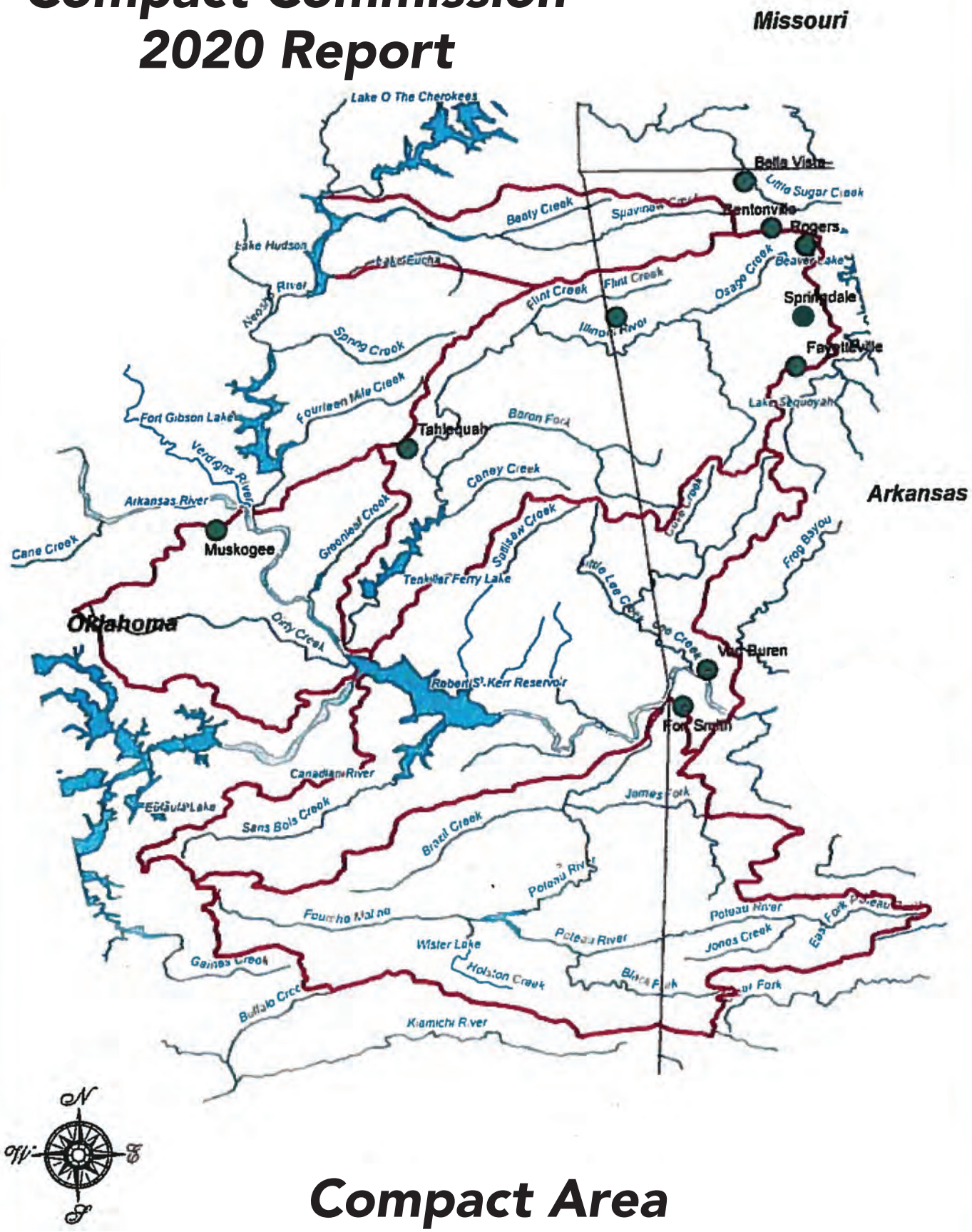
Arkansas River Compact Commission 2020 Report



Compact Area

Arkansas River Compact Commission

ARKANSAS NATURAL RESOURCES COMMISSION
10421 W Markham
Little Rock, AR 72205
Phone (501) 682-1611 / Fax (501) 682-3991
www.agriculture.arkansas.gov

OKLAHOMA WATER RESOURCES BOARD
3800 North Classen Blvd.
Oklahoma City, Oklahoma 73118
Phone (405) 530-8800 / Fax (405) 530-8900
www.owrb.ok.gov

September 23, 2021

The President
United States of America

The Honorable Kevin Stitt
Governor, State of Oklahoma

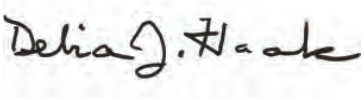
The Honorable Asa Hutchinson
Governor, State of Arkansas

Dear Mr. President and Governors:

Pursuant to Article 9B(6) of the Arkansas-Oklahoma Arkansas River Compact (AOARC), submitted herewith is a copy of the report covering the activities of the Commission for 2020. A budget covering the anticipated expenses of the Commission for July 1, 2020 – June 30, 2021 is included in the report.

The 2020 Annual Meeting was hosted by the State of Arkansas. Reports of the Budget, Engineering, Environmental and Natural Resources, and Legal Committees were presented, and the Commission approved committee assignments and appointments.

Respectfully submitted.



Dr. Delia Haak
Federal Commissioner and Chairman
Arkansas-Oklahoma Arkansas River Compact Commission

DH/ah

2020
Arkansas-Oklahoma Arkansas River
Compact Commission Annual Report

TABLE OF CONTENTS

ARKANSAS-OKLAHOMA
ARKANSAS RIVER COMPACT COMMISSION
2020 DIRECTORY

FEDERAL CHAIRMAN
Dr. Delia Haak
Chairman/Federal Commissioner
20083 Dawn Hill East Road
Gentry, AR 72734
PH: (479) 238-4671
dhaak@jbu.edu

ALTERNATE FEDERAL CHAIRMAN
Joel West Williams
Staff Attorney
Native American Rights Fund
1514 P Street NW (Rear), Suite D
Washington, DC 20005
(202) 785-4166
williams@narf.org

ARKANSAS
Bruce Holland, Arkansas Commissioner
Director
AR Natural Resources Division
101 East Capitol, Suite 350
Little Rock, AR 72201-3823
PH: (501) 682-3986
FAX: (501) 682-3991
Bruce.holland@arkansas.gov

James Mardis, III
Arkansas Commissioner
P.O. Box 3036
Russellville, AR 72811
PH: (479) 263-9546
Jimmy.mardis@denaliwater.com

Roy Reaves, Arkansas Commissioner
1601 Center Valley Road
Russellville, AR 72802
PH: (479) 857-6435
RReaves43@hotmail.com

OKLAHOMA
Julie Cunningham, Oklahoma
Commissioner
Executive Director
Oklahoma Water Resources Board
3800 N. Classen Boulevard
Oklahoma City, OK 73118
PH: (405) 530-8800
FAX: (405) 530-8900
Julie.cunningham@owrb.ok.gov

Stephen Baldridge
Senior Counsel, Secretary of Energy &
Environment
204 N. Robinson, Suite 1010
Oklahoma City, OK 73012
Phone: (405) 522-7226
Cell: (405) 208-9450
Stephen.baldridge@ee.ok.gov

Scott Thompson, Oklahoma Commissioner
Executive Director, Oklahoma Department
of Environmental Quality
707 North Robinson
Post Office Box 1677
Oklahoma City, OK 73101-1677
(405) 702-7163
Scott.Thompson@deq.ok.gov

Arkansas Committee Staff

April Harris, Administrative Analyst
AR Natural Resources Division
101 East Capitol, Suite 350
Little Rock, AR 72118-5317
501-682-3986
April.Harris@arkansas.gov

