Beaver River (100.4400, 36.8169). As per Appendix A, Table 7 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 2) Agriculture—Class III Irrigation (AG), 3) Primary Body Contact—Recreation (PBCR), and 4) Aesthetics.

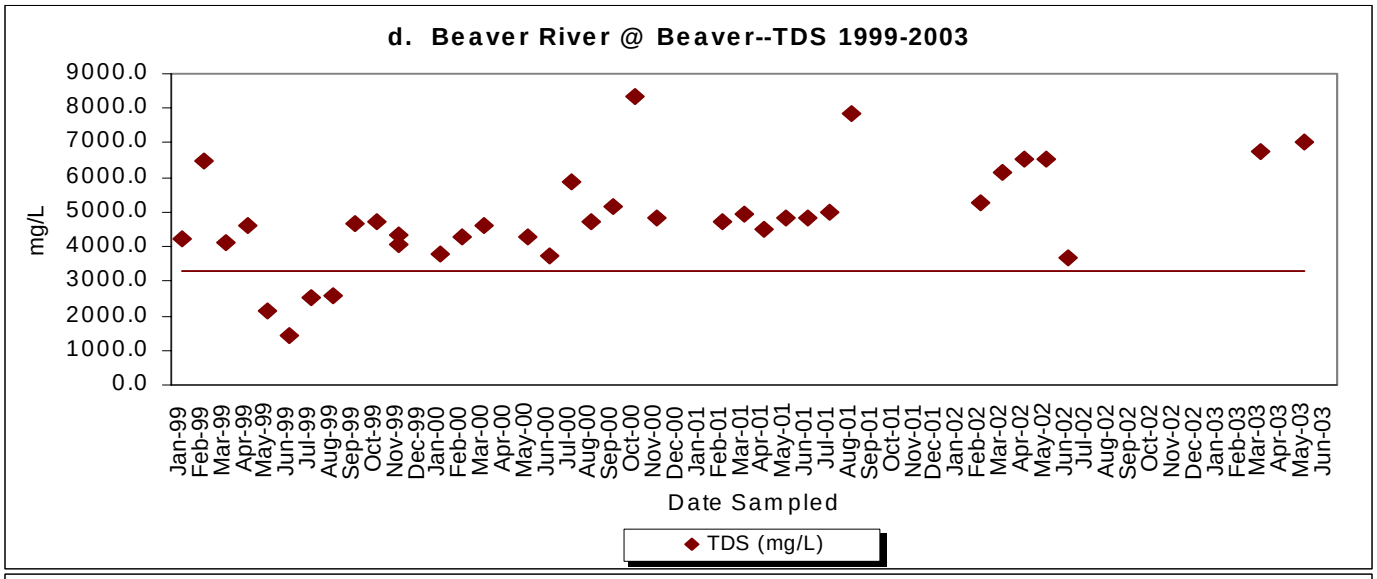
The WWAC beneficial use is not supported. Of the 11 toxicant samples collected, 2 of the selenium concentrations (or 18%) exceeded the prescribed chronic criteria of 5 µg/L (Table 22). Dissolved oxygen (Figure 47a), pH (Figure 47b), and turbidity (Figure 47c) data met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is not supported (Figure 47d and Figure 47e). Of the 36 total dissolved solids concentrations, 32 samples (or 89%) exceeded the sample standard of 3275.0 mg/L, and the geometric mean (5834.6 mg/L) exceeded the yearly mean standard (2575 mg/L). Of the 34 chloride concentrations, 31 samples (or 91%) exceeded the sample standard of 1118.0 mg/L, and the geometric mean (2152.5 mg/L) exceeded the yearly mean standard (868 mg/L). The geometric mean (886.6 mg/L) exceeded the yearly mean standard (736.0 mg/L) for sulfates. The PBCR beneficial use is not supported (Table 23). Of the 15 fecal coliform concentrations, 7 samples (or 47%) exceeded the prescribed screening level of 400 cfu/mL, and the geometric mean (407.5 cfu/mL) exceeded the prescribed mean standard of 400 cfu/mL. Of the 15 enterococci concentrations, 8 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (242.2 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. Of the 15 *E. coli* concentrations, 5 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (463.0 cfu/mL) exceeded the prescribed mean standard of 126 cfu/mL. This segment of the Beaver River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 47f).

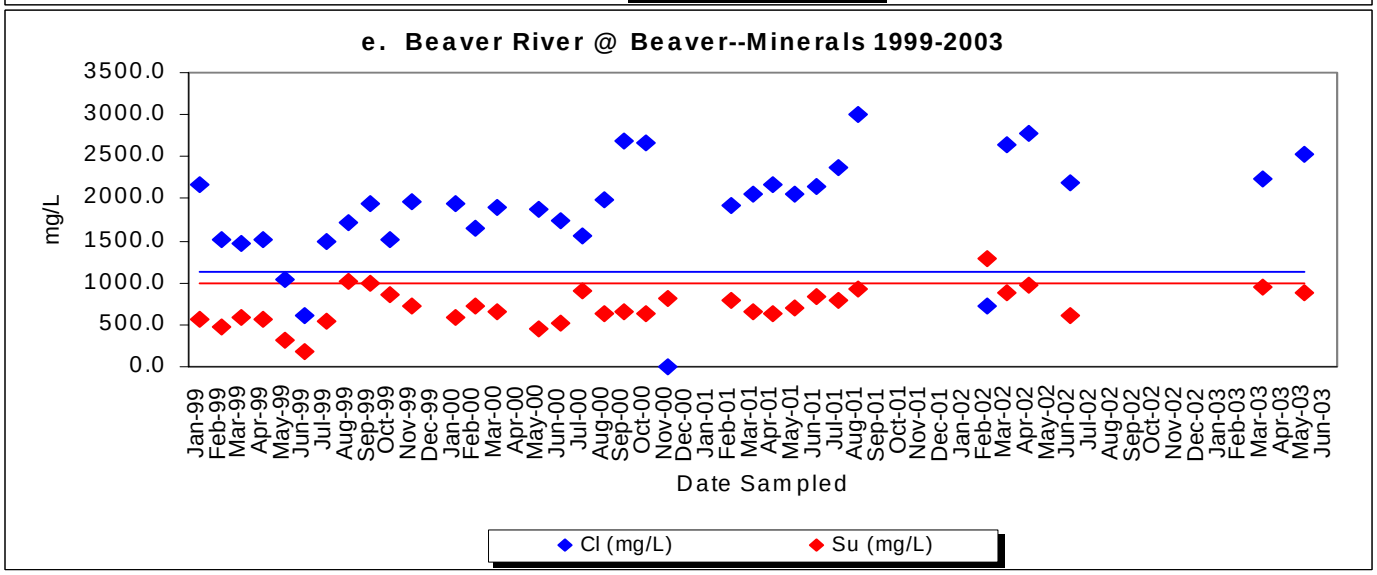
Figure 47a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Beaver River at Beaver (AT234000), 1999-2003.

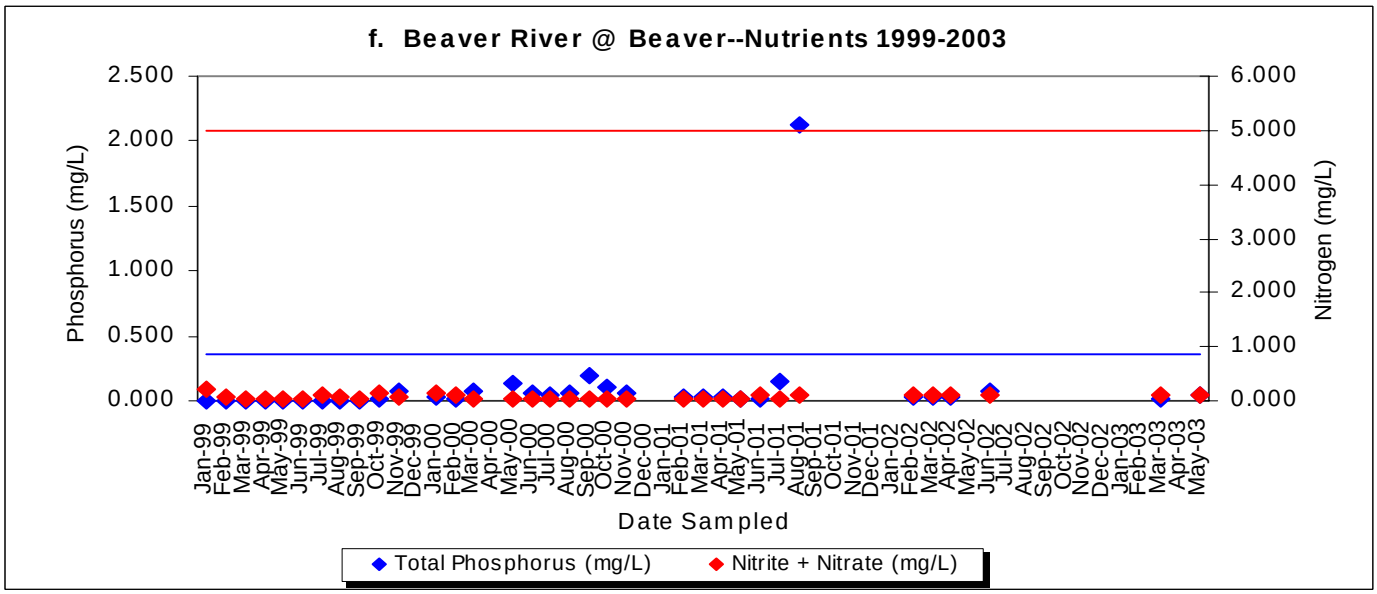







d. Beaver River @ Beaver--TDS 1999-2003
mg/L
9000.0
8000.0
7000.0
6000.0
5000.0
4000.0
3000.0
2000.0
1000.0
0.0
Date Sampled
TDS (mg/L)


e. Beaver River @ Beaver--Minerals 1999-2003
mg/L
3500.0
3000.0
2500.0
2000.0
1500.0
1000.0
500.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Beaver River @ Beaver--Nutrients 1999-2003
Phosphorus (mg/L)
2.500
2.000
1.500
1.000
0.500
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

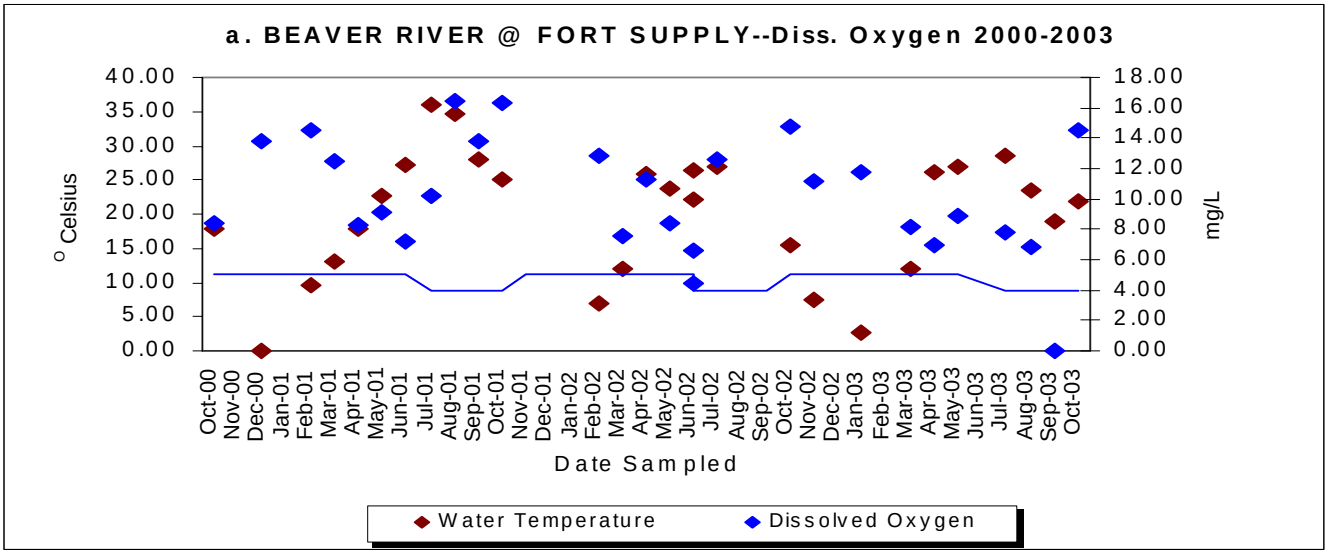
Beaver River near Fort Supply

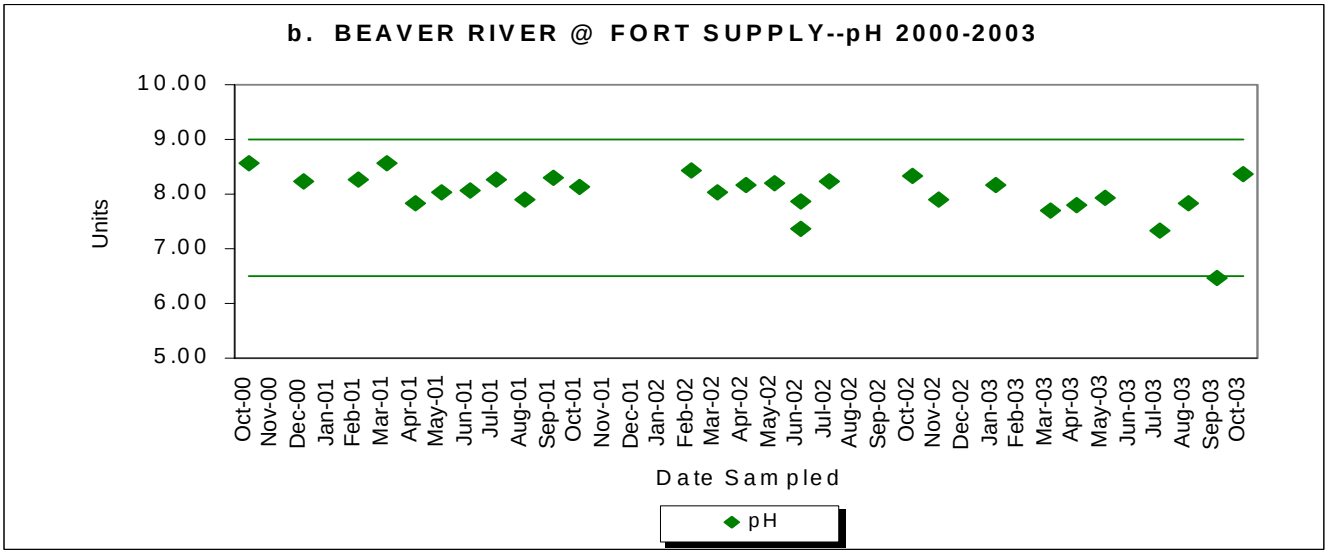
Station AT234450 (720500020010-002AT) is a permanent ambient trend monitoring station located on the Beaver River in Oklahoma. Situated in the extreme northwest corner of Woodward County, the site was established northwest of the Town of Fort Supply on US Highway 183. The station is positioned near the terminal end of stream segment 720500020010 and is classified within the Lower Beaver River 8-digit HUC watershed (11100201). Water enters the stream system from Clear Creek and Otter Creek, among others.

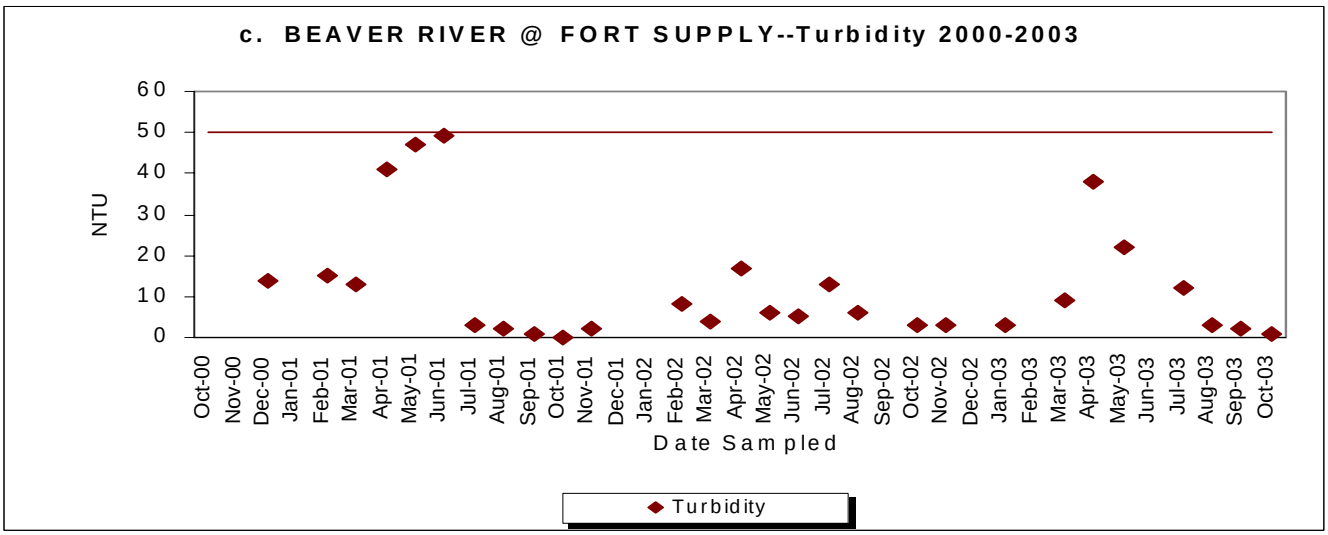
This station on the Beaver River has been active for all water quality variables since October of 2000. The following assessment of beneficial uses is based on data collected from October of 2000 through October of 2003. For purposes of reporting, this station is representative of the Beaver River from the confluence of Clear Creek (99.7681, 36.6469) downstream to the confluence of Wolf Creek with the Beaver River (99.5019, 36.5886). As per Appendix A, Table 7 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 2) Agriculture—Class III Irrigation (AG), 3) Primary Body Contact—Recreation (PBCR), and 4) Aesthetics.

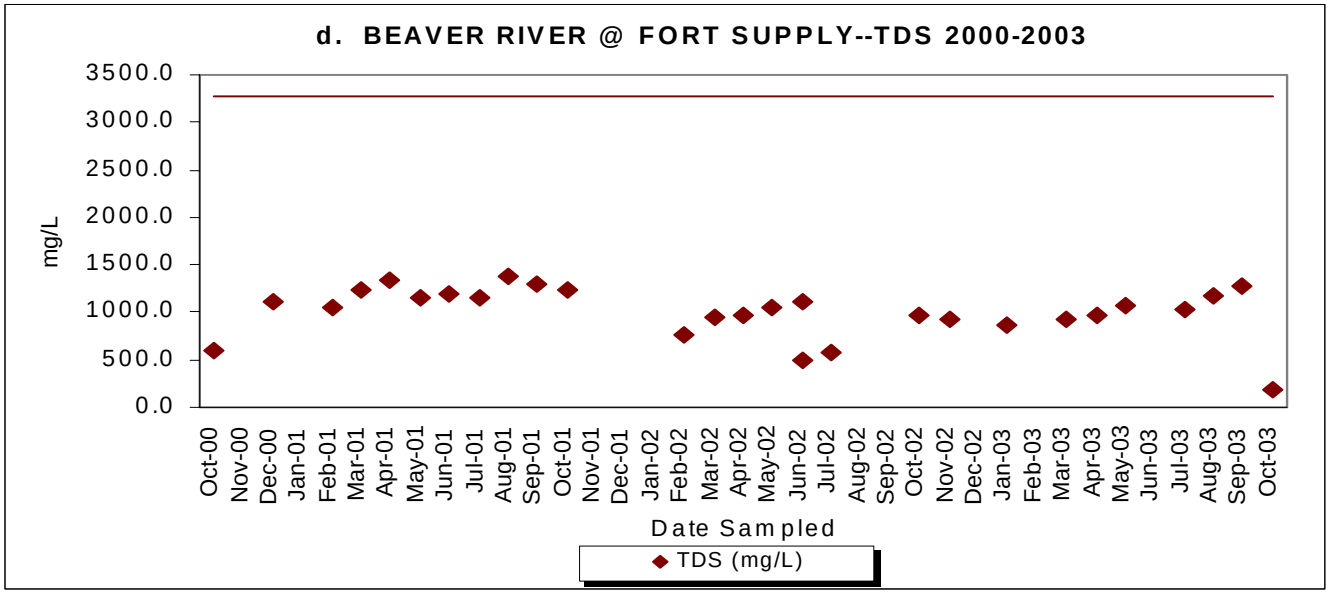
The WWAC beneficial use is supported. Dissolved oxygen (Figure 48a), pH (Figure 48b), turbidity (Figure 48c), and toxicant data met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 48d and Figure 48e). The PBCR beneficial use is not supported (Table 23). Of the 10 enterococci concentrations, 5 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (429.4 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Beaver River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 48f).

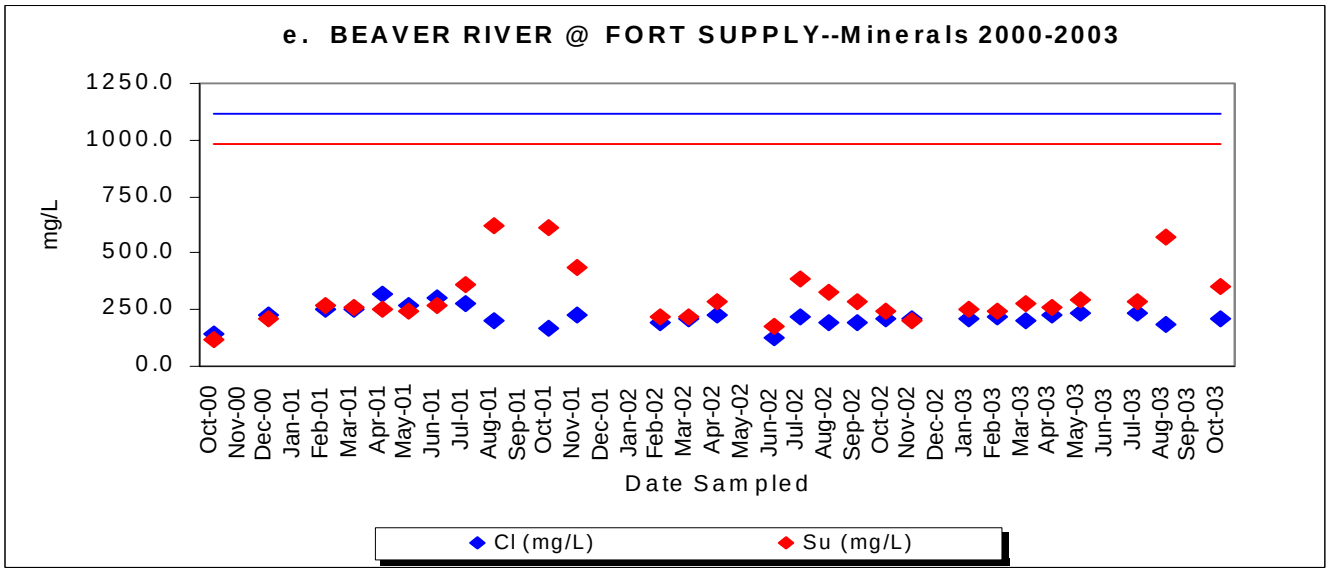
Figure 48a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Beaver River at Fort Supply (AT234450), 2000-2003.

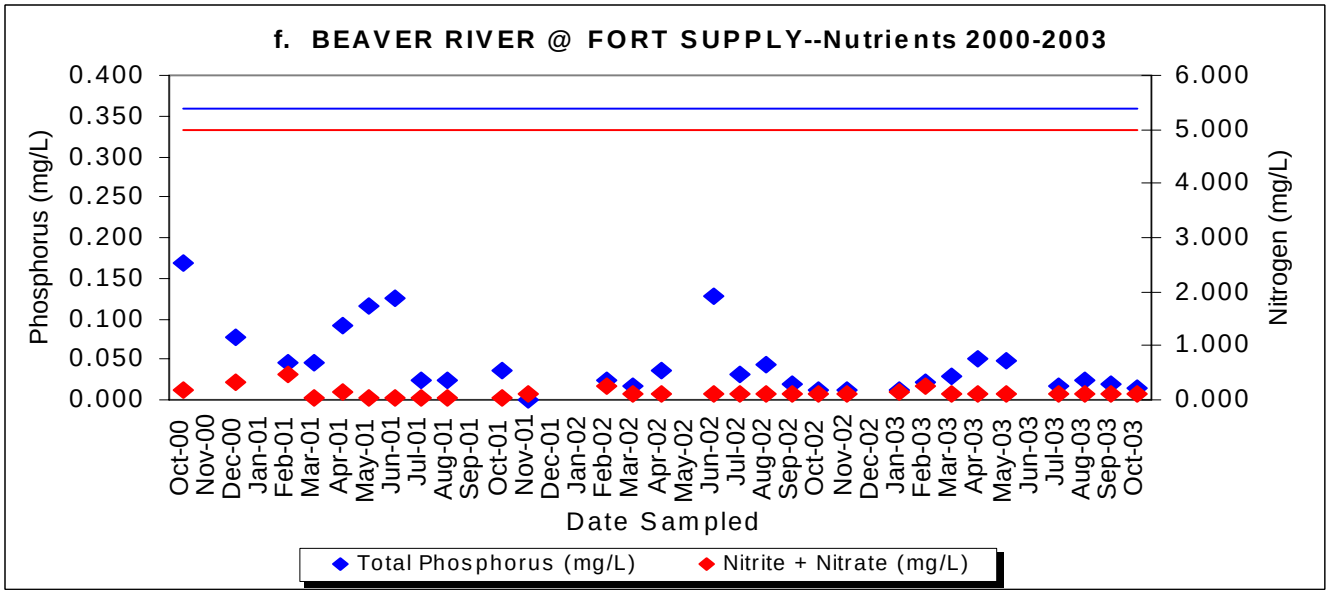







d. BEAVER RIVER @ FORT SUPPLY--TDS 2000-2003
mg/L
3500.0
3000.0
2500.0
2000.0
1500.0
1000.0
500.0
0.0
Oct-00 Nov-00 Dec-00 Jan-01 Feb-01 Mar-01 Apr-01 May-01 Jun-01 Jul-01 Aug-01 Sep-01 Oct-01 Nov-01 Dec-01 Jan-02 Feb-02 Mar-02 Apr-02 May-02 Jun-02 Jul-02 Aug-02 Sep-02 Oct-02 Nov-02 Dec-02 Jan-03 Feb-03 Mar-03 Apr-03 May-03 Jun-03 Jul-03 Aug-03 Sep-03 Oct-03
Date Sampled
TDS (mg/L)


e. BEAVER RIVER @ FORT SUPPLY--Minerals 2000-2003
mg/L
1250.0
1000.0
750.0
500.0
250.0
0.0
Oct-00 Nov-00 Dec-00 Jan-01 Feb-01 Mar-01 Apr-01 May-01 Jun-01 Jul-01 Aug-01 Sep-01 Oct-01 Nov-01 Dec-01 Jan-02 Feb-02 Mar-02 Apr-02 May-02 Jun-02 Jul-02 Aug-02 Sep-02 Oct-02 Nov-02 Dec-02 Jan-03 Feb-03 Mar-03 Apr-03 May-03 Jun-03 Jul-03 Aug-03 Sep-03 Oct-03
Date Sampled
Cl (mg/L)
Su (mg/L)


f. BEAVER RIVER @ FORT SUPPLY--Nutrients 2000-2003
Phosphorus (mg/L)
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Oct-00 Nov-00 Dec-00 Jan-01 Feb-01 Mar-01 Apr-01 May-01 Jun-01 Jul-01 Aug-01 Sep-01 Oct-01 Nov-01 Dec-01 Jan-02 Feb-02 Mar-02 Apr-02 May-02 Jun-02 Jul-02 Aug-02 Sep-02 Oct-02 Nov-02 Dec-02 Jan-03 Feb-03 Mar-03 Apr-03 May-03 Jun-03 Jul-03 Aug-03 Sep-03 Oct-03
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

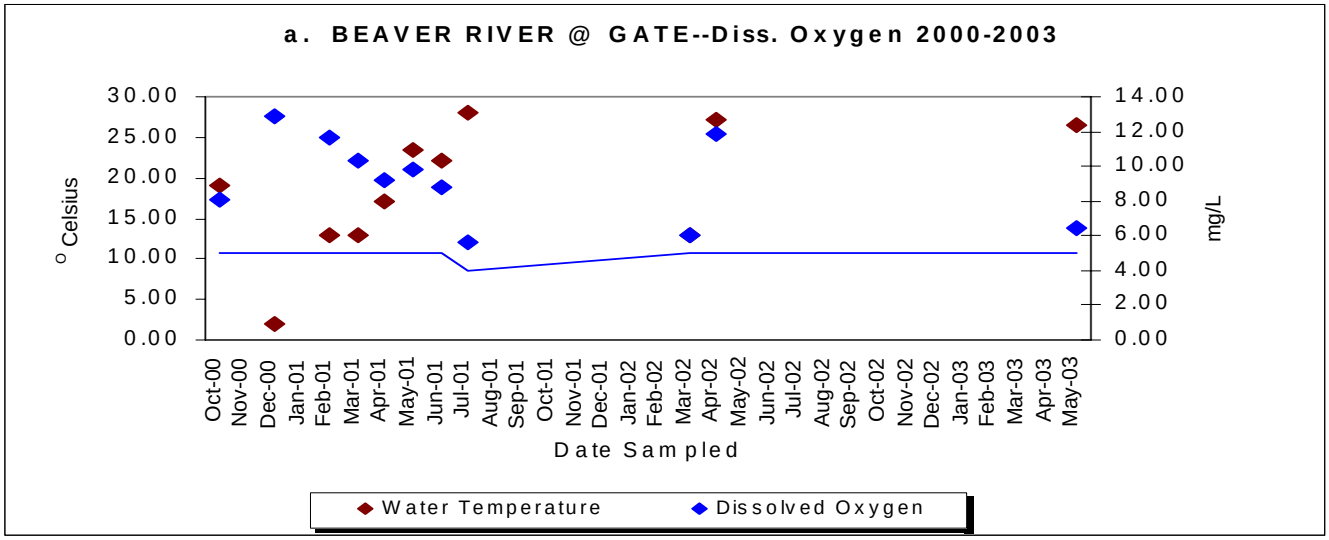
Beaver River near Gate

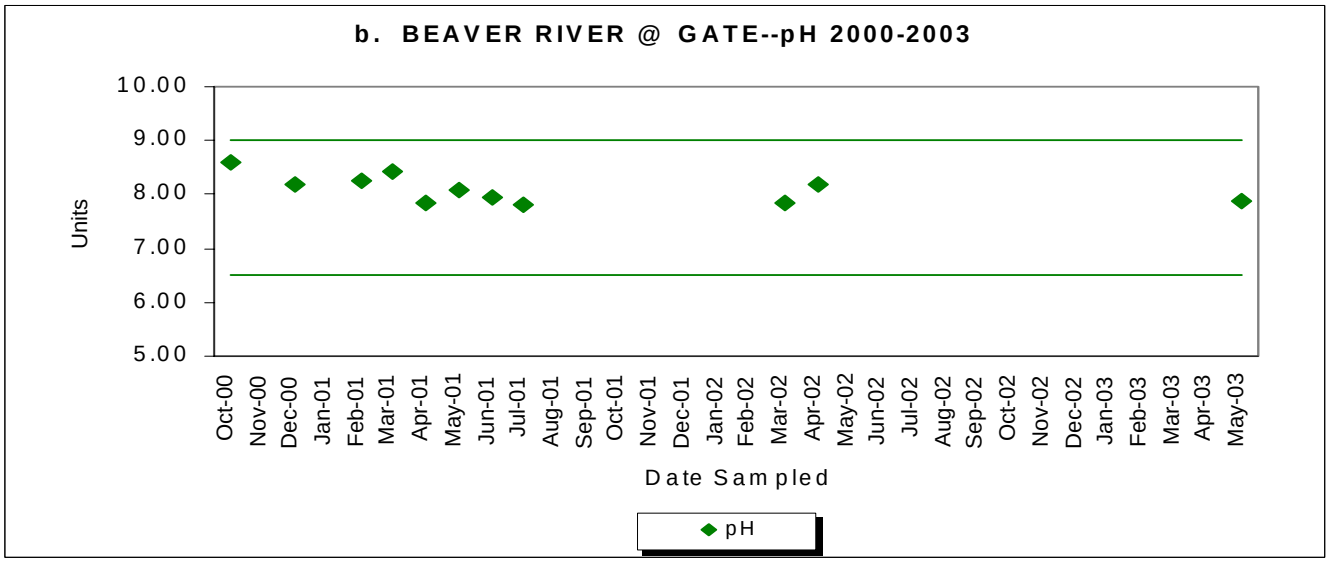
Station AT234200 (720500020140-001AT) is a permanent ambient trend monitoring station located on the Beaver River in Oklahoma. Situated in the east central portion of Beaver County, the site was established south of the Town of Gate on County Road 1650N. The station is positioned near the terminal end of stream segment 720500020140 and is classified within the Lower Beaver River 8-digit HUC watershed (11100201). Water enters the stream system from Clear Creek, Duck Pond Creek, and Mexico Creek (Evans Chambers Lake), among others.

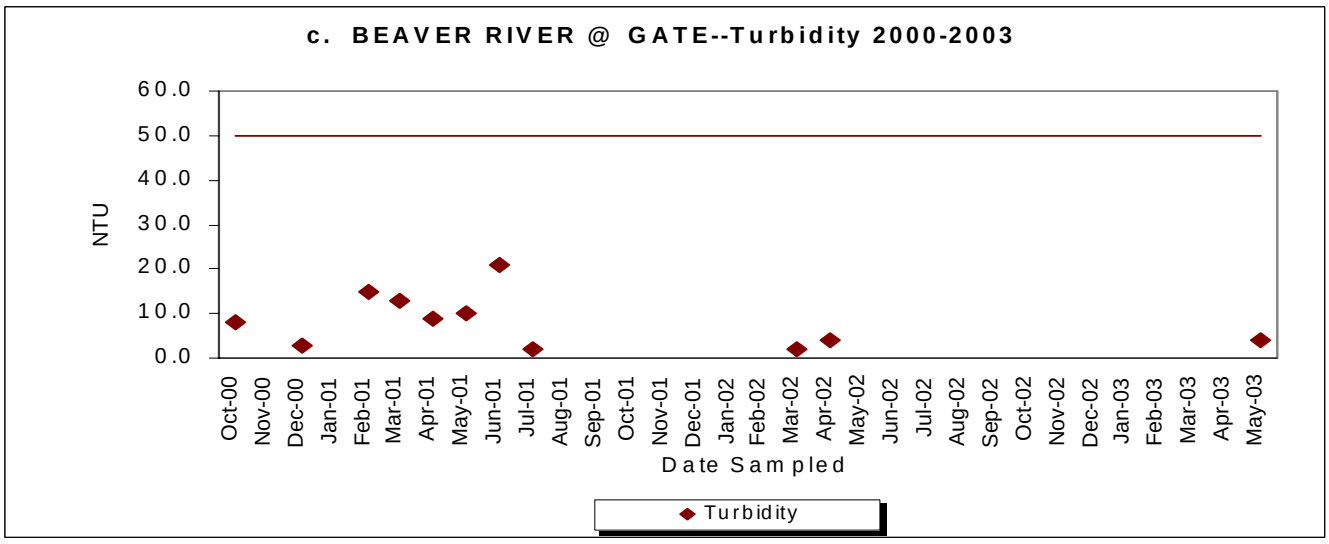
This station on the Beaver River has been active for all water quality variables since October of 2000. The following assessment of beneficial uses is based on data collected from October of 2000 through May of 2003, when the stream went dry for the season. For purposes of reporting, this station is representative of the Beaver River from the confluence of Clear Creek (100.4400, 36.8169) downstream to the confluence of the Beaver River with Kiowa Creek (99.9060, 36.7591). As per Appendix A, Table 7 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 2) Agriculture—Class III Irrigation (AG), 3) Primary Body Contact—Recreation (PBCR), and 4) Aesthetics.

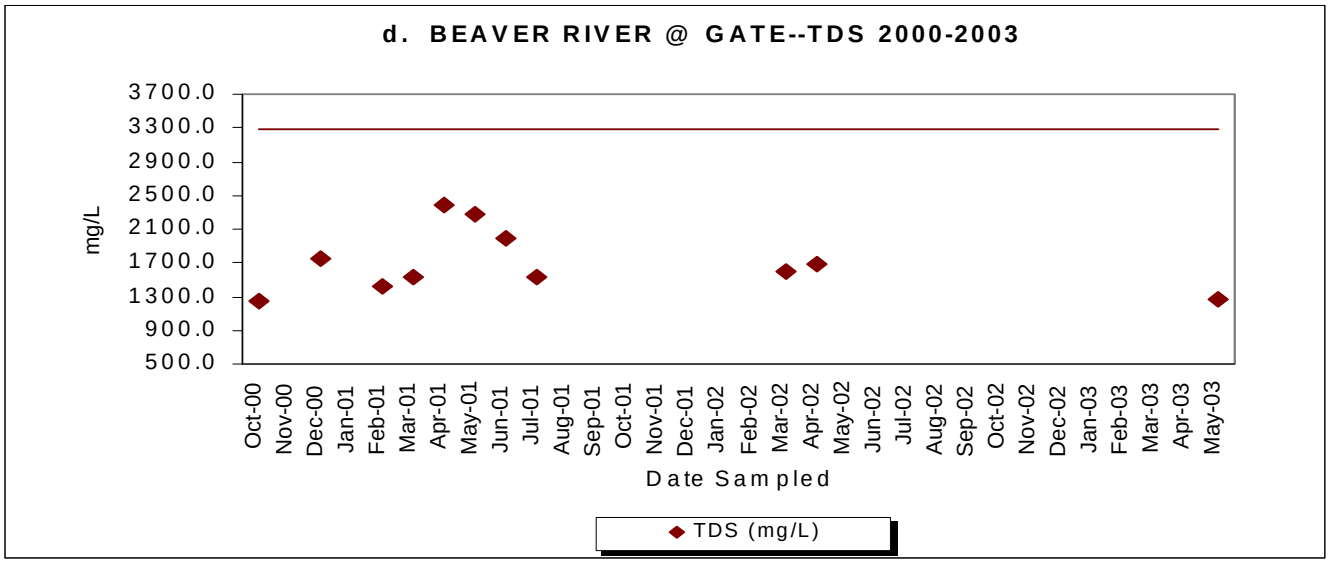
The WWAC beneficial use is supported. Dissolved oxygen (Figure 49a), pH (Figure 49b), and turbidity (Figure 49c) data met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 49d and Figure 49e). The PBCR beneficial use is not supported (Table 23). Of the 5 enterococci concentrations, 3 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (186.1 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Beaver River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 49f).

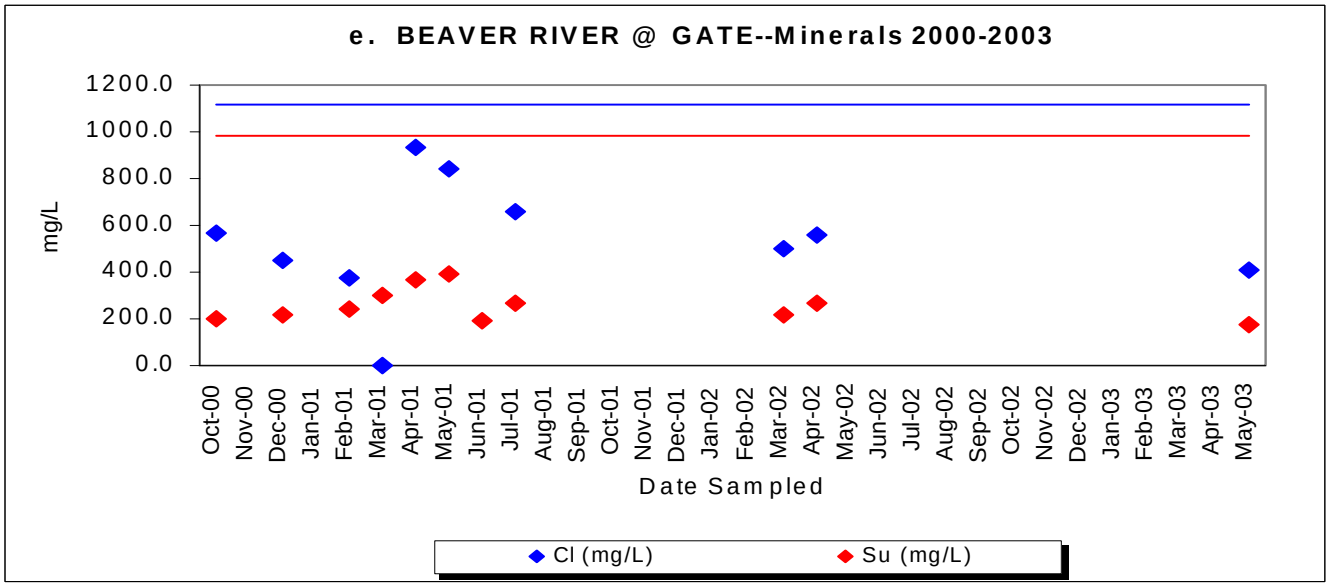
Figure 49a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Beaver River at Gate (AT234200), 2000-2003.

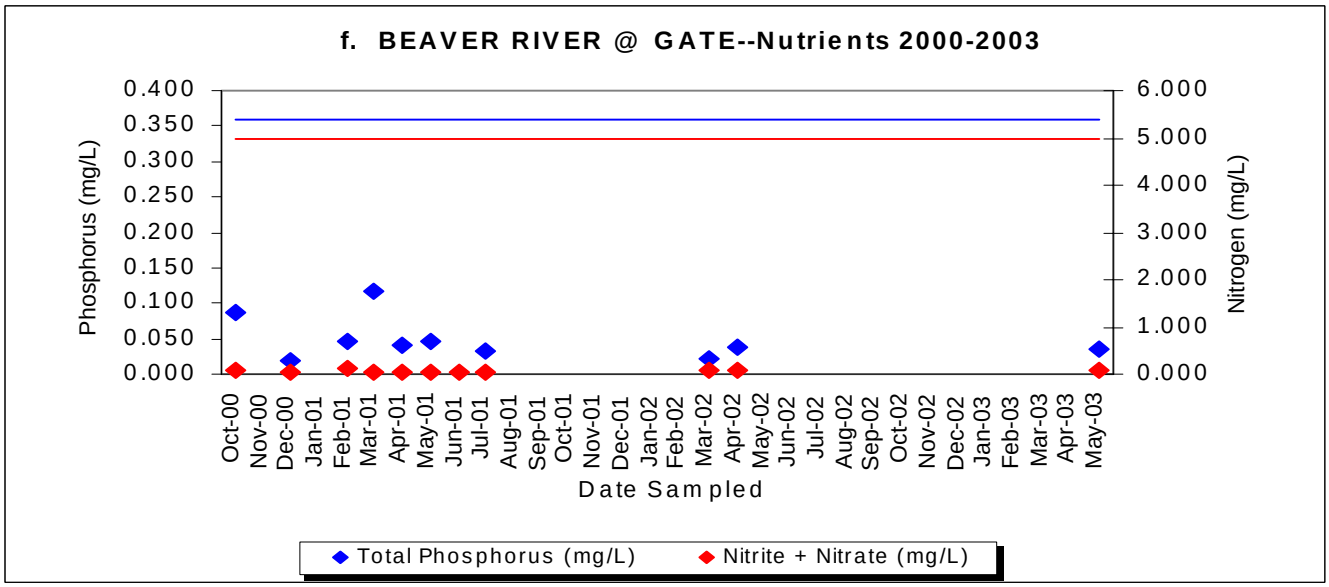







d. BEAVER RIVER @ GATE--TDS 2000-2003
mg/L
3700.0
3300.0
2900.0
2500.0
2100.0
1700.0
1300.0
900.0
500.0
Oct-00 Nov-00 Dec-00 Jan-01 Feb-01 Mar-01 Apr-01 May-01 Jun-01 Jul-01 Aug-01 Sep-01 Oct-01 Nov-01 Dec-01 Jan-02 Feb-02 Mar-02 Apr-02 May-02 Jun-02 Jul-02 Aug-02 Sep-02 Oct-02 Nov-02 Dec-02 Jan-03 Feb-03 Mar-03 Apr-03 May-03
Date Sampled
TDS (mg/L)


e. BEAVER RIVER @ GATE--Minerals 2000-2003
mg/L
1200.0
1000.0
800.0
600.0
400.0
200.0
0.0
Oct-00 Nov-00 Dec-00 Jan-01 Feb-01 Mar-01 Apr-01 May-01 Jun-01 Jul-01 Aug-01 Sep-01 Oct-01 Nov-01 Dec-01 Jan-02 Feb-02 Mar-02 Apr-02 May-02 Jun-02 Jul-02 Aug-02 Sep-02 Oct-02 Nov-02 Dec-02 Jan-03 Feb-03 Mar-03 Apr-03 May-03
Date Sampled
Cl (mg/L)
Su (mg/L)


f. BEAVER RIVER @ GATE--Nutrients 2000-2003
Phosphorus (mg/L)
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Oct-00 Nov-00 Dec-00 Jan-01 Feb-01 Mar-01 Apr-01 May-01 Jun-01 Jul-01 Aug-01 Sep-01 Oct-01 Nov-01 Dec-01 Jan-02 Feb-02 Mar-02 Apr-02 May-02 Jun-02 Jul-02 Aug-02 Sep-02 Oct-02 Nov-02 Dec-02 Jan-03 Feb-03 Mar-03 Apr-03 May-03
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

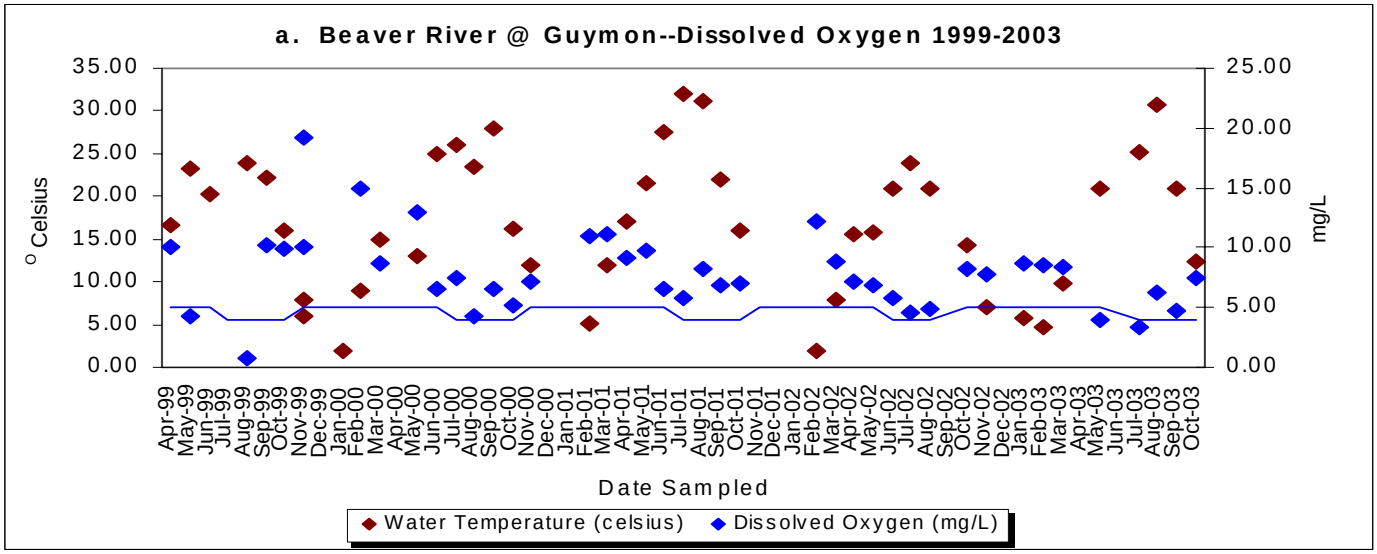
Beaver River near Guymon

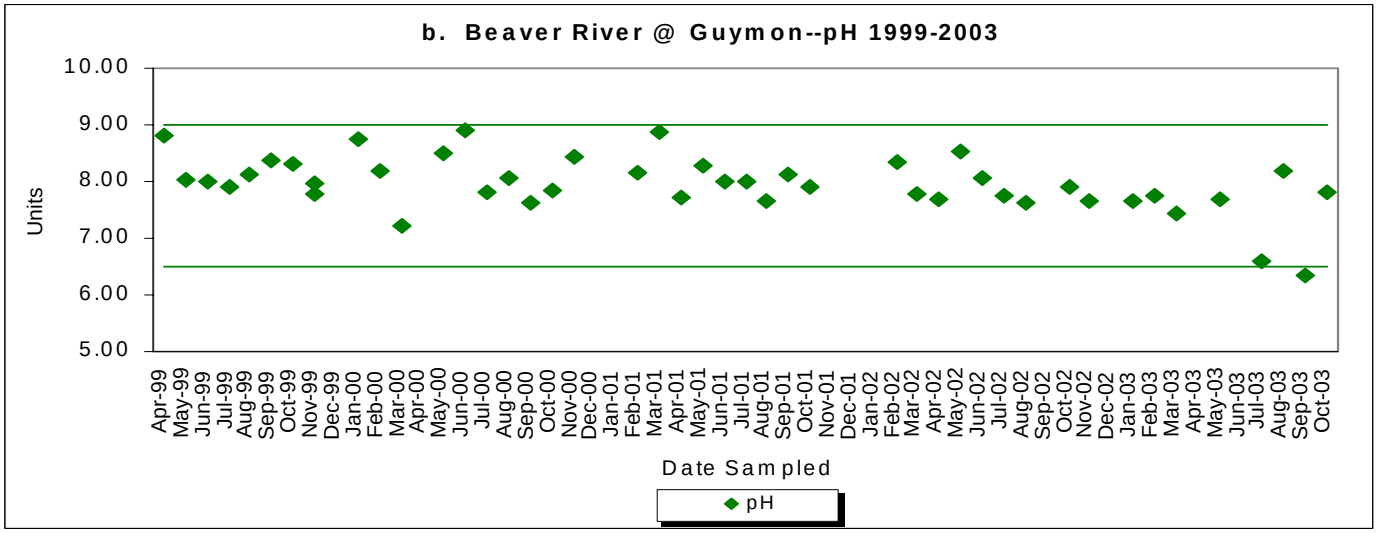
Station AT232500 (720510000190-001AT) is a permanent ambient trend monitoring station located on the Beaver River in Oklahoma. Situated in the central portion of Texas County, the site was established west of the City of Guymon off of US Highway 64 on County Road 40. The station is positioned near the midpoint of stream segment 720510000190 and is classified within the Upper Beaver River 8-digit HUC watershed (11100101). Water enters the stream system from several tributaries including Sand Creek, Tepee Creek, Dry Sand Creek, and Goff Creek, among others.

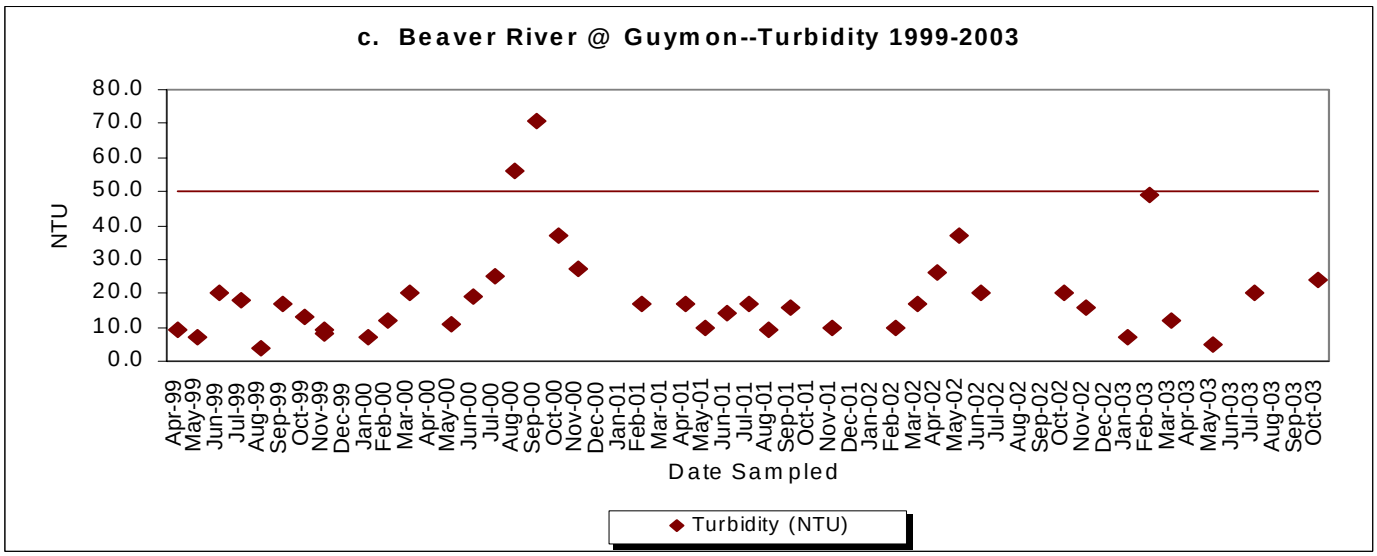
This station on the Beaver River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from April of 1999 through October of 2003. For purposes of reporting, this station is representative of the Beaver River from the confluence of Sand Creek (101.7692, 36.5976) downstream to confluence of Goff Creek with the Beaver River (101.4709, 36.7255). As per Appendix A, Table 7 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

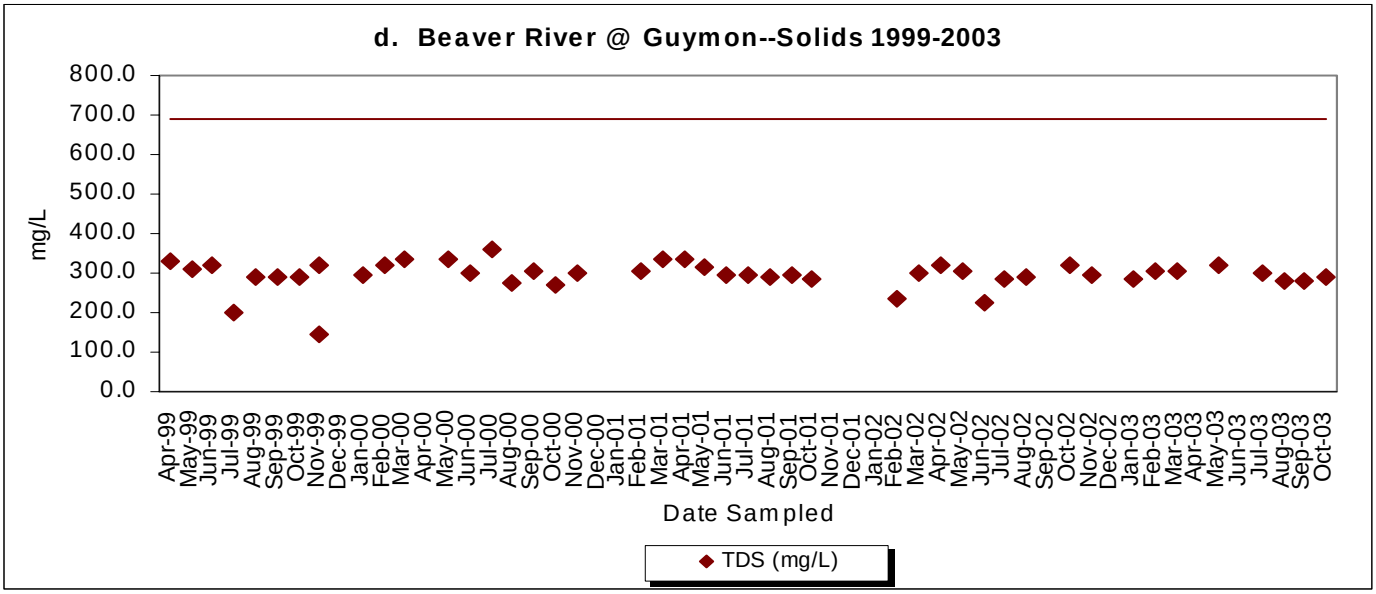
The PPWS beneficial use is supported. The WWAC beneficial use is supported. Dissolved oxygen (Figure 50a), pH (Figure 50b), turbidity (Figure 50c), and toxicant data met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 50d and Figure 50e). The PBCR beneficial use is not supported (Table 23). Of the 16 enterococci concentrations, 5 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (186.1 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. Of the 16 *E. coli* concentrations, 3 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (174.5 cfu/mL) exceeded the prescribed mean standard of 126 cfu/mL. This segment of the Beaver River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 50f).

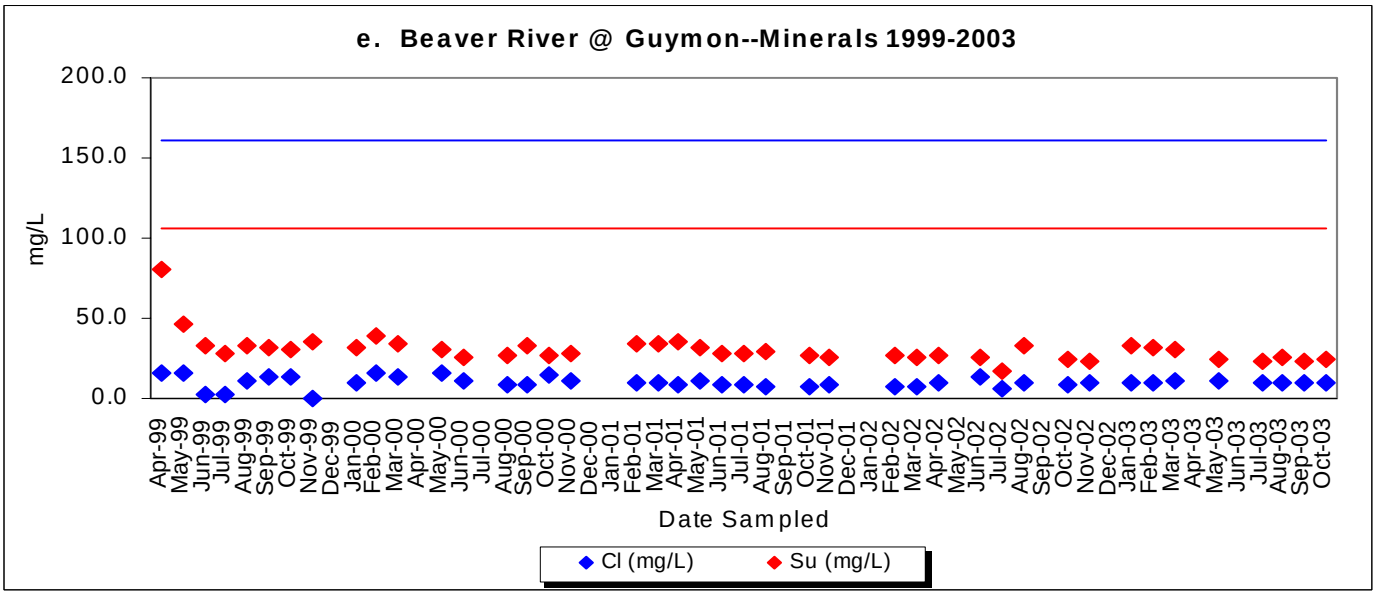
Figure 50a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Beaver River at Guymon (AT232500), 1999-2003.

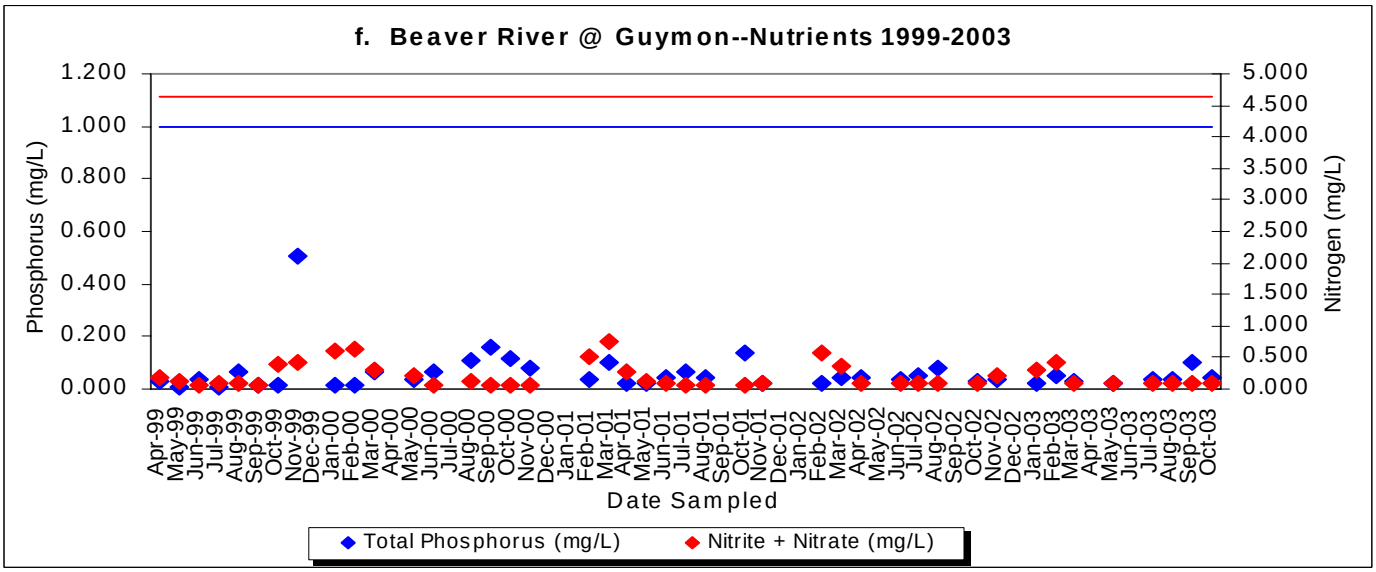







d. Beaver River @ Guymon--Solids 1999-2003
mg/L
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Date Sampled
TDS (mg/L)


e. Beaver River @ Guymon--Minerals 1999-2003
mg/L
200.0
150.0
100.0
50.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Beaver River @ Guymon--Nutrients 1999-2003
Phosphorus (mg/L)
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Nitrogen (mg/L)
5.000
4.500
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

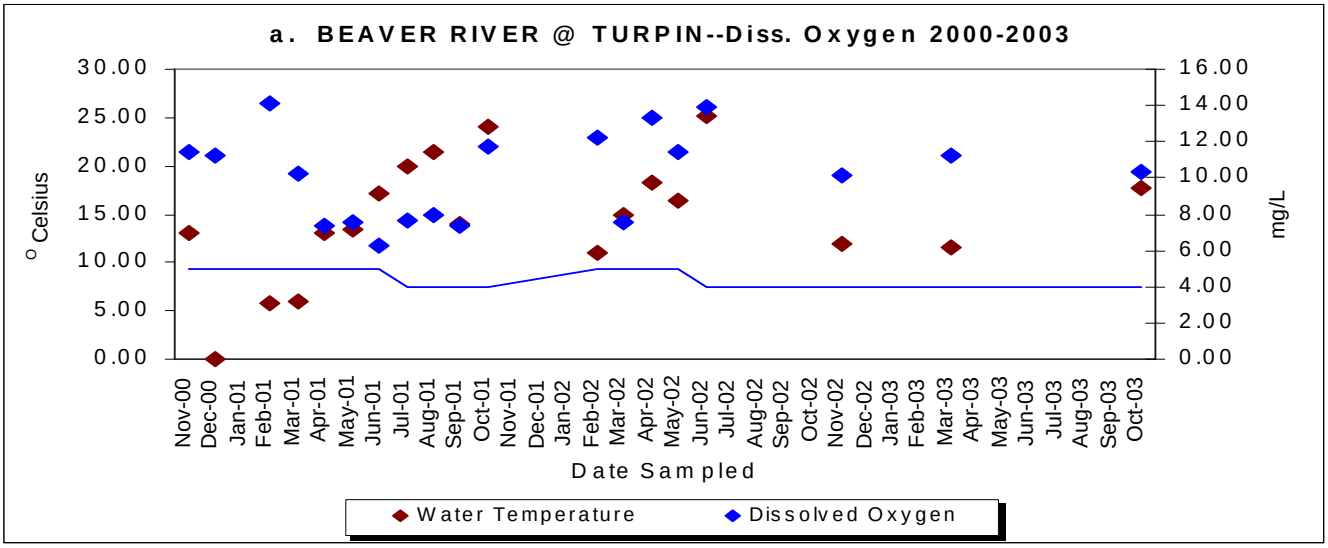
Beaver River near Turpin

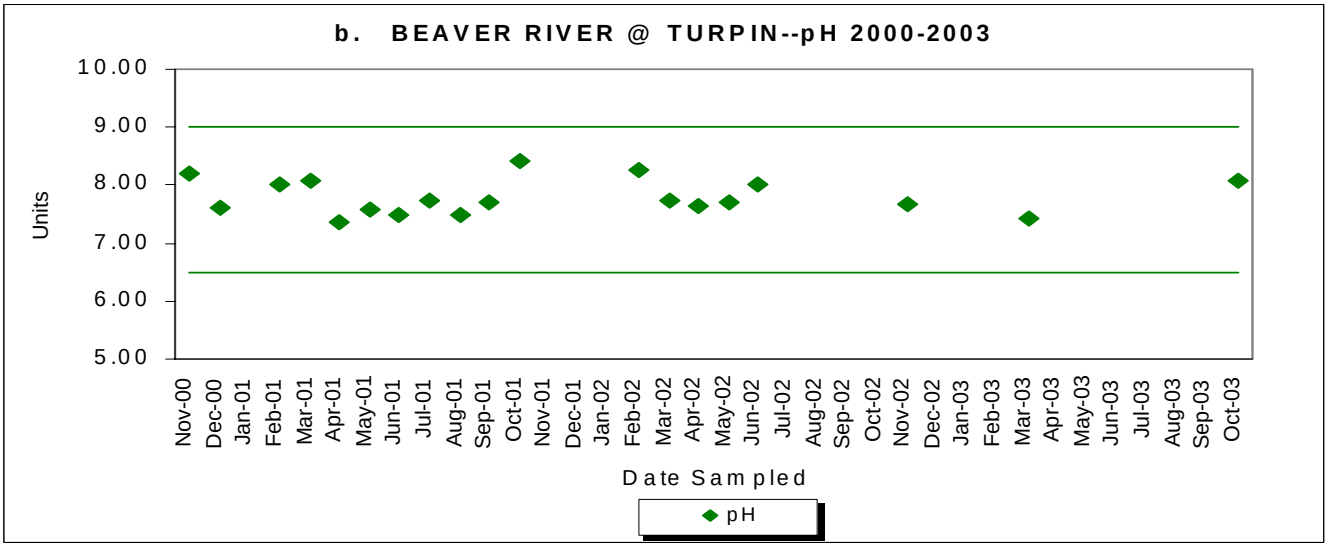
Station AT233900 (720500020450-001AT) is a permanent ambient trend monitoring station located on the Beaver River in Oklahoma. Situated in the west central portion of Beaver County, the site was established south of the Town of Turpin on US Highway 83. The station is positioned near the terminal end of stream segment 720500020450 and is classified within the Middle Beaver River 8-digit HUC watershed (11100102). Water enters the stream system from Optima Lake and from several tributaries including Fulton Creek (Palo Duro Creek), Bull Creek, and Jackson Creek, among others.

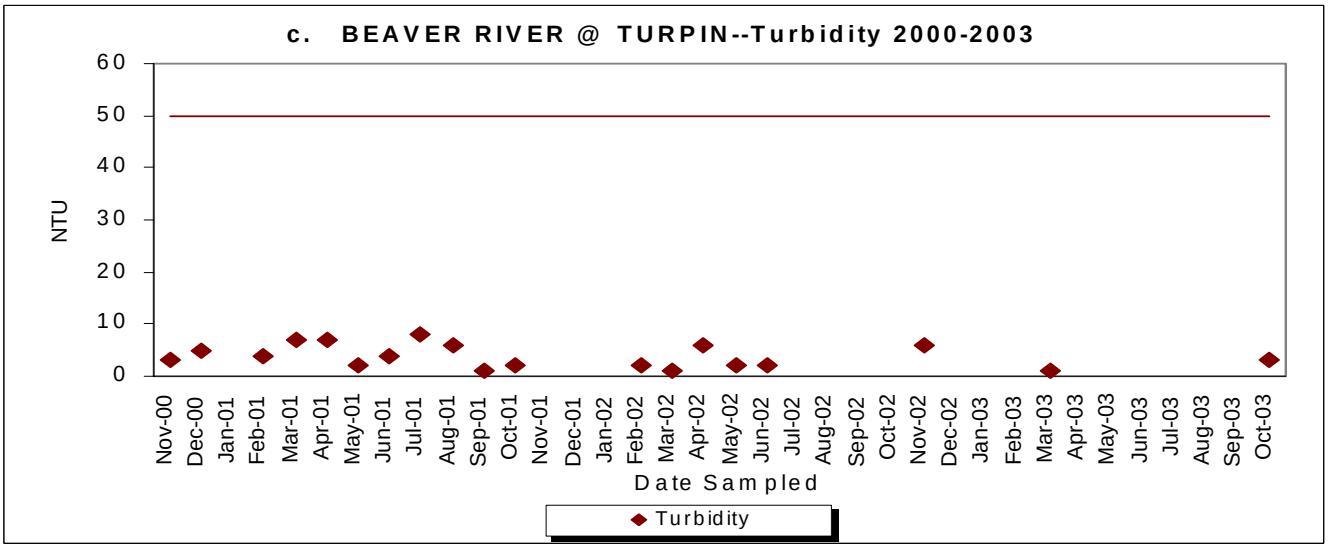
This station on the Beaver River has been active for all water quality variables since October of 2000. The following assessment of beneficial uses is based on data collected from November of 2000 through October of 2003. For purposes of reporting, this station is representative of the Beaver River from just downstream of Optima Lake (101.0968, 36.6651) downstream to the confluence of the Beaver River with Sharp Creek (100.8064, 36.7972). As per Appendix A, Table 7 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 2) Agriculture—Class III Irrigation (AG), 3) Primary Body Contact—Recreation (PBCR), and 4) Aesthetics.

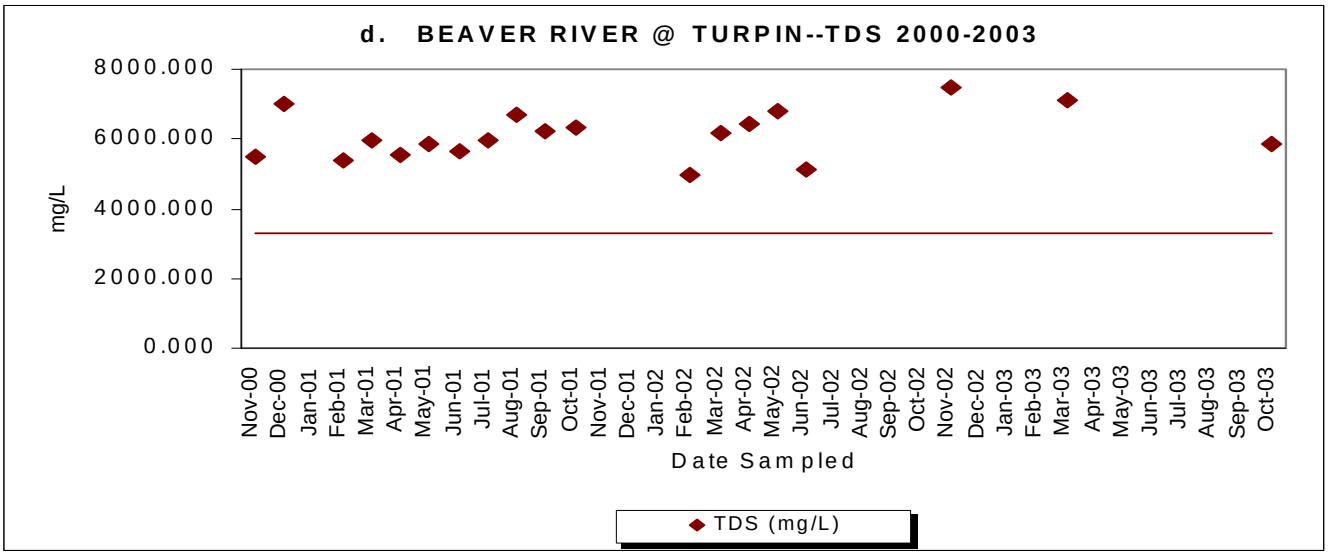
The WWAC beneficial use is supported. Dissolved oxygen (Figure 51a), pH (Figure 51b), turbidity (Figure 51c), and toxicant data met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is not supported (Figure 51d and Figure 51e). Of the 19 total dissolved solids concentrations, 19 samples (or 100%) exceeded the sample standard of 3275.0 mg/L, and the geometric mean (6183.7 mg/L) exceeded the yearly mean standard (2575 mg/L). Of the 17 chloride concentrations, 15 samples (or 88%) exceeded the sample standard of 1118.0 mg/L, and the geometric mean (2141.8 mg/L) exceeded the yearly mean standard (868 mg/L). Sulfate values met the segment-specific criteria. The PBCR beneficial use is not supported (Table 23). Of the 7 fecal coliform concentrations, 5 samples (or 50% of the required 10) exceeded the prescribed screening level of 400 cfu/mL, and the geometric mean (660.8 cfu/mL) exceeded the prescribed mean standard of 400 cfu/mL. Of the 6 enterococci concentrations, 4 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (312.4 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. Of the 7 *E. coli* concentrations, 4 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (577.5 cfu/mL) exceeded the prescribed mean standard of 126 cfu/mL. This segment of the Beaver River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 51f).

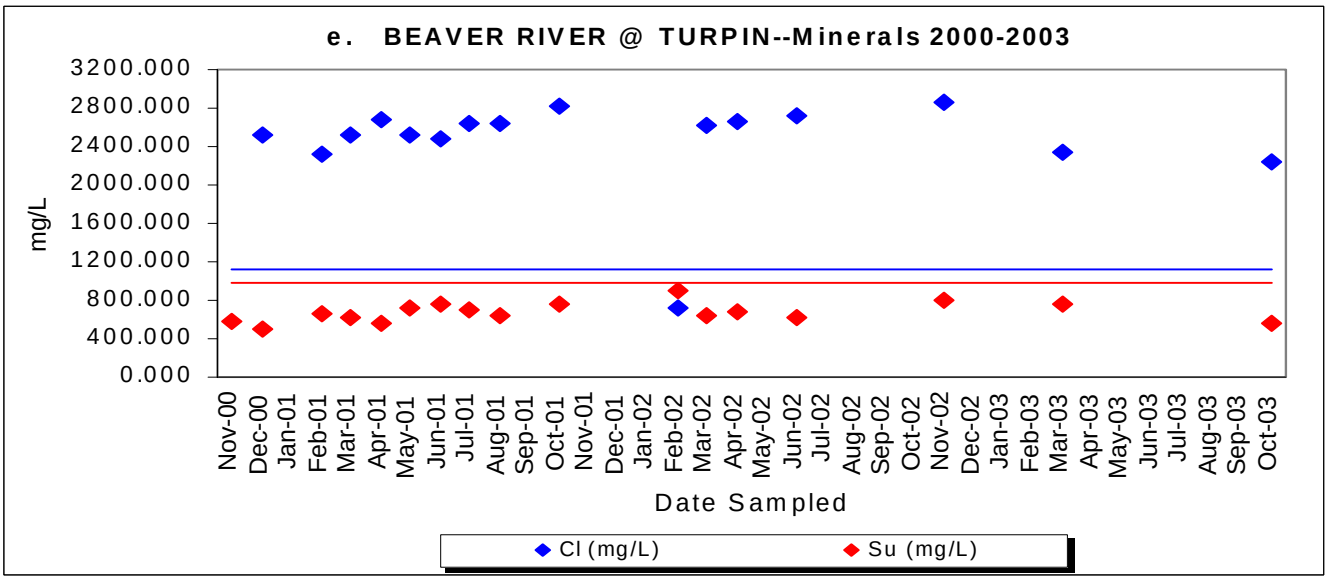
Figure 51a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Beaver River at Turpin (AT233900), 2000-2003.

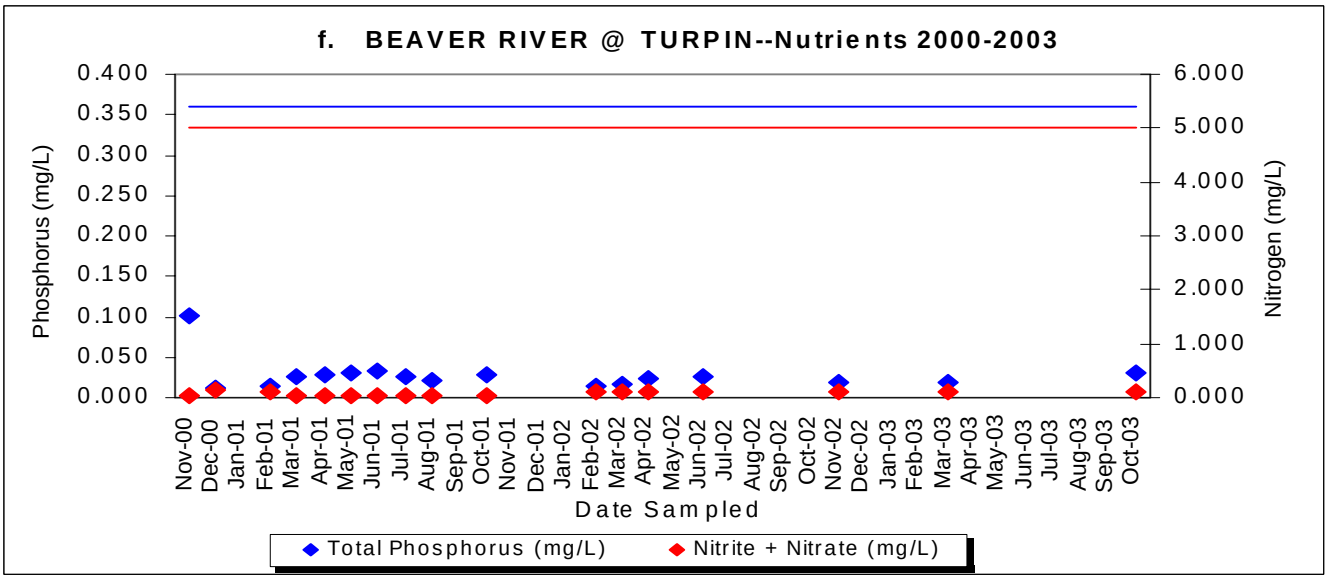







d. BEAVER RIVER @ TURPIN--TDS 2000-2003
mg/L
8000.000
6000.000
4000.000
2000.000
0.000
Nov-00 Dec-00 Jan-01 Feb-01 Mar-01 Apr-01 May-01 Jun-01 Jul-01 Aug-01 Sep-01 Oct-01 Nov-01 Dec-01 Jan-02 Feb-02 Mar-02 Apr-02 May-02 Jun-02 Jul-02 Aug-02 Sep-02 Oct-02 Nov-02 Dec-02 Jan-03 Feb-03 Mar-03 Apr-03 May-03 Jun-03 Jul-03 Aug-03 Sep-03 Oct-03
Date Sampled
TDS (mg/L)


e. BEAVER RIVER @ TURPIN--Minerals 2000-2003
mg/L
3200.000
2800.000
2400.000
2000.000
1600.000
1200.000
800.000
400.000
0.000
Nov-00 Dec-00 Jan-01 Feb-01 Mar-01 Apr-01 May-01 Jun-01 Jul-01 Aug-01 Sep-01 Oct-01 Nov-01 Dec-01 Jan-02 Feb-02 Mar-02 Apr-02 May-02 Jun-02 Jul-02 Aug-02 Sep-02 Oct-02 Nov-02 Dec-02 Jan-03 Feb-03 Mar-03 Apr-03 May-03 Jun-03 Jul-03 Aug-03 Sep-03 Oct-03
Date Sampled
Cl (mg/L)
Su (mg/L)


f. BEAVER RIVER @ TURPIN--Nutrients 2000-2003
Phosphorus (mg/L)
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Nov-00 Dec-00 Jan-01 Feb-01 Mar-01 Apr-01 May-01 Jun-01 Jul-01 Aug-01 Sep-01 Oct-01 Nov-01 Dec-01 Jan-02 Feb-02 Mar-02 Apr-02 May-02 Jun-02 Jul-02 Aug-02 Sep-02 Oct-02 Nov-02 Dec-02 Jan-03 Feb-03 Mar-03 Apr-03 May-03 Jun-03 Jul-03 Aug-03 Sep-03 Oct-03
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

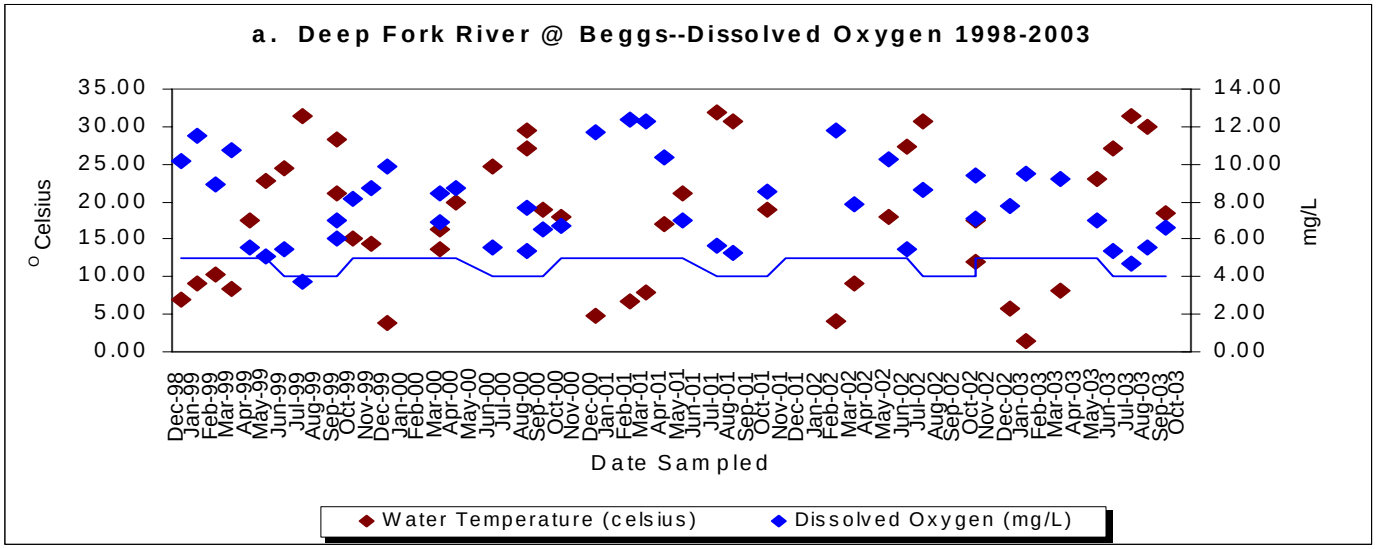
Deep Fork River near Beggs

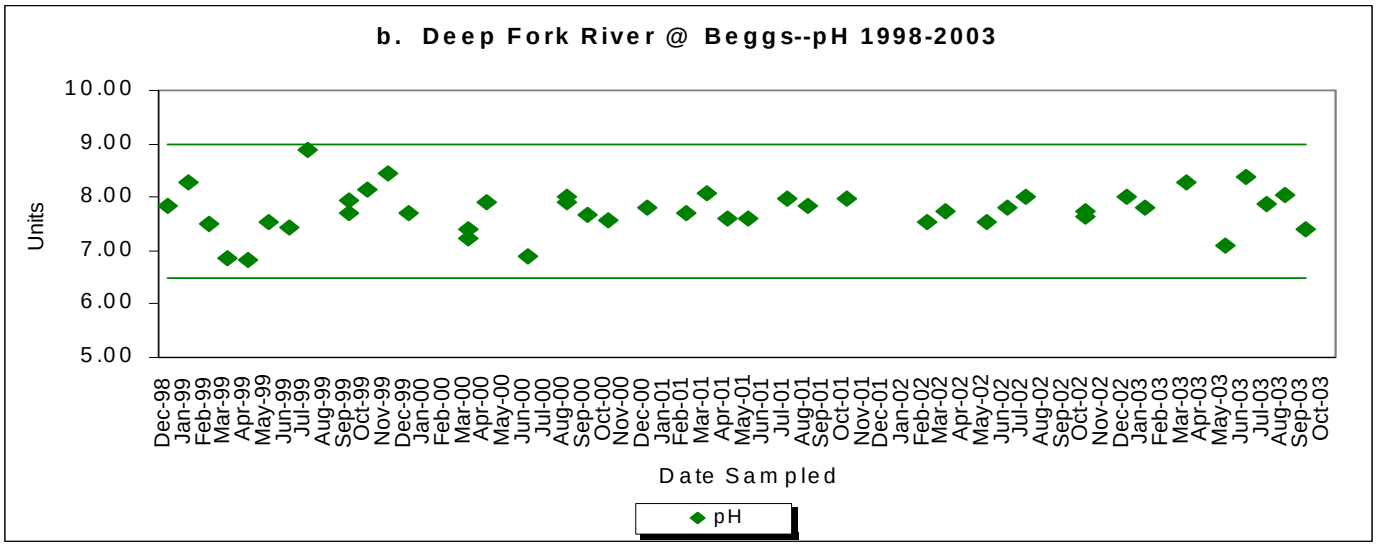
Station AT243500 (520700020010-001AT) is a permanent ambient trend monitoring station located on the Deep Fork River in Oklahoma. Situated in the west central portion of Okmulgee County, the site was established south of the Town of Beggs off State Highway 16 on County Road N3900. The station is positioned near the terminal end of stream segment 520700020010 and is classified within the Deep Fork River 8-digit HUC watershed (11110303). Water enters the stream system from Todd Lake and from several tributaries including Buckeye Creek (Okemah Lake), Nuyaka Creek, Little Deep Fork Creek, and Salt Creek, among others.

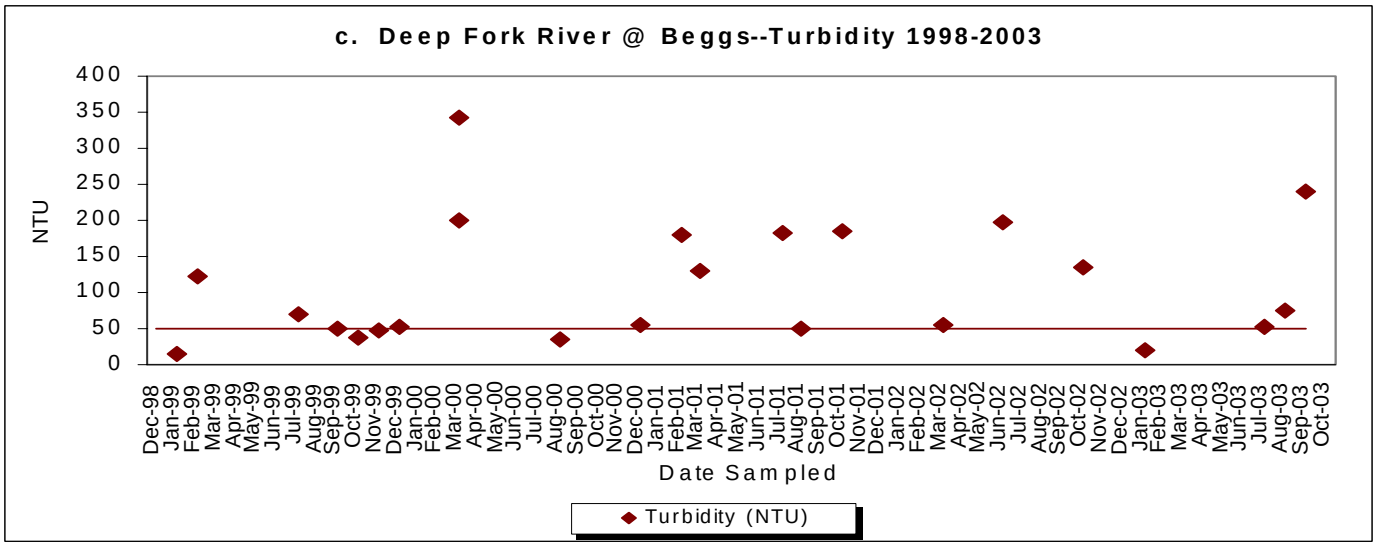
This station on the Deep Fork River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on the required 10 months of data collected from December of 1998 through September of 2003. For purposes of reporting, this station is representative of the Deep Fork River from the confluence of Buckeye Creek (96.2682, 35.6225) downstream to confluence of Salt Creek with the Deep Fork River (96.0242, 35.5887). As per Appendix A, Table 5 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class II Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

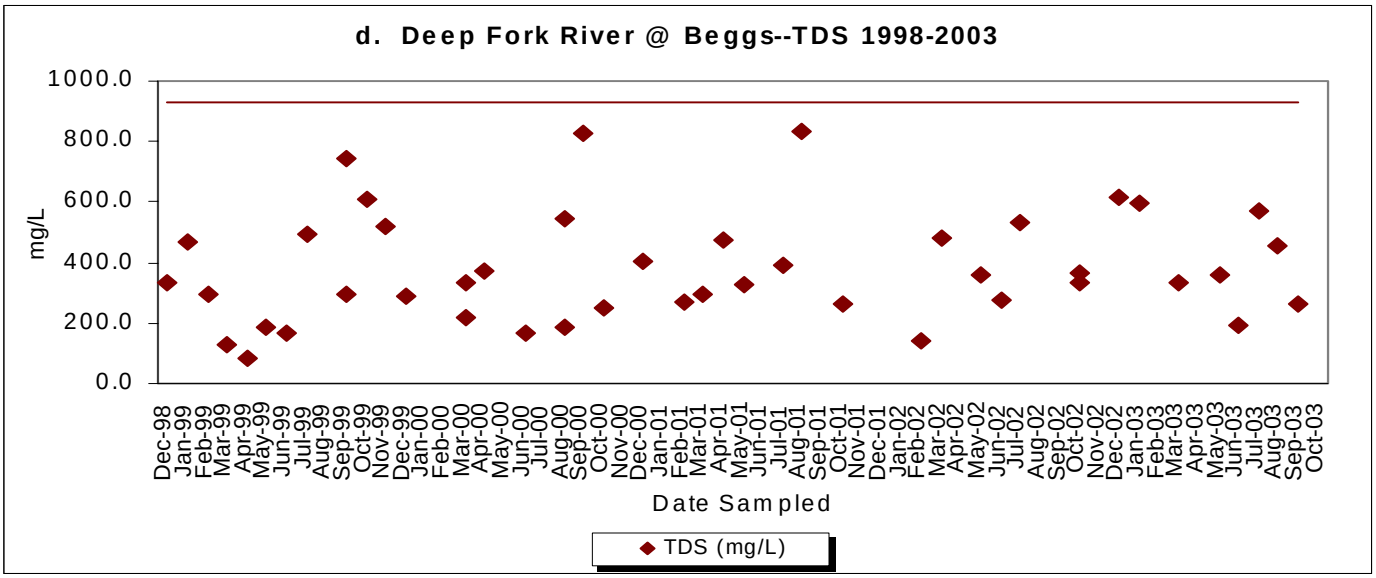
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 23 turbidity samples (Figure 52c), 17 samples (or 74%) exceeded the numerical criteria of 50. Of the 12 lead samples collected, 2 of the concentrations (or 18%) exceeded the prescribed, hardness-dependant chronic criterion of 8.26 µg/L (Table 22). Dissolved oxygen (Figure 52a) and pH (Figure 52b) data met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 52d and Figure 52e). The PBCR beneficial use is not supported (Table 23). Of the 15 enterococci concentrations, 3 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (34.2 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Deep Fork River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 52f).

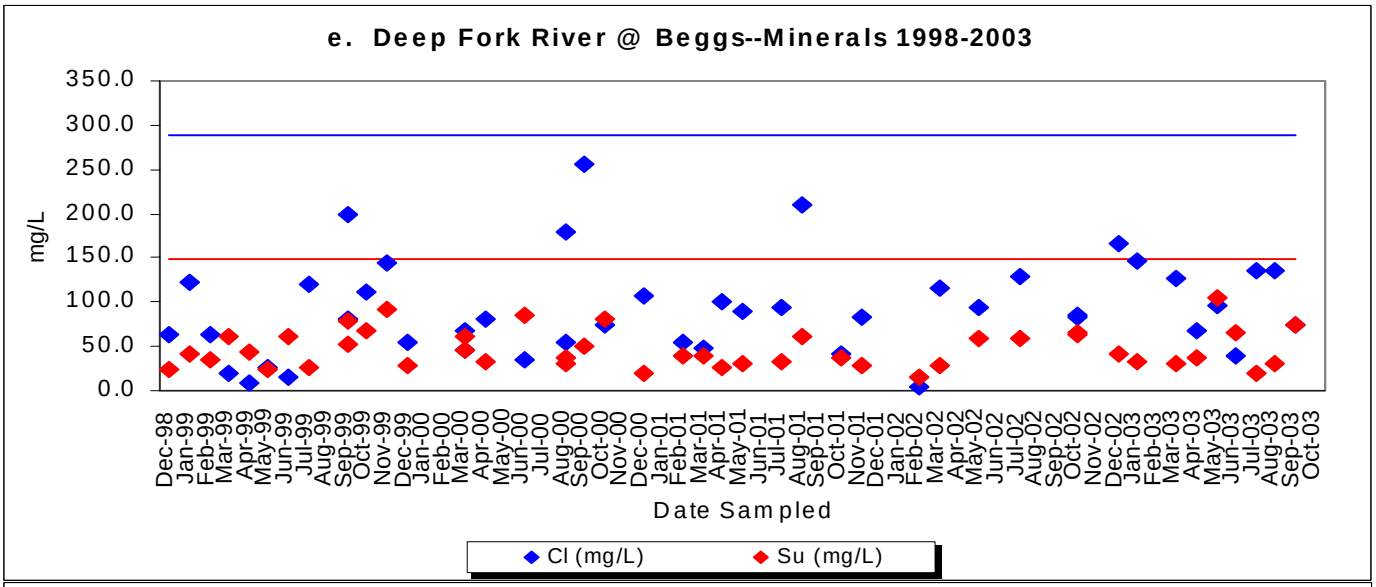
Figure 52a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Deep Fork River at Beggs (AT243500), 1998-2003.

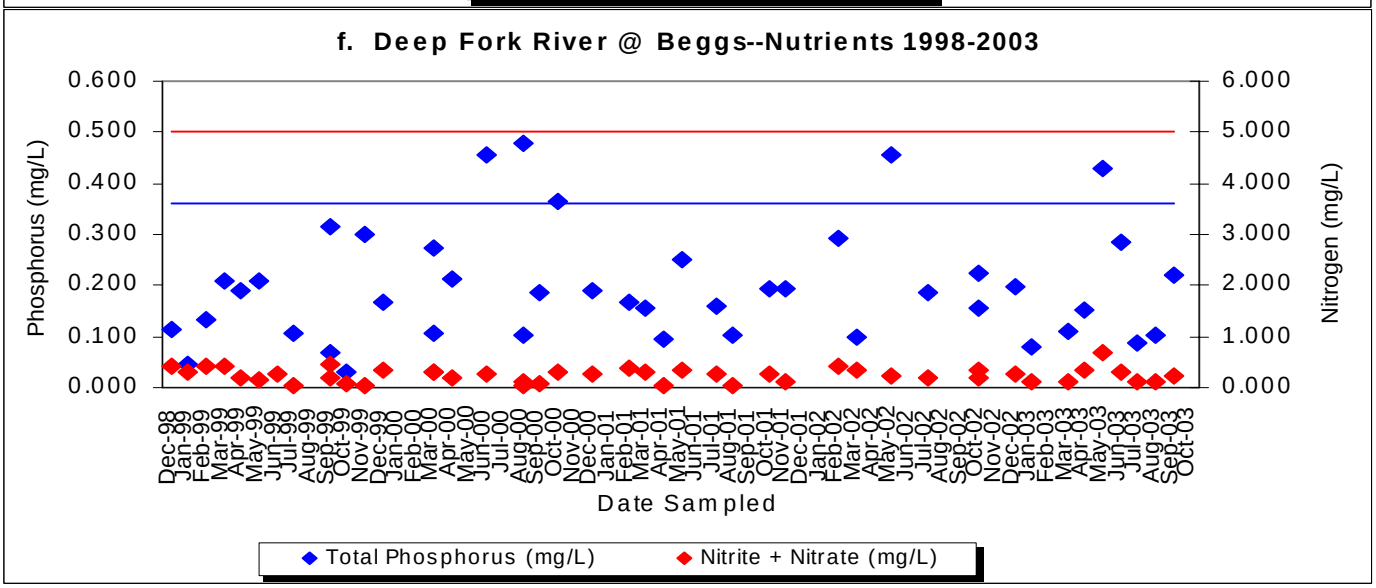







d. Deep Fork River @ Beggs--TDS 1998-2003
mg/L
1000.0
800.0
600.0
400.0
200.0
0.0
Date Sampled
TDS (mg/L)


e. Deep Fork River @ Beggs--Minerals 1998-2003
mg/L
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Deep Fork River @ Beggs--Nutrients 1998-2003
Phosphorus (mg/L)
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

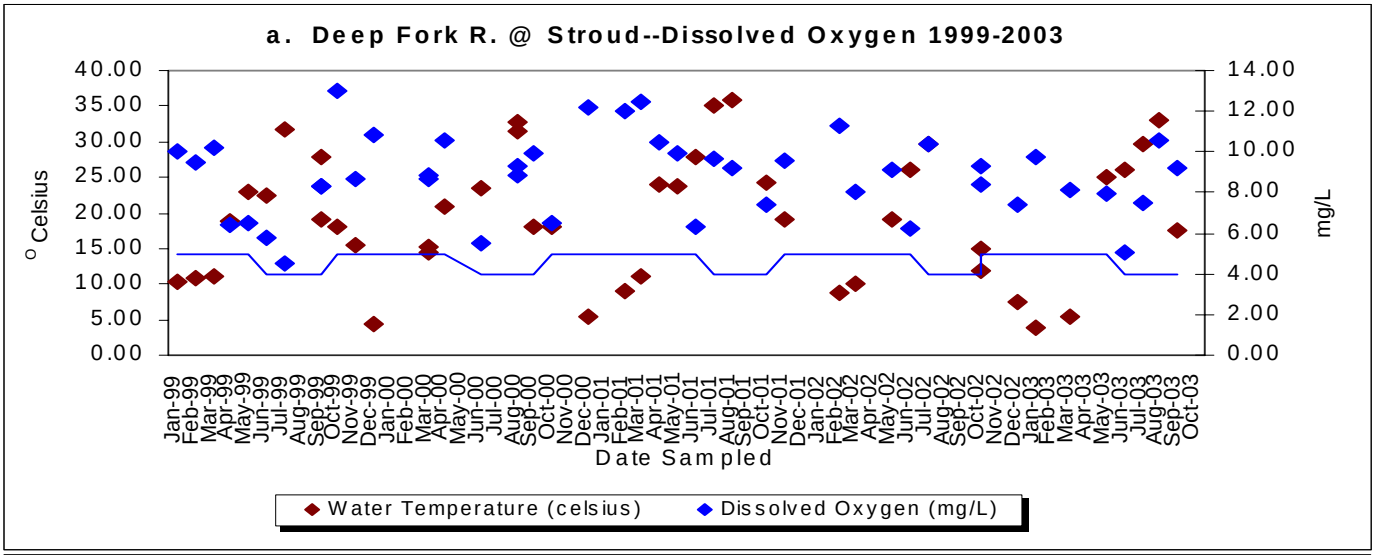
Deep Fork River near Stroud

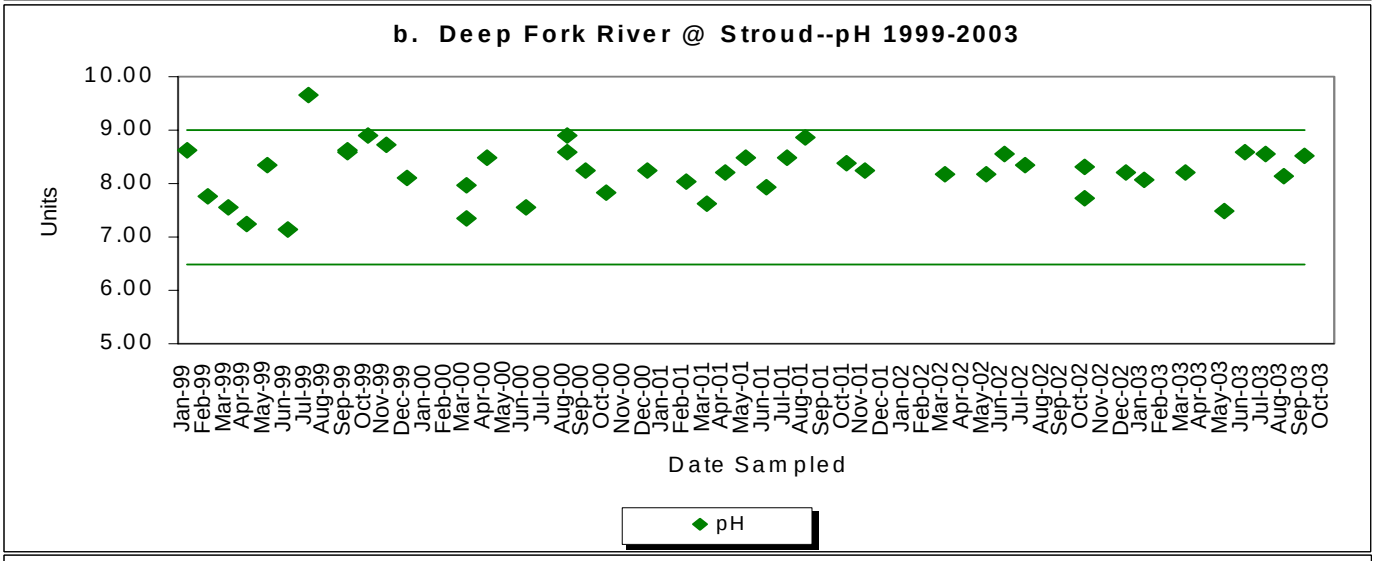
Station AT242500 (520700040010-001AT) is a permanent ambient trend monitoring station located on the Deep Fork River in Oklahoma. Situated in the east central portion of Lincoln County, the site was established south of the City of Stroud on US Highway 377. The station is positioned near the terminal end of stream segment 520700040010 and is classified within the Deep Fork River 8-digit HUC watershed (11110303). Water enters the stream system from Browns Lake and Lake Todd and from several tributaries including Quapaw Creek, Robinson Creek, Dry Creek, Deer Creek, and Grayhorse Creek, among others.

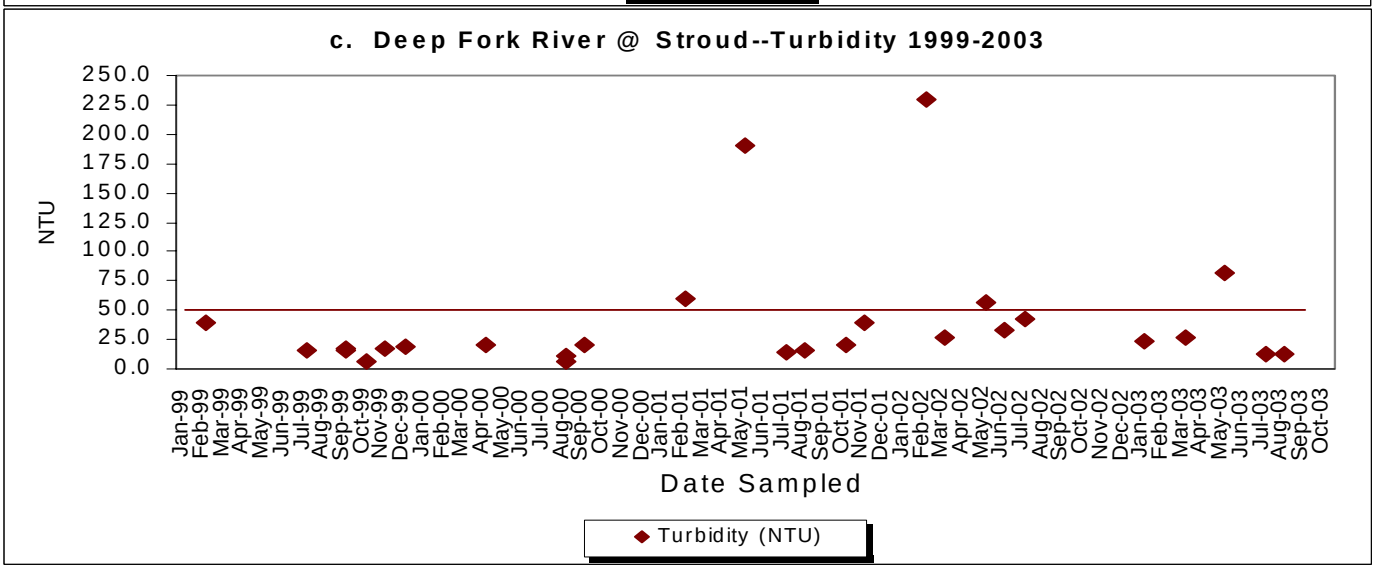
This station on the Deep Fork River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from January of 1999 through September of 2003. For purposes of reporting, this station is representative of the Deep Fork River from the confluence of Quapaw Creek (96.8059, 35.6287) downstream to confluence of Todd Lake with the Deep Fork River (96.6220, 35.6554). As per Appendix A, Table 5 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class II Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

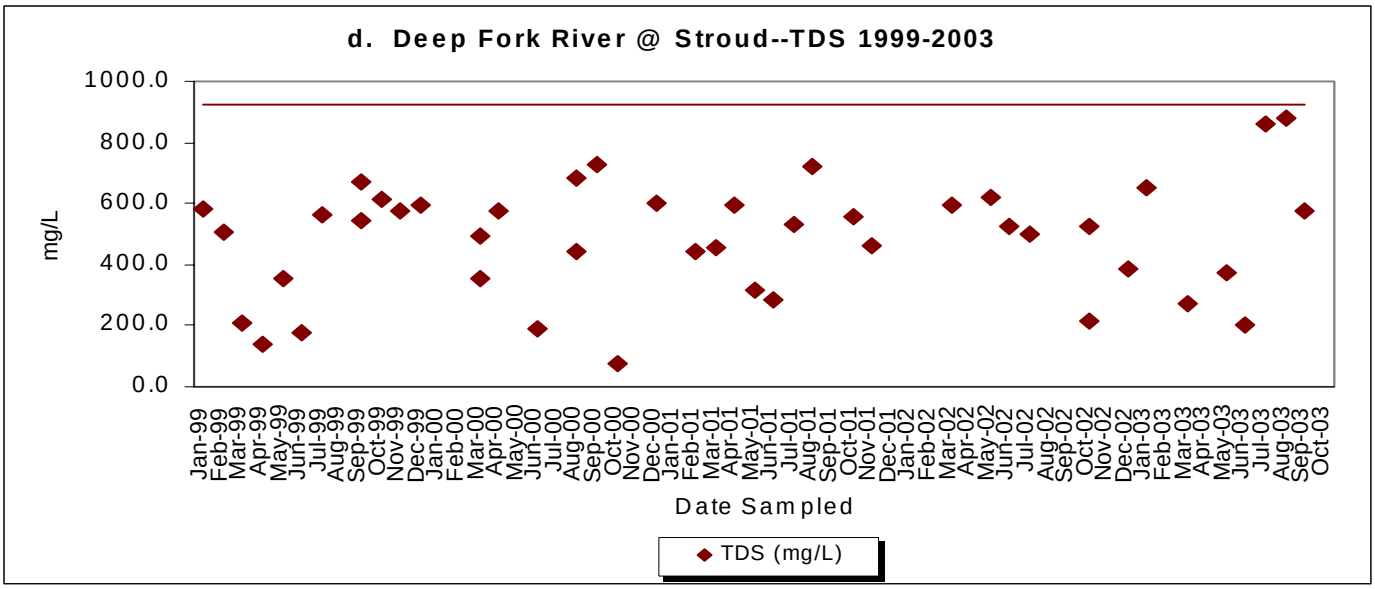
The PPWS beneficial use is partially supported. Of the 12 chromium samples collected, 2 of the concentrations (or 17%) exceeded the prescribed of 50 µg/L (Table 22). Of The WWAC beneficial use is not supported. Of the 12 lead samples collected, 3 of the concentrations (or 25%) exceeded the prescribed, hardness-dependant chronic criterion of 11.05 µg/L (Table 22). Of the 27 turbidity samples (Figure 53c), 5 samples (or 19%) exceeded the numerical criteria of 50. Dissolved oxygen (Figure 53a) and pH (Figure 53b) samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 53d and Figure 53e). The PBCR beneficial use is not supported (Table 23). Of the 20 enterococci concentrations, 4 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (208.4 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Deep Fork River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 53f).

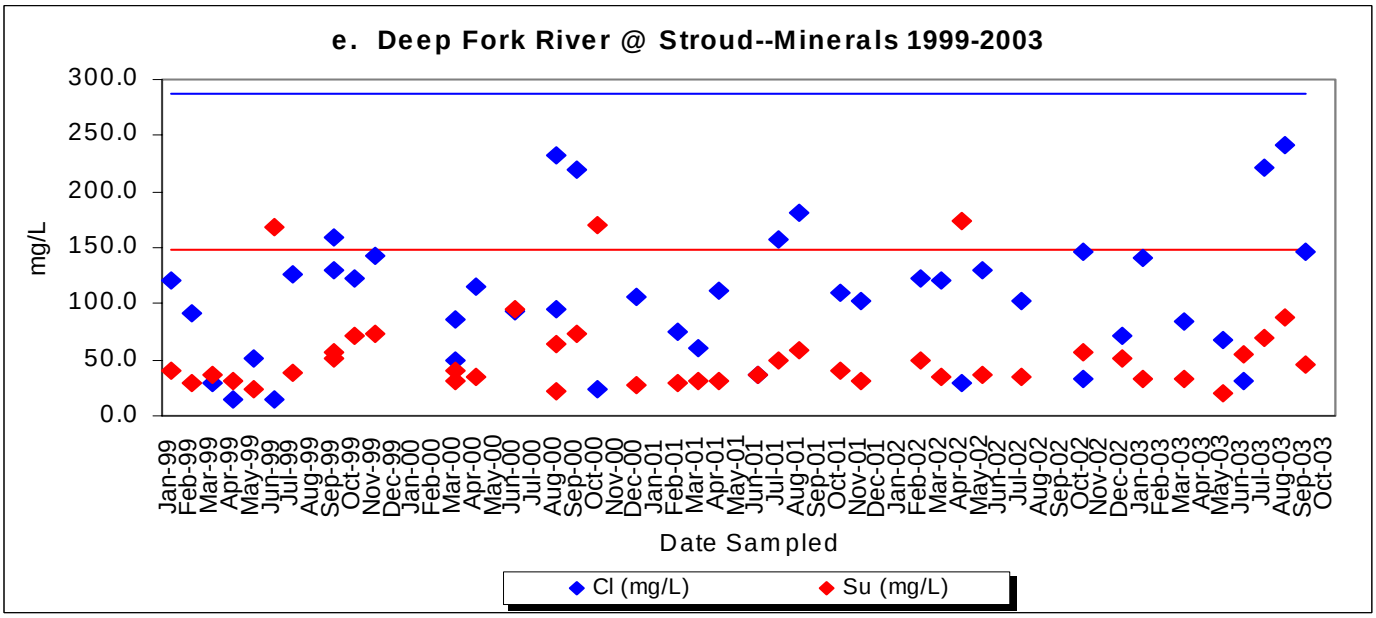
Figure 53a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Deep Fork River at Stroud (AT242500), 1999-2003.

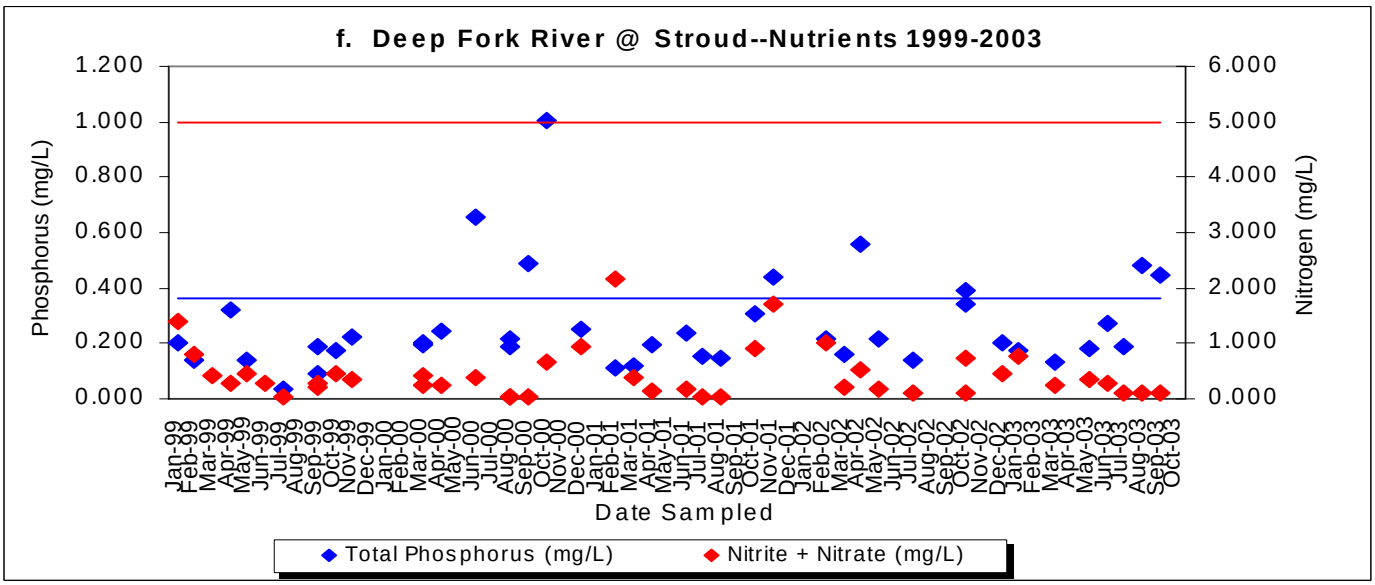







d. Deep Fork River @ Stroud--TDS 1999-2003
mg/L
1000.0
800.0
600.0
400.0
200.0
0.0
Date Sampled
TDS (mg/L)


e. Deep Fork River @ Stroud--Minerals 1999-2003
mg/L
300.0
250.0
200.0
150.0
100.0
50.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Deep Fork River @ Stroud--Nutrients 1999-2003
Phosphorus (mg/L)
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

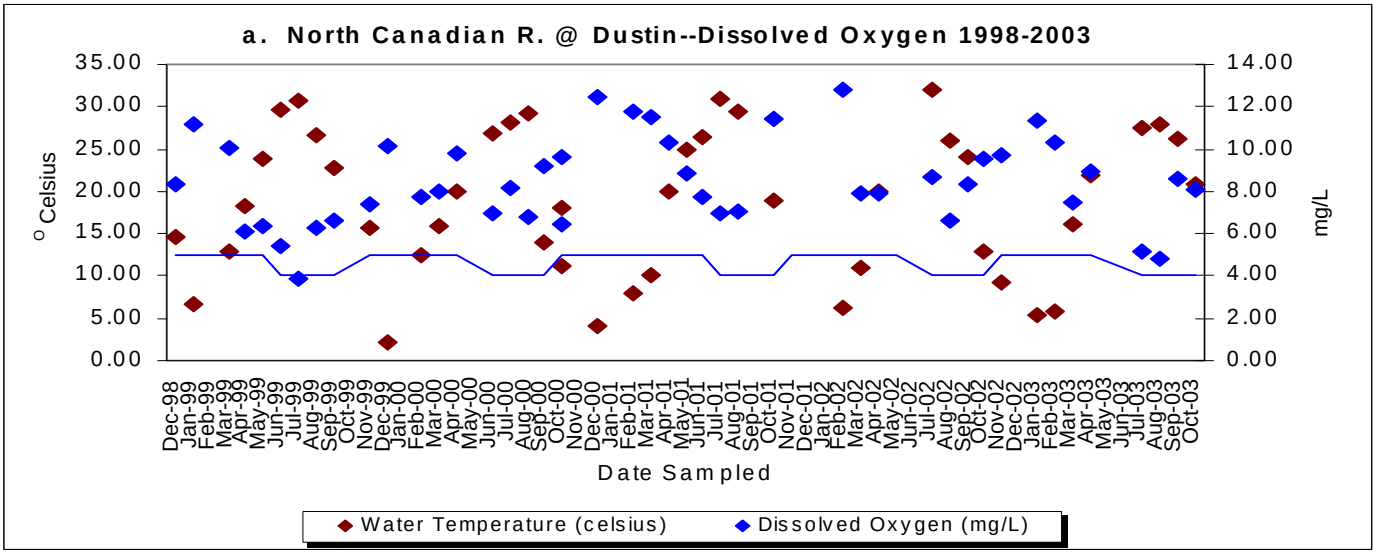
North Canadian River at Dustin

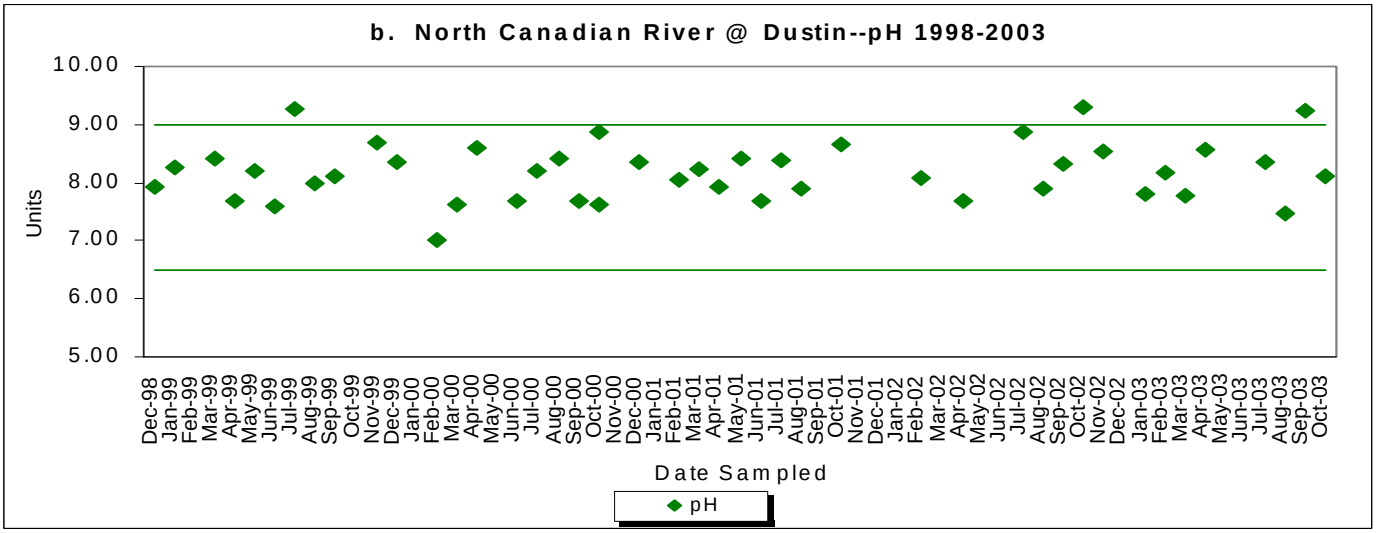
Station AT242200 (520500010110-001AT) is a permanent ambient trend monitoring station located on the North Canadian River. Situated in the west central portion of McIntosh County, the site was established on the Indian Nation Turnpike. The station is positioned near the upper end of stream segment 520500010110 and is classified within the Lower North Canadian River 8-digit HUC watershed (11100302). Water enters the stream system from Wewoka Creek (Lake Wewoka), Alabama Creek, and Bad Creek, among others.

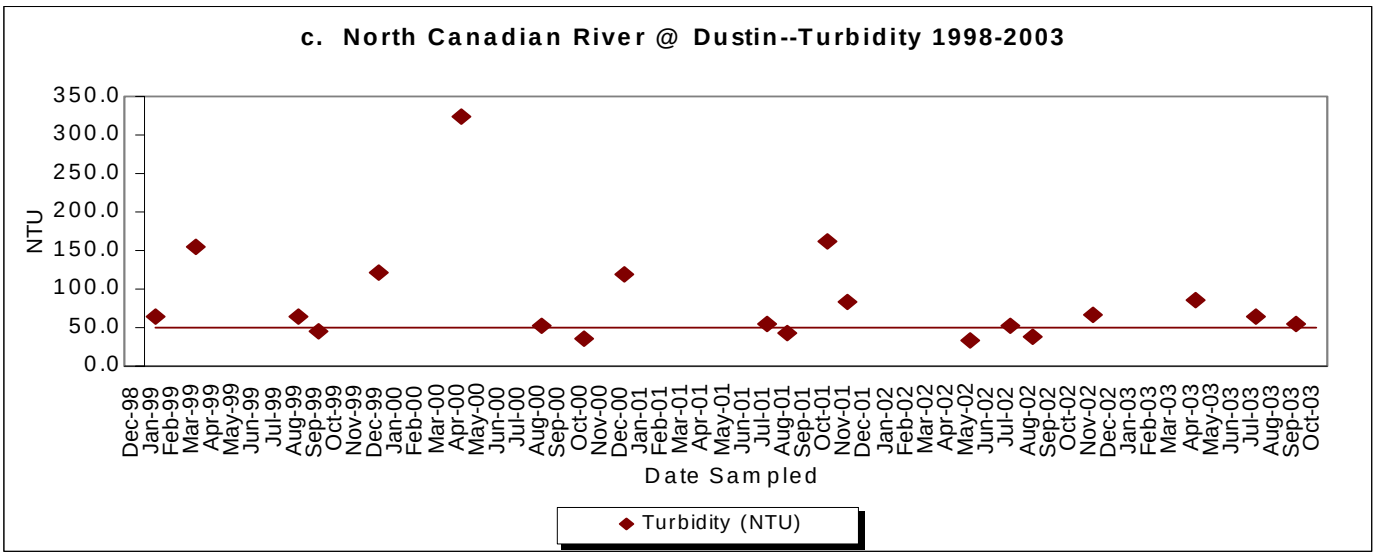
This station on the North Canadian River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through October of 2003. For purposes of reporting, this station is representative of the North Canadian River from the confluence of Wetumka Creek (96.1690, 35.2556) downstream to confluence of the North Canadian River with Lake Eufaula (95.8105, 35.4048). As per Appendix A, Table 5 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

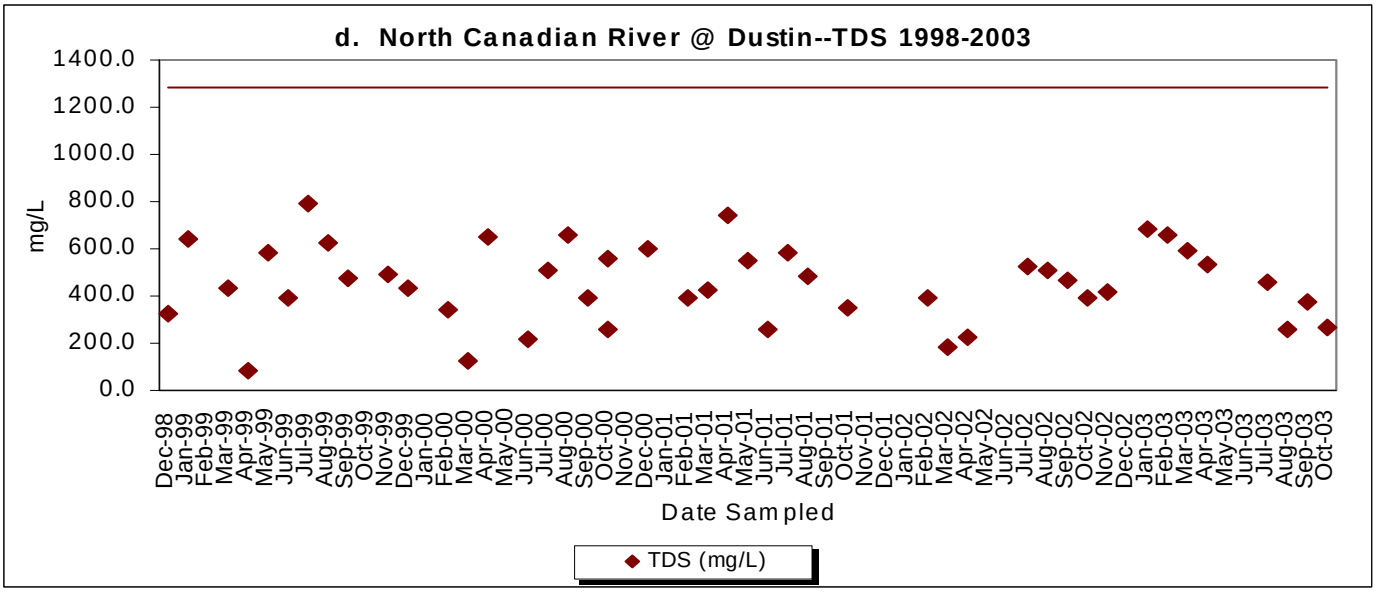
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 20 turbidity samples (Figure 54c), 15 samples (or 75%) exceeded the numerical criteria of 50. Of the 10 lead samples collected, 5 of the concentrations (or 50%) exceeded the prescribed, hardness-dependant chronic criteria of 8.48 µg/L (Table 22). Dissolved oxygen (Figure 54a) and pH (Figure 54b) samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 54d and Figure 54e). The PBCR beneficial use is not supported (Table 23). Of the 26 fecal coliform concentrations, 8 samples (or 31%) exceeded the prescribed screening level of 400 cfu/mL. Of the 26 enterococci concentrations, 9 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (301.4 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the North Canadian River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 54f).

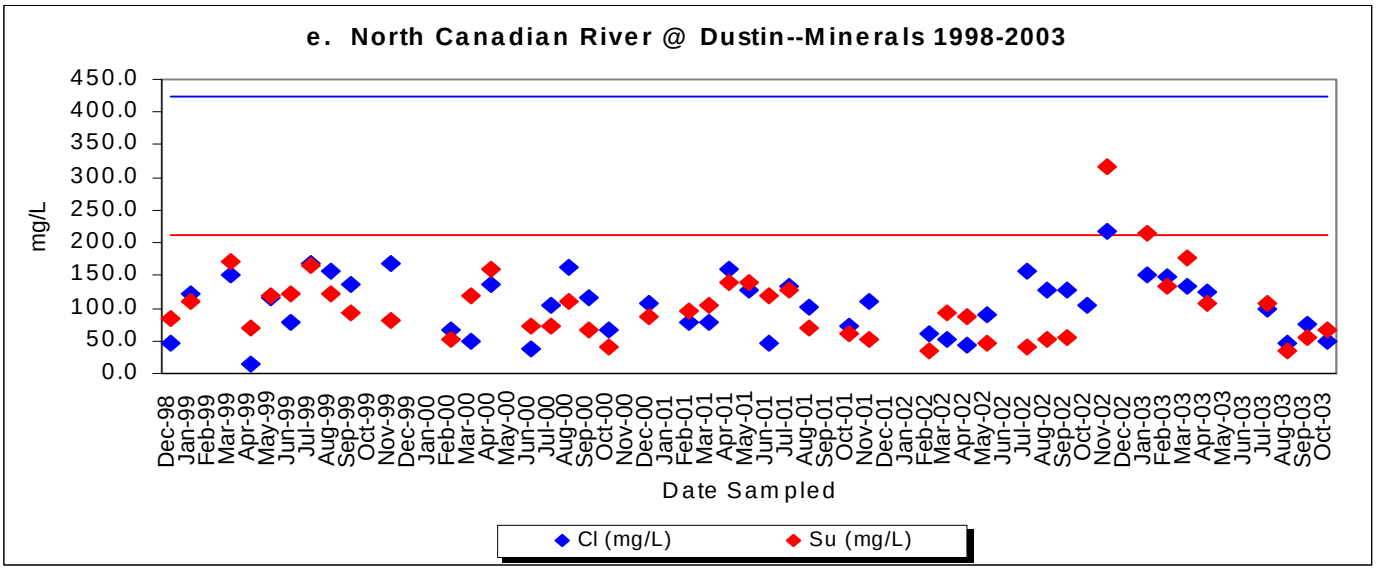
Figure 54a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the North Canadian River at Dustin (AT242200), 1998-2003.

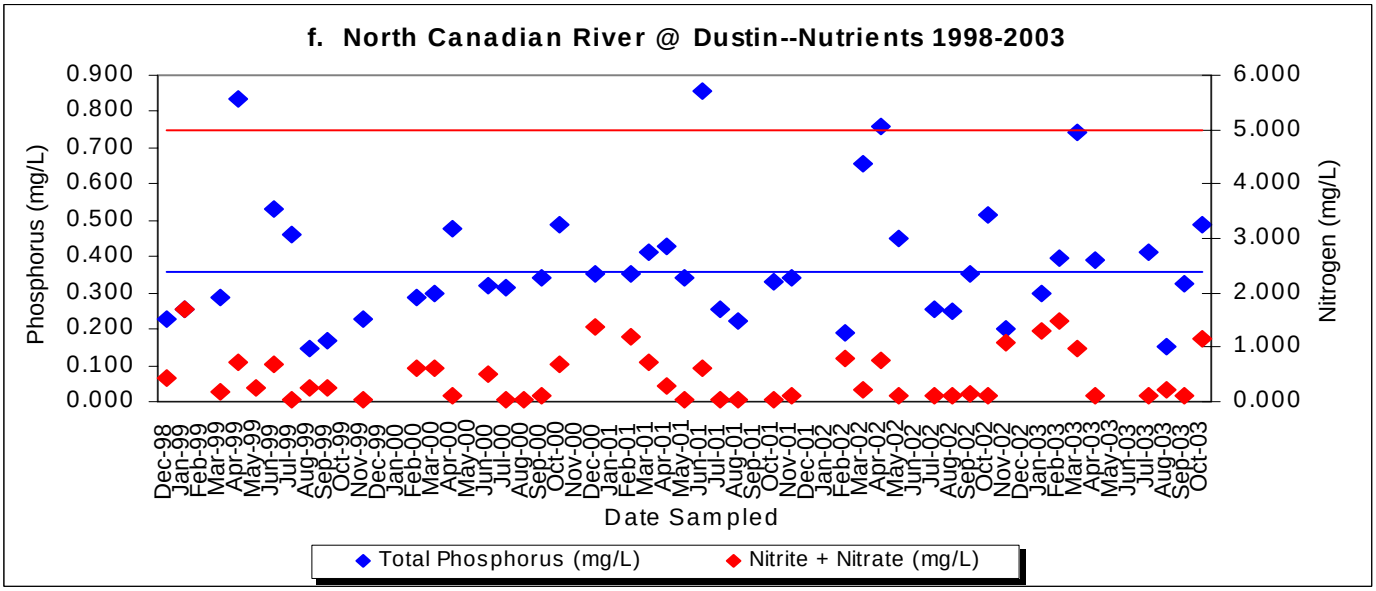







d. North Canadian River @ Dustin--TDS 1998-2003
mg/L
Date Sampled
TDS (mg/L)


e. North Canadian River @ Dustin--Minerals 1998-2003
mg/L
Date Sampled
Cl (mg/L)
Su (mg/L)


f. North Canadian River @ Dustin--Nutrients 1998-2003
Phosphorus (mg/L)
Nitrogen (mg/L)
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

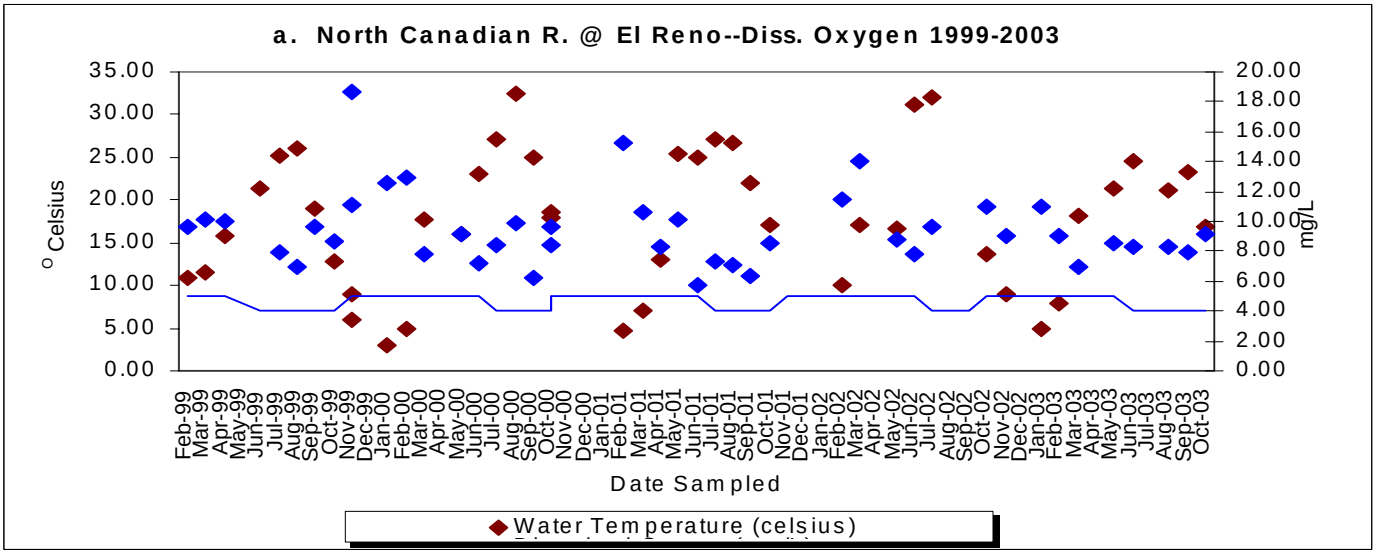
North Canadian River near El Reno

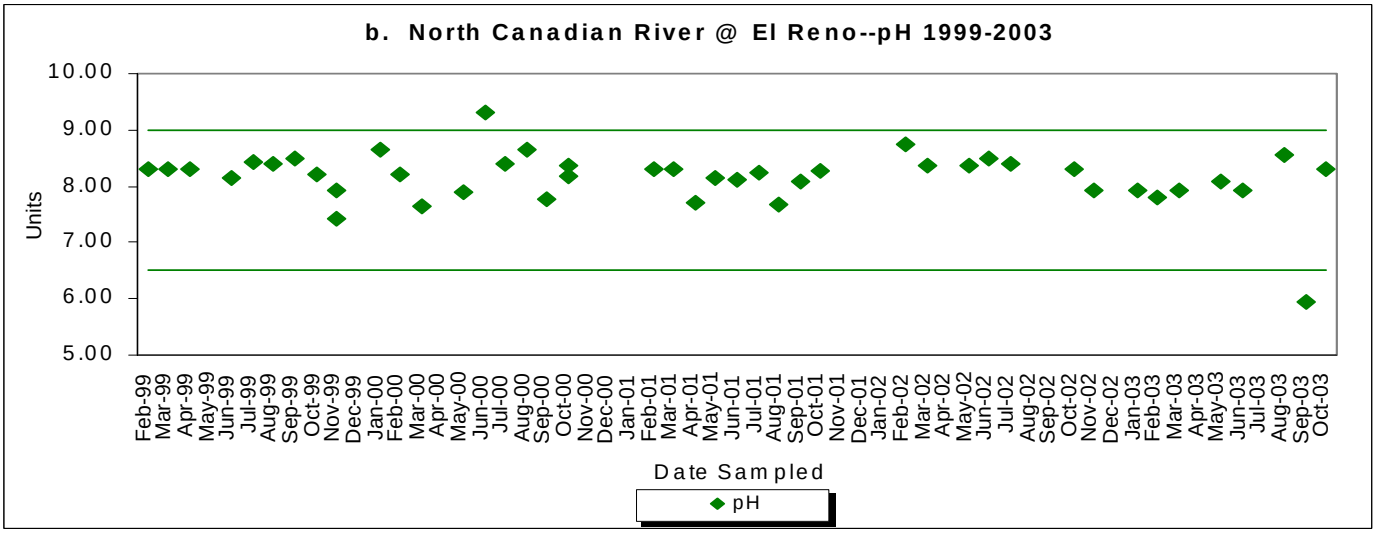
Station AT239500 (520530000010-001AT) is a permanent ambient trend monitoring station located on the North Canadian River. Situated in the central portion of Canadian County, the site was established within the City of El Reno on US Highway 81. The station is positioned between the midpoint and the lower end of stream segment 520530000010 and is classified within the Middle North Canadian River 8-digit HUC watershed (11100301). Water enters the stream system from several tributaries including Sixmile Creek, Purcell Creek, and Shell Creek, among others.

