

2010-2011 Oklahoma Lakes Report

Beneficial Use Monitoring Program

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OWRB

OKLAHOMA WATER RESOURCES BOARD
the water agency

2010-2011 Oklahoma Lakes Report

Beneficial Use Monitoring Program

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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 WQS, 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 Water Resources Board with input and concurrence of Oklahoma's other environmental agencies. Specifically, USAPs establish a consistent method to determine if beneficial uses assigned for individual waters through Oklahoma Water Quality Standards (WQS) are being supported. The legitimacy of data analyzed following protocols other than those outlined in the USAP (or the Oklahoma Continuing Planning Process (CPP) document where the USAP is silent) for use support determination is not appropriate. 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.

The Oklahoma Water Resources Board (OWRB) has worked diligently to follow the guidelines outlined in the USAP. Recommendations in this report should be consistent with recommendations for the state's 303(d) list. Although certain inconsistencies do exist, every effort has been taken to assure compatibility between the BUMP Report and the 303(d) list. Issues regarding stream/lake segmenting additional data from non-BUMP sources and unique non-representative conditions all affect the impairment decision-making process

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, WQS process, lake trophic status determination, water quality impact assessments from non-point 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, who promulgates the WQS and WQS Implementation Rule. The BUMP brings the OWRB's overall water quality management program full circle. From the promulgation of WQS, to permitting and enforcement of permits stemming from WQS-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 Lake 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 annually published documents in Oklahoma.

Beneficial Use Monitoring Program Components

1. **Monitoring Rivers & Streams** - The OWRB is currently monitoring approximately one hundred thirty (130) 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.

- a. *Fixed Station Monitoring on Rivers & Streams* – Fixed station monitoring is based largely upon the sixty-seven (67) United States Geological Survey 8-digit hydrologic unit code (HUC) basins present in Oklahoma. In general, at least one (1) sample station is located in all of the 8-digit HUCs with the exception of some of the smaller watersheds adjacent to the state line or that do 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 one hundred and seventeen (117) fixed stations of which ninety-one (91) are currently being monitored.
 - b. *Rotating Station Monitoring on Rivers & Streams* – Over the life of the BUMP, rotational sampling has occurred on over five hundred (500) 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. The second stream/river monitoring activity is focused on a number of sample sites whose locations rotate on an annual basis. These sites are selected at random and allow a general determination of the overall condition of the state's waters on a biannual basis.
2. **Fixed Station Load Monitoring** – The OWRB is currently working with several partners including the USGS, US Army Corps of Engineers, Grand River Dam Authority and National Weather Service to conduct flow monitoring on all our fixed station sites that are not part of the Oklahoma/USGS Cooperative Gaging Network. This cooperative effort will allow for loadings to be calculated, trends to be assessed statewide and provide much needed data for the Use Support Assessment process.
 3. **Fixed Station Lakes Monitoring** – Fixed station lakes monitoring goal is designed to facilitate sampling on the 130 largest lakes in Oklahoma. To accomplish this task, the OWRB is currently sampling approximately 30-40 lakes on a quarterly basis. Under this scenario, repeat sampling on a lake should occur every three (3) to four (4) years. The OWRB works with other agencies, such as the US Army Corps of Engineers (USACE), for inclusion of additional information on waterbodies managed by the Corps. Data collected consists primarily of water chemistry, nutrients, and chlorophyll-a information. In general, a minimum of three to five stations per reservoir is sampled depending on the size of the reservoir. Stations are located such that they represent the lacustrine, transitional, and riverine zones of the lake. 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 program ability to make use support determinations.
 4. **Fixed Station Groundwater Monitoring** – Limited monitoring as a part of this task has occurred in the program. 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.
 5. **Intensive Investigations** – Historically, work occurred in the area in the early years of the program, but no work of this nature has occurred in the last 5-6 years. Work was discontinued to address other monitoring needs as the costs to operate the program have continued to increase since program inception.

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. The two sampling programs, one for lakes and one for streams, had separate starting dates for a number of reasons. First, the OWRB has been conducting a lake-sampling program during the warmer summer months since 1990 as part of the Federal Clean Lakes Program. This historical lake sampling program was funded through federal dollars with the express purpose of determining lake trophic status. The trophic status of a lake can range from oligotrophic (low biological productivity) to hypereutrophic (excessive biological productivity). In general, the more productive a lake is the more water quality problems it is likely to experience. Federal dollars to fund this trophic state assessment of our state's lakes were discontinued in 1994. At that time, the OWRB searched for other funding sources, and through

working with the Secretary of the Environment and the Oklahoma Conservation Commission, the Water Board was able to obtain a one time federal 319 non-point source grant to continue the lake trophic state assessment program. The OWRB subsequently initiated a quarterly lake sampling program in the spring of 1998 and was able to roll the existing lake program into the BUMP.

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 the all of the monitoring agencies.

The state must follow consistent procedures for listing waters as impaired. Using the OWRB Use Support Assessment Protocols, it has been 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 Lakes Sampling Efforts

Data was collected by the OWRB on a quarterly basis for 34 lakes in 2010-2011. For the current sample year, data was collected from the October of 2010 through August of 2011. The results of the sampling efforts are summarized below. As shown in Figure 1, 12% of lakes sampled were determined to have serious water quality nutrient concerns based upon their classification as hypereutrophic. Lakes classified as hypereutrophic have the potential for beneficial use impairments due to low dissolved oxygen concentrations, taste and odor problems, nutrient inputs, excessive productivity, and general lake aesthetics. Hypereutrophic waters are adversely impacted primarily by excessive nutrients and primary productivity and should be monitored intensively in the future to document the presence or absence of “beneficial use impairments.” Fifty-nine percent of the lakes sampled were classified as eutrophic, characterized by high primary productivity and nutrient rich conditions. A eutrophic lake also has the potential for beneficial use impairments, though the potential is less than for hypereutrophic waters. Mesotrophic waters have a small potential for beneficial use impairments and overall are representative of good water quality, low to moderate levels of nutrients, and productivity. Of the lakes sampled, 29% were classified as mesotrophic. Oligotrophic waters have very low levels of primary productivity and usually low concentrations of nutrient constituents. In Oklahoma, oligotrophic waters are either very clear waters with little nutrient inputs and genuinely good water quality conditions, or the waters are very turbid with poor water clarity with the absence of sufficient ambient light inhibiting lake productivity. None of the 34 lakes sampled were classified as oligotrophic. Based on the results for trophic state index calculations, 71% of the waters sampled were exhibiting high to excessive levels of primary productivity and nutrient rich conditions characteristic of eutrophic and hypereutrophic waterbodies.

The distribution changes somewhat when the lake surface acres for each are classified into the corresponding trophic status. Results in Figure 2 are different than Figure 1, indicating the lakes classified as eutrophic were larger in surface acres than the lakes classified as mesotrophic and hypereutrophic. When you look at lake trophic status broken out by the number of lake surface acres in each trophic state category, 79% of all surface acres sampled were eutrophic,

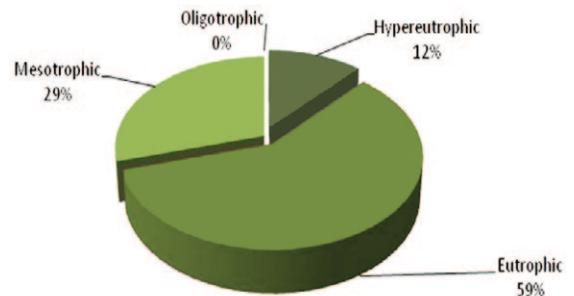


Figure 1 - Trophic Status of Lakes for Sample Year 2010-2011

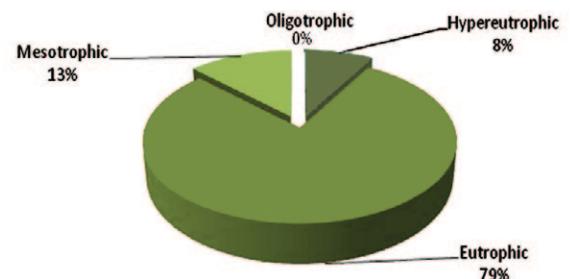


Figure 2. Lake Surface Acres by Trophic Status for Lakes Sampled in 2010-2011

13% were mesotrophic, 8% were hypereutrophic, and 0% were oligotrophic. One of the largest lakes sampled in 2010-2011 was classified as eutrophic (Texoma), which skewed the surface acres percentages heavily towards the eutrophic category. In general, the larger lakes in the state have more extensive watersheds and are generally deeper than smaller lakes, which increase the likelihood of beneficial use impairments being present since a larger surface area is available. During stratification, the larger/deeper lakes have a greater portion of the water column that becomes anoxic for long periods of time, which also increases the potential for nutrient release from sediments. It is obvious that many lakes in Oklahoma are experiencing adverse environmental impacts. However, with the available data it is not possible to adequately assess if lakes are meeting their assigned beneficial uses as they relate to nutrients. At this time, 21 lakes have been identified by the OWRB as “Nutrient-Limited Watersheds” (NLW) in the WQS and efforts should be taken to definitively determine if NLW waters are meeting their uses through initiation of a Nutrient Impairment Study to definitively determine the presence or absence of nutrient impairments in our NLW lakes. NLW are lakes with a TSI \geq 62, based on Carlson’s trophic state classification system and using chlorophyll-a as the trophic state indicator. Lakes sampled as part of the BUMP, their trophic status, and potential threats or impairments are listed in Table 1.

Table 1. Lakes Sampled by the BUMP with Associated Use Attainment Status.

Lake Name	County	W.Q. Segment #	Last Year Sampled	FWP	PPWS	PBCR	AG	AES
American Horse	Blaine	520620	2007-2008	D.O.				
Arbuckle	Murray	310800	2010-2011					
Arcadia	Oklahoma	520710	2006-2007					
Ardmore City	Carter	310800	2006-2007	D.O.				
Atoka	Atoka	410400	2006-2007	Turbidity				True Color
Bellcow	Lincoln	520700	2007-2008	D.O.				
Birch	Osage	121300	2010-2011					
Bixhoma	Wagoner	120410	2005-2006	D.O.				
Bluestem	Osage	121300	2008-2009	D.O., Turbidity				
Boomer	Payne	620900	2008-2009	Turbidity				
Broken Bow	Mccurtain	410210	2010-2011	pH				
Brushy Creek	Sequoyah	220200	2007-2008	pH		Ent.		
Burtschi	Grady	31082002	2005-2006	pH				NLW
Canton	Blaine	720500	2008-2009					
Carl Albert	Latimer	410310	2007-2008					
Carl Blackwell	Payne	620900	2010-2011	Turbidity				
Carter	Marshall	310800	2007-2008					
Cedar (Mena)	Leflore	410210 410300	2010-2011	pH				
Chandler	Lincoln	520700	2007-2008					
Chickasha	Caddo	310830	2010-2011				Sulfates	NLW
Claremore	Rogers	121500	2005-2006					NLW
Clear Creek	Stephens	310810	2006-2007					NLW
Cleveland City	Pawnee	621200	2006-2007	D.O.				
Clinton	Washita	310830	2003-2004	Turbidity		Ent.		True Color, NLW
Coalgate City	Coal	410400	2006-2007	D.O., Turbidity				True Color
Comanche	Stephens	311300	2010-2011					
Copan	Washington	121400	2007-2008	Turbidity, D.O.				True Color
Crowder	Washita	310830	2005-2006					NLW
Cushing Municipal	Payne	620900	2006-2007	Turbidity				True Color

Table 1. Lakes Sampled by the BUMP with Associated Use Attainment Status.

Lake Name	County	W.Q. Segment #	Last Year Sampled	FWP	PPWS	PBCR	AG	AES
Dave Boyer (Walters)	Cotton	311300	2007-2008	Turbidity				True Color
Dripping Springs	Okmulgee	520700	2008-2009	D.O.				
Duncan	Stephens	310810	2006-2007					True Color
El Reno	Canadian	520530	2006-2007	Turbidity				True Color, NLW
Elk City	Beckham	311500	2005-2006					NLW
Ellsworth	Comanche	311300	2008-2009	Turbidity				
Elmer Thomas	Comanche	311300	2006-2007	pH				
Etling, Carl	Cimarron	720900	2003-2004	Turbidity, pH				NLW
Eucha	Delaware	121600	2006-2007	D.O.				NLW
Eufaula	Haskell	220600	2008-2009	Turbidity				True Color
Fairfax City	Osage	621200	2010-2011					
Fort Cobb	Caddo	310830	2010-2011	Turbidity				NLW
Fort Gibson	Cherokee	121600	2006-2007	D.O.				NLW
Fort Supply	Woodward	720500	2010-2011	Turbidity				NLW
Foss	Custer	310800 310810 310820 310830 310840	2010-2011					
Frederick	Tillman	311310	2006-2007	Turbidity				True Color
Fuqua	Stephens	310810	2006-2007					
Grand Lake	Mayes	121600	2008-2009	Turbidity, D.O.				
Great Salt Plains	Alfalfa	621010	2005-2006	Turbidity			Sulfates & Chlorides	NLW
Greenleaf	Muskogee	120400	2005-2006	D.O.				
Guthrie	Logan	620910	2005-2006					NLW
Healdton City	Carter	311100	2005-2006					
Hefner	Oklahoma	520520 520530	2010-2011					NLW
Henryetta	Okmulgee	520700	2007-2008	Turbidity				True Color
Heyburn	Creek	120420	2010-2011	Turbidity				
Holdenville	Hughes	520800	2006-2007	pH, D.O.				
Hominy Municipal	Osage	121300	2006-2007	D.O.				
Hudson	Osage	121400	2008-2009	D.O.				
Hudson	Mayes	121600	2008-2009					
Hugo	Choctaw	410300	2007-2008	Turbidity				True Color
Hulah	Osage	121400	2007-2008	Turbidity				NLW
Humphreys	Stephens	310810	2008-2009			Ent.		
Jean Neustadt	Carter	310800	2006-2007	D.O.				
John Wells	Haskell	220200	2008-2009					
Kaw	Osage	621210	2007-2008	Turbidity, D.O.				
Keystone	Tulsa	621200 620900	2008-2009	Turbidity				
Konawa	Seminole		2008-2009			Ent.		
Langston	Logan	620900	2010-2011					
Lawtonka	Comanche	311300	2010-2011					
Liberty	Logan	620910	2005-2006	Turbidity				
Lloyd Church	Latimer	220100	2005-2006	pH, D.O.				True Color
Lone Chimney	Pawnee	621200	2010-2011					

Table 1. Lakes Sampled by the BUMP with Associated Use Attainment Status.

Lake Name	County	W.Q. Segment #	Last Year Sampled	FWP	PPWS	PBCR	AG	AES
Lugert-Altus	Greer	311500 311510	2010-2011	Turbidity				
Maysville/Wiley Post	McClain		2007-2008	Turbidity				True Color
McAlester	Pittsburg	220600	2008-2009	Turbidity				
McGee Creek	Atoka	410400	2008-2009	pH, D.O.				
McMurtry	Noble	620900	2008-2009					
Meeker	Lincoln	520700	2008-2009	Turbidity				
Murray	Love	311100	2008-2009	D.O.				
Nanah Waiya	Pushmataha		2007-2008					
New Spiro ■	Leflore	220100	2005-2006	pH				NLW
Okemah	Okfuskee	520700	2006-2007	Turbidity, D.O.		Ent.		True Color
Okmulgee	Okmulgee	520700	2010-2011	pH				
Oologah	Rogers	121510	2007-2008	Turbidity, D.O.				
Overholser ■	Oklahoma	520520 520530	2005-2006	Turbidity				NLW True Color
Ozzie Cobb	Pushmataha	410300	2007-2008	pH				NLW
Pauls Valley City	Garvin	310810	2007-2008	Turbidity				True Color
Pawhuska	Osage	121600	2007-2008					
Pawnee	Pawnee	621200	2006-2007					
Perry	Noble	621200	2006-2007	Turbidity				True Color
Pine Creek	Mccurtain	410210	2010-2011	D.O. pH				
Ponca	Kay	621200	2010-2011	D.O.				
Prague City	Lincoln	520510	2007-2008					
Purcell	McClain	520610	2007-2008	Turbidity				
Raymond Gary	Choctaw	410300	2008-2009	D.O.				True Color
R.C. Longmire	Garvin	310810	2007-2008	D.O.				
Robert S. Kerr	Sequoyah	220200	2010-2011					
Rock Creek	Carter	310800	2008-2009					
Rocky (Hobart) ■	Washita	311500	2008-2009	Turbidity				NLW
Sahoma	Creek	120420	2005-2006	D.O.				
Sardis	Pushmataha	410310	2010-2011	pH				
Shawnee Twin # 1	Pottawatomie	520510	2010-2011	D.O.				
Shawnee Twin # 2	Pottawatomie	520510	2010-2011					
Shell	Osage	120420	2008-2009	D.O.				
Skiatook	Osage	121300	2008-2009	D.O.				
Sooner	Pawnee		2006-2007	D.O.			Chlorides, Sulfates, TDS	
Spavinaw ●	Mayer	121600	2008-2009					NLW
Sportsman	Seminole	520500	2007-2008	Turbidity				True Color
Stanley Draper	Cleveland		2005-2006	D.O.				
Stilwell City	Adair	220200	2005-2006	D.O.				
Stroud	Creek	520700	2005-2006	D.O.			Sulfates & Chlorides	
Talawanda # 1	Pittsburg	220600	2010-2011	pH				
Talawanda # 2	Pittsburg	220600	2010-2011					
Taylor (Marlow)	GradY	310840	2008-2009					NLW
Tecumseh	Pottawatomie	520510	2007-2008					
Tenkiller Ferry ■	Sequoyah	121700	2005-2006	D.O.				NLW

Table 1. Lakes Sampled by the BUMP with Associated Use Attainment Status.

Lake Name	County	W.Q. Segment #	Last Year Sampled	FWP	PPWS	PBCR	AG	AES
Texoma	Bryan	311100 310800	2010-2011	D.O.				
Thunderbird 	Cleveland	520810	2006-2007					NLW
Tom Steed 	Kiowa	311500	2006-2007	Turbidity				
Vanderwork	Washita	310830	2007-2008					NLW
Vincent, Lloyd	Ellis	720500	2010-2011	D.O.				
W.R. Holway	Mayes		2010-2011	D.O.				
Waurika	Jefferson	311210	2007-2008	Turbidity				
Waxhoma	Osage		2005-2006	D.O.				
Wayne Wallace	Latimer	220100	2007-2008					
Webbers Falls	Muskogee	121400	2010-2011					
Wes Watkins	Pottawatomie	520510	2010-2011					
Wetumka	Hughes		2006-2007	D.O.				True Color
Wewoka	Seminole	520500	2008-2009	Turbidity				
Wister 	Leflore	220100	2007-2008					NLW
Yahola 	Tulsa	121300	1998-1999	pH				

Symbols:

- † Lake Listed Based Upon 1995 U.S. Army Corps. Of Engineers Intensive Study
-  Lake Listed Based Upon OWRB Phase I Clean Lakes Study
-  Lake does not fit classic definition of oligotrophy. Inorganic particulates are limiting biological productivity
-  Lake was not assessed through the BUMP, but through another OWRB project
-  These Lakes will be recommended for NLW listing as part of the next WQS revision process

Acronyms: NLW = Nutrient Limited Water; D.O. = Dissolved Oxygen; ENT. = Enterococci Bacteria

Assigned WQS Beneficial Uses: FWP = Fish & Wildlife Propagation; AES = Aesthetics; PPWS = Public & Private Water Supply; AG = Agriculture; PBCR = Primary Body Contact Recreation

Note:

Red colored parameter entries indicate not supporting.

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 into state coffers through fishing, hunting, camping, and related activities. (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 waters also fuel the state's economy, 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 (WQS) 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 WQS as outlined by the OWRB through development of Implementation plans. Protecting our waters is a cooperative effort between many state agencies, and because the WQS 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 WQS 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 WQS 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 that impairment must be identified and restoration activities should be implemented to improve water quality such that it can meet its 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 WQS Implementation, allows the WQS 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.

With the development of the BUMP, the need for protocols to determine beneficial use impairment was identified. Development of these protocols 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 concerned parties, developed Use Support Assessment Protocols (USAP) to be used by

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.

all parties for assessing if waters were meeting their assigned beneficial uses. In addition, protocols were developed that 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 WQS and in developing appropriate numerical and narrative criteria for future WQS documents. It is essential that our waters meet their assigned uses and that WQS 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 every year since then to refine the existing protocols and pursue the addition or modification of USAP protocols to further enhance its utility and effectiveness.

Work to be performed towards development and implementation of the critical fourth component of the WQS 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" [305(b) Report and 303(d) list], §319 Non-point Source (NPS) Assessment, and §314 Lake Water Quality Assessment (LWQA).

Background and 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, the WQS process, lake trophic status determination, determining water quality impacts from point source dischargers, stream flow measurements, documenting 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 for lakes and efforts that are currently ongoing for lakes and streams across Oklahoma as part of a comprehensive, long-term, state-wide 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.

LAKES MONITORING PROGRAM

Lake trophic status is important from a water quality perspective because it is an indicator of potential nutrient impacts to a lake. In general, the higher the trophic state index (TSI) of a lake, the more nutrient loading into the system is occurring and the more productive the lake. One outcome of historical trophic assessment activity on Oklahoma's lakes was the prioritization of lakes most in need of remediation. Outcomes have included in-lake restoration activities or implementation of best management practices in the lake watershed. Results from the BUMP sampling effort should be viewed as a means to make relative comparisons between lakes and to determine beneficial use impairments based on USAP, detailed in Oklahoma Administrative Code (OAC) 785:46-15-5. Lakes with relatively poor water quality are identified, but that does not necessarily mean that these lakes have beneficial use impairments. Some lakes, due to the nature of their watershed and basin morphometry, may never attain the water quality of some of the state's more pristine waters. For example, an expectation that Broken Bow Lake and Great Salt Plains can attain the same level of water quality would be unrealistic, because these two lakes exhibit great differences in basin morphometry and substrate material and are located in totally different parts of the state. Soil types such as clays have a very small particle size such that the clay particulates are constantly re-suspended in the lake water column and never settle out, which is evident in some lakes across the state. In addition, the shallow nature of many of our lakes contributes to lake bottom sediments being re-suspended in the water column due to wind action. Because so many factors affect the water quality of a , comparing lakes from various parts of the state should only be viewed as a relative comparison.

For 2010-2011, the BUMP identified lakes that had beneficial use impairments or threats. However, a data set to truly determine which lakes are not supporting their beneficial uses due to excess nutrients does not currently exist, nor have nutrient criteria for lakes been promulgated into the WQS. The OWRB has previously identified 21 lakes that are listed in the WQS as Nutrient Limited Watersheds (NLW). More intensive work on these lakes is required before a definitive assessment of nutrient impairment or non-support can be made. The OWRB recommends a Nutrient Impairment Study (NIS) be performed on identified NLW lakes. An NLW is defined in the WQS as “a watershed of a waterbody with a designated beneficial use which is adversely affected by excess nutrients as determined by Carlson’s TSI (chlorophyll-a) of 62 or greater.” If a lake is identified as having a TSI ≥ 62 based on chlorophyll-a, and the minimum data requirements are met (n=10 on lakes with <250 surface acres; n=20 on lakes with >250 surface acres), it is recommended for listing as an NLW through the WQS setting process. Currently, the parameters that are analyzed to determine whether or not there is beneficial use impairment or threat include turbidity, true color, dissolved oxygen, metals, chloride, sulfates, biological collections, total dissolved solids, and pH values. A brief discussion on lake monitoring procedures and methods is provided below with data results following.

Materials & Methods for Lake Sampling

Data was collected quarterly on 34 lakes across the state from the fall of 2010 through the summer of 2011. Vertical water quality profiles were recorded at one meter intervals from the lake surface to the lake bottom for the following parameters; temperature, pH, dissolved oxygen, salinity, dissolved oxygen % saturation, oxidation-reduction potential (redox), specific conductivity, and total dissolved solids (TDS). A vertical profile was recorded for at least three sites per lake : in the central pool area near the dam (lacustrine zone), in the upper portion of the lake and in the major arms of the water body (riverine zone), and in the area between the lacustrine zone and the riverine zone (transitional zone). Turbidity values for each surface site were measured using a HACH portable turbidimeter. For lakes greater than 250 acres in size with only three routine chemical monitoring stations, additional sample sites have been established to ensure minimum data requirements are met. Secchi disk depths (in centimeters) were determined at all routine water chemistry sample sites. Water quality samples were collected at each site at the surface and one meter from the lake bottom at site 1, the dam, and preserved for analysis of nitrate nitrogen, nitrite nitrogen, ammonia nitrogen, Kjeldahl nitrogen, ortho-phosphorus, total phosphorus, true color, chloride, sulfate, and total alkalinity. OWRB staff calculated total nitrogen based on laboratory-derived values. A Van Dorn sampler was used to collect samples near the lake bottom and grab samples were collected at the lake surface. At the dam site, a churn-splitter was used to split the surface sample for Quality Assurance (QA) purposes.

Surface samples were also collected at all sites and analyzed for chlorophyll-a and pheophytin concentrations. Additional chlorophyll-a samples were collected for QA purposes. Filtration and grinding (extraction of the chlorophyll-a collected in a filter with acetone) of the samples was performed immediately upon return to the OWRB lab. All chlorophyll-a samples were filtered, as stated in Standard Methods (APHA 1995), within 24 hours and stored for no more than 30 days in the freezer.

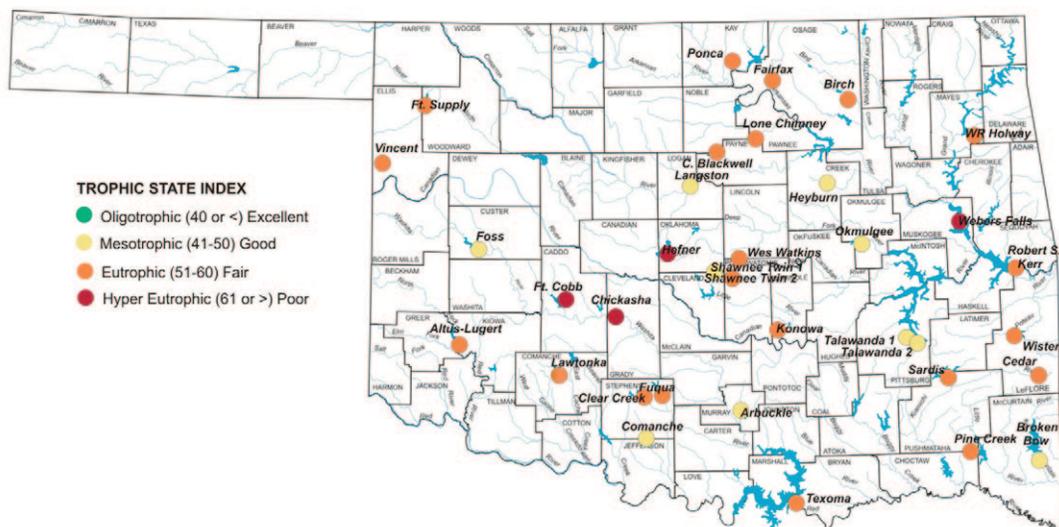


Figure 3. Lakes sampled by the Beneficial Use Monitoring Program in 2010-2011.

Sample Lake Locations

Lakes sampled by the BUMP Lakes staff in 2010-2011 are shown in Figure 3. Lake locations are identified on the map and are shaded in different colors based on their calculated TSI values.

Lake Data Analysis Protocols

There are numerous methods available for determining the trophic status of lakes. The majority of the trophic state models rely on a mathematical calculation to generate a single numerical value that is then categorized in an assessment hierarchy. Numerous chemical, and in some cases biological data are utilized in the various trophic indices, which characterize the “trophic status” of a water body. Some of the commonly used water quality parameters utilized in trophic state indices include chlorophyll-a, secchi disc depth, total phosphorus, total nitrogen, aquatic macrophytes, organic nitrogen, turbidity, lake user surveys, and hypolimnetic oxygen depletion rates, etc. Most indices use one or more variables in the determination of trophic status with varying degrees of applicability to systems. The OWRB has traditionally used Carlson’s Trophic State Index (TSI) (Carlson, 1977) for reporting purposes, utilizing chlorophyll-a concentrations in calculating the lake trophic status. Carlson’s TSI equation using chlorophyll-a (in µg/L) as the trophic status indicator is as follows:

$$\text{TSI} = 9.81 \times \ln(\text{chlorophyll-a}) + 30.6.$$

In 1998, 1999, and 2000, the TSI was calculated using chlorophyll-a concentrations from the growing season (spring and summer only). Beginning in sample year 2001, an annualized trophic assessment was made as this was determined to be a more accurate reflection of trophic conditions for each . In order to make beneficial use determinations, minimum data requirements must be met as listed in OAC 785:46-15-3. A minimum of 20 samples is required on lakes greater than 250 surface acres, and a minimum of 10 samples on lakes 250 surface acres and less. In 2001-2002, sites were added for chlorophyll-a and turbidity collections on lakes greater than 250 surface acres, in order to meet the minimum data requirements annually. Although data can be aggregated and historical values used, there was a concern in using data that was collected in the summer only as this would bias the data. An analysis of the limnological data collected on lakes is performed to determine the trophic state of each lake monitored. Chlorophyll-a concentrations for each lake sample site are determined and all values are averaged for each lake for all four sampling quarters. This annual chlorophyll-a value is then used in Carlson’s TSI equation to determine trophic status of the lake. Through use of this technique the presence of localized trophic conditions are minimized (i.e. the effects of a single elevated chlorophyll-a value is minimized in the calculation of the TSI). The derived TSI represents an accurate assessment of the water quality of the as a whole and individual isolated areas that may be impacted due to eutrophication will be minimized in the reported TSI. A list of lake trophic state categories and corresponding TSI numerical values are displayed in Table 2. There are other descriptive terms and subset categories for trophic status, like dystrophic; however, Carlson’s TSI has four major categories and these will be used to describe lake trophic status. Further discussion is included in each of the lake summaries as necessary. As stated earlier, prior to 2001, the TSI was based on growing season (spring and summer) chlorophyll-a concentrations. However, beginning in 2001, all TSI evaluations were based on an annualized chlorophyll-a value for each lake and comparisons to previous TSI calculations will be specified as annual, growing season, or summer only evaluations. Prior to the onset of BUMP collections, lakes were sampled only in the summer and therefore the TSI was typically much higher than the annual assessments that are being done currently.

Table 2. Lake Trophic State Categories.

Carlson TSI No.	Trophic State	Definition
≤ 40	Oligotrophic	Low primary productivity and/or low nutrient levels
41 - 50	Mesotrophic	Moderate primary productivity with moderate nutrient levels
51 – 60	Eutrophic	High primary productivity and nutrient rich
≥ 61	Hypereutrophic	Excessive primary productivity and excessive nutrients

The beneficial use support determinations for the lakes sampled were determined following guidelines outline in the Use Support Assessment Protocols (USAP) promulgated into Oklahoma Administrative Code (OAC) 785-46: Subchapter 15. In general the USAP states that environmental data must be collected to take seasonal conditions into consideration. A minimum of 20 samples is required on lakes more than 250 surface acres to assess beneficial use support for water quality parameters such as dissolved oxygen, pH and temperature. In addition, data more than ten years old should not be used for use support purposes unless more recent data is not available. A minimum of 10 samples is required on lakes or lake-arms of 250 surface acres of less. Samples may be aggregated to meet the minimum data requirements. For some parameters such as metals, organic compounds, or toxics, fewer samples are required. Toxicants (metals and organics) require a minimum of 5 samples to determine use support, but 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 WQS by two or more orders of magnitude, then the use is determined to be “not supporting”.

The USAP also addresses the issue of how the data should be used spatially for lake monitoring. In general, when determining what size area the data is representative of best professional judgment is used. Such things as major tributaries and major lake arms are considered when deciding the extent of the area that the data was applied to. Arms or portions of lake may be treated separately from the main body of a lake, however in most instances Water Resources Board staff chose to deal with the lake as a single unit. Unless it was demonstrated to the contrary, a single site was not considered representative of an entire lake or an arm of the lake that was greater than two hundred and fifty surface acres in size.

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, turbidity samples collected monthly from January through December are considered unique samples, and consequently, are not aggregated into a single sample for analysis but are considered a fraction of the whole.

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 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, and
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 10 samples are required to calculate a geometric mean.

Assessment of Fish & Wildlife Propagation Beneficial Use Support

The Fish & Wildlife Propagation (FWP) beneficial use utilizes five different water quality variables to assess use support: dissolved oxygen (D.O.) concentration, toxicants, hydrogen ion activity (pH), 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.

The USAP for each parameter as it relates to USAP are located in OAC:45-5-12 and can be found on the OWRB website:

www.owrb.ok.gov/standards

Assessment of Agriculture Beneficial Use 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 also compared to each sample using a short-term average numerical protocol. A description of the the USAP for the AG beneficial use can be found on the OWRB website:

www.owrb.ok.gov/standards

Assessment of Aesthetics Beneficial Use Support

The Aesthetics beneficial use is assessed using a couple of water quality parameters--true color and nutrients. The sample standard for each variable is compared to the each sample using a short-term average numerical protocol. Criteria are located in OAC 785:45-5-19 which can be found on the OWRB website:

www.owrb.ok.gov/standards

Assessment of Primary Body Contact Recreation (PBCR) Support

The PBCR beneficial use utilizes the following microorganisms to assess use support:, Escherichia coli (E. coli), and enterococci (Ent.). The criteria are located in OAC 785:45-5-16 and can be found on the OWRB website:

www.owrb.ok.gov/standards

Lake Monitoring Results & Discussion

A lake-wide annual average of the chlorophyll-a values was calculated for each lake and used in the final calculation of the TSI. A summary table is included (Table 3) to present the number of lakes and appropriate surface acre size for each of the four trophic categories in 2010-2011 as well as the percentages of the total. As shown in Table 3, four lakes were hypereutrophic, twenty were eutrophic, ten were mesotrophic, and none were oligotrophic. Of the total 225,966 surface acres sampled, 19,020 were classified hypereutrophic, 177,938 were classified as eutrophic, 29,008 were classified as mesotrophic and 0 acres were classified as oligotrophic. TSI results, county, surface area, and volume for lakes sampled in 2010-2011 are listed in Table 4.

Table 3. Summary of Lake Trophic Status Results

Trophic Status	Number of Lakes	Percent of Total Lakes	Surface Area (Acres)	Percent of Total Surface Acres
Hypereutrophic	4	12%	19,020	8%
Eutrophic	20	59%	177,938	79%
Mesotrophic	10	29%	29,008	13%
Oligotrophic	0	0%	0	0%
Totals =	34	100%	225,966	100%

Although TSI based on the chlorophyll-a concentration is used for the BUMP, a comparison of TSI values calculated with total phosphorus and secchi disk depth was generated and displayed on Table 5. Data displayed is for the growing season using the various water quality parameters that can be used in calculating Carlson's TSI. The chlorophyll-a and phosphorus TSI calculations were derived through results of regression analysis relating secchi disk depth to the other two variables.

Calculations using secchi disk depth may not be a good parameter to use in highly colored or turbid reservoirs where turbidity is inorganic in nature. Both are common components of Oklahoma lakes. Additionally, phosphorus may not be an accurate variable to use in calculating the TSI in lakes that are not phosphorus-limited or those that are highly turbid due to clay particulates. Carlson (1977) stated chlorophyll-a seems to be the most acceptable parameter to use in calculating TSI, especially during the growing season, and for estimating algal biomass. In accordance with historical calculations at OWRB and Carlson's suggestion to measure chlorophyll-a, rather than secchi disk depth or total phosphorus, it is the variable utilized for BUMP's TSI calculations. The values displayed in Table 5 were calculated using lake-wide annual averages for all three parameters.

Table 4. List of Lakes Sampled in Sample Year 2010-2011

Lake Name	County	Surface Area	Volume	TSI	Year Sampled	Threats or Impairments	Carlson's TSI
Arbuckle	Murray	2,350	72,400	50	2011		Mesotrophic
Birch	Osage	1,137	19,200	51	2011		Eutrophic
Broken Bow	Mccurtain	14,200	918,070	41	2011	pH	Mesotrophic
Carl Blackwell	Payne	3,370	61,500	51	2011	Turbidity	Eutrophic
Cedar	Leflore	78	990	56	2011	pH	Eutrophic
Chickasha	Caddo	820	41,080	63	2011	NLW, Ag	Hypereutrophic
Clear Creek	Stephens	722	7,710	59	2011		Eutrophic
Comanche	Stephens	184	2,500	50	2011		Mesotrophic
Fairfax	Osage	111	1,795	55	2011		Eutrophic
Fort Cobb	Caddo	4,100	80,010	64	2011	NLW, Turbidity	Hypereutrophic
Fort Supply	Woodward	1,820	13,900	59	2011	Turbidity, NLW	Eutrophic
Foss	Custer	8,800	256,220	49	2011		Mesotrophic
Fuqua	Stephens	1,500	21,100	57	2011	Turbidity	Eutrophic
Hefner	Oklahoma	2,500	75,000	63	2011	TSI	Hypereutrophic
Heyburn	Creek	880	7,105	49	2011	Turbidity	Mesotrophic
Kerr, R.S.	Sequoyah	43,380	525,700	54	2011		Eutrophic
Langston	Logan	304	5,792	45	2011		Mesotrophic
Lawtonka	Comanche	2,398	56,574	56	2011		Eutrophic
Lone Chimney	Pawnee	550	6,200	53	2011		Eutrophic
Altus-Lugert	Greer	6,260	132,830	58	2011	Turbidity	Eutrophic
Okmulgee	Okmulgee	668	14,170	48	2011	pH	Mesotrophic
Pine Creek	Mccurtain	3,750	53,750	58	2011	D.O., pH	Eutrophic
Ponca	Kay	805	14,440	57	2011		Eutrophic
Sardis	Pushmataha	13,610	274,330	52	2011	pH	Eutrophic
Shawnee Twin # 1	Pottawatomie	1,336	22,600	46	2011		Mesotrophic
Shawnee Twin #2	Pottawatomie	1,100	11,400	52	2011		Eutrophic
Talawanda # 1	Pittsburg	91	1,200	47	2011	pH	Mesotrophic
Talawanda # 2	Pittsburg	195	2,750	44	2011		Mesotrophic
Texoma	Bryan	88,000	2,643,300	61	2011		Hypereutrophic
Vincent	Ellis	160	2,579	51	2011		Eutrophic
WR Holway	Mayes	712	48,000	56	2011		Eutrophic
Webbers Falls	Muskogee	11,600	170,100	63	2011	NLW	Hypereutrophic
Wes Watkins	Pottawatomie	1,142		56	2011	Turbidity	Eutrophic
Wister	LeFlore	7,333	62,360	57	2011	pH, NLW	Eutrophic

Table 5. Comparison of Methods Used to Calculate Carlson’s Trophic State Index for 2010-2011.

Lake Name	Chl-A	Trophic State	Total P	Trophic State	Secchi	Trophic State
Altus-Lugert	58	Eutrophic	59	Eutrophic	66	Hypereutrophic
Arbuckle	50	Mesotrophic	45	Mesotrophic	52	Eutrophic
Birch	51	Eutrophic	47	Mesotrophic	62	Hypereutrophic
Broken Bow	41	Mesotrophic	33	Oligotrophic	45	Mesotrophic
Carl Blackwell	51	Eutrophic	55	Eutrophic	71	Hypereutrophic
Cedar	56	Eutrophic	55	Eutrophic	60	Eutrophic
Chickasha	63	Hypereutrophic	60	Eutrophic	70	Hypereutrophic
Clear Creek	59	Eutrophic	55	Eutrophic	66	Hypereutrophic
Comanche	50	Mesotrophic	47	Mesotrophic	62	Hypereutrophic
Fairfax	55	Eutrophic	48	Mesotrophic	62	Hypereutrophic
Fort Cobb	64	Hypereutrophic	68	Hypereutrophic	69	Hypereutrophic
Fort Supply	59	Eutrophic	67	Hypereutrophic	79	Hypereutrophic
Foss	49	Mesotrophic	48	Mesotrophic	60	Eutrophic
Fuqua	57	Eutrophic	48	Mesotrophic	62	Hypereutrophic
Hefner	63	Hypereutrophic	66	Hypereutrophic	66	Hypereutrophic
Heyburn	49	Mesotrophic	60	Eutrophic	68	Hypereutrophic
Kerr, R.S.	54	Eutrophic	68	Hypereutrophic	68	Hypereutrophic
Langston	45	Mesotrophic	41	Mesotrophic	65	Hypereutrophic
Lawtonka	56	Eutrophic	51	Eutrophic	56	Eutrophic
Lone Chimney	53	Eutrophic	55	Eutrophic	66	Hypereutrophic
Okmulgee	48	Mesotrophic	45	Mesotrophic	58	Eutrophic
Pine Creek	58	Eutrophic	54	Eutrophic	66	Hypereutrophic
Ponca	57	Eutrophic	55	Eutrophic	64	Hypereutrophic
Sardis	52	Eutrophic	48	Mesotrophic	63	Hypereutrophic
Shawnee Twin # 1	46	Mesotrophic	42	Mesotrophic	60	Eutrophic
Shawnee Twin #2	52	Eutrophic	45	Mesotrophic	63	Hypereutrophic
Talawanda # 1	47	Mesotrophic	41	Mesotrophic	54	Eutrophic
Talawanda # 2	44	Mesotrophic	35	Oligotrophic	57	Eutrophic
Texoma	59	Eutrophic	59	Eutrophic	61	Hypereutrophic
Vincent	51	Eutrophic	48	Mesotrophic	67	Hypereutrophic
Wr Holway	56	Eutrophic	62	Hypereutrophic	50	Eutrophic
Webbers Falls	63	Hypereutrophic	74	Hypereutrophic	67	Hypereutrophic
Wes Watkins	56	Eutrophic	55	Eutrophic	66	Hypereutrophic
Wister	57	Eutrophic	60	Eutrophic	69	Hypereutrophic

Using the chlorophyll-a methodology, four lakes were hypereutrophic, twenty- lakes were eutrophic, ten lakes were mesotrophic, and none were oligotrophic. Using total phosphorus and secchi disk depth in the TSI calculation produced a much different result although classification using these two variables is somewhat comparable to each other. Using the total phosphorus variable for TSI, six lakes were hypereutrophic, thirteen lakes were eutrophic, thirteen lakes were mesotrophic and two were oligotrophic. Using the secchi disk depth variable for TSI twenty-four lakes were identified as hypereutrophic, none lakes were eutrophic, one lake was mesotrophic and zero lakes were oligotrophic. The TSI values calculated using secchi depth were the highest of the three variables. For example, Heyburn Lake was classified as mesotrophic using chlorophyll-a concentration, eutrophic using total phosphorus as the, and hypereutrophic using secchi disk depth. Most of the TSI values were lowest using the chlorophyll-a concentration; therefore, it seems reasonable to say that this parameter is the most conservative variable to use.

Results for each of the 130 BUMP lakes from the most recent sampling are listed in Table 1. As stated previously, the OWRB is currently monitoring 30 to 40 lakes with repeat sampling on each scheduled to occur every three years. Prior to 1998, data was only collected once for each lake during the summer months. In 1998, the OWRB began collecting data quarterly. This greatly improved the data set available to resource managers.

Lakes that are identified as hypereutrophic should be sampled more often than quarterly, especially during the warmer months. Lakes identified as “Nutrient-Limited Watersheds” (NLW) should also be sampled more intensively to confirm if a water quality threat or impairment is present. Minimum data requirements as listed in USAP were closely followed to make beneficial use determinations. All impairments are listed in Table 1. Toxicity concerns, if present, are listed as provided by the ODEQ as part of their Rotating Lakes Toxics Program and/or through sampling conducted by the OWRB.

The pH was examined and compared to the WQS for pH, 6.5 to 9 units, listed in 785:45-5. Twenty-eight of the 34 lakes sampled in 2010-2011 were listed as supporting the Fish & Wildlife Propagation (FWP) beneficial use based on pH values and six lakes were listed as not supporting (Figure 4).

Turbidity, in Nephelometric turbidity units (NTU), was measured via a HACH turbidimeter for all sites on each lake sampled to identify lakes that exceeded the WQS of 25 NTU. Of the 34 lakes sampled in 2010-2011, seven lakes were not supporting their FWP beneficial use, two did not have enough information and twenty-five were fully supporting the use based on turbidity values (see Figure 5).

For dissolved oxygen (D.O.) vertical profiles recorded with a Hydrolab® were examined to determine if anoxic conditions were present and whether or not the lake was meeting the FWP beneficial use. The USAP lists D.O. violations as values below 2.0 mg/L in >70% of the entire water column, undetermined if between 50% and 70% of the water column and fully supporting if 50% of the water column is below 2.0 mg/L. Of the 34 lakes sampled in 2010-2011, only one lake was not supporting the FWP beneficial use based on anoxic conditions, primarily in the summer season (See Figure6.).

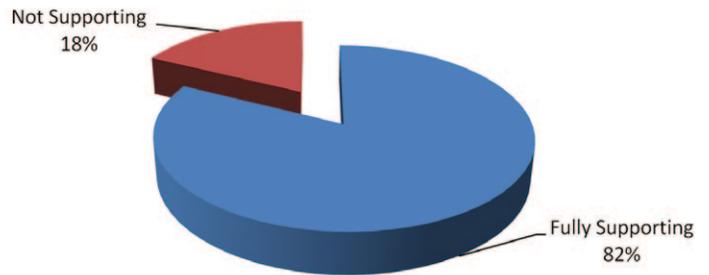


Figure 4. Comparison of pH Values to OWQS for Sample Year 2010-2011.

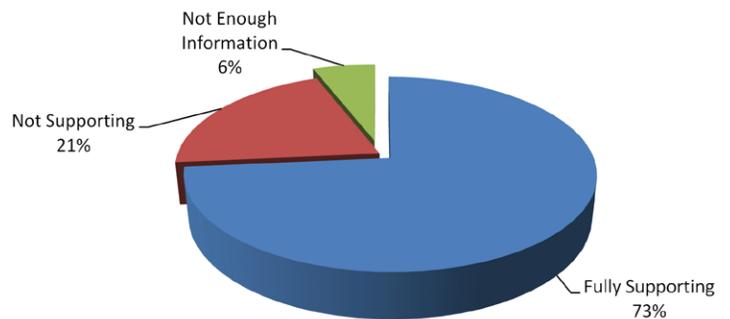


Figure 5. Comparison of Turbidity Values to the OWQS for Sample Year 2010-2011.

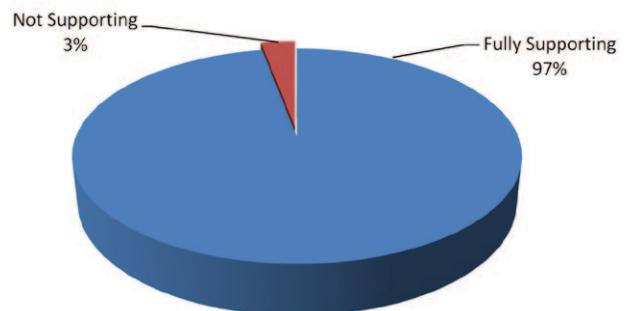


Figure 6. Comparison of Dissolved oxygen Values to the OWQS for Sample Year 2010-2011.

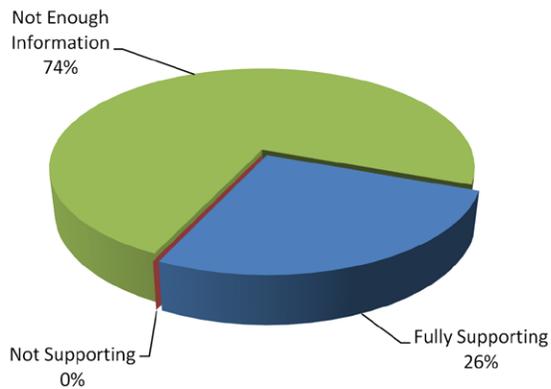


Figure 7. Comparison of Bacteria Values to OWQS for Sample Year 2010-2011

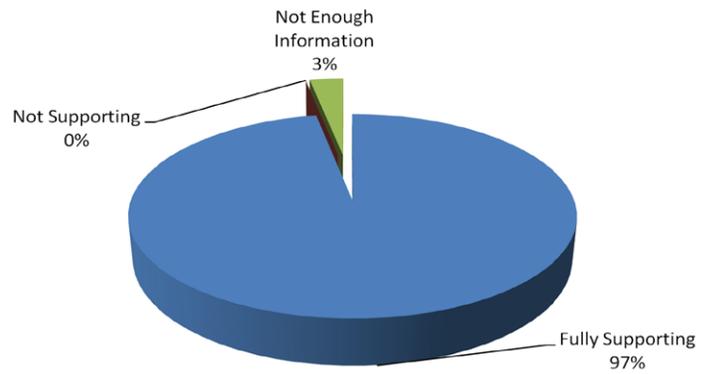


Figure 8. Comparison of Chloride and Sulfate Values to OWQS for Sample Year 2010-2011.

Chloride and sulfate water quality parameters were also added to the lake sampling program in year 2003-2004. These additions allow for an assessment of the agriculture beneficial use of our lakes and much like metals sampling is a sampling effort that we plan on continuing into the future. The chloride and sulfate data revealed that thirty-three of the thirty-four lakes sampled were supporting the agriculture beneficial use (See Figure 7).

Bacteria analysis indicated nine of the lakes sampled were supporting their Primary Body Contact Recreation beneficial use and twenty-five did not have enough information (See Figure 8).

It is the intent of the OWRB monitoring program to pursue adding additional monitoring parameters to the lake sampling initiative to allow all beneficial uses to be assessed. It is also the OWRB intent to accomplish this without having to reduce the number of lakes sampled annually.