Ryan Benefield, Treasurer
AR Natural Resources Division
101 East Capitol, Suite 350
Little Rock, AR 72118-5317
(501) 682-0959
Ryan.benefield@arkansas.gov

Ken Brazil
AR Natural Resources Division
101 East Capitol, Suite 350
Little Rock, AR 72201-3823
PH: (501) 682-3985
FAX: (501) 682-3991
Ken.brazil@arkansas.gov

Wade Hodge, Chief Counsel
AR Department of Agriculture
1 Natural Resources Drive
Little Rock, AR 72205
PH: (501) 219-6361
FAX: (501) 219-1697
Wade.hodge@agriculture.arkansas.gov

Shawn Jackson
AR Natural Resources Division
101 East Capitol, Suite 350
Little Rock, AR 72201
(501) 682-3985
Shawn.jackson@arkansas.gov

Oklahoma Committee Staff

Bill Cauthron, Chief
Water Quality Programs Division
Oklahoma Water Resources Board
3800 N. Classen Boulevard
Oklahoma City, OK 73118
PH: (405) 530-8800
FAX: (405) 530-8900
Bill.cauthron@owrb.ok.gov

Kent Wilkins, Chief
Planning and Management Division
Oklahoma Water Resources Board
3800 N. Classen Boulevard
Oklahoma City, OK 73118
PH: (405) 530-8800
FAX: (405) 530-8900
Kent.wilkins@owrb.ok.gov

Sara Gibson, General Counsel
Oklahoma Water Resources Board
3800 N. Classen Boulevard
Oklahoma City, OK 73118
PH: (405) 530-8800
FAX: (405) 530-8900
sara.gibson@owrb.ok.gov

Mary Schooley, Executive Secretary
Oklahoma Water Resources Board
3800 N. Classen Boulevard
Oklahoma City, OK 73118
PH: (405) 530-8800
FAX: (405) 530-8900
Mary.schooley@owrb.ok.gov

Julie Chambers, Water Quality Programs Division
Oklahoma Water Resources Board
3800 N. Classen Boulevard
Oklahoma City, OK 73118
PH: (405) 530-8800
FAX: (405) 530-8900
Julie.chambers@owrb.ok.gov

Yohanes Sugeng
Planning and Management Division
Oklahoma Water Resources Board
3800 N. Classen Boulevard
Oklahoma City, OK 73118
Yohanes.sugeng@owrb.ok.gov
PH: (405) 530-8800
FAX: (405) 530-8900

FEDERAL, STATE AGENCIES and OTHERS

Division Engineer
Department of the Army
Southwest Division, COE
1114 Commerce Street
Dallas, Texas 75242-0216

District Engineer
Department of the Army
Corps of Engineers
Little Rock District
P. O. Box 867
Little Rock, Arkansas 72203

District Chief
Department of the Army
Corps of Engineers, Tulsa District
1645 South 101 East Avenue
Tulsa, Oklahoma 74128
(Lori Hunninghake, Mike Abate)
Mike.R.Abate@usace.army.mil

U. S. Geological Survey, WRD
401 Hardin Road
Little Rock, Arkansas 72211
Phone: (501) 228-3600
Fax: (501) 228-3601

Jason Lewis
U. S. Geological Survey, WRD
Building 7, 2020 Northwest 66th Street
Oklahoma City, Oklahoma 73116
jmlewis@usgs.gov

U. S. Fish and Wildlife Service
9041 E. 21st
Tulsa, Oklahoma 74127

Gary O'Neill, State Conservationist
100 USDA
Stillwater, OK 74074
Office 405-742-1000
gary.oneill@ok.usda.gov

Nathan Kuhnert
Bureau of Reclamation
5924 NW 2nd Street Suite 200
Oklahoma City, Oklahoma 73127
(405) 470-4800
NKuhnert@usbr.gov

David Yarbrough, Director
Port of Catoosa
5350 Cimarron Road
Catoosa, Oklahoma 74105

Scott Robinson, Director
Port of Muskogee
5201 Three Forks Road
P.O. Box 2819
Ft. Gibson, OK 74434

Waterways, ODOT
4002 Mingo Valley Expressway
P. O. Box 660
Tulsa, Oklahoma 74101

State Conservationist
Arkansas NRCS
Room 3416 Federal Building
700 W. Capitol
Little Rock, Arkansas 72201
PH: 301-3100

Melvin Tobin
US Fish and Wildlife Service
110 S. Amity Road
Conway, AR 72032
(501) 513-4470

Ed Fite, VP Water Quality & Scenic Rivers
Grand River Dam Authority
P.O. Box 292
Tahlequah, OK 74464
PH: (918) 456-3251
edward.fite@grda.com

2004 ADDITIONAL APPOINTMENTS BY STATES TO ENVIRONMENTAL COMMITTEE

STATE OF OKLAHOMA

Blayne Arthur, Secretary
Oklahoma Department of Agriculture, Food & Forestry
2800 North Lincoln
Oklahoma City, OK 73015
PH: (405) 521-3864
FAX: (405) 521-4912
blayne.arthur@ag.ok.gov

Caleb Whitcomb
Asst. Director, Agriculture Environmental Management Services Division
Oklahoma Department of Agriculture, Food & Forestry
2800 North Lincoln
Oklahoma City, OK 73015
(405)522-4659
caleb.whitcomb@ag.ok.gov

Trey Lam, Executive Director
Oklahoma Conservation Commission
2800 N. Lincoln Boulevard, Suite 168
Oklahoma City, OK 73105
(405) 521-2384
Trey.lam@conservation.ok.gov

J.D. Strong, Executive Director
Oklahoma Department of Wildlife Conservation
P.O. Box 53465
Oklahoma City, OK 73152
(405) 521-3851
Jd.strong@odwc.ok.gov
josh.johnston@odwc.ok.gov

STATE OF ARKANSAS

Pat Fitts
Arkansas Game & Fish Commission
#2 Natural Resources Drive
Little Rock, AR 72205
PH: 223-6300

Dr. Nate Smith, Secretary
Arkansas Department of Health
4815 W. Markham
Little Rock, AR 72204
PH: 661-2000

Deidre Smith
Arkansas Waterways Commission
101 E. Capitol, Suite 370
Little Rock, AR 72201
PH: 682-1173

INTERESTED OTHERS

Tom Elkins, Cherokee Nation
P.O. Box 948
Tahlequah, OK 74465
(918) 453-5237
Tom-elkins@cherokee.org

Becky Keogh, Secretary
Arkansas Department of Energy and Environmental
5301 Northshore Drive
North Little Rock, AR 72118-5317
keogh@adeq.state.ar.us

Office of the Attorney General
313 N.E. 21st
Oklahoma City, Ok 73105

The OKLAHOMAN
P. O. Box 25125
Oklahoma City, OK 73125-0125

Marla Peek
Oklahoma Farm Bureau
2501 N. Stiles
Oklahoma City, OK 73105
marla.peek@okfb.com

NRCS Regional Water Management Center
101 East Capitol, Suite 212
Little Rock, AR 72201-3811

Ava Roberts, Executive Director
Arkansas Environmental Federation
415 N. McKinley, suite 835
Little Rock, AR 72201

City Desk
Arkansas Democrat-Gazette
P .O. Box 2221
Little Rock, AR 72201

Richard A. Gordon, Jr.
Public Awareness Committee, Inc.
1145 No. 57th Place
Fort Smith, AR 72904

Brian Rosenthal
The Rose Law Firm
120 E. Fourth Street
Little Rock, AR 72201
PH: 375-9131

M. Lane Crider, P.E.
Beaver Water District
P. O. Box 400
Lowell, AR 72745
lcrider@bwdh2o.org
(479) 756-3651

Megan Perkins, Liaison
Office of the Governor
Room 120 State Capitol
Little Rock, AR 72201