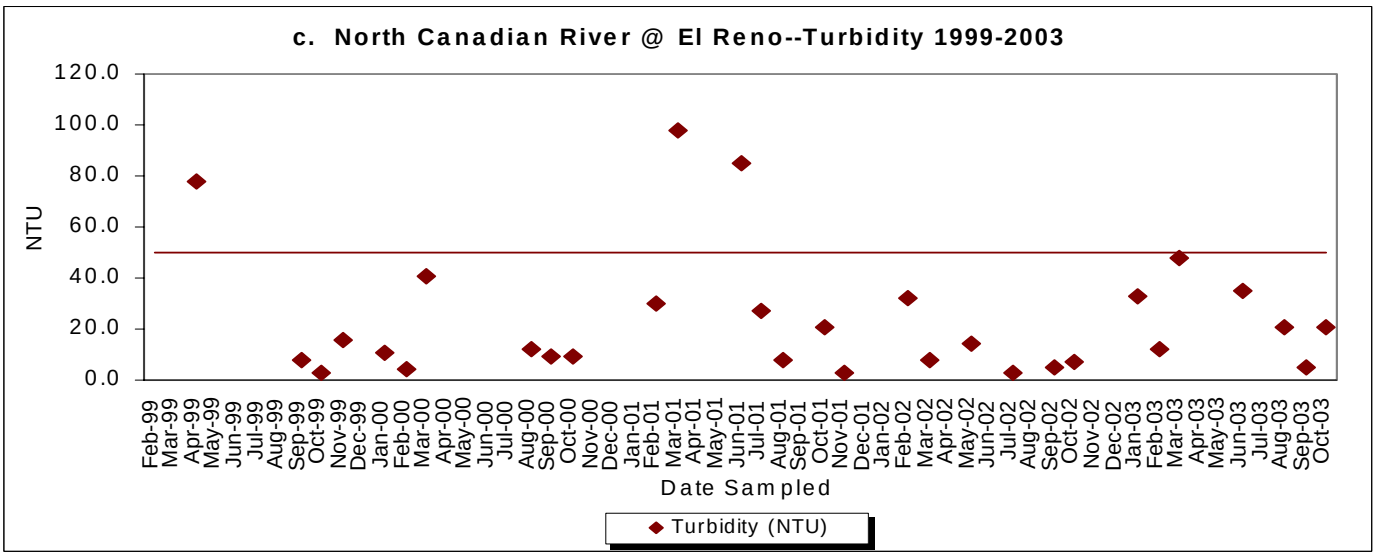
This station on the Canadian River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from February of 1999 through October of 2003. For purposes of reporting, this station is representative of the North Canadian River from where it intersects the Canadian/Blaine County Line (98.3134, 35.7180) downstream to confluence of the North Canadian River with Lake Overholser (97.6776, 35.5370). As per Appendix A, Table 5 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

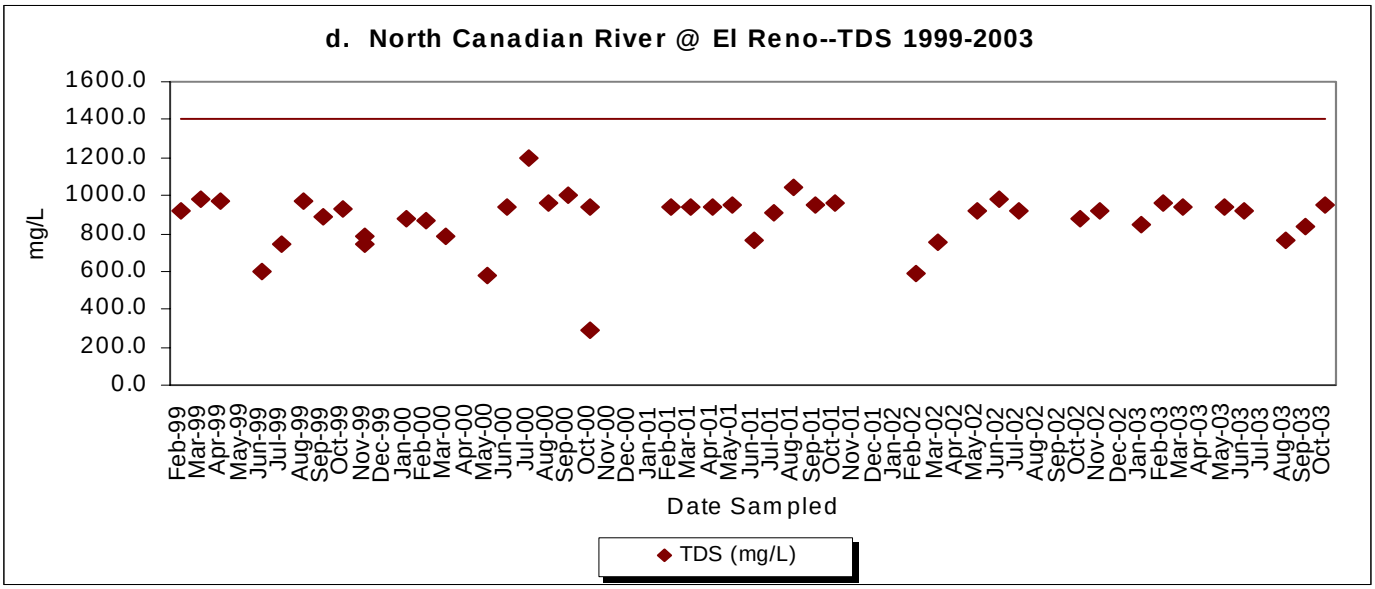
The PPWS beneficial use is supported. The WWAC beneficial use is supported. Dissolved oxygen (Figure 55a), pH (Figure 55b), turbidity (Figure 55c) and toxicant samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 55d and Figure 55e). The PBCR beneficial use is not supported (Table 23). Of the 26 enterococci concentrations, 7 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (147.6 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the North Canadian River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 55f).

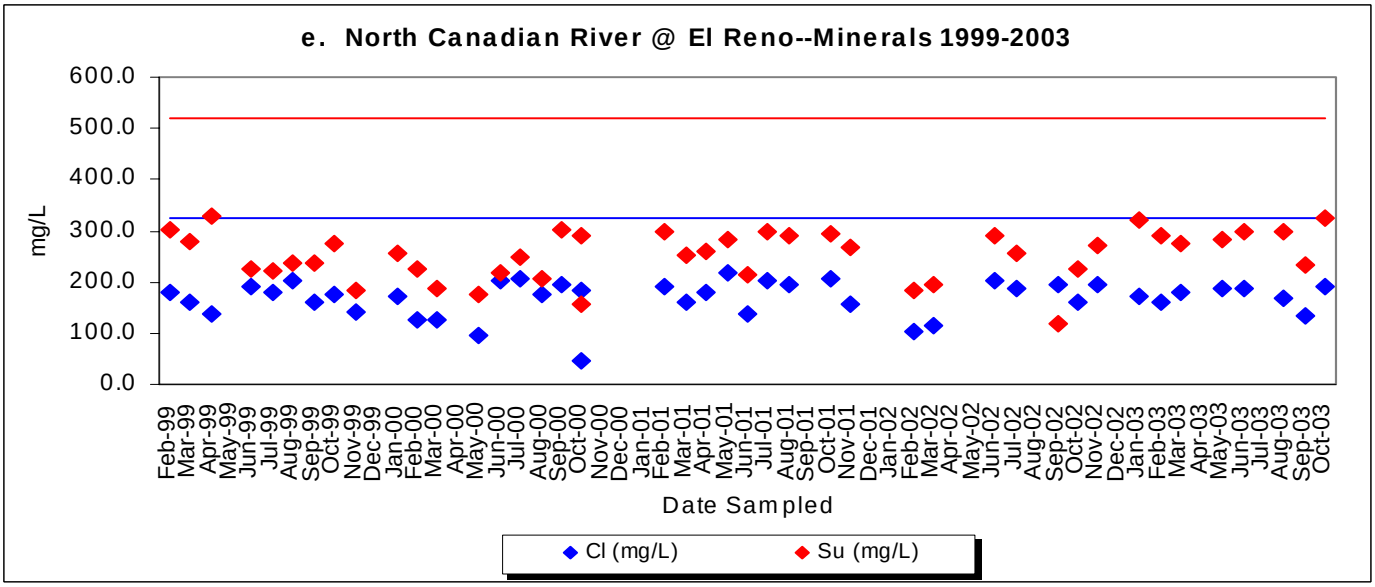
Figure 55a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the North Canadian River at El Reno (AT239500), 1999-2003.

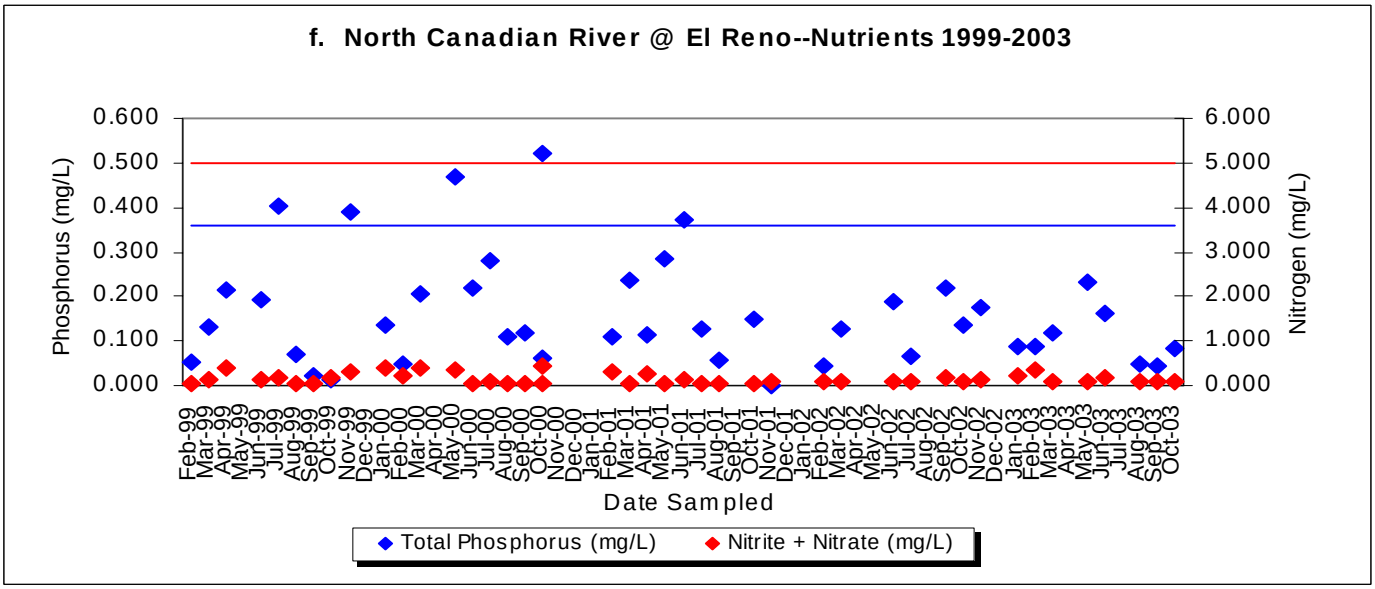







d. North Canadian River @ El Reno--TDS 1999-2003
mg/L
1600.0
1400.0
1200.0
1000.0
800.0
600.0
400.0
200.0
0.0
Date Sampled
TDS (mg/L)


e. North Canadian River @ El Reno--Minerals 1999-2003
mg/L
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. North Canadian River @ El Reno--Nutrients 1999-2003
Phosphorus (mg/L)
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

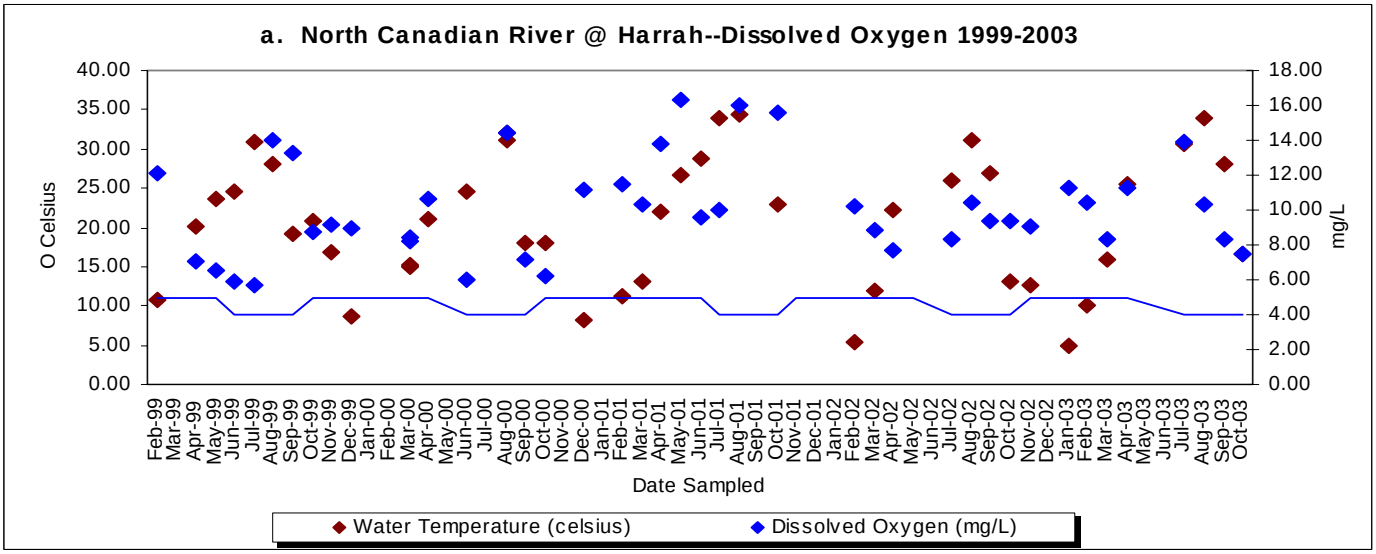
North Canadian River near Harrah

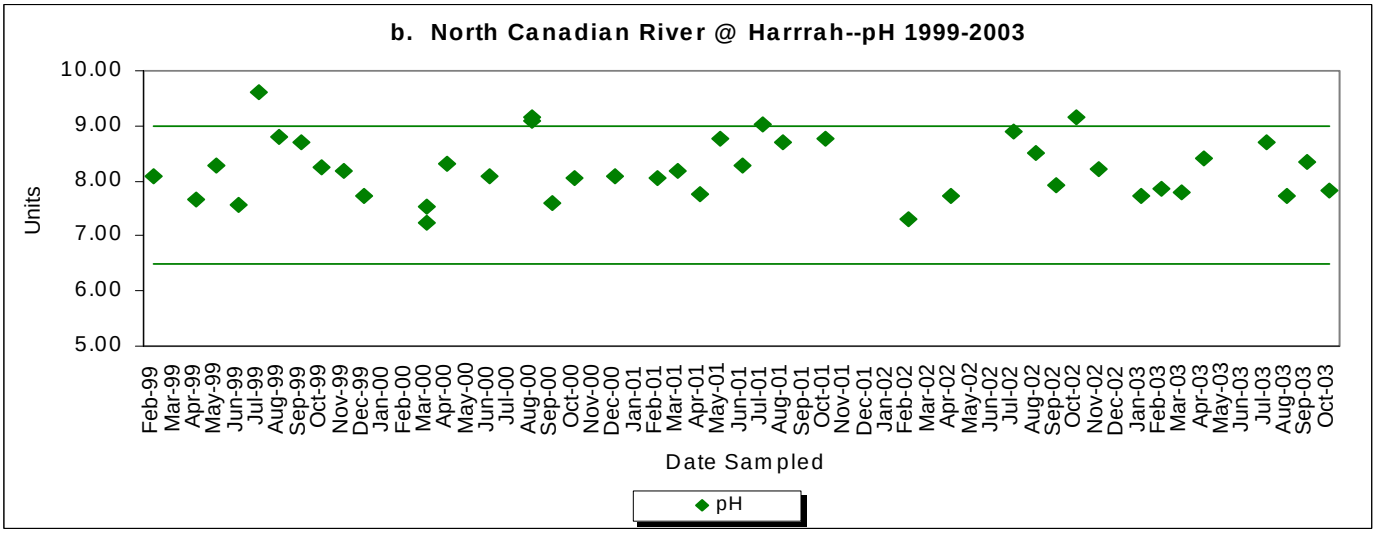
Station 241550 (520510000110-001AT) is a permanent ambient trend monitoring station located on the North Canadian River. Situated in the southeastern portion of Oklahoma County, the site was established east of the City of Harrah on US Highway 62. The station is positioned near the lower end of stream segment 520520000010 and is classified within the Lower North Canadian River 8-digit HUC watershed (11100302). Water enters the stream system from Lake Overholser and Horseshoe Lake and from several tributaries including Mustang Creek, Crooked Oak Creek, Crutcho Creek, and Choctaw Creek, among others.

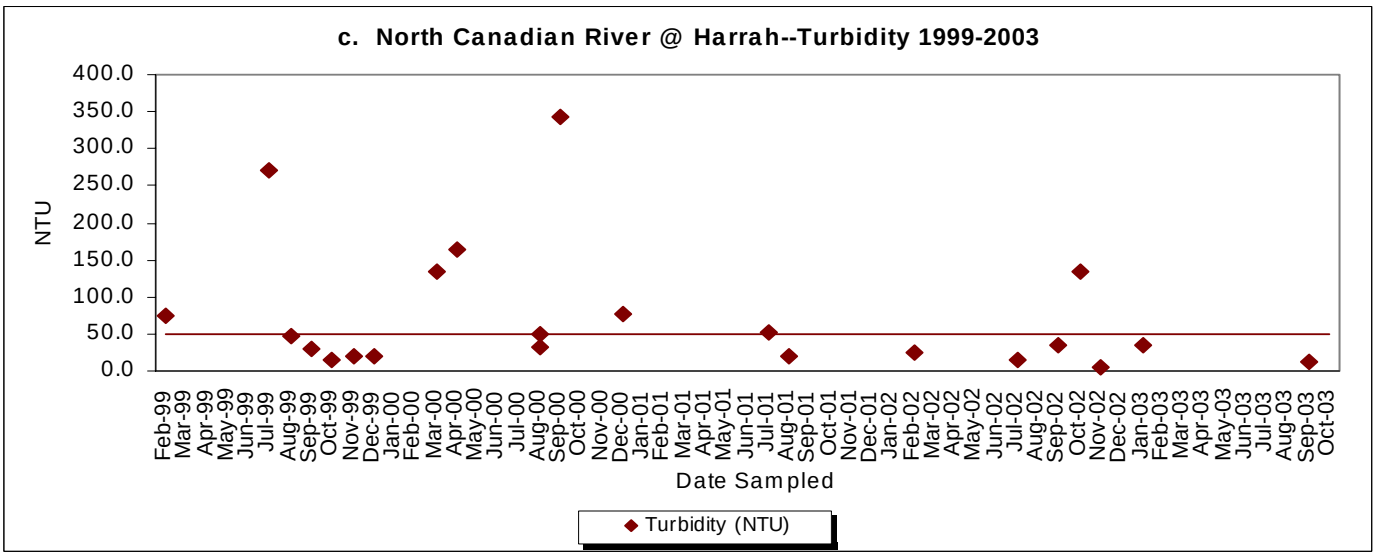
This station on the North Canadian River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from February of 1999 through October of 2003. For purposes of reporting, this station is representative of the North Canadian River from the confluence of Crooked Oak Creek (97.4604, 35.4684) downstream to the confluence of an unnamed tributary near Horseshoe Lake with the North Canadian River (97.1797, 35.5027). As per Appendix A, Table 5 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Emergency Water Supply (EWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

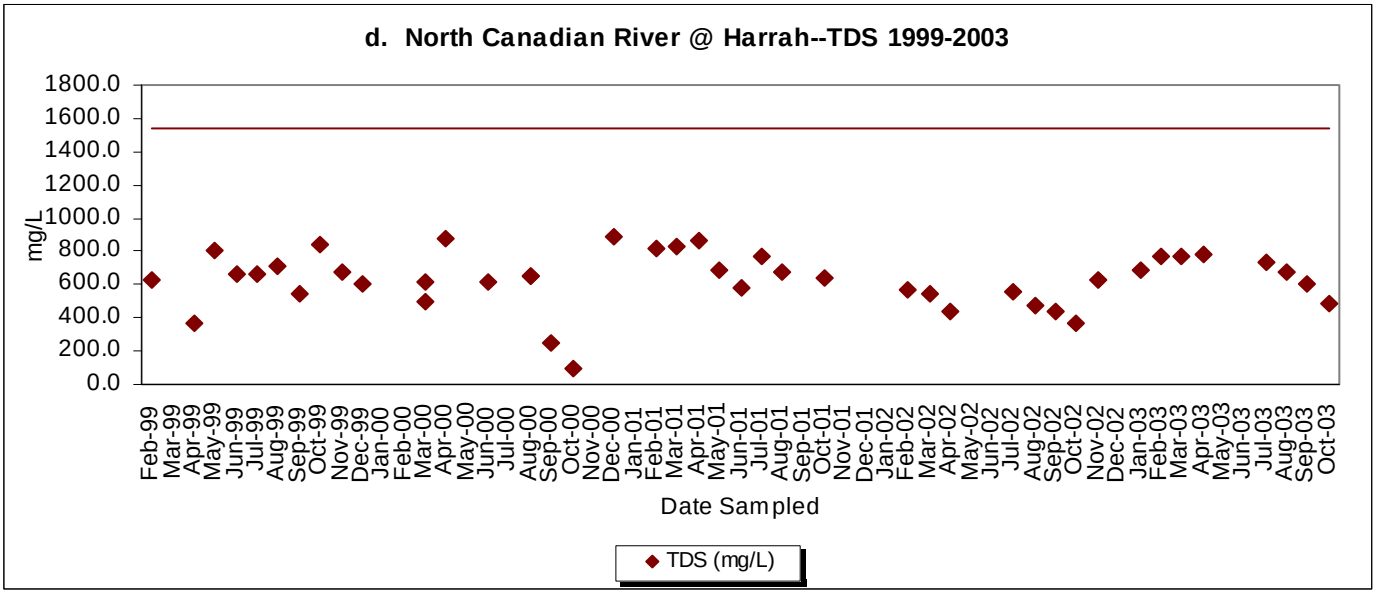
The WWAC beneficial use is not supported. Of the 23 turbidity samples (Figure 56c), 8 samples (or 35%) exceeded the numerical criteria of 50. Of the 42 pH samples (Figure 56b), 5 samples (or 12%) exceeded the upper numerical criteria of 9.0 units. Dissolved oxygen (Figure 56a) and toxicant samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids (TDS), chlorides, and sulfates (Figure 56d and Figure 56e). The PBCR beneficial use is not supported (Table 23). Of the 26 enterococci concentrations, 7 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (106.7 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the North Canadian River is nutrient-threatened. The median of the total phosphorus concentrations (0.860 mg/L) exceeded the threshold median of 0.36 mg/L. The station also has a mean organic or mixed turbidity of 25 NTU. The nitrate/nitrite median value was below the threshold median of 5.0 mg/L (Figure 56f).

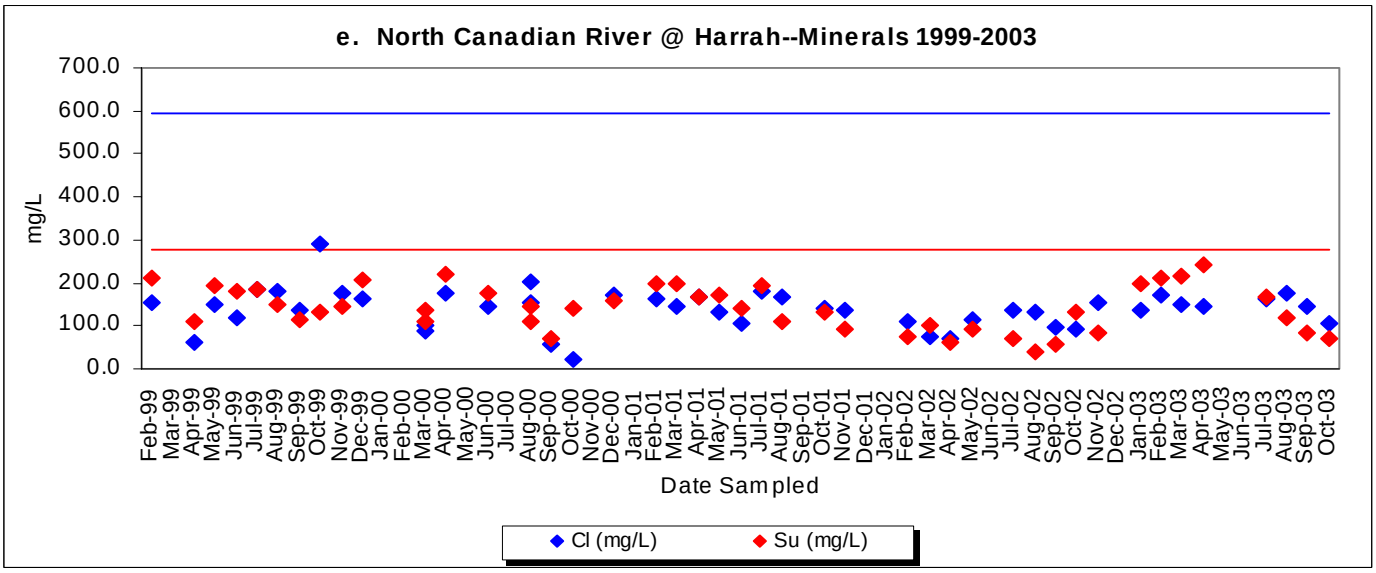
Figure 56a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the North Canadian River at Harrah (AT241550), 1999-2003.

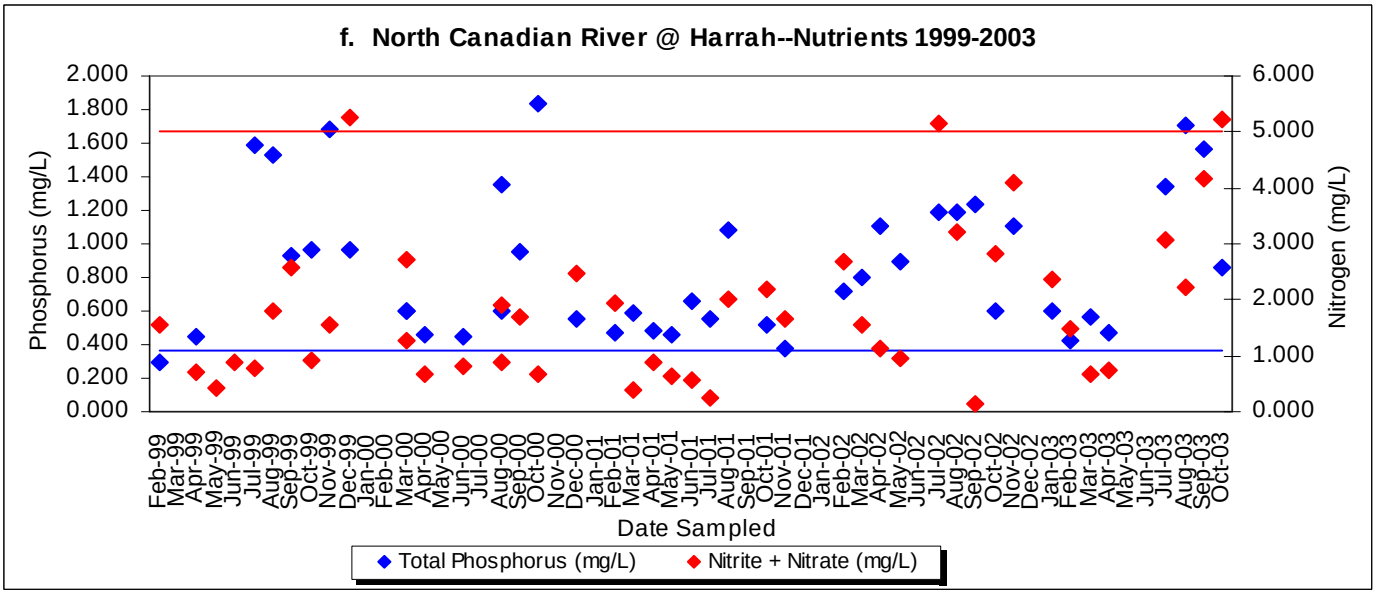







d. North Canadian River @ Harrah--TDS 1999-2003
mg/L
Date Sampled
TDS (mg/L)


e. North Canadian River @ Harrah--Minerals 1999-2003
mg/L
Date Sampled
Cl (mg/L)
Su (mg/L)


f. North Canadian River @ Harrah--Nutrients 1999-2003
Phosphorus (mg/L)
Nitrogen (mg/L)
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

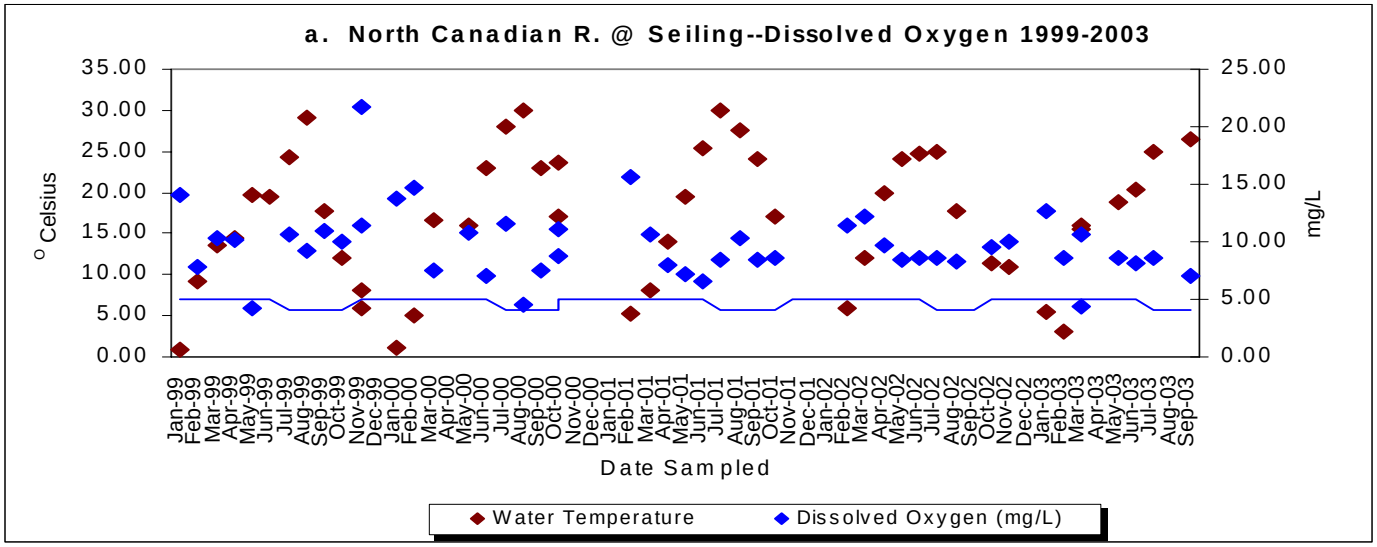
North Canadian River near Seiling

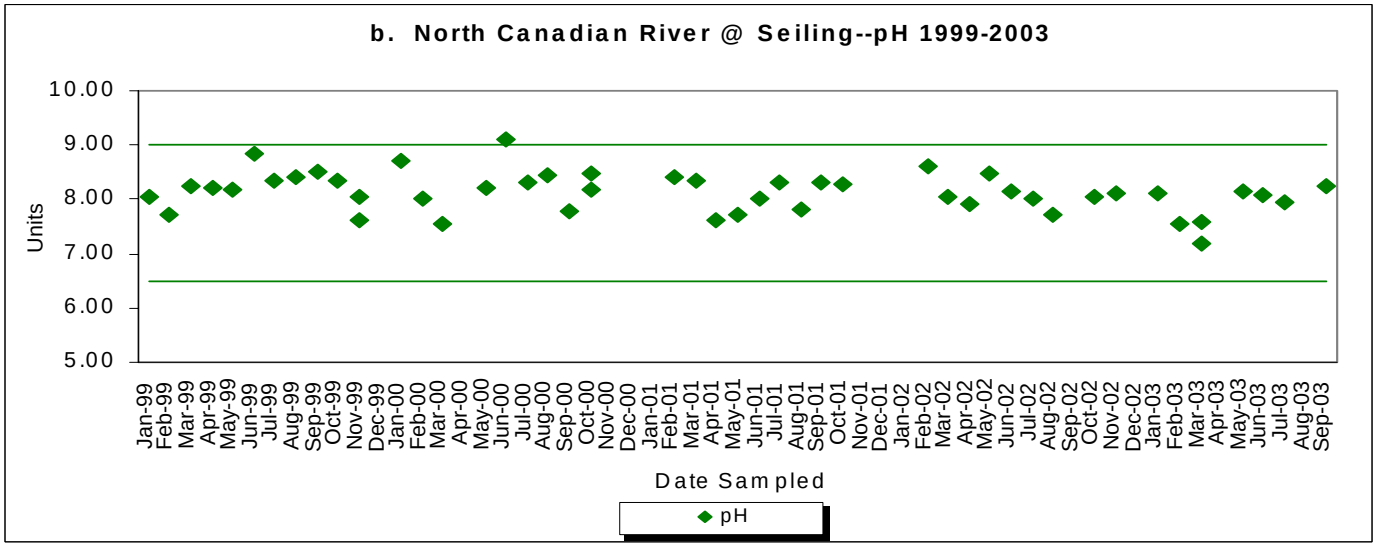
Station AT238000 (720500010010-001AT) is a permanent ambient trend monitoring station located on the North Canadian River. Situated in the southwestern portion of Major County, the site was established north of the Town of Seiling on US Highway 281. The station is positioned near the midpoint of stream segment 720500010010 and is classified within the Middle North Canadian River 8-digit HUC watershed (11100301). Water enters the stream system from several tributaries including Bent Creek, Deep Creek, and Cheyenne Creek, among others.

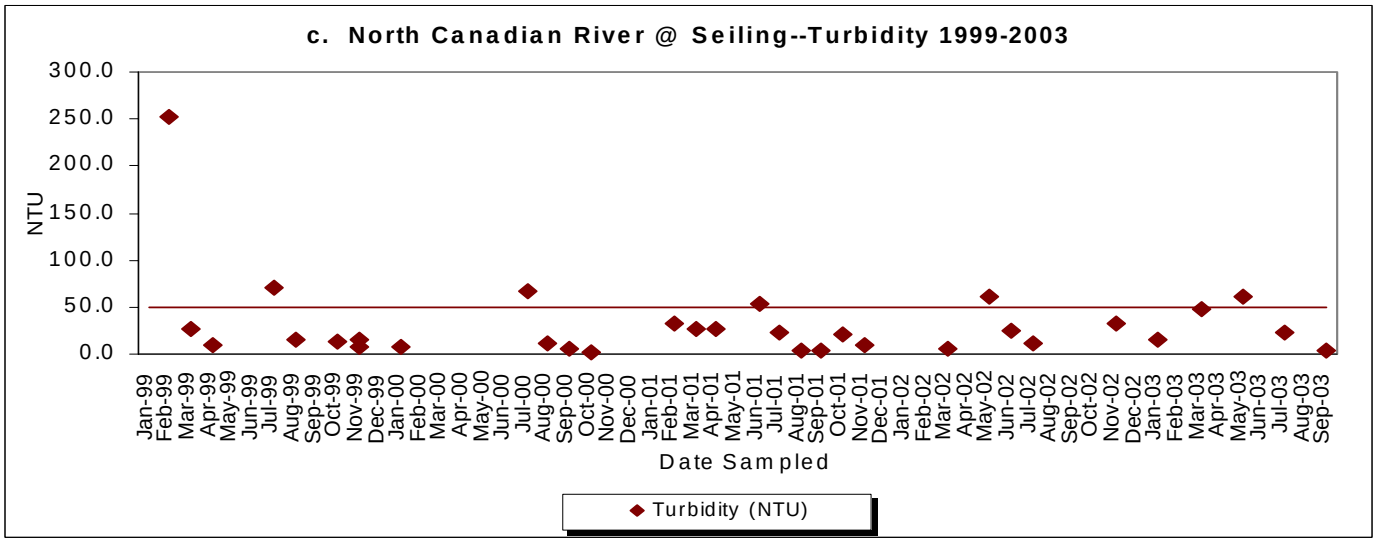
This station on the North Canadian River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from January of 1999 through September of 2003. For purposes of reporting, this station is representative of the North Canadian River from the confluence of an unnamed tributary near Mutual, Oklahoma (99.0817, 36.2638) downstream to confluence of the North Canadian River with Canton Lake (98.6641, 36.1355). As per Appendix A, Table 7 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class III Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

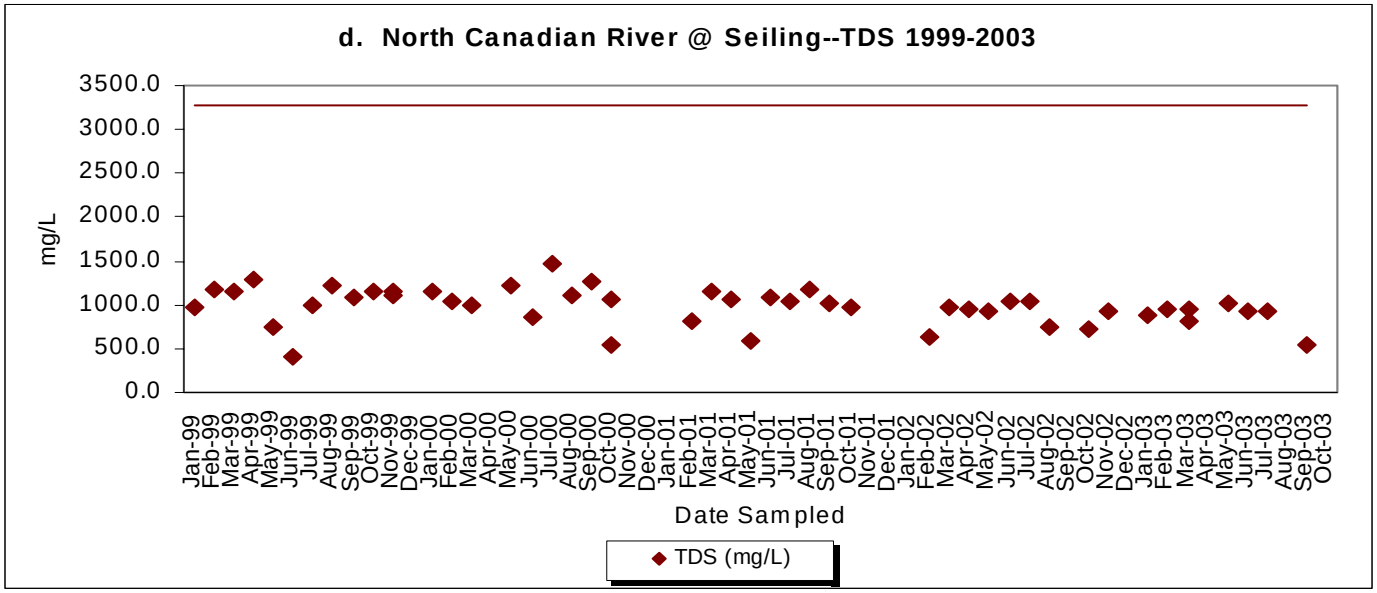
The PPWS beneficial use is supported. The WWAC beneficial use is partially supported. Of the 32 turbidity samples (Figure 57c), 6 samples (or 19%) exceeded the numerical criteria of 50. Dissolved oxygen (Figure 57a), pH (Figure 57b), and toxicant samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 57d and Figure 57e). The PBCR beneficial use is not supported (Table 23). Of the 17 enterococci concentrations, 4 samples exceeded the prescribed screening level of 406cfu/mL, and the geometric mean (180.0 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the North Canadian River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 1.0 mg/L and 4.65 mg/L, respectively (Figure 57f).

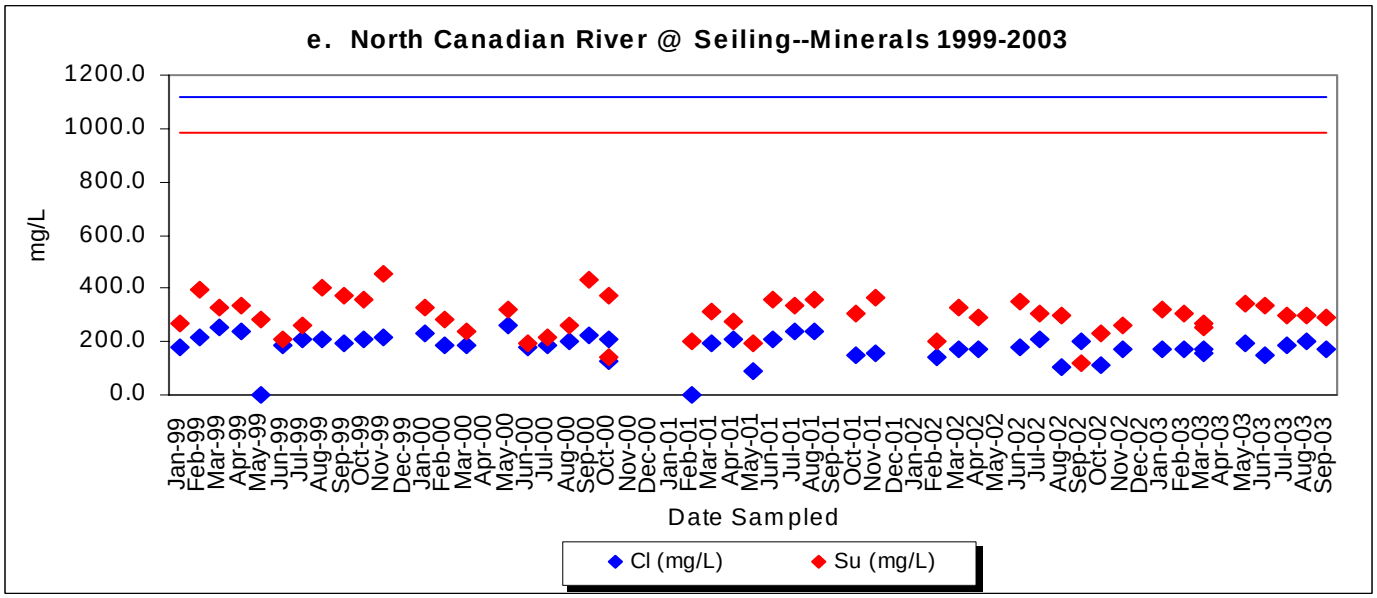
Figure 57a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the North Canadian River at Seiling (AT238000), 1999-2003.

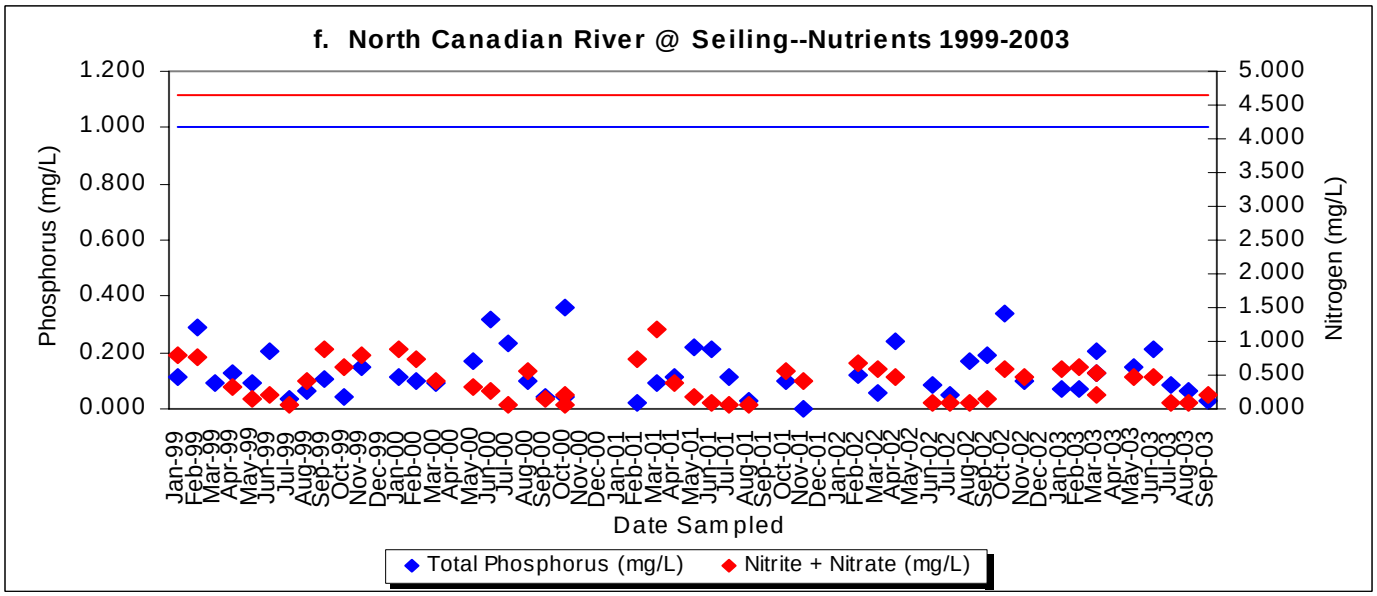







d. North Canadian River @ Seiling--TDS 1999-2003
mg/L
3500.0
3000.0
2500.0
2000.0
1500.0
1000.0
500.0
0.0
Date Sampled
TDS (mg/L)


e. North Canadian River @ Seiling--Minerals 1999-2003
mg/L
1200.0
1000.0
800.0
600.0
400.0
200.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. North Canadian River @ Seiling--Nutrients 1999-2003
Phosphorus (mg/L)
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Nitrogen (mg/L)
5.000
4.500
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

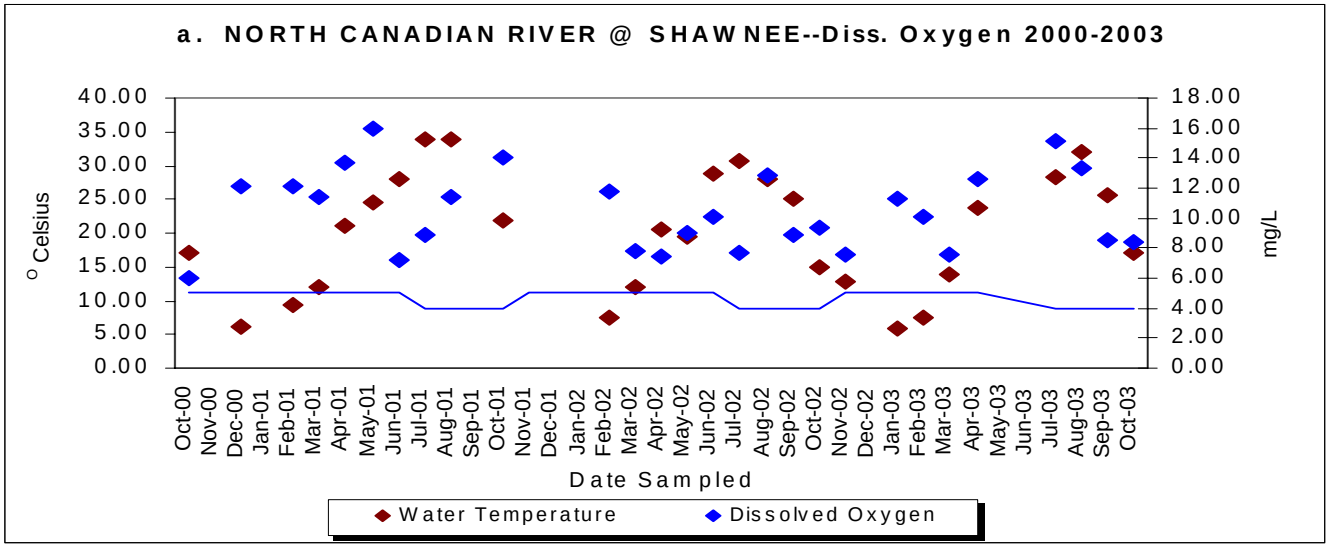
North Canadian River near Shawnee

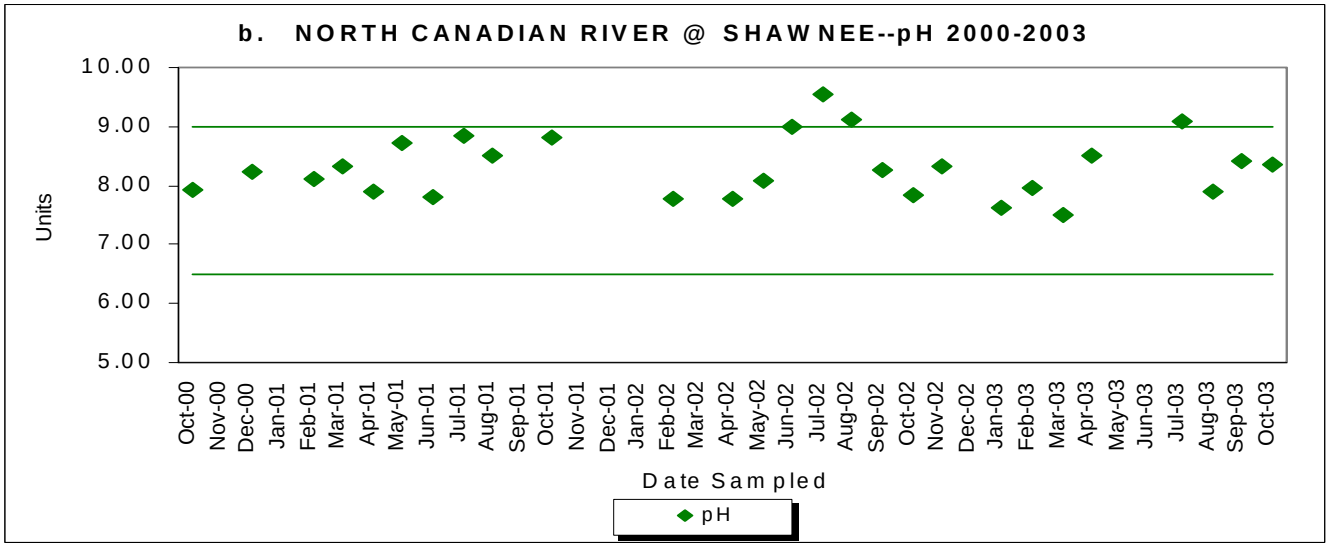
Station AT241700 (520510000110-005AT) is a permanent ambient trend monitoring station located on the North Canadian River in Oklahoma. Situated in the extreme northeast corner of Pottawatomie County, the site was established east of the City of Shawnee off of Interstate 40. In October of 2002, the station was moved to the State Highway 3E bridge to facilitate the gathering of discharge data. The station is positioned near the terminal end of stream segment 520510000110 and is classified within the Lower North Canadian River 8-digit HUC watershed (11100302). Water enters the stream system from Shawnee Twin Reservoirs and Tecumseh Lake and from several tributaries including North Deer Creek (Wes Watkins Lake), among others.

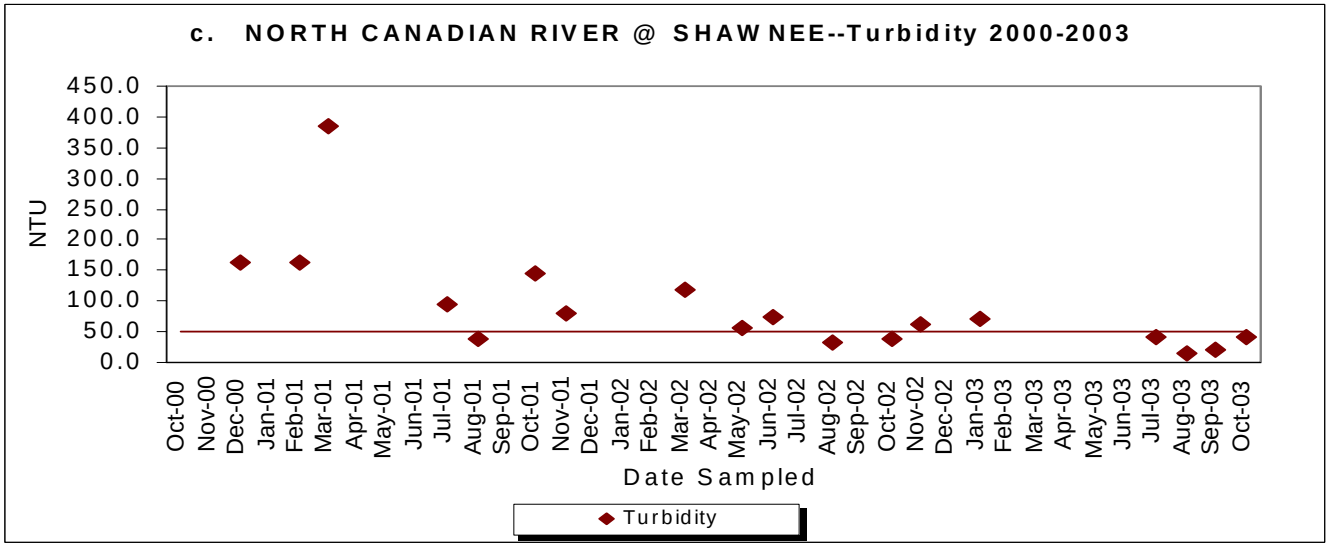
This station on the North Canadian River has been active for all water quality variables since October of 2000. The following assessment of beneficial uses is based on data collected from October of 2000 through October of 2003. For purposes of reporting, this station is representative of the Beaver River from the confluence of an unnamed tributary near Horseshoe Lake (97.1797, 35.5027) downstream to the confluence of Turkey Creek with the North Canadian River (96.632, 35.3922). As per Appendix A, Table 7 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Emergency Water Supply (EWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

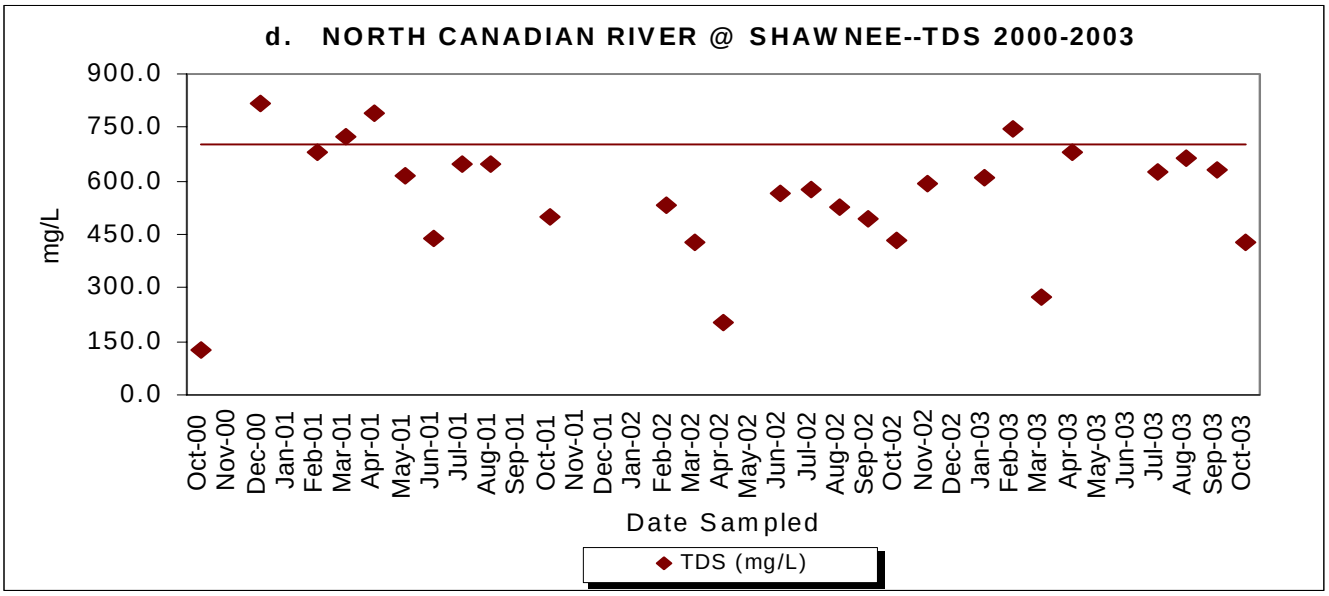
The WWAC beneficial use is not supported. Of the 18 turbidity samples (Figure 58c), 11 samples (or 61%) exceeded the numerical criteria of 50. Of the 8 lead samples collected, 4 of the concentrations (or 50%) exceeded the prescribed, hardness-dependant chronic criterion of 10.51 µg/L (Table 22). Dissolved oxygen (Figure 58a) and pH (Figure 58b) samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported (Figure 58d and Figure 58e). The PBCR beneficial use is not supported (Table 23). Of the 17 enterococci concentrations, 6 exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (85.6 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the North Canadian River is nutrient-threatened. The median of the total phosphorus concentrations (0.705 mg/L) exceeded the threshold median of 0.36 mg/L. The station also has a mean organic or mixed turbidity of 61 NTU. The nitrate/nitrite median value was below the threshold median of 5.0 mg/L (Figure 58f).

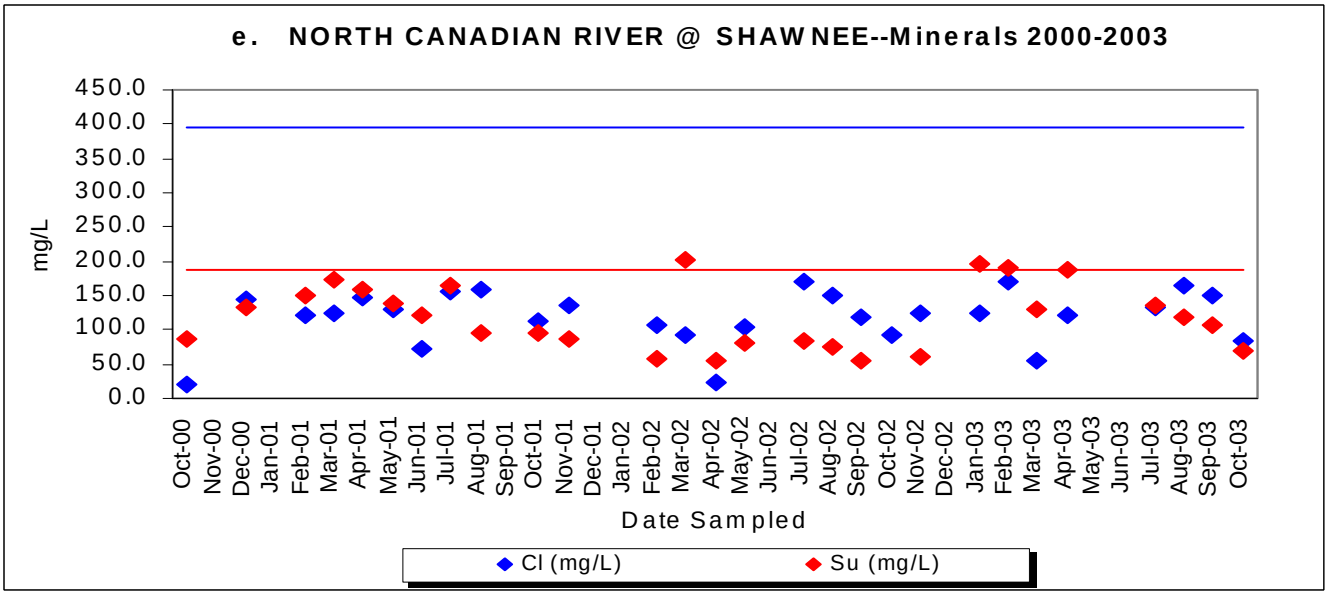
Figure 58a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the North Canadian River at Shawnee (AT241700), 2000-2003.

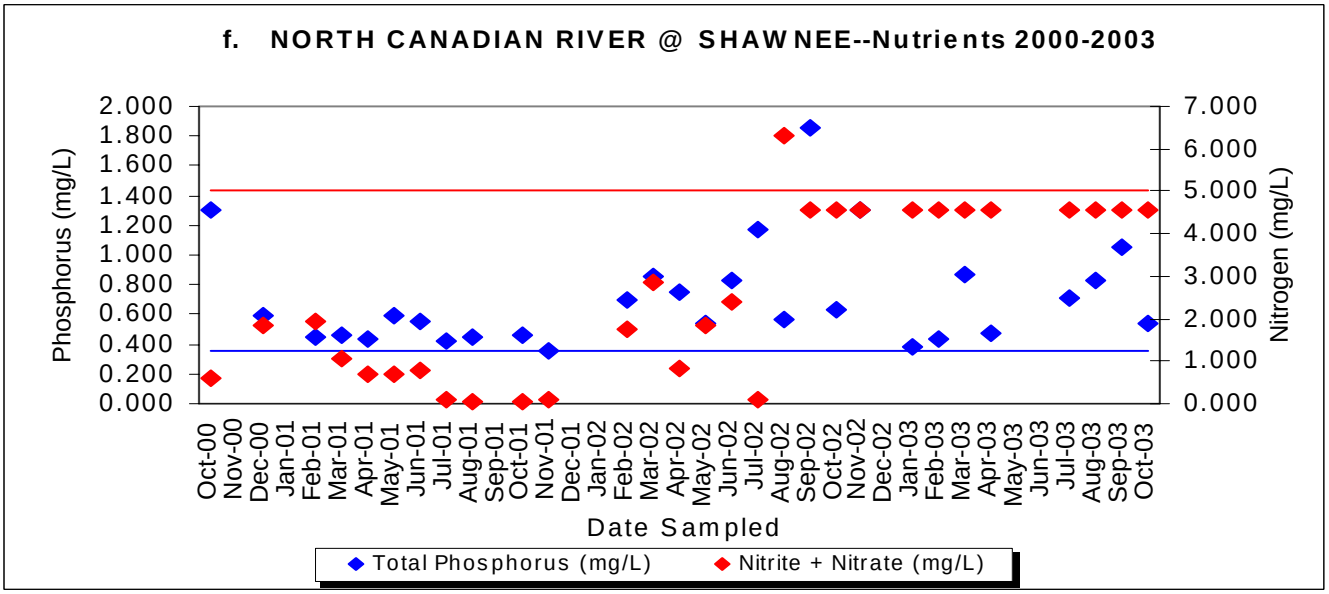







d. NORTH CANADIAN RIVER @ SHAWNEE--TDS 2000-2003
mg/L
900.0
750.0
600.0
450.0
300.0
150.0
0.0
Oct-00 Nov-00 Dec-00 Jan-01 Feb-01 Mar-01 Apr-01 May-01 Jun-01 Jul-01 Aug-01 Sep-01 Oct-01 Nov-01 Dec-01 Jan-02 Feb-02 Mar-02 Apr-02 May-02 Jun-02 Jul-02 Aug-02 Sep-02 Oct-02 Nov-02 Dec-02 Jan-03 Feb-03 Mar-03 Apr-03 May-03 Jun-03 Jul-03 Aug-03 Sep-03 Oct-03
Date Sampled
TDS (mg/L)


e. NORTH CANADIAN RIVER @ SHAWNEE--Minerals 2000-2003
mg/L
450.0
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
Oct-00 Nov-00 Dec-00 Jan-01 Feb-01 Mar-01 Apr-01 May-01 Jun-01 Jul-01 Aug-01 Sep-01 Oct-01 Nov-01 Dec-01 Jan-02 Feb-02 Mar-02 Apr-02 May-02 Jun-02 Jul-02 Aug-02 Sep-02 Oct-02 Nov-02 Dec-02 Jan-03 Feb-03 Mar-03 Apr-03 May-03 Jun-03 Jul-03 Aug-03 Sep-03 Oct-03
Date Sampled
Cl (mg/L)
Su (mg/L)


f. NORTH CANADIAN RIVER @ SHAWNEE--Nutrients 2000-2003
Phosphorus (mg/L)
2.000
1.800
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Nitrogen (mg/L)
7.000
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Oct-00 Nov-00 Dec-00 Jan-01 Feb-01 Mar-01 Apr-01 May-01 Jun-01 Jul-01 Aug-01 Sep-01 Oct-01 Nov-01 Dec-01 Jan-02 Feb-02 Mar-02 Apr-02 May-02 Jun-02 Jul-02 Aug-02 Sep-02 Oct-02 Nov-02 Dec-02 Jan-03 Feb-03 Mar-03 Apr-03 May-03 Jun-03 Jul-03 Aug-03 Sep-03 Oct-03
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

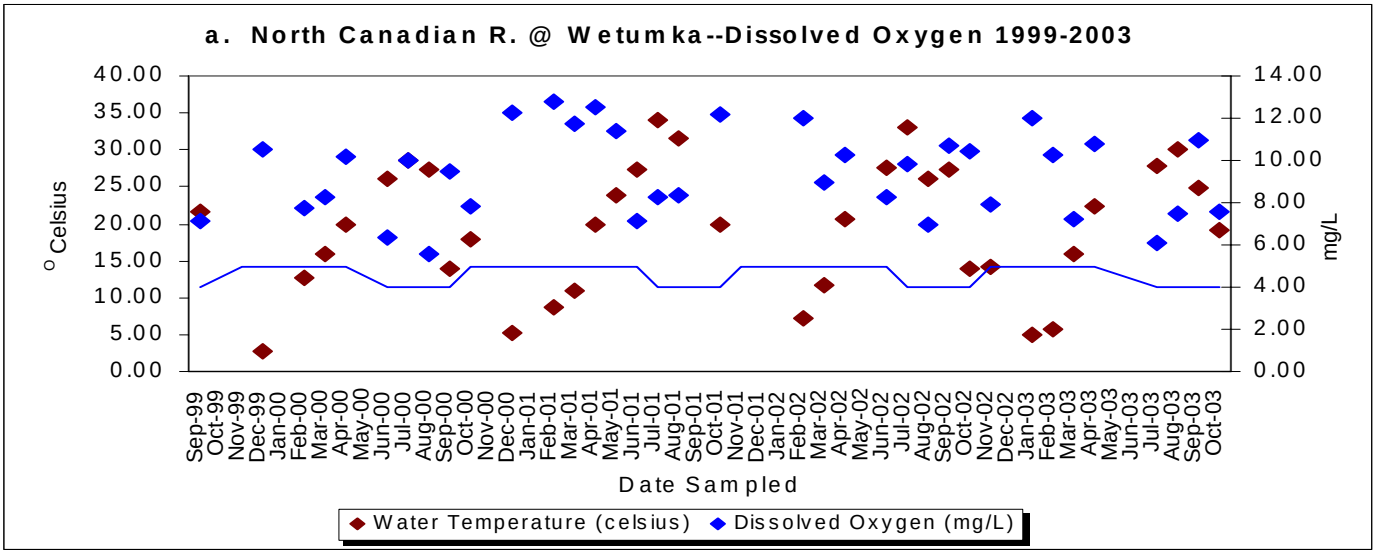
North Canadian River near Wetumka

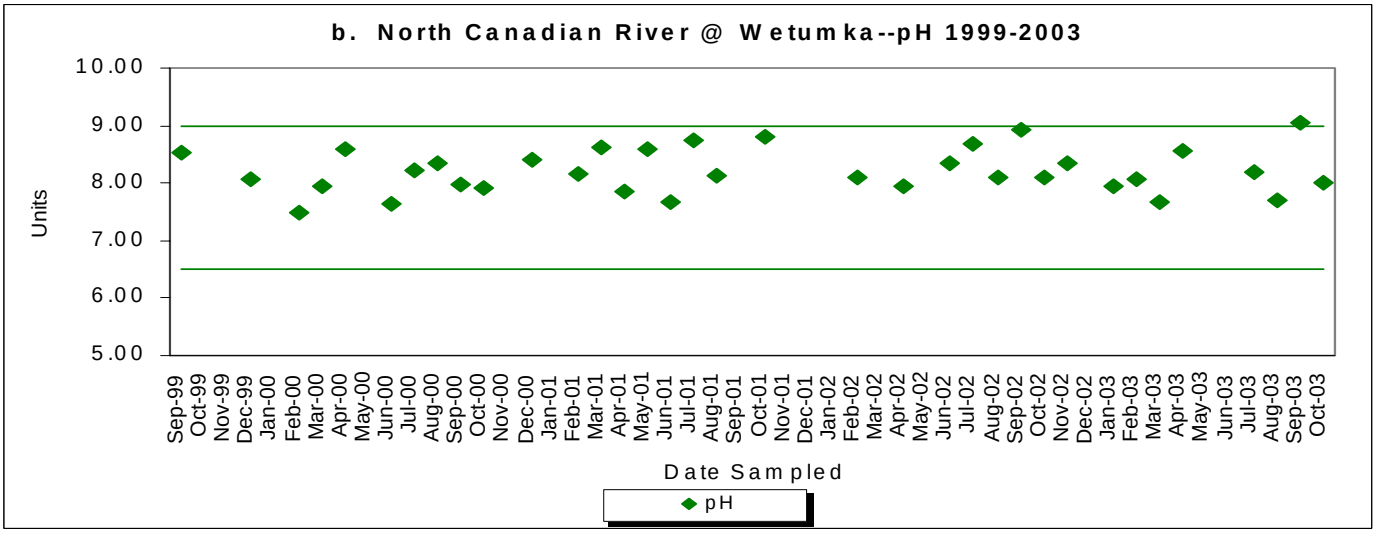
Station AT242000 (520510000010-001AT) is a permanent ambient trend monitoring station located on the North Canadian River. Situated in the north central portion of Hughes County, the site was established northeast of the City of Wetumka on US Highway 75. The station is positioned near the upper end of stream segment 520510000010 and is classified within the Lower North Canadian River 8-digit HUC watershed (11100302). Water enters the stream system from Cohee Lake and Lake Wetumka and from several tributaries including Turkey Creek, Sand Creek, Flat Rock Creek, among others.

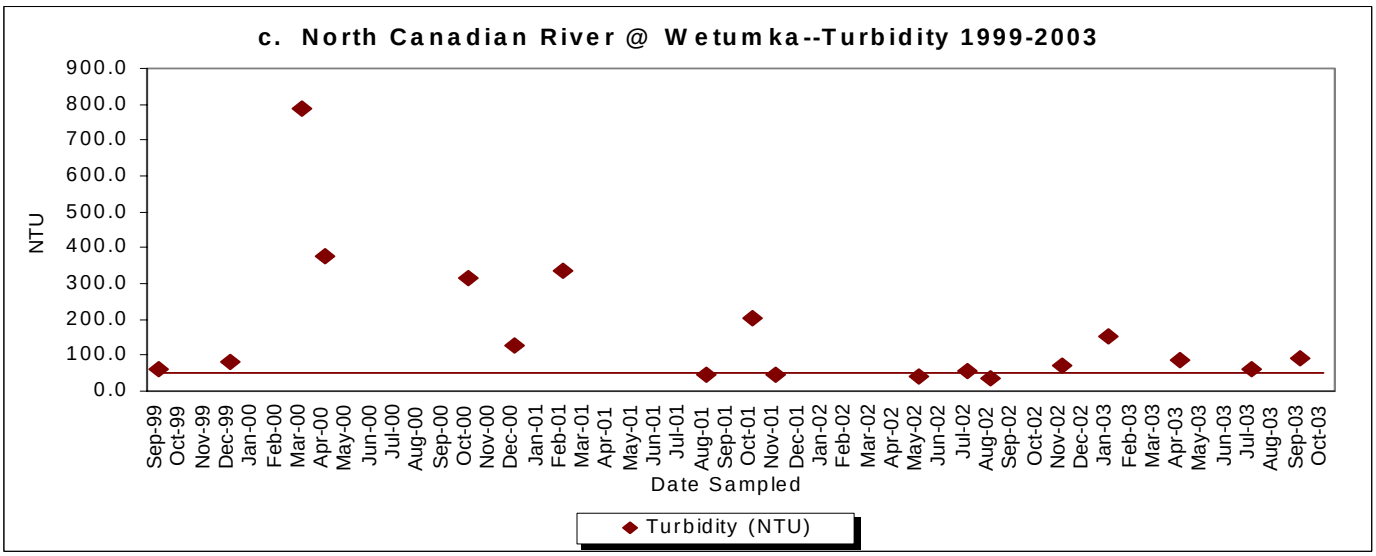
This station on the North Canadian River has been active for all water quality variables since September of 1999. The following assessment of beneficial uses is based on data collected from September of 1999 through October of 2003. For purposes of reporting, this station is representative of the North Canadian River from the confluence of Sand Creek (96.3996, 35.3964) downstream to above the confluence of Wewoka Creek with the North Canadian River (96.1690, 35.2556). As per Appendix A, Table 5 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

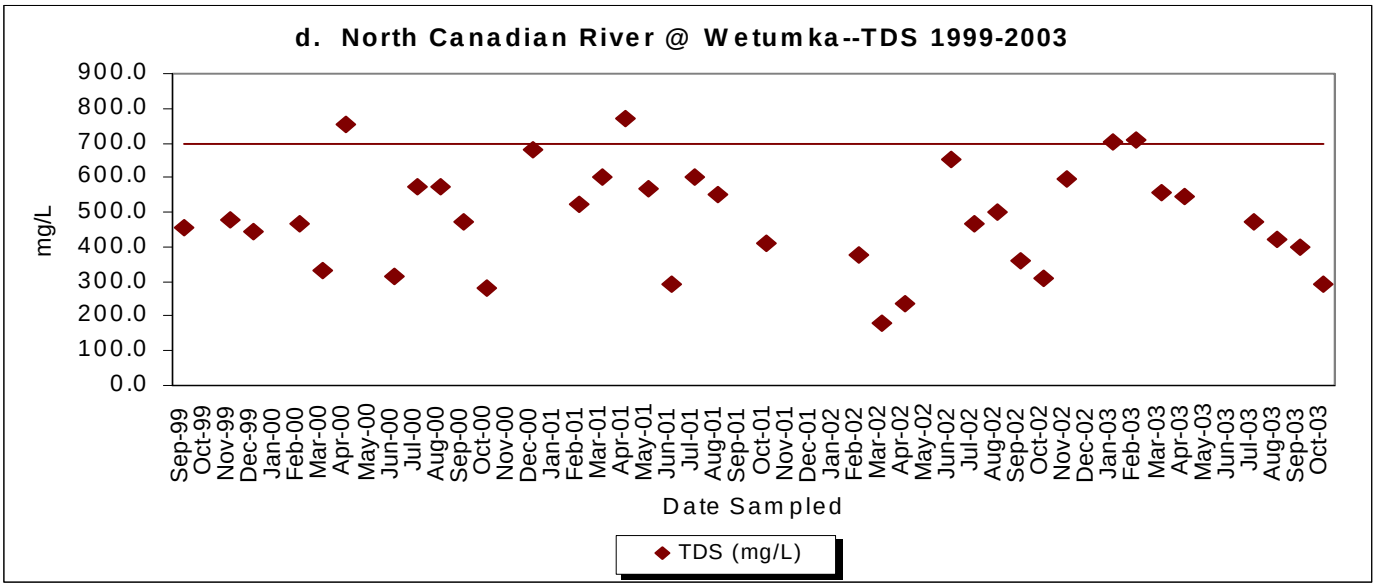
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 18 turbidity samples (Figure 59c), 14 samples (or 78%) exceeded the numerical criteria of 50. Of the 12 lead samples collected, 5 of the concentrations (or 42%) exceeded the prescribed, hardness-dependant chronic criterion of 8.35 µg/L (Table 22). Of the 9 copper samples collected, 2 of the concentrations (or 22%) exceeded the prescribed, hardness-dependant chronic criterion of 24.46 µg/L (Table 22). Dissolved oxygen (Figure 59a) and pH (Figure 59b) samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 59d and Figure 59e). The PBCR beneficial use is not supported (Table 23). Of the 21 fecal coliform concentrations, 6 samples (or 29%) exceeded the prescribed screening level of 400 cfu/mL. Of the 21 enterococci concentrations, 5 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (196.1 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the North Canadian River is nutrient-threatened. The median of the total phosphorus concentrations (0.417 mg/L) exceeded the threshold median of 0.36 mg/L. The mean mixed turbidity is 64 NTU. The nitrate/nitrite median value was below the threshold median of 5.0 mg/L (Figure 59f).

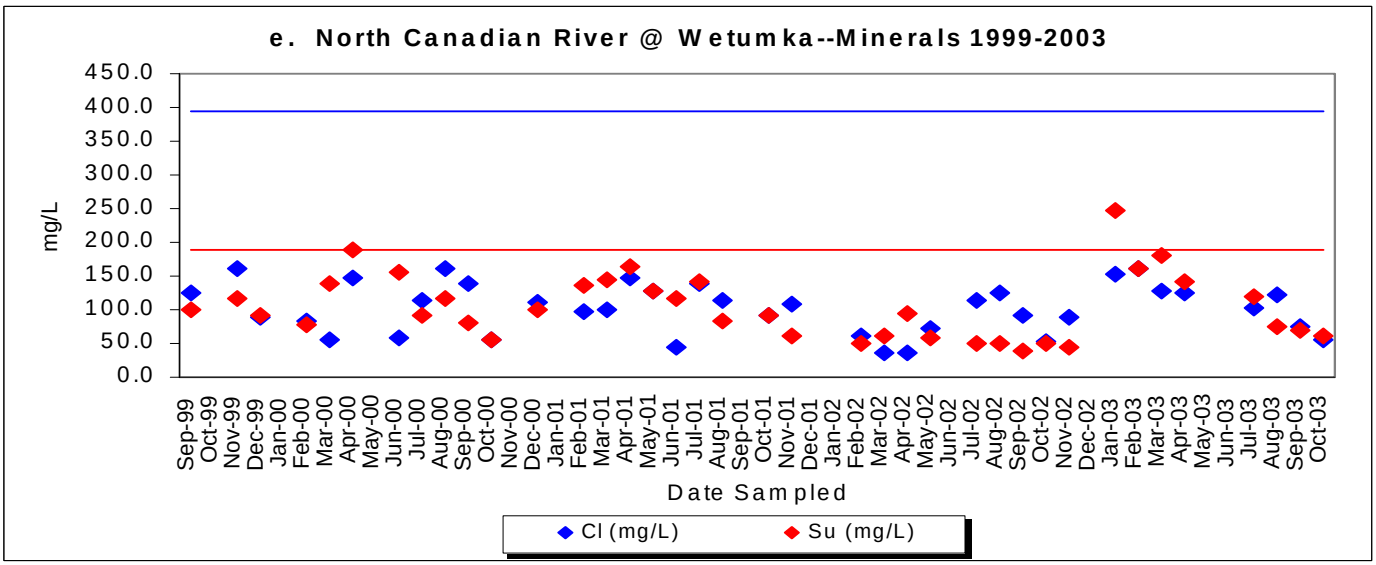
Figure 59a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the North Canadian River at Wetumka (AT242000), 1999-2003.

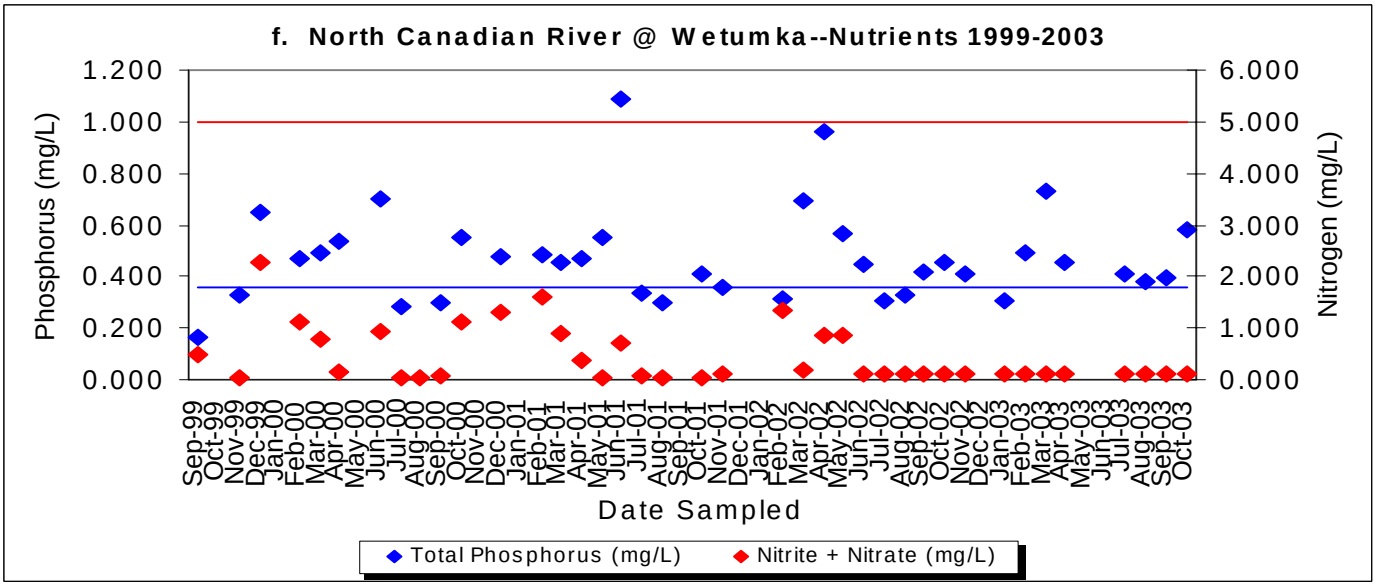







d. North Canadian River @ Wetumka--TDS 1999-2003
mg/L
900.0
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Date Sampled
TDS (mg/L)


e. North Canadian River @ Wetumka--Minerals 1999-2003
mg/L
450.0
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. North Canadian River @ Wetumka--Nutrients 1999-2003
Phosphorus (mg/L)
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

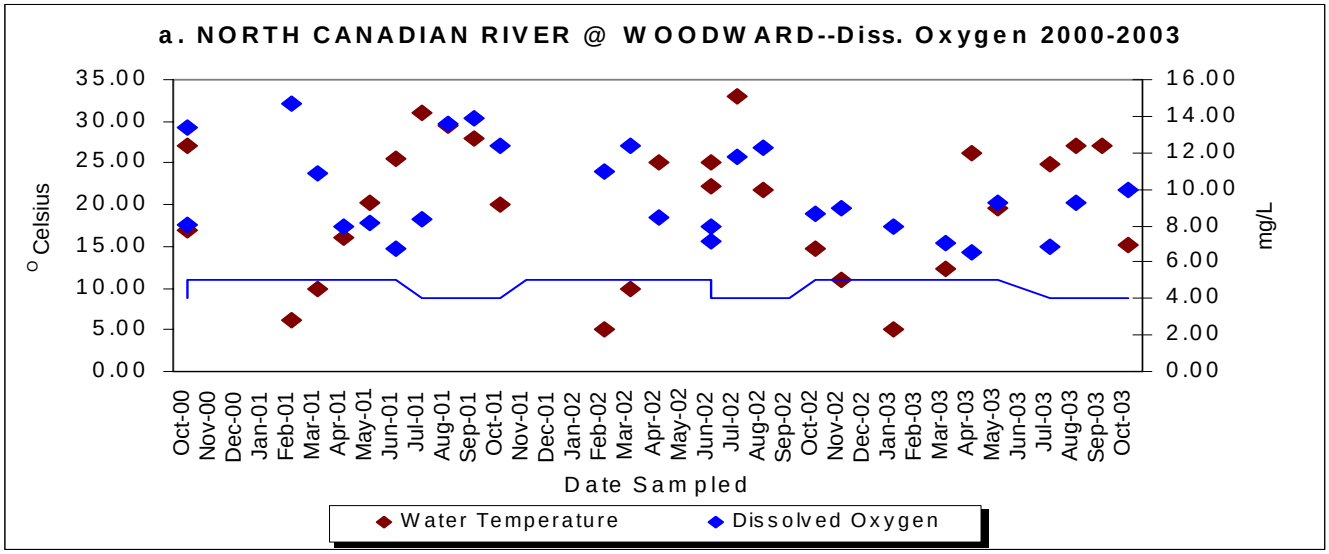
North Canadian River near Woodward

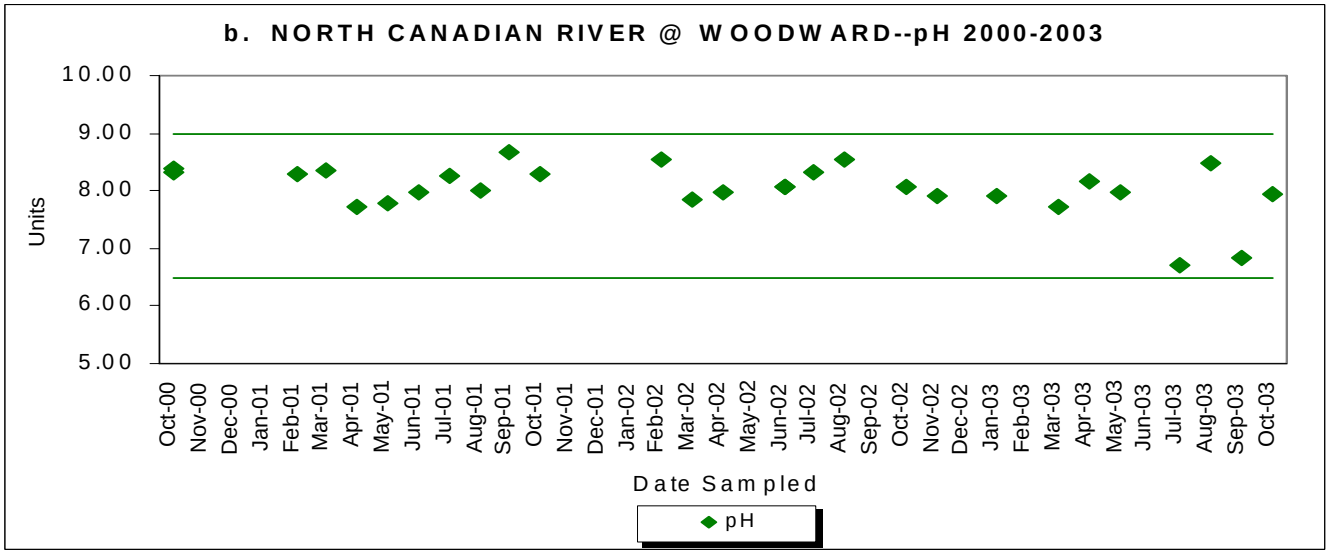
Station AT237500 (720500010140-001AT) is a permanent ambient trend monitoring station located on the North Canadian River in Oklahoma. Situated in the center portion of Woodward County, the site was established east of the City of Woodward on US Highway 412. The station is positioned near the terminal end of stream segment 720500010140 and is classified within the Middle North Canadian River 8-digit HUC watershed (11100301). Water enters the stream system from Clear Creek and Otter Creek, among others.

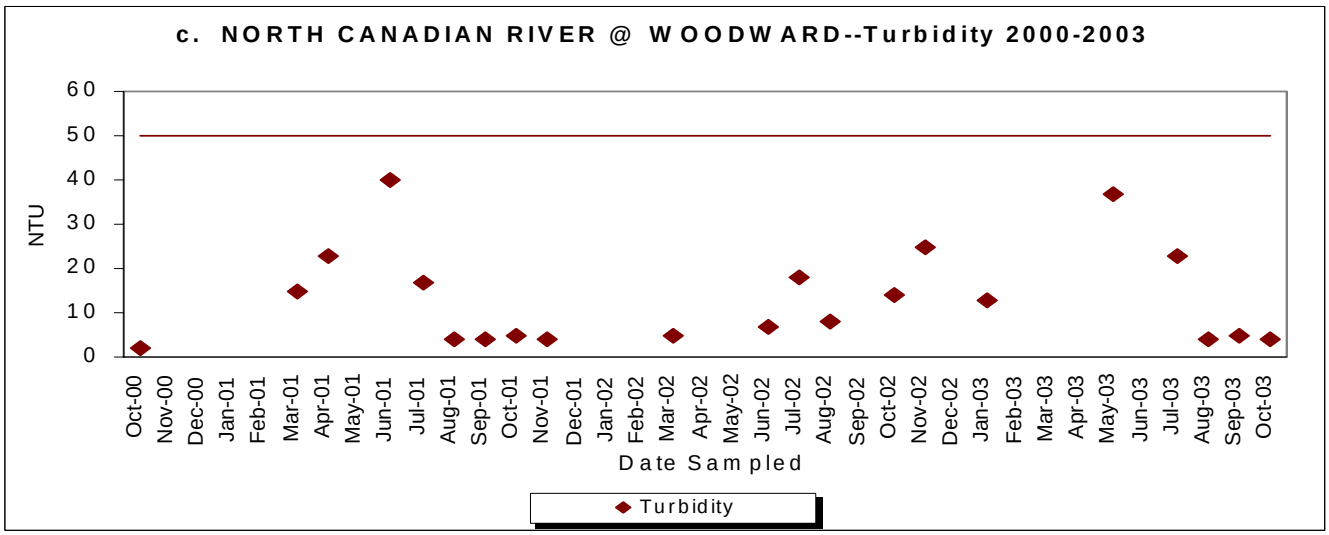
This station on the North Canadian River has been active for all water quality variables since October of 2000. The following assessment of beneficial uses is based on data collected from October of 2000 through October of 2003. For purposes of reporting, this station is representative of the Beaver River from the confluence of Wolf Creek (99.5019, 36.5886) downstream to the confluence of an unnamed tributary near Mutual, Oklahoma (99.0817, 36.2638). As per Appendix A, Table 7 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 2) Agriculture—Class III Irrigation (AG), 3) Primary Body Contact—Recreation (PBCR), and 4) Aesthetics.

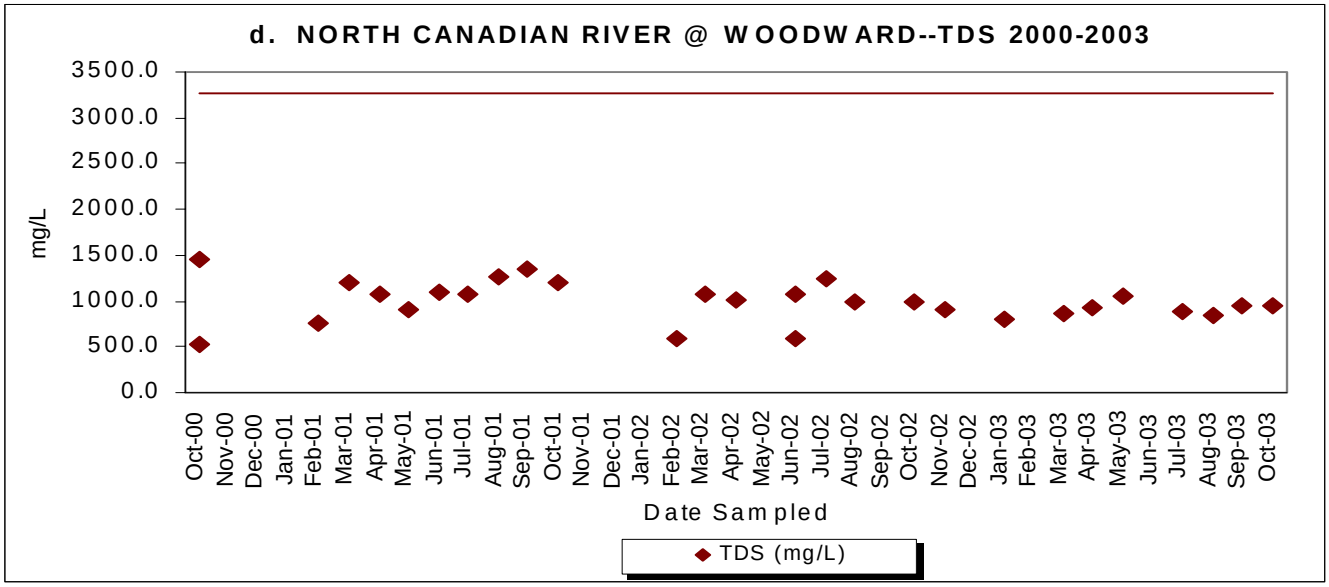
The WWAC beneficial use is supported. Dissolved oxygen (Figure 60a), pH (Figure 60b), turbidity (Figure 60c), and toxicant data met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 60d and Figure 60e). The PBCR beneficial use is not supported (Table 23). Of the 9 enterococci concentrations, 3 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (97.2 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the North Canadian River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 1.0 mg/L and 4.65 mg/L, respectively (Figure 60f).

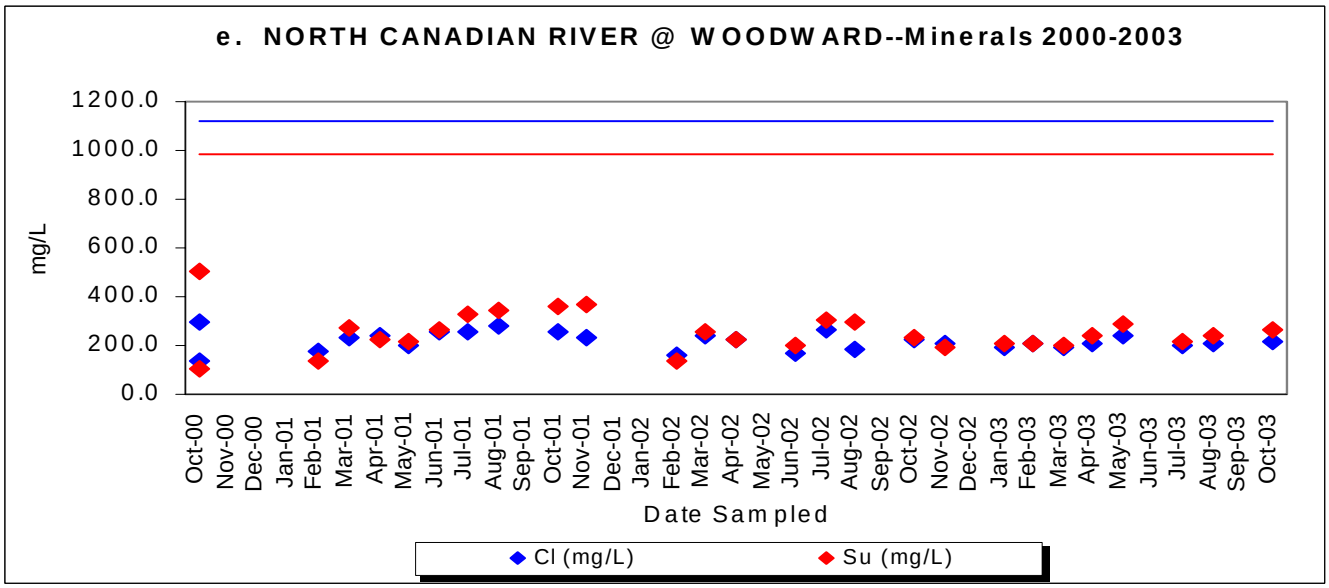
Figure 60a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the North Canadian River at Woodward (AT237500), 2000-2003.

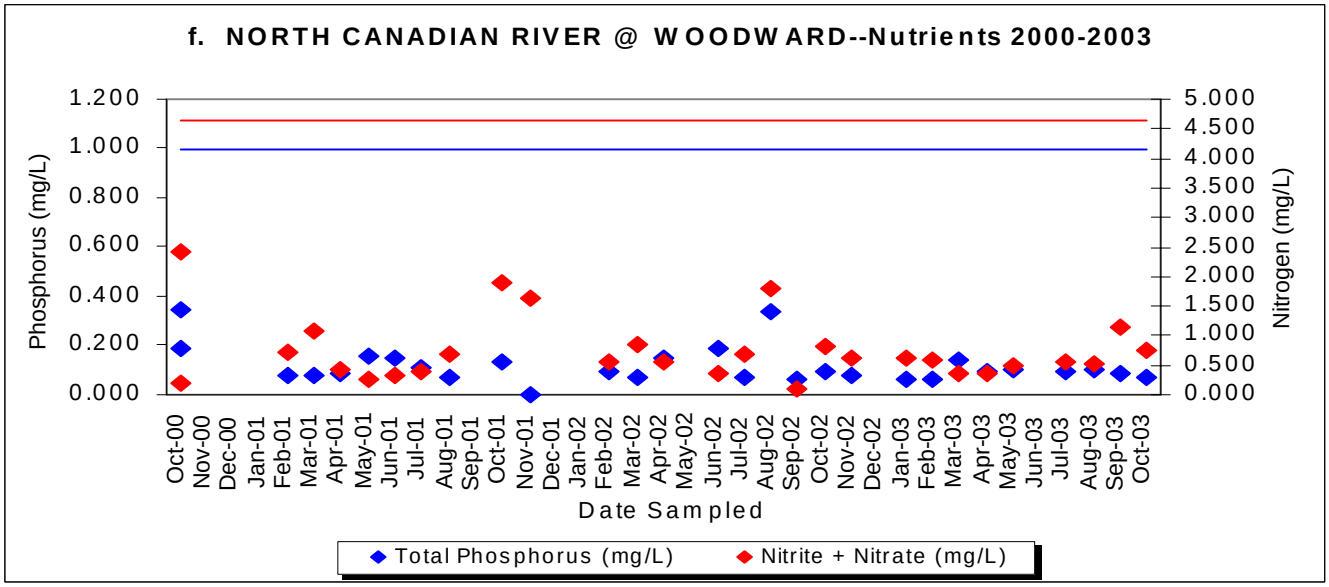







d. NORTH CANADIAN RIVER @ WOODWARD--TDS 2000-2003
mg/L
3500.0
3000.0
2500.0
2000.0
1500.0
1000.0
500.0
0.0
Oct-00 Nov-00 Dec-00 Jan-01 Feb-01 Mar-01 Apr-01 May-01 Jun-01 Jul-01 Aug-01 Sep-01 Oct-01 Nov-01 Dec-01 Jan-02 Feb-02 Mar-02 Apr-02 May-02 Jun-02 Jul-02 Aug-02 Sep-02 Oct-02 Nov-02 Dec-02 Jan-03 Feb-03 Mar-03 Apr-03 May-03 Jun-03 Jul-03 Aug-03 Sep-03 Oct-03
Date Sampled
TDS (mg/L)


e. NORTH CANADIAN RIVER @ WOODWARD--Minerals 2000-2003
mg/L
1200.0
1000.0
800.0
600.0
400.0
200.0
0.0
Oct-00 Nov-00 Dec-00 Jan-01 Feb-01 Mar-01 Apr-01 May-01 Jun-01 Jul-01 Aug-01 Sep-01 Oct-01 Nov-01 Dec-01 Jan-02 Feb-02 Mar-02 Apr-02 May-02 Jun-02 Jul-02 Aug-02 Sep-02 Oct-02 Nov-02 Dec-02 Jan-03 Feb-03 Mar-03 Apr-03 May-03 Jun-03 Jul-03 Aug-03 Sep-03 Oct-03
Date Sampled
Cl (mg/L)
Su (mg/L)


f. NORTH CANADIAN RIVER @ WOODWARD--Nutrients 2000-2003
Phosphorus (mg/L)
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Nitrogen (mg/L)
5.000
4.500
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
Oct-00 Nov-00 Dec-00 Jan-01 Feb-01 Mar-01 Apr-01 May-01 Jun-01 Jul-01 Aug-01 Sep-01 Oct-01 Nov-01 Dec-01 Jan-02 Feb-02 Mar-02 Apr-02 May-02 Jun-02 Jul-02 Aug-02 Sep-02 Oct-02 Nov-02 Dec-02 Jan-03 Feb-03 Mar-03 Apr-03 May-03 Jun-03 Jul-03 Aug-03 Sep-03 Oct-03
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

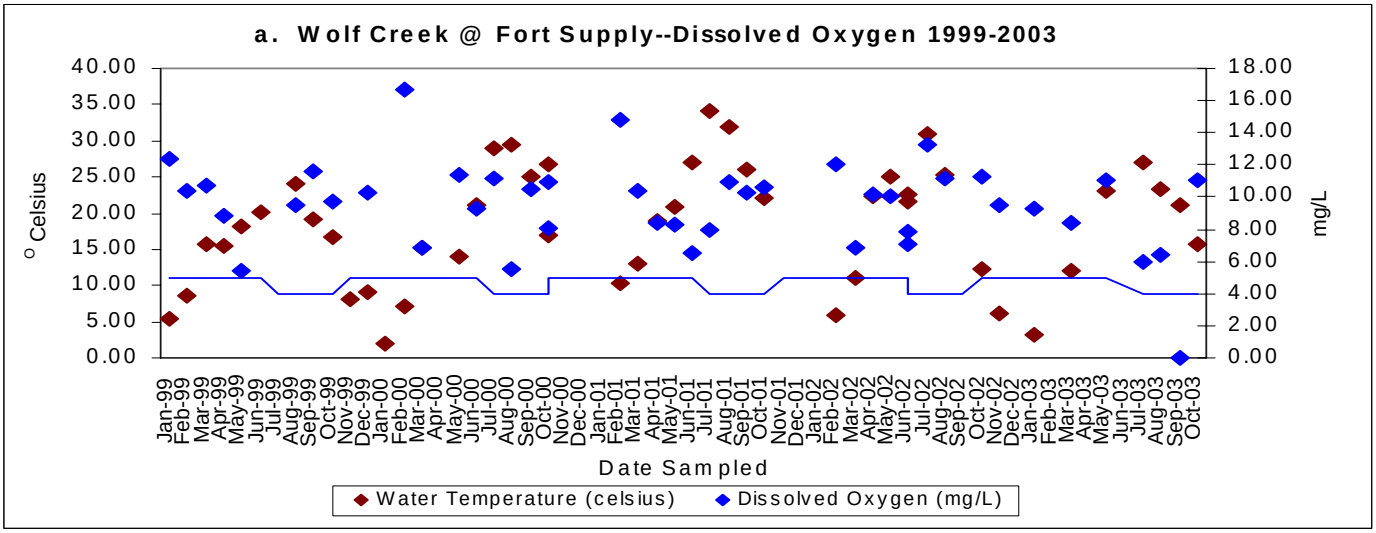
Wolf Creek near Fort Supply

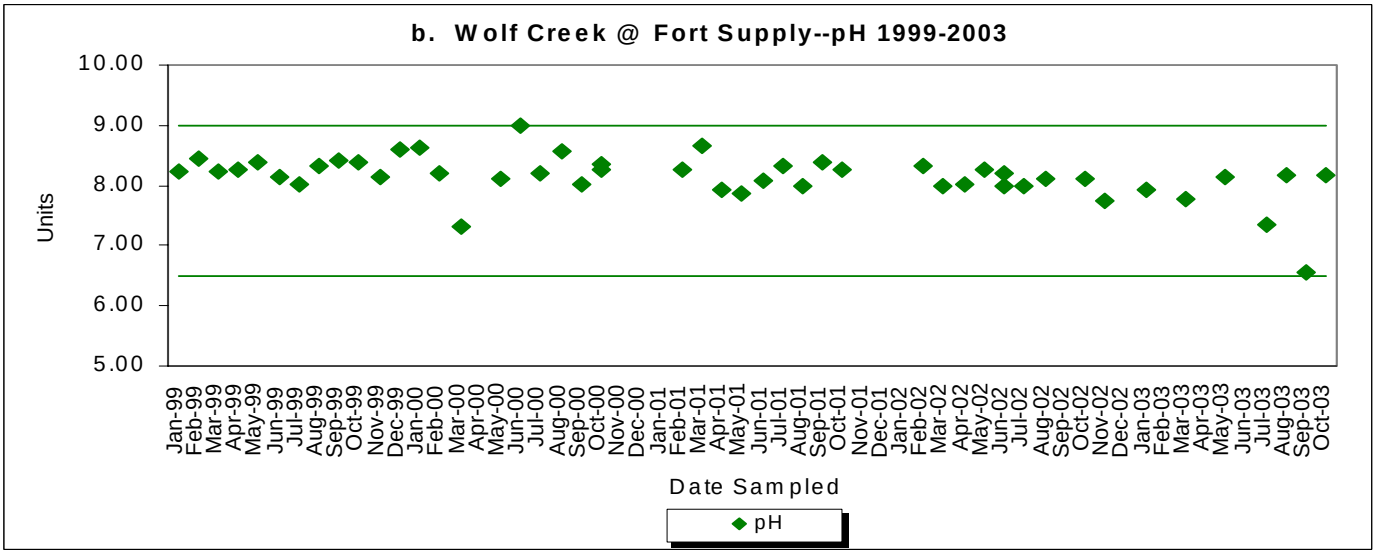
Station AT237050 (720500030010-001AT) is a permanent ambient trend monitoring station located on Wolf Creek in Oklahoma. Situated in the west central portion of Woodward County, the site was established south of the Town of Fort Supply off US High way 270. The station is positioned near the terminal end of stream segment 720500030010 and is classified within the Lower Wolf Creek 8-digit HUC watershed (11100203). Water enters the stream system from Texas and from several tributaries including Twenty-five Mile Creek, Little Wolf Creek, and Sixteen-mile Creek, among others.

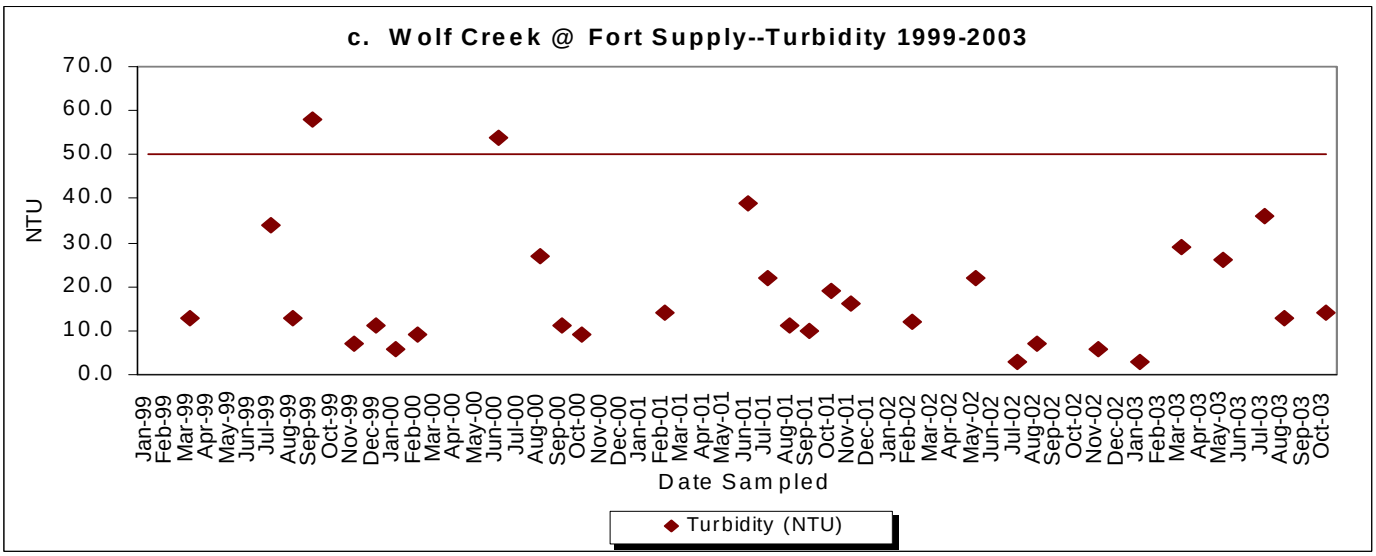
This station on Wolf Creek has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from January 1999 through October of 2003. For purposes of reporting, this station is representative of Wolf Creek from the confluence of Twenty-five Mile Creek (99.7333, 36.3337) downstream to confluence of Wolf Creek with Fort Supply Reservoir (99.5762, 36.5094). As per Appendix A, Table 7 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

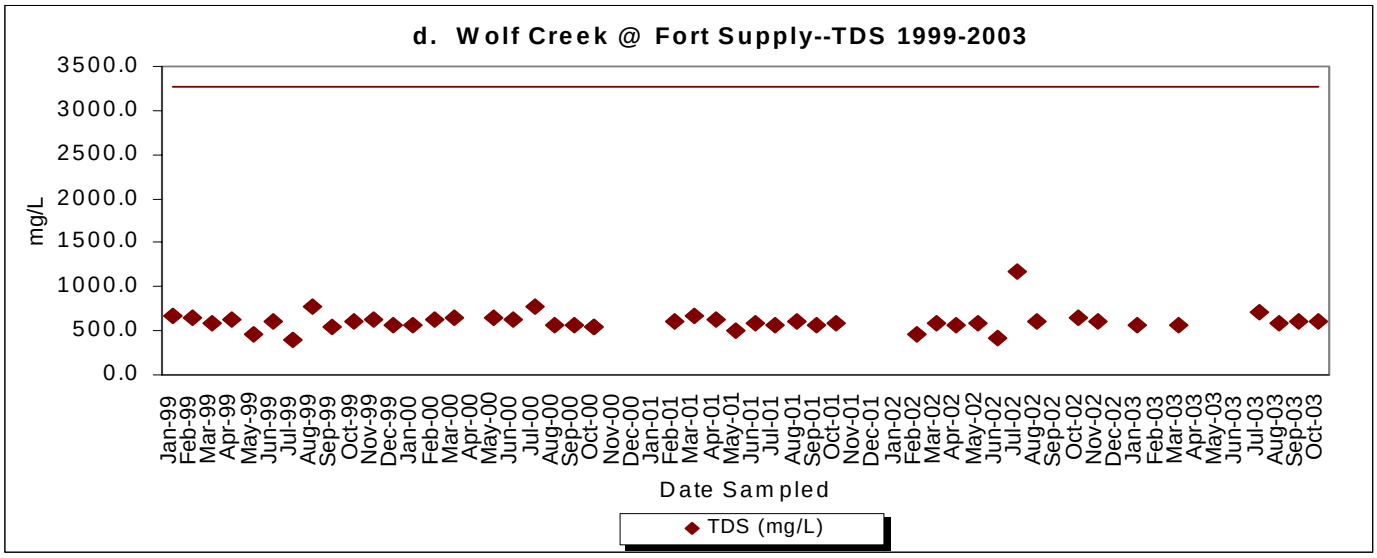
The PPWS beneficial use is supported. The WWAC beneficial use is supported. Dissolved oxygen (Figure 61a), pH (Figure 61b), turbidity (Figure 61c), and toxicant data collected during the same period met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 61d and Figure 61e). The PBCR beneficial use is not supported (Table 23). Of the 18 enterococci concentrations, 5 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (352.3 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of Wolf Creek is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 61f).

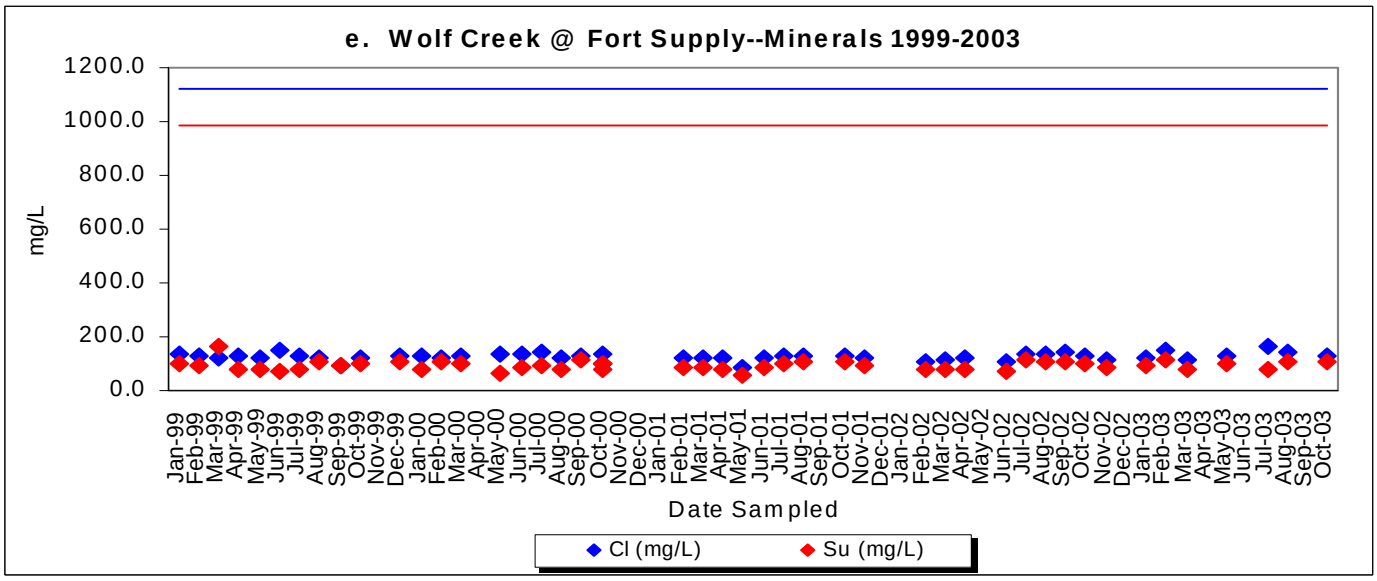
Figure 61a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on Wolf Creek at Fort Supply (AT237050), 1999-2003.

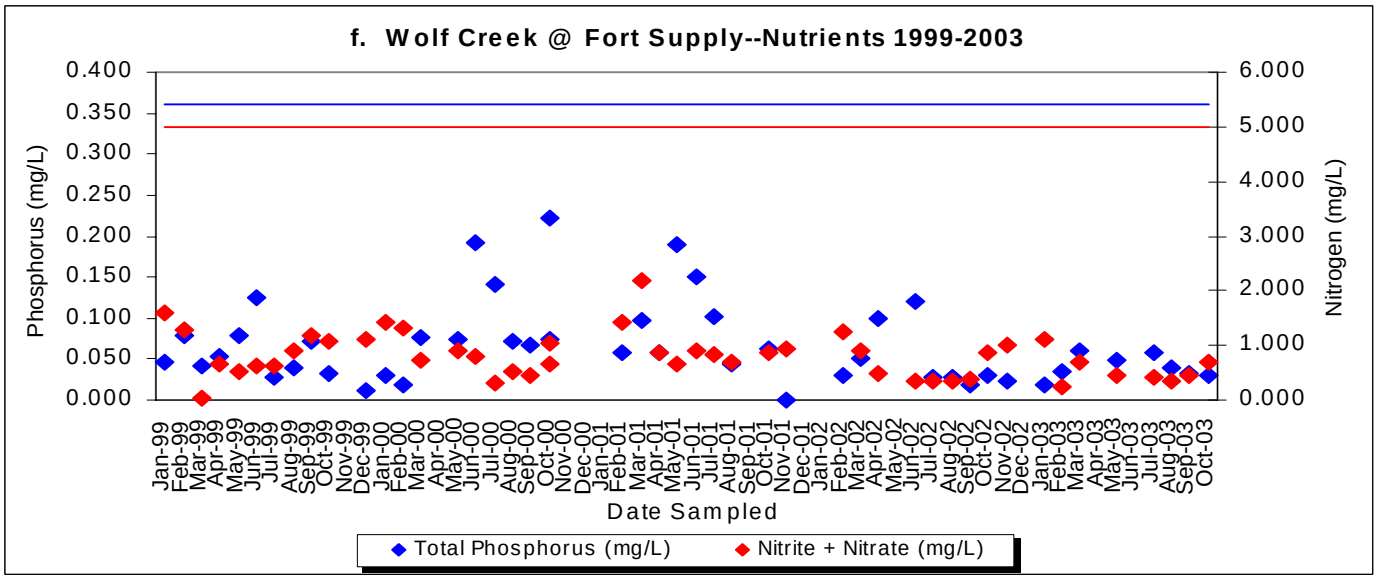







d. Wolf Creek @ Fort Supply--TDS 1999-2003
mg/L
3500.0
3000.0
2500.0
2000.0
1500.0
1000.0
500.0
0.0
Date Sampled
TDS (mg/L)


e. Wolf Creek @ Fort Supply--Minerals 1999-2003
mg/L
1200.0
1000.0
800.0
600.0
400.0
200.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Wolf Creek @ Fort Supply--Nutrients 1999-2003
Phosphorus (mg/L)
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

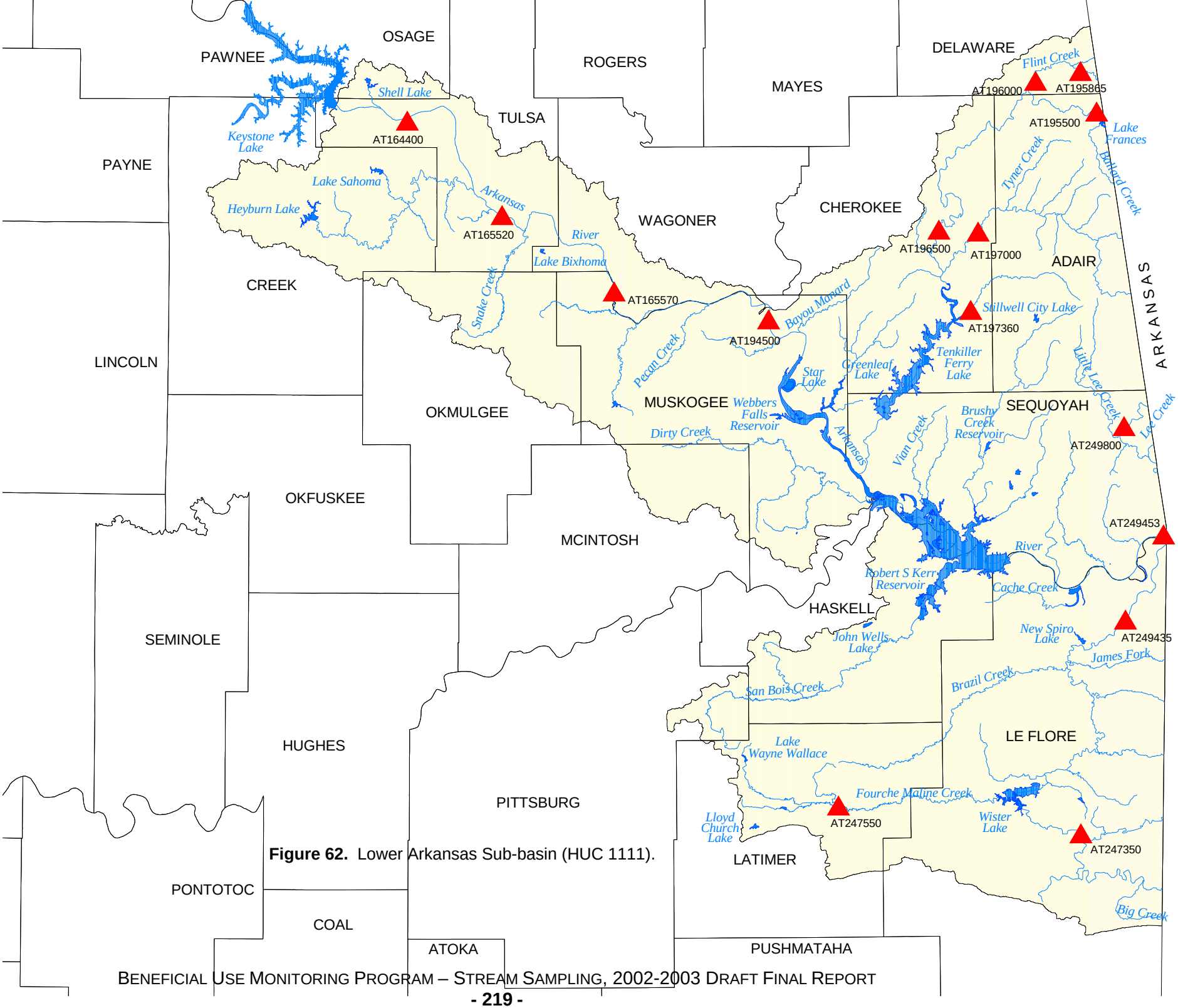


Figure 62. Lower Arkansas Sub-basin (HUC 1111).

HUC 1111

LOWER ARKANSAS SUB-BASIN

The Lower Arkansas sub-basin (4-digit hydrologic unit 1111) is situated in the central eastern portion of the state. It originates in the western portion of Creek and Tulsa Counties, continues eastward through portions of Okmulgee, Wagoner, Muskogee, McIntosh, Cherokee, Delaware, Haskell, and Latimer Counties, and terminates in the eastern parts of Adair, Sequoyah, and LeFlore Counties. Major cities and County seats located within the basin include Sand Springs, Tulsa, Broken Arrow, Sapulpa, Jenks, Glenpool, Bixby, Coweta, Muskogee, Tahlequah, Stillwell, Sallisaw, Wilburton, and Poteau. Minor cities of note include Kellyville, Haskell, Checotah, Warner, Gore, Roland, Heavener, and Spiro.

The basin is subdivided into five 8-digit hydrologic units (HUC) within the state. These HUC's are the Polecat–Snake (11110101), the Dirty–Greenleaf (11110102), the Illinois (11110103), the Robert S. Kerr Reservoir (11110104), and the Poteau (11110105). The major surface water in the basin is the lower Arkansas River (McClellan-Kerr Navigational System). Major tributaries include the Illinois River, the Poteau River, Polecat Creek, Bayou Manard, Greenleaf Creek, Sager Creek, Flint Creek, Barren Fork, Caney Creek, Dirty Creek, Sallisaw Creek, Big Skin Bayou, Lee Creek, Cache Creek, San Bois Creek, Brazil Creek, Fourche-Maline Creek, Caston Creek, Black Fork, and James Fork. Five major lakes are located in the basin—Heyburn Lake formed by Polecat Creek, Webbers Falls Reservoir formed by the Arkansas River and Greenleaf Creek, Tenkiller Ferry Lake formed by the Illinois River and Caney Creek, Robert S. Kerr Reservoir formed by the Arkansas River and several tributaries, and Wister Lake formed by the Poteau River and Fourche-Maline Creek. Fifteen active permanent monitoring stations (Table 24) are located in the basin—AT164400, AT165520, AT165570, AT194500, AT195500, AT195865, AT196000, AT196500, AT197000, AT197360, AT247350, AT247550, AT249435, AT249453, and AT249800. Station AT249800, Lee Creek near Short, was added in the beginning of 2003 and will not be assessed in this report due to lack of data. One inactive water quality-monitoring station (AT165610) is located in the sub-basin. This station was last assessed in the 2000 BUMP Report.

The basin is characterized by five ecoregions. The Central Irregular Plains begins in eastern Okmulgee County, covers the majority of Muskogee County, and continues through parts of McIntosh, Delaware, Sequoyah and eastern Cherokee Counties. The Ozark Highlands begins in Delaware County, continuing through the northern one-half (½) of Adair County, and is also in northern Cherokee County. The Boston Mountains begin in eastern Cherokee County, continue through the southern one-half (½) of Adair County, and end in northern Sequoyah County. The Arkansas Valley covers the southern three-quarters (¾) of Sequoyah County, southeast Muskogee County, Haskell County, the northern one-half (½) of Latimer County, and the northern one-third of LeFlore County. The Ouachita Mountains cover the southern one-half (½) of Latimer County and the southern two-thirds of LeFlore County. The primary land uses in the sub-basin are forestland (post oak–blackjack oak, hickory–oak, bottomland hardwoods, and shortleaf pine) and pastureland (brushy and mixed). Forestland is prevalent throughout the sub-basin with concentrations in the central, northeast and southeast portions. Pastureland is prevalent in the northwest and central eastern portions. Rangeland (post – blackjack oak scrub and open grasslands) is the secondary land use. It is prevalent in the western portion of the sub-basin and is interspersed throughout the central and eastern portions. The tertiary land use

is cropland in the northern portion of the sub-basin. Other land uses of note are farmsteads, major urban areas, wetlands, and confined animal feeding operations.

Table 24. Permanent Ambient Trend Monitoring Stations Located in HUC 1111.

WBID #	STATION #	STATION NAME	STATUS	FS	PS	NS/T	CBD
120420010010	AT165520	Arkansas River, US 64, Bixby	Active 11/98-P	AG, AES	NONE	FWP, PBCR	NONE
120410010080	AT165570	Arkansas River, SH 104, Haskell	Active 11/98-P	AES	FWP, AG	PBCR	NONE
220200010010	AT249453	Arkansas River, US 64, Moffett	Active 11/98-P	AG, AES, PBCR, PPWS	FWP	NONE	NONE
121410010260	AT194500	Arkansas River, US 62, Muskogee	Active 9/99-P	AG, PBCR, AES	NONE	FWP	NONE
120420010130	AT164400	Arkansas River, SH 97, Sand Springs	Active 9/99-P	AG, FWP, AES, PBCR	NONE	NONE	NONE
121700050010	AT197000	Barren Fork, SH 51, Eldon	Active 11/98-P	AG, FWP, PPWS, AES	NONE	PBCR	NONE
121700040010	AT197360	Caney Creek, off SH 100, Barber	Active 9/99-P	AG, FWP, AES, PBCR, PPWS	NONE	NONE	NONE
121700060010	AT196000	Flint Creek, US 412, Kansas	Active 11/98-P	AG, FWP, PPWS	NONE	PBCR, AES	NONE
220100040020	AT247550	Fourche-Maline Creek, off US 270, Red Oak	Active 11/98-P	AG, AES, PPWS	NONE	FWP, PBCR	NONE
121700030010	AT196500	Illinois River, US 62, Tahlequah	Active 11/98-P	FWP, AG, PPWS	NONE	PBCR, AES	NONE
121700030350	AT195500	Illinois River, US 59, Watts	Active 11/98-P	AG, PPWS	NONE	FWP, PBCR, AES	NONE
220100020010	AT247350	Poteau River, US 59, Heavener	Active 11/98-P	AG, FWP, AES, PBCR, PPWS	NONE	NONE	NONE
220100010010	AT249435	Poteau River, off SH 112, Pocola	Active 11/98-P	AG, AES, PPWS	NONE	FWP, PBCR	NONE
121700060080	AT195865	Sager Creek, off US 412, West Siloam Springs	Active 11/98-P	AG, FWP	PPWS	AES, PBCR	NONE

ASSIGNED OWQS BENEFICIAL USES AND SUPPORT CODES

PPWS = PUBLIC AND PRIVATE WATER SUPPLY	EWS = EMERGENCY WATER SUPPLY
FWP = FISH & WILDLIFE PROPAGATION	PBCR = PRIMARY BODY CONTACT RECREATION
AG = AGRICULTURE	AES = AESTHETICS
FS = FULLY SUPPORTING	PS = PARTIALLY SUPPORTING
NS/T = NOT SUPPORTING/THREATENED	CBD = CANNOT BE DETERMINED

Table 25. Toxicant exceedances in HUC 1111.

STATION #	STATION NAME	DATE	Copper (µg/L)	Lead (µg/L)
AT165520	Arkansas River, US 64, Bixby	04/02/2001		12.00
		04/08/2002		12.00
AT194500	Arkansas River, US 62, Muskogee	05/29/2002		8.74
		02/04/2003		7.00
AT247550	Fourche-Maline Creek, off US 270, Red Oak	04/23/2001		2.52
		05/29/2001		3.08
		06/19/2000		2.62
		08/21/2001		1.82
		04/23/2002		1.50
		04/15/2003		2.28
		09/03/2003		2.53
AT249435	Poteau River, off SH 112, Pocola	05/08/2000		3.00

STATION #	STATION NAME	DATE	Copper (µg/L)	Lead (µg/L)
		06/13/2000		4.00
		11/06/2000	8.00	
		04/23/2001		1.97
		05/29/2001	7.08	6.79
		06/19/2001		2.22
		08/21/2001		1.84
		09/24/2001		2.43
		10/23/2002		1.84
		04/23/2002		1.41
		04/14/2003		2.59

Table 26. Exceedances of fecal coliform, enterococci, and *E. coli* screening limits in HUC 1111. Only values leading to a determination of not supporting for the Public and Private Water Supply and the Primary Body Contact Recreation beneficial uses are in included.

STATION #	STATION NAME	DATE	Fecal Coliform (cfu/mL)	Enterococci (cfu/mL)	*E. coli* (cfu/mL)
AT165520	ARKANSAS RIVER, US 64, BIXBY	09/22/1999	520		
		07/25/2000	640		
		09/10/2001	1000		
		06/03/2002	1200		
		06/02/2003	6000	4000	836
		07/07/2003	800		
		08/11/2003	6700	1700	512
		09/15/2003	500	800	
		10/01/2003	1100		408
AT165570	ARKANSAS RIVER, SH 104, HASKELL	06/20/2000		2400	
AT197000	BARON FORK, SH 51, ELDON	07/20/1999		90	
		08/16/1999		130	
		06/20/2000		800	
		07/25/2000		80	
		05/30/2001		3900	
		06/20/2001		2000	
		07/25/2001		90	
		08/22/2001		80	
		06/03/2002		70	
		07/10/2002		80	
		09/04/2002		120	
		05/13/2003		70	
		06/03/2003		600	
		07/22/2003		200	
AT196000	FLINT CREEK, US 412, KANSAS	06/21/1999		100	
		06/20/2000		450	
		07/25/2000		90	

STATION #	STATION NAME	DATE	Fecal Coliform (cfu/mL)	Enterococci (cfu/mL)	*E. coli* (cfu/mL)
		08/22/2001		100	
		09/25/2001		100	
		06/04/2002		200	
		09/04/2002		100	
		06/03/2003		70	
		06/18/2003		180	
		07/21/2003		3000	
		08/12/2003		500	
		09/16/2003		100	
		09/30/2003		300	
AT247550	Fourche-Maline Creek, off US 270, Red Oak	06/14/1999		10000	
		05/10/2000		1800	
		05/23/2001		2100	
		09/18/2001		3000	
		07/22/2002		500	
		05/05/2003		2000	
		07/14/2003		8000	
AT196500	Illinois River, US 62, Tahlequah	06/20/2000		620	
		07/25/2000		210	
		06/20/2001		130	
		05/08/2002		800	
		07/10/2002		70	
		06/03/2003		1000	
		07/22/2003		100	
		09/16/2003		100	
AT195500	Illinois River, US 59, Watts	07/20/1999		140	
		08/16/1999		110	
		06/20/2000		820	
		09/19/2000		100	
		06/20/2001		100	
		05/22/2002		120	
		07/09/2002		220	
		06/03/2003		6000	
		07/22/2003		500	
AT249435	Poteau River, off SH 112, Pocola	07/26/1999		470	
		09/18/2001		1300	
AT195865	Sager Creek, off US 412, West Siloam Springs	06/20/2001		1000	
		08/22/2001		600	
		06/03/2003		500	
		06/18/2003		500	
		07/22/2003		1200	

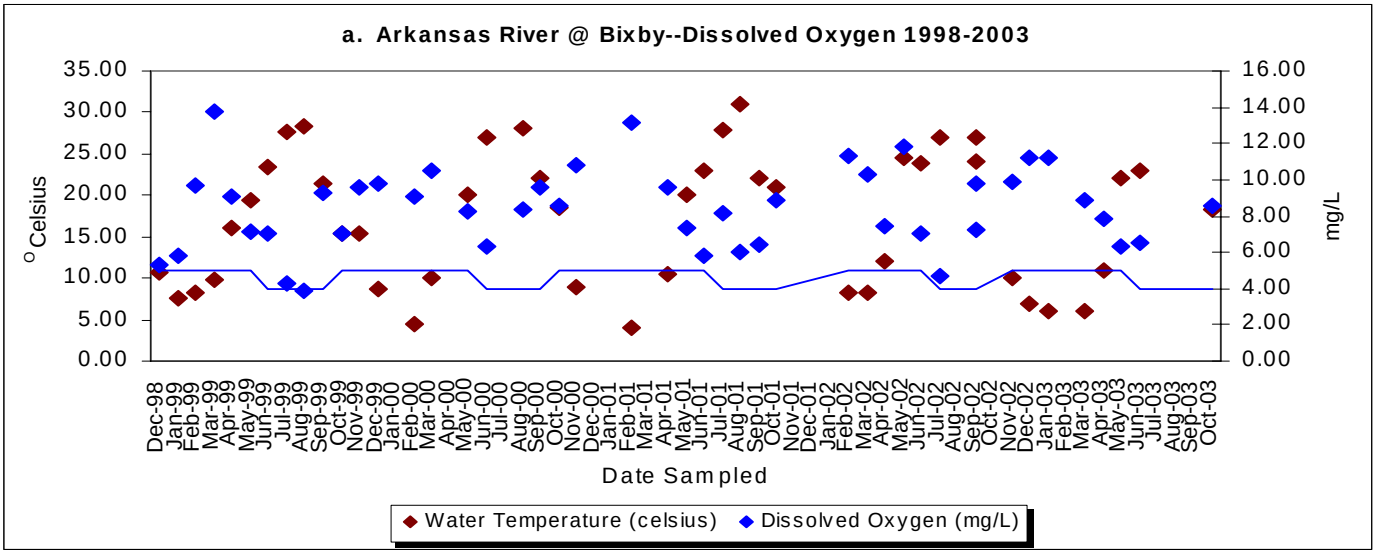
Arkansas River at Bixby

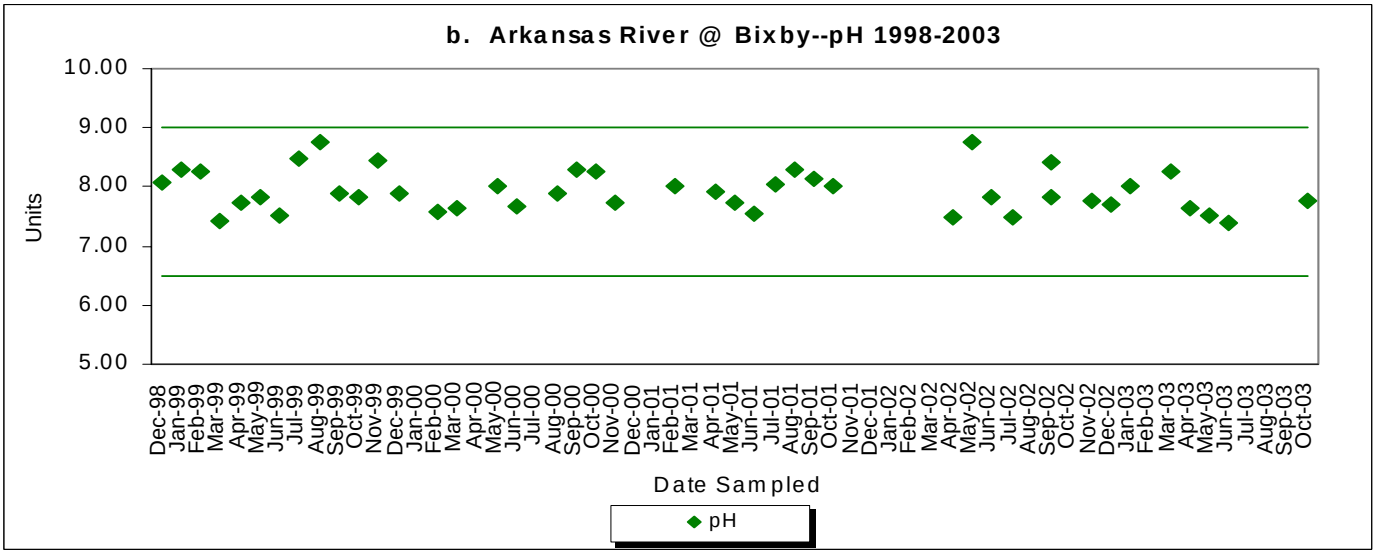
Station AT165520 (120420010010-001AT) is a permanent ambient trend monitoring station near the midpoint of the Arkansas River in Oklahoma. Situated in the south central portion of Tulsa County, the site was established within the City of Bixby on US Highway 64. The station is positioned near the terminal end of stream segment 120420010010 and is classified within the Polecat - Snake Creek 8-digit HUC watershed (11110101). Water enters the stream system from Polecat Creek (Sahoma Reservoir and Heyburn Lake), Posey Creek, and Duck Creek, among others.

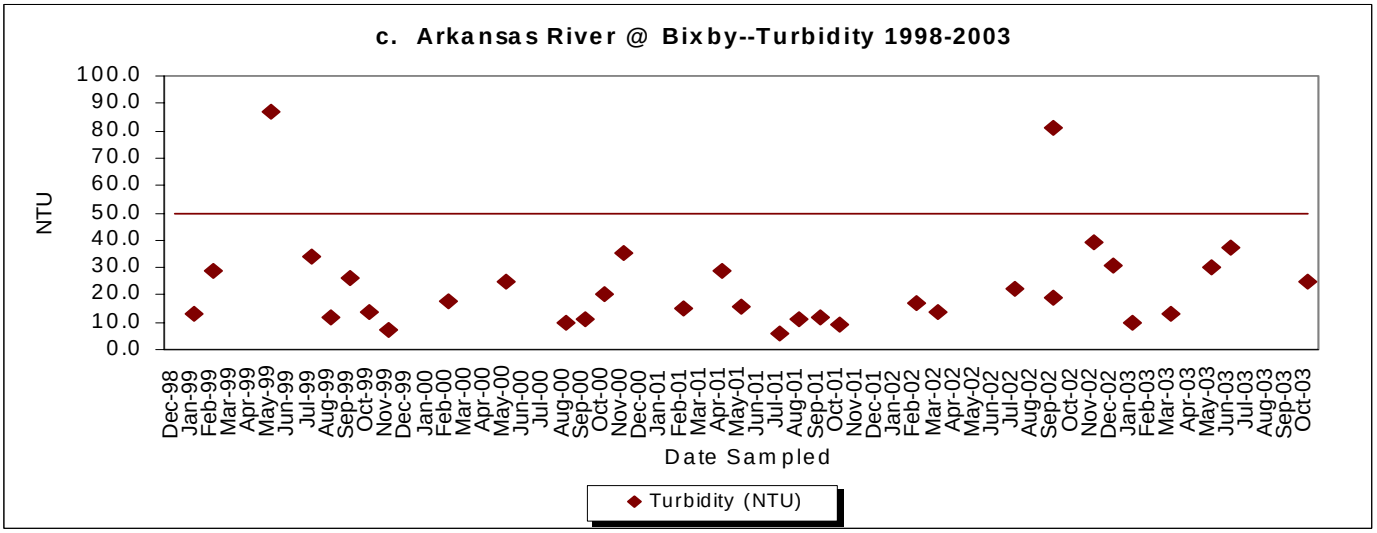
This station on the Arkansas River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through October of 2003. For purposes of reporting, this station is representative of the Arkansas River from above the City of Tulsa (-96.0569, 36.1392) downstream to confluence of the Arkansas River with Snake Creek (-95.8344, 35.9305). As per Appendix A, Table 1 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Emergency Water Supply (EWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Secondary Body Contact (2)—Recreation (PBCR), and 5) Aesthetics.