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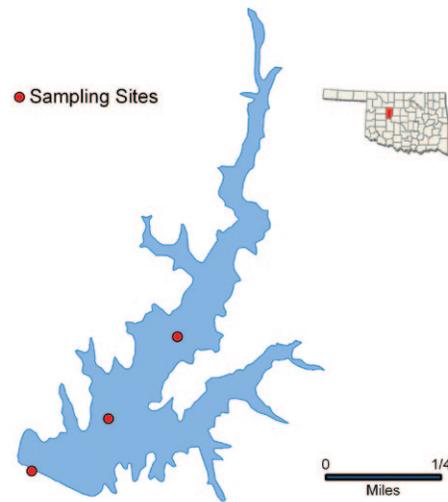
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American Horse

● Sampling Sites



Sample Period	Times Visited	Sampling Sites
October 2007 - July 2008	4	3

Lake Data	Location	Blaine County
	Impoundment	1966
	Area	100 acres
	Capacity	2,200 acre-feet
	Purposes	Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	13 NTU	Lake-wide average	
	Average True Color	54 units	25% of values > OWQS of 70	
	Average Secchi Disk Depth	118 cm		
	Water Clarity Rating	good		
	Trophic State Index	38	Previous value = 49	
	Trophic Class	oligotrophic		
	Profile	Salinity	0.07 - 0.13 ppt	
		Specific Conductivity	151.5 - 274.7 μ S/cm	
		pH	7.01 - 8.08 pH units	
		Oxidation-Reduction Potential	-4 to 551 mV	
	Nutrients	Dissolved Oxygen	Up to 60% of water column < 2 mg/L in July	
		Surface Total Nitrogen	0.38 mg/L to 1.07 mg/L	
Surface Total Phosphorus		0.018 mg/L to 0.053 mg/L		
	Nitrogen to Phosphorus Ratio	19:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En. ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	NS	NEI				
	Aesthetics					S	NS		
	Agriculture						S		
	Primary Body Contact Recreation							S	
Public & Private Water Supply									

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

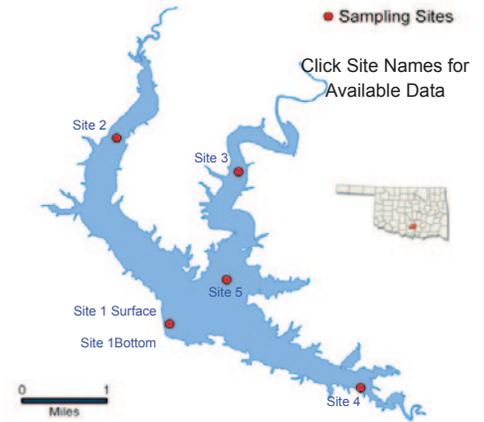
Notes
 Lab accident – not enough data to make an assessment

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 μ S/cm = microsiemens per centimeter mV = millivolts μ S/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Arbuckle

Sample Period	Times Visited	Sampling Sites
October 2010-June 2011	4	5

General	Location	Murray County	Click map for site data
	Impoundment	1967	
	Area	2,350 acres	
	Capacity	72,400 acre-feet	
	Purposes	Water Supply, Flood Control, Fish and Wildlife, and Recreation	

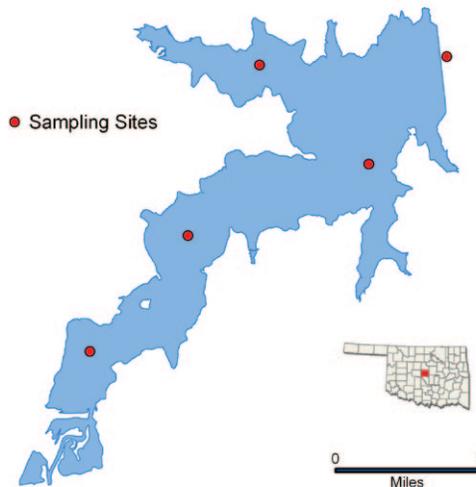


Parameters	In Situ	Parameter (<i>Descriptions</i>)	Result	Notes/Comments
		Average Turbidity	5 NTU	100% of values < OWQS of 25 NTU (n=20)
		Average Secchi Disk Depth	177 cm	
		Water Clarity Rating	Excellent	
		Chlorophyll-a	7 mg/m ³	
		Trophic State Index	50	Previous value = 59
		Trophic Class	Mesotrophic	
Parameters	Profile	Salinity	0.03-0.23 ppt	
		Specific Conductivity	88.7-454.3 μS/cm	
		pH	6.77-8.28 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	-68-406 mV	
		Dissolved Oxygen	Up to 57% of water column < 2.0 mg/L in summer	
Parameters	Nutrients	Surface Total Nitrogen	0.35 mg/L to 0.57 mg/L	
		Surface Total Phosphorus	0.013 mg/L to 0.027 mg/L	
		Nitrogen to Phosphorus Ratio	26:1	Phosphorus limited

Beneficial Uses	Click to learn more about Beneficial Uses											
	Turbidity	pH	Dissolved	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	En & E.coli	Chlor-a	
	Fish & Wildlife Propagation	S	S	S	S							
	Aesthetics					S	*					
	Agriculture							*	*	S		
	Primary Body Contact Recreation										S	
Public & Private Water Supply												
S = Fully Supporting NS = Not Supporting NEI = Not Enough Information		Notes	*Did not collect for these parameters									

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 μS/cm = microsiemens per centimeter mV = millivolts μS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Arcadia



Sample Period	Times Visited	Sampling Sites
October 2006 - August 2007	4	5

Lake Data	Location	Oklahoma County
	Impoundment	1986
	Area	1,820 acres
	Capacity	27,520 acre-feet
	Purposes	Water Supply, Flood Control, Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	42 NTU	30% of values > OWQS of 25 NTU	
	Average True Color	53 units	10% of values > OWQS of 70	
	Average Secchi Disk Depth	67 cm		
	Water Clarity Rating	average		
	Trophic State Index	58		
	Trophic Class	eutrophic		
	Profile	Salinity	0.10 – 0.20 ppt	
		Specific Conductivity	209.7 - 422 µS/cm	
		pH	7.32 - 8.47 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	148 to 415 mV	
	Dissolved Oxygen	Up to 38% of water column < 2 mg/L in August		
	Nutrients	Surface Total Nitrogen	0.75 mg/L to 1.85 mg/L	
Surface Total Phosphorus		0.025 mg/L to 0.231 mg/L		
Nitrogen to Phosphorus Ratio		15:1	Phosphorus limited	

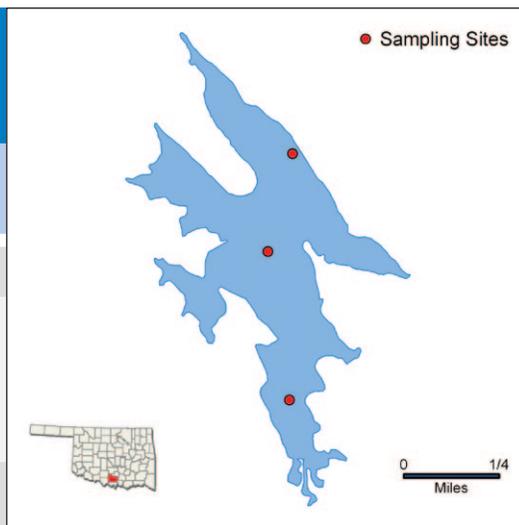
Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En.ecal coli, & E.coli	Chlor-a
	Fish & Wildlife Propagation	S	S	S	S				
	Aesthetics					S	S		
	Agriculture							S	
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes The PBCR beneficial use cannot be assessed as minimum data requirement were not met due to QA/QC issues for E.coli and Enterococci. The peaks reported in turbidity & color are due to seasonal storm events and the lake is considered the supporting the Fish and Wildlife Propagation and Aesthetics beneficial uses.

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Ardmore City



Sample Period	Times Visited	Sampling Sites
October 2006 - July 2007	4	3

Lake Data	Location	Carter County
	Impoundment	1910
	Area	142 acres
	Capacity	600 acre-feet
	Purposes	Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	10 NTU	100% of values < OWQS of 25 NTU	
	Average True Color	25 units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	106 cm		
	Water Clarity Rating	excellent		
	Trophic State Index	52		
	Trophic Class	eutrophic		
	Profile	Salinity	0.13 – 0.18 ppt	
		Specific Conductivity	278.6 – 365 µS/cm	
		pH	7.16 - 8.85 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	48 to 436 mV	
	Nutrients	Dissolved Oxygen	Up to 63% of water column < 2 mg/L in August	
		Surface Total Nitrogen	0.32 mg/L to 0.62 mg/L	
Surface Total Phosphorus		0.009 mg/L to 0.035 mg/L		
	Nitrogen to Phosphorus Ratio	22:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	NS	S				
	Aesthetics					S	S		
	Agriculture							S	
	Primary Body Contact Recreation								S
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

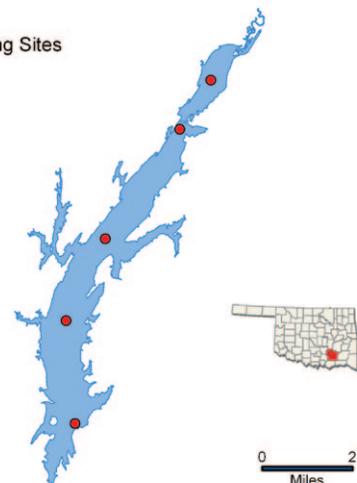
OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Atoka

● Sampling Sites



Sample Period	Times Visited	Sampling Sites
October 2006 - July 2007	4	5

Lake Data	Location	Atoka County
	Impoundment	1964
	Area	5,700 acres
	Capacity	125,000 acre-feet
	Purposes	Water Supply, Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	53 NTU	85% of values > OWQS of 25 NTU	
	Average True Color	160 units	100% of values > OWQS of 70	
	Average Secchi Disk Depth	33 cm		
	Water Clarity Rating	poor		
	Trophic State Index	51		
	Trophic Class	eutrophic		
	Profile	Salinity	0.01 – 0.04 ppt	
		Specific Conductivity	44.1 – 97.7 μS/cm	
		pH	6.36 – 8.41 pH units	Only 12 values (6.9%) < 6.5 pH units
		Oxidation-Reduction Potential	325 to 457 mV	
	Nutrients	Dissolved Oxygen	Up to 50% of water column < 2 mg/L in August	
		Surface Total Nitrogen	0.46 mg/L to 1.06 mg/L	
Surface Total Phosphorus		0.039 mg/L to 0.105 mg/L		
	Nitrogen to Phosphorus Ratio	11:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En.ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	S	S				
	Aesthetics					S	NS		
	Agriculture							S	
	Primary Body Contact Recreation								S
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

NTU = nephelometric turbidity units
 μS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 μS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Bell Cow

● Sampling Sites



Sample Period	Times Visited	Sampling Sites
October 2007 - July 2008	4	5

Lake Data	Location	Lincoln County
	Impoundment	1990
	Area	1,153 acres
	Capacity	15,613 acre-feet
	Purposes	Water Supply, Flood Control, Recreation

Parameters	Parameter		Result	Notes/Comments
	Profile	Average Turbidity	22 NTU	30% of values > OWQS of 25 NTU
		Average True Color	67 units	75% of values > OWQS of 70
		Average Secchi Disk Depth	54 cm	
		Water Clarity Rating	average	
		Trophic State Index	52	
		Trophic Class	eutrophic	
		Salinity	0.10 - 020 ppt	
	Nutrients	Specific Conductivity	205 - 442 μ S/cm	
		pH	7.18 - 8.49 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	34 to 434 mV	
		Dissolved Oxygen	Up to 50% of water column < 2 mg/L in August	
		Surface Total Nitrogen	0.56 mg/L to 0.92 mg/L	
		Surface Total Phosphorus	0.016 mg/L to 0.073 mg/L	
		Nitrogen to Phosphorus Ratio	24:1	Phosphorus limited

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En.ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	NS	S				
	Aesthetics					S	NS		
	Agriculture						S		
	Primary Body Contact Recreation							S	
	Public & Private Water Supply								

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 NS = Not Supporting
 NEI = Not Enough Information

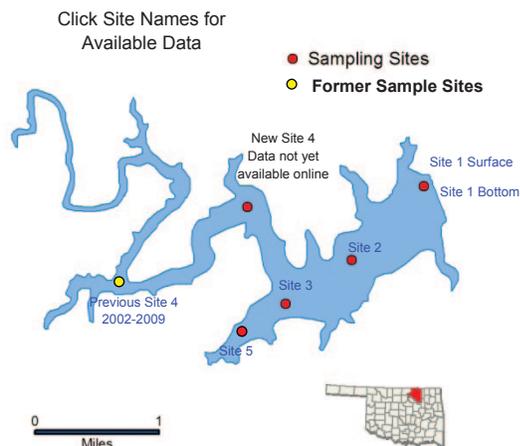
Notes

NTU = nephelometric turbidity units
 μ S/cm = microsiemens per centimeter
 E. coli = Escherichia coli
 OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a
 mg/L = milligrams per liter
 μ S/cm = microsiemens/cm
 ppt = parts per thousand
 En = Enterococci

Birch

Sample Period	Times Visited	Sampling Sites
December 2010-September 2011	4	5

General	Location	Osage County
	Impoundment	1977
	Area	1,137 acres
	Capacity	19,200 acre-feet
	Purposes	Water Supply, Recreation, Flood Control, Water Quality Control and Fish and Wildlife



Parameters	In Situ	Parameter (<i>Descriptions</i>)	Result	Notes/Comments
		Average Turbidity	10 NTU	100% of values < OWQS of 25 NTU (n=16)
		Average Secchi Disk Depth	88 cm	
		Water Clarity Rating	Good	
		Chlorophyll-a	8 mg/m ³	
		Trophic State Index	51	Previous value = 53
	Trophic Class	Eutrophic		
	Profile	Salinity	0.08 – 0.11 ppt	
		Specific Conductivity	183.3 – 235.6 µS/cm	TDS=12.8 g/L
		pH	6.8 – 8.12 pH units	
		Oxidation-Reduction Potential	231 to 519 mV	
		Dissolved Oxygen	Up to 10% of water column < 2.0 mg/L in summer	
	Nutrients	Surface Total Nitrogen	0.51 mg/L to 0.78 mg/L	
		Surface Total Phosphorus	0.014 mg/L to 0.026 mg/L	
		Nitrogen to Phosphorus Ratio	30:1	Phosphorus limited

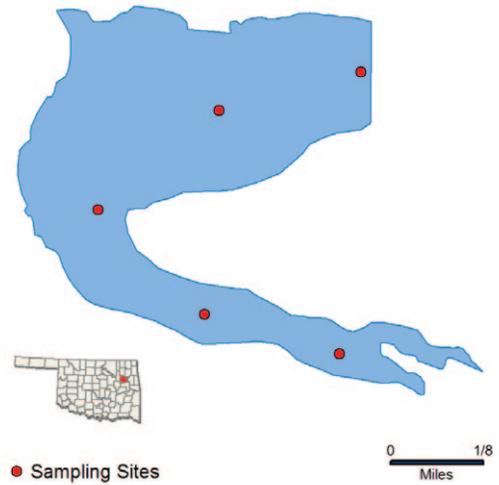
Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	En & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	S	S							
	Aesthetics					S	*					
	Agriculture							*	*	S		
	Primary Body Contact Recreation										S	
	Public & Private Water Supply											

S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

Notes *Did not collect for these parameters.

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Bixhoma



Sample Period	Times Visited	Sampling Sites
October 2005 - July 2006	4	3

Lake Data	Location	Wagoner County
	Impoundment	1965
	Area	110 acres
	Capacity	3,130 acre-feet
	Purposes	Water Supply, Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	5 NTU	100% of values < OWQS of 25 NTU	
	Average True Color	23 units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	146 cm		
	Water Clarity Rating	excellent		
	Trophic State Index	45		
	Trophic Class	mesotrophic		
	Profile	Salinity	0.01 – 0.05 ppt	
		Specific Conductivity	47.4 – 127.5 µS/cm	
		pH	6.44 – 8.63 pH units	Only 3 (2.3%) values < 6.5 pH units
		Oxidation-Reduction Potential	111 to 482 mV	
	Nutrients	Dissolved Oxygen	Up to 56% of water column < 2 mg/L in the fall & 67% in July	
		Surface Total Nitrogen	0.25 mg/L to 0.45 mg/L	
		Surface Total Phosphorus	0.010 mg/L to 0.026 mg/L	
		Nitrogen to Phosphorus Ratio	22:1	Phosphorus limited

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E.coli	Chlor-a
	Fish & Wildlife Propagation	S	S	NS	S				
	Aesthetics					S	S		
	Agriculture							S	
	Primary Body Contact Recreation								S
	Public & Private Water Supply								

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 NS = Not Supporting
 NEI = Not Enough Information

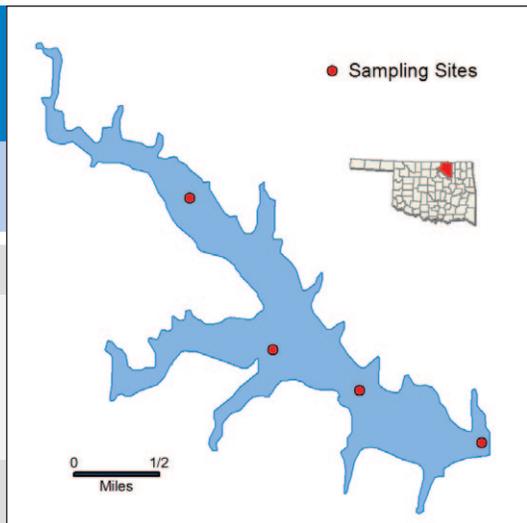
Notes

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En,ecal = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Bluestem

Sample Period	Times Visited	Sampling Sites
October 2005 - July 2006	4	5

Lake Data	Location	Osage County
	Impoundment	1958
	Area	762 acres
	Capacity	17,000 acre-feet
	Purposes	Water Supply, Recreation



Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	14 NTU	10.5% of values > OWQS of 25 NTU	
	Average True Color	20 units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	84 cm		
	Water Clarity Rating	average		
	Trophic State Index	44		
	Trophic Class	mesotrophic		
	Profile	Salinity	0.14 – 0.18 ppt	
		Specific Conductivity	290.7 – 366.6 µS/cm	
		pH	7.18 – 8.41 pH units	
		Oxidation-Reduction Potential	113 to 437 mV	
	Nutrients	Dissolved Oxygen	Up to 53% of water column < 2 mg/L in July	Occurred at sites 1 and 5
		Surface Total Nitrogen	0.15 mg/L to 0.54 mg/L	
		Surface Total Phosphorus	0.016 mg/L to 0.132 mg/L	
		Nitrogen to Phosphorus Ratio	12:1	Phosphorus limited

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	NS	S				
	Aesthetics					S	S		
	Agriculture							S	
	Primary Body Contact Recreation								S
	Public & Private Water Supply								

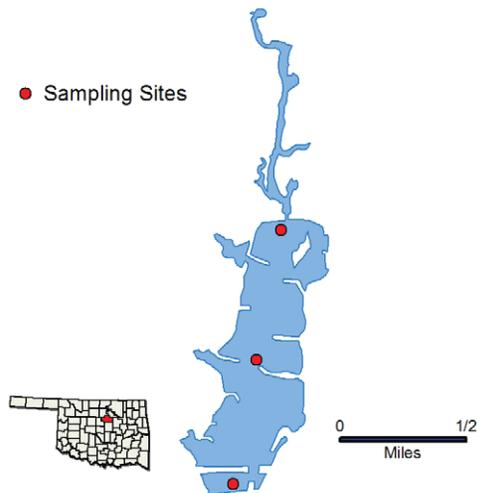
S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

Notes

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Boomer

● Sampling Sites



Sample Period	Times Visited	Sampling Sites
October 2007 - July 2008	4	5

Lake Data	Location	Payne County
	Impoundment	1932
	Area	260 acres
	Capacity	3,200 acre-feet
	Purposes	Cooling Water and Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	50 NTU	75% of values > 25 NTU	
	Average True Color	177 units	75% of values > OWQS of 70	
	Average Secchi Disk Depth	32 cm		
	Water Clarity Rating	average		
	Trophic State Index	51	Previous value = 53	
	Trophic Class	eutrophic		
	Profile	Salinity	0.09 - 0.16 ppt	
		Specific Conductivity	191.4 - 322.1 μ S/cm	
		pH	5.15 - 8.19 pH units	Only 1 value < 6.5 units
Oxidation-Reduction Potential		33 to 606 mV		
Nutrients	Dissolved Oxygen	100% of water column < 2 mg/L in July	Occurred at site 3	
	Surface Total Nitrogen	0.60 mg/L to 1.09 mg/L		
	Surface Total Phosphorus	0.035 mg/L to 0.083 mg/L		
	Nitrogen to Phosphorus Ratio	17:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	NS	S				
	Aesthetics					S	NS		
	Agriculture						S		
	Primary Body Contact Recreation								NS
	Public & Private Water Supply								

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 NS = Not Supporting
 NEI = Not Enough Information

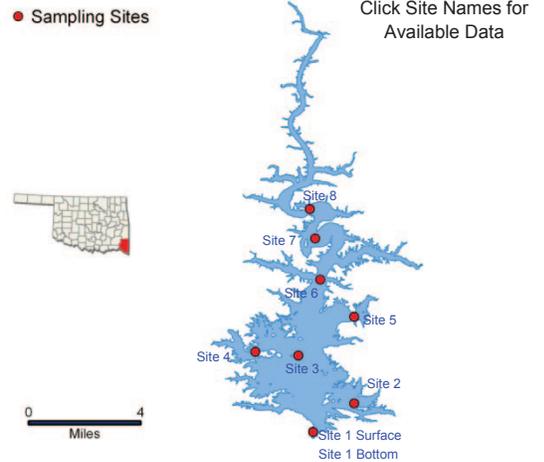
Notes The PBCR use is not supported as 50% of reported values exceeded the screening level for all three parameters

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 μ S/cm = microsiemens per centimeter mV = millivolts μ S/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Broken Bow

Sample Period	Times Visited	Sampling Sites
November 2010 – July 2011	4	8

General	Location	McCurtain County	Click map for site data
	Impoundment	1970	
	Area	14,200 acres	
	Capacity	918,070 acre-feet	
	Purposes	Flood Control, Hydropower, Water Supply, Recreation, Fish & Wildlife	



Parameters	In Situ	Parameter (<i>Descriptions</i>)	Result	Notes/Comments
		Average Turbidity	3 NTU	100% of values < OWQS of 25 NTU (n=32)
		Average Secchi Disk Depth	274 cm	
		Water Clarity Rating	Excellent	
		Chlorophyll-a	3 mg/m3	
		Trophic State Index	41	Previous value = 46
		Trophic Class	Mesotrophic	
Parameters	Profile	Salinity	0.0 – 0.01 ppt	
		Specific Conductivity	27.2 - 41.1 µS/cm	
		pH	5.01 – 7.48 pH units	79.5% of values < 6.50 pH units
		Oxidation-Reduction Potential	305 - 570 mV	
		Dissolved Oxygen	Up to 44% of water column < 2.0 mg/L in the summer	
Parameters	Nutrients	Surface Total Nitrogen	0.12 mg/L to 0.36 mg/L	
		Surface Total Phosphorus	0.005 mg/L to 0.017 mg/L	
		Nitrogen to Phosphorus Ratio	27:1	Phosphorus limited

Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	En & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	NS*	S	S							
	Aesthetics					S	*					
	Agriculture							*	*	S		
	Primary Body Contact Recreation										S	
	Public & Private Water Supply											

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

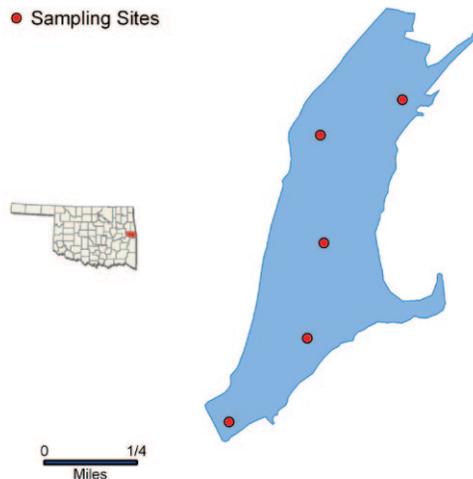
Notes

*Slightly acidic conditions are not unusual in this part of the state due to relatively low soil pH and lack of soluble bedrock. Because of these conditions it is likely that the low pH values may be due to natural causes; therefore, the Water Board is looking at the applicability of developing site-specific criteria for waters in the southeastern portion of the state. *Did not collect for these parameters.

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Brushy Creek

● Sampling Sites



Sample Period	Times Visited	Sampling Sites
October 2007 - July 2008	4	5

Lake Data	Location	Sequoyah County
	Impoundment	1964
	Area	358 acres
	Capacity	3,258 acre-feet
	Purposes	Flood Control and Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	10 NTU	25% of values > 25 NTU	
	Average True Color	41 units	25% of values > OWQS of 70	
	Average Secchi Disk Depth	103 cm		
	Water Clarity Rating	good		
	Trophic State Index	53	Previous value = 51	
	Trophic Class	eutrophic		
	Profile	Salinity	0.00 - 0.10 ppt	
		Specific Conductivity	36.3 - 605 µS/cm	
		pH	6.02 - 8.12 pH units	Only 7 values < 6.5 units
		Oxidation-Reduction Potential	33 to 606 mV	
	Dissolved Oxygen	Up to 69% of water column < 2 mg/L in July	Occurred at site 1, the dam	
	Nutrients	Surface Total Nitrogen	0.38 mg/L to 0.72 mg/L	
Surface Total Phosphorus		0.016 mg/L to 0.050 mg/L		
Nitrogen to Phosphorus Ratio		20:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En.ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	NS	S				
	Aesthetics					S	S		
	Agriculture							S	
	Primary Body Contact Recreation								S
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

Precipitation data suggests the peak in color & turbidity are likely due to runoff, therefore the uses are considered supporting.

NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Burtschi

● Sampling Sites

Sample Period	Times Visited	Sampling Sites
November 2005 - August 2006	4	3

Lake Data

Location	Grady County
Impoundment	1958
Area	180 acres
Capacity	2,140 acre-feet
Purposes	Recreation



Parameters

Parameter	Result	Notes/Comments	
Average Turbidity	11 NTU	100% of values < OWQS of 25 NTU	
Average True Color	18 units	100% of values < OWQS of 70	
Average Secchi Disk Depth	72 cm		
Water Clarity Rating	good		
Trophic State Index	63		
Trophic Class	hypereutrophic		
Profile	Salinity	0.53 – 0.67 ppt	
	Specific Conductivity	1011 – 1273 µS/cm	
	pH	7.19 – 10.74 pH units	16% of values were > 9 pH units
	Oxidation-Reduction Potential	42 to 428 mV	
Nutrients	Dissolved Oxygen	Up to 38% of water column < 2 mg/L in August	
	Surface Total Nitrogen	0.92 mg/L to 1.82 mg/L	
	Surface Total Phosphorus	0.027 mg/L to 0.109 mg/L	
Nitrogen to Phosphorus Ratio	24:1	Phosphorus limited	

Beneficial Uses

	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
Fish & Wildlife Propagation	S	NS	S	S					
Aesthetics					S	S			
Agriculture							S		
Primary Body Contact Recreation								S	
Public & Private Water Supply									

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

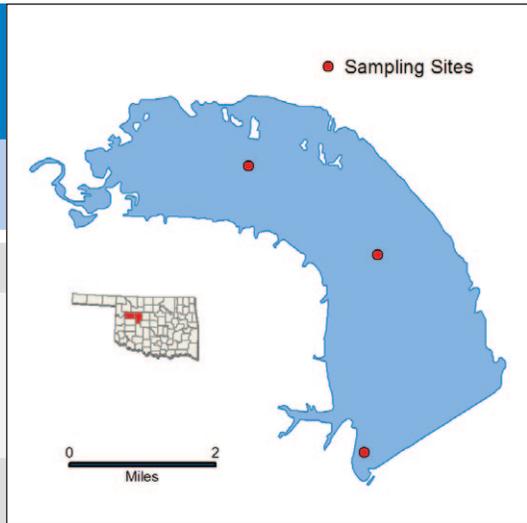
NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Canton



Sample Period	Times Visited	Sampling Sites
October 2005 - July 2006	4	5

Lake Data	Location	Blaine County
	Impoundment	1948
	Area	7,910 acres
	Capacity	111,310 acre-feet
	Purposes	Flood Control, Water Supply, Irrigation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	16 NTU	15% of values > OWQS of 25 NTU	
	Average True Color	18 units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	63 cm		
	Water Clarity Rating	average		
	Trophic State Index	57		
	Trophic Class	eutrophic		
	Profile	Salinity	0.63 – 0.93 ppt	
		Specific Conductivity	1201 – 1749 μ S/cm	
		pH	7.51– 8.49 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	368 to 487 mV	
	Nutrients	Dissolved Oxygen	Up to 25% of water column < 2 mg/L in July	Occurred at sites 1 and 2
		Surface Total Nitrogen	0.63 mg/L to 1.03 mg/L	
Surface Total Phosphorus		0.033 mg/L to 0.167 mg/L		
	Nitrogen to Phosphorus Ratio	13:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	S	S				
	Aesthetics					S	S		
	Agriculture							S	
	Primary Body Contact Recreation								S
	Public & Private Water Supply								

S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

Notes

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 μ S/cm = microsiemens per centimeter mV = millivolts μ S/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Carl Albert



Sample Period	Times Visited	Sampling Sites
October 2007 - July 2008	4	3

Lake Data	Location	Latimer County
	Impoundment	1964
	Area	183 acres
	Capacity	2,739 acre-feet
	Purposes	Water Supply, Flood Control, and Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	14 NTU	All values < 25 NTU	
	Average True Color	72 units	50% of values > OWQS of 70	
	Average Secchi Disk Depth	90 cm		
	Water Clarity Rating	good		
	Trophic State Index	41	Previous value = 41	
	Trophic Class	mesotrophic		
	Profile	Salinity	0.00 - 0.01 ppt	
		Specific Conductivity	36 - 97 µS/cm	
		pH	5.8 - 7.32 pH units	21% of values < 6.5 units
		Oxidation-Reduction Potential	22 to 553 mV	
	Nutrients	Dissolved Oxygen	Up to 62% of water column < 2 mg/L in August	Occurred at site 1, the dam
		Surface Total Nitrogen	0.28 mg/L to 0.49 mg/L	
		Surface Total Phosphorus	0.013 mg/L to 0.031 mg/L	
	Nitrogen to Phosphorus Ratio	16:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	NS	NS	*				
	Aesthetics					S	NS		
	Agriculture							S	
	Primary Body Contact Recreation								S
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

*Not supporting for lead as chronic criteria was exceeded. All other toxicants are fully supporting.

NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

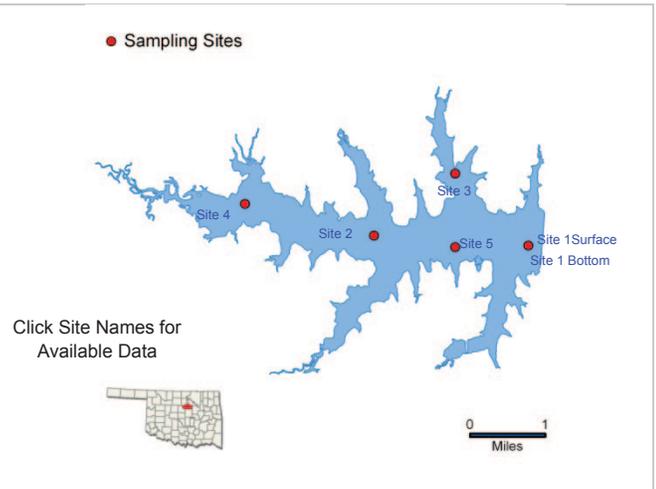
mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Carl Blackwell

Sample Period	Times Visited	Sampling Sites
November 2010 - July 2011	4	5

General	Location	Payne County	Click map for site data
	Impoundment	1937	
	Area	3,370 acres	
	Capacity	61,500 acre-feet	
	Purposes	Water Supply and Recreation	



Parameters	In Situ	Parameter (Descriptions)	Result	Notes/Comments
		Average Turbidity	28 NTU	47% of values > 25 NTU
		Average Secchi Disk Depth	46 cm	
		Water Clarity Rating	Average	
		Chlorophyll-a	8 mg/m3	
		Trophic State Index	51	Previous value = 53
	Trophic Class	Eutrophic		
	Profile	Salinity	0.19 – 0.22 ppt	
		Specific Conductivity	379.3 - 433 µS/cm	
		pH	6.82 – 8.64 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	33 - 497 mV	
		Dissolved Oxygen	Up to 50% of water column < 2 mg/L in summer	
	Nutrients	Surface Total Nitrogen	0.47 mg/L to 1.22 mg/L	
		Surface Total Phosphorus	0.023 mg/L to 0.054 mg/L	
		Nitrogen to Phosphorus Ratio	25:1	Phosphorus limited

Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enterro. & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	S	S							
	Aesthetics					S	*					
	Agriculture							S	S	S		
	Primary Body Contact Recreation										NEI	
	Public & Private Water Supply											

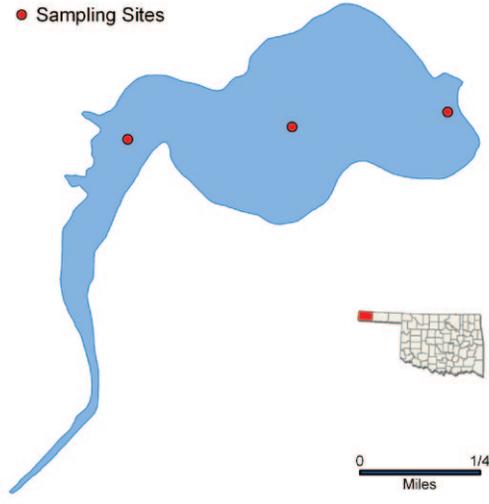
S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

*Did not collect for these parameters.

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Carl Etling



Sample Period	Times Visited	Sampling Sites
September 2003 – June 2004	4	3

Location	Cimarron County
Impoundment	1958
Area	159 acres
Capacity	1717 acre-feet
Purposes	Recreation

Parameter	Result	Notes/Comments	
Average Turbidity	65 NTU	75% of values > OWQS of 25 NTU	
Average True Color	18 units	100% of values < OWQS of 70	
Average Secchi Disk Depth	22 cm		
Water Clarity Rating	fair		
Trophic State Index	72		
Trophic Class	hypereutrophic		
Profile	Salinity	0.90 – 1.4 ppt	
	Specific Conductivity	1688 – 2596 µS/cm	
	pH	8.18 – 9.42 pH units	28% of recorded values > 9.0 pH units
	Oxidation-Reduction Potential	269 to 499 mV	
	Dissolved Oxygen		Lake well-mixed – not stratified
Nutrients	Surface Total Nitrogen	2.31 mg/L to 4.51 mg/L	
	Surface Total Phosphorus	0.122 mg/L to 0.293mg/L	
	Nitrogen to Phosphorus Ratio	16:1	Phosphorus limited

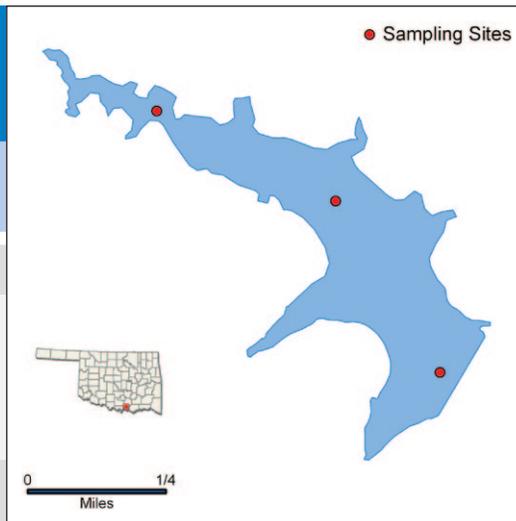
	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
Fish & Wildlife Propagation	NS	NS	S	S					
Aesthetics					NS*	S			
Agriculture							S		
Primary Body Contact Recreation								S	
Public & Private Water Supply									

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes *The lake is listed in the WQS as a NLW indicating that the Aesthetics beneficial use is considered threatened by nutrients until studies can be conducted to confirm non-support status.

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Carter



Sample Period	Times Visited	Sampling Sites
November 2007 - August 2008	4	3

Lake Data	Location	Marshall County
	Impoundment	1960
	Area	108 acres
	Capacity	990 acre-feet
	Purposes	Water Supply and Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	7 NTU	All values < 25 NTU	
	Average True Color	25 units	All Values < OWQS of 70	
	Average Secchi Disk Depth	121 cm		
	Water Clarity Rating	excellent		
	Trophic State Index	40	Previous value = 40	
	Trophic Class	oligotrophic		
	Profile	Salinity	0.10 - 0.20 ppt	
		Specific Conductivity	212 – 325 µS/cm	
		pH	6.98 – 8.33 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	60 to 557 mV	
	Nutrients	Dissolved Oxygen	Up to 44% of water column < 2 mg/L in August	Occurred at site 1, the dam
		Surface Total Nitrogen	0.41 mg/L to 0.54 mg/L	
Surface Total Phosphorus		0.011 mg/L to 0.018 mg/L		
	Nitrogen to Phosphorus Ratio	37:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	S	S				
	Aesthetics					S	S		
	Agriculture							S	
	Primary Body Contact Recreation								S
	Public & Private Water Supply								

Notes

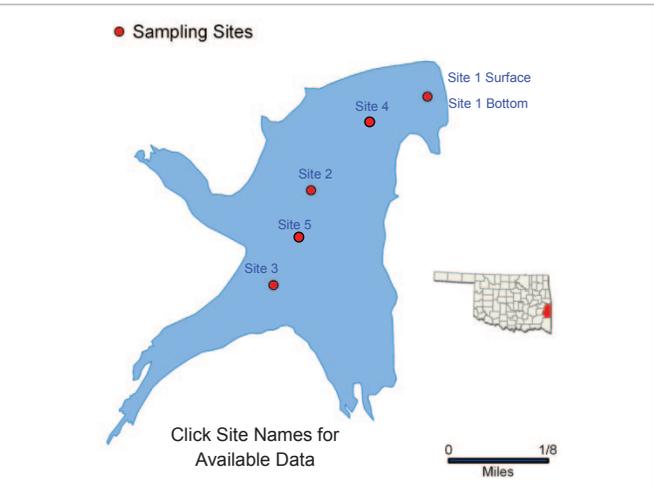
S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Cedar

Sample Period	Times Visited	Sampling Sites
February 2011 - July 2011	4	5

General	Location	Le Flore County	Click map for site data
	Impoundment	1937	
	Area	78 acres	
	Capacity	1,000 acre-feet	
	Purposes	Recreation	



Parameters		Parameter (Descriptions)	Result	Notes/Comments
In Situ	Average Turbidity		6 NTU	100% of values < OWQS of 25 NTU
	Average Secchi Disk Depth		99 cm	
	Water Clarity Rating		Excellent	
	Chlorophyll-a		13 mg/m ³	
	Trophic State Index		56	Previous Value=53
	Trophic Class		Eutrophic	
Profile	Salinity		0.0– 0.04 ppt	
	Specific Conductivity		32.8 – 106.4 μS/cm	
	pH		5.6 - 8.94 pH units	51.56% < 6.5
	Oxidation-Reduction Potential		-12 - 509 mV	
	Dissolved Oxygen		Up to 70% of water column < 2 mg/L in summer	
Nutrients	Surface Total Nitrogen		0.18 mg/L to 0.97 mg/L	
	Surface Total Phosphorus		0.016 mg/L to 0.057 mg/L	
	Nitrogen to Phosphorus Ratio		18:1	Phosphorus limited

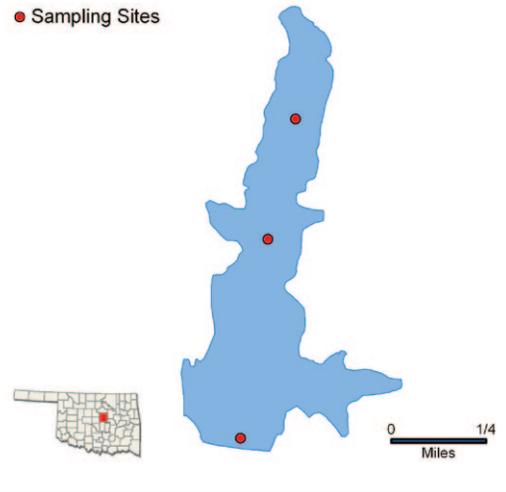
Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enteroc. & E. coli	Chlor-a
	Fish & Wildlife Propagation	NEI	NS	S	S							
	Aesthetics					S	*					
	Agriculture							*	*	S		
	Primary Body Contact Recreation										S	
	Public & Private Water Supply											

S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

Notes *Did not collect for these parameters. Although all turbidity values are <25 NTU, The FWP beneficial use cannot be assessed for this sample year as minimum data requirements were not met.

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 μS/cm = microsiemens per centimeter mV = millivolts μS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Chandler



Sample Period	Times Visited	Sampling Sites
October 2007 - July 2008	4	3

Lake Data	Location	Lincoln County
	Impoundment	1960
	Area	129 acres
	Capacity	2,778 acre-feet
	Purposes	Water Supply and Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	29 NTU	58% of values > 25 NTU	
	Average True Color	59 units	25% of values > OWQS of 70	
	Average Secchi Disk Depth	39 cm		
	Water Clarity Rating	average		
	Trophic State Index	60	Previous value = 50	
	Trophic Class	eutrophic		
	Profile	Salinity	0.10 - 0.18 ppt	
		Specific Conductivity	268 – 365.7 μ S/cm	
		pH	7.35 – 8.82 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	23 to 533 mV	
	Nutrients	Dissolved Oxygen	Up to 62% of water column < 2 mg/L in July	Occurred at site 1, the dam
		Surface Total Nitrogen	0.82 mg/L to 1.59 mg/L	
Surface Total Phosphorus		0.036 mg/L to 0.082 mg/L		
	Nitrogen to Phosphorus Ratio	27:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	NS					
	Aesthetics					S	NS		
	Agriculture							S	
	Primary Body Contact Recreation								S
	Public & Private Water Supply				S				

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 NS = Not Supporting
 NEI = Not Enough Information

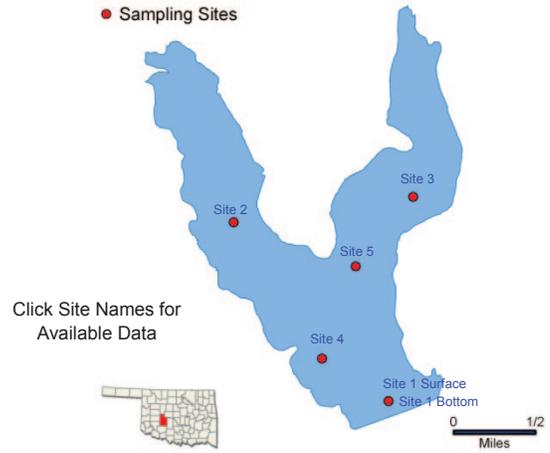
Notes

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 μ S/cm = microsiemens per centimeter mV = millivolts μ S/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Chickasha

Sample Period	Times Visited	Sampling Sites
October 2010 - June 2011	4	5

General	Location	Caddo County	Click map for site data
	Impoundment	1958	
	Area	820 acres	
	Capacity	41,080 acre-feet	
	Purposes	Water Supply, Recreation	



Parameters		Parameter (<i>Descriptions</i>)	Result	Notes/Comments
		In Situ	Average Turbidity	14 NTU
Average Secchi Disk Depth	51 cm			
Water Clarity Rating	Good			
Chlorophyll-a	27 mg/m ³			
Trophic State Index	63		Previous Value=62	
Trophic Class	Hypereutrophic			
Profile	Salinity	1.15 – 1.22 ppt		
	Specific Conductivity	2140 – 2266 µS/cm		
	pH	7.43 – 8.39 pH units	Neutral to slightly alkaline	
	Oxidation-Reduction Potential	349 to 472 mV		
	Dissolved Oxygen	All data are above screening level		
Nutrients	Surface Total Nitrogen	0.82 mg/L to 1.35 mg/L		
	Surface Total Phosphorus	0.032 mg/L to 0.07 mg/L		
	Nitrogen to Phosphorus Ratio	21:1	Phosphorus limited	

Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enterro. & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	S	S							
	Aesthetics					NS	S					
	Agriculture							NS	S	S		
	Primary Body Contact Recreation										S	
	Public & Private Water Supply											

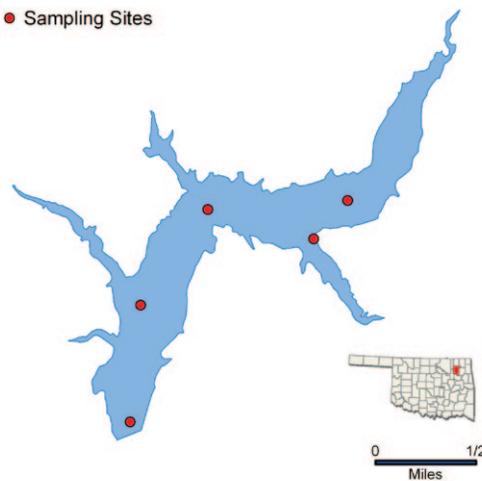
S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes The lake is currently listed in the Oklahoma Water Quality Standards (WQS) as a Nutrient Limited Watershed (NLW). This listing means that the lake is considered threatened from nutrients until a more intensive study can confirm the Aesthetics beneficial use non-support status.

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Claremore

● Sampling Sites



Sample Period	Times Visited	Sampling Sites
November 2005 - August 2006	3	5

Lake Data	Location	Rogers County
	Impoundment	1930
	Area	470 acres
	Capacity	7,900 acre-feet
	Purposes	Water Supply, Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	19 NTU	13% of values > OWQS of 25 NTU	
	Average True Color	24units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	41 cm		
	Water Clarity Rating	good		
	Trophic State Index	67		
	Trophic Class	hypereutrophic		
	Profile	Salinity	0.11– 0.12 ppt	
		Specific Conductivity	242 – 257.4 μ S/cm	
		pH	7.03– 8.10 pH units	
		Oxidation-Reduction Potential	252 to 454 mV	
	Nutrients	Dissolved Oxygen	Up to 29% of water column < 2 mg/L in May	Occurred at site 1, the dam
		Surface Total Nitrogen	0.91 mg/L to 2.00 mg/L	
Surface Total Phosphorus		0.072 mg/L to 0.193 mg/L		
	Nitrogen to Phosphorus Ratio	12:1	Phosphorus Limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En.ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	*	S	S	S				
	Aesthetics					NS**	*		
	Agriculture							S	
	Primary Body Contact Recreation								S
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes
 *An assessment of the Fish & Wildlife Propagation (FWP) and Aesthetics beneficial use based on turbidity and color cannot be made at this time as minimum data requirements were not met for this sample year.
 **The lake is listed in the WQS as a NLW indicating that the Aesthetics beneficial use is considered threatened by nutrients until studies can be conducted to confirm non-support status.

NTU = nephelometric turbidity units
 μ S/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

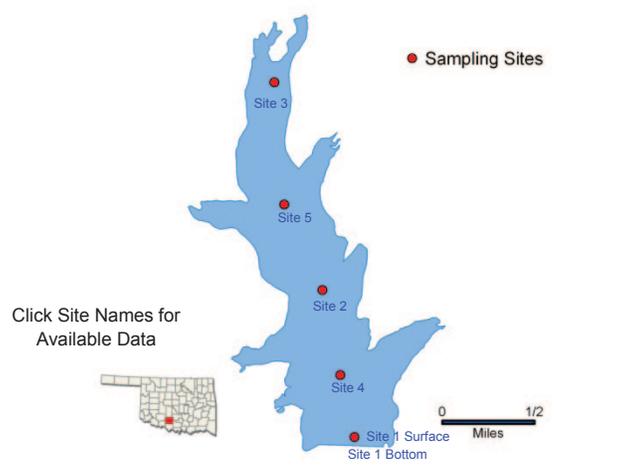
mg/L = milligrams per liter
 μ S/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Clear Creek

Sample Period	Times Visited	Sampling Sites
December 2010 - August 2011	4	5

General	Location	Stephens County	Click map for site data
	Impoundment	1948	
	Area	722 acres	
	Capacity	7,711 acre-feet	
	Purposes	Water Supply, Recreation	



Parameters	In Situ	Parameter (<i>Descriptions</i>)	Result	Notes/Comments
		Average Turbidity	11 NTU	100% of values < OWQS of 25 NTU
		Average Secchi Disk Depth	65 cm	
		Water Clarity Rating	Average	
		Chlorophyll-a	17 mg/m3	
		Trophic State Index	59	Previous Value=58
	Trophic Class	Eutrophic		
	Profile	Salinity	0.3 – 0.35 ppt	
		Specific Conductivity	588.3 – 687.6 µS/cm	
		pH	5.92 – 7.37 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	-101 to 438 mV	
		Dissolved Oxygen	Up to 25% of water column < 2 mg/L in summer	
	Nutrients	Surface Total Nitrogen	0.7 mg/L to 0.99 mg/L	
		Surface Total Phosphorus	0.023 mg/L to 0.053 mg/L	
		Nitrogen to Phosphorus Ratio	23:1	Phosphorus limited

Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enterococci & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	S	S							
	Aesthetics					S	*					
	Agriculture							S	S	S		
	Primary Body Contact Recreation										NEI	
	Public & Private Water Supply											

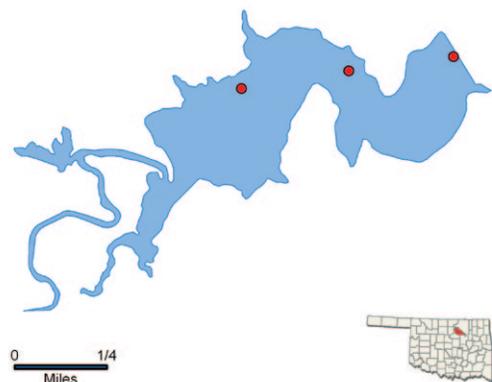
Notes
S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

The PBCR beneficial use cannot be assessed as minimum data requirement were not met due to QA/QC issues for *E.coli*. * Did not collect for this parameter.

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Cleveland City

● Sampling Sites



Sample Period	Times Visited	Sampling Sites
November 2006 - August 2007	4	3

Lake Data	Location	Pawnee County
	Impoundment	1936
	Area	159 acres
	Capacity	2,200 acre-feet
	Purposes	Water Supply, Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	17 NTU	8% of values >OWQS of 25 NTU	
	Average True Color	63 units	25% of values > OWQS of 70	
	Average Secchi Disk Depth	56 cm		
	Water Clarity Rating	average		
	Trophic State Index	56		
	Trophic Class	eutrophic		
	Profile	Salinity	0.08 – 0.11 ppt	
		Specific Conductivity	173.3 – 235.3 μ S/cm	
		pH	6.93 – 8.64 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	82 to 438 mV	
		Dissolved Oxygen	Up to 70% of water column < 2 mg/L in May	
	Nutrients	Surface Total Nitrogen	0.85 mg/L to 1.24 mg/L	
Surface Total Phosphorus		0.021 mg/L to 0.050 mg/L		
Nitrogen to Phosphorus Ratio		30:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E.coli	Chlor-a
	Fish & Wildlife Propagation	S	S	NS	S				
	Aesthetics					S	S		
	Agriculture							S	
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

The PBCR beneficial use cannot be assessed as minimum data requirement were not met due to QA/QC issues for enterococci. The peak reported in color is due to seasonal storm events and the lake is considered supporting the Aesthetics beneficial use.