Bill Baldwin, Data Chief
U.S. Geological Survey
Lower Mississippi Gulf Water Science Center
401 Hardin Rd.
Little Rock, AR 72211
501-228-3602
http://ar.water.usgs.gov

Thomas S. Soerens, Associate Professor
University of Arkansas
Civil Engineering
Fayetteville, AR 72201

Marty D. Matlock
Room 203 – Engineering Hall
University of Arkansas
Fayetteville, AR 72701

Director of the Water Quality Lab
700 Research Center Blvd. Chemistry 101
Fayetteville, AR 72701

Northwest Arkansas Council
4100 Corporate Center Drive, Suite 205
Springdale, AR 72765

Representative Robin Lundstrum
PO Box 14
Elm Springs, AR 72728

City Administrator
P. O. Box 80
Siloam Springs, AR 72761

Mr. James Moore
Parson's Engineering
2530 Elmer King Road
Belton, Texas 76513

Updated 9/2020

Arkansas River Compact Commission

ARKANSAS NATURAL RESOURCES COMMISSION
101 East Capitol Ave, Suite 350
Little Rock, AR 72201
Phone (501) 682-1611 / Fax (501) 682-3991
www.anrc.arkansas.gov

OKLAHOMA WATER RESOURCES BOARD
3800 North Classen Blvd.
Oklahoma City, Oklahoma 73118
Phone (405) 530-8800 / Fax (405) 530-8900
www.owrb.ok.gov

AGENDA
ARKANSAS-OKLAHOMA ARKANSAS RIVER
COMPACT COMMISSION ANNUAL MEETING

September 24, 2020
1:30 p.m.
via Webex

Committee Meetings; 10:00 a.m.

a.	10:00 a.m.	Environmental and Natural Resources Committee
b.	11:00 a.m.	Engineering Committee
c.	11:30 a.m.	Budget Committee
d.	12:00 p.m.	Legal Committee
	12:30 p.m.	Lunch

COMMISSION MEETING; 1:30 p.m.

A. Call to Order

B. Introductions and Announcements

C. Approval of Agenda

D. Consideration and Approval of Meeting Minutes of 2019 Annual Meeting

E. Report of the Chairman – Delia Haak, Federal Commissioner

F. Report of the Treasurer – Ryan Benefield

G. Report of the Commissioners
1. Arkansas
2. Oklahoma

ARKANSAS NATURAL RESOURCES COMMISSION
101 East Capitol Ave, Suite 350
Little Rock, AR 72201
Phone (501) 682-1611 / Fax (501) 682-3991
www.anrc.arkansas.gov

OKLAHOMA WATER RESOURCES BOARD
3800 North Classen Blvd.
Oklahoma City, Oklahoma 73118
Phone (405) 530-8800 / Fax (405) 530-8900
www.owrb.ok.gov

H. Committee Reports
1. Budget Committee, Ryan Benefield, Chair
2. Engineering Committee, Ken Brazil, Chair
3. Environmental and Natural Resources, Shawn Jackson, Chair
4. Legal Committee, Wade Hodge, Chair

I. Unfinished Business

J. New Business
1. Appointments/Assignments to Committees and Selection of Chairs
    a. Budget Committee
    b. Engineering Committee
    c. Environmental and Natural Resources Committee
    d. Legal Committee
2. Election of Officers (Secretary and Treasurer)
3. 2021 Annual Meeting

K. Federal and State Government Representative Reports
1. Nicole Hardiman - Illinois River Watershed Partnership
2. Jaysonn Funkhouser, USACE – Cherokee Nation Flood Study Report
3. Stephen Baldridge – Steering Committee Update
4. Becky Keogh - EPA Grant to ADEQ
5. Mike Abate, USACE – Tulsa District Projects Within Arkansas River Basin
6. Nathan Kuhnert, USBR – Recent Planning Activities

L. Public Comment

M. Adjournment

Minutes of the
ARKANSAS-OKLAHOMA ARKANSAS RIVER COMPACT COMMISSION
Annual Meeting

September 24, 2020
1:30 p.m.

Virtual Meeting
101 East Capitol, Suite 350
Little Rock, AR 72201

A. CALL TO ORDER

Chairman and Federal Commissioner Delia Haak called the Annual Meeting of the Arkansas-Oklahoma Arkansas River Compact Commission (AOARCC) to order at 1:30 p.m. on September 24, 2020. Due to Covid-19, the meeting was held virtual via Webex.

Chairman Haak thanked everyone for their hard work, and for being in attendance online although it would have been nice to have had the meeting in person. She stated she is very glad she's gotten to know everyone the last few years because it certainly helps looking at everyone on the computer today.

Chairman Haak welcomed new members and, again, thanked all for their hard work and flexibility. She asked to begin the meeting that everyone recite the Pledge of Allegiance since this is a federal compact meeting.

B. INTRODUCTIONS and ANNOUNCEMENTS

Chairman Haak asked the Commissioners and attendees to make self-introductions. Commission members in attendance were: Federal Commissioner and Chairman Delia Haak; Oklahoma Commissioners: Julie Cunningham, Stephen Baldridge, and Scott Thompson; Arkansas Commissioners: Bruce Holland and Jimmy Mardis; Roy Reaves was not able to attend.

(See attendance list for state staff and other attendees present.)

C. APPROVAL OF AGENDA

Chairman Haak stated she would accept a motion to approve the agenda. There were no additions or deletions to the agenda. Commissioner Holland moved to approve the agenda, and Commissioner Cunningham seconded the motion. The motion carried unanimously.

D. CONSIDERATION AND APPROVAL OF MEETING MINUTES OF THE 2019 ANNUAL MEETING, September 26, 2019, Siloam Springs, Arkansas.

Chairman Haak asked if there was a motion to accept the minutes of the 2019 Annual Meeting as written, or if there are any changes. There were no changes or comments, and Commissioner Mardis moved to approve the minutes of the 2019 Annual Meeting of the Arkansas-Oklahoma Arkansas River Compact Commission. Commissioner Thompson seconded. There was no discussion, and Chairman Haak called for the vote. Commissioner Baldridge sustained from making a motion because he was not on the commission last year. The motion carried unanimously.

E. REPORT OF THE CHAIRMAN

Chairman Haak stated a lot has happened in terms of growth & challenges in our regions and states. She thanked everyone for working with the AOARCC while continuing to do other work amongst changes and personal challenges.

F. REPORT OF THE TREASURER

Mr. Ryan Benefield, Arkansas Natural Resources Commission (ANRC)/Arkansas Department of Agriculture, Natural Resources Division (NRD), and Commission Treasurer, presented the report of the Treasurer. He shared a written report covering the 2020 year from July 1, 2019 to June 30, 2020. He stated we are in great financial shape. We have two accounts: checking and Certificate of Deposit. We started the fiscal year with $24,541.57; we had a total income of $7,406.88. The income entails $3,500 per state in dues, a small amount of interest, and $375 returned from a disputed transaction (Cindy Bearden in Tennessee erroneously withdrew & deposited money into the account). We are currently up $140 because of deposits by Tennessee's Ms. Bearden; we were up $190 then she withdrew $50. Our employee Cynthia Bearden is leaving Arkansas Natural Resources Commission; therefore, her name will be removed from the account and this should stop Cindy Bearden in Tennessee from accessing our account. Our total expenses last year were low; $1,984.76. Most of the expenses were for reports. We will soon be making the stream gage payment (normally this would have been included in last year's expenses).

The Certificate of Deposit did make a little money; the balance on June 30, 2020 was $11,155.86, total interest income received was $18.09, plus a small amount on the checking account, making the total balance of Commission accounts at $41,051.46. Both states are up on their assessments.