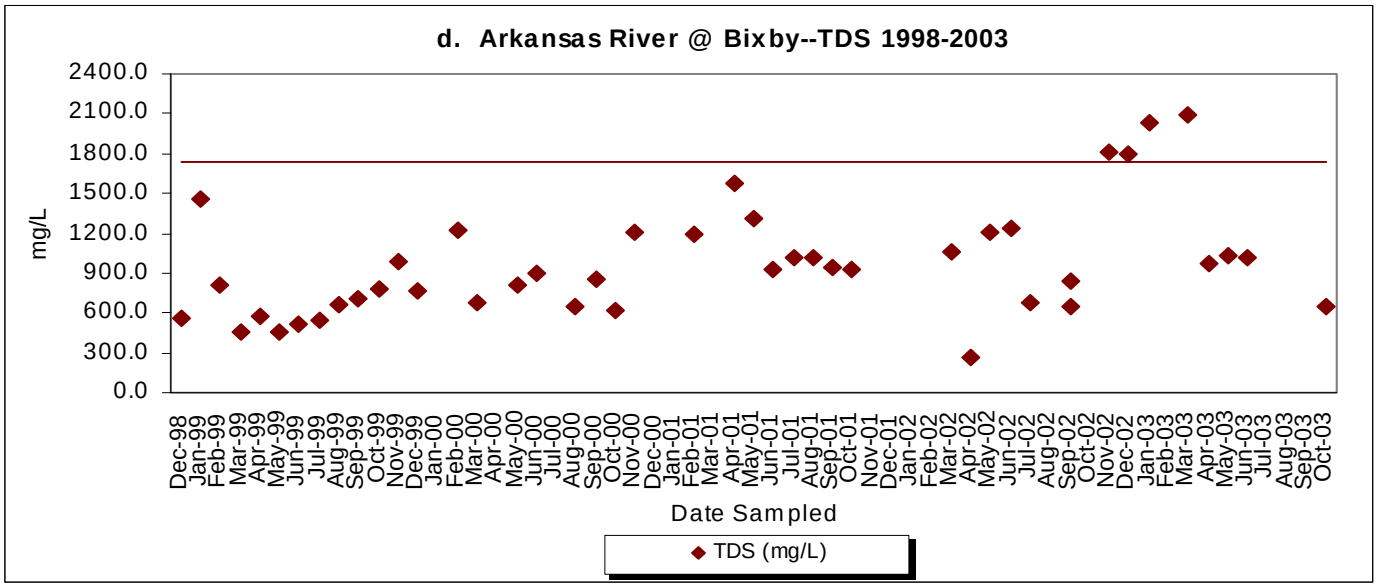
The WWAC beneficial use is not supported. Of the 19 toxicant samples collected, 2 of the lead concentrations (or 11%) exceeded the prescribed hardness-dependant chronic criteria of 10.35 µg/L (Table 25). Dissolved oxygen (Figure 63a), pH (Figure 63b), and turbidity (Figure 63c) samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 63d and Figure 63e). The PBCR beneficial use is not supported (Table 26). Of the 26 fecal coliform concentrations, 9 samples (or 35%) exceeded the prescribed screening level of 400 cfu/mL, and the geometric mean (884.8 cfu/mL) exceeded the prescribed mean standard of 400 cfu/mL. Of the 26 *E. coli* concentrations, 3 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (141.8 cfu/mL) exceeded the prescribed mean standard of 126 cfu/mL. Of the 26 Enterococci concentrations, 3 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (415.5 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Arkansas River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 63f).

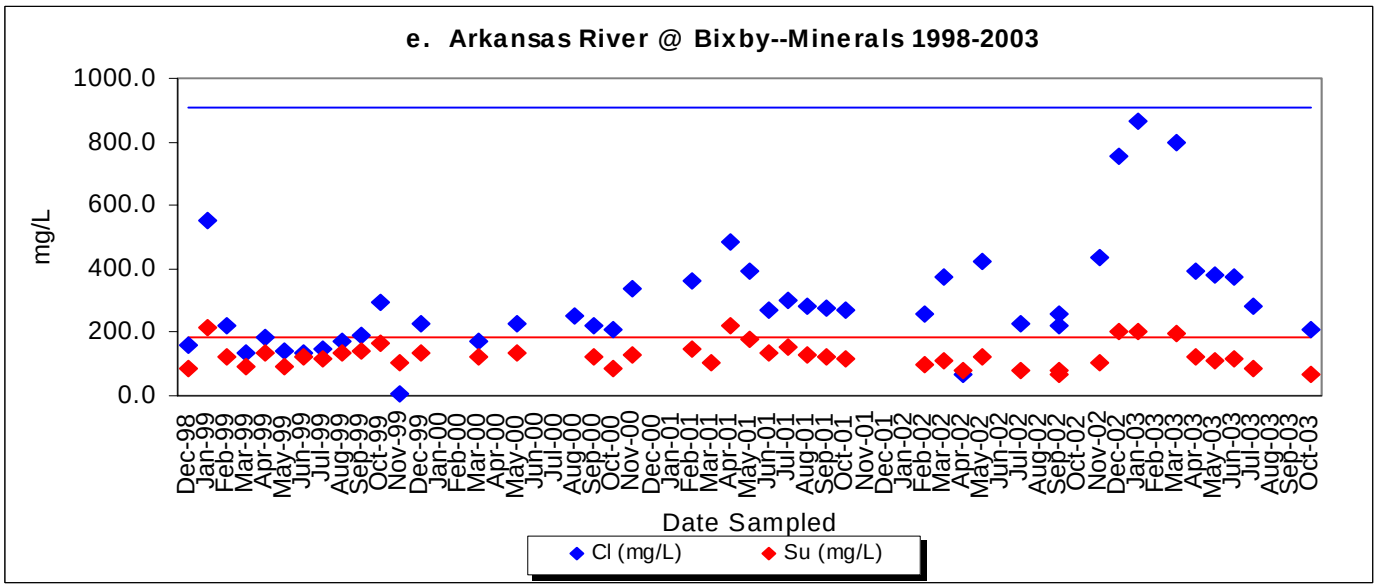
Figure 63a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) for the Arkansas River at Bixby (AT165520), 1998-2003.

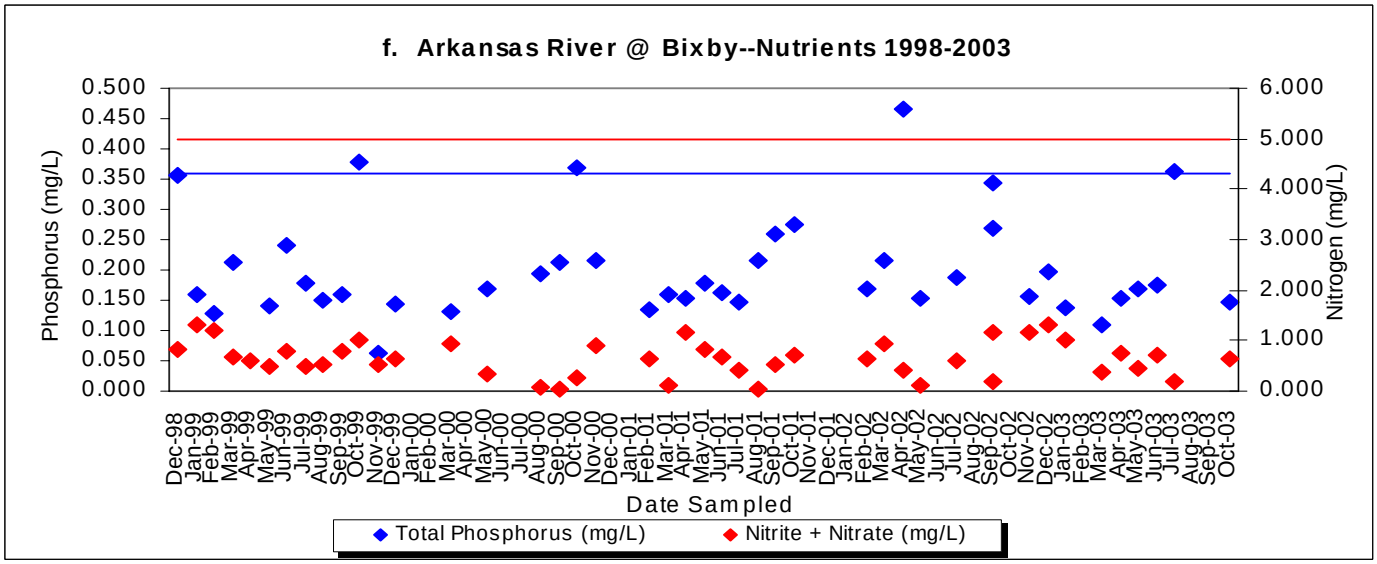







d. Arkansas River @ Bixby--TDS 1998-2003
mg/L
2400.0
2100.0
1800.0
1500.0
1200.0
900.0
600.0
300.0
0.0
Date Sampled
TDS (mg/L)


e. Arkansas River @ Bixby--Minerals 1998-2003
mg/L
1000.0
800.0
600.0
400.0
200.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Arkansas River @ Bixby--Nutrients 1998-2003
Phosphorus (mg/L)
0.500
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

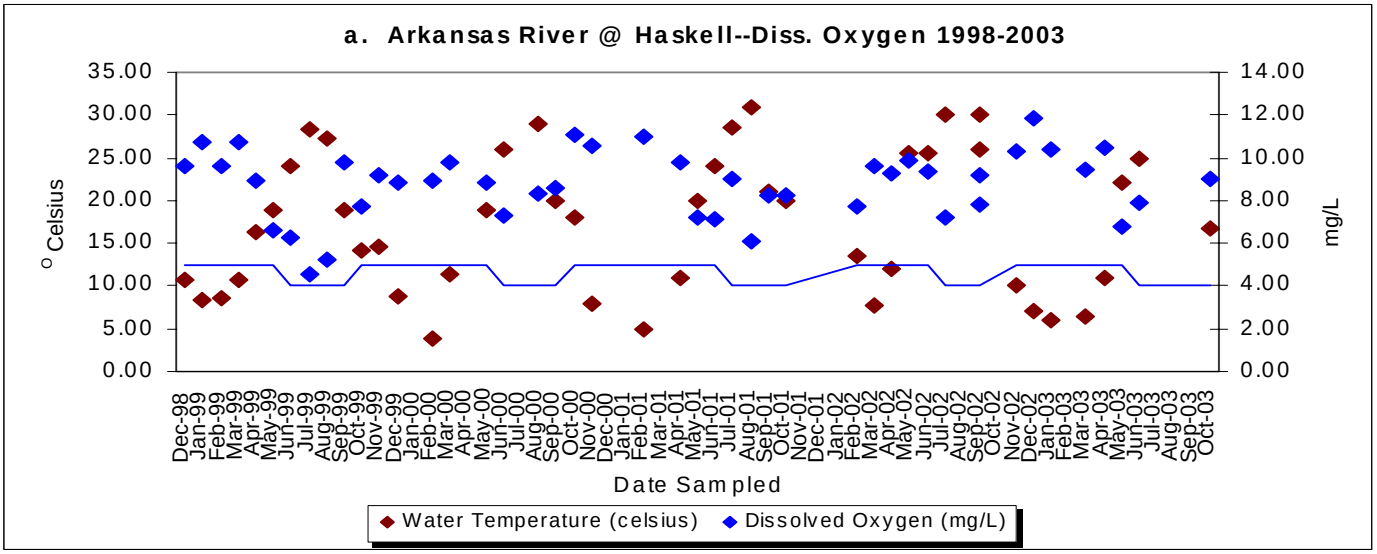
Arkansas River near Haskell

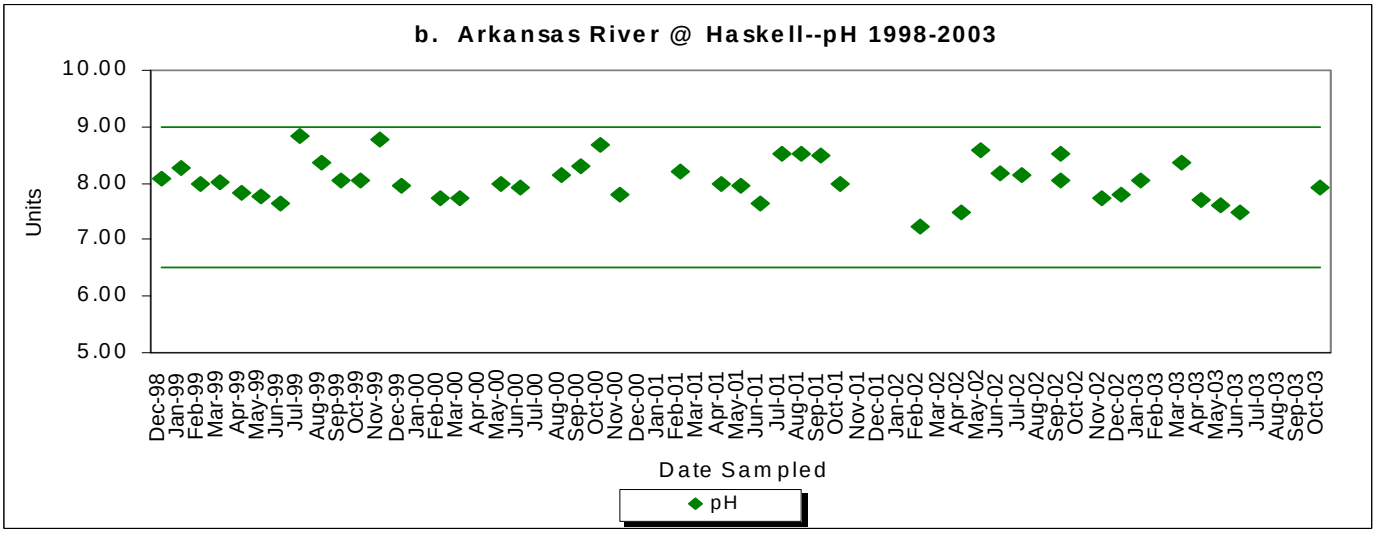
Station AT165570 (120410010080-001AT) is a permanent ambient trend monitoring station near the midpoint of the Arkansas River in Oklahoma. Situated in the northeastern portion of Muskogee County, the site was established east of the Town of Haskell on State Highway 104. The station is positioned near the midpoint of stream segment 120410010080 and is classified within the Polecat - Snake Creek 8-digit HUC watershed (11110101). Water enters the stream system from several tributaries including Snake Creek, Ash Creek, Cloud Creek, and Pecan Creek, among others.

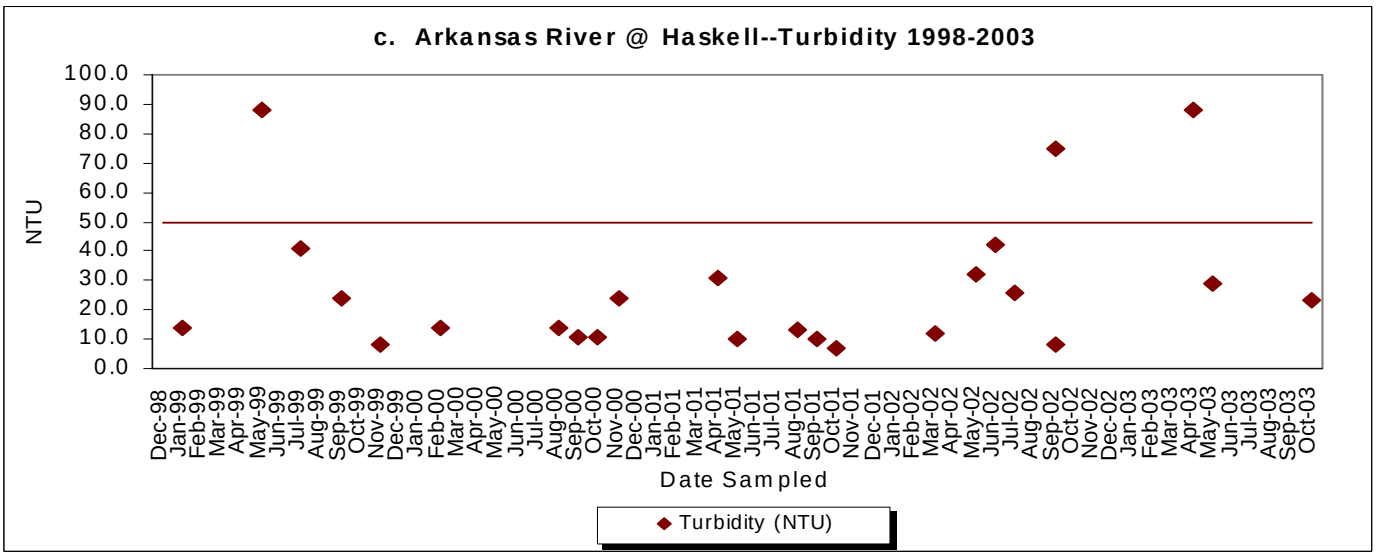
This station on the Arkansas River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through October of 2003. For purposes of reporting, this station is representative of the Arkansas River from the confluence of Snake Creek (95.8344, 35.9305) downstream to confluence of the Arkansas River with Pecan Creek (95.4348, 35.7990). As per Appendix A, Table 6 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Emergency Water Supply (EWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Secondary Body Contact (2)—Recreation (PBCR), and 5) Aesthetics.

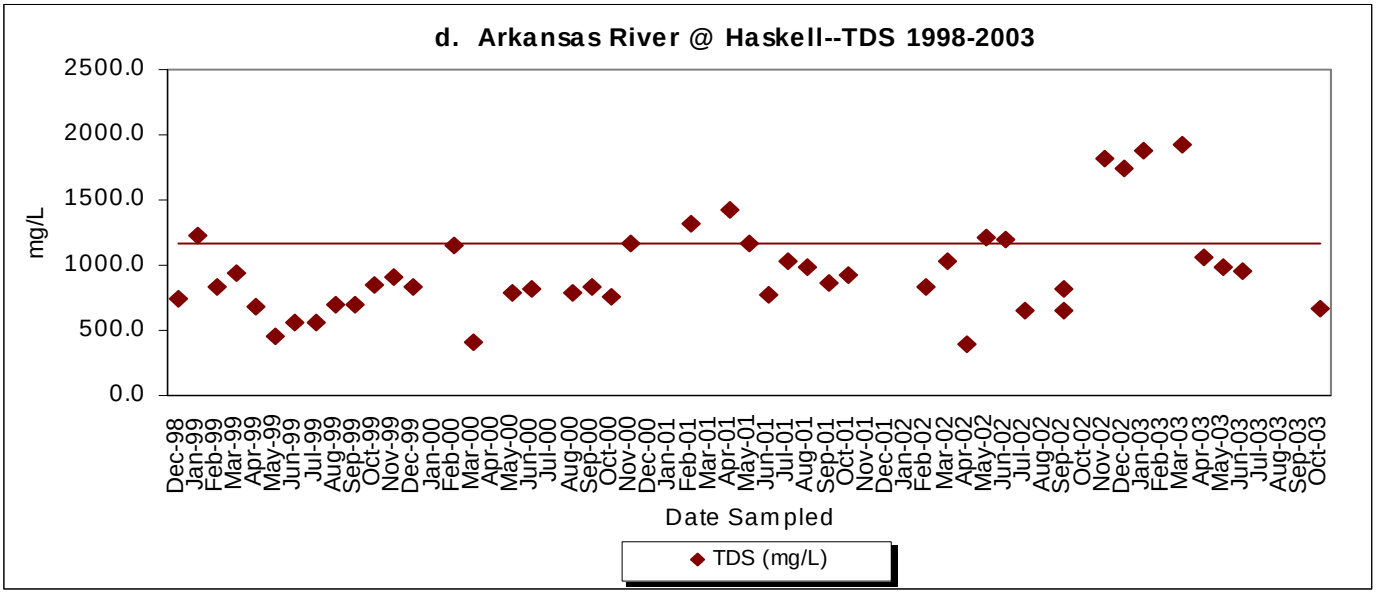
The WWAC beneficial use is partially supported. Of the 24 turbidity samples (Figure 64c), 3 samples (or 13%) exceeded the numerical criteria of 50. Dissolved oxygen (Figure 64a), pH (Figure 64b), and toxicant samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is partially supported (Figure 64d and Figure 64e). Of the 45 total dissolved solids concentrations, 10 of the samples (or 22%) exceeded the minimum sample standard of 1168 mg/L. Chlorides and sulfates are within the prescribed sample standards and yearly means. The PBCR beneficial use is not supported (Table 26). Of the 26 enterococci concentrations, 1 sample exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (40.0 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Arkansas River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 64f).

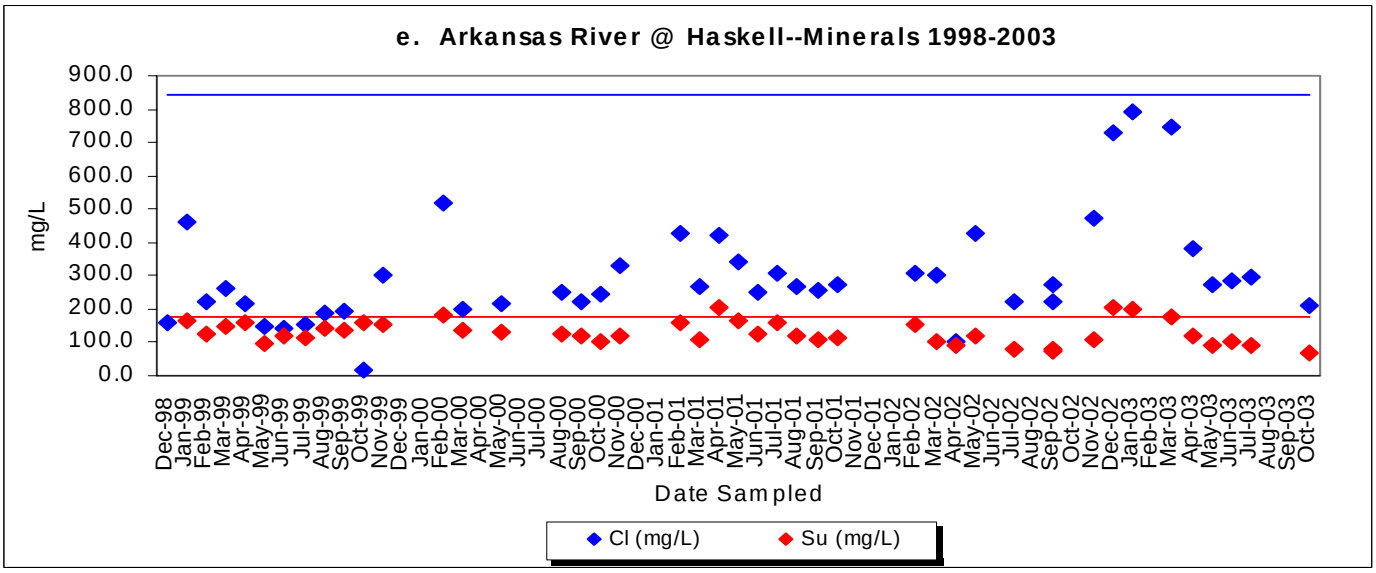
Figure 64a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) for the Arkansas River at Haskell (AT165570), 1998-2003.

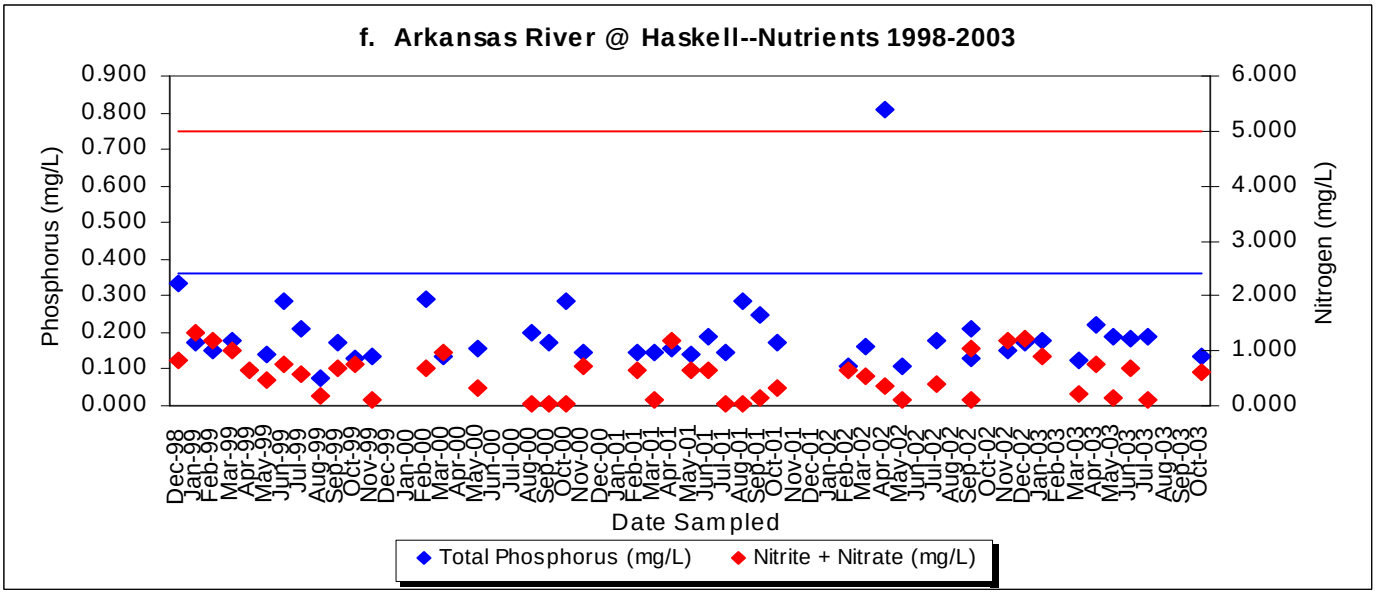







d. Arkansas River @ Haskell--TDS 1998-2003
mg/L
2500.0
2000.0
1500.0
1000.0
500.0
0.0
Date Sampled
TDS (mg/L)


e. Arkansas River @ Haskell--Minerals 1998-2003
mg/L
900.0
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Arkansas River @ Haskell--Nutrients 1998-2003
Phosphorus (mg/L)
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

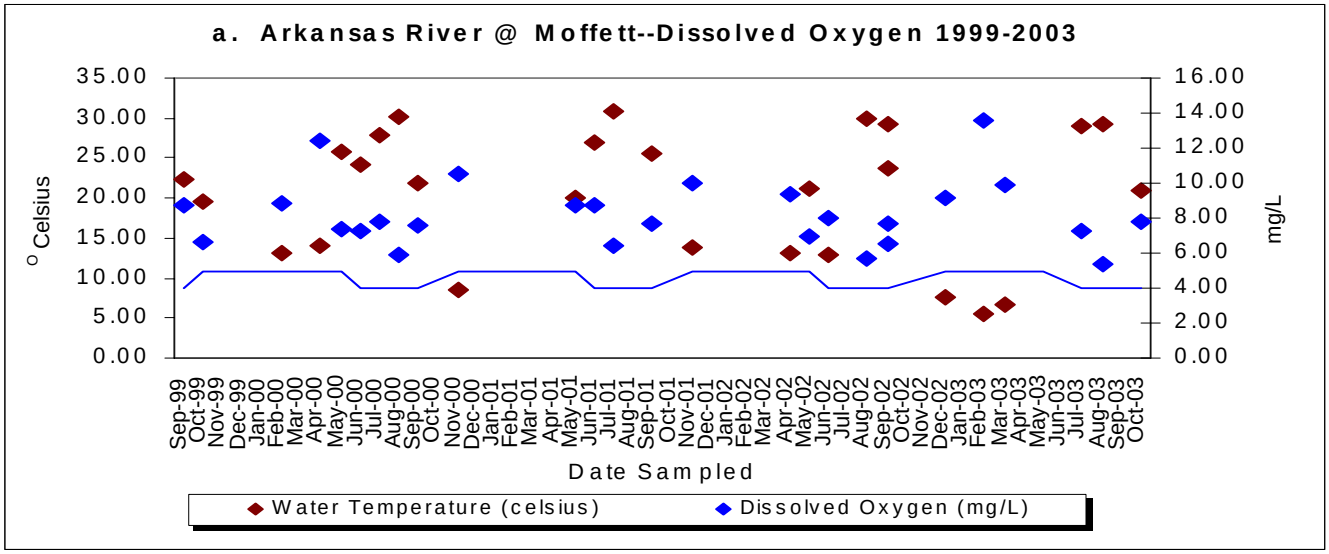
Arkansas River near Moffett

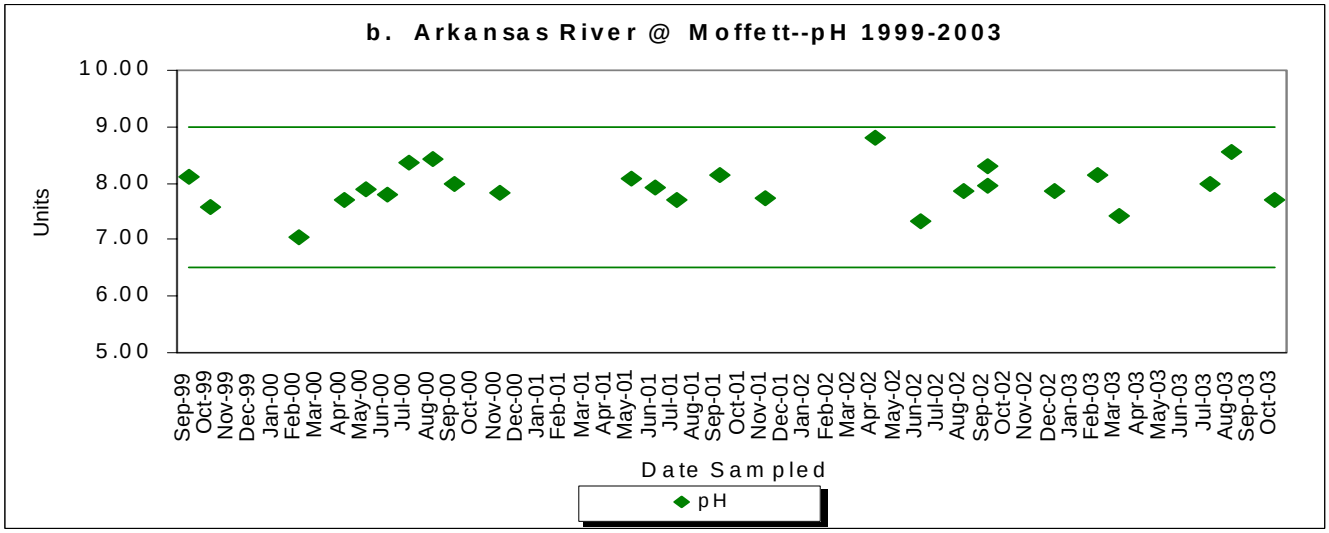
Station AT249453 (220200010010-001AT) is a permanent ambient trend monitoring station located on the Arkansas River (Kerr-McClellan Navigational System) in Oklahoma. Situated in the southeastern portion of Sequoyah County, the site was established east of the Town of Moffett on State Highway 64. The station is positioned at the terminal end of stream segment 220200010010 and is classified within the Robert S. Kerr Reservoir 8-digit HUC watershed (11110104). Water enters the stream system from several tributaries including Onion Creek, Cache Creek, Big Skin Bayou, Camp Creek, and the Poteau River, among others.

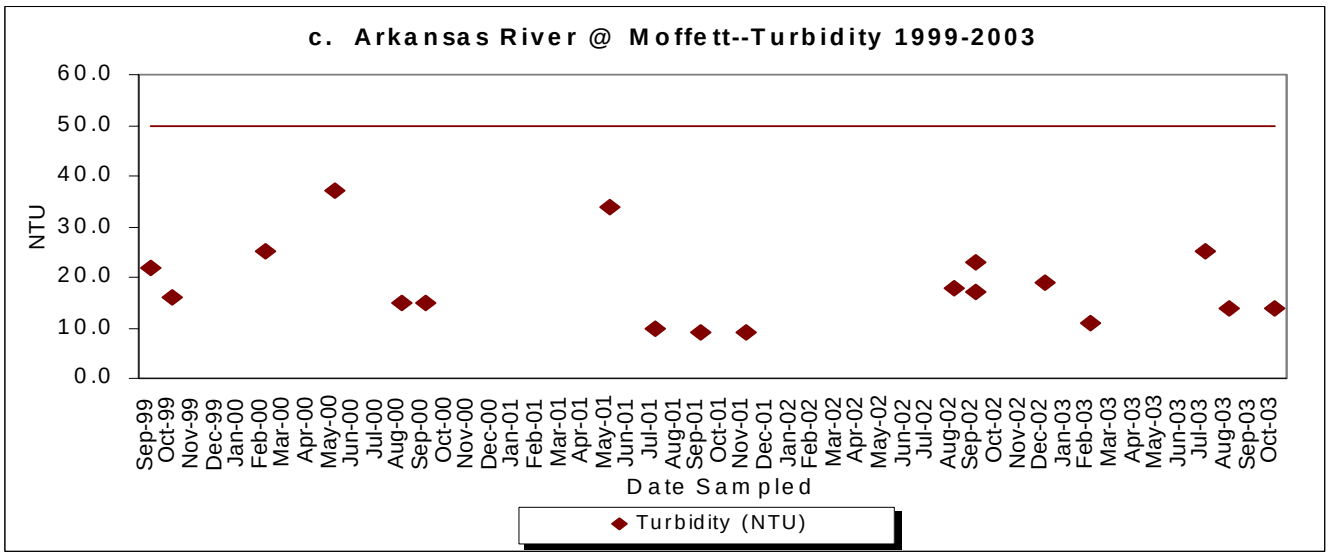
This station on the Arkansas River has been listed on the ambient trend network since November of 1998 but has only been active for all water quality variables since September of 1999 because of access difficulties. The following assessment of beneficial uses is based on data collected from September of 1999 through October of 2003. For purposes of reporting, this station is representative of the Arkansas River from confluence of Onion Creek (94.6744, 35.3006) downstream to its exit from Oklahoma near Moffett, Oklahoma (94.4340, 35.3865). As per Appendix A, Table 2 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

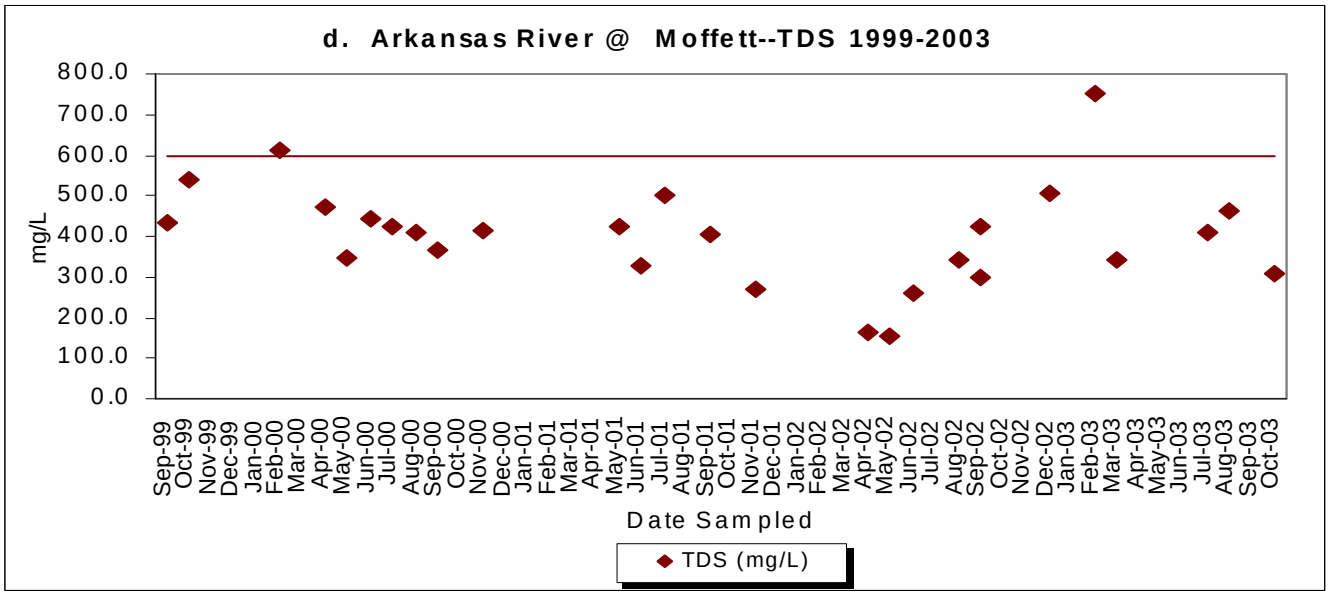
The PPWS beneficial use is supported. The WWAC beneficial use is partially supported. Of the 30 turbidity samples (Figure 65c), 4 samples (or 13%) exceeded the numerical criteria of 50. Dissolved oxygen (Figure 65a), pH (Figure 65b), and toxicant samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 65d and Figure 65e). The PBCR beneficial use is supported for fecal coliform, enterococci, and *E. coli* concentrations. This segment of the Arkansas River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 65f).

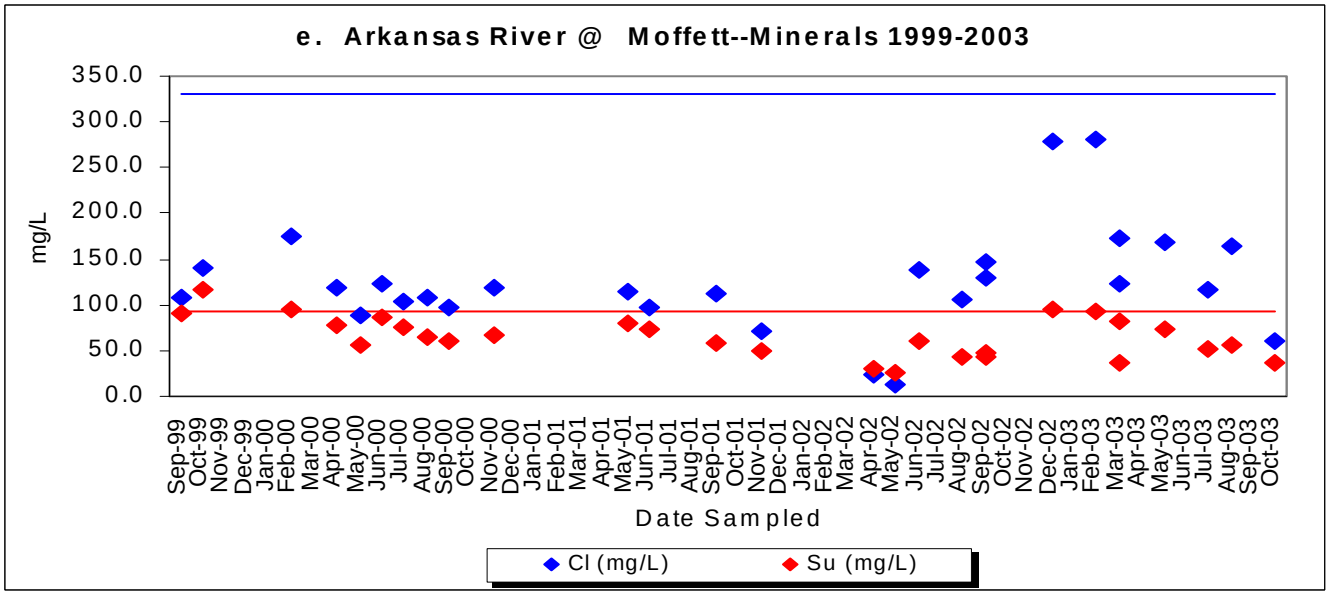
Figure 65a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Arkansas River at Moffett (AT249453), 1999-2003.

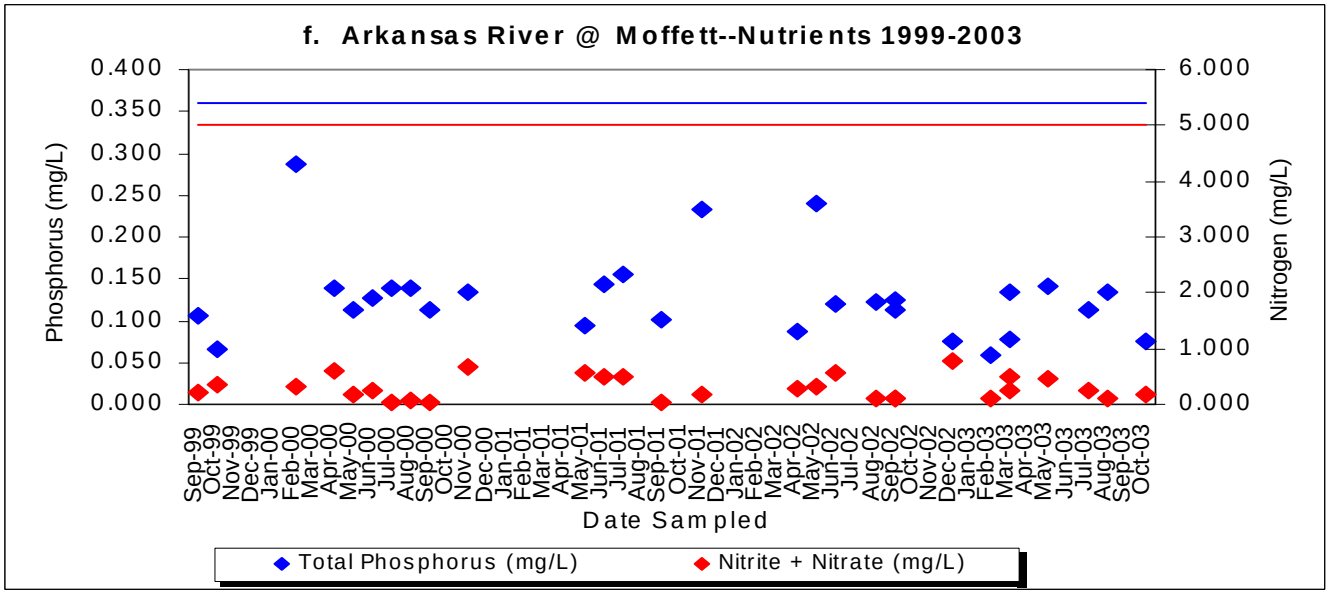







d. Arkansas River @ Moffett--TDS 1999-2003
mg/L
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Date Sampled
TDS (mg/L)


e. Arkansas River @ Moffett--Minerals 1999-2003
mg/L
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Arkansas River @ Moffett--Nutrients 1999-2003
Phosphorus (mg/L)
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

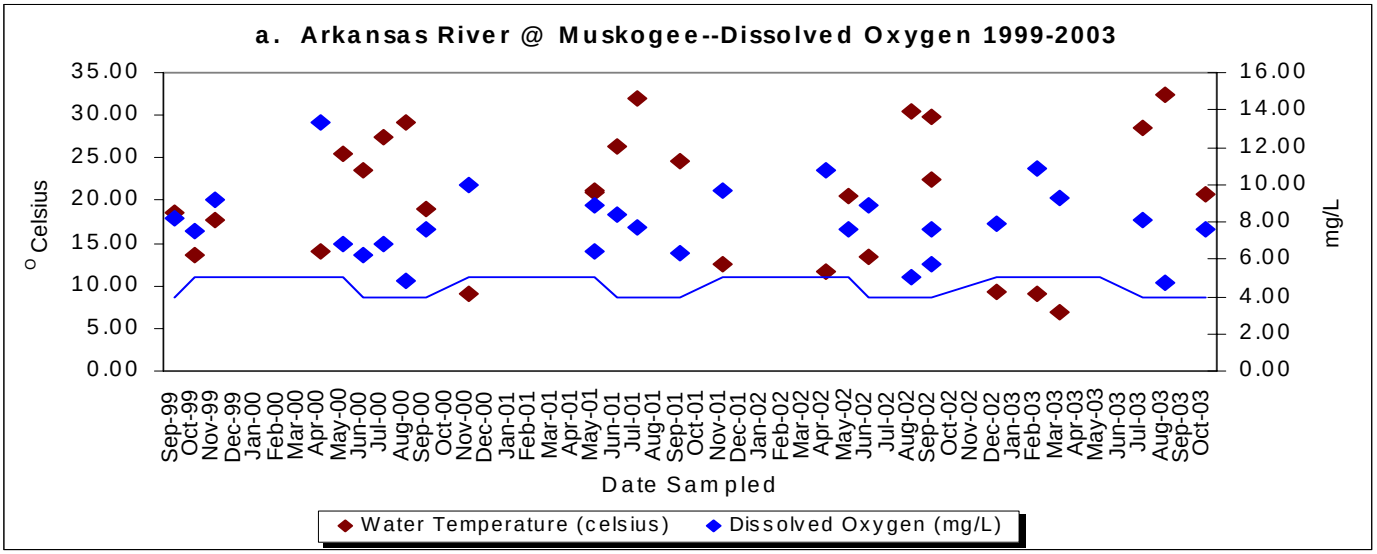
Arkansas River near Muskogee (at US 62)

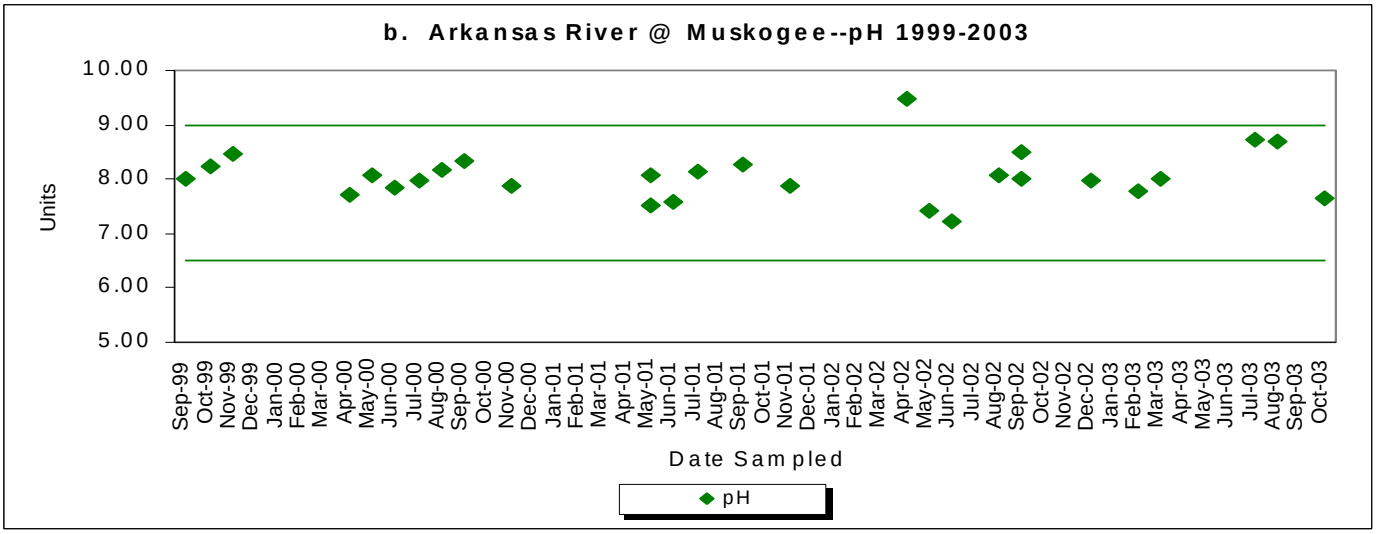
Station AT194500 (121400010260-001AT) is a permanent ambient trend monitoring station located on the Arkansas River (McClellan-Kerr Navigational System) in Oklahoma. Situated in the east central portion of Muskogee County, the site was established east of the City of Muskogee on US Highway 62. The station is positioned near the upper end of stream segment 121400010260 and is classified within the Dirty-Greenleaf Creek 8-digit HUC watershed (11110102). Water enters the stream system from several tributaries including the Verdigris River, the Neosho River (Fort Gibson Reservoir), Coody Creek, and Bayou Manard, among others.

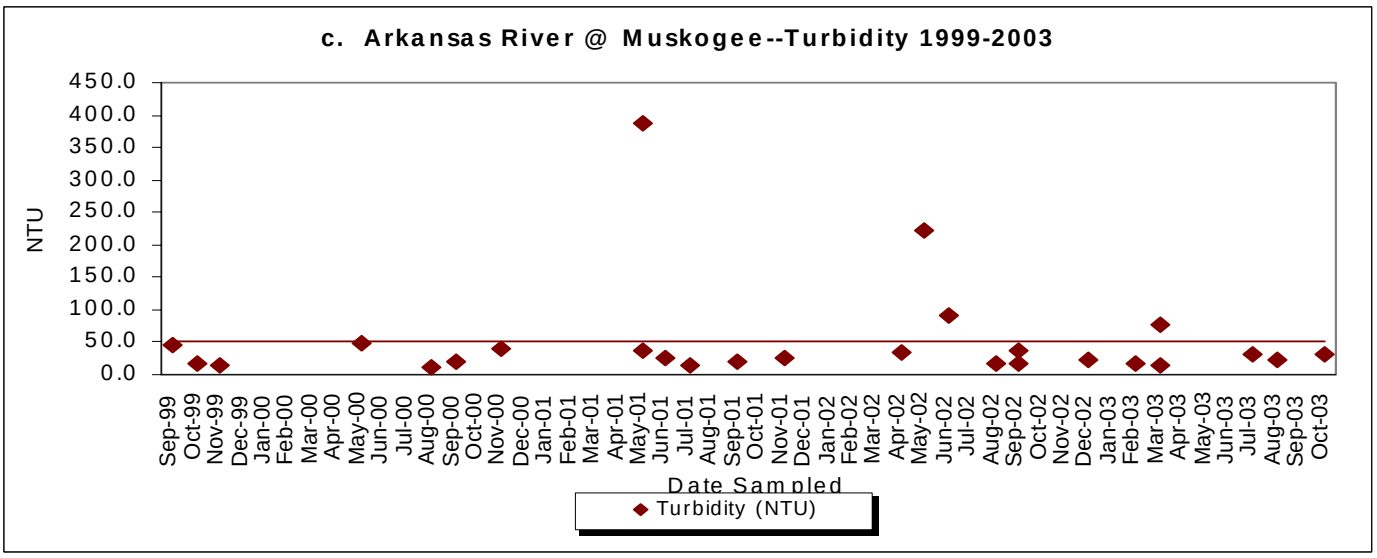
This station on the Arkansas River has been active for all water quality variables since September of 1999. The following assessment of beneficial uses is based on data collected from September of 1999 through October of 2003. For purposes of reporting, this station is representative of the Arkansas River from the confluence of the Verdigris River (-95.3073, 35.7983) downstream to the Arkansas River's confluence with Webber's Falls Reservoir (-95.2275, 35.7036). As per Appendix A, Table 1 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Emergency Water Supply (EWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

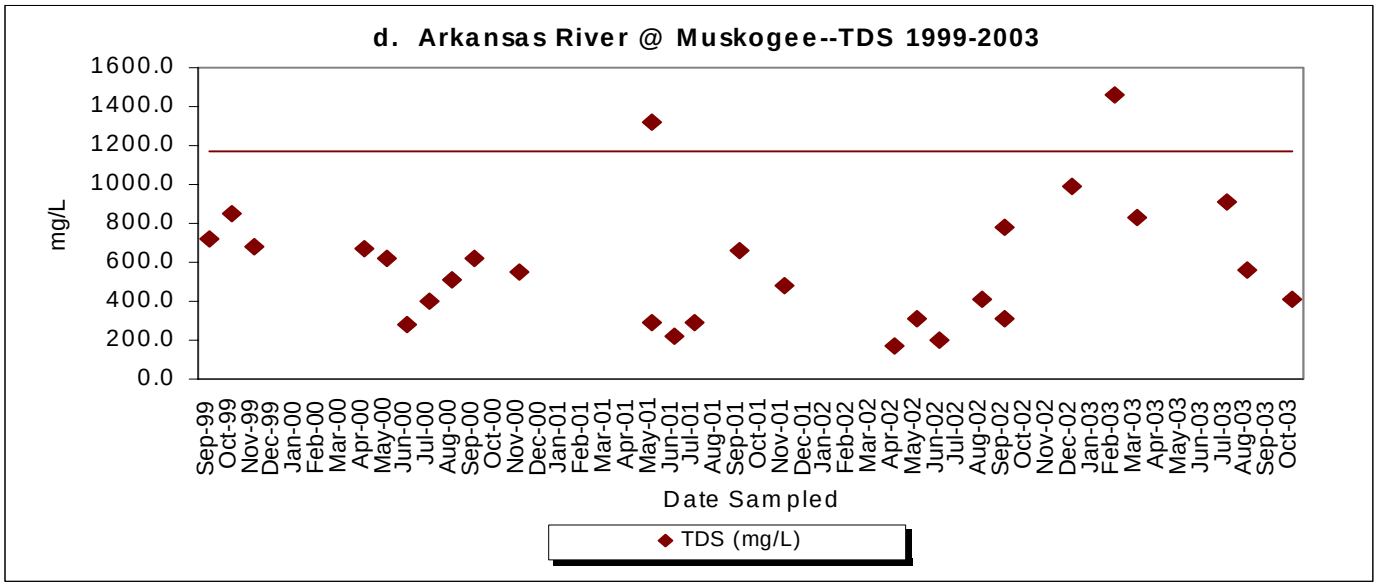
The WWAC beneficial use is not supported. Of the 9 lead samples collected, 3 of the concentrations (or 33%) exceeded the prescribed hardness-dependant chronic criteria of 6.76 µg/L (Table 25). Dissolved oxygen (Figure 66a), pH (Figure 66b), and turbidity (Figure 66c) samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 66d and Figure 66e). The PBCR beneficial use is supported (Table 16). This segment of the Arkansas River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 66f).

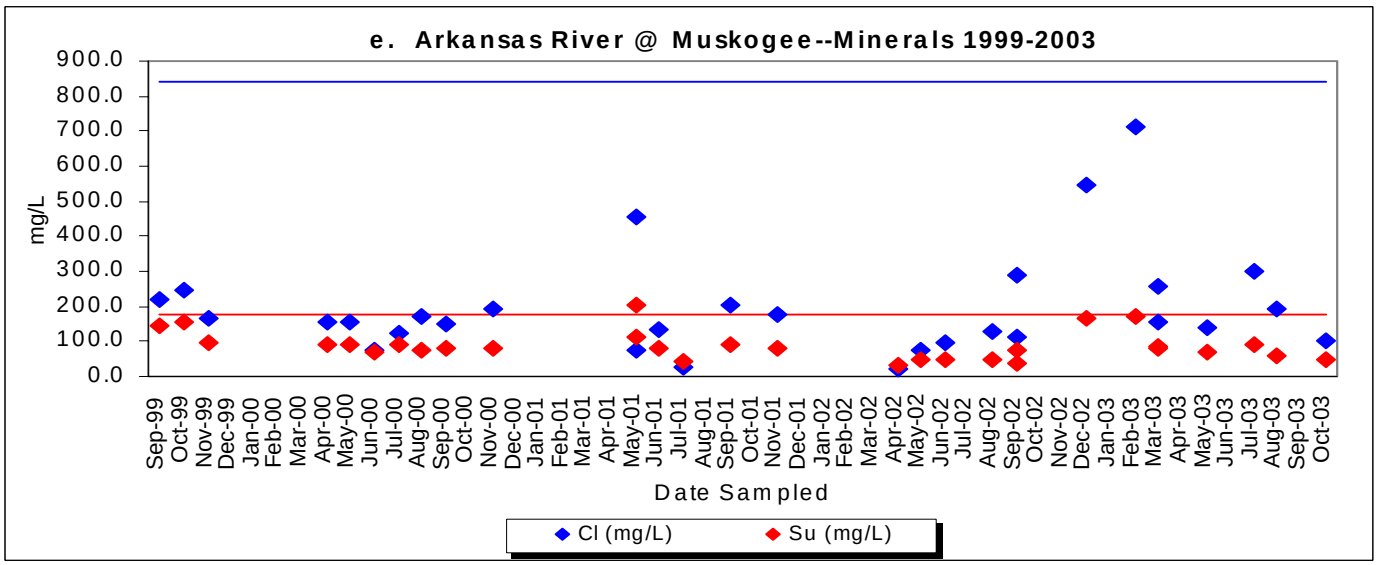
Figure 66a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) the Arkansas River at Muskogee (AT194500), 1999-2003.

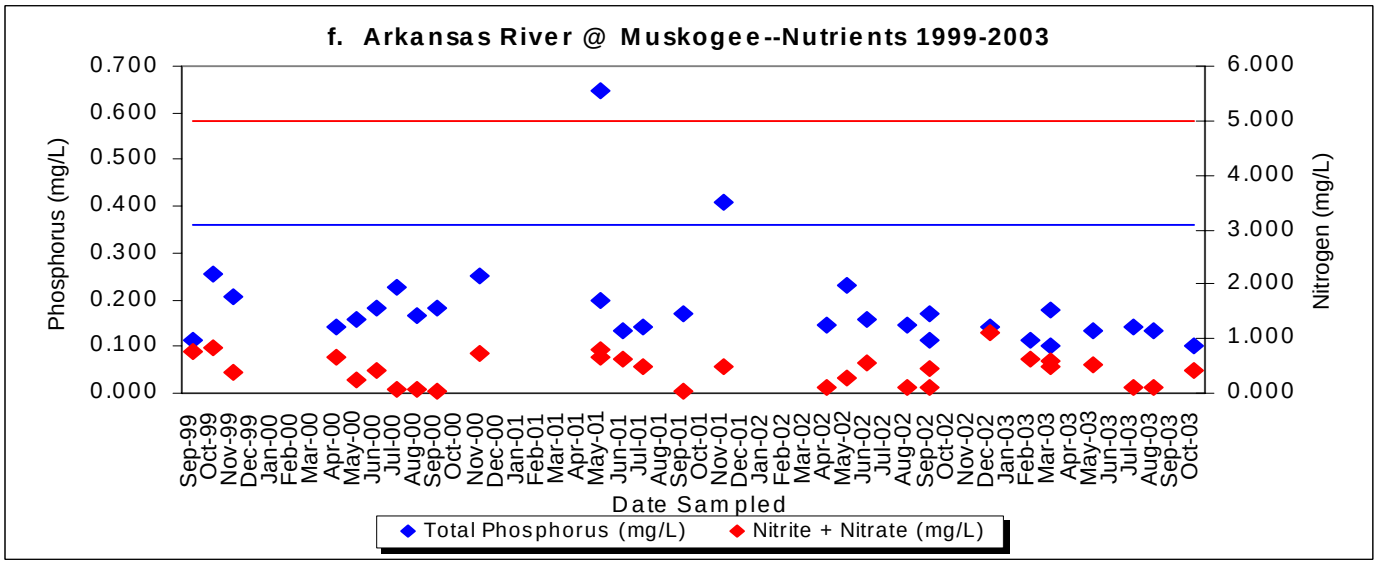







d. Arkansas River @ Muskogee--TDS 1999-2003
mg/L
1600.0
1400.0
1200.0
1000.0
800.0
600.0
400.0
200.0
0.0
Date Sampled
TDS (mg/L)


e. Arkansas River @ Muskogee--Minerals 1999-2003
mg/L
900.0
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Arkansas River @ Muskogee--Nutrients 1999-2003
Phosphorus (mg/L)
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

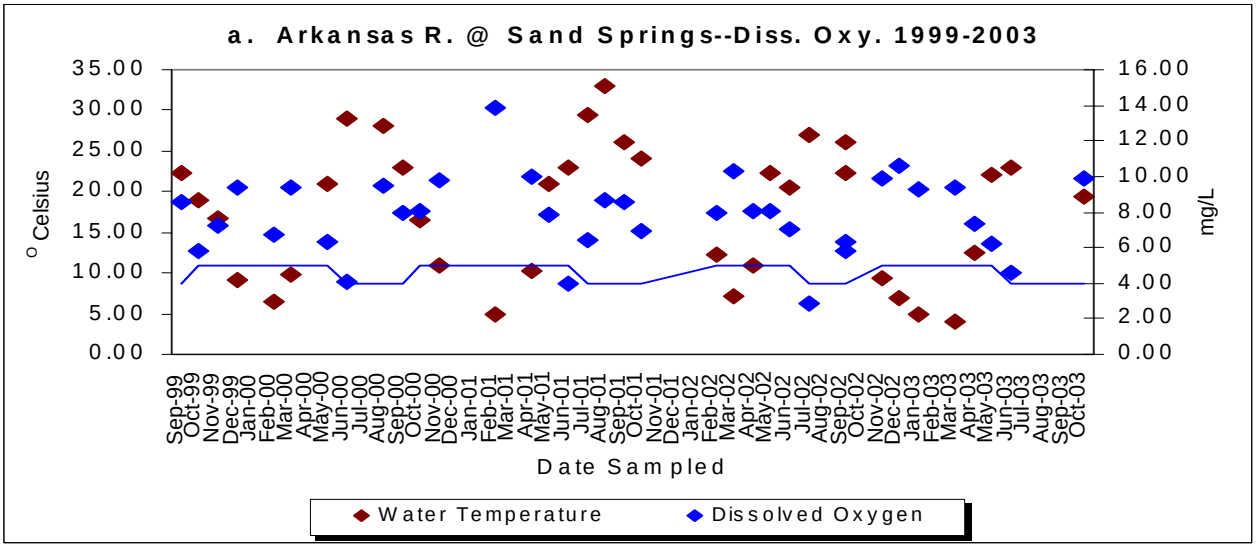
Arkansas River near Sand Springs

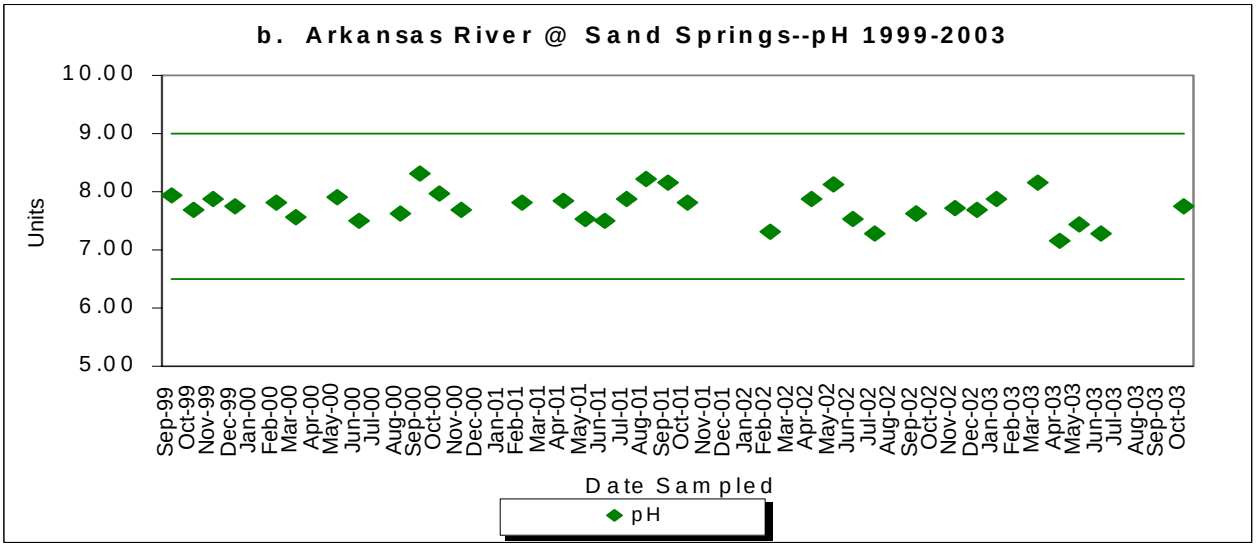
Station AT164400 (120420010130-001AT) is a permanent ambient trend monitoring station located on the Arkansas River in Oklahoma. Situated in the west central portion of Tulsa County, the site was established within the City of Sand Springs on State Highway 97. The station is positioned near the terminal end of stream segment 120420010130 and is classified within the Polecat - Snake Creek 8-digit HUC watershed (11110101). Water enters the stream system from Keystone Lake and from several tributaries including Shell Creek (Shell Lake), among others.

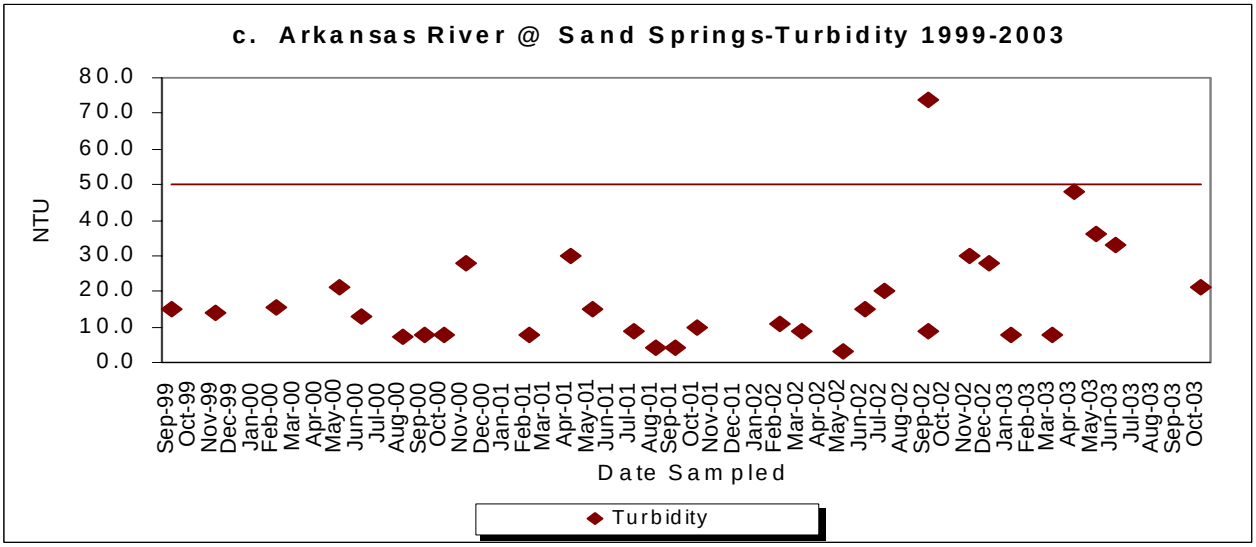
This station on the Arkansas River has been active for all water quality variables since September of 1999. The following assessment of beneficial uses is based on data collected from September of 1999 through October of 2003. For purposes of reporting, this station is representative of the Arkansas River from Keystone Reservoir (96.2528, 36.1504) downstream to above the City of Tulsa (96.0569, 36.1392). As per Appendix A, Table 1 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Emergency Water Supply (EWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Secondary Body Contact (2)—Recreation (PBCR), and 5) Aesthetics.

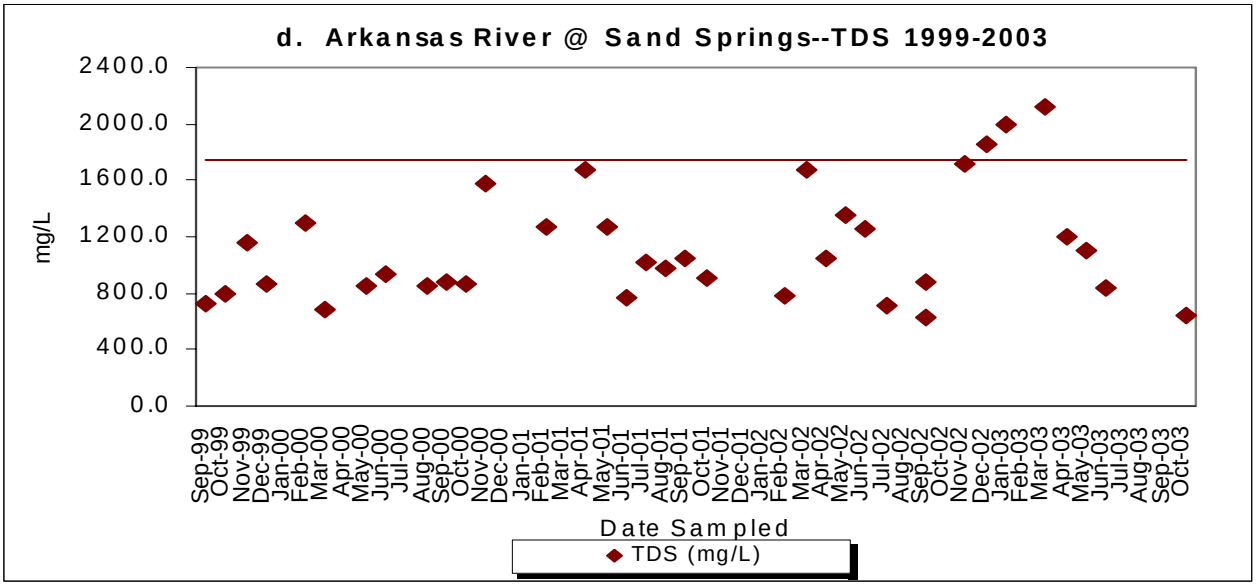
The WWAC beneficial use is supported. Dissolved oxygen (Figure 67a), pH (Figure 67b), turbidity (Figure 67c) and toxicant samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 67d and Figure 67e). The PBCR beneficial use is supported for fecal coliform, enterococci, and *E. coli* concentrations. This segment of the Arkansas River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 67f).

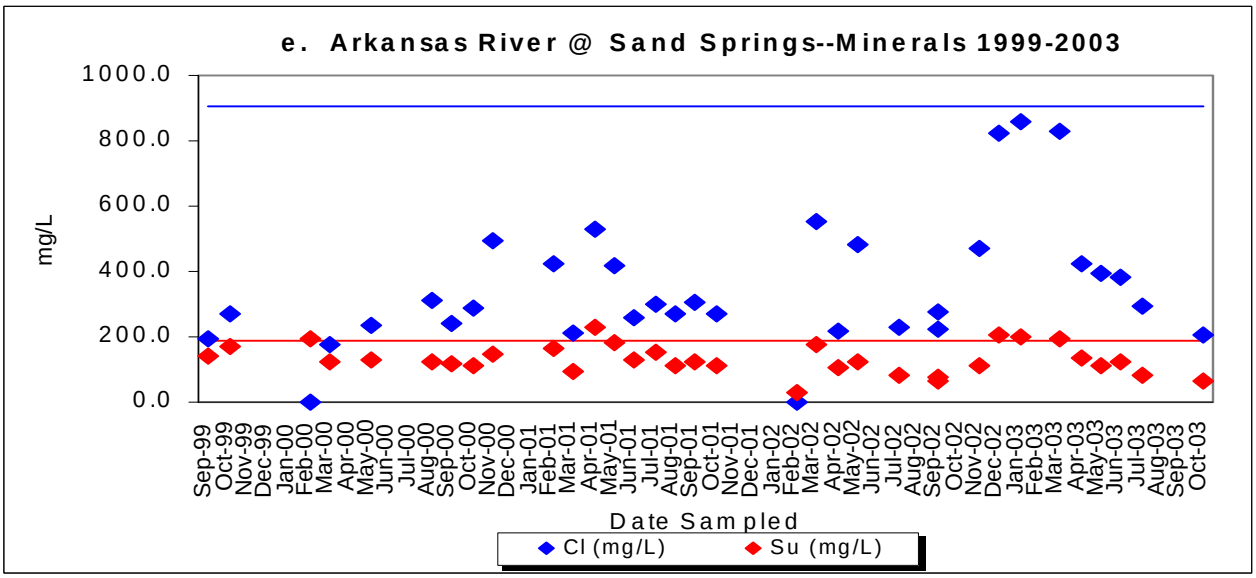
Figure 67a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) for the Arkansas River at Sand Springs (AT164400), 1999-2003.

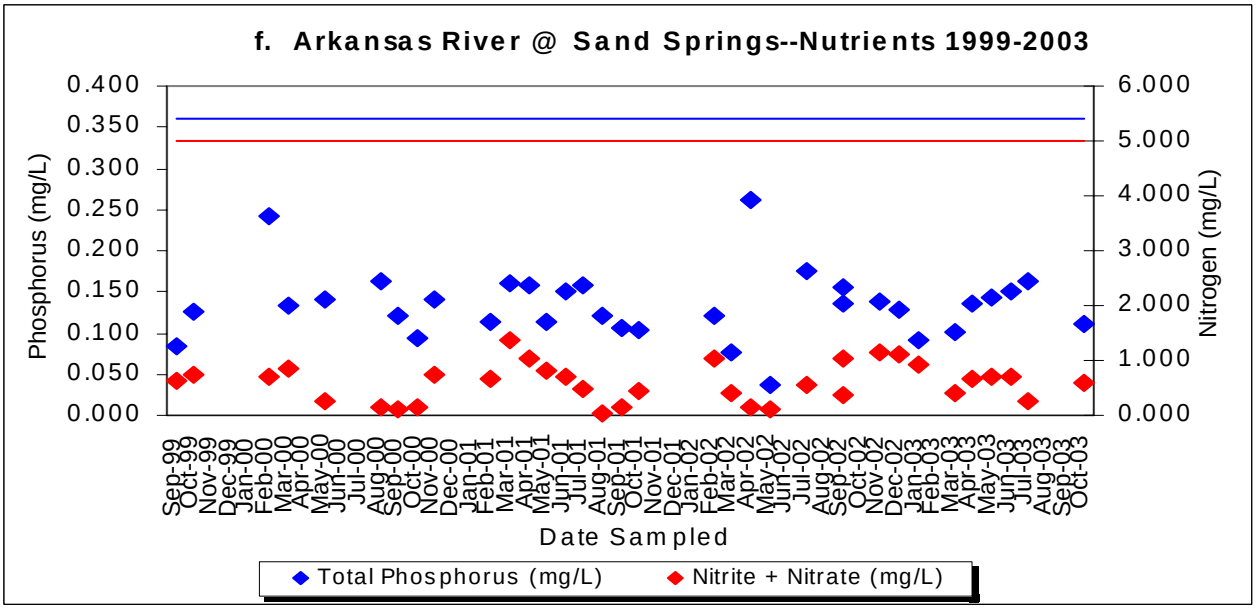







d. Arkansas River @ Sand Springs--TDS 1999-2003
mg/L
2400.0
2000.0
1600.0
1200.0
800.0
400.0
0.0
Date Sampled
TDS (mg/L)


e. Arkansas River @ Sand Springs--Minerals 1999-2003
mg/L
1000.0
800.0
600.0
400.0
200.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Arkansas River @ Sand Springs--Nutrients 1999-2003
Phosphorus (mg/L)
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

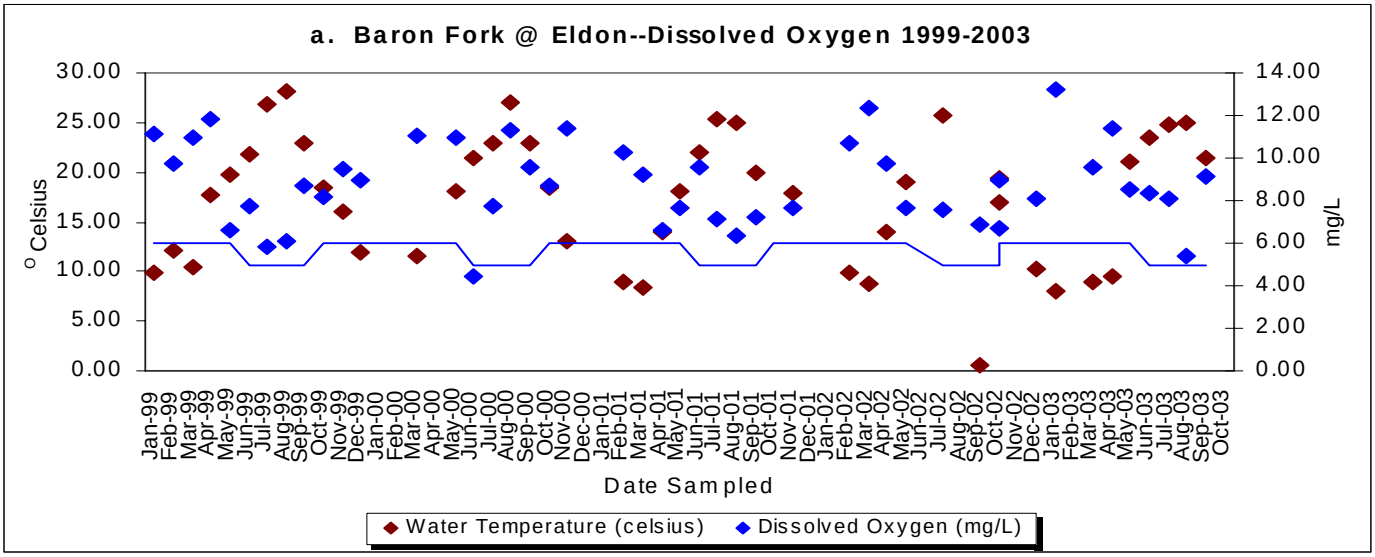
Barren Fork near Eldon

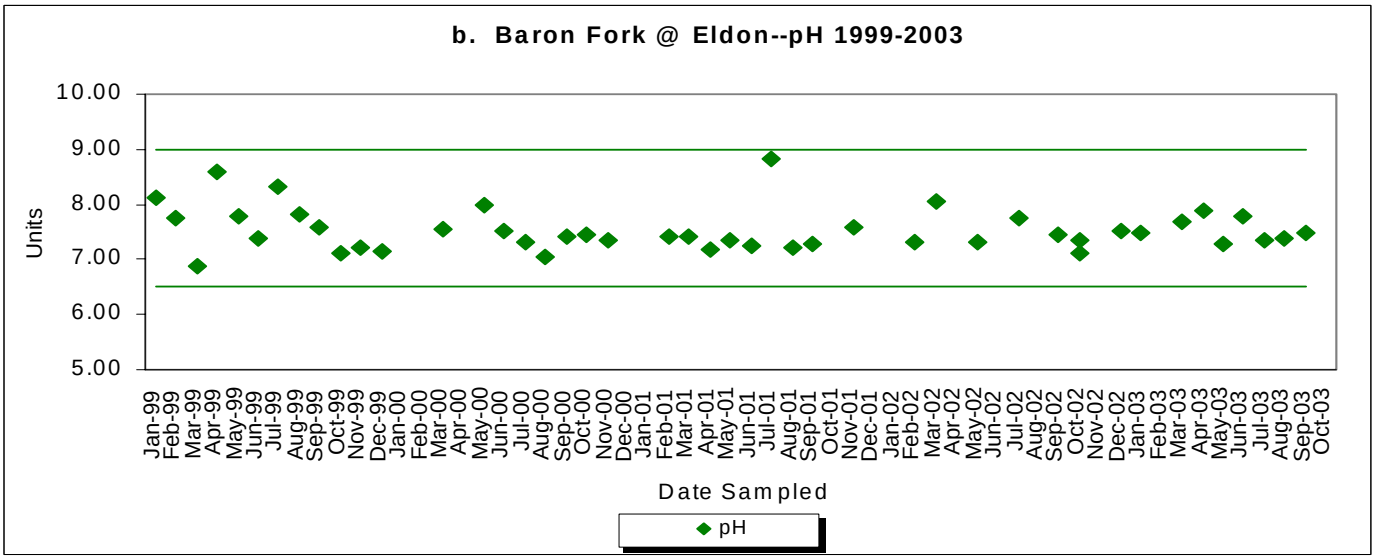
Station AT197000 (121700050010-001AT) is a permanent ambient trend monitoring station located on the Barren Fork River in Oklahoma. Situated in the east central portion of Cherokee County, the site was established west of the Town of Eldon on State Highway 51. The station is positioned near the terminal end of stream segment 121700050010 and is classified within the Illinois River 8-digit HUC watershed (11110103). Water enters the stream system from Arkansas and from several tributaries including Green Creek (Westville Reservoir), England Hollow Creek, Scraper Hollow Creek, Peacheater Creek, Dennison Hollow Creek, and Tyner Creek, among others.

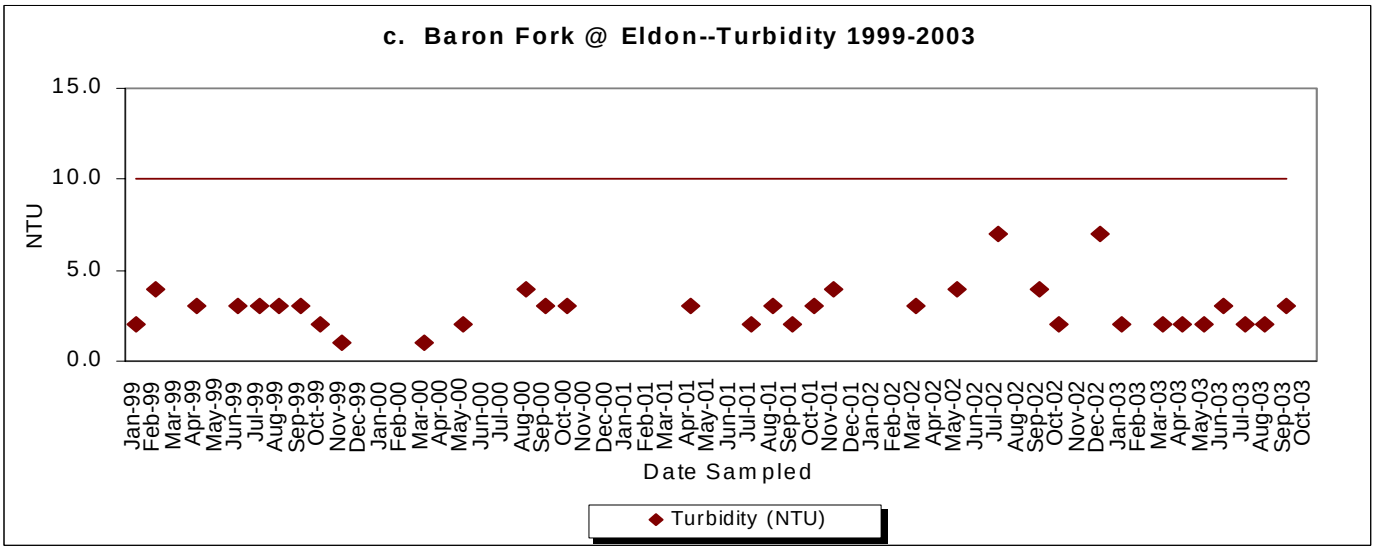
This station on the Barren Fork River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from January 1999 through September of 2003. For purposes of reporting, this station is representative of the Barren Fork River from the confluence of Green Creek (94.6506, 35.9495) downstream to confluence of the Barren Fork River with the Illinois River (94.9142, 35.8510). As per Appendix A, Table 1 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Cool Water Aquatic Community—Fish and Wildlife Propagation (CWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics. The Barren Fork is also designated as an Outstanding Resource Water and Scenic River.

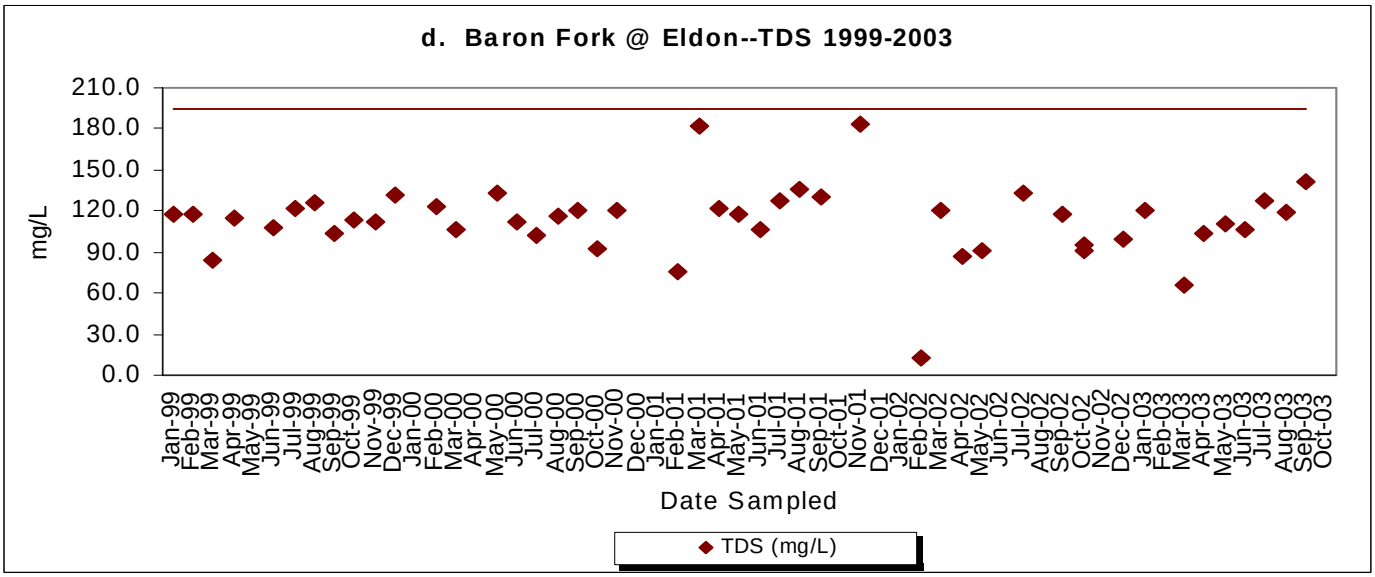
The PPWS beneficial use is supported. The CWAC beneficial use is supported. Dissolved oxygen (Figure 68a), pH (Figure 68b), turbidity (Figure 68c), and toxicant samples met the criteria prescribed in the CWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 68d and Figure 68e). The PBCR beneficial use is not supported (Table 26). Of the 26 enterococci concentrations, 14 samples exceeded the prescribed screening level of 61 cfu/mL, and the geometric mean (45 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. The aesthetics beneficial use is not impaired for total phosphorus (Figure 68f). The 2-year geometric mean of total phosphorus values (0.030 mg/L) does not exceed the scenic river total phosphorus criterion (0.037mg/L).

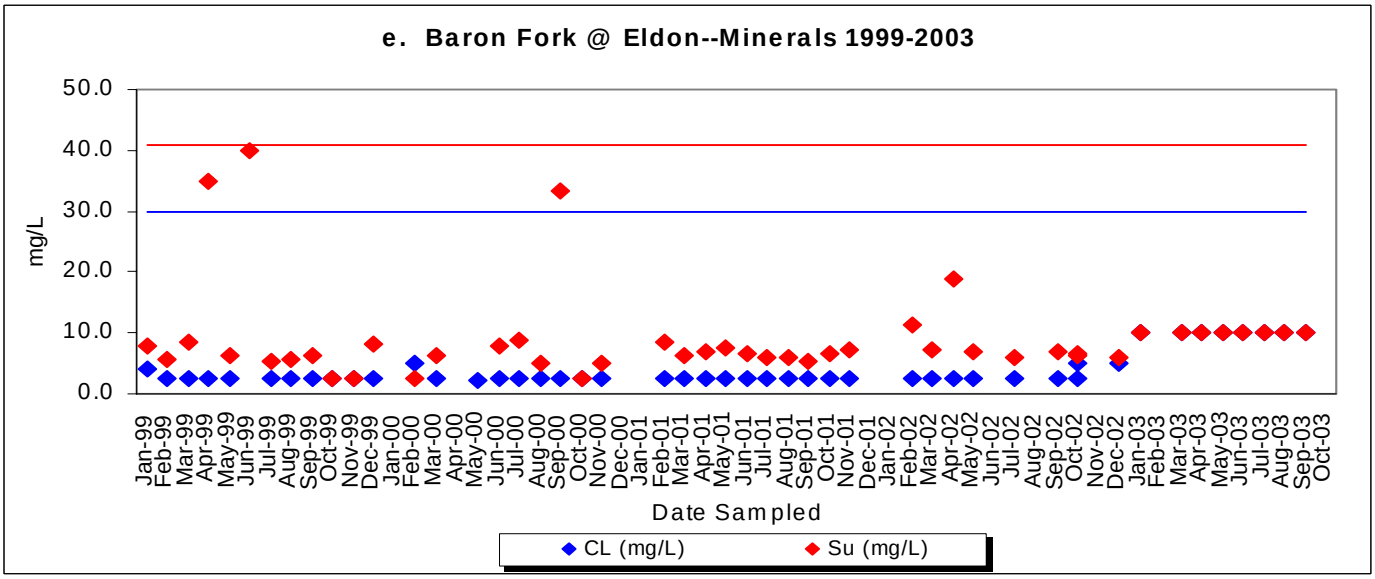
Figure 68a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) the Barren Fork River at Eldon (AT197000), 1999-2003.

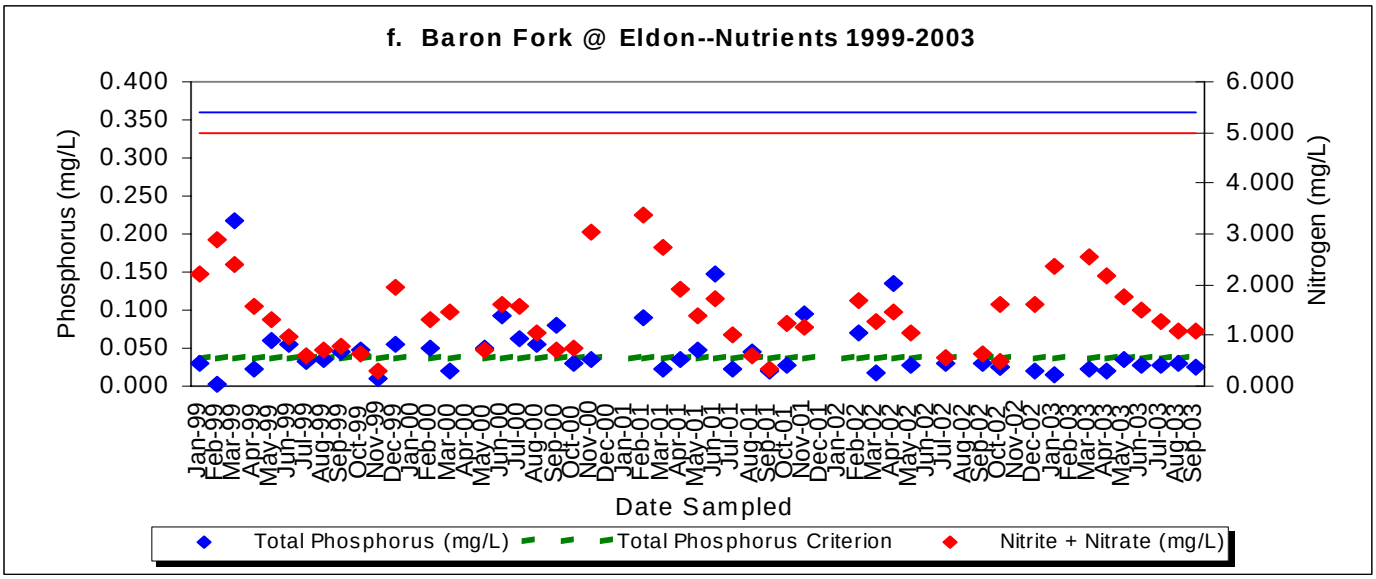







d. Baron Fork @ Eldon--TDS 1999-2003
mg/L
210.0
180.0
150.0
120.0
90.0
60.0
30.0
0.0
Date Sampled
TDS (mg/L)


e. Baron Fork @ Eldon--Minerals 1999-2003
mg/L
50.0
40.0
30.0
20.0
10.0
0.0
Date Sampled
CL (mg/L)
Su (mg/L)


f. Baron Fork @ Eldon--Nutrients 1999-2003
Phosphorus (mg/L)
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Total Phosphorus Criterion
Nitrite + Nitrate (mg/L)

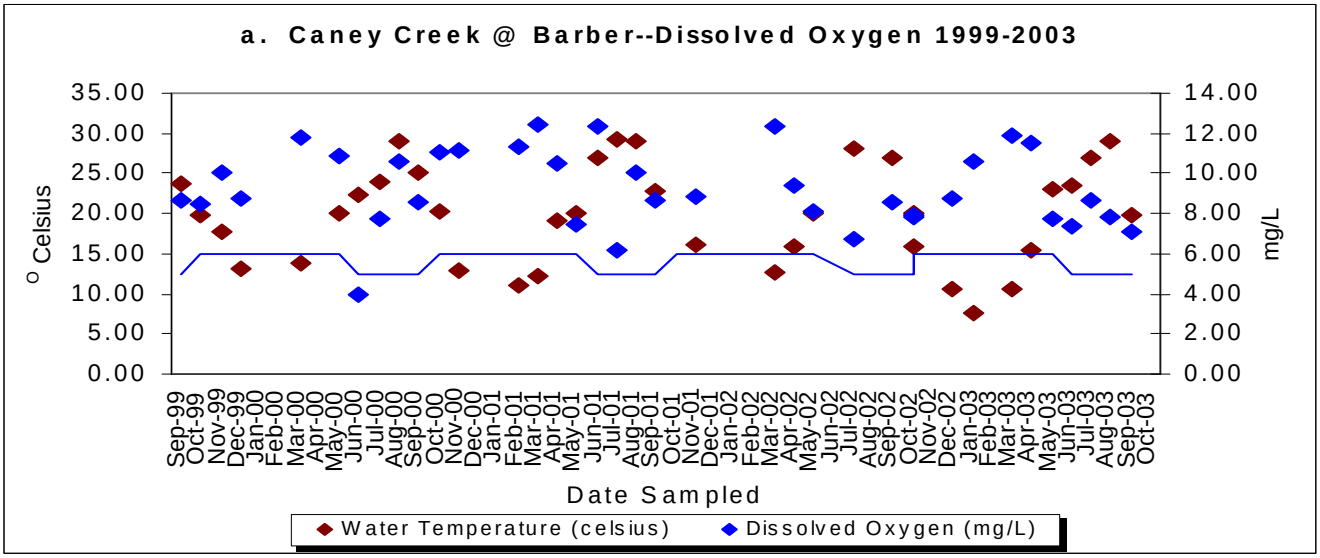
Caney Creek near Barber

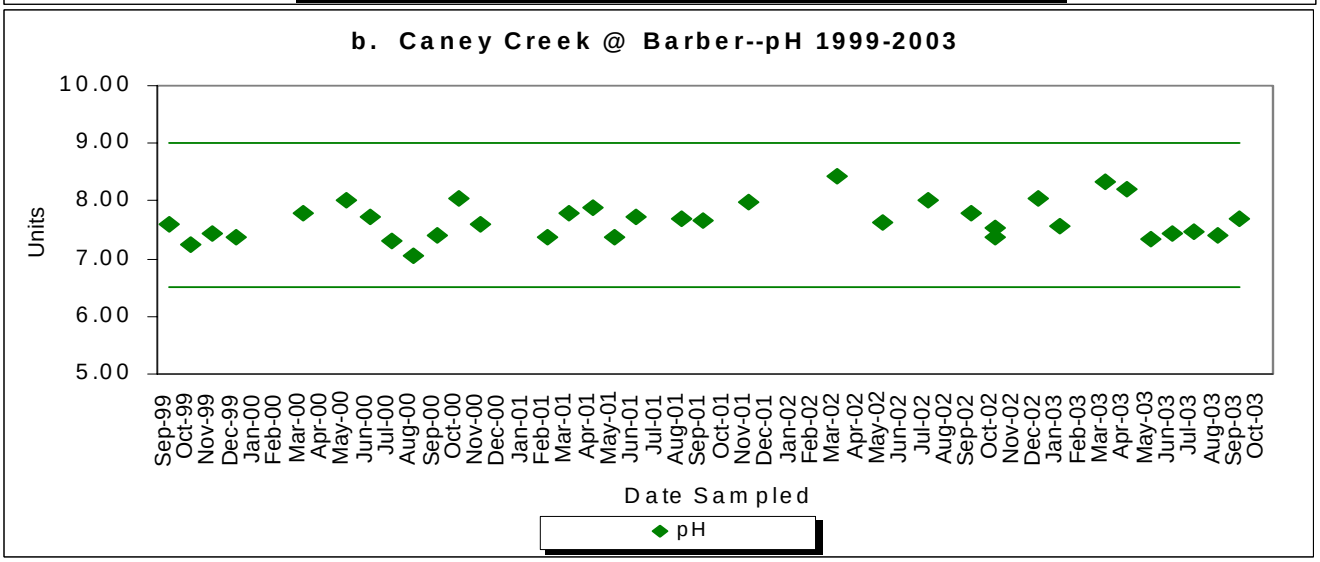
Station AT197360 (121700040010-001AT) is a permanent ambient trend monitoring station located on Caney Creek. Situated in the southeastern portion of Cherokee County, the site was established north-northeast of the Town of Barber off of State Highway 100 on Welling Road. The station is positioned near the terminal end of stream segment 121700040010 and is classified within the Illinois River 8-digit HUC watershed (11110103). Water enters the stream system from several tributaries.

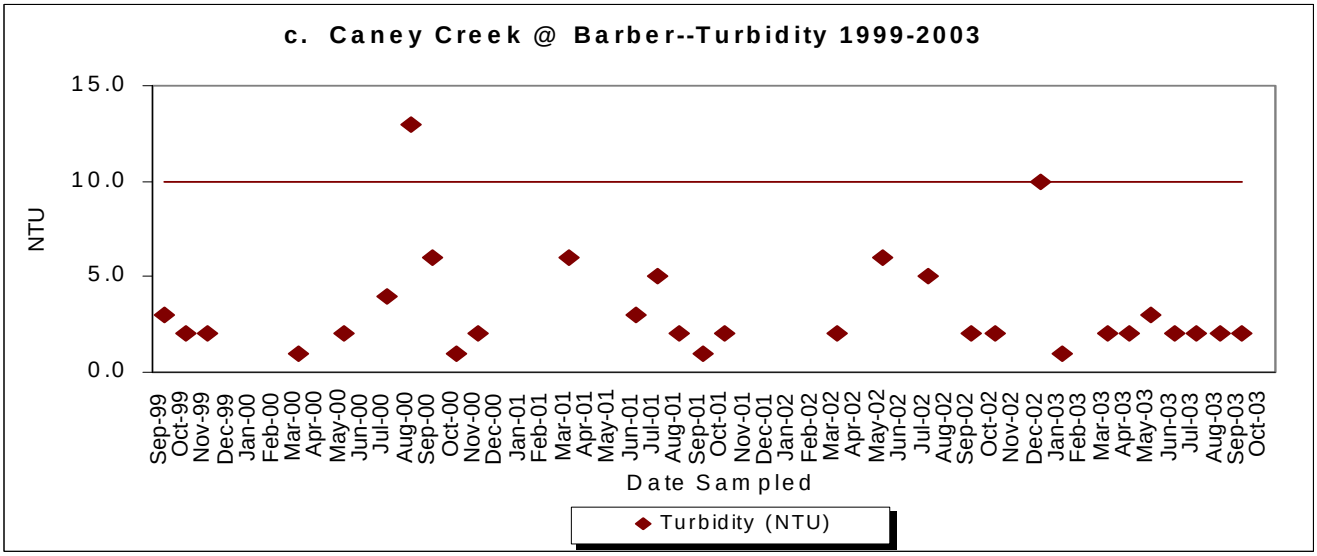
This station on Caney Creek has been active for all water quality variables since September of 1999. The following assessment of beneficial uses is based on data collected from September of 1999 through September of 2003. For purposes of reporting, this station is representative of Caney Creek from the confluence of the Mulberry Hollow Tributary west of Stilwell, Oklahoma (94.7059, 35.8417) downstream to confluence of Caney Creek with Tenkiller Reservoir (94.8631, 35.7788). As per Appendix A, Table 1 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Cool Water Aquatic Community—Fish and Wildlife Propagation (CWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

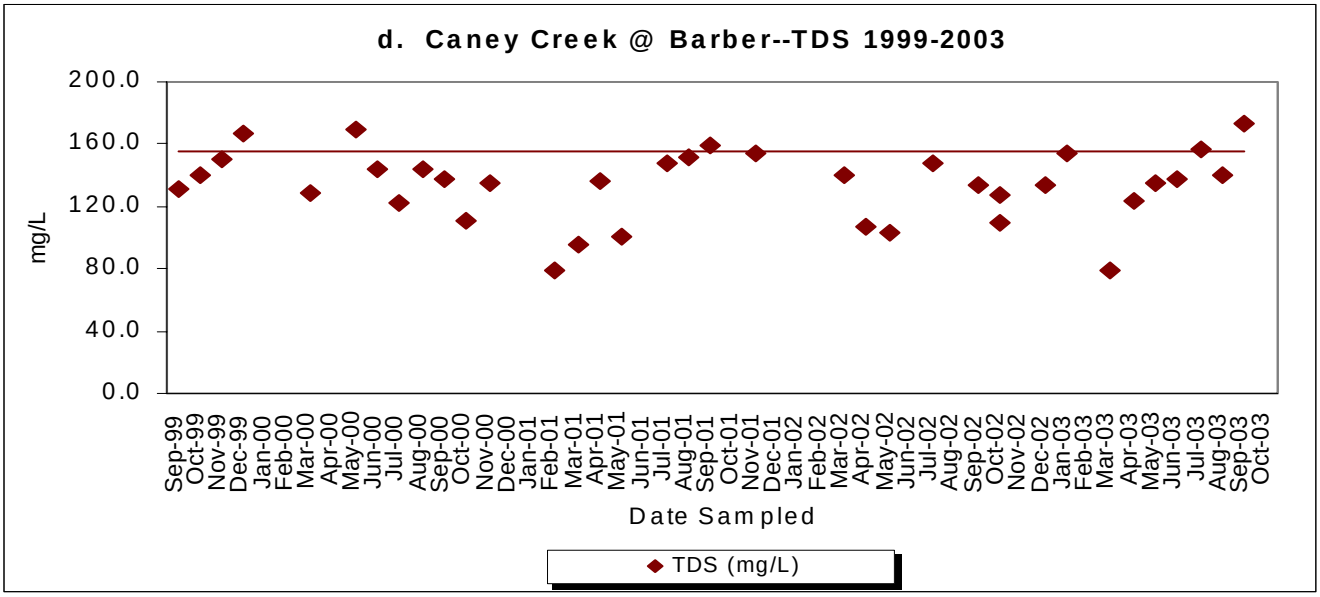
The PPWS beneficial use is supported. The CWAC beneficial use is supported. Dissolved oxygen (Figure 69a), pH (Figure 69b), turbidity (Figure 69c), and toxicant samples met the criteria prescribed in the CWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 69d and Figure 69e). The PBCR beneficial use is supported for all parameters. This segment of Caney Creek is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 69f).

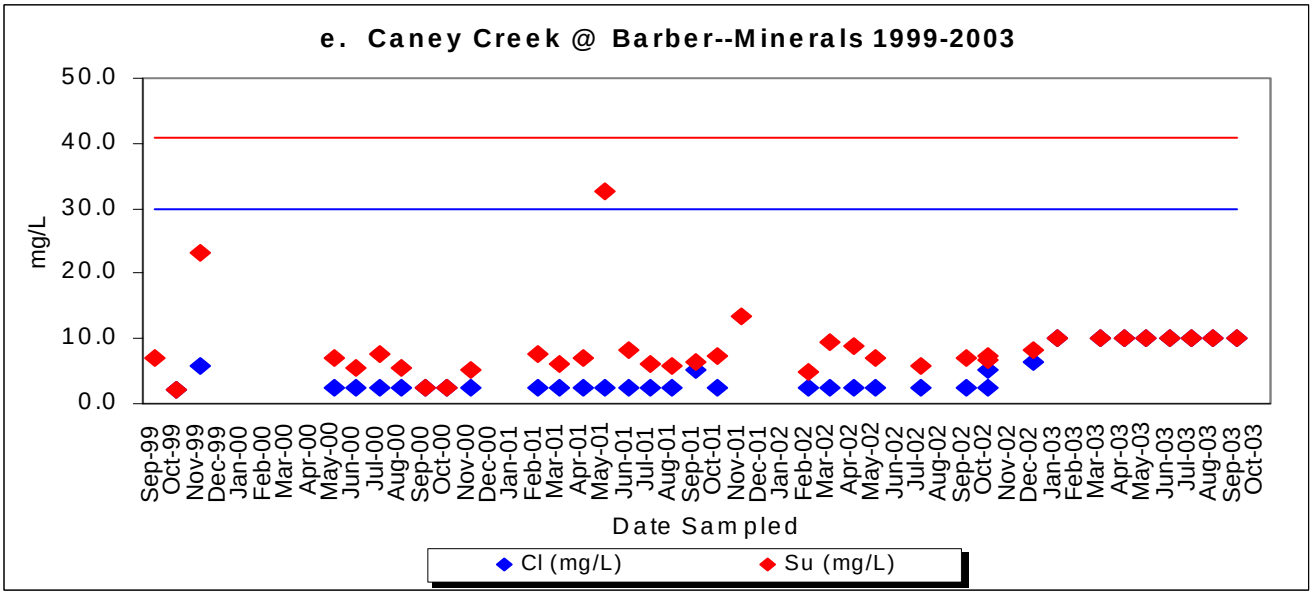
Figure 69a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) Caney Creek at Barber (AT197360), 1999-2003.

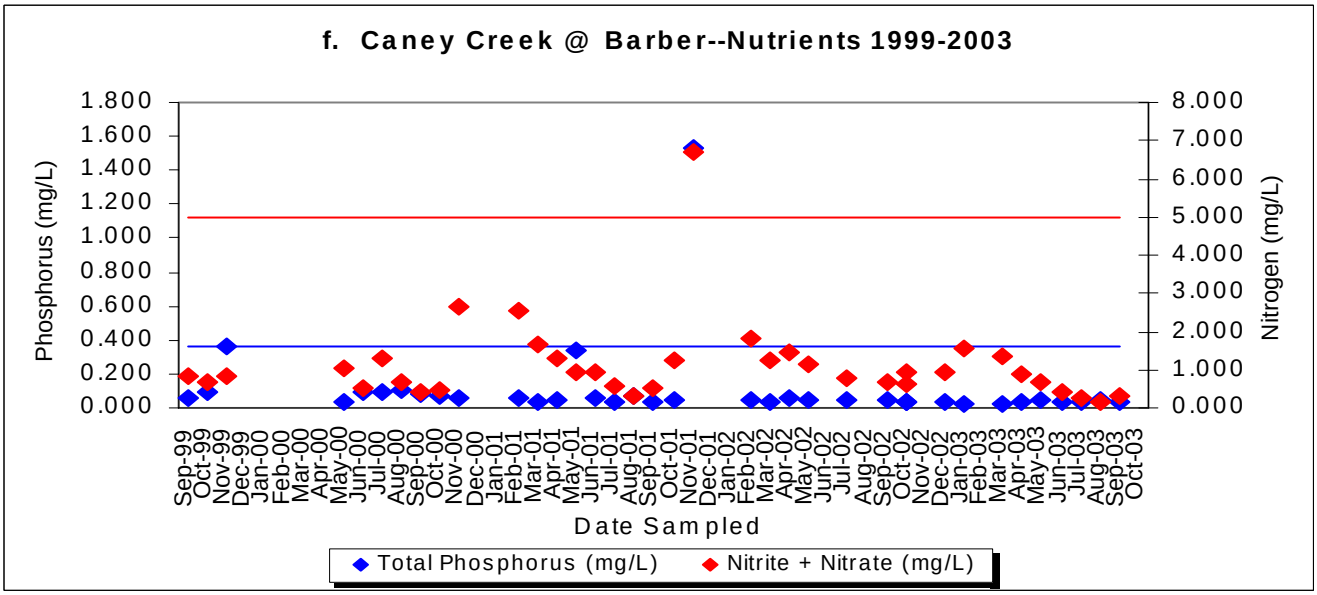







d. Caney Creek @ Barber--TDS 1999-2003
mg/L
200.0
160.0
120.0
80.0
40.0
0.0
Date Sampled
TDS (mg/L)


e. Caney Creek @ Barber--Minerals 1999-2003
mg/L
50.0
40.0
30.0
20.0
10.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Caney Creek @ Barber--Nutrients 1999-2003
Phosphorus (mg/L)
1.800
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Nitrogen (mg/L)
8.000
7.000
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

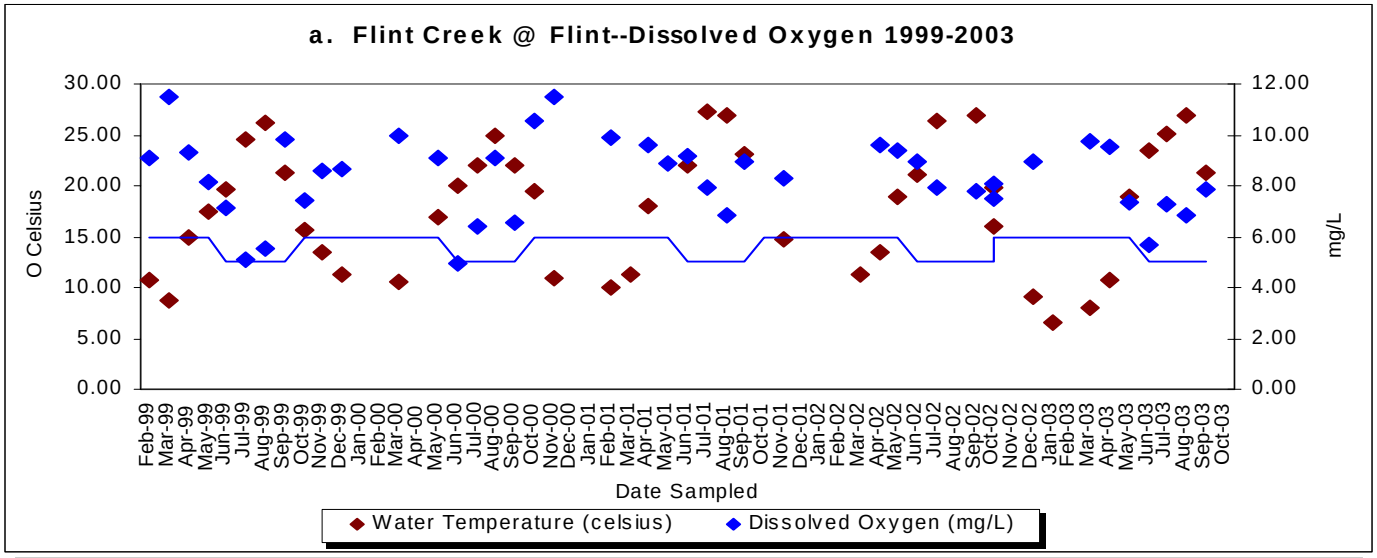
Flint Creek near Flint, OK

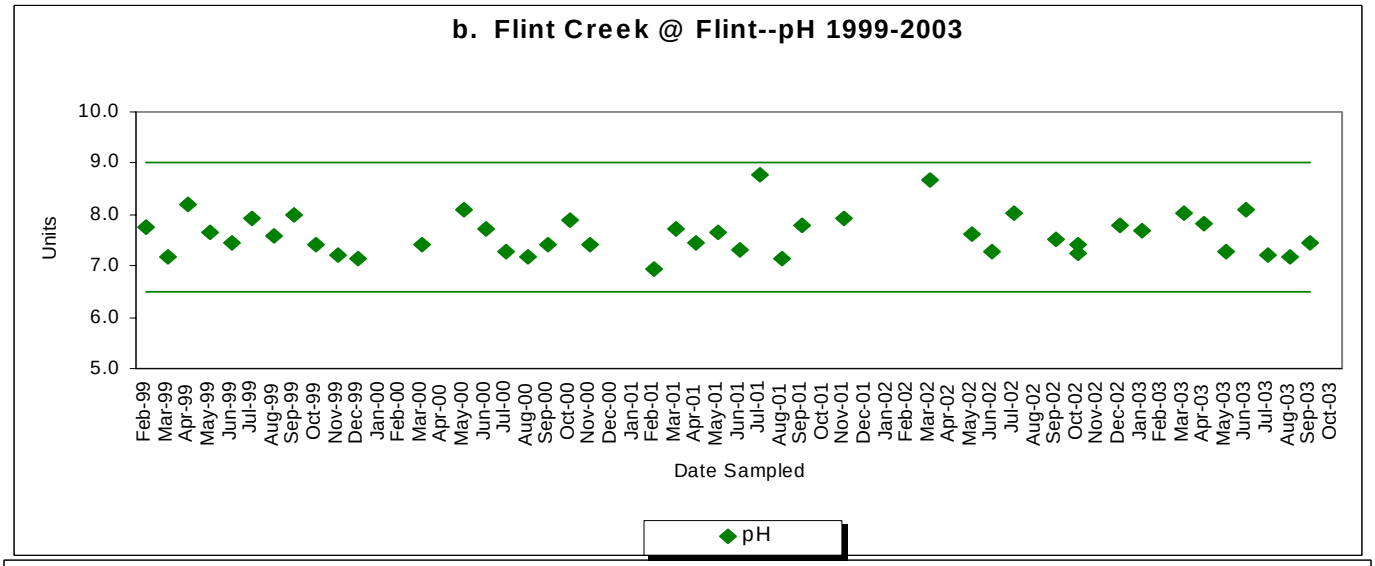
Station AT196000 (121700060010-001AT) is a permanent ambient trend monitoring station located on Flint Creek in Oklahoma. Situated in the southeastern portion of Delaware County, the site was established east of the Town of Flint on US Highway 412. The station is positioned near the terminal end of stream segment 121700060010 and is classified within the Illinois River 8-digit HUC watershed (11110103). Water enters the stream system from Arkansas and from several tributaries including Sager Creek, among others.

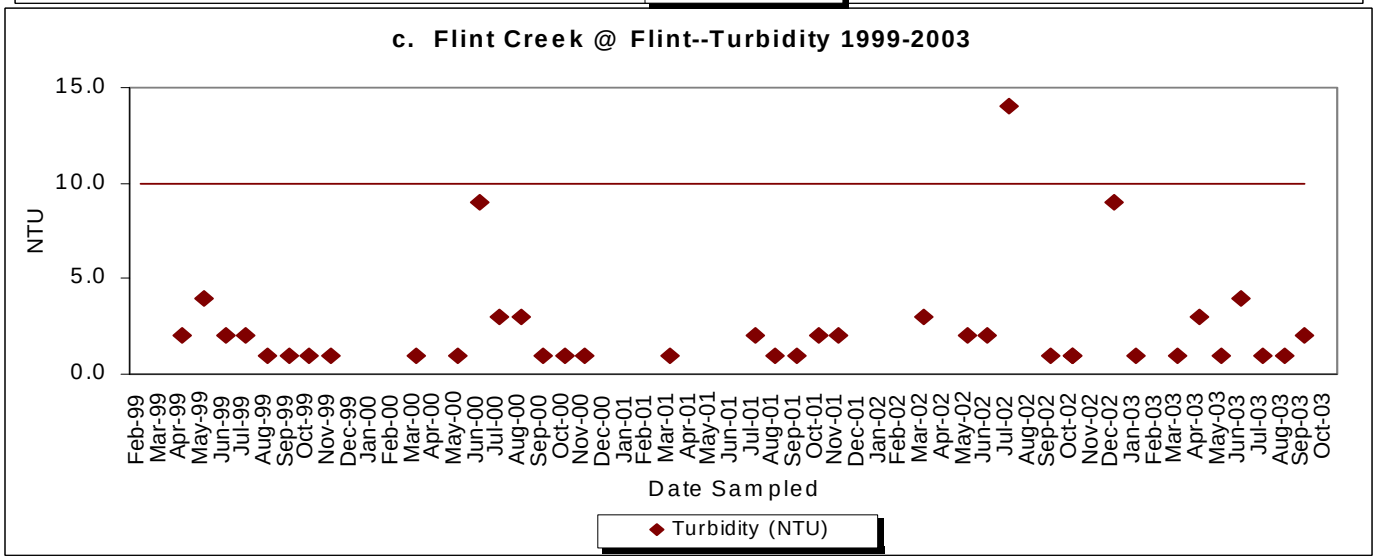
This station on Flint Creek has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from February of 1999 through September of 2003. For purposes of reporting, this station is representative of Flint Creek from the confluence of an unlisted tributary (94.6318, 36.2169) downstream to a point above Flint Creek's intersection with US Highway 412 (94.7076, 36.1863). As per Appendix A, Table 1 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Cool Water Aquatic Community—Fish and Wildlife Propagation (CWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics. Flint Creek is also designated as an Outstanding Resource Water and Scenic River.

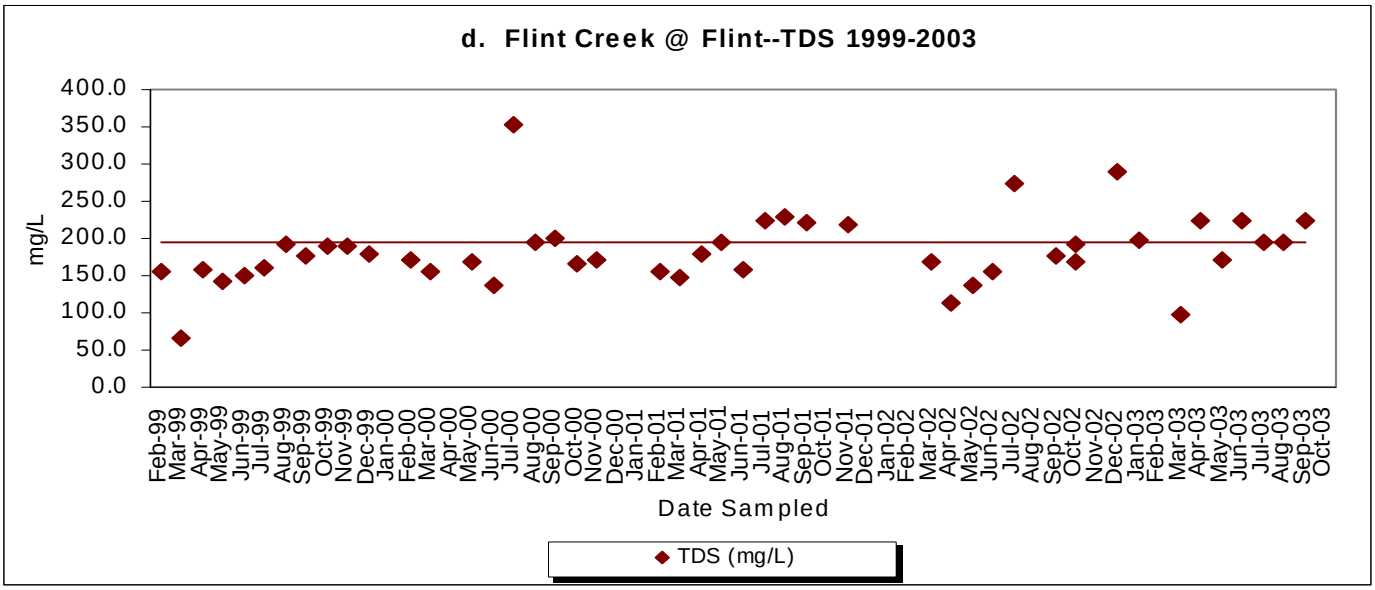
The PPWS beneficial use is supported. The CWAC beneficial use is supported. Dissolved oxygen (Figure 70a), pH (Figure 70b), turbidity (Figure 70c), and toxicant samples met the criteria prescribed in the CWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 70d and Figure 70e). Although 31% of the TDS concentrations are above the sample standards of 194.0 mg/L, the values are below the minimum value of 750mg/L. The PBCR beneficial use is not supported (Table 26). Of the 24 enterococci concentrations, 13 samples exceeded the prescribed screening level of 61 cfu/mL, and the geometric mean (230.0 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. The aesthetics beneficial use is impaired for total phosphorus (Figure 70f). The 2-year geometric mean of total phosphorus values (0.244 mg/L) exceeds the scenic river total phosphorus criterion (0.037mg/L).

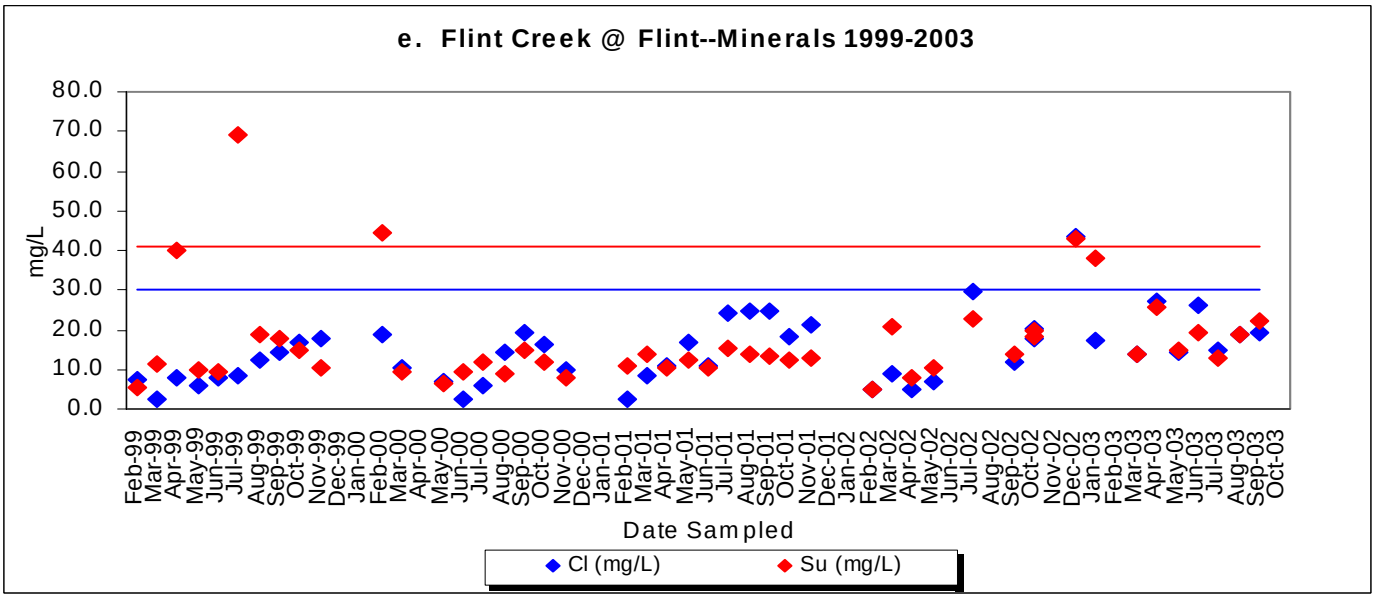
Figure 70a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) Flint Creek at Flint (AT196000), 1999-2003.

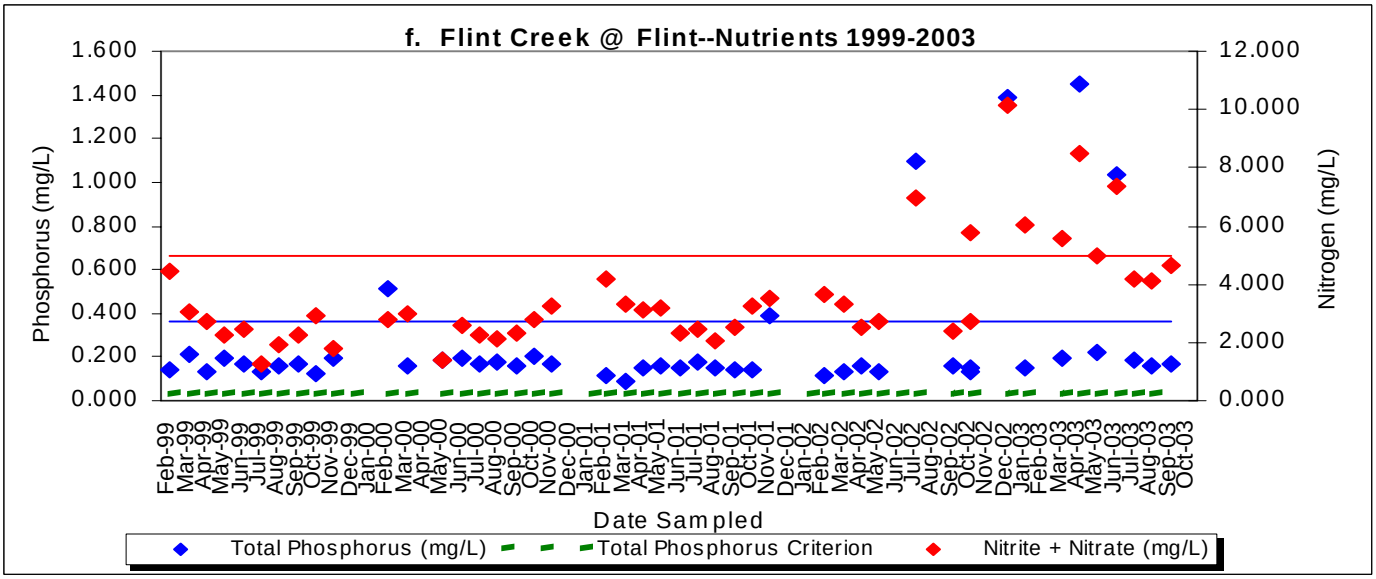







d. Flint Creek @ Flint--TDS 1999-2003
mg/L
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
Date Sampled
TDS (mg/L)


e. Flint Creek @ Flint--Minerals 1999-2003
mg/L
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Flint Creek @ Flint--Nutrients 1999-2003
Phosphorus (mg/L)
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Nitrogen (mg/L)
12.000
10.000
8.000
6.000
4.000
2.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Total Phosphorus Criterion
Nitrite + Nitrate (mg/L)

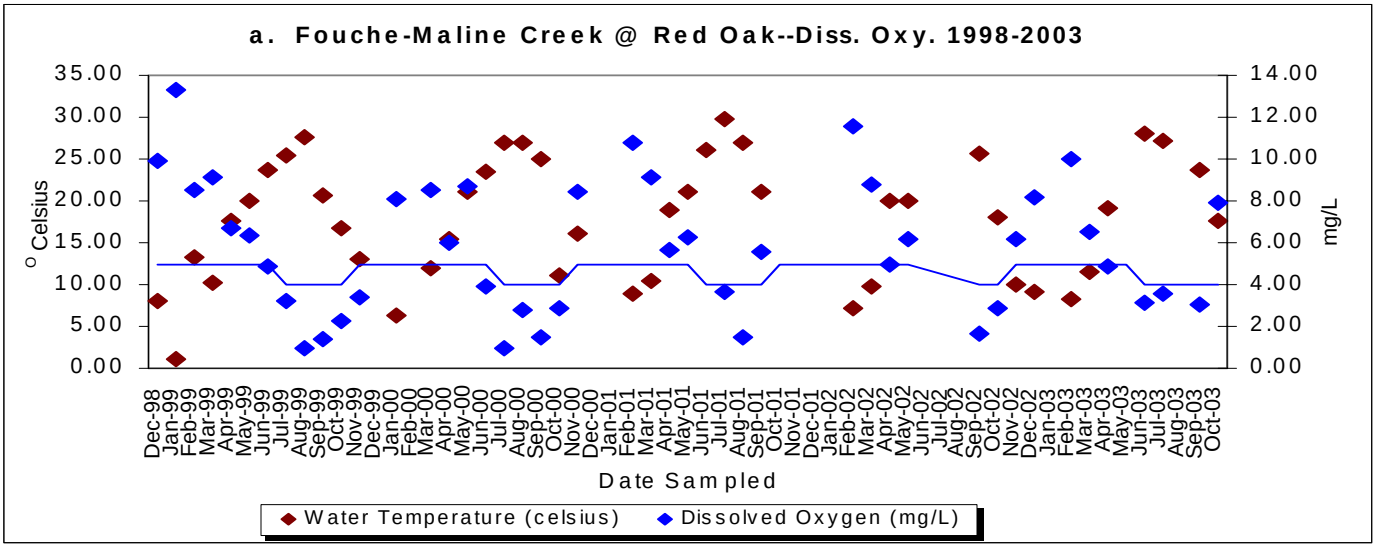
Fourche-Maline Creek near Red Oak

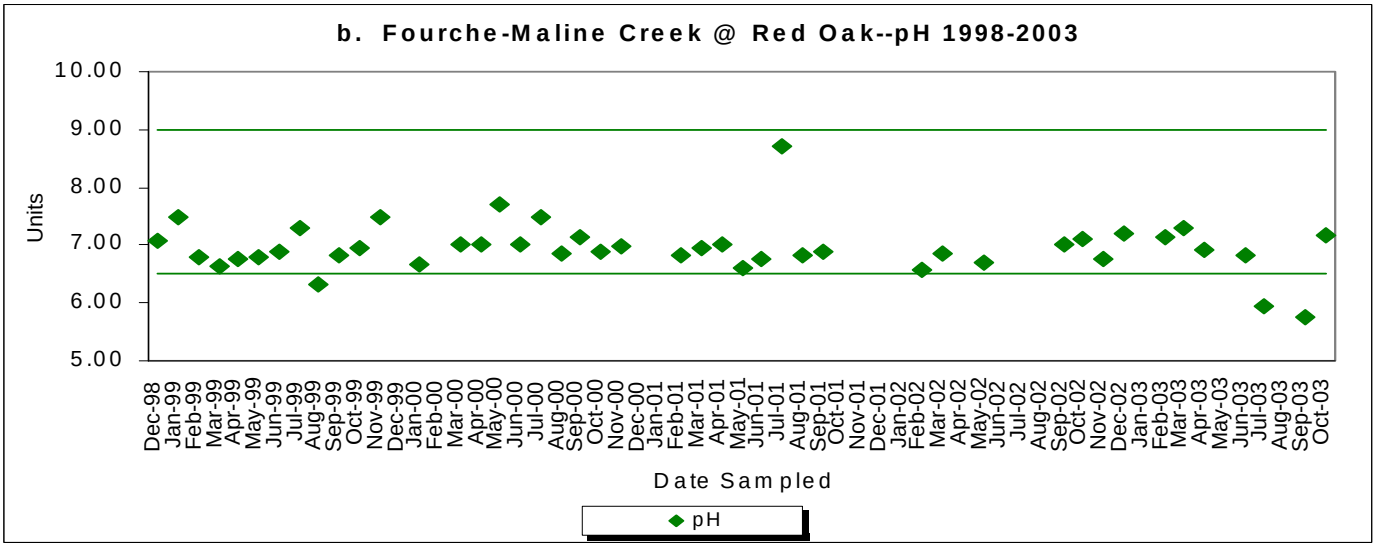
Station AT247550 (220100040020-001AT) is a permanent ambient trend monitoring station located on Fourche-Maline Creek. Situated in the east central portion of Latimer County, the site was established southwest of the Town of Red Oak off of US Highway 270 on Craven Road. The station is positioned between the upper end and the midpoint of stream segment 220100040020 and is classified within the Poteau River 8-digit HUC watershed (11110105). Water enters the stream system from several tributaries including Coon Creek (Coon Creek Lake), Bandy Creek, Little Fourche-Maline Creek, and Spring Creek, among others.

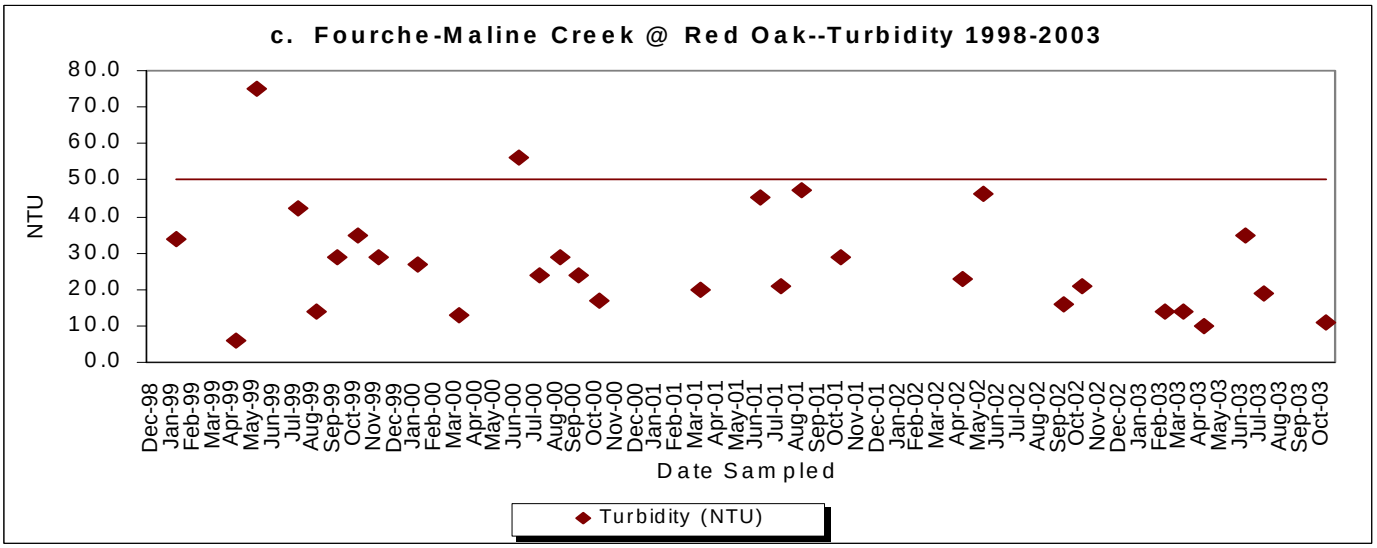
This station on Fourche-Maline Creek has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through October of 2003. For purposes of reporting, this station is representative of Fourche-Maline Creek from the confluence of Coon Creek (95.3566, 34.9726) downstream to confluence of Spring Creek with Fourche-Maline Creek (95.1338, 34.9026). As per Appendix A, Table 2 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

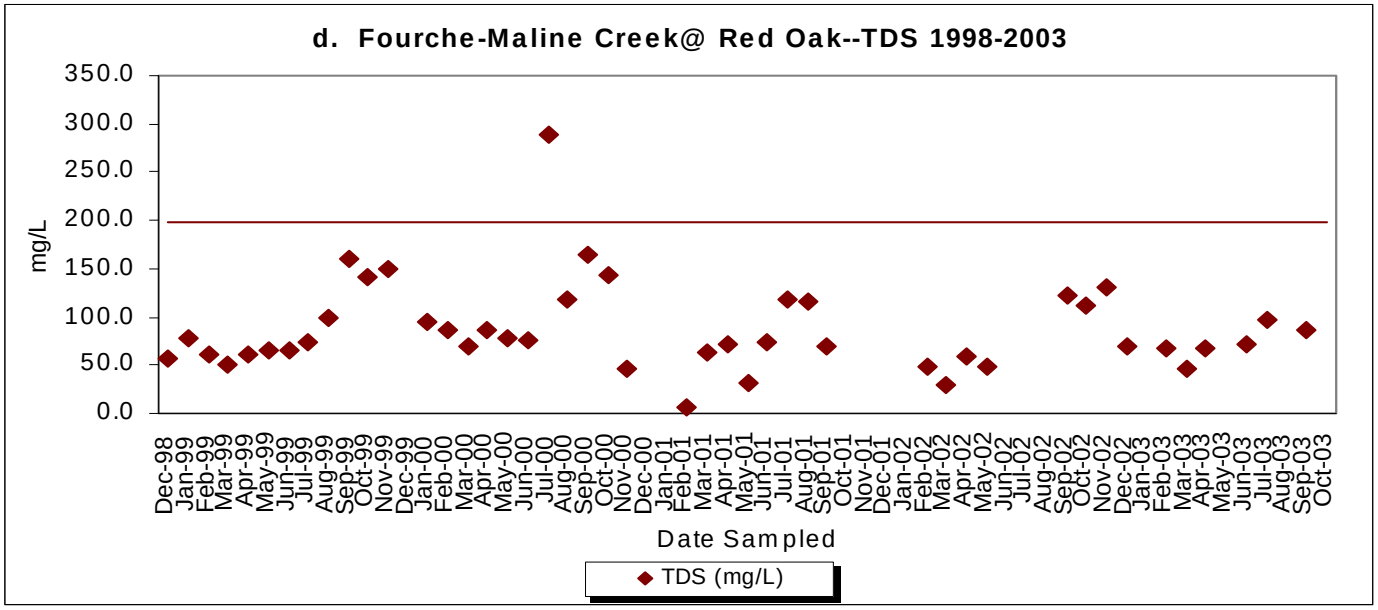
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 45 dissolved oxygen concentrations (Figure 71a), 21 samples (or 47%) were below the screening level. Of the 10 lead samples collected, 7 of the concentrations (or 70%) exceeded the prescribed hardness-dependant chronic criteria of 1.32 µg/L (Table 25). The pH (Figure 71b) and turbidity samples (Figure 71c) met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 71d and Figure 71e). The PBCR beneficial use is not supported (Table 26). Of the 16 enterococci concentrations, 7 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (314.9 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of Fourche-Maline Creek is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 71f).

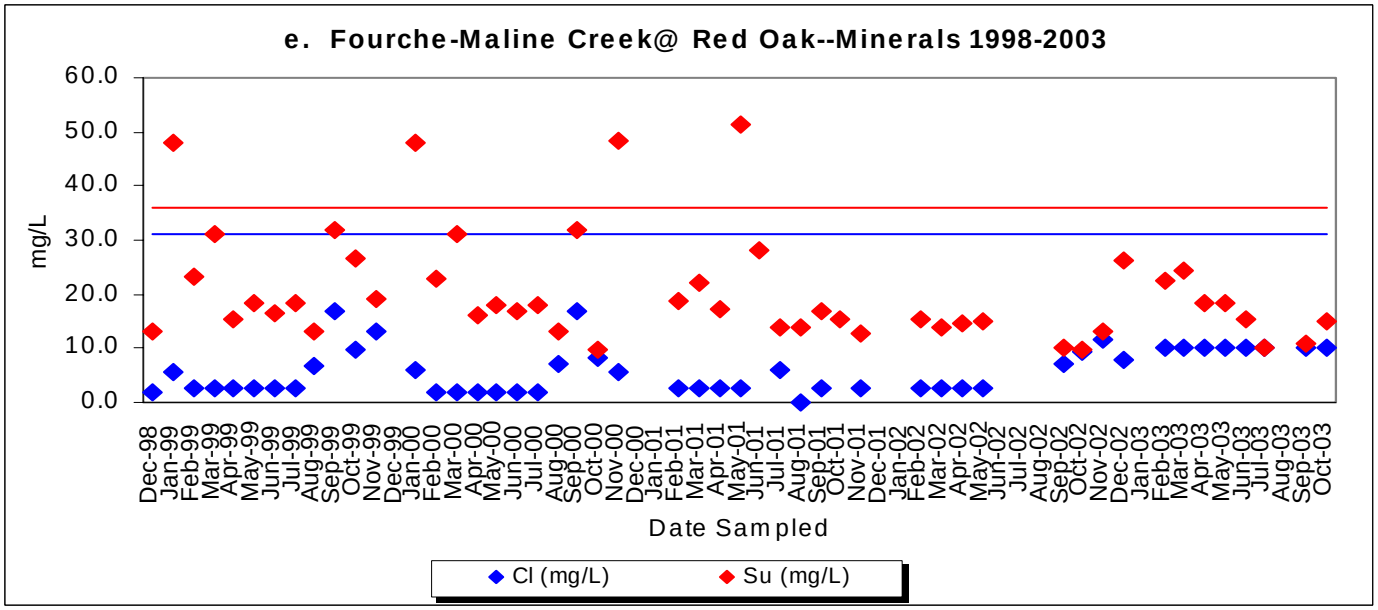
Figure 71a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on Fourche-Maline Creek at Red Oak (AT247550), 1998-2003.