NTU = nephelometric turbidity units
 μ S/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

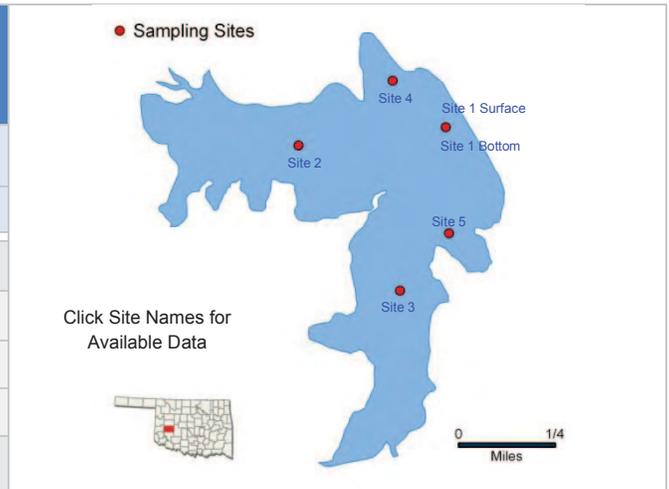
mg/L = milligrams per liter
 μ S/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Clinton

Sample Period	Times Visited	Sampling Sites
October 2003 – July 2004	4	5

General	Location	Washita County	Click map for site data
	Impoundment	1931	
	Area	335 acres	
	Capacity	3,980 acre-feet	
	Purposes	Water Supply, Recreation	

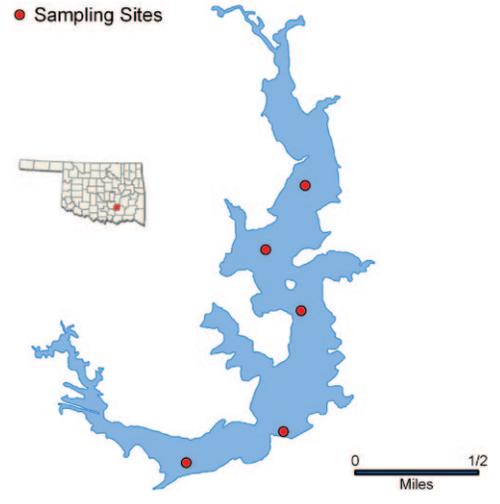


Parameters	Parameter (<i>Descriptions</i>)	Result	Notes/Comments	
	Profile	Average Turbidity	67 NTU	100% of values > OWQS of 25 NTU
Average True Color		36 units	15% of values > OWQS of 70	
Average Secchi Disk Depth		23 cm		
Water Clarity Rating		poor		
Trophic State Index		66		
Trophic Class		hypereutrophic		
Nutrients		Salinity	0.23 – 0.33 ppt	
		Specific Conductivity	460.4 – 642.9 µS/cm	
		pH	8.00 – 8.74 pH units	Slightly alkaline
		Oxidation-Reduction Potential	149 – 534 mV	
	Dissolved Oxygen		Lake well-mixed – not stratified	
Nutrients	Surface Total Nitrogen	1.36 mg/L to 3.06 mg/L		
	Surface Total Phosphorus	0.089 mg/L to 0.244 mg/L		
	Nitrogen to Phosphorus Ratio	13:1	Phosphorus limited	

Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enterococci & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	S	S							
	Aesthetics					NS*	NS					
	Agriculture							S	S	S		
	Primary Body Contact Recreation										NS**	
	Public & Private Water Supply											NS
<i>S = Fully Supporting</i> <i>NS = Not Supporting</i> <i>NEI = Not Enough Information</i>		Notes *The lake is listed in the WQS as a NLW indicating that the Aesthetics beneficial use is considered threatened by nutrients until studies can be conducted to confirm non-support status. ** Both the screening level & geometric mean for enterococci were exceeded.										

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Coalgate City



Sample Period	Times Visited	Sampling Sites
October 2006 - July 2007	4	5

Lake Data	Location	Coal County
	Impoundment	1965
	Area	352 acres
	Capacity	3,437 acre-feet
	Purposes	Water Supply, Recreation and Flood Control

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	92 NTU	85% of values > OWQS of 25 NTU	
	Average True Color	249 units	100% of values > OWQS of 70	
	Average Secchi Disk Depth	26 cm		
	Water Clarity Rating	poor		
	Trophic State Index	47		
	Trophic Class	mesotrophic		
	Profile	Salinity	0.01 – 0.02 ppt	
		Specific Conductivity	47.1 – 72.7 µS/cm	
		pH	6.32– 8.03 pH units	Only 8 (8%) of vales < 6.5 pH units
Oxidation-Reduction Potential		230 to 445 mV		
Nutrients	Dissolved Oxygen	Up to 71% of water column < 2 mg/L in July	Occurred at site 2	
	Surface Total Nitrogen	0.90 mg/L to 1.43 mg/L		
	Surface Total Phosphorus	0.061 mg/L to 0.155 mg/L		
	Nitrogen to Phosphorus Ratio	13:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	NS	S				
	Aesthetics					S	NS		
	Agriculture						S		
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

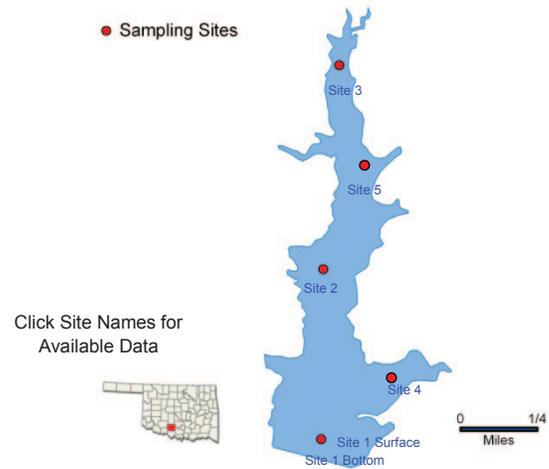
Notes The PBCR beneficial use cannot be assessed as minimum data requirement were not met due to QA/QC issues for fecal coliform.

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Comanche

Sample Period	Times Visited	Sampling Sites
December 2010 – August 2011	4	5

General	Location	Stephens County	Click map for site data
	Impoundment	1960	
	Area	184 acres	
	Capacity	2,500 acre-feet	
	Purposes	Water Supply and Recreation	



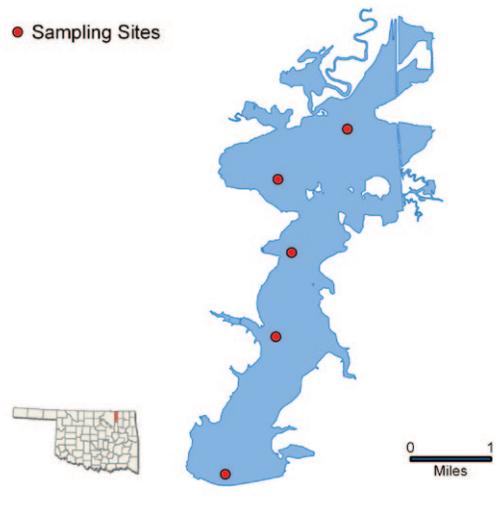
		Parameter (Descriptions)	Result	Notes/Comments
Parameters	In Situ	Average Turbidity	12 NTU	100% of values < OWQS of 25 NTU
		Average Secchi Disk Depth	86	Did not collect for true color
		Water Clarity Rating	Good	
		Chlorophyll-a	8 mg/m3	
		Trophic State Index	50	Previous value = 58
		Trophic Class	Mesotrophic	
	Profile	Salinity	0.14 - 0.2 ppt	
		Specific Conductivity	284.8 – 398.1 µS/cm	
		pH	6.9 – 8.89 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	-47 to 427 mV	
		Dissolved Oxygen	50% of water column < 2.0 mg/L in summer	
	Nutrients	Surface Total Nitrogen	0.49 mg/L to 0.72 mg/L	
Surface Total Phosphorus		0.015 mg/L to 0.031 mg/L		
Nitrogen to Phosphorus Ratio		28:1	Phosphorus limited	

Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	En & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	S	S							
	Aesthetics					S	*					
	Agriculture							*	*	S		
	Primary Body Contact Recreation										S	
	Public & Private Water Supply											
S = Fully Supporting NS = Not Supporting NEI = Not Enough Information		Notes *Did not collect for these parameters										

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Copan

● Sampling Sites



Sample Period	Times Visited	Sampling Sites
October 2007 - July 2008	4	5

Lake Data	Location	Washington County
	Impoundment	1983
	Area	4,850 acres
	Capacity	43,400 acre-feet
	Purposes	Flood Control, Water Supply, Water Quality Control, Fish and Wildlife, and Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	46 NTU	80% of values > 25 NTU	
	Average True Color	123 units	60% of values > OWQS of 70	
	Average Secchi Disk Depth	32 cm		
	Water Clarity Rating	average		
	Trophic State Index	60	Previous value = 51	
	Trophic Class	eutrophic		
	Profile	Salinity	0.07 - 0.14 ppt	
		Specific Conductivity	152.2 – 286.8 µS/cm	
		pH	6.95 – 8.33 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	230 to 486 mV	
	Nutrients	Dissolved Oxygen	44% of water column < 2 mg/L in July	Occurred at site 1, the dam
		Surface Total Nitrogen	0.49 mg/L to 1.24 mg/L	
Surface Total Phosphorus		0.034 mg/L to 0.160 mg/L		
	Nitrogen to Phosphorus Ratio	10:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	S	S				
	Aesthetics					S	NS		
	Agriculture						S		
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

The PBCR cannot be assessed as minimum data requirements were not met due to QA/QC issues for E. coli and enterococci.

NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

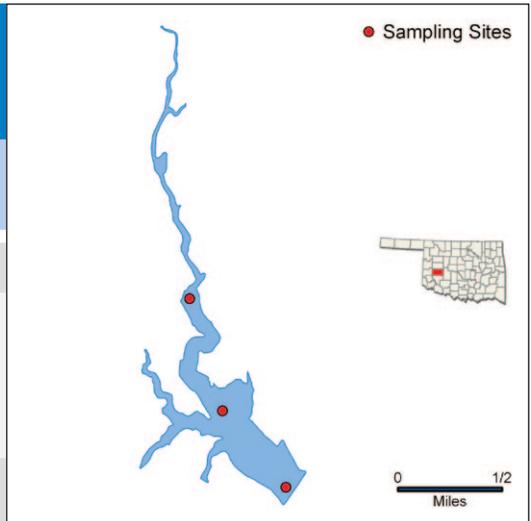
ppt = parts per thousand
 En = Enterococci

Crowder

Sample Period	Times Visited	Sampling Sites
November 2005 - August 2006	4	3

Lake Data

Location	Washita County
Impoundment	1959
Area	158 acres
Capacity	2,094 acre-feet
Purposes	Flood Control, Recreation



Parameters

Parameter	Result	Notes/Comments	
Average Turbidity	9 NTU	100% of values < OWQS of 25 NTU	
Average True Color	17 units	100% of values < OWQS of 70	
Average Secchi Disk Depth	65 cm		
Water Clarity Rating	average		
Trophic State Index	57		
Trophic Class	eutrophic		
Profile	Salinity	0.38– 0.57 ppt	
	Specific Conductivity	744 – 1088 µS/cm	
	pH	7.03– 8.34 pH units	Neutral to slightly alkaline
	Oxidation-Reduction Potential	275 to 445 mV	
Nutrients	Dissolved Oxygen	Up to 37.5% of water column < 2 mg/L in May	Occurred at sites 1 and 2
	Surface Total Nitrogen	0.54 mg/L to 0.93 mg/L	
	Surface Total Phosphorus	0.026 mg/L to 0.053 mg/L	
Nitrogen to Phosphorus Ratio	21:1	Phosphorus Limited	

Beneficial Uses

	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
Fish & Wildlife Propagation	S	S	S	S					
Aesthetics					NS*	S			
Agriculture							S		
Primary Body Contact Recreation								S	
Public & Private Water Supply									

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 NEI = Not Enough Information

Notes

*The lake is listed in the WQS as a NLW indicating that the Aesthetics beneficial use is considered threatened by nutrients until studies can be conducted to confirm non-support status.

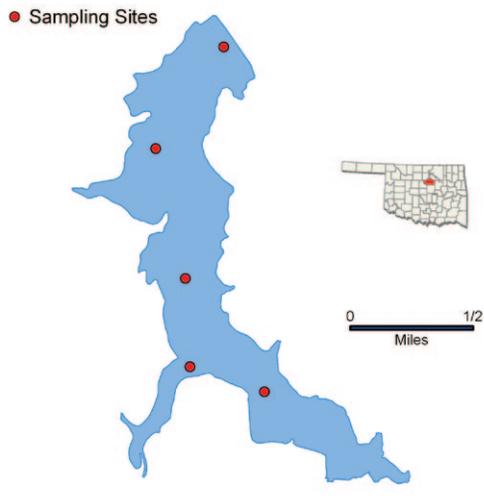
NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Cushing Municipal



Sample Period	Times Visited	Sampling Sites
October 2006 - July 2007	4	5

Lake Data	Location	Payne County
	Impoundment	1950
	Area	591 acres
	Capacity	3,304 acre-feet
	Purposes	Water Supply, Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	45 NTU	70% of values > OWQS of 25 NTU	
	Average True Color	85 units	45% of values > OWQS of 70	
	Average Secchi Disk Depth	43 cm		
	Water Clarity Rating	poor		
	Trophic State Index	50		
	Trophic Class	mesotrophic		
	Profile	Salinity	0.05 – 0.15 ppt	
		Specific Conductivity	131.5 – 325 µS/cm	
		pH	6.84– 8.31 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	359 to 432 mV	
		Dissolved Oxygen	Up to 25% of water column < 2 mg/L in July	
	Nutrients	Surface Total Nitrogen	0.66mg/L to 1.71 mg/L	
Surface Total Phosphorus		0.036 mg/L to 0.187 mg/L		
Nitrogen to Phosphorus Ratio		9:1	Approaching co-limitation	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	S	S				
	Aesthetics					S	NS		
	Agriculture						S		
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

The PBCR beneficial use cannot be assessed as minimum data requirement were not met due to QA/QC issues for all parameters.

NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

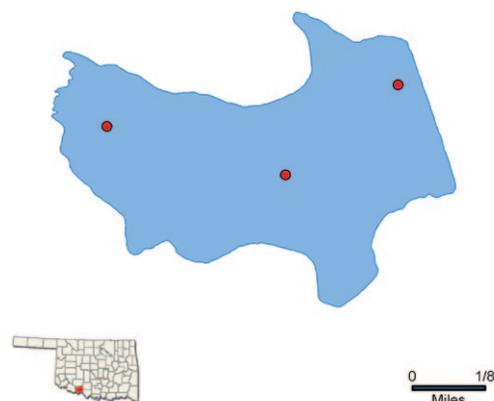
OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Dave Boyer (Walters)

● Sampling Sites



Sample Period	Times Visited	Sampling Sites
October 2007 – July 2008	4	3

Lake Data	Location	Cotton County
	Impoundment	1936
	Area	148 acres
	Capacity	861 acre feet
	Purposes	Water Supply, and Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	98 NTU	75% of values > 25 NTU	
	Average True Color	166 units	75% of values > OWQS of 70	
	Average Secchi Disk Depth	21 cm		
	Water Clarity Rating	poor		
	Trophic State Index	51	Previous value = 52	
	Trophic Class	eutrophic		
	Profile	Salinity	0.12 – 0.17 ppt	
		Specific Conductivity	253.8 – 353 µS/cm	
		pH	7.92 – 8.34 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	376 to 520 mV	
		Dissolved Oxygen		All values >7 mg/L
	Nutrients	Surface Total Nitrogen	0.47 mg/L to 1.19 mg/L	
Surface Total Phosphorus		0.029 mg/L to 0.138 mg/L		
Nitrogen to Phosphorus Ratio		10:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	S	S				
	Aesthetics					S	NS		
	Agriculture						S		
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

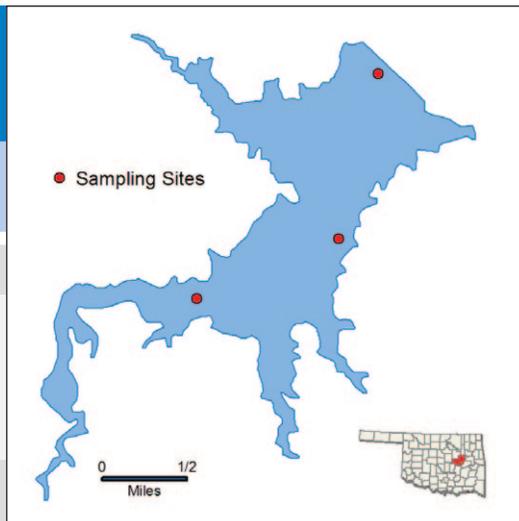
NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Dripping Springs



Sample Period	Times Visited	Sampling Sites
October 2006 - July 2007	4	5

Lake Data	Location	Okmulgee County
	Impoundment	1976
	Area	1,150 acres
	Capacity	16,200 acre-feet
	Purposes	Water Supply, Recreation and Flood Control

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	21 NTU	45% of values > OWQS of 25 NTU	
	Average True Color	89 units	75% of values > OWQS of 70	
	Average Secchi Disk Depth	76 cm		
	Water Clarity Rating	average		
	Trophic State Index	48		
	Trophic Class	mesotrophic		
	Profile	Salinity	0.01 – 0.07 ppt	
		Specific Conductivity	49.7 – 156 µS/cm	
		pH	6.31– 7.70 pH units	Only 13 (7.8%) of values < 6.5 pH units
		Oxidation-Reduction Potential	128 to 454 mV	
		Dissolved Oxygen	Up to 69% of water column < 2 mg/L in July	Occurred at site 1, the dam
	Nutrients	Surface Total Nitrogen	0.43 mg/L to 1.07 mg/L	
Surface Total Phosphorus		0.014 mg/L to 0.044 mg/L		
Nitrogen to Phosphorus Ratio		26:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	NS	S				
	Aesthetics					S	NS		
	Agriculture						S		
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

The PBCR beneficial use cannot be assessed as minimum data requirement were not met due to QA/QC issues for fecal coliform and enterococci.

NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Duncan

● Sampling Sites



Sample Period	Times Visited	Sampling Sites
November 2006 - August 2007	4	5

Lake Data	Location	Stephens County
	Impoundment	1937
	Area	500 acres
	Capacity	7,200 acre-feet
	Purposes	Water Supply, Recreation

Parameters	Parameter		Result	Notes/Comments
	Profile	Average Turbidity	15 NTU	100% of values < OWQS of 25 NTU
		Average True Color	34 units	15% of values > OWQS of 70
		Average Secchi Disk Depth	58 cm	
		Water Clarity Rating	average	
		Trophic State Index	57	
		Trophic Class	eutrophic	
		Nutrients	Salinity	0.12 – 0.24 ppt
	Specific Conductivity		244.5 – 472.2 µS/cm	
	pH		7.32– 8.44 pH units	Only 13 (7.8%) of values < 6.5 pH units
	Oxidation-Reduction Potential		95 to 426 mV	
	Dissolved Oxygen		Up to 22% of water column < 2 mg/L in August	Occurred at site 2
	Surface Total Nitrogen		0.59 mg/L to 0.84 mg/L	
	Surface Total Phosphorus		0.016 mg/L to 0.039 mg/L	
	Nitrogen to Phosphorus Ratio		26:1	Phosphorus limited

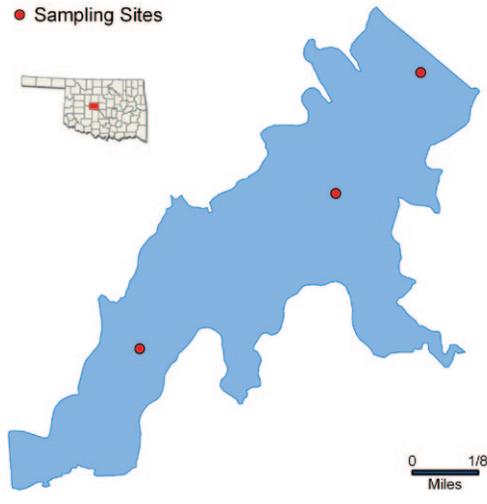
Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En.ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	S	S				
	Aesthetics					S	NS		
	Agriculture						S		
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes The PBCR beneficial use cannot be assessed as minimum data requirement were not met due to QA/QC issues for fecal coliform and enterococci.

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

El Reno



Sample Period	Times Visited	Sampling Sites
November 2006 - August 2007	4	3

Lake Data	Location	Canadian County
	Impoundment	1966
	Area	170 acres
	Capacity	709 acre-feet
	Purposes	Flood Control, Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	36 NTU	50% of values > OWQS of 25 NTU	
	Average True Color	86 units	25% of values > OWQS of 70	
	Average Secchi Disk Depth	35 cm		
	Water Clarity Rating	poor		
	Trophic State Index	65		
	Trophic Class	hypereutrophic		
	Profile	Salinity	0.53 – 0.79 ppt	
		Specific Conductivity	1019 – 1494 μ S/cm	
		pH	8.25 – 8.45 pH units	Slightly alkaline
		Oxidation-Reduction Potential	412 to 435mV	
	Nutrients	Dissolved Oxygen		All DO was > 2 mg/L throughout the study period
		Surface Total Nitrogen	1.39 mg/L to 2.05 mg/L	
		Surface Total Phosphorus	0.093 mg/L to 0.670 mg/L	
Nitrogen to Phosphorus Ratio		6:1	Nitrogen limited or possibly co-limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	S	S				
	Aesthetics					NS	NS		
	Agriculture							S	
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

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 NEI = Not Enough Information

Notes

The PBCR beneficial use cannot be assessed as minimum data requirement were not met due to QA/QC issues for fecal coliform and enterococci.

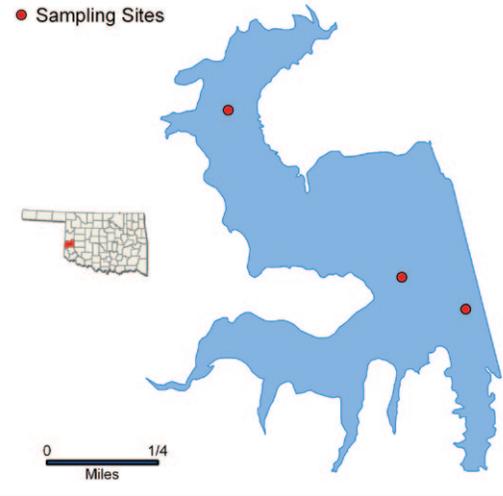
NTU = nephelometric turbidity units
 μ S/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 μ S/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Elk City



Sample Period	Times Visited	Sampling Sites
November 2005 - August 2006	4	3

Lake Data	Location	Beckham County
	Impoundment	1970
	Area	240 acres
	Capacity	2,583 acre-feet
	Purposes	Flood Control, Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	15 NTU	100% of values < OWQS of 25 NTU	
	Average True Color	26 units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	56 cm		
	Water Clarity Rating	Fair to poor		
	Trophic State Index	59		
	Trophic Class	eutrophic		
	Profile	Salinity	0.30– 0.39 ppt	
		Specific Conductivity	593.3 – 749.9 μ S/cm	
		pH	7.70– 8.49 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	374 to 448 mV	
	Nutrients	Dissolved Oxygen	Up to 22% of water column < 2 mg/L in May	
		Surface Total Nitrogen	0.74 mg/L to 1.08 mg/L	
Surface Total Phosphorus		0.037 mg/L to 0.067 mg/L		
Nitrogen to Phosphorus Ratio	17:1	Possibly co-limited		

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	S	S				
	Aesthetics					NS*	S		
	Agriculture						S		
	Primary Body Contact Recreation							S	
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes
 *The lake is listed in the WQS as a NLW indicating that the Aesthetics beneficial use is considered threatened by nutrients until studies can be conducted to confirm non-support status.

NTU = nephelometric turbidity units
 μ S/cm = microsiemens per centimeter
 E. coli = Escherichia coli
 OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a
 mg/L = milligrams per liter
 μ S/cm = microsiemens/cm
 ppt = parts per thousand
 En = Enterococci

Ellsworth



Sample Period	Times Visited	Sampling Sites
October 2006 - July 2007	4	5

Lake Data	Location	Comanche County
	Impoundment	1962
	Area	5,600 acres
	Capacity	95,200 acre-feet
	Purposes	Water Supply, Recreation

Parameters	Parameter		Result	Notes/Comments
	Profile	Average Turbidity	45 NTU	80% of values > OWQS of 25 NTU
		Average True Color	52 units	10% of values > OWQS of 70
		Average Secchi Disk Depth	48 cm	
		Water Clarity Rating	Fair to poor	
		Trophic State Index	56	
		Trophic Class	eutrophic	
	Nutrients	Salinity	0.11 – 0.30 ppt	
		Specific Conductivity	235.1 – 591.6 µS/cm	
		pH	6.86 – 8.28 pH units	Slightly alkaline
		Oxidation-Reduction Potential	110 to 474mV	
		Dissolved Oxygen	Up to 64% of water column < 2 mg/L in July	Occurred at site 1, the dam
		Surface Total Nitrogen	0.57 mg/L to 0.96 mg/L	
		Surface Total Phosphorus	0.056 mg/L to 0.235 mg/L	
		Nitrogen to Phosphorus Ratio	9:1	Phosphorus limited

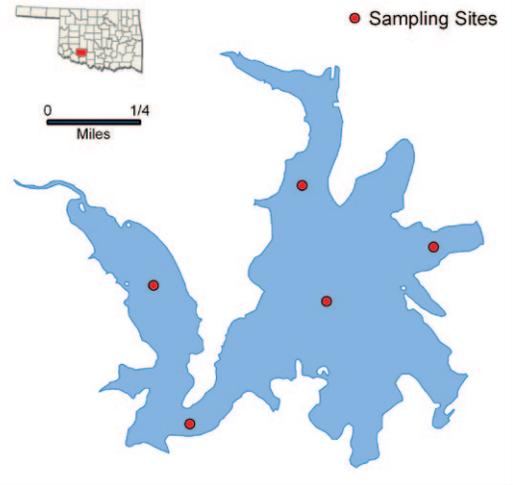
Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	NS	S				
	Aesthetics					S	NS		
	Agriculture						S		
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes The PBCR beneficial use cannot be assessed as minimum data requirement were not met due to QA/QC issues for fecal coliform.

NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli
 OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a
 mg/L = milligrams per liter
 µS/cm = microsiemens/cm
 ppt = parts per thousand
 En = Enterococci

Elmer Thomas



Sample Period	Times Visited	Sampling Sites
October 2006 - July 2007	4	5

Lake Data	Location	Comanche County
	Impoundment	N/A
	Area	334 acres
	Capacity	12,000 acre-feet
	Purposes	Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	2 NTU	100% of values < OWQS of 25 NTU	
	Average True Color	27 units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	175 cm		
	Water Clarity Rating	excellent		
	Trophic State Index	39		
	Trophic Class	oligotrophic		
	Profile	Salinity	0.01 – 0.07 ppt	
		Specific Conductivity	36.2 – 150.6 µS/cm	
		pH	5.43 – 8.13 pH units	38 (15.4%) of values < 6.5 pH units
		Oxidation-Reduction Potential	41 to 522mV	
	Nutrients	Dissolved Oxygen	Up to 76% of water column < 2 mg/L in July	Occurred at sites 1 and 2
		Surface Total Nitrogen	0.31 mg/L to 0.63 mg/L	
Surface Total Phosphorus		0.005 mg/L to 0.015 mg/L		
Nitrogen to Phosphorus Ratio	46:1	Phosphorus limited		

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	NS	NS	S				
	Aesthetics					S	S		
	Agriculture						S		
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes The PBCR beneficial use cannot be assessed as minimum data requirement were not met due to QA/QC issues for E. coli and fecal coliform.

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

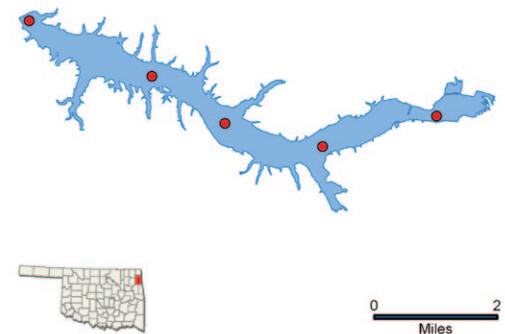
Eucha

● Sampling Sites

Sample Period	Times Visited	Sampling Sites
November 2006 - August 2007	4	5

Lake Data

Location	Delaware County
Impoundment	1952
Area	2,860 acres
Capacity	79,600 acre-feet
Purposes	Water Supply, Recreation



Parameters

Parameter	Result	Notes/Comments
Average Turbidity	4 NTU	100% of values < OWQS of 25 NTU
Average True Color	14 units	100% of values < OWQS of 70
Average Secchi Disk Depth	151 cm	
Water Clarity Rating	excellent	
Trophic State Index	50	
Trophic Class	mesotrophic	
Profile		
Salinity	0.07 – 0.14 ppt	
Specific Conductivity	168.2 – 296.3 µS/cm	
pH	7.15 – 8.76 pH units	Neutral to slightly alkaline
Oxidation-Reduction Potential	63 to 500 mV	
Dissolved Oxygen	Up to 71% of water column < 2 mg/L in August	Occurred at sites 1, the dam
Nutrients		
Surface Total Nitrogen	0.36 mg/L to 3.26 mg/L	
Surface Total Phosphorus	0.007 mg/L to 0.050 mg/L	
Nitrogen to Phosphorus Ratio	71:1	Phosphorus limited

Beneficial Uses

	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E.coli	Chlor-a
Fish & Wildlife Propagation	S	S	NS	S					
Aesthetics					NS	S			
Agriculture							S		
Primary Body Contact Recreation								S	
Public & Private Water Supply									

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

The lake is currently listed as a Nutrient Limited Watershed (NLW) in the Oklahoma Water Quality Standards (WQS) and is considered nutrient threatened.

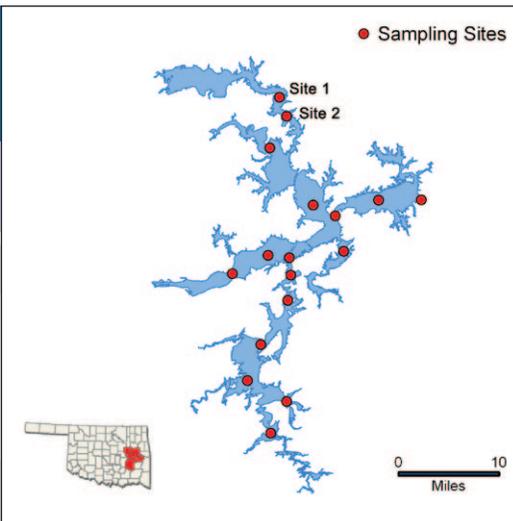
NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Eufaula, Deep Fork Arm (1-2)



Sample Period	Times Visited	Sampling Sites
November 2006 - August 2007	4	17

Lake Data	Location	Haskell County
	Impoundment	1964
	Area	105,500 acres
	Capacity	2,314,600 acre-feet
	Purposes	Water Supply, Flood Control, Hydropower, Sediment Control

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	24 NTU	25% of values > OWQS of 25 NTU	
	Average True Color	71 units	67% of values > OWQS of 70	
	Average Secchi Disk Depth	44 cm		
	Water Clarity Rating	poor		
	Trophic State Index	53		
	Trophic Class	eutrophic		
	Profile	Salinity	0.10 – 0.30 ppt	
		Specific Conductivity	206.4 – 596.1 μ S/cm	
		pH	6.85 – 8.15pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	216 to 302 mV	
	Nutrients	Dissolved Oxygen	Up to 45% of water column < 2 mg/L in August	
		Surface Total Nitrogen	0.68mg/L to 0.93 mg/L	
Surface Total Phosphorus		0.061 mg/L to 0.108 mg/L		
	Nitrogen to Phosphorus Ratio	9:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En.ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NEI	S	S	S				
	Aesthetics					S	NEI		
	Agriculture						S		
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes Although 25% of values exceeded the OWQS for turbidity and 67 % true color, the minimum data requirements were not met and an assessment of the FWP and Aesthetics beneficial use cannot be made for this sample year.

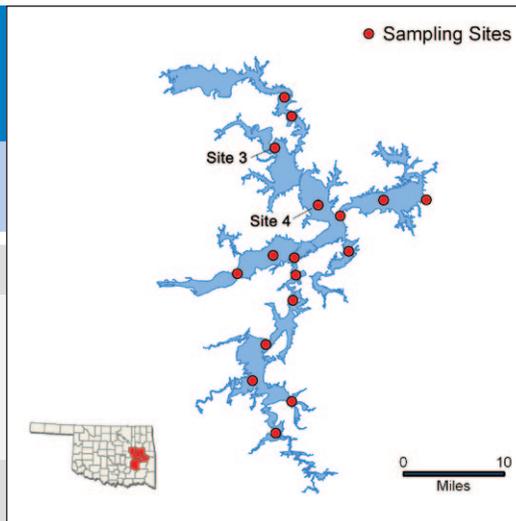
NTU = nephelometric turbidity units
 μ S/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 μ S/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Eufaula, N. Canadian Arm (3-4)



Sample Period	Times Visited	Sampling Sites
November 2006 - August 2007	4	17

Lake Data	Location	Haskell County
	Impoundment	1964
	Area	105,500 acres
	Capacity	2,314,600 acre-feet
	Purposes	Water Supply, Flood Control, Hydropower, Sediment Control

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	27 NTU	25% of values > OWQS of 25 NTU	
	Average True Color	69 units	50% of values > OWQS of 70	
	Average Secchi Disk Depth	49 cm		
	Water Clarity Rating	poor		
	Trophic State Index	55		
	Trophic Class	eutrophic		
	Profile	Salinity	0.13 – 0.30 ppt	
		Specific Conductivity	262.2 – 578.7 µS/cm	
		pH	6.92 – 8.21 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	242 to 328 mV	
	Nutrients	Dissolved Oxygen	Up to 41% of water column < 2 mg/L in August	
		Surface Total Nitrogen	0.66 mg/L to 1.52 mg/L	
Surface Total Phosphorus		0.053 mg/L to 0.146 mg/L		
	Nitrogen to Phosphorus Ratio	11:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En.ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NEI	S	S	S				
	Aesthetics					S	NEI		
	Agriculture						S		
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

Although 25% of values exceeded the OWQS for turbidity and 50% true color, the minimum data requirements were not met and an assessment of the FWP and Aesthetics beneficial use cannot be made for this sample year.

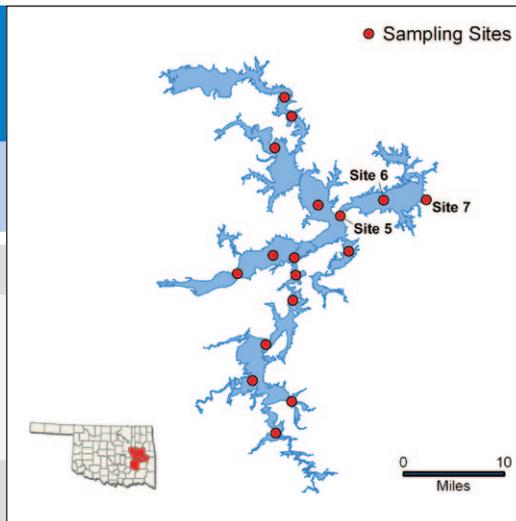
NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Eufaula (5-7)



Sample Period	Times Visited	Sampling Sites
November 2006 - August 2007	4	17

Lake Data	Location	Haskell County
	Impoundment	1964
	Area	105,500 acres
	Capacity	2,314,600 acre-feet
	Purposes	Water Supply, Flood Control, Hydropower, Sediment Control

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	23 NTU	8% of values > OWQS of 25 NTU	
	Average True Color	62 units	25% of values > OWQS of 70	
	Average Secchi Disk Depth	84 cm		
	Water Clarity Rating	Fair to poor		
	Trophic State Index	55		
	Trophic Class	eutrophic		
	Profile	Salinity	0.13 – 0.29 ppt	
		Specific Conductivity	272.8 – 574.9 µS/cm	
		pH	6.95 – 8.16 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	194 to 382 mV	
	Nutrients	Dissolved Oxygen	Up to 55% of water column < 2 mg/L in August	
		Surface Total Nitrogen	0.65 mg/L to 1.46 mg/L	
Surface Total Phosphorus		0.030 mg/L to 0.127 mg/L		
	Nitrogen to Phosphorus Ratio	16:1	Phosphorus limited	

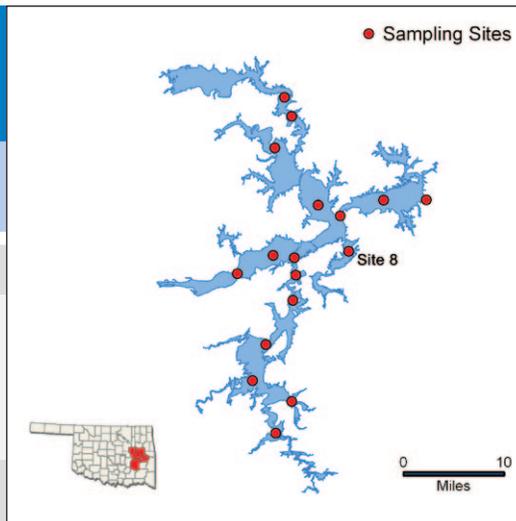
Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NEI	S	NS	S				
	Aesthetics					S	NEI		
	Agriculture						S		
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes Although 8% of values exceeded the OWQS for turbidity and 25% true color, the minimum data requirements were not met and an assessment of the FWP and Aesthetics beneficial use cannot be made for this sample year.

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Eufaula, Longtown Creek Arm (8)



Sample Period	Times Visited	Sampling Sites
November 2006 - August 2007	4	17

Lake Data	Location	Haskell County
	Impoundment	1964
	Area	105,500 acres
	Capacity	2,314,600 acre-feet
	Purposes	Water Supply, Flood Control, Hydropower, Sediment Control

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	8 NTU	100% of values < OWQS of 25 NTU	
	Average True Color	32 units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	86 cm		
	Water Clarity Rating	good		
	Trophic State Index	56		
	Trophic Class	eutrophic		
	Profile	Salinity	0.17– 0.29 ppt	
		Specific Conductivity	339.6 – 567.4 µS/cm	
		pH	6.94 – 8.29 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	186 to 335 mV	
	Nutrients	Dissolved Oxygen	Up to 56% of water column < 2 mg/L in August	
		Surface Total Nitrogen	0.61 mg/L to 1.20 mg/L	
		Surface Total Phosphorus	0.026 mg/L to 0.034 mg/L	
	Nitrogen to Phosphorus Ratio	24:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NEI	S	NS	S				
	Aesthetics					S	NEI		
	Agriculture						S		
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

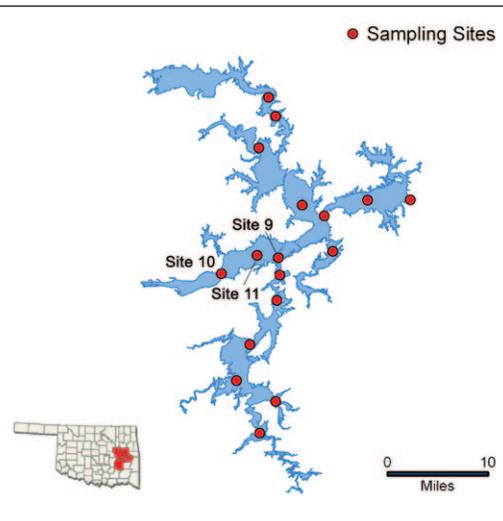
NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Eufaula, Canadian River Arm (9-11)



Sample Period	Times Visited	Sampling Sites
November 2006 - August 2007	4	17

Lake Data	Location	Haskell County
	Impoundment	1964
	Area	105,500 acres
	Capacity	2,314,600 acre-feet
	Purposes	Water Supply, Flood Control, Hydropower, Sediment Control

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	74 NTU	58% of values > OWQS of 25 NTU	
	Average True Color	100 units	50% of values > OWQS of 70	
	Average Secchi Disk Depth	59 cm		
	Water Clarity Rating	poor		
	Trophic State Index	45		
	Trophic Class	mesotrophic		
	Profile	Salinity	0.20– 0.30 ppt	
		Specific Conductivity	346 – 578.9 μ S/cm	
		pH	7.24 – 8.27 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	120 to 450 mV	
	Nutrients	Dissolved Oxygen	Up to 56% of water column < 2 mg/L in August	
		Surface Total Nitrogen	0.74 mg/L to 1.27 mg/L	
Surface Total Phosphorus		0.045 mg/L to 0.220 mg/L		
	Nitrogen to Phosphorus Ratio	11:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NEI	S	NS	S				
	Aesthetics					S	NEI		
	Agriculture						S		
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

Although 58% of values exceeded the OWQS for turbidity and 50% true color, the minimum data requirements were not met and an assessment of the FWP and Aesthetics beneficial use cannot be made for this sample year.

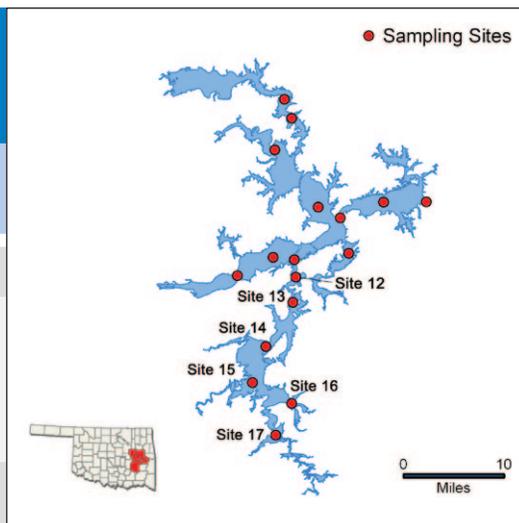
NTU = nephelometric turbidity units
 μ S/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 μ S/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Eufaula, Gaines Creek Arm (12-17)



Sample Period	Times Visited	Sampling Sites
November 2006 - August 2007	4	17

Lake Data	Location	Haskell County
	Impoundment	1964
	Area	105,500 acres
	Capacity	2,314,600 acre-feet
	Purposes	Water Supply, Flood Control, Hydropower, Sediment Control

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	44 NTU	58% of values > OWQS of 25 NTU	
	Average True Color	124 units	63% of values > OWQS of 70	
	Average Secchi Disk Depth	59 cm		
	Water Clarity Rating	Fair to poor		
	Trophic State Index	52		
	Trophic Class	eutrophic		
	Profile	Salinity	0.10– 0.26 ppt	
		Specific Conductivity	339.6 – 567.4 µS/cm	
		pH	6.94 – 8.29 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	27 to 481 mV	
	Dissolved Oxygen	Up to 46% of water column < 2 mg/L in August		
	Nutrients	Surface Total Nitrogen	0.55 mg/L to 2.18 mg/L	
Surface Total Phosphorus		0.030 mg/L to 0.129 mg/L		
Nitrogen to Phosphorus Ratio		13:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	S	S				
	Aesthetics					S	NS		
	Agriculture						S		
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

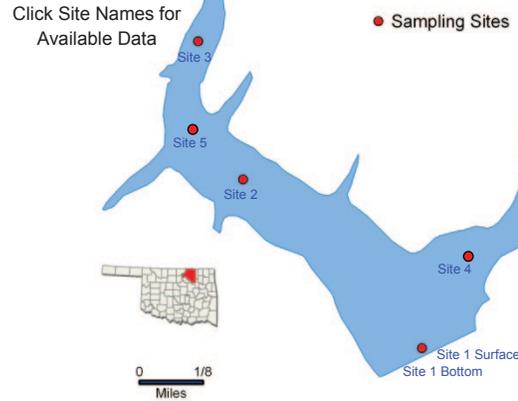
NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Fairfax



Sample Period	Times Visited	Sampling Sites
March 2011 – September 2011	4	5

General	Location	Osage County	Click map for site data
	Impoundment	1936	
	Area	111 acres	
	Capacity	1,795 acre-feet	
	Purposes	Water Supply, Recreation	

Parameters	In Situ	Parameter (<i>Descriptions</i>)	Result	Notes/Comments
		Average Turbidity	11 NTU	100% of values < OWQS of 25 NTU
		Average Secchi Disk Depth	87 cm	
		Water Clarity Rating	good	
		Chlorophyll-a	12 mg/m ³	
		Trophic State Index	55	Previous Value= 57
	Trophic Class	Eutrophic		
	Profile	Salinity	0.12– 0.2 ppt	
		Specific Conductivity	243.9 – 400.4 μS/cm	
		pH	7.08 – 8.36 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	-23 – 473 mV	
		Dissolved Oxygen	Up to 40% of water column < 2 mg/L in summer	
	Nutrients	Surface Total Nitrogen	0.46 mg/L to 0.73 mg/L	
		Surface Total Phosphorus	0.025 mg/L to 0.033 mg/L	
		Nitrogen to Phosphorus Ratio	22:1	Phosphorus limited

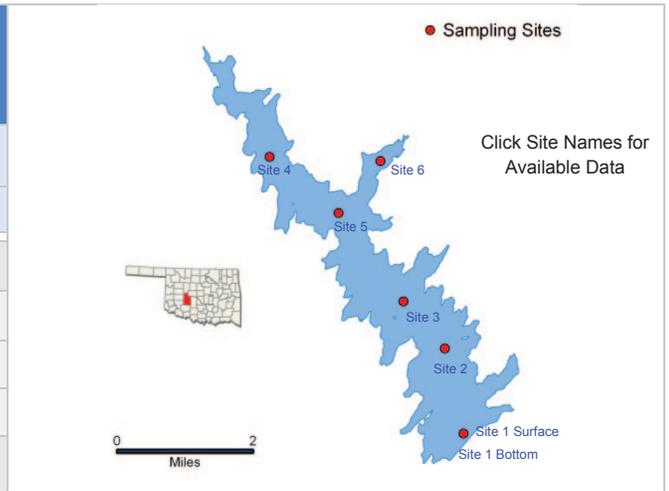
Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enterro. & E. coli	Chlor-a
	Fish & Wildlife Propagation	NEI	S	S	S							
	Aesthetics					S	*					
	Agriculture							S	S	S		
	Primary Body Contact Recreation										NEI	
	Public & Private Water Supply											
S = Fully Supporting NS = Not Supporting NEI = Not Enough Information		Notes	*Did not collect for this parameter. Although all turbidity values are <25 NTU, The FWP beneficial use cannot be assessed for this sample year as minimum data requirements were not met. The PBCR use cannot be assessed as minimum data requirements were not met due to QA/QC issue for Enterococci.									

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 μS/cm = microsiemens per centimeter mV = millivolts μS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Ft. Cobb

Sample Period	Times Visited	Sampling Sites
October 2010 - June 2011	4	6

General	Location	Caddo County	Click map for site data
	Impoundment	1959	
	Area	4,100 acres	
	Capacity	80,010 acre-feet	
	Purposes	Flood Control, Water Supply, Fish & Wildlife, Recreation	

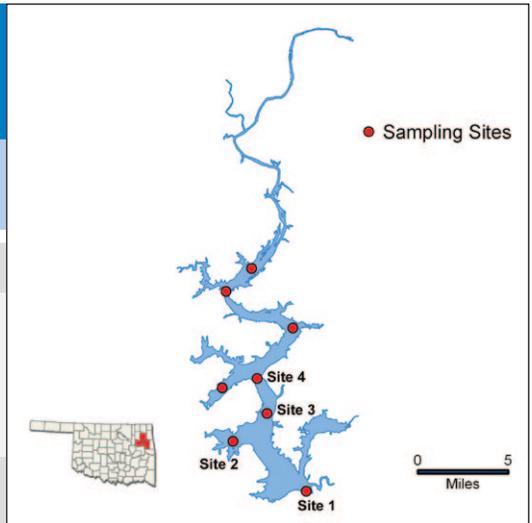


Parameters	In-Situ	Parameter (<i>Descriptions</i>)	Result	Notes/Comments
		Average Turbidity	13 NTU	11% of values > OWQS of 25 NTU (n=24)
		Average Secchi Disk Depth	55 cm	
		Water Clarity Rating	Good	
		Chlorophyll-a	31 mg/m ³	
		Trophic State Index	64	Previous value =65
	Trophic Class	Hypereutrophic		
	Profile	Salinity	0.11– 0.29 ppt	
		Specific Conductivity	241.6 – 565.4 μS/cm	
		pH	7.3 – 9.09 pH units	0.97% of values > 9 pH units.
		Oxidation-Reduction Potential	269 – 511 mV	
		Dissolved Oxygen	All data are above screening level	
	Nutrients	Surface Total Nitrogen	0.8 mg/L to 1.26 mg/L	
		Surface Total Phosphorus	0.063 mg/L to 0.123 mg/L	
		Nitrogen to Phosphorus Ratio	13:1	Phosphorus limited

Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enterococci & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	S	S							
	Aesthetics					NS*	*					
	Agriculture							S	S	S		
	Primary Body Contact Recreation										S	
	Public & Private Water Supply											NS
S = Fully Supporting NS = Not Supporting NEI = Not Enough Information		Notes *Did not collect for these parameters. *The lake is listed in the WQS as a NLW indicating that the Aesthetics beneficial use is considered threatened by nutrients until studies can be conducted to confirm non-support status.										

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 μS/cm = microsiemens per centimeter mV = millivolts μS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Fort Gibson, Lower (1-4)



Sample Period	Times Visited	Sampling Sites
October 2006 - July 2007	4	8

Lake Data	Location	Cherokee County
	Impoundment	1953
	Area	19,900 acres
	Capacity	365,200 acre-feet
	Purposes	Hydropower and Flood Control

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	7 NTU	100% of values < OWQS of 25 NTU	
	Average True Color	32 units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	86 cm		
	Water Clarity Rating	good		
	Trophic State Index	60		
	Trophic Class	eutrophic		
	Profile	Salinity	0.07– 0.15 ppt	
		Specific Conductivity	168.8 – 303.9 µS/cm	
		pH	6.26 – 8.79 pH units	12% of values < 6.5 pH units
		Oxidation-Reduction Potential	2 to 403 mV	
		Dissolved Oxygen	Up to 82% of water column < 2 mg/L in July	Occurred at site 3
	Nutrients	Surface Total Nitrogen	0.62 mg/L to 1.43 mg/L	
		Surface Total Phosphorus	0.038 mg/L to 0.125 mg/L	
Nitrogen to Phosphorus Ratio		11:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	NS	S				
	Aesthetics					NS	S		
	Agriculture						S		
	Primary Body Contact Recreation							S	
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

The lake is currently listed in the Oklahoma Water Quality Standards (WQS) as a Nutrient Limited Watershed (NLW). This listing means that the lake is considered threatened from nutrients until a more intensive study can confirm the Aesthetics beneficial use non-support status.