Mr. Benefield presented a report showing transactions budgeted for versus actual expenses for FY 2020. He stated they were under budget on all items except for report printing/reproduction (budgeted $1,100.00/actual $1,819.76), which he was authorized by the commission to exceed budget for. Mr. Benefield stated he has upped that line item for future report expense which will be reflected during the budget committee report.

Chairman Haak asked if anyone had questions or suggestions; there were neither.

G. REPORT OF THE COMMISSIONERS

Chairman Haak invited Arkansas as host to present the state report of the Arkansas Commissioners.

1. Arkansas

Arkansas Commissioner Bruce Holland shared the report for the State of Arkansas. He stated a year ago this time we were a couple of months into the Arkansas Levee Task Force which the Governor established and appointed NRD to. The purpose of this task force is to study and analyze current conditions of levees in the state, identify funding sources for levee repair and maintenance, evaluate potential monitoring and reporting systems necessary to track levee conditions, and assess existing laws and organizational structures governing levee districts. The governor approved $10 million appropriation which, would pass through NRD, in cooperation with the Division of Emergency Management, to support the restoration and maintenance of levees which received damage from recent historic flooding. The most severe damage was in the Dardanelle area where a levee breached causing significant damage to a state highway and several farms.

NRD also took over the Unpaved Roads Program. Mr. Holland clarified this program is not about paving roads, but instead to help fix county roads where wash-outs, etc. have occurred and the sediment goes into rivers, streams, and lakes.

There are several Water Resource Development projects, totaling around $82 million, going to sewer & wastewater projects and water projects within the Illinois River Watershed area. That area was also selected for a septic tank remediation program; $1 million will go into three different areas of the state (Illinois River Watershed, Beaver Lake Watershed, and Buffalo River Watershed). We'll be working with the Health Department & local areas giving grants to people to redo their septic systems.

The Non-Point Source section has approximately $2.5 million being spent on several projects we are very proud of.

Additionally, Director Holland stated the NRD staff has spent about three months working from home due to Covid-19 impacting the state of Arkansas. He commended the agency & staff for doing a tremendous job while doing so.

Lastly, Commissioner Holland thanked Shawn Jackson, Ken Brazil, & Ryan Benefield for their hard work on the reports provided for the AOARCC.

There were no comments, and Commissioner Holland concluded the Arkansas Report.

Chairman Haak stated it is exciting to see all the work being done and the impact that comes from it. She stated Dr. Nicole Hardiman, Executive Director of Illinois River Watershed Partnership, will be giving a report after the two state reports; it will be given early so she can attend another appointment.

2. Oklahoma

Oklahoma Commissioner Julie Cunningham thanked Ryan & others for organizing the virtual meeting. She began the Oklahoma report by reporting on climate. She stated the Oklahoma Climate Survey reports for the past 30 days over 33% of the state (western counties) is in moderate drought or above while the south central and southeast regions are experiencing the 1st and 2nd wettest ranking since 1921 when measurements began.

Commissioner Cunningham stated the response to Covid-19 in Oklahoma has been handled very well. The staff at Oklahoma Water Resources Board (OWRB) has adapted & handled moving things to digital very well. The OWRB has modified operations and is assessing permanent changes, including increased online services for permitting, testing, and continuing education; optimizing administrative transactions and assistance; adopting virtual public meetings to mobile workforce model configuration.

Commissioner Cunningham stated they are looking into launching the 2025 Oklahoma Comprehensive Water Plan. The requirement is to update it every 10 years; this is a traditional fifth year plan. Emphasis typically is on draught planning; the next heading is the new state flood resiliency plan. Oklahoma Senate bill 1269, a request bill from the OWRB, directing the agency to develop a Statewide Flood Resiliency Plan, was signed into law by Governor J. Kevin Stitt on May 18, 2020. She sated so many people are trying to figure out how to do flood planning management & flood planning to become more coordinated. She stated flood planning & flood mitigation is done at so many different levels with so many federal & local industries. Commissioner Cunningham also stated they want to inventory their flood control infrastructure & reservoirs across the state. Overall, they want to have more coordination and outreach to the public since there is a lack of understanding on how flood insurance, flood plain management, and infrastructure works. Commissioner Cunningham stated they are working with several entities (Oklahoma Emergency Management, Oklahoma Department of Commerce, and Federal Emergency Management Agency are the primary agencies) and would like to match federal dollars with local dollars.

The OWRB conducted an Instream Flow (ISF) Pilot Study in the Upper Illinois River Basin in northeast Oklahoma. The pilot study included technical studies initiated by OWRB, following the Instream Flow Incremental Methodology (IFIM). Most members of the workgroup agreed that assessing potential economic impacts of various scenarios that promote consumptive and non-consumptive uses is warranted to promote long range economic development in the diverse areas of the state.

The Strategic Partnership Alliance is between the OWRB, Oklahoma Department of Environmental Quality, and the Oklahoma Rural Water Association. This alliance agreement commits the organizations to collaborate and combine resources to improve the sustainability of Oklahoma rural and small community water and wastewater systems while meeting their own mission. This program helps to save hundreds of thousands of dollars are year in water loss, as well as provides training & assistance to help small communities run local systems more sustainably drawing from modern business practices and principles.

During the 2020 Oklahoma legislative session two bills related to Oklahoma water law and water resource management programs were approved (SB1269- Oklahoma Flood Resiliency Act; SB1875- Oil and Gas Produced Water and Waste Recycling Act).

For the Arkansas River Basin Infrastructure Investment, OWRB approved funding for 34 water & wastewater projects totaling $313,290,192 between June 2019 and June 2020.

The OWRB is conducting statutorily mandated hydrologic investigations in the Arkansas River basin including the Salt Fork, Boone, Roubidoux, Cimarron, and the Ada-Vamoosa aquifers. The aquifers are characterized, and the water availability quantified so when it is permitted for use they will know how much is there and how much should be divvied up between the land owners overlying the basin. Mr. Ed Fite stated the in the last five years the Illinois River Basin has had the biggest rise ever recorded.

There were no other questions, and Commissioner Cunningham concluded the Oklahoma Report.

H. COMMITTEE REPORTS

1. Budget Committee

Mr. Ryan Benefield served as Chair of the Budget Committee and presented the proposed 2021 budget covering July 1, 2020 through June 30, 2021. He displayed the written report & stated it includes the proposed budget, with the beginning balance of $41,051.46, on July 1, 2020, and anticipating annual dues receipts of $7,000.00 for total available funds of $48,051.46. He touched on proposed budget items totaling $11,000 and stated this year we were way under budget. Also, next year we will be funding the stream gauge as well as reproduction cost. With such significant funds in the bank, even if we spent all proposed expenditures, it would still be about 12 years before we had to consider raising fees. Mr. Benefield proposed budget to the committee for next year.

Commissioner Cunningham asked about printing cost versus going electronic. Mr. Benefield stated we will have to print a hard copy for the governors and president, but we do ask staff in advance to see who needs a hard copy, otherwise they will receive compact disc. Commissioner Cunningham stated the OWRB puts reports on their website for viewing. Mr. Benefield agreed it is important to see that reports get put on either the OWRB or NRD website. He stated working with our Memorandum of Agreement between the two states we are setting up a data repository on a website linked through the Environmental Protection Agency (EPA); it will be very appropriate that these reports get connected either through the OWRB or NRD website, if not both.

Commissioner Baldridge moved to approve the Budget Committee Report, and Commissioner Holland seconded. Chairman Haak called for the vote, and the budget was approved unanimously.

Chairman Haak recognized the AOARCC Alternate Federal Chair, Joel West Williams, as being in attendance of the meeting today and thanked him for joining.

2. Engineering Committee

Mr. Ken Brazil, Arkansas Chair of the Engineering Committee, began by saying there were not any special assignments last year. He shared the written Engineering Committee Annual Compact Compliance Report and presented the report findings. Mr. Brazil stated Oklahoma provided plenty of water to Arkansas during 2019. For the year 2019, there were not any deficits related to the apportionment requirements. Mr. Brazil recognized Shawn Jackson & Yohanes Sugeng for their help in compiling data for this report.