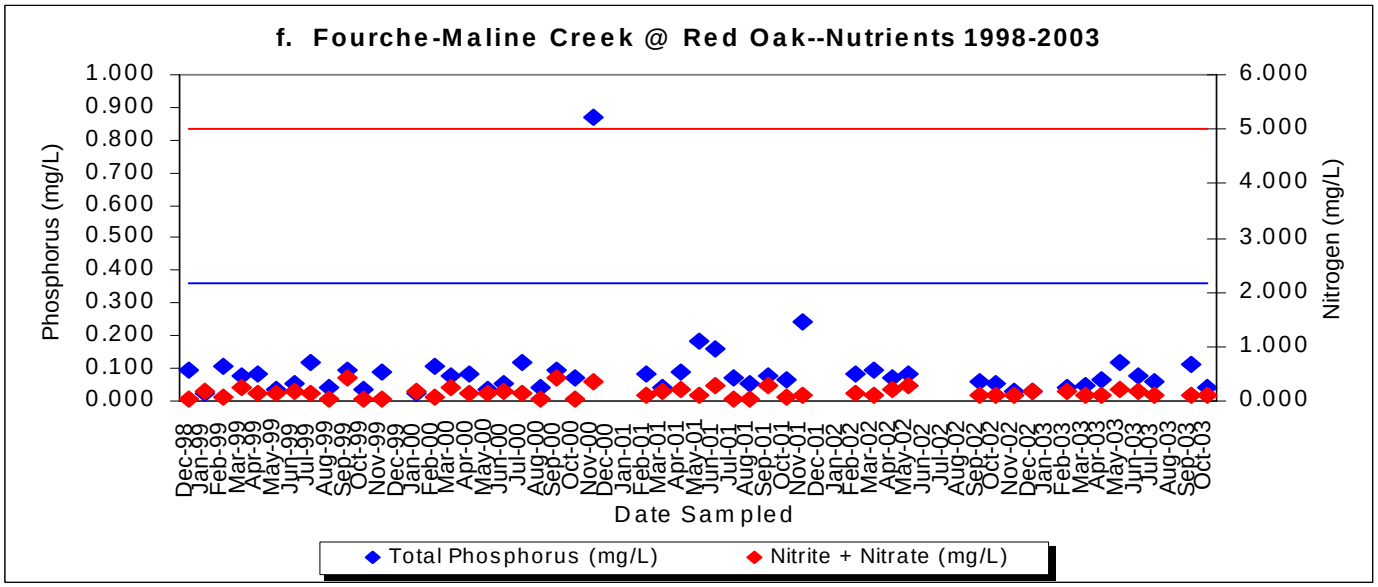







d. Fourche-Maline Creek@ Red Oak--TDS 1998-2003
mg/L
Date Sampled
TDS (mg/L)


e. Fourche-Maline Creek@ Red Oak--Minerals 1998-2003
mg/L
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Fourche-Maline Creek @ Red Oak--Nutrients 1998-2003
Phosphorus (mg/L)
Nitrogen (mg/L)
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

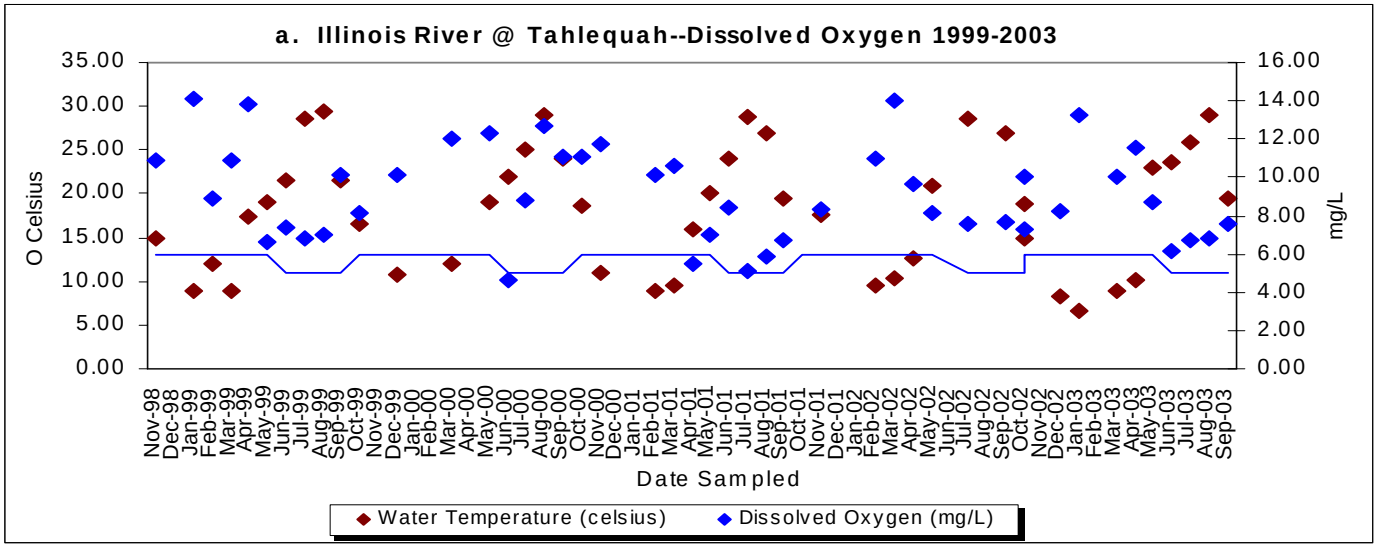
Illinois River near Tahlequah

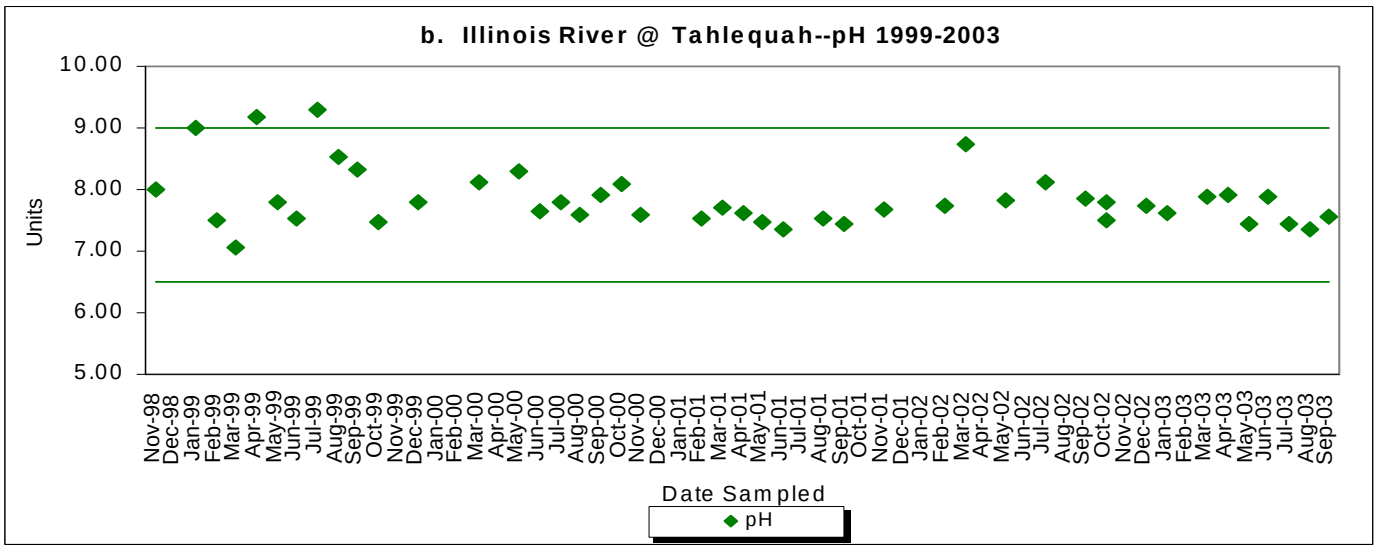
Station AT196500 (121700030010-001AT) is a permanent ambient trend monitoring station located on the Illinois River in Oklahoma. Situated in the east central portion of Cherokee County, the site was established east of the City of Tahlequah on US Highway 62. The station is positioned near the upper end of stream segment 121700030010 and is classified within the Illinois River 8-digit HUC watershed (11110103). Water enters the stream system from several tributaries including Tahlequah Creek, among others.

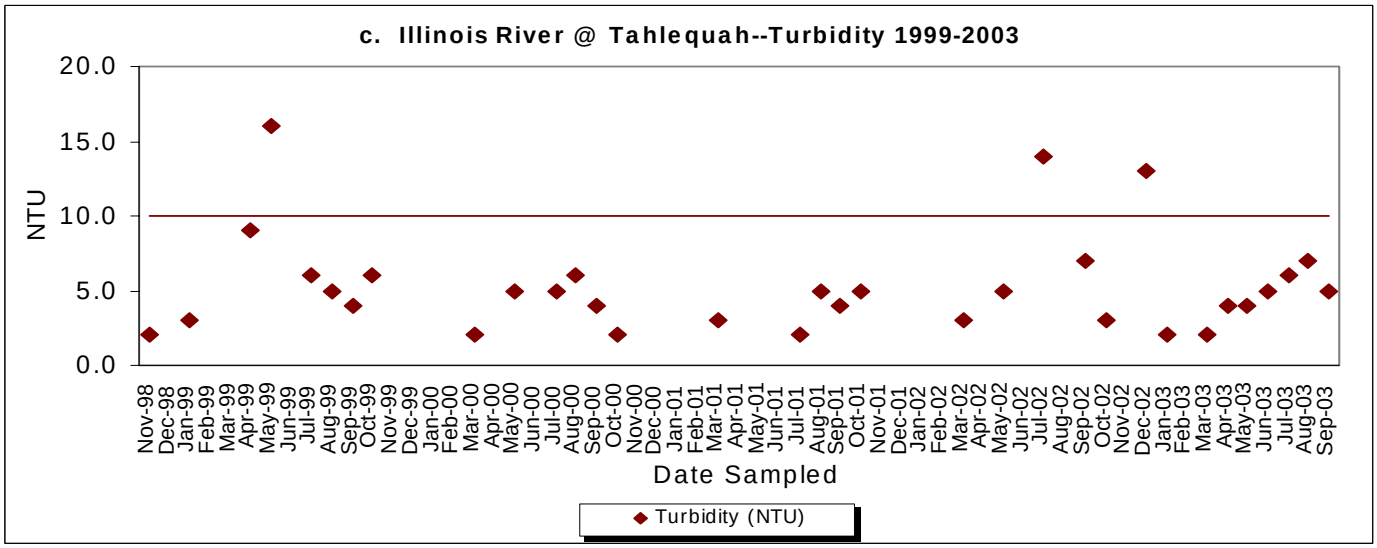
This station on the Illinois River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from January of 1999 through September of 2003. For purposes of reporting, this station is representative of the Illinois River from the confluence of an unlisted tributary near Ellerville, Oklahoma (94.9221, 36.0094) downstream to confluence of Tahlequah Creek with the Illinois River (94.9445, 35.8860). As per Appendix A, Table 1 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Cool Water Aquatic Community—Fish and Wildlife Propagation (CWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics. The Illinois River is also designated as an Outstanding Resource Water and Scenic River.

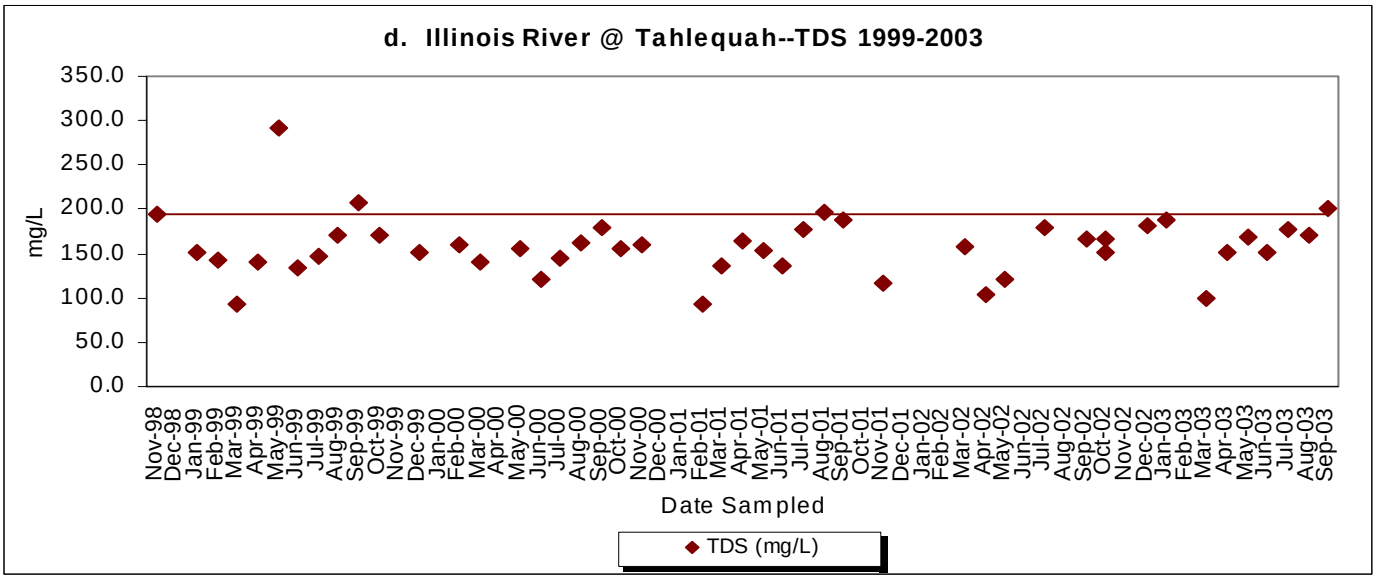
The PPWS beneficial use is supported. The CWAC beneficial use is supported. Dissolved oxygen (Figure 72a), pH (Figure 72b), turbidity (Figure 72c), and toxicant data met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids (TDS), chlorides, and sulfates (Figure 72d and Figure 72e). Although 11% of the TDS concentrations are above the sample standard of 194.0mg/L, these values are below the prescribed minimum sample standard of 750mg/L. The PBCR beneficial use is not supported (Table 26). Of the 24 enterococci concentrations, 8 samples exceeded the prescribed screening level of 61 cfu/mL, and the geometric mean (54.7 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. The aesthetics beneficial use is impaired for total phosphorus (Figure 72f). The 2-year geometric mean of total phosphorus values (0.119 mg/L) exceeded the scenic river total phosphorus criterion (0.037mg/L).

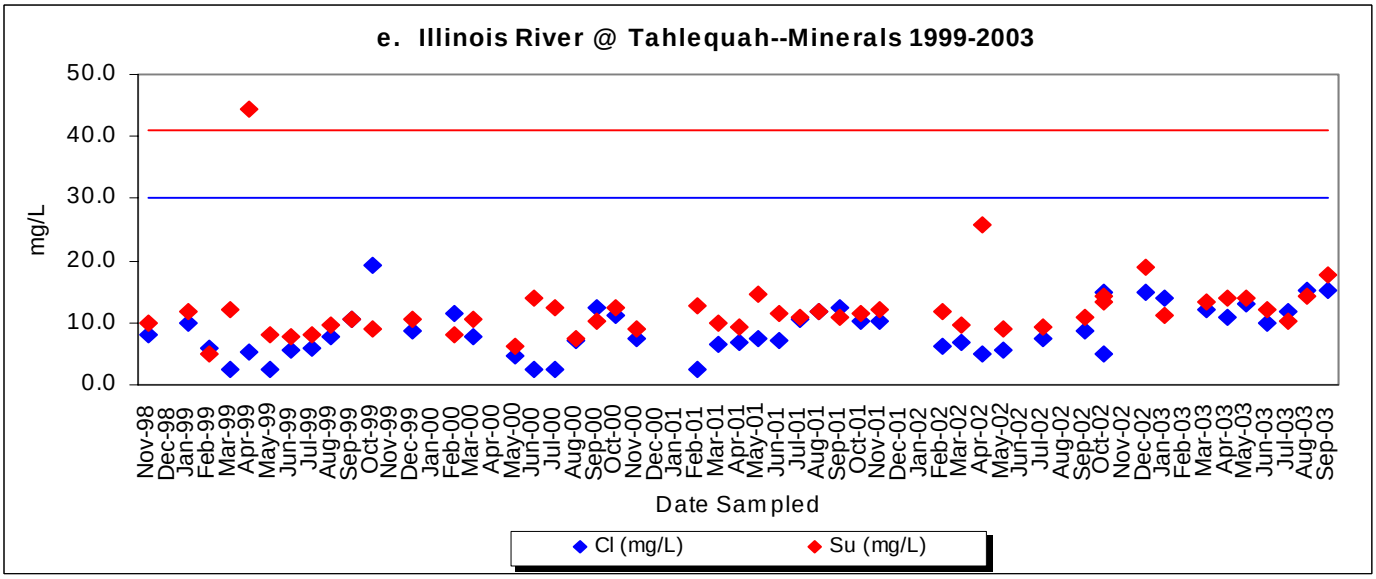
Figure 72a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) the Illinois River at Tahlequah (AT196500), 1999-2003.

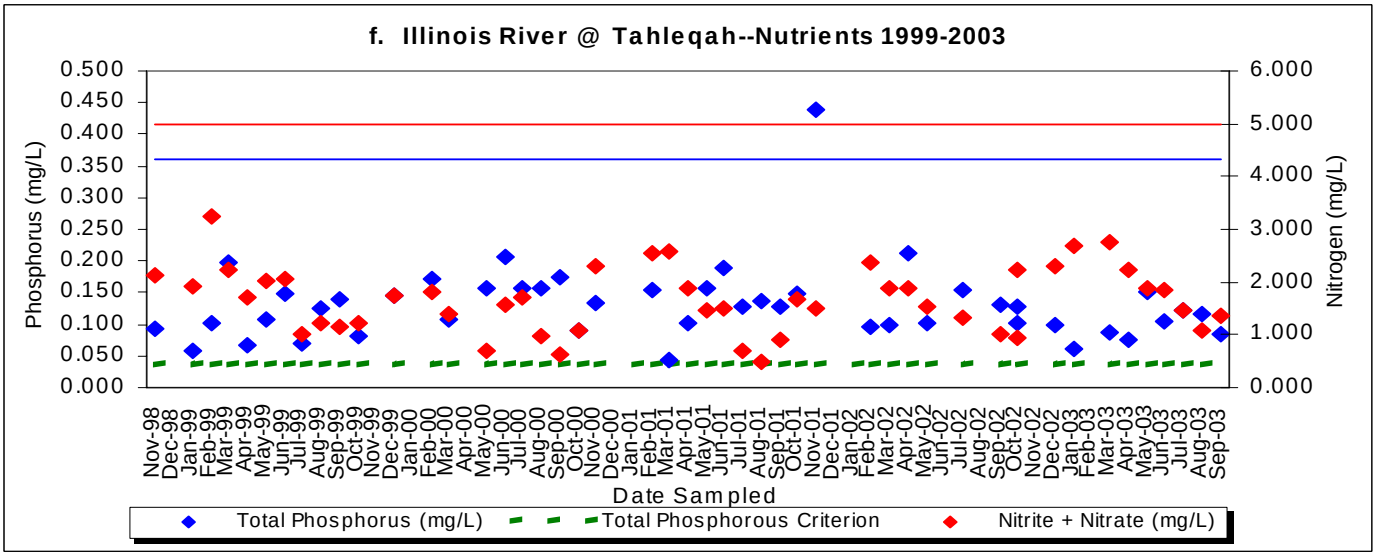







d. Illinois River @ Tahlequah--TDS 1999-2003
mg/L
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
Date Sampled
TDS (mg/L)


e. Illinois River @ Tahlequah--Minerals 1999-2003
mg/L
50.0
40.0
30.0
20.0
10.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Illinois River @ Tahleqah--Nutrients 1999-2003
Phosphorus (mg/L)
0.500
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Total Phosphorous Criterion
Nitrite + Nitrate (mg/L)

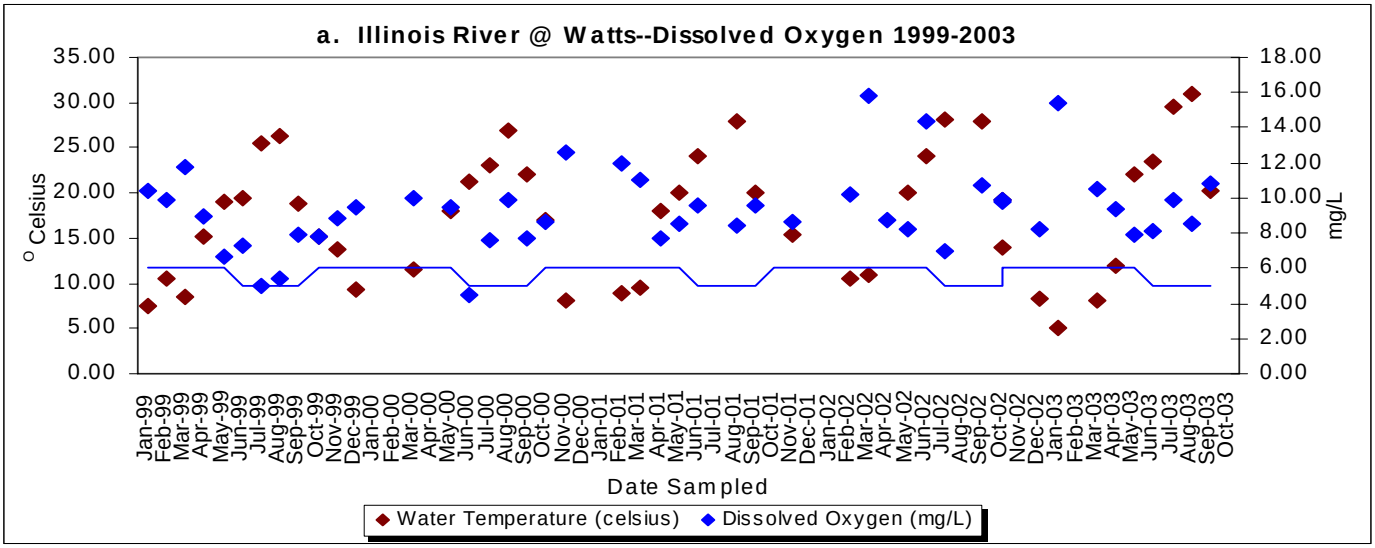
Illinois River near Watts

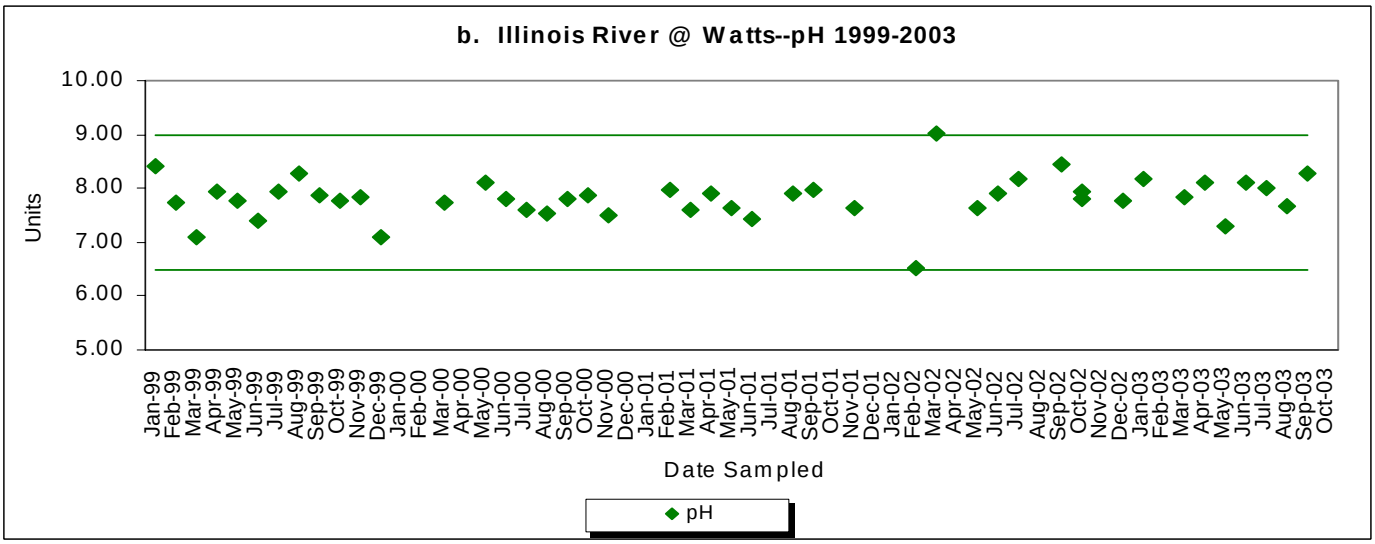
Station AT195500 (121700030350-001AT) is a permanent ambient trend monitoring station located on the Illinois River in Oklahoma. Situated in the northeastern portion of Adair County, the site was established north of the City of Watts on US Highway 59. The station is positioned near the upper end of stream segment 121700030350 and is classified within the Illinois River 8-digit HUC watershed (11110103). Water enters the stream system from Arkansas and several tributaries including Ballard Creek and Flint Creek, among others.

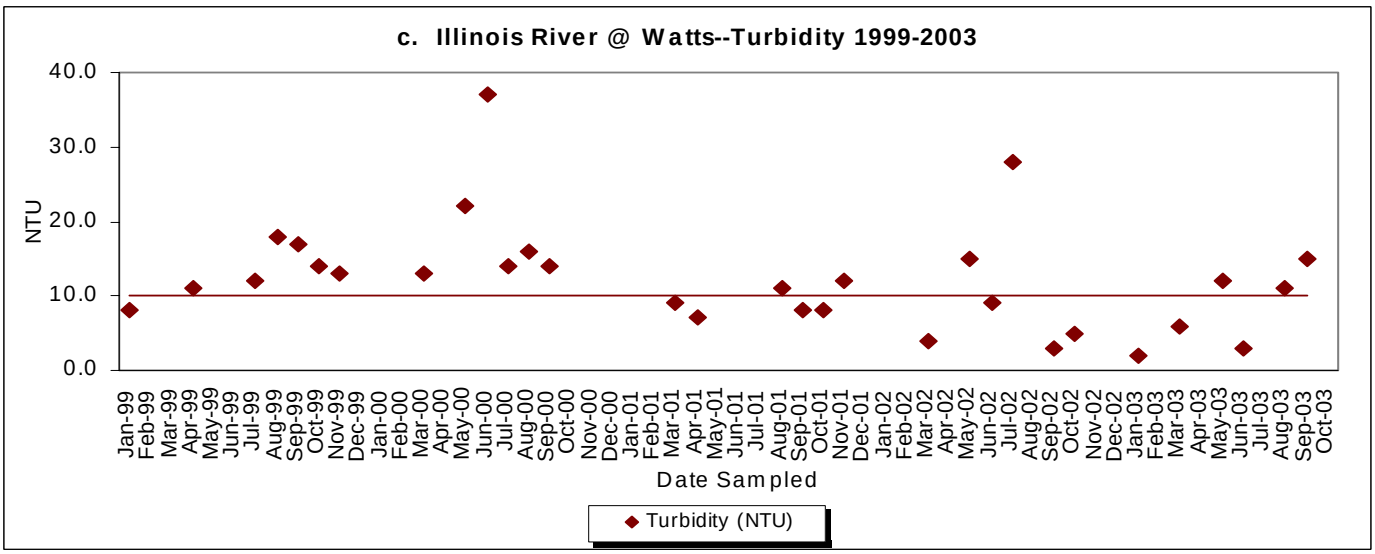
This station on the Illinois River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from January of 1999 through September of 2003. For purposes of reporting, this station is representative of the Illinois River from its entrance into Oklahoma near Watts, Oklahoma (94.5551, 36.1189) downstream to confluence of Flint Creek with the Illinois River (94.7210, 36.1744). As per Appendix A, Table 1 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Cool Water Aquatic Community—Fish and Wildlife Propagation (CWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics. The Illinois River is also designated as an Outstanding Resource Water and Scenic River.

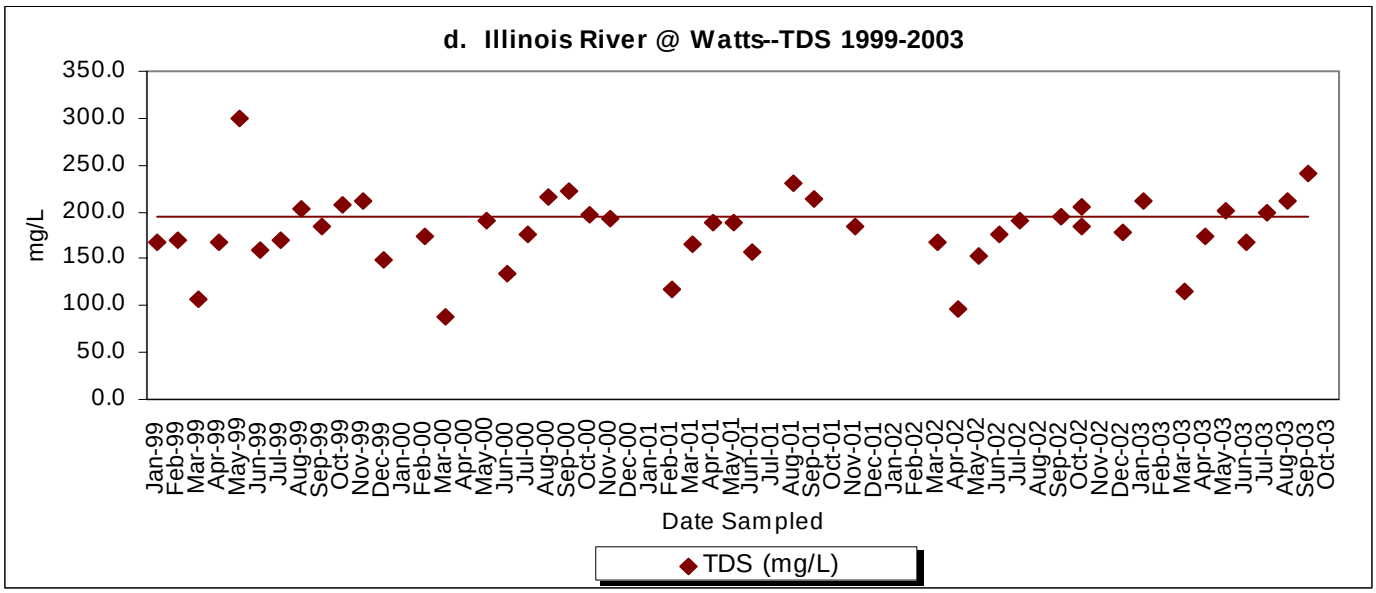
The PPWS beneficial use is supported. The CWAC beneficial use is not supported. Of the 31 turbidity samples (Figure 73c), 19 samples (or 61%) exceeded the numerical criteria of 10. Dissolved oxygen (Figure 73a), pH (Figure 73b), and toxicant samples met the criteria prescribed in the CWAC beneficial use. The AG beneficial use is supported for total dissolved solids (TDS), chlorides, and sulfates (Figure 73d and Figure 73e). Although 33% of the TDS concentrations exceeded the sample standard of 194 mg/L and the geometric mean (176.8 mg/L) exceeded the yearly mean standard of 156.0 mg/L, these values are below the prescribed minimum values of 750mg/L and 700 mg/L, respectively. The PBCR beneficial use is not supported (Table 26). Of the 23 enterococci concentrations, 9 samples exceeded the prescribed screening level of 61 cfu/mL, and the geometric mean (68.7 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. The aesthetics beneficial use is impaired for total phosphorus (Figure 73f). The 2-year geometric mean of total phosphorus values (0.225 mg/L) exceeded the scenic river total phosphorus criterion (0.037mg/L).

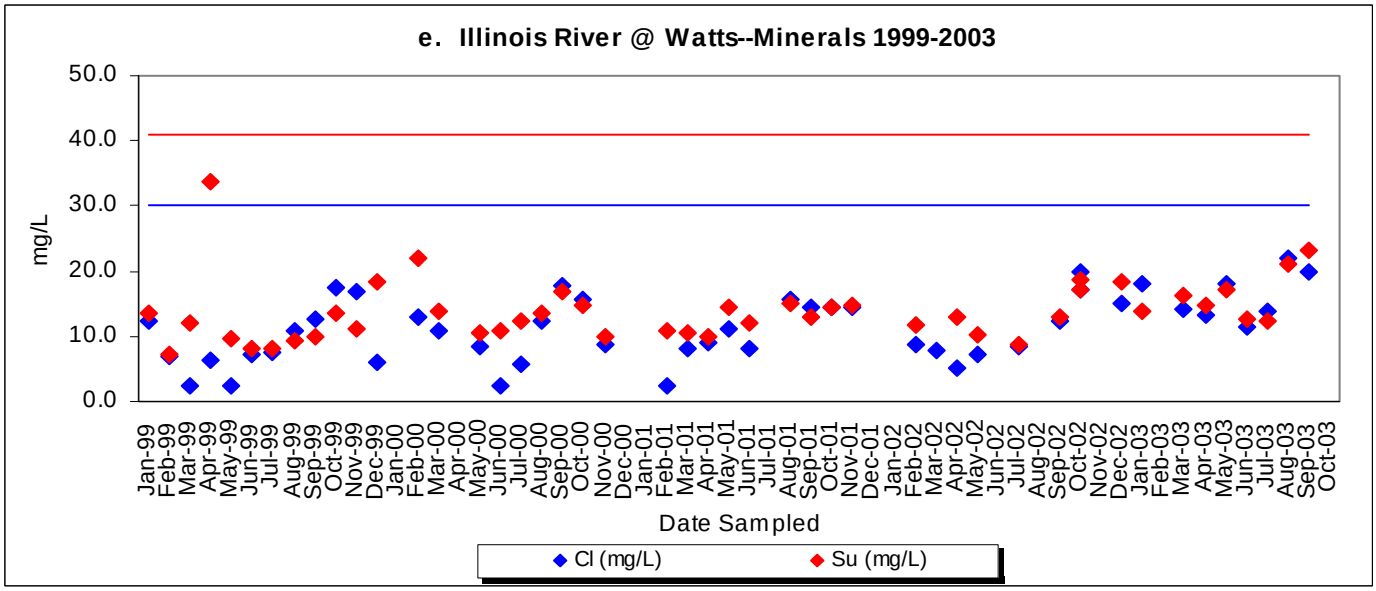
Figure 73a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) the Illinois River at Watts (AT195500), 1999-2003.

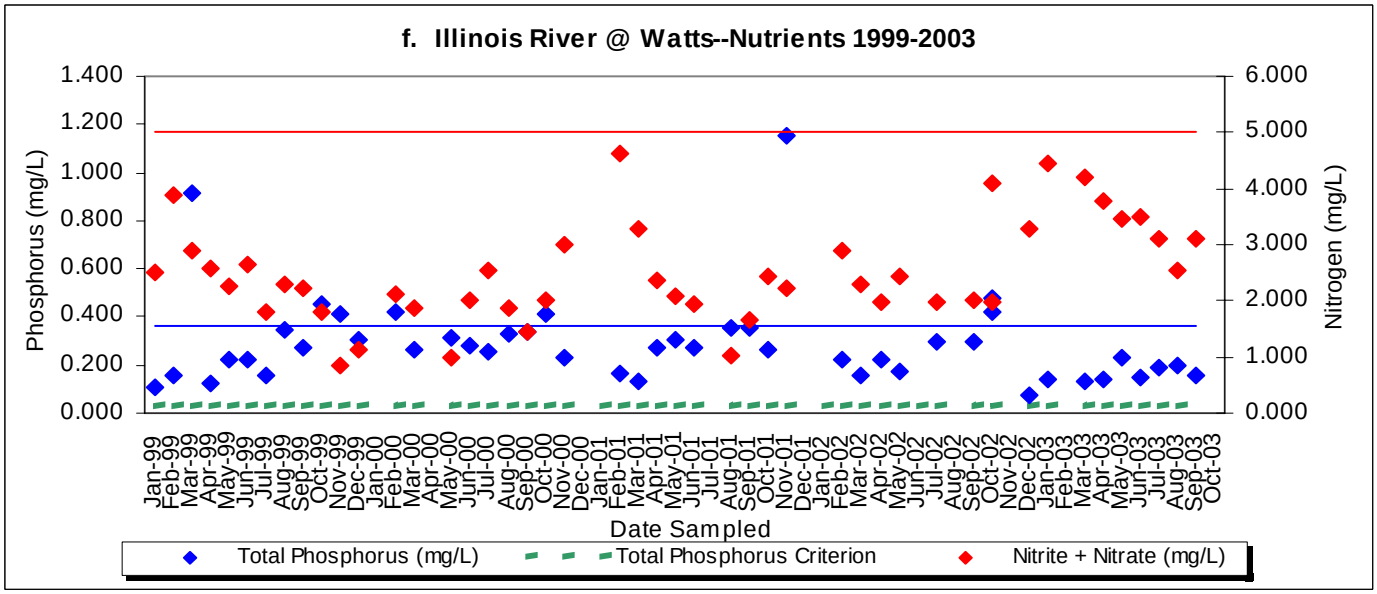







d. Illinois River @ Watts--TDS 1999-2003
mg/L
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
Date Sampled
TDS (mg/L)


e. Illinois River @ Watts--Minerals 1999-2003
mg/L
50.0
40.0
30.0
20.0
10.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Illinois River @ Watts--Nutrients 1999-2003
Phosphorus (mg/L)
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Total Phosphorus Criterion
Nitrite + Nitrate (mg/L)

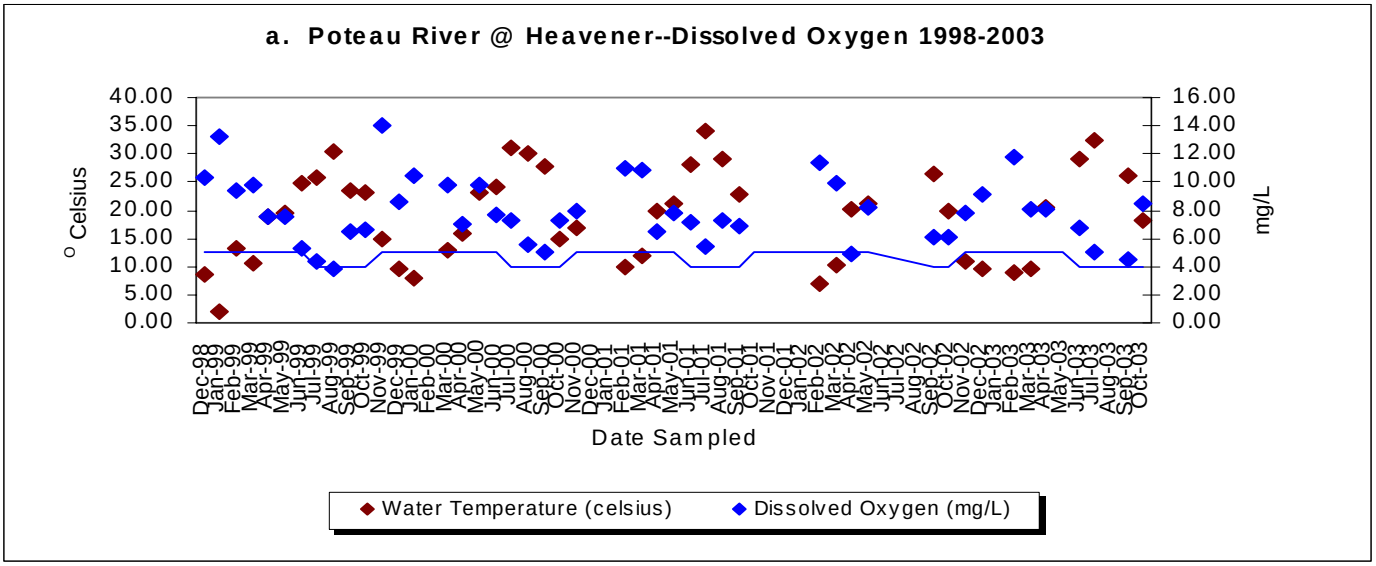
Poteau River near Heavener

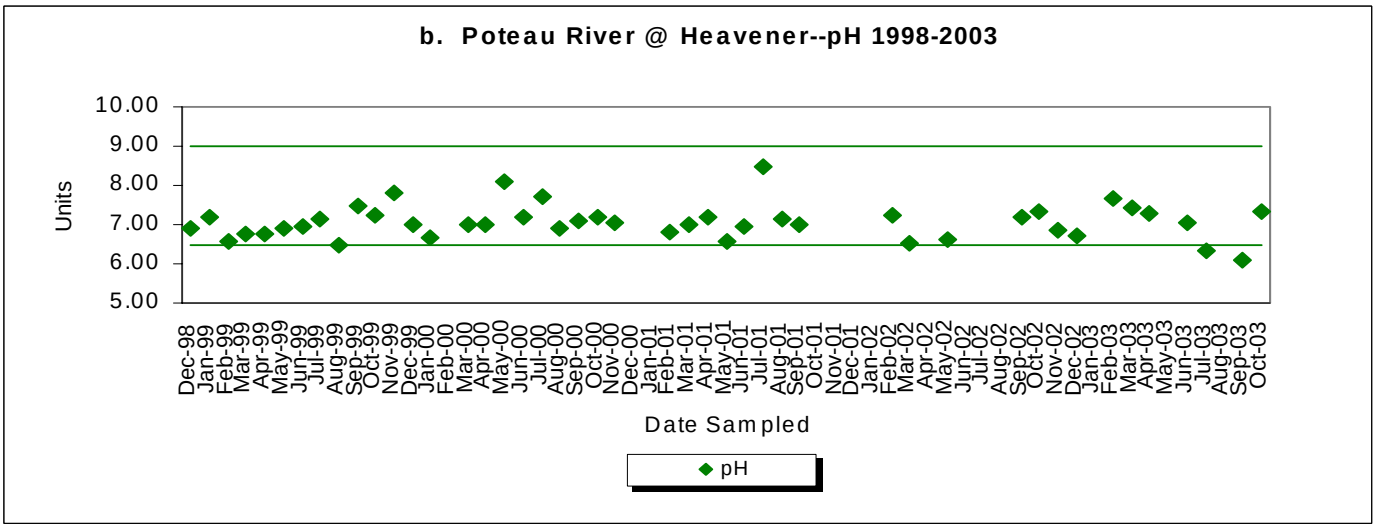
Station AT247350 (220100020010-001AT) is a permanent ambient trend monitoring station located on the Poteau River in Oklahoma. Situated in the central portion of LeFlore County, the site was established south of the City of Heavener on US Highway 59. The station is positioned near the midpoint of stream segment 220100020010 and is classified within the Poteau River 8-digit HUC watershed (11110105). Water enters the stream system from Arkansas and from several tributaries including Oil Branch, Black Fork Creek, and Conser Creek, among others.

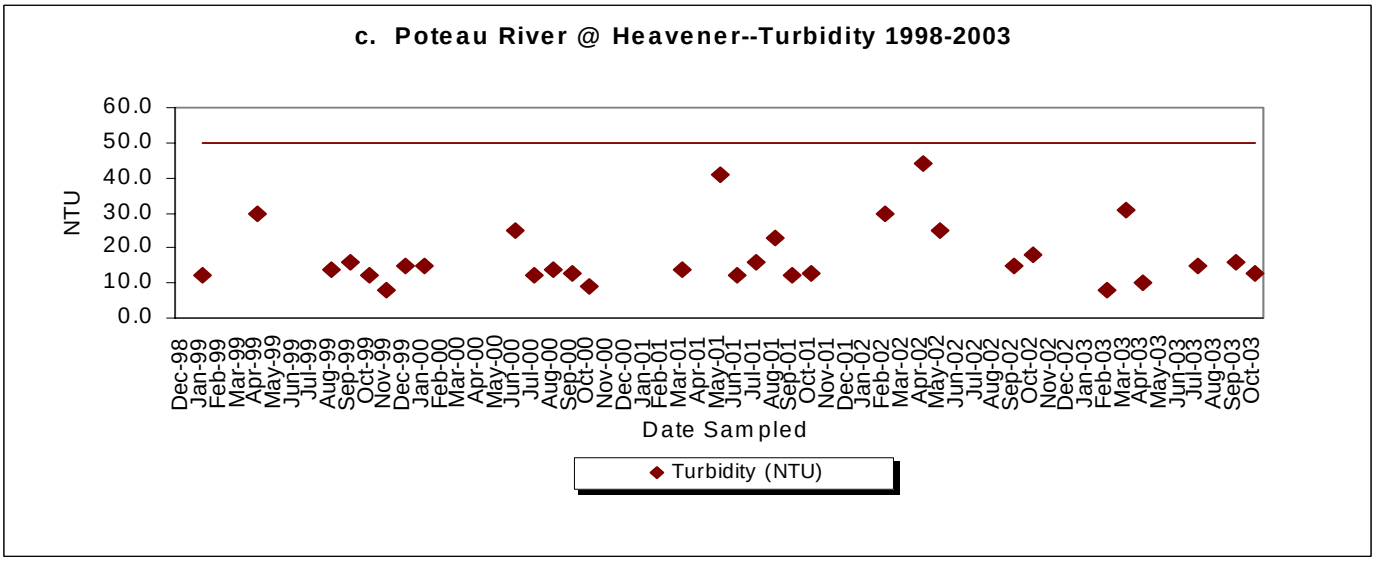
This station on the Poteau River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through October of 2003. For purposes of reporting, this station is representative of the Poteau River from its entrance into Oklahoma near Loving, Oklahoma (94.4493, 34.8849) downstream to confluence of the Poteau River with Lake Wister (94.7561, 34.9035). As per Appendix A, Table 2 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

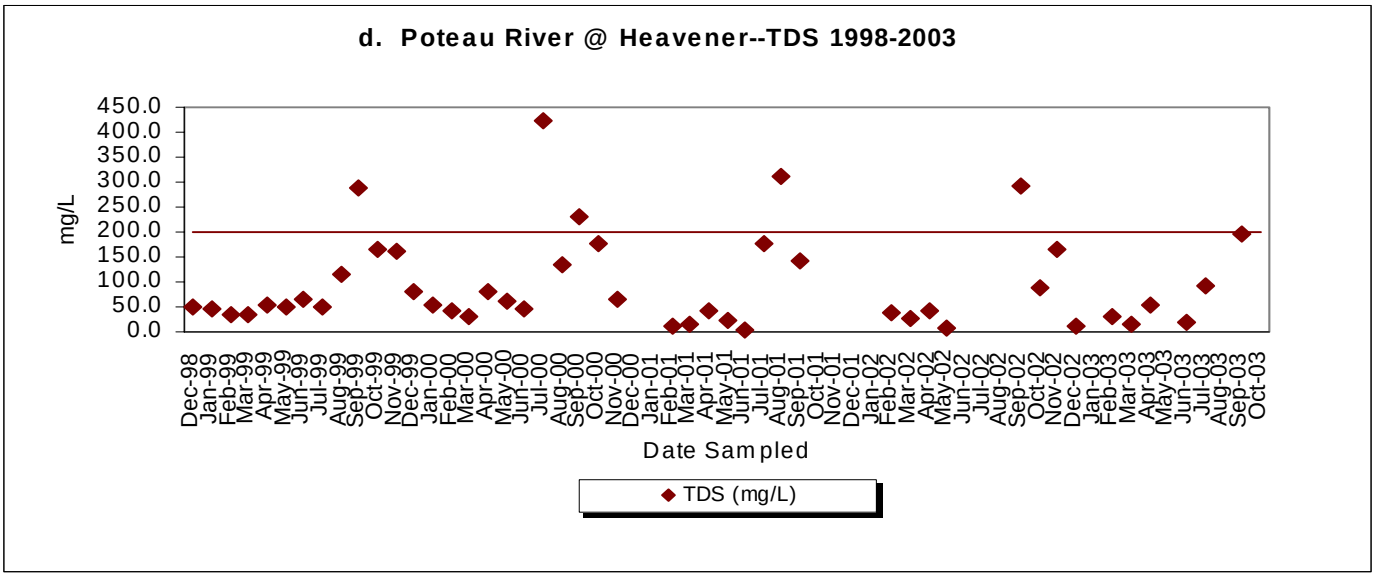
The PPWS beneficial use is supported. The WWAC beneficial use is supported. Dissolved oxygen (Figure 74a), pH (Figure 74b), turbidity (Figure 74c), and toxicant samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids (TDS), chlorides, and sulfates (Figure 74d and Figure 74e). Although 13% of the TDS concentrations exceeded the sample standard of 199.0 mg/L, the values are below the minimum standard of 750 mg/L. Although 26% of the sulfate concentrations exceeded the sample standard of 36.0 mg/L, the values are below the minimum standard of 250 mg/L. The PBCR beneficial use is supported for fecal coliform, enterococci, and *E. coli*. This segment of the Poteau River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 74f).

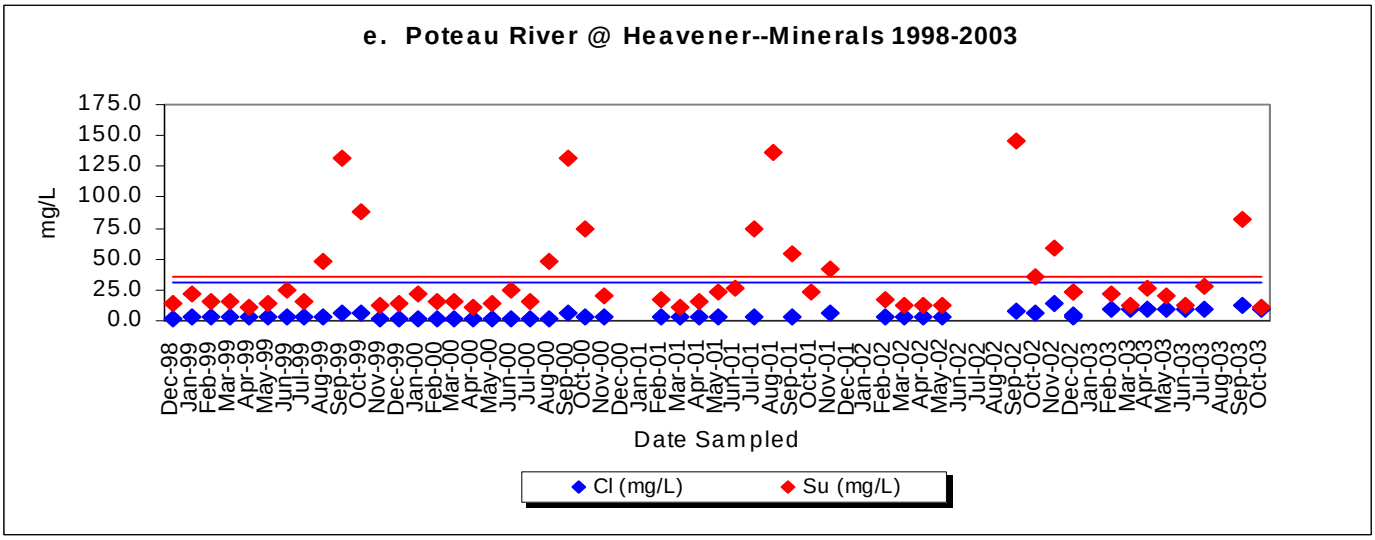
Figure 74a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) the Poteau River at Heavener (AT247350), 1998-2003.

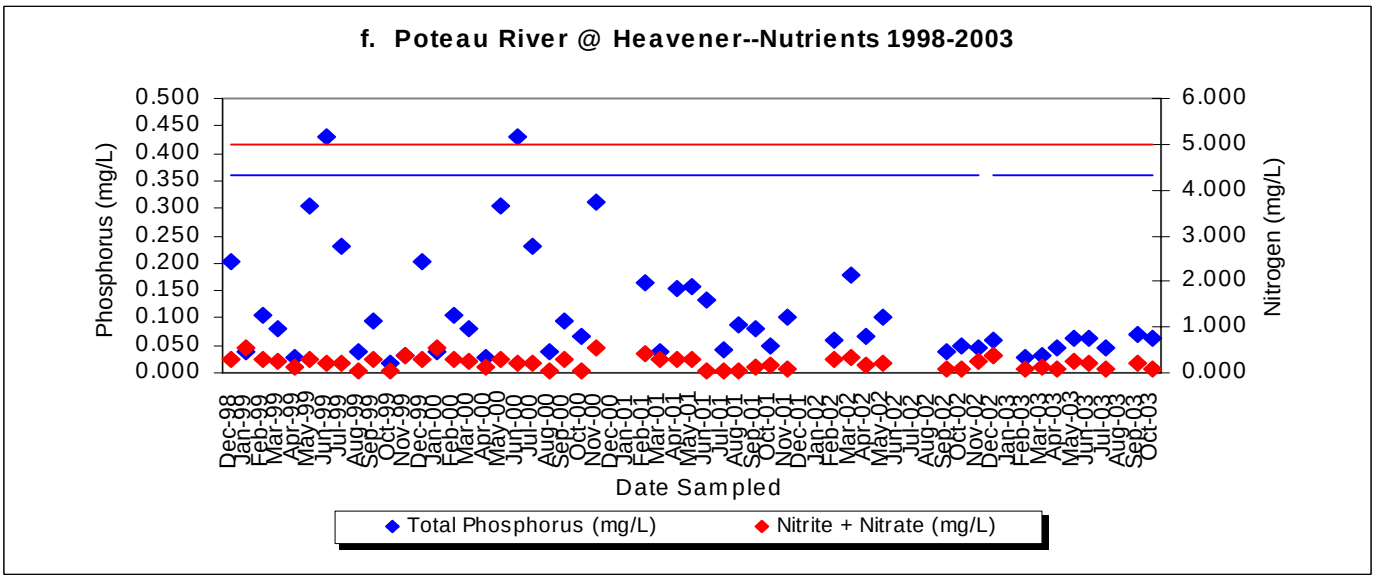







d. Poteau River @ Heavener--TDS 1998-2003
mg/L
450.0
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
Date Sampled
TDS (mg/L)


e. Poteau River @ Heavener--Minerals 1998-2003
mg/L
175.0
150.0
125.0
100.0
75.0
50.0
25.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Poteau River @ Heavener--Nutrients 1998-2003
Phosphorus (mg/L)
0.500
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

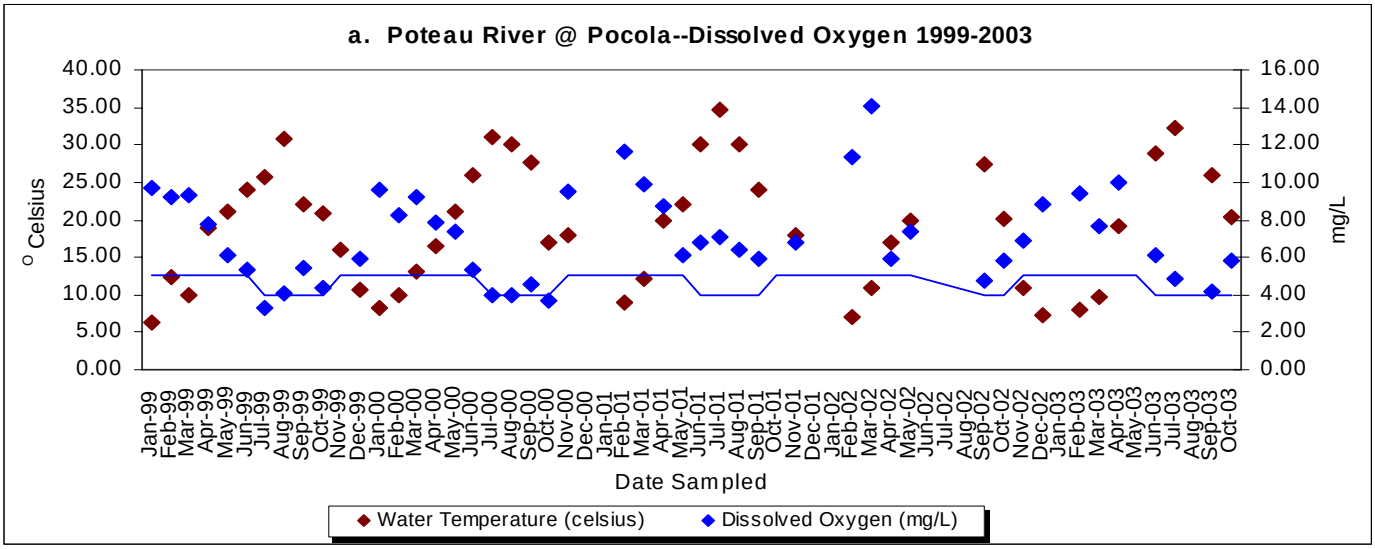
Poteau River near Pocola

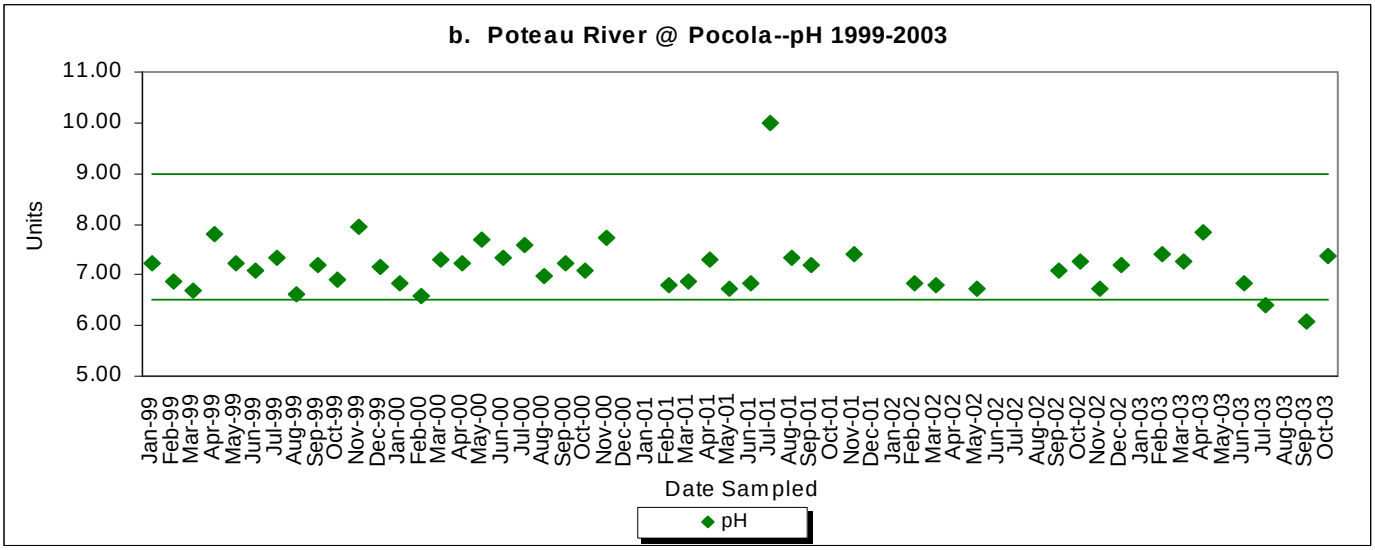
Station AT249435 (220100010010-001AT) is a permanent ambient trend monitoring station located on the Poteau River in Oklahoma. Situated in the northeastern portion of LeFlore County, the site was established west of the City of Pocola off of State Highway 112 on County Road E1220. The station is positioned near the midpoint of stream segment 220100010010 and is classified within the Poteau River 8-digit HUC watershed (11110105). Water enters the stream system from New Spiro Lake and from several tributaries including Brazil Creek, James Fork Creek, and Wells Creek, among others.

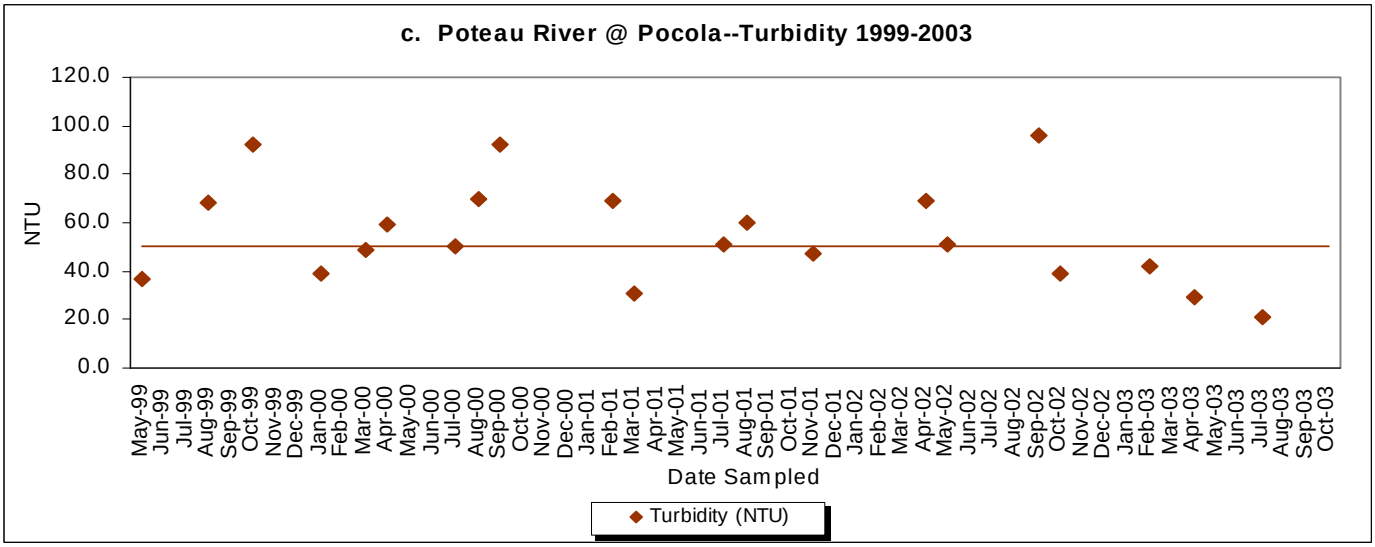
This station on the Poteau River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from January of 1999 through October of 2003. For purposes of reporting, this station is representative of the Poteau River from the confluence of Brazil Creek (94.6538, 35.1510) downstream to confluence of the Poteau River with the Arkansas River (94.4331, 35.3850). As per Appendix A, Table 2 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

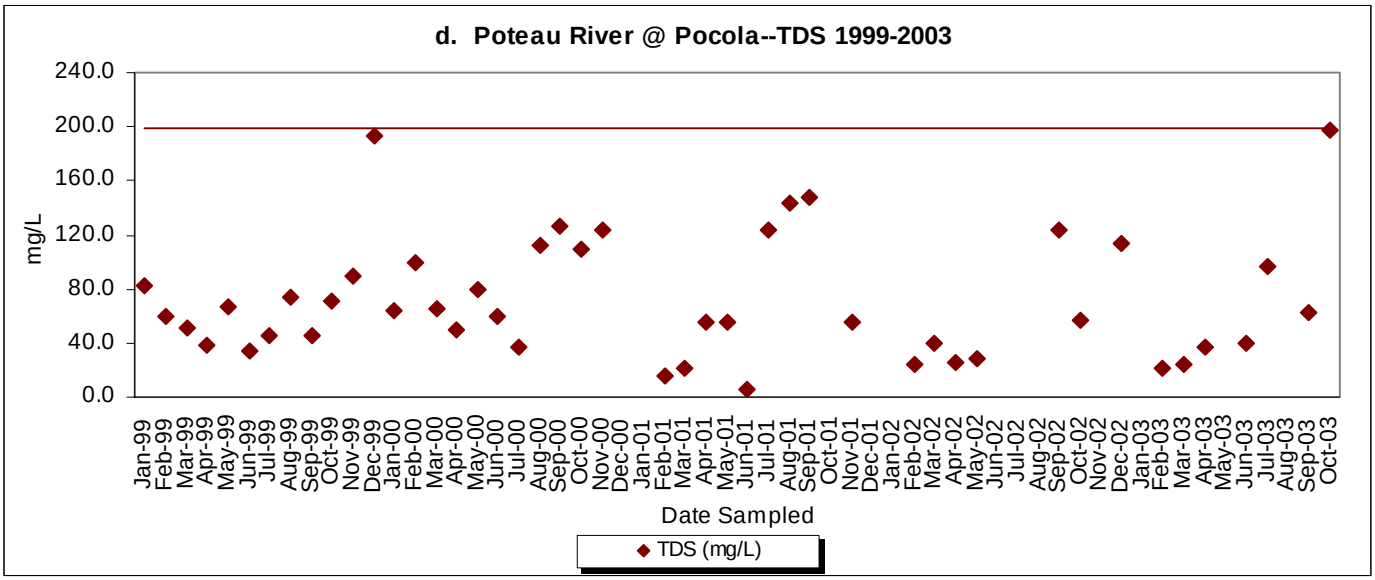
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 22 turbidity samples (Figure 75c), 12 samples (or 55%) exceeded the numerical criteria of 50. Of the 15 copper samples collected, 2 of the concentrations (or 13%) exceeded the prescribed, hardness-dependant chronic criteria of 6.81 µg/L (Table 25). Of the 11 lead samples collected, 10 of the concentrations (or 91%) exceeded the prescribed, hardness-dependant chronic criteria of 1.24 µg/L (Table 25). Dissolved oxygen (Figure 75a) and pH (Figure 75b) samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 75d and Figure 75e). Although 31% of the sulfate concentrations exceeded the sample standard of 36.0 mg/L, the values are below the minimum standard of 250 mg/L. The PBCR beneficial use is not supported (Table 26). Of the 14 enterococci concentrations, 2 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (75.5 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Poteau River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 75f).

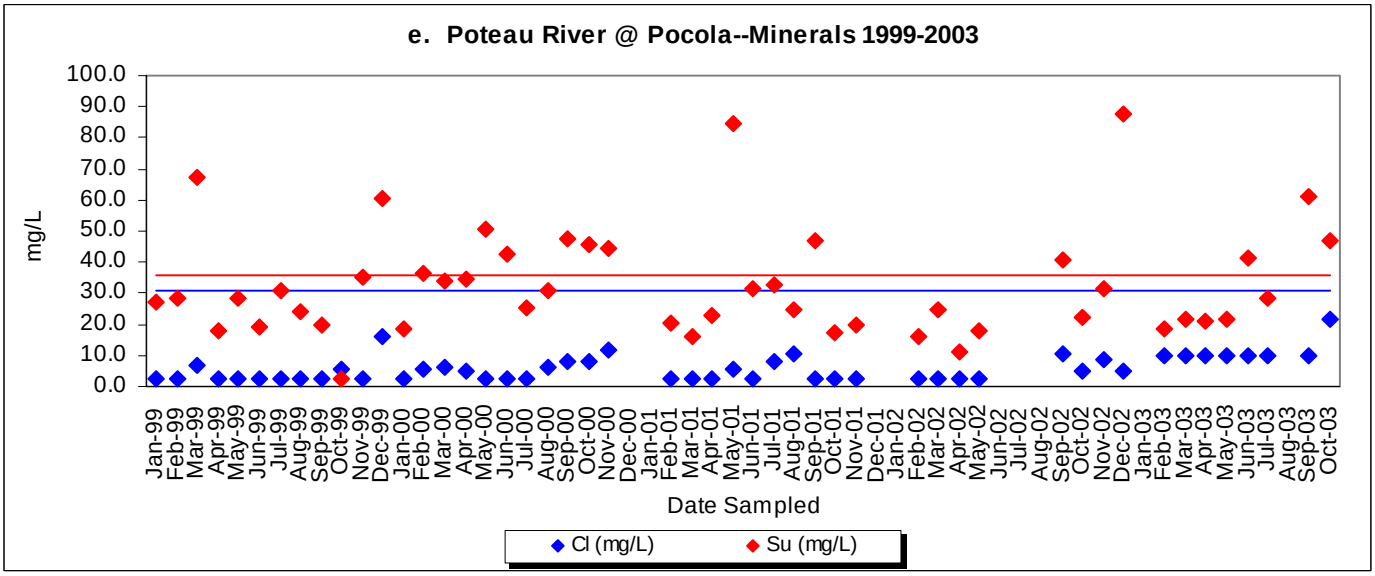
Figure 75a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) the Poteau River at Pocola (AT249435), 1999-2003.

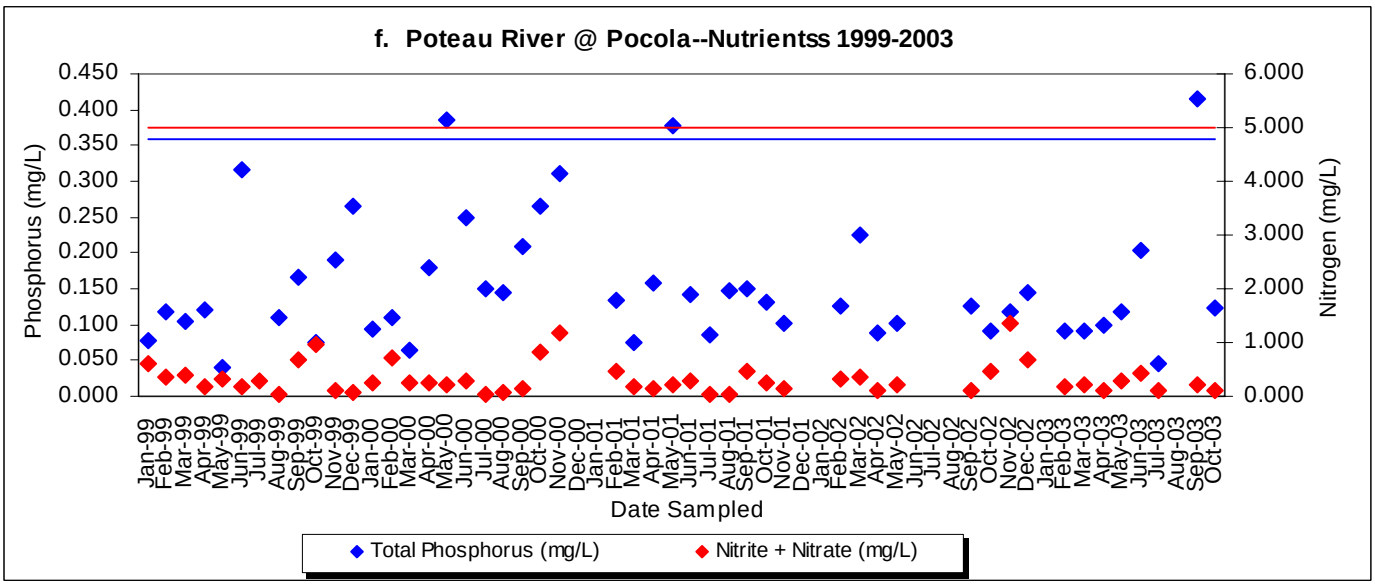







d. Poteau River @ Pocola--TDS 1999-2003
mg/L
240.0
200.0
160.0
120.0
80.0
40.0
0.0
Date Sampled
TDS (mg/L)


e. Poteau River @ Pocola--Minerals 1999-2003
mg/L
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Poteau River @ Pocola--Nutrientss 1999-2003
Phosphorus (mg/L)
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

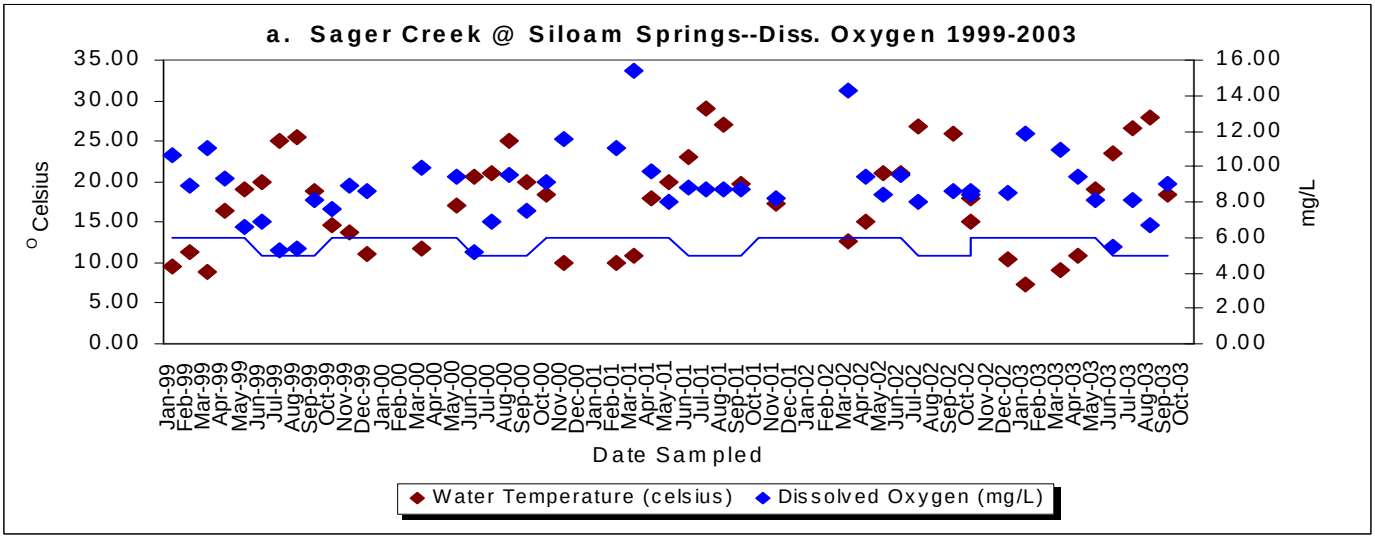
Sager Creek near West Siloam Springs

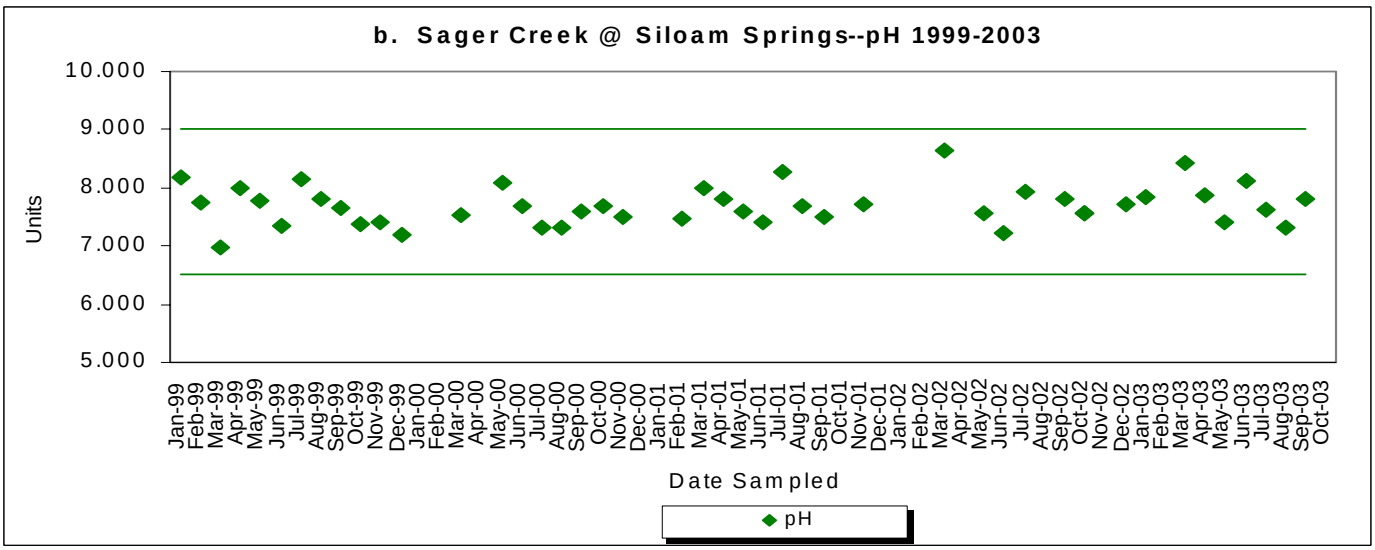
Station AT195865 (121700060080-001AT) is a permanent ambient trend monitoring station located on Sager Creek in Oklahoma. Situated in the southeastern portion of Delaware County, the site was established north of the Town of West Siloam Springs off of US Highway 412 on County Road D0565. The station is positioned near the midpoint of stream segment 121700060080 and is classified within the Illinois River 8-digit HUC watershed (11110103). Water enters the stream system from Arkansas.

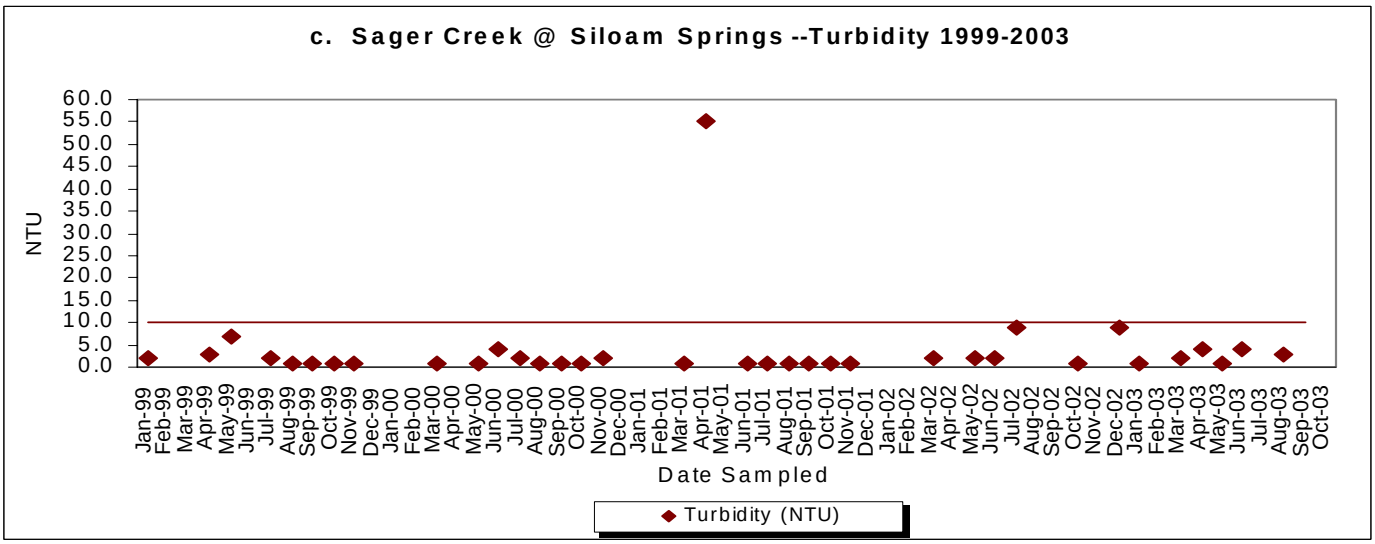
This station on Sager Creek has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from January of 1999 through September of 2003. For purposes of reporting, this station is representative of Sager Creek from its entrance into Oklahoma near West Siloam Springs, Oklahoma (94.5680, 36.1923) downstream to confluence of Sager Creek with Flint Creek (94.5757, 36.1974). As per Appendix A, Table 1 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Cool Water Aquatic Community—Fish and Wildlife Propagation (CWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

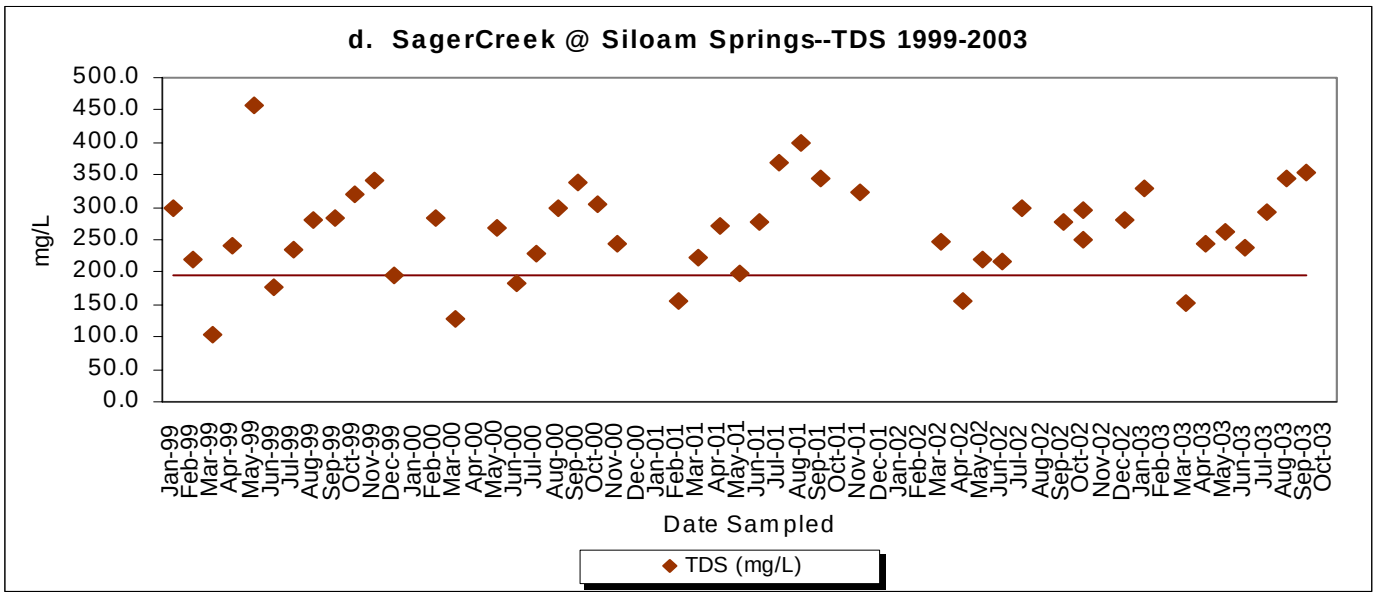
The PPWS beneficial use is partially supported. Of the 48 nitrate concentrations, 6 samples (or 13%) exceeded the numerical criterion of 10.0 mg/L (Figure 76f). The CWAC beneficial use is supported. Dissolved oxygen (Figure 76a), pH (Figure 76b), turbidity (Figure 76c), and toxicant samples met the criteria prescribed in the CWAC beneficial use. The AG beneficial use is supported for total dissolved solids (TDS), chlorides, and sulfates (Figure 76d and Figure 76e). Although 85% of the TDS concentrations exceeded the sample standard of 194.0 mg/L and the geometric mean (259.3 mg/L) exceeded the yearly mean standard of 156.0 mg/L, the values are below the minimum standard of 750 mg/L. Although 61% of the chloride concentrations exceeded the sample standard of 30.0 mg/L and the geometric mean (34.2 mg/L) exceeded the yearly mean standard of 21.0 mg/L, the values are below the minimum standard of 250 mg/L. The PBCR beneficial use is not supported (Table 26). Of the 27 enterococci concentrations, 5 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (125.3 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of Sager Creek is nutrient-threatened. The median of the total phosphorus samples (1.380 mg/L) exceeded the prescribed threshold median of 0.150 mg/L, and the median of the nitrate/nitrite samples (6.970 mg/L) exceeded the prescribed threshold median of 2.40 mg/L (Figure 76f). The station is not light-limited with a mean turbidity of 2 NTU and less than 80% canopy coverage.

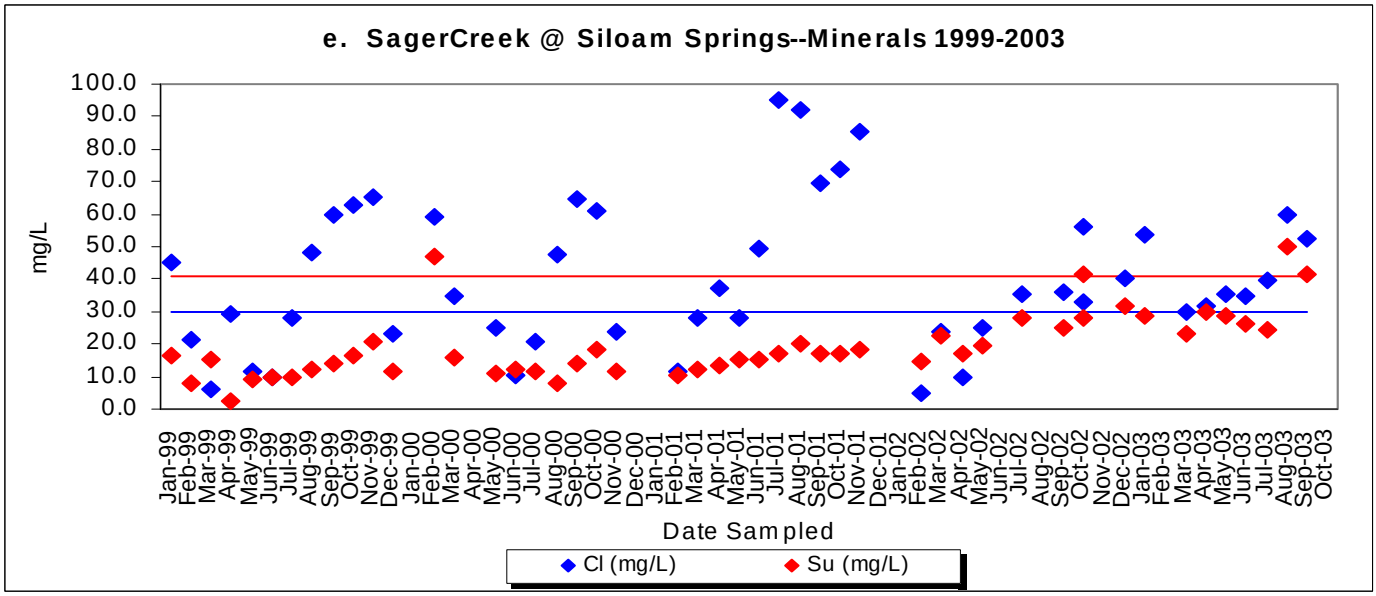
Figure 76a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) Sager Creek at West Siloam Springs (AT195865), 1999-2003.

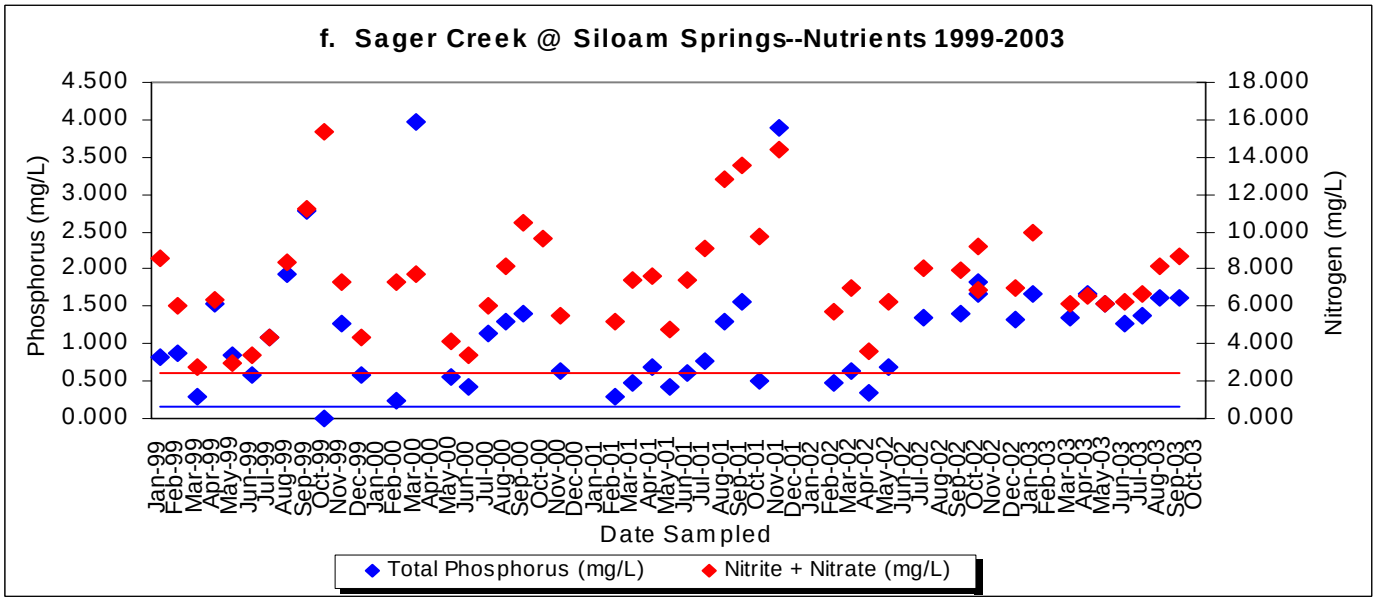







d. SagerCreek @ Siloam Springs--TDS 1999-2003
mg/L
Date Sampled
TDS (mg/L)


e. SagerCreek @ Siloam Springs--Minerals 1999-2003
mg/L
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Sager Creek @ Siloam Springs--Nutrients 1999-2003
Phosphorus (mg/L)
Nitrogen (mg/L)
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

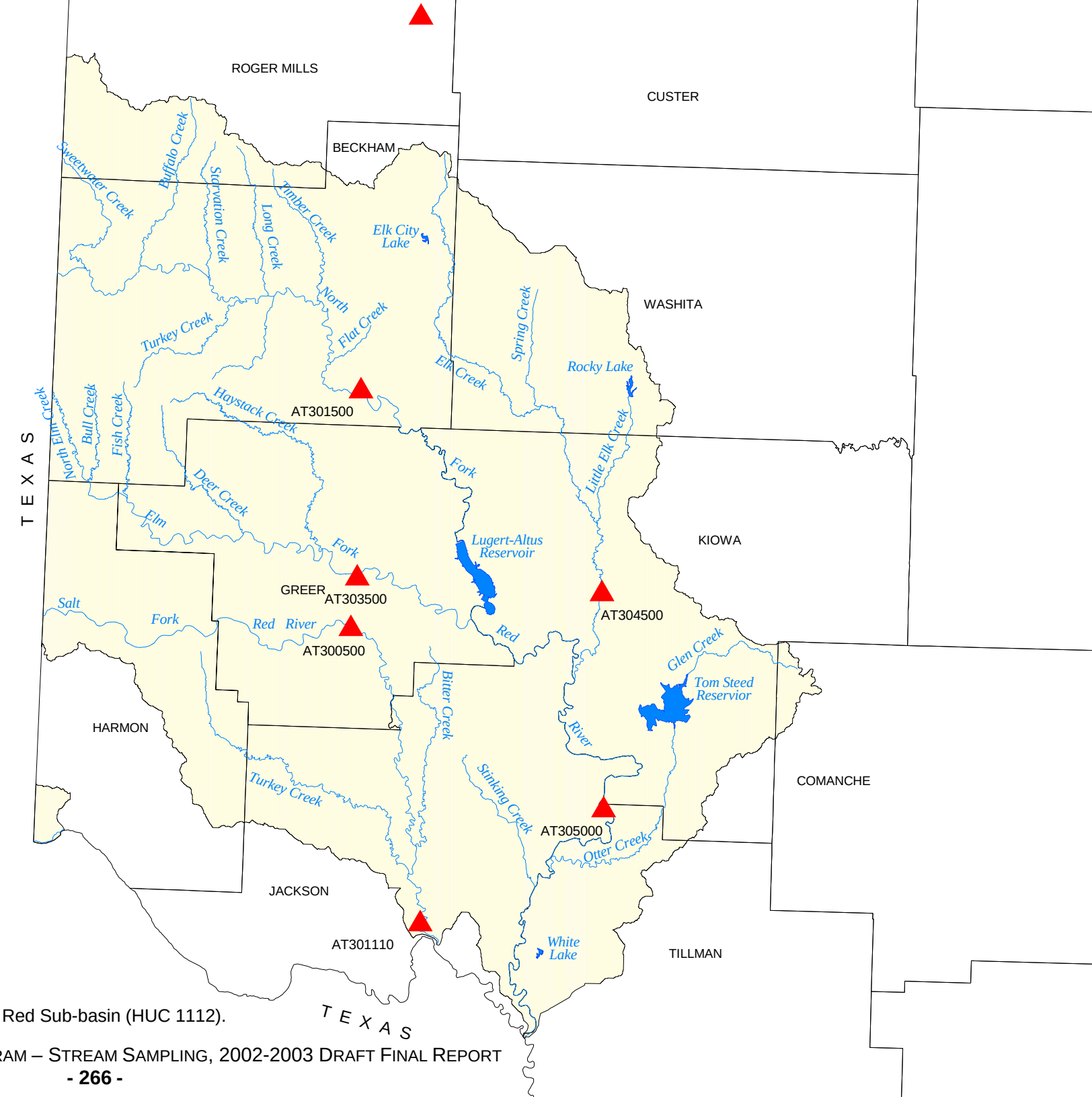


Figure 77. North Fork of the Red Sub-basin (HUC 1112).

HUC 1112

NORTH FORK OF THE RED SUB-BASIN

The North Fork of the Red sub-basin (4-digit hydrologic unit 1112) is situated in the southwestern tip of the state. It originates in the western portions of Roger Mills, Beckham and Harmon Counties, continues eastward through portions of Greer, Washita, Kiowa, Jackson, and Tillman Counties and terminates in the northeastern tip of Comanche County. Major cities and County seats located within the basin include Elk City, Sayre, Mangum, Altus, and Hobart. Minor cities of note include Granite, Lone Wolf, Duke, Headrick, and Snyder.

The basin is subdivided into five 8-digit hydrologic units (HUC) within the state. These HUC's are the Lower Prairie Dog Town Fork of the Red (11120105), the Lower Salt Fork of the Red (11120202), the Middle North Fork of the Red (11120302), Lower North Fork of the Red (11120303), and Elm Fork of the Red (11120304). The major surface water in the sub-basin is the North Fork of the Red River. Major tributaries include the Elm Fork of the Red River, the Salt Fork of the Red River, Elk Creek, Turkey Creek, and Otter Creek. Two major lakes are located in the basin—Altus Reservoir formed by the North Fork of the Red River and Tom Steed Reservoir formed by Otter Creek. Six permanent water quality-monitoring stations (Table 27) are located in the basin—AT300500, AT301110, AT301500, AT303500, AT304500, and AT305000.

The sub-basin is characterized by two ecoregions. The Central Great Plains is the primary ecoregion covering all but a small portion of the sub-basin. The Southwestern Tablelands cover a small portion of the east central portion in Beckham, Greer, and Harmon Counties. The primary land usage in the sub-basin is cropland. It dominates the central south and central east portions of the sub-basin and is interspersed throughout the remainder of the sub-basin. The secondary land use is rangeland (open grassland and mesquite) that dominates the southern part of Beckham County and is prevalent in other southern portions of the sub-basin. It is interspersed throughout the remainder of the sub-basin. The tertiary land use is pastureland, which is dominant in northeastern Greer County and is sparsely interspersed throughout the remainder of the sub-basin. Other land uses of note are woodlands, bottom woodlands, farmsteads, major urban areas, and confined animal feeding operations.

Table 27. Permanent Ambient Trend Monitoring Stations Located in HUC 1112.

WBID #	STATION #	STATION NAME	STATUS	FS	PS	NS/T	CBD
311500030010	AT304500	Elk Creek, off US 183, Hobart	Active 11/98-P	AG, AES, PPWS	NONE	FWP, PBCR	NONE
311800000010	AT303500	Elm Fork River, SH 9, Mangum	Active 11/98-P	AG, AES	NONE	FWP, PBCR, PPWS	NONE
311510010010	AT301500	North Fork of the Red River, SH 34, Carter	Active 11/98-P	AG, FWP, AES, PPWS	NONE	PBCR	NONE
311500010020	AT305000	North Fork of the Red River, US 62, Headrick	Active 11/98-P	AES	PPWS	AG, FWP, PBCR	NONE
311600020010	AT301110	Salt Fork of the Red River, off US 283, Elmer	Active 11/98-P	AG, AES	PPWS	FWP, PBCR	NONE
311600020010	AT300500	Salt Fork of the Red River, SH 34, Mangum	Active 10/00-P	AG, FWP, AES, PPWS	NONE	PBCR	NONE

ASSIGNED OWQS BENEFICIAL USES AND SUPPORT CODES

PPWS = PUBLIC AND PRIVATE WATER SUPPLY	EWS = EMERGENCY WATER SUPPLY
FWP = FISH & WILDLIFE PROPAGATION	PBCR = PRIMARY BODY CONTACT RECREATION
AG = AGRICULTURE	AES = AESTHETICS
FS = FULLY SUPPORTING	PS = PARTIALLY SUPPORTING
NS/T = NOT SUPPORTING/THREATENED	CBD = CANNOT BE DETERMINED

Table 28. Toxicant exceedances in HUC 1112.

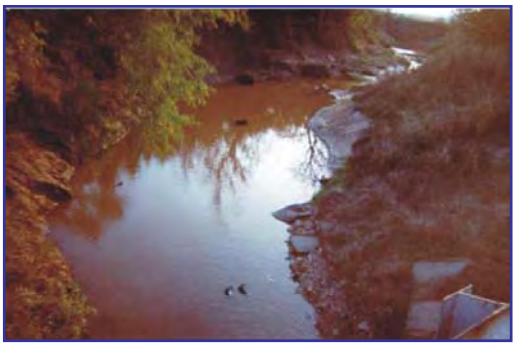
STATION #	STATION NAME	DATE	Selenium (µg/L)
AT304500	Elk Creek, off US 183, Hobart	05/24/1999	6.00
		05/22/2000	11.00
AT303500	Elm Fork River, SH 9, Mangum	05/25/1999	12.00
		12/20/1999	34.00
		05/22/2000	34.00
AT305000	North Fork of the Red River, US 62, Headrick	12/20/1999	14.00
		05/22/2000	14.00
AT301110	Salt Fork of the Red River, off US 283, Elmer	05/24/1999	13.00
		12/20/1999	32.00
		05/22/2000	24.00
		06/26/2000	8.00
		01/14/2003	7.00

Table 29. Exceedances of fecal coliform, enterococci, and *E. coli* screening limits in HUC 1112. Only values leading to a determination of not supporting for the Public and Private Water Supply and the Primary Body Contact Recreation beneficial uses are in included.

STATION #	STATION NAME	DATE	Fecal Coliform (cfu/mL)	Enterococci (cfu/mL)	*E. coli* (cfu/mL)
AT304500	ELK CREEK, OFF US 183, HOBART	09/19/2001		1700	
		05/29/2002		600	
		05/19/2003		900	
		06/23/2003		1100	
		09/02/2003		2100	
		09/24/2003		4200	
AT303500	ELM FORK RIVER, SH 9, MANGUM	06/27/2000	12000	6000	430
		09/26/2000			1211
		05/22/2001		6000	
		07/24/2001			717
		08/21/2001			465
		09/18/2001	1400	900	
		06/24/2002		1200	1860
		08/07/2002			6867
		08/21/2002	700		2851
		09/25/2002			768
		05/07/2003	500		443
		05/19/2003	600	600	1201
		06/03/2003			909
		06/23/2003	800	6000	1515
		07/15/2003			1669
		07/28/2003			6131
		08/20/2003			1421
		09/02/2003	500	1600	1450
		09/24/2003			842
AT301500	NORTH FORK OF THE RED RIVER, SH 34, CARTER	06/27/2000		11000	
		08/29/2000		2400	
		05/22/2001		9000	
		05/19/2003		2100	
AT305000	NORTH FORK OF THE RED RIVER, US 62, HEADRICK	06/22/1999		730	
		07/24/2001		1100	
		05/29/2002		800	
AT301110	SALT FORK OF THE RED RIVER, OFF US 283, ELMER	06/22/1999	620	7100	
		07/20/1999	420		
		08/17/1999	1500	1100	
		05/23/2000	500		
		08/01/2000	11000	1400	
		08/29/2000			

STATION #	STATION NAME	DATE	Fecal Coliform (cfu/mL)	Enterococci (cfu/mL)	*E. coli* (cfu/mL)
		09/26/2000	69000	15000	
		05/22/2001	1000	21000	
		07/24/2001	9000	900	
		08/21/2001	900		
		05/29/2002	1200	1000	
		08/06/2002	6000	900	
AT300500	SALT FORK OF THE RED RIVER, SH 34, MANGUM	05/22/2001	1000	1000	
		06/24/2002		4000	
		08/06/2002	600	600	
		06/23/2003	1300	11000	
		07/15/2003	2000	11000	
		09/24/2003		1000	

Elk Creek near Hobart

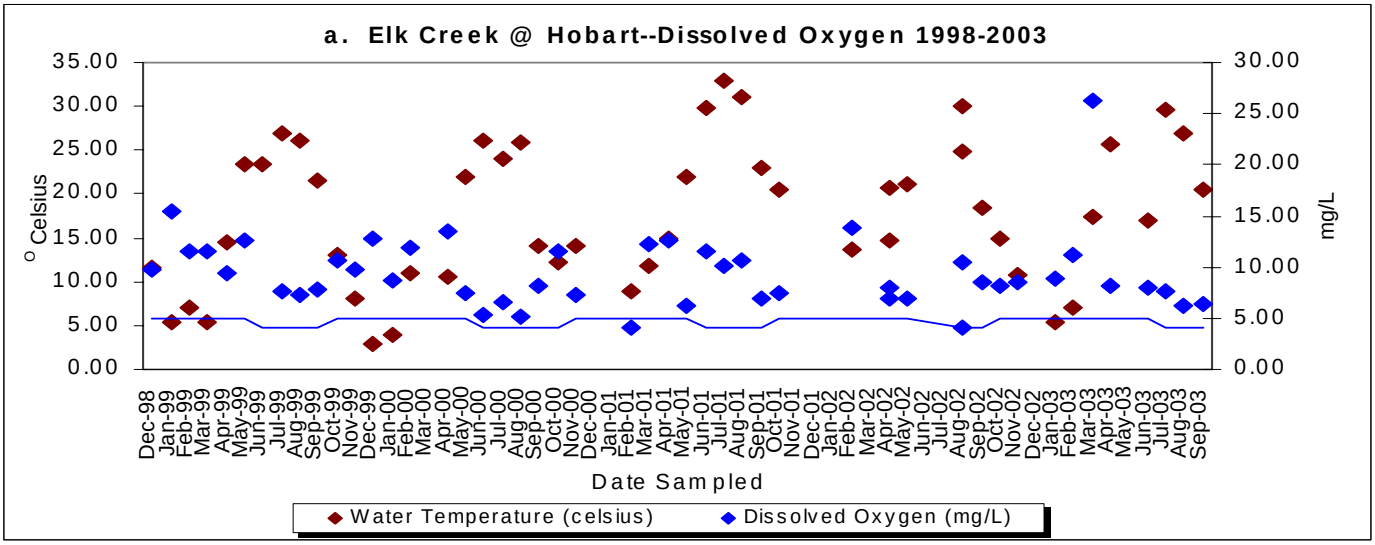


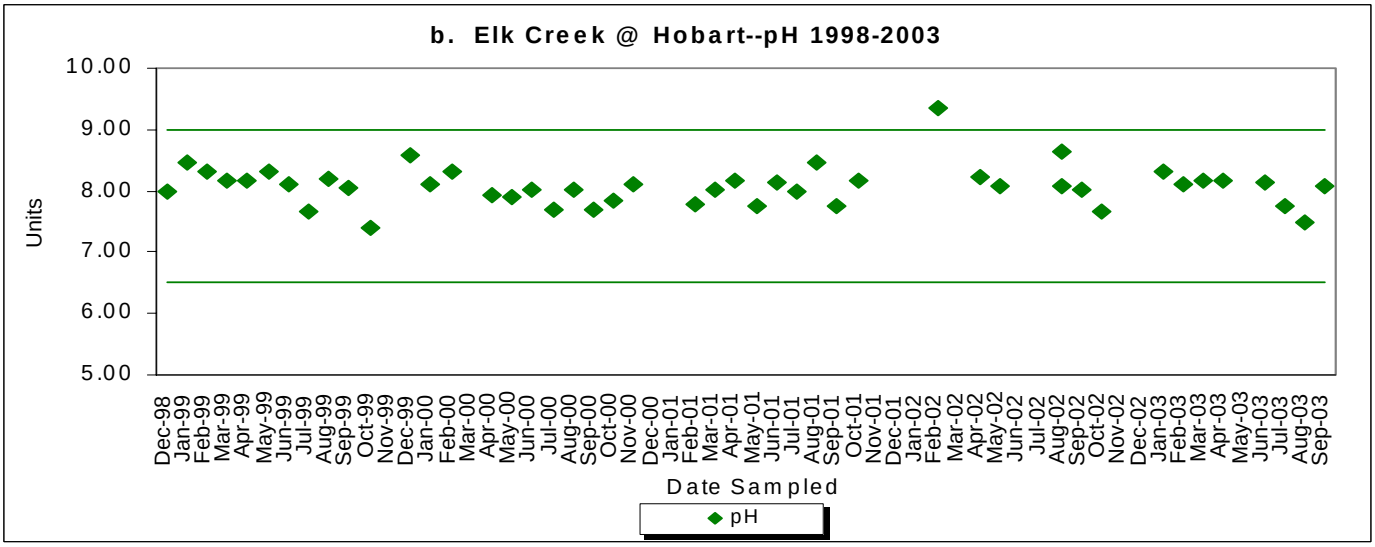
Station AT304500 (311500030010-001AT) is a permanent ambient trend monitoring station located on Elk Creek. Situated in the west central portion of Kiowa County, the site was established south southwest of the City of Hobart off of US Highway 183 on County Road E1450. The station is positioned near the midpoint of stream segment 311500030010 and is classified within the Lower North Fork of the Red River 8-digit HUC watershed (11120303). Water enters the stream system from Lake Elk City and from several tributaries including Little Elk Creek (Lake Hobart), among others.

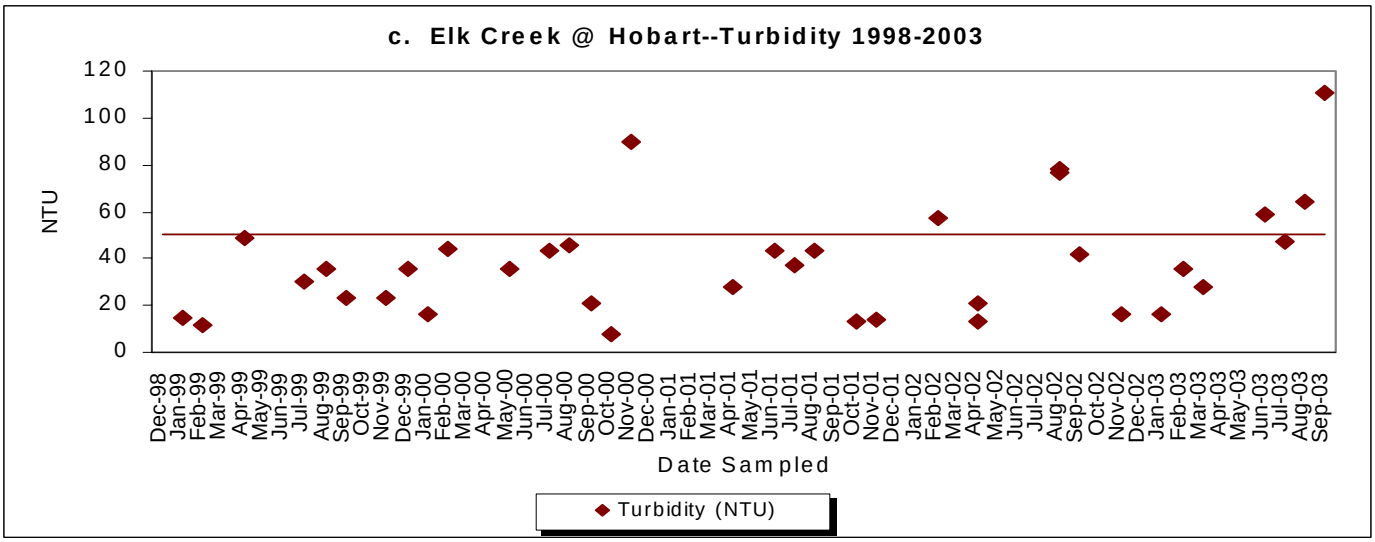
This station on Elk Creek has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through September of 2003. For purposes of reporting, this station is representative of Elk Creek from the confluence of Little Elk Creek (99.1214, 35.0008) downstream to confluence of Elk Creek with the North Fork of the Red River (99.1488, 34.7985). As per Appendix A, Table 3 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class II Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

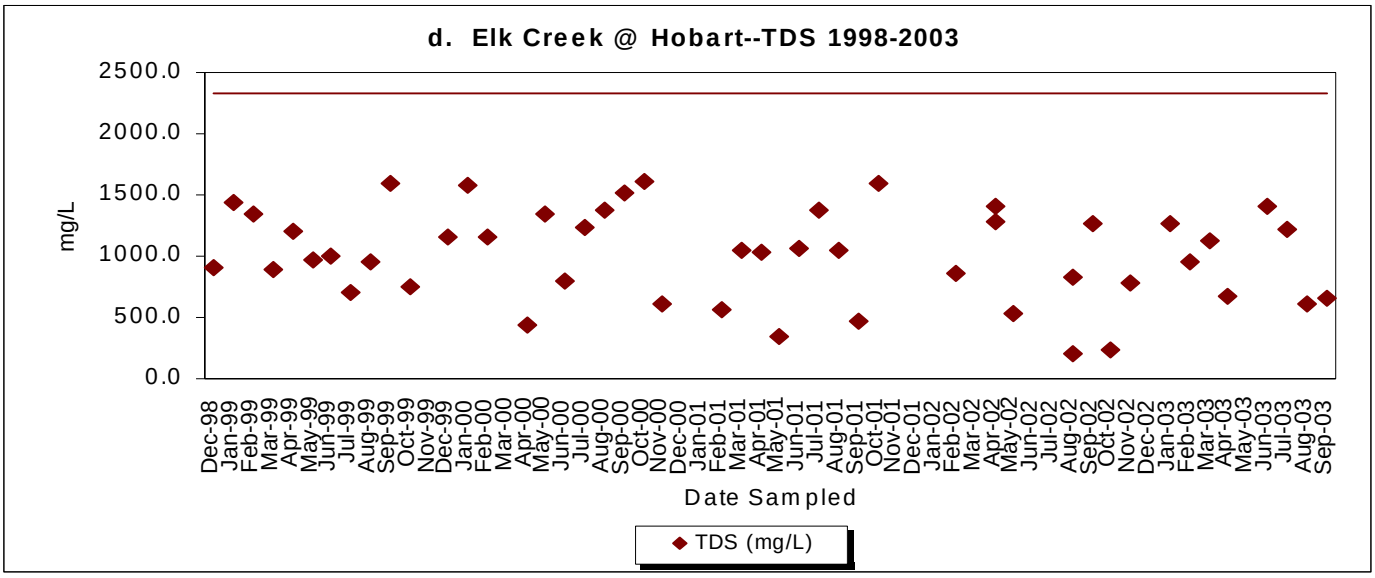
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 15 selenium samples collected, 2 of the concentrations (or 13%) exceeded the prescribed chronic criteria of 5 µg/L (Table 28). Of the 36 turbidity samples (Figure 78c), 7 samples (or 19%) exceeded the numerical criteria of 50. Dissolved oxygen (Figure 78a) and pH (Figure 78b) samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 78d and Figure 78e). The PBCR beneficial use is not supported (Table 29). Of the 26 enterococci concentrations, 6 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (267.3 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of Elk Creek is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 78f).

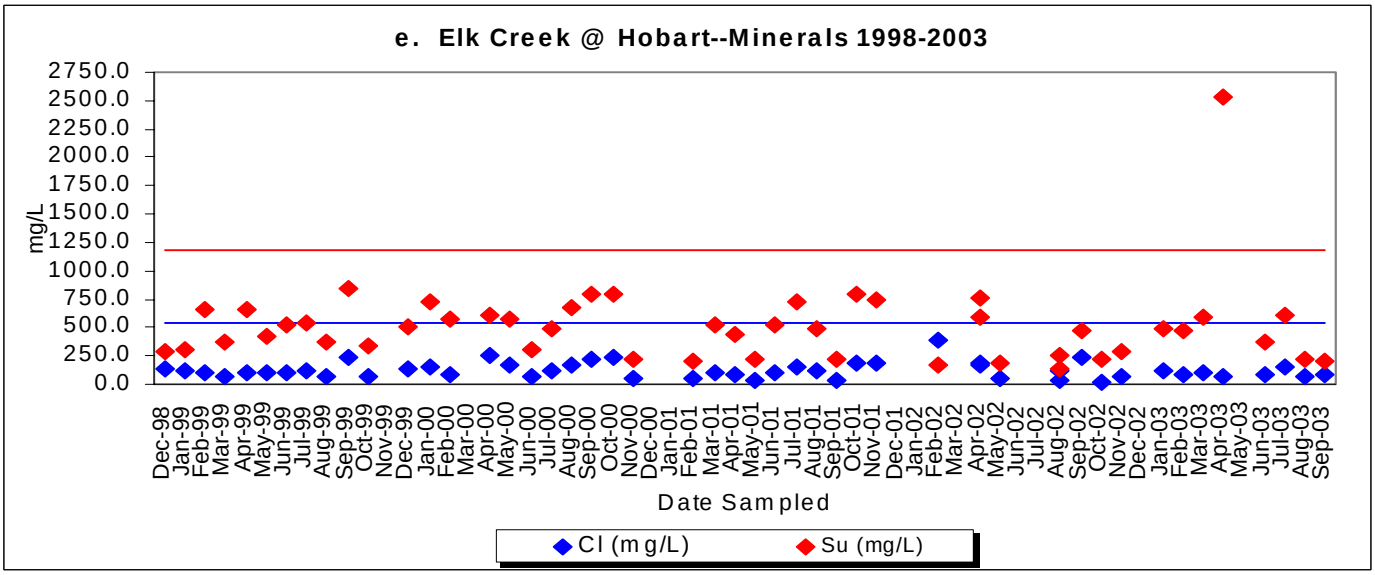
Figure 78a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on Elk Creek at Hobart (AT304500), 1998-2003.

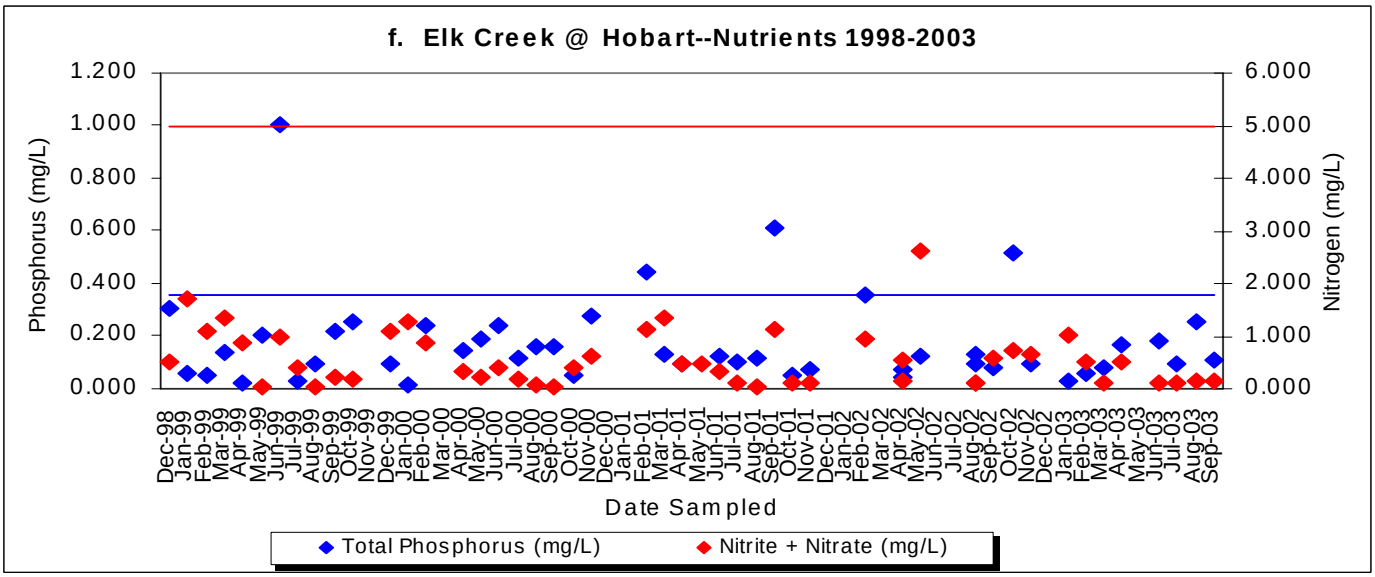







d. Elk Creek @ Hobart--TDS 1998-2003
mg/L
2500.0
2000.0
1500.0
1000.0
500.0
0.0
Date Sampled
TDS (mg/L)


e. Elk Creek @ Hobart--Minerals 1998-2003
mg/L
2750.0
2500.0
2250.0
2000.0
1750.0
1500.0
1250.0
1000.0
750.0
500.0
250.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Elk Creek @ Hobart--Nutrients 1998-2003
Phosphorus (mg/L)
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

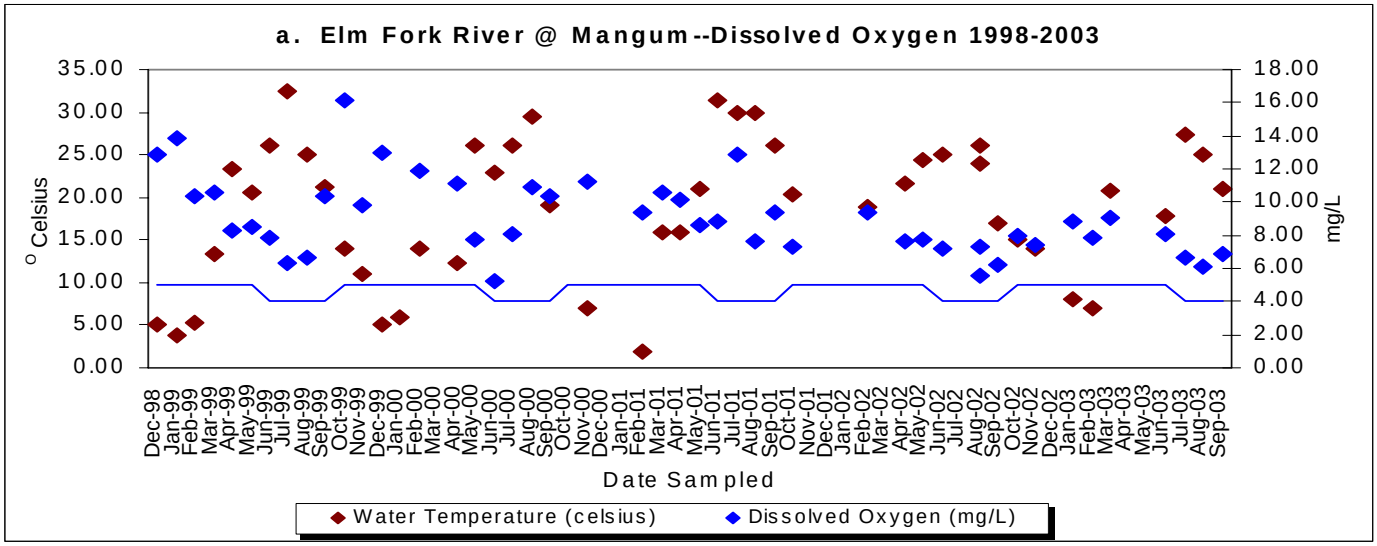
Elm Fork of the Red near Mangum

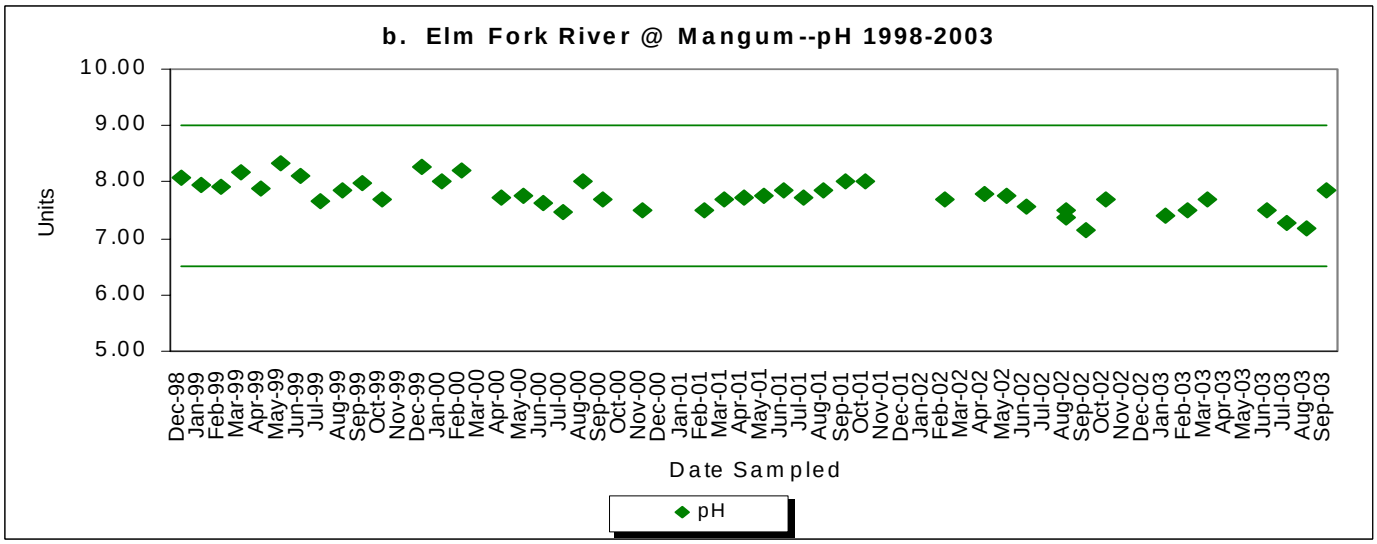
Station AT303500 (311800000010-001AT) is a permanent ambient trend monitoring station located on the Elm Fork of the Red River in Oklahoma. Situated in the central portion of Greer County, the site was established north of the Town of Mangum on State Highway 9. The station is positioned between the midpoint and the lower end of stream segment 311800000010 and is classified within the Elm Fork of the Red River 8-digit HUC watershed (11120304). Water enters the stream system from Texas and from several tributaries including Deer Creek and Haystack Creek, among others.

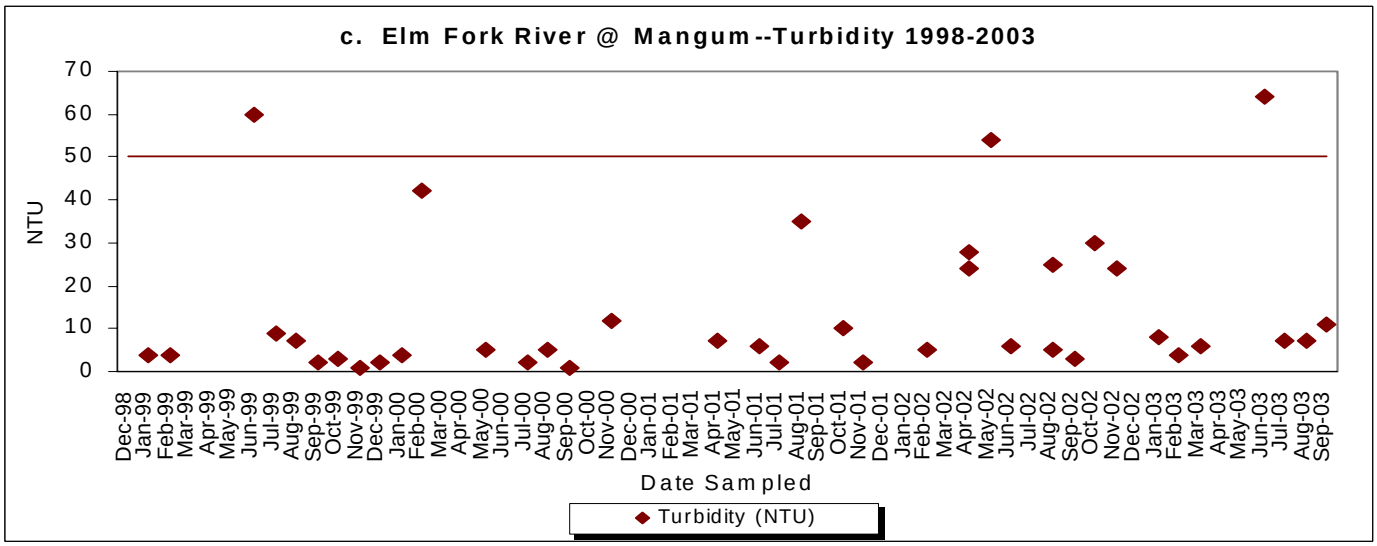
This station on the Elm Fork of the Red River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through September of 2003. For purposes of reporting, this station is representative of the Elm Fork of the Red River from the confluence of Deer Creek (99.6855, 34.9722) downstream to confluence of the Elm Fork of the Red River with the North Fork of the Red River (99.3173, 34.8714). As per Appendix A, Table 3 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class III Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

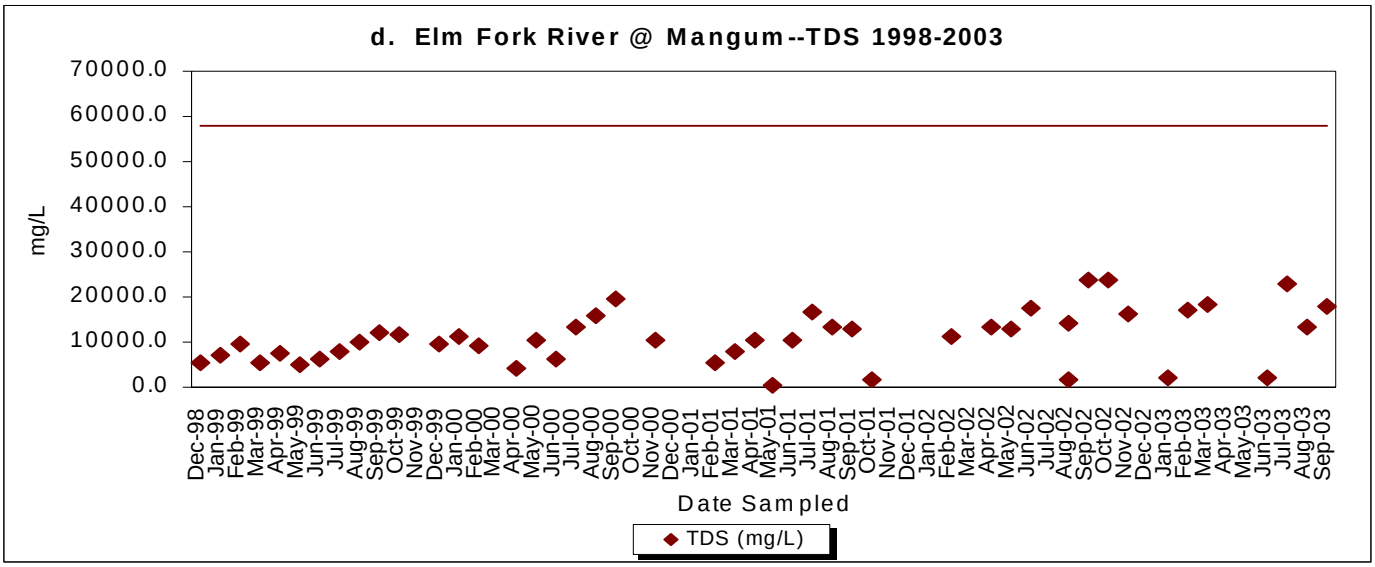
The PPWS beneficial use is partially supported. Of the 14 selenium samples collected, 3 of the concentrations (or 21%) exceeded the prescribed criterion of 10 µg/L (Table 28). The WWAC beneficial use is not supported. Of the 14 selenium samples collected, 4 of the concentrations (or 29%) exceeded the prescribed chronic criteria of 5 µg/L, and 2 of the concentrations (or 14%) exceeded the prescribed acute criteria of 20 µg/L (Table 28). Dissolved oxygen (Figure 79a), pH (Figure 79b), and turbidity (Figure 79c) samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 79d and Figure 79e). The PBCR beneficial use is not supported (Table 29). Of the 27 fecal coliform concentrations, 7 samples (or 26%) exceeded the prescribed screening level of 400 cfu/mL. Of the 27 enterococci concentrations, 7 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (244.3 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. Of the 27 *E. coli* concentrations, 17 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (1329.8 cfu/mL) exceeded the prescribed mean standard of 126 cfu/mL. This segment of the Elm Fork of the Red River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 79f).

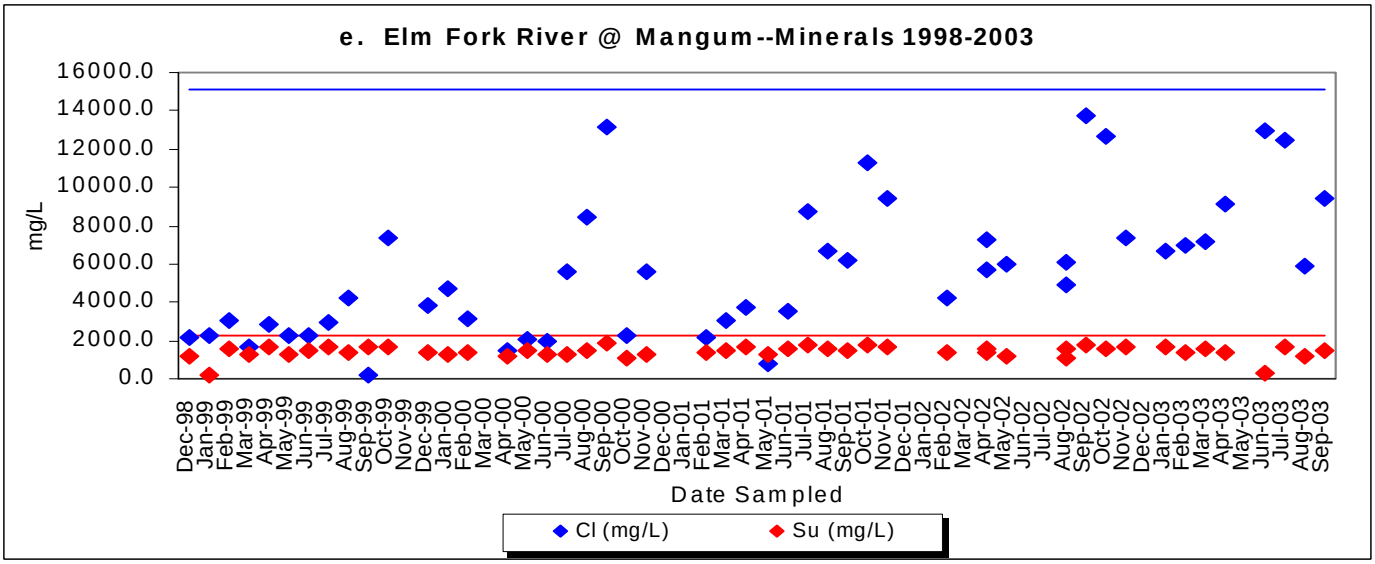
Figure 79a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Elm Fork River at Mangum (AT303500), 1998-2003.

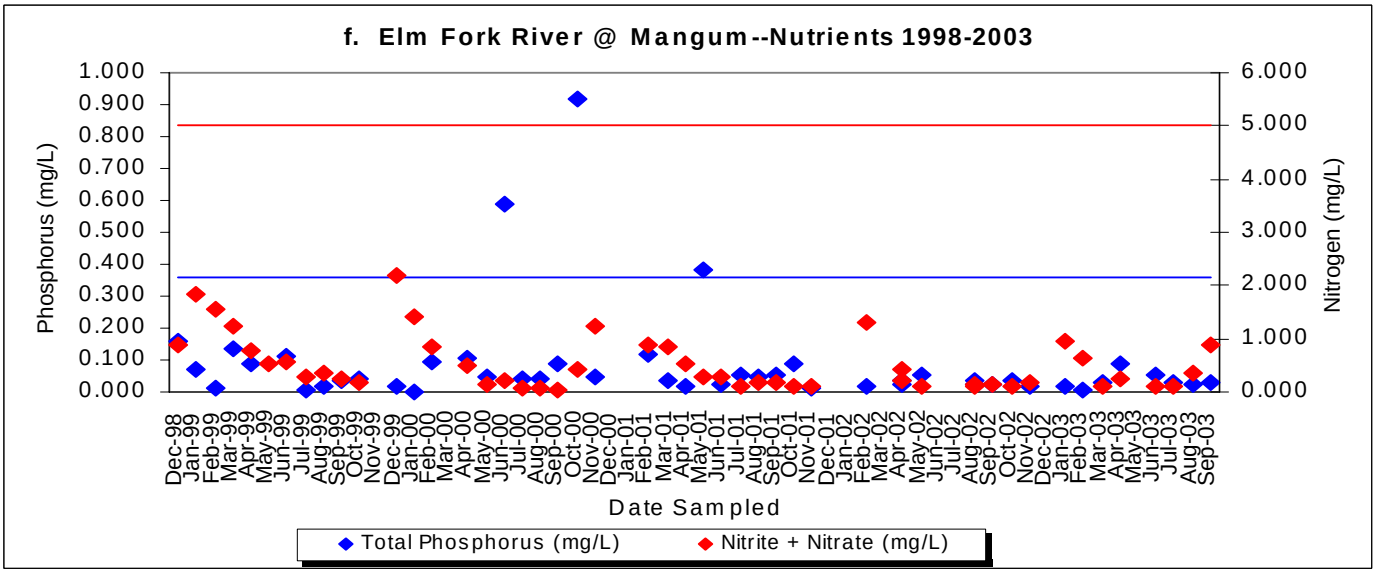







d. Elm Fork River @ Mangum--TDS 1998-2003
mg/L
70000.0
60000.0
50000.0
40000.0
30000.0
20000.0
10000.0
0.0
Date Sampled
TDS (mg/L)


e. Elm Fork River @ Mangum--Minerals 1998-2003
mg/L
16000.0
14000.0
12000.0
10000.0
8000.0
6000.0
4000.0
2000.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Elm Fork River @ Mangum--Nutrients 1998-2003
Phosphorus (mg/L)
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

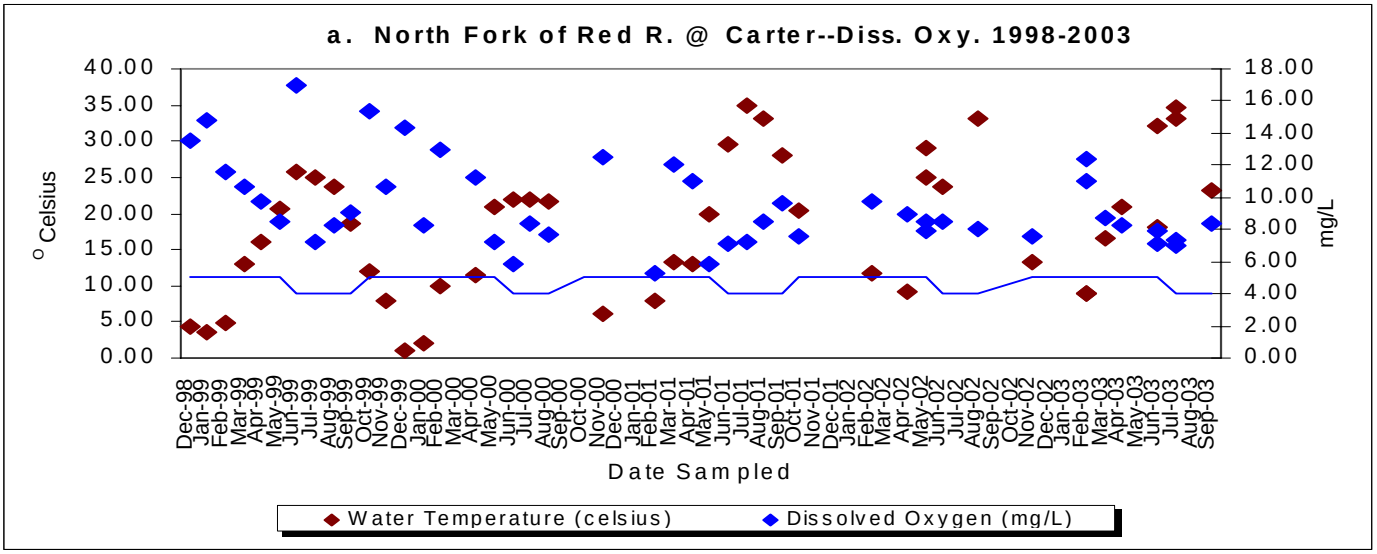
North Fork of the Red near Carter

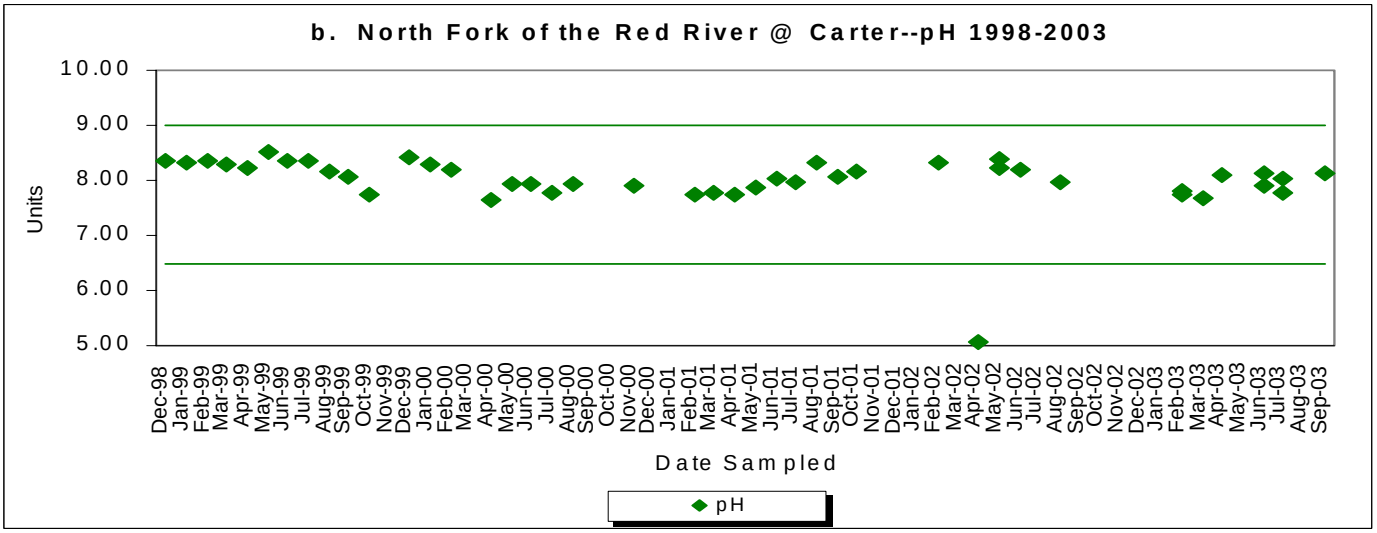
Station AT301500 (311510010010-001AT) is a permanent ambient trend monitoring station located on the North Fork of the Red River in Oklahoma. Situated in the southeastern portion of Beckham County, the site was established south of the Town of Carter on State Highway 34. The station is positioned between the upper end and the midpoint of stream segment 311510010010 and is classified within the Middle North Fork of the Red River 8-digit HUC watershed (11120302). Water enters the stream system from several tributaries including Timber Creek and Flat Creek, among others.