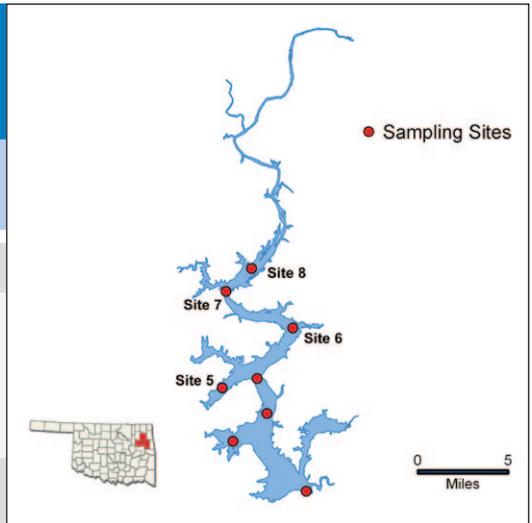
NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Fort Gibson, Upper (5-8)



Sample Period	Times Visited	Sampling Sites
October 2006 - July 2007	4	8

Lake Data	Location	Cherokee County
	Impoundment	1953
	Area	19,900 acres
	Capacity	365,200 acre-feet
	Purposes	Hydropower and Flood Control

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	10 NTU	100% of values < OWQS of 25 NTU	
	Average True Color	33 units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	73 cm		
	Water Clarity Rating	good		
	Trophic State Index	61		
	Trophic Class	hypereutrophic		
	Profile	Salinity	0.07– 0.15 ppt	
		Specific Conductivity	164.9 – 351.1 µS/cm	
		pH	6.04 – 8.91 pH units	16.5% of values < 6.5 pH units
		Oxidation-Reduction Potential	6 to 382 mV	
		Dissolved Oxygen	Up to 79% of water column < 2 mg/L in July	Occurred at site 6
	Nutrients	Surface Total Nitrogen	0.62 mg/L to 1.50 mg/L	
Surface Total Phosphorus		0.034 mg/L to 0.261 mg/L		
Nitrogen to Phosphorus Ratio		8:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	NS	S				
	Aesthetics					NS	S		
	Agriculture						S		
	Primary Body Contact Recreation							S	
	Public & Private Water Supply								

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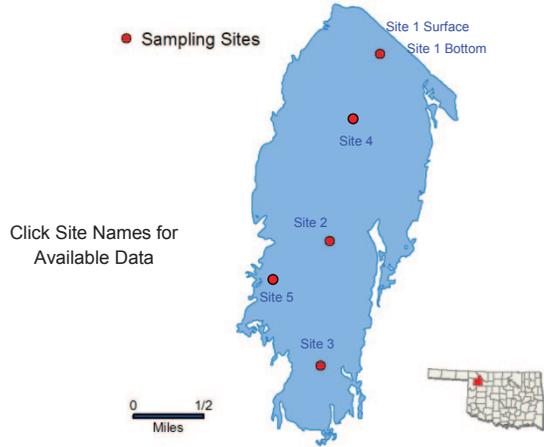
Notes The lake is currently listed in the Oklahoma Water Quality Standards (WQS) as a Nutrient Limited Watershed (NLW). This listing means that the lake is considered threatened from nutrients until a more intensive study can confirm the Aesthetics beneficial use non-support status.

NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli
 OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a
 mg/L = milligrams per liter
 µS/cm = microsiemens/cm
 ppt = parts per thousand
 En = Enterococci

Ft. Supply

Sample Period	Times Visited	Sampling Sites
November 2010 - July 2011	4	5

General	Location	Woodward County	Click map for site data
	Impoundment	1942	
	Area	1,820 acres	
	Capacity	13,900 acre-feet	
	Purposes	Flood Control, Conservation Purposes	



Parameters	Parameter (<i>Descriptions</i>)		Result	Notes/Comments	
	In-Situ	Average Turbidity		59 NTU	53% of values > OWQS of 25 NTU
		Average Secchi Disk Depth		26 cm	
		Water Clarity Rating		Fair to Poor	
		Chlorophyll-a		18 mg/m ³	
		Trophic State Index		59	Previous value = 58
		Trophic Class		Eutrophic	
	Profile	Salinity		0.51 – 0.64 ppt	
		Specific Conductivity		983 – 1217 µS/cm	
		pH		7.53 – 10.36 pH units	Only 2.2% of values > 9 pH units
		Oxidation-Reduction Potential		212 – 617 mV	
		Dissolved Oxygen		All data are above screening level of 2.0 mg/L	
	Nutrients	Surface Total Nitrogen		0.5 mg/L to 1.37 mg/L	
		Surface Total Phosphorus		0.037 mg/L to 0.119 mg/L	
		Nitrogen to Phosphorus Ratio		11:1	Possibly co-limited

Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	En & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	S	S							
	Aesthetics					NS*	*					
	Agriculture							S	S	S		
	Primary Body Contact Recreation										NEI	
	Public & Private Water Supply											NS

Notes
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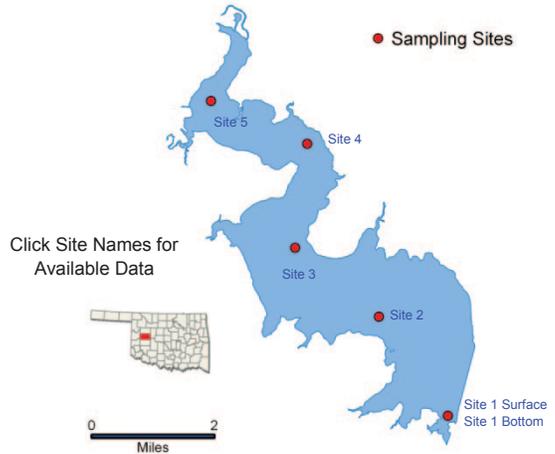
*Did not collect for these parameters. *The lake is listed in the WQS as a NLW indicating that the Aesthetics beneficial use is considered threatened by nutrients until studies can be conducted to confirm non-support status. The PBCR beneficial use cannot be assessed as minimum data requirement were not met due to QA/QC issues for *E. coli* and enterococci.

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Foss

Sample Period	Times Visited	Sampling Sites
October 2010 – July 2011	4	5

General	Location	Custer County	Click map for site data
	Impoundment	1961	
	Area	8,800 acres	
	Capacity	256,220 acre-feet	
	Purposes	Recreation	



Parameters		Parameter (<i>Descriptions</i>)	Result	Notes/Comments
		In-Situ	Average Turbidity	11 NTU
Average Secchi Disk Depth	98 cm			
Water Clarity Rating	Good			
Chlorophyll-a	7 mg/m ³			
Trophic State Index	49		Previous Value= 52	
Trophic Class	Mesotrophic			
Profile	Salinity	1.07– 1.23 ppt		
	Specific Conductivity	1994 –2297 µS/cm		
	pH	6.69 – 8.28 pH units		
	Oxidation-Reduction Potential	234– 663 mV		
	Dissolved Oxygen	Up to 50% < 2 mg/L in summer		
Nutrients	Surface Total Nitrogen	0.46 mg/L to 0.72 mg/L		
	Surface Total Phosphorus	0.011 mg/L to 0.038 mg/L		
	Nitrogen to Phosphorus Ratio	26:1	Phosphorus limited	

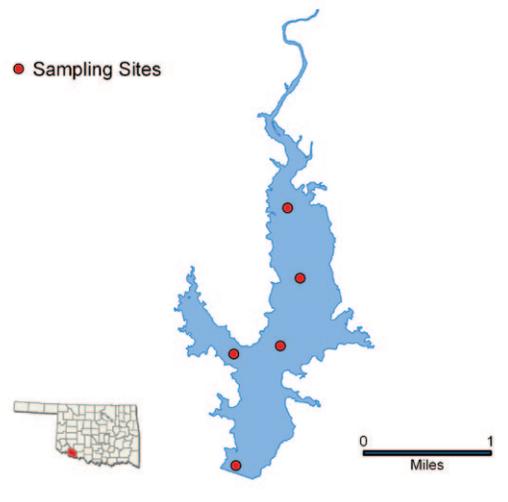
Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enterro. & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	S	S							
	Aesthetics					S	*					
	Agriculture							S	S	S		
	Primary Body Contact Recreation										NEI	
	Public & Private Water Supply											

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Notes *Did not collect for this parameter. The PBCR beneficial use cannot be assessed as minimum data requirement were not met due to QA/QC issues for *E.coli* and enterococci.

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Frederick



Sample Period	Times Visited	Sampling Sites
November 2006 - August 2007	4	5

Lake Data	Location	Tillman County
	Impoundment	1974
	Area	925 acres
	Capacity	9,526 acre-feet
	Purposes	Water Supply, Recreation and Flood Control

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	59 NTU	100% of values > OWQS of 25 NTU	
	Average True Color	83 units	50% of values > OWQS of 70	
	Average Secchi Disk Depth	26 cm		
	Water Clarity Rating	poor		
	Trophic State Index	57		
	Trophic Class	eutrophic		
	Profile	Salinity	0.12– 0.31 ppt	
		Specific Conductivity	245.5 – 614 µS/cm	
		pH	7.61 – 8.61 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	47 to 394 mV	
	Nutrients	Dissolved Oxygen	Up to 36% of water column < 2 mg/L in August	
		Surface Total Nitrogen	0.74 mg/L to 1.09 mg/L	
Surface Total Phosphorus		0.023 mg/L to 0.069 mg/L		
	Nitrogen to Phosphorus Ratio	21:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	S	S				
	Aesthetics					S	NS		
	Agriculture						S		
	Primary Body Contact Recreation							S	
	Public & Private Water Supply								

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Notes

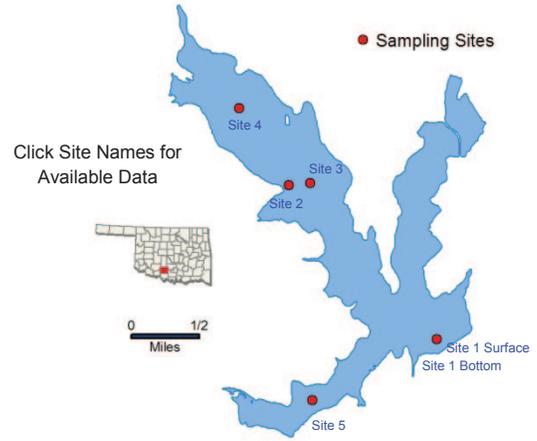
NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Fuqua



Sample Period		Times Visited	Sampling Sites
December 2010 - August 2011		4	5
General	Location	Stephens County	Click map for site data
	Impoundment	1953	
	Area	1,500 acres	
	Capacity	21,100 acre-feet	
	Purposes	Water Supply, Recreation and Flood Control	

Parameters		Parameter (<i>Descriptions</i>)	Result	Notes/Comments
		In-Situ	Average Turbidity	14 NTU
Average Secchi Disk Depth	87 cm			
Water Clarity Rating	Average			
Chlorophyll-a	14 mg/m3			
Trophic State Index	57		Previous Value= 52	
Trophic Class	Eutrophic			
Profile	Salinity	0.27– 0.33 ppt		
	Specific Conductivity	529.4 – 647.5 µS/cm		
	pH	6.69 – 8.74 pH units		
	Oxidation-Reduction Potential	-89 - 434 mV		
	Dissolved Oxygen	Up to 40% of water column < 2 mg/L in summer		
Nutrients	Surface Total Nitrogen	0.33 mg/L to 0.97 mg/L		
	Surface Total Phosphorus	0.010 mg/L to 0.047 mg/L		
	Nitrogen to Phosphorus Ratio	27:1	Phosphorus limited	

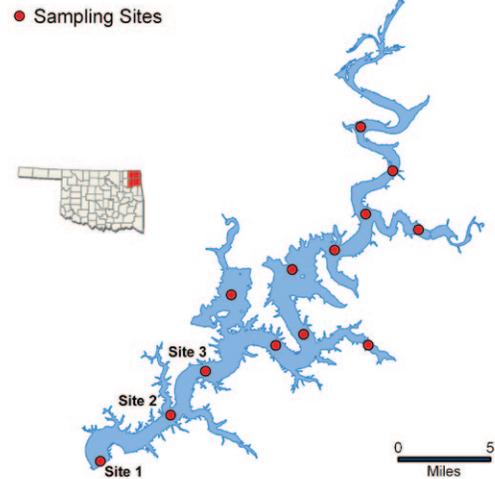
Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enterococci & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	S	S							
	Aesthetics					S	*					
	Agriculture							S	S	S		
	Primary Body Contact Recreation										NEI	
	Public & Private Water Supply											

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NS = Not Supporting
NEI = Not Enough Information

Notes The PBCR beneficial use cannot be assessed as minimum data requirement were not met due to QA/QC issues for enterococci. * did not collect for these parameters.

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Grand, Lower Lake (1-3)



Sample Period	Times Visited	Sampling Sites
November 2005 - August 2006	4	13

Lake Data	Location	Mayes County
	Impoundment	1940
	Area	46,500 acres
	Capacity	1,672,000 acre-feet
	Purposes	Flood Control, Hydropower

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	5 NTU	100% of values < OWQS of 25 NTU	
	Average True Color	21 units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	134 cm		
	Water Clarity Rating	excellent		
	Trophic State Index	50		
	Trophic Class	eutrophic		
	Profile	Salinity	0.13– 0.19 ppt	
		Specific Conductivity	264 – 374 μ S/cm	
		pH	7.07– 8.68 pH units	
		Oxidation-Reduction Potential	289 to 460 mV	
	Nutrients	Dissolved Oxygen	Up to 62% of water column < 2 mg/L in August	
		Surface Total Nitrogen	0.46 mg/L to 0.77 mg/L	
Surface Total Phosphorus		0.023 mg/L to 0.107 mg/L		
Nitrogen to Phosphorus Ratio	10:1	Phosphorus limited or possibly co-limited		

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En.ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	NS	S				
	Aesthetics					S	S		
	Agriculture						S		
	Primary Body Contact Recreation							S	
	Public & Private Water Supply								

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 NEI = Not Enough Information

Notes

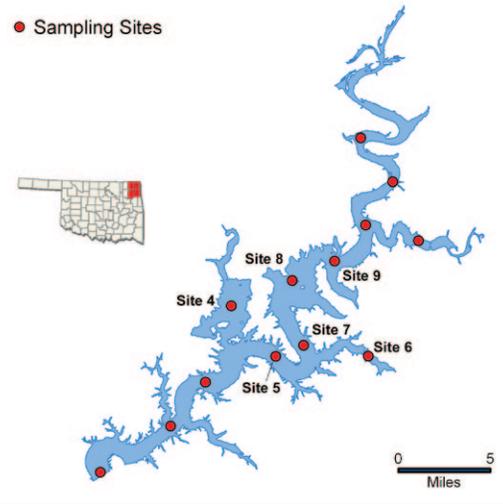
NTU = nephelometric turbidity units
 μ S/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 μ S/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Grand, Mid Lake (4-9)



	Sample Period	Times Visited	Sampling Sites
	November 2005 - August 2006	4	13

Lake Data	Location	Mayes County
	Impoundment	1940
	Area	46,500 acres
	Capacity	1,672,000 acre-feet
	Purposes	Flood Control, Hydropower

Parameters	Parameter		Result	Notes/Comments
	Profile	Average Turbidity	9 NTU	100% of values < OWQS of 25 NTU
		Average True Color	25 units	100% of values < OWQS of 70
		Average Secchi Disk Depth	91 cm	
		Water Clarity Rating	Average to good	
		Trophic State Index	60	
		Trophic Class	eutrophic	
		Salinity	0.11– 0.15ppt	
	Nutrients	Specific Conductivity	235.5 – 354 μS/cm	
		pH	6.53– 8.59 pH units	
		Oxidation-Reduction Potential	62 to 469 mV	
		Dissolved Oxygen	Up to 43% of water column < 2 mg/L in August	
		Nitrogen to Phosphorus Ratio	9:1	Phosphorus limited or possibly co-limited

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	S	S				
	Aesthetics					S	S		
	Agriculture							S	
	Primary Body Contact Recreation								S
	Public & Private Water Supply								

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Notes

NTU = nephelometric turbidity units
 μS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

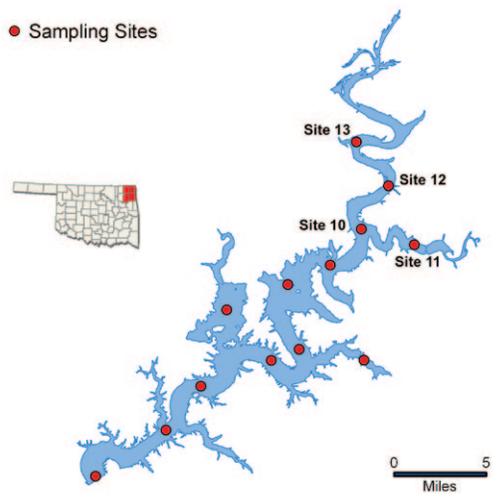
OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 μS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Grand, Upper Lake (10-13)

● Sampling Sites



Sample Period	Times Visited	Sampling Sites
November 2005 - August 2006	4	13

Lake Data	Location	Mayes County
	Impoundment	1940
	Area	46,500 acres
	Capacity	1,672,000 acre-feet
	Purposes	Flood Control, Hydropower

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	13 NTU	100% of values < OWQS of 25 NTU	
	Average True Color	25 units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	69 cm		
	Water Clarity Rating	average		
	Trophic State Index	62		
	Trophic Class	hypereutrophic		
	Profile	Salinity	0.11– 0.23 ppt	
		Specific Conductivity	233.4 – 453.7 μS/cm	
		pH	6.75– 8.34 pH units	
		Oxidation-Reduction Potential	331 to 423 mV	
	Nutrients	Dissolved Oxygen	Up to 43% of water column < 2 mg/L in August	
		Surface Total Nitrogen	0.45 mg/L to 1.79 mg/L	
Surface Total Phosphorus		0.040 mg/L to 0.212 mg/L		
	Nitrogen to Phosphorus Ratio	8:1	Phosphorus limited or possibly co-limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En. cal. coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	S	S				
	Aesthetics					S	S		
	Agriculture							S	
	Primary Body Contact Recreation								S
	Public & Private Water Supply								

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Notes

NTU = nephelometric turbidity units
 μS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

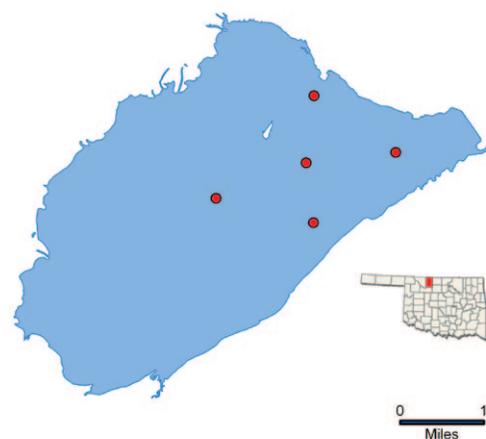
OWQS = Oklahoma Water Quality Standards
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 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 μS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Great Salt Plains

● Sampling Sites



Sample Period	Times Visited	Sampling Sites
October 2005 – July 2006	2	5

Lake Data	Location	Alfalfa County
	Impoundment	1941
	Area	8,690 acres
	Capacity	31,420 acre-feet
	Purposes	Flood Control, Conservation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	193 NTU	98% of values > OWQS of 25 NTU	
	Average True Color	62 units	17% of values > OWQS of 70	
	Average Secchi Disk Depth	10 cm		
	Water Clarity Rating	poor		
	Trophic State Index	71		
	Trophic Class	hypereutrophic		
	Profile	Salinity	0.02– 5.67 ppt	
		Specific Conductivity	494.6 – 10,016 μ S/cm	
		pH	5.11 – 8.80 pH units	Only 6.4% of values < 6.5 pH units
Oxidation-Reduction Potential		93 to 490 mV		
Dissolved Oxygen			Not stratified at any sampling event	
Nutrients	Surface Total Nitrogen	0.75 mg/L to 2.85 mg/L		
	Surface Total Phosphorus	0.046 mg/L to 1.783 mg/L		
	Nitrogen to Phosphorus Ratio	6:1	Nitrogen limited or possibly co-limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	S	S				
	Aesthetics					NS*	S		
	Agriculture							NS**	
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

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Notes

*The lake is listed in the WQS as a NLW indicating that the Aesthetics beneficial use is considered threatened by nutrients until studies can be conducted to confirm non-support status.
 ** Because the extremely high chloride conditions are due to natural conditions, the OWRB is looking into site-specific criteria for this waterbody.

NTU = nephelometric turbidity units
 μ S/cm = microsiemens per centimeter
 E. coli = Escherichia coli

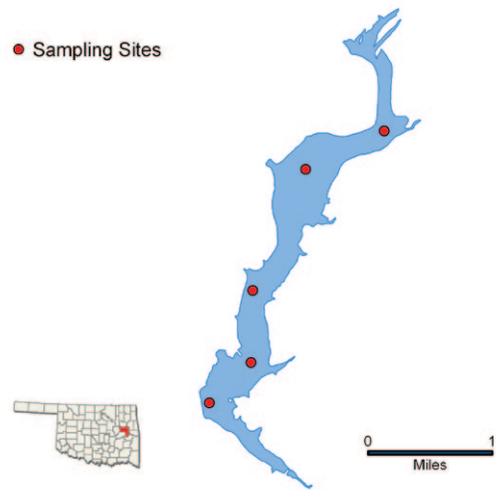
OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 μ S/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Greenleaf

● Sampling Sites



Sample Period	Times Visited	Sampling Sites
November 2005 – Sept. 2006	4	5

Lake Data	Location	Muskogee County
	Impoundment	1939
	Area	920 acres
	Capacity	14,720 acre-feet
	Purposes	Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	7 NTU	100% of values < OWQS of 25 NTU	
	Average True Color	15 units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	111 cm		
	Water Clarity Rating	good		
	Trophic State Index	52		
	Trophic Class	eutrophic		
	Profile	Salinity	0.06– 0.14 ppt	
		Specific Conductivity	143.6 – 297 µS/cm	
		pH	6.81 – 8.31 pH units	
		Oxidation-Reduction Potential	55 to 511 mV	
		Dissolved Oxygen	Up to 71% of water column < 2 mg/L in September	
	Nutrients	Surface Total Nitrogen	0.42 mg/L to 0.83 mg/L	
		Surface Total Phosphorus	0.025 mg/L to 0.067 mg/L	
Nitrogen to Phosphorus Ratio		15:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	NS	S				
	Aesthetics					S	S		
	Agriculture							S	
	Primary Body Contact Recreation								S
	Public & Private Water Supply								

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Notes

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 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

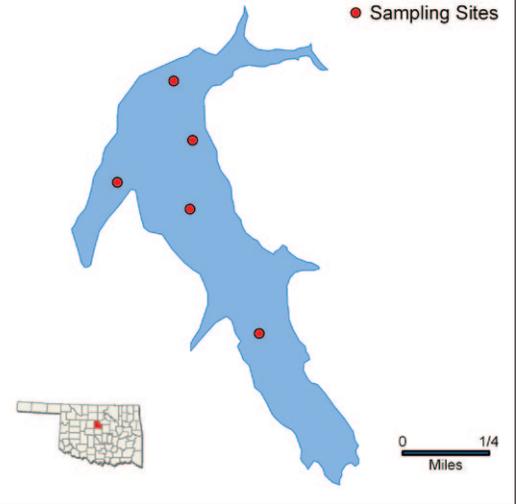
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 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Guthrie

● Sampling Sites



Sample Period	Times Visited	Sampling Sites
October 2005 – July 2006	4	5

Lake Data	Location	Logan County
	Impoundment	1919
	Area	274 acres
	Capacity	3,875 acre-feet
	Purposes	Water Supply, Recreation

Parameters	Parameter		Result	Notes/Comments
	Profile	Average Turbidity	19 NTU	20% of values > OWQS of 25 NTU
		Average True Color	21 units	100% of values < OWQS of 70
		Average Secchi Disk Depth	52 cm	
		Water Clarity Rating	Average to good	
		Trophic State Index	61	
		Trophic Class	hypereutrophic	
	Nutrients	Salinity	0.32– 0.43 ppt	
		Specific Conductivity	623.1 – 821 µS/cm	
		pH	7.78 – 8.21 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	357 to 470 mV	
		Dissolved Oxygen		Not stratified during any sampling interval
		Surface Total Nitrogen	0.61 mg/L to 1.33 mg/L	
Surface Total Phosphorus		0.041mg/L to 0.103 mg/L		
Nitrogen to Phosphorus Ratio	15:1	Phosphorus limited		

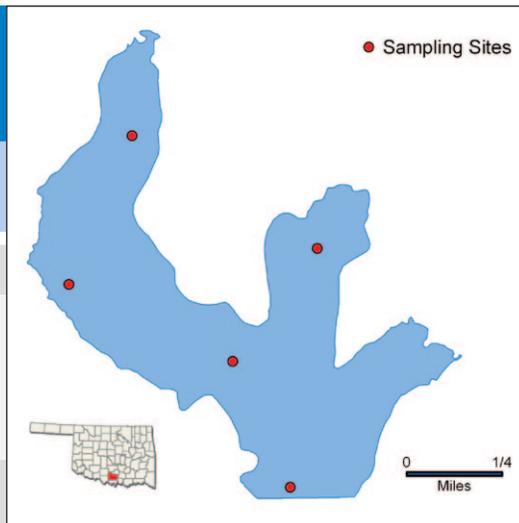
Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En.ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S*	S	S	S				
	Aesthetics					S	S		
	Agriculture						S		
	Primary Body Contact Recreation							S	
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes * Although 20% of the collected turbidity values exceeded the QWS of 25 NTU, available flow and rainfall data suggest that the peak in turbidity, which occurred in October, is likely due to seasonal storm events. Therefore, the lake will be listed as supporting its FWP use.

NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli
 OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a
 mg/L = milligrams per liter
 µS/cm = microsiemens/cm
 ppt = parts per thousand
 En = Enterococci

Healdton City



Sample Period	Times Visited	Sampling Sites
November 2005 – August 2006	4	5

Lake Data	Location	Carter County
	Impoundment	1979
	Area	370 acres
	Capacity	3,766 acre-feet
	Purposes	Water Supply, Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	48 NTU	100% of values > OWQS of 25 NTU	
	Average True Color	159 units	100% of values > OWQS of 70	
	Average Secchi Disk Depth	34 cm		
	Water Clarity Rating	poor		
	Trophic State Index	49		
	Trophic Class	mesotrophic		
	Profile	Salinity	0.13– 0.19 ppt	
		Specific Conductivity	275.6 – 378.5 µS/cm	
		pH	7.05 – 7.86 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	304 to 450 mV	
	Nutrients	Dissolved Oxygen	Up to 33% of water column < 2 mg/L in August	
		Surface Total Nitrogen	0.59 mg/L to 0.94 mg/L	
Surface Total Phosphorus		0.043 mg/L to 0.100 mg/L		
	Nitrogen to Phosphorus Ratio	11:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS*	S	S	S				
	Aesthetics					S	NS*		
	Agriculture						S		
	Primary Body Contact Recreation								NEI*
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

* Due to inclement weather conditions all sites could not be sample in May, therefore an assessment cannot be made for turbidity, true color or bacteria as minimum data requirements were not met.

NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

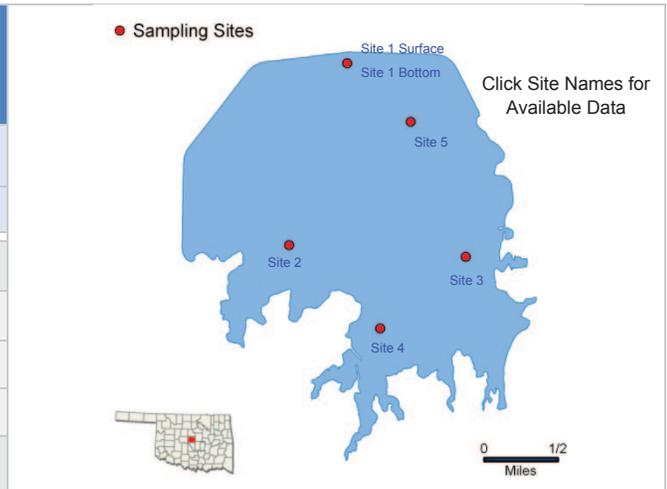
mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Hefner

Sample Period	Times Visited	Sampling Sites
October 2010 – June 2011	4	5

General	Location	Oklahoma County	Click map for site data
	Impoundment	1947	
	Area	2,500 acres	
	Capacity	75,000 acre-feet	
	Purposes	Water Supply, Recreation	



Parameters	Parameter (<i>Descriptions</i>)		Result	Notes/Comments	
	In-Situ	Average Turbidity		9 NTU	100% of values < OWQS of 25 NTU
		Average Secchi Disk Depth		67 cm	
		Water Clarity Rating		Good	
		Chlorophyll-a		26 mg/m3	
		Trophic State Index		63	Previous Value= 63
		Trophic Class		Hypereutrophic	
	Profile	Salinity		0.55– 0.65 ppt	
		Specific Conductivity		1042 – 1237 µS/cm	
		pH		7.76 – 8.63 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential		317 – 505 mV	
		Dissolved Oxygen		Up to 6% of water column < 2 mg/L in summer	
	Nutrients	Surface Total Nitrogen		0.75 mg/L to 1.04 mg/L	
		Surface Total Phosphorus		0.054mg/L to 0.104 mg/L	
		Nitrogen to Phosphorus Ratio		12:1	Phosphorus limited

Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enterro. & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	S	S							
	Aesthetics					NS	*					
	Agriculture							S	S	S		
	Primary Body Contact Recreation										NEI	
	Public & Private Water Supply											

S = Fully Supporting
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NEI = Not Enough Information

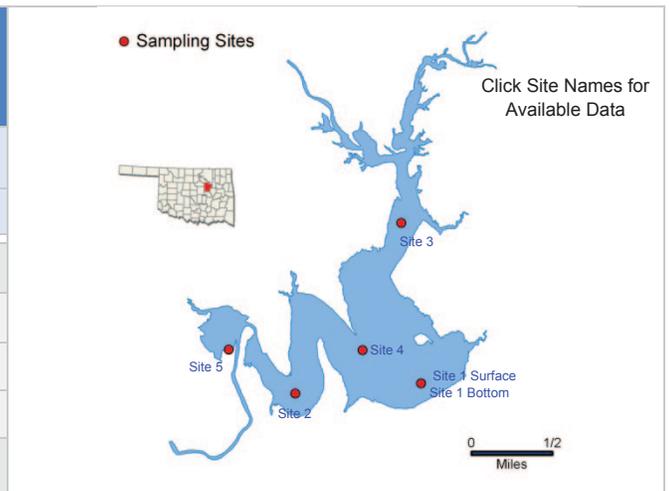
Notes The PBCR beneficial use cannot be assessed as minimum data requirement were not met due to QA/QC issues for *E.coli* and enterococci. * This parameter not collected for.

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Heyburn

Sample Period	Times Visited	Sampling Sites
December 2010 - July 2011	4	5

General	Location	Creek County	Click map for site data
	Impoundment	1950	
	Area	880 acres	
	Capacity	7,105 acre-feet	
	Purposes	Flood Control and Conservation	



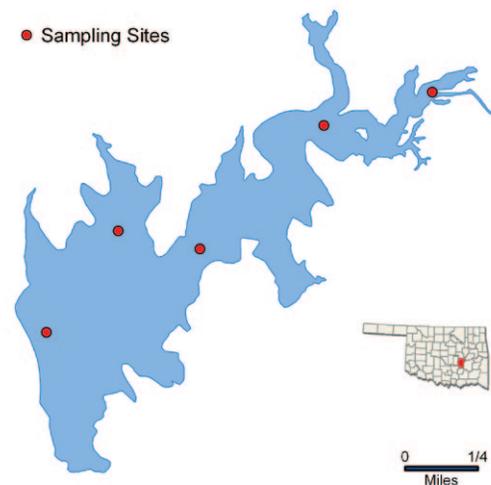
		Parameter (<i>Descriptions</i>)	Result	Notes/Comments
Parameters	In-Situ	Average Turbidity	53 NTU	42% of values > 25 NTU (n=16)
		Average Secchi Disk Depth	59 cm	75% of values > OWQS of 70
		Water Clarity Rating	Fair	
		Chlorophyll-a	6 mg/m3	
		Trophic State Index	49	Previous value = 49
		Trophic Class	Mesotrophic	
	Profile	Salinity	0.08 - 0.16 ppt	
		Specific Conductivity	181.2 – 323.6 µS/cm	
		pH	6.64 – 7.74 pH units	Neutral
		Oxidation-Reduction Potential	215 to 607 mV	
		Dissolved Oxygen	Up to 60% of water column < 2 mg/L in summer	
	Nutrients	Surface Total Nitrogen	0.27 mg/L to 0.97 mg/L	
Surface Total Phosphorus		0.009 mg/L to 0.087 mg/L		
Nitrogen to Phosphorus Ratio		13:1	Phosphorus limited	

Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enterococci & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	S	S							
	Aesthetics					S	*					
	Agriculture							S	S	S		
	Primary Body Contact Recreation										NEI	
	Public & Private Water Supply											
<i>S = Fully Supporting</i> <i>NS = Not Supporting</i> <i>NEI = Not Enough Information</i>		Notes	* Did not collect for this parameter. The PBCR beneficial use cannot be assessed as minimum data requirement were not met due to QA/QC issues for enterococci.									

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Holdenville

● Sampling Sites



Sample Period	Times Visited	Sampling Sites
October 2006 - July 2007	3	5

Lake Data	Location	Hughes County
	Impoundment	1931
	Area	550 acres
	Capacity	11,000 acre-feet
	Purposes	Water Supply, Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	16 NTU	20% of values > OWQS of 25 NTU	
	Average True Color	42 units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	75 cm		
	Water Clarity Rating	Average to good		
	Trophic State Index	60		
	Trophic Class	eutrophic		
	Profile	Salinity	0.06– 0.19 ppt	
		Specific Conductivity	141.6 – 391.7 µS/cm	
		pH	6.10 – 8.26 pH units	11% of values < 6.5 pH units
		Oxidation-Reduction Potential	2 to 435 mV	
		Dissolved Oxygen	Up to 83% of water column < 2 mg/L in July	
	Nutrients	Surface Total Nitrogen	0.57 mg/L to 1.01 mg/L	
Surface Total Phosphorus		0.015 mg/L to 0.067 mg/L		
Nitrogen to Phosphorus Ratio		21:1	Phosphorus limited	

Beneficial Uses		Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	NS	NS	S					
	Aesthetics					S	S			
	Agriculture							S		
	Primary Body Contact Recreation									NEI
	Public & Private Water Supply									

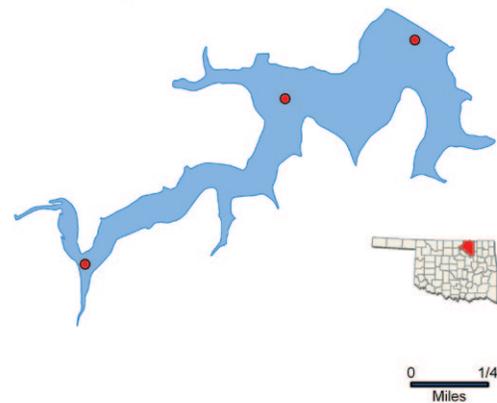
S = Fully Supporting
 NS = Not Supporting
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Notes Although 20% of the samples collected in 2006-2007 were above the standard, minimum data requirements were not met therefore assessment of the Fish & Wildlife Propagation (FWP) beneficial cannot be made at this time.

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Hominy Municipal

● Sampling Sites



Sample Period	Times Visited	Sampling Sites
November 2006 - August 2007	3	3

Lake Data	Location	Osage County
	Impoundment	1940
	Area	165 acres
	Capacity	5,000 acre-feet
	Purposes	Water Supply, Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	9 NTU	100% of values < OWQS of 25 NTU	
	Average True Color	35 units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	101 cm		
	Water Clarity Rating	excellent		
	Trophic State Index	56		
	Trophic Class	eutrophic		
	Profile	Salinity	0.10– 0.14 ppt	
		Specific Conductivity	224 – 297.7 μS/cm	
		pH	7.12 – 8.66 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	-22 to 430 mV	
	Nutrients	Dissolved Oxygen	Up to 62% of water column < 2 mg/L in August	Occurred at sites 1 and 2
		Surface Total Nitrogen	0.45 mg/L to 0.98 mg/L	
Surface Total Phosphorus		0.010 mg/L to 0.028 mg/L		
	Nitrogen to Phosphorus Ratio	34:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E.coli	Chlor-a
	Fish & Wildlife Propagation	NEI	S	NS	S				
	Aesthetics					S			NEI
	Agriculture						S		
	Primary Body Contact Recreation								S
	Public & Private Water Supply								

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Notes

Although 100% of the turbidity and color samples were below the standard, the Fish & Wildlife Propagation (FWP) and Aesthetics beneficial use cannot be assessed as minimum data requirements were not met.

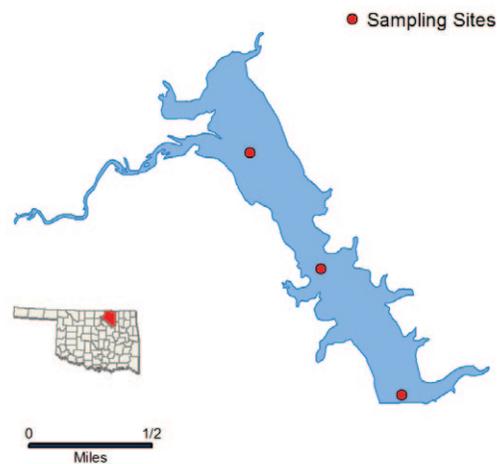
NTU = nephelometric turbidity units
 μS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 μS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Hudson



Sample Period	Times Visited	Sampling Sites
October 2005 – July 2006	4	3

Lake Data	Location	Osage County
	Impoundment	1949
	Area	250 acres
	Capacity	4,000 acre-feet
	Purposes	Water Supply, Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	8 NTU	100% of values < OWQS of 25 NTU	
	Average True Color	21 units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	98 cm		
	Water Clarity Rating	good		
	Trophic State Index	57		
	Trophic Class	eutrophic		
	Profile	Salinity	0.08– 0.14 ppt	
		Specific Conductivity	178.3 – 297.4 μ S/cm	
		pH	6.84 – 8.75 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	61 to 442 mV	
	Nutrients	Dissolved Oxygen	Up to 44% of water column < 2 mg/L in July	
		Surface Total Nitrogen	0.45 mg/L to 1.01 mg/L	
Surface Total Phosphorus		0.021 mg/L to 0.073 mg/L		
	Nitrogen to Phosphorus Ratio	18:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	S	S				
	Aesthetics					S	S		
	Agriculture							S	
	Primary Body Contact Recreation								S
	Public & Private Water Supply								

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 NS = Not Supporting
 NEI = Not Enough Information

Notes

NTU = nephelometric turbidity units
 μ S/cm = microsiemens per centimeter
 E. coli = Escherichia coli

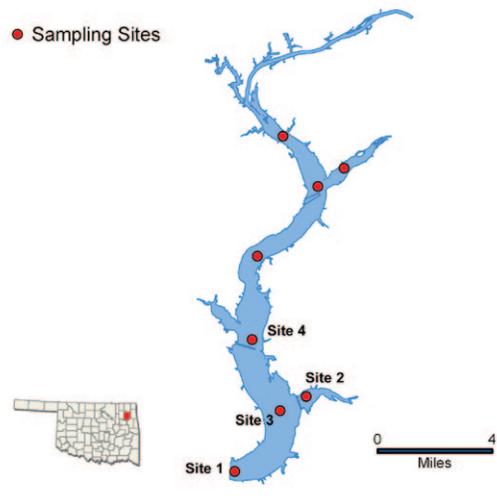
OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 μ S/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Hudson, Lower (1-4)

● Sampling Sites



Sample Period	Times Visited	Sampling Sites
November 2006 - August 2007	4	8

Lake Data	Location	Mayes County
	Impoundment	1964
	Area	10,900 acres
	Capacity	200,300 acre-feet
	Purposes	Flood Control, Hydropower

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	7 NTU	100% of values < OWQS of 25 NTU	
	Average True Color	32 units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	107 cm		
	Water Clarity Rating	excellent		
	Trophic State Index	58		
	Trophic Class	eutrophic		
	Profile	Salinity	0.08– 0.14 ppt	
		Specific Conductivity	172.8 – 286.2 μ S/cm	
		pH	6.98 – 9.36 pH units	Only 0.28% of values > 9.0 pH units
		Oxidation-Reduction Potential	255 to 464 mV	
	Nutrients	Dissolved Oxygen	Up to 43% of water column < 2 mg/L in August	
		Surface Total Nitrogen	0.53 mg/L to 1.75 mg/L	
Surface Total Phosphorus		0.051 mg/L to 0.118 mg/L		
	Nitrogen to Phosphorus Ratio	12:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	S	S				
	Aesthetics					S	S		
	Agriculture							S	
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

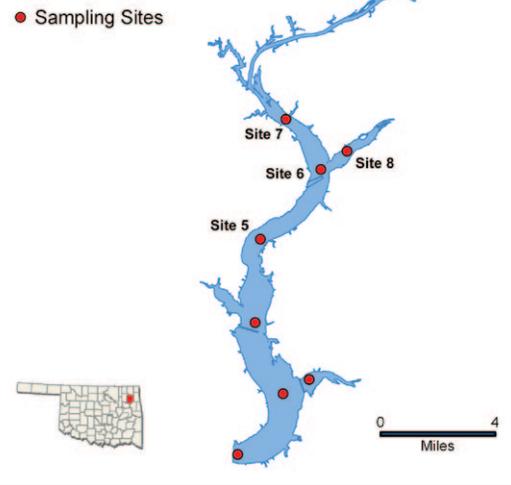
NTU = nephelometric turbidity units
 μ S/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 μ S/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Hudson, Upper (5-8)



Sample Period	Times Visited	Sampling Sites
November 2006 - August 2007	4	8

Lake Data	Location	Mayes County
	Impoundment	1964
	Area	10,900 acres
	Capacity	200,300 acre-feet
	Purposes	Flood Control, Hydropower

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	7 NTU	100% of values < OWQS of 25 NTU	
	Average True Color	35 units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	90 cm		
	Water Clarity Rating	good		
	Trophic State Index	58		
	Trophic Class	eutrophic		
	Profile	Salinity	0.08– 0.14 ppt	
		Specific Conductivity	172.3 – 298.7 μ S/cm	
		pH	6.86 – 9.30pH units	Only 2.4% of values > 9.0 pH units
		Oxidation-Reduction Potential	288 to 447 mV	
	Nutrients	Dissolved Oxygen	Up to 44% of water column < 2 mg/L in August	
		Surface Total Nitrogen	0.54 mg/L to 1.74 mg/L	
Surface Total Phosphorus		0.032mg/L to 0.128 mg/L		
	Nitrogen to Phosphorus Ratio	12:1	Phosphorus limited	

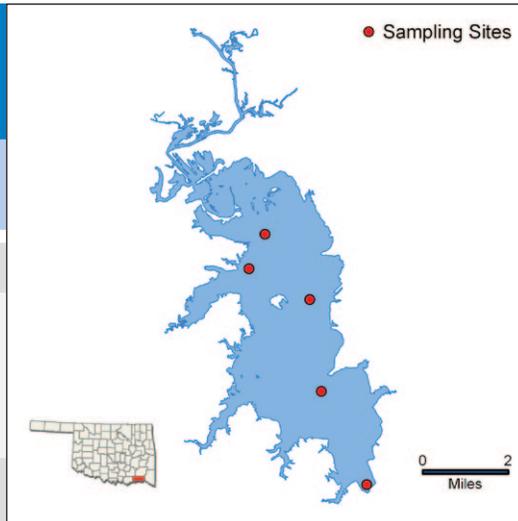
Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	S	S				
	Aesthetics					S	S		
	Agriculture							S	
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

NTU = nephelometric turbidity units
 μ S/cm = microsiemens per centimeter
 E. coli = Escherichia coli
 OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a
 mg/L = milligrams per liter
 μ S/cm = microsiemens/cm
 ppt = parts per thousand
 En = Enterococci

Hugo



Sample Period	Times Visited	Sampling Sites
November 2007 - August 2008	4	5

Lake Data	Location	Choctaw County
	Impoundment	1974
	Area	13,250 acres
	Capacity	157,600 acre-feet
	Purposes	Flood Control, Water Supply, Water Quality Control, Fish and Wildlife, and Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	37 NTU	80% of values > 25 NTU	
	Average True Color	116 units	95% of values > OWQS of 70	
	Average Secchi Disk Depth	33 cm		
	Water Clarity Rating	poor		
	Trophic State Index	54	Previous value = 53	
	Trophic Class	eutrophic		
	Profile	Salinity	0.00 - 0.02 ppt	
		Specific Conductivity	55 – 78 µS/cm	
		pH	6.64 – 7.44 pH units	Neutral
		Oxidation-Reduction Potential	388 to 553 mV	
		Dissolved Oxygen		All DO was >2 mg/L throughout the study period
	Nutrients	Surface Total Nitrogen	0.50 mg/L to 0.83 mg/L	
Surface Total Phosphorus		0.047 mg/L to 0.079 mg/L		
Nitrogen to Phosphorus Ratio		10:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	S	S				
	Aesthetics					S	NS		
	Agriculture							S	
	Primary Body Contact Recreation								NEI*
	Public & Private Water Supply								

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 NS = Not Supporting
 NEI = Not Enough Information

Notes

* The PBCR cannot be assessed as minimum data requirements were not met due to QA/QC issues for E. coli and fecal coliform.

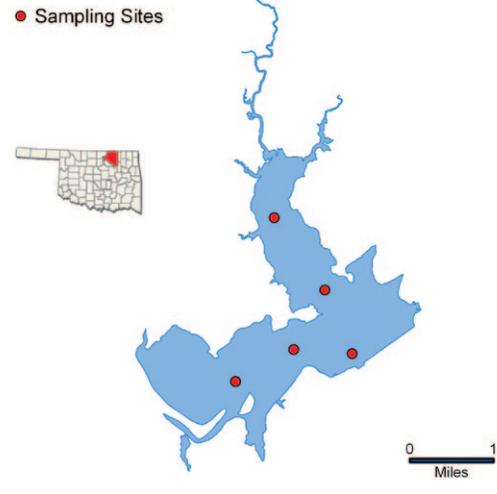
NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Hulah



Sample Period	Times Visited	Sampling Sites
October 2007 – July 2008	4	5

Lake Data	Location	Osage County
	Impoundment	1951
	Area	3,570 acres
	Capacity	31,160 acre-feet
	Purposes	Flood Control, Water Supply, Low-flow Regulation, and Conservation

Parameters	Parameter		Result	Notes/Comments
	Profile	Average Turbidity	48 NTU	85% of values > 25 NTU
		Average True Color	106 units	75% of values > OWQS of 70
		Average Secchi Disk Depth	27 cm	
		Water Clarity Rating	poor	
		Trophic State Index	55	Previous value = 54
		Trophic Class	eutrophic	
	Nutrients	Salinity	0.10 - 0.20 ppt	
		Specific Conductivity	249 – 398.5 µS/cm	
		pH	7.21 – 8.37 pH units	Neutral
		Oxidation-Reduction Potential	188 to 487 mV	
		Dissolved Oxygen	Up to 40% of water column < 2 mg/L	Occurred at site 5
		Surface Total Nitrogen	0.60 mg/L to 1.24 mg/L	
Surface Total Phosphorus		0.029 mg/L to 0.083 mg/L		
Nitrogen to Phosphorus Ratio	13:1	Phosphorus limited		

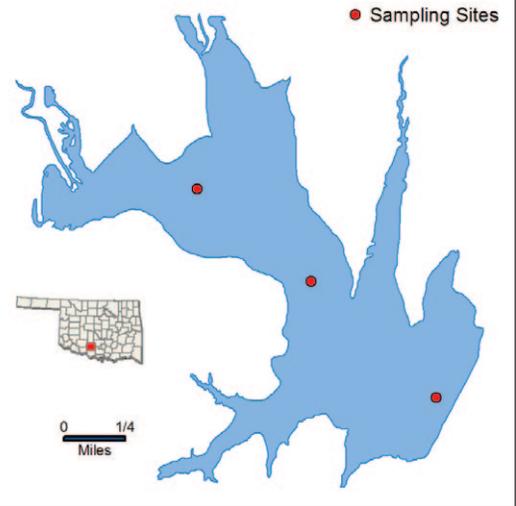
Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En, fecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	S	S				
	Aesthetics					NS	NS		
	Agriculture							S	
	Primary Body Contact Recreation								S
	Public & Private Water Supply								

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 NEI = Not Enough Information

Notes Currently, this lake is listed as a Nutrient Limited Watershed (NLW) in the Oklahoma Water Quality Standards (WQS). This means that the lake is considered threatened from nutrients until a more intensive study can confirm the Aesthetics beneficial use non-support status.

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Humphreys



Sample Period	Times Visited	Sampling Sites
November 2006 - August 2007	4	5

Lake Data	Location	Stephens County
	Impoundment	1958
	Area	882 acres
	Capacity	14,041 acre-feet
	Purposes	Water Supply, Flood Control, Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	16 NTU	10% of values >OWQS of 25 NTU	
	Average True Color	32 units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	58 cm		
	Water Clarity Rating	Good to average		
	Trophic State Index	61		
	Trophic Class	hypereutrophic		
	Profile	Salinity	0.19– 0.34 ppt	
		Specific Conductivity	389.8 – 659.3 μ S/cm	
		pH	7.32 – 8.30 pH units	
		Oxidation-Reduction Potential	-61 to 435mV	
	Nutrients	Dissolved Oxygen	Up to 54% of water column < 2 mg/L in August	Occurred at site 1, the dam
		Surface Total Nitrogen	0.61 mg/L to 1.20 mg/L	
Surface Total Phosphorus		0.026mg/L to 0.091 mg/L		
	Nitrogen to Phosphorus Ratio	20:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	NS	S				
	Aesthetics					S	S		
	Agriculture							S	
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

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 NS = Not Supporting
 NEI = Not Enough Information

Notes

The PBCR beneficial use cannot be determined as minimum data requirements were not met due to quality control issues for E. coli and enterococci.