Mr. Brazil concluded the report. There were no questions from Commissioners.

3. Environmental and Natural Resources Committee

Ms. Shawn Jackson, Arkansas Chair, presented the report of the Environmental and Natural Resources Committee. She stated for 2019 climate summary, everything was normal with the exception of rain fall. We ended up being about 20 inches above normal, therefore, effecting the phosphorous run-off. Ms. Jackson discussed the top six flows of the four monitoring stations AR uses (Flint Creek, Sager Creek, Illinois River, and Baron Fork).

Ms. Jackson moved on to discuss the water quality monitoring. She presented the five year rolling average of phosphorous loading for years 2015-2019 and stated it has increased during these

years due to additional rainfall in each water shed. Ms. Jackson also presented tables on each of the four monitoring stations.

The Arkansas 303 (d) list has not changed much. Ms. Jackson stated ADEQ & EPA have reached an agreement on the 2018 list. She listed the impaired waters & segments within the Illinois River Basin during 2018 and stated the parameter(s) for each (Illinois River- chloride, sulfate; Illinois River- chloride, sulfate; Moores Creek- sulfate; Illinois River & Muddy Fork- sulfate; Fayetteville [Lake]- pH; Poteau River- dissolved oxygen; Poteau River- turbidity, sulfate; Unnamed Tributary to Poteau- chloride, total dissolved solids; and Lee Creek [Lake]- pH).

Ms. Jackson concluded the Arkansas portion of the Environment Report.

Julie Chambers, Oklahoma Chair, presented the Oklahoma portion of the Environmental report using a PowerPoint presentation and referring to the written report provided. She began by going over Oklahoma's average annual total phosphorous loading in kilograms per year (excluding targeted high flows). This chart noted all four monitoring stations (Flint Creek near Kansas, Illinois River near Watts, Illinois River near Tahlequah, and Barren Fork near Eldon) beginning broken up from 1980-1993 then the five year rolling average from 1993-1997 forward, while focusing on the last five years (2015-2019). She stated there has been an uptick of loading within the last five years.

Additionally, Ms. Chambers presented a water quality trend analysis chart for the four monitoring stations of the Illinois River Basin at various flow regimes. Not only does this show base flow, but it shows higher and lower flow data. This chart depicts there is a downward trend in phosphorus concentrations since 1993.

Next, Ms. Chambers presented data on the four monitoring stations (Baren Fork River near Eldon, Flint Creek near Kansas, Illinois River near Tahlequah, and Illinois River near Watts) for the annual flow, annual concentration, and annual loading in kilograms per year since 1980 through 2019. She also presented the five year rolling average, the base line from 1980-1993, and the 40% reduction of loads in Kg per year. Additionally, the total phosphorus and scenic river criteria implementation from 199-2019 were presented for each of the four monitoring stations.

Ms. Chambers also provided tables on site monitoring in the Oklahoma Scenic River and the comparison of stations for how they are moving along to meet the .037 criteria within the last five years versus from record period 1999, the impaired waters in the Illinois River Basin listed on Oklahoma's 2018 303(d) list, other notable impaired waters in the compact area, and graphs based off of Seasonal Kendall tests which portray a downward trend of each monitoring station's trend use assessment geometric means from 1999-2019.

Lastly, Ms. Chambers highlighted funding for cities & districts in the Illinois River Basin provided by the OWRB's financial assistance program. She also listed permits for water rights in the Illinois River Watershed issued by OWRB's planning and management division in CY 2019, and touched on Oklahoma Conservation Commission program activities in the Illinois River Watershed for the period of October 2019 through 2020. Program activities include Illinois River Riparian Protection, Rotating Basin Monitoring Program, Blue Thumb Monitoring and Education, Oklahoma/Arkansas Memorandum of Agreement, and lastly, Upcoming programs in the Illinois River Watershed.

4. Legal Committee

Mr. Wade Hodge, Arkansas Chair, introduced himself and reported to the Commission there were no assignments to the Legal Committee the previous year. He stated to the commission to please let him know if he can be of service to anyone. Chairman Haak welcomed Mr. Hodge to the Commission and thanked him for being available. There were no comments by the Commissioners.

I. UNFINISHED BUSINESS

There were no items of unfinished business brought before the Commission for consideration.

J. NEW BUSINESS

1. Appointments/Assignments to Committee and Selection of Chairs, Election of Officers, and 2021 Annual Meeting

Chairman Haak said the Committee Chairs will stay in Arkansas. Due to the meeting being virtual this year, next year Arkansas will host again. Proposed meeting date of September 23, 2021, at Queen Wilhelmina Lodge. The Committee Chairs for the year 2021 will be as they are currently comprised:

a. Budget Committee - Ryan Benefield
b. Engineering Committee – Ken Brazil
c. Environmental and Natural Resources Committee - Shawn Jackson
d. Legal Committee – Wade Hodge

Commissioner Cunningham offered as a motion for the meeting to be hosted by Arkansas on September 23, 2021, and Committee Chair assignments to remain as are. Commissioner Mardis seconded. Chairman Haak called for the vote, and the motion carried unanimously.

There were no other New Business items for the Commission's consideration.

K. FEDERAL AND STATE GOVERNMENT REPRESENTATIVE REPORTS

1. Nicole Hardiman, Director, Illinois River Watershed Partnership (IRWP). Dr. Nicole Hardiman thanked the chairman, commission, and staff for letting her present early due to prior obligations. She addressed the Commission and used a PowerPoint presentation to update the members and audience on the mission, vision, and activities of the IRWP. Director Hardiman stated IRWP is a 14 year old non-profit.

Director Hardiman discussed the 2016 Arkansas Department of Environmental Quality (ADEQ) listing of impaired subwatersheds. This summer IRWP partnered with Northwest AR Regional Planning Commission and ADEQ to do a monitoring project within the 2016 impaired subwatersheds. E. coli measures in Moore's Creek, Lower Muddy Fork, and Illinois River are pretty high. The Lower Muddy Fork exceeds standards in Arkansas 100% of the time.

Director Hardiman also addressed streambank erosion. In 2017, IRWP completed a streambank erosion inventory assessment. The average erosion rate across 49 miles of the Illinois River Watershed is 5.2 feet/year with a range as high as 42 feet/year, sediment loading was 37,500 tons/year, and an estimate of phosphorus loading was 56,250 lbs/year. She stated the four largest wastewater treatment facilities in the watershed reported they load 24,196 lbs/year. Therefore, just within the 49 mile study area, twice the amount of phosphorus loading is from streambank erosion versus wastewater treatment facilities. As for the flooding issue, a chart reflecting Spring Creek at

Sanders Ave at Springdale, AR was presented showing the discharge from 2012 to 2020. During this time there was a 327% increase in number of high flow events. Often times the increase in discharge is said to be because of a rapidly urbanizing area, but the role of changing weather patterns and how to handle them while battling streambank erosion also needs to be looked at.

Director Hardiman touched on other IRWP projects such as youth education programs, mobile learning labs, school field trips, stakeholder education, field tours & workshops, and a landowner services program. IRWP also offers one-on-one assistance. She stated ANRC has invested a lot over the last two years in Illinois River Watershed Partnership in order to implement restoration projects such as riparian restoration, unpaved roads, and septic remediation. The riparian restoration project is 11.96 miles with 608 acres of new rotational grazing systems. IRWP is implementing unpaved roads demonstration projects in Benton County of the Illinois River. IRWP hopes to achieve sediment reduction & reduce maintenance requirements for county road workers. Lastly, the septic remediation program is to help failing & dysfunctional septic systems, and address nutrient loading and pathogen impairment; it will be a mix of grant and loans in addition to a small cost share depending on the income level of the homeowner.