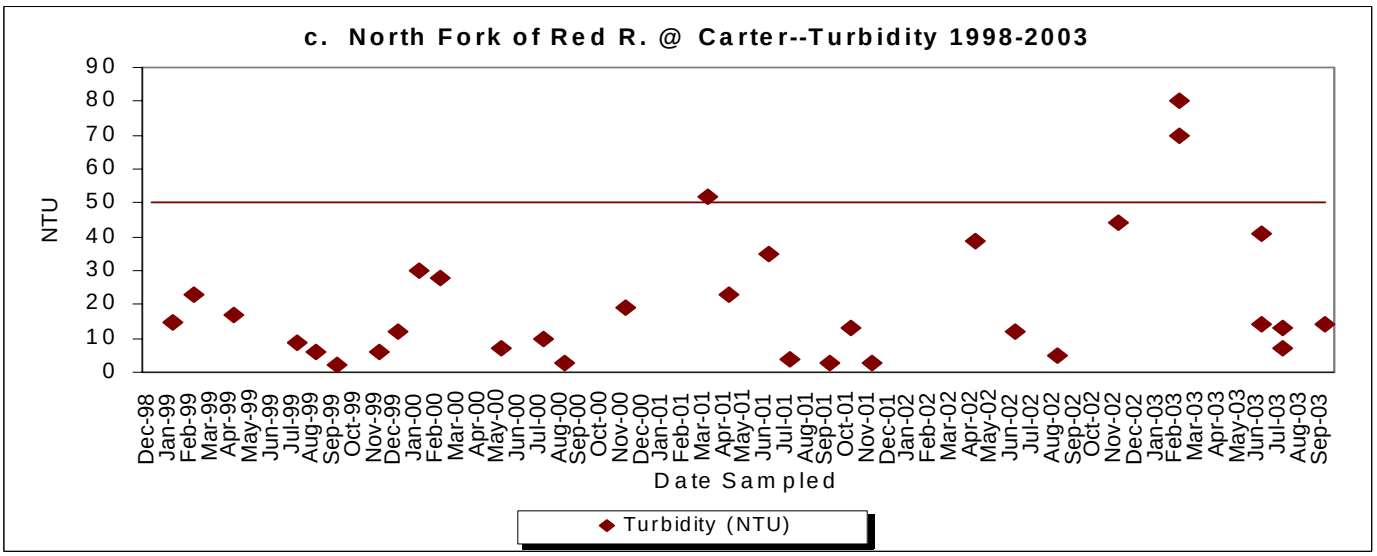
This station on the North Fork of the Red River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through September of 2003. For purposes of reporting, this station is representative of the North Fork of the Red River from the confluence of Timber Creek (99.5759, 35.2753) downstream to confluence of the North Fork of the Red River with Altus Reservoir (99.3413, 34.9715). As per Appendix A, Table 3 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class III Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

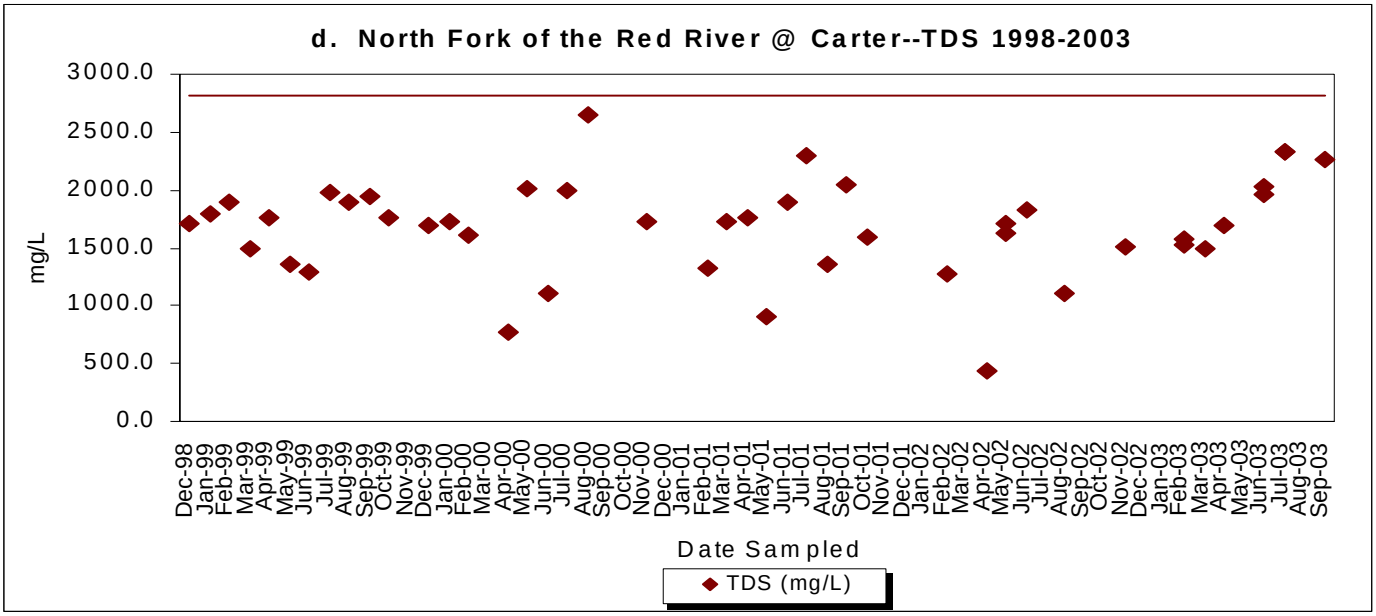
The PPWS beneficial use is supported. The WWAC beneficial use is supported. Dissolved oxygen (Figure 80a), pH (Figure 80b), turbidity (Figure 80c), and toxicant samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 80d and Figure 80e). The PBCR beneficial use is not supported (Table 29). Of the 20 enterococci concentrations, 4 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (114.6 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the North Fork of the Red River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 80f).

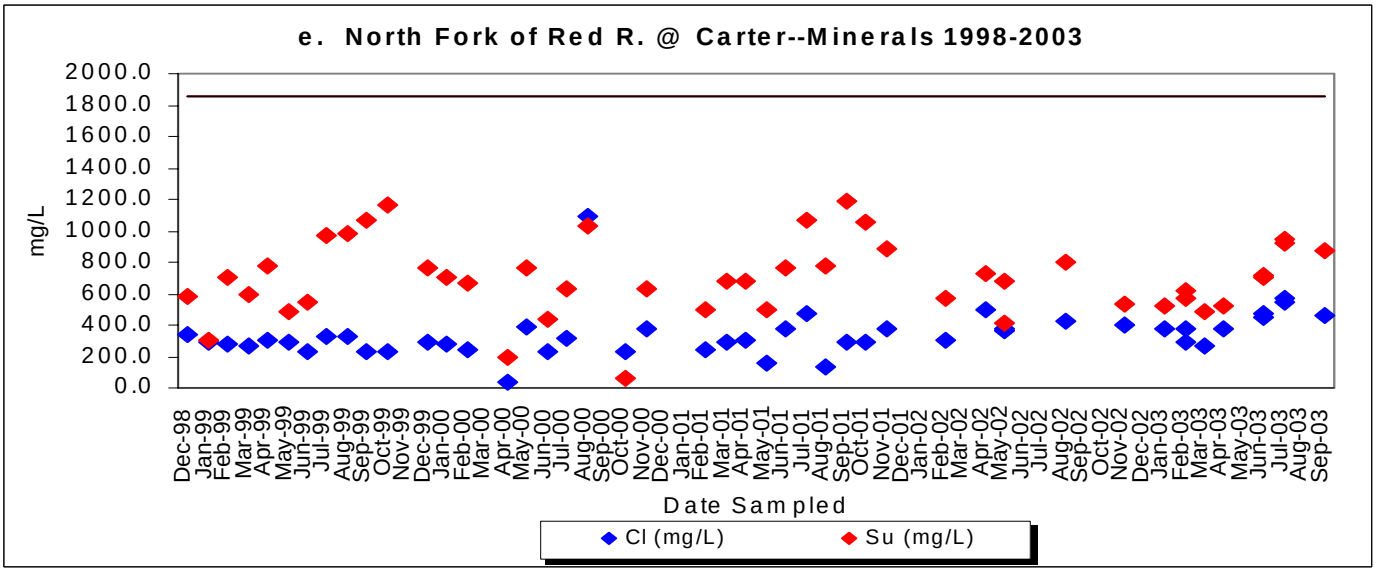
Figure 80a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the North Fork of the Red River at Carter (AT301500), 1998-2003.

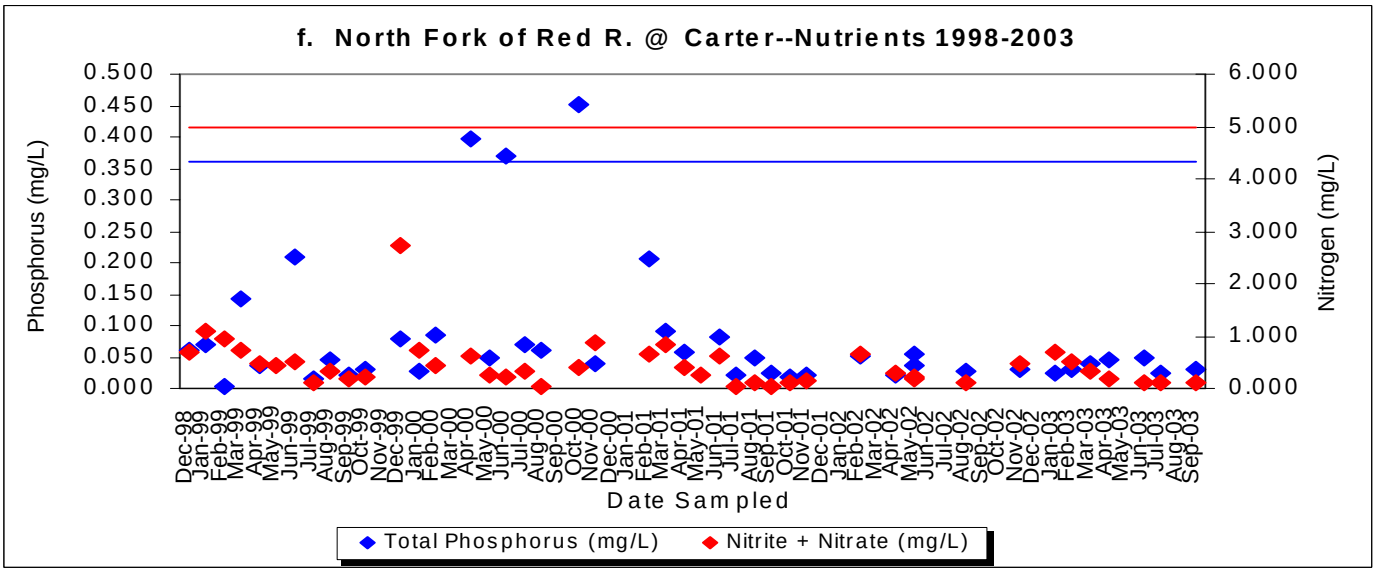







d. North Fork of the Red River @ Carter--TDS 1998-2003
mg/L
3000.0
2500.0
2000.0
1500.0
1000.0
500.0
0.0
Date Sampled
TDS (mg/L)


e. North Fork of Red R. @ Carter--Minerals 1998-2003
mg/L
2000.0
1800.0
1600.0
1400.0
1200.0
1000.0
800.0
600.0
400.0
200.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. North Fork of Red R. @ Carter--Nutrients 1998-2003
Phosphorus (mg/L)
0.500
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

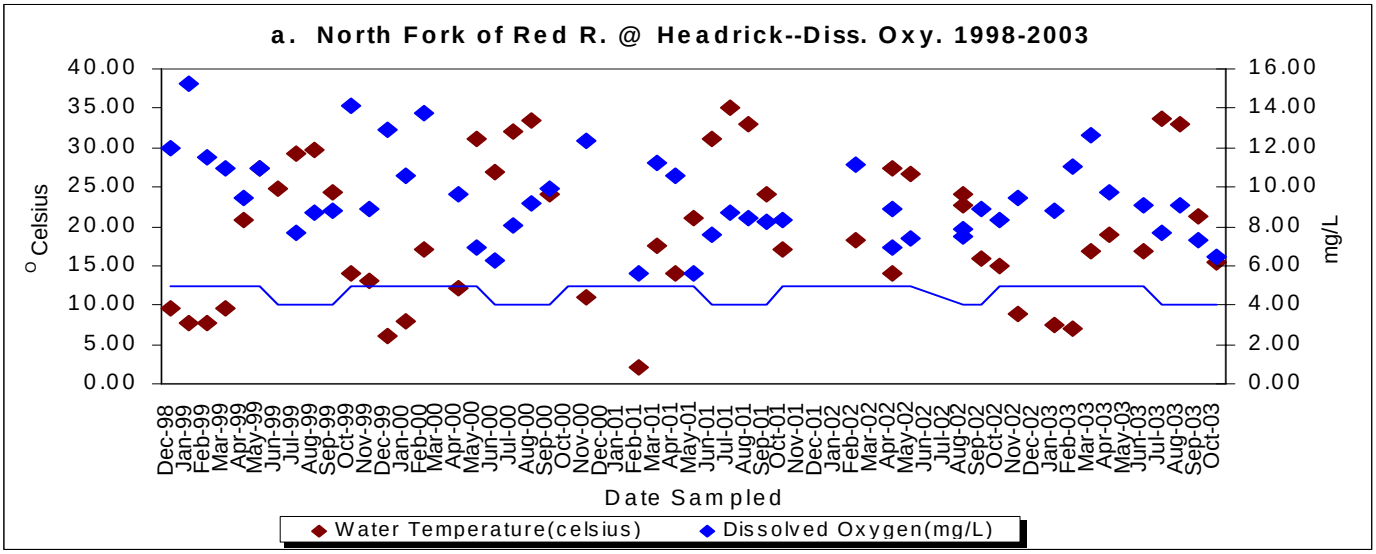
North Fork of the Red near Headrick

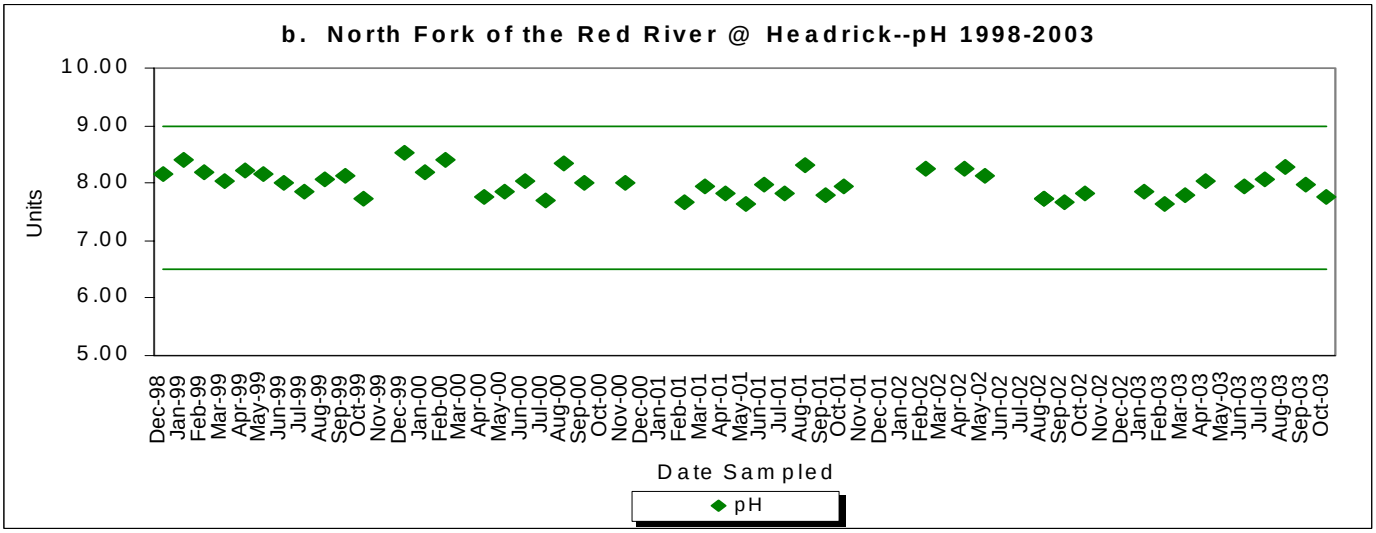
Station AT305000 (311500010020-001AT) is a permanent ambient trend monitoring station located on the North Fork of the Red River in Oklahoma. Situated on the border of Jackson and Tillman counties, the site was established east of the Town of Headrick on US Highway 62. The station is positioned near the midpoint of stream segment 31150010020 and is classified within the Lower North Fork of the Red River 8-digit HUC watershed (11120303). Water enters the stream system from several tributaries including Elk Creek, Otter Creek (Tom Steed Reservoir), and Stinking Creek, among others.

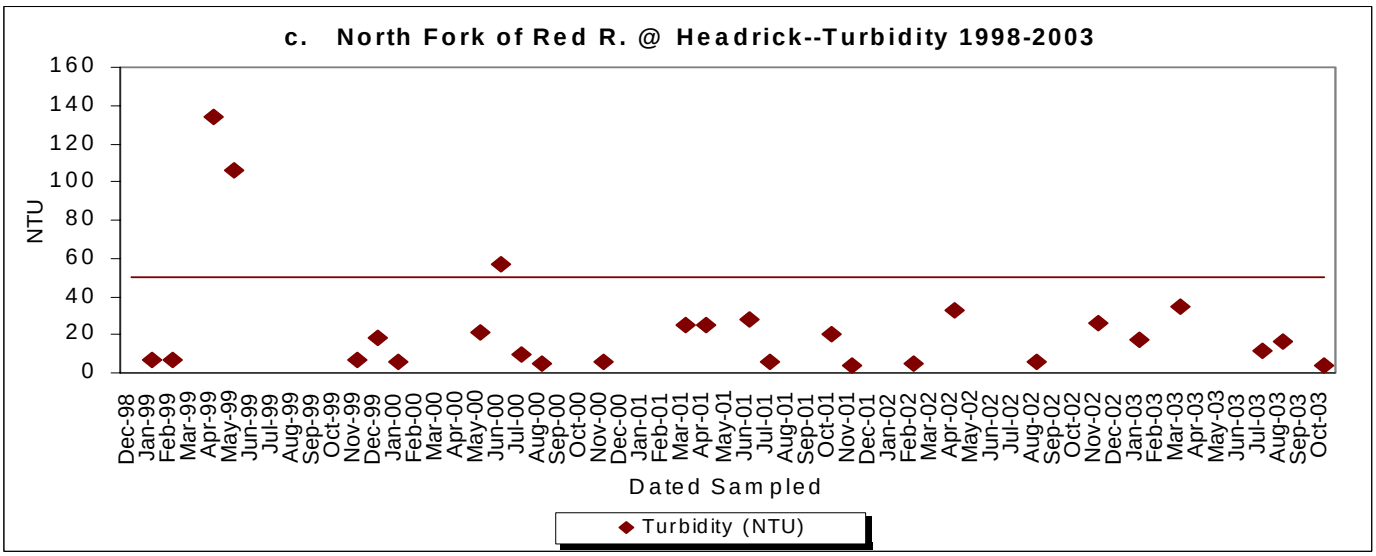
This station on the North Fork of the Red River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through September of 2003. For purposes of reporting, this station is representative of the North Fork of the Red River from the confluence of Elk Creek (99.1488, 34.7985) downstream to confluence of Stinking Creek with the North Fork of the Red River (99.2009, 34.5282). As per Appendix A, Table 3 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class III Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

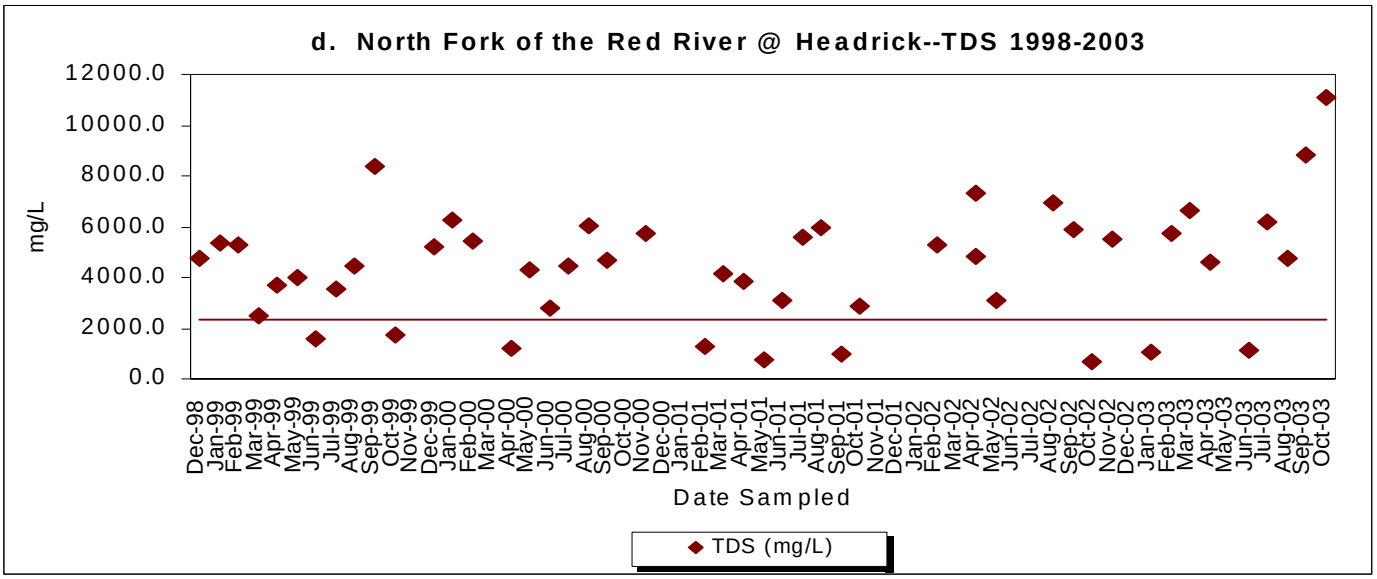
The PPWS beneficial use is partially supported. Of the 15 selenium samples collected, 3 of the concentrations (or 20%) exceeded the prescribed criterion of 10 µg/L (Table 28). The WWAC beneficial use is not supported. Of the 15 toxicant samples collected, 3 of the selenium concentrations (or 20%) exceeded the prescribed chronic criteria of 5 µg/L (Table 28). Of the 27 turbidity samples (Figure 81c), 3 samples (or 11%) exceeded the numerical criteria of 50. Dissolved oxygen (Figure 81a) and pH (Figure 81b) samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is not supported (Figure 81d and Figure 81e). Of the 47 total dissolved solids concentrations, 38 samples (or 81%) exceeded the sample standard of 2323.0 mg/L, and the geometric mean (4173.3 mg/L) exceeded the yearly mean standard (1801 mg/L). Of the 47 chloride concentrations, 40 or 85% exceeded the sample standard of 543.0 mg/L, and the geometric mean (2050.5 mg/L) exceeded the yearly mean standard (347 mg/L). Sulfate samples met the prescribed, site-specific criteria. The PBCR beneficial use is not supported (Table 29). Of the 16 enterococci concentrations, 3 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (260.1 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the North Fork of the Red River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 81f).

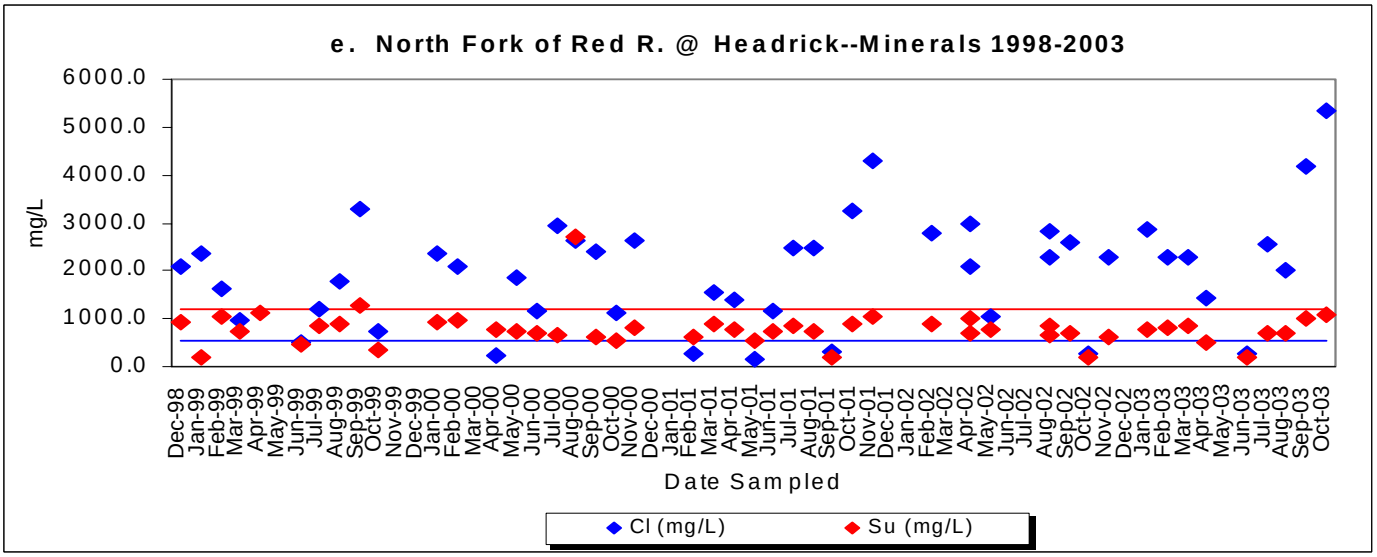
Figure 81a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the North Fork of the Red River at Headrick (AT305000), 1998-2003.

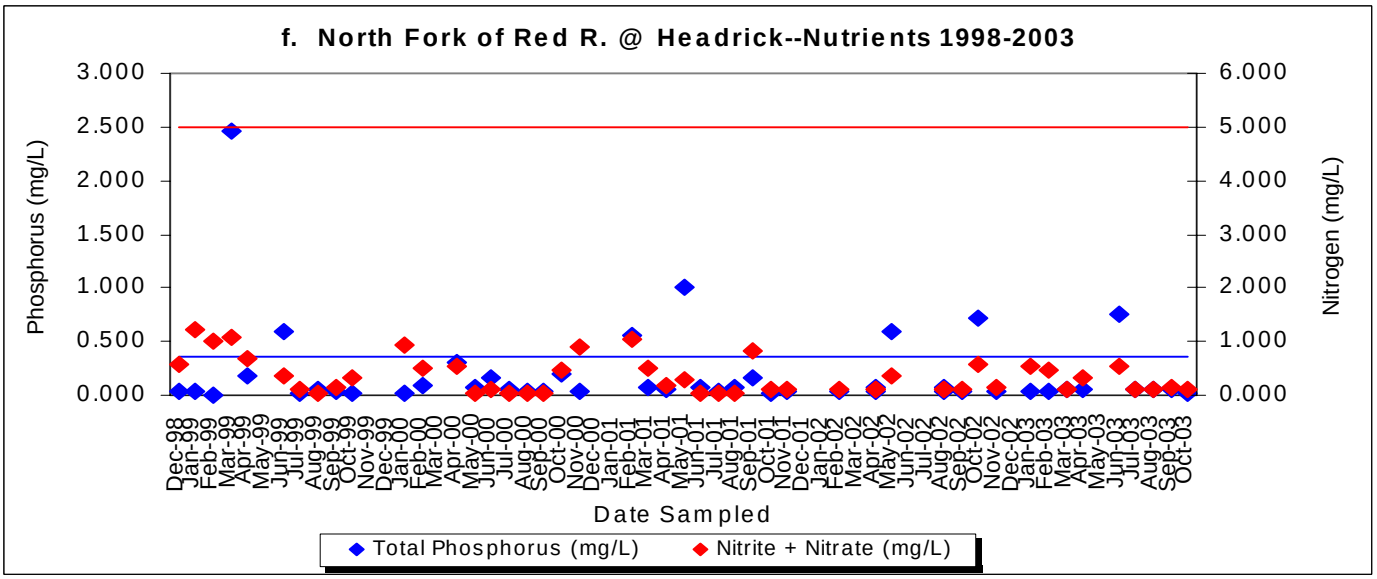







d. North Fork of the Red River @ Headrick--TDS 1998-2003
mg/L
12000.0
10000.0
8000.0
6000.0
4000.0
2000.0
0.0
Date Sampled
TDS (mg/L)


e. North Fork of Red R. @ Headrick--Minerals 1998-2003
mg/L
6000.0
5000.0
4000.0
3000.0
2000.0
1000.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. North Fork of Red R. @ Headrick--Nutrients 1998-2003
Phosphorus (mg/L)
3.000
2.500
2.000
1.500
1.000
0.500
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

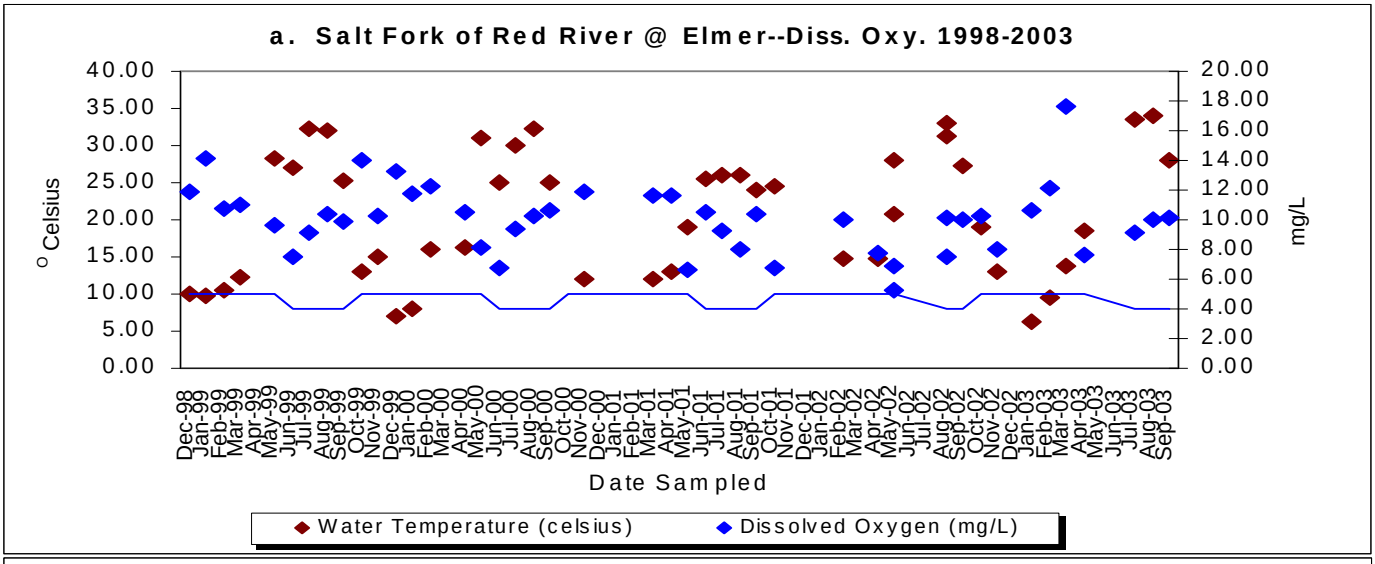
Salt Fork of the Red River near Elmer

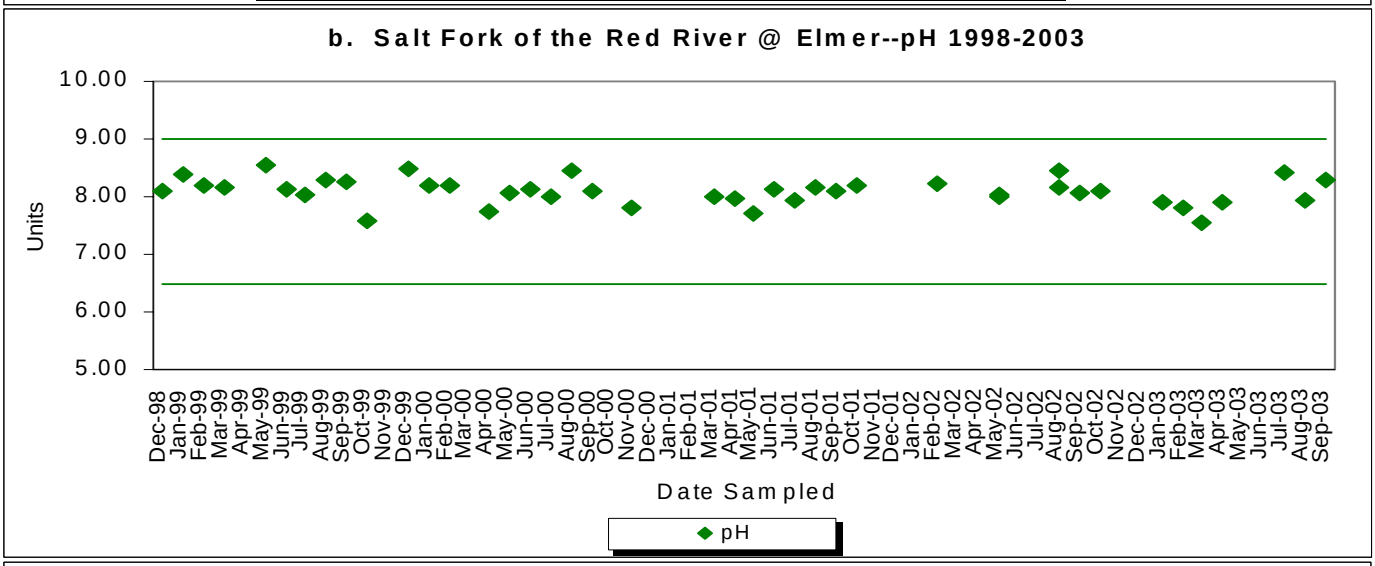
Station AT301110 (311600020010-002AT) is a permanent ambient trend monitoring station located on the Salt Fork of the Red River in Oklahoma. Situated in the south central portion of Jackson County, the site was established west of the Town of Elmer off of US Highway 283 on County Road E1750. The station is positioned near the terminal end of stream segment 311600020010 and is classified within the Lower Salt Fork of the Red River 8-digit HUC watershed (11120202). Water enters the stream system from several tributaries including Bitter Creek and Turkey Creek, among others.

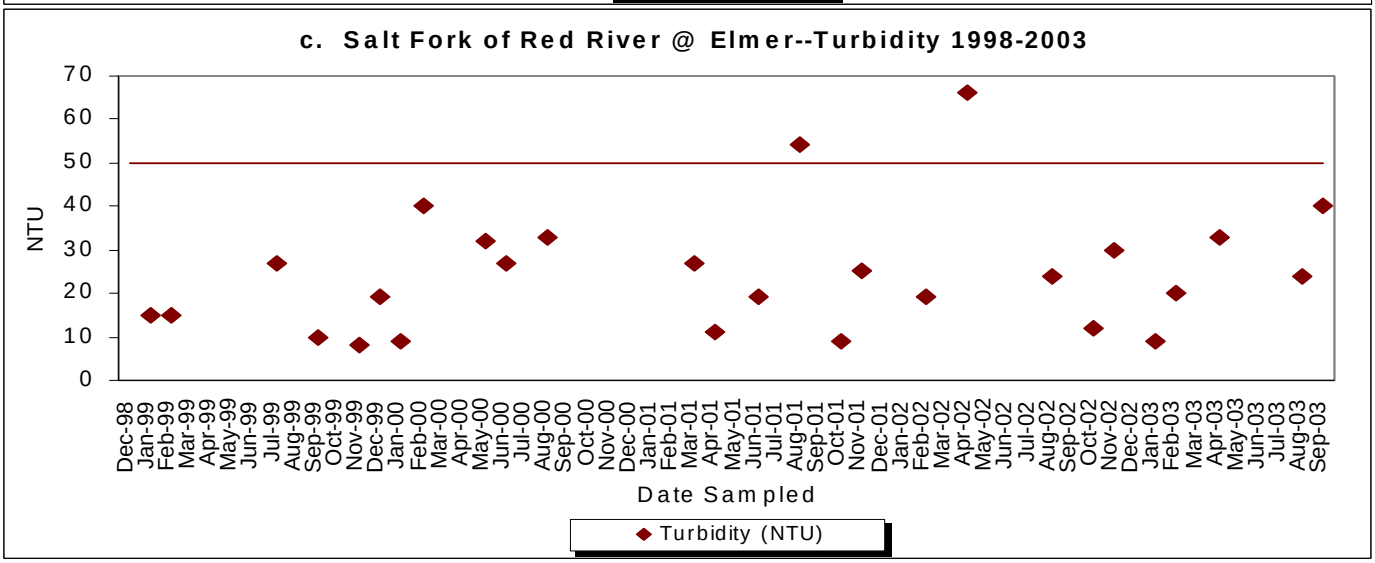
This station on the Salt Fork of the Red River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through September of 2003. For purposes of reporting, this station is representative of the Salt Fork of the Red River from the confluence of Bitter Creek (99.3923, 34.5751) downstream to confluence of the Salt Fork of the Red River with the Red River (99.3549, 34.4497). As per Appendix A, Table 3 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class III Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

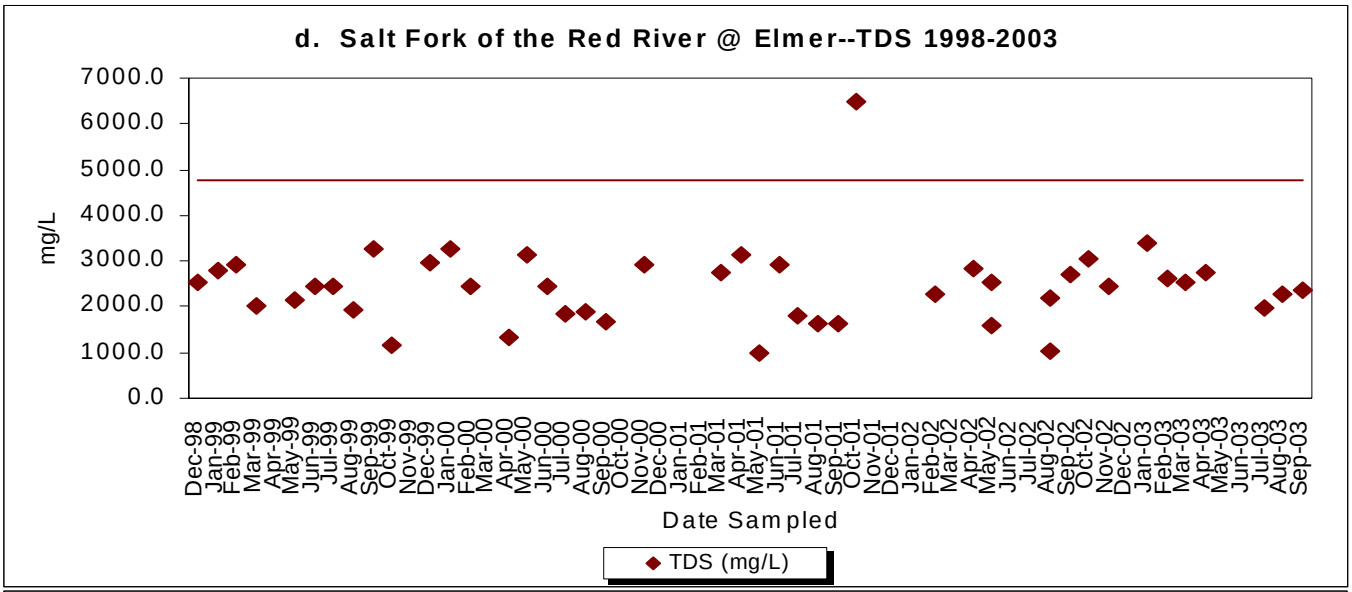
The PPWS beneficial use is partially supported. Of the 15 toxicant samples collected, 3 of the selenium concentrations (or 20%) exceeded the prescribed criterion of 10 µg/L (Table 28). The WWAC beneficial use is not supported. Of the 15 selenium samples collected, 5 of the concentrations (or 33%) exceeded the prescribed chronic criteria of 5 µg/L, and 2 of the concentrations (or 13%) exceeded the prescribed acute criteria of 20 µg/L (Table 28). Dissolved oxygen (Figure 82a), pH (Figure 82b), and turbidity (Figure 82c) samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 82d and Figure 82e). The PBCR beneficial use is not supported (Table 29). Of the 18 fecal coliform concentrations, 11 samples (or 61%) exceeded the prescribed screening level of 400 cfu/mL, and the geometric mean (728.3 cfu/mL) exceeded the prescribed mean standard of 400 cfu/mL. Of the 18 enterococci concentrations, 8 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (730.4 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Salt Fork of the Red River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 82f).

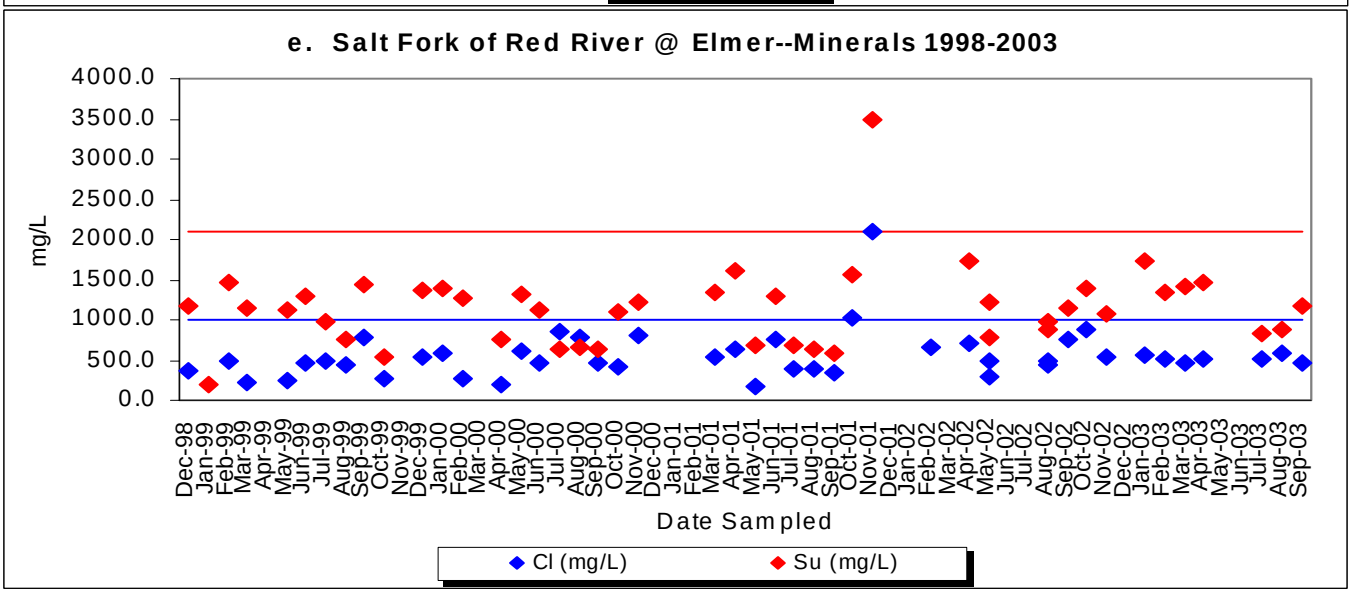
Figure 82a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Salt Fork of the Red River at Elmer (AT301110), 1998-2003.

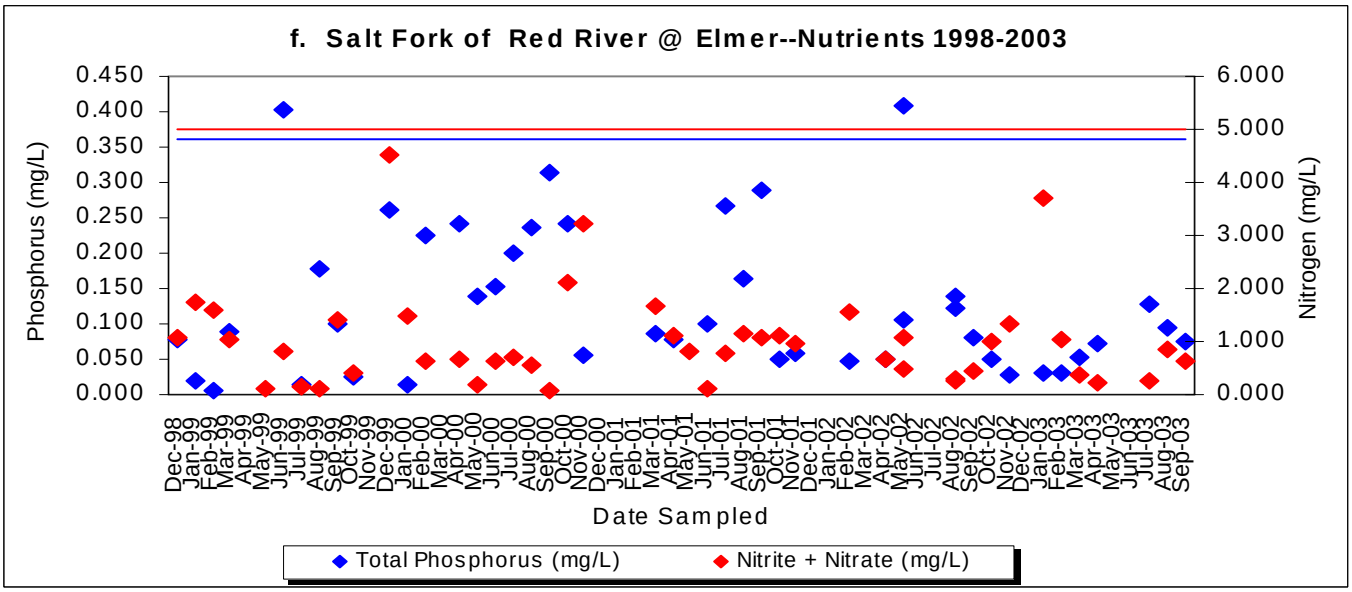







d. Salt Fork of the Red River @ Elmer--TDS 1998-2003
mg/L
Date Sampled
TDS (mg/L)


e. Salt Fork of Red River @ Elmer--Minerals 1998-2003
mg/L
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Salt Fork of Red River @ Elmer--Nutrients 1998-2003
Phosphorus (mg/L)
Nitrogen (mg/L)
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

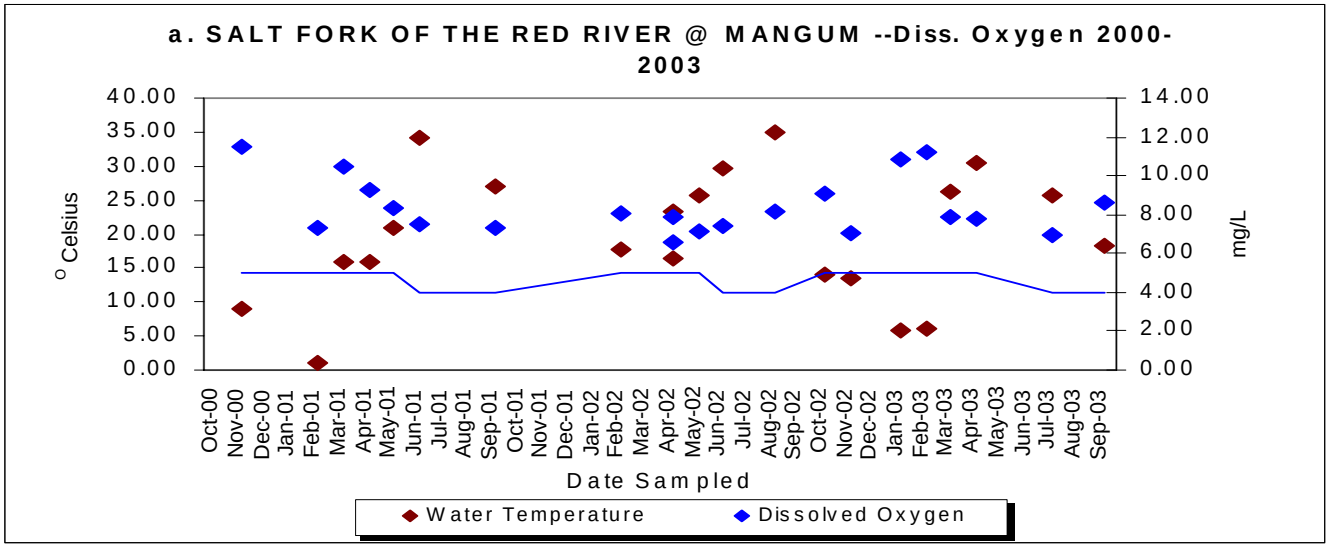
Salt Fork of the Red River near Mangum

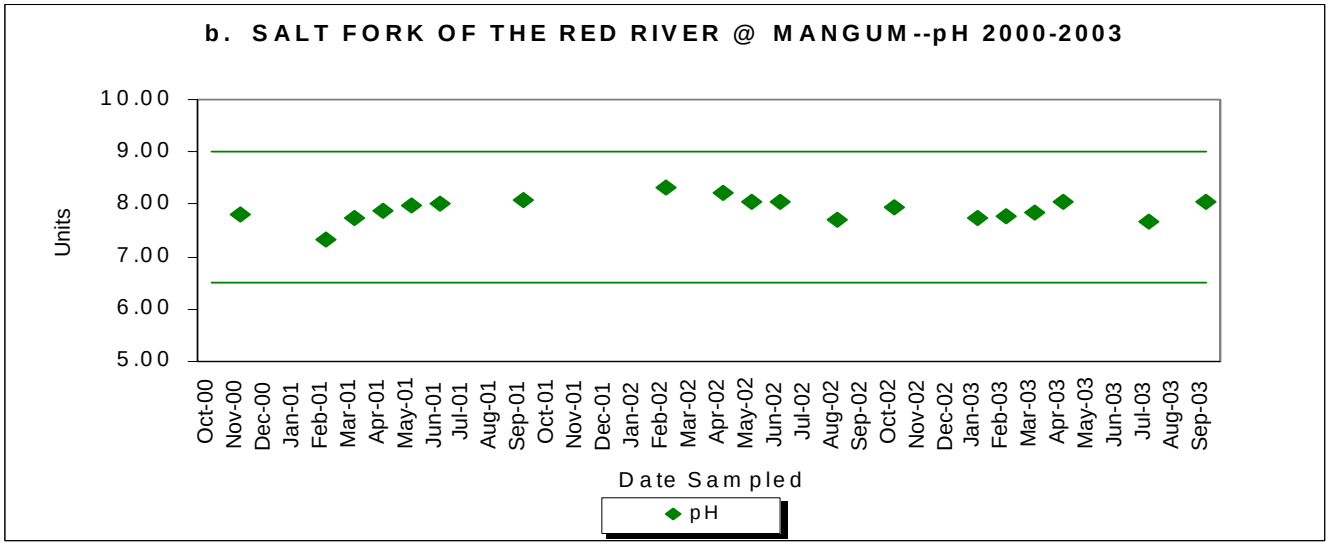
Station AT300500 (311600020010-001AT) is a permanent ambient trend monitoring station located on the Salt Fork of the Red River in Oklahoma. Situated in the south central portion of Greer County, the site was established south of the Town of Mangum on State Highway 34. The station is positioned near the midpoint of stream segment 311600020010 and is classified within the Lower Salt Fork of the Red River 8-digit HUC watershed (11120202). Water enters the stream system from Texas, Lake Hall, and several unlisted tributaries within Oklahoma.

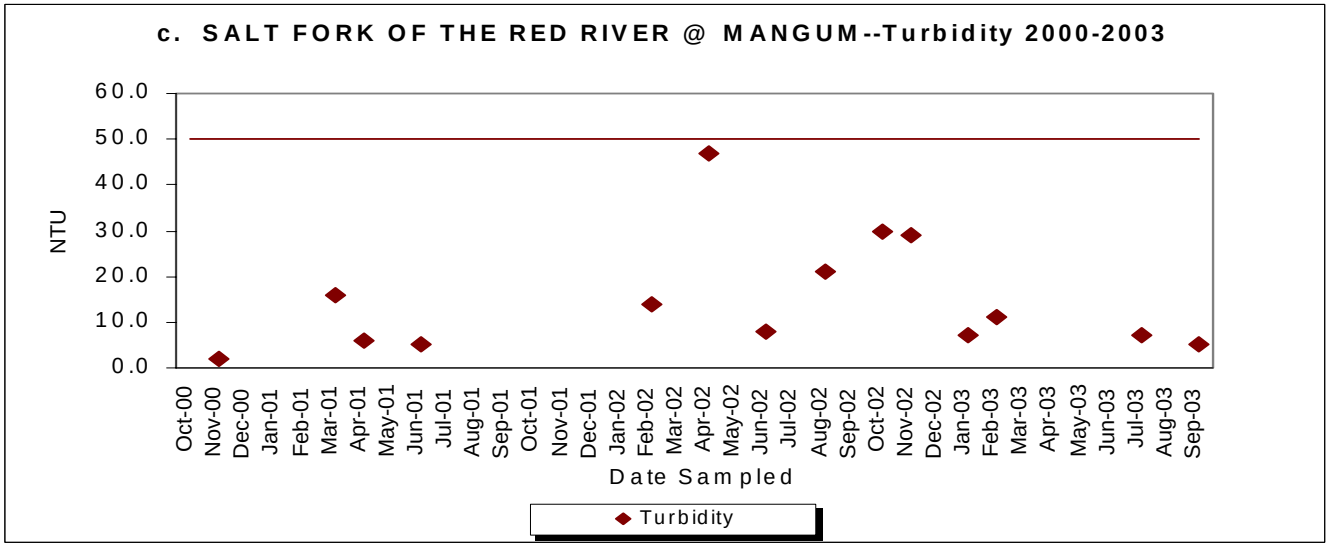
This station on the Salt Fork of the Red River has been active for all water quality variables since October of 2000. The following assessment of beneficial uses is based on data collected from October of 2000 through September of 2003. For purposes of reporting, this station is representative of the Salt Fork of the Red River from its entrance into Oklahoma (100.0004, 34.8536) downstream to the confluence of the Salt Fork of the Red River with Bitter Creek (99.3923, 34.5751). As per Appendix A, Table 3 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class III Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

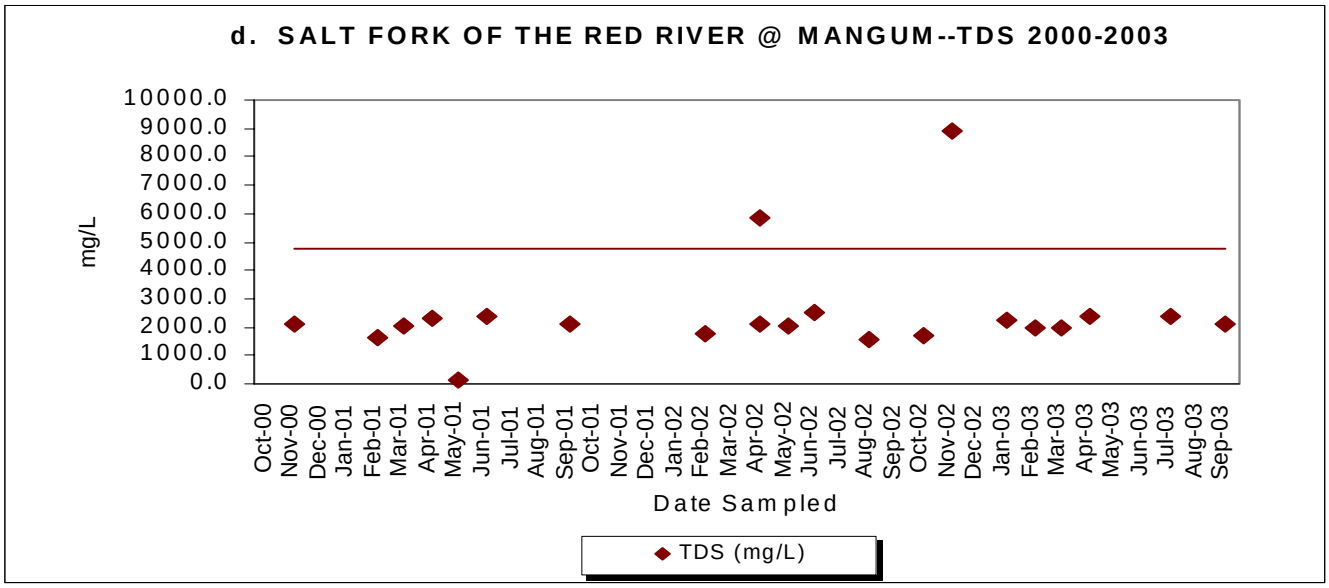
The PPWS beneficial is supported. The WWAC beneficial use is supported for dissolved oxygen (Figure 83a), pH (Figure 83b), turbidity (Figure 83c) and toxicants data. The AG beneficial is supported for total dissolved solids, chlorides, and sulfates samples (Figure 83d and Figure 83e). The PBCR beneficial use is not supported (Table 29). Of the 11 fecal coliform concentrations, 4 samples (or 44%) exceeded the prescribed screening level of 400 cfu/mL, and the geometric mean (412.6 cfu/mL) exceeded the prescribed mean standard of 400 cfu/mL. Of the 11 enterococci concentrations, 6 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (1193.3 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Salt Fork of the Red River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 83f).

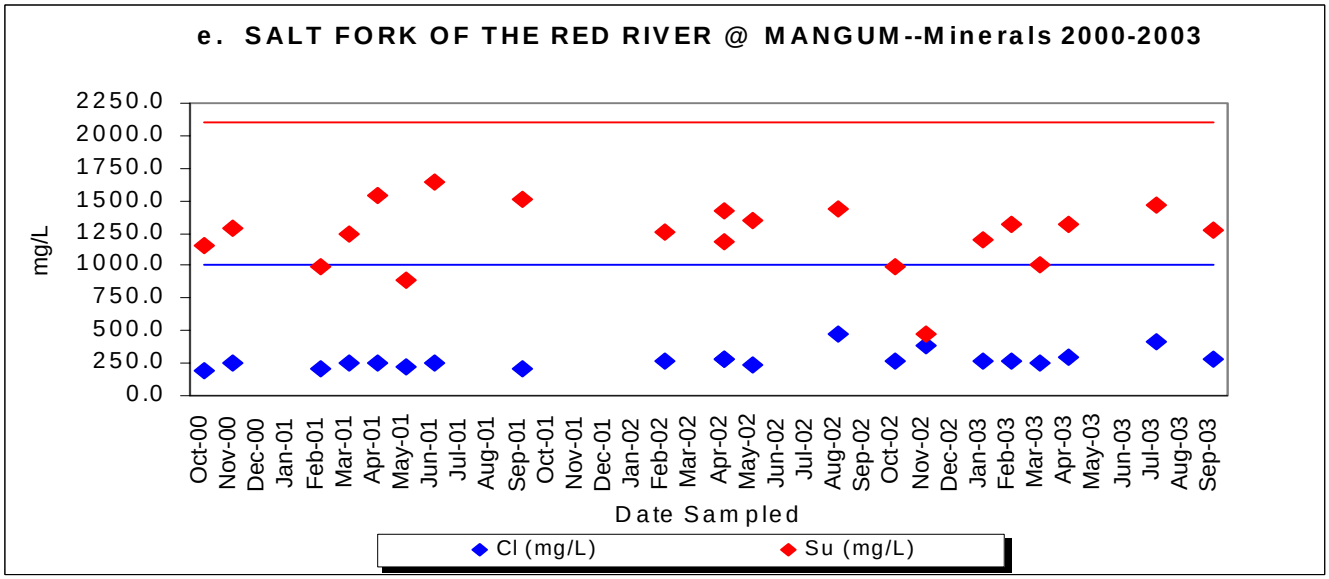
Figure 83a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Salt Fork of the Red River at Mangum (AT300500), 2000-2003.

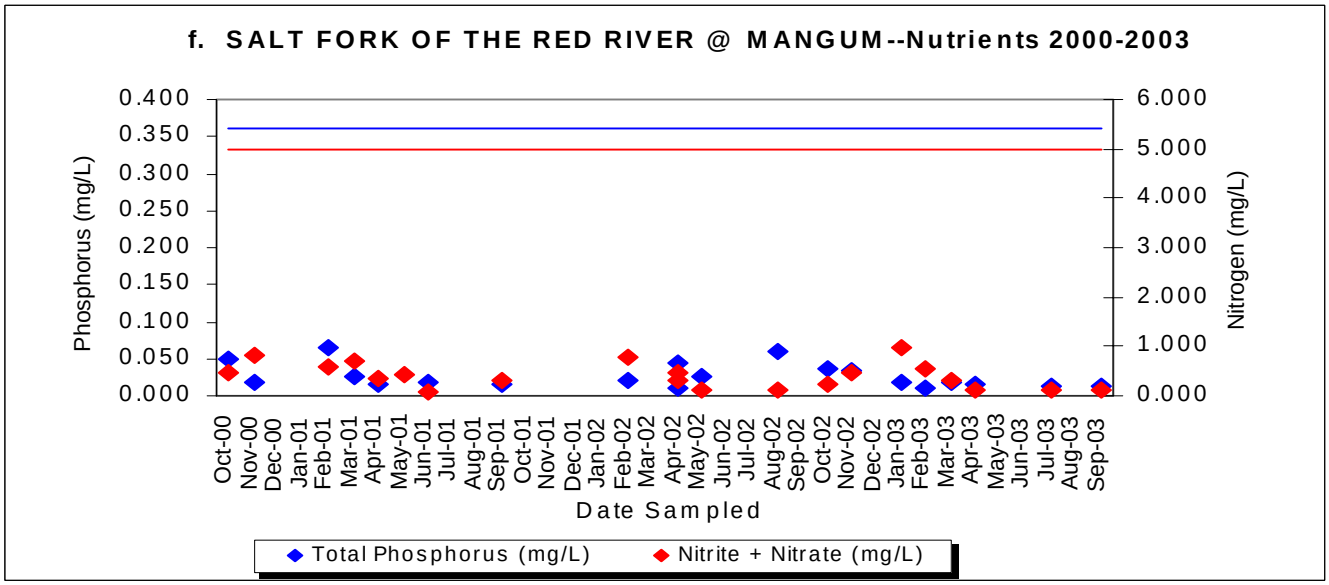







d. SALT FORK OF THE RED RIVER @ MANGUM--TDS 2000-2003
mg/L
10000.0
9000.0
8000.0
7000.0
6000.0
5000.0
4000.0
3000.0
2000.0
1000.0
0.0
Oct-00 Nov-00 Dec-00 Jan-01 Feb-01 Mar-01 Apr-01 May-01 Jun-01 Jul-01 Aug-01 Sep-01 Oct-01 Nov-01 Dec-01 Jan-02 Feb-02 Mar-02 Apr-02 May-02 Jun-02 Jul-02 Aug-02 Sep-02 Oct-02 Nov-02 Dec-02 Jan-03 Feb-03 Mar-03 Apr-03 May-03 Jun-03 Jul-03 Aug-03 Sep-03
Date Sampled
TDS (mg/L)


e. SALT FORK OF THE RED RIVER @ MANGUM--Minerals 2000-2003
mg/L
2250.0
2000.0
1750.0
1500.0
1250.0
1000.0
750.0
500.0
250.0
0.0
Oct-00 Nov-00 Dec-00 Jan-01 Feb-01 Mar-01 Apr-01 May-01 Jun-01 Jul-01 Aug-01 Sep-01 Oct-01 Nov-01 Dec-01 Jan-02 Feb-02 Mar-02 Apr-02 May-02 Jun-02 Jul-02 Aug-02 Sep-02 Oct-02 Nov-02 Dec-02 Jan-03 Feb-03 Mar-03 Apr-03 May-03 Jun-03 Jul-03 Aug-03 Sep-03
Date Sampled
Cl (mg/L)
Su (mg/L)


f. SALT FORK OF THE RED RIVER @ MANGUM--Nutrients 2000-2003
Phosphorus (mg/L)
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Oct-00 Nov-00 Dec-00 Jan-01 Feb-01 Mar-01 Apr-01 May-01 Jun-01 Jul-01 Aug-01 Sep-01 Oct-01 Nov-01 Dec-01 Jan-02 Feb-02 Mar-02 Apr-02 May-02 Jun-02 Jul-02 Aug-02 Sep-02 Oct-02 Nov-02 Dec-02 Jan-03 Feb-03 Mar-03 Apr-03 May-03 Jun-03 Jul-03 Aug-03 Sep-03
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

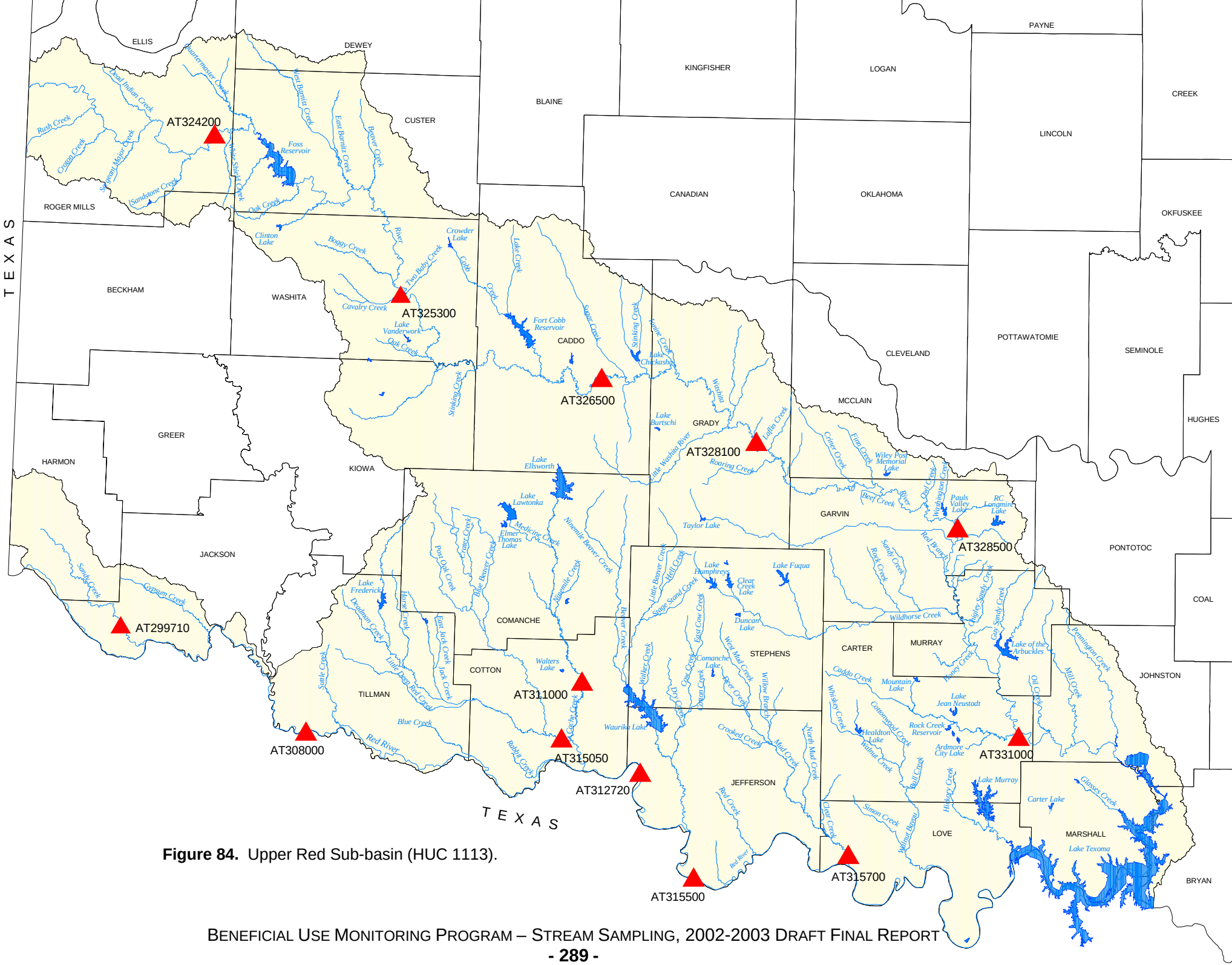


Figure 84. Upper Red Sub-basin (HUC 1113).

HUC 1113

UPPER RED SUB-BASIN

The Upper Red sub-basin (4-digit hydrologic unit 1113) is situated in the southwestern portion of the state. It originates in the western portion of Roger Mills County, continues eastward through portions of Beckham, Dewey, Custer, Washita, Kiowa, Caddo, Comanche, Tillman, Cotton, Grady, Stephens, Jefferson, McClain, Garvin, Murray, Pontotoc, Carter, Johnston, and Love Counties and terminates in the western part of Marshall and Bryan Counties, briefly touching Harmon and Jackson Counties. Major cities and County seats located within the basin include Cheyenne, Hollis, Arapaho, Clinton, Frederick, Anadarko, Lawton, Walters, Chickasha, Marlow, Duncan, Waurika, Lindsay, Pauls Valley, Sulphur, Lone Grove, Ardmore, Marietta, Madill, and Tishomingo. Minor cities of note include Hammon, Fort Cobb, Binger, Rush Springs, Davis, and Wynnewood.

The basin is subdivided into eleven 8-digit hydrologic units (HUC) within the state. These HUC's are the Groesbeck–Sandy (11130101), the Blue–China (11130102), the Farmer's–Mud (11130201), the Cache (11130202), the West Cache (11130203), the Northern Beaver (11130208), the Lake Texoma (11130210), the Washita Headwaters (11130301), the Upper Washita (11130302), the Middle Washita (11130303), and the Lower Washita (11130304). The major surface water in the basin is the upper Red River. Major tributaries include the Prairie Dog Town Fork of the Red River, the Washita River, the Little Washita River, Barnitz Creek, Cobb Creek, Bitter Creek, Rush Creek, Wildhorse Creek, Rock Creek, Caddo Creek, Mill Creek, Sandy Creek, Deep Red Creek, West Cache Creek, East Cache Creek, Cow Creek, Beaver Creek, Mud Creek, Walnut Bayou, and Hickory Creek. Eight major lakes are located in the basin—Foss Reservoir formed by the Washita River, Fort Cobb Reservoir formed by Cobb Creek, Lake Ellsworth formed by East Cache Creek, Lake Lawtonka formed by Medicine Creek, Waurika Lake formed by Beaver Creek, Lake of the Arbuckles formed by Rock Creek, Lake Murray formed by Anadarche Creek, and Lake Texoma formed by the Red and Washita Rivers and Hickory Creek. Thirteen active permanent water quality-monitoring stations (Table 30) are located in the basin—AT299710, AT308000, AT311000, AT312720, AT315050, AT315500, AT315700, AT324200, AT325300, AT326500, AT328100, AT328500, and AT331000 as well as four inactive water quality-monitoring stations (AT313600, AT315900, AT316000, AT331110). Stations AT315900 and AT331110 were last assessed in the 2000 BUMP report while station AT316000 was last assessed in the 1999 BUMP report. Station AT313600 was last assessed in the 2003 BUMP report. Station AT328100, Washita River near Alex, will not be included in this report due to lack of data.

The basin is characterized by three ecoregions. The Central Great Plains is the primary ecoregion beginning in the western portion of Roger Mills County and continuing through the western parts of Grady, Stephens, and Jefferson Counties. The Central Oklahoma/Texas Plains begins in the eastern parts of Grady, Stephens, and Jefferson Counties and continues eastward over the rest of the sub-basin. The Southwestern Tablelands typify portions of Roger Mills, Custer, and Beckham Counties. The primary land usage in the sub-basin is rangeland (open grasslands, mesquite, and other woody areas). It is prevalent in the western, southern and central portions of the sub-basin and is interspersed throughout the sub-basin. The secondary land use is cropland, which dominates the southwestern portion and is interspersed throughout the sub-basin. The tertiary land uses are pastureland (brushy or mixed) and

forestland (post oak–blackjack oak, hickory–oak, and bottomland hardwoods). Other land uses of note are woodlands, bottom woodlands, farmsteads, major urban areas, and wetlands.

Table 30. Permanent Ambient Trend Monitoring Stations Located in HUC 1113.

WBID #	STATION #	STATION NAME	STATUS	FS	PS	NS/T	CBD
311300010020	AT311000	East Cache Creek, SH 53, Walters	Active 11/98-P	AG, AES, PPWS	NONE	FWP, PBCR	NONE
311100040010	AT315700	Mud Creek, SH 32, Courtney	Active 11/98-P	AG, AES, PPWS	NONE	FWP, PBCR	NONE
311310010010	AT308000	Red River, US 183, Davidson	Active 11/98-P	AES	NONE	AG, FWP, PBCR	NONE
311100010190	AT315500	Red River, US 81, Terral	Active 11/98-P	AES, PPWS	NONE	AG, FWP, PBCR	NONE
311200000010	AT312720	Red River, SH 79, Waurika	Active 11/98-P	AES	PPWS	AG, FWP, PBCR	NONE
311600010040	AT299710	Sandy Creek, SH 6, Eldorado	Active 11/98-P	AES	NONE	AG, FWP	NONE
310830010010	AT326500	Washita River, US 281, Anadarko	Active 11/98-P	AG, AES, PPWS	NONE	FWP, PBCR	NONE
310830030010	AT325300	Washita River, SH 152, Cordell	Active 11/98-P	AG, AES, PPWS	NONE	FWP, PBCR	NONE
310800020010	AT331000	Washita River, US 177, Durwood	Active 11/98-P	AG, AES, PPWS	NONE	FWP, PBCR	NONE
310840010010	AT324200	Washita River, SH 33, Hammon	Active 11/98-P	AG, AES, PPWS	FWP	PBCR	NONE
310810010010	AT328500	Washita River, SH 19, Pauls Valley	Active 11/98-P	AES, PPWS	NONE	AG, FWP, PBCR	NONE
311310020010	AT315050	West Cache Creek, SH 5B, Taylor	Active 11/98-P	AES, PPWS	AG	FWP, PBCR	NONE

ASSIGNED OWQS BENEFICIAL USES AND SUPPORT CODES

PPWS = PUBLIC AND PRIVATE WATER SUPPLY	EWS = EMERGENCY WATER SUPPLY
FWP = FISH & WILDLIFE PROPAGATION	PBCR = PRIMARY BODY CONTACT RECREATION
AG = AGRICULTURE	AES = AESTHETICS
FS = FULLY SUPPORTING	PS = PARTIALLY SUPPORTING
NS/T = NOT SUPPORTING/THREATENED	CBD = CANNOT BE DETERMINED

Table 31. Toxicant exceedances in HUC 1113. Underlined values were measured at the minimum quantification limit (MQL) and are reported at one-half of the MQL per 785:46-15-3(e)(2).

STATION #	STATION NAME	DATE	Lead (µg/L)	Selenium (µg/L)
AT311000	East Cache Creek, SH 53, Walters	12/21/1999		6.00
		10/31/2000		10.00
AT308000	Red River, US 183, Davidson	05/24/1999		18.00
		12/20/1999		14.00
		05/22/2000		17.00
		04/18/2001		23.00
		01/14/2003		7.00
		03/25/2003		6.00
AT315500	Red River, US 81, Terral	12/21/1999		14.00
		05/23/2000		10.00
AT312720	Red River, SH 79, Waurika	12/21/1999		14.00
		05/23/2000		13.00
AT299710	Sandy Creek, SH 6, Eldorado	05/24/1999		12.00
		12/20/1999		51.00
		05/22/2000		34.00

STATION #	STATION NAME	DATE	Lead (µg/L)	Selenium (µg/L)
		06/26/2000		20.00
		06/19/2001		22.00
		08/21/2001		15.00
		09/18/2001		24.00
		05/01/2002		23.00
		01/14/2003		29.00
		03/24/2003		25.00
		08/19/2003		17.00
AT331000	WASHITA RIVER, US 177, DURWOOD	06/01/1999	32.00	
		05/09/2000	28.00	
AT315050	WEST CACHE CREEK, SH 5B, TAYLOR	06/01/1999	18.00	
		10/31/2000	13.00	

Table 32. Exceedances of fecal coliform, enterococci, and *E. coli* screening limits in HUC 1113. Only values leading to a determination of not supporting for the Public and Private Water Supply and the Primary Body Contact Recreation beneficial uses are in included.

STATION #	STATION NAME	DATE	Fecal Coliform (cfu/mL)	Enterococci (cfu/mL)	*E. coli* (cfu/mL)
AT311000	EAST CACHE CREEK, SH 53, WALTERS	06/30/1999		860	
		08/23/1999	1300	930	785
		09/22/1999	1500		
		05/23/2000		600	
		08/29/2000		2200	
		09/26/2000	600	2000	459
		05/16/2001	500	600	
		07/17/2001		500	
		08/14/2001	500		
		09/04/2001	1100	4000	
		05/28/2002		1000	
		08/06/2002	600		
		08/21/2002		1100	
		06/04/2003	500	43000	
		06/23/2003	1000	800	620
		07/28/2003		500	
		08/19/2003	500	800	
		09/02/2003	24100	5300	4352
		09/23/2003		470	
AT315700	MUD CREEK, SH 32, COURTNEY	07/27/1999	410		
		08/23/1999	1300		
		09/22/1999	32000	600	
		05/09/2000	470		
		05/15/2001	900		
		09/05/2001		800	

STATION #	STATION NAME	DATE	Fecal Coliform (cfu/mL)	Enterococci (cfu/mL)	*E. coli* (cfu/mL)
		05/29/2002	4000	17000	
		08/06/2002		600	
AT308000	RED RIVER, US 183, DAVIDSON	06/22/1999	1300	550	
		09/21/1999	3600	900	
		09/26/2000	63000	11000	
		05/22/2001	10000	14000	
		08/21/2001	2000	21000	
		09/18/2001			
		05/29/2002	10000	11000	
		08/20/2002	1000		
AT315500	RED RIVER, US 81, TERRAL	05/23/2000		410	
		05/15/2001		500	
AT312720	RED RIVER, SH 79, WAURIKA	06/04/2003		700	
		09/02/2003		1300	
AT326500	WASHITA RIVER, US 281, ANADARKO	06/16/1999		470	
		07/12/1999	51000		
		05/09/2000		1200	
		05/16/2001	4000	2000	
		06/12/2001		1000	
		08/14/2001	3000	600	
		07/23/2002		2000	
AT325300	WASHITA RIVER, SH 152, CORDELL	07/12/1999	610		
		08/18/1999	2800	1100	
		05/09/2000	1600	1700	
		07/19/2000		700	
		05/16/2001		3100	
		06/12/2001		3000	
		08/14/2001	500		
		05/21/2002	600	1700	
		06/18/2002	600	6000	
		07/23/2002		600	
AT331000	WASHITA RIVER, US 177, DURWOOD	06/02/1999	1290	75000	
		06/29/1999	2300	2700	
		09/28/1999			
		05/10/2000	690	1400	
		05/15/2001	500		
		06/11/2001	600	500	
		09/05/2001	800	600	
		06/18/2002	520		
		08/19/2002	470		
AT324200	WASHITA RIVER, SH 33, HAMMON	06/22/1999		490	
		07/20/1999		420	

STATION #	STATION NAME	DATE	Fecal Coliform (cfu/mL)	Enterococci (cfu/mL)	*E. coli* (cfu/mL)
		05/09/2000		600	
		06/13/2000	1800	3800	
		07/19/2000		1800	
		08/16/2000		1600	
		09/13/2000	700	1400	
		05/22/2001	900		
		06/19/2001		800	
		07/24/2001		1000	
		08/21/2001	600	7000	
		05/21/2002	600		
		06/18/2002	700	5000	
		07/23/2002	6000		
		08/21/2002		4000	
AT328500	WASHITA RIVER, SH 19, PAULS VALLEY	06/02/1999	1000	900	
		06/29/1999	2200	41000	
		09/28/1999	2200		
		05/10/2000	740	680	
		05/15/2001	1000	500	
		06/11/2001		2000	
		08/19/2002		3000	
		09/23/2002		600	
AT315050	WEST CACHE CREEK, SH 5B, TAYLOR	06/30/1999	590	64000	5475
		05/23/2000		640	
		06/27/2000	600	950	
		05/16/2001	900	2000	
		08/14/2001		600	
		09/04/2001	2800	1200	
		05/28/2002	800	800	
		08/21/2002	22000		
		06/04/2003		600	
		06/23/2003	600		776
		08/19/2003	500	500	
		09/02/2003	5300	4100	1553

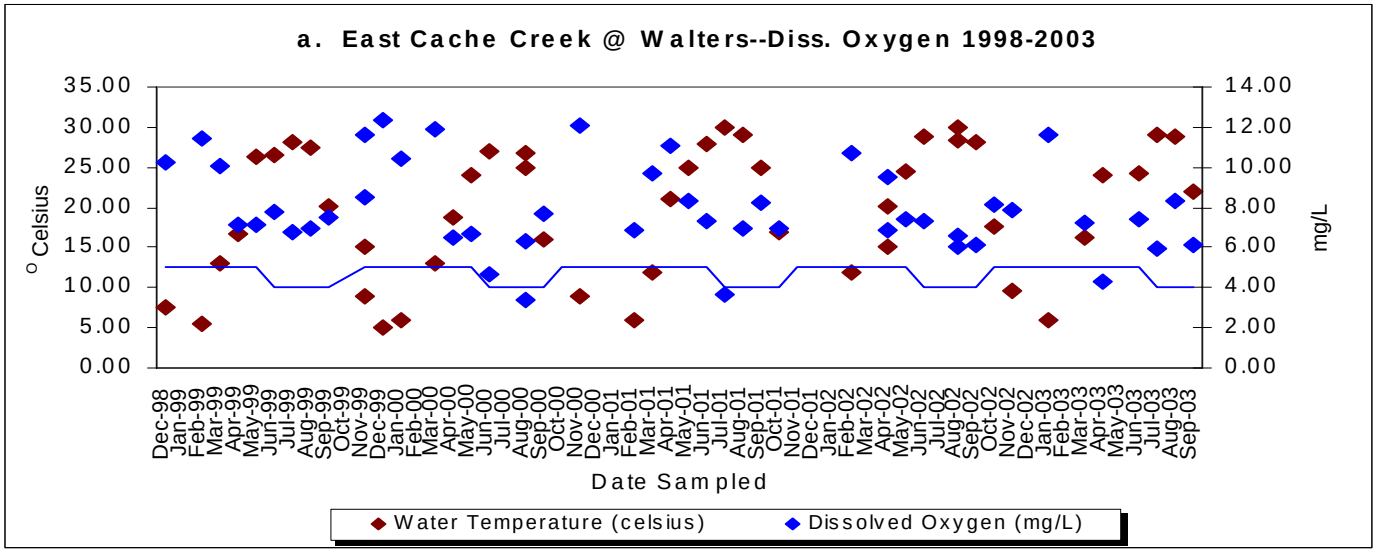
East Cache Creek near Walters

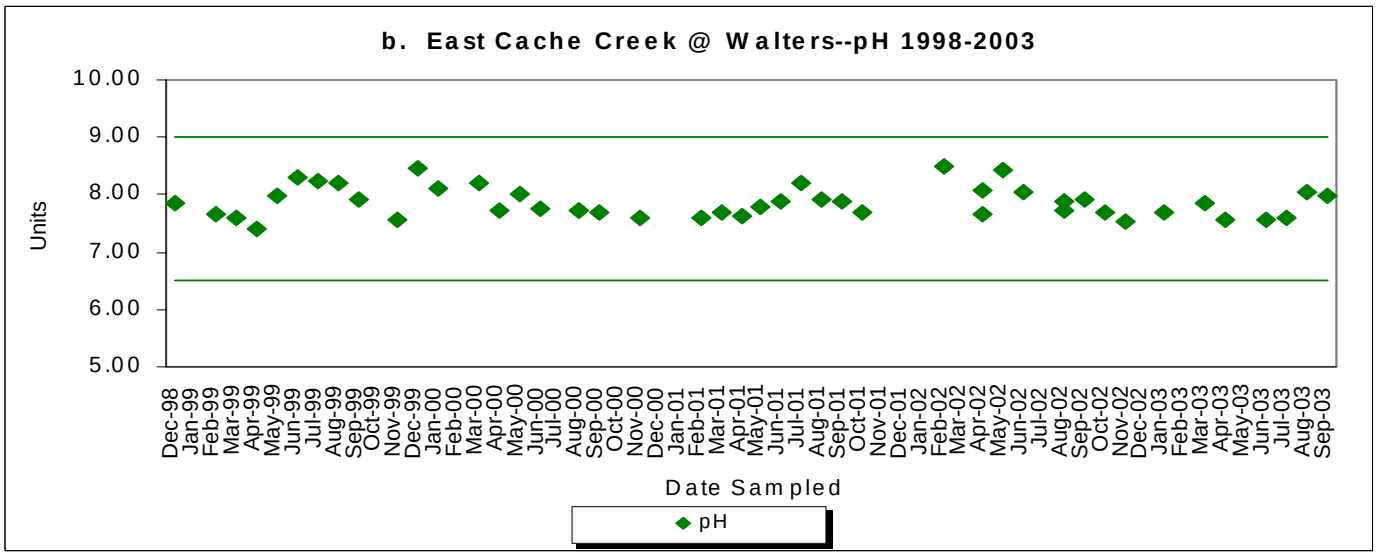
Station AT311000 (311300010020-001AT) is a permanent ambient trend monitoring station located on East Cache Creek. Situated in the northeastern portion of Cotton County, the site was established east of the Town of Walters on State Highway 53. The station is positioned near the terminal end of stream segment 311300010020 and is classified within the Cache Creek 8-digit HUC watershed (11130202). Water enters the stream system from Dave Boyer Lake, Walters Lake, and Temple Lake and from several tributaries including Snake Creek, among others.

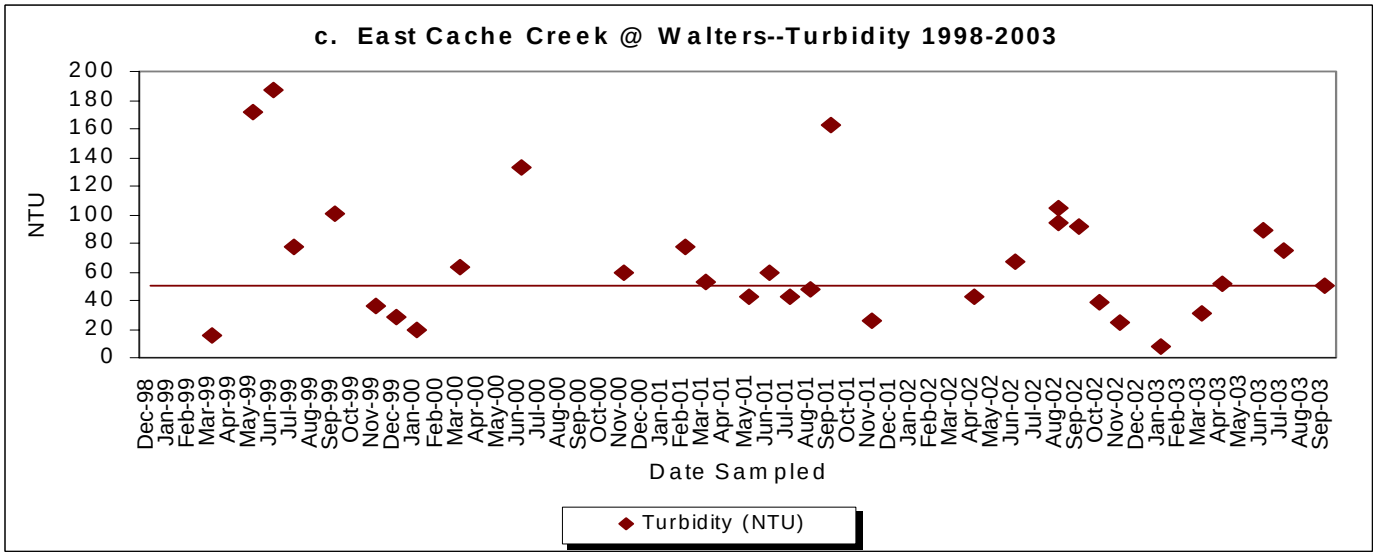
This station on East Cache Creek has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through September of 2003. For purposes of reporting, this station is representative of East Cache Creek from the confluence of Medicine Creek (98.3764, 34.6747) downstream to confluence of East Cache Creek with Cache Creek (98.3070, 34.2066). As per Appendix A, Table 7 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

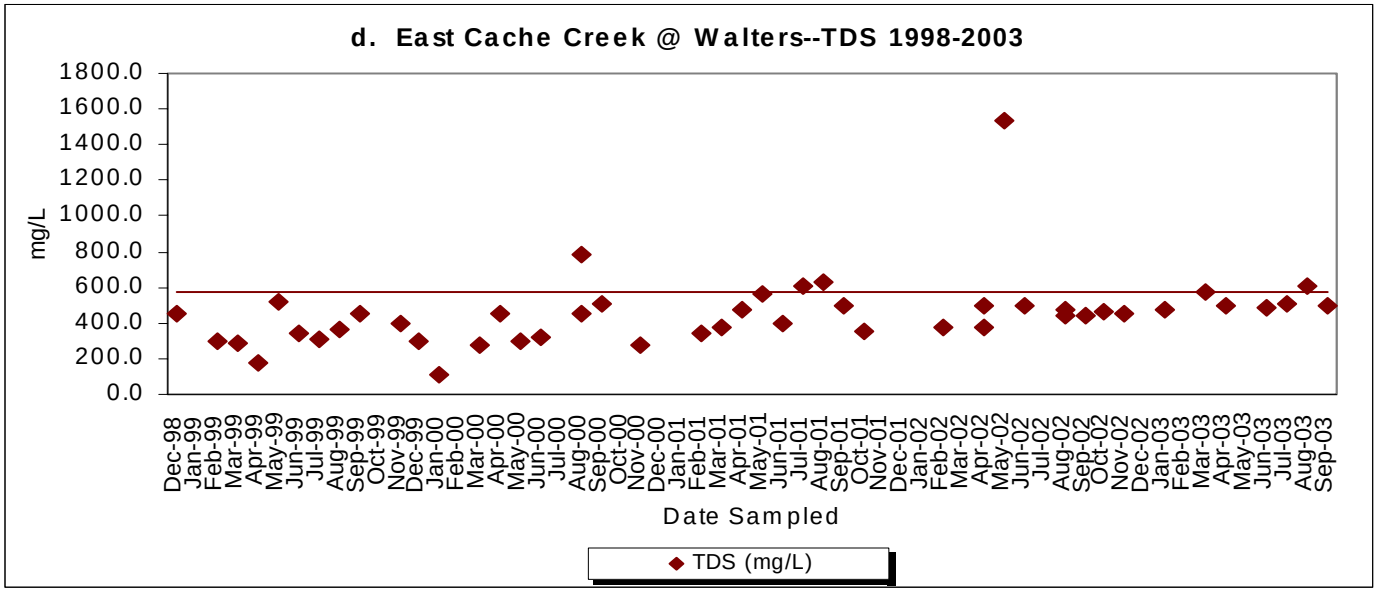
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 32 turbidity samples (Figure 85c), 18 samples (or 56%) exceeded the numerical criteria of 50. Of the 15 toxicant samples collected, 2 of the selenium concentrations (or 13%) exceeded the prescribed chronic criteria of 5 µg/L (Table 31). Dissolved oxygen (Figure 85a), pH (Figure 85b), and toxicant samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 85d and Figure 85e). The PBCR beneficial use is not supported (Table 32). Of the 27 fecal coliform concentrations, 11 samples (or 41%) exceeded the prescribed screening level of 400 cfu/mL, and the geometric mean (666.7 cfu/mL) exceeded the prescribed mean standard of 400 cfu/mL. Of the 27 enterococci concentrations, 16 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (906.0 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. Of the 27 *E.coli* concentrations, 4 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (203.1 cfu/mL) exceeded the prescribed mean standard of 126 cfu/mL. This segment of East Cache Creek is not nutrient-threatened. Although the median of the total phosphorus concentrations (0.823 mg/L) exceeded the threshold median of 0.36 mg/L, the station is light-limited due to a mean inorganic turbidity of > 20 NTU. The nitrate/nitrite median value was below the threshold median of 5.0 mg/L (Figure 85f).

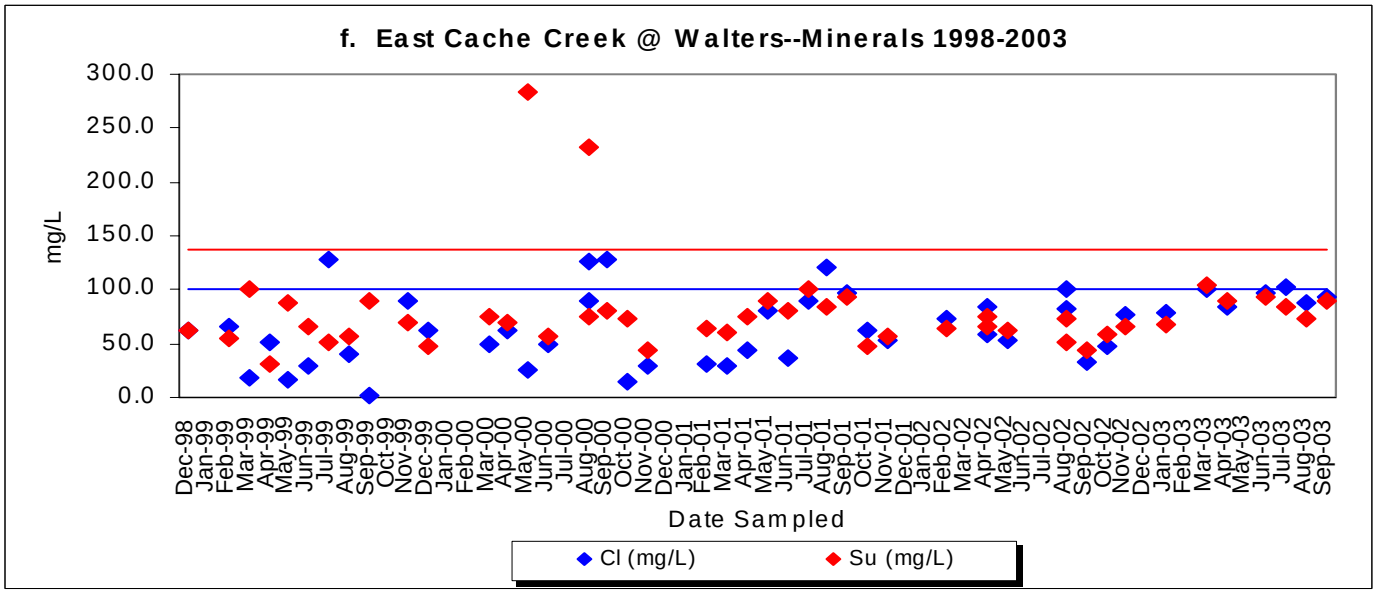
Figure 85a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on East Cache Creek at Walters (AT311000), 1998-2003.

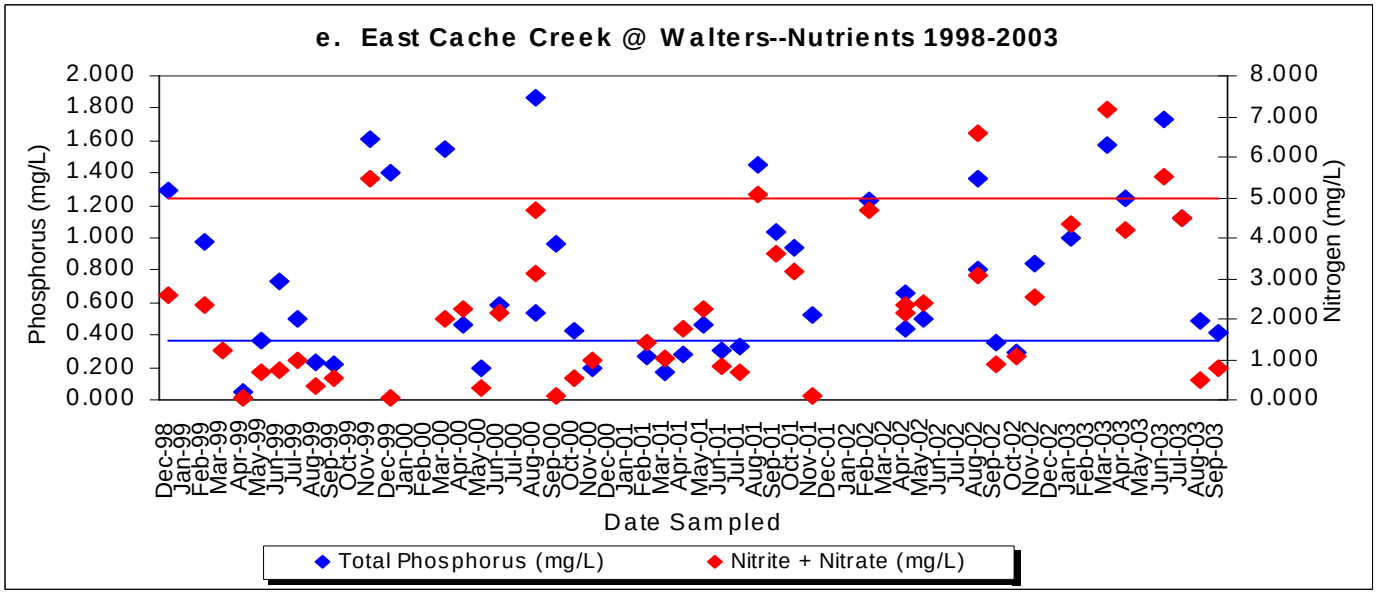







d. East Cache Creek @ Walters--TDS 1998-2003
mg/L
Date Sampled
TDS (mg/L)


f. East Cache Creek @ Walters--Minerals 1998-2003
mg/L
Date Sampled
Cl (mg/L)
Su (mg/L)


e. East Cache Creek @ Walters--Nutrients 1998-2003
Phosphorus (mg/L)
Nitrogen (mg/L)
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

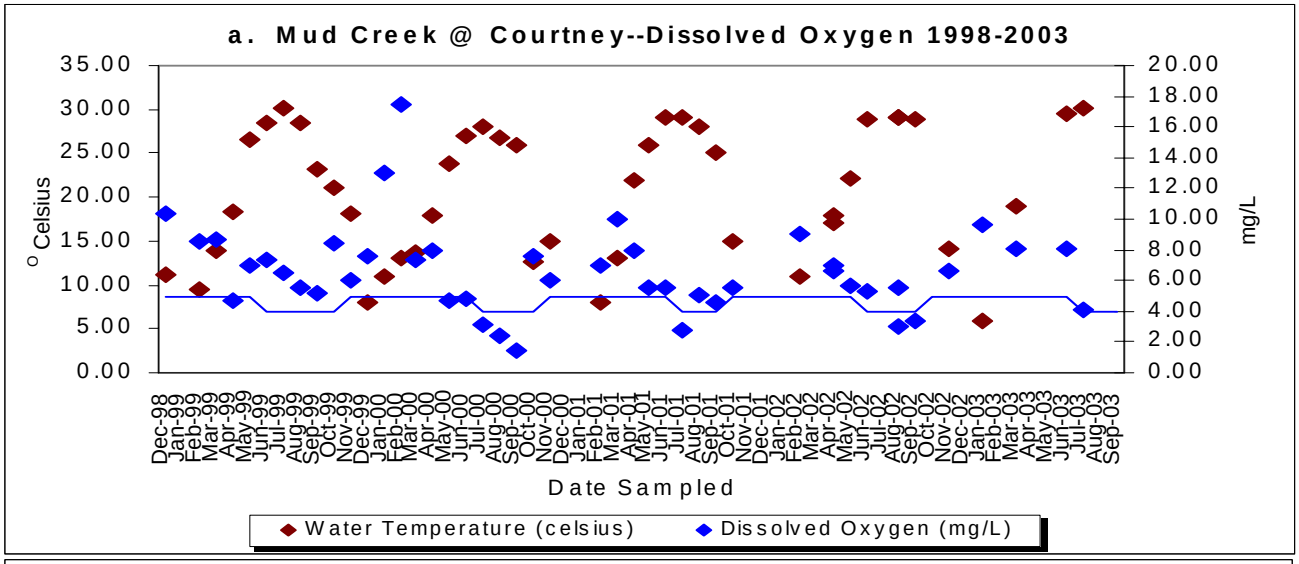
Mud Creek near Courtney

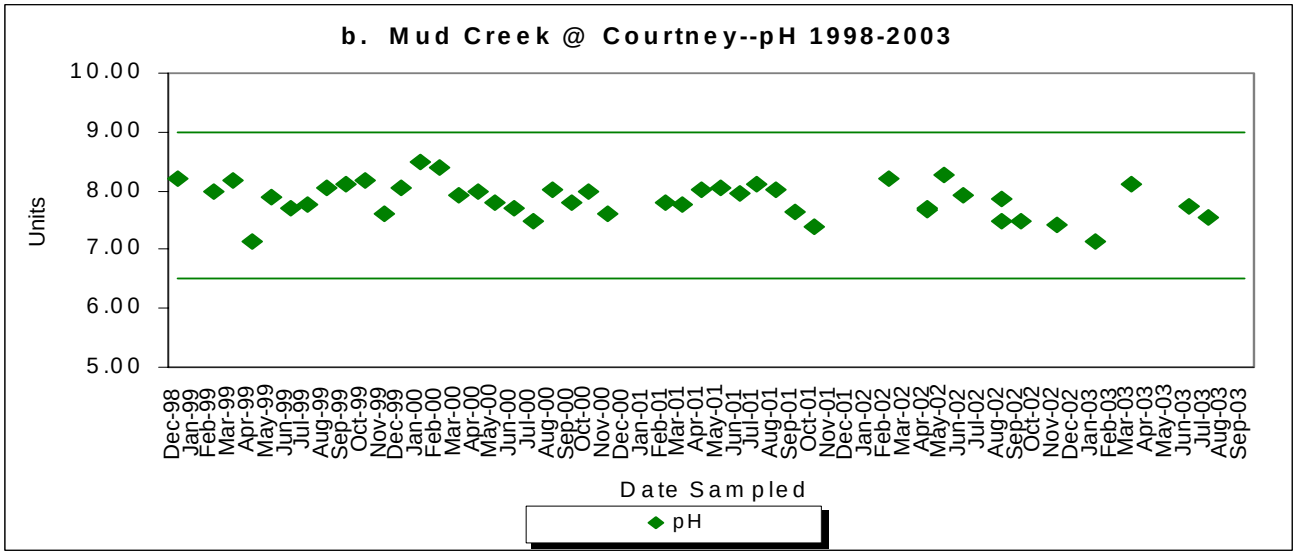
Station AT315700 (311100040010-001AT) is a permanent ambient trend monitoring station located on Mud Creek. Situated in the southwestern portion of Love County, the site was established west of the Town of Courtney on State Highway 32. The station is positioned near the terminal end of stream segment 311100040010 and is classified within the Farmer's - Mud Creek 8-digit HUC watershed (11130201). Water enters the stream system from several tributaries including Crooked Creek, Negro Creek, North Mud Creek, and Clear Creek, among others.

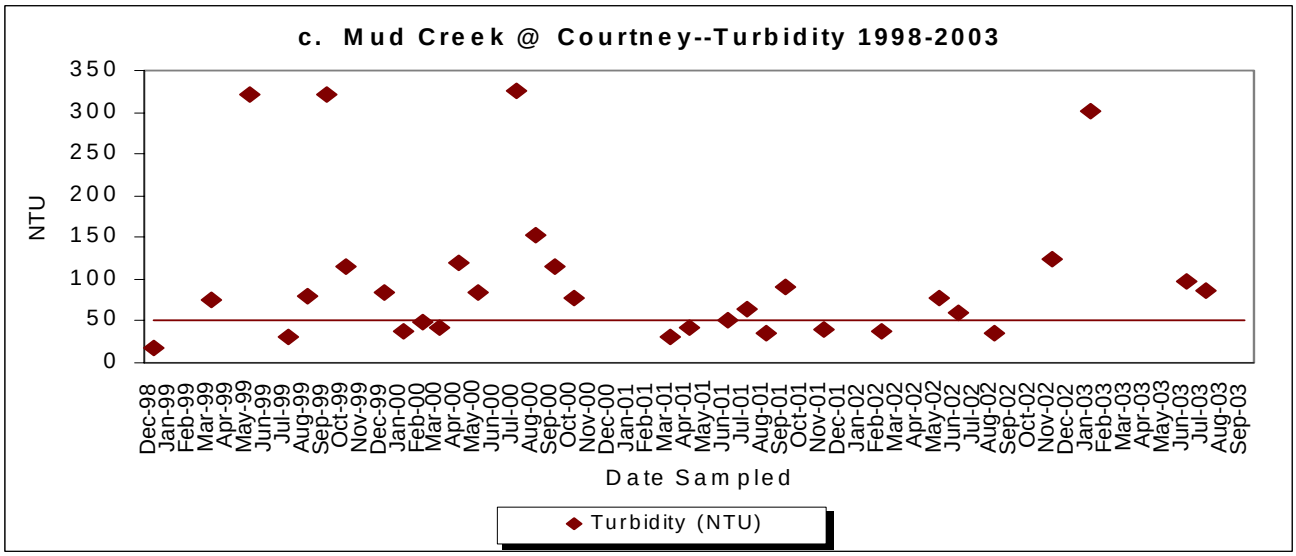
This station on Mud Creek has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through September of 2003. For purposes of reporting, this station is representative of Mud Creek from the confluence of Crooked Creek (97.7102, 34.2055) downstream to confluence of Mud Creek with the Red River (97.4740, 33.9120). As per Appendix A, Table 3 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

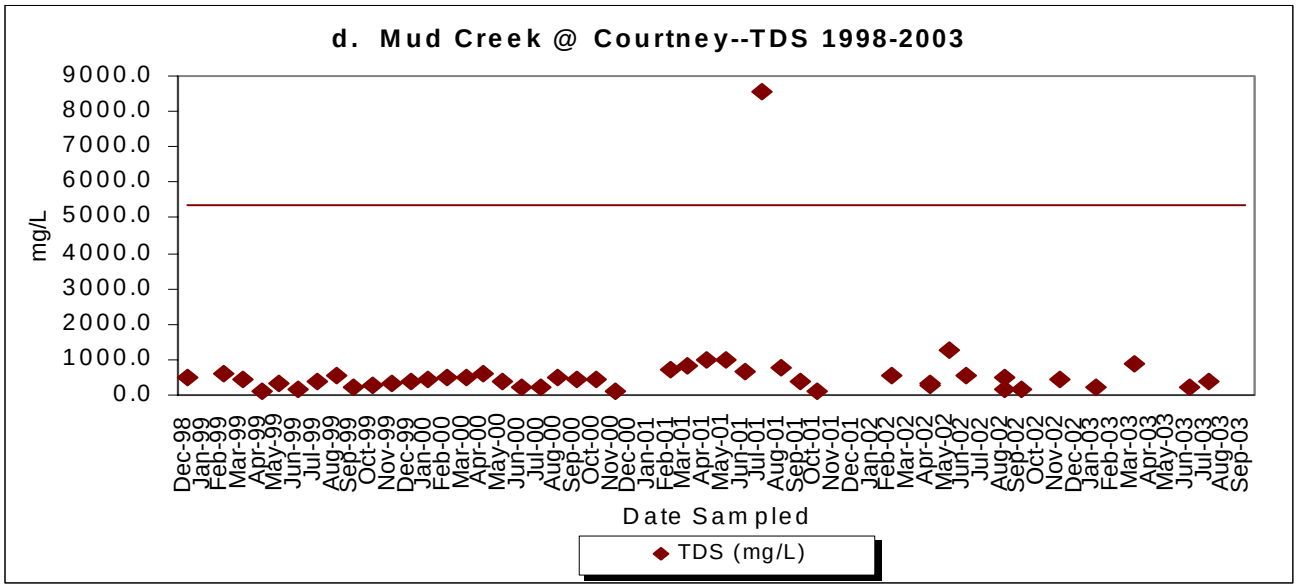
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 32 turbidity samples (Figure 86c), 21 samples (or 66%) exceeded the numerical criteria of 50. Of the 47 dissolved oxygen samples (Figure 86a), 11 samples (or 23%) were below the screening level. The pH (Figure 86b) and toxicant samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 86d and Figure 86e). The PBCR beneficial use is not supported (Table 32). Of the 19 fecal coliform concentrations, 6 samples (or 32%) exceeded the prescribed screening level of 400 cfu/mL. Of the 19 enterococci concentrations, 4 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (118.2 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of Mud Creek is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 86f).

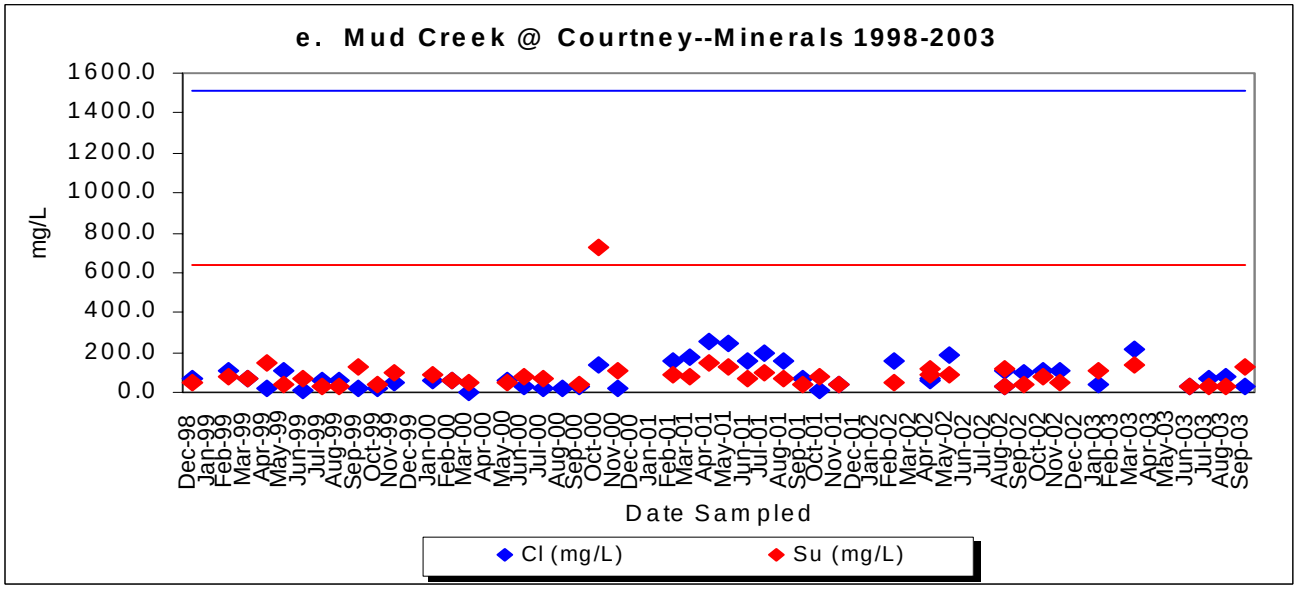
Figure 86a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on Mud Creek at Courtney (AT315700), 1998-2003.

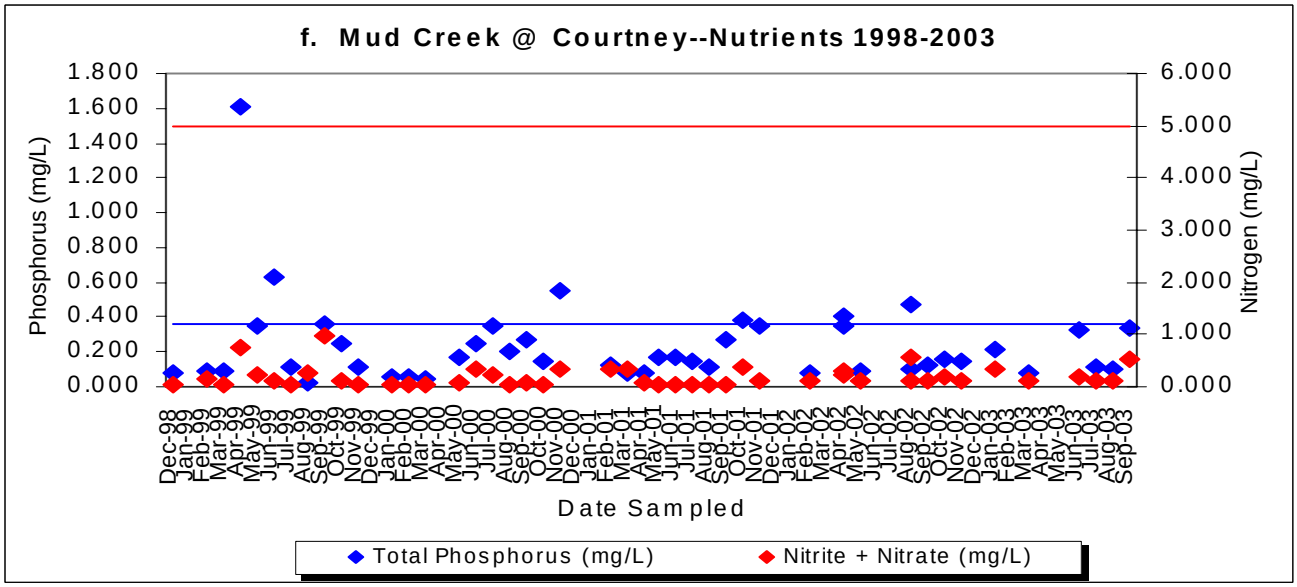







d. Mud Creek @ Courtney--TDS 1998-2003
mg/L
Date Sampled
TDS (mg/L)


e. Mud Creek @ Courtney--Minerals 1998-2003
mg/L
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Mud Creek @ Courtney--Nutrients 1998-2003
Phosphorus (mg/L)
Nitrogen (mg/L)
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

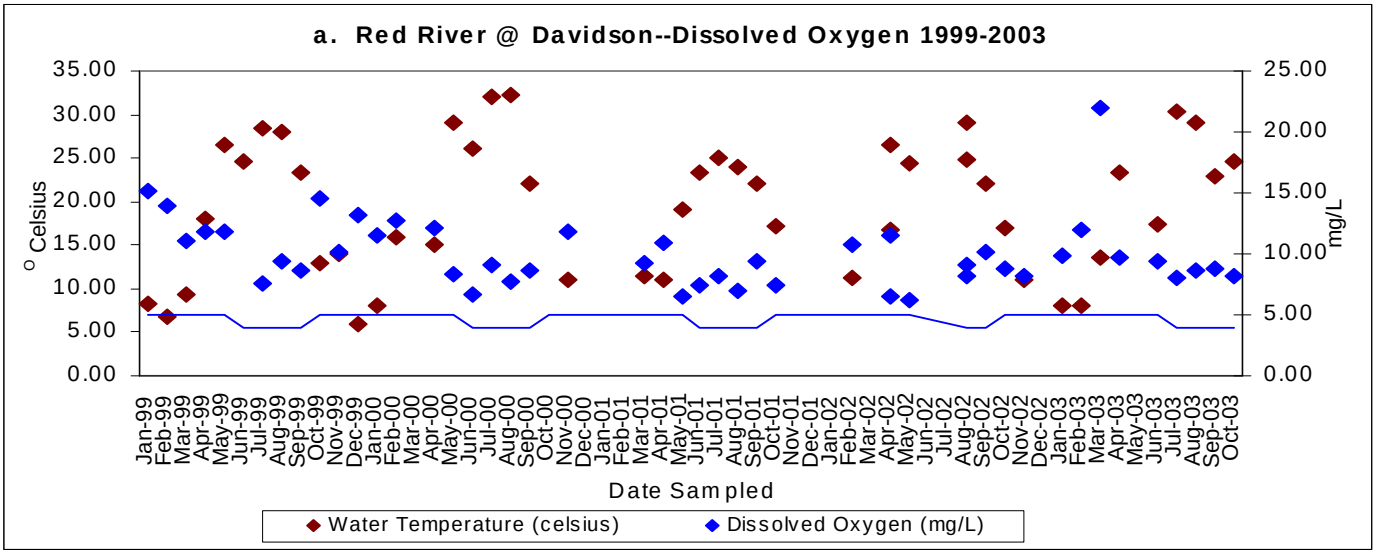
Red River near Davidson

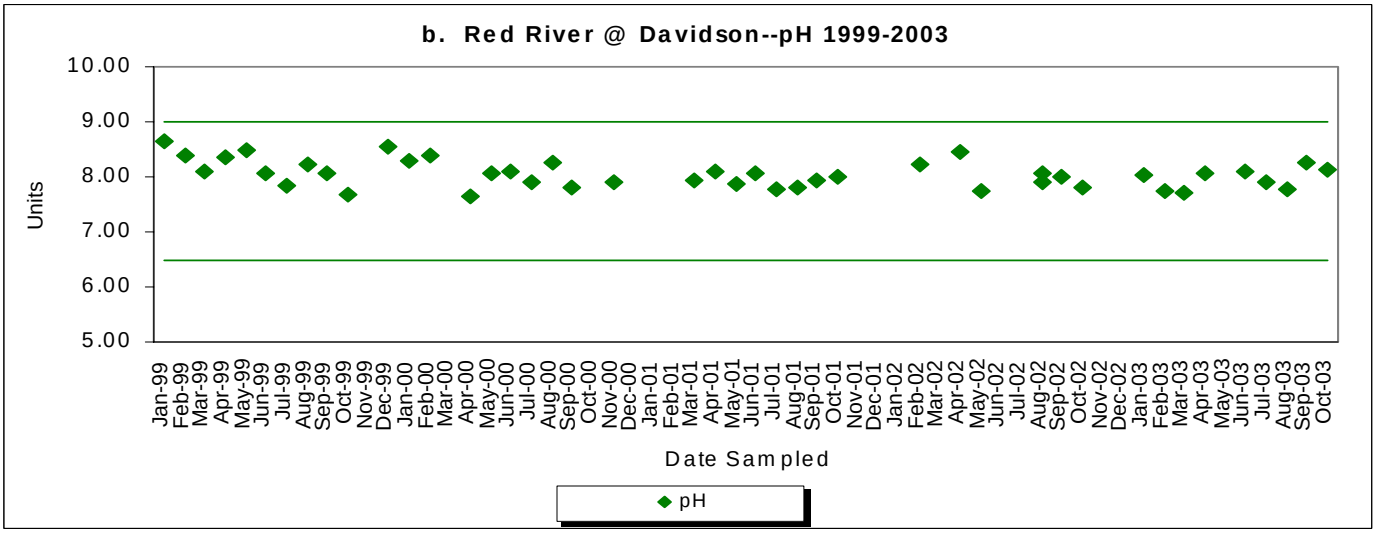
Station AT308000 (311310010010-001AT) is a permanent ambient trend monitoring station located on the Red River in Oklahoma. Situated in the southwestern portion of Tillman County, the site was established south of the Town of Davidson on US Highway 183. The station is positioned between the upper end and the midpoint of stream segment 311310010010 and is classified within the Blue Creek - China Creek 8-digit HUC watershed (11130102). Water enters the stream system from several tributaries including the North Fork of the Red River, Suttle Creek, Blue Creek, and Rabbit Creek, among others.

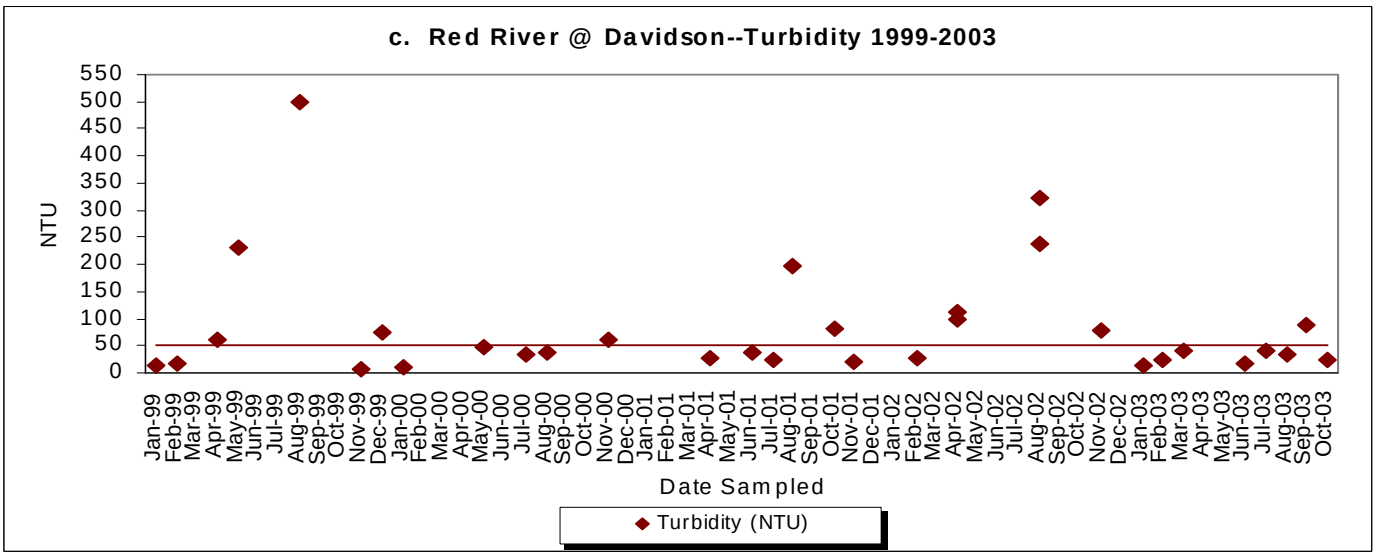
This station on the Red River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from January of 1999 through October of 2003. For purposes of reporting, this station is representative of the Red River from the confluence of the North Fork of the Red River (99.2096, 34.3326) downstream to above the confluence of Cache Creek with the Red River (98.2686, 34.1324). As per Appendix A, Table 3 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Emergency Water Supply (EWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

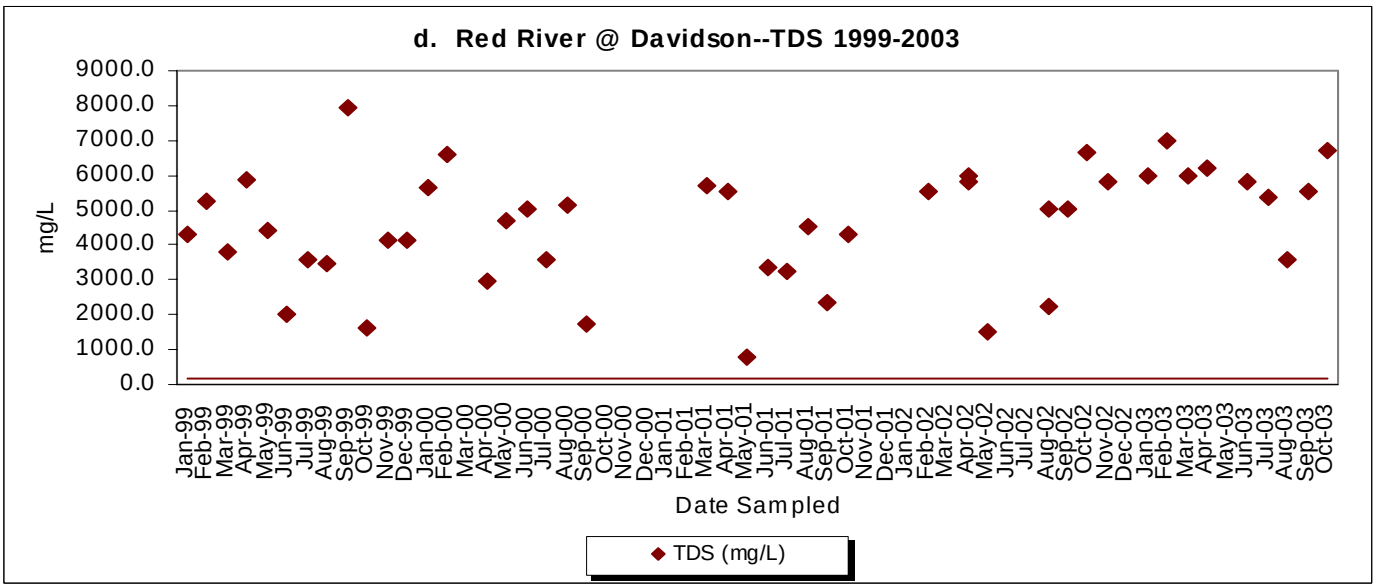
The WWAC beneficial use is not supported. Of the 15 toxicant samples collected, 6 of the selenium concentrations (or 40%) exceeded the prescribed chronic criteria of 5 µg/L (Table 31). Of the 32 turbidity samples (Figure 87c), 13 samples (or 41%) exceeded the numerical criteria of 50. Dissolved oxygen (Figure 87a) and pH (Figure 87b) samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is not supported (Figure 87d and Figure 87e). Of the 46 total dissolved solids concentrations, 46 samples (or 100%) exceeded the minimum sample standard of 750 mg/L (Appendix F sample standard is 151 mg/L), and the geometric mean (4980.3 mg/L) exceeded the yearly mean standard (126.0 mg/L) (Appendix F sample standard is 126 mg/L). Of the 47 chloride concentrations, 46 samples (or 98%) exceeded the sample standard of 450 mg/L, and the geometric mean (2089.2 mg/L) exceeded the yearly mean standard (292 mg/L). Of the 47 sulfate concentrations, 47 samples (or 100%) exceeded the prescribed minimum sample standard of 250 mg/L (Appendix F sample standard is 179 mg/L), and the geometric mean (1153.4 mg/L) exceeded the yearly mean standard (116 mg/L). The PBCR beneficial use is not supported (Table 32). Of the 18 fecal coliform concentrations, 7 samples (or 39%) exceeded the prescribed screening level of 400 cfu/mL. Of the 18 enterococci concentrations, 6 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (439.9 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Red River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 87f).

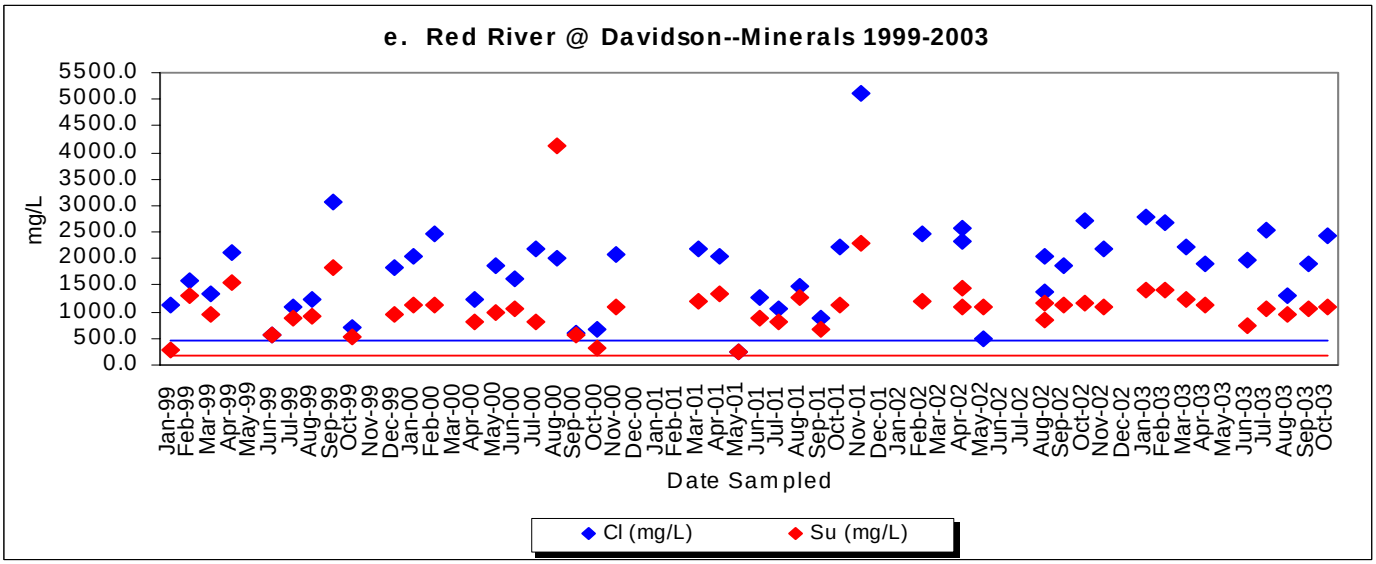
Figure 87a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Red River at Davidson (AT308000), 1999-2003.

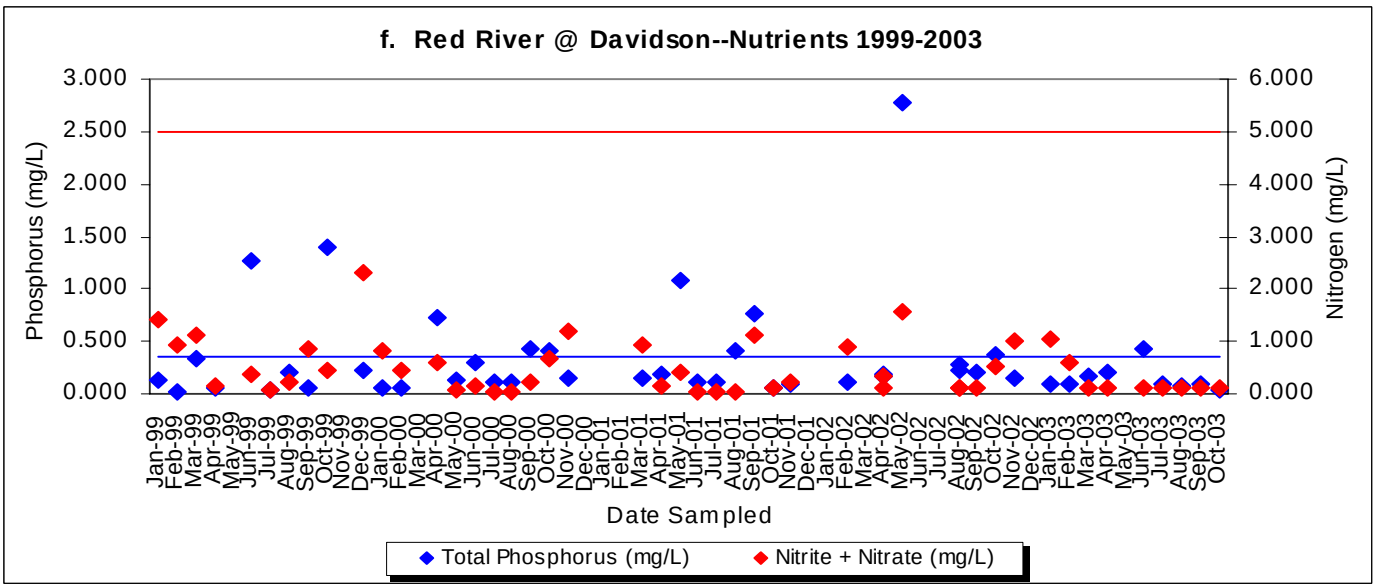







d. Red River @ Davidson--TDS 1999-2003
mg/L
Date Sampled
TDS (mg/L)


e. Red River @ Davidson--Minerals 1999-2003
mg/L
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Red River @ Davidson--Nutrients 1999-2003
Phosphorus (mg/L)
Nitrogen (mg/L)
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

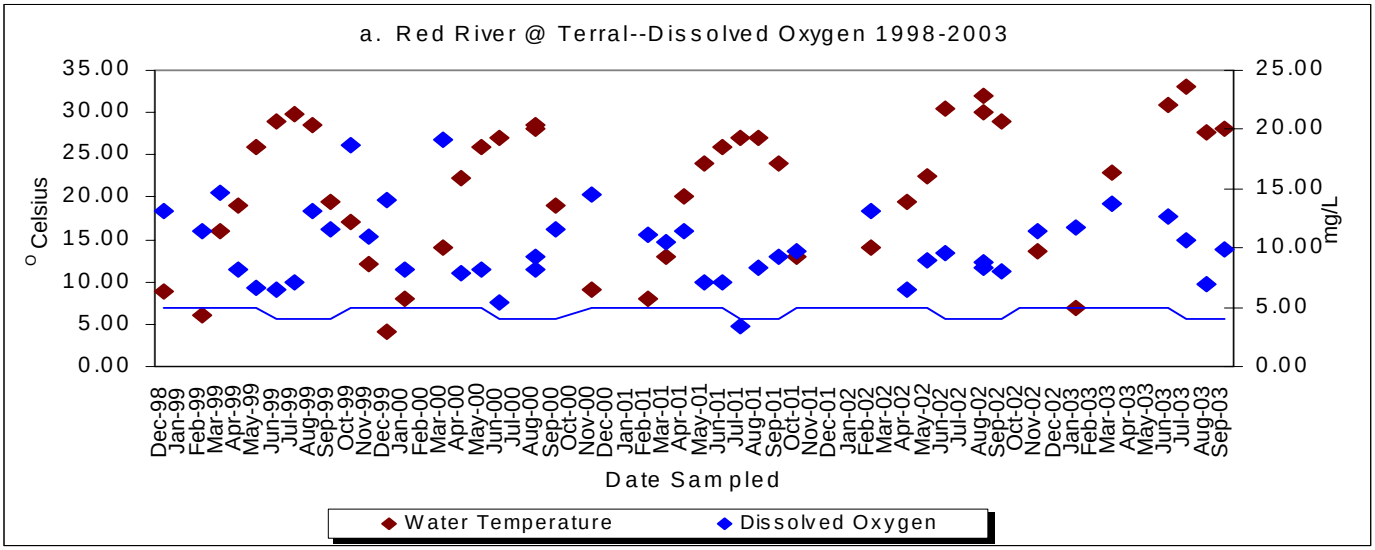
Red River near Terral

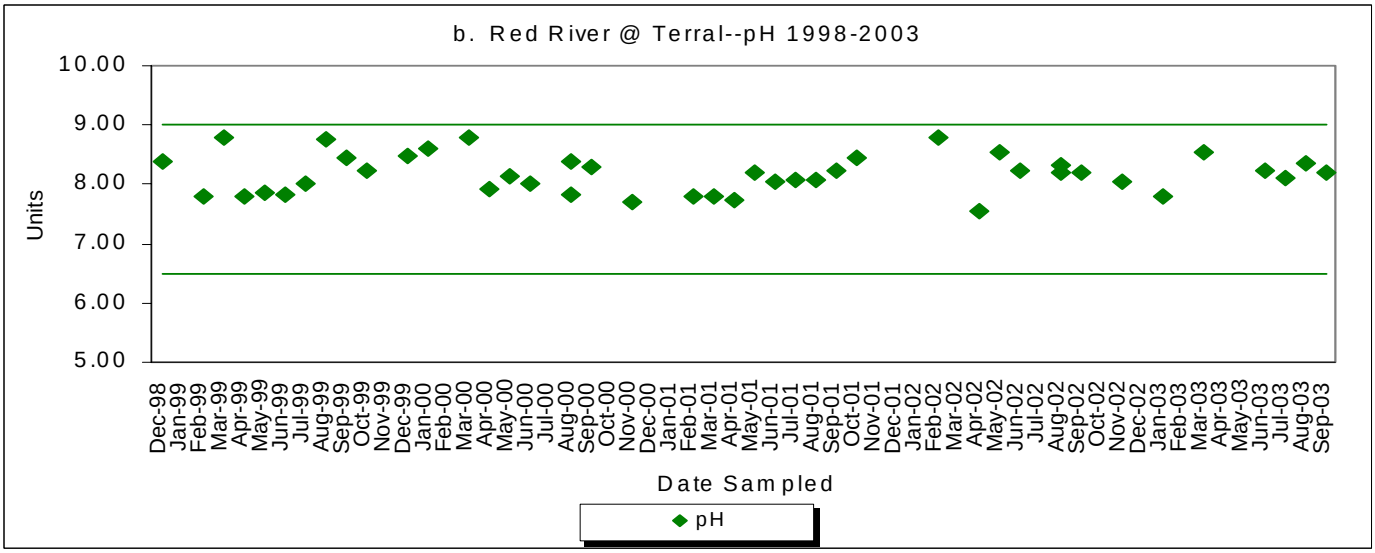
Station AT315500 (311100010190-001AT) is a permanent ambient trend monitoring station located on the Red River in Oklahoma. Situated in the south central portion of Jefferson County, the site was established south of the Town of Terral on US Highway 81. The station is positioned near the upper end of stream segment 311100010190 and is classified within the Farmer's - Mud Creek 8-digit HUC watershed (11130201). Water enters the stream system from several tributaries Fleetwood Creek and Red Creek, among others.