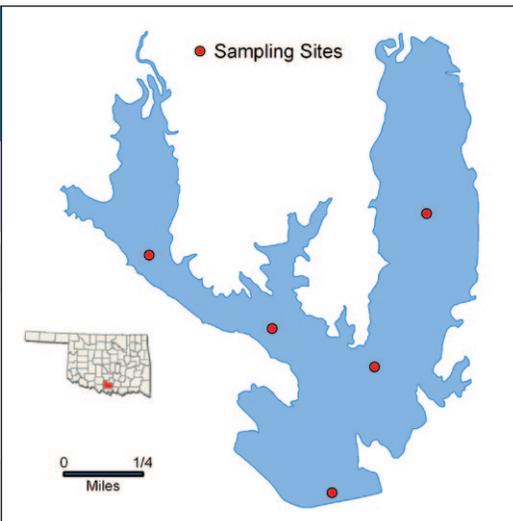
NTU = nephelometric turbidity units
 μ S/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 μ S/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Jean Neustadt



Sample Period	Times Visited	Sampling Sites
October 2006 - July 2007	4	5

Lake Data	Location	Carter County
	Impoundment	1969
	Area	462 acres
	Capacity	6,106 acre-feet
	Purposes	Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	13 NTU	100% of values <OWQS of 25 NTU	
	Average True Color	27 units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	76 cm		
	Water Clarity Rating	Good		
	Trophic State Index	58		
	Trophic Class	eutrophic		
	Profile	Salinity	0.11– 0.16 ppt	
		Specific Conductivity	231.1 – 332.4 µS/cm	
		pH	7.16 – 8.7 pH units	
		Oxidation-Reduction Potential	95 to 440mV	
		Dissolved Oxygen	Up to 70% of water column < 2 mg/L in July	Occurred at site 1, the dam
	Nutrients	Surface Total Nitrogen	0.45 mg/L to 0.98 mg/L	
Surface Total Phosphorus		0.015mg/L to 0.048 mg/L		
Nitrogen to Phosphorus Ratio		27:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	NS	S				
	Aesthetics					S	S		
	Agriculture							S	
	Primary Body Contact Recreation								S
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

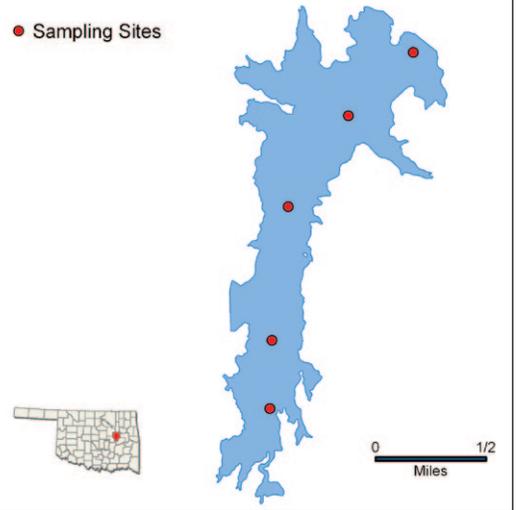
OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Jim Hall (Henryetta)

● Sampling Sites



Sample Period	Times Visited	Sampling Sites
October 2007 - July 2008	4	5

Lake Data	Location	Okmulgee County
	Impoundment	1928
	Area	450 acres
	Capacity	6,600 acre-feet
	Purposes	Water Supply and Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	69 NTU	All values > 25 NTU	
	Average True Color	254 units	All values > OWQS of 70	
	Average Secchi Disk Depth	23 cm		
	Water Clarity Rating	poor		
	Trophic State Index	45	Previous value = 47	
	Trophic Class	mesotrophic		
	Profile	Salinity	0.01 - 0.04 ppt	
		Specific Conductivity	50.7 – 105.1 μS/cm	
		pH	6.58 – 7.53 pH units	Neutral to slightly alkaline
Oxidation-Reduction Potential		126 to 636 mV		
Nutrients	Dissolved Oxygen	30% of water column < 2 mg/L in July	Occurred at site 1, the dam	
	Surface Total Nitrogen	0.90 mg/L to 1.08 mg/L		
	Surface Total Phosphorus	0.058 mg/L to 0.121 mg/L		
	Nitrogen to Phosphorus Ratio	12:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	S	*				
	Aesthetics					S	NS		
	Agriculture							S	
	Primary Body Contact Recreation								NEI**
	Public & Private Water Supply								

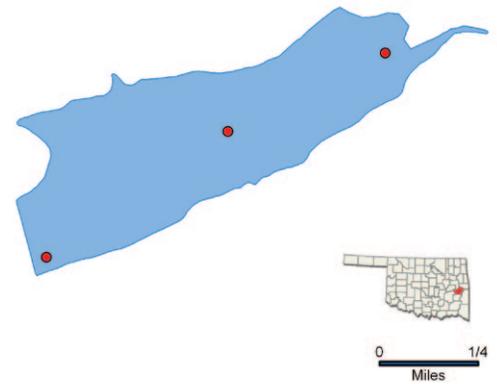
S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes
 *Not supporting for lead as chronic criteria was exceeded. All other toxicants are fully supporting.
 **The PBCR cannot be assessed as minimum data requirements were not met due to QA/QC issues for all parameters.

NTU = nephelometric turbidity units
 μS/cm = microsiemens per centimeter
 E. coli = Escherichia coli
 OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a
 mg/L = milligrams per liter
 μS/cm = microsiemens/cm
 ppt = parts per thousand
 En = Enterococci

John Wells

● Sampling Sites



Sample Period	Times Visited	Sampling Sites
November 2005 – August 2006	4	3

Lake Data	Location	Haskell County
	Impoundment	1936
	Area	194 acres
	Capacity	1,352 acre-feet
	Purposes	Water Supply, Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	5 NTU	100% of values < OWQS of 25 NTU	
	Average True Color	16 units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	151 cm		
	Water Clarity Rating	excellent		
	Trophic State Index	46		
	Trophic Class	mesotrophic		
	Profile	Salinity	0.01– 0.05 ppt	
		Specific Conductivity	59.8 – 117.9 μ S/cm	
		pH	6.4 – 8.38 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	189 to 483 mV	
	Nutrients	Dissolved Oxygen	Up to 45% of water column < 2 mg/L in May	
		Surface Total Nitrogen	0.20 mg/L to 0.56 mg/L	
Surface Total Phosphorus		0.013 mg/L to 0.020 mg/L		
	Nitrogen to Phosphorus Ratio	27:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	S	S				
	Aesthetics					S	S		
	Agriculture							S	
	Primary Body Contact Recreation								S
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

NTU = nephelometric turbidity units
 μ S/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

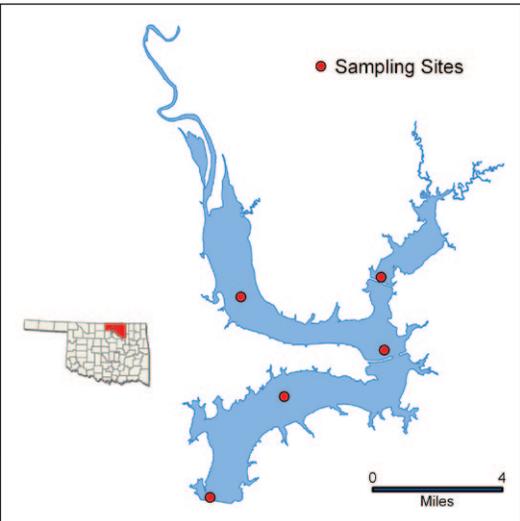
mg/L = milligrams per liter
 μ S/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Kaw (Lower)

Sample Period	Times Visited	Sampling Sites
October 2007 – July 2008	4	5

Lake Data	Value
Location	Osage County
Impoundment	1976
Area	17,040 acres
Capacity	428,600 acre-feet
Purposes	Flood Control, Water Supply, Water Quality Control, and Conservation



Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	18 NTU	25% of values > 25 NTU	
	Average True Color	75 units	25% of values > OWQS of 70	
	Average Secchi Disk Depth	66 cm		
	Water Clarity Rating	average		
	Trophic State Index	42	Previous value = 56 (lake-wide average)	
	Trophic Class	mesotrophic		
	Profile	Salinity	0.21 - 0.58 ppt	
		Specific Conductivity	416.2 – 1100 µS/cm	
		pH	6.97 – 8.38 pH units	Neutral to slightly alkaline
Oxidation-Reduction Potential		103 to 487 mV		
Dissolved Oxygen		Up to 24% of water column < 2 mg/L	Occurred at site 1, the dam	
Nutrients	Surface Total Nitrogen	1.08 mg/L to 2.46 mg/L		
	Surface Total Phosphorus	0.168 mg/L to 0.223 mg/L		
	Nitrogen to Phosphorus Ratio	10:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	S	S				
	Aesthetics					NS	NEI		
	Agriculture						S		
	Primary Body Contact Recreation							S	
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes Although 25% of values exceeded the OWQS for turbidity and true color, the minimum data requirements were not met and an assessment of the FWP and Aesthetics beneficial use cannot be made for this sample year.

NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

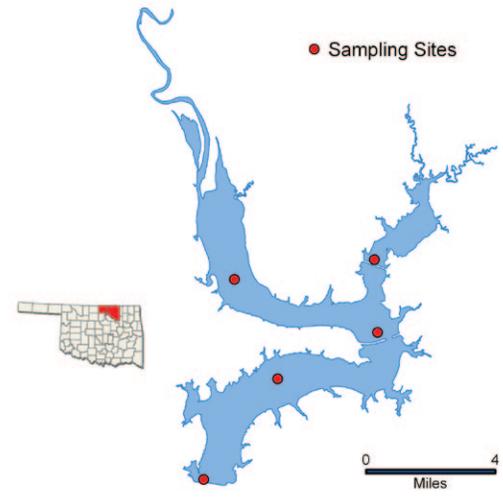
ppt = parts per thousand
 En = Enterococci

Kaw (Upper)

Sample Period	Times Visited	Sampling Sites
October 2007 – July 2008	4	5

Lake Data

Location	Osage County
Impoundment	1976
Area	17,040 acres
Capacity	428,600 acre-feet
Purposes	Flood Control, Water Supply, Water Quality Control, and Conservation



Parameters

Parameter	Result	Notes/Comments
Average Turbidity	27 NTU	50% of values > 25 NTU
Average True Color	81 units	67% of values > OWQS of 70
Average Secchi Disk Depth	35 cm	
Water Clarity Rating	poor	
Trophic State Index	53	Previous value = 56 (lake-wide average)
Trophic Class	eutrophic	
Salinity	0.16 - 0.65 ppt	
Specific Conductivity	332.2– 1233 μS/cm	
pH	7.09 – 8.54 pH units	Neutral to slightly alkaline
Oxidation-Reduction Potential	103 to 487 mV	
Dissolved Oxygen	Up to 24% of water column < 2 mg/L	Occurred at site 1, the dam
Surface Total Nitrogen	1.14 mg/L to 2.64 mg/L	
Surface Total Phosphorus	0.119 mg/L to 0.263 mg/L	
Nitrogen to Phosphorus Ratio	9:1	Phosphorus limited

Beneficial Uses

	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
Fish & Wildlife Propagation	NS	S	S	S					
Aesthetics					NS	NEI			
Agriculture							S		
Primary Body Contact Recreation								S	
Public & Private Water Supply									

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

Although 50-67% of values exceeded the OWQS for turbidity and true color, the minimum data requirements were not met and an assessment of the FWP and Aesthetics beneficial use cannot be made for this sample year.

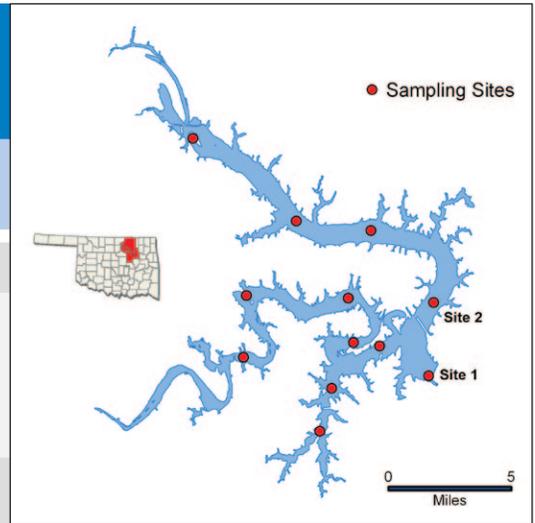
NTU = nephelometric turbidity units
 μS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 μS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Keystone (1-2)



Sample Period	Times Visited	Sampling Sites
October 2005 – July 2006	4	12

Lake Data	Location	Tulsa County
	Impoundment	1964
	Area	23,610 acres
	Capacity	557,600 acre-feet
	Purposes	Flood Control, Water Supply, Hydropower, Navigation, Fish & Wildlife

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	13 NTU	13% of values > OWQS of 25 NTU	
	Average True Color	29 units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	91 cm		
	Water Clarity Rating	good		
	Trophic State Index	54		
	Trophic Class	eutrophic		
	Profile	Salinity	0.45 – 4.03 ppt	
		Specific Conductivity	867 – 7232 μ S/cm	
		pH	7.16 – 8.56 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	93 to 511 mV	
	Nutrients	Dissolved Oxygen	Up to 62% of water column < 2 mg/L in July	
		Surface Total Nitrogen	0.65 mg/L to 1.10 mg/L	
Surface Total Phosphorus		0.063 mg/L to 0.193 mg/L		
	Nitrogen to Phosphorus Ratio	8:1	Possibly co-limited	

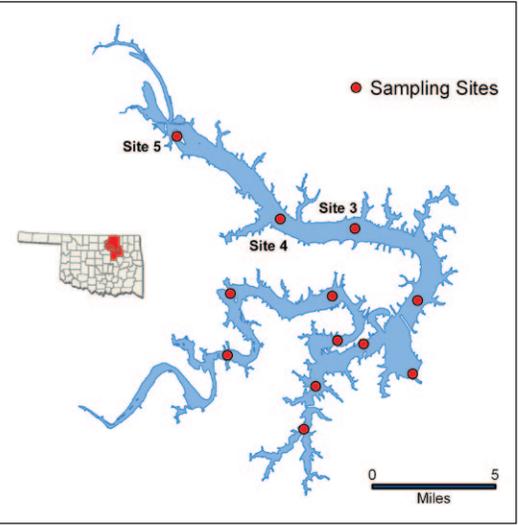
Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S*	S	NS	S				
	Aesthetics					S	S*		
	Agriculture						S		
	Primary Body Contact Recreation							S	
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes *Although 12.5% of the values exceeded 25 NTU an assessment of the Fish & Wildlife Propagation (FWP) beneficial use cannot be made, as minimum data requirements are not being met. All true color values were below the Aesthetics criteria 70 units however like turbidity there are not enough data for this segment to assess the Aesthetics beneficial use.

NTU = nephelometric turbidity units
 μ S/cm = microsiemens per centimeter
 E. coli = Escherichia coli
 OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a
 mg/L = milligrams per liter
 μ S/cm = microsiemens/cm
 ppt = parts per thousand
 En = Enterococci

Keystone, Arkansas River Arm (3-5)



Sample Period	Times Visited	Sampling Sites
October 2005 – July 2006	4	12

Lake Data	Location	Tulsa County
	Impoundment	1964
	Area	23,610 acres
	Capacity	557,600 acre-feet
	Purposes	Flood Control, Water Supply, Hydropower, Navigation, Fish & Wildlife

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	51 NTU	67% of values > OWQS of 25 NTU	
	Average True Color	40 units	8% of values > OWQS of 70	
	Average Secchi Disk Depth	47 cm		
	Water Clarity Rating	average		
	Trophic State Index	64		
	Trophic Class	hypereutrophic		
	Profile	Salinity	0.28– 1.24 ppt	
		Specific Conductivity	542 – 2317 µS/cm	
		pH	7.34 – 8.96 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	68 to 421 mV	
	Nutrients	Dissolved Oxygen	Up to 20% of water column < 2 mg/L in July	
		Surface Total Nitrogen	0.64 mg/L to 2.04 mg/L	
Surface Total Phosphorus		0.094 mg/L to 0.362 mg/L		
Nitrogen to Phosphorus Ratio	6:1	Possibly co-limited		

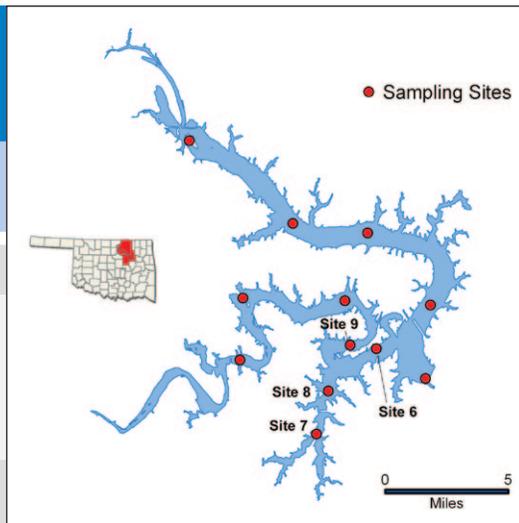
Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S*	S	S	S				
	Aesthetics					S	S*		
	Agriculture						S		
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes *Although 67% of the values exceeded 25 NTU an assessment of the Fish & Wildlife Propagation (FWP) beneficial use cannot be made, as minimum data requirements are not being met. Similarly, only 8.3% of true color values were below the Aesthetics criteria 70 units however like turbidity there are not enough data for this segment to assess the Aesthetics beneficial use.

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Keystone, Lower Cimarron River Arm (6-9)



Sample Period	Times Visited	Sampling Sites
October 2005 – July 2006	4	12

Lake Data	Location	Tulsa County
	Impoundment	1964
	Area	23,610 acres
	Capacity	557,600 acre-feet
	Purposes	Flood Control, Water Supply, Hydropower, Navigation, Fish & Wildlife

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	14 NTU	19% of values > OWQS of 25 NTU	
	Average True Color	28 units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	76 cm		
	Water Clarity Rating	good		
	Trophic State Index	60		
	Trophic Class	eutrophic		
	Profile	Salinity	0.15– 2.66 ppt	
		Specific Conductivity	314 – 4849 µS/cm	
		pH	7.36 – 8.56 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	233 to 432 mV	
		Dissolved Oxygen	Up to 47% of water column < 2 mg/L in July	
	Nutrients	Surface Total Nitrogen	0.61 mg/L to 1.20 mg/L	
Surface Total Phosphorus		0.055 mg/L to 0.186 mg/L		
Nitrogen to Phosphorus Ratio		8:1	Possibly co-limited	

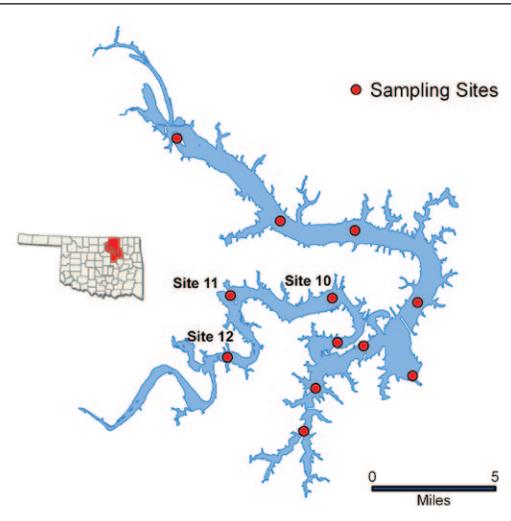
Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S*	S	S	S				
	Aesthetics					S	S*		
	Agriculture						S		
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes *Although 19% of the values exceeded 25 NTU an assessment of the Fish & Wildlife Propagation (FWP) beneficial use cannot be made, as minimum data requirements are not being met. All true color values were below the Aesthetics criteria 70 units however like turbidity there are not enough data for this segment to assess the Aesthetics beneficial use.

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En,ecal coli, & E. coli = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Keystone, Upper Cimarron River Arm (10-12)



Sample Period	Times Visited	Sampling Sites
October 2005 – July 2006	4	12

Lake Data	Location	Tulsa County
	Impoundment	1964
	Area	23,610 acres
	Capacity	557,600 acre-feet
	Purposes	Flood Control, Water Supply, Hydropower, Navigation, Fish & Wildlife

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	41 NTU	58% of values > OWQS of 25 NTU	
	Average True Color	40 units	17% of values > OWQS of 70	
	Average Secchi Disk Depth	41 cm		
	Water Clarity Rating	average		
	Trophic State Index	63		
	Trophic Class	hypereutrophic		
	Profile	Salinity	0.73– 6.34 ppt	
		Specific Conductivity	1373 – 11,134 µS/cm	
		pH	7.39 – 8.38 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	331 to 423 mV	
	Nutrients	Dissolved Oxygen	Up to 31% of water column < 2 mg/L in July	
		Surface Total Nitrogen	0.66 mg/L to 1.77 mg/L	
Surface Total Phosphorus		0.059 mg/L to 0.328 mg/L		
Nitrogen to Phosphorus Ratio	8:1	Possibly co-limited		

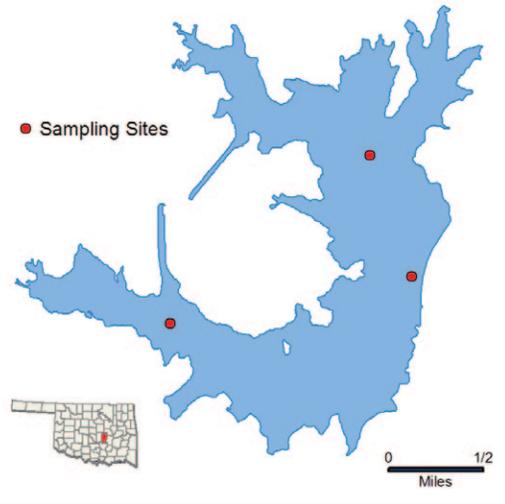
Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S*	S	S	S				
	Aesthetics					S	S*		
	Agriculture						S		
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes
 *Although 58% of the values exceeded 25 NTU an assessment of the Fish & Wildlife Propagation (FWP) beneficial use cannot be made, as minimum data requirements are not being met. Similarly, 17% of true color values were below the Aesthetics criteria 70 units however like turbidity there are not enough data for this segment to assess the Aesthetics beneficial use.

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Konawa



Sample Period	Times Visited	Sampling Sites
October 2007 – July 2008	4	5

Lake Data	Location	Seminole County
	Impoundment	1968
	Area	1,350 acres
	Capacity	23,000 acre-feet
	Purposes	Cooling Water

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	8 NTU	100% of values < 25 NTU	
	Average True Color	21 units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	82 cm		
	Water Clarity Rating	good		
	Trophic State Index	57	Previous value = 53	
	Trophic Class	eutrophic		
	Profile	Salinity	0.51 – 0.62 ppt	
		Specific Conductivity	971.7 – 1178 µS/cm	
		pH	7.07 – 8.66 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	-94 to 452 mV	
		Dissolved Oxygen	Up to 33% of water column , 2 mg/L in July	Occurred at site 1
	Nutrients	Surface Total Nitrogen	0.64 mg/L to 0.99 mg/L	
Surface Total Phosphorus		0.022 mg/L to 0.045 mg/L		
Nitrogen to Phosphorus Ratio		23:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	S	S				
	Aesthetics					S	S		
	Agriculture							S	
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

The PBCR cannot be assessed as minimum data requirements were not met due to QA/QC issues for E. coli and enterococci.

NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

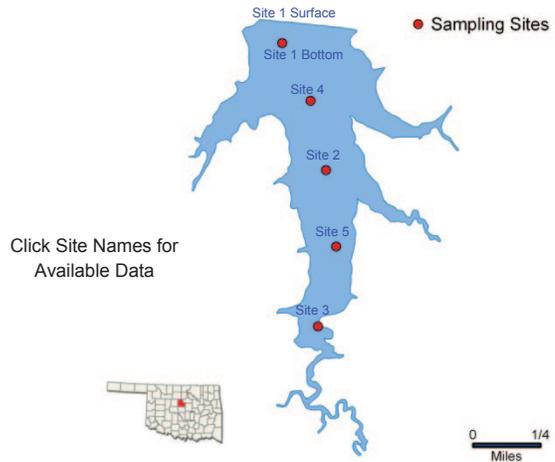
mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Langston

Sample Period	Times Visited	Sampling Sites
November 2010 – July 2011	4	5

General	Location	Logan County	Click map for site data
	Impoundment	1966	
	Area	304 acres	
	Capacity	5,792 acre-feet	
	Purposes	Water Supply, Flood Control, and Recreation	



Parameters		Parameter (<i>Descriptions</i>)	Result	Notes/Comments
		In-Situ	Average Turbidity	13 NTU
Average Secchi Disk Depth	73 cm			
Water Clarity Rating	Average			
Chlorophyll-a	4 mg/m ³			
Trophic State Index	45		Previous value = 44	
Trophic Class	Mesotrophic			
Profile	Salinity	0.16 – 0.19 ppt		
	Specific Conductivity	325.2 – 384.3 μS/cm		
	pH	6.49 – 8.54 pH units	Only 0.97% of values < 6.5 pH units	
	Oxidation-Reduction Potential	-104 to 518 mV		
	Dissolved Oxygen	Up to 46% of water column < 2 mg/L in summer		
Nutrients	Surface Total Nitrogen	0.27 mg/L to 0.64 mg/L		
	Surface Total Phosphorus	0.011 mg/L to 0.014 mg/L		
	Nitrogen to Phosphorus Ratio	41:1	Phosphorus limited	

Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enterococci & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	S	S							
	Aesthetics					S	S					
	Agriculture							S	S	S		
	Primary Body Contact Recreation										S	
	Public & Private Water Supply											

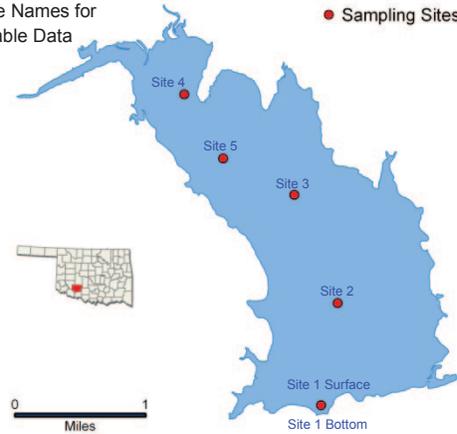
Notes
<p>S = Fully Supporting NS = Not Supporting NEI = Not Enough Information</p>

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 μS/cm = microsiemens per centimeter mV = millivolts μS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Lawtonka

Click Site Names for Available Data

● Sampling Sites



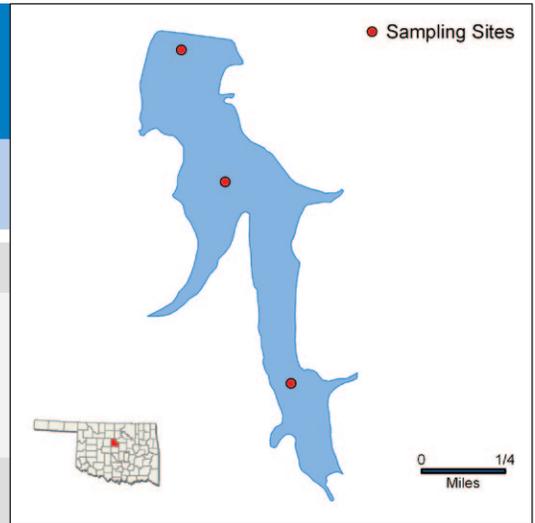
Sample Period		Times Visited	Sampling Sites
December 2010 – August 2011		4	5
General	Location	Comanche County	Click map for site data
	Impoundment	1905	
	Area	2,398 acres	
	Capacity	56,574 acre-feet	
	Purposes	Water Supply, Recreation	

Parameters	In-Situ	Parameter (<i>Descriptions</i>)	Result	Notes/Comments
		Average Turbidity	7 NTU	100% of values <OWQS of 25 NTU
		Average Secchi Disk Depth	130 cm	
		Water Clarity Rating	Excellent	
		Chlorophyll-a	13 mg/m3	
		Trophic State Index	56	Previous Value= 60
		Trophic Class	Eutrophic	
Parameters	Profile	Salinity	0.16– 0.21 ppt	
		Specific Conductivity	326.9 – 422.1 μS/cm	
		pH	6.55 – 8.73 pH units	
		Oxidation-Reduction Potential	-123 - 456 mV	
		Dissolved Oxygen	Up to 66% of water column < 2 mg/L in summer	
Parameters	Nutrients	Surface Total Nitrogen	0.35 mg/L to 0.88 mg/L	
		Surface Total Phosphorus	0.015mg/L to 0.030 mg/L	
		Nitrogen to Phosphorus Ratio	22:1	Phosphorus limited

Beneficial Uses	Click to learn more about Beneficial Uses											
	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enterro. & E. coli	Chlor-a	
	Fish & Wildlife Propagation	S	S	S	S							
	Aesthetics					S	*					
	Agriculture							*	*	S		
	Primary Body Contact Recreation										S	
Public & Private Water Supply											NS	
<i>S = Fully Supporting</i> <i>NS = Not Supporting</i> <i>NEI = Not Enough Information</i>		Notes	*Did not collect for these parameters									

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 μS/cm = microsiemens per centimeter mV = millivolts μS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Liberty



Sample Period	Times Visited	Sampling Sites
October 2005 – July 2006	4	3

Lake Data	Location	Logan County
	Impoundment	1948
	Area	167 acres
	Capacity	2,740 acre-feet
	Purposes	Water Supply, Recreation

Parameters	Parameter		Result	Notes/Comments
	Profile	Average Turbidity	21 NTU	16.7% of values > OWQS of 25 NTU
		Average True Color	20 units	100% of values < OWQS of 70
		Average Secchi Disk Depth	42 cm	
		Water Clarity Rating	good	
		Trophic State Index	67	
		Trophic Class	hypereutrophic	
		Nutrients	Salinity	0.22 – 0.30 ppt
	Specific Conductivity		439.1 – 580.5 µS/cm	
	pH		7.94 – 8.48 pH units	Neutral to slightly alkaline
	Oxidation-Reduction Potential		404 to 544 mV	
	Dissolved Oxygen			All DO was >2 mg/L throughout the study period
	Nitrogen to Phosphorus Ratio		16:1	Phosphorus limited

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	S	S				
	Aesthetics					S	S*		
	Agriculture						S		
	Primary Body Contact Recreation							S	
	Public & Private Water Supply								

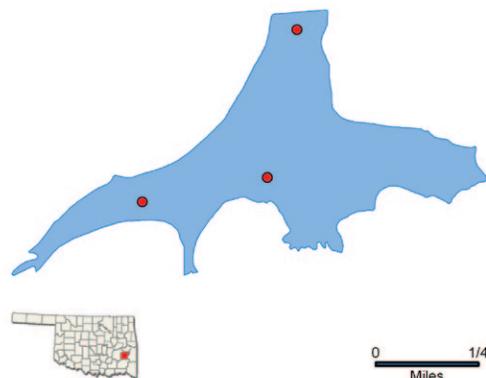
S = Fully Supporting
 NS = Not Supporting
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Notes

NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli
 OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a
 mg/L = milligrams per liter
 µS/cm = microsiemens/cm
 ppt = parts per thousand
 En = Enterococci

Lloyd Church

● Sampling Sites



Sample Period	Times Visited	Sampling Sites
November 2005 – August 2006	4	3

Lake Data	Location	Latimer County
	Impoundment	1964
	Area	160 acres
	Capacity	3,060 acre-feet
	Purposes	Water Supply, Recreation, Flood Control

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	14 NTU	25% of values > OWQS of 25 NTU	
	Average True Color	79 units	75% of values > OWQS of 70	
	Average Secchi Disk Depth	64 cm		
	Water Clarity Rating	good		
	Trophic State Index	45		
	Trophic Class	mesotrophic		
	Profile	Salinity	0.0 – 0.01 ppt	
		Specific Conductivity	25.4 – 71.9 μ S/cm	
		pH	5.9 – 7.51 pH units	26% of values < 6.5 pH units
		Oxidation-Reduction Potential	79 to 503 mV	
	Nutrients	Dissolved Oxygen	Up to 62% of water column < 2 mg/L in August	
		Surface Total Nitrogen	0.15 mg/L to 0.57 mg/L	
Surface Total Phosphorus		0.020 mg/L to 0.043 mg/L		
	Nitrogen to Phosphorus Ratio	12:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	NS	NS	S				
	Aesthetics					S	NS		
	Agriculture						S		
	Primary Body Contact Recreation							S	
	Public & Private Water Supply								

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 NS = Not Supporting
 NEI = Not Enough Information

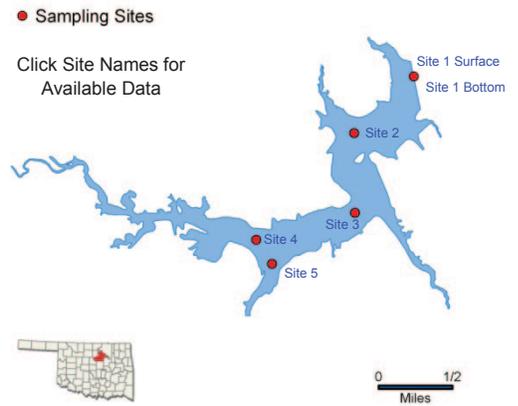
Notes Available flow and rainfall data suggest that the peak in turbidity, which occurred in March is likely due to seasonal storm events, therefore Lloyd Church Lake will be listed as supporting its Fish & Wildlife Propagation (FWP) beneficial use

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 μ S/cm = microsiemens per centimeter mV = millivolts μ S/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Lone Chimney

Sample Period	Times Visited	Sampling Sites
November 2010 – June 2011	4	5

General	Location	Pawnee County	Click map for site data
	Impoundment	1984	
	Area	550 acres	
	Capacity	6,200 acre-feet	
	Purposes	Water Supply, Recreation and Flood Control	



Parameters		Parameter (<i>Descriptions</i>)	Result	Notes/Comments
		In-Situ	Average Turbidity	15 NTU
Average Secchi Disk Depth	67 cm			
Water Clarity Rating	Good			
Chlorophyll-a	10 mg/m ³			
Trophic State Index	53		Previous Value=53	
Trophic Class	Eutrophic			
Profile	Salinity	0.1– 0.14 ppt		
	Specific Conductivity	223.2 – 290.9 μS/cm	TDS= 152 g/L	
	pH	6.78 – 8.24 pH units		
	Oxidation-Reduction Potential	64 - 449 mV		
	Dissolved Oxygen	Up to 50% of water column < 2 mg/L in summer		
Nutrients	Surface Total Nitrogen	0.59 mg/L to 0.74 mg/L		
	Surface Total Phosphorus	0.018 mg/L to 0.034 mg/L		
	Nitrogen to Phosphorus Ratio	19:1	Phosphorus limited	

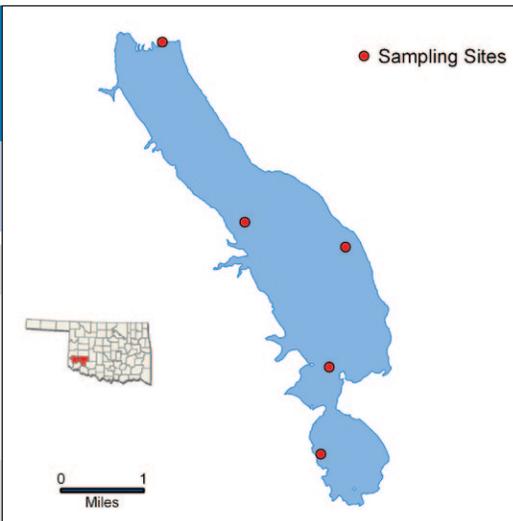
Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enterro. & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	S								
	Aesthetics					S	S					
	Agriculture							S	S	S		
	Primary Body Contact Recreation										S	
	Public & Private Water Supply											

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Notes

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 μS/cm = microsiemens per centimeter mV = millivolts μS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Lugert-Altus



Sample Period	Times Visited	Sampling Sites
September 2004 - June 2005	4	5

Lake Data	Location	Greer County
	Impoundment	1947
	Area	6,260 acres
	Capacity	132,830 acre-feet
	Purposes	Water Supply, Flood Control, Irrigation

Parameters	Parameter		Result	Notes/Comments	
	Profile	Average Turbidity		23 NTU	30% of values >OWQS of 25 NTU
		Average True Color		18 units	100% of values < OWQS of 70
		Average Secchi Disk Depth		37 cm	
		Water Clarity Rating		fair	
		Trophic State Index		59	
		Trophic Class		eutrophic	
	Nutrients	Salinity		1.01 – 1.29 ppt	
		Specific Conductivity		1866 – 2397 µS/cm	
		pH		7.67 – 8.22 pH units	
		Oxidation-Reduction Potential		343 to 480 mV	
		Dissolved Oxygen			All DO was >2 mg/L throughout the study period
		Surface Total Nitrogen		0.69 mg/L to 1.17 mg/L	
Surface Total Phosphorus		0.031 mg/L to 0.084 mg/L			
Nitrogen to Phosphorus Ratio		17:1	Phosphorus limited		

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	S	*				
	Aesthetics					S	S		
	Agriculture							S	
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

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Notes Bacteriological samples were not collected during the 2005 recreation season therefore an assessment of the Primary Body Contact Recreation (PBCR) beneficial use cannot be made at this time.
 *Metals not collected this sample period.

NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

McAlester

● Sampling Sites



Sample Period	Times Visited	Sampling Sites
November 2007 – August 2008	4	5

Lake Data	Location	Pittsburg County
	Impoundment	1930
	Area	1,521 acres
	Capacity	13,398 acre feet
	Purposes	Water Supply and Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	26 NTU	40% of values > 25 NTU	
	Average True Color	96 units	50% of values > OWQS of 70	
	Average Secchi Disk Depth	44 cm		
	Water Clarity Rating	average		
	Trophic State Index	50	Previous value = 42	
	Trophic Class	mesotrophic		
	Profile	Salinity	0.00 – 0.10 ppt	
		Specific Conductivity	85.5 – 164 µS/cm	
		pH	6.59 – 8.42 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	50 to 635 mV	
	Nutrients	Dissolved Oxygen	Up to 42% of water column < 2 mg/L in August	Occurred at site 1
		Surface Total Nitrogen	0.45 mg/L to 0.83 mg/L	
Surface Total Phosphorus		0.027 mg/L to 0.066 mg/L		
Nitrogen to Phosphorus Ratio	15:1	Phosphorus limited		

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E.coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	S	S				
	Aesthetics					S	NS		
	Agriculture						S		
	Primary Body Contact Recreation							S	
	Public & Private Water Supply								

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Notes

NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

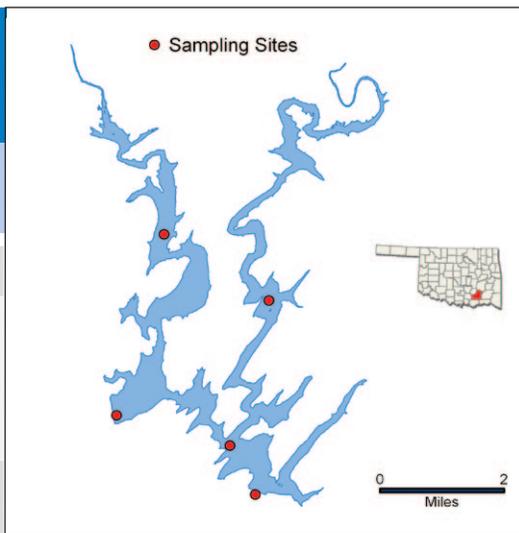
mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

McGee Creek

Sample Period	Times Visited	Sampling Sites
October 2006 - July 2007	4	5

Lake Data	Location	Atoka County
	Impoundment	1987
	Area	3,810 acres
	Capacity	113,930 acre-feet
	Purposes	Water Supply, Recreation, Water Quality Control, Flood Control, Fish & Wildlife



Parameters	Parameter		Result	Notes/Comments
	Profile	Average Turbidity	9 NTU	5% of values >OWQS of 25 NTU
		Average True Color	52 units	10% of values >OWQS of 70
		Average Secchi Disk Depth	132 cm	
		Water Clarity Rating	Good	
		Trophic State Index	43	
		Trophic Class	mesotrophic	
	Nutrients	Salinity	0.0– 0.03 ppt	
		Specific Conductivity	0.6 – 76.9 µS/cm	
		pH	5.58 – 7.63 pH units	41% of values < 6.5 pH units
		Oxidation-Reduction Potential	-43 to 486 mV	
		Dissolved Oxygen	Up to 57% of water column < 2 mg/L in October and up to 80% in July	
		Surface Total Nitrogen	0.0– 0.03 ppt	
Surface Total Phosphorus		0.6 – 76.9 µS/cm		
Nitrogen to Phosphorus Ratio	5.58 – 7.63 pH units	41% of values < 6.5 pH units		

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	NS*	NS	S				
	Aesthetics					S	S		
	Agriculture							S	
	Primary Body Contact Recreation								S
	Public & Private Water Supply								
<i>S = Fully Supporting</i> <i>NS = Not Supporting</i> <i>NEI = Not Enough Information</i>		Notes <i>*Slightly acidic conditions are not unusual in this part of the state due to relatively low soil pH and lack of soluble bedrock. Because of these conditions it is likely that the low pH values may be due to natural causes; therefore the Water Board is looking at the applicability of developing site-specific criteria for waters in the southeastern portion of the state.</i>							

NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

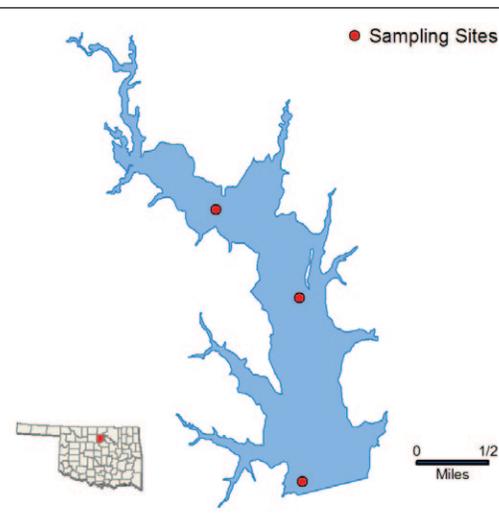
ppt = parts per thousand
 En = Enterococci

McMurtry

Sample Period	Times Visited	Sampling Sites
November 2007 – August 2008	4	5

Lake Data

Location	Noble County
Impoundment	1971
Area	1,155 acres
Capacity	19,733 acre feet
Purposes	Water Supply, Flood Control, and Recreation



Parameters

Parameter	Result	Notes/Comments
Average Turbidity	33 NTU	55% of values > 25 NTU
Average True Color	103 units	50% of values > OWQS of 70
Average Secchi Disk Depth	48 cm	
Water Clarity Rating	average	
Trophic State Index	48	Previous value = 47
Trophic Class	mesotrophic	
Profile		
Salinity	0.15 – 0.20 ppt	
Specific Conductivity	303.8 – 348.3 μ S/cm	
pH	7.36 – 8.60 pH units	Neutral to slightly alkaline
Oxidation-Reduction Potential	41 to 820 mV	
Dissolved Oxygen	Up to 62% of water column < 2 mg/L in August	Occurred at site 1
Nutrients		
Surface Total Nitrogen	0.43 mg/L to 1.02 mg/L	
Surface Total Phosphorus	0.014 mg/L to 0.056 mg/L	
Nitrogen to Phosphorus Ratio	27:1	Phosphorus limited

Beneficial Uses

	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
Fish & Wildlife Propagation	NS	S	NS	S					
Aesthetics					S	NS			
Agriculture							S		
Primary Body Contact Recreation								S	
Public & Private Water Supply									

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 NEI = Not Enough Information

Notes

NTU = nephelometric turbidity units
 μ S/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

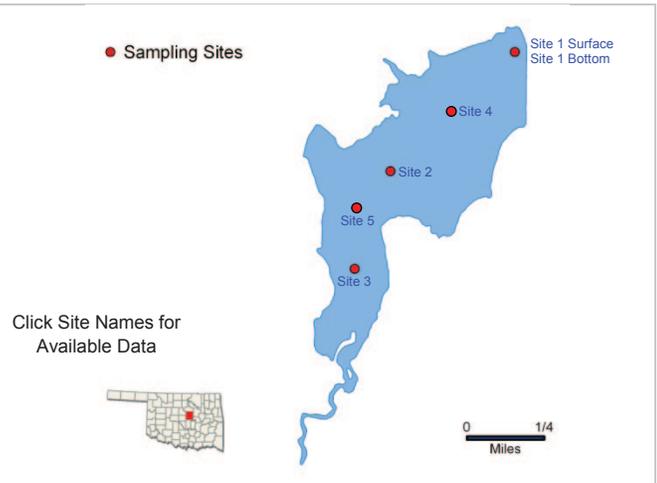
mg/L = milligrams per liter
 μ S/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Meeker

Sample Period	Times Visited	Sampling Sites
October 2008 – July 2009	4	5

General	Location	Lincoln County	Click map for site data
	Impoundment	1970	
	Area	250 acres	
	Capacity	1,818 acre-feet	
	Purposes	Water Supply, Recreation, Flood Control	



Parameters	Parameter (<i>Descriptions</i>)	Result	Notes/Comments	
	Average Turbidity	143 NTU	100% of values > OWQS of 25 NTU (n=12)	
	Average True Color		Did not collect for true color	
	Average Secchi Disk Depth	10 cm		
	Water Clarity Rating	Poor		
	Trophic State Index	50	Previous value = 50	
	Trophic Class	Mesotrophic		
	Profile	Salinity	0.10 – 0.11 ppt	
		Specific Conductivity	208.9 – 231.5 µS/cm	
		pH	7.33 – 8.37 pH units	
		Oxidation-Reduction Potential	213 to 468 mV	
		Dissolved Oxygen	All data are above screening level of 2.0 mg/L	
	Nutrients	Surface Total Nitrogen	0.73 mg/L to 1.07 mg/L	
		Surface Total Phosphorus	0.062 mg/L to 0.105 mg/L	
		Nitrogen to Phosphorus Ratio	11:1	Phosphorus limited, possibly co-limited

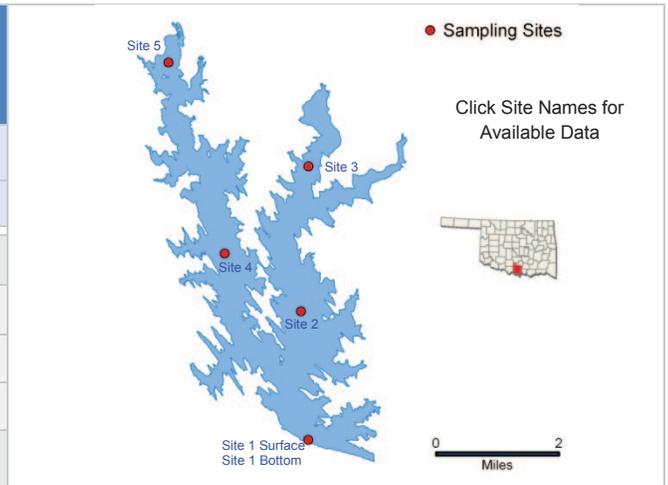
Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	En & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	S	*							
	Aesthetics					S	*					
	Agriculture							*	*	S		
	Primary Body Contact Recreation										S	
	Public & Private Water Supply											
	<i>S = Fully Supporting</i> <i>NS = Not Supporting</i> <i>NEI = Not Enough Information</i>		Notes *Did not collect for these parameters									

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Murray

Sample Period	Times Visited	Sampling Sites
October 2008 – July 2009	4	5

General	Location	Love County	Click map for site data
	Impoundment	1937	
	Area	5,728 acres	
	Capacity	153,250 acre-feet	
	Purposes	Recreation	



		Parameter (Descriptions)	Result	Notes/Comments
Parameters	Profile	Average Turbidity	6 NTU	100% of values < OWQS of 25 NTU (n=20)
		Average True Color		Did not collect for true color
		Average Secchi Disk Depth	180 cm	
		Water Clarity Rating	Excellent	
		Trophic State Index	37	Previous value = 36
		Trophic Class	Oligotrophic	
		Nutrients	Salinity	0.10 – 0.20 ppt
	Specific Conductivity		306 – 336.7 µS/cm	
	pH		7.11 – 8.57 pH units	
			Oxidation-Reduction Potential	208 to 487 mV
		Dissolved Oxygen	Up to 74% of water column < 2.0 mg/L in July	Occurred at site 1, the dam
		Surface Total Nitrogen	0.24 mg/L to 0.45 mg/L	
		Surface Total Phosphorus	0.005 mg/L to 0.023 mg/L	
		Nitrogen to Phosphorus Ratio	42:1	Phosphorus limited

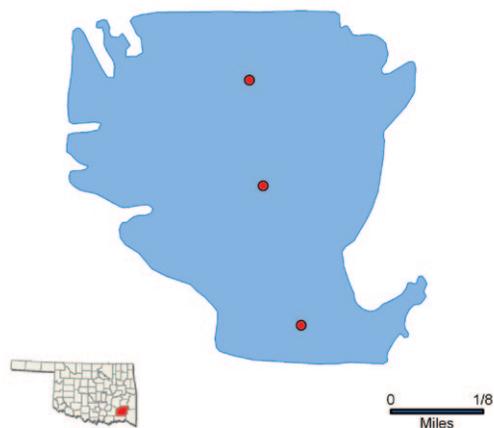
		Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	En & E. coli	Chlor-a
Beneficial Uses	Fish & Wildlife Propagation		S	S	NS	*							
	Aesthetics						S	*					
	Agriculture								*	*	S		
	Primary Body Contact Recreation											S	
	Public & Private Water Supply												

<p>S = Fully Supporting NS = Not Supporting NEI = Not Enough Information</p>	Notes	*Did not collect for these parameters
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NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Nanah Waiya

● Sampling Sites



Sample Period	Times Visited	Sampling Sites
December 2007 – July 2008	4	3

Lake Data	Location	Pushmataha County
	Impoundment	1958
	Area	131 acres
	Capacity	1,064 acre feet
	Purposes	Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	9 NTU	All values < 25 NTU	
	Average True Color	45 units	25% of values > OWQS of 70	
	Average Secchi Disk Depth	98 cm		
	Water Clarity Rating	average		
	Trophic State Index	45	Previous value = 45	
	Trophic Class	mesotrophic		
	Profile	Salinity	0.0 – 0.10 ppt	
		Specific Conductivity	63 – 262 µS/cm	
		pH	6.31 – 8.22 pH units	4 values (6.5%) < 6.5 pH units
		Oxidation-Reduction Potential	5 to 576 mV	
	Nutrients	Dissolved Oxygen	Up to 42% of water column < 2 mg/L in August	Occurred at site 1
		Surface Total Nitrogen	0.32 mg/L to 0.70 mg/L	
Surface Total Phosphorus		0.018 mg/L to 0.032 mg/L		
	Nitrogen to Phosphorus Ratio	18:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En.ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	S	S				
	Aesthetics					S	NS		
	Agriculture						S		
	Primary Body Contact Recreation							S	
	Public & Private Water Supply								

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Notes

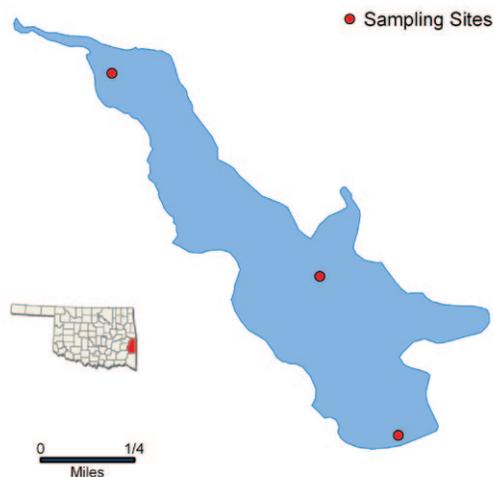
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 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

New Spiro



Sample Period	Times Visited	Sampling Sites
October 2005 – August 2006	4	3

Lake Data	Location	Le Flore County
	Impoundment	1960
	Area	254 acres
	Capacity	2,160 acre-feet
	Purposes	Water Supply, Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	18 NTU	8% of values >OWQS of 25 NTU	
	Average True Color	26 units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	47 cm		
	Water Clarity Rating	good		
	Trophic State Index	68		
	Trophic Class	hypereutrophic		
	Profile	Salinity	0.04 – 0.09 ppt	
		Specific Conductivity	106.8 – 155.4 μ S/cm	
		pH	7.09 – 9.24 pH units	10% of values > 9.0 pH units
		Oxidation-Reduction Potential	121 to 483 mV	
		Dissolved Oxygen	Up to 33% of water column < 2 mg/L in August	Occurred at site 2
	Nutrients	Surface Total Nitrogen	0.98 mg/L to 1.68 mg/L	
Surface Total Phosphorus		0.076 mg/L to 0.170 mg/L		
Nitrogen to Phosphorus Ratio		11:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En.ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	NS	S	S				
	Aesthetics					NS*	S		
	Agriculture						S		
	Primary Body Contact Recreation							S	
	Public & Private Water Supply								

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 NEI = Not Enough Information

Notes

*The lake is listed in the WQS as a NLW indicating that the Aesthetics beneficial use is considered threatened by nutrients until studies can be conducted to confirm non-support status.