Dr. Hardiman concluded her report. There were no questions.

2. Jaysson Funkhouser, Little Rock District Program Manager, US Army Corps of Engineers.

Mr. Jason Funkhouser, US Army Corps of Engineers, reported on the Cherokee Nation Flood Study while presenting a flood analysis of the Illinois River in northwest Arkansas and northeast Arkansas. He stated the study area looks at the entire basin from Lake Tenkiller all the way to the headwaters of the Illinois River and some of the major tributaries.

Mr. Funkhouser presented a chart on 1-percent flood event over the last eight years. In 2010 the 100 year flood annual peak flow (in CFS) was below 80 whereas it has risen nearly 50% in 2018. He stated hydrology has changed and there are a lot of issues causing flooding concerns.

Mr. Funkhouser also presented annual peeks over the last 60 years for Watts & Tahlequah. United States Geological Survey (USGS) gage datum for Watts is 893.78 ft while Tahlequah is 664.14 ft. Furthermore, prism data for rainfall focusing on northwest Arkansas headwaters during 1959-1973 the average was 42.3 inches per year. Fast forward to years 2004-2018, the same area has had an upwards of 8-10 inches more annually.

Land use is being analyzed and during the fifteen year span from 2001-2016 there was not a big impact. In 2001 there was 49% forest, 42% pasture, and 9% developed land. In 2016 land use average is 49% forest, 40% pasture, and 11% developed land.

Mr. Funkhouser touched on the Illinois River flood risk management objectives breakdown of flood analysis (hydrology) and flood risk management (hydraulics). There is an estimated two-year timeline for this study.

3. Stephen Baldridge, Steering Committee Update. Mr. Baldridge introduced himself stating he serves as Senior Counsel for the Oklahoma Secretary of Energy & Environment. In 2018 a Memorandum of Agreement (MOA) was entered into by the State of Oklahoma and the State of Arkansas and was signed by the Energy & Environmental cabinet secretaries of each state as well as the Agricultural secretaries of each state. The purpose of the MOA is to maintain the water quality of the Illinois River Watershed. The steering committee consists of the cabinet secretaries, the designee of the Region 6 Administrator for the Environmental Protection Area, and the Cherokee Nation if they wish to participate.

Mr. Baldridge touched on highlights of the MOA such as both states accepted the existing criteria of .037 Mg per liter of phosphorous; OWRB is tasked with implementing joint state

recommendation into a new water quality standard which is coming soon. The MOA also creates a monitoring assessment workgroup which is co-chaired by the OWRB and ADEQ to monitor & assess all the data collected around the river. One major point of the MOA is to create a watershed improvement plan which will be implemented watershed wide and will contemplate both point source and non-point source solutions, therefore, it is important for all agencies on both sides of the border to be part of. There is major emphasis on stakeholder engagement as this plan starts to come together.

The MOA requires there is an annual steering committee meeting which is scheduled for November 9, 2020. This meeting will most likely be virtual due to Covid-19. Updates will be provided by the various workgroups (monitoring & assessment, watershed improvement plan, and rulemaking).

Chairman Haak stated the Arkansas-Oklahoma compact was formed 51 years ago. The Illinois River Watershed Basin between the two states is squarely in the middle of the compact area and, because of that, Chairman Haak recommended the assistance of the AOARCC commission & committee staff. Being the AOARCC is a federal compact it may be beneficial to the steering committee because of federal resources.

4. Julie Linck, Deputy Secretary, Arkansas Department of Energy & Environment.

Ms. Linck addressed three areas which are involved with the compact commission. First, they received $2,027,877.00 back in the Clean Water state grant; refund dedicated to state-wide water monitoring. Second, Energy & Environment has a multi-purpose EPA grant which $20k of the grant is available for water quality, specifically for supporting data collection hosted on the EPA website. Lastly, Department of Environmental Quality will continue collecting chemical, biological, and habitat data in the stream in the Ozark Highland. Ms. Linck stated that Secretary Keogh would like to become involved in the environmental committee, if it is the pleasure of the committee, by offering research from Department of Energy & Environment.

5. Mike Abate, Tulsa District, United States Army Corp of Engineers (USACE).

Mr. Abate began by touching on the civil works mission areas. He stated last year there was a very significant flood event on the Arkansas River and there was $26.8 billion in cumulative flood damage reductions; USACE prevented over $9 billion last year with their flood control project.

The Tulsa District covers the southern half of Kansas, all of Oklahoma, and the Red River Basin in Texas. There are 35 projects covered on the Arkansas River and 15 projects on the Red River. Mr. Abate touched on Planning Assistance to States (PAS) funding requests for USACE projects. In FY2019 they received $633k; most went to two tribal studies in OK (Chickasaw & Choctaw Water Study, and Otoe-Missouria Regional Study). In FY2020 USACE picked up $383k of which $250k applied to Oklahoma, $100k to Kansas, and $15k to Chickasaw & Choctaw water study.

Mr. Abate touched on civil works high priority projects to include Keystone Dam Safety Modification Study, Tulsa West-Tulsa Levees Feasibility, and Arkansas River Corridor Feasibility. The significance of the Tulsa West-Tulsa Levees Feasibility study is that it is the first study in the Corp of Engineers to ever be completed using life safety as a reason versus the National Economic Development plan.

Additionally, Mr. Abate mentioned that Congress passed special appropriation and USACE received over $82 million for flood damage repairs ($81,303,200 went to the AR River; $1,000,000 went to Pine Creek in the Red River System). Lastly, Mr. Abate briefly touched current drought conditions along the Arkansas River Basin.

6. Nathan Kuhnert, United States Bureau of Reclamation (USBR). Mr. Kuhnert provided an introduction of the U.S. Bureau of Reclamation and listed the various programs. The Native American Affairs Program had two new projects awarded in FY2019 totaling $397,610 in federal funding (Choctaw Nation and Osage Nation). He touched FY2017 & FY2018 projects as well.

Other programs with USBR are the Water Conservation Field Services Program, WaterSMART Program, and the Research & Development Program. Within the WaterSMART Program are the following programs: Basin Study Program, Applied Science Grants, Water & Energy Efficiency Grants, Small-Scale Water Efficiency Grants, Water Marketing, Cooperative Watershed Management Program, Title XVI & Desalination WINN Act Programs, and Drought Response Programs. Within the Research and Development Program are the Science & Technology Program, and the Desalination & Water Purification Research Program.

Mr. Kuhnert stated currently there are three programs with Funding Opportunity Announcements (FOA) which are the Native American Affairs Program, the Cooperative Watershed Management Program, and the Title XVI & Desalination Water Infrastructure Improvements for the Nation (WIIN) Act Programs. In addition to these, USBR has several other programs involving stakeholders.

7. Ed Fite, Vice-President for Rivers Operations and Water Quality, Grand River Dam Authority (GRDA). Mr. Fite provided an update on the kayak park at Lake Frances Dam & stated the project may possibly be a go within the next 3-4 weeks. A permit was obtained in March from the Corp of Engineers and GRDA has been working with sister agencies in AR & OK, small aspects of engineering questions were passed and satisfied, final plans are being worked on, and hopefully groundbreaking we begin sometime in October. Mr. Fite stated this project will be a significant influence to northwest and northeast Oklahoma as well as northwest Arkansas.

Additionally, Mr. Fite stated they, with Shannon Phillips of the Oklahoma Conservation Commission, are getting very close to achieving one-third of the state's goal in OK to protect 9,000 acres of riparian areas in the Illinois River Basin.

L. PUBLIC COMMENT

Bill Cauthron, Chief of Water Quality Programs Division, Oklahoma Water Resources Board stated October 6, 2020, will be the last informal public meeting regarding the 2020-2021 Illinois River Watershed total phosphorous criterion revision.