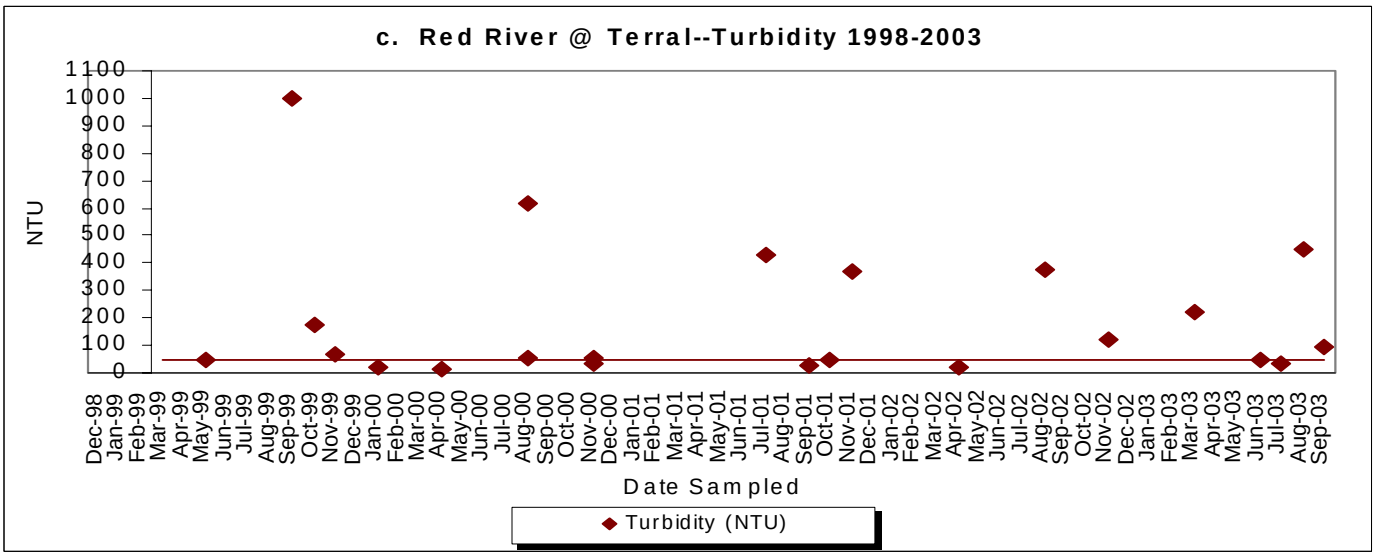
This station on the Red River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through September 2003. For purposes of reporting, this station is representative of the Red River from below the confluence of Beaver Creek (97.9465, 33.9913) downstream to above the confluence of Mud Creek with the Red River (97.4741, 33.9121). As per Appendix A, Table 3 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

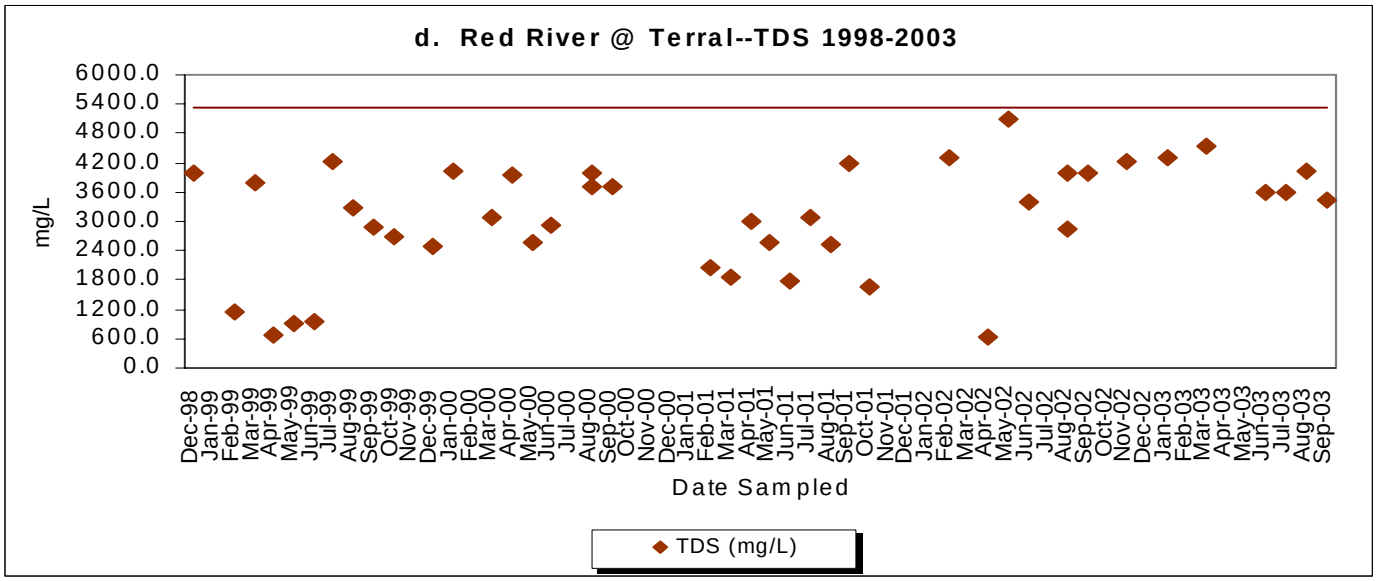
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 22 turbidity samples (Figure 88c), 13 samples (or 59%) exceeded the numerical criteria of 50. Of the 15 selenium samples collected, 2 of the concentrations (or 13%) exceeded the prescribed chronic criteria of 5 µg/L (Table 31). Dissolved oxygen (Figure 88a), pH (Figure 88b), and toxicant data collected during the same period met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is not supported (Figure 88d and Figure 88e). Of the 44 sulfate concentrations, 25 samples (or 57%) exceeded the sample standard of 634 mg/L, and the geometric mean (509.7 mg/L) exceeded the yearly mean standard (455 mg/L). Of the 44 chloride concentrations, 11 samples (or 25%) exceeded the sample standard of 1508 mg/L, and the geometric mean (1222.3 mg/L) exceeded the yearly mean standard (1059 mg/L). The PBCR beneficial use is not supported (Table 32). Of the 19 enterococci concentrations, 2 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (105.3 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of Red River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 88f).

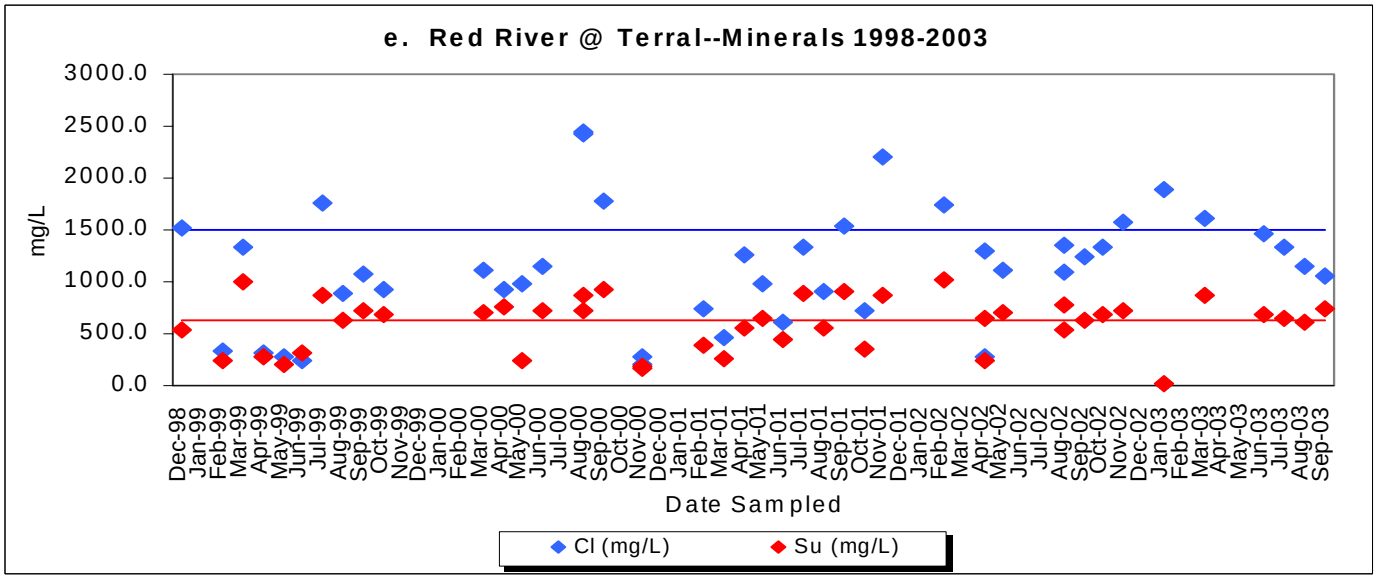
Figure 88a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Red River at Terral (AT315500), 1998-2003.

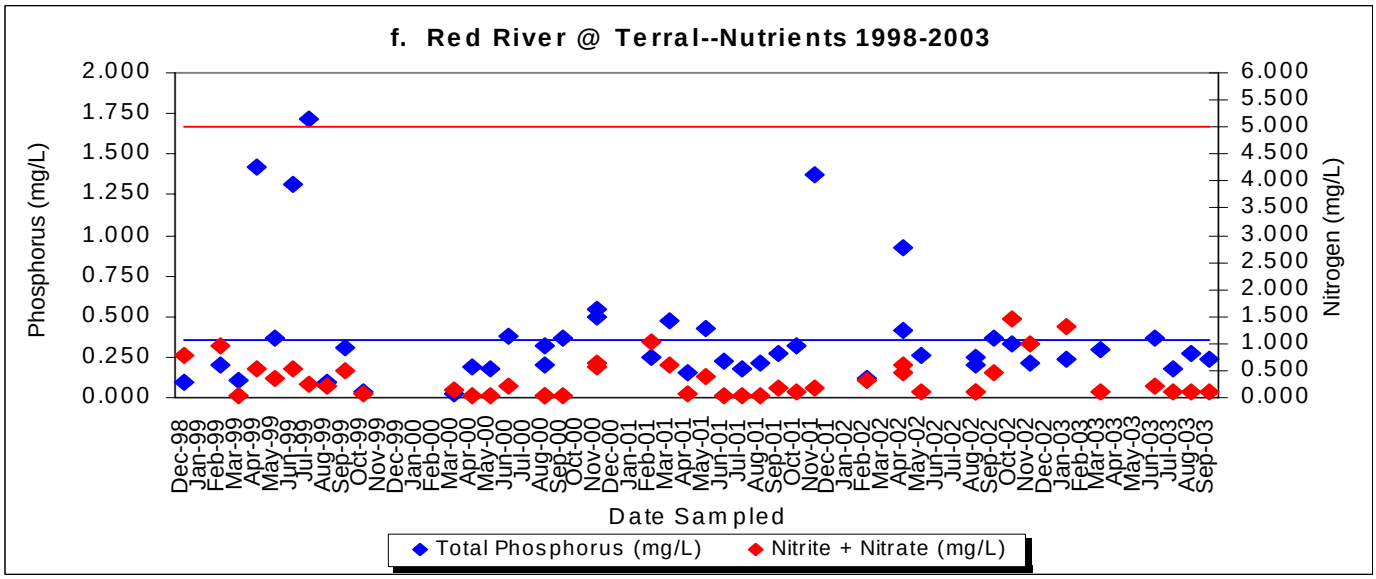







d. Red River @ Terral--TDS 1998-2003
mg/L
Date Sampled
TDS (mg/L)


e. Red River @ Terral--Minerals 1998-2003
mg/L
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Red River @ Terral--Nutrients 1998-2003
Phosphorus (mg/L)
Nitrogen (mg/L)
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

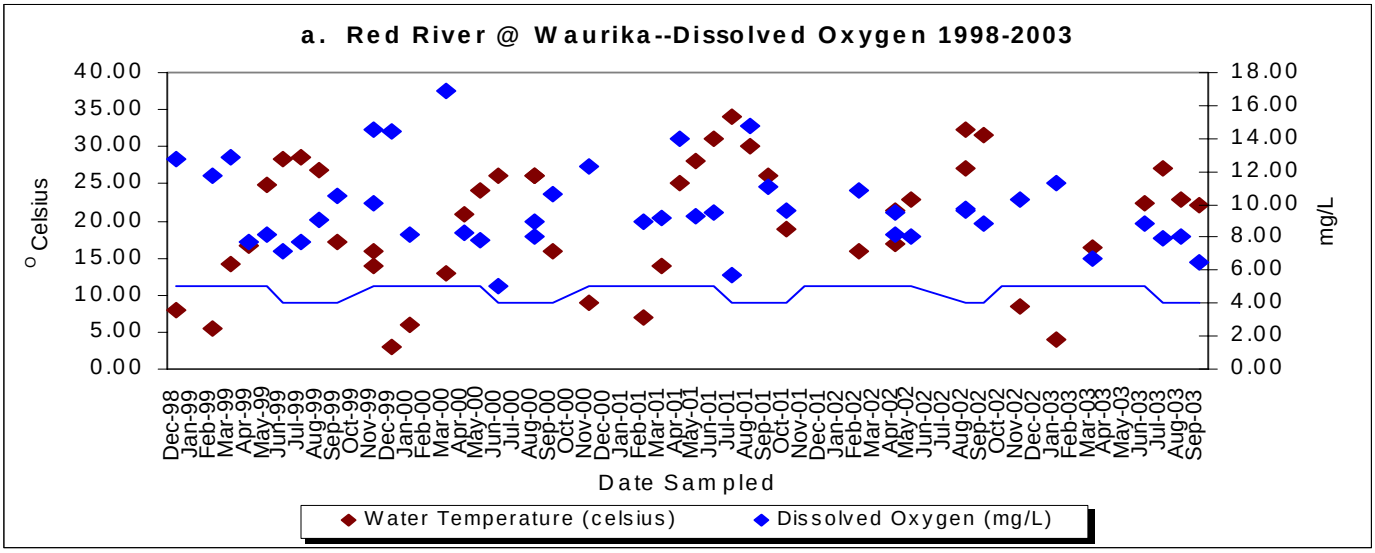
Red River near Waurika

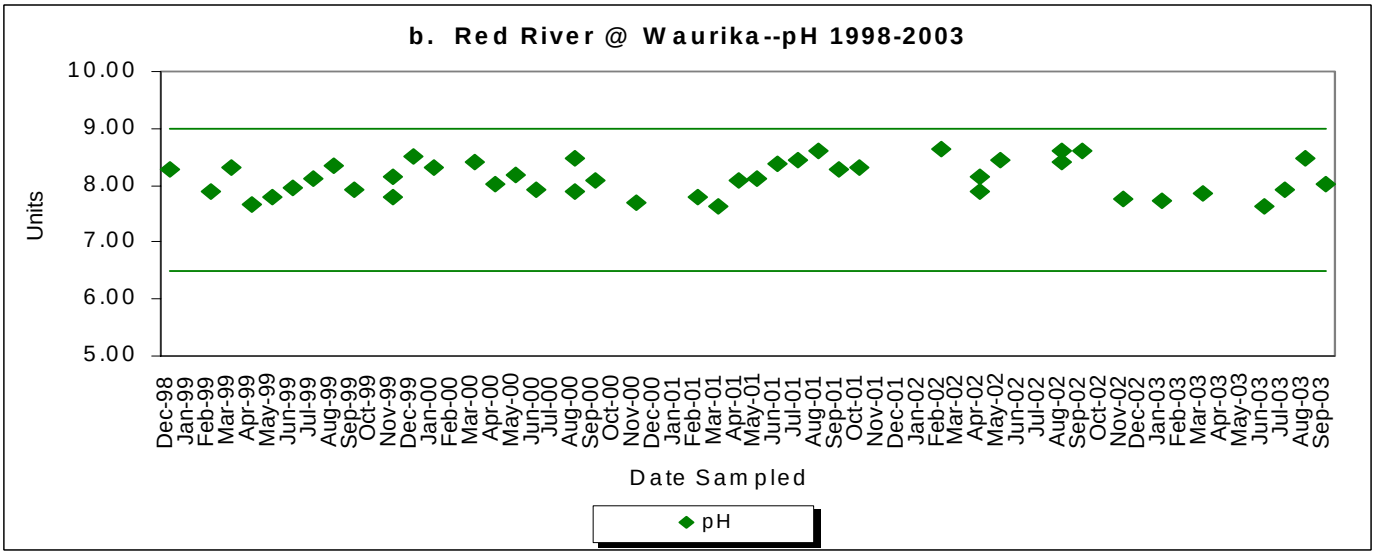
Station AT312720 (311200000010-001AT) is a permanent ambient trend monitoring station located on the Red River in Oklahoma. Situated in the northwestern portion of Jefferson County, the site was established west-southwest of the Town of Waurika on State Highway 79. The station is positioned near the upper end of stream segment 311200000010 and is classified within the Farmer's - Mud Creek 8-digit HUC watershed (11130201). Water enters the stream system from Cache Creek and Beaver Creek, among others.

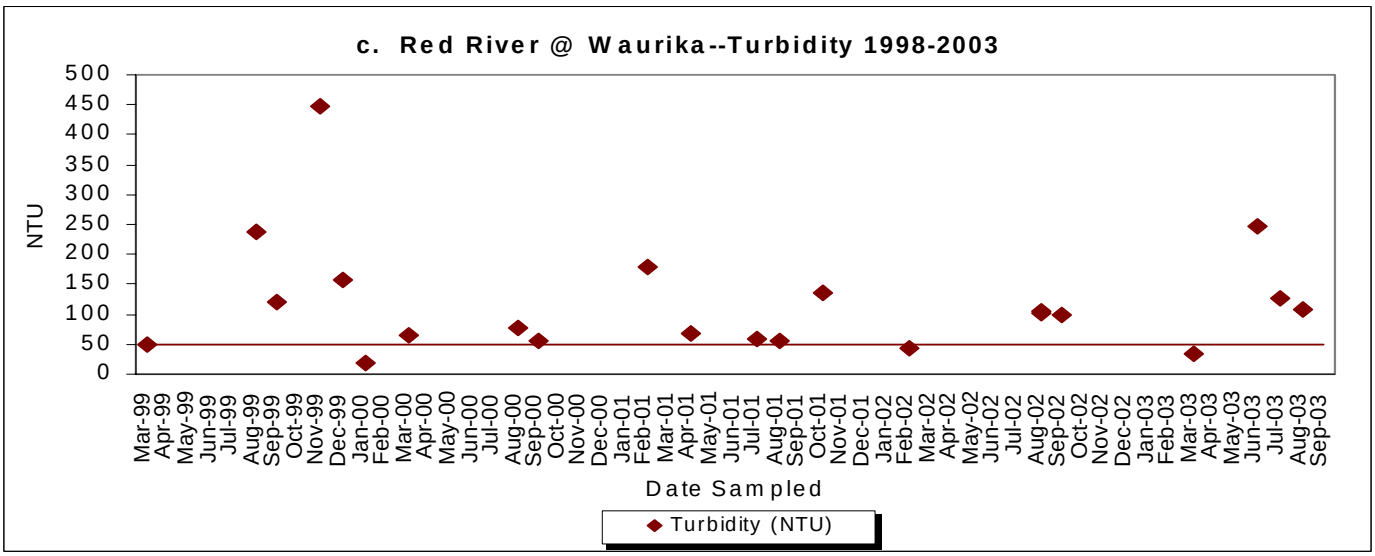
This station on the Red River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through September of 2003. For purposes of reporting, this station is representative of the Red River from the confluence of Cache Creek (98.2680, 34.1325) downstream to confluence of Beaver Creek with the Red River (97.9470, 33.9916). As per Appendix A, Table 7 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

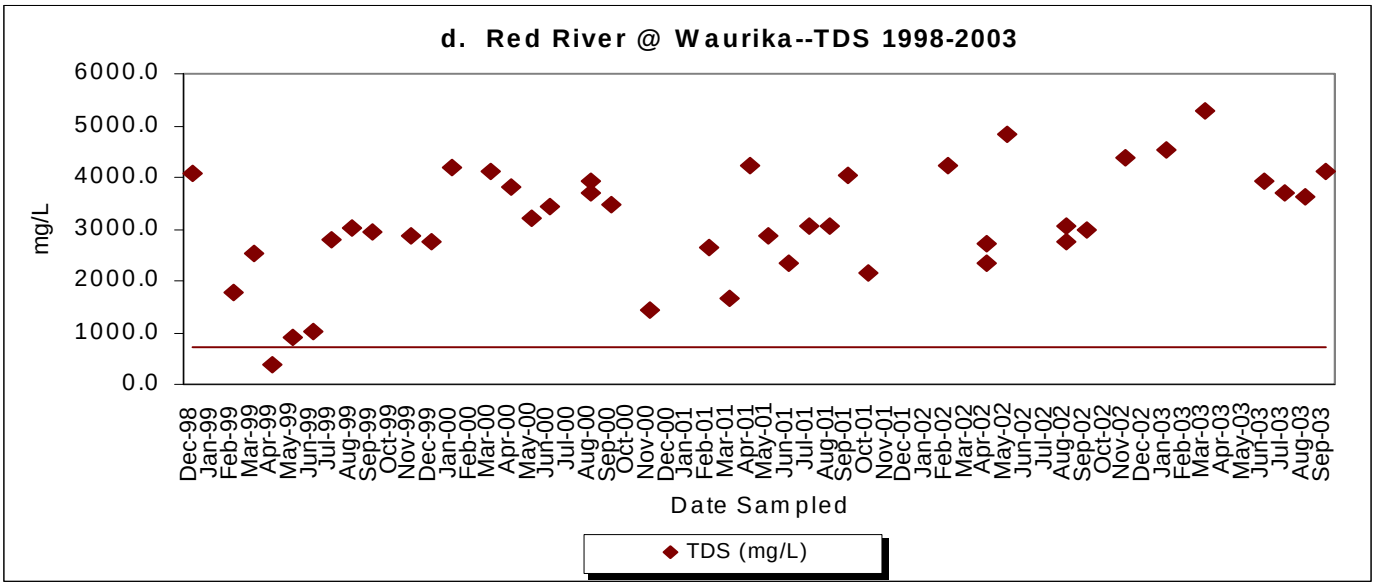
The PPWS beneficial use is partially supported. Of the 14 selenium samples collected, 2 of the concentrations (or 14%) exceeded the prescribed criterion of 10 µg/L (Table 31). The WWAC beneficial use is not supported. Of the 22 turbidity samples (Figure 89c), 18 samples (or 82%) exceeded the numerical criteria of 50. Of the 14 toxicant samples collected, 2 of the selenium concentrations (or 14%) exceeded the prescribed chronic criteria of 5 µg/L (Table 31). Dissolved oxygen (Figure 89a) and pH (Figure 89b) data collected during the same period met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is not supported (Figure 89d and Figure 89e). Of the 43 total dissolved solids concentrations, 42 samples (or 98%) exceeded the minimum sample standard of 750 mg/L (Appendix F sample standard is 700 mg/L), and the geometric mean (3518.2 mg/L) exceeded the yearly mean standard (700 mg/L). Of the 45 chloride concentrations, 39 samples (or 87%) exceeded the prescribed sample standard of 313 mg/L, and the geometric mean (1123.6 mg/L) exceeded the yearly mean standard (229 mg/L). Of the 45 sulfate concentrations, 37 samples (or 78%) exceeded the prescribed sample standard of 348 mg/L, and the geometric mean (623.9 mg/L) exceeded the yearly mean standard (246 mg/L). The PBCR beneficial use is not supported (Table 32). Of the 26 enterococci concentrations, 2 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (76.6 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Red River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 89f).

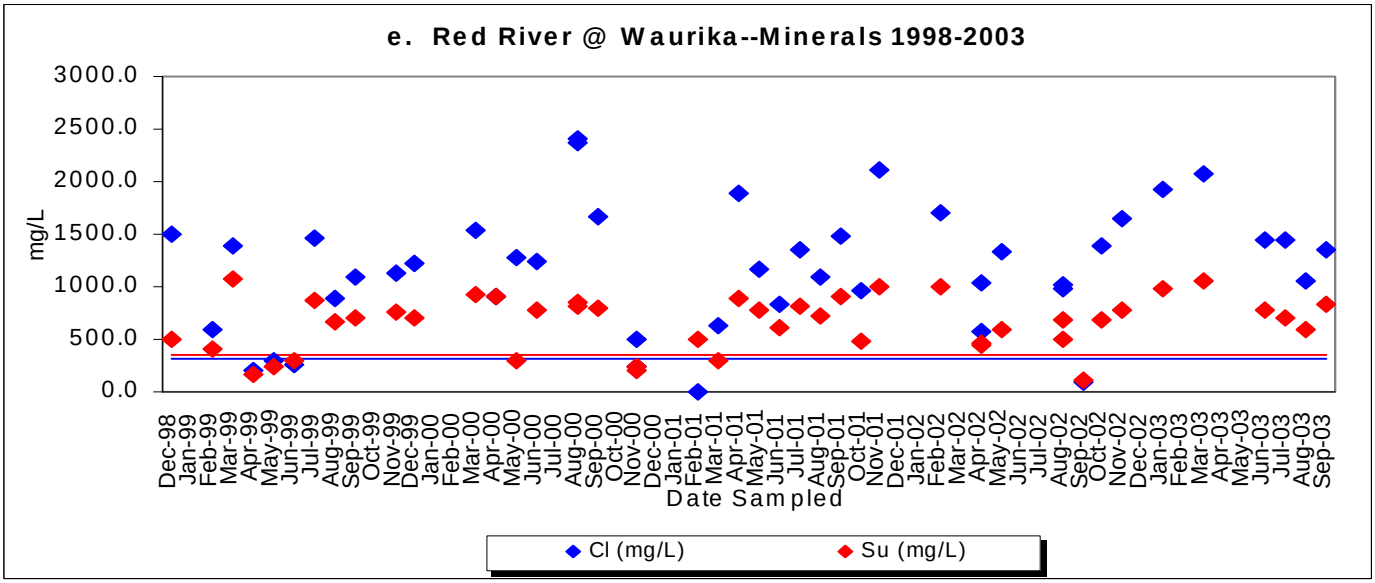
Figure 89a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Red River at Waurika (AT312720), 1998-2003.

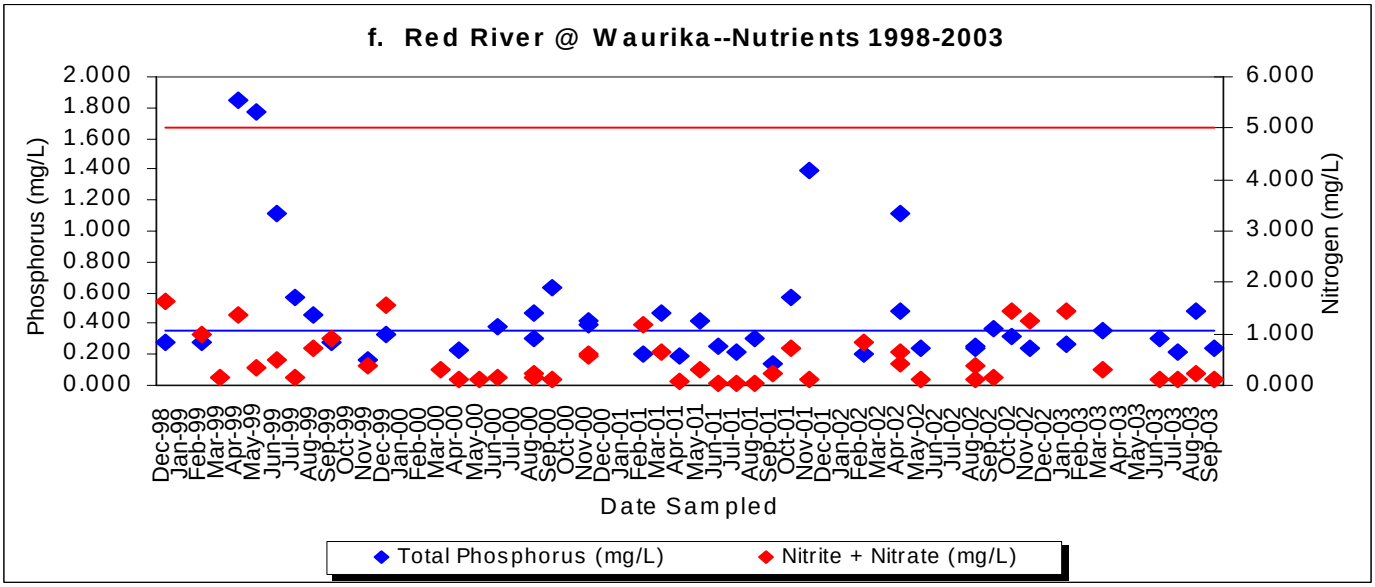







d. Red River @ Waurika--TDS 1998-2003
mg/L
6000.0
5000.0
4000.0
3000.0
2000.0
1000.0
0.0
Date Sampled
TDS (mg/L)


e. Red River @ Waurika--Minerals 1998-2003
mg/L
3000.0
2500.0
2000.0
1500.0
1000.0
500.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Red River @ Waurika--Nutrients 1998-2003
Phosphorus (mg/L)
2.000
1.800
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

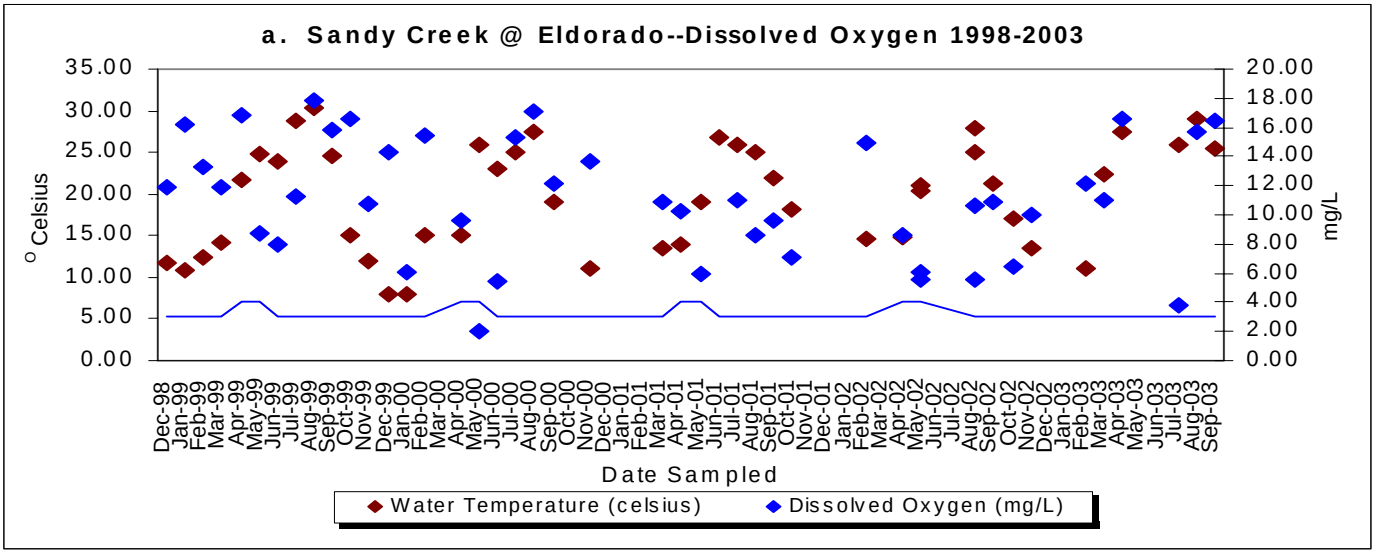
Sandy Creek near Eldorado

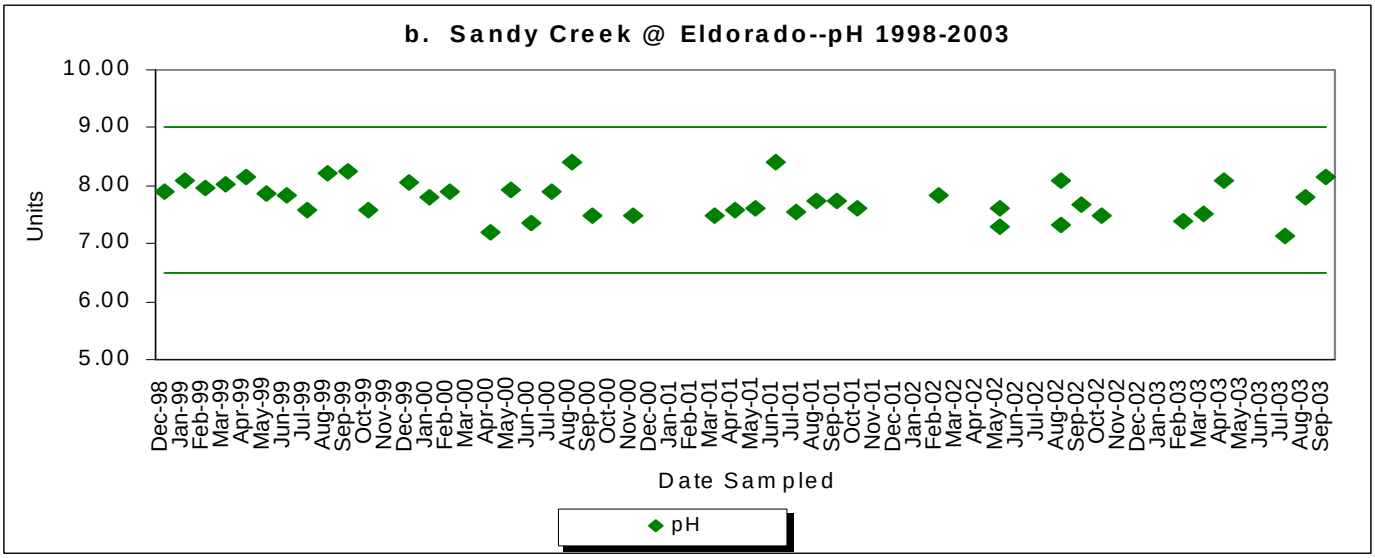
Station AT299710 (311600010040-001AT) is a permanent ambient trend monitoring station located on Sandy Creek. Situated in the southwestern portion of Jackson County, the site was established west of the Town of Eldorado on State Highway 6. The station is positioned near the terminal end of stream segment 311600010040 and is classified within the Groesbeck Creek - Sandy Creek 8-digit HUC watershed (11130101). Water enters the stream system from several tributaries including Lebos Creek, among others.

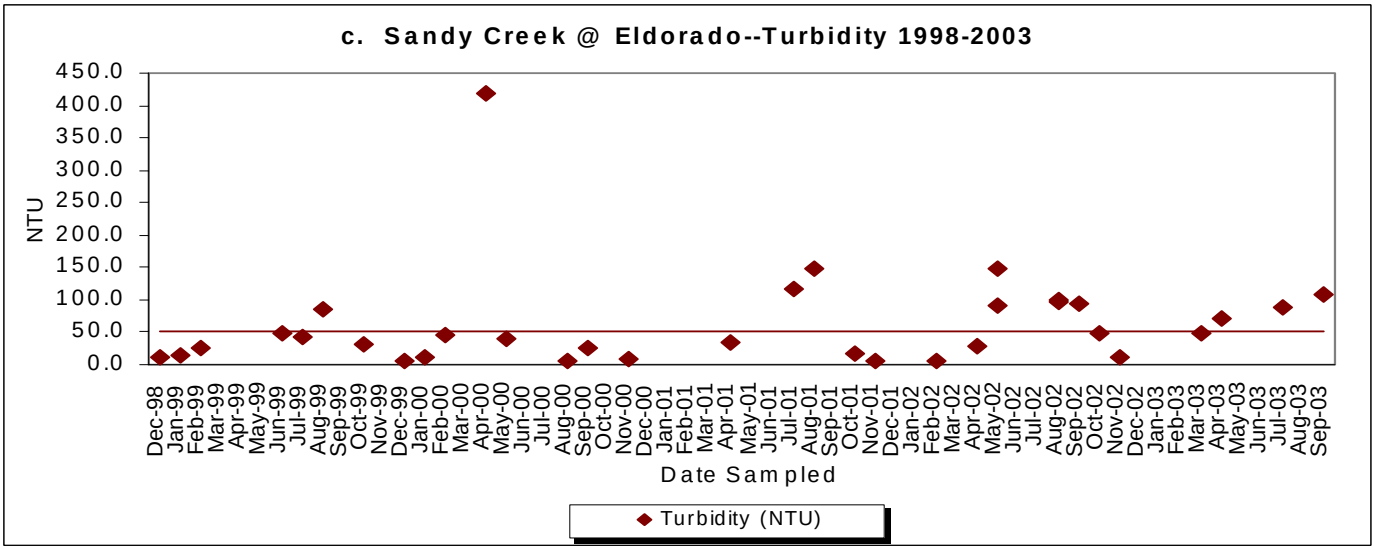
This station on Sandy Creek has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through September of 2003. For purposes of reporting, this station is representative of Sandy Creek from the confluence of Lebos Creek (99.8453, 34.6414) downstream to confluence of Sandy Creek with the Red River (99.5800, 34.4166). As per Appendix A, Table 3 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Emergency Water Supply (EWS), 2) Habitat Limited Aquatic Community—Fish and Wildlife Propagation (HLAC), 3) Agriculture—Class I Irrigation (AG), 4) Secondary Body Contact—Recreation (SBCR), and 5) Aesthetics.

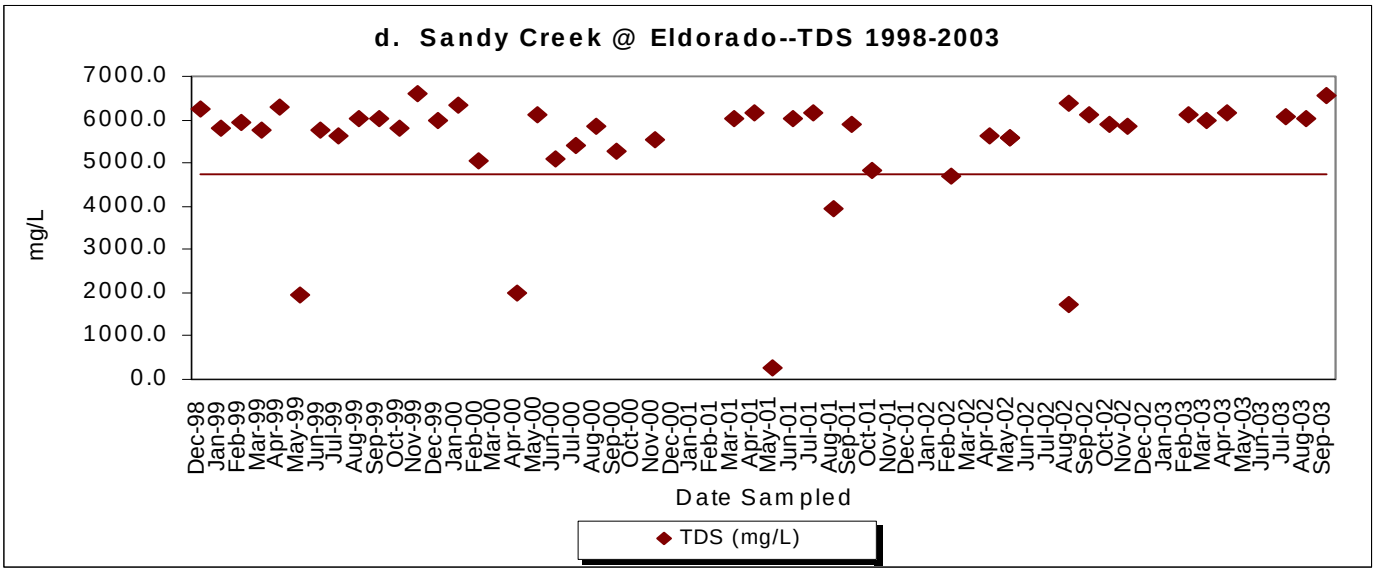
The HLAC beneficial use is not supported. Of the 14 selenium samples collected, 11 of the concentrations (or 79%) exceeded the prescribed chronic criteria of 5 µg/L, and 7 of the concentrations (or 50%) exceeded the prescribed acute criteria of 20 µg/L (Table 31). Of the 33 turbidity samples (Figure 90c), 12 samples (or 36%) exceeded the numerical criteria of 50. Dissolved oxygen (Figure 90a) and pH (Figure 90b) samples met the criteria prescribed in the HLAC beneficial use. The AG beneficial use is not supported (Figure 90d and Figure 90e). Of the 45 total dissolved solids concentrations, 39 samples (or 87%) exceeded the sample standard of 4762.0 mg/L, and the geometric mean (5384.7 mg/L) exceeded the yearly mean standard of 3730 mg/L. Of the 46 chloride concentrations, 44 samples (or 96%) exceeded the sample standard of 1011.0 mg/L, and the geometric mean (2011.8 mg/L) exceeded the yearly mean standard of 704 mg/L. The geometric mean (1789.6 mg/L) of the sulfate samples exceeded the yearly mean standard of 1680 mg/L. Sulfate values met the prescribed segment-specific sample and yearly mean standards. This segment of Sandy Creek is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 90f).

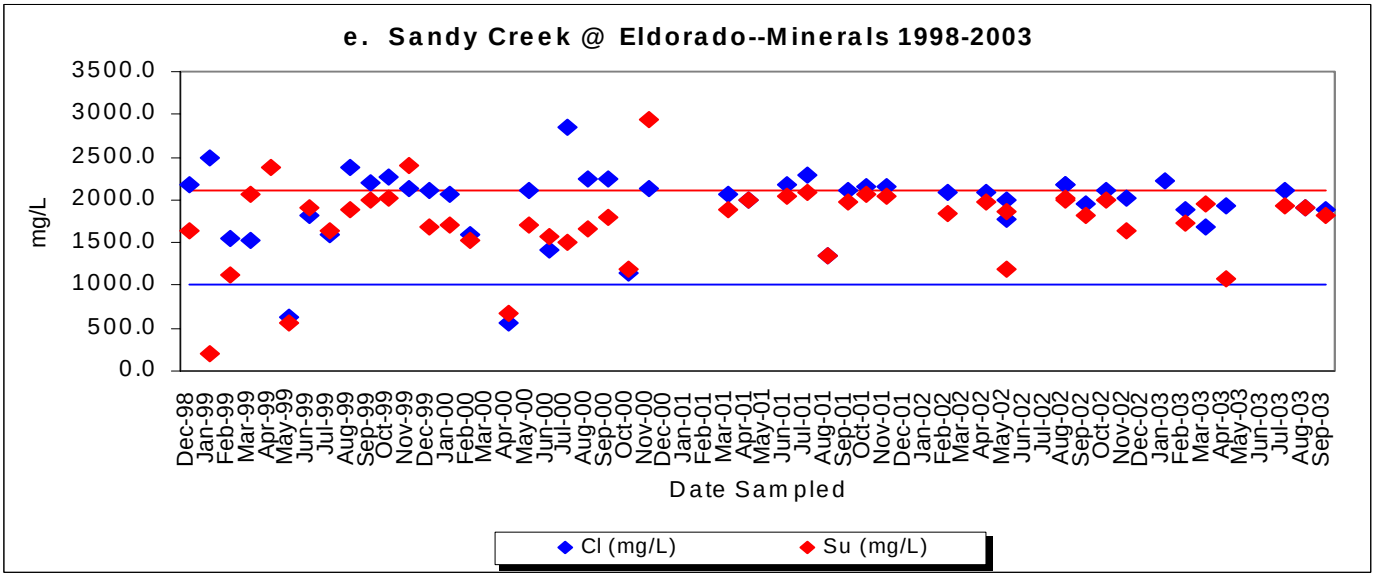
Figure 90a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on Sandy Creek at Eldorado (AT299710), 1998-2003.

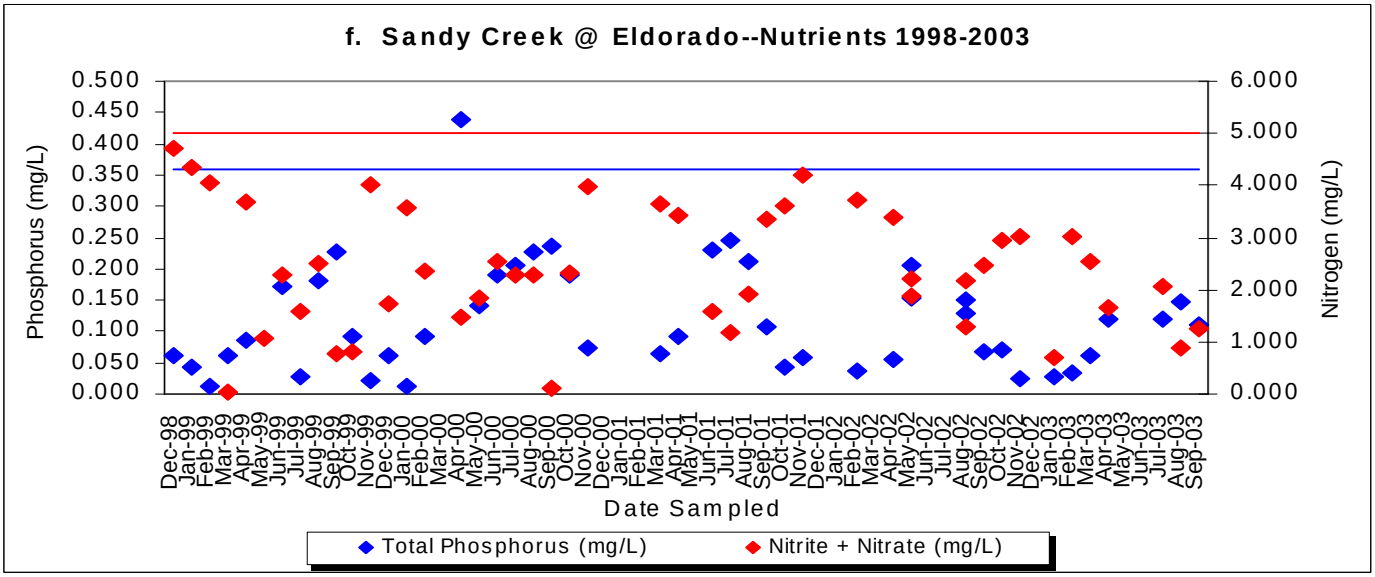







d. Sandy Creek @ Eldorado--TDS 1998-2003
mg/L
7000.0
6000.0
5000.0
4000.0
3000.0
2000.0
1000.0
0.0
Date Sampled
TDS (mg/L)


e. Sandy Creek @ Eldorado--Minerals 1998-2003
mg/L
3500.0
3000.0
2500.0
2000.0
1500.0
1000.0
500.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Sandy Creek @ Eldorado--Nutrients 1998-2003
Phosphorus (mg/L)
0.500
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

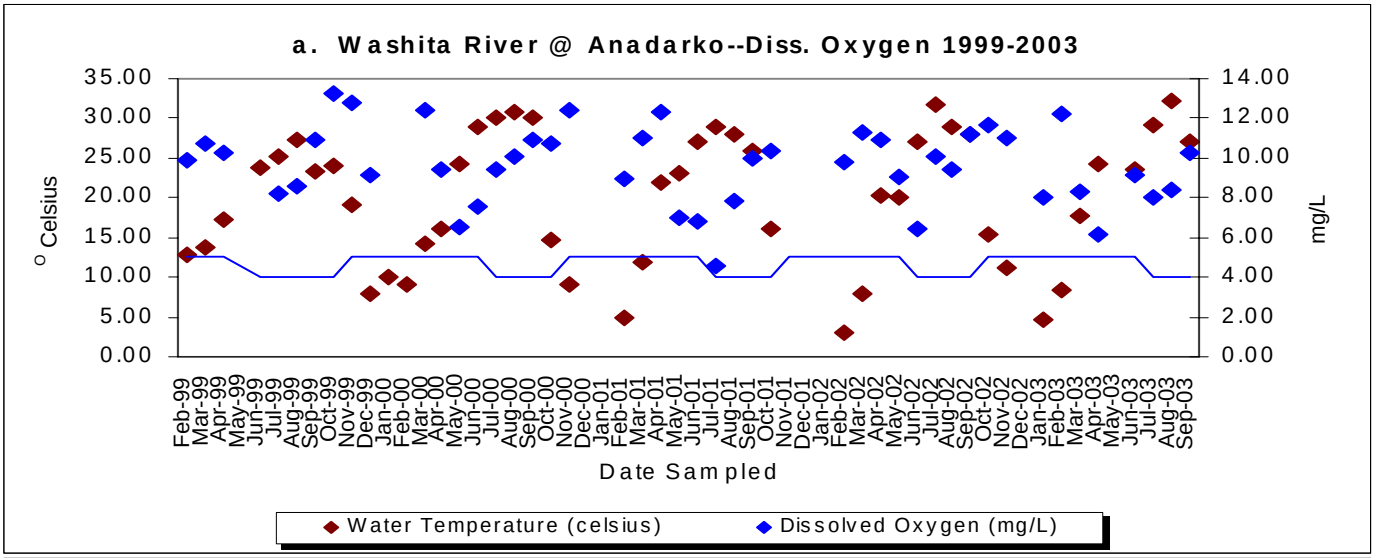
Washita River near Anadarko

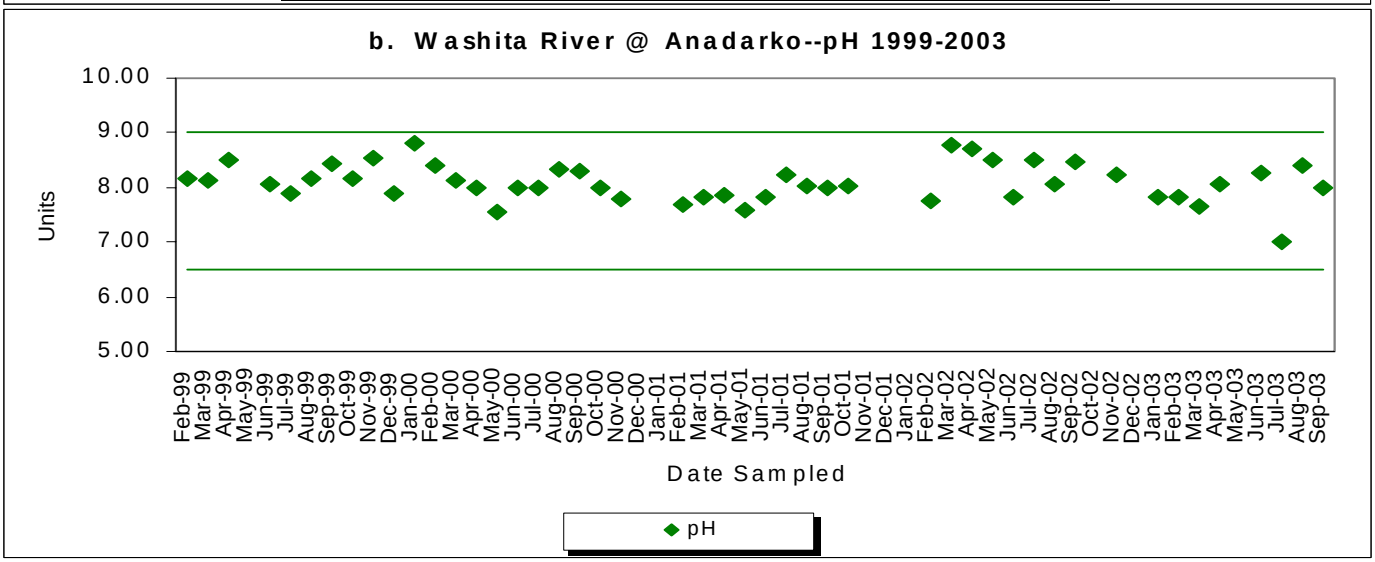
Station AT326500 (310830010010-001AT) is a permanent ambient trend monitoring station located on the Washita River in Oklahoma. Situated in the east-central portion of Caddo County, the site was established south of the City of Anadarko on US Highway 281. The station is positioned between the midpoint and the lower end of stream segment 310830010010 and is classified within the Upper Washita River 8-digit HUC watershed (11130302). Water enters the stream system from Public Service Lake 3 and from several tributaries including Spring Creek, Cobb Creek (Fort Cobb Reservoir), Sugar Creek, Delaware Creek, and Spring Creek (Lake Chickasha), among others.

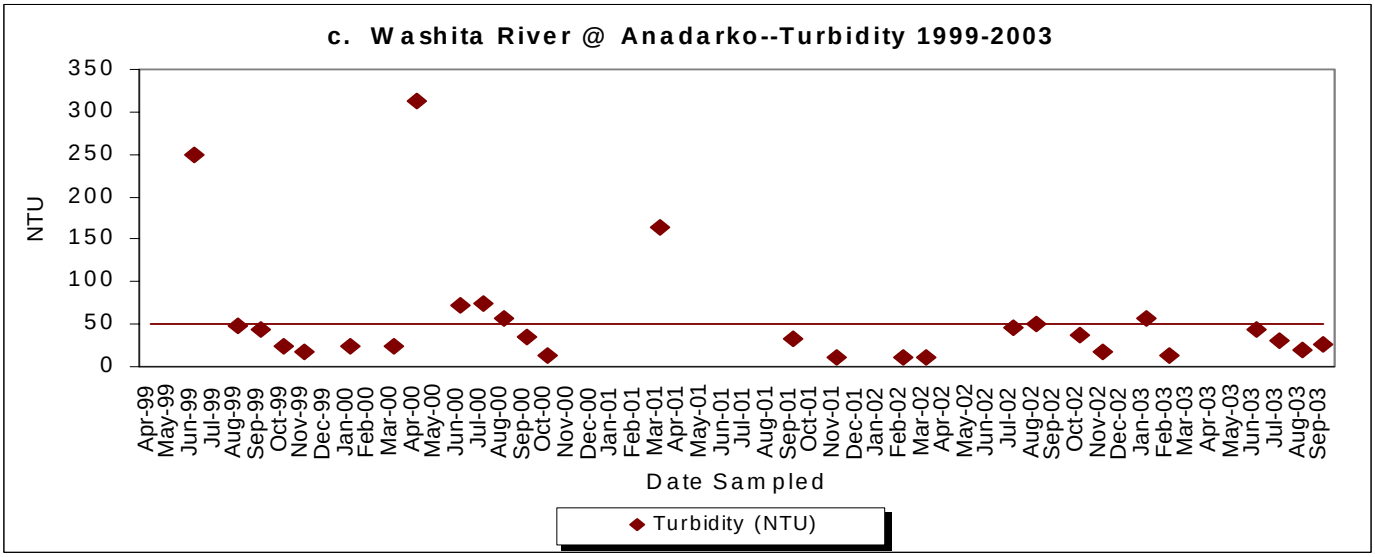
This station on the Washita River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from February of 1999 through September of 2003. For purposes of reporting, this station is representative of the Washita River from the confluence of Cobb Creek (98.4279, 35.0906) downstream to confluence of Spring Creek with the Washita River (98.1065, 35.1017). As per Appendix A, Table 3 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

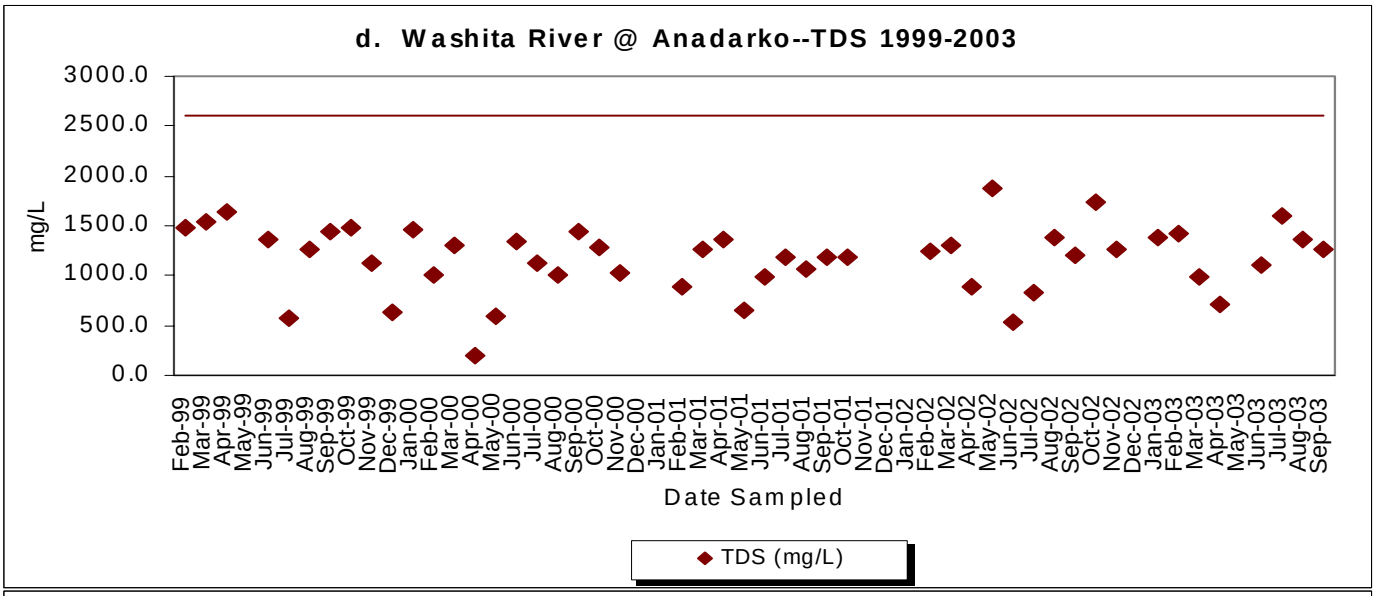
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 28 turbidity samples (Figure 91c), 7 samples (or 25%) exceeded the numerical criteria of 50. Dissolved oxygen (Figure 91a), pH (Figure 91b), and toxicant samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chloride, and sulfate samples (Figure 91d and Figure 91e). The PBCR beneficial use is not supported (Table 32). Of the 17 fecal coliform concentrations, the geometric mean (464.4 cfu/mL) exceeded the prescribed mean standard of 400 cfu/mL. Of the 17 enterococci concentrations, 6 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (522.7 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Washita River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 91f).

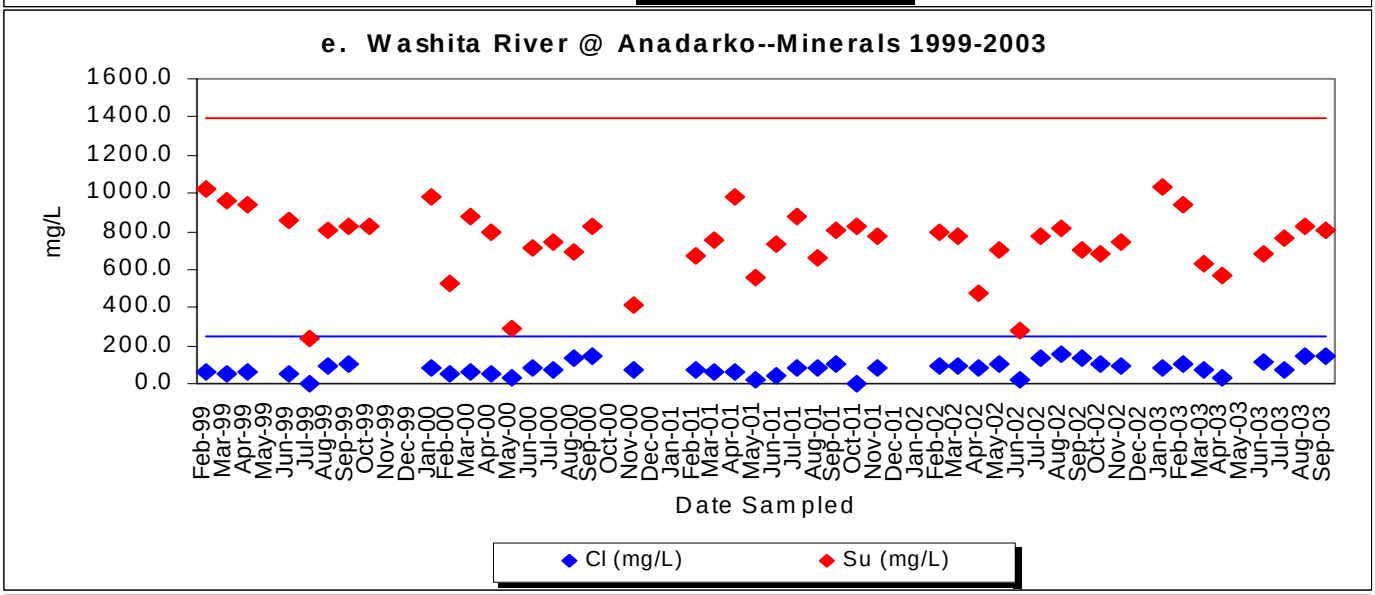
Figure 91a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Washita River at Anadarko (AT326500), 1999-2003.

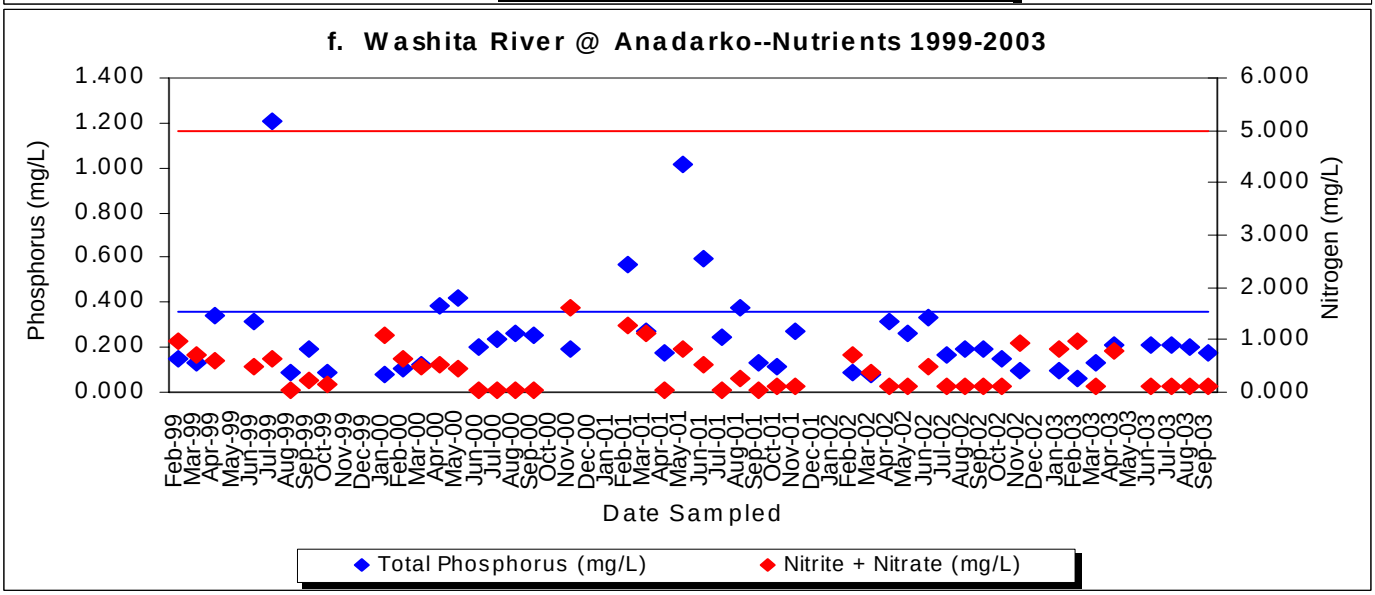







d. Washita River @ Anadarko--TDS 1999-2003
mg/L
3000.0
2500.0
2000.0
1500.0
1000.0
500.0
0.0
Date Sampled
TDS (mg/L)


e. Washita River @ Anadarko--Minerals 1999-2003
mg/L
1600.0
1400.0
1200.0
1000.0
800.0
600.0
400.0
200.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Washita River @ Anadarko--Nutrients 1999-2003
Phosphorus (mg/L)
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

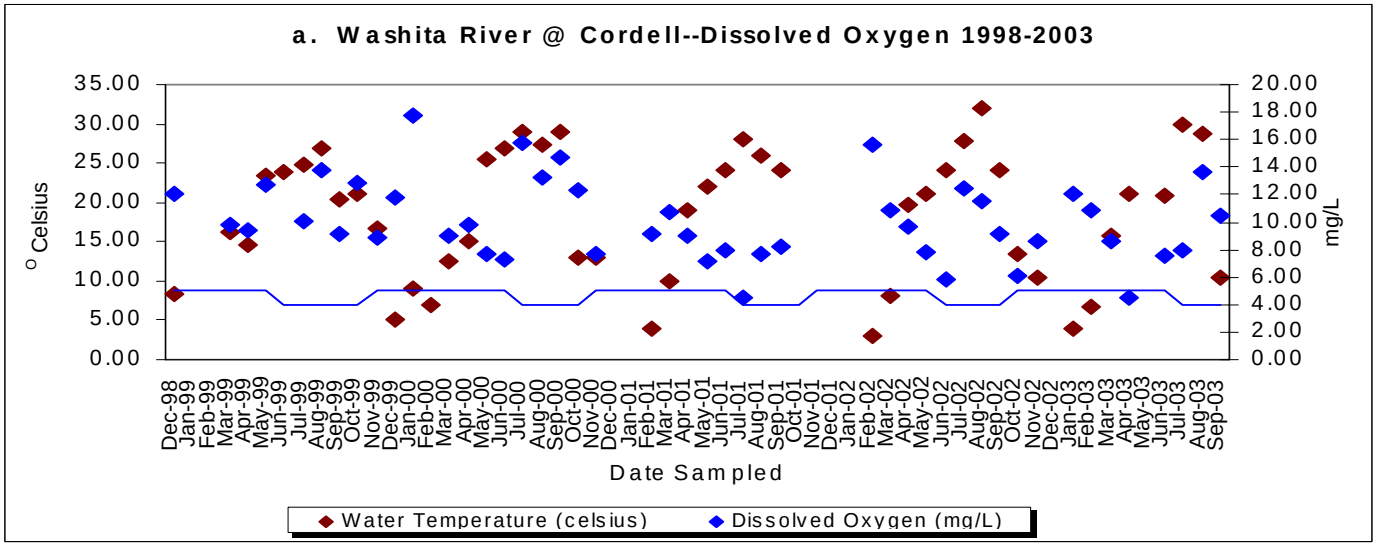
Washita River near Cordell

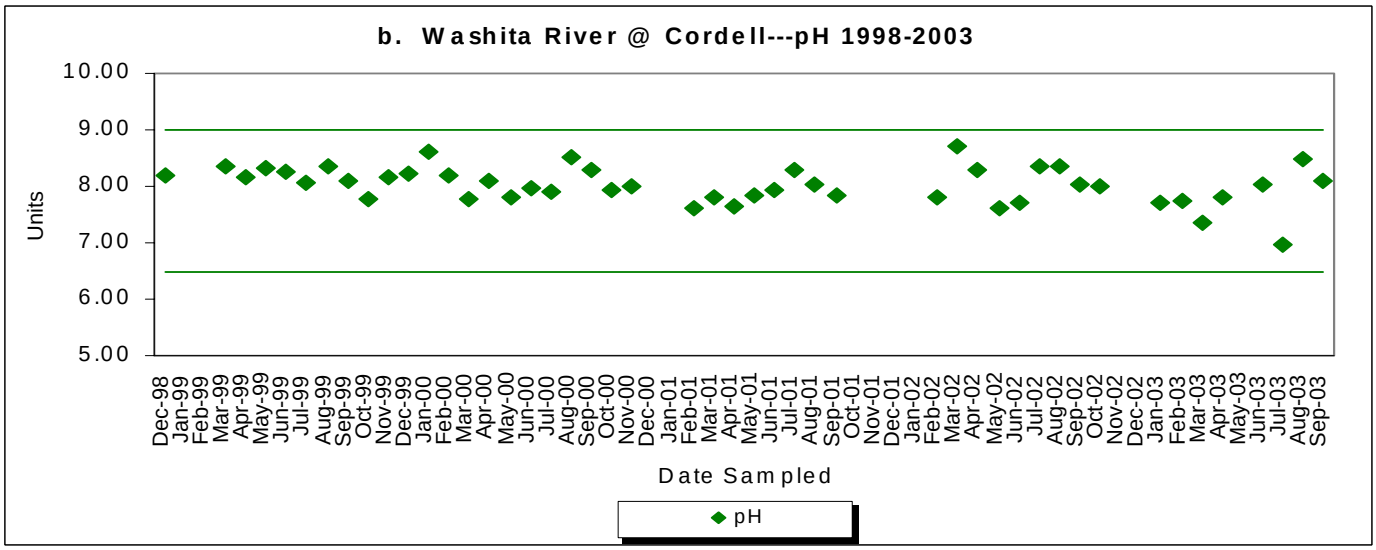
Station AT325300 (310830030010-001AT) is a permanent ambient trend monitoring station located on the Washita River in Oklahoma. Situated in the east-central portion of Washita County, the site was established east of the City of Cordell on State Highway 152. The station is positioned between the midpoint and the lower end of stream segment 310830030010 and is classified within the Upper Washita River 8-digit HUC watershed (11130302). Water enters the stream system from several tributaries including Barnitz Creek, Beaver Creek, Boggy Creek, Cavalry Creek, and Two Baby Creek, among others.

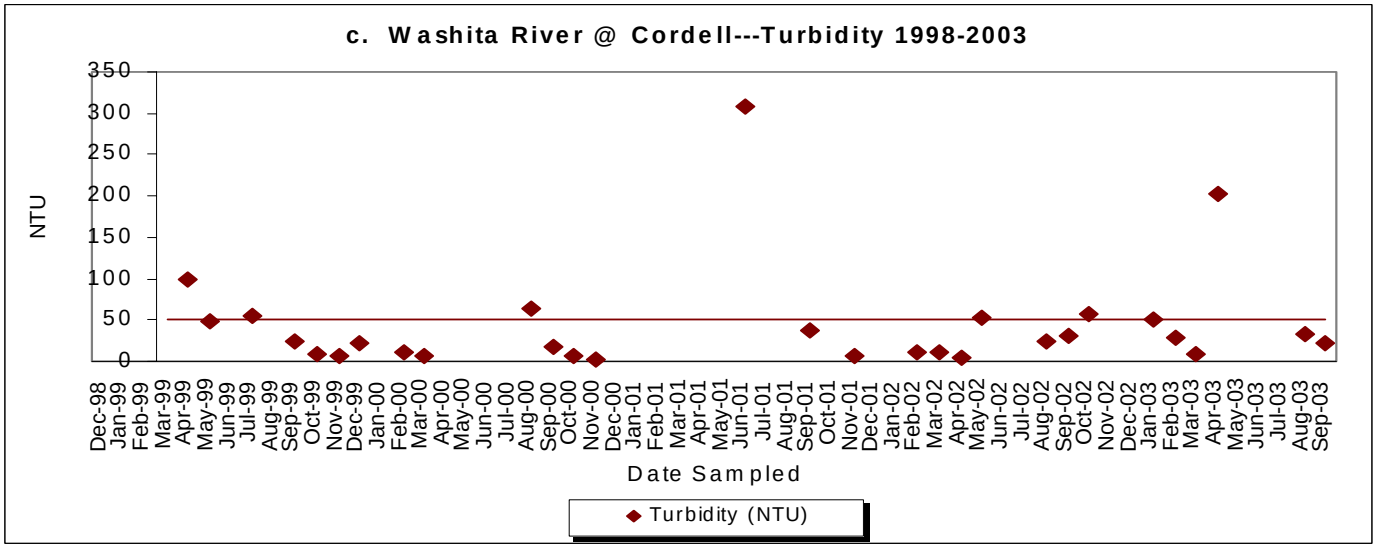
This station on the Washita River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through September of 2003. For purposes of reporting, this station is representative of the Washita River from the confluence of Barnitz Creek (99.0098, 35.5336) downstream to confluence of Two Baby Creek with the Washita River (98.8382, 35.2761). As per Appendix A, Table 3 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

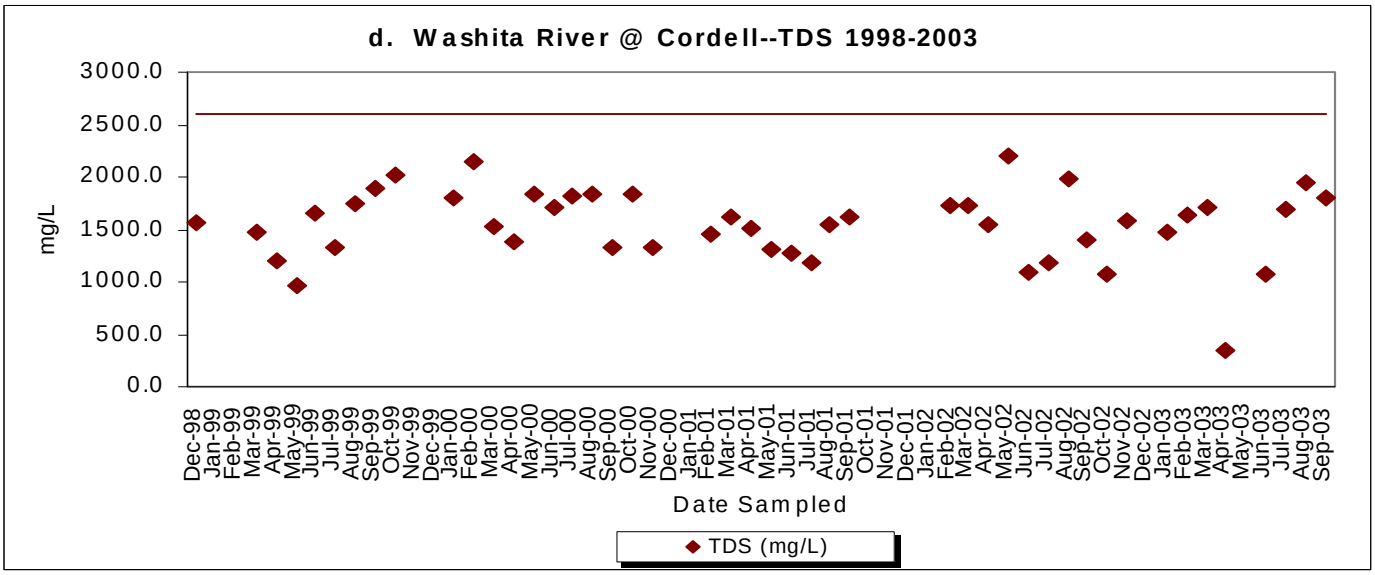
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 30 turbidity samples (Figure 92c), 8 samples (or 27%) exceeded the numerical criteria of 50. Dissolved oxygen (Figure 92a), pH (Figure 92b), and toxicant data collected during the same period met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 92d and Figure 92e). The PBCR beneficial use is not supported (Table 32). Of the 17 fecal coliform concentrations, 6 samples (or 35%) exceeded the prescribed screening level of 400 cfu/mL. Of the 18 enterococci concentrations, 8 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (704.0 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Washita River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 92f).

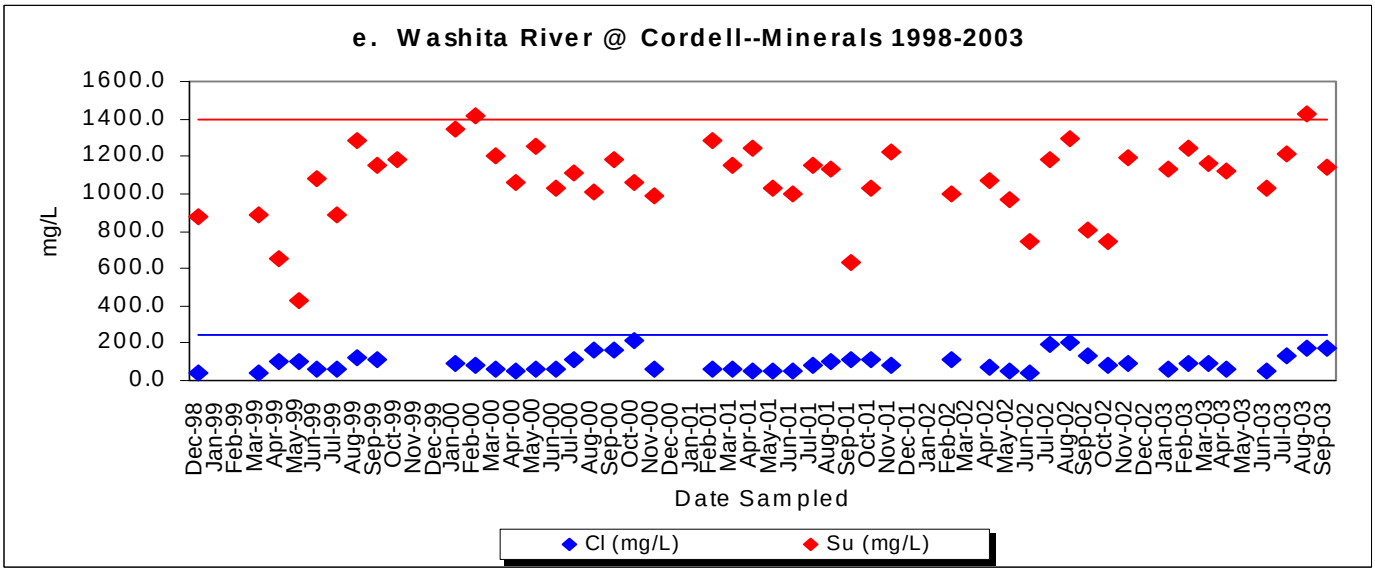
Figure 92a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Washita River at Cordell (AT325300), 1998-2003.

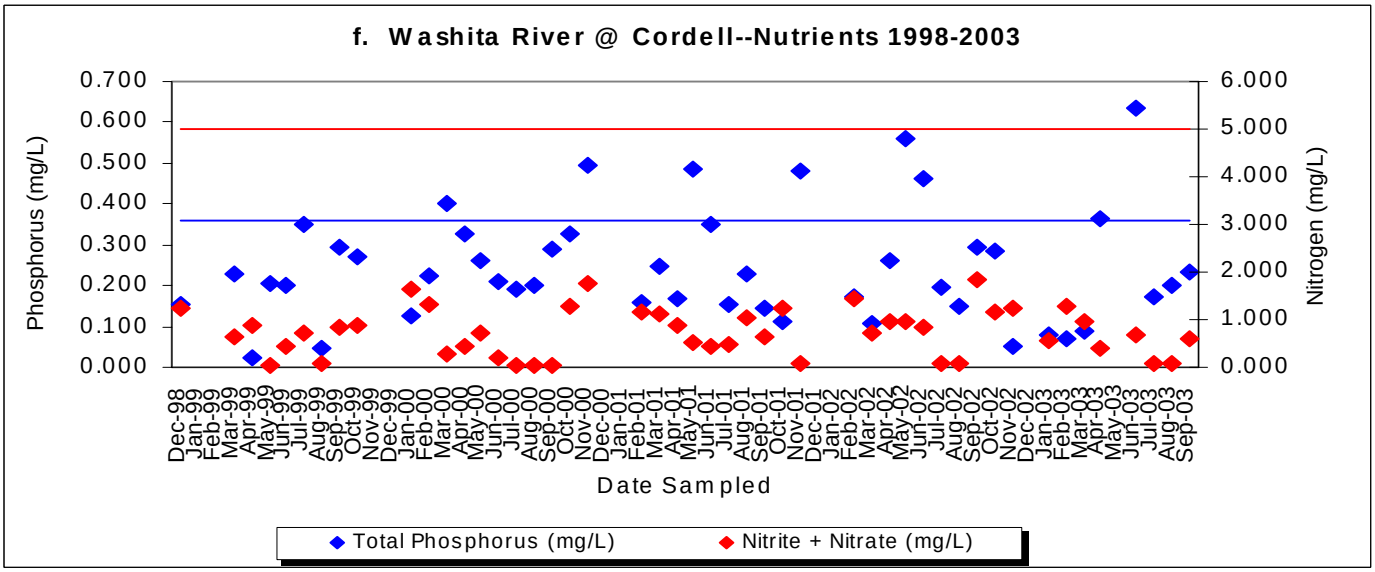







d. Washita River @ Cordell--TDS 1998-2003
mg/L
3000.0
2500.0
2000.0
1500.0
1000.0
500.0
0.0
Date Sampled
TDS (mg/L)


e. Washita River @ Cordell--Minerals 1998-2003
mg/L
1600.0
1400.0
1200.0
1000.0
800.0
600.0
400.0
200.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Washita River @ Cordell--Nutrients 1998-2003
Phosphorus (mg/L)
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

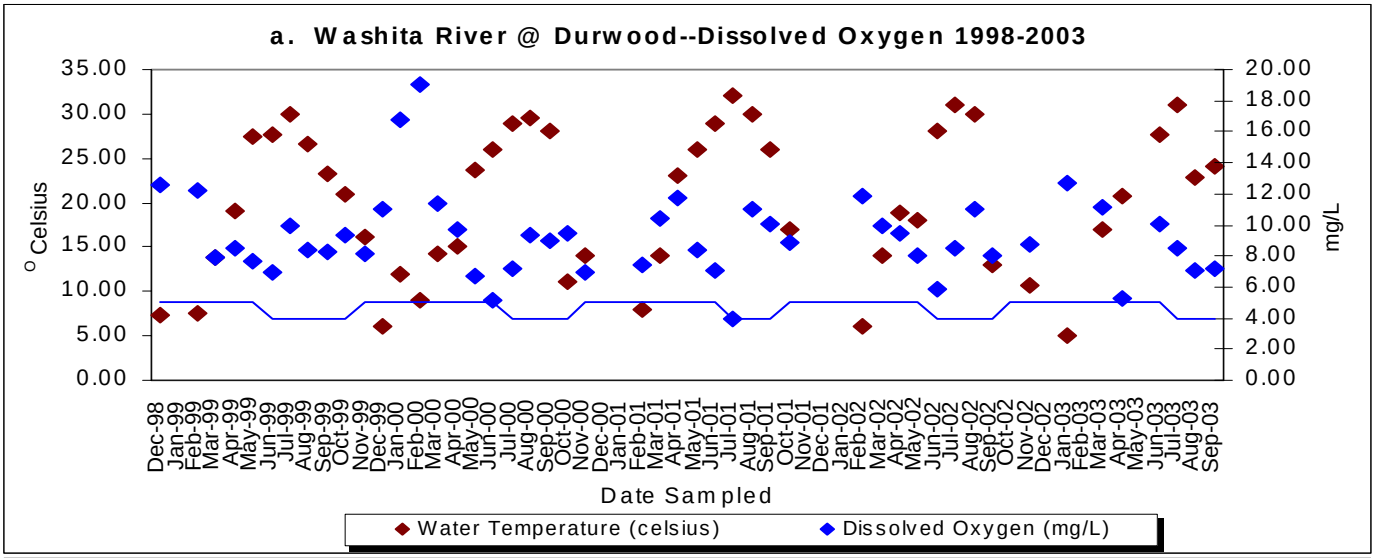
Washita River near Durwood

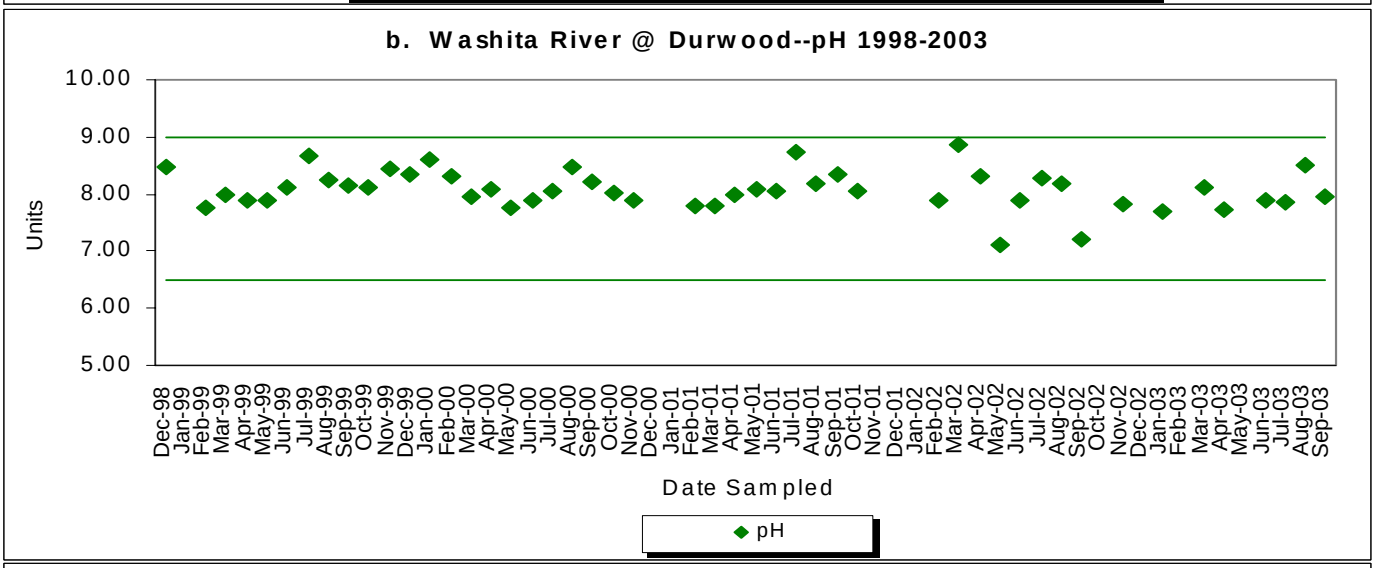
Station AT331000 (310800020010-001AT) is a permanent ambient trend monitoring station located on the Washita River in Oklahoma. Situated in the east-central portion of Carter County, the site was established north of the Town of Durwood on US Highway 177. The station is positioned near the terminal end of stream segment 310800020010 and is classified within the Middle Washita River 8-digit HUC watershed (11130303). Water enters the stream system from several tributaries including Rock Creek (Arbuckle Reservoir), Caddo Creek (Lake Jean Neustadt, Rock Creek Reservoir, Lake Ardmore, and the Ardmore City Lake), Oil Creek, Mill Creek, and Pennington Creek, among others.

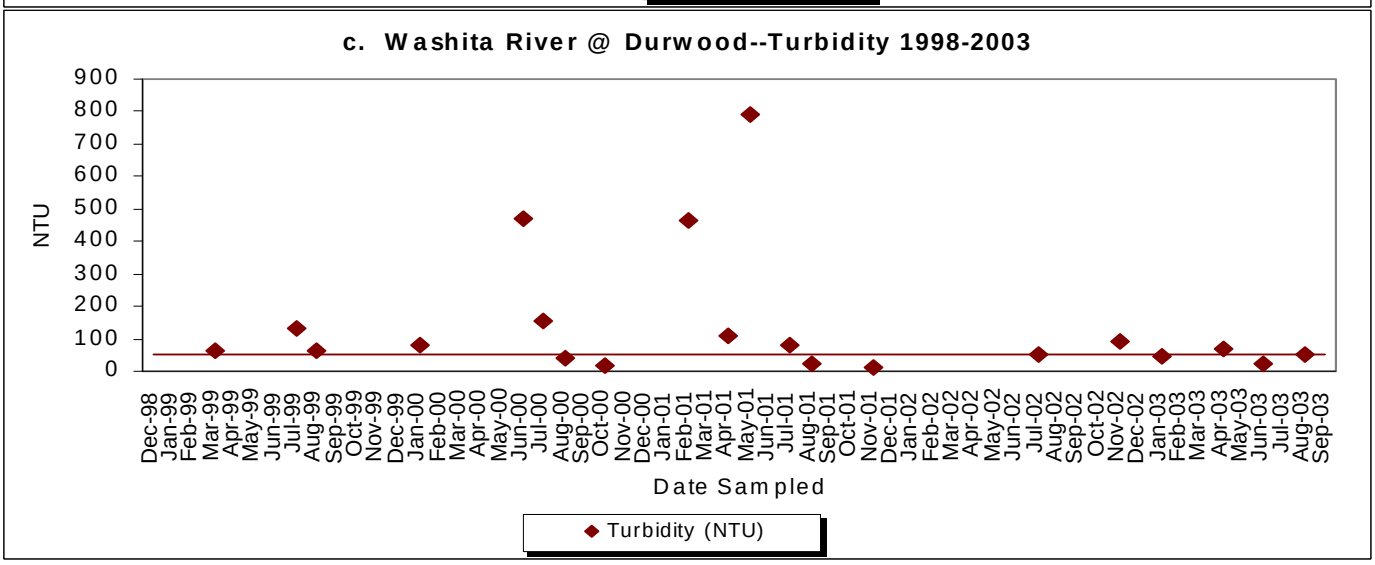
This station on the Washita River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through September of 2003. For purposes of reporting, this station is representative of the Washita River from the confluence of Rock Creek (97.0411, 34.3847) downstream to confluence of Oil Creek with the Washita River (96.8850, 34.2442). As per Appendix A, Table 3 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

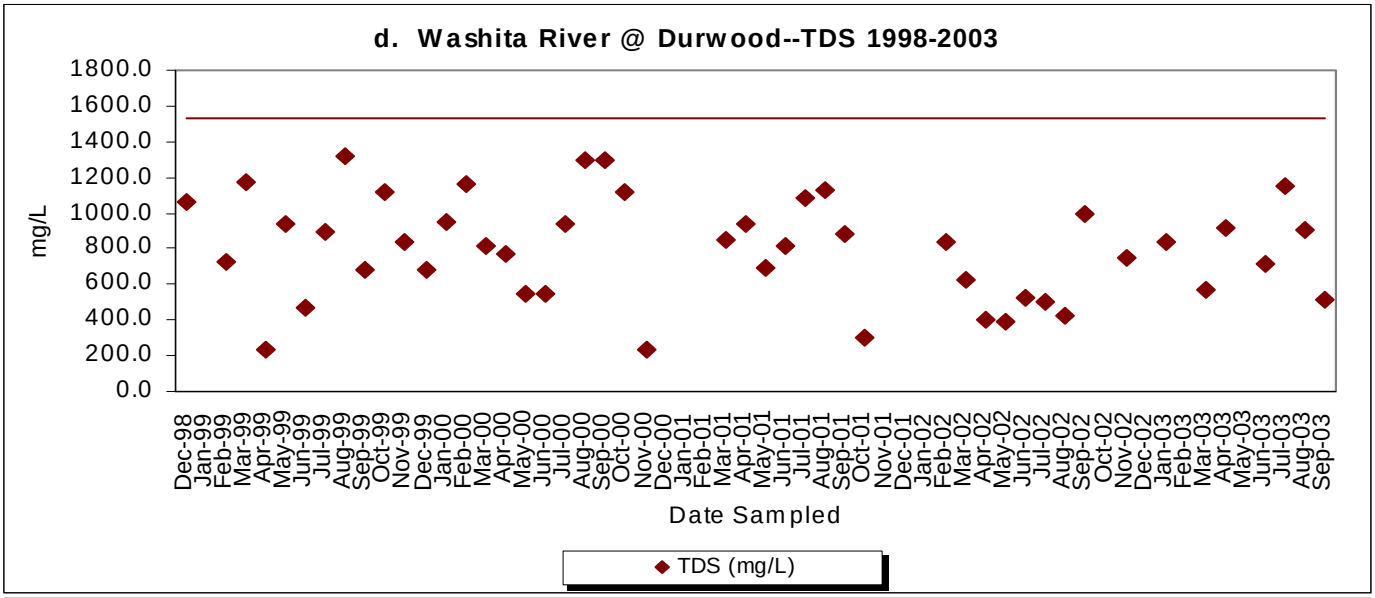
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 21 turbidity samples (Figure 93c), 13 samples (or 62%) exceeded the numerical criteria of 50. Of the 14 lead samples collected, 2 of the concentrations (or 14%) exceeded the prescribed hardness-dependant chronic criteria of 26.16 µg/L (Table 31). Dissolved oxygen (Figure 93a) and pH (Figure 93b) samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 93d and Figure 93e). The PBCR beneficial use is not supported (Table 32). Of the 19 fecal coliform concentrations, 8 samples (or 42%) exceeded the prescribed screening level of 400 cfu/mL. Of the 19 enterococci concentrations, 5 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (184.9 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Washita River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 93f).

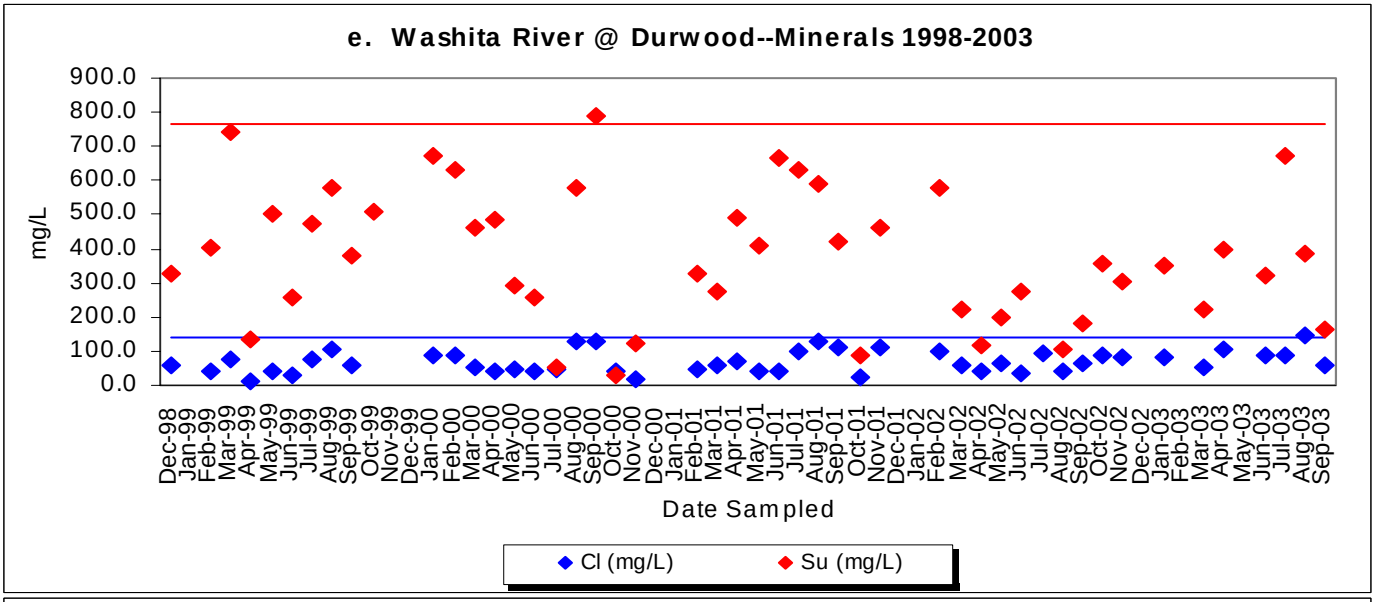
Figure 93a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Washita River at Durwood (AT331000), 1998-2003.

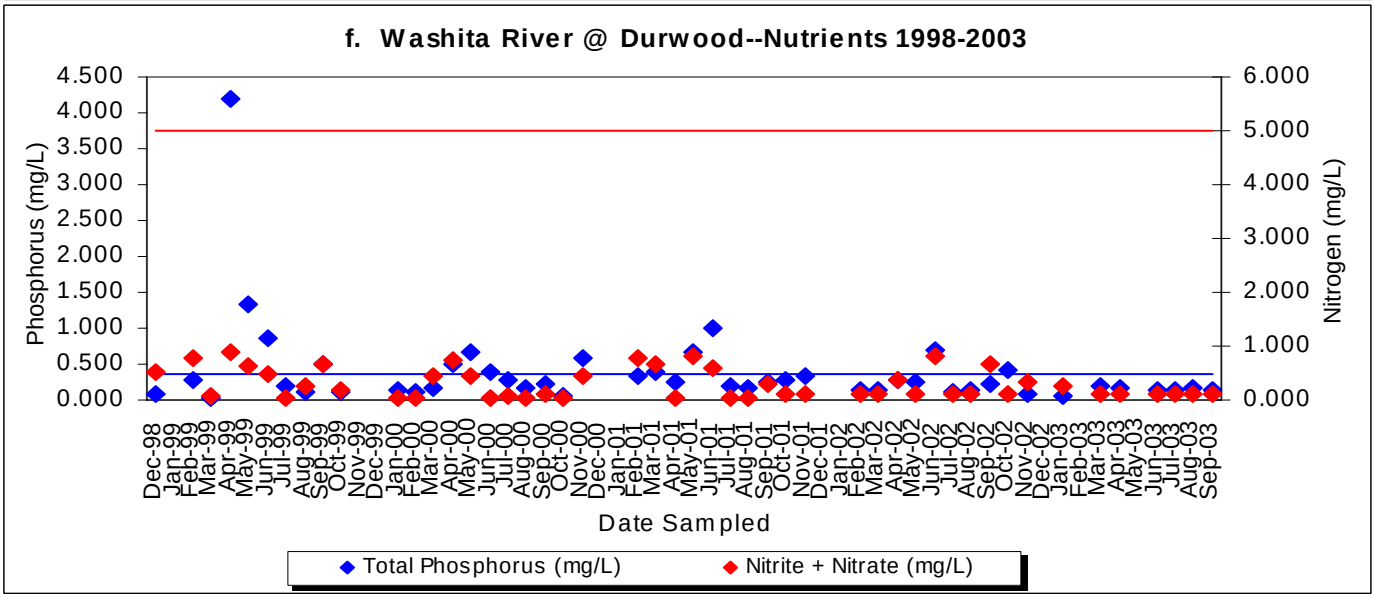







d. Washita River @ Durwood--TDS 1998-2003
mg/L
Date Sampled
TDS (mg/L)


e. Washita River @ Durwood--Minerals 1998-2003
mg/L
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Washita River @ Durwood--Nutrients 1998-2003
Phosphorus (mg/L)
Nitrogen (mg/L)
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

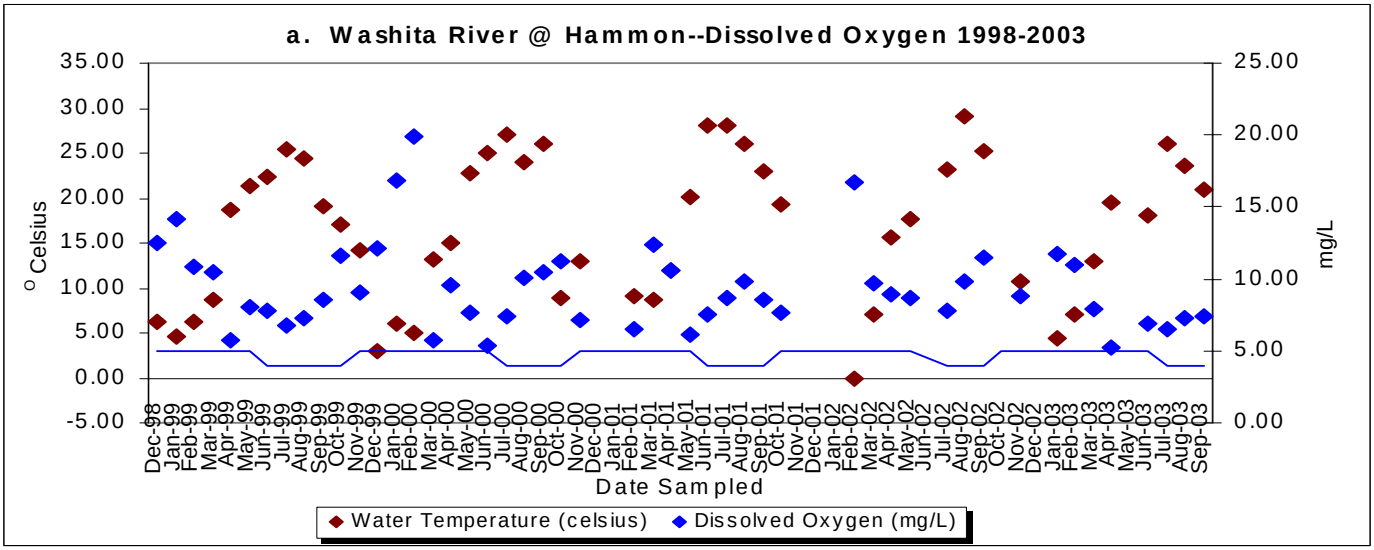
Washita River near Hammon

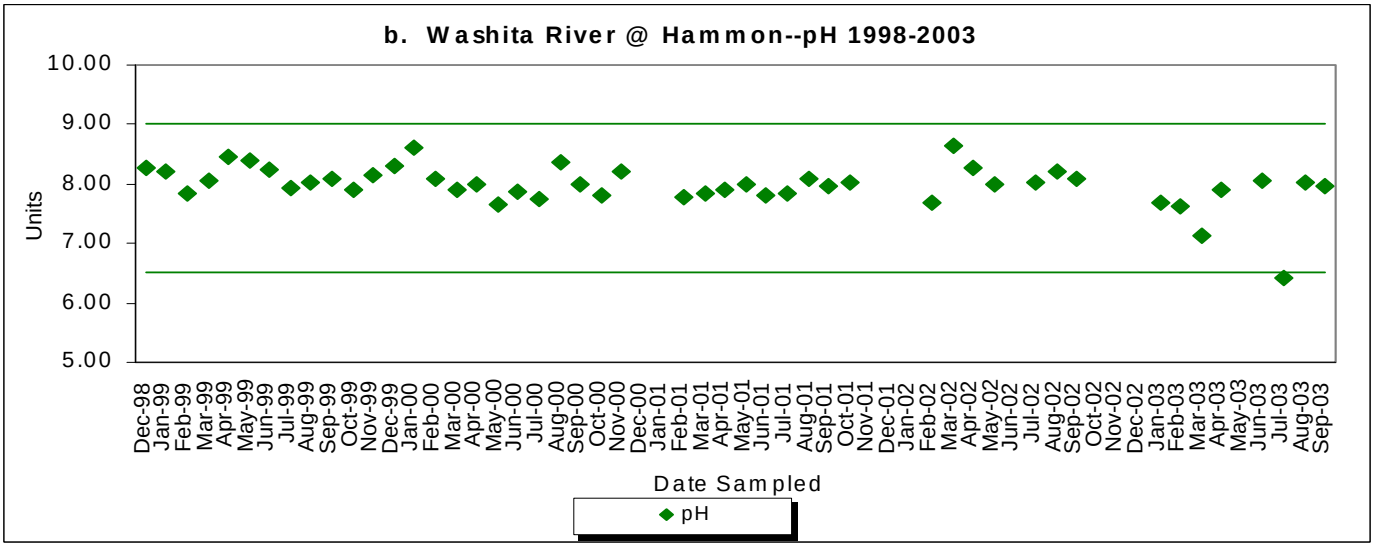
Station AT324200 (310840010010-001AT) is a permanent ambient trend monitoring station located on the Washita River in Oklahoma. Situated in the west central portion of Custer County, the site was established east of the Town of Hammon on State Highway 33. The station is positioned near the midpoint of stream segment 310840010010 and is classified within the Washita Headwaters 8-digit HUC watershed (11130301). Water enters the stream system from several tributaries including Sandstone Creek, White Shield Creek, and Quartermaster Creek, among others.

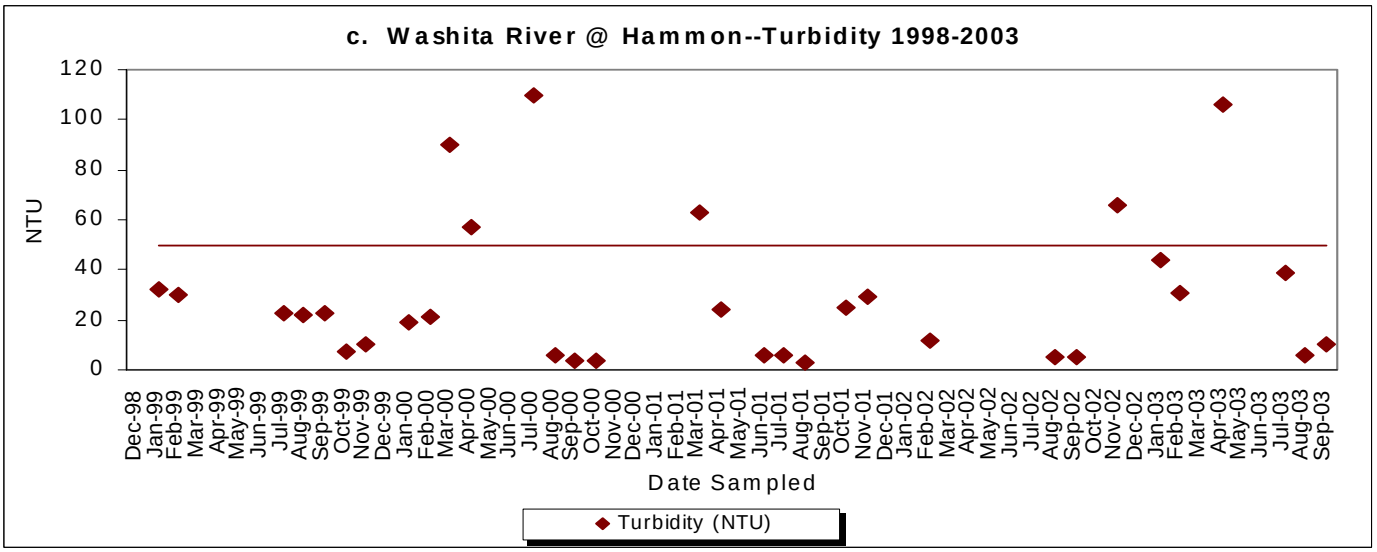
This station on the Washita River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through September of 2003. For purposes of reporting, this station is representative of the Washita River from the confluence of Sandstone Creek (99.5017, 35.6007) downstream to confluence of the Washita River with Foss Lake (99.3057, 35.6566). As per Appendix A, Table 3 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

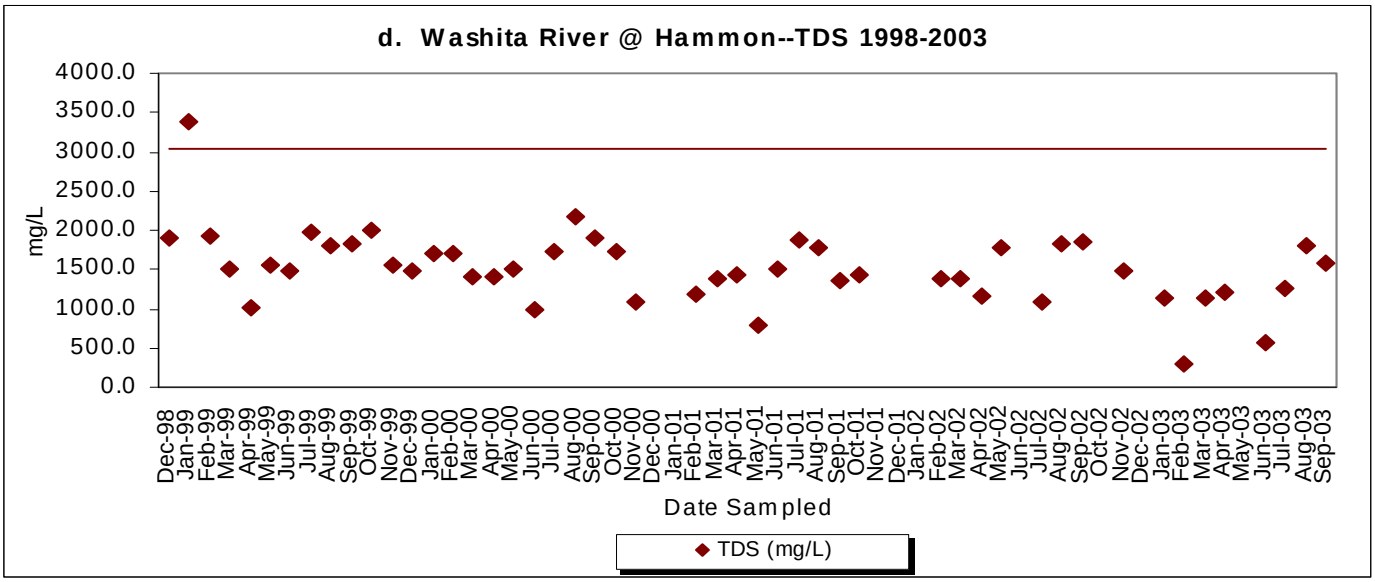
The PPWS beneficial use is supported. The WWAC beneficial use is partially supported. Of the 32 turbidity samples (Figure 94c), 6 samples (or 19%) exceeded the numerical criteria of 50. Dissolved oxygen (Figure 94a), pH (Figure 94b), and toxicant samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 94d and Figure 94e). The PBCR beneficial use is not supported (Table 32). Of the 17 fecal coliform concentrations, 7 samples (or 41%) exceeded the prescribed screening level of 400 cfu/mL, and the geometric mean (424.3 cfu/mL) exceeded the prescribed mean standard of 400 cfu/mL. Of the 16 enterococci concentrations, 12 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (1775.8 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Washita River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 94f).

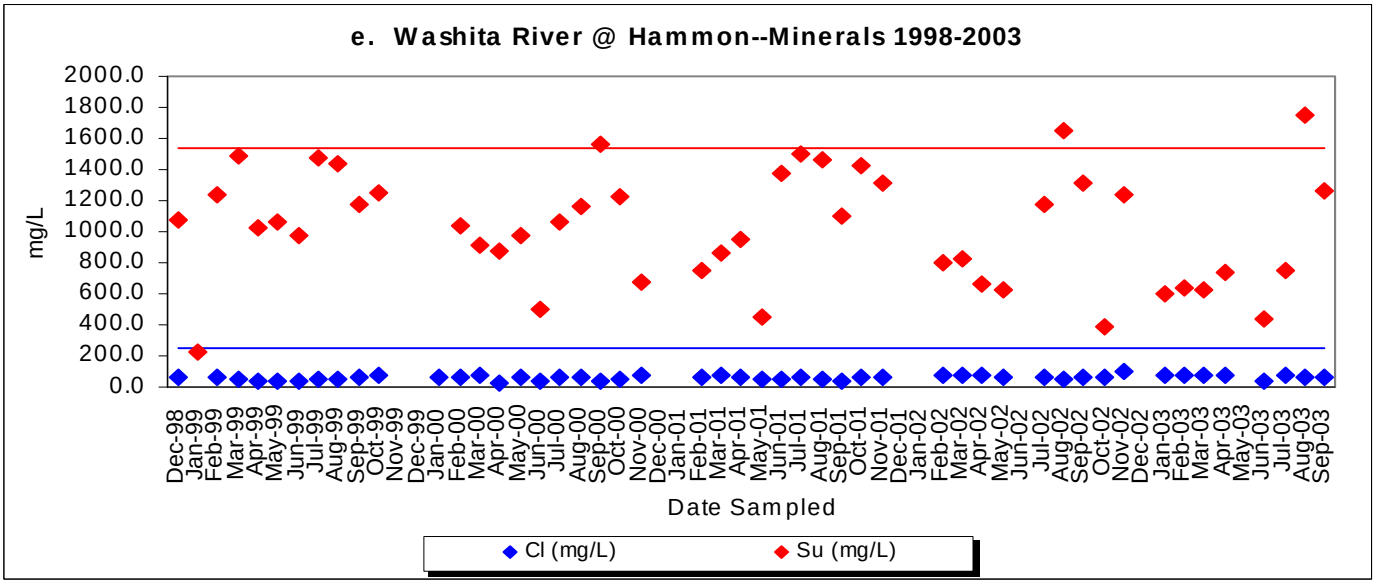
Figure 94a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Washita River at Hammon (AT324200), 1998-2003.

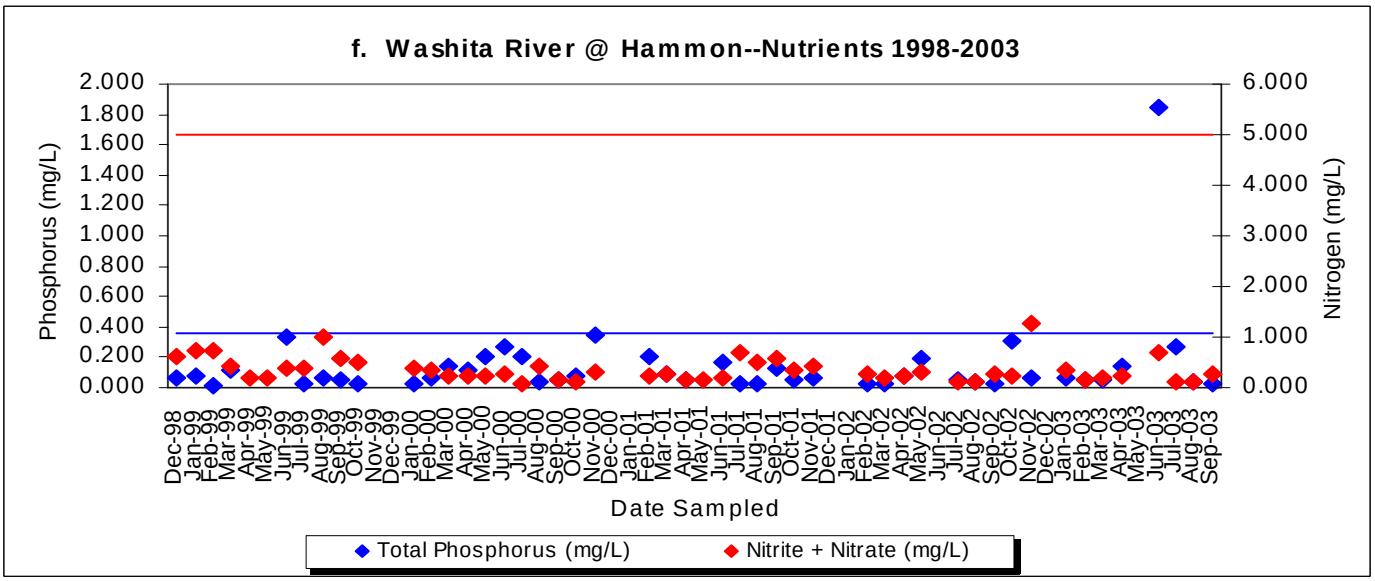







d. Washita River @ Hammon--TDS 1998-2003
mg/L
Date Sampled
TDS (mg/L)


e. Washita River @ Hammon--Minerals 1998-2003
mg/L
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Washita River @ Hammon--Nutrients 1998-2003
Phosphorus (mg/L)
Nitrogen (mg/L)
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

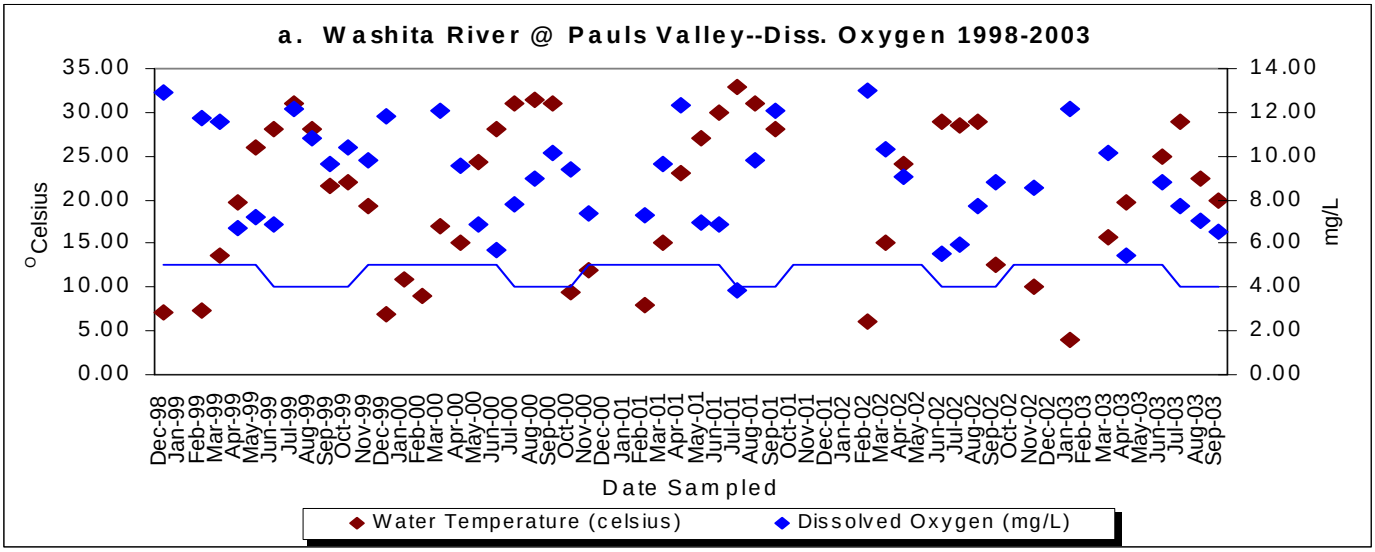
Washita River near Pauls Valley

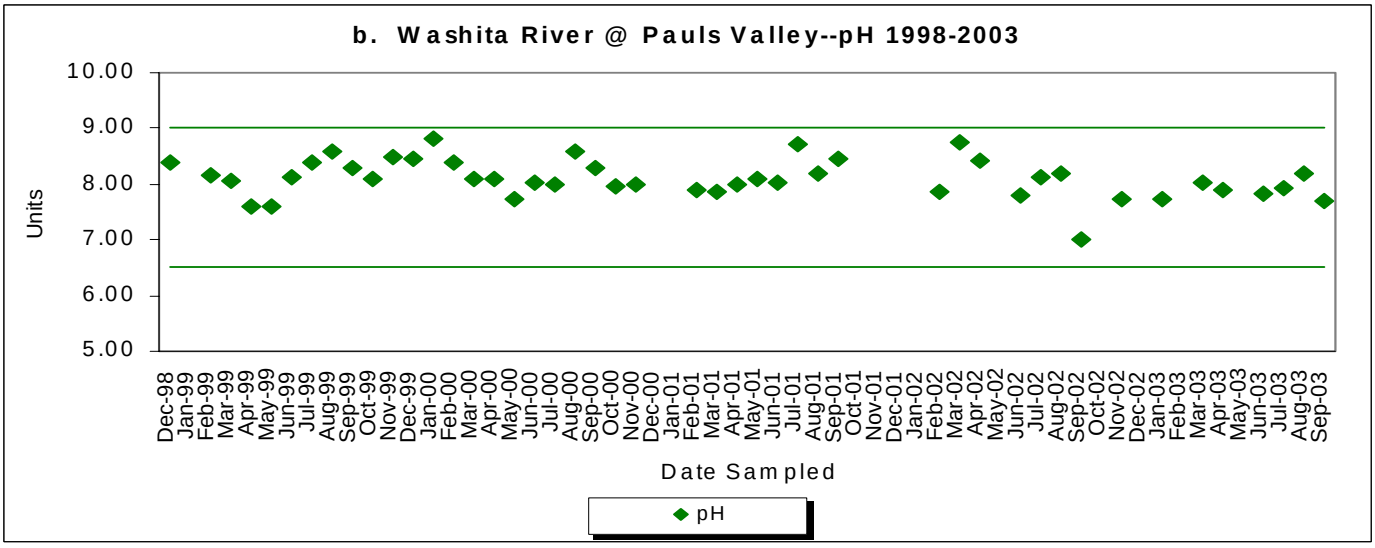
Station AT328500 (310810010010-001AT) is a permanent ambient trend monitoring station located on the Washita River in Oklahoma. Situated in the north central portion of Garvin County, the site was established northeast of the City of Pauls Valley on State Highway 19. The station is positioned near the midpoint of stream segment 310810010010 and is classified within the Middle Washita River 8-digit HUC watershed (11130303). Water enters the stream system from Wiley Post Memorial Lake and from several tributaries including Beef Creek, Owl Creek, Washington Creek (Pauls Valley Lake), Peavine Creek, Cherokee Sandy Creek (R. C. Longmire Lake), and Wildhorse Creek, among others.

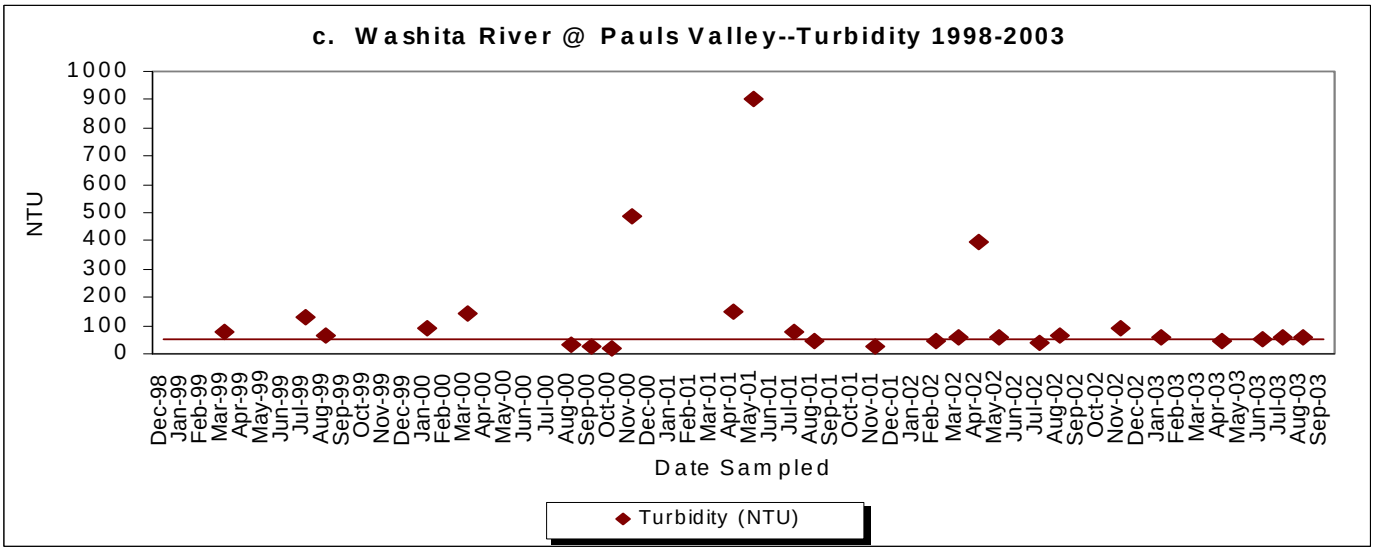
This station on the Washita River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through September of 2003. For purposes of reporting, this station is representative of the Washita River from the confluence of Beef Creek (97.3902, 34.8169) downstream to confluence of Wildhorse Creek with the Washita River (97.1650, 34.5321). As per Appendix A, Table 3 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

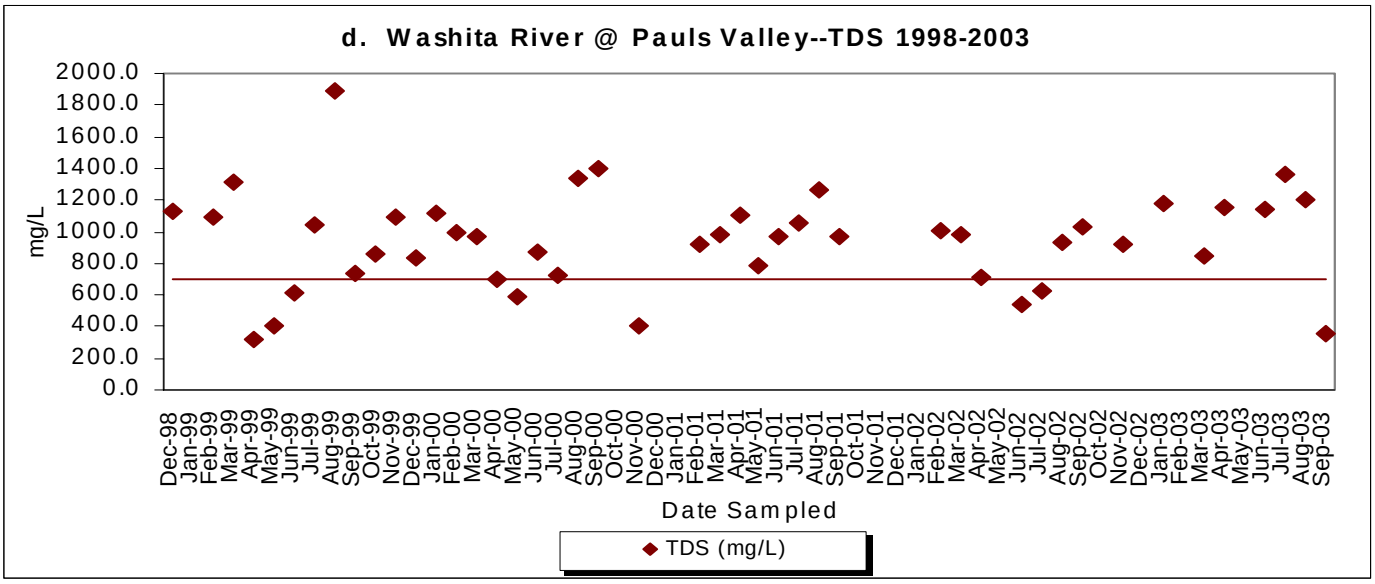
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 26 turbidity samples (Figure 95c), 18 samples (or 69%) exceeded the numerical criteria of 50. Dissolved oxygen (Figure 95a), pH (Figure 95b), and toxicant samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is not supported (Figure 95d and Figure 95e). Of the 45 total dissolved solids concentrations, 33 samples (or 73%) exceeded the minimum sample standard of 750 mg/L (Appendix F sample standard is 700 mg/L), and the geometric mean (908.5 mg/L) exceeded the yearly mean standard of 700 mg/L. Chloride and sulfate concentrations met the criteria prescribed in the AG beneficial use. The PBCR beneficial use is not supported (Table 32). Of the 18 fecal coliform concentrations, 5 samples (or 28%) exceeded the prescribed screening level of 400 cfu/mL. Of the 18 enterococci concentrations, seven (7) samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (242.6 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Washita River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 95f).

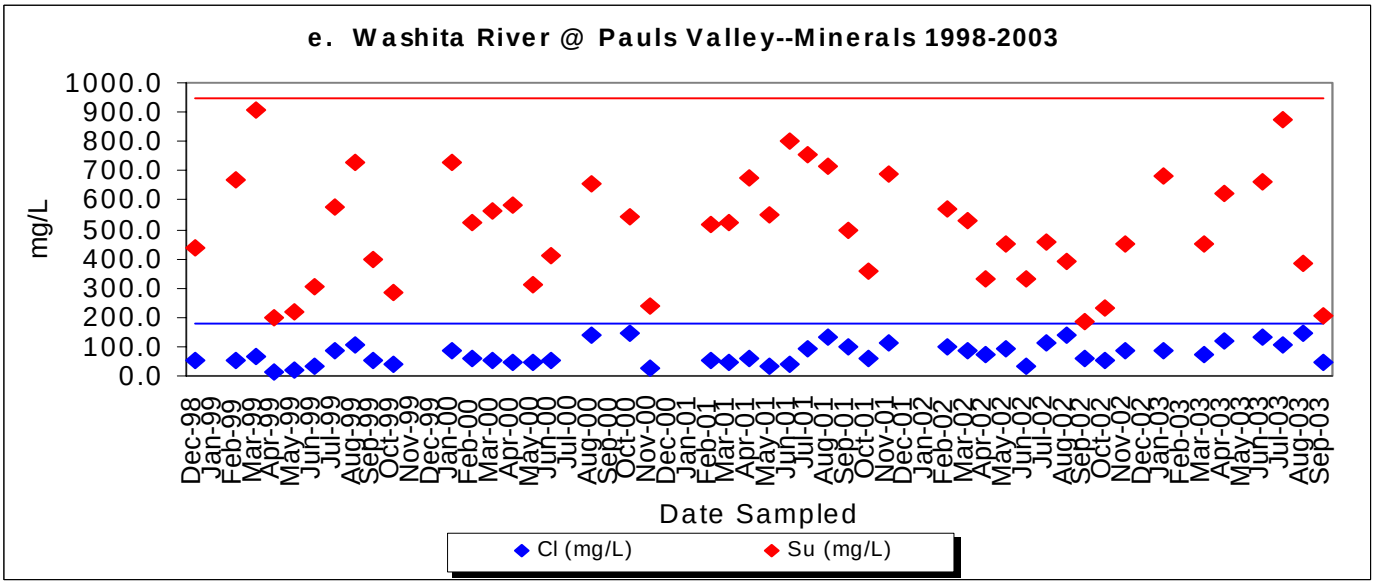
Figure 95a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Washita River at Paul's Valley (AT328500), 1998-2003.

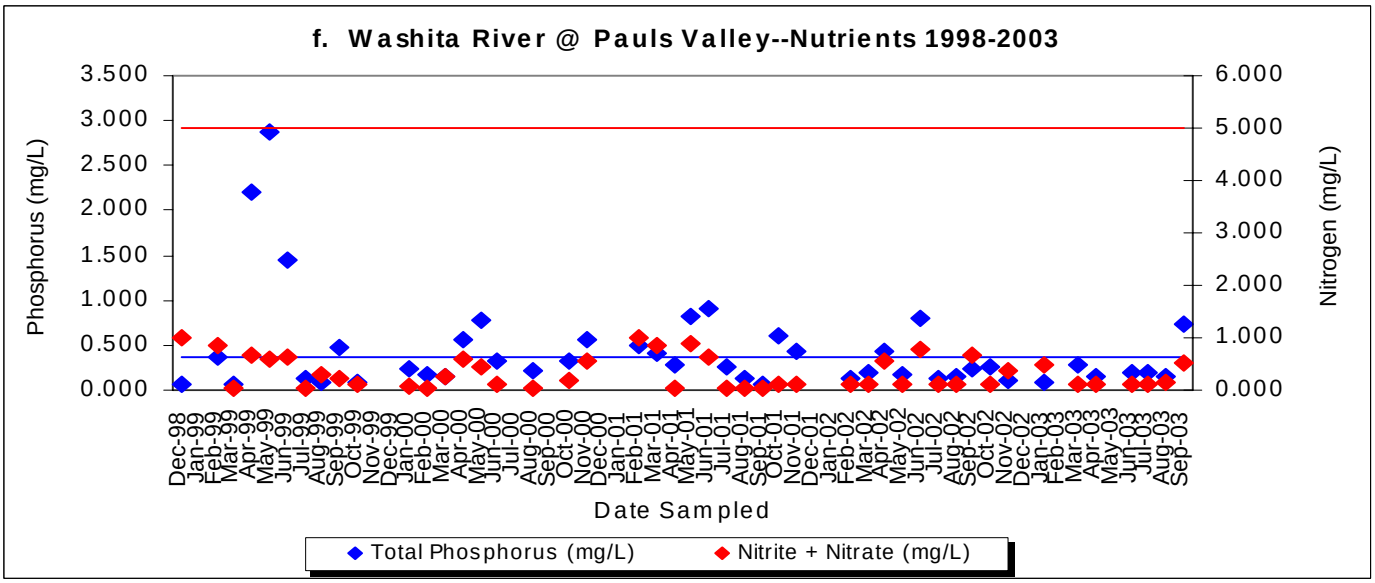







d. Washita River @ Pauls Valley--TDS 1998-2003
mg/L
Date Sampled
TDS (mg/L)


e. Washita River @ Pauls Valley--Minerals 1998-2003
mg/L
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Washita River @ Pauls Valley--Nutrients 1998-2003
Phosphorus (mg/L)
Nitrogen (mg/L)
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

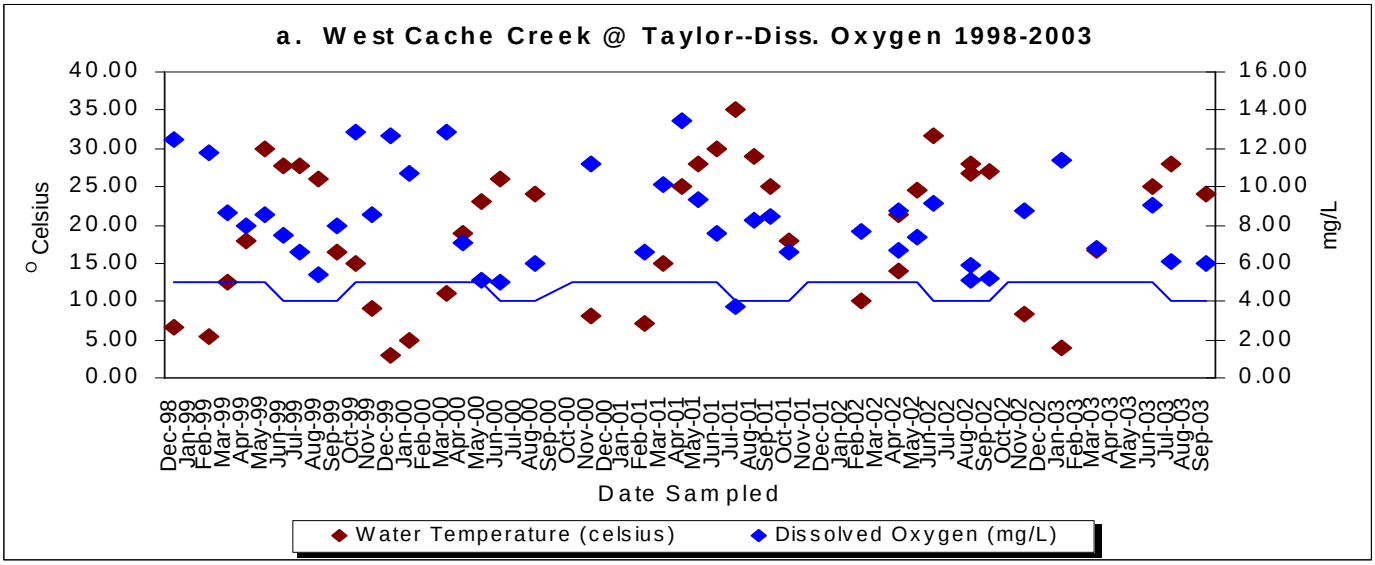
West Cache Creek near Taylor

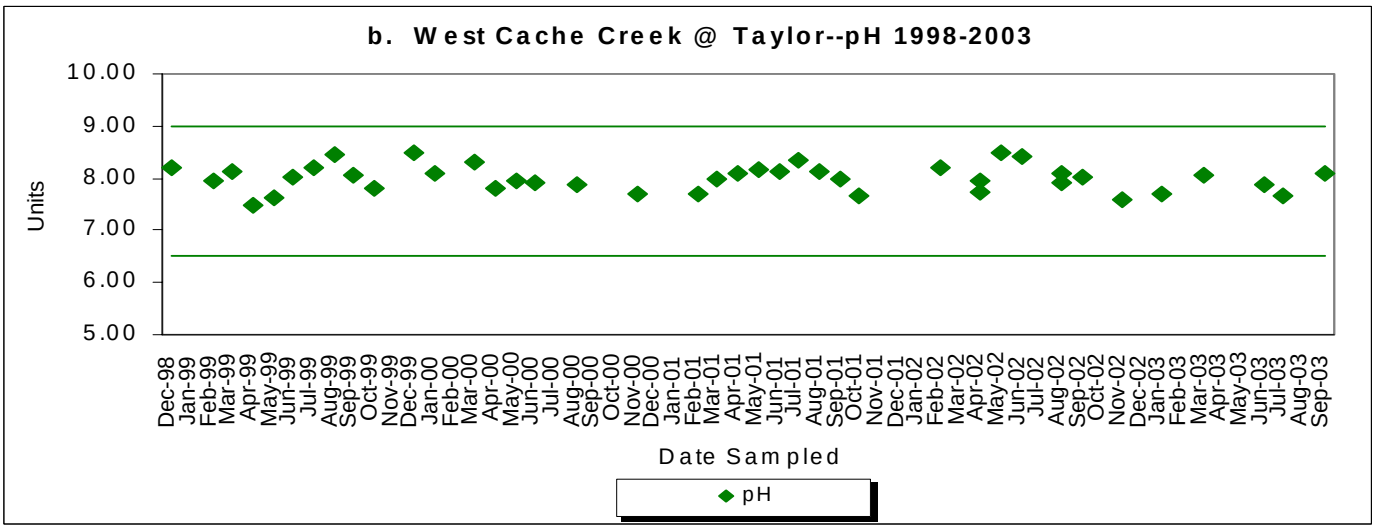
Station AT315050 (311310020010-001AT) is a permanent ambient trend monitoring station located on West Cache Creek. Situated in the south central portion of Cotton County, the site was established north of the Town of Taylor on State Highway 5B. The station is positioned near the terminal end of stream segment 311310020010 and is classified within the West Cache Creek 8-digit HUC watershed (11130203). Water enters the stream system from several tributaries including Deep Red Creek (Lake Frederick and Whites Lake), among others.

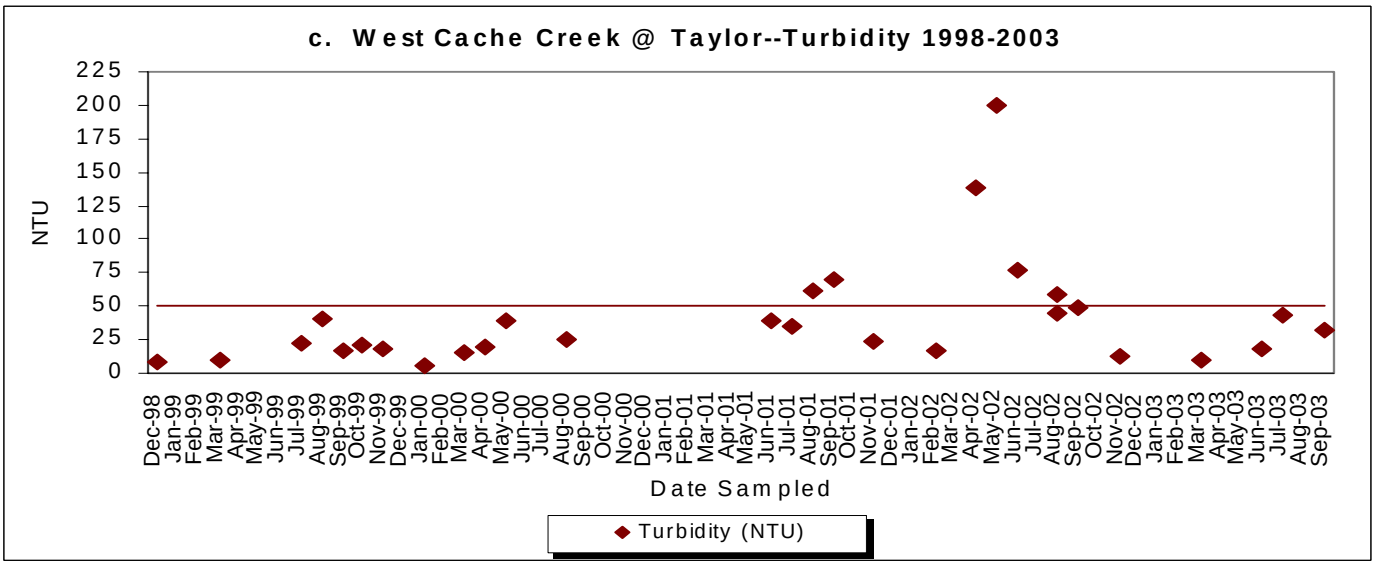
This station on West Cache Creek has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through September of 2003. For purposes of reporting, this station is representative of West Cache Creek from the confluence of Deep Red Creek (98.3800, 34.2154) downstream to confluence of West Cache Creek with Cache Creek (98.3070, 34.2066). As per Appendix A, Table 3 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

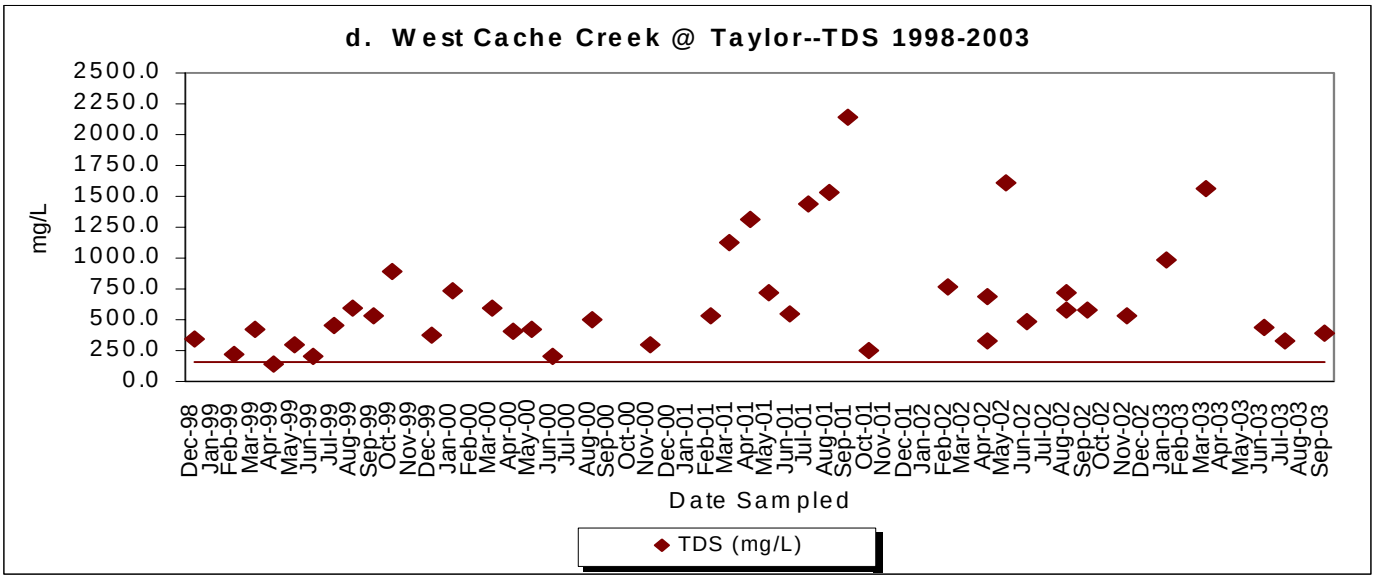
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 29 turbidity samples (Figure 96c), 6 samples (or 21%) exceeded the numerical criteria of 50. Of the 13 lead samples collected, 2 of the concentrations (or 15%) exceeded the prescribed hardness-dependant chronic criteria of 11.22 µg/L (Table 31). Dissolved oxygen (Figure 96a) and pH (Figure 96b) samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is partially supported (Figure 96d and Figure 96e). Of the 41 total dissolved solids concentrations, 10 samples (or 24%) exceeded the minimum sample standard of 750 mg/L (Appendix F sample standard is 151 mg/L). Chloride and sulfate concentrations met the criteria prescribed in the AG beneficial use. The PBCR beneficial use is not supported (Table 32). Of the 22 fecal coliform concentrations, 9 samples (or 41%) exceeded the prescribed screening level of 400 cfu/mL and the geometric mean (428.9 cfu/mL) exceeded the prescribed mean standard of 400 cfu/mL. Of the 21 enterococci concentrations, 10 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (404.5 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. Of the 22 *E. coli* concentrations, 3 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (222.3 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of West Cache Creek is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 96f).