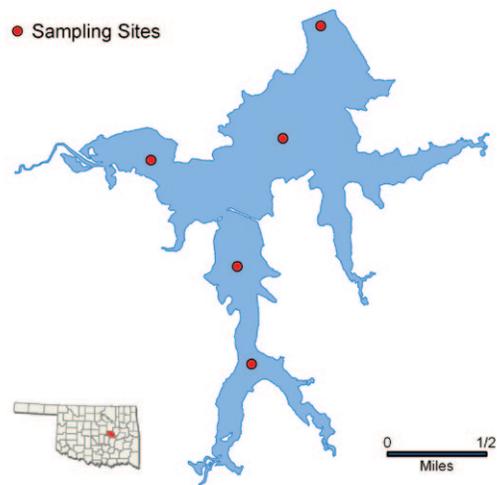
NTU = nephelometric turbidity units
 μ S/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 μ S/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Okemah



Sample Period	Times Visited	Sampling Sites
October 2006 - July 2007	4	5

Lake Data	Location	Okfuskee County
	Impoundment	N/A
	Area	761 acres
	Capacity	13,100 acre-feet
	Purposes	Water Supply, Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	17 NTU	20% of values >OWQS of 25 NTU	
	Average True Color	61 units	35% of values >OWQS of 70	
	Average Secchi Disk Depth	78 cm		
	Water Clarity Rating	average		
	Trophic State Index	46		
	Trophic Class	mesotrophic		
	Profile	Salinity	0.06– 0.14ppt	
		Specific Conductivity	140.7 – 289.3 μ S/cm	
		pH	6.71 – 8.03 pH units	
		Oxidation-Reduction Potential	126 to 426 mV	
		Dissolved Oxygen	Up to 69% of water column < 2 mg/L in July	
	Nutrients	Surface Total Nitrogen	0.38 mg/L to 1.01 mg/L	
Surface Total Phosphorus		0.012 mg/L to 0.063 mg/L		
Nitrogen to Phosphorus Ratio		23:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	Enterococci, E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	NS	S				
	Aesthetics					S	NS		
	Agriculture						S		
	Primary Body Contact Recreation							NS	
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

Of the 10 samples collected, 20% of the values exceeded the screening level of 61 cfu/100 ml and the geometric mean of 33 was also exceeded for enterococci.

NTU = nephelometric turbidity units
 μ S/cm = microsiemens per centimeter
 E. coli = Escherichia coli

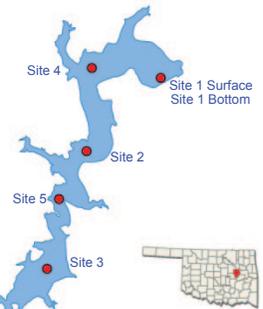
OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 μ S/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Okmulgee

● Sampling Sites



Click Site Names for Available Data



Sample Period	Times Visited	Sampling Sites
November 2010 – June 2011	4	5

General	Location	Okmulgee County	Click map for site data
	Impoundment	1928	
	Area	668 acres	
	Capacity	14,170 acre-feet	
	Purposes	Water Supply, Recreation	

Parameters		Parameter (Descriptions)	Result	Notes/Comments
In-Situ	Average Turbidity		8 NTU	100% of values <OWQS of 25 NTU
	Average Secchi Disk Depth		116	
	Water Clarity Rating		Excellent	
	Chlorophyll-a		6 mg/m3	
	Trophic State Index		48	Previous Value= 46
	Trophic Class		Mesotrophic	
Profile	Salinity		0.05– 0.06 ppt	
	Specific Conductivity		118.6 – 136.9 µS/cm	
	pH		6.18– 7.62 pH units	12% of values < 6.5 pH units
	Oxidation-Reduction Potential		270 - 441 mV	
	Dissolved Oxygen		Up to 54% of water column < 2 mg/L in summer	
Nutrients	Surface Total Nitrogen		0.29 mg/L to 0.56 mg/L	
	Surface Total Phosphorus		0.010 mg/L to 0.030 mg/L	
	Nitrogen to Phosphorus Ratio		25:1	Phosphorus limited

Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enterro. & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	NS	S	S							
	Aesthetics					S	*					
	Agriculture							*	*	S		
	Primary Body Contact Recreation										NEI	
	Public & Private Water Supply											

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 NS = Not Supporting
 NEI = Not Enough Information

Notes

*Did not collect for this parameter

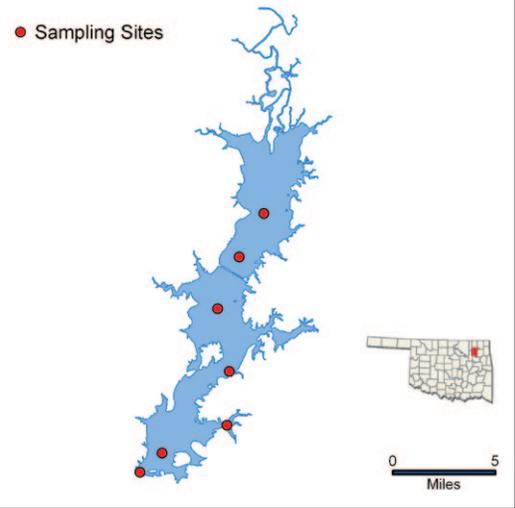
NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Oologah



Sample Period	Times Visited	Sampling Sites
December 2007 – July 2008	4	7

Lake Data	Location	Rogers County
	Impoundment	1963
	Area	29,460 acres
	Capacity	553,400 acre feet
	Purposes	Water Supply, Flood Control, and Navigation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	20 NTU	25% of values > 25 NTU	
	Average True Color	54 units	25% of values > OWQS of 70	
	Average Secchi Disk Depth	68 cm		
	Water Clarity Rating	average		
	Trophic State Index	54	Previous value = 46	
	Trophic Class	eutrophic		
	Profile	Salinity	0.10 – 0.23 ppt	
		Specific Conductivity	161- 451.9 µS/cm	
		pH	7.10 – 8.65 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	171 to 563 mV	
	Nutrients	Dissolved Oxygen	Up to 85% of water column < 2 mg/L in August	Occurred at site 1
		Surface Total Nitrogen	0.33 mg/L to 1.13 mg/L	
Surface Total Phosphorus		0.026 mg/L to 0.109 mg/L		
Nitrogen to Phosphorus Ratio	12:1	Phosphorus limited		

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En.ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	S	S				
	Aesthetics					S	S		
	Agriculture							S	
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

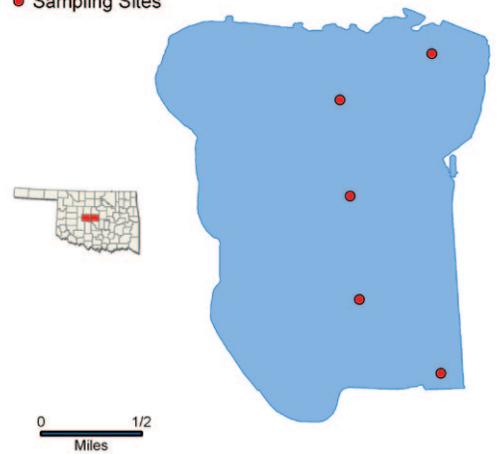
S = Fully Supporting
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 NEI = Not Enough Information

Notes Precipitation data suggest that the peak in turbidity and true color, which occurred in May are likely due to seasonal storm events, therefore Oologah Lake will be listed as supporting its Fish & Wildlife Propagation (FWP) and Aesthetics beneficial use for these parameters. The PBCR cannot be assessed as minimum data requirements were not met due to QA/QC issues for E. coli.

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Overholser

● Sampling Sites



Sample Period	Times Visited	Sampling Sites
November 2005 – August 2006	4	5

Lake Data	Parameter	Value
Location	Oklahoma County	
Impoundment	1919	
Area	1,500 acres	
Capacity	15,000 acre-feet	
Purposes	Water Supply, Recreation	

Parameters	Profile	Parameter	Result	Notes/Comments
		Average Turbidity	60 NTU	75% of values > OWQS of 25 NTU
	Average True Color	38 units	10% of values > OWQS of 70	
	Average Secchi Disk Depth	32 cm		
	Water Clarity Rating	Fair to poor		
	Trophic State Index	67		
	Trophic Class	hypereutrophic		
	Nutrients	Salinity	0.04 – 0.74 ppt	
		Specific Conductivity	102 – 1399 μ S/cm	
		pH	7.80– 8.64 pH units	Neutral to slightly alkaline
Nutrients	Oxidation-Reduction Potential	359 to 431 mV		
	Dissolved Oxygen		Not stratified during any sampling interval	
	Surface Total Nitrogen	0.88 mg/L to 2.38 mg/L		
	Surface Total Phosphorus	0.100 mg/L to 0.317 mg/L		
	Nitrogen to Phosphorus Ratio	7:1	Possibly co- limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	NS	S				
	Aesthetics					NS*	NS		
	Agriculture						S		
	Primary Body Contact Recreation							S	
	Public & Private Water Supply								

S = Fully Supporting
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 NEI = Not Enough Information

Notes

*The lake is listed in the WQS as a NLW indicating that the Aesthetics beneficial use is considered threatened by nutrients until studies can be conducted to confirm non-support status

NTU = nephelometric turbidity units
 μ S/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

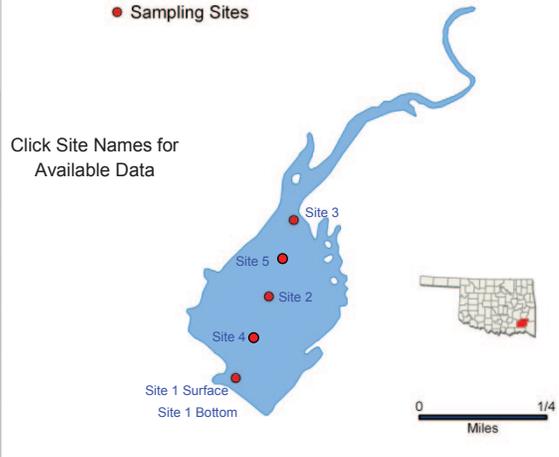
mg/L = milligrams per liter
 μ S/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Ozzie Cobb

Sample Period	Times Visited	Sampling Sites
November 2007 – August 2008	4	5

General	Location	Pushmataha County	Click map for site data
	Impoundment	1958	
	Area	116 acres	
	Capacity	833 acre feet	
	Purposes	Recreation	

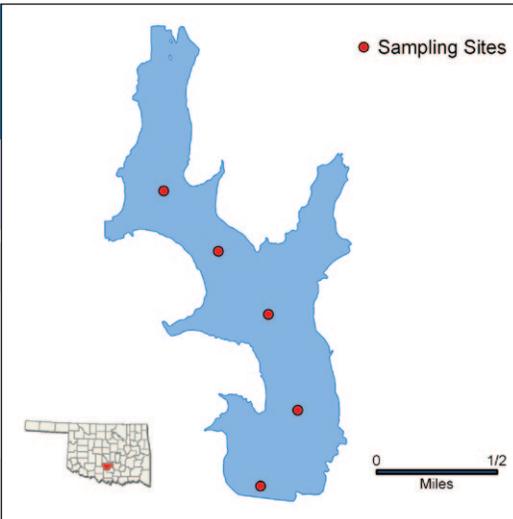


Parameters	Parameter (Descriptions)	Result	Notes/Comments	
	Average Turbidity	12 nephelometric turbidity units (NTU)	All values < 25 NTU	
	Average True Color	51 units	25% of values > OWQS of 70	
	Average Secchi Disk Depth	56 cm		
	Water Clarity Rating	average		
	Trophic State Index	59	Previous value = 55	
	Trophic Class	eutrophic		
	Profile	Salinity	0.00 – 0.20 ppt	
		Specific Conductivity	50.6 - 311 µS/cm	
		pH	6.32 – 7.96 pH units	7 (13%) of values < 6.5
		Oxidation-Reduction Potential	15 to 543 mV	
		Dissolved Oxygen	Up to 50% of water column < 2 mg/L in August	Occurred at site 1
	Nutrients	Surface Total Nitrogen	0.47 mg/L to 0.94 mg/L	
		Surface Total Phosphorus	0.034 mg/L to 0.072 mg/L	
		Nitrogen to Phosphorus Ratio	17:1	Phosphorus limited

Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enterro. & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	NS	S	S							
	Aesthetics					NS*	NS					
	Agriculture							S	S	S		
	Primary Body Contact Recreation										S	
	Public & Private Water Supply											
S = Fully Supporting NS = Not Supporting NEI = Not Enough Information		Notes Slightly acidic conditions are not unusual in this part of the state due to relatively low soil pH and lack of soluble bedrock. Because of these conditions it is likely that the low pH values may be due to natural causes; therefore the Water Board is looking at the applicability of developing site-specific criteria for waters in the southeastern portion of the state. **This is an NLW waterbody in the OWQS.										

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Pauls Valley



Sample Period	Times Visited	Sampling Sites
October 2007 – July 2008	4	5

Lake Data	Location	Garvin County
	Impoundment	1954
	Area	750 acres
	Capacity	8,730 acre feet
	Purposes	Water Supply and Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	43 NTU	80% of values > 25 NTU	
	Average True Color	126 units	75% of values > OWQS of 70	
	Average Secchi Disk Depth	37 cm		
	Water Clarity Rating	poor		
	Trophic State Index	50	Previous value = 49	
	Trophic Class	mesotrophic		
	Profile	Salinity	0.10 – 0.12 ppt	
		Specific Conductivity	206.9 - 271 μ S/cm	
		pH	7.14 – 8.59 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	82 to 494 mV	
		Dissolved Oxygen	Up to 44% of water column < 2 mg/L in July	Occurred at site 1
	Nutrients	Surface Total Nitrogen	0.44 mg/L to 0.98 mg/L	
Surface Total Phosphorus		0.018 mg/L to 0.078 mg/L		
Nitrogen to Phosphorus Ratio		17:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E.coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	S	S				
	Aesthetics					S	NS		
	Agriculture						S		
	Primary Body Contact Recreation							S	
	Public & Private Water Supply								

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 NEI = Not Enough Information

Notes

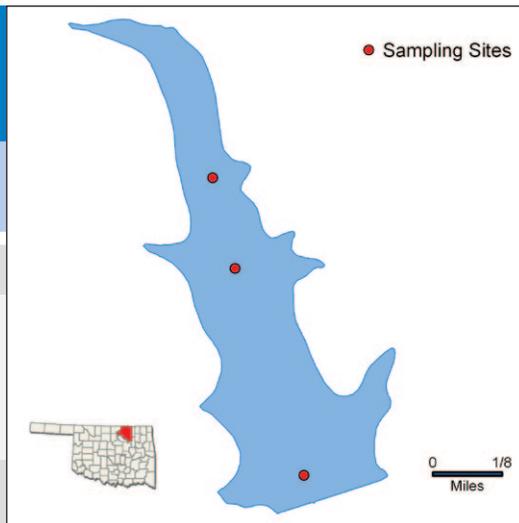
NTU = nephelometric turbidity units
 μ S/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 μ S/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Pawhuska



Sample Period	Times Visited	Sampling Sites
October 2007 – July 2008	4	3

Lake Data	Location	Osage County
	Impoundment	1936
	Area	96 acres
	Capacity	3,600 acre feet
	Purposes	Water Supply and Recreation

Parameters	Profile	Parameter	Result	Notes/Comments
		Average Turbidity	3 NTU	All values < 25 NTU
	Average True Color	21 units	All values < OWQS of 70	
	Average Secchi Disk Depth	195 cm		
	Water Clarity Rating	excellent		
	Trophic State Index	41	Previous value = 39	
	Trophic Class	mesotrophic		
	Nutrients	Salinity	0.15 – 0.27 ppt	
		Specific Conductivity	311.1 – 523.1 µS/cm	
		pH	6.91 – 8.66 pH units	Neutral to slightly alkaline
Oxidation-Reduction Potential		-114 to 485 mV		
Dissolved Oxygen		Up to 54% of water column < 2 mg/L in July	Occurred at site 1	
Surface Total Nitrogen	0.24 mg/L to 0.46 mg/L			
Surface Total Phosphorus	0.005 mg/L to 0.009 mg/L			
Nitrogen to Phosphorus Ratio	51:1	Phosphorus limited		

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	NS	S				
	Aesthetics					S	S		
	Agriculture						S		
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

The PBCR cannot be assessed as minimum data requirements were not met due to QA/QC issues for E. coli and fecal coliform.

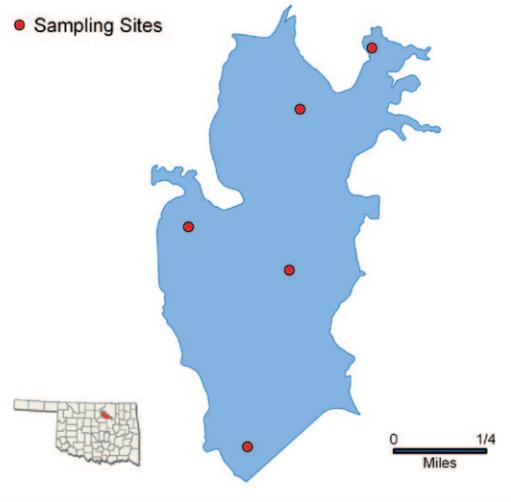
NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Pawnee



Sample Period	Times Visited	Sampling Sites
November 2006 - August 2007	4	5

Lake Data	Location	Pawnee County
	Impoundment	1932
	Area	257 acres
	Capacity	3,855 acre-feet
	Purposes	Water Supply, Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	22 NTU	30% of values > OWQS of 25 NTU	
	Average True Color	66 units	50% of values > OWQS of 70	
	Average Secchi Disk Depth	44 cm		
	Water Clarity Rating	average		
	Trophic State Index	59		
	Trophic Class	eutrophic		
	Profile	Salinity	0.09– 0.16 ppt	
		Specific Conductivity	205.9 – 331 µS/cm	
		pH	7.25 – 8.69 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	73 to 506 mV	
	Nutrients	Dissolved Oxygen	Up to 38% of water column < 2 mg/L in August	Occurred at sites 1 & 2
		Surface Total Nitrogen	0.80 mg/L to 1.25 mg/L	
		Surface Total Phosphorus	0.023 mg/L to 0.060 mg/L	
	Nitrogen to Phosphorus Ratio	24:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	S	S				
	Aesthetics					S	S		
	Agriculture							S	
	Primary Body Contact Recreation								S
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

Available flow and rainfall data suggest that the peak in turbidity and color, which occurred in May is likely due to seasonal storm events, therefore Pawnee Lake will be listed as supporting its Fish & Wildlife Propagation (FWP) and Aesthetics beneficial uses.

NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

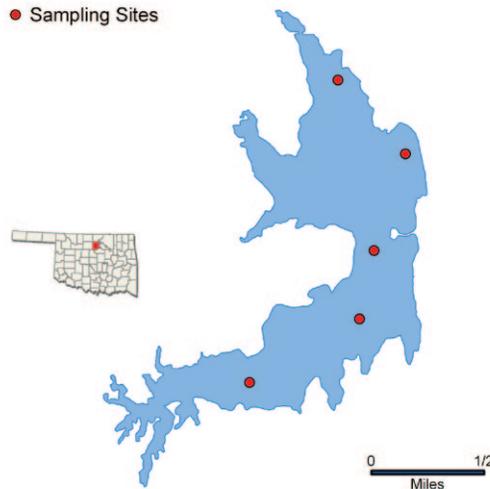
OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Perry

● Sampling Sites



Sample Period	Times Visited	Sampling Sites
November 2006 - August 2007	4	5

Lake Data	Location	Noble County
	Impoundment	1937
	Area	614 acres
	Capacity	6,892 acre-feet
	Purposes	Water Supply, Recreation and Flood Control

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	75 NTU	100% of values > OWQS of 25 NTU	
	Average True Color	143 units	50% of values > OWQS of 70	
	Average Secchi Disk Depth	22 cm		
	Water Clarity Rating	poor		
	Trophic State Index	48		
	Trophic Class	mesotrophic		
	Profile	Salinity	0.08– 0.21 ppt	
		Specific Conductivity	181.9 – 415 µS/cm	
		pH	6.90 – 8.19 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	339 to 435mV	
	Nutrients	Dissolved Oxygen	Up to 36% of water column < 2 mg/L in August	
		Surface Total Nitrogen	0.50 mg/L to 1.35 mg/L	
Surface Total Phosphorus		0.027 mg/L to 0.253 mg/L		
	Nitrogen to Phosphorus Ratio	9:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	S	S				
	Aesthetics					S	NS		
	Agriculture							S	
	Primary Body Contact Recreation								S
	Public & Private Water Supply								

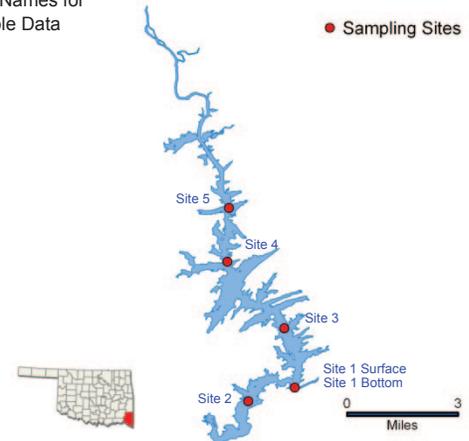
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Notes

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 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Pine Creek

Click Site Names for Available Data



Sample Period	Times Visited	Sampling Sites
November 2010 – July 2011	4	5

General	Location	Mc Curtain County	Click map for site data
	Impoundment	1969	
	Area	3,750 acres	
	Capacity	53,750 acre feet	
	Purposes	Water Supply, Flood Control, Water quality Control, Fish and Wildlife, and Recreation	

Parameters	In-Situ	Parameter (Descriptions)	Result	Notes/Comments
		Average Turbidity	13 NTU	100% of Values < OWQS of 25
		Average Secchi Disk Depth	67 cm	
		Water Clarity Rating	Good	
		Chlorophyll-a	16 mg/m3	
		Trophic State Index	58	Previous value = 53
	Trophic Class	Eutrophic		
	Profile	Salinity	0.0 – 0.03 ppt	
		Specific Conductivity	34.4 – 190.8 µS/cm	
		pH	5.34 – 8.49 pH units	67.7% of values < 6.5
		Oxidation-Reduction Potential	-23 to 500 mV	
		Dissolved Oxygen	Up to 71% of water column < 2 mg/L in summer	
	Nutrients	Surface Total Nitrogen	0.27 mg/L to 0.73 mg/L	
		Surface Total Phosphorus	0.021 mg/L to 0.060 mg/L	
		Nitrogen to Phosphorus Ratio	16:1	Phosphorus limited

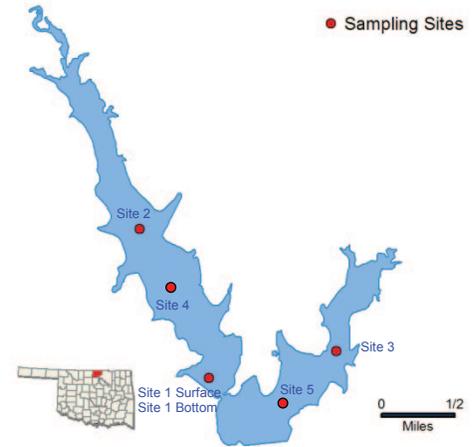
Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enteroc. & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	NS	NS	S							
	Aesthetics					S	*					
	Agriculture							*	*	S		
	Primary Body Contact Recreation										NEI	
	Public & Private Water Supply											

Notes *Slightly acidic conditions are common in this part of the state, due to relatively low soil pH and lack of soluble bedrock. Due to these conditions it is likely that the low pH values may be due to natural causes; therefore the Water Board is looking at the applicability of developing site-specific criteria for waters in the southeastern portion of the state.* Did not collect for this parameter.*

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Ponca

Sample Period	Times Visited	Sampling Sites
November 2010 – July 2011	4	5
Location	Kay County	Click map for site data
Impoundment	1935	
Area	805 acres	
Capacity	14,440 acre feet	
Purposes	Water Supply and Recreation	



	Parameter (Descriptions)	Result	Notes/Comments
	In-Situ	Average Turbidity	11NTU
Average Secchi Disk Depth		78 cm	
Water Clarity Rating		Good	
Chlorophyll-a		15 mg/m ³	
Trophic State Index		57	Previous value = 61
Trophic Class		Eutrophic	
Profile	Salinity	0.17 – 0.19 ppt	
	Specific Conductivity	340 – 376.8 μS/cm	
	pH	7.11 – 8.49 pH units	
	Oxidation-Reduction Potential	167 to 504 mV	
	Dissolved Oxygen	Up to 35% of water column < 2.0 mg/L in summer	
Nutrients	Surface Total Nitrogen	0.49 mg/L to 0.81 mg/L	
	Surface Total Phosphorus	0.019 mg/L to 0.046 mg/L	
	Nitrogen to Phosphorus Ratio	20:1	Phosphorus limited

	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	En & E. coli	Chlor-a
	Fish & Wildlife Propagation		S	S	NS	*						
Aesthetics						S	*					
Agriculture								S	S	S		
Primary Body Contact Recreation											NEI	
Public & Private Water Supply												NS
S = Fully Supporting NS = Not Supporting NEI = Not Enough Information		Notes *Did not collect for these parameters The PBCR beneficial use cannot be assessed as minimum data requirement were not met due to QA/QC issues for <i>E.coli</i> and enterococci.										

NTU = nephelometric turbidity units
 μS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 μS/cm = microsiemens/cm

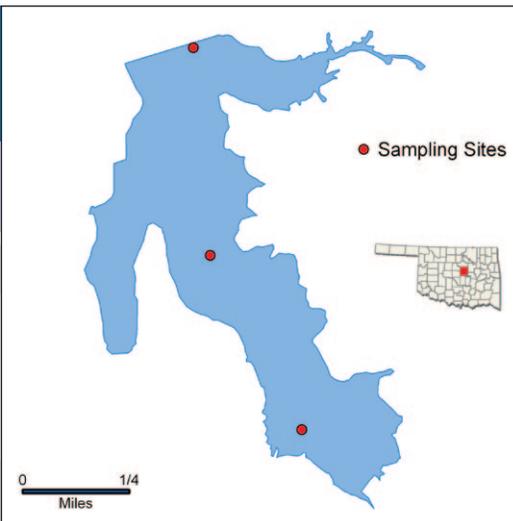
ppt = parts per thousand
 En = Enterococci

Prague City

Sample Period	Times Visited	Sampling Sites
October 2007 – July 2008	4	3

Lake Data

Location	Lincoln County
Impoundment	1984
Area	225 acres
Capacity	2,415 acre feet
Purposes	Water Supply, Flood Control and Recreation



Parameters

Parameter	Result	Notes/Comments
Average Turbidity	12 NTU	All values < 25 NTU
Average True Color	46 units	10% of values > OWQS of 70
Average Secchi Disk Depth	74 cm	
Water Clarity Rating	good	
Trophic State Index	48	Previous value = 52
Trophic Class	mesotrophic	
Profile		
Salinity	0.0 – 0.20 ppt	
Specific Conductivity	112 – 362 μ S/cm	
pH	6.78 – 8.65 pH units	Neutral to slightly alkaline
Oxidation-Reduction Potential	-51 to 543 mV	
Dissolved Oxygen	57 - 63% of water column < 2 mg/L in August	Occurred at sites 1, 4 & 5
Nutrients		
Surface Total Nitrogen	0.51 mg/L to 1.17 mg/L	
Surface Total Phosphorus	0.024 mg/L to 0.057 mg/L	
Nitrogen to Phosphorus Ratio	25:1	Phosphorus limited

Beneficial Uses

	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En. ecal coli, & E. coli	Chlor-a
Fish & Wildlife Propagation	S	S	NS	S					
Aesthetics					S	NS			
Agriculture							S		
Primary Body Contact Recreation									NEI
Public & Private Water Supply									

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

The PBCR cannot be assessed as minimum data requirements were not met due to QA/QC issues for E. coli.

NTU = nephelometric turbidity units
 μ S/cm = microsiemens per centimeter
 E. coli = Escherichia coli

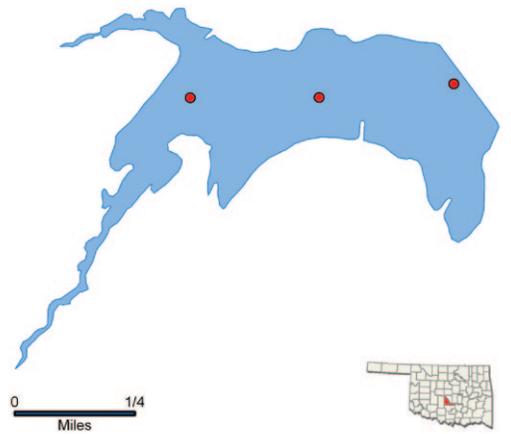
OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 μ S/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Purcell

● Sampling Sites



Sample Period	Times Visited	Sampling Sites
November 2007 – August 2008	4	3

Lake Data	Location	McClain County
	Impoundment	1930
	Area	150 acres
	Capacity	2,600 acre feet
	Purposes	Water Supply and Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	14 NTU	All values < 25 NTU	
	Average True Color	25 units	All values < OWQS of 70	
	Average Secchi Disk Depth	57 cm		
	Water Clarity Rating	good		
	Trophic State Index	51	Previous value = 50	
	Trophic Class	eutrophic		
	Profile	Salinity	0.19 – 0.23 ppt	
		Specific Conductivity	374 – 462.8 µS/cm	
		pH	7.17 – 8.37 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	18 to 645 mV	
	Nutrients	Dissolved Oxygen	Up to 50% of water column < 2 mg/L in August	Occurred at site 1 & 2
		Surface Total Nitrogen	0.60 mg/L to 0.83 mg/L	
Surface Total Phosphorus		0.018 mg/L to 0.041 mg/L		
	Nitrogen to Phosphorus Ratio	24:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En. ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	NS	S				
	Aesthetics					S	S		
	Agriculture							S	
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

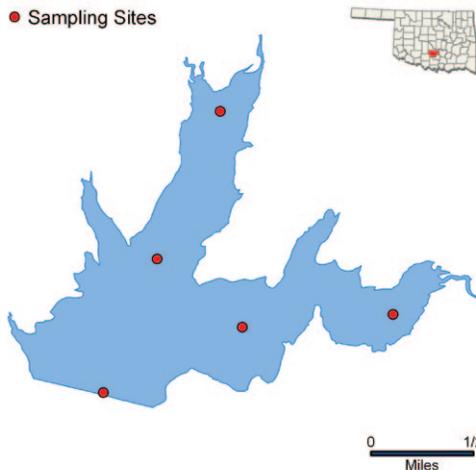
S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

The PBCR cannot be assessed as minimum data requirements were not met due to QA/QC issues for E. coli and fecal coliform.

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

R.C. Longmire



Sample Period	Times Visited	Sampling Sites
November 2007 – August 2008	4	5

Lake Data	Location	Garvin County
	Impoundment	1989
	Area	935 acres
	Capacity	13,162 acre-feet
	Purposes	Water Supply and Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	12 NTU	All values < 25 NTU	
	Average True Color	29 units	All values < OWQS of 70	
	Average Secchi Disk Depth	67 cm		
	Water Clarity Rating	good		
	Trophic State Index	57	Previous value = 56	
	Trophic Class	eutrophic		
	Profile	Salinity	0.10 – 0.20 ppt	
		Specific Conductivity	267 – 388 μ S/cm	
		pH	6.9 – 8.61 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	65 to 545 mV	
	Nutrients	Dissolved Oxygen	Up to 58% of water column < 2 mg/L in August	Occurred at site 1
		Surface Total Nitrogen	0.56 mg/L to 0.89 mg/L	
Surface Total Phosphorus		0.021 mg/L to 0.047 mg/L		
	Nitrogen to Phosphorus Ratio	24:1	Phosphorus limited	

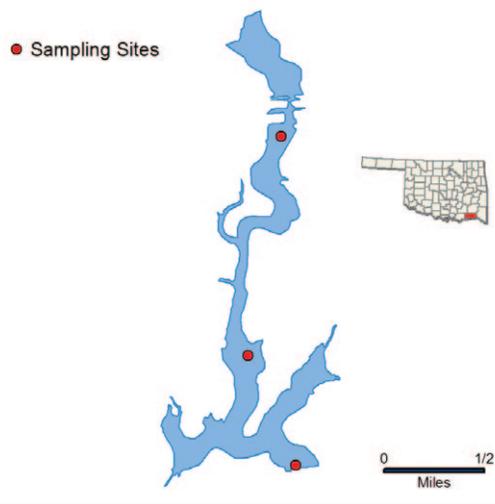
Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	S					
	Aesthetics					S	S		
	Agriculture							S	
	Primary Body Contact Recreation								S
	Public & Private Water Supply				S				

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

NTU = nephelometric turbidity units
 μ S/cm = microsiemens per centimeter
 E. coli = Escherichia coli
 OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a
 mg/L = milligrams per liter
 μ S/cm = microsiemens/cm
 ppt = parts per thousand
 En = Enterococci

Raymond Gary



Sample Period	Times Visited	Sampling Sites
November 2007 – August 2008	4	5

Lake Data	Location	Choctaw County
	Impoundment	1956
	Area	263 acres
	Capacity	1,681 acre feet
	Purposes	Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	11 NTU	All values < 25 NTU	
	Average True Color	53 units	32% of values > OWQS of 70	
	Average Secchi Disk Depth	67 cm		
	Water Clarity Rating	good		
	Trophic State Index	55	Previous value = 50	
	Trophic Class	eutrophic		
	Profile	Salinity	0.0 – 0.60 ppt	
		Specific Conductivity	64.4 – 1217 µS/cm	
		pH	6.64 – 7.53 pH units	Neutral
		Oxidation-Reduction Potential	38 to 513 mV	
	Nutrients	Dissolved Oxygen	Up to 50% of water column < 2 mg/L in August	Occurred at site 1
		Surface Total Nitrogen	0.23 mg/L to 0.62 mg/L	
		Surface Total Phosphorus	0.027 mg/L to 0.059 mg/L	
	Nitrogen to Phosphorus Ratio	12:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	NS	S				
	Aesthetics					S	NS		
	Agriculture						S		
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

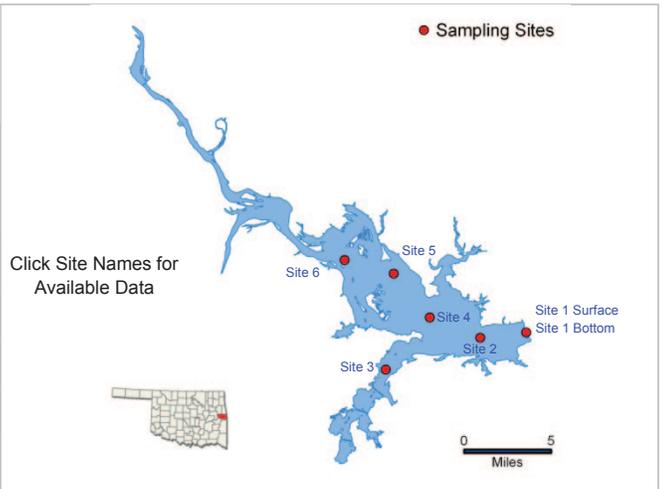
Notes The PBCR cannot be assessed as minimum data requirements were not met due to QA/QC issues for E. coli and fecal coliform.

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Robert S. Kerr

Sample Period	Times Visited	Sampling Sites
November 2010 – June 2011	4	6

General	Location	Sequoyah County	Click map for site data
	Impoundment	1970	
	Area	43,800 acres	
	Capacity	525,700 acre feet	
	Purposes	Navigation, Hydropower, and Recreation	



Parameters		Parameter (Descriptions)	Result	Notes/Comments
In-Situ	Average Turbidity		30 NTU	63% of values > 25 NTU (n=24)
	Average Secchi Depth		57 cm	All values > OWQS of 70
	Water Clarity Rating		Fair	
	Chlorophyll-a		11 mg/m3	
	Trophic State Index		54	Previous value = 50
	Trophic Class		Eutrophic	
Profile	Salinity		0.09– 0.93 ppt	
	Specific Conductivity		190.2 – 1754 µS/cm	
	pH		7.25 – 8.52 pH units	Neutral to slightly alkaline
	Oxidation-Reduction Potential		301 to 448 mV	
	Dissolved Oxygen		All data are above screening level of 2.0 mg/L	
Nutrients	Surface Total Nitrogen		0.26 mg/L to 1.12 mg/L	
	Surface Total Phosphorus		0.048 mg/L to 0.124mg/L	
	Nitrogen to Phosphorus Ratio		9:1	Phosphorus limited

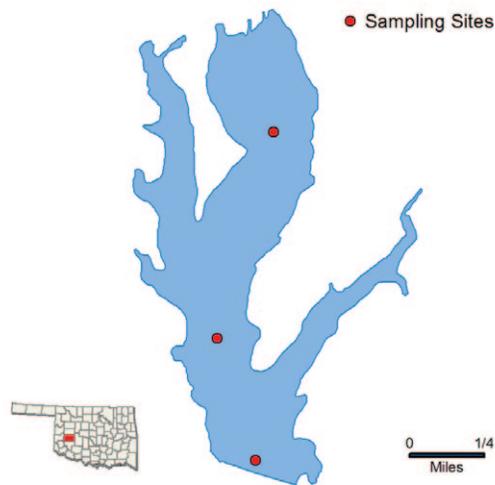
Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enterro. & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	S	S							
	Aesthetics					S	*					
	Agriculture							S	S	S		
	Primary Body Contact Recreation										NEI	
	Public & Private Water Supply											

S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

Notes *Did not collect for this parameter. The PBCR cannot be assessed as minimum data requirements were not met due to QA/QC issues for E. coli and fecal coliform.

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Rocky



Sample Period	Times Visited	Sampling Sites
November 2006 - July 2007	4	5

Lake Data	Location	Washita County
	Impoundment	1933
	Area	347 acres
	Capacity	4,210 acre-feet
	Purposes	Water Supply, Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	46 NTU	90% of values > OWQS of 25 NTU	
	Average True Color	46 units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	27 cm		
	Water Clarity Rating	poor		
	Trophic State Index	69		
	Trophic Class	hypereutrophic		
	Profile	Salinity	0.24– 0.34 ppt	
		Specific Conductivity	471.5 – 652.6 µS/cm	
		pH	7.77 – 8.67 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	264 to 430 mV	
		Dissolved Oxygen	Up to 25% of water column < 2 mg/L in July	
	Nutrients	Surface Total Nitrogen	1.23 mg/L to 1.81 mg/L	
Surface Total Phosphorus		0.074 mg/L to 0.181 mg/L		
Nitrogen to Phosphorus Ratio		12:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	S	S				
	Aesthetics					NS*	S		
	Agriculture						S		
	Primary Body Contact Recreation								NEI**
	Public & Private Water Supply								

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 NS = Not Supporting
 NEI = Not Enough Information

Notes

*The lake is currently listed in the Oklahoma Water Quality Standards (WQS) as a Nutrient Limited Watershed (NLW). This listing means that the lake is considered threatened from nutrients until a more intensive study can confirm the Aesthetics beneficial use non-support status.
 **The PBCR beneficial use cannot be determined as minimum data requirements were not met due to quality control issues for E. coli and Fecal Coliform.

NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

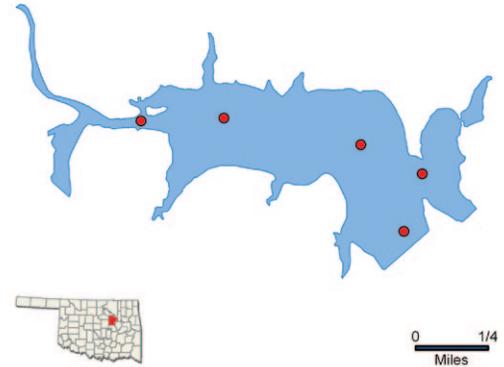
OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Sahoma

● Sampling Sites



Sample Period	Times Visited	Sampling Sites
November 2005 – August 2006	4	5

Lake Data	Location	Creek County
	Impoundment	1947
	Area	312 acres
	Capacity	4,850 acre-feet
	Purposes	Water Supply, Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	9 NTU	100% of values < OWQS of 25 NTU	
	Average True Color	30 units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	73 cm		
	Water Clarity Rating	Fair		
	Trophic State Index	51		
	Trophic Class	eutrophic		
	Profile	Salinity	0.08 – 0.09 ppt	
		Specific Conductivity	184.1 – 203.1 μ S/cm	
		pH	7.02– 7.80 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	125 to 451 mV	
	Nutrients	Dissolved Oxygen	Up to 69% of water column < 2 mg/L in May	Occurred at site 1, the dam
		Surface Total Nitrogen	0.58 mg/L to 0.74 mg/L	
Surface Total Phosphorus		0.023 mg/L to 0.039 mg/L		
Nitrogen to Phosphorus Ratio	22:1	Phosphorus limited		

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	NS	S				
	Aesthetics					S	S		
	Agriculture							S	
	Primary Body Contact Recreation								S
	Public & Private Water Supply								

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 NS = Not Supporting
 NEI = Not Enough Information

Notes

NTU = nephelometric turbidity units
 μ S/cm = microsiemens per centimeter
 E. coli = Escherichia coli

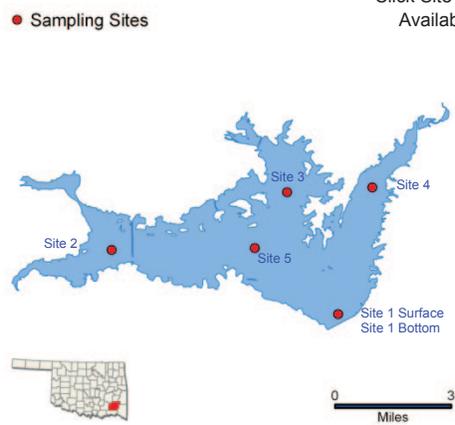
OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 μ S/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Sardis

Click Site Names for Available Data



Sample Period	Times Visited	Sampling Sites
November 2010 – July 2011	4	5

General	Location	Pushmataha County	Click map for site data
	Impoundment	1970	
	Area	13,610 acres	
	Capacity	274,330 acre feet	
	Purposes	Flood Control, Waters Supply, Fish and Wildlife, and Recreation	

Parameters	In-Situ	Parameter (Descriptions)	Result	Notes/Comments
		Average Turbidity	16 NTU	21% of values > 25 NTU (n=20)
		Average Secchi Disk Depth	81 cm	30% of values > OWQS of 70
		Water Clarity Rating	Average	
		Chlorophyll-a	9 mg/m3	
		Trophic State Index	52	Previous value = 46
	Trophic Class	Eutrophic		
	Profile	Salinity	0.01 – 0.02 ppt	
		Specific Conductivity	49.4 – 71.8 µS/cm	
		pH	5.5 – 7.77 pH units	35.7% of values < 6.5 pH units
		Oxidation-Reduction Potential	288 to 570 mV	
		Dissolved Oxygen	Up to 44% of water column < 2 mg/L in summer	
	Nutrients	Surface Total Nitrogen	0.16 mg/L to 0.47 mg/L	
		Surface Total Phosphorus	0.012 mg/L to 0.04 mg/L	
		Nitrogen to Phosphorus Ratio	16:1	Phosphorus limited

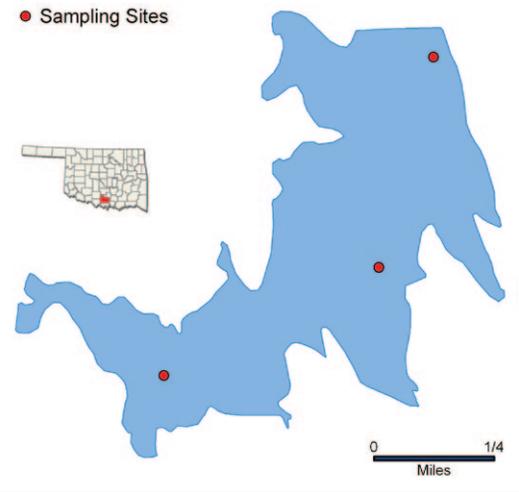
Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enterococci & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	NS	S	S							
	Aesthetics					S	*					
	Agriculture							*	*	S		
	Primary Body Contact Recreation										NEI	
	Public & Private Water Supply											

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 NEI = Not Enough Information

Notes Available rainfall data suggest that the peak in turbidity and true color, which occurred in May is likely due to seasonal storm events, therefore Sardis Lake will be listed as supporting its Fish & Wildlife Propagation (FWP) and Aesthetics beneficial use for these parameters. * Did not collect for these parameters.

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Scott King (Rock Creek)



Sample Period	Times Visited	Sampling Sites
October 2006 - July 2007	4	3

Lake Data	Location	Carter County
	Impoundment	1979
	Area	248 acres
	Capacity	3,588 acre-feet
	Purposes	Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	13 NTU	100% of values < OWQS of 25 NTU	
	Average True Color	26 units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	85 cm		
	Water Clarity Rating	good		
	Trophic State Index	48		
	Trophic Class	mesotrophic		
	Profile	Salinity	0.12– 0.16 ppt	
		Specific Conductivity	250.7 – 333 µS/cm	
		pH	7.20 – 8.71 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	97 to 519 mV	
	Nutrients	Dissolved Oxygen	Up to 60% of water column < 2 mg/L in July	Occurred at site 1, the dam
		Surface Total Nitrogen	0.44 mg/L to 0.96 mg/L	
Surface Total Phosphorus		0.011 mg/L to 0.032 mg/L		
Nitrogen to Phosphorus Ratio	33:1	Phosphorus limited		

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	NS	S				
	Aesthetics					S	S		
	Agriculture						S		
	Primary Body Contact Recreation							S	
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

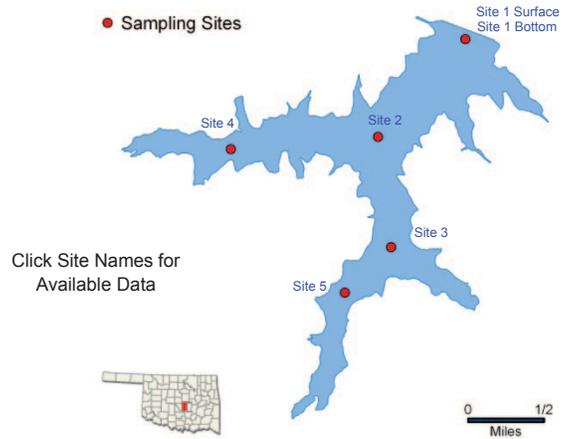
mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Shawnee Twin No. 1

Sample Period	Times Visited	Sampling Sites
November 2010 – July 2011	4	5

General	Location	Pottawatomie County	Click map for site data
	Impoundment	1935	
	Area	1,336 acres	
	Capacity	22,600 acre-feet	
	Purposes	Water Supply, Recreation	



Parameters	In-Situ	Parameter (<i>Descriptions</i>)	Result	Notes/Comments
		Average Turbidity	13 NTU	100% of value < OWQS of 25 NTU
		Average Secchi Disk Depth	103 cm	
		Water Clarity Rating	Average	
		Chlorophyll-a	5 mg/m3	
		Trophic State Index	46	Previous Value=41
	Trophic Class	Mesotrophic		
	Profile	Salinity	0.11 – 0.13 ppt	
		Specific Conductivity	161.7 – 268.2 μ S/cm	
		pH	7.32 – 8.57 pH units	
		Oxidation-Reduction Potential	180 to 402 mV	
		Dissolved Oxygen	Up to 31% of water column < 2 mg/L in summer	
	Nutrients	Surface Total Nitrogen	0.26 mg/L to 0.5 mg/L	
		Surface Total Phosphorus	0.008 mg/L to 0.014 mg/L	
		Nitrogen to Phosphorus Ratio	30:1	Phosphorus limited

Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enterro. & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	S	S							
	Aesthetics					S	*					
	Agriculture							*	*	S		
	Primary Body Contact Recreation										S	
	Public & Private Water Supply											

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

*Did not collect for these parameters.