Commissioner Julie Cunningham noted agenda item J.2. (Election of Officers) was skipped and asked for a motion of Election of Officers for Secretary & Treasurer. Ryan Benefield volunteered to remain as compact treasurer and suggested April Harris remain as secretary for the following year since AR will host again in 2021. Commissioner Cunningham motioned for Ryan Benefield to serve as Treasurer and April Harris to serve as Secretary for 2021. Commissioner Bruce Holland seconded the motion. The motion carried unanimously.

M. ADJOURNMENT

There being no further business, Federal Commissioner and Chairman Delia Haak thanked everyone for their attendance.

Commissioner Holland moved to adjourn the meeting, and Commissioner Cunningham seconded the motion. Chairman Delia Haak adjourned the 2020 Annual Meeting of the Arkansas-Oklahoma Arkansas River Compact Commission at 4:10 p.m. on September 24, 2020.

Delia Haak — 9-25-2021

Delia Haak
Federal Commissioner and Chairman

Date

April Harris

April Harris, Arkansas Natural Resources Division
2020 Commission Secretary

ARKANSAS-OKLAHOMA ARKANSAS RIVER COMPACT COMMISSION
September 23, 2020
10:00 a.m.
VIRTUAL MEETING
101 East Capitol, Suite 350
Little Rock, Arkansas 72201

PLEASE PRINT NAME/TITLE	PLEASE PRINT BUSINESS
Federal Chairman Delia Haak	Arkansas-Oklahoma Arkansas River Compact Commission
AR Commissioner Bruce Holland	AOARCC/Arkansas Dpt. of Agriculture- Natural Resources Division
AR Commissioner Jimmy Mardis	AOARCC/Denali Water Solutions
OK Commissioner Julie Cunningham	AOARCC/Oklahoma Water Resources Board
OK Commissioner Stephen Baldridge	AOARCC/Secretary of Energy & Environment
OK Commissioner Scott Thompson	AOARCC/Oklahoma Dept. of Environmental Quality
Alternate Federal Chairman Joel West Williams	Arkansas-Oklahoma Arkansas River Compact Commission
April Harris, Secretary	AOARCC/Arkansas Dpt. of Agriculture- Natural Resources Division
Ryan Benefield, Treasurer	AOARCC/Arkansas Dpt. of Agriculture- Natural Resources Division
Ken Brazil, Chair of Engineering Committee	AOARCC/Arkansas Dpt. of Agriculture- Natural Resources Division
Shawn Jackson, Chair of Environmental Committee	AOARCC/Arkansas Dpt. of Agriculture- Natural Resources Division
Wade Hodge, Chair of Legal Counsel	AOARCC/Arkansas Dpt. of Agriculture- Natural Resources Division

ARKANSAS-OKLAHOMA ARKANSAS RIVER COMPACT COMMISSION
September 23, 2020
10:00 a.m.
VIRTUAL MEETING
101 East Capitol, Suite 350
Little Rock, Arkansas 72201

PLEASE PRINT NAME/TITLE	PLEASE PRINT BUSINESS
Julie Chambers, Environmental Committee	AOARCC/Oklahoma Water Resources Board
Bill Cauthron, Committee Staff	AOARCC/Oklahoma Water Resources Board
Sara Gibson, Committee Staff	AOARCC/Oklahoma Water Resources Board
Mary Schooley, Committee Staff	AOARCC/Oklahoma Water Resources Board
Yohanes Sugeng	AOARCC/ Oklahoma Water Resources Board
Nicole Hardiman, Director	Illinois River Watershed Partnership
Jaysson Funkhouser, Little Rock, AR District Program Manager	U.S. Army Corps of Engineers
Julie Linck, Deputy Secretary	Arkansas Department of Energy & Environment
Mike Abate, Tulsa District	U.S. Army Corps of Engineers
Nathan Kuhnert	U.S. Bureau of Reclamation
Ed Fite, Vice President for Rivers Operations and Water Quality	Grand River Dam Authority
Shanon Phillips	OK Conservation Commission

ARKANSAS-OKLAHOMA ARKANSAS RIVER COMPACT COMMISSION
September 23, 2020
10:00 a.m.
VIRTUAL MEETING
101 East Capitol, Suite 350
Little Rock, Arkansas 72201

PLEASE PRINT NAME/TITLE	PLEASE PRINT BUSINESS
Blayne Arthur, Secretary	Oklahoma Dpt. of Agriculture, Food, & Forestry
Teena Gunter, General Counsel/Agricultural Environmental Management Services Director	Oklahoma Dpt. of Agriculture, Food, & Forestry
Caleb Whitcomb, Asst. Director Agriculture Environmental Management Services Division	Oklahoma Dpt. of Agriculture, Food, & Forestry
Cynthia Edwards, Deputy Secretary	Arkansas Department of Agriculture
Marla Peek	Oklahoma Farm Bureau
John Bailey	Arkansas Farm Bureau
Daryl Townsend	Grand River Dam Authority

Report of the Treasurer

Arkansas Oklahoma Arkansas River Compact Commission

September 24, 2020

The 2020 Year-end Financial Report covering July 1, 2019 through June 30, 2020.

Regions Bank Balance on July 1, 2019		$ 24,541.57
Total Income	$ 7,406.88	
Total Expenses	$ 1,984.76	
NET TOTAL	$ 5,422.12	
Regions Bank Balance June 30, 2020		$ 29,895.60
Certificate of Deposit Balance July 1, 2019		$ 11,137.73
Total Income	$ 18.09	
Certificate of Deposit Balance June 30, 20120		$ 11,155.86

Account Balances as of June 30, 2019

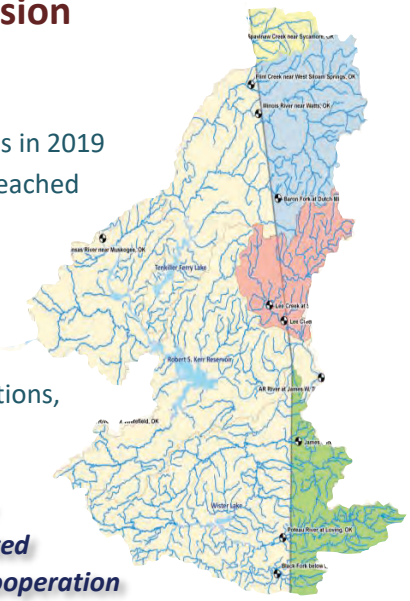
Regions Bank Balance	$ 29,895.60
Certificate of Deposit Balance	$ 11,155.86
TOTAL	**$ 41,051.46**

Assessments for both states are current.

NATURAL RESOURCES DIVISION

(2020) ARKANSAS COMMISSIONER REPORT

Arkansas-Oklahoma Arkansas River Compact Commission



ARKANSAS RIVER FLOODING

Record flooding from the Arkansas River during the spring and early summer months in 2019 impacted multiple states bordering the Arkansas River. In Arkansas, levees were breached which caused property damage and brought public attention to past maintenance practices and oversight of Arkansas River levees. In response, Governor Hutchison established the **Arkansas Levee Task Force** to study and analyze current conditions of levees in the state, identify funding sources for levee repair, and maintenance, evaluate potential monitoring and reporting systems necessary to track levee conditions, and assess existing laws and organizational structures governing levee districts.

The transfer of $10 million from the Budget Stabilization Trust Fund for the repair of levees in National Disaster Areas on the Arkansas River was initiated by Governor Hutchison in 2019. The Natural Resources Division (NRD), in cooperation with the Division of Emergency Management, is administering these funds for eligible levee rehabilitation and repair activities.