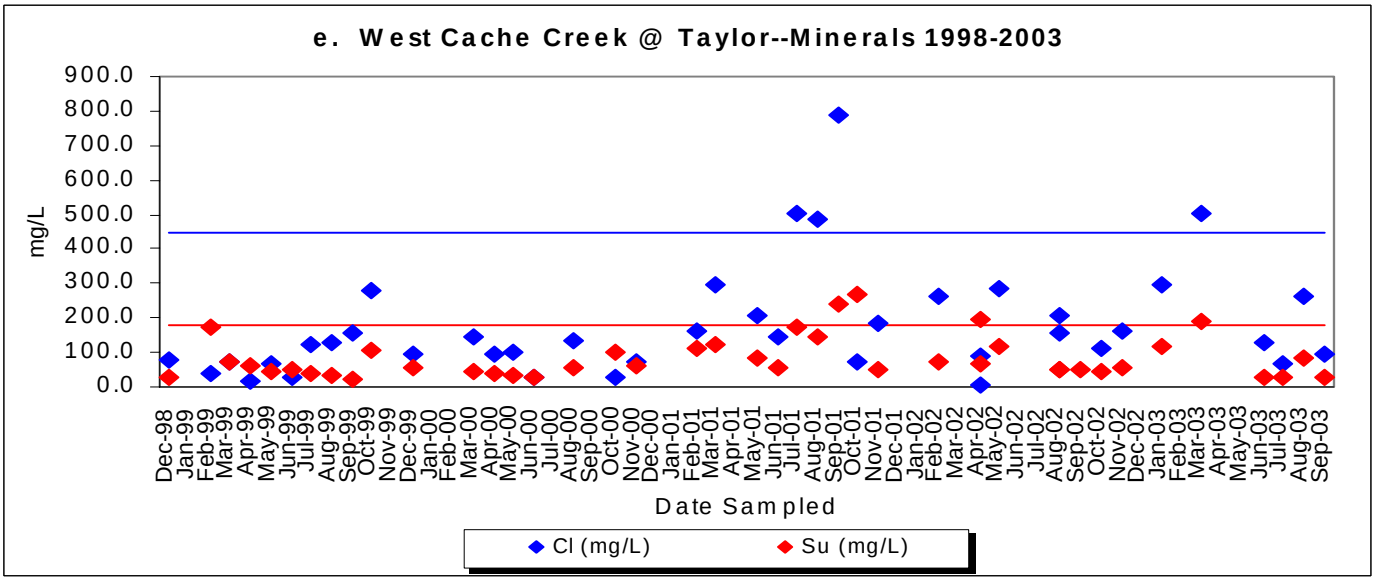
Figure 96a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on West Cache Creek at Taylor (AT315050), 1998-2003.

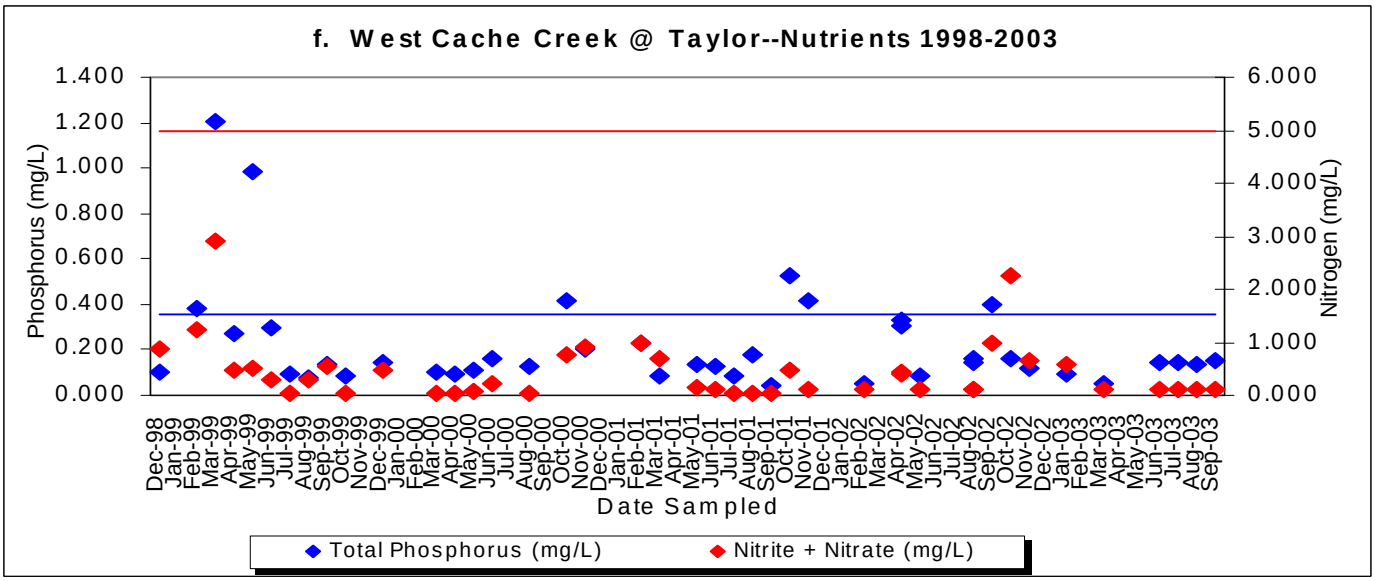







d. West Cache Creek @ Taylor--TDS 1998-2003
mg/L
Date Sampled
TDS (mg/L)


e. West Cache Creek @ Taylor--Minerals 1998-2003
mg/L
Date Sampled
Cl (mg/L)
Su (mg/L)


f. West Cache Creek @ Taylor--Nutrients 1998-2003
Phosphorus (mg/L)
Nitrogen (mg/L)
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

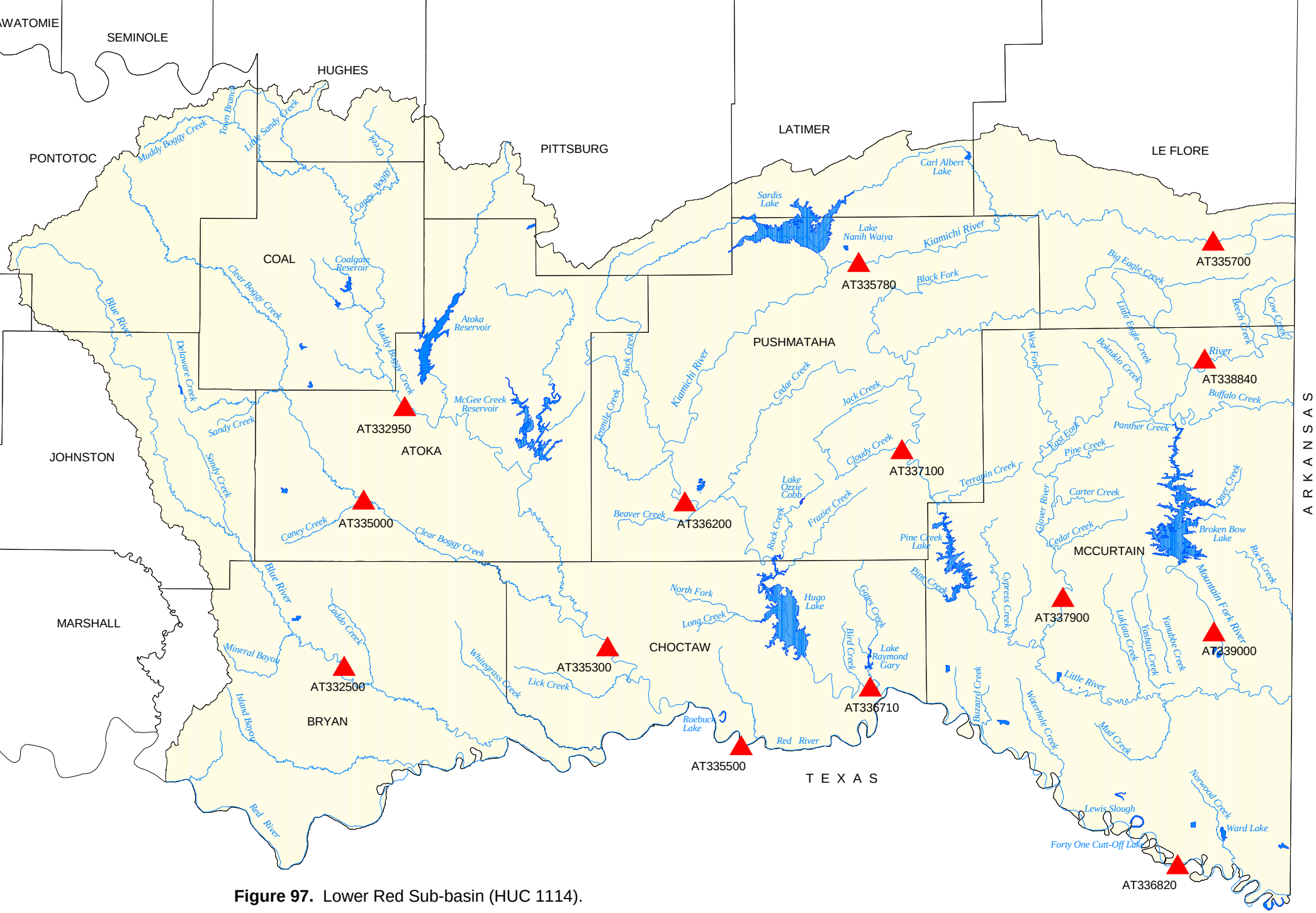


Figure 97. Lower Red Sub-basin (HUC 1114).

HUC 1114

LOWER RED SUB-BASIN

The Lower Red sub-basin (4-digit hydrologic unit 1114) is situated in the southeastern portion of the state. It originates in the central portion of Pontotoc County, continues eastward through portions of Murray, Johnston, Bryan, Hughes, Coal, Atoka, Pittsburg, Latimer, Pushmataha, and Choctaw Counties, and terminates in the eastern parts of LeFlore and McCurtain Counties. Major cities and County seats located within the basin include Coalgate, Atoka, Durant, Antlers, Hugo, Broken Bow, and Idabel. Minor cities of note include Kiowa, Fort Towson, Rattan, Clayton, Talihina, Smithville, and Valliant.

The basin is subdivided into nine 8-digit hydrologic units (HUC) that are all contained wholly within the state. These HUC's are the Bois D'Arc–Island (11140101), the Blue (11140102), the Muddy Boggy (11140103), the Clear Boggy (11140104), the Kiamichi (11140105), the Pecan–Waterhole (11140106), the Upper Little (11140107), the Mountain Fork (11140108), and Lower Little (11140109). The major surface water in the basin is the lower Red River. Major tributaries include the Blue River, the Kiamichi River, the Little River, the Glover River, the Mountain Fork River, Island Bayou, Whitegrass Creek, Clear Boggy Creek, Muddy Boggy Creek, Jackfork Creek, Cedar Creek, Buzzard Creek, Black Fork, Lukfata Creek, and Big Eagle Creek. Six major lakes are located in the basin—Atoka Reservoir formed by North Boggy Creek, McGee Creek Reservoir formed by McGee Creek, Sardis Lake formed by Jackfork and Buffalo Creeks, Hugo Lake formed by the Kiamichi River, Pine Creek Lake formed by the Little River, and Broken Bow Lake formed by the Mountain Fork River. Fourteen active permanent water quality-monitoring stations (Table 33) are located in the basin—AT332500, AT332950, AT335000, AT335300, AT335500, AT335700, AT335780, AT336200, AT336820, AT337100, AT337900, AT338000, AT338840, and AT339000. Two inactive water quality-monitoring station (AT334000 and AT338500) is located in the sub-basin. Station AT33400 was last assessed in the 1999 BUMP report. Station 338500, Little River near Idabel, was included in the 2003 BUMP report, but will not be assessed further. Because the station is located within a regulatory mixing zone, the OWRB cannot support previously collected data and will not include in future federal and state lists. Station AT338000, Little River near Holly Creek, was begun in the beginning of 2003 and will replace the Idabel station. However, it will not be assessed in this report due to lack of data.

The basin is characterized by three ecoregions. The Central Oklahoma/Texas Plains is the primary ecoregion beginning in the northwestern portion and continuing through the southern one-half (½) of the sub-basin. The Ouachita Mountains cover the remainder of the northern one-half (½) of the sub-basin. The South Central Plains cover the southeastern quarter (¼) of the McCurtain County. The primary land usage in the sub-basin is forestland (shortleaf pine, loblolly pine, pine plantations, and oak–hickory). It dominates the central and most of the eastern portions and is further interspersed throughout the sub-basin. The secondary land use is pastureland (brushy and mixed) that dominates parts of the western portion of the sub-basin and is interspersed throughout the sub-basin with areas of concentration in Pushmataha and southern McCurtain Counties. The tertiary land use is rangeland (open grasslands and woody areas) that is prevalent in the northwestern portion and is interspersed throughout the central and southern portions of the sub-basin. Other land uses of note are cropland, bottom woodlands, farmsteads, major urban areas, wetlands, and confined animal feeding operations.

Table 33. Permanent Ambient Trend Monitoring Stations Located in HUC 1114.

WBID #	STATION #	STATION NAME	STATUS	FS	PS	NS/T	CBD
410600010010	AT332500	Blue River, US 70, Durant	Active 11/98-P	AG, AES, PPWS	FWP	PBCR	NONE
410400030010	AT335000	Clear Boggy Creek, off US 69, Caney	Active 11/98-P	AG, AES, PPWS	NONE	FWP, PBCR	NONE
410210080010	AT337900	Glover River, SH 3, Glover	Active 11/98-P	AG, AES, PPWS	NONE	FWP, PBCR	NONE
410300030010	AT336200	Kiamichi River, US 271, Antlers	Active 11/98-P	AG, AES, PPWS	NONE	FWP, PBCR	NONE
410310020010	AT335700	Kiamichi River, SH 63, Big Cedar	Active 11/98-P	AG, AES, PBCR, PPWS	NONE	FWP	NONE
410310010010	AT335780	Kiamichi River, off US 271, Tuskahoma	Active 11/98-P	AG, AES, PBCR, PPWS	NONE	FWP	NONE
410210020140	AT337100	Little River, off SH 3, Cloudy	Active 11/98-P	AG, AES, PPWS	NONE	FWP, PBCR	NONE
410210040010	AT339000	Mountain Fork, US 70, Eagletown	Active 11/98-P	AG, AES, PPWS	NONE	FWP, PBCR	NONE
410210060010	AT338840	Mountain Fork, SH 4, Smithville	Active 11/98-P	AG, AES, PPWS	NONE	FWP, PBCR	NONE
410400050270	AT332950	Muddy Boggy Creek, US 69, Atoka	Active 9/99-P	AG, AES, PPWS	NONE	FWP, PBCR	NONE
410400010070	AT335300	Muddy Boggy Creek, US 70, Unger	Active 7/99-P	AG, AES, PPWS	NONE	FWP, PBCR	NONE
410100010010	AT336820	Red River, US 259, Harris	Active 11/98-P	AES, PBCR, PPWS	FWP	AG	NONE
410400010010	AT335500	Red River, US 271, Hugo	Active 11/98-P	AES, PPWS	FWP	AG, PBCR	NONE

ASSIGNED OWQS BENEFICIAL USES AND SUPPORT CODES

PPWS = PUBLIC AND PRIVATE WATER SUPPLY	EWS = EMERGENCY WATER SUPPLY
FWP = FISH & WILDLIFE PROPAGATION	PBCR = PRIMARY BODY CONTACT RECREATION
AG = AGRICULTURE	AES = AESTHETICS
FS = FULLY SUPPORTING	PS = PARTIALLY SUPPORTING
NS/T = NOT SUPPORTING/THREATENED	CBD = CANNOT BE DETERMINED

Table 34. Toxicant exceedances in HUC 1114.

STATION #	STATION NAME	DATE	Cadmium (µg/L)	Copper (µg/L)	Lead (µg/L)	Zinc (µg/L)
AT335000	Clear Boggy Creek, off US 69, Caney	05/03/2000			9.00	
		04/10/2001			12.00	
		09/03/2003			14.93	
AT337900	Glover River, SH 3, Glover	05/23/2001			0.90	
		09/18/2001			0.45	
		10/24/2001			1.53	
		04/23/2002			0.58	
		04/16/2003			1.21	
		09/03/2003			0.77	
AT336200	Kiamichi River, US 271, Antlers	11/06/2000		5.00		
		04/25/2001			0.66	
		05/23/2001			2.50	
		06/20/2001			4.42	
		08/21/2001			0.88	
		09/18/2001		3.90	0.97	
		10/24/2001		4.80	1.08	

STATION #	STATION NAME	DATE	Cadmium (µg/L)	Copper (µg/L)	Lead (µg/L)	Zinc (µg/L)
		04/24/2002			2.11	
		02/05/2003			1.60	
		04/16/2003			1.77	
		09/03/2003			1.15	
AT335700	KIAMICHI RIVER, SH 63, BIG CEDAR	05/22/2001			0.29	
		06/19/2001			0.53	
		08/20/2001			0.50	
		09/17/2001			0.42	
		04/24/2002			0.34	
		04/14/2003			1.60	
		09/03/2003			0.45	
AT	KIAMICHI RIVER, SH 109, FORT TOWSON	04/24/2002			2.41	
		2/04/2003			1.21	
		04/16/2003			2.07	
		09/02/2003			11.39	
AT335780	KIAMICHI RIVER, OFF US 271, TUSKAHOMA	11/06/2000		8.00		
		04/24/2001			2.26	
		05/22/2001		3.88	2.97	
		06/19/2001			0.59	
		08/20/2001			0.48	
		09/17/2001			0.86	
		10/23/2001			0.56	
		04/15/2003			1.47	
		09/03/2003			0.88	
AT337100	LITTLE RIVER, OFF SH 3, CLOUDY	11/30/1999				35.00
		04/25/2001			0.34	
		05/23/2001			0.69	
		06/20/2001			0.52	24.00
		08/21/2001			0.55	
		09/18/2001			0.68	
		10/24/2001			1.16	
		04/24/2002			0.68	
		02/05/2003			0.46	
		04/16/2003			0.97	
		09/03/2003			0.47	
AT339000	MOUNTAIN FORK, US 70, EAGLETOWN	05/03/2000			4.00	
		04/25/2001			1.81	
		05/22/2001			5.77	
		08/21/2001			0.69	
		09/18/2001			4.28	
		10/24/2001			19.73	
		04/23/2002			8.65	

STATION #	STATION NAME	DATE	Cadmium (µg/L)	Copper (µg/L)	Lead (µg/L)	Zinc (µg/L)
		02/04/2003	0.54			
		04/15/2003	0.30		3.84	
		09/02/2003			1.86	
AT338840	MOUNTAIN FORK, SH 4, SMITHVILLE	11/07/2000		6.00		
		04/24/2001			0.37	
		05/22/2001			0.51	
		08/20/2001		6.50	0.68	
		09/17/2001			0.78	
		04/23/2002			0.57	
		04/15/2003			1.09	
		09/03/2003			0.47	
AT332950	MUDDY BOGGY CREEK, US 69, ATOKA	05/03/2000			10.00	
		04/10/2001			2.81	
		05/15/2001			3.49	
		06/12/2001			2.97	
		08/14/2001			3.02	
		10/16/2001			3.86	
		09/03/2003			13.60	
AT335300	MUDDY BOGGY CREEK, US 70, UNGER	05/03/2000			10.00	
		11/08/2000			15.00	
		05/15/2001			6.72	

Table 35. Exceedances of fecal coliform, enterococci, and *E. coli* screening limits in HUC 1114. Only values leading to a determination of not supporting for the Public and Private Water Supply and the Primary Body Contact Recreation beneficial uses are in included.

STATION #	STATION NAME	DATE	Fecal Coliform (cfu/mL)	Enterococci (cfu/mL)	*E. coli* (cfu/mL)
AT332500	BLUE RIVER, US 70, DURANT	08/08/2000		500	
		06/10/2002		1400	
		09/11/2002		5000	
		07/30/2003		1900	
		08/19/2003		500	
		09/03/2003		2300	
AT335000	CLEAR BOGGY CREEK, OFF US 69, CANEY	08/10/1999	440		
		06/06/2000		690	520
		09/13/2000		900	
		05/30/2001	2500		1396
		09/04/2001	1000		2333
		05/15/2002	1600	5000	619
		09/11/2002	600		
		06/10/2003	4000		

STATION #	STATION NAME	DATE	Fecal Coliform (cfu/mL)	Enterococci (cfu/mL)	*E. coli* (cfu/mL)
		09/03/2003	2700		
		09/23/2003	800		
AT337900	GLOVER RIVER, SH 3, GLOVER	05/23/2001		500	
AT336200	KIAMICHI RIVER, US 271, ANTLERS	05/23/2001		1100	
		09/18/2001		700	
		05/22/2002		6000	
		05/21/2003		800	
		09/03/2003		500	
AT337100	LITTLE RIVER, OFF SH 3, CLOUDY	08/22/2000		8000	
		09/18/2001		500	
		07/14/2003		700	
		08/18/2003		2800	
		09/03/2003		700	
AT339000	MOUNTAIN FORK, US 70, EAGLETOWN	05/02/2000		410	
		08/22/2000		1600	
		08/21/2001		4000	
		05/22/2002		1100	
		07/23/2002		2600	
		09/11/2002		3000	
AT338840	MOUNTAIN FORK, SH 4, SMITHVILLE	08/10/1999		80	
		09/13/1999		310	
		06/13/2000		180	
		07/18/2000		80	
		08/15/2000		120	
		07/24/2001		130	
		07/23/2002		800	
		06/25/2003		100	
		07/14/2003		100	
		09/02/2003		1800	
		09/22/2003		200	
AT332950	MUDDY BOGGY CREEK, US 69, ATOKA	06/06/2000	440		
		05/30/2001	1700		
		06/13/2001	15000		
		05/15/2002	5000	3000	
		06/10/2002	900	1300	
		07/17/2002		800	
		06/25/2003	700		
		07/15/2003		900	
		09/03/2003	1400	1600	
		09/23/2003	1500	1270	
AT335300	MUDDY BOGGY CREEK, US 70, UNGER	07/11/1999	900		
		06/06/2000	700		

STATION #	STATION NAME	DATE	Fecal Coliform (cfu/mL)	Enterococci (cfu/mL)	*E. coli* (cfu/mL)
		09/13/2000	1280		
		05/30/2001	1000		
		09/04/2001	700		
		05/13/2002	500	8000	
		06/10/2002	600	1600	
		09/09/2002	4000	4000	
AT335500	RED RIVER, US 271, HUGO	06/28/1999	480		
		06/06/2000	1120	440	
		09/13/2000	1130		
		05/13/2002	4000	1500	
		06/10/2002	500		
		09/09/2002	3000	900	

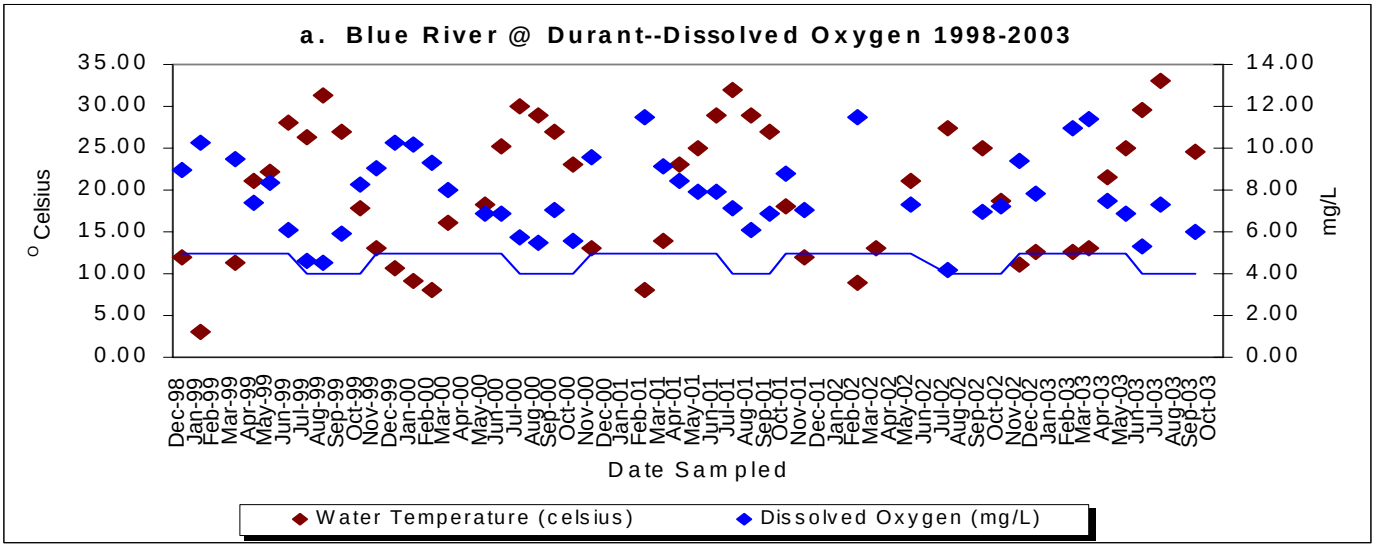
Blue River near Durant

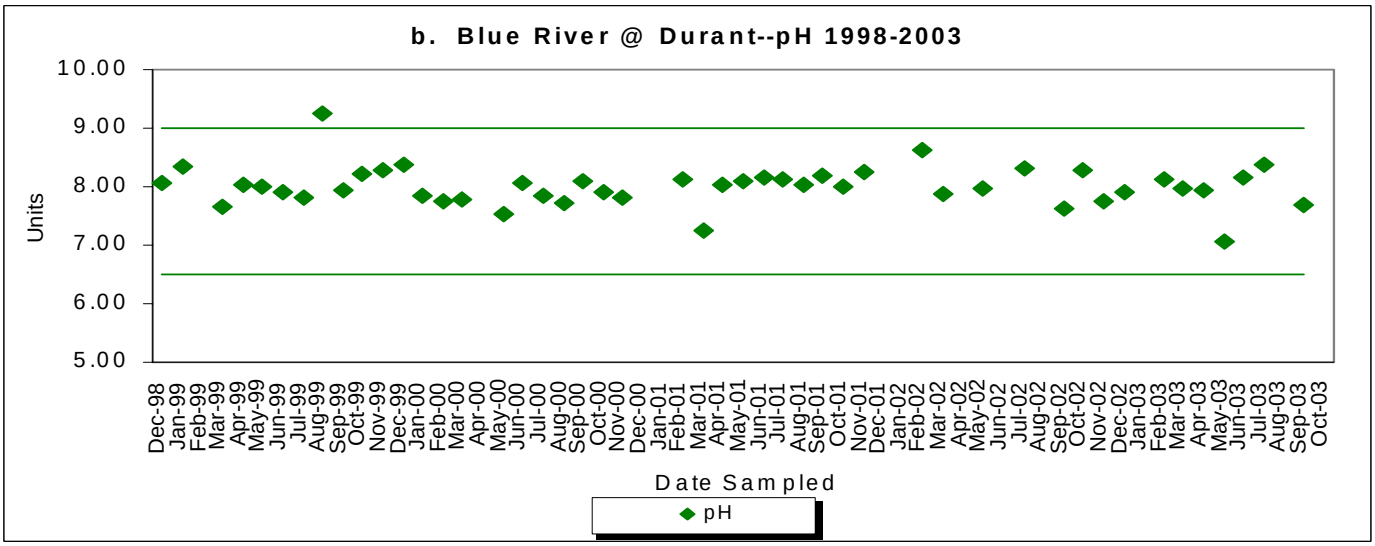
Station AT332500 (410600010010-001AT) is a permanent ambient trend monitoring station located on the Blue River. Situated in the central portion of Bryan County, the site was established east of the City of Durant on US Highway 70. The station is positioned between the upper end and midpoint of stream segment 410600010010 and is classified within the Blue River 8-digit HUC watershed (11140102). Water enters the stream system from several tributaries including Mineral Bayou and Caddo Creek, among others.

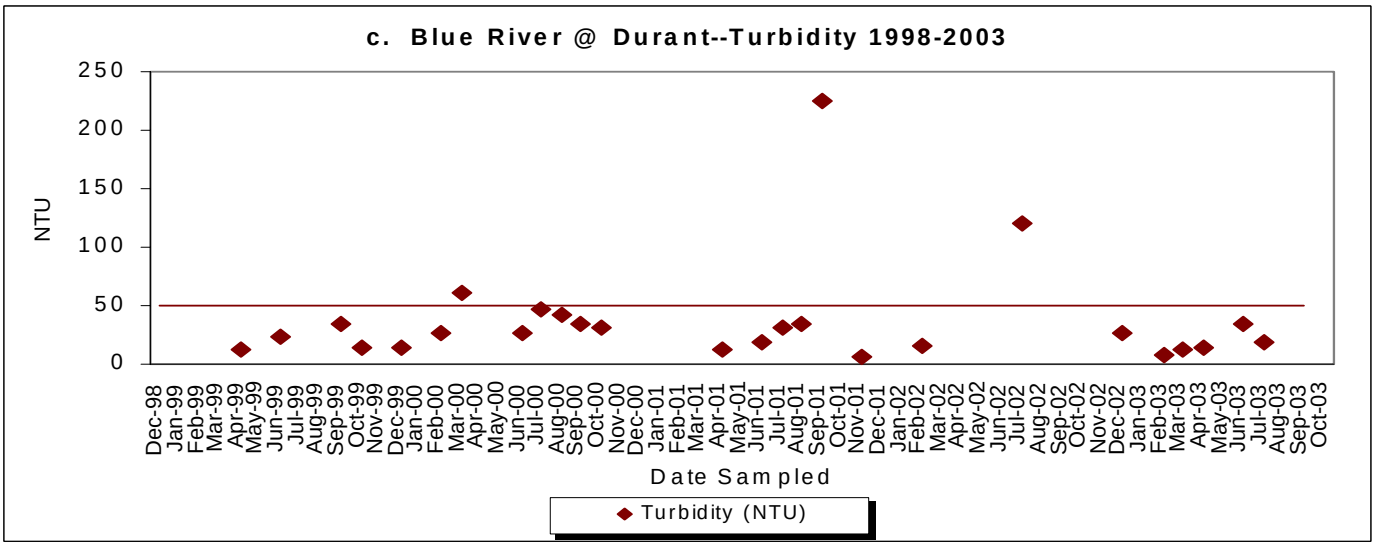
This station on the Blue River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through September of 2003. For purposes of reporting, this station is representative of the Blue River from the confluence of Mineral Bayou (96.3357, 34.0462) downstream to confluence of the Blue River with the Red River (95.9356, 33.8879). As per Appendix A, Table 4 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

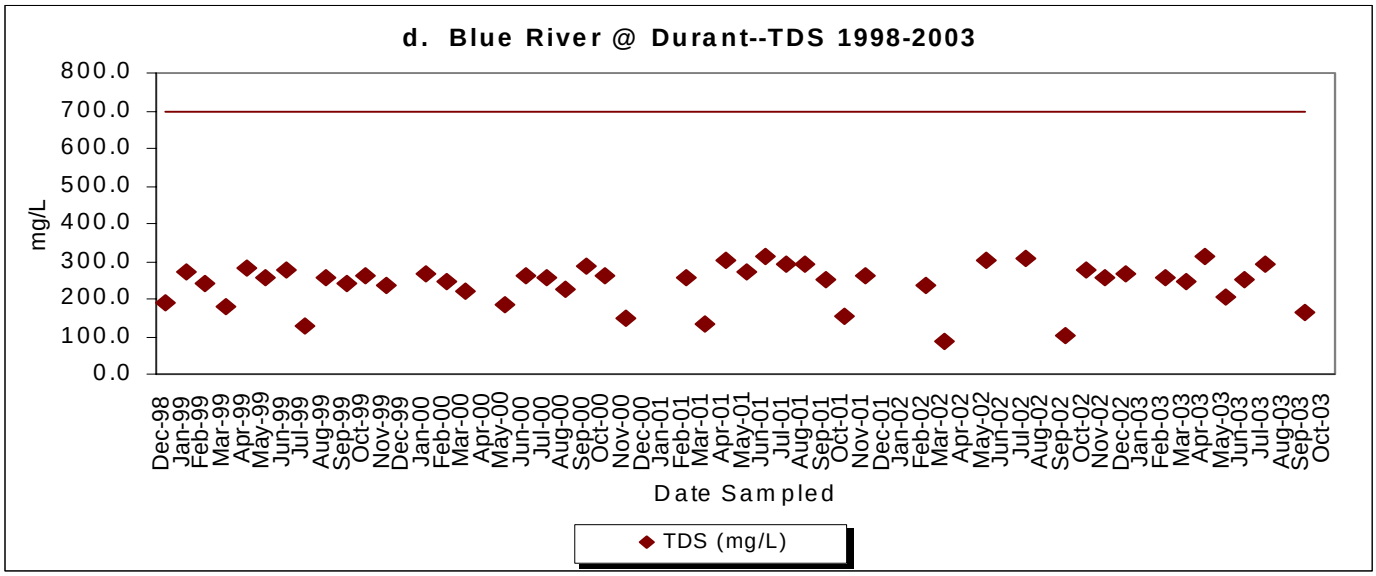
The PPWS beneficial use is supported. The WWAC beneficial use is partially supported. Of the 26 turbidity samples (Figure 98c), 3 samples (or 12%) exceeded the numerical criteria of 50. Dissolved oxygen (Figure 98a), pH (Figure 98b), and toxicant samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 98d and Figure 98e). The PBCR beneficial use is not supported (Table 35). Of the 24 enterococci concentrations, 6 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (273.7 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Blue River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 98f).

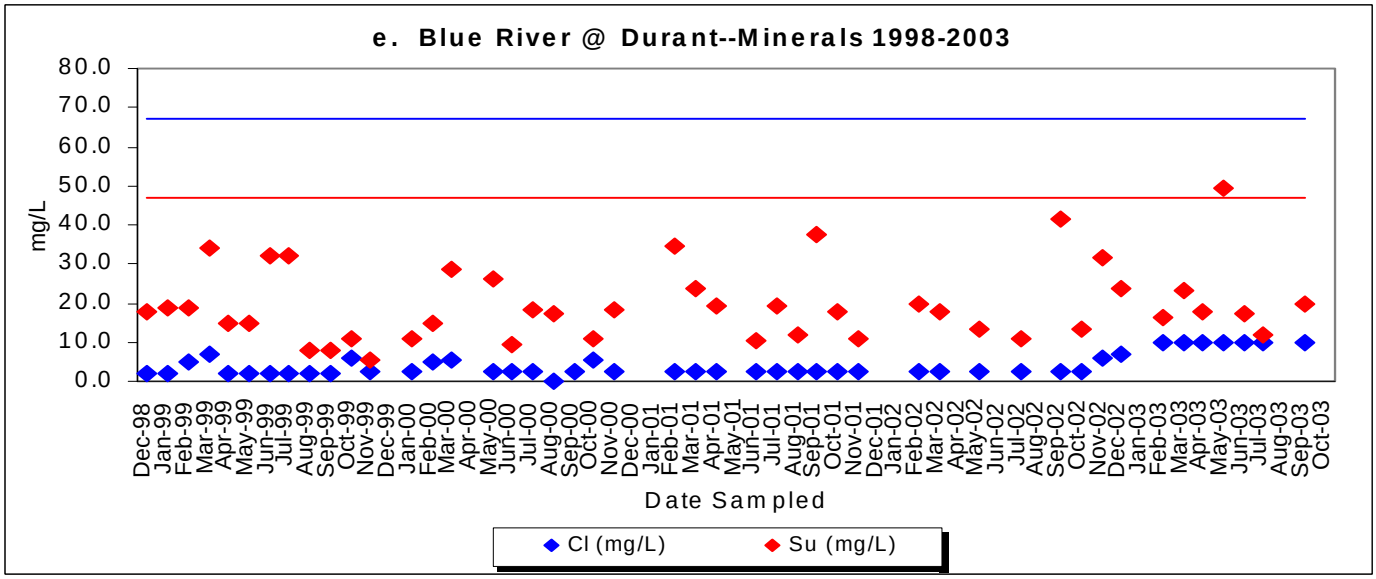
Figure 98a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Blue River at Durant (AT332500), 1998-2003.

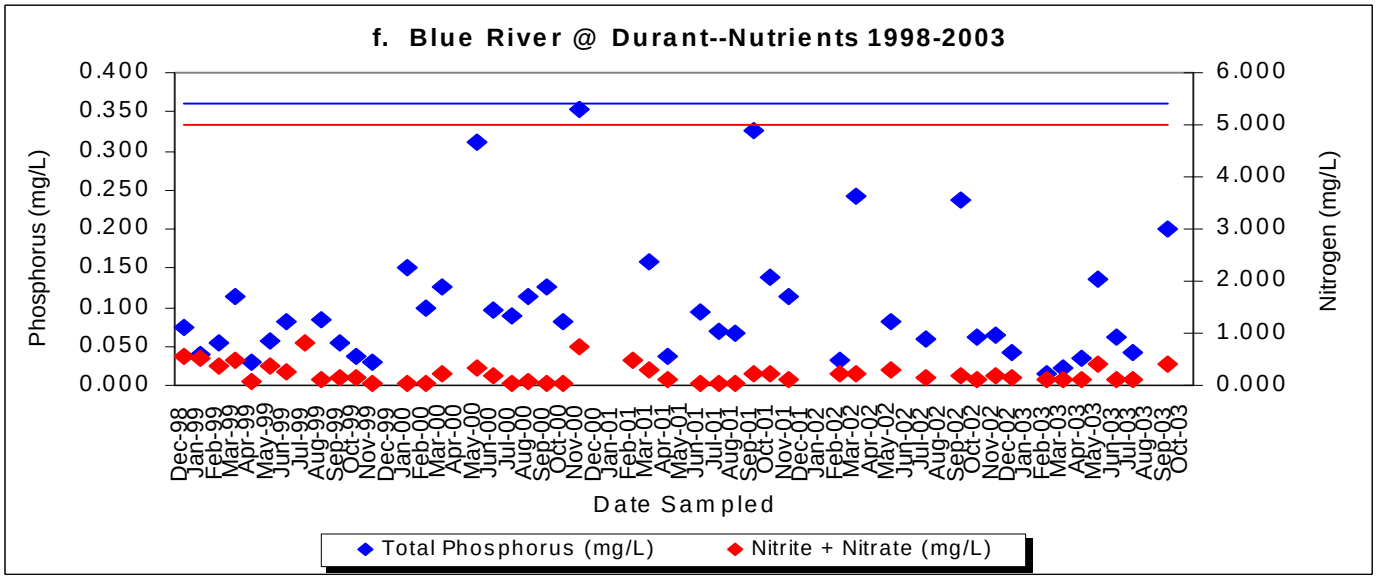







d. Blue River @ Durant--TDS 1998-2003
mg/L
Date Sampled
TDS (mg/L)


e. Blue River @ Durant--Minerals 1998-2003
mg/L
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Blue River @ Durant--Nutrients 1998-2003
Phosphorus (mg/L)
Nitrogen (mg/L)
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

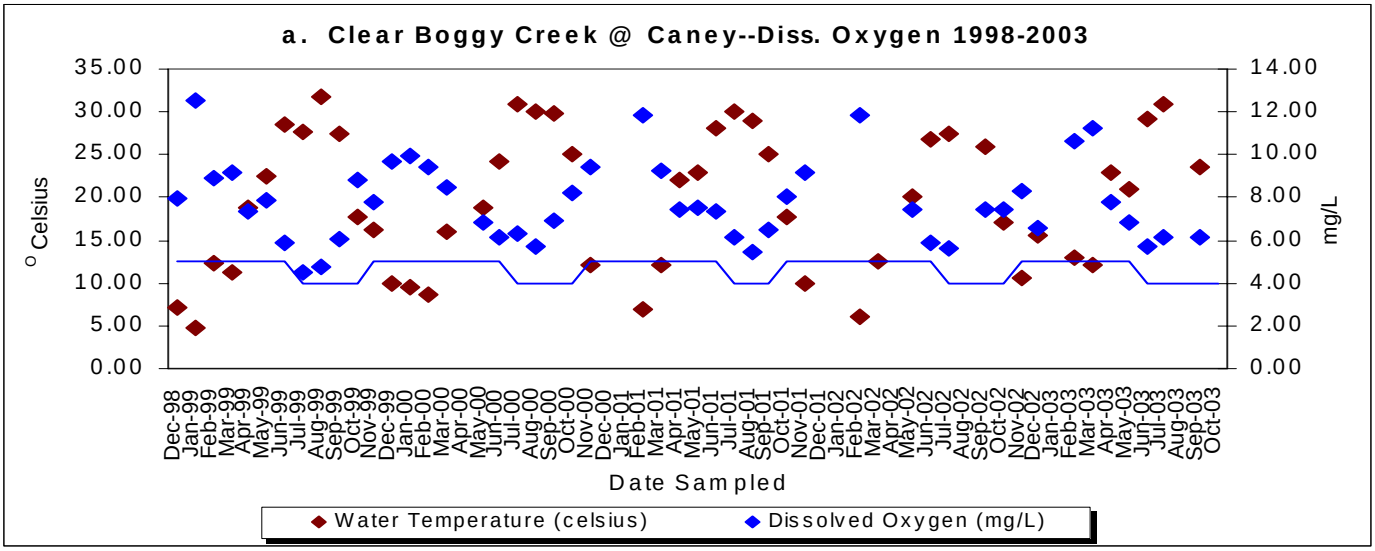
Clear Boggy Creek near Caney

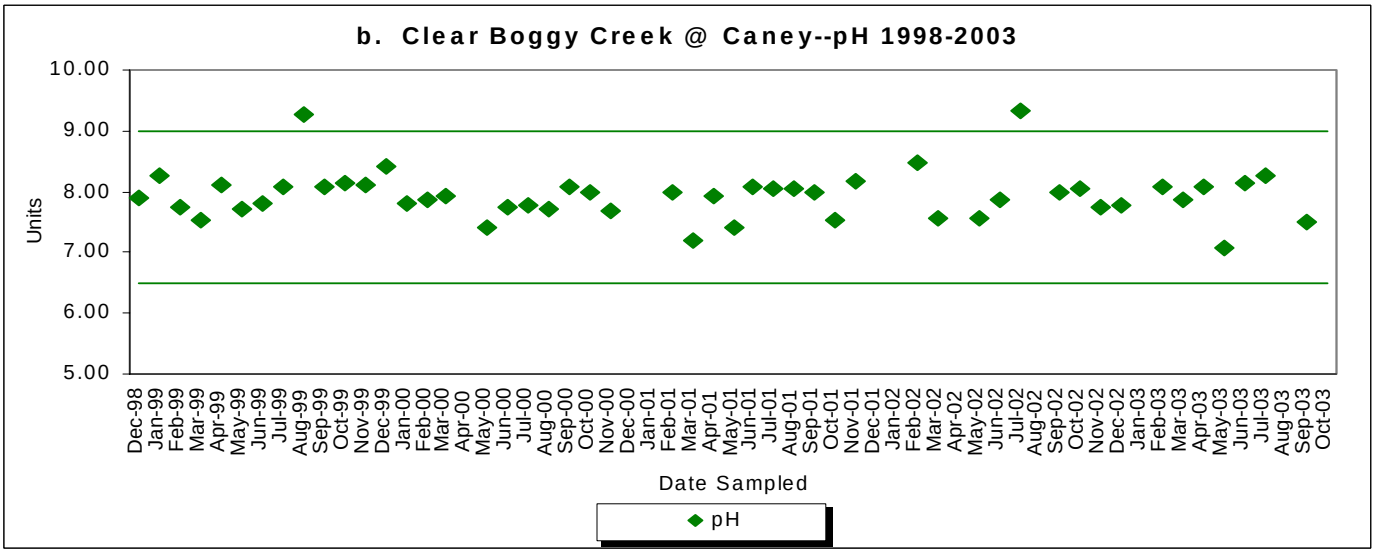
Station AT335000 (410400030010-001AT) is a permanent ambient trend monitoring station between the midpoint and the lower end of Clear Boggy Creek. Situated in the southwestern portion of Atoka County, the site was established north of the Town of Caney off of US Highway 69 on Old 69. The station is positioned near the terminal end of stream segment 410400030010 and is classified within the Clear Boggy Creek 8-digit HUC watershed (11140104). Water enters the stream system from several tributaries including Delaware Creek, Sandy Creek, Salt Creek, and Caney Creek, among others.

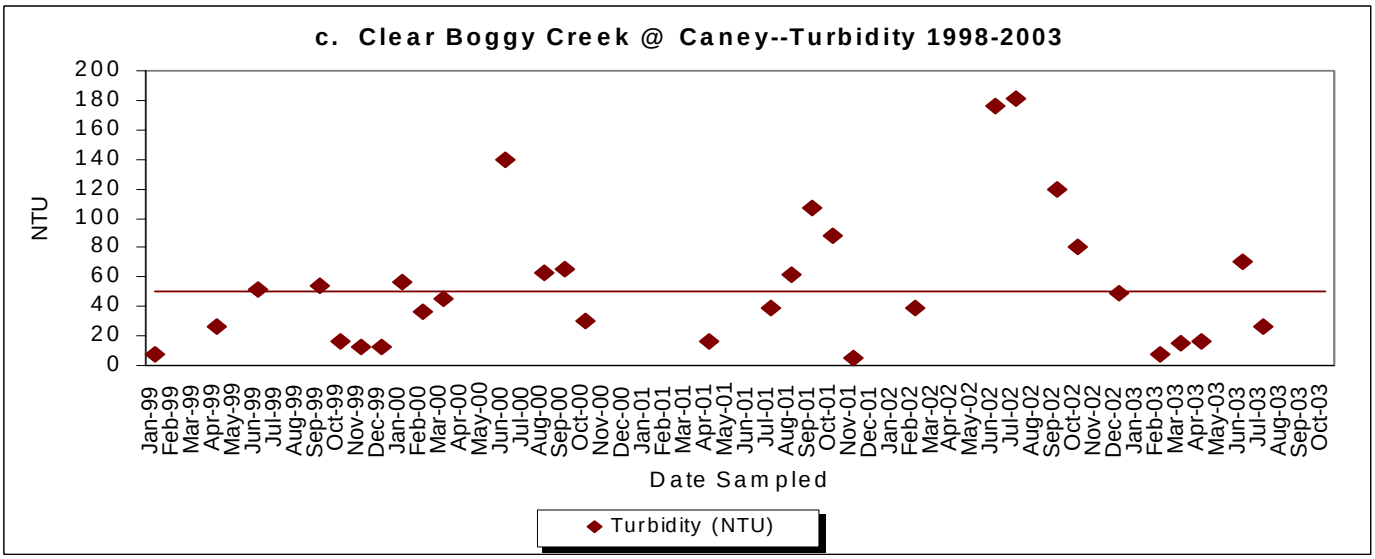
This station on Clear Boggy Creek has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through October of 2003. For purposes of reporting, this station is representative of Clear Boggy Creek from the confluence of Delaware Creek (96.3571, 34.4173) downstream to the confluence of an unnamed tributary near Taloah, Oklahoma with Clear Boggy Creek (96.1834, 34.2474). As per Appendix A, Table 4 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

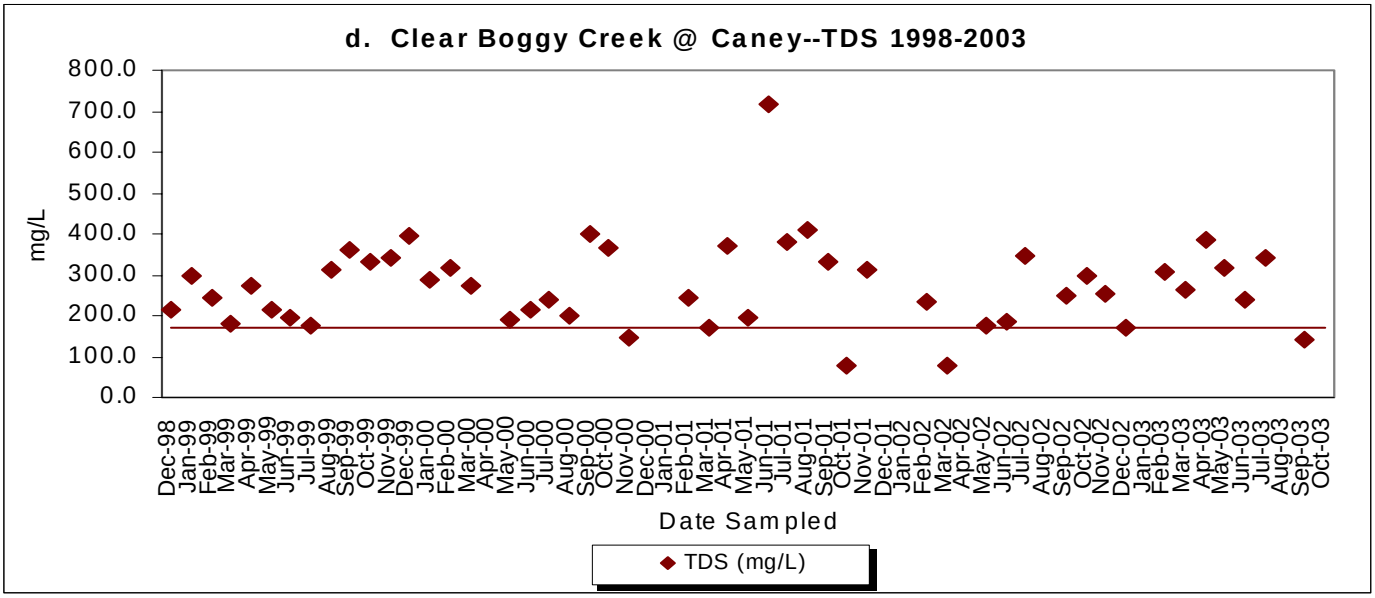
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 31 turbidity samples (Figure 99c), 14 samples (or 45%) exceeded the numerical criteria of 50. Of the 14 lead samples collected, 3 of the concentrations (or 21%) exceeded the prescribed hardness-dependant chronic criteria of 7.41 µg/L (Table 34). Dissolved oxygen (Figure 99a) and pH (Figure 99b) samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 99d and Figure 99e). Although 88% of the TDS concentrations exceeded the sample standard of 172.0 mg/L and the geometric mean (222.7 mg/L) exceeded the yearly mean standard of 114 mg/L, the values are below the minimum values of 750 and 700 mg/L, respectively. The PBCR beneficial use is not supported (Table 35). Of the 23 fecal coliform concentrations, 8 samples (or 35%) exceeded the prescribed screening level of 400 cfu/mL. Of the 22 enterococci concentrations, 6 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (211.5 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of Clear Boggy Creek is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 99f).

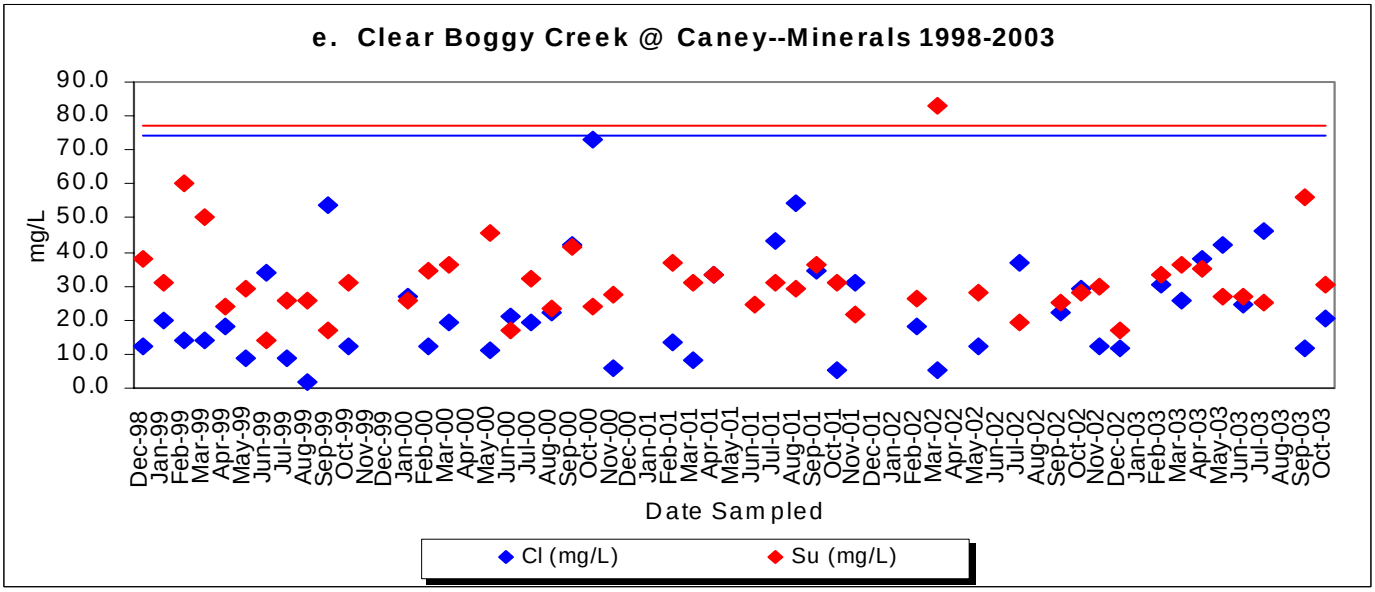
Figure 99a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on Clear Boggy Creek at Caney (AT335000), 1998-2003.

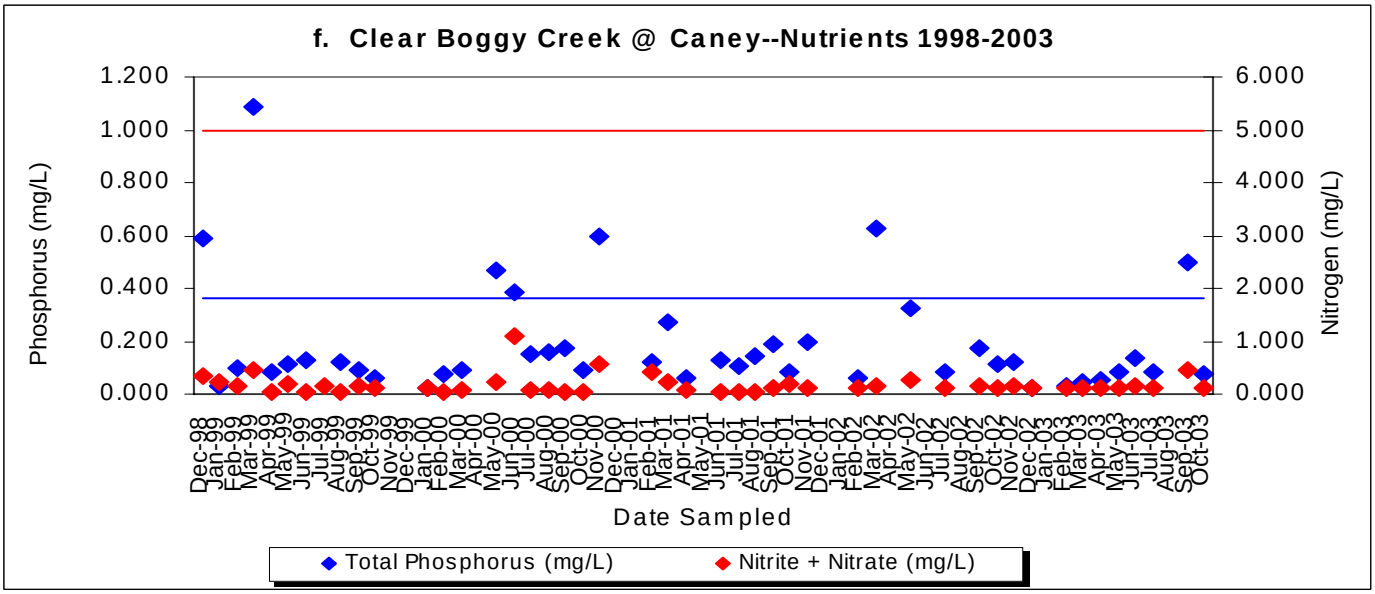







d. Clear Boggy Creek @ Caney--TDS 1998-2003
mg/L
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Date Sampled
TDS (mg/L)


e. Clear Boggy Creek @ Caney--Minerals 1998-2003
mg/L
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Clear Boggy Creek @ Caney--Nutrients 1998-2003
Phosphorus (mg/L)
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

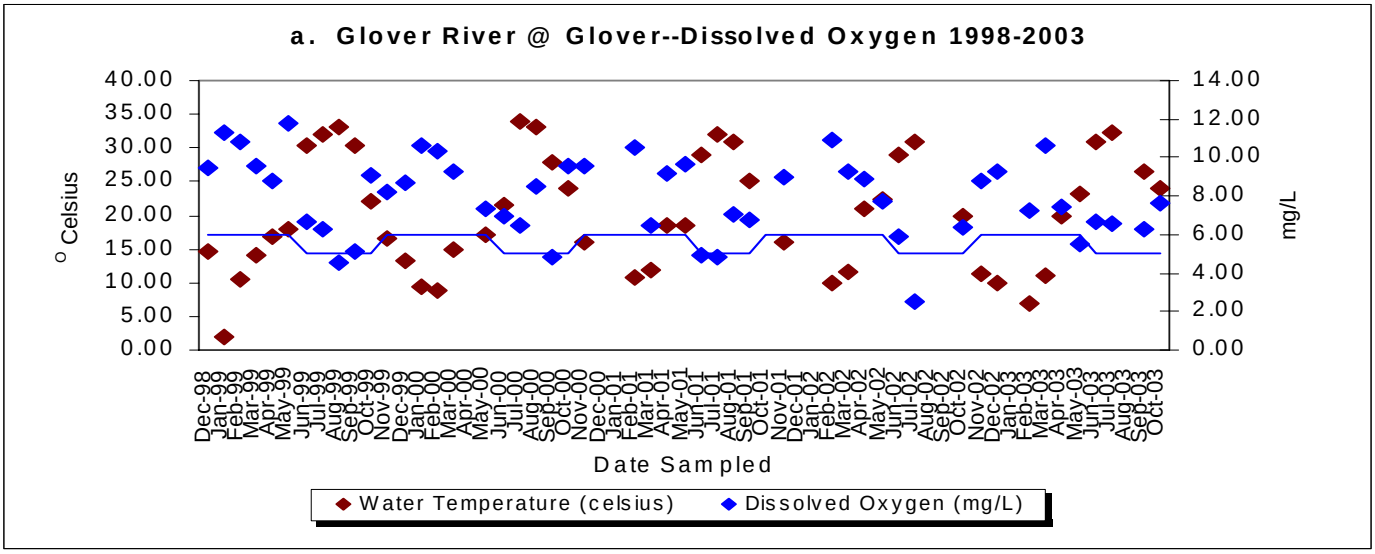
Glover River near Glover

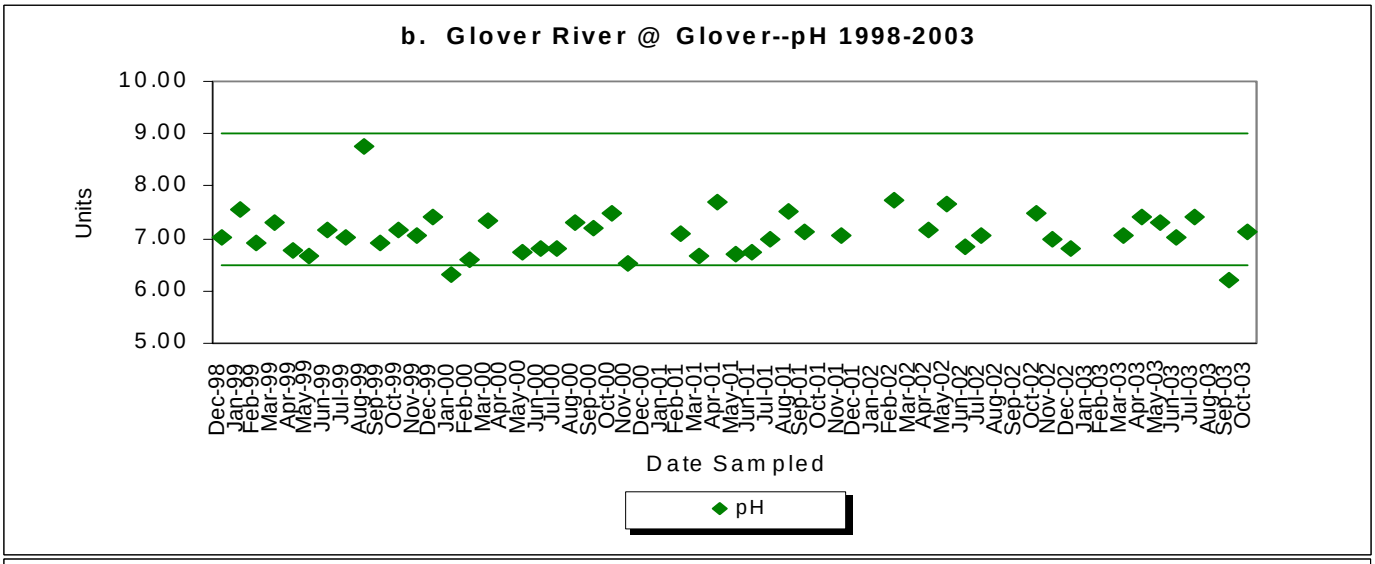
Station AT337900 (410210080010-001AT) is a permanent ambient trend monitoring station located on the Glover River. Situated in the east central portion of McCurtain County, the site was established west of the Town of Glover on State Highway 3. The station is positioned near the midpoint end of stream segment 410210080010 and is classified within the Upper Little River 8-digit HUC watershed (11140107). Water enters the stream system from several tributaries including Pine Creek, Beeman Creek, Carter Creek, Shell Rock Creek, Cedar Creek, and Colbert Creek, among others.

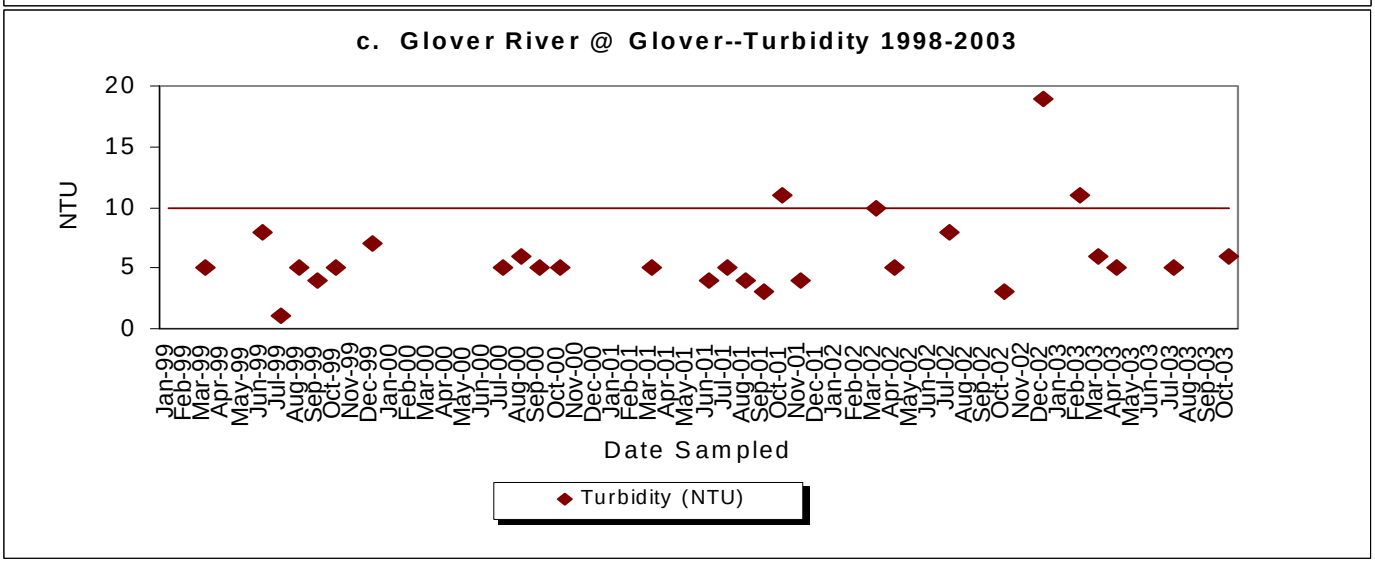
This station on the Glover River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through October of 2003. For purposes of reporting, this station is representative of the Glover River from the confluence of the West Fork and the East Fork (94.9352, 34.3092) downstream to confluence of the Glover River with the Little River (94.9379, 34.0192). As per Appendix A, Table 7 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Cool Water Aquatic Community—Fish and Wildlife Propagation (CWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

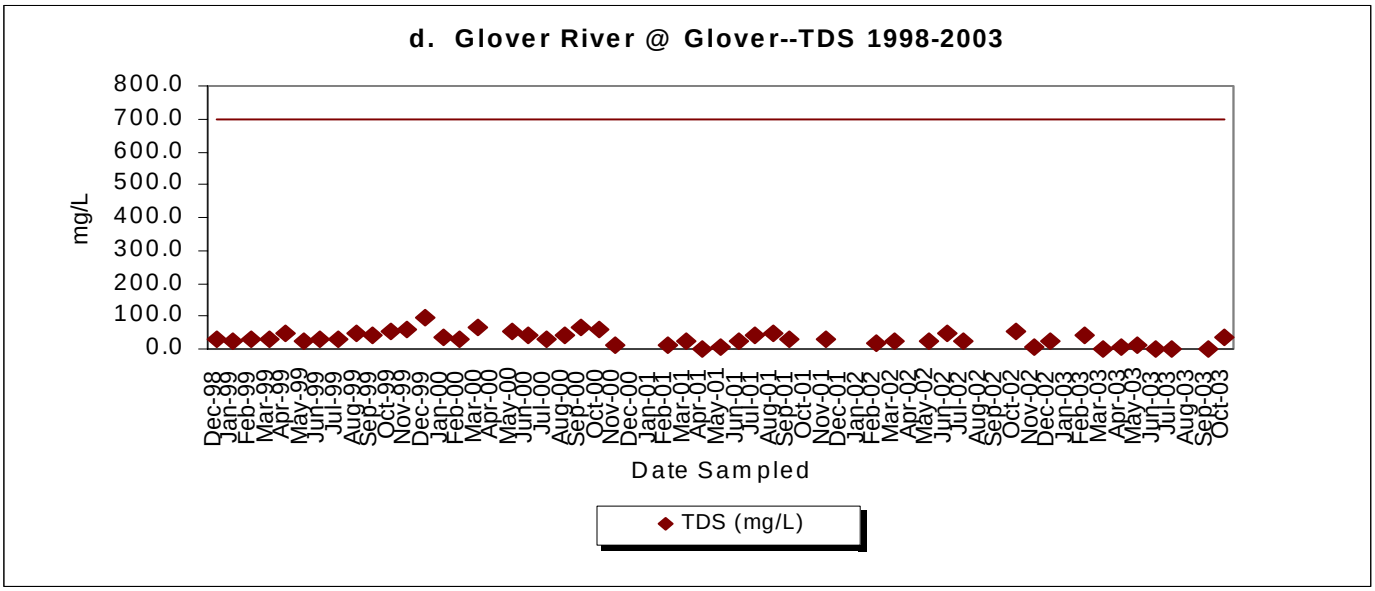
The PPWS beneficial use is supported. The CWAC beneficial use is not supported. Of the 11 lead samples collected, 7 of the concentrations (or 76%) exceeded the hardness-specific chronic criteria of 0.37 µg/L (Table 34). Of the 49 dissolved oxygen concentrations (Figure 100a), 6 samples (or 12%) were below the screening level. The pH (Figure 100b) and turbidity (Figure 100c) samples met the criteria prescribed in the CWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 100d and Figure 100e). The PBCR beneficial use is not supported (Table 35). Of the 17 enterococci concentrations, 1 sample exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (37.6 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Glover River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 100f).

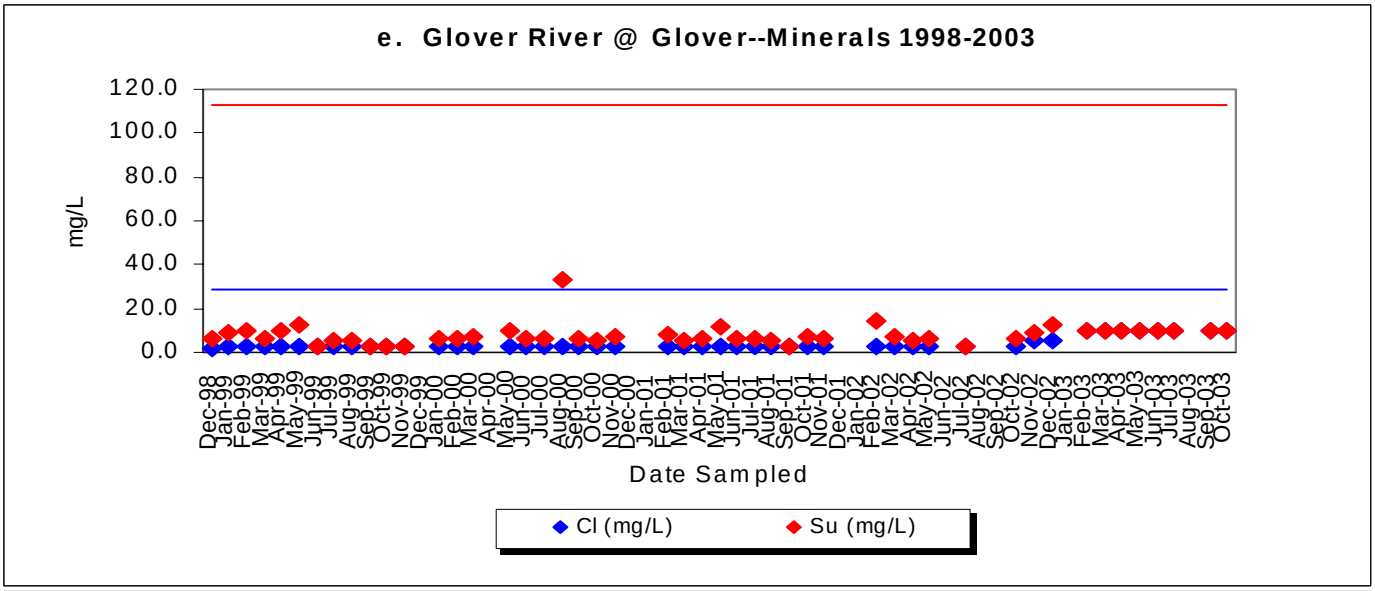
Figure 100a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Glover River at Glover (AT337900), 1998-2003.

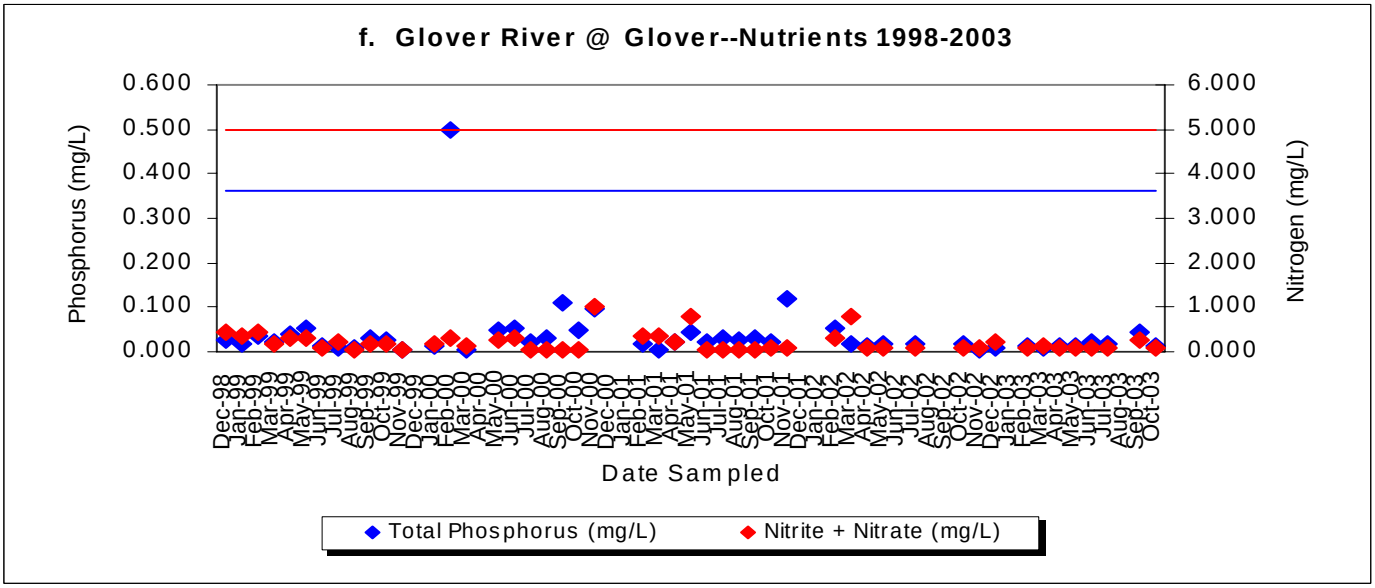







d. Glover River @ Glover--TDS 1998-2003
mg/L
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Date Sampled
TDS (mg/L)


e. Glover River @ Glover--Minerals 1998-2003
mg/L
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Glover River @ Glover--Nutrients 1998-2003
Phosphorus (mg/L)
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

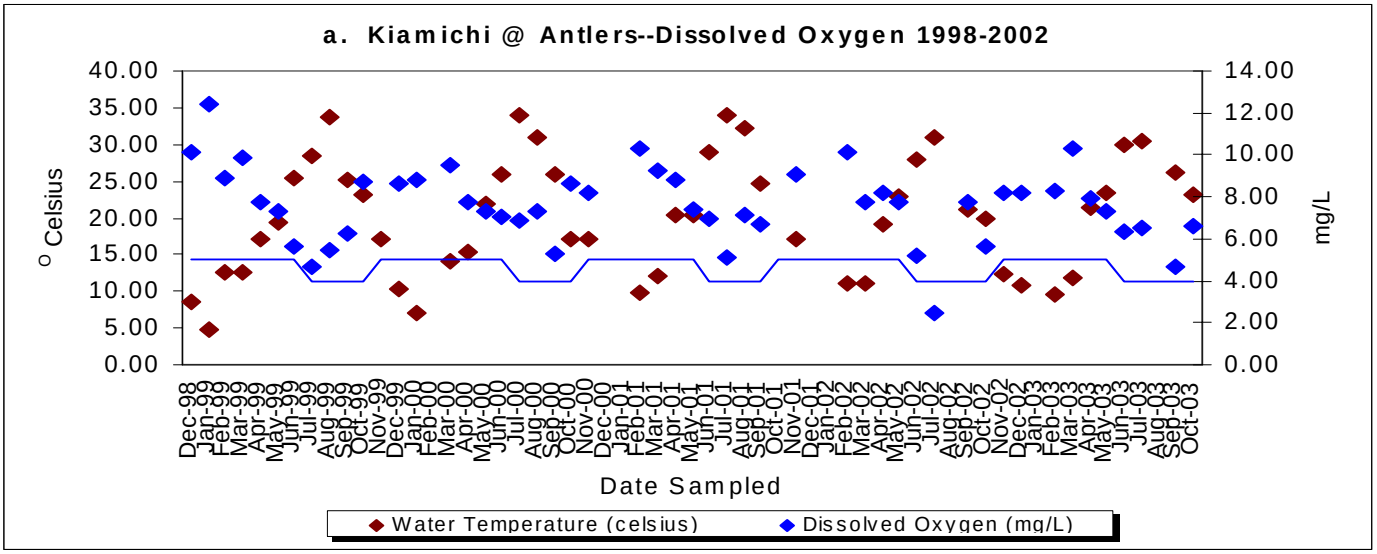
Kiamichi River near Antlers

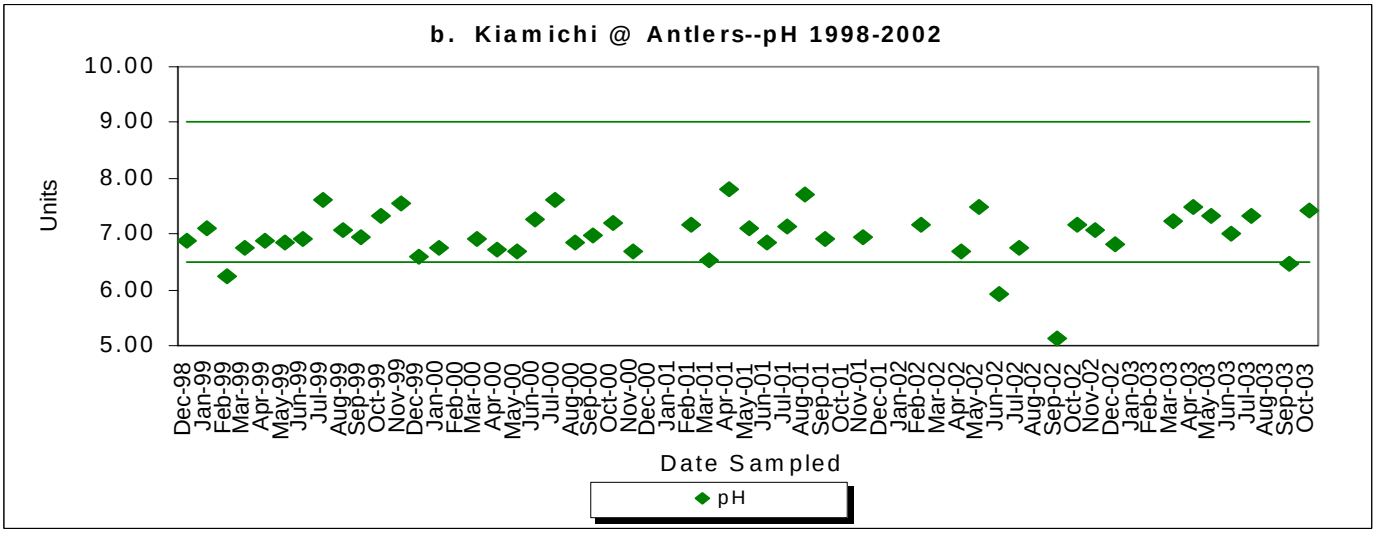
Station AT336200 (410300030010-001AT) is a permanent ambient trend monitoring station located on the Kiamichi River in Oklahoma. Situated in the southwestern portion of Pushmataha County, the site was established north of the Town of Antlers on US Highway 271. The station is positioned near the midpoint of stream segment 410300030010 and is classified within the Kiamichi River 8-digit HUC watershed (11140105). Water enters the stream system from several tributaries including Lily Pond Creek, Buck Creek, Tenmile Creek, Cedar Creek, and Duck Creek, among others.

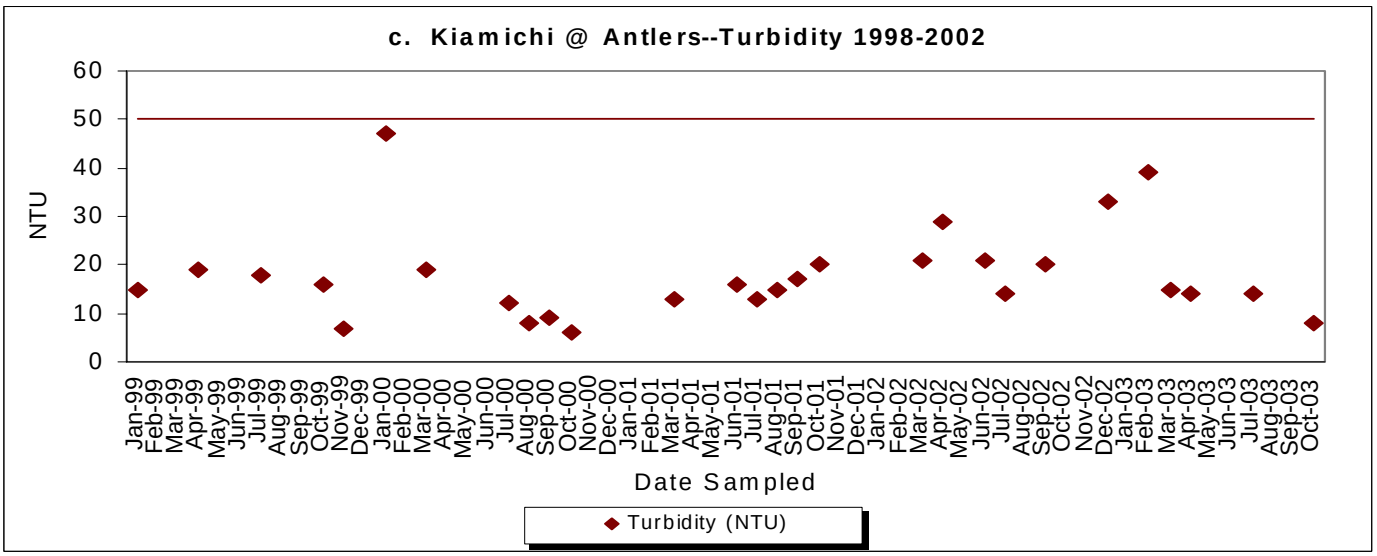
This station on the Kiamichi River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through October of 2003. For purposes of reporting, this station is representative of the Kiamichi River from below the confluence of Caney Creek (95.5955, 34.3819) downstream to below the confluence of Duck Creek with the Kiamichi River (95.4968, 34.2398). As per Appendix A, Table 4 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

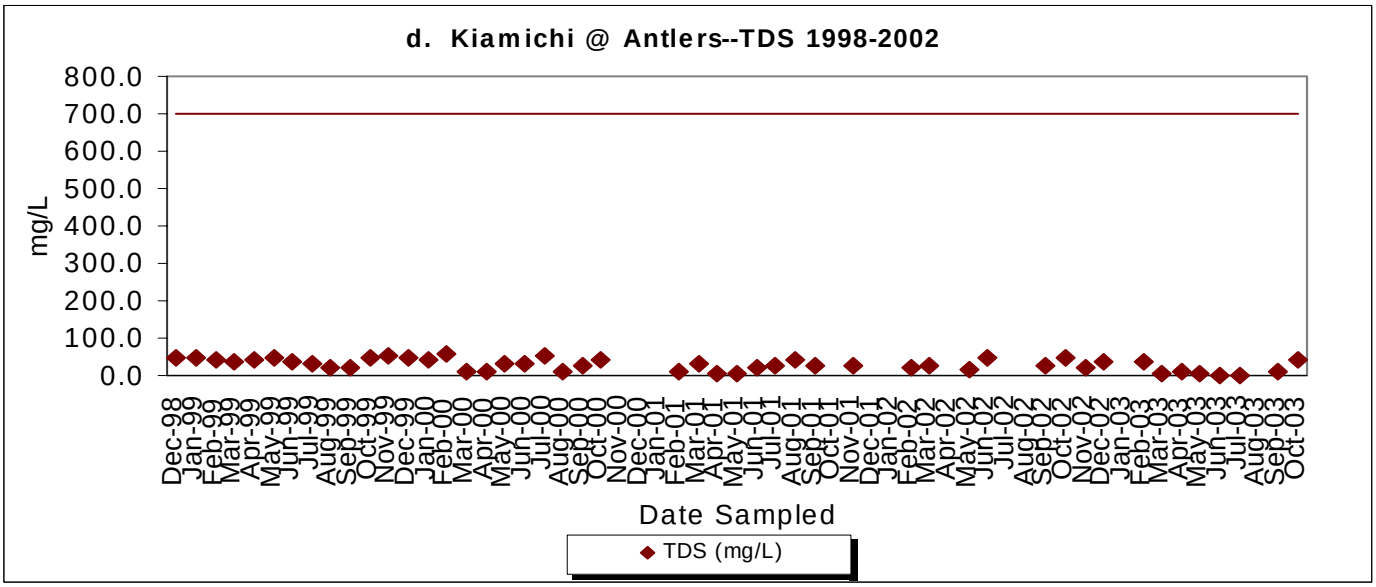
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 10 lead samples collected, 10 of the concentrations (or 100%) exceeded the hardness-specific chronic criteria of 0.36 µg/L (Table 34). Of the 11 copper samples collected, 3 of the concentrations (or 27%) exceeded the hardness-specific acute criterion of 3.85 µg/L (Table 34). Dissolved oxygen (Figure 101a), pH (Figure 101b) and turbidity (Figure 101c) samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 101d and Figure 101e). The PBCR beneficial use is not supported (Table 35). Of the 25 enterococci concentrations, 5 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (93.0 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Kiamichi River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 101f).

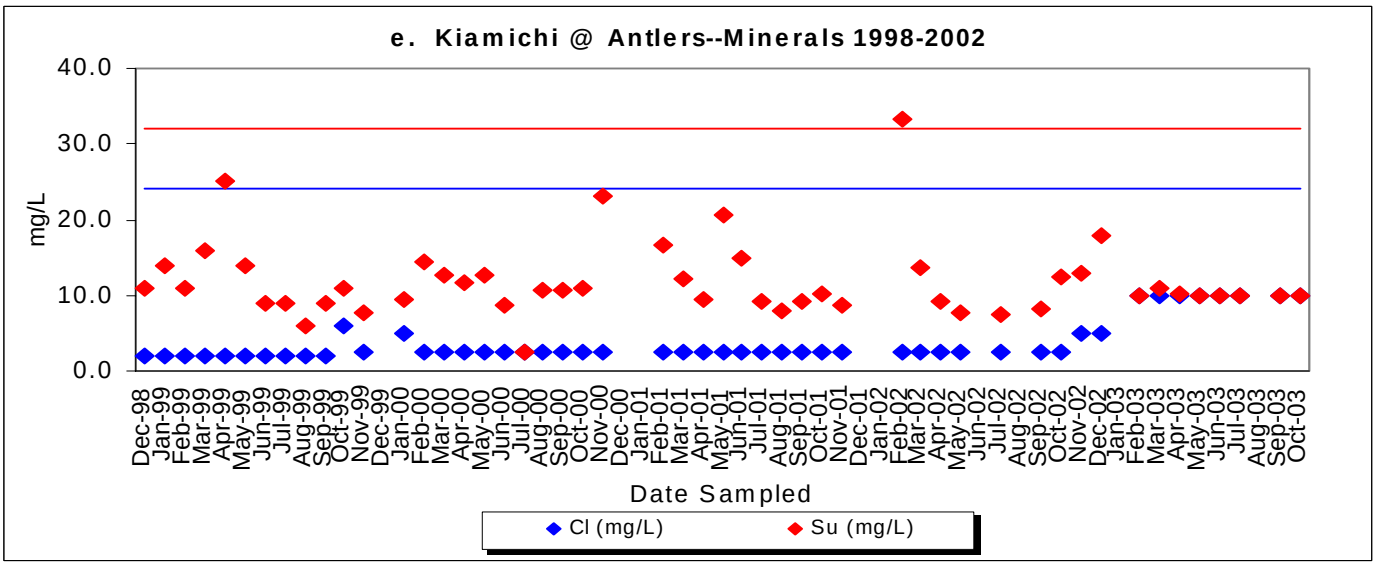
Figure 101a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Kiamichi River at Antlers (AT336200), 1998-2003.

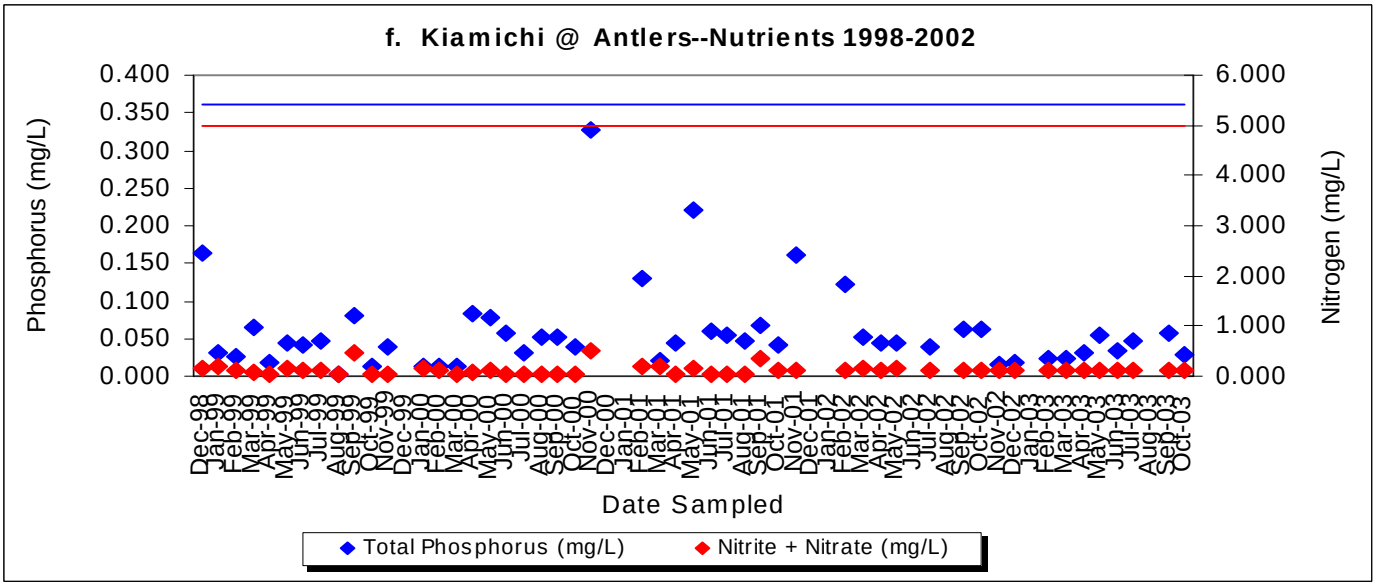







d. Kiamichi @ Antlers--TDS 1998-2002
mg/L
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Date Sampled
TDS (mg/L)


e. Kiamichi @ Antlers--Minerals 1998-2002
mg/L
40.0
30.0
20.0
10.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Kiamichi @ Antlers--Nutrients 1998-2002
Phosphorus (mg/L)
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

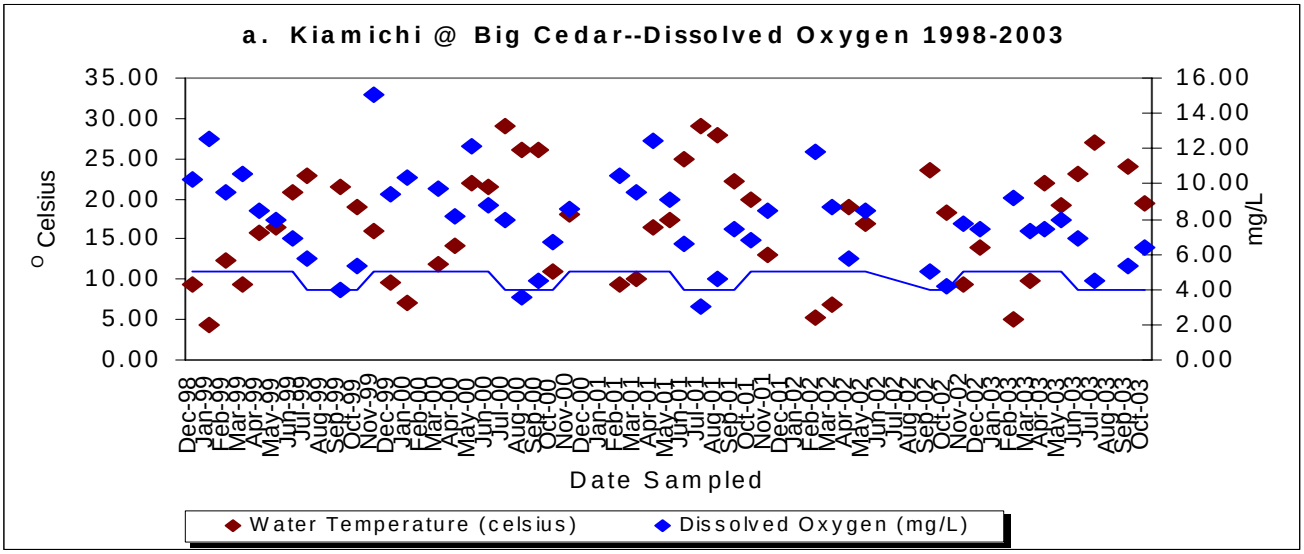
Kiamichi River near Big Cedar

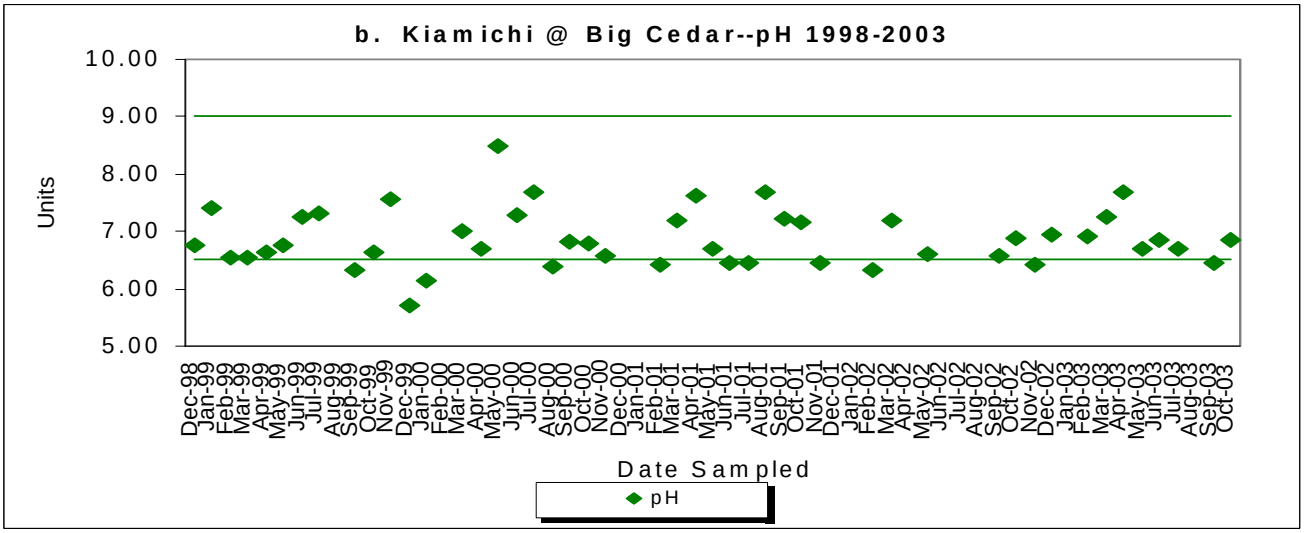
Station AT335700 (410310020010-001AT) is a permanent ambient trend monitoring station located on the Kiamichi River in Oklahoma. Situated in the southeastern portion of LeFlore County, the site was established east of the Town of Big Cedar on State Highway 63. The station is positioned near the upper end of stream segment 410310020010 and is classified within the Kiamichi River 8-digit HUC watershed (11140105). Water enters the stream system from Arkansas and from several tributaries including Pigeon Creek and Billy Creek, among others.

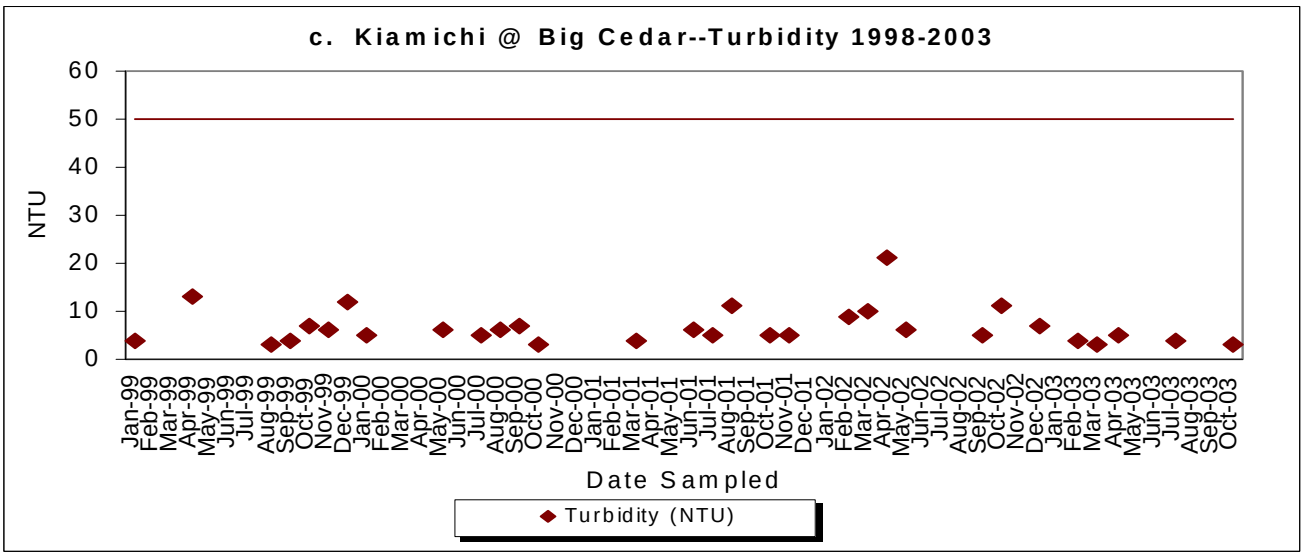
This station on the Kiamichi River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through October of 2003. For purposes of reporting, this station is representative of the Kiamichi River from its entrance into Oklahoma near Fogel, Arkansas (97.4561, 34.6783) downstream to above the confluence of Rock Creek with the Kiamichi River (95.0157, 34.6813). As per Appendix A, Table 4 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

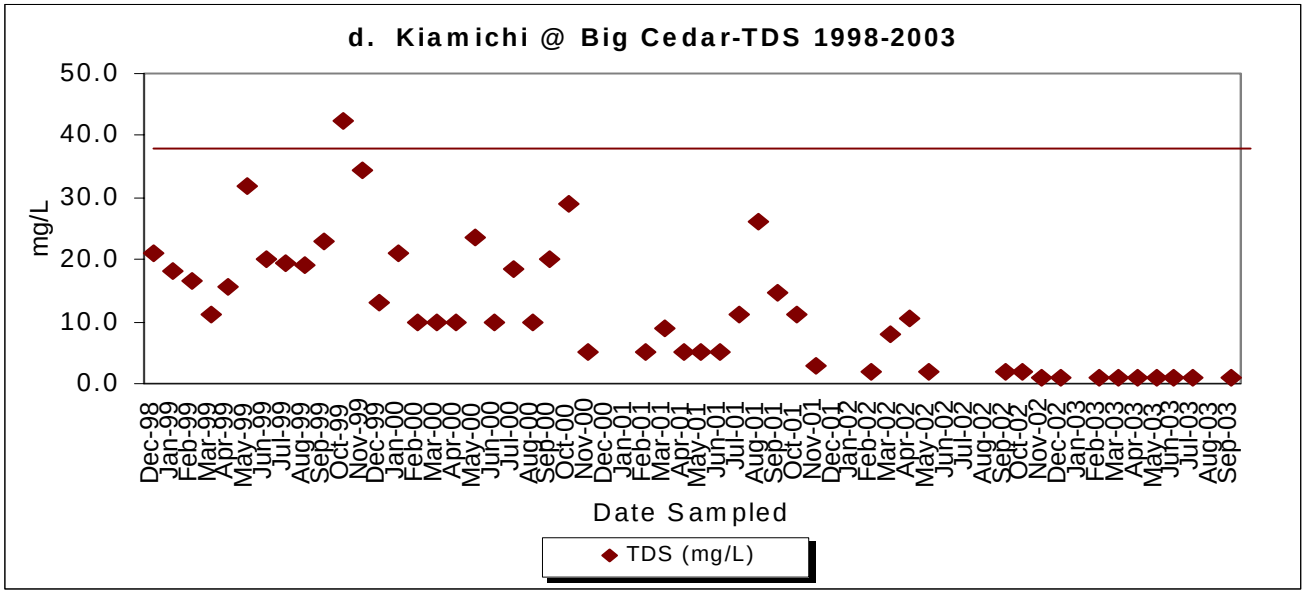
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the eleven (11) lead samples collected, seven (7) of the concentrations (or 64%) exceeded the hardness-specific chronic criteria of 0.29 µg/L (Table 34). Of the forty-seven (47) pH concentrations (Figure 102b), eleven (11) of the samples (or 23%) were below the minimum standard of 6.5 units. Dissolved oxygen (Figure 102a) and turbidity samples (Figure 102c) met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 102d and Figure 102e). The PBCR beneficial use is supported for fecal coliform, *E. coli* and enterococci samples. This segment of the Kiamichi River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 1.0 mg/L and 4.65 mg/L, respectively (Figure 102f).

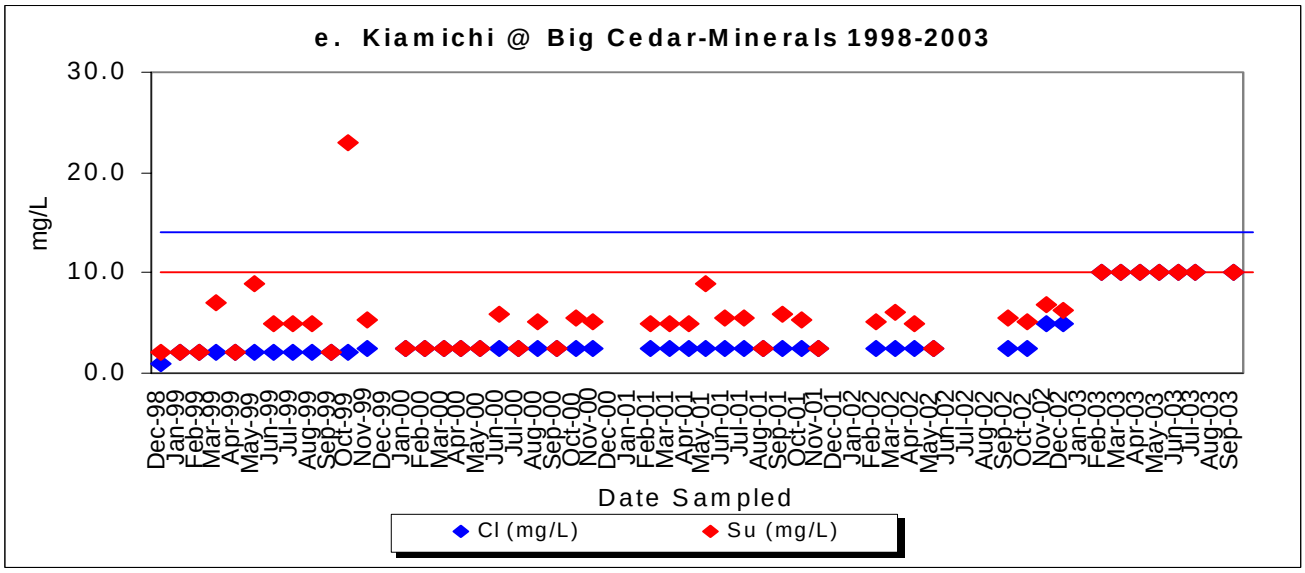
Figure 102a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Kiamichi River at Big Cedar (AT335700), 1998-2003.

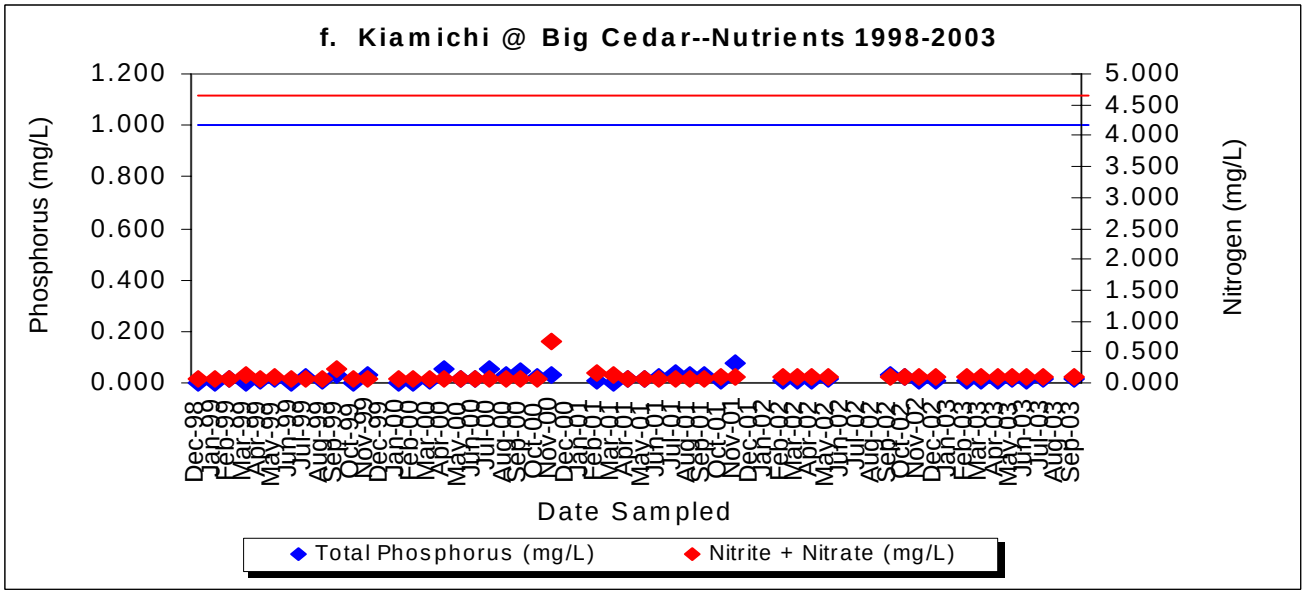







d. Kiamichi @ Big Cedar-TDS 1998-2003
mg/L
50.0
40.0
30.0
20.0
10.0
0.0
Date Sampled
TDS (mg/L)


e. Kiamichi @ Big Cedar-Minerals 1998-2003
mg/L
30.0
20.0
10.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Kiamichi @ Big Cedar--Nutrients 1998-2003
Phosphorus (mg/L)
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Nitrogen (mg/L)
5.000
4.500
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

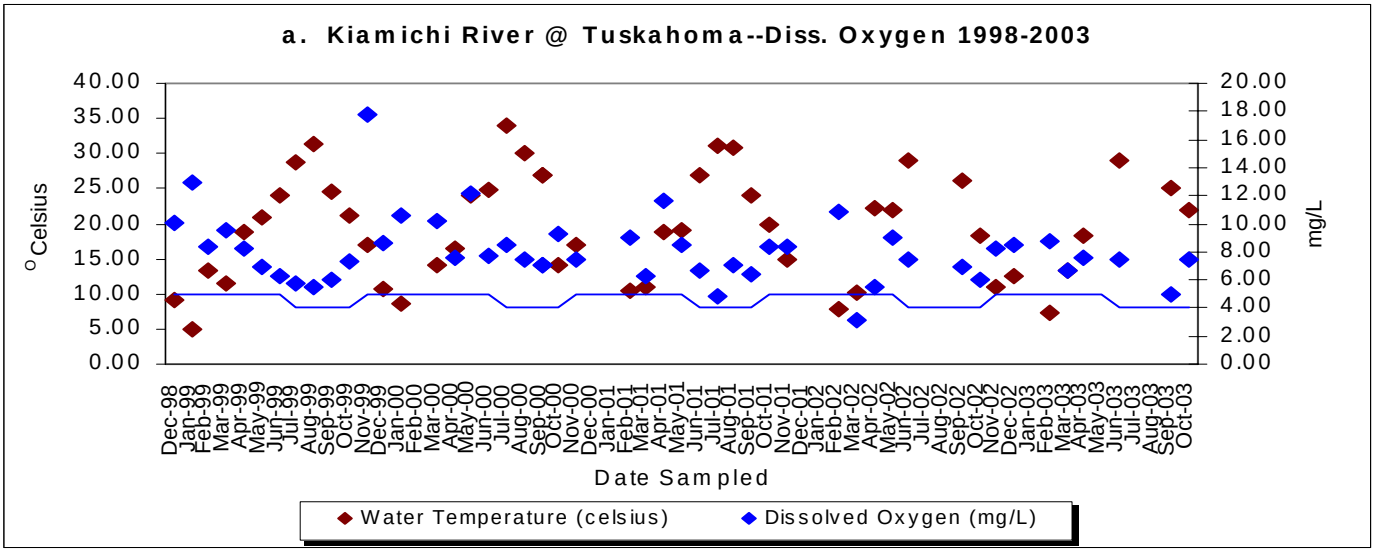
Kiamichi River near Tuskahoma

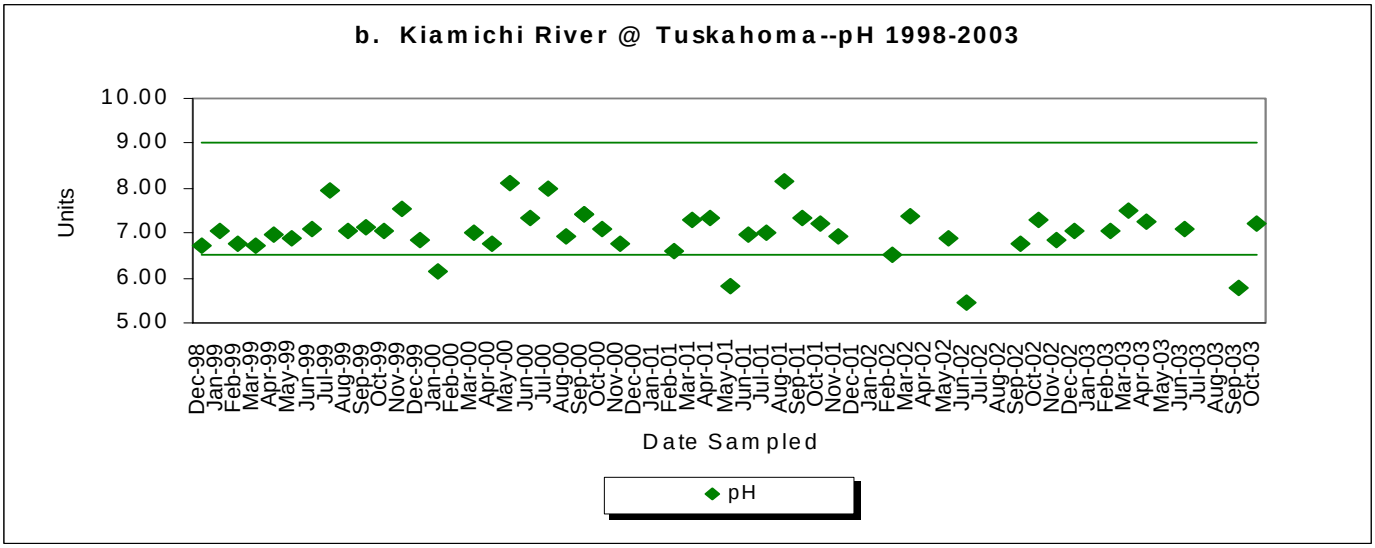
Station AT335780 (410310010010-001AT) is a permanent ambient trend monitoring station located on the Kiamichi River in Oklahoma. Situated in the northeastern portion of Pushmataha County, the site was established south of the Town of Tuskahoma off of US Highway 271 on Tuskahoma School Road. The station is positioned near the lower end of stream segment 410310010010 and is classified within the Kiamichi River 8-digit HUC watershed (11140105). Water enters the stream system from several tributaries including Rock Creek (Lake Talihina and Lake Carl Albert), Albion Creek, Cedar Creek, Dry Creek, and Jackfork Creek (Sardis Lake), among others.

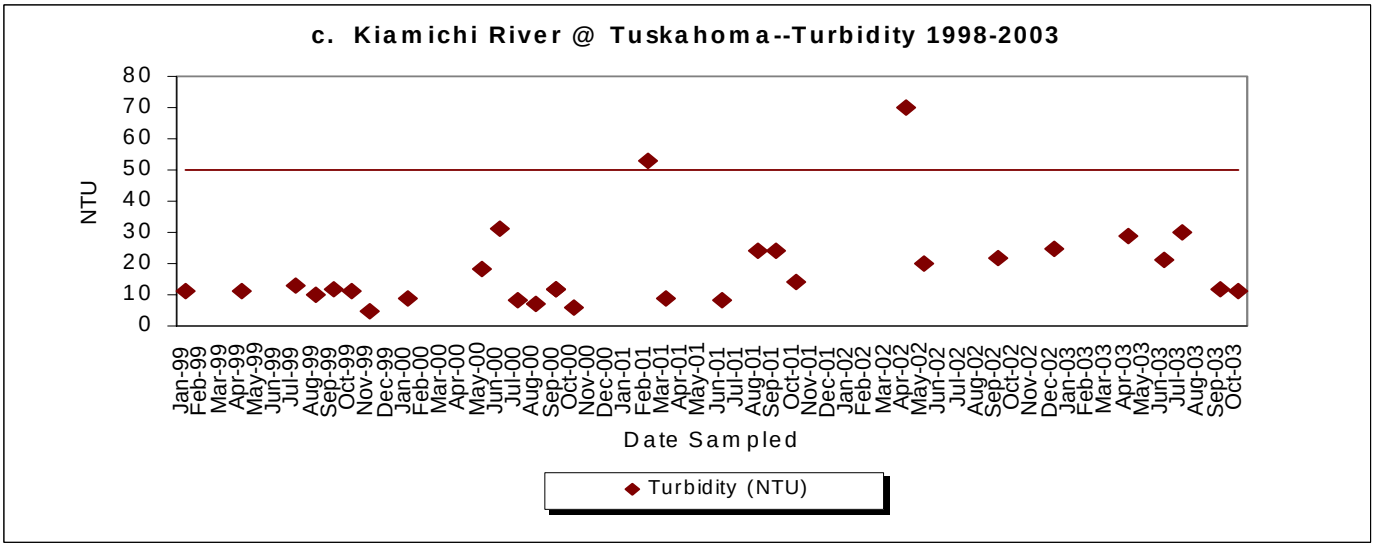
This station on the Kiamichi River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through October of 2003. For purposes of reporting, this station is representative of the Kiamichi River from the confluence of Rock Creek (95.0157, 34.6813) downstream to confluence of Jackfork Creek with the Kiamichi River (95.3354, 34.5973). As per Appendix A, Table 4 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

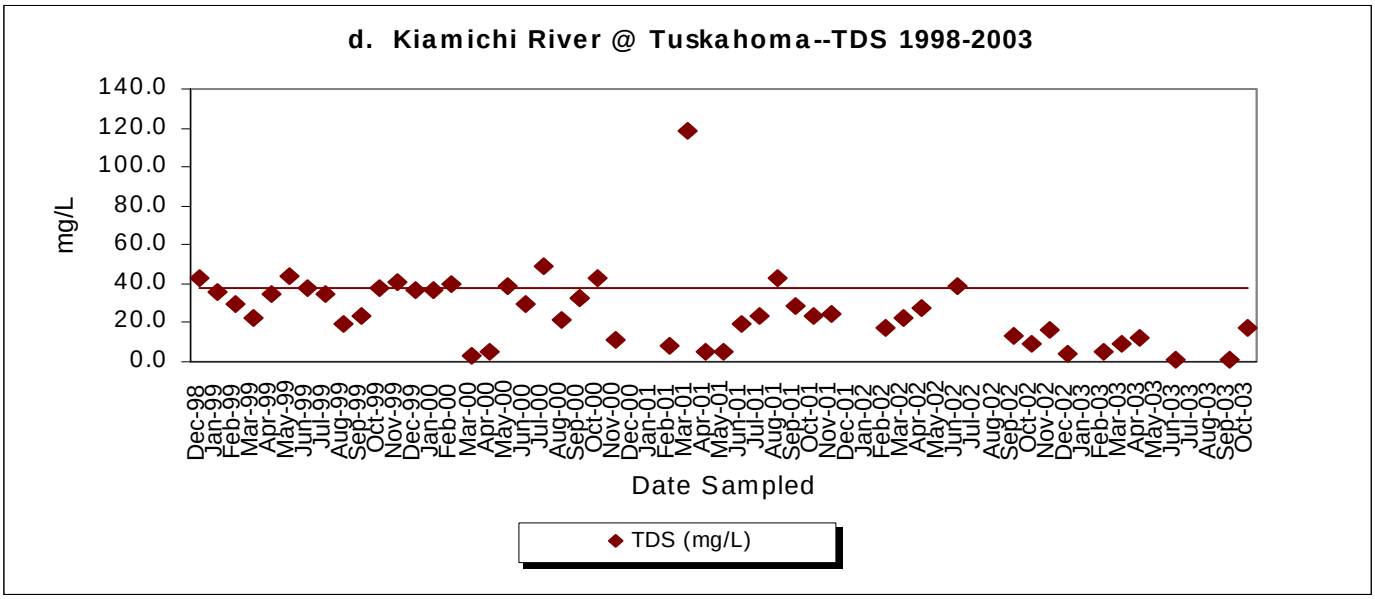
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 12 copper samples collected, 2 of the concentrations (or 17%) exceeded the hardness-specific chronic criterion of 3.37 µg/L (Table 34). Of the 11 lead samples collected, 8 of the concentrations (or 73%) exceeded the hardness-specific acute criteria of 0.44 µg/L (Table 34). Dissolved oxygen (Figure 103a), pH (Figure 103b), and turbidity (Figure 103c) samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids (TDS), chlorides, and sulfates (Figure 103d and Figure 103e). Although 19% of the TDS concentrations and 22% of the sulfate concentrations exceeded the sample standards of 38 mg/L and 10 mg/L, the values are below the prescribed minimum standards of 750 mg/L and 250 mg/L, respectively. The PBCR beneficial use is supported for fecal coliform, *E. coli* and enterococci samples. This segment of the Kiamichi River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 103f).

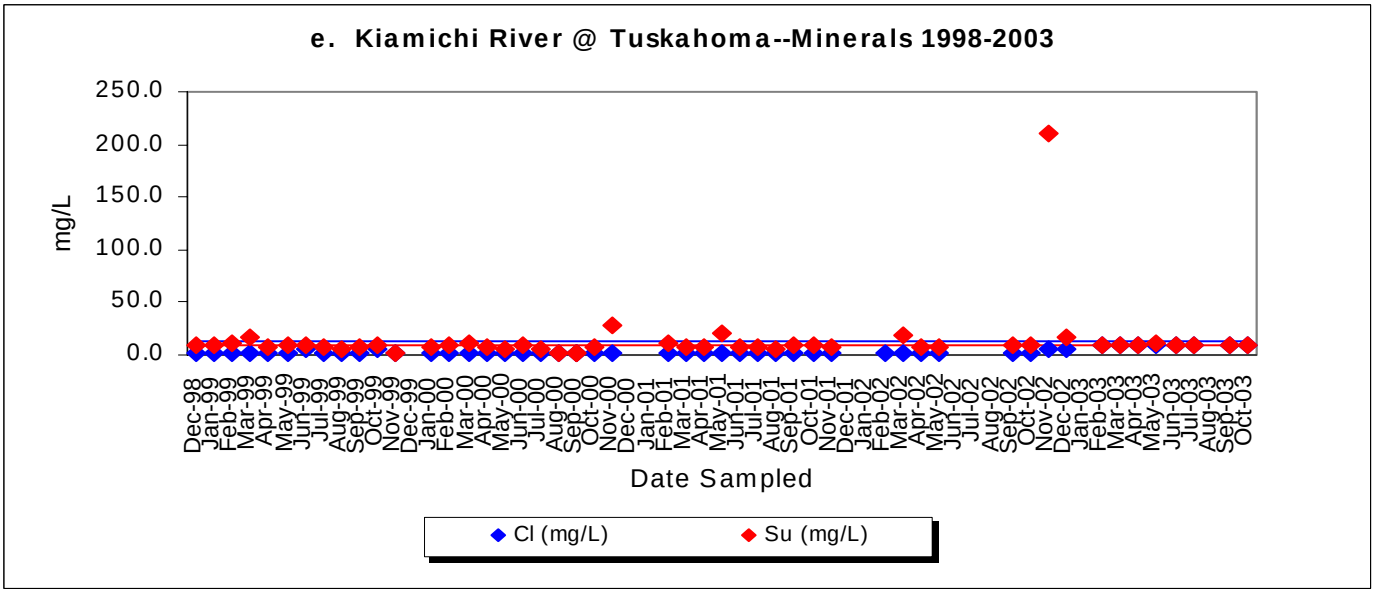
Figure 103a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Kiamichi River at Tuskahoma (AT335780), 1998-2003.

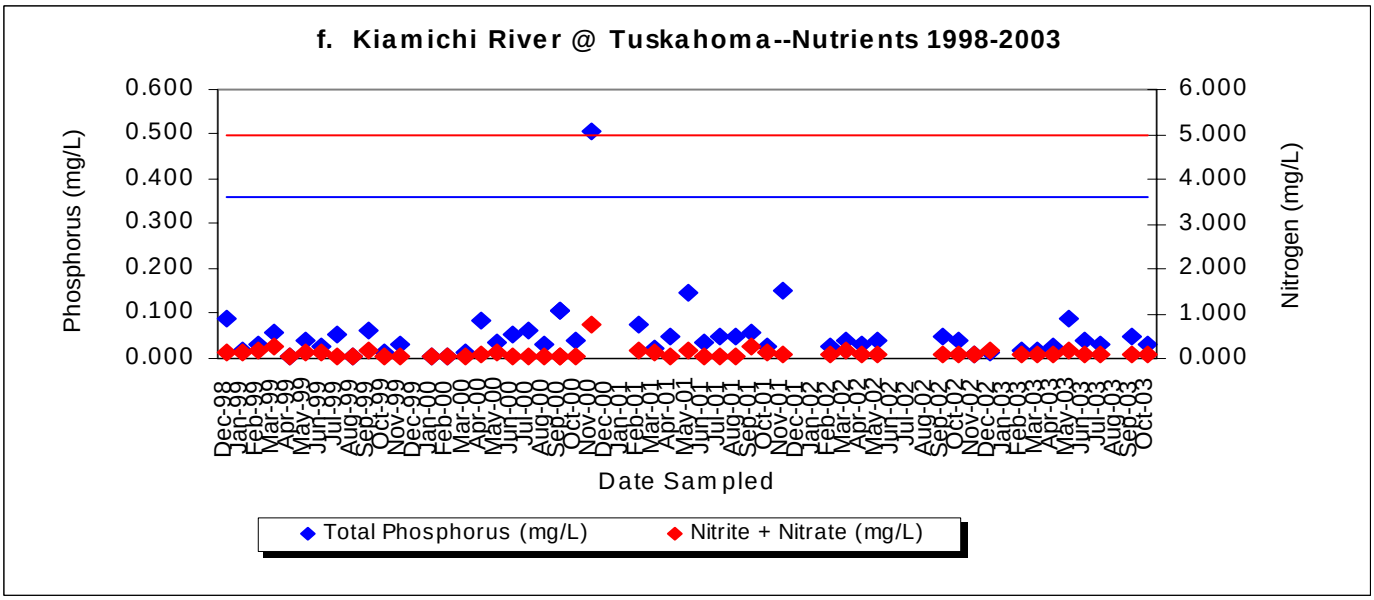







d. Kiamichi River @ Tuskahoma--TDS 1998-2003
mg/L
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Date Sampled
TDS (mg/L)


e. Kiamichi River @ Tuskahoma--Minerals 1998-2003
mg/L
250.0
200.0
150.0
100.0
50.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Kiamichi River @ Tuskahoma--Nutrients 1998-2003
Phosphorus (mg/L)
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

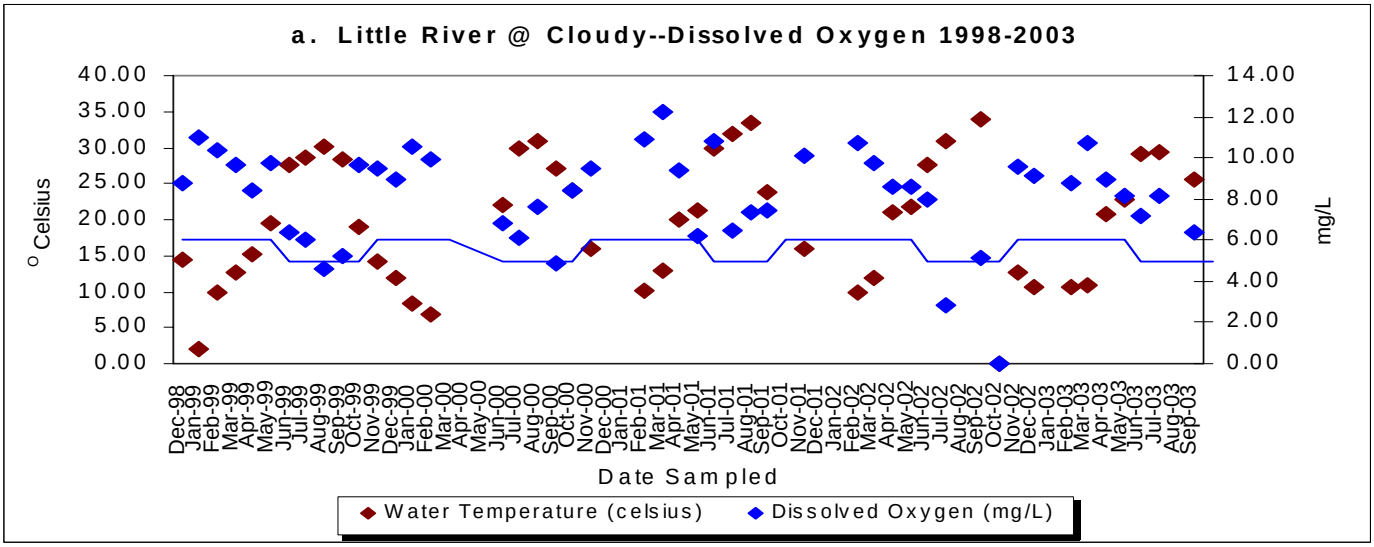
Little River near Cloudy

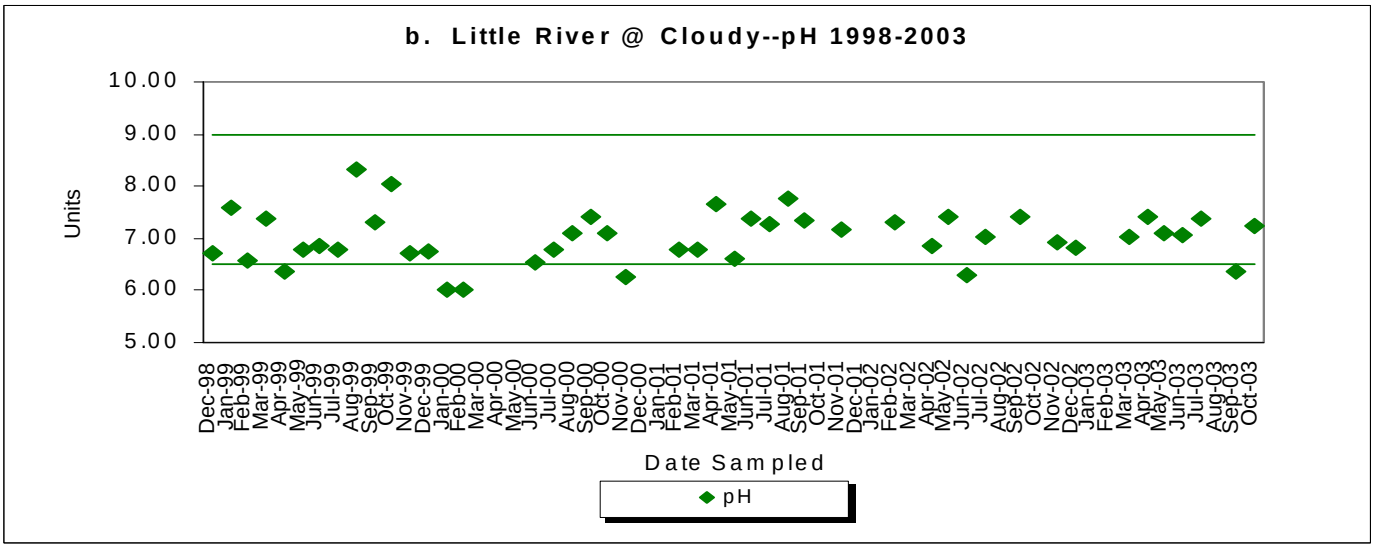
Station AT337100 (410210020140-001AT) is a permanent ambient trend monitoring station located on the Little River in Oklahoma. Situated in the southeastern portion of Pushmataha County, the site was established east-northeast of the Town of Cloudy off of State Highway 3 on Cloudy Road. The station is positioned near the midpoint of stream segment 410210020140 and is classified within the Upper Little River 8-digit HUC watershed (11140107). Water enters the stream system from several tributaries including Watson Creek, Jack Creek, Cloudy Creek, Houston Creek, and Terrapin Creek, among others.

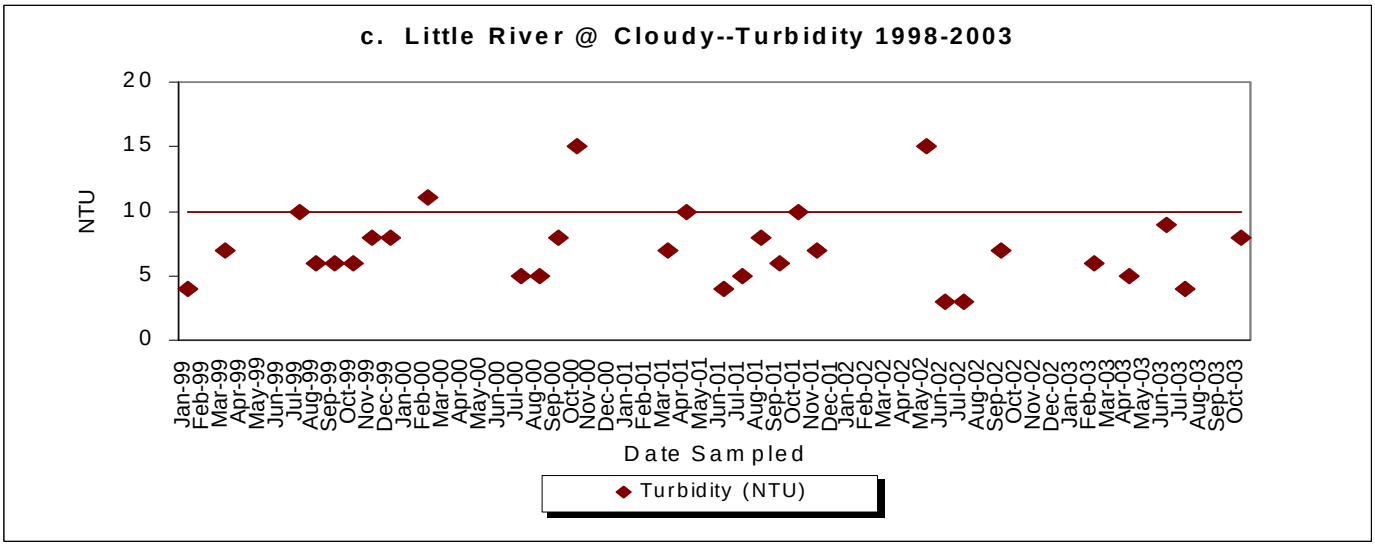
This station on the Little River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through October of 2003. For purposes of reporting, this station is representative of the Little River from the confluence of Watson Creek (95.1730, 34.4522) downstream to the confluence of the Little River with Pine Creek Lake (95.1293, 34.2264). As per Appendix A, Table 4 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Cool Water Aquatic Community—Fish and Wildlife Propagation (CWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

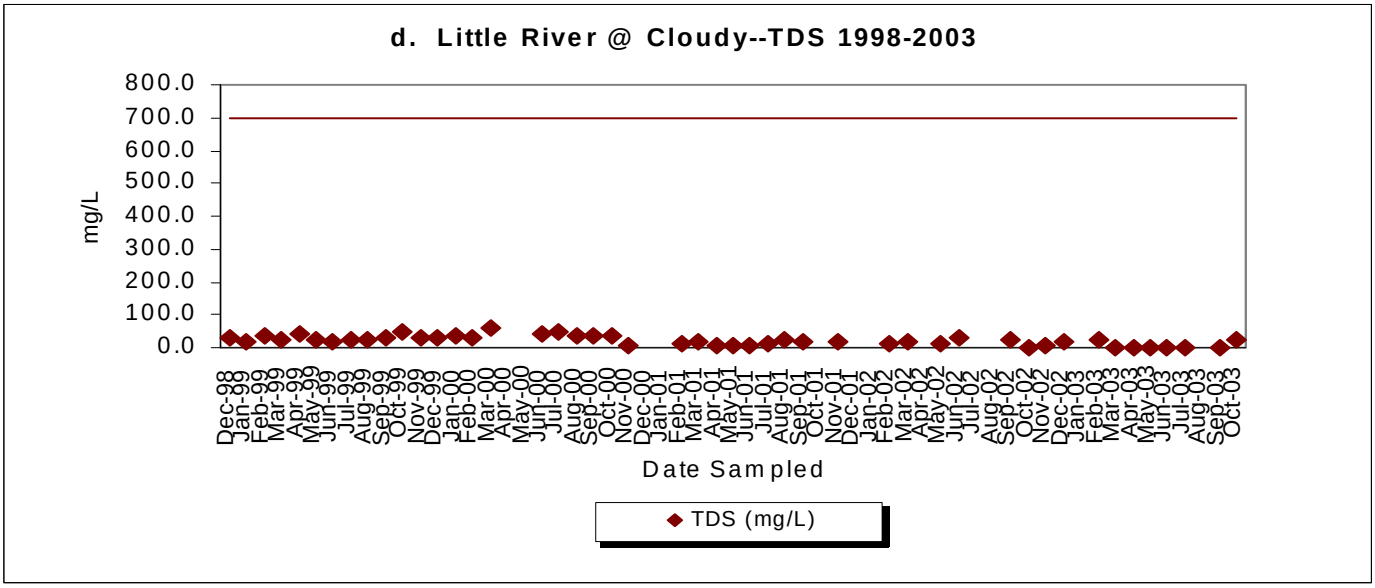
The PPWS beneficial use is supported. The CWAC beneficial use is not supported. Of the 14 zinc samples collected, 2 of the concentrations (or 14%) exceeded the hardness-specific acute criterion of 16.89 µg/L (Table 34). Of the 10 lead samples collected, 10 of the concentrations (or 100%) exceeded the hardness-specific chronic criterion of 0.17 µg/L (Table 34). Of the 46 pH samples (Figure 104b), 6 samples (or 13%) were below the minimum criterion of 6.5 units. Dissolved oxygen (Figure 104a) and turbidity (Figure 104c) data collected during the same period met the criteria prescribed in the CWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 104d and Figure 104e). The PBCR beneficial use is not supported (Table 35). Of the 23 enterococci concentrations, 5 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (221.3 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Little River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 104f).