NTU = nephelometric turbidity units
 μ S/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 μ S/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Shawnee Twin No. 2

Click Site Names for Available Data

● Sampling Sites



Sample Period		Times Visited	Sampling Sites
November 2010 – July 2011		4	5
General	Location	Pottawatomie County	Click map for site data
	Impoundment	1960	
	Area	1,100 acres	
	Capacity	11,400 acre feet	
	Purposes	Waters Supply and Recreation	

Parameters	Parameter (<i>Descriptions</i>)	Result	Notes/Comments
	In-Situ	Average Turbidity	12 NTU
Average Secchi Disk Depth		80 cm	
Water Clarity Rating		Good	
Chlorophyll-a		9 mg/m3	
Trophic State Index		52	Previous value = 43
Trophic Class		Eutrophic	
Profile	Salinity	0.1 – 0.15 ppt	
	Specific Conductivity	224.6 – 301.6 µS/cm	TDS= 160 g/L
	pH	7.21 – 8.69 pH units	Neutral
	Oxidation-Reduction Potential	-67 to 451 mV	
	Dissolved Oxygen	Up to 45% of water column < 2 mg/L in summer	
Nutrients	Surface Total Nitrogen	0.35 mg/L to 2.00 mg/L	
	Surface Total Phosphorus	0.010 mg/L to 0.026 mg/L	
	Nitrogen to Phosphorus Ratio	36:1	Phosphorus limited

Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enterococci & E. coli	Chlor-a
	Fish & Wildlife Propagation		NS	S	S	S						
Aesthetics						S	*					
Agriculture								*	*	S		
Primary Body Contact Recreation											NEI	
Public & Private Water Supply												
S = Fully Supporting NS = Not Supporting NEI = Not Enough Information		Notes *Did not collect for these parameters.										

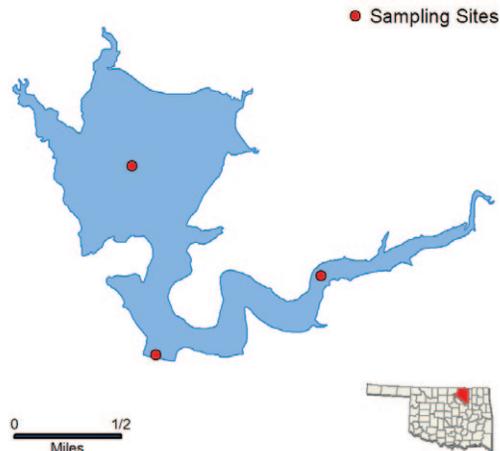
NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Shell



Sample Period	Times Visited	Sampling Sites
November 2005 – August 2006	4	5

Lake Data	Location	Osage County
	Impoundment	1922
	Area	573 acres
	Capacity	9,500 acre-feet
	Purposes	Water Supply, Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	9 NTU	100% of values < OWQS of 25 NTU	
	Average True Color	21 units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	83 cm		
	Water Clarity Rating	excellent		
	Trophic State Index	53		
	Trophic Class	eutrophic		
	Profile	Salinity	0.08 – 0.20 ppt	
		Specific Conductivity	172.2 – 280.5 µS/cm	
		pH	6.74 – 8.52 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	327 to 496 mV	
	Nutrients	Dissolved Oxygen	Up to 67% of water column < 2 mg/L in May	Occurred at site 1, the dam
		Surface Total Nitrogen	0.55 mg/L to 0.96 mg/L	
Surface Total Phosphorus		0.019 mg/L to 0.027 mg/L		
	Nitrogen to Phosphorus Ratio	35:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En.ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	NS	S				
	Aesthetics					S	S		
	Agriculture							S	
	Primary Body Contact Recreation								S
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

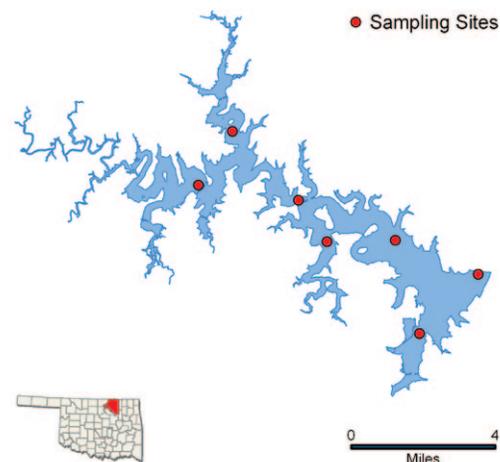
NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Skiatook



Sample Period	Times Visited	Sampling Sites
November 2006 - August 2007	4	7

Lake Data	Location	Osage County
	Impoundment	1984
	Area	10,190 acres
	Capacity	322,700 acre-feet
	Purposes	Flood Control, Water Supply, Water Quality Control, Recreation and Fish & Wildlife

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	13 NTU	7% of values > OWQS of 25 NTU	
	Average True Color	34 units	10% of values > OWQS of 70	
	Average Secchi Disk Depth	98 cm		
	Water Clarity Rating	good		
	Trophic State Index	47		
	Trophic Class	mesotrophic		
	Profile	Salinity	0.07– 0.15 ppt	
		Specific Conductivity	7.5 – 305.5 µS/cm	
		pH	6.80 – 8.05 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	38 to 395 mV	
	Nutrients	Dissolved Oxygen	Up to 59% of water column < 2 mg/L in August	Occurred at site 3
		Surface Total Nitrogen	0.35 mg/L to 1.02 mg/L	
Surface Total Phosphorus		0.006 mg/L to 0.054 mg/L		
Nitrogen to Phosphorus Ratio	29:1	Phosphorus limited		

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En.ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	NS	S				
	Aesthetics					S	NS		
	Agriculture						S		
	Primary Body Contact Recreation							S	
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

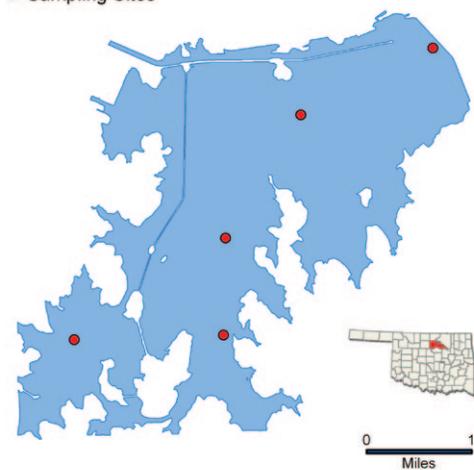
OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Sooner

● Sampling Sites



Sample Period	Times Visited	Sampling Sites
November 2006 - August 2007	4	5

Lake Data	Location	Pawnee County
	Impoundment	1972
	Area	5,400 acres
	Capacity	149,000 acre-feet
	Purposes	Cooling Water

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	6 NTU	100% of values < OWQS of 25 NTU	
	Average True Color	20 units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	115 cm		
	Water Clarity Rating	excellent		
	Trophic State Index	46		
	Trophic Class	mesotrophic		
	Profile	Salinity	0.54 – 1.10 ppt	
		Specific Conductivity	1039 – 2066 µS/cm	
		pH	7.21 – 8.46 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	269 to 485 mV	
	Nutrients	Dissolved Oxygen	Up to 52% of water column < 2 mg/L in August	Occurred at sites 1 and 4
		Surface Total Nitrogen	0.46 mg/L to 0.69 mg/L	
Surface Total Phosphorus		0.007 mg/L to 0.027 mg/L		
	Nitrogen to Phosphorus Ratio	38:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En.ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	NS	S				
	Aesthetics					S	S		
	Agriculture							NS*	
	Primary Body Contact Recreation								NEI**
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes
 * Approximately 70% of the Sulfate values were above the standard, the AG use is therefore considered not supported.
 ** Due to minimum data requirements not being met, an assessment of the PBCR beneficial use cannot be made for sample year 2006-2007.

NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

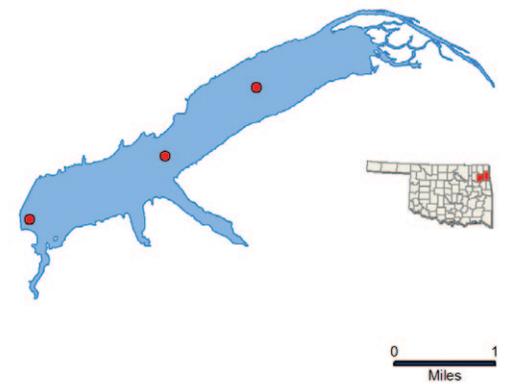
OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Spavinaw

● Sampling Sites



Sample Period	Times Visited	Sampling Sites
November 2006 - August 2007	4	5

Location	Mayes County
Impoundment	1924
Area	1,584 acres
Capacity	38,000 acre-feet
Purposes	Water Supply, Recreation, Fish & Wildlife

Parameter	Result	Notes/Comments	
Average Turbidity	6 NTU	100% of values < OWQS of 25 NTU	
Average True Color	15 units	100% of values < OWQS of 70	
Average Secchi Disk Depth	131 cm		
Water Clarity Rating	excellent		
Trophic State Index	53		
Trophic Class	eutrophic		
Profile	Salinity	0.07 – 0.16 ppt	
	Specific Conductivity	167.9 – 331.2 μ S/cm	
	pH	7.22 – 8.89 pH units	Neutral to slightly alkaline
	Oxidation-Reduction Potential	58 to 485 mV	
Nutrients	Dissolved Oxygen	Up to 67% of water column < 2 mg/L in August	Occurred at sites 1, the dam
	Surface Total Nitrogen	0.44 mg/L to 1.24 mg/L	
	Surface Total Phosphorus	0.009 mg/L to 0.038 mg/L	
	Nitrogen to Phosphorus Ratio	33:1	Phosphorus limited

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	NS	S				
Aesthetics					NS*	S			
Agriculture							S		
Primary Body Contact Recreation								S	
Public & Private Water Supply									

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

*The lake is currently listed as a Nutrient Limited Watershed (NLW) in the Oklahoma Water Quality Standards (WQS) and is considered nutrient threatened.

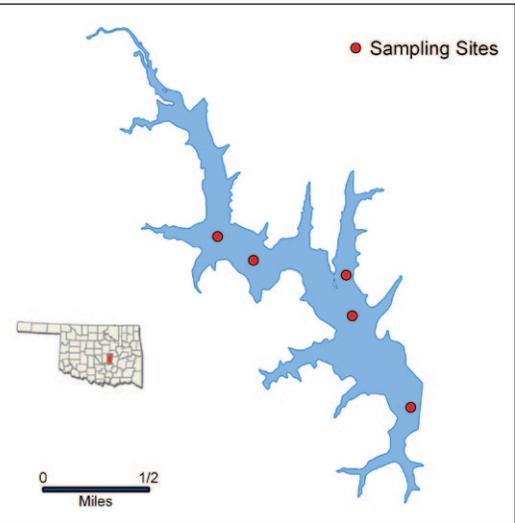
NTU = nephelometric turbidity units
 μ S/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 μ S/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Sportsman



Sample Period	Times Visited	Sampling Sites
October 2007 – July 2008	4	5

Lake Data	Location	Seminole County
	Impoundment	1958
	Area	354 acres
	Capacity	5,349 acre feet
	Purposes	Waters Supply and Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	23 NTU	25% of values > 25 NTU	
	Average True Color	82 units	25% of values > OWQS of 70	
	Average Secchi Disk Depth	76 cm		
	Water Clarity Rating	average		
	Trophic State Index	43	Previous value = 40	
	Trophic Class	mesotrophic		
	Profile	Salinity	0.06 – 0.12 ppt	
		Specific Conductivity	148.3 – 251.2 µS/cm	
		pH	6.6 – 7.93 pH units	Neutral
		Oxidation-Reduction Potential	37 to 504 mV	
	Nutrients	Dissolved Oxygen	Up to 60% of water column < 2 mg/L in July	Occurred at site 1
		Surface Total Nitrogen	0.43 mg/L to 0.71 mg/L	
Surface Total Phosphorus		0.010 mg/L to 0.062 mg/L		
Nitrogen to Phosphorus Ratio	23:1	Phosphorus limited		

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En, ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	NS	S				
	Aesthetics					S	S		
	Agriculture							S	
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

Precipitation data suggest that the peaks in turbidity and true color, which occurred in May are likely due to seasonal storm events, therefore Sportsman Lake will be listed as supporting its Fish & Wildlife Propagation (FWP) and Aesthetics beneficial use for these parameters. The PBCR cannot be assessed due to QA/QC issues for fecal coliform and enterococci.

NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

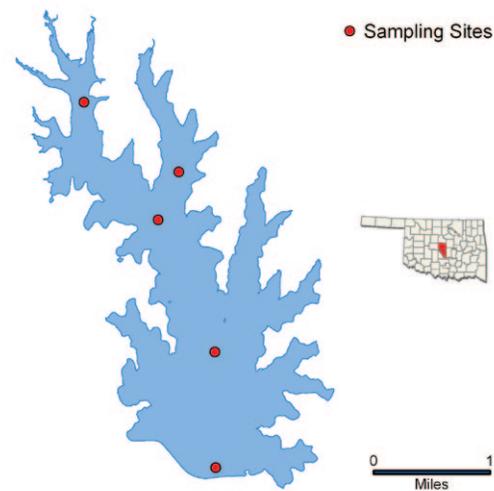
ppt = parts per thousand
 En = Enterococci

Stanley Draper

Sample Period	Times Visited	Sampling Sites
November 2005 – August 2006	4	5

Lake Data

Location	Cleveland County
Impoundment	1962
Area	2,900 acres
Capacity	100,000 acre-feet
Purposes	Water Supply, Recreation



Parameters

Parameter	Result	Notes/Comments
Average Turbidity	7 NTU	100% of values < OWQS of 25 NTU
Average True Color	28 units	100% of values < OWQS of 70
Average Secchi Disk Depth	133 cm	
Water Clarity Rating	good	
Trophic State Index	40	
Trophic Class	oligotrophic	
Profile		
Salinity	0.03 – 0.09 ppt	
Specific Conductivity	95 – 191.5 µS/cm	
pH	6.90 – 8.18 pH units	
Oxidation-Reduction Potential	356 to 445 mV	
Dissolved Oxygen	Up to 52% of water column < 2 mg/L in August	Occurred at site 1, the dam
Nutrients		
Surface Total Nitrogen	0.16 mg/L to 0.33 mg/L	
Surface Total Phosphorus	0.010 mg/L to 0.015 mg/L	
Nitrogen to Phosphorus Ratio	20:1	Phosphorus limited

Beneficial Uses

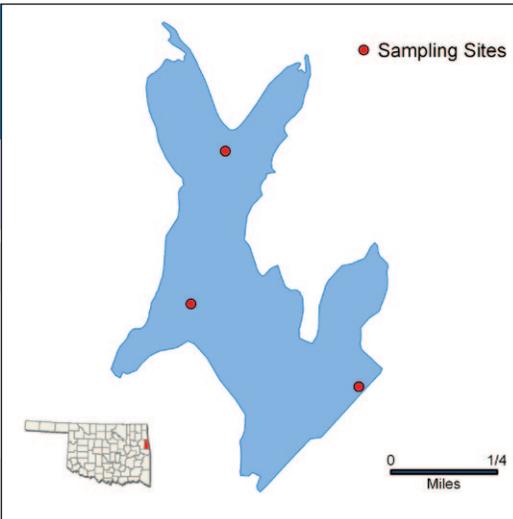
	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
Fish & Wildlife Propagation	S	S	NS	S					
Aesthetics					S	S			
Agriculture							S		
Primary Body Contact Recreation								S	
Public & Private Water Supply									

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli
 OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a
 mg/L = milligrams per liter
 µS/cm = microsiemens/cm
 ppt = parts per thousand
 En = Enterococci

Stilwell City



Sample Period	Times Visited	Sampling Sites
October 2005 – August 2006	3	3

Lake Data	Location	Adair County
	Impoundment	1965
	Area	188 acres
	Capacity	3,110 acre-feet
	Purposes	Water Supply, Recreation, Flood Control

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	6 NTU	100% of values < OWQS of 25 NTU	
	Average True Color	14 units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	161 cm		
	Water Clarity Rating	excellent		
	Trophic State Index	54		
	Trophic Class	eutrophic		
	Profile	Salinity	0.07 – 0.14 ppt	
		Specific Conductivity	159.1 – 297.2 µS/cm	
		pH	6.87 – 8.53 pH units	
		Oxidation-Reduction Potential	88 to 452 mV	
	Nutrients	Dissolved Oxygen	Up to 64% of water column < 2 mg/L in August	Occurred at site 1, the dam
		Surface Total Nitrogen	0.32 mg/L to 0.88 mg/L	
Surface Total Phosphorus		0.019 mg/L to 0.044 mg/L		
	Nitrogen to Phosphorus Ratio	20:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	NS	S				
	Aesthetics					S	S		
	Agriculture						S		
	Primary Body Contact Recreation							S	
	Public & Private Water Supply								

Notes

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

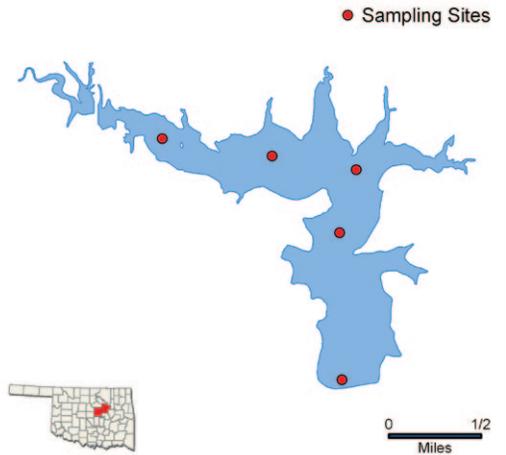
NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Stroud



Sample Period	Times Visited	Sampling Sites
October 2005 – July 2006	4	5

Lake Data	Location	Creek County
	Impoundment	1968
	Area	600 acres
	Capacity	8,800 acre-feet
	Purposes	Water Supply, Recreation, Flood Control

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	5 NTU	100% of values < OWQS of 25 NTU	
	Average True Color	15 units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	126 cm		
	Water Clarity Rating	excellent		
	Trophic State Index	41		
	Trophic Class	mesotrophic		
	Profile	Salinity	0.08 – 0.10 ppt	
		Specific Conductivity	178.6 – 214.5 µS/cm	
		pH	7.03 – 8.90 pH units	
		Oxidation-Reduction Potential	155 to 500 mV	
		Dissolved Oxygen	Up to 60% of water column < 2 mg/L in July	Occurred at site 2
	Nutrients	Surface Total Nitrogen	0.10 mg/L to 0.41 mg/L	
Surface Total Phosphorus		0.008 mg/L to 0.020 mg/L		
Nitrogen to Phosphorus Ratio		22:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E.coli	Chlor-a
	Fish & Wildlife Propagation	S	S	NS	S				
	Aesthetics					S	S		
	Agriculture							NS*	
	Primary Body Contact Recreation								S
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

*Sampling in 2005-2006 found the Agriculture beneficial use not supported based on numerical criteria for sulfates located in OAC 785:45 – Appendix F.

NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

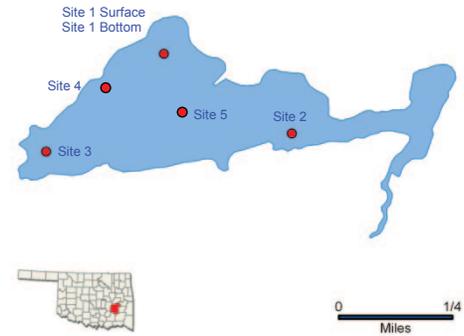
mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Talawanda No. 1

Click Site Names for Available Data

● Sampling Sites



Sample Period		Times Visited	Sampling Sites
December 2010 – July 2011		4	5

General	Location	Pittsburg County	Click map for site data
	Impoundment	1902	
	Area	91 acres	
	Capacity	12,000 acre feet	
	Purposes	Waters Supply and Recreation	

Parameters		Parameter (<i>Descriptions</i>)	Result	Notes/Comments
		In-Situ	Average Turbidity	3 NTU
Average Secchi Disk Depth	153 cm			
Water Clarity Rating	Excellent			
Chlorophyll-a	5 mg/m3			
Trophic State Index	47		Previous value = 42	
Trophic Class	Mesotrophic			
Profile	Salinity	0.03 – 0.07 ppt		
	Specific Conductivity	90.4 – 152.1 μS/cm		
	pH	6.22 – 7.75 pH units	10.53% of values < 6.5 pH units	
	Oxidation-Reduction Potential	-34 to 434 mV		
	Dissolved Oxygen	Up to 44% of water column < 2 mg/L in summer		
Nutrients	Surface Total Nitrogen	0.41 mg/L to 0.65 mg/L		
	Surface Total Phosphorus	0.009 mg/L to 0.016 mg/L		
	Nitrogen to Phosphorus Ratio	39:1	Phosphorus limited	

Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enterro. & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	NS	S	S							
	Aesthetics					S	*					
	Agriculture							*	*	S		
	Primary Body Contact Recreation										S	
	Public & Private Water Supply											

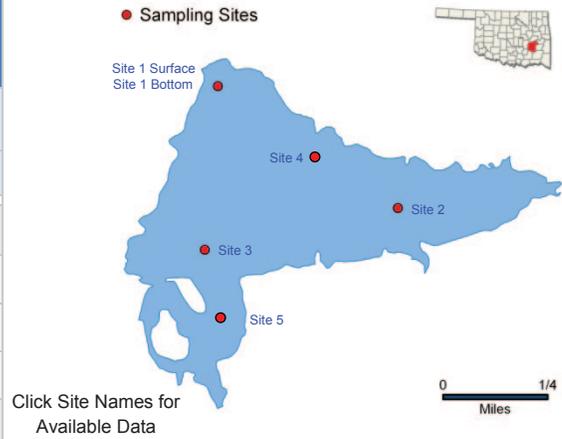
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 NS = Not Supporting
 NEI = Not Enough Information

Notes

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 μS/cm = microsiemens per centimeter mV = millivolts μS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Talawanda No. 2

Sample Period	Times Visited	Sampling Sites
December 2010 – July 2011	4	5
Location	Pittsburg County	Click map for site data
Impoundment	1924	
Area	195 acres	
Capacity	2,750 acre feet	
Purposes	Waters Supply and Recreation	



Parameters		Parameter (Descriptions)	Result	Notes/Comments
		In-Situ	Average Turbidity	6 NTU
Average Secchi Disk Depth	123 cm			
Water Clarity Rating	Excellent			
Chlorophyll-a	4 mg/m ³			
Trophic State Index	44		Previous value = 45	
Trophic Class	Mesotrophic			
Profile	Salinity	0.04 – 0.06 ppt		
	Specific Conductivity	99.7 – 141.2 µS/cm		
	pH	6.42 – 8.06 pH units	6.82% of values < 6.5 pH units	
	Oxidation-Reduction Potential	-48 to 486 mV		
	Dissolved Oxygen	Up to 50% of water column < 2 mg/L in summer		
Nutrients	Surface Total Nitrogen	0.19 mg/L to 0.37 mg/L		
	Surface Total Phosphorus	0.006 mg/L to 0.013 mg/L		
	Nitrogen to Phosphorus Ratio	31:1	Phosphorus limited	

Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enterococci & E. coli	Chlor-a
		Fish & Wildlife Propagation	S	S	S	S						
Aesthetics					S	S						
Agriculture							S	S	S			
Primary Body Contact Recreation										NEI		
Public & Private Water Supply												
S = Fully Supporting NS = Not Supporting NEI = Not Enough Information		Notes The PBCR beneficial use cannot be assessed for this sample year as minimum data requirement were not met due to QA/QC issues for <i>E. coli</i> .										

NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

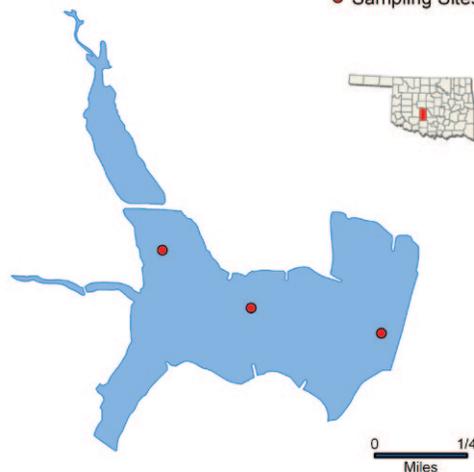
OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Taylor

● Sampling Sites



Sample Period	Times Visited	Sampling Sites
October 2007 – July 2008	4	3

Lake Data	Location	Grady County
	Impoundment	1960
	Area	227 acres
	Capacity	1,877 acre feet
	Purposes	Water Supply, Flood Control, and Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	20 NTU	17% of values > 25 NTU	
	Average True Color	34 units	All values < OWQS of 70	
	Average Secchi Disk Depth	41 cm		
	Water Clarity Rating	average		
	Trophic State Index	64	Previous value = 63	
	Trophic Class	hypereutrophic		
	Profile	Salinity	0.20 – 0.33 ppt	
		Specific Conductivity	399.9 – 645 µS/cm	
		pH	7.7 – 8.62 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	381 to 460 mV	
		Dissolved Oxygen		D.O. always > 5.0 mg/L
	Nutrients	Surface Total Nitrogen	0.95 mg/L to 1.53 mg/L	
Surface Total Phosphorus		0.077 mg/L to 0.237 mg/L		
Nitrogen to Phosphorus Ratio		8:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	S	S				
	Aesthetics					NS	S		
	Agriculture						S		
	Primary Body Contact Recreation							S	
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

Currently, the lake listed as a Nutrient Limited Watershed (NLW) in the Oklahoma Water Quality Standards (WQS). This listing means that the lake is considered threatened from nutrients until a more intensive study can confirm the Aesthetics beneficial use non-support status.

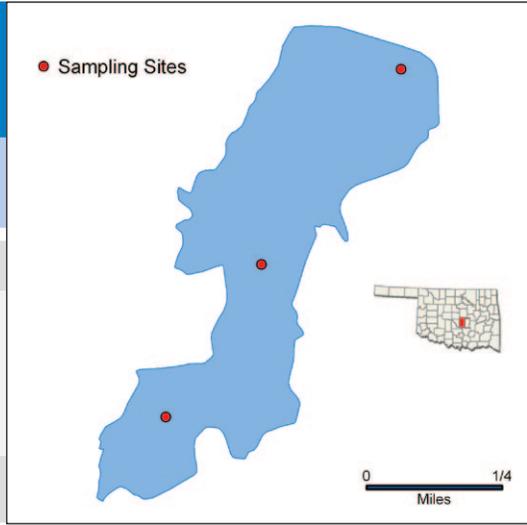
NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Tecumseh



Sample Period	Times Visited	Sampling Sites
October 2007 – July 2008	4	3

Lake Data	Location	Pottawatomie County
	Impoundment	1934
	Area	127 acres
	Capacity	1,118 acre feet
	Purposes	Water Supply, and Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	132 NTU	All values > 25 NTU	
	Average True Color	244 units	All values > OWQS of 70	
	Average Secchi Disk Depth	11 cm		
	Water Clarity Rating	poor		
	Trophic State Index	49	Previous value = 57	
	Trophic Class	mesotrophic		
	Profile	Salinity	0.00 – 0.10 ppt	
		Specific Conductivity	105.6 – 141 µS/cm	
		pH	7.08 – 7.60 pH units	Neutral
		Oxidation-Reduction Potential	337 to 537 mV	
		Dissolved Oxygen		D.O. always > 5.0 mg/L
	Nutrients	Surface Total Nitrogen	1.01 mg/L to 1.55 mg/L	
		Surface Total Phosphorus	0.066 mg/L to 0.131 mg/L	
		Nitrogen to Phosphorus Ratio	12:1	Phosphorus limited

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	S	*				
	Aesthetics					S	NS		
	Agriculture							S	
	Primary Body Contact Recreation								NEI**
	Public & Private Water Supply								

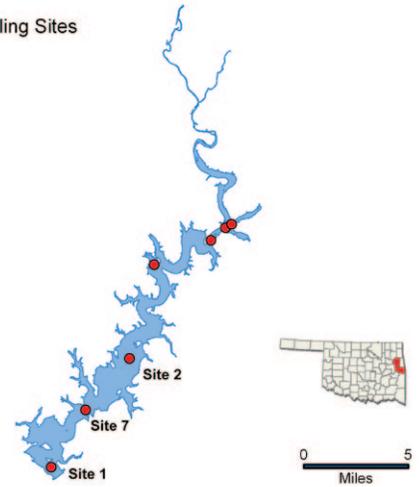
S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

Notes
 *Not supporting for lead as chronic criteria was exceeded. All other toxicants are fully supporting.
 **The PBCR cannot be assessed as minimum data requirements were not met due to QA/QC issues for E. coli and enterococci.

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Tenkiller Ferry (1,2,7)

● Sampling Sites



Sample Period	Times Visited	Sampling Sites
October 2005 – July 2006	4	7

Lake Data	Location	Sequoyah County
	Impoundment	1953
	Area	12,900 acres
	Capacity	654,100 acre-feet
	Purposes	Flood Control, Hydropower

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	2 NTU	100% of values < OWQS of 25 NTU	
	Average True Color	11 units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	217 cm		
	Water Clarity Rating	excellent		
	Trophic State Index	48		
	Trophic Class	mesotrophic		
	Profile	Salinity	0.05 – 0.42 ppt	
		Specific Conductivity	135.3 – 806.2 µS/cm	
		pH	6.57 – 10.05 pH units	10% of recorded values > 9.0 pH units
		Oxidation-Reduction Potential	38 to 528 mV	
		Dissolved Oxygen	52 to 69% of water column < 2 mg/L in July	
	Nutrients	Surface Total Nitrogen	0.11 mg/L to 0.46 mg/L	
Surface Total Phosphorus		0.009 mg/L to 0.022 mg/L		
Nitrogen to Phosphorus Ratio		23:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S*	S	NS	S				
	Aesthetics					NS	S*		
	Agriculture						S		
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

*Although values were below 25 NTU an assessment of the FWP beneficial use cannot be made, as minimum data requirements are not being met. True color values were below the Aesthetics criteria 70 units however like turbidity there are not enough data for this segment to assess the Aesthetics beneficial use. The lake is listed in the WQS as a NLW indicating that the Aesthetics beneficial use is considered threatened by nutrients until studies can be conducted to confirm non-support status.

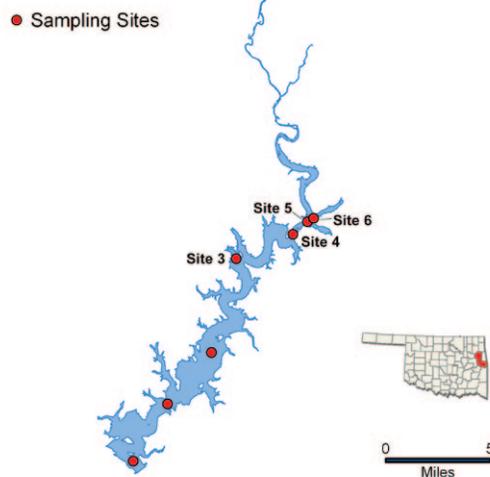
NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Tenkiller Ferry Illinois River Arm (3-6)



Sample Period	Times Visited	Sampling Sites
October 2005 – July 2006	4	7

Lake Data	Location	Sequoyah County
	Impoundment	1953
	Area	12,900 acres
	Capacity	654,100 acre-feet
	Purposes	Flood Control, Hydropower

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	7 NTU	100% of values < OWQS of 25 NTU	
	Average True Color	13 units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	106 cm		
	Water Clarity Rating	excellent		
	Trophic State Index	59		
	Trophic Class	eutrophic		
	Profile	Salinity	0.07 – 0.41 ppt	
		Specific Conductivity	159.3 – 786.4 µS/cm	
		pH	7.02 – 9.23 pH units	4% of recorded values > 9.0 pH units
		Oxidation-Reduction Potential	103 to 454 mV	
		Dissolved Oxygen	50 to 60% of water column < 2 mg/L in July	
	Nutrients	Surface Total Nitrogen	0.19 mg/L to 0.85 mg/L	
Surface Total Phosphorus		0.015 mg/L to 0.085mg/L		
Nitrogen to Phosphorus Ratio		10:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S*	S	NS	S				
	Aesthetics					NS	S*		
	Agriculture						S		
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

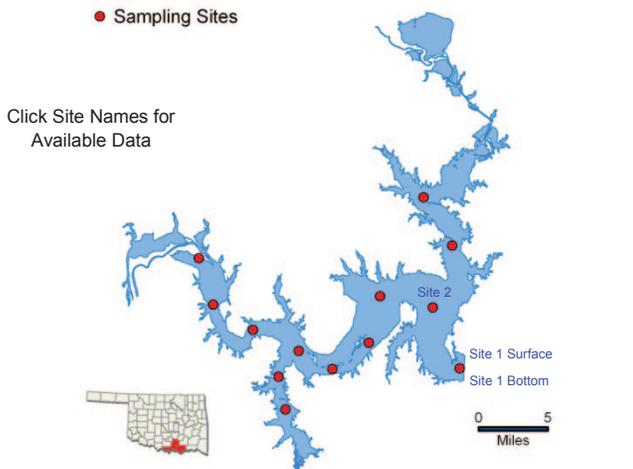
S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes *Although values were below 25 NTU an assessment of the FWP beneficial use cannot be made, as minimum data requirements are not being met. True color values were below the Aesthetics criteria 70 units however like turbidity there are not enough data for this segment to assess the Aesthetics beneficial use. The lake is listed in the WQS as a NLW indicating that the Aesthetics beneficial use is considered threatened by nutrients until studies can be conducted to confirm non-support status.

NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli
 OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a
 mg/L = milligrams per liter
 µS/cm = microsiemens/cm
 ppt = parts per thousand
 En = Enterococci

Texoma (1-2)

Sample Period	Times Visited	Sampling Sites
October 2010 – June 2011	4	13
Location	Bryan County	Click map for site data
Impoundment	1944	
Area	88,000 acres	
Capacity	2,643,000 acre-feet	
Purposes	Flood Control, Waters Supply, Hydropower, Low-flow Regulation, and Recreation	



	Parameter (Descriptions)	Result	Notes/Comments
	In-Situ	Average Turbidity	5 NTU
Average Secchi Disk Depth		142 cm	
Water Clarity Rating		Excellent	
Chlorophyll-a		8 mg/m ³	
Trophic State Index		51	Previous value = 56
Trophic Class		Eutrophic	
Profile	Salinity	0.9 – 1.02 ppt	
	Specific Conductivity	1698 - 1908 µS/cm	
	pH	7.16 – 8.47 pH units	
	Oxidation-Reduction Potential	255 to 422 mV	
	Dissolved Oxygen	Up to 12% of water column < 2.0 mg/L in summer	
Nutrients	Surface Total Nitrogen	0.45 mg/L to 0.66 mg/L	
	Surface Total Phosphorus	0.018 mg/L to 0.038 mg/L	
	Nitrogen to Phosphorus Ratio	19:1	Phosphorus limited

	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	En & E. coli	Chlor-a
	Fish & Wildlife Propagation		NEI	S	S	NEI						
Aesthetics						S	*					
Agriculture								NEI	NEI	S		
Primary Body Contact Recreation											NEI	
Public & Private Water Supply												
S = Fully Supporting NS = Not Supporting NEI = Not Enough Information		Notes Although all values were less than the OWQS for turbidity, the minimum data requirements were not met and an assessment of the FWP beneficial use cannot be made for this sample year. *Did not collect for these parameters.										

NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

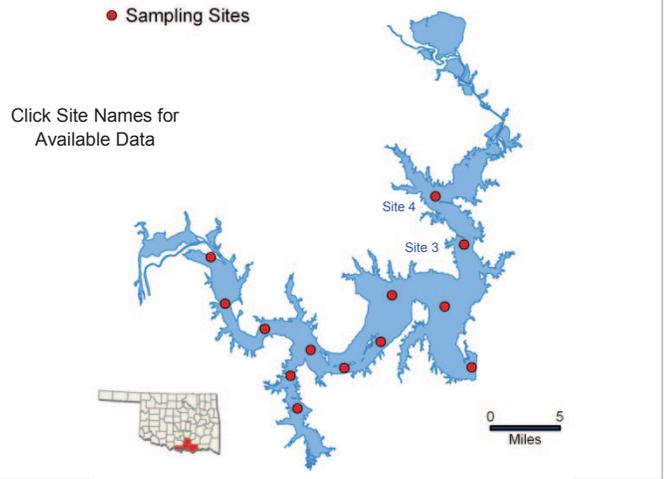
mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Texoma Lower Washita River Arm (3-4)

Sample Period	Times Visited	Sampling Sites
October 2010 – June 2011	4	13

General	Location	Bryan County	Click map for site data
	Impoundment	1944	
	Area	88,000 acres	
	Capacity	2,643,000 acre-feet	
	Purposes	Flood Control, Waters Supply, Hydropower, Low-flow Regulation, and Recreation	



Parameters	In-Situ	Parameter (<i>Descriptions</i>)	Result	Notes/Comments
		Average Turbidity	8 NTU	100% of values < OWQS of 25 NTU
	Average Secchi Disk Depth	105 cm	Did not collect for true color	
	Water Clarity Rating	Excellent		
	Chlorophyll-a	10 mg/m ³		
	Trophic State Index	53	Previous value = 56	
	Trophic Class	Eutrophic		
	Profile	Salinity	0.73 – 1.01 ppt	
		Specific Conductivity	1388 - 1899 µS/cm	
		pH	7.49 – 8.35 pH units	
		Oxidation-Reduction Potential	299 to 413 mV	
		Dissolved Oxygen	Up to 9% of water column < 2.0 mg/L in summer	
	Nutrients	Surface Total Nitrogen	0.46 mg/L to 0.64 mg/L	
		Surface Total Phosphorus	0.024 mg/L to 0.035 mg/L	
		Nitrogen to Phosphorus Ratio	18:1	Phosphorus limited

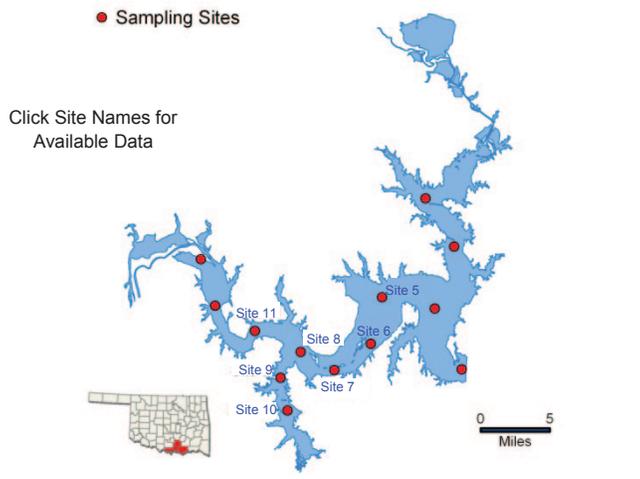
Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	En & E. coli	Chlor-a
	Fish & Wildlife Propagation	NEI	S	S	NEI							
	Aesthetics					S	*					
	Agriculture							NEI	NEI	S		
	Primary Body Contact Recreation										NEI	
	Public & Private Water Supply											
	S = Fully Supporting NS = Not Supporting NEI = Not Enough Information		Notes Although all values were less than the OWQS for turbidity, the minimum data requirements were not met and an assessment of the FWP beneficial use cannot be made for this sample year. *Did not collect for these parameters. Although 63% of Chloride samples exceeded sample standard, an assessment for the Ag beneficial use cannot be made for Chlorides and Sulfates, as minimum data requirements are not being met.									

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Texoma Lower Red River Arm (5-11)

Sample Period	Times Visited	Sampling Sites
October 2010 – June 2011	4	13

General	Location	Bryan County	Click map for site data
	Impoundment	1944	
	Area	88,000 acres	
	Capacity	2,643,000 acre-feet	
	Purposes	Flood Control, Waters Supply, Hydropower, Low-flow Regulation, and Recreation	



Parameters	Parameter (<i>Descriptions</i>)		Result	Notes/Comments	
	In-Situ	Average Turbidity		9 NTU	100% of Values < OWQS of 25 NTU
		Average Secchi Disk Depth		87 cm	
		Water Clarity Rating		Good	
		Chlorophyll-a		45 mg/m ³	
		Trophic State Index		59	Previous value = 59
		Trophic Class		Eutrophic	
	Profile	Salinity		0.00 – 1.56 ppt	
		Specific Conductivity		33.2 – 2897 μS/cm	
		pH		7.10 – 8.63 pH units	
		Oxidation-Reduction Potential		172 to 437 mV	
		Dissolved Oxygen		Up to 33% of water column < 2.0 mg/L in summer	
	Nutrients	Surface Total Nitrogen		0.42 mg/L to 0.88 mg/L	
		Surface Total Phosphorus		0.024 mg/L to 0.065 mg/L	
		Nitrogen to Phosphorus Ratio		15:1	Phosphorus limited

Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	En & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	S	NEI							
	Aesthetics					S	*					
	Agriculture							S	S	S		
	Primary Body Contact Recreation										NEI	
	Public & Private Water Supply											

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

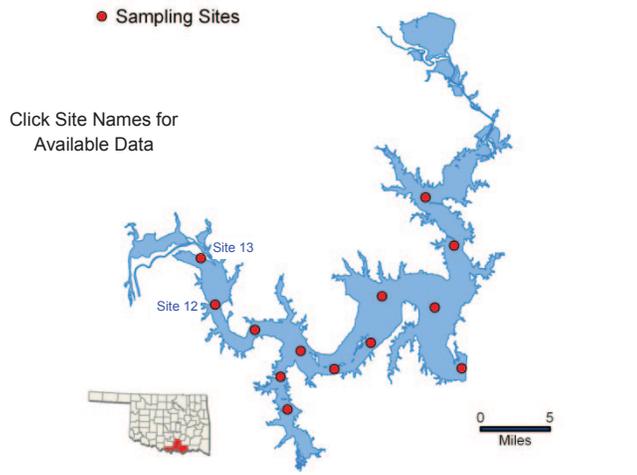
Notes
 *Did not collect for these parameters

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 μS/cm = microsiemens per centimeter mV = millivolts μS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Texoma Upper Red River Arm (12-13)

Sample Period	Times Visited	Sampling Sites
October 2010 – June 2011	4	13

General	Location	Bryan County	Click map for site data
	Impoundment	1944	
	Area	88,000 acres	
	Capacity	2,643,000 acre-feet	
	Purposes	Flood Control, Waters Supply, Hydropower, Low-flow Regulation, and Recreation	



Parameters		Parameter (<i>Descriptions</i>)	Result	Notes/Comments
		In-Situ	Average Turbidity	40 NTU
Average Secchi Disk Depth	27 cm		Did not collect for true color	
Water Clarity Rating	Fair to Poor			
Chlorophyll-a	84 mg/m ³			
Trophic State Index	66		Previous value = 63	
Trophic Class	Hypereutrophic			
Profile	Salinity	1.21 – 1.77 ppt		
	Specific Conductivity	2262 - 3271 μS/cm		
	pH	8.06 – 8.58 pH units		
	Oxidation-Reduction Potential	355 to 413 mV		
	Dissolved Oxygen	All data are above screening level of 2.0 mg/L		
Nutrients	Surface Total Nitrogen	0.75 mg/L to 1.03 mg/L		
	Surface Total Phosphorus	0.055 mg/L to 0.115mg/L		
	Nitrogen to Phosphorus Ratio	10:1	Phosphorus limited	

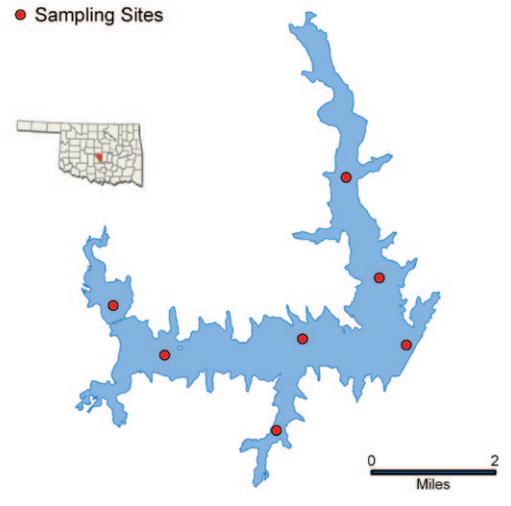
Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	En & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	S	NEI							
	Aesthetics					NS*	*					
	Agriculture							NEI	NEI	S		
	Primary Body Contact Recreation										NEI	
	Public & Private Water Supply											

S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

Notes Although 21% of the values exceeded the OWQS for turbidity, the minimum data requirements were not met and an assessment of the FWP beneficial use cannot be made for this sample year. *Did not collect for these parameters.

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 μS/cm = microsiemens per centimeter mV = millivolts μS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Thunderbird



Sample Period	Times Visited	Sampling Sites
October 2006 - June 2007	4	7

Lake Data	Location	Cleveland County
	Impoundment	1965
	Area	6,070 acres
	Capacity	119,600 acre-feet
	Purposes	Flood Control, Water Supply, Recreation, Fish & Wildlife

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	28 NTU	46% of values > OWQS of 25 NTU	
	Average True Color	32 units	7% of values >OWQS of 70	
	Average Secchi Disk Depth	53 cm		
	Water Clarity Rating	average		
	Trophic State Index	57		
	Trophic Class	eutrophic		
	Profile	Salinity	0.18 – 0.23 ppt	
		Specific Conductivity	367.5 – 460.9 μ S/cm	
		pH	7.28 – 8.57 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	95 to 447 mV	
	Nutrients	Dissolved Oxygen	Up to 47% of water column < 2 mg/L in June	Occurred at sites 1, the dam
		Surface Total Nitrogen	0.59 mg/L to 1.18 mg/L	
Surface Total Phosphorus		0.023 mg/L to 0.429 mg/L		
	Nitrogen to Phosphorus Ratio	13:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	S	S				
	Aesthetics					NS*	S		
	Agriculture						S		
	Primary Body Contact Recreation							S	
	Public & Private Water Supply								

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 NS = Not Supporting
 NEI = Not Enough Information

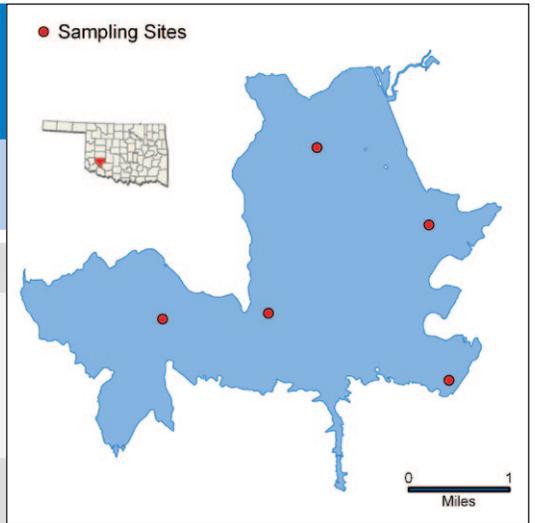
Notes * The lake is listed in the Oklahoma Water Quality Standards (WQS) as a Nutrient Limited watershed (NLW). This listing means that the lake is considered threatened from nutrients until a more intensive study can confirm the Aesthetics beneficial use non-support status.

NTU = nephelometric turbidity units
 μ S/cm = microsiemens per centimeter
 E. coli = Escherichia coli
 OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a
 mg/L = milligrams per liter
 μ S/cm = microsiemens/cm
 ppt = parts per thousand
 En = Enterococci

Tom Steed

Sample Period	Times Visited	Sampling Sites
November 2006 - July 2007	4	5

Lake Data	Location	Kiowa County
	Impoundment	1975
	Area	6,400 acres
	Capacity	88,970 acre-feet
	Purposes	Flood Control, Water Supply, Recreation, Fish & Wildlife



Parameters	Parameter		Result	Notes/Comments	
	Profile	Average Turbidity		30 NTU	50% of values > OWQS of 25 NTU
		Average True Color		40 units	100% of values < OWQS of 70
		Average Secchi Disk Depth		57 cm	
		Water Clarity Rating		average	
		Trophic State Index		55	
		Trophic Class		eutrophic	
	Nutrients	Salinity		0.37 – 0.52ppt	
		Specific Conductivity		722.9 – 1001 µS/cm	
		pH		7.70 – 8.55 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	277 to 399 mV		
		Dissolved Oxygen	Up to 25% of water column < 2 mg/L in July	Occurred at sites 1, the dam	
		Surface Total Nitrogen	0.59 mg/L to 1.04 mg/L		
		Surface Total Phosphorus	0.038 mg/L to 0.108 mg/L		
		Nitrogen to Phosphorus Ratio	12:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	S	S				
	Aesthetics					S	S		
	Agriculture						S		
	Primary Body Contact Recreation							S	
	Public & Private Water Supply								

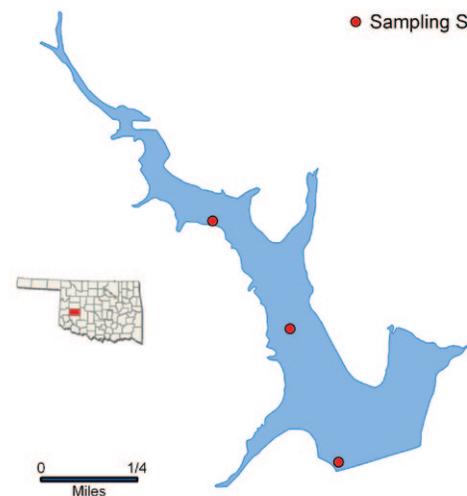
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Notes

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Vanderwork

● Sampling Sites



Sample Period	Times Visited	Sampling Sites
October 2007 – July 2008	4	3

Lake Data	Location	Washita County
	Impoundment	1968
	Area	135 acres
	Capacity	1,578 acre feet
	Purposes	Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	9 NTU	All values < 25 NTU	
	Average True Color	17 units	All values < OWQS of 70	
	Average Secchi Disk Depth	59 cm		
	Water Clarity Rating	good		
	Trophic State Index	64	Previous value = 60	
	Trophic Class	hypereutrophic		
	Profile	Salinity	0.83 - 1.01 ppt	
		Specific Conductivity	1568 – 1896 μS/cm	
		pH	7.2 – 8.18 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	-116 to 530 mV	
	Nutrients	Dissolved Oxygen	Up to 50% of water column < 2 mg/L in June	Occurred at site 1
		Surface Total Nitrogen	0.87 mg/L to 1.75 mg/L	
Surface Total Phosphorus		0.041 mg/L to 0.100 mg/L		
	Nitrogen to Phosphorus Ratio	18:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E.coli	Chlor-a
	Fish & Wildlife Propagation	S	S	NS	S				
	Aesthetics					NS	NS		
	Agriculture							S	
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

The lake is listed as a Nutrient Limited Watershed (NLW) in the Oklahoma Water Quality Standards (WQS). This listing means that the lake is considered threatened from nutrients until a more intensive study can confirm the Aesthetics beneficial use non-support status.