A summary of approved projects and associated funding is included in the table below:

Arkansas River Levee Funded Projects

Entity	County	Approved Funding
Conway County Levee District #6	Conway	$339,520
Conway County-Pope County Levee District #1	Conway & Pope	$997,459
Fourche Dam Island Drainage District #2	Pulaski	$576,000
Old River Drainage District	Pulaski	$270,000
Perry County Levee District #1	Perry	$450,000
Plum Bayou Levee District	Pulaski	$540,000
Riverdale Harbor Municipal PO Improvement District #1	Pulaski	$1,623,397
Riverdale Levee Improvement District # 134	Pulaski	$1,331,106
Roland Drainage District of Pulaski County	Pulaski	$480,440
Tucker Lake Levee & Drainage District	Jefferson	$1,167,270
Tupelo Bayou Irrigation & Watershed District	Faulkner	$46,400
Yell County-Dardanelle Drainage Levee District	Yell	$1,505,700
Yell County-Petit Jean Levee District	Yell	$263,000
McLean Bottoms levee & Drainage District #3	Logan	$91,000
City of Clarksville	Johnson	$1,000,000
Little Rock Pulaski County Drainage District #2	Pulaski	$349,200

Note: Entity to utilize own funds for loan portion.

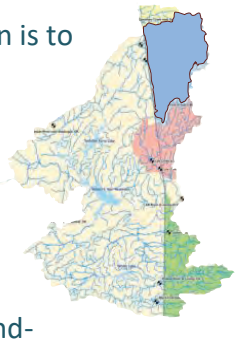
ARKANSAS UNPAVED ROADS PROGRAM

Unpaved roads in the state are the transportation backbone for rural communities and provide access for hunting, fishing, boating, hiking, and other recreation and tourist activities. Erosion of unpaved roads has negative effects on the state's economy, tourism, and natural resources. This NRD program provides incentives to counties for maintaining and improving select low-volume, unpaved public roads in Arkansas. Eligible activities include demonstration, training, promotion, and use of best management practices in construction and maintenance of unpaved roads near lakes, rivers, and streams. Program participation as of July 2020 includes the following Arkansas Counties:

Arkansas Unpaved Roads Program

County	Program Funding	County Match	Project Status
Calhoun	$27,500	$29,500	Completed
Dallas	$50,369	$53,268	Ongoing
Calhoun	$75,000	$75,000	Ongoing
Lincoln	$59,994	$62,193	Ongoing

ILLINOIS RIVER WATERSHED PARTNERSHIP (IRWP)

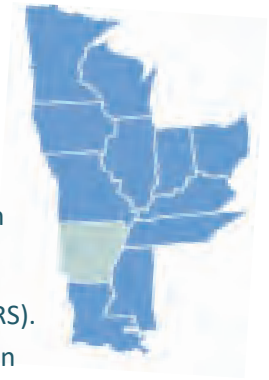


IRWP, the non-profit watershed management organization whose mission is to improve the integrity of the Illinois River through public education and community outreach, water quality monitoring, and the implementation of conservation and restoration practices throughout the Illinois River Watershed, leveraged substantial support for implementation of the **IRWP Riparian Restoration Program** in the Illinois River Watershed. The program promotes riparian buffer protection and streambank restoration by providing **75% of eligible project costs** to landowners who participate in the Riparian Restoration Program. As of July 2020, land-owner participation and implementation of stream restoration projects are meeting IRWP milestones for overall watershed improvement. A summary of current activity is shown below.

IRWP Riparian Restoration Program

	Watershed	Stream Miles Restored	Rotational Grazing Acres	Status of Projects
Signed Agreements	Clear Creek	2.66	N/A	Completed or Ongoing
	Sager Creek	2.20	N/A	Ongoing
	Lower Muddy Fork	3.17	200	Ongoing
Conservation. Plans Prepared	Clear Creek	0.51	N/A	Ongoing
	Moore's Creek	3.89	164	Ongoing
	Lake Wedington	1.02	20	Ongoing
	Sager Creek	3.92	300	Ongoing

MISSISSIPPI RIVER/GULF OF MEXICO HYPOXIA TASK FORCE



The next regular meeting of the Mississippi River/Gulf of Mexico Hypoxia Task Force **will be a virtual event in September 2020** (times and dates are to be determined). The agenda will include sessions open to the public and presentations from state, federal, and private entities involved in nutrient reduction activities at the state and national levels. Detailed information on the upcoming meeting will be provided soon.

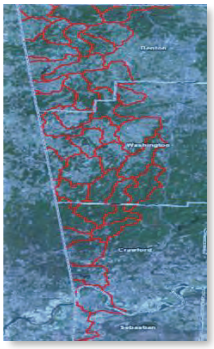
NRD has added full-time staff to work on the new Arkansas Nutrient Reduction Strategy (ANRS). Efforts have been refocused to concentrate and reallocate limited resources more intensely in select watersheds. Watersheds are being categorized and targeted through collaboration with the University of Arkansas's Water Resources Center in Fayetteville, Arkansas. This refocus will verify water quality improvements realized from nutrient reduction activities in these targeted watersheds. Emphasis is being placed on the establishment and maintenance of long-term ambient monitoring networks, assessment of current water quality trends, and identification of tools for reporting success and tracking nutrient reduction progress. Achievements in reduction associated with these refocused efforts will be measurable to meet the overall Gulf of Mexico Hypoxia Task Force goal of reducing nutrient exports to the Gulf. Mechanisms for successful implementation of the strategy include, but are not limited to, those shown below:

Mechanisms for Success & Implementation

Arkansas Nutrient Reduction Strategy

• 319 Priority Watershed Designations	• CW RLF Nutrient Reduction Incentives
• Watershed Based Plans	• NRCS NWQI Projects and Designations
• Water Quality Technicians – NMP Adoption	• Nutrient Surplus Area Designations
• Point Source Monitoring & Reporting	• Discovery Farms/Watershed
• NRCS RCPP, CSP, AWEP, EQIP, WRE Projects	• Watershed Group Establishment and Support
• Sceptic Tank Replacement Grant/Loan Program	

2020 NUTRIENT MANAGEMENT REPORTING



In designated nutrient surplus area watersheds, special limitations govern land application of litter, sewage sludge, and commercial fertilizer. Poultry feeding operations are required to:

a) Obtain nutrient management plans developed by approved nutrient management planners;

b) Limit nutrient application rates according to the phosphorus index developed for the region, &

c) Register operation with NRD.

NRD provides water quality technicians who work closely with USDA Natural Resources Conservation Service District Conservationists in select Conservation Districts to help landowners implement water quality improvement and conservation planning activities.

2020 NUTRIENT MANAGEMENT REPORTING (cont.)

Statistical information collected on poultry farm feeding operations is aggregated for Washington, Benton, Sebastian, and Crawford Counties and shown below. It should be noted data totals for 2020 have not been finalized. Incomplete reporting from producers may be due to limitations and impacts of Covid-19.

2020 Poultry Feeding Operations Data
Arkansas River Compact Area

COUNTY	Number of Acres	Tons Generated	Tons Removed	TONS USED				Number of Houses	Bird Capacity	Farms Reported
				Applied	Stored	Transferred or Sold	Litter Use Difference			
Benton	11,462	170,387	102,809	6,561	29,264	89,684	55,518	899	36,848,128	196
Washington	19,937	129,166	89,981	10,757	9,415	70,929	1,274	705	73,149,955	147
Crawford	2,380	10,457	2,729	2,273	26	430	0	29	5,459,900	10
Sebastian	3,930	20,011	19,341	3,153	400	14,338	-1,450	172	3,454,800	41

WATER RESOURCE DEVELOPMENT PROJECTS

NRD provides funding for public water and sewer projects through its federal and state low-interest loan and grant programs. NRD currently has approximately **$81 Million** invested in recently completed or ongoing projects in the Arkansas River Compact area of northwest Arkansas.

ANRC