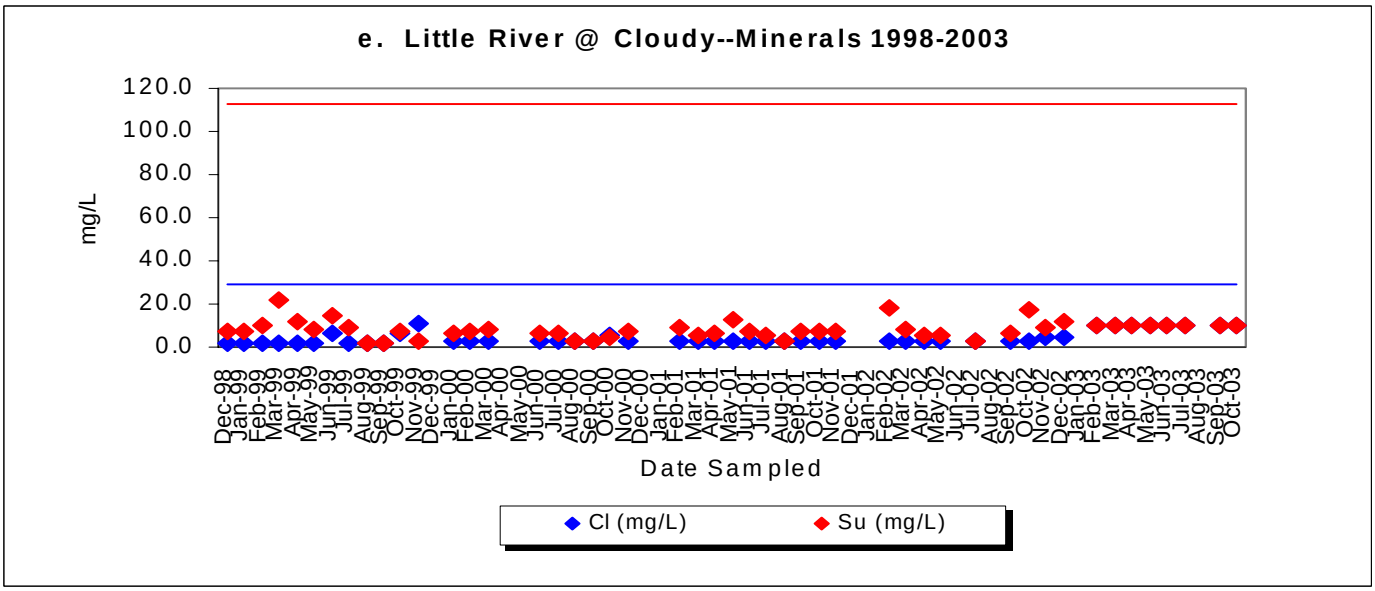
Figure 104a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Little River at Cloudy (AT337100), 1998-2003.

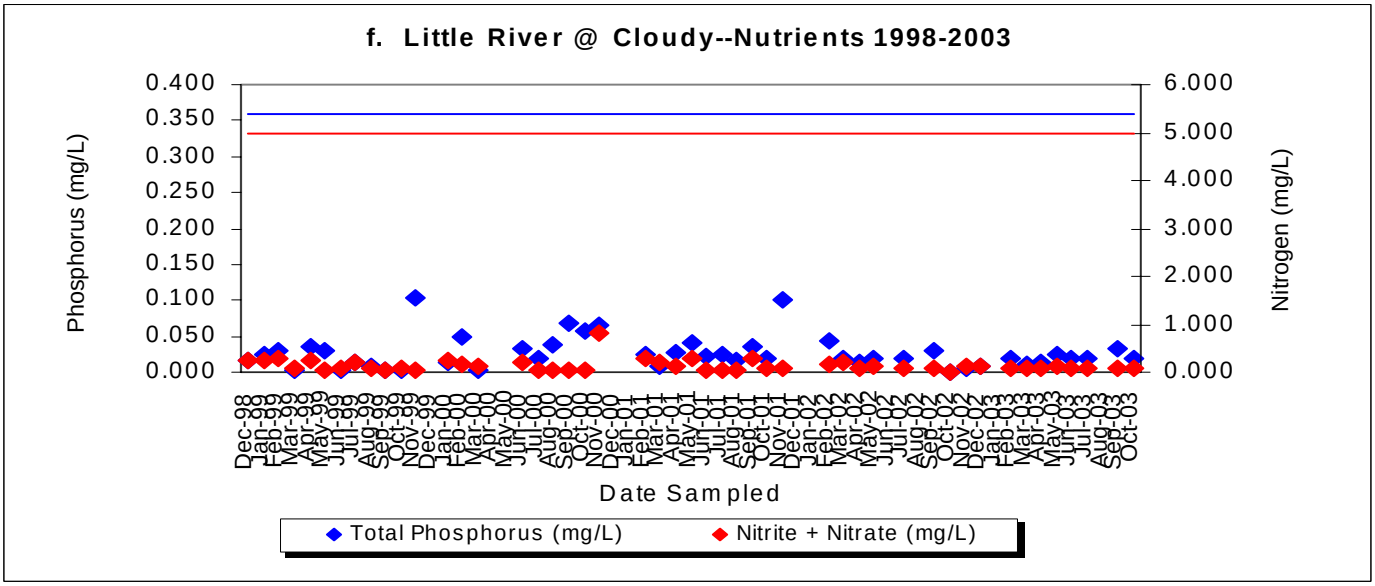







d. Little River @ Cloudy--TDS 1998-2003
mg/L
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Date Sampled
TDS (mg/L)


e. Little River @ Cloudy--Minerals 1998-2003
mg/L
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Little River @ Cloudy--Nutrients 1998-2003
Phosphorus (mg/L)
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

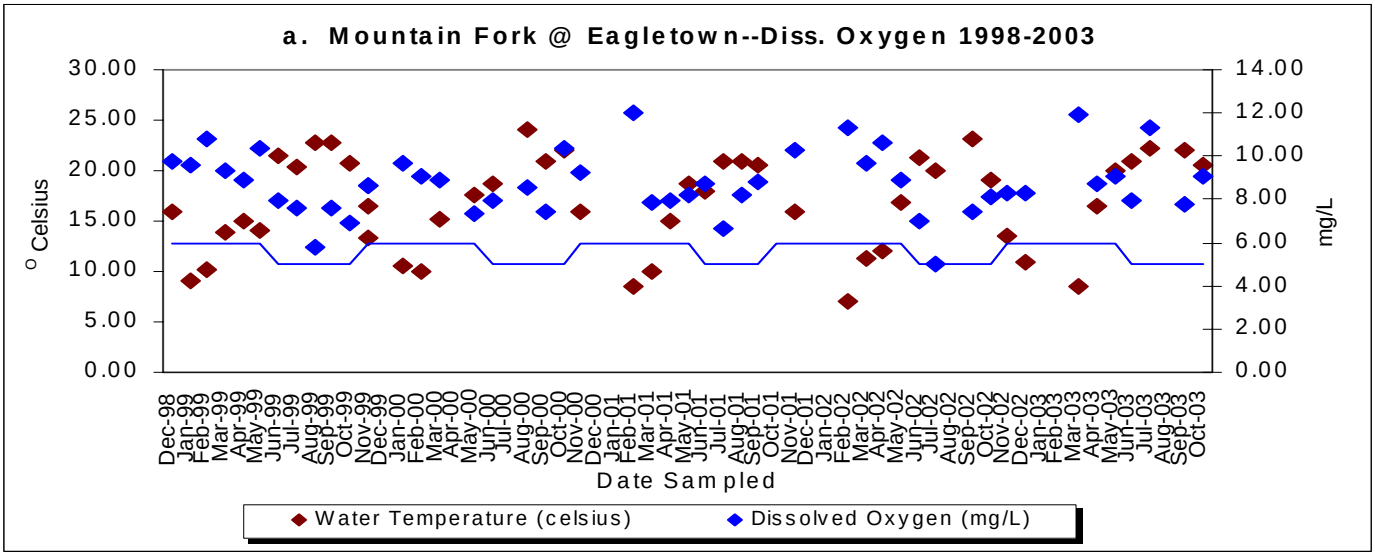
Mountain Fork River near Eagletown

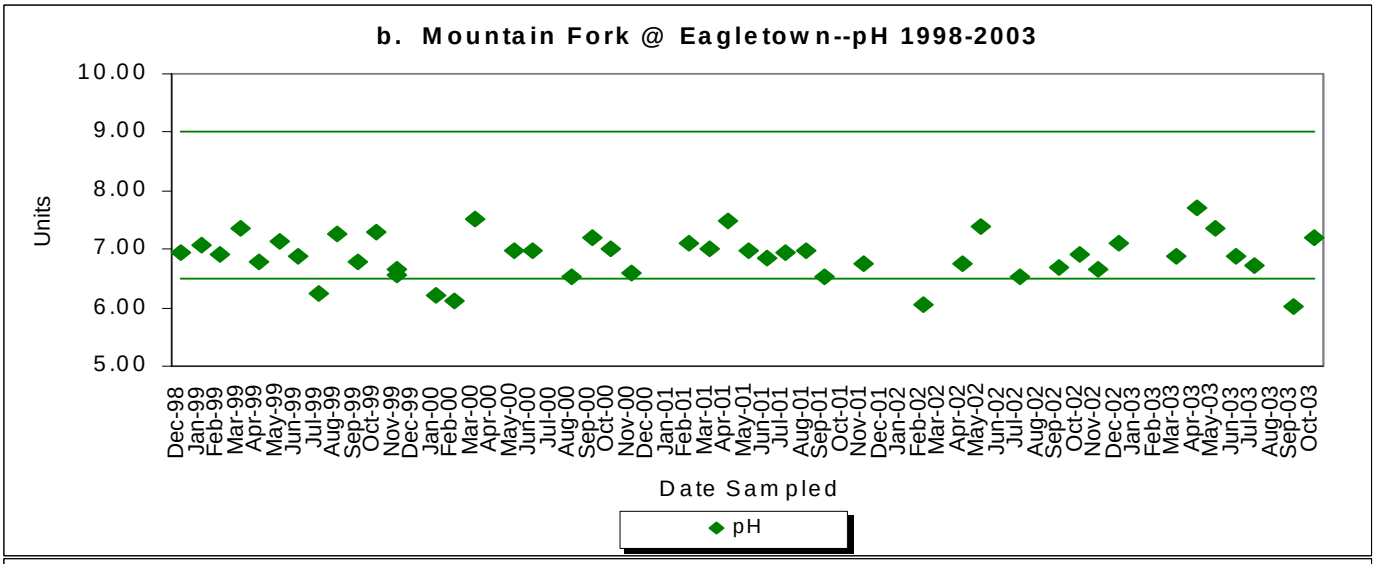
Station AT339000 (410210040010-001AT) is a permanent ambient trend monitoring station located on the Mountain Fork River in Oklahoma. Situated in the east central portion of McCurtain County, the site was established west of the Town of Eagletown on US Highway 70. The station is positioned near the upper end of stream segment 410210040010 and is classified within the Mountain Fork River 8-digit HUC watershed (11140108). Water enters the stream system from several tributaries including Cooper Creek, Lick Creek, and Luksuklo Creek, among others.

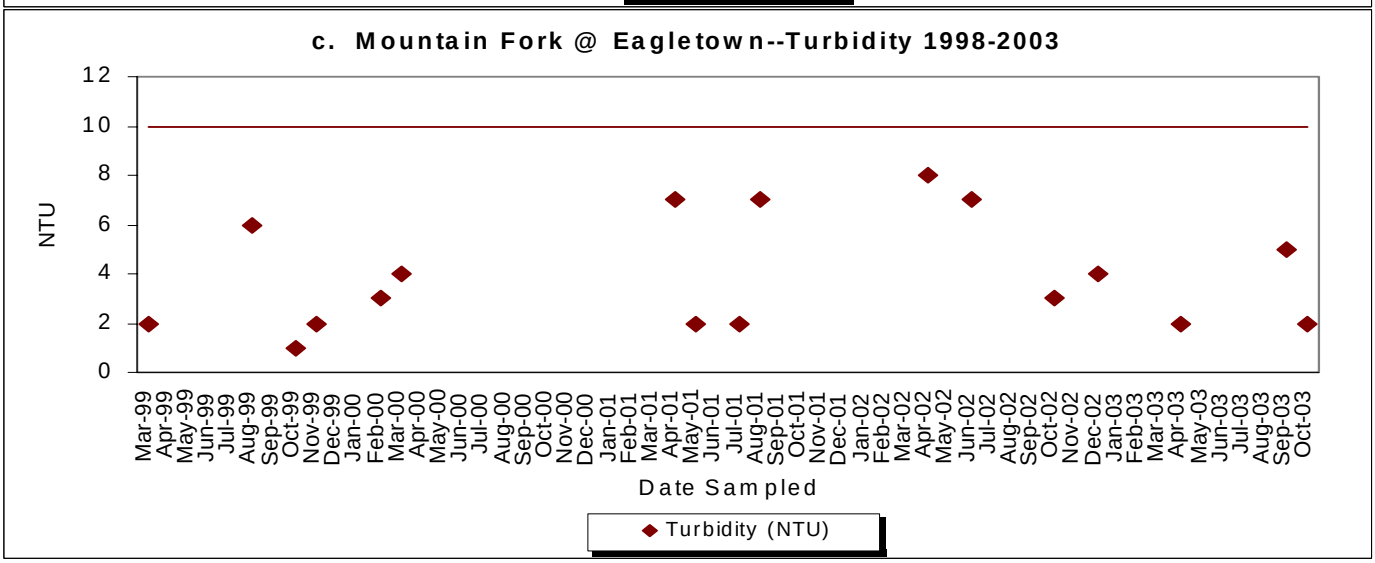
This station on the Mountain Fork River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through October of 2003. For purposes of reporting, this station is representative of the Mountain Fork River from the confluence of Cooper Creek (94.6195, 34.0567) downstream to confluence of the Mountain Fork River with the Little River (94.5755, 33.9518). As per Appendix A, Table 4 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Trout Fishery—Fish and Wildlife Propagation (CWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

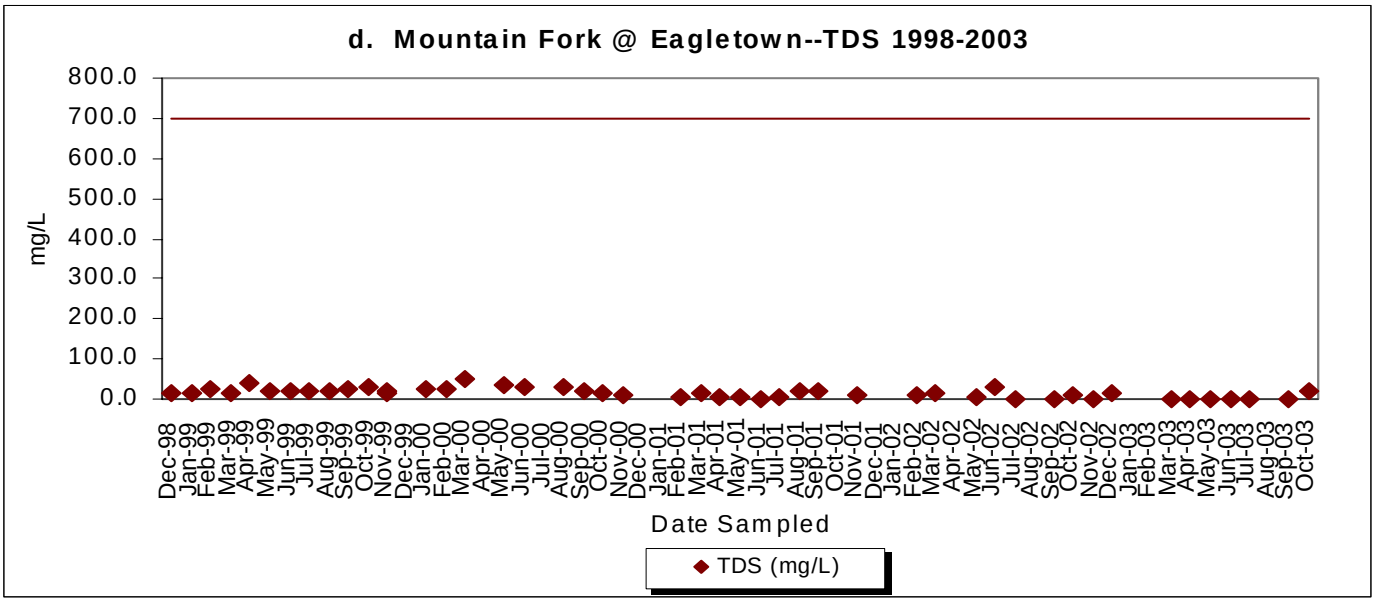
The PPWS beneficial use is supported. The CWAC beneficial use is not supported. Of the 10 lead samples collected, 3 of the concentrations (or 30%) exceeded the hardness-specific acute criterion of 4.90 µg/L, and 9 of the lead concentrations (or 90%) exceeded the hardness-specific chronic criterion of 0.19 µg/L (Table 34). Of the 10 cadmium samples collected, 2 of the concentrations (or 20%) exceeded the hardness-specific chronic criterion of 0.20 µg/L (Table 34). Dissolved oxygen (Figure 105a), pH (Figure 105b), and turbidity (Figure 105c) data met the criteria prescribed in the CWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 105d and Figure 105e). The PBCR beneficial use is not supported (Table 35). Of the 18 enterococci concentrations, 6 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (172.5 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Mountain Fork River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 105f).

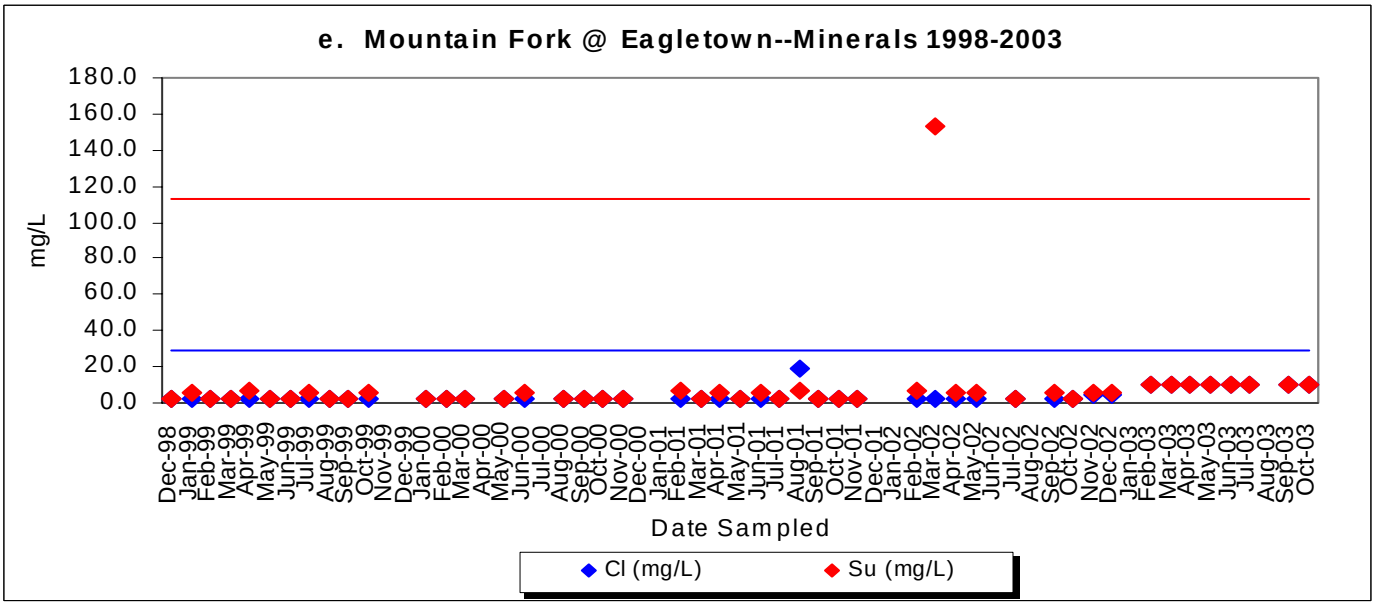
Figure 105a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Mountain Fork River at Eagletown (AT339000), 1998-2003.

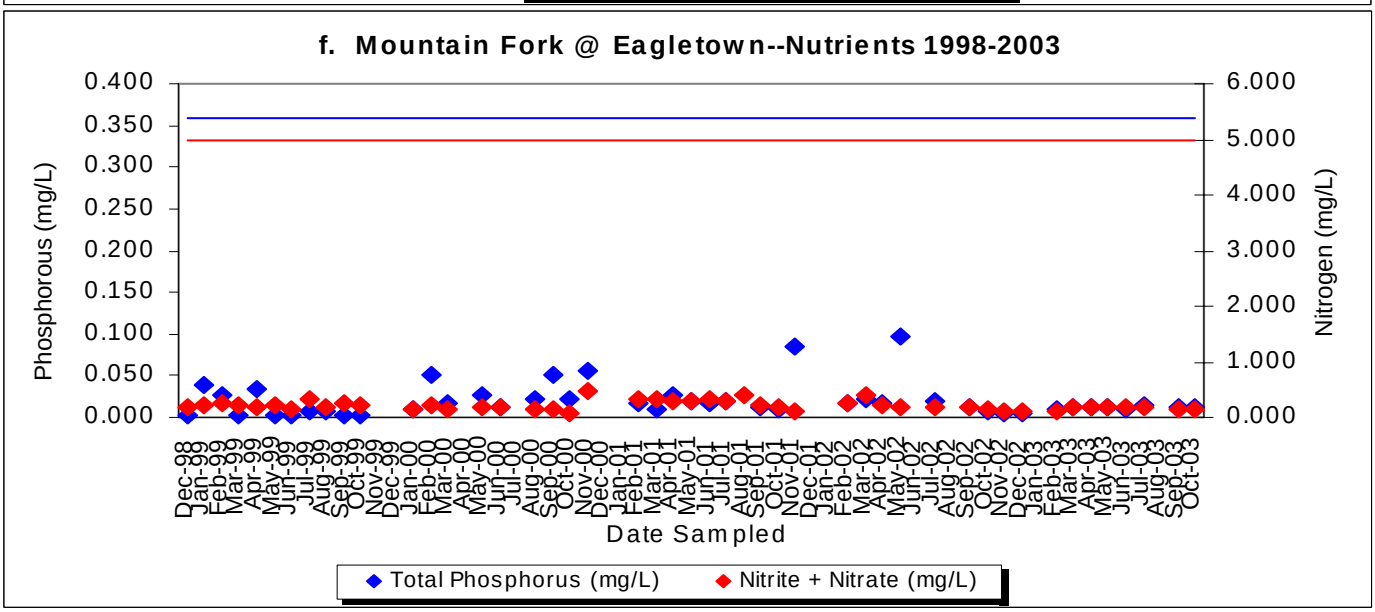







d. Mountain Fork @ Eagletown--TDS 1998-2003
mg/L
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Date Sampled
TDS (mg/L)


e. Mountain Fork @ Eagletown--Minerals 1998-2003
mg/L
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Mountain Fork @ Eagletown--Nutrients 1998-2003
Phosphorous (mg/L)
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

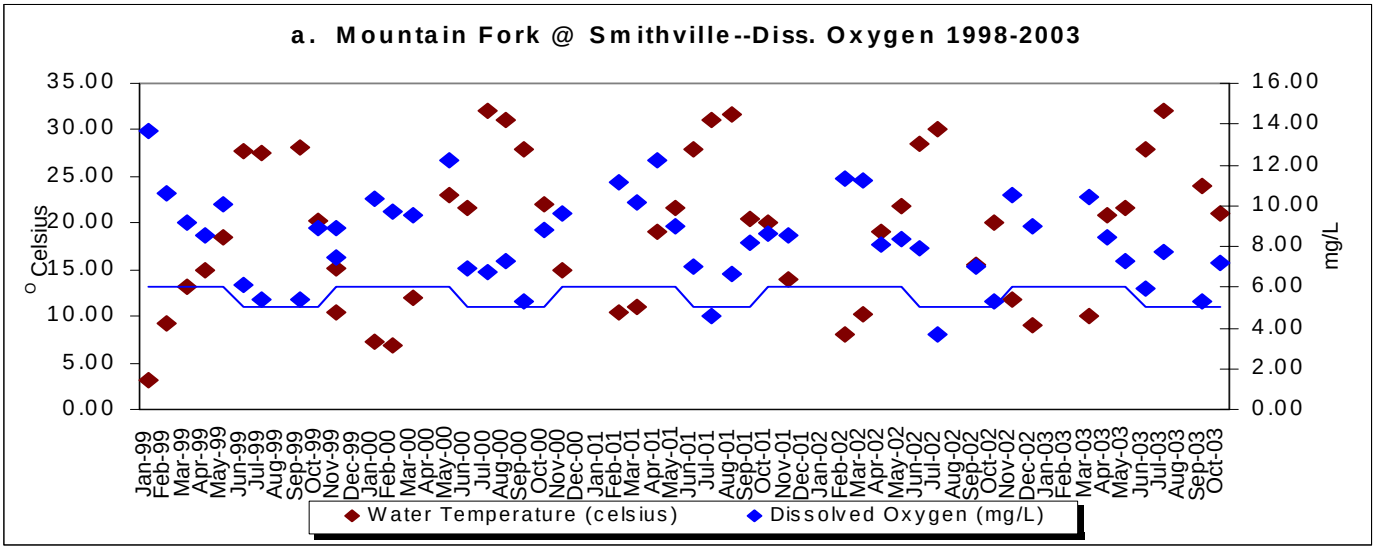
Mountain Fork River near Smithville

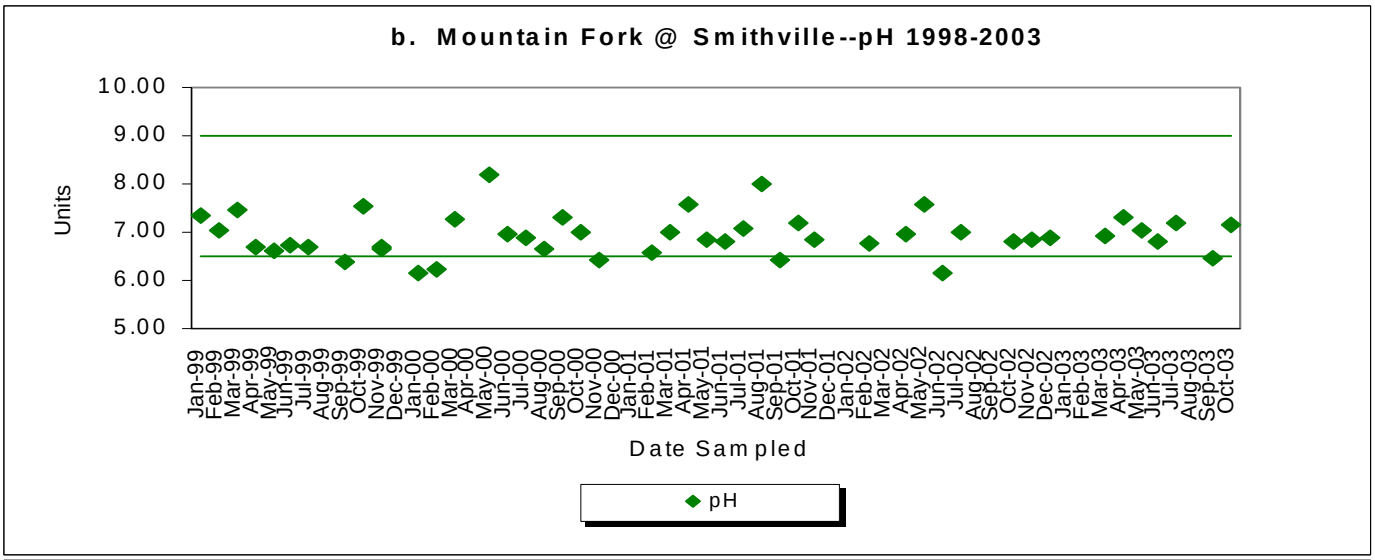
Station AT338750 (410210060010-001AT) is a permanent ambient trend monitoring station located on the Mountain Fork River in Oklahoma. Situated in the northeastern portion of McCurtain County, the site was established east of the Town of Smithville on State Highway 4. The station is positioned near the midpoint of stream segment 410210060010 and is classified within the Mountain Fork River 8-digit HUC watershed (11140108). Water enters the stream system from Arkansas and from several tributaries including Cow Creek, Beech Creek, Big Eagle Creek, Boktuklo Creek, and Buffalo Creek, among others.

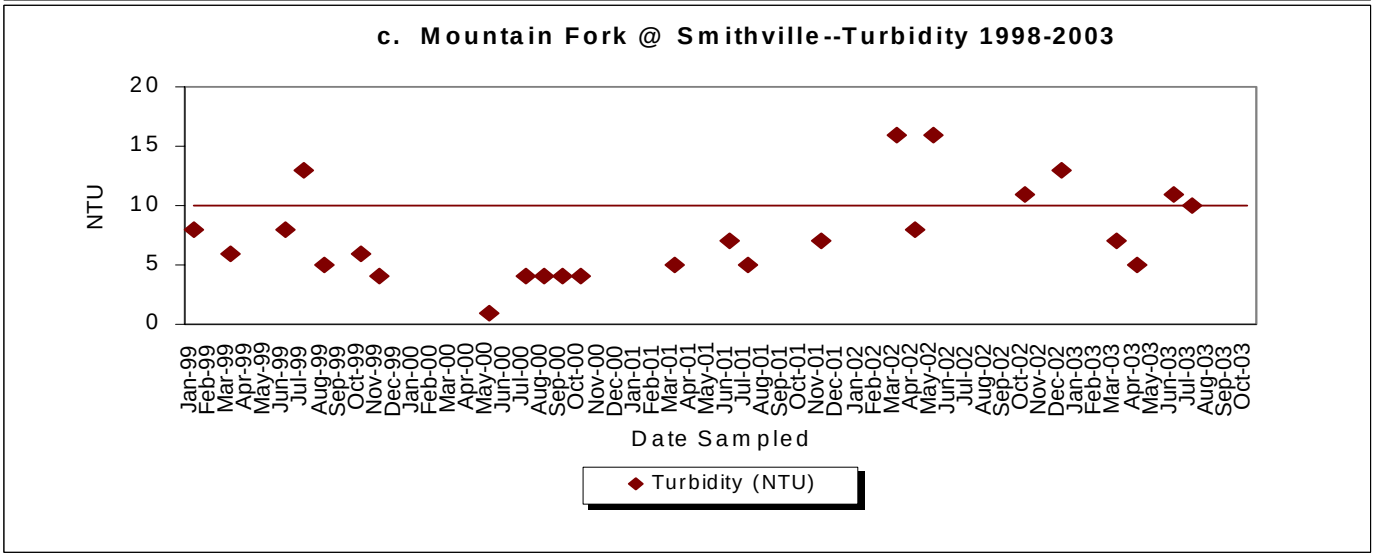
This station on the Mountain Fork River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from January of 1999 through October of 2003. For purposes of reporting, this station is representative of the Mountain Fork River from its entrance into Oklahoma near Hatfield, Arkansas (94.4616, 34.4971) downstream to confluence of the Mountain Fork River with Broken Bow Reservoir (94.6869, 34.3617). As per Appendix A, Table 4 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Cool Water Aquatic Community—Fish and Wildlife Propagation (CWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics. This portion of the Mountain Fork is also designated as an Outstanding Resource Water and Scenic River.

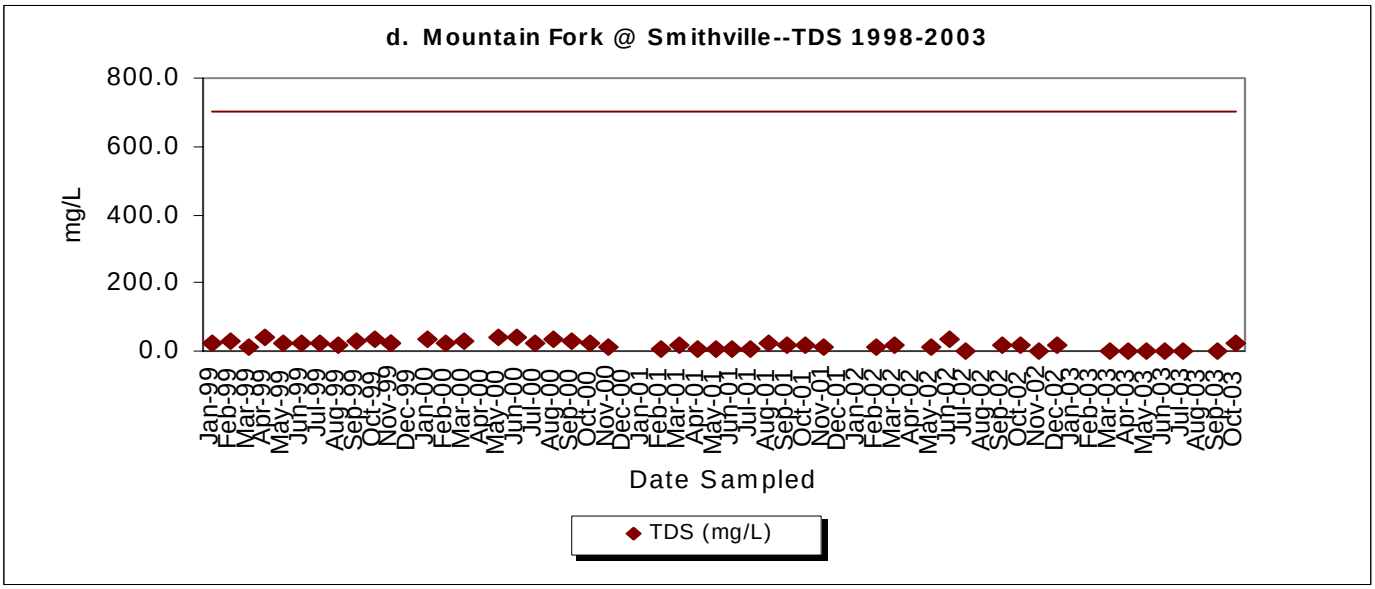
The PPWS beneficial use is supported. The CWAC beneficial use is not supported. Of the 10 lead samples collected, 7 of the concentrations (or 70%) exceeded the hardness-specific chronic criteria of 0.34 µg/L (Table 34). Of the 11 copper samples collected, 2 of the concentrations (or 18%) exceeded the hardness-specific acute criteria of 3.65 µg/L (Table 34). Of the 25 turbidity samples (Figure 106c), 6 samples (or 24%) exceeded the numerical criteria of 10. Of the 46 pH samples (Figure 106b), 7 samples (or 15%) were below the minimum criterion of 6.5 units. Dissolved oxygen (Figure 106a) data met the criteria prescribed in the CWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 106d and Figure 106e). The PBCR beneficial use is not supported (Table 35). Of the 22 enterococci concentrations, 11 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (118.3 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. The aesthetics beneficial use is not impaired for total phosphorus (Figure 106f). The 2-year geometric mean of total phosphorus values (0.024 mg/L) did not exceed the scenic river total phosphorus criterion (0.037mg/L).

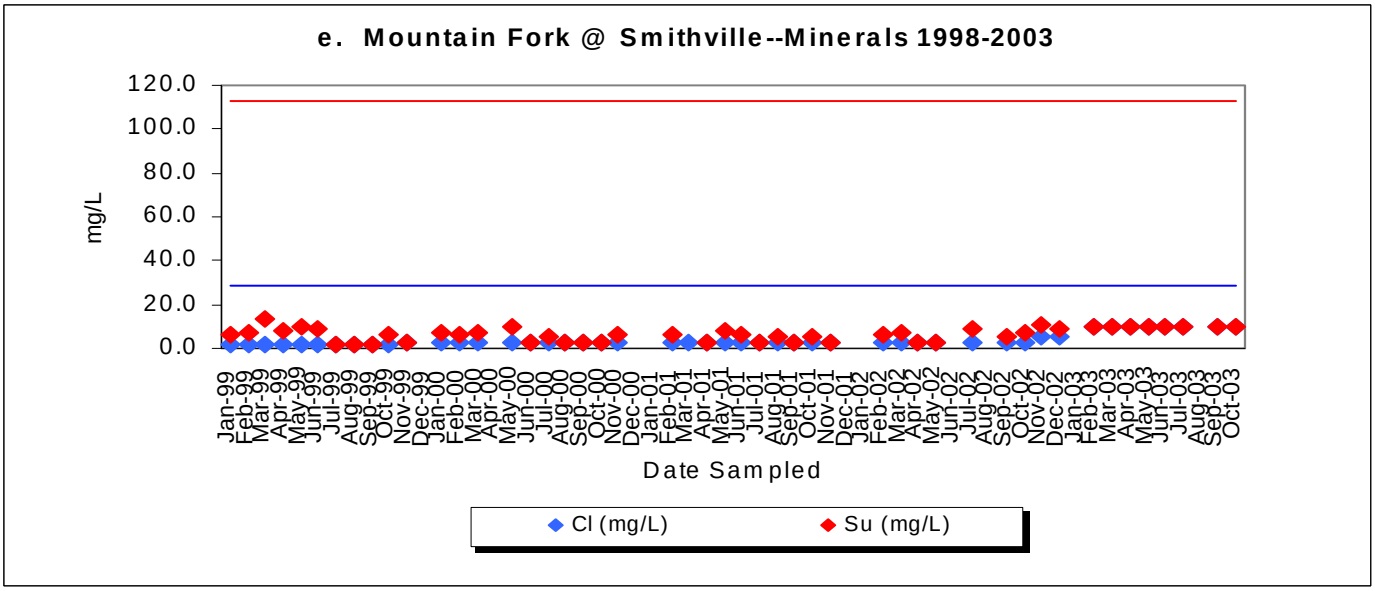
Figure 106a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Mountain Fork River at Smithville (AT338840), 1998-2003.

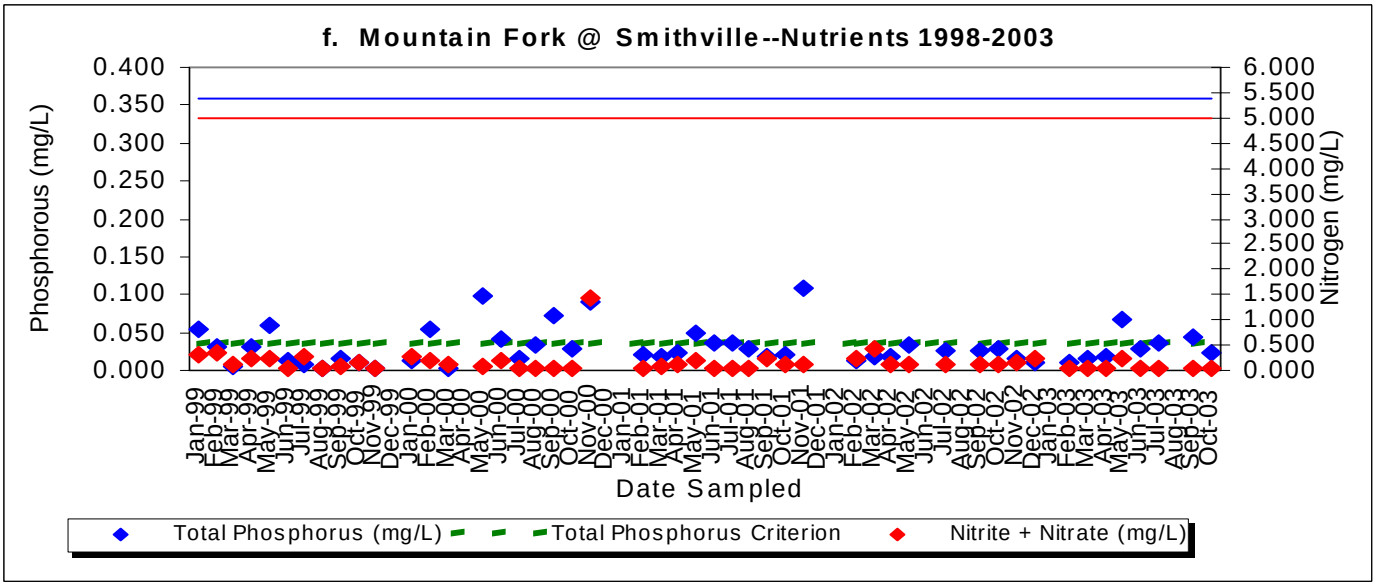







d. Mountain Fork @ Smithville--TDS 1998-2003
mg/L
800.0
600.0
400.0
200.0
0.0
Date Sampled
TDS (mg/L)


e. Mountain Fork @ Smithville--Minerals 1998-2003
mg/L
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Mountain Fork @ Smithville--Nutrients 1998-2003
Phosphorous (mg/L)
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
Nitrogen (mg/L)
6.000
5.500
5.000
4.500
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
Date Sampled
Total Phosphorus (mg/L)
Total Phosphorus Criterion
Nitrite + Nitrate (mg/L)

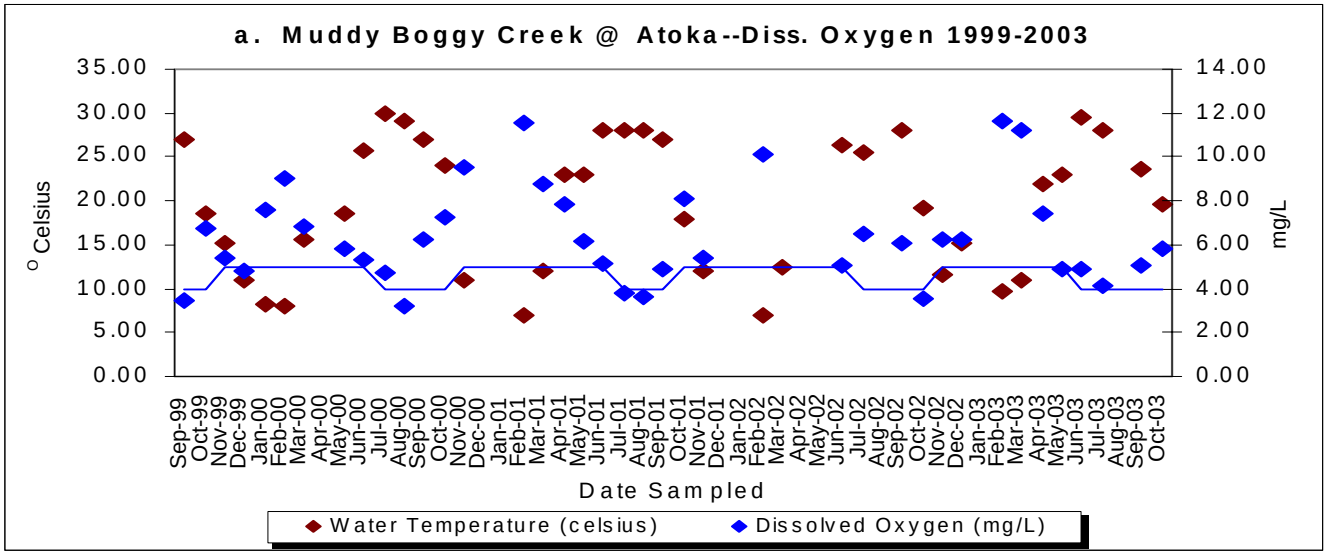
Muddy Boggy Creek near Atoka

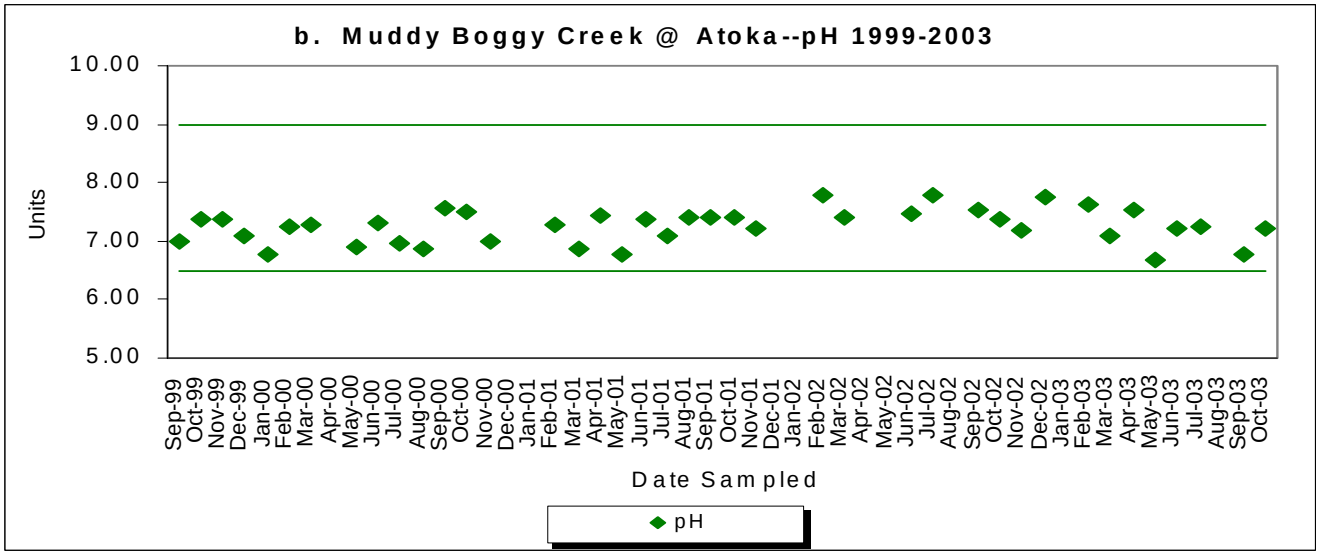
Station AT332950 (410400050270-001AT) is a permanent ambient trend monitoring station near the upper end of Muddy Boggy Creek. Situated in the north central portion of Atoka County, the site was established north of the Town of Atoka on US Highway 69. The station is positioned near the midpoint of stream segment 410400050270 and is classified within the Muddy Boggy Creek 8-digit HUC watershed (11140103). Water enters the stream system from several tributaries including Caney Creek, Brier Creek, Coal Creek, and North Boggy Creek (Atoka Reservoir), Campbell Creek, August Creek, and Wilson Creek, among others.

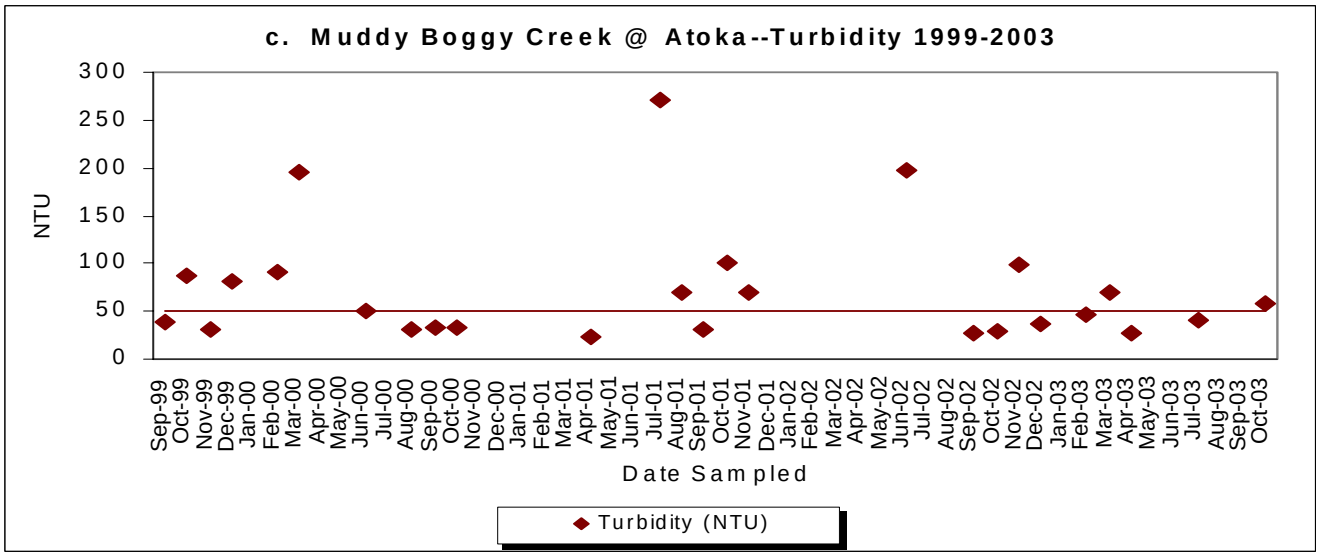
This station on Muddy Boggy Creek has been active for all water quality variables since September of 1999. The following assessment of beneficial uses is based on data collected from September of 1999 through October of 2003. For purposes of reporting, this station is representative of Muddy Boggy Creek from the confluence of Caney Creek (96.1923, 34.5354) downstream to above the confluence of North Boggy Creek with Muddy Boggy Creek (96.0620, 34.3781). As per Appendix A, Table 4 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

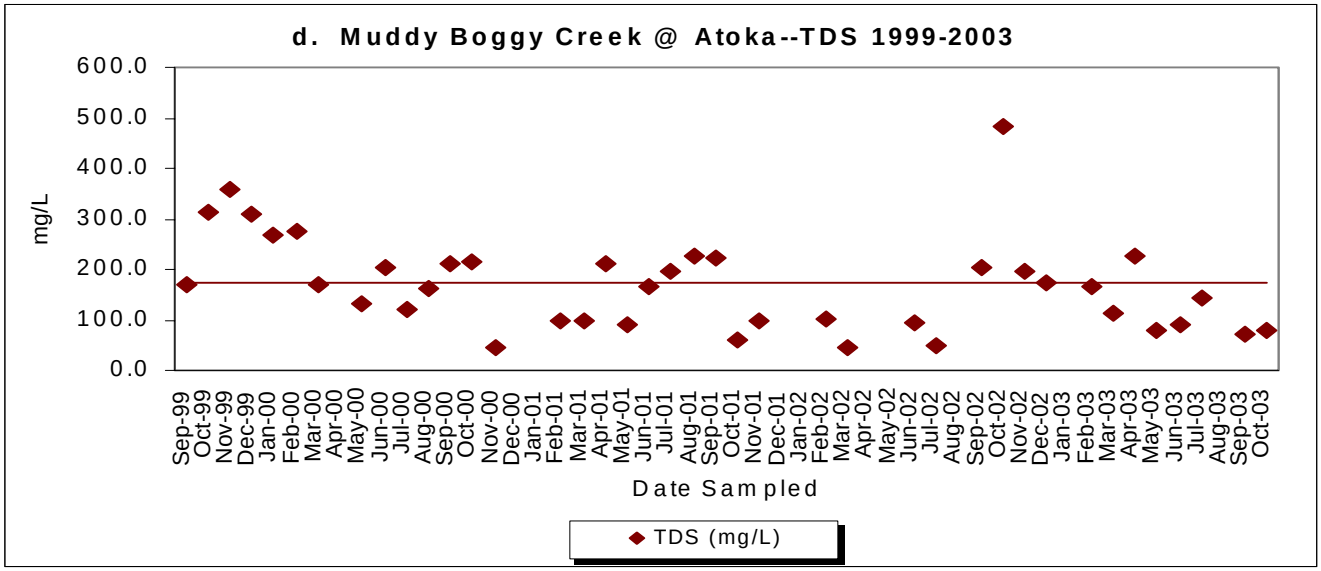
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 26 turbidity samples (Figure 107c), 12 samples (or 46%) exceeded the numerical criteria of 50. Of the 39 dissolved oxygen samples (Figure 107a), 7 concentrations (or 18%) were below the prescribed screening level. Of the 15 lead samples collected, 7 of the concentrations (or 47%) exceeded the prescribed hardness-dependant chronic criteria of 2.80 µg/L (Table 34). The pH (Figure 107b) samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids (TDS), chlorides, and sulfates (Figure 107d and Figure 107e). Although 40% of the TDS concentrations exceeded the sample standard of 172.0 mg/L, the values are below the minimum values of 750 and 700 mg/L, respectively. Although 26% of the sulfate concentrations exceed the sample standard of 77.0 mg/L, these values are below the minimum value of 250 mg/L. The PBCR beneficial use is not supported (Table 35). Of the 21 fecal coliform concentrations, 8 samples (or 38%) exceeded the prescribed screening level of 400 cfu/mL. Of the 20 enterococci concentrations, 6 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (256.0 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of Muddy Boggy Creek is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 107f).

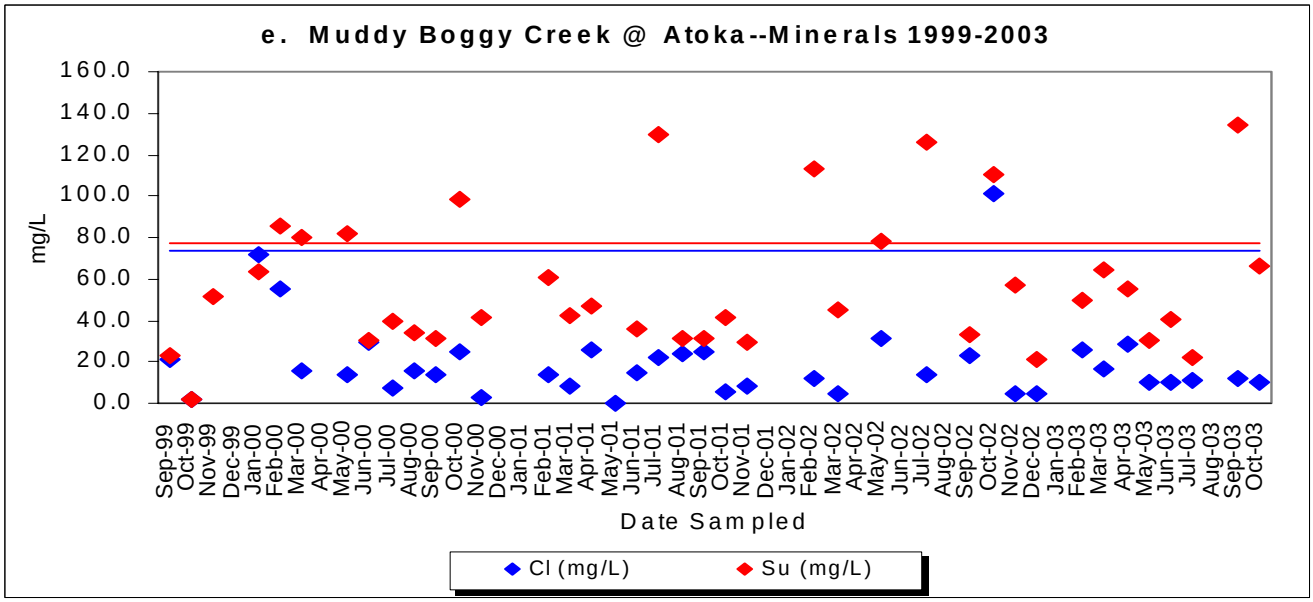
Figure 107a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on Muddy Boggy Creek at Atoka (AT332950), 1999-2003.

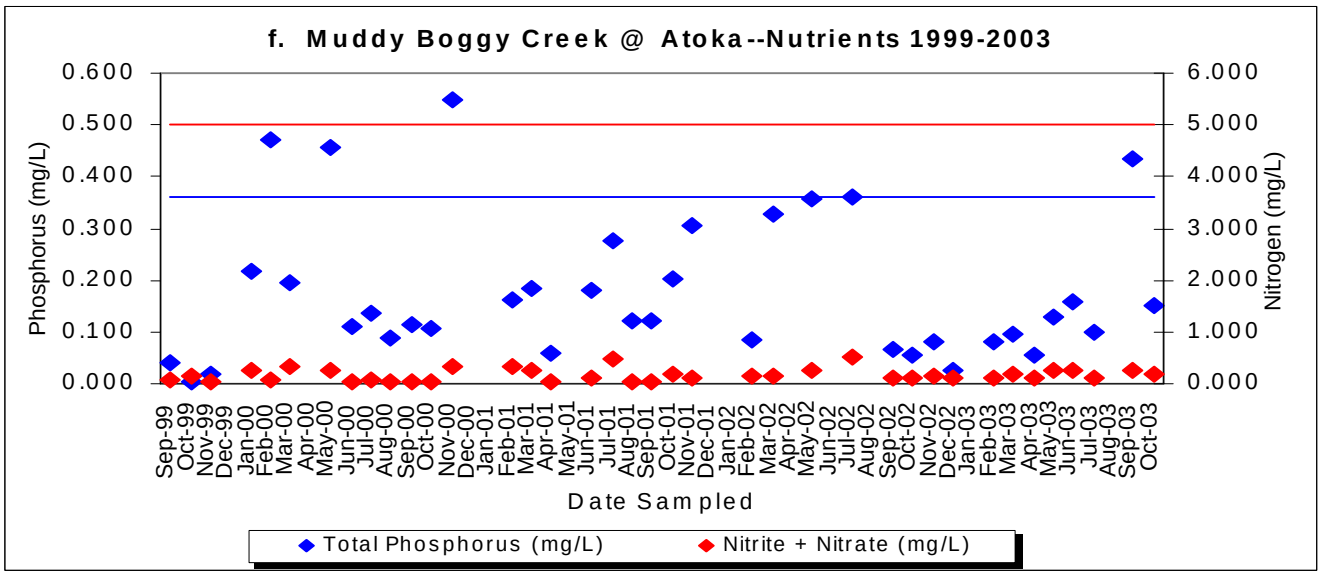







d. Muddy Boggy Creek @ Atoka--TDS 1999-2003
mg/L
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Date Sampled
TDS (mg/L)


e. Muddy Boggy Creek @ Atoka--Minerals 1999-2003
mg/L
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Muddy Boggy Creek @ Atoka--Nutrients 1999-2003
Phosphorus (mg/L)
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

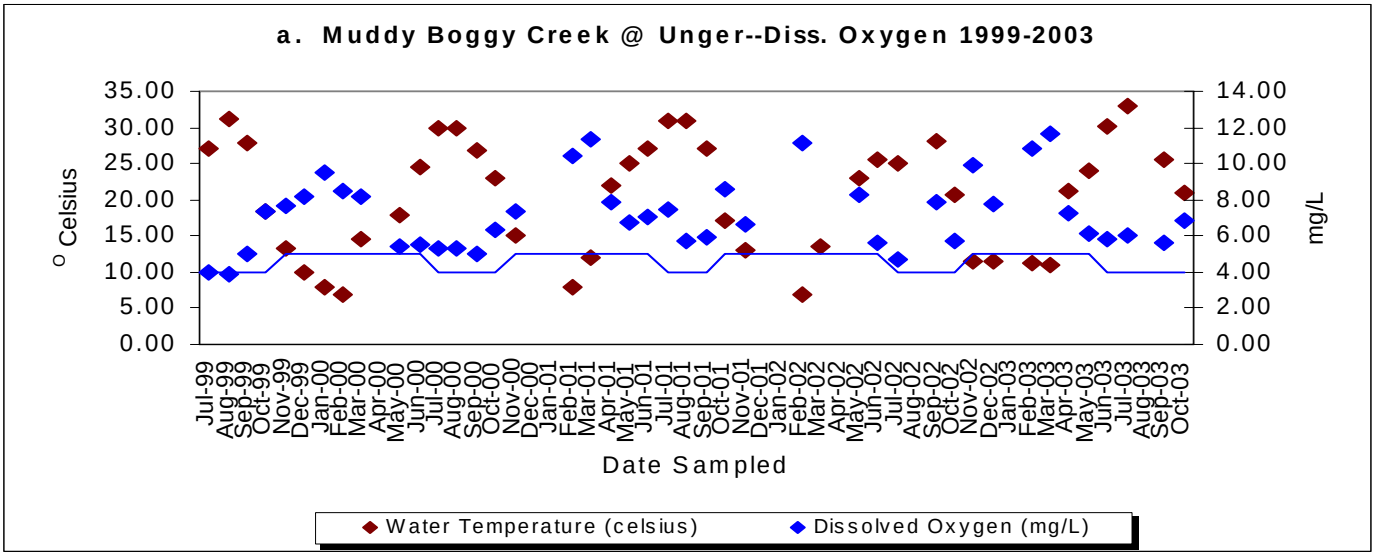
Muddy Boggy Creek near Unger

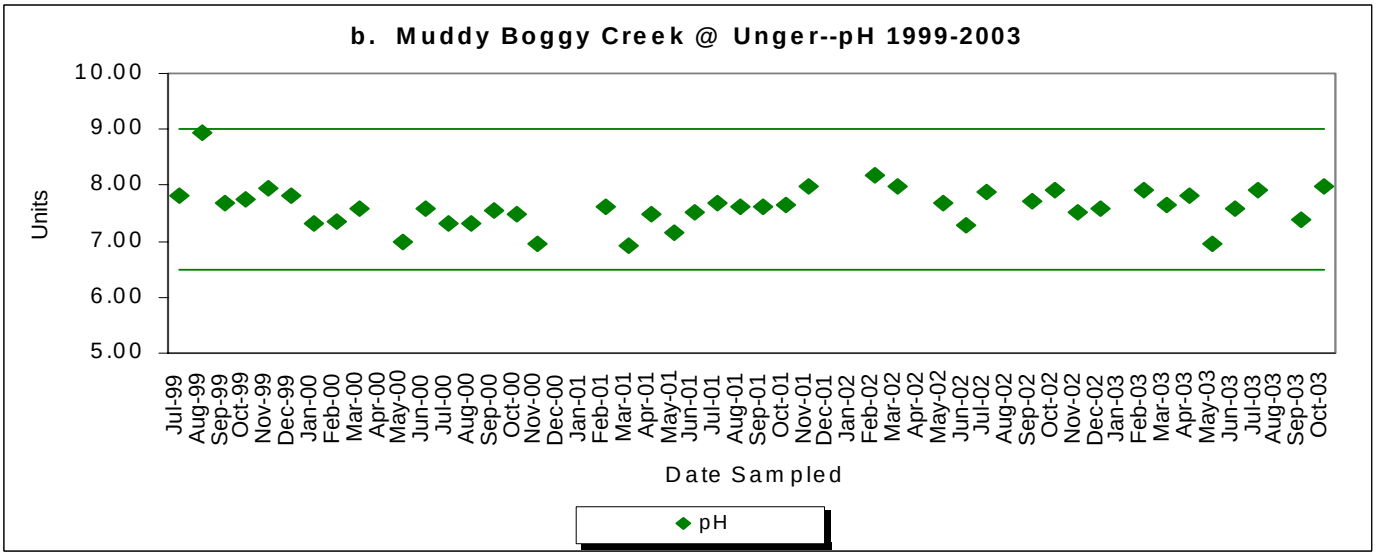
Station AT335300 (410400010070-001AT) is a permanent ambient trend monitoring station near the lower end of Muddy Boggy Creek. Situated in the west central portion of Choctaw County, the site was established east of the Town of Unger on US Highway 70. The station is positioned near the upper end of stream segment 410400010070 and is classified within the Muddy Boggy Creek 8-digit HUC watershed (11140103). Water enters the stream system from several tributaries including Clear Boggy Creek, Lick Creek, Bokchito Creek, and Hanubby Creek, among others.

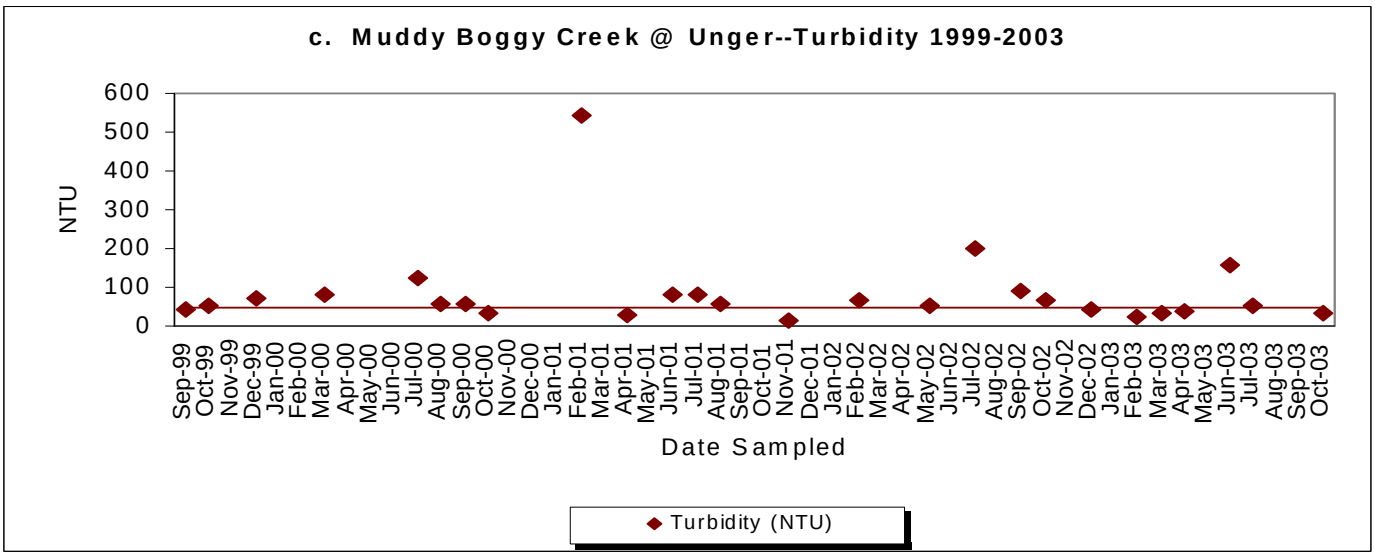
This station on Muddy Boggy Creek has been active for all water quality variables since July of 1999. The following assessment of beneficial uses is based on data collected from July of 1999 through October of 2003. For purposes of reporting, this station is representative of Muddy Boggy Creek from the confluence of Clear Boggy Creek (95.7990, 34.0565) downstream to confluence of Muddy Boggy Creek with the Red River (95.5989, 33.9412). As per Appendix A, Table 4 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

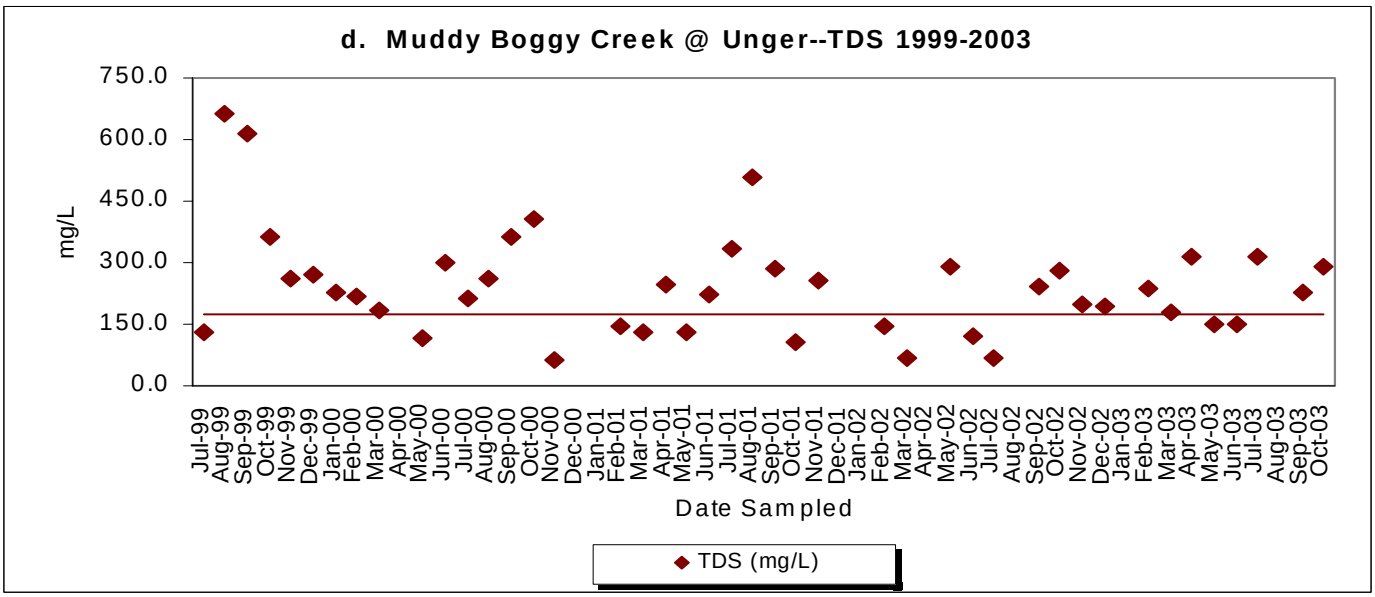
The PPWS beneficial use is supported. The WWAC beneficial use is not supported. Of the 26 turbidity samples (Figure 108c), 17 samples (or 65%) exceeded the numerical criteria of 50. Of the 13 lead samples collected, 3 of the concentrations (or 23%) exceeded the prescribed hardness-dependant chronic criteria of 4.66 µg/L (Table 34). The dissolved oxygen (Figure 108a) and pH (Figure 108b) samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is supported for total dissolved solids, chlorides, and sulfates (Figure 108d and Figure 108e). Although 70% of the TDS concentrations exceeded the sample standard of 172.0 mg/L and the geometric mean (182.8 mg/L) exceeded the yearly mean standard of 114 mg/L, the values are below the minimum values of 750 and 700 mg/L, respectively. Although 15% of chloride concentrations exceeded the sample standard of 74.0 mg/L, the values are below the prescribed minimum standard of 250 mg/L. The PBCR beneficial use is not supported (Table 35). Of the 15 fecal coliform concentrations, 8 samples (or 53%) exceeded the prescribed screening level of 400 cfu/mL. Of the 14 enterococci concentrations, 3 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (43.7 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Muddy Boggy Creek is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 108f).

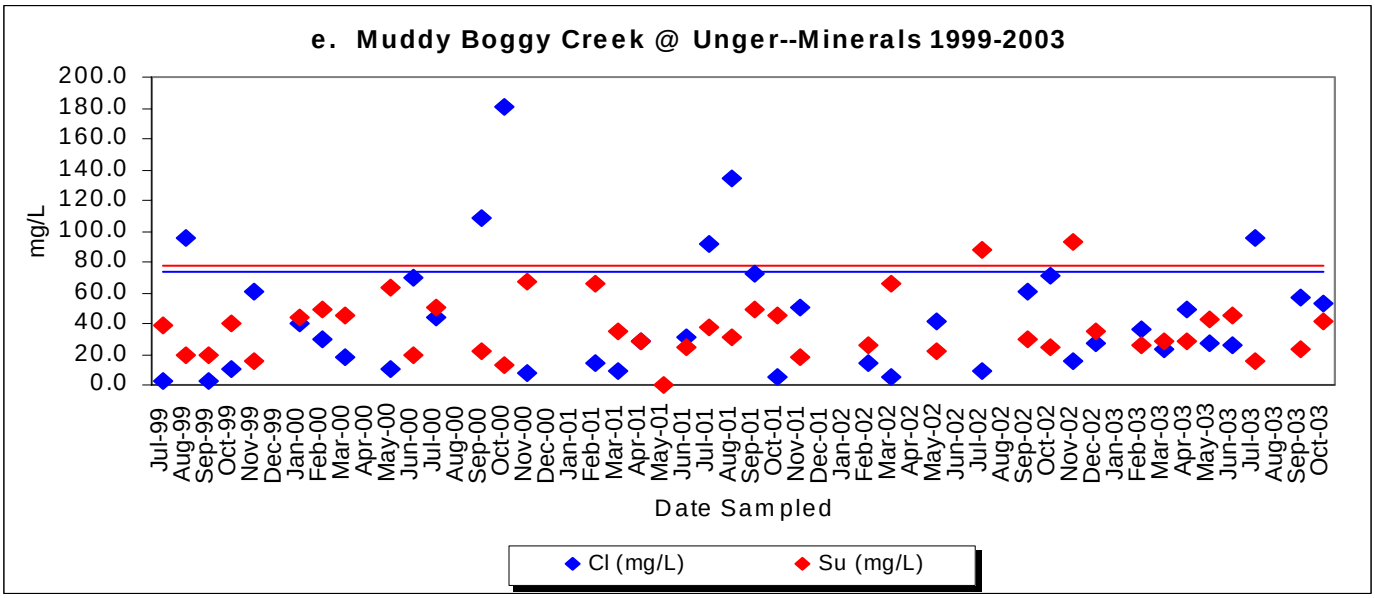
Figure 108a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on Muddy Boggy Creek at Unger (AT335300), 1999-2003.

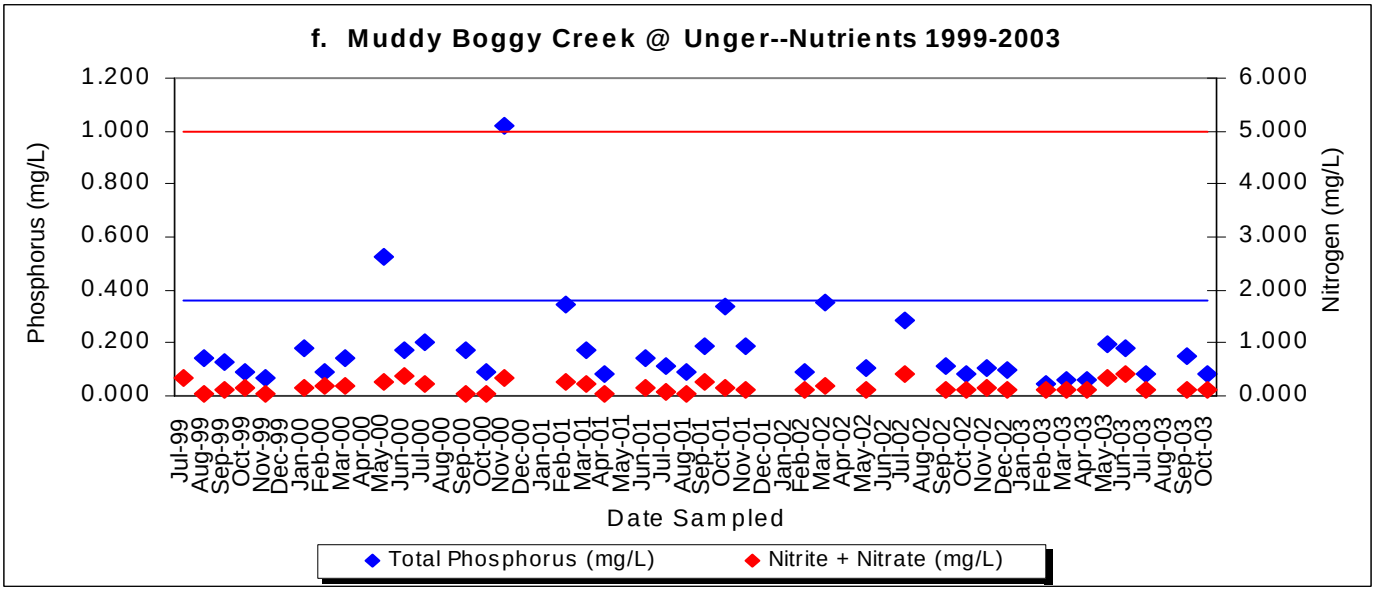







d. Muddy Boggy Creek @ Unger--TDS 1999-2003
mg/L
750.0
600.0
450.0
300.0
150.0
0.0
Date Sampled
TDS (mg/L)


e. Muddy Boggy Creek @ Unger--Minerals 1999-2003
mg/L
200.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Muddy Boggy Creek @ Unger--Nutrients 1999-2003
Phosphorus (mg/L)
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

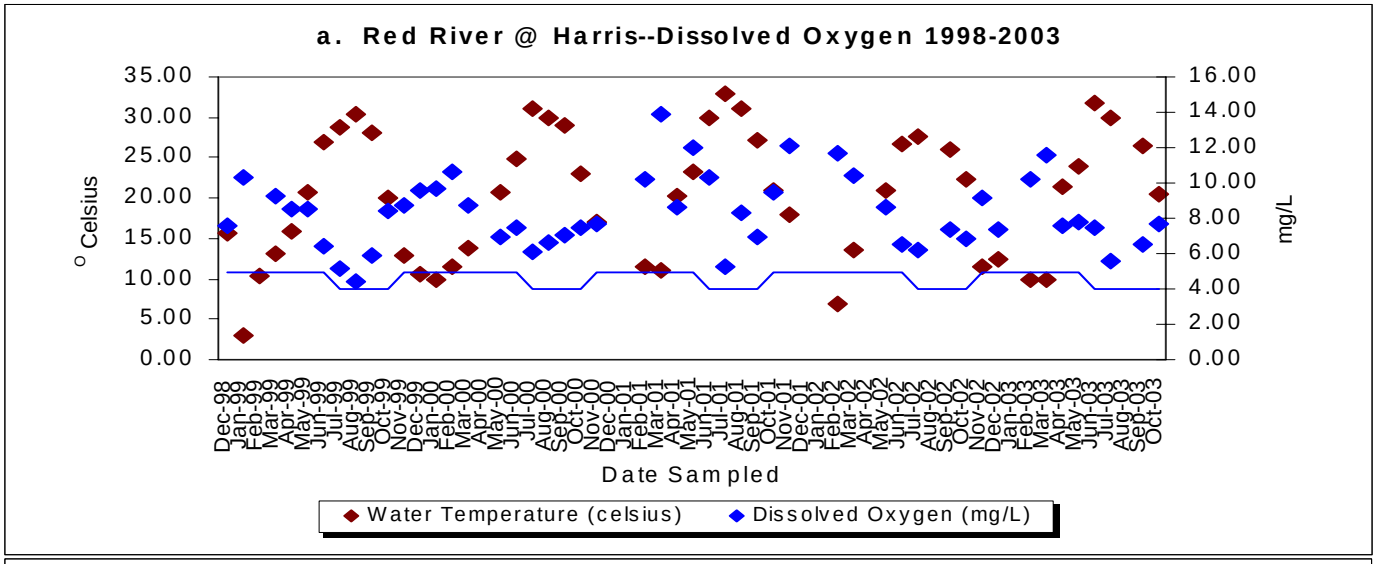
Red River near Harris

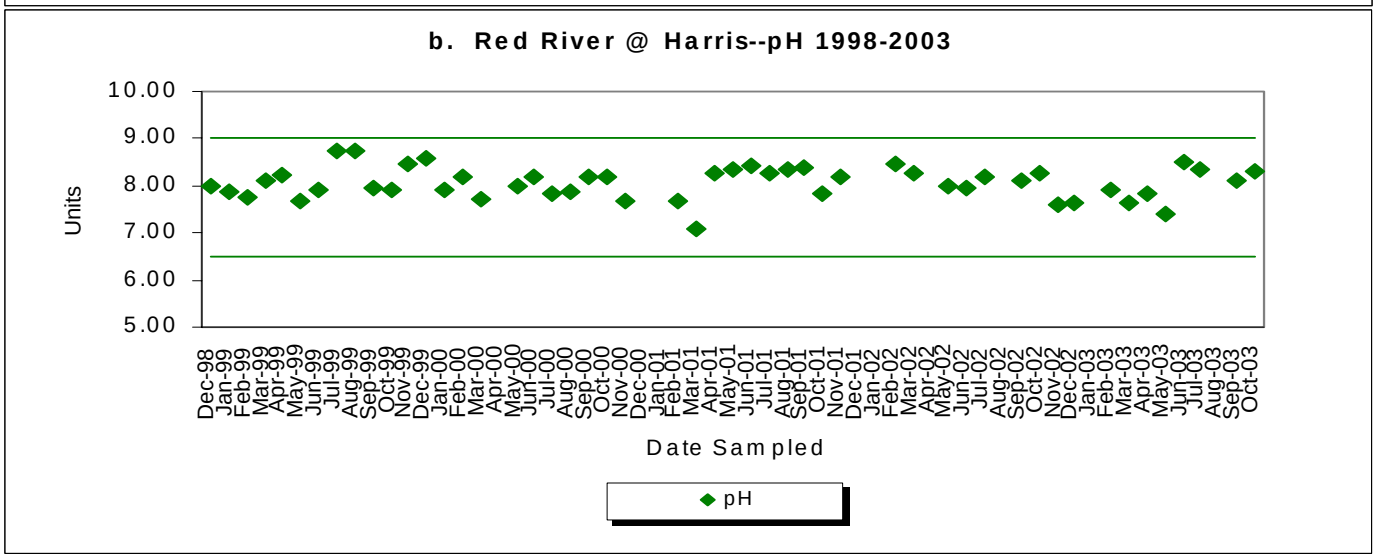
Station AT336820 (410100010010-001AT) is a permanent ambient trend monitoring station located on the Red River in Oklahoma. Situated in the southeastern portion of McCurtain County, the site was established south of the Town of Harris on US Highway 259. The station is positioned near the terminal end of stream segment 410100010010 and is classified within the Pecan Creek - Waterhole Creek 8-digit HUC watershed (11140106). Water enters the stream system from Hugo Lake, Lake Raymond Gary, and Ward Lake and from several tributaries including Garland Creek, Buzzard Creek, Waterhole Creek, and Norwood Creek (Ward Lake), among others.

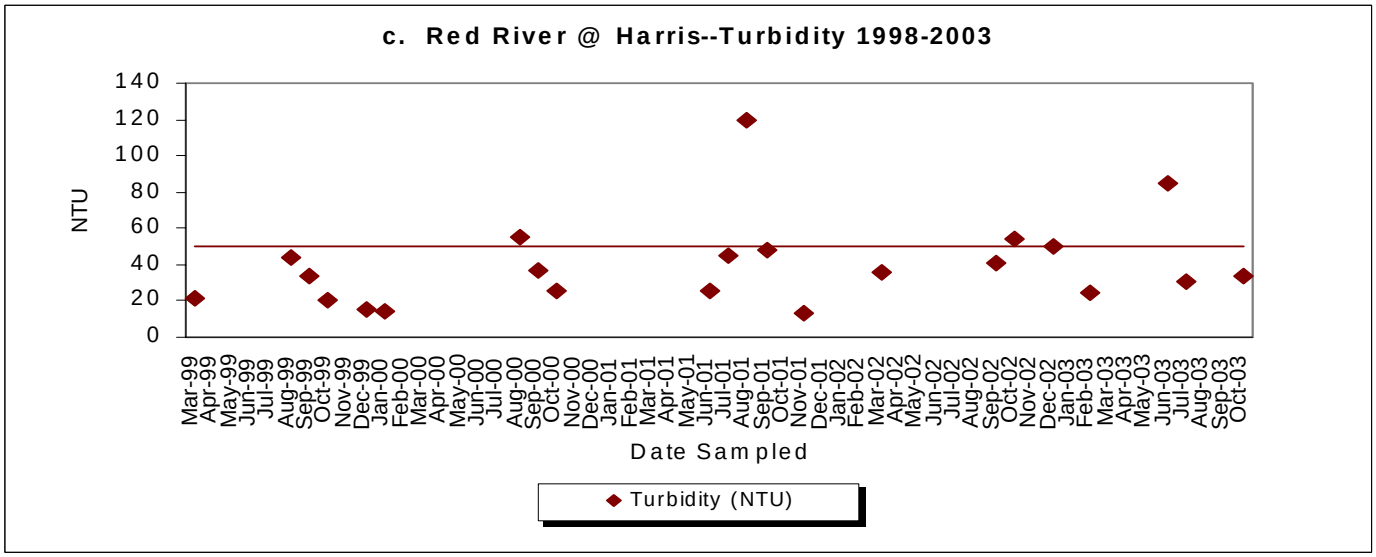
This station on the Red River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through October of 2003. For purposes of reporting, this station is representative of the Red River from below the confluence of the Kiamichi River (95.2272, 33.9625) downstream to where the Red River exits Oklahoma (94.4868, 33.6374). As per Appendix A, Table 4 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class II Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

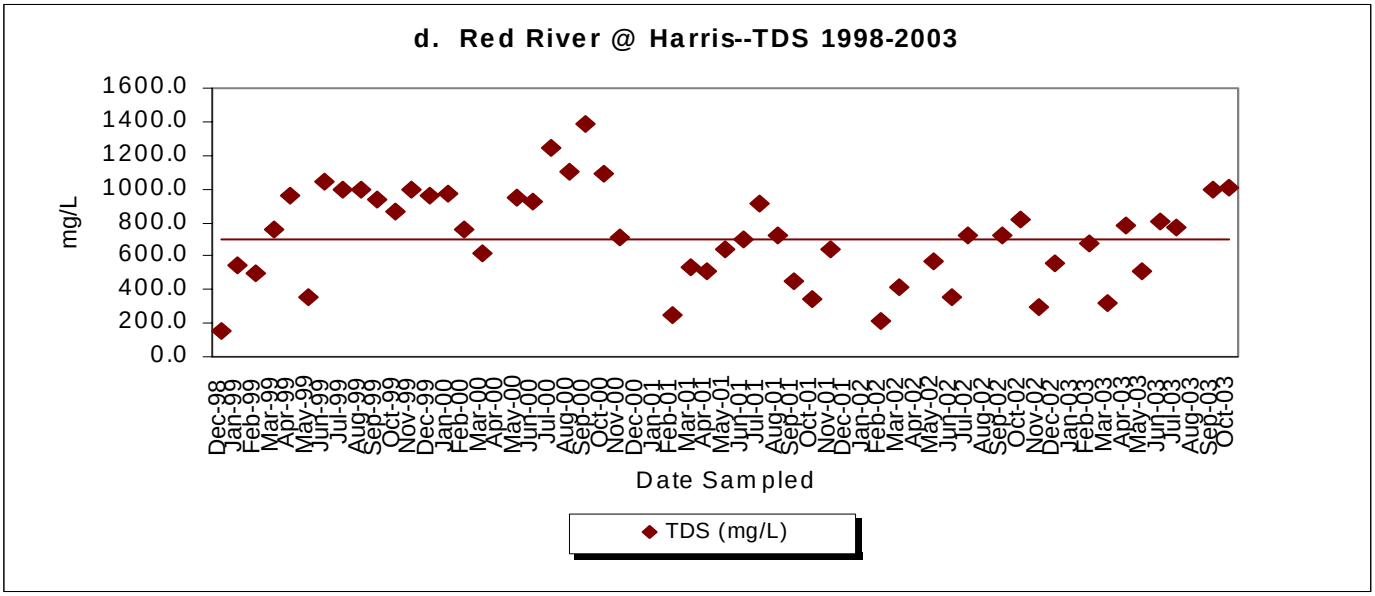
The PPWS beneficial use is supported. The WWAC beneficial use is partially supported. Of the 22 turbidity samples (Figure 109c), 4 samples (or 18%) exceeded the numerical criteria of 50. Dissolved oxygen (Figure 109a), pH (Figure 109b), and toxicant samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is not supported (Figure 109d and Figure 109e). Of the 50 total dissolved solids concentrations, 24 samples (or 48%) exceeded the prescribed minimum sample standard of 750 mg/L (Appendix F sample standard is 700 mg/L). Chloride and sulfate concentrations met the criteria prescribed in the AG beneficial use. The PBCR beneficial use is supported for fecal coliform, *E. coli* and enterococci samples. This segment of the Red River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 109f).

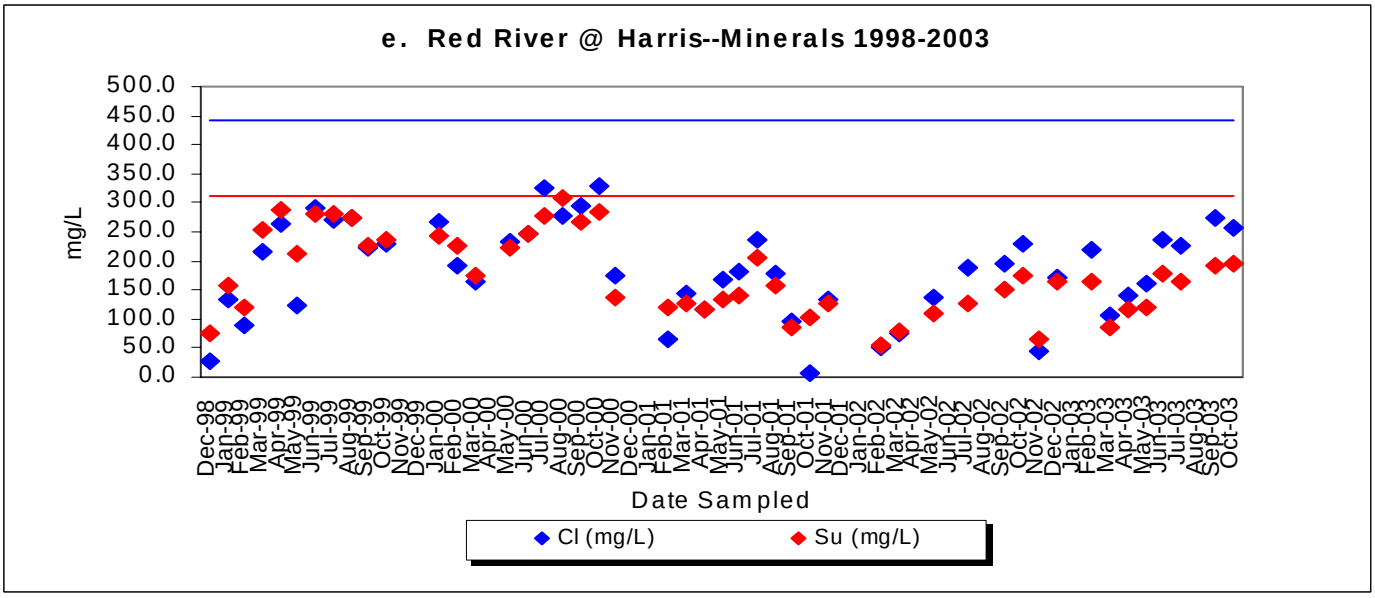
Figure 109a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Red River at Harris (AT336820), 1998-2003.

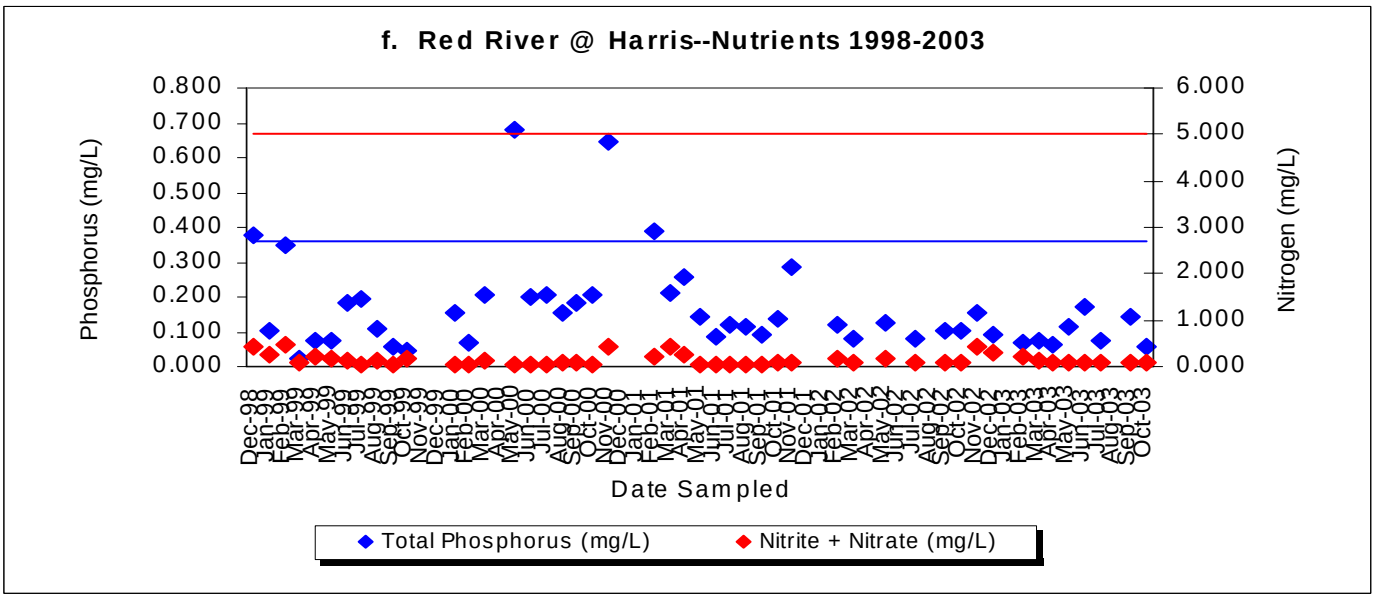







d. Red River @ Harris--TDS 1998-2003
mg/L
Date Sampled
TDS (mg/L)


e. Red River @ Harris--Minerals 1998-2003
mg/L
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Red River @ Harris--Nutrients 1998-2003
Phosphorus (mg/L)
Nitrogen (mg/L)
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

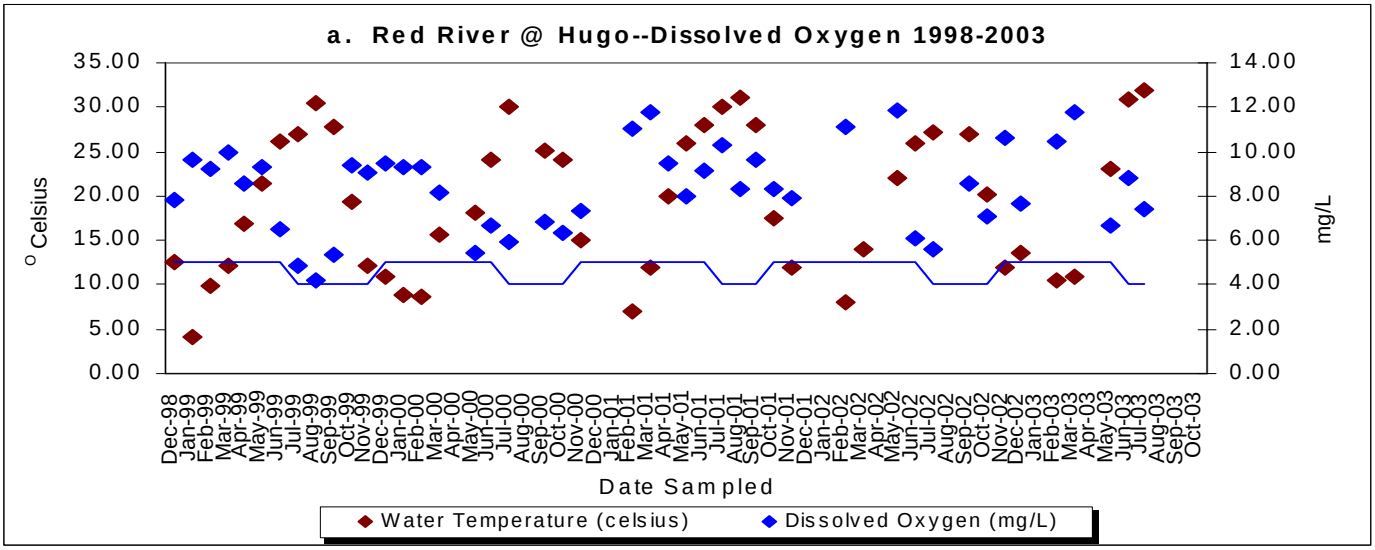
Red River near Hugo

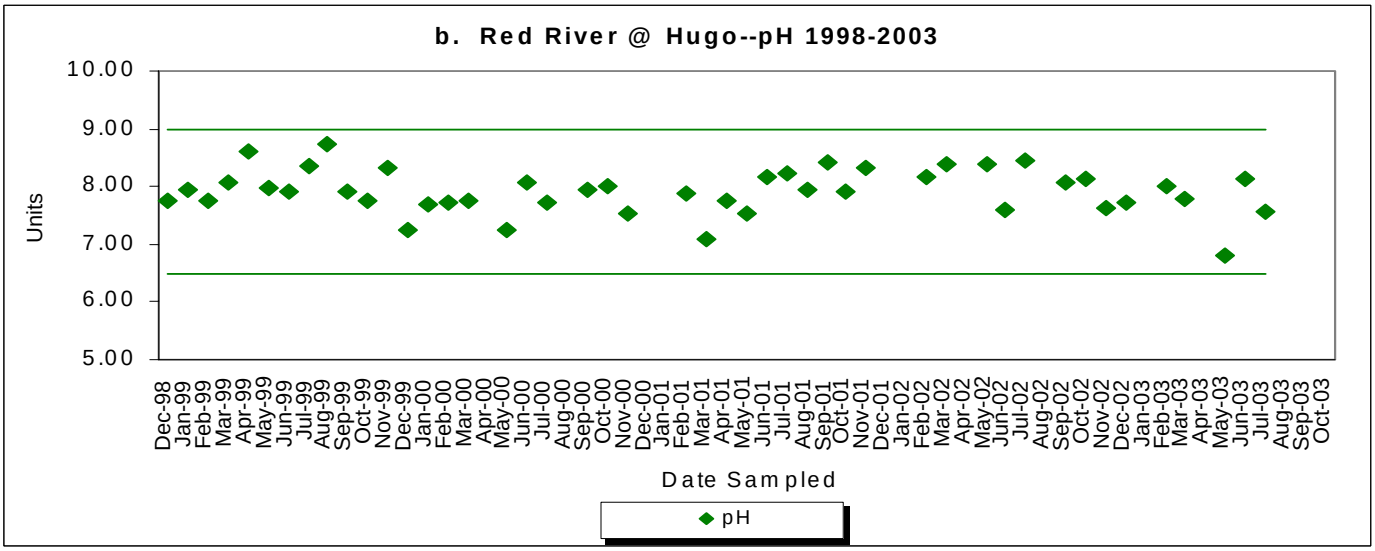
Station AT335500 (410400010010-001AT) is a permanent ambient trend monitoring station located on the Red River in Oklahoma. Situated in the south central portion of Choctaw County, the site was established south of the City of Hugo on US Highway 271. The station is positioned near the midpoint of stream segment 410400010010 and is classified within the Bois D'Arc - Island Creek 8-digit HUC watershed (11140101). Water enters the stream system from several tributaries including the Blue River, Whitegrass Creek, the Muddy Boggy River, Horse Creek, and the Kiamichi River, among others.

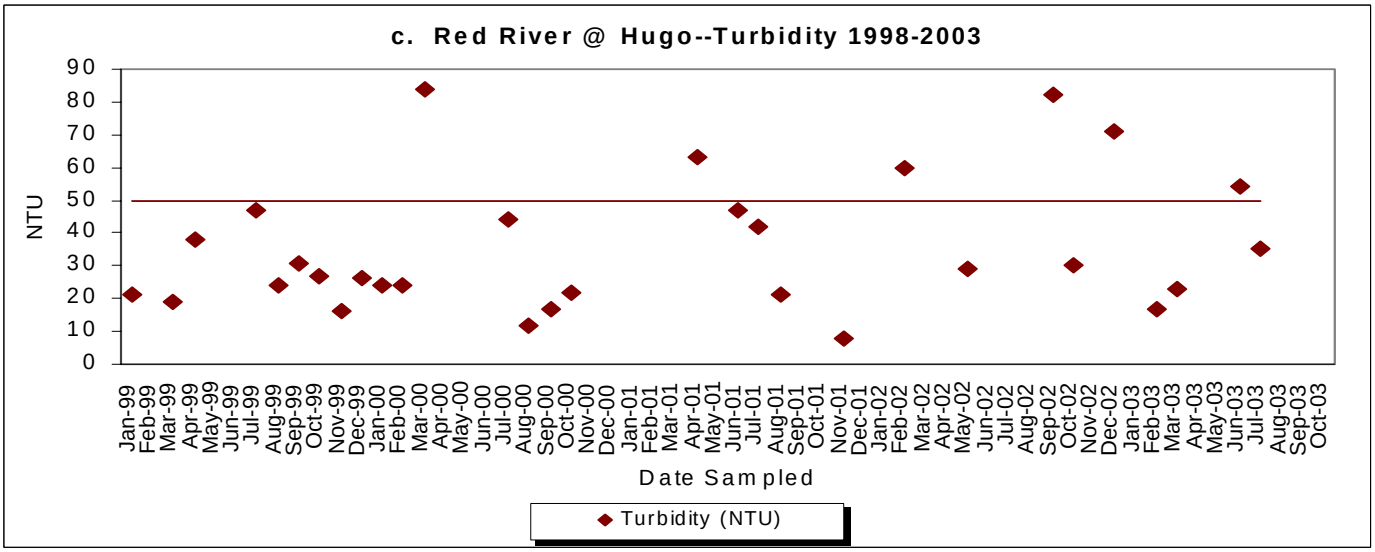
This station on the Red River has been active for all water quality variables since November of 1998. The following assessment of beneficial uses is based on data collected from December of 1998 through July of 2003. For purposes of reporting, this station is representative of the Red River from the confluence of the Blue River (95.9356, 33.8879) downstream to confluence of the Kiamichi River with the (95.2300, 33.9615). As per Appendix A, Table 4 of OAC 785:45, this water quality management segment is assigned the following designated beneficial uses: 1) Public and Private Water Supply (PPWS), 2) Warm Water Aquatic Community—Fish and Wildlife Propagation (WWAC), 3) Agriculture—Class I Irrigation (AG), 4) Primary Body Contact—Recreation (PBCR), and 5) Aesthetics.

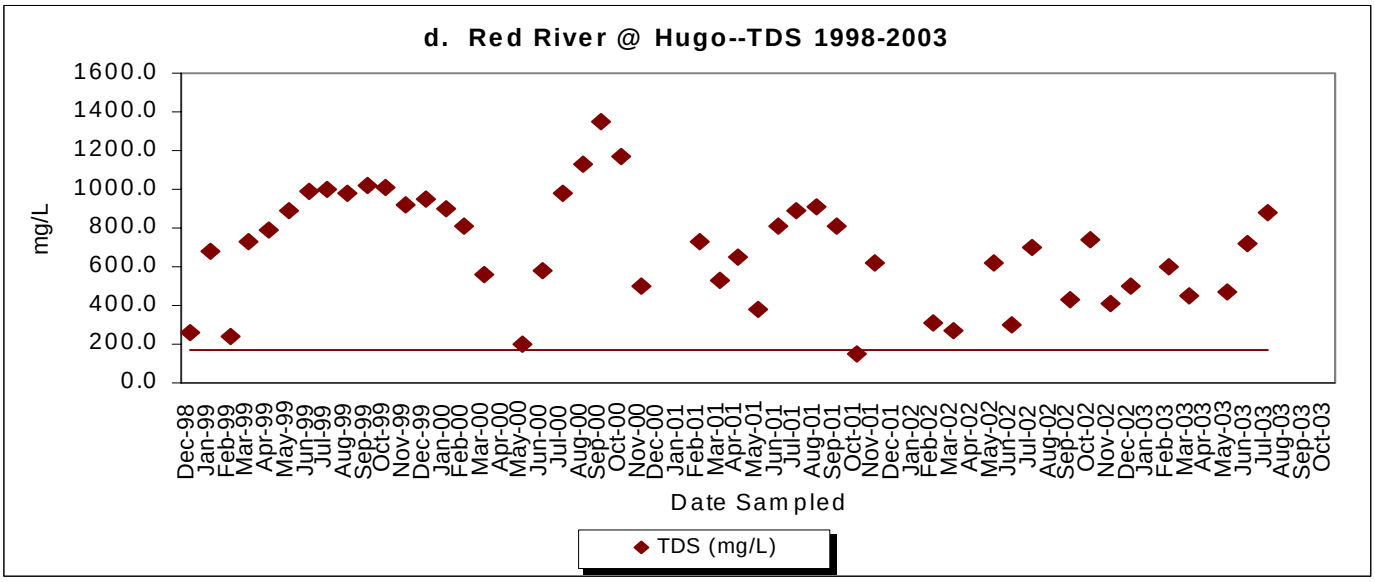
The PPWS beneficial use is supported. The WWAC beneficial use is partially supported. Of the 30 turbidity samples (Figure 110c), 6 samples (or 20%) exceeded the numerical criteria of 50. Dissolved oxygen (Figure 110a), pH (Figure 110b), and toxicant samples met the criteria prescribed in the WWAC beneficial use. The AG beneficial use is not supported (Figure 110d and Figure 110e). Of the 47 total dissolved solids concentrations, 20 samples (or 43%) exceeded the prescribed minimum sample standard of 750 mg/L (Appendix F sample standard is 172 mg/L). Of the 42 chloride concentrations, 9 samples (or 21%) exceeded the prescribed minimum sample standard of 250 mg/L (Appendix F sample standard is 74 mg/L). Of the 42 sulfate concentrations, 8 samples (or 19%) exceeded the prescribed minimum sample standard of 250 mg/L (Appendix F sample standard is 77 mg/L). The PBCR beneficial use is not supported (Table 35). Of the 16 fecal coliform concentrations, 6 samples (or 38%) exceeded the prescribed screening level of 400 cfu/mL. Of the 17 enterococci concentrations, 3 samples exceeded the prescribed screening level of 406 cfu/mL, and the geometric mean (123.6 cfu/mL) exceeded the prescribed mean standard of 33 cfu/mL. This segment of the Red River is not nutrient-threatened. The total phosphorus and nitrate/nitrite median values were below the threshold medians of 0.36 mg/L and 5.0 mg/L, respectively (Figure 110f).

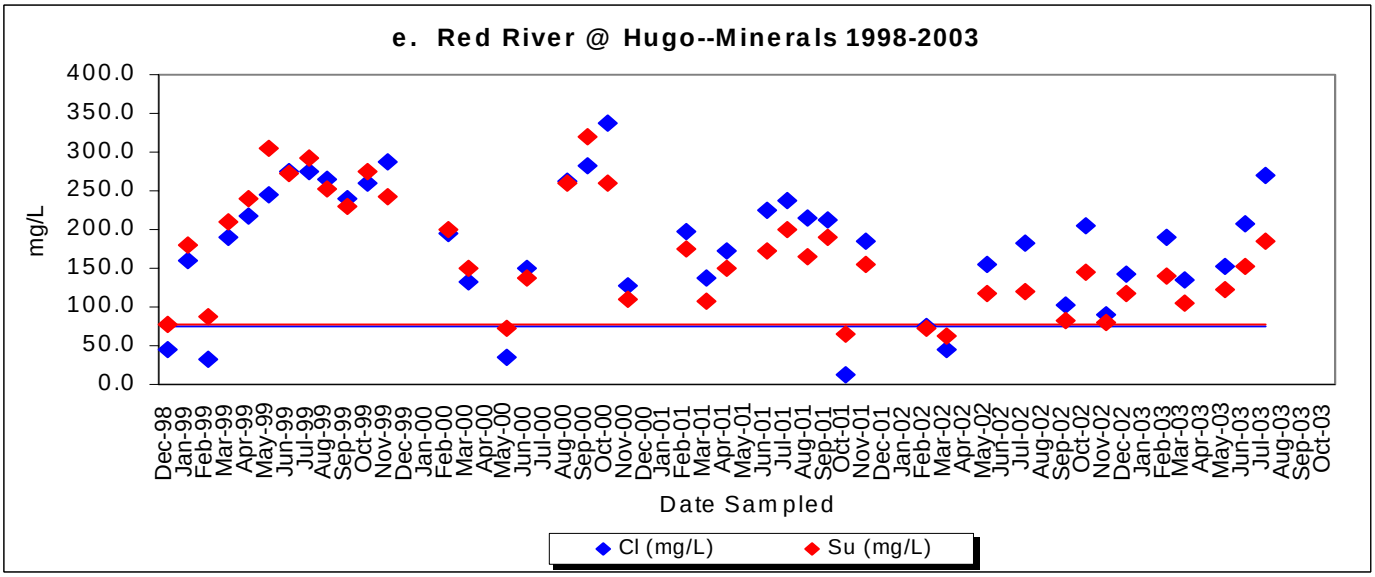
Figure 110a-f. Dissolved Oxygen (a), pH (b), Turbidity (c), Total Dissolved Solids (d), Minerals (e), and Nutrients (f) on the Red River at Hugo (AT335500), 1998-2003.

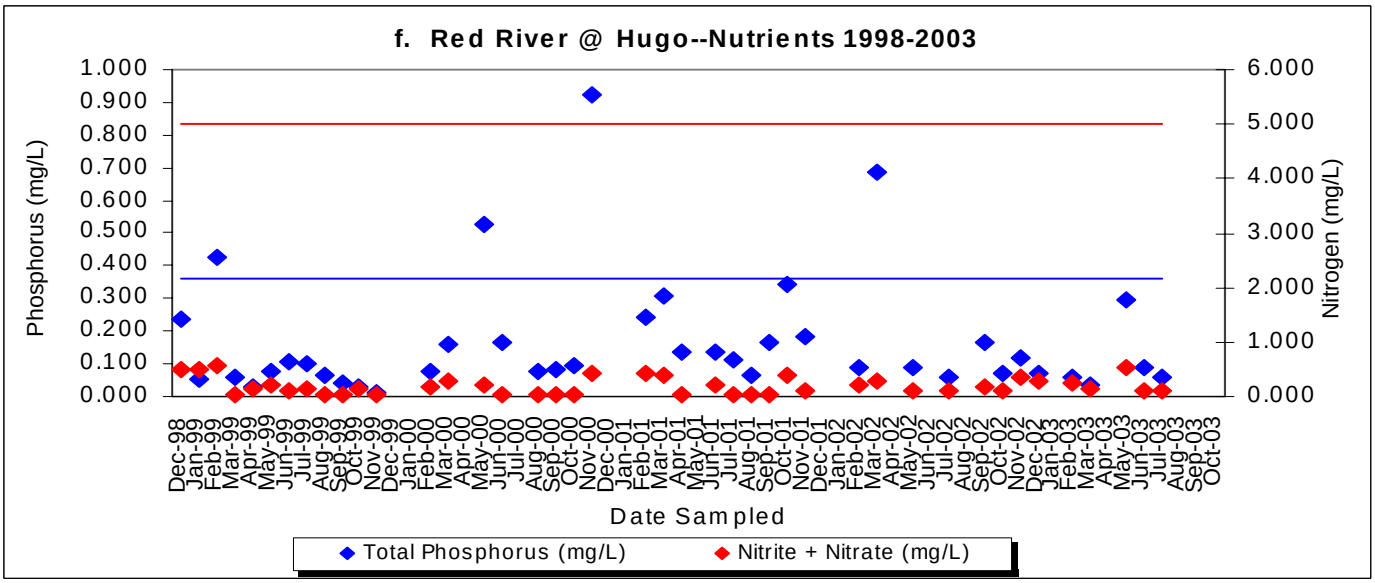







d. Red River @ Hugo--TDS 1998-2003
mg/L
1600.0
1400.0
1200.0
1000.0
800.0
600.0
400.0
200.0
0.0
Date Sampled
TDS (mg/L)


e. Red River @ Hugo--Minerals 1998-2003
mg/L
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
Date Sampled
Cl (mg/L)
Su (mg/L)


f. Red River @ Hugo--Nutrients 1998-2003
Phosphorus (mg/L)
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Nitrogen (mg/L)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Date Sampled
Total Phosphorus (mg/L)
Nitrite + Nitrate (mg/L)

ROTATING STATION MONITORING RESULTS & DISCUSSION

The goal of the rotating portion of the program is to provide short-term assessments on priority waters as identified by a state agency or other party. Two over-arching objectives were identified to aid in the determination of what would qualify as a rotating site. First of all, it was determined that data collection at a particular site should be short-term in nature and not extend past one sampling year. Data collected within that year should allow water quality managers to make the appropriate decisions regarding the segment being monitored. For instance, if a stream reach is listed as impaired due to pH on the 303(d) list, measuring pH throughout one year should allow the requesting agency or entity to either de-list the segment or determine what other monitoring efforts are necessary. Secondly, the monitoring should fall within the framework of the USAP. Since the inception of the program, the staff of the OWRB has met individually with representatives of other state agencies to identify their priority short-term monitoring needs. Once the OWRB receives a list of waters for monitoring from the interested agencies, staff evaluates the nominations and notifies the nominating agency of which waters would be monitored (all of the waters requested for monitoring have been accommodated since program inception). In all, over two hundred (200) monitoring stations have been or are currently being monitored. In most instances, the segments were listed for one or more variables in the state's 303d list. For a comprehensive list of historic and/or current rotational monitoring stations, **please contact the Oklahoma Water Resources Board/Water Quality Programs Division at (405) 530-8800.**

INTENSIVE INVESTIGATIONS

If beneficial use impairments are identified or suspected, then all appropriate state agencies will be alerted and an investigation will be initiated to confirm the impairment. If routine monitoring cannot definitively identify a threat or impairment, then an intensive study will be undertaken. If impairment is positively identified, the source of the impairment will be identified if possible. Potential causes of beneficial use impairment include but are not limited too; improper beneficial use or criteria (Oklahoma Water Resources Board jurisdiction), point source problems (Oklahoma Department of Environmental Quality or Oklahoma Department of Agriculture, Food & Forestry), non-point source problems (Oklahoma Conservation Commission, Oklahoma Department of Agriculture, Food & Forestry, Oklahoma Corporation Commission, or Oklahoma Department of Environmental Quality), oil and gas contamination (Oklahoma Corporation Commission), agricultural activities (Oklahoma Department of Agriculture, Food & Forestry), or mining activities (Oklahoma Department of Mines). All monitoring activities undertaken will be cooperative in nature with the agency with statutory authority assuming the lead role for intensive monitoring. Other entities (i.e. tribal or governmental units outside of Oklahoma) will be involved as appropriate. All intensive-monitoring activities will be consistent with and driven by the Water Resources Board OWQS and OWQS Implementation Plan.

The latest revisions to the Oklahoma Water Quality Standards states that an intensive monitoring program should be conducted on waters identified as nutrient-limited. The nature of the intensive monitoring is not explained in great detail and it is not envisioned that monies from the Beneficial Use Monitoring Program would be used to conduct these intensive studies. The intent of the intensive monitoring task of the BUMP is to work in priority areas identified by other entities, be they local, state, or federal. Priority areas may be a geographic area or may be a specialized water quality variable or indicator not normally included in the monitoring program (i.e. fish collections for toxics analysis or collection of other biological organisms). It is still the intent of the Water Resources Board to use the intensive monitoring monies for short-term, high priority areas identified by the Water Resources Board or other state/federal environmental agencies.

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APPENDIX A

Oklahoma's Use Support Assessment Protocols

[UNOFFICIAL]

Proposed Amendments as of 11/17/2003
Under consideration for adoption in 2004

TITLE 785. OKLAHOMA WATER RESOURCES BOARD
CHAPTER 46. IMPLEMENTATION OF OKLAHOMA'S WATER QUALITY STANDARDS

SUBCHAPTER 15. USE SUPPORT ASSESSMENT PROTOCOLS

785:46-15-1. Scope and applicability
(a) **General.** The rules in this Subchapter provide protocols which shall be used on and after October 1, 2000 to determine whether certain beneficial uses of waters of the state designated in OAC 785:45 are being supported. Such determinations shall be made only to the extent that pertinent provisions of OAC 785:45 apply to a waterbody or its designated uses. The rules in this Subchapter are not intended and should not be construed to limit any actions by federal or state agencies or citizens to prevent pollution or to limit remedies to abate pollution from a single incident or activity or series of incidents or activities.
(b) **Significance of assessment that a use is other than fully supported.** A determination based upon application of the rules in this Subchapter that a waterbody's beneficial use is not supported or is partially supported creates a presumption that the use is impaired <u>or not attained for that waterbody and that the waterbody segment is a water quality limited segment</u>.

785:46-15-5. Assessment of Fish and Wildlife Propagation support
(a) **Scope.** The provisions of this Section shall be used to determine whether the beneficial use of Fish and Wildlife Propagation or any subcategory thereof designated in OAC 785:45 for a waterbody is supported.
(b) **Dissolved oxygen.**

(1) **Screening levels for DO in streams.**

(A) Screening levels for DO in habitat limited aquatic communities shall be 4.0 mg/L from April 1 through June 15 each year and 3.0 mg/L for the remainder of the year.

(B) Screening levels for DO in warm water aquatic communities shall be 4.0 mg/L from June 16 through October 15 each year and 5.0 mg/L for the remainder of the year.

(C) Screening levels for DO in cool water aquatic communities and trout fisheries shall be 5.0 mg/L from June 1 through October 15 each year and 6.0 mg/L for the remainder of the year.

(2) **Screening levels for DO in lakes.**

(A) If greater than 70% of the water column at any given sample site in a lake or an arm of a lake is less than 2 mg/L <u>due to other than naturally occurring conditions</u>, the Fish and Wildlife Propagation beneficial use shall be deemed to be not supported.

(B) If 50% or more, but not greater than 70%, of the water column at any given sample site in a lake or arm of a lake is less than 2 mg/L <u>due to other than naturally occurring conditions</u>, the Fish and Wildlife Propagation beneficial use shall be deemed to be partially supported.

(C) The screening level for surface DO in a lake or arm of a lake shall be 4 mg/L from June 16 through October 15 each year and 5.0 mg/L for the remainder of the year.

(3) **Support tests.**

(A) The Fish and Wildlife Propagation beneficial use designated for a waterbody shall be deemed to be fully supported with respect to the DO criterion if no more than 10% of the samples from a waterbody are less than the screening level for DO prescribed in (b)(1) or (b)(2)(C) of this Section and such result is due to other than naturally occurring conditions.

(B) The Fish and Wildlife Propagation beneficial use designated for a waterbody shall be deemed to be partially supported with respect to the DO criterion if greater than 10% but less than 25% of the samples from a waterbody are less than the screening level for DO prescribed in (b)(1) or (b)(2)(C) of this Section.

(C) The Fish and Wildlife Propagation beneficial use designated for a waterbody shall be deemed to be not supported with respect to the DO criterion if at least 5% of the samples from a waterbody are less than the screening level for DO prescribed in (b)(1) or (b)(2)(C) of this Section.

(c) **Toxicants.**

(1) The Fish and Wildlife Propagation beneficial use designated for a waterbody shall be deemed to be fully supported with respect to any individual toxicant parameter if no more than one of the sample concentrations from the waterbody exceeds the acute or chronic criterion for that toxicant prescribed in the numerical criteria for toxic substances in OAC ~~785:45-5-12(f)(6)(G)~~ 785:45-5-12(f)(6)(D), (E) and (G) and 785:45 Appendix G, Table 2.

(2) The Fish and Wildlife Propagation beneficial use designated for a waterbody shall be deemed to be partially supported with respect to any individual toxicant parameter if more than one but not greater than 10% of the sample concentrations from the waterbody exceed the acute or chronic criterion for that toxicant prescribed in the numerical criteria for toxic substances in OAC ~~785:45-5-12(f)(6)(G)~~ 785:45-5-12(f)(6)(D), (E) and (G) and 785:45 Appendix G, Table 2.

(3) The Fish and Wildlife Propagation beneficial use designated for a waterbody shall be deemed to be not supported with respect to any individual toxicant parameter if greater than 10% of the sample concentrations from that waterbody exceed the acute or chronic criterion for that toxicant prescribed in the numerical criteria for toxic substances in OAC ~~785:45-5- 12(f)(6)(G)~~ 785:45-5-12(f)(6)(D), (E) and (G) and 785:45 Appendix G, Table 2.

(d) **pH.**

(1) The Fish and Wildlife Propagation beneficial use designated for a waterbody shall be deemed to be fully supported with respect to pH occurring other than by natural causes if no more than 10% of the sample concentrations from that waterbody fall outside the screening interval prescribed in 785:45-5-12(f)(3).

(2) The Fish and Wildlife Propagation beneficial use designated for a waterbody shall be deemed to be partially supported with respect to pH occurring other than by natural causes if greater than 10% but less than 25% of the sample concentrations from that waterbody fall outside the screening interval prescribed in 785:45-5-12(f)(3).

(3) The Fish and Wildlife Propagation beneficial use designated for a waterbody shall be deemed to be not supported with respect to pH occurring other than by natural causes if at least 25% of the sample concentrations from that waterbody fall outside the screening interval prescribed in 785:45-5-12(f)(3).

(e) **Biological criteria.**

(1) If data demonstrate that an assemblage of fish or macro invertebrates from a waterbody is significantly degraded, according to 785:45-5-12(f)(5), from that expected for the subcategory of Fish and Wildlife Propagation designated in OAC 785:45 for that waterbody, then that subcategory may be deemed by the appropriate state environmental agency to be not supported.

(2) All physical assessments and biological collections shall be performed in accordance with the requirements set forth in OWRB Technical Report No. 99-3 entitled "Standard Operating Procedures for Stream Assessments and Biological Collections Related to Biological Criteria in Oklahoma".

(3) Evaluation of the biological collections shall include identification of fish samples to species level. Determinations of tolerance level shall be made according to Jester et al. 1992, "The Fishes of Oklahoma, Their Gross Habitats, and Their Tolerance of Degradation in Water Quality and Habitat", Proceedings of Oklahoma Academy of Sciences, 72:7-19.

(4) The determination of whether the use of Fish and Wildlife Propagation is supported in wadable streams in Oklahoma ecoregions shall be made according to all of the requirements of this subsection (e), the application of Appendix C of this Chapter, and the special provisions in subsections (g)(h) through (i) (l), where applicable, of this Section. Streams with undetermined use support status shall be subject to additional investigation that considers stream order, habitat factors and local reference streams before the use support determination is made.

(f) **Turbidity.** The criteria for turbidity stated in 785:45-5-12(f)(7) shall constitute the screening levels for turbidity. The tests for use support shall follow the default protocol in 785:46-15-4(b).

(g) **Oil and grease.**

(1) The Fish and Wildlife Propagation beneficial use designated for a waterbody shall be deemed to be fully supported with respect to oil and grease if a visible sheen or bottom deposits of oil or grease are observed on that waterbody in 10% or less of the observations.

(2) The Fish and Wildlife Propagation beneficial use designated for a waterbody shall be deemed to be not supported with respect to oil and grease if a visible sheen or bottom deposits of oil or grease are observed on that waterbody in more than 10% of the observations.

(h) **Special provisions for Ouachita Mountains wadable streams.** The determination of whether the use of Fish and Wildlife Propagation is supported for wadable streams located in the Ouachita Mountains ecoregion shall be made according to the application of Appendix C of this Chapter, together with this subsection, as follows:

(1) Where designated, the subcategory of Warm Water Aquatic Community shall be deemed fully supported if the application of Appendix C produces a score of 35 or more. Such subcategory shall be deemed not supported if the application of Appendix C produces a score of 24 or less. If a score is 25 to 34 inclusive, the issue of whether this subcategory is supported shall be deemed undetermined.

(2) Where designated, the subcategory of Habitat Limited Aquatic Community shall be deemed fully supported if the application of Appendix C produces a score of 27 or more. Such subcategory shall be deemed not supported if the application of Appendix C produces a score of 18 or less. If a score is 19 to 26 inclusive, the issue of whether this subcategory is supported shall be deemed undetermined.

~~(h)~~(i) **Special provisions for Arkansas Valley wadable streams.** The determination of whether the use of Fish and Wildlife Propagation is supported for wadable streams located in the Arkansas Valley ecoregion shall be made according to the application of Appendix C of this Chapter, together with this subsection, as follows:

(1) Where designated, the subcategory of Warm Water Aquatic Community shall be deemed fully supported if the application of Appendix C produces a score of 35 or more. Such subcategory shall be deemed not supported if the application of Appendix C produces a score of 24 or less. If a score is 25 to 34 inclusive, the issue of whether this subcategory is supported shall be deemed undetermined.

(2) Where designated, the subcategory of Habitat Limited Aquatic Community shall be

deemed fully supported if the application of Appendix C produces a score of 27 or more. Such subcategory shall be deemed not supported if the application of Appendix C produces a score of 18 or less. If a score is 19 to 26 inclusive, the issue of whether this subcategory is supported shall be deemed undetermined.

~~(i)~~(j) **Special provisions for Boston Mountains and Ozark Highlands wadable streams.** The determination of whether the use of Fish and Wildlife Propagation is supported for wadable streams located in the Boston Mountains and Ozark Highlands ecoregions shall be made according to the application of Appendix C of this Chapter, together with this subsection, as follows:

(1) Where designated, the subcategory of Cool Water Aquatic Community shall be deemed fully supported if the application of Appendix C produces a score of 37 or more. Such subcategory shall be deemed not supported if the application of Appendix C produces a score of 29 or less. If a score is 30 to 36 inclusive, the issue of whether this subcategory is supported shall be deemed undetermined.

(2) Where designated, the subcategory of Warm Water Aquatic Community shall be deemed fully supported if the application of Appendix C produces a score of 31 or more. Such subcategory shall be deemed not supported if the application of Appendix C produces a score of 22 or less. If a score is 23 to 30 inclusive, the issue of whether this subcategory is supported shall be deemed undetermined.

~~(j)~~(k) **Special provisions for Central Irregular Plains wadable streams.** The determination of whether the use of Fish and Wildlife Propagation is supported for wadable streams located in the Central Irregular Plains ecoregion shall be made according to the application of Appendix C of this Chapter, together with this subsection, as follows:

(1) Where designated, the subcategory of Cool Water Aquatic Community shall be deemed fully supported if the application of Appendix C produces a score of 35 or more. Such subcategory shall be deemed not supported if the application of Appendix C produces a score of 28 or less. If a score is 29 to 34 inclusive, the issue of whether this subcategory is supported shall be deemed undetermined.

(2) Where designated, the subcategory of Warm Water Aquatic Community shall be deemed fully supported if the application of Appendix C produces a score of 30 or more. Such subcategory shall be deemed not supported if the application of Appendix C produces a score of 22 or less. If a score is 23 to 29 inclusive, the issue of whether this subcategory is supported shall be deemed undetermined.

(3) Where designated, the subcategory of Habitat Limited Aquatic Community shall be deemed fully supported if the application of Appendix C produces a score of 25 or more. Such subcategory shall be deemed not supported if the application of Appendix C produces a score of 16 or less. If a score is 17 to 24 inclusive, the issue of whether this subcategory is supported shall be deemed undetermined.

(l) **Special provisions for Central Oklahoma - Texas Plains wadable streams.** The determination of whether the Warm Water Aquatic Community subcategory of the Fish and Wildlife Propagation beneficial use is supported for wadable streams located in the Central Oklahoma - Texas Plains ecoregion shall be made according to the application of Appendix C of this Chapter, together with this subsection, as follows:

(1) Such subcategory shall be deemed fully supported if the application of Appendix C produces a score of 26 or more.

(2) Such subcategory shall be deemed not supported if the application of Appendix C produces a score of 19 or less.

(3) If the application of Appendix C produces a score of 20 to 25 inclusive, the issue of whether this subcategory is supported shall be deemed undetermined.

785:46-15-6. Assessment of Primary Body Contact Recreation support

(a) **Scope.** The provisions of this Section shall be used to determine whether the subcategory of Primary Body Contact of the beneficial use of Recreation designated in OAC 785:45 for a waterbody is supported during the recreation season from May 1 through September 30 each year. Where data exist for multiple bacterial indicators on the same waterbody or waterbody segment, the determination of use support shall be based upon the use and application of all applicable tests and data.

(b) **Screening levels.**

(1) The screening level for fecal coliform shall be a density of 400 colonies per 100ml.

(2) The screening level for Escherichia coli shall be a density of 235 colonies per 100 ml in streams designated in OAC 785:45 as Scenic Rivers and in lakes, and 406 colonies per 100 ml in all other waters of the state designated as Primary Body Contact Recreation.

(3) The screening level for enterococci shall be a density of 61 colonies per 100 ml in streams designated in OAC 785:45 as Scenic Rivers and in lakes, and 406 colonies per 100 ml in all other waters of the state designated as Primary Body Contact Recreation.

(c) **Fecal coliform.**

(1) The Primary Body Contact Recreation subcategory designated for a waterbody shall be deemed to be fully supported with respect to fecal coliform if the geometric mean of 400 colonies per 100 ml is met and no greater than 25% of the sample concentrations from that waterbody exceed the screening level prescribed in (b) of this Section.

(2) The parameter of fecal coliform is not susceptible to an assessment that Primary Body Contact Recreation is partially supported.

(3) The Primary Body Contact Recreation subcategory designated for a waterbody shall be deemed to be not supported with respect to fecal coliform if the geometric mean of 400 colonies per 100 ml is not met, or greater than 25% of the sample concentrations from that waterbody exceed the screening level prescribed in (b) of this Section, or both such conditions exist.

(d) **Escherichia coli (*E. coli*).**

(1) The Primary Body Contact Recreation subcategory designated for a waterbody shall be deemed to be fully supported with respect to *E. coli* if the geometric mean of 126 colonies per 100 ml is met, or the sample concentrations from that waterbody taken during the recreation season do not exceed the screening level prescribed in (b) of this Section, or both such conditions exist.

(2) The parameter of *E. coli* is not susceptible to an assessment that Primary Body Contact Recreation is partially supported.

(3) The Primary Body Contact Recreation subcategory designated for a waterbody shall be deemed to be not supported with respect to *E. coli* if the geometric mean of 126 colonies per 100 ml is not met and any of the sample concentrations from that waterbody taken during the recreation season exceed a screening level prescribed in (b) of this Section.

(e) **Enterococci.**

(1) The Primary Body Contact Recreation subcategory designated for a waterbody shall be deemed to be fully supported with respect to enterococci if the geometric mean of 33 colonies per 100 ml is met, or the sample concentrations from that waterbody taken during the recreation season do not exceed the screening level prescribed in (b) of this Section, or both such conditions exist.

(2) The parameter of enterococci is not susceptible to an assessment that Primary Body Contact Recreation is partially supported.

(3) The Primary Body Contact Recreation subcategory designated for a waterbody shall be deemed to be not supported with respect to enterococci if the geometric mean of 33

colonies per 100 ml is not met and any of the sample concentrations from that waterbody taken during the recreation season exceed a screening level prescribed in (b) of this Section.

785:46-15-7. Assessment of Public and Private Water Supply support

(a) **Scope.** The provisions of this Section shall be used to determine whether the beneficial use of Public and Private Water Supply or any subcategory thereof designated in OAC 785:45 for a waterbody is supported.

(b) **Toxicants.**

(1) The Public and Private Water Supply beneficial use designated for a waterbody shall be deemed to be fully supported with respect to any substance with criteria for such use listed in ~~785:45-5-10(1) or 785:45-5-10(6)~~ OAC 785:45 Appendix G if the sample concentrations from that waterbody do not exceed the criterion for that substance prescribed in ~~785:45-5-10~~ OAC 785:45 Appendix G more than 10% of the time, or drinking water use restrictions are not in effect, or both such conditions exist.

(2) The Public and Private Water Supply beneficial use designated for a waterbody shall be deemed to be partially supported with respect to any substance with criteria for such use listed in ~~785:45-5-10(1) or 785:45-5-10(6)~~ OAC 785:45 Appendix G if the sample concentrations from that waterbody exceed the criterion for that substance prescribed in ~~785:45-5-10~~ OAC 785:45 Appendix G more than 10% but less than 25% of the time, or drinking water use restrictions imposed by an agency with jurisdiction in effect require more than conventional treatment, or both such conditions exist.

(3) The Public and Private Water Supply beneficial use designated for a waterbody shall be deemed to be not supported with respect to any substance with criteria for such use listed in ~~785:45-5-10(1) or 785:45-5-10(6)~~ OAC 785:45 Appendix G if the sample concentrations from that waterbody exceed the criterion for that substance prescribed in ~~785:45-5-10~~ OAC 785:45 Appendix G more than 25% of the time, or drinking water use restrictions imposed by an agency with jurisdiction in effect require closure of the water supply, or both such conditions exist.

(c) **Bacteria.** The screening level for fecal coliform bacteria shall be 5000 colonies per 100 ml. The tests for use support shall follow the default protocol in 785:46-15-4.

(d) **Threatened water supplies.** Waters of the state designated in OAC 785:45 as Public and Private Water Supply shall be presumed to be threatened when toxicants are detected but do not exceed the applicable criteria prescribed in ~~785:45-5-10~~ OAC 785:45 Appendix G, or some drinking water use restrictions have been put into effect by an agency with jurisdiction, or the potential for adverse impacts to water quality exists, or more than one such conditions exist.

(e) **Oil and grease.**

(1) The Public and Private Water Supply beneficial use designated for a waterbody shall be deemed to be fully supported with respect to oil and grease if a visible sheen or bottom deposits of oil or grease are observed on that waterbody in 10% or less of the observations, and drinking water use restrictions that require more than conventional treatment related to oil and grease have not been put into effect by an agency with jurisdiction.

(2) The Public and Private Water Supply beneficial use designated for a waterbody shall be deemed to be not supported with respect to oil and grease if a visible sheen or bottom deposits of oil or grease are observed on that waterbody in more than 10% of the observations, or drinking water use restrictions that require more than conventional treatment related to oil and grease have been put into effect by an agency with jurisdiction.

785:46-15-10. Nutrients

(a) **General.** OAC 785:45-3-2(c) prohibits water quality degradation by nutrients which will interfere with the attainment or maintenance of any existing or designated beneficial use. OAC 785:46-13-3(a)(1) requires maintenance of any existing or designated beneficial use. This Section provides a framework which shall be used in assessing threats or impairments to beneficial uses and waterbodies and watersheds caused by nutrients, and the consequences of such assessments.

(b) **Determining whether a stream is nutrient-threatened.** The dichotomous process stated in this subsection shall be used in the determination of whether a stream is nutrient-threatened.

(1) The stream order shall be identified. If the stream order is 1, 2 or 3, then proceed to paragraph (2). If the stream order is not 1, 2 or 3, then proceed to paragraph (9).

(2) The stream slope shall be identified. If the stream slope is greater than or equal to 17 feet per mile, then proceed to paragraph (3). If the stream slope is less than 17 feet per mile, then proceed to paragraph (4).

(3) Subject to the application of the foregoing paragraphs of this subsection, if ~~phosphorous~~ phosphorus concentrations in the stream are greater than 0.24 mg/L or if nitrite plus nitrate concentrations in the stream are greater than 4.95 mg/L, then proceed to paragraph (5). If such nutrient concentrations are less than the levels specified in this paragraph, then the stream is not threatened by nutrients.

(4) Subject to the application of the foregoing paragraphs of this subsection, if ~~phosphorous~~ phosphorus concentrations in the stream are greater than 0.15 mg/L or if nitrite plus nitrate concentrations in the stream are greater than 2.4 mg/L, then proceed to paragraph (5). If such nutrient concentrations are less than the levels specified in this paragraph, then the stream is not threatened by nutrients.

(5) Subject to the application of the foregoing paragraphs of this subsection, if the percentage of canopy shading is greater than or equal to 80%, then the stream is not threatened by nutrients. If the percentage of canopy shading is less than 80%, then proceed to paragraph (6).

(6) Subject to the application of the foregoing paragraphs of this subsection, if the stream's turbidity is organic, then proceed to paragraph (7). If the stream's turbidity is inorganic, then proceed to paragraph (8).

(7) Subject to the application of the foregoing paragraphs of this subsection, if turbidity measured at seasonal base flow conditions is less than 20 NTU, then the stream is not threatened by nutrients. If turbidity measured at seasonal base flow conditions is 20 or more NTU, then the stream is threatened by nutrients.

(8) Subject to the application of the foregoing paragraphs of this subsection, if turbidity measured at seasonal base flow conditions is less than 20 NTU, then the stream is threatened by nutrients. If turbidity measured at seasonal base flow conditions is 20 or more NTU, then the stream is not threatened by nutrients.

(9) Subject to the application of the foregoing paragraphs of this subsection, if the stream slope is greater than or equal to 17 feet per mile, then proceed to paragraph (10). If the stream slope is less than 17 feet per mile, then proceed to paragraph (11).

(10) Subject to the application of the foregoing paragraphs of this subsection, if ~~phosphorous~~ phosphorus concentrations in the stream are greater than 1.00 mg/L, or if nitrite plus nitrate concentrations in the stream are greater than 4.65 mg/L, then proceed to paragraph (12). If such nutrient concentrations are less than the levels specified in this paragraph, then the stream is not threatened by nutrients.

(11) Subject to the application of the foregoing paragraphs of this subsection, if ~~phosphorous~~ phosphorus concentrations in the stream are greater than 0.36 mg/L, or if nitrite plus nitrate concentrations in the stream are greater than 5.0 mg/L, then proceed

to paragraph (12). If such nutrient concentrations are less than the levels specified in this paragraph, then the stream is not threatened by nutrients.

(12) Subject to the application of the foregoing paragraphs of this subsection, if the stream's inorganic turbidity measured at seasonal base flow conditions is greater than or equal to 20 NTU, then the stream is not threatened by nutrients. If the stream's inorganic turbidity measured at seasonal base flow conditions is less than 20 NTU, then the stream is threatened.

(c) **Alternative to dichotomous process for streams.**

(1) A wadable stream shall be deemed threatened by nutrients if the arithmetic mean of benthic chlorophyll-a data exceeds 100 mg per square meter under seasonal base flow conditions, or if two or more benthic chlorophyll-a measurements exceed 200 mg per square meter under seasonal base flow conditions. A non-wadable stream shall be deemed threatened by nutrients if planktonic chlorophyll-a values in the water column indicate it has a Carlson's Trophic State Index of 62 or greater.

(2) If clear and convincing evidence indicates a result for a stream different from that obtained from application of the dichotomous process in (b) of this Section, then the appropriate state environmental agency may, after completing the public participation process developed by the Secretary of Environment pursuant to 27A O.S. 1-2-101, accordingly identify the stream as threatened or not threatened by nutrients.

(d) **Demonstration that nutrients may be adversely impacting a beneficial use in a lake.** If it is demonstrated that nutrient loading in a lake may be adversely impacting a beneficial use designated for that waterbody, then the Board may determine that the lake and its watershed is an NLW, and shall identify the lake and watershed as NLW in Appendix A of OAC 785:45.

(e) **Consequence of identification as NLW; results of study.** If a lake or its watershed is identified as NLW in Appendix A of OAC 785:45, then the Board or other appropriate state environmental agency may cause an NLW Impairment Study to be performed. The beneficial uses designated for lakes identified in OAC 785:45 Appendix A as NLW shall be presumed to be fully supported but threatened, unless an NLW Impairment Study demonstrates that the uses are partially supported or not supported; provided, if an NLW Impairment Study demonstrates that the uses are not threatened, then the Board shall consider deleting the NLW identification.

(f) **Consequence of assessment that use is threatened by nutrients.** If it is determined that one or more beneficial uses designated for a waterbody are threatened by nutrients, then that waterbody shall be presumed to be nutrient-threatened. If it is determined or presumed, in accordance with this Section, that a waterbody is nutrient-threatened, then before the waterbody is determined to be nutrient-impaired, an NLW Impairment Study if a lake or an impairment study if a stream must be completed by the appropriate state environmental agency.

(g) **Result of impairment study.**

(1) **Impaired or threatened.** If, independent of or in addition to the process set forth in (b) of this Section, an impairment study of a waterbody demonstrates that a waterbody is impaired or threatened by nutrients, then the appropriate state environmental agency shall initiate the appropriate listing procedure developed by the Secretary of Environment pursuant to 27A O.S. 1-2-101.

(2) **Not threatened nor impaired.** If, independent of or in addition to the process set forth in (b) of this Section, an impairment study of a waterbody demonstrates that a waterbody is neither threatened nor impaired by nutrients, then the appropriate state environmental agency shall initiate the appropriate de-listing procedure developed by the Secretary of Environment pursuant to 27A O.S. 1-2-101.

785:46-15-11. Assessment of Hydroelectric Power Generation support

The Hydroelectric Power Generation beneficial use designated for a waterbody shall be deemed to be fully supported for the purpose of water quality reporting.

785:46-15-12. Assessment of Industrial and Municipal Process and Cooling Water support

The Industrial and Municipal Process and Cooling Water beneficial use designated for a waterbody shall be deemed to be fully supported for the purpose of water quality reporting.

785:46-15-13. Assessment of Navigation support

The Navigation beneficial use designated for a waterbody shall be deemed to be fully supported for the purpose of water quality reporting.