NTU = nephelometric turbidity units
 μS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

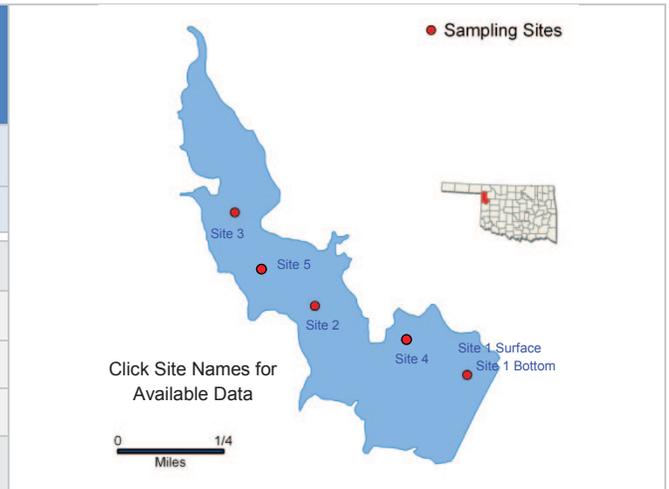
mg/L = milligrams per liter
 μS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Vincent

Sample Period	Times Visited	Sampling Sites
November 2010 – July 2011	4	5

General	Location	Ellis County	Click map for site data
	Impoundment	1961	
	Area	160 acres	
	Capacity	2,579 acre feet	
	Purposes	Recreation	



Parameters	In-Situ	Parameter (<i>Descriptions</i>)	Result	Notes/Comments
		Average Turbidity	14 NTU	100% of Values < OWQS of 25 NTU
		Average Secchi Disk Depth	63 cm	
		Water Clarity Rating	Good	
		Chlorophyll-a	8 mg/m3	
		Trophic State Index	51	Previous value = 46
	Trophic Class	Eutrophic		
	Profile	Salinity	0.43 – 0.48 ppt	
		Specific Conductivity	833.1 - 928 µS/cm	
		pH	7.14 – 8.19 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	-50 to 490 mV	
		Dissolved Oxygen	Up to 45 % < 2 mg/L in summer	
	Nutrients	Surface Total Nitrogen	0.27 mg/L to 0.55 mg/L	
		Surface Total Phosphorus	0.015 mg/L to 0.028 mg/L	
		Nitrogen to Phosphorus Ratio	21:1	Phosphorus limited

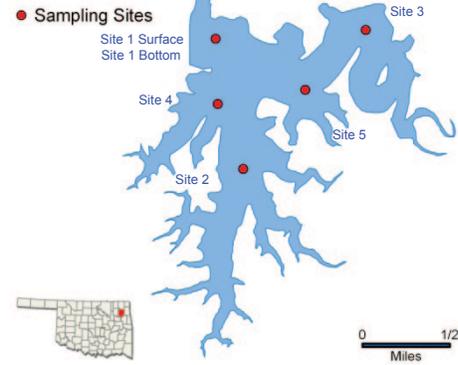
Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enterococci & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	S	S							
	Aesthetics					S	S					
	Agriculture							S	S	S		
	Primary Body Contact Recreation										NEI	
	Public & Private Water Supply											

Notes	<p><i>S = Fully Supporting</i> <i>NS = Not Supporting</i> <i>NEI = Not Enough Information</i></p> <p>The PBCR cannot be assessed as minimum data requirements were not met due QA/QC issue with enterococci.</p>
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NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

W.R. Holway

Click Site Names for Available Data



Sample Period		Times Visited	Sampling Sites
March 2011 – September 2011		4	5
General	Location	Mayes County	Click map for site data
	Impoundment	1968	
	Area	712 acres	
	Capacity	48,000 acre-feet	
	Purposes	Water Supply, Hydropower, Recreation	

Parameters		Parameter (<i>Descriptions</i>)	Result	Notes/Comments
		In-Situ	Average Turbidity	4 NTU
Average Secchi Disk Depth	198 cm			
Water Clarity Rating	Excellent			
Chlorophyll-a	13 mg/m ³			
Trophic State Index	56		Previous Value= 58	
Trophic Class	Eutrophic			
Profile	Salinity	0.10 – 0.14 ppt		
	Specific Conductivity	215.4 - 283 μS/cm		
	pH	7.10 – 9.01 pH units	0.30% of Values > 9 pH units	
	Oxidation-Reduction Potential	308 to 600 mV		
	Dissolved Oxygen	Up to 45% of water column < 2 mg/L in summer		
Nutrients	Surface Total Nitrogen	0.45 mg/L to 1.18 mg/L		
	Surface Total Phosphorus	0.051 mg/L to 0.066 mg/L		
	Nitrogen to Phosphorus Ratio	14:1	Phosphorus limited	

Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enterro. & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	S	S							
	Aesthetics					S	*					
	Agriculture							*	*	S		
	Primary Body Contact Recreation										NEI	
	Public & Private Water Supply											

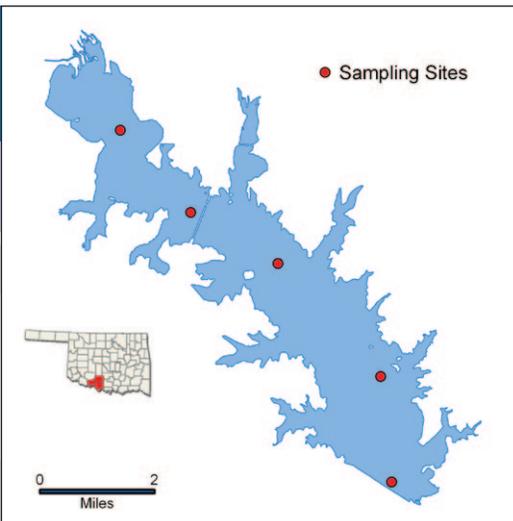
S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

*Did not collect for these parameters

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 μS/cm = microsiemens per centimeter mV = millivolts μS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Waurika



Sample Period	Times Visited	Sampling Sites
October 2007 – July 2008	4	5

Location	Jefferson County
Impoundment	1977
Area	10,100 acres
Capacity	203,100 acre feet
Purposes	Flood Control, Irrigation, Water Supply, Water Quality Control, Fish and Wildlife, and Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	34 NTU	45% of values > 25 NTU	
	Average True Color	63 units	10% of values > OWQS of 70	
	Average Secchi Disk Depth	51 cm		
	Water Clarity Rating	average		
	Trophic State Index	54	Previous value = 60	
	Trophic Class	eutrophic		
	Profile	Salinity	0.19 – 0.35 ppt	
		Specific Conductivity	389.3 – 687.5 µS/cm	
		pH	7.57 – 8.59 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	228 to 507 mV	
		Dissolved Oxygen	Up to 27% of water column , 2 mg/L in July	Occurred at site 1, the dam
	Nutrients	Surface Total Nitrogen	0.53 mg/L to 1.09 mg/L	
Surface Total Phosphorus		0.063 mg/L to 0.154 mg/L		
Nitrogen to Phosphorus Ratio		8:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E.coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	S	S				
	Aesthetics					S	NS		
	Agriculture							S	
	Primary Body Contact Recreation								S
	Public & Private Water Supply								

S = Fully Supporting
 NS = Not Supporting
 NEI = Not Enough Information

Notes

NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

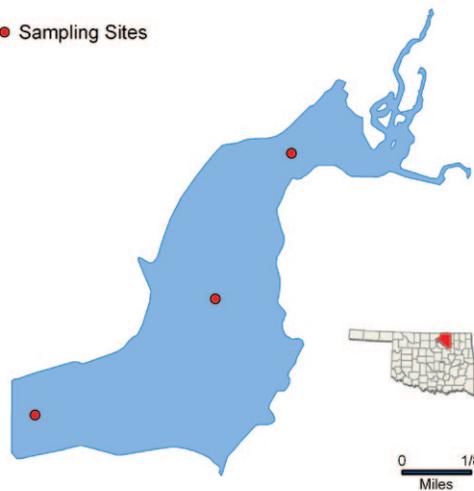
OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Waxhoma

● Sampling Sites



Sample Period	Times Visited	Sampling Sites
October 2005 – July 2006	4	3

Lake Data	Location	Osage County
	Impoundment	1955
	Area	197 acres
	Capacity	2,000 acre-feet
	Purposes	Water Supply, Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	5 NTU	100% of values < OWQS of 25 NTU	
	Average True Color	18 units	100% of values < OWQS of 70	
	Average Secchi Disk Depth	153 cm		
	Water Clarity Rating	excellent		
	Trophic State Index	45		
	Trophic Class	mesotrophic		
	Profile	Salinity	0.09 – 0.11 ppt	
		Specific Conductivity	187.6 – 231.6 µS/cm	
		pH	6.77 – 8.77 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	135 to 438 mV	
	Nutrients	Dissolved Oxygen	Up to 62% of water column < 2 mg/L in July	
		Surface Total Nitrogen	0.15 mg/L to 0.49 mg/L	
Surface Total Phosphorus		0.011mg/L to 0.023 mg/L		
	Nitrogen to Phosphorus Ratio	14:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En.ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	NS	S				
	Aesthetics					S	S		
	Agriculture							S*	
	Primary Body Contact Recreation								S
	Public & Private Water Supply								

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 NEI = Not Enough Information

Notes

*Sampling in 2005-2006 found the Agriculture beneficial use not supported based on numerical criteria for sulfates located in OAC 785:45 – Appendix F.

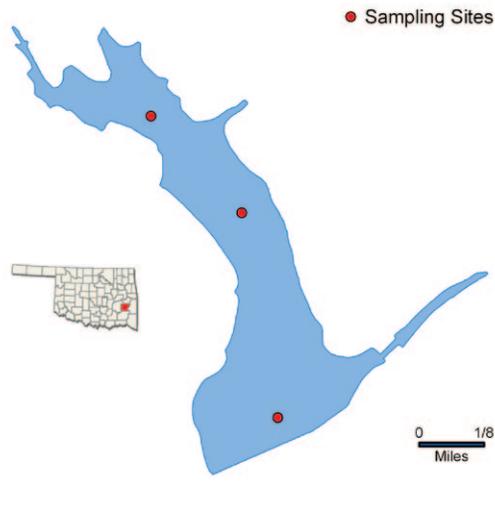
NTU = nephelometric turbidity units
 µS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 µS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Wayne Wallace



Sample Period	Times Visited	Sampling Sites
December 2007 – August 2008	4	3

Lake Data	Location	Latimer County
	Impoundment	1969
	Area	94 acres
	Capacity	1,746 acre feet
	Purposes	Flood Control and Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	16 NTU	All values < 25 NTU	
	Average True Color	98 units	All values > OWQS of 70	
	Average Secchi Disk Depth	76 cm		
	Water Clarity Rating	average		
	Trophic State Index	48	Previous value = 41	
	Trophic Class	mesotrophic		
	Profile	Salinity	0.0 – 0.02 ppt	
		Specific Conductivity	46 – 59.5 µS/cm	
		pH	6.09 – 7.11 pH units	33% of pH values < 6.5
		Oxidation-Reduction Potential	437 to 542 mV	
	Nutrients	Dissolved Oxygen	Up to 20% of water column , 2 mg/L in August	Occurred at site 1, the dam
		Surface Total Nitrogen	0.47 mg/L to 0.59 mg/L	
Surface Total Phosphorus		0.027 mg/L to 0.045 mg/L		
	Nitrogen to Phosphorus Ratio	16:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En.ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	NS	S	S				
	Aesthetics					S	NS		
	Agriculture						S		
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

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 NS = Not Supporting
 NEI = Not Enough Information

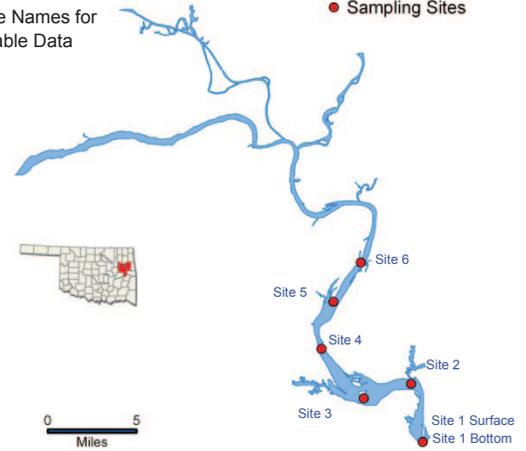
Notes Slightly acidic conditions are common in this part of the state, due to relatively low soil pH and lack of soluble bedrock. Due to these conditions it is likely that the low pH values may be due to natural causes; therefore the Water Board is looking at the applicability of developing site-specific criteria for waters in the southeastern portion of the state.

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Webbers Falls

Click Site Names for Available Data

● Sampling Sites



Sample Period		Times Visited	Sampling Sites
November 2010 – August 2011		4	6
General	Location	Muskogee County	Click map for site data
	Impoundment	170	
	Area	11,600 acres	
	Capacity	170,100 acre-feet	
	Purposes	Navigation, Hydropower	

Parameters	Parameter (Descriptions)	Result	Notes/Comments
	In-Situ	Average Turbidity	13 NTU
Average Secchi Disk Depth		63 cm	
Water Clarity Rating		Average	
Chlorophyll-a		27 mg/m3	
Trophic State Index		63	Previous value = 55
Trophic Class		Hypereutrophic	
Profile	Salinity	0.21 – 0.79 ppt	
	Specific Conductivity	422.1 - 1490 µS/cm	
	pH	7.52 – 9.07 pH units	0.45% of Values > 9 pH units
	Oxidation-Reduction Potential	276 - 458 mV	
	Dissolved Oxygen	All data are above screening level of 2.0 mg/L	
Nutrients	Surface Total Nitrogen	0.38 mg/L to 1.3 mg/L	
	Surface Total Phosphorus	0.101 mg/L to 0.166 mg/L	
	Nitrogen to Phosphorus Ratio	7:1	Phosphorus limited, possibly co-limited

Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	En & E. coli	Chlor-a
	Fish & Wildlife Propagation	NEI	S	S	S							
	Aesthetics					S	*					
	Agriculture							S	S	S		
	Primary Body Contact Recreation										NEI	
	Public & Private Water Supply											

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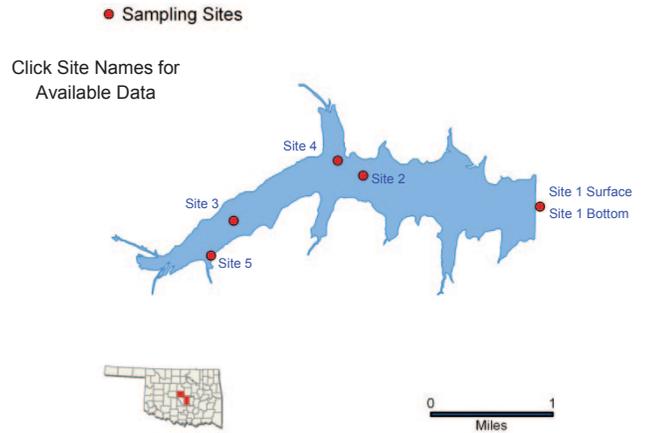
Notes Although 100% of the turbidity values are < 25 NTU, an assessment of the FWP beneficial use cannot be made for this sample year as minimum data requirements were not met.

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Wes Watkins

Sample Period	Times Visited	Sampling Sites
November 2010 – June 2011	3	5

General	Location	Pottawatomie County	Click map for site data
	Impoundment	1997	
	Area	1,142 acres	
	Capacity	14,065 acre-feet	
	Purposes	Water Supply, Recreation, Flood Control	



Parameters	Parameter (Descriptions)		Result	Notes/Comments
	In-Situ	Average Turbidity	18 NTU	16% of values > OWQS of 25 NTU
		Average Secchi Disk Depth	65 cm	
		Water Clarity Rating	Good	
		Chlorophyll-a	13 mg/m ³	
		Trophic State Index	56	Previous Values= 53
		Trophic Class	Eutrophic	
	Profile	Salinity	0.11 – 0.16 ppt	
		Specific Conductivity	231.5 – 336.1 µS/cm	
		pH	6.91 – 8.83 pH units	
		Oxidation-Reduction Potential	18 - 459 mV	
		Dissolved Oxygen	Up to 45 % < 2 mg/L in summer	
	Nutrients	Surface Total Nitrogen	0.69 mg/L to 1.12 mg/L	
		Surface Total Phosphorus	0.033 mg/L to 0.050 mg/L	
		Nitrogen to Phosphorus Ratio	25:1	Phosphorus limited

Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enterococci & E. coli	Chlor-a
	Fish & Wildlife Propagation	S*	S	S	S							
	Aesthetics					S	*					
	Agriculture							*	*	S		
	Primary Body Contact Recreation										NEI	
	Public & Private Water Supply											

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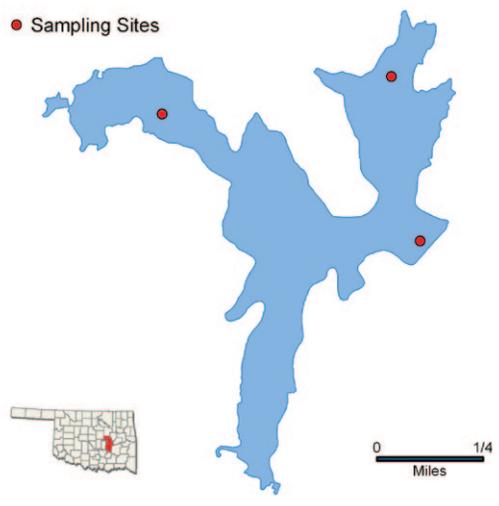
Notes

*Although 16% of the values exceeded 25 NTU, available rainfall data suggests this is likely due to seasonal rain events. The lake is therefore considered supporting the FWP beneficial use for this sample year.

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

Wetumka

● Sampling Sites



Sample Period	Times Visited	Sampling Sites
October 2006 - July 2007	4	3

Lake Data	Location	Hughes County
	Impoundment	1939
	Area	169 acres
	Capacity	1,839 acre-feet
	Purposes	Water Supply, Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	18 NTU	8% of values >OWQS of 25 NTU	
	Average True Color	58 units	58% of values > OWQS of 70	
	Average Secchi Disk Depth	59 cm		
	Water Clarity Rating	fair		
	Trophic State Index	53		
	Trophic Class	eutrophic		
	Profile	Salinity	0.03 – 0.08 ppt	
		Specific Conductivity	92.4 – 173.3 μS/cm	
		pH	6.49 – 7.90 pH units	Only 2 values < 6.5 pH units
		Oxidation-Reduction Potential	298 to 461 mV	
		Dissolved Oxygen	Up to 67% of water column < 2 mg/L in July	Occurred at site 1, the dam
	Nutrients	Surface Total Nitrogen	0.52 mg/L to 1.35 mg/L	
Surface Total Phosphorus		0.022 mg/L to 0.088 mg/L		
Nitrogen to Phosphorus Ratio		13:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	S	S	NS	S				
	Aesthetics					S	NS		
	Agriculture						S		
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

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 NEI = Not Enough Information

Notes

The PBCR cannot be assessed as minimum data requirements were not met due to QA/QC issues for fecal coliform and enterococci.

NTU = nephelometric turbidity units
 μS/cm = microsiemens per centimeter
 E. coli = Escherichia coli

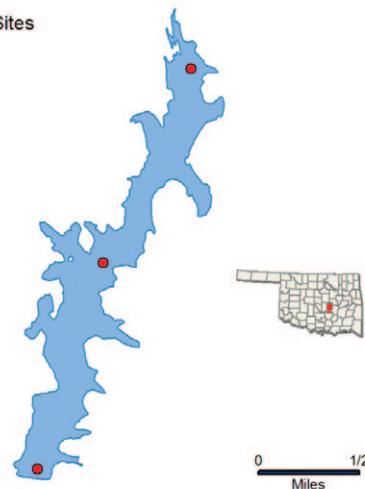
OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 μS/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Wewoka

● Sampling Sites



Sample Period	Times Visited	Sampling Sites
October 2006 - July 2007	4	5

Lake Data	Location	Seminole County
	Impoundment	1925
	Area	371 acres
	Capacity	3,301 acre-feet
	Purposes	Water Supply, Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	59 NTU	75% of values > OWQS of 25 NTU	
	Average True Color	103 units	60% of values > OWQS of 70	
	Average Secchi Disk Depth	35 cm		
	Water Clarity Rating	poor		
	Trophic State Index	55		
	Trophic Class	eutrophic		
	Profile	Salinity	0.00 – 0.10 ppt	
		Specific Conductivity	25.6 – 219 μ S/cm	
		pH	6.67 – 8.18 pH units	
		Oxidation-Reduction Potential	139 to 447 mV	
	Nutrients	Dissolved Oxygen	Up to 50% of water column < 2 mg/L in July	Occurred at site 1, the dam
		Surface Total Nitrogen	0.67 mg/L to 1.32 mg/L	
Surface Total Phosphorus		0.021 mg/L to 0.190 mg/L		
	Nitrogen to Phosphorus Ratio	15:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	NS	S				
	Aesthetics					S	NS		
	Agriculture						S		
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

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Notes

The PBCR cannot be assessed as minimum data requirements were not met due to QA/QC issues for fecal coliform and enterococci.

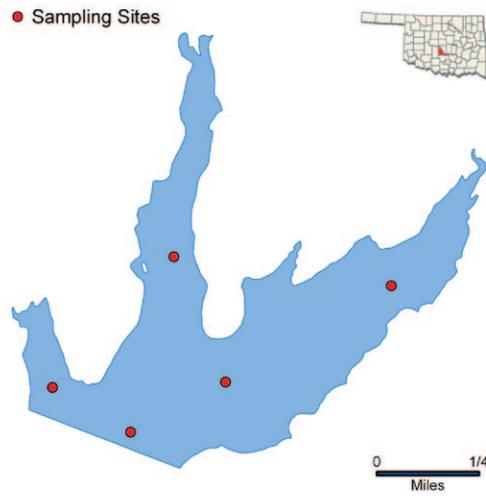
NTU = nephelometric turbidity units
 μ S/cm = microsiemens per centimeter
 E. coli = Escherichia coli

OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a

mg/L = milligrams per liter
 μ S/cm = microsiemens/cm

ppt = parts per thousand
 En = Enterococci

Wiley Post Memorial (Maysville)



Sample Period	Times Visited	Sampling Sites
November 2007 – August 2008	4	5

Lake Data	Location	McClain County
	Impoundment	1971
	Area	302 acres
	Capacity	2,082 acre feet
	Purposes	Water Supply, Flood Control, and Recreation

Parameters	Parameter	Result	Notes/Comments	
	Average Turbidity	79 NTU	100% of values > 25 NTU	
	Average True Color	223 units	100% of values > OWQS of 70	
	Average Secchi Disk Depth	16 cm		
	Water Clarity Rating	poor		
	Trophic State Index	51	Previous value = 57	
	Trophic Class	eutrophic		
	Profile	Salinity	0.10 – 0.20 ppt	
		Specific Conductivity	280 – 349.9 μ S/cm	
		pH	7.24 – 8.41 pH units	Neutral to slightly alkaline
		Oxidation-Reduction Potential	246 to 664 mV	
	Nutrients	Dissolved Oxygen	Up to 50% of water column < 2 mg/L in August	Occurred at site 4
		Surface Total Nitrogen	0.66 mg/L to 1.28 mg/L	
Surface Total Phosphorus		0.081 mg/L to 0.159 mg/L		
Nitrogen to Phosphorus Ratio		9:1	Phosphorus limited	

Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	S	S				
	Aesthetics					S	NS		
	Agriculture							S	
	Primary Body Contact Recreation								NEI
	Public & Private Water Supply								

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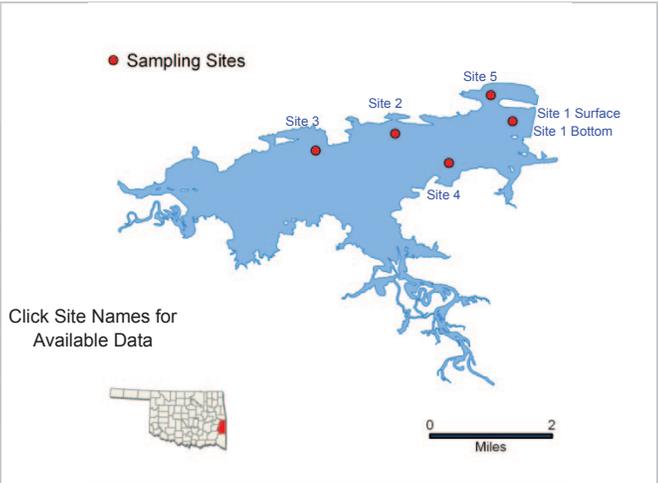
Notes The PBCR cannot be assessed as minimum data requirements were not met due to QA/QC issues for E. coli and fecal coliform.

NTU = nephelometric turbidity units
 μ S/cm = microsiemens per centimeter
 E. coli = Escherichia coli
 OWQS = Oklahoma Water Quality Standards
 mV = millivolts
 Chlor-a = Chlorophyll-a
 mg/L = milligrams per liter
 μ S/cm = microsiemens/cm
 ppt = parts per thousand
 En = Enterococci

Wister

Sample Period	Times Visited	Sampling Sites
November 2010 – July 2011	4	5

General	Location	LeFlore County	Click map for site data
	Impoundment	1949	
	Area	7,333 acres	
	Capacity	62,360 acre feet	
	Purposes	Flood Control, Water Supply, Low flow Regulation, and Conservation	



Parameters		Parameter (Descriptions)	Result	Notes/Comments
		In-Situ	Average Turbidity	17 NTU
Average Secchi Disk Depth	54 cm			
Water Clarity Rating	Average			
Chlorophyll-a	14 mg/m3			
Trophic State Index	57		Previous value = 62	
Trophic Class	Eutrophic			
Profile	Salinity	0.01 – 0.04 ppt		
	Specific Conductivity	53.9 – 112.8 µS/cm		
	pH	6.04 – 8.64 pH units	24.1 % of Values < 6.5 pH units	
	Oxidation-Reduction Potential	32 to 493 mV		
	Dissolved Oxygen	Up to 30% of water column < 2.0 mg/L in spring		
Nutrients	Surface Total Nitrogen	0.29 mg/L to 0.67 mg/L		
	Surface Total Phosphorus	0.036 mg/L to 0.063 mg/L		
	Nitrogen to Phosphorus Ratio	9:1	Phosphorus limited	

Beneficial Uses	Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	En & E. coli	Chlor-a
		Fish & Wildlife Propagation	S	NS	S	S						
Aesthetics						NS*	*					
Agriculture								*	*	S		
Primary Body Contact Recreation											NEI	
Public & Private Water Supply												NS

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NS = Not Supporting
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Notes *Did not collect for these parameters. *Currently, the lake is listed as a Nutrient Limited Watershed (NLW) in the Oklahoma Water Quality Standards (WQS). This listing means that the lake is considered threatened from nutrients until a more intensive study can confirm the Aesthetics beneficial use non-support status.

NTU = nephelometric turbidity units OWQS = Oklahoma Water Quality Standards mg/L = milligrams per liter ppt = parts per thousand
 µS/cm = microsiemens per centimeter mV = millivolts µS/cm = microsiemens/cm En = Enterococci
 E. coli = Escherichia coli Chlor-a = Chlorophyll-a

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APPENDIX A

OKLAHOMA'S USE SUPPORT ASSESSMENT PROTOCOLS

[UNOFFICIAL]

Amendments effective as of 07/01/2007

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 or not attained for that waterbody and that the waterbody segment is a water quality limited segment.

[Source: Added at 17 Ok Reg 1775, eff 7-1-00; Amended at 21 Ok Reg 1910, eff 7-1-04]

785:46-15-2. Definitions

The following words and terms, when used in this Subchapter, shall have the following meaning, unless the context clearly indicates otherwise:

"Ecoregion" means a geographical area within which ecosystems and the type, quality and quantity of environmental resources are generally similar, as more specifically described in EPA's 1997 revision of Omernick, "Ecoregions of the Conterminous United States", Annals of the Association of American Geographers.

"Impaired" means one or more designated beneficial uses are not being attained.

"MQL" means minimum quantification level.

"Non-wadable" means a stream which is not wadable.

"Rolling average" means the mathematical average of data values across a fixed length of time that incrementally changes its starting point but retains a fixed length of time by also incrementally changing its end point for each recalculation of the average. This term is also known as "moving average".

"Screening level" means an evaluation threshold based upon criteria prescribed in OAC 785:45 to protect a designated beneficial use.

“Seasonal base flow” means the sustained or fair-weather runoff, which includes but is not limited to groundwater runoff and delayed subsurface runoff.

“303(d) List” means the list of waterbodies with uses that are either threatened or impaired, developed for the State of Oklahoma in accordance with Section 303(d) of the federal Clean Water Act.

“305(b) Report” means the report of water quality in the State of Oklahoma developed in accordance with Section 305(b) of the federal Clean Water Act.

“Wadable” means a stream or segment thereof, at least 10 percent of which under seasonal base flow conditions is:

- (1) less than 1.25 meters deep at its thalweg, and
- (2) has an instantaneous discharge of less than 10 cubic feet per second, or has a velocity of less than 10 centimeters per second.

“Waterbody” means a body of waters of the state.

[Source: Added at 17 Ok Reg 1775, eff 7-1-00; Amended at 18 Ok Reg 3379, eff 8-13-01; Amended at 19 Ok Reg 2512, eff 6-27-02; Amended at 24 Ok Reg 2445, eff 7-1-07]

785:46-15-3. Data requirements

(a) General. In order to determine whether a given beneficial use of a waterbody is supported, scientific data from the waterbody shall be used as prescribed in this Section. Data shall be collected and analyzed in a manner consistent with testing procedures provided in 785:45-1-4 or practices that are institutionally recognized and appropriate for the parameter of concern and documented in accordance with 785:46-15-3(g). All existing data available for a waterbody shall be used in the analysis, subject to the spatial, temporal and other requirements of this Section.

(b) Spatial coverage.

- (1) General for streams. The spatial extent of assessment of use support in terms of stream miles shall be determined after taking into account existing data, spatial distribution of monitoring sites, sources of pollution and influence of tributaries. Major hydrological features, such as the confluence of a major tributary or a dam, may limit the spatial extent of an assessment based on one station.
- (2) Non-wadable streams. Unless it is demonstrated to the contrary, a single monitoring site shall be considered representative of no more than 25 stream miles for non-wadable streams.
- (3) Wadable streams. Unless it is demonstrated to the contrary, a single monitoring site shall be considered representative of no more than 10 stream miles for wadable streams.
- (4) Lakes. The spatial extent of assessment of use support in terms of lake surface acres shall be estimated based on the spatial distribution of monitoring sites having the requisite number of samples, sources of pollution, influence of tributaries and best professional judgment. Arms or portions of a lake may be treated separately from the main body of a lake. Unless it is demonstrated to the contrary, a single site shall be considered representative of an entire lake or an arm of no more than two hundred and fifty surface acres in size.
- (5) Spatial limitation for sampling sites. For purposes of this Subchapter, observations, samples, and other data shall not be taken within any regulatory mixing zone.

(c) Temporal coverage.

- (1) General. Observations, samples or other data collected for purposes of assessing use support shall be taken to avoid temporal bias, and seasonality shall be represented in the sampling scheme.
- (2) Streams. Data no older than five years old shall be utilized in assessing use support for a stream unless
 - (A) the data available from the preceding five year period is insufficient to satisfy the requirements of 785:46-15-3(d) or other more specific minimum requirements provided in this Subchapter, in which case data older than five years old may be utilized, or

(B) the provisions of 785:46-15-4(b)(3) or 785:46-15-4(c)(3) apply.

- (3) Lakes. Data no older than ten years old shall be utilized in assessing use support for a lake unless
- (A) the data available from the preceding ten year period is insufficient to satisfy the requirements of 785:46-15-3(d) or other more specific minimum requirements provided in this Subchapter, in which case data older than ten years old may be utilized, or
- (B) the provisions of 785:46-15-4(b)(3) or 785:46-15-4(c)(3) apply.

(d) **Minimum number of samples.**

- (1) **Streams.** Except when (f) of this Section or any of subsections (e), (h), (i), (j), (k), (l), or (m) of 785:46-15-5 applies, a minimum of 10 samples shall be required to assess beneficial use support due to field parameters including but not limited to DO, pH and temperature, and due to routine water quality constituents including but not limited to coliform bacteria, dissolved solids and salts. Analyses may be aggregated to meet the 10 sample minimum requirements in non-wadable stream reaches that are 25 miles or less in length, and in wadable stream reaches that are 10 miles or less in length, if water quality conditions are similar at all sites. Provided, a minimum of 10 samples shall not be necessary if the existing samples already assure exceedance of the applicable percentage of a prescribed screening level.
- (2) **Lakes.** Except when (f) of this Section applies, a minimum of 20 samples shall be required on lakes of more than 250 surface acres to assess beneficial use support due to water quality parameters including but not limited to DO, pH and temperature. A minimum of 20 samples shall likewise be required on such lakes for other routine water quality constituents including but not limited to coliform bacteria, chlorophyll a, and dissolved solids. A minimum of 10 samples shall be required on lakes or arms of 250 surface acres or less. Samples may be aggregated to meet the minimum requirements of this paragraph.
- (3) **Toxicants.** Notwithstanding any other provision of this Subchapter, a minimum of five samples shall be required to determine that a beneficial use is supported with respect to all toxicants in water. A determination that a beneficial use is partially supported or not supported with respect to toxicants may be made upon less than five samples. Samples may be aggregated consistent with the spatial and temporal requirements prescribed in (b) and (c) of this Section in order to satisfy the minimum sample requirement of this paragraph. Additional samples for the calculation of pH and hardness dependent acute and chronic criteria shall be collected as required by OAC 785:46-5-8.

(e) **Application of PQL.**

(1) **Criteria above PQL.**

- (A) If sample values are below the PQL for a parameter whose criterion is above the PQL, appropriate nonparametric statistical measures shall be used to determine the reporting value.
- (B) For waterbodies identified as impaired on the current 303(d) List or 305(b) Report, if sample values are nondetectable for a parameter whose criterion is above the PQL, then such value shall be deemed to be one-half (1/2) of the parameter PQL.
- (C) All sample values that are above the PQL shall be the reported values.

(2) **Criteria equal to or below PQL.**

- (A) If sample values are below the PQL for a criterion which is less than or equal to one-half (1/2) of the PQL, then the values shall be deemed to be zero (0) until the first test result above the PQL appears. After that time, sample values which are equal to or below the PQL shall be deemed to be equal to the criterion value until four (4) subsequent contiguous samples are shown to be below the PQL. Any subsequent sample values which are nondetectable may be treated as zero (0) until the next test result appears above the PQL.
- (B) For those parameters whose criteria are at least two (2) orders of magnitude below the PQL, evidence considered with respect to assessment of use support shall include fish tissue analysis, biological community analysis, biological thresholds wherever available, or other holistic indicators which are appropriate for the beneficial use in question.

(C) If sample values are below the PQL for a criterion which is greater than or equal to one-half (1/2) of the PQL but less than the PQL, then the values shall be deemed to be one-half (1/2) of the criterion value until the first test result above the PQL appears. After that time, sample values which are below the PQL shall be deemed to be equal to the criterion value until four (4) subsequent contiguous samples are shown to be below the PQL. Any subsequent sample values which are nondetectable may be treated as equal to one-half (1/2) of the criterion value until the next test result appears above the PQL.

(D) For waterbodies identified as impaired on the current 303(d) List or 305(b) Report, if sample values are nondetectable for a parameter whose criterion is below the PQL, then such value shall be deemed to be one-half (1/2) of the criterion value.

(E) All sample values that are above the PQL shall be the reported values.

(f) **Magnitude of criteria exceedance.**

(1) **General.** The magnitude of exceedance, as well as frequency of exceedances, shall be used in determining beneficial use support. Samples shall be taken only during conditions when criteria apply.

(2) **Toxicants.** If two or more concentrations of toxicants exceed criteria or screening levels to protect human health or aquatic life by two orders of magnitude or more, the associated beneficial use shall be deemed to be not supported.

(3) **Dissolved oxygen.** If more than two concentrations of DO in a stream are observed to be below 2 mg/L in any given year, the Fish and Wildlife Propagation beneficial use shall be deemed to be not supported.

(4) **Other parameters.** The magnitude and frequency of exceedances to be used for determining beneficial use support for parameters other than toxicants and DO shall be as prescribed in the rules elsewhere in this Subchapter.

(g) **Quality assurance.** On and after July 1, 2002, data collected for purposes of use support assessment shall be collected using documented programmatic quality assurance and quality control methods substantially in accordance with those required by "EPA Requirements for Quality Assurance Project Plans", EPA publication no. EPA/240/B-01/003 (March 2001). The sampling and testing methods used shall protect the integrity of the sample and provide detailed documentation of analysis.

[Source: Added at 17 Ok Reg 1775, eff 7-1-00; Amended at 18 Ok Reg 3379, eff 8-13-01; Amended at 19 Ok Reg 2512, eff 6-27-02; Amended at 20 Ok Reg 1429, eff 7-1-03; Amended at 22 Ok Reg 1607, eff 7-1-05; Amended at 23 Ok Reg 1568, eff 7-1-06]

785:46-15-4. Default protocols

(a) **General.** The protocols prescribed in this Section shall apply whenever the more specific protocols prescribed elsewhere in this Subchapter do not apply.

(b) **Short term average numerical parameters.**

(1) Short term average numerical parameters are based upon exposure periods of less than seven days. Short term average parameters to which this Section applies include, but are not limited to, sample standards and turbidity.

(2) A beneficial use shall be deemed to be fully supported for a given parameter whose criterion is based upon a short term average if 10% or less of the samples for that parameter exceed the applicable screening level prescribed in this Subchapter.

(3) A beneficial use shall be deemed to be fully supported but threatened if the use is supported currently but the appropriate state environmental agency determines that available data indicate that during the next five years the use may become not supported due to anticipated sources or adverse trends of pollution not prevented or controlled. If data from the preceding two year period indicate a trend away from impairment, the appropriate agency shall remove the threatened status.

(4) A beneficial use shall be deemed to be partially supported for a given parameter whose criterion is based upon a short term average if greater than 10% but less than 25% of the samples for that parameter exceed the applicable screening level prescribed in this Subchapter.

(5) A beneficial use shall be deemed to be not supported for a given parameter whose criterion is based upon a short term average if at least 25% of the samples for that parameter exceed the applicable screening level prescribed in this Subchapter.

(c) **Long term average numerical parameters.**

(1) Long term average numerical parameters are based upon exposure periods of seven days or longer. Long term average parameters to which this Section applies include, but are not limited to, fish consumption water column numerical criteria and yearly mean standards. For purposes of assessing use support, calculations of means shall be limited to a two-year rolling average for those beneficial use applications requiring long term averages.

(2) A beneficial use shall be deemed to be fully supported for a given parameter whose criterion is based upon a long term average if the mean of the sample results does not exceed the long term average.

(3) A beneficial use shall be deemed to be fully supported but threatened if the use is supported currently but the appropriate state environmental agency determines that available data indicate that during the next five years the use may become not supported due to anticipated sources or adverse trends of pollution not prevented or controlled. If data from the preceding two year period indicate a trend away from impairment, the appropriate agency shall remove the threatened status.

(4) Because means are compared with screening levels when addressing long term average numerical parameters, such parameters are not susceptible to an assessment that a use is partially supported.

(5) A beneficial use shall be deemed to be not supported for a given parameter whose criterion is based upon a long term average if the mean of the sample results exceeds the criterion or screening level.

[Source: Added at 17 Ok Reg 1775, eff 7-1-00; Amended at 19 Ok Reg 2512, eff 6-27-02]

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 due to other than naturally occurring conditions, 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 due to other than naturally occurring conditions, 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 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) **Toxicants.**

(1) Test for Full Support

(A) 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 criterion for that toxicant prescribed in the numerical criteria for toxic substances in OAC 785:45-5-12(f)(6)(D) and (E) and 785:45 Appendix G, Table 2.

(B) 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 not more than 1 sample concentration or not more than 10% of the sample concentrations from the waterbody exceeds the chronic criterion for that toxicant prescribed in the numerical criteria for toxic substances in OAC 785:45-5-12(f)(6)(D), (E) and 785:45 Appendix G, Table 2.

(2) Test for Non-Support

(A) 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 more than one of the sample concentrations from the waterbody exceed the acute criterion for that toxicant prescribed in the numerical criteria for toxic substances in OAC 785:45-5-12(f)(6)(D) and (E) and 785:45 Appendix G, Table 2.

(B) 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 more than 10 % of the sample concentrations from the waterbody exceed chronic criterion for that toxicant prescribed in the numerical criteria for toxic substances in OAC 785:45-5-12(f)(6)(D) and (E) 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) **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).

(f) **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.

(g) **Suspended and Bedded Sediments.**

(1) If a stream is supporting the biological criteria assigned to that stream as provided in (e) and (i) through (n) of this section, then that stream will be deemed to be supporting its assigned Fish and Wildlife Propagation beneficial use with respect to suspended and bedded sediments.

(2) If a stream is not supporting the biological criteria assigned to that stream as provided in (e) and (i) through (n) of this section, then a habitat assessment must be conducted using the habitat assessment protocols found in OWRB Technical Report TRWQ2001-1, "Unified Protocols for Beneficial Use Assignment for Oklahoma Wadable Streams." The results of the habitat assessment shall then be compared to either historical conditions or regional reference conditions in order to determine attainment with respect to suspended and bedded sediments in that stream.

(3) The method for establishing reference conditions shall meet the following requirements:

(A) a minimum of five (5) reference streams or reaches shall be assessed;

(B) all of the reference streams or reaches must be within the same ecoregion as the test stream;

(C) all of the reference streams or reaches must be streams with similar flow regimes no more than two (2) stream orders removed from the test stream; and

(D) the reference streams shall be selected from the least impacted streams in the ecoregion whose watersheds contain soils, vegetation, land uses, and topography typical of the watershed of the test stream(s).

(4) The Fish and Wildlife Propagation beneficial use will be considered to be not supported with respect to suspended and bedded sediments if any of the following habitat parameters deviate from the reference conditions by the specified amount:

(A) The total percent of clay, silt, and loose sand in the pool bottom substrate of the test stream is increased by more than 30% over the reference condition;

(B) Cobble embeddedness in the test stream is increased by 15% or more over the reference condition;

(C) The percentage of the length of the reach containing fresh (non-vegetated) point bars and/or islands in the test stream is 20 or more percentage points above that of the reference condition; or

(D) The percentage of the length of the reach dominated by pools of a depth of 0.5 meters or more in the test stream is less than 70% of that of the reference condition.

(5) If all of the habitat parameters identified in (h)(4) of this section deviate from the reference conditions by less than the amounts specified in (h)(4) of this section, then the Fish and Wildlife Propagation beneficial use is not impaired due to suspended and bedded sediments.

(h) **Metals.** The Fish and Wildlife Propagation beneficial use designated for a waterbody may be assessed using either total recoverable or dissolved metals. When available, the concentrations of dissolved metals shall be compared following the provisions of (c) of this subsection to the criteria in OAC 785:45 Appendix G converted to dissolved criteria by multiplying the total metal criterion listed in table 2 by the appropriate conversion factor listed in Table 3. Preference shall be given to the beneficial use determinations based upon dissolved metals.

(i) **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 (i) through (o), 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. A finding of impairment for biocriteria due to any one of the parameters listed in this section shall trigger an evaluation of all likely causes, not precluding monitoring, assessment, and subsequent support determination of the Fish and Wildlife beneficial use for any of the other parameters in this section.

(j) **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.

(k) **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.

(l) **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.

(m) **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.

(n) **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.

(o) **Special provisions for Central Great Plains wadable streams.** The subcategory of Warm Water Aquatic Community of the beneficial use of Fish and Wildlife Propagation in the wadable streams located in the Central Great Plains ecoregion shall be deemed fully supported if the application of Appendix C of this Chapter produces a score of 22 or more. Such subcategory shall be deemed not supported for the streams in this ecoregion if the application of Appendix C produces a score of 18 or less. If the application of Appendix C produces a score of 19 to 21 inclusive, the issue of whether this subcategory is supported for the streams in this ecoregion shall be deemed undetermined. Provided, however, this subsection does not apply to the area bounded by State Highway 54 on the west, U.S. Highway 62 on the south, U.S. Highway 281 on the east and State Highway 19 on the north.

[Source: Added at 17 Ok Reg 1775, eff 7-1-00; Amended at 18 Ok Reg 171, eff 10-25-00 (emergency); Amended at 18 Ok Reg 3379, eff 8-13-01; Amended at 19 Ok Reg 2512, eff 6-27-02; Amended at 20 Ok Reg 1429, eff 7-1-03; Amended at 21 Ok Reg 1910, eff 7-1-04; Amended at 22 Ok Reg 1607, eff 7-1-05; Amended at 24 Ok Reg 2445, eff 7-1-07]

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.

[Source: Added at 17 Ok Reg 1775, eff 7-1-00; Amended at 21 Ok Reg 1910, eff 7-1-04]

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 OAC 785:45 Appendix G if the sample concentrations from that waterbody do not exceed the criterion for that substance prescribed in 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 OAC 785:45 Appendix G if the sample concentrations from that waterbody exceed the criterion for that substance prescribed in 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 OAC 785:45 Appendix G if the sample concentrations from that waterbody exceed the criterion for that substance prescribed in 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 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.

[Source: Added at 17 Ok Reg 1775, eff 7-1-00; Amended at 21 Ok Reg 1910, eff 7-1-04]

785:46-15-8. Assessment of Agriculture support

(a) **Scope.** The provisions of this Section shall be used to determine whether the beneficial use of Agriculture designated in OAC 785:45 for a waterbody is supported.

(b) **General support tests for chlorides, sulfates and TDS.**

(1) The Agriculture beneficial use designated for a waterbody shall be deemed to be fully supported with respect to chlorides, sulfates and TDS if the mean of all chlorides, sulfates and TDS sample concentrations from that waterbody do not exceed the yearly mean standard prescribed in Appendix F of OAC

785:45 and no more than 10% of the sample concentrations from that waterbody exceed the sample standard prescribed in Appendix F of OAC 785:45. Provided, if the TDS sample concentrations are less than 700 mg/L and the chlorides and sulfates are each less than 250 mg/L, then the Agriculture beneficial use shall be deemed to be fully supported with respect to those substances.

(2) The Agriculture beneficial use designated for a waterbody shall be deemed to be partially supported with respect to chlorides, sulfates and TDS if the mean of all chlorides, sulfates and TDS sample concentrations from that waterbody does not exceed the yearly mean standard prescribed in Appendix F of OAC 785:45 and more than 10% but less than 25% of the sample concentrations from that waterbody exceed the sample standard prescribed in Appendix F of OAC 785:45.

(3) The Agriculture beneficial use designated for a waterbody shall be deemed to be not supported with respect to chlorides, sulfates and TDS if the mean of all chlorides, sulfates and TDS sample concentrations from that waterbody exceeds the yearly mean standard prescribed in Appendix F of OAC 785:45, or at least 25% of the sample concentrations from that waterbody exceed the sample standard prescribed in Appendix F of OAC 785:45, or both such conditions exist.

(c) **Use of site specific data.** If the appropriate state environmental agency determines that the stream segment averages prescribed in Appendix F of OAC 785:45 are not appropriate for the entirety of a given stream segment or there is no value listed in Appendix F for the stream segment average for the parameter of concern, then yearly mean standards and sample standards developed from site specific data may be used to assess whether the use of Agriculture is supported for that waterbody.

(d) **Use of data for lakes.**

(1) Lakes with one WBID segment. For support assessment in lakes with a single WBID segment, the segment averaged value prescribed in Appendix F to that same WQM segment shall be used.

(2) Lakes with multiple WBID segments. For support assessment in lakes with multiple WBID segments, each segment shall use the segment averaged value prescribed in Appendix F to that same WQM segment when available. If a WBID segment in a lake has no corresponding WQM segment data available in Appendix F, the segment averaged value prescribed in Appendix F to the WQM segment immediately downstream of the lake shall be used.

[Source: Added at 17 Ok Reg 1775, eff 7-1-00; Amended at 22 Ok Reg 1607, eff 7-1-05; Amended at 24 Ok Reg 2445, eff 7-1-07]

785:46-15-9. Assessment of Fish Consumption support

(a) **Scope.** The provisions of this Section shall be used to determine whether the beneficial use of Fish Consumption designated in OAC 785:45 for a waterbody is supported.

(b) **Support tests.**

(1) The Fish Consumption beneficial use designated for a waterbody shall be deemed to be partially supported if restricted consumption as imposed by an agency with jurisdiction is in effect or if a fish or shellfish ban is in effect for a sub-population thereof.

(2) The Fish Consumption beneficial use designated for a waterbody shall be deemed to be not supported if an aquatic life closure or if a "no consumption" advisory imposed by an agency with jurisdiction is in effect.

(3) The water column criteria for protection of the Fish Consumption beneficial use stated in 785:45 Appendix G Table 2 shall be used according to the default protocol in 785:46-15-4(c) to determine use support.

[Source: Added at 17 Ok Reg 1775, eff 7-1-00; Amended at 19 Ok Reg 2512, eff 6-27-02]

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 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 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 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 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 condi-

tions. 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.

(h) **Special provisions for Scenic Rivers.**

(1) **Scope and applicability.** This subsection (h) shall be used to determine whether the beneficial use of Aesthetics designated for a segment of a Scenic River is supported with respect to the criterion of total phosphorus.

(2) **Data and procedure.**

(A) The data used shall satisfy all of the requirements of 785:46-15-3 except subsection (f) thereof. Notwithstanding such requirements, the data shall include samples collected from stream flow of at least six (6) storm events per calendar year or, if fewer than nine (9) storm events occurred in that year, then the majority of the storm events that occurred that year.

(B) Whenever multiple samples are taken from a single storm event, the event mean concentration shall be determined and used as representative of that storm event.

(C) A three-calendar-month geometric mean concentration shall be determined each month using the total phosphorus data from that month together with such data from the preceding two calendar months.

(3) **Support tests.**

(A) The Aesthetics beneficial use designated for a segment of a Scenic River shall be deemed to be supported with respect to total phosphorus if less than 25% of the monthly determinations made in accordance with (h)(2)(C) of this Section exceed 0.037 mg/L total phosphorus.

(B) The Aesthetics beneficial use designated for a segment of a Scenic River shall be deemed to be not supported with respect to total phosphorus if 25% or greater of the monthly determinations made in accordance with (h)(2)(C) of this Section exceed 0.037 mg/L total phosphorus.

[Source: Added at 17 Ok Reg 1775, eff 7-1-00; Amended at 18 Ok Reg 171, eff 10-25-00 (emergency); Amended at 18 Ok Reg 3379, eff 8-13-01; Amended at 21 Ok Reg 1910, eff 7-1-04; Amended at 22 Ok Reg 1607, eff 7-1-05]

785:46-15-11. Assessment of Hydroelectric Power Generation support [REVOKED]

[Source: Added at 21 Ok Reg 1910, eff 7-1-04; Revoked at 24 Ok Reg 2445, eff 7-1-07]

785:46-15-12. Assessment of Industrial and Municipal Process and Cooling Water support [REVOKED]

[Source: Added at 21 Ok Reg 1910, eff 7-1-04; Revoked at 24 Ok Reg 2445, eff 7-1-07]

785:46-15-13. Assessment of Navigation support [REVOKED]

[Source: Added at 21 Ok Reg 1910, eff 7-1-04; Revoked at 24 Ok Reg 2445, eff 7-1-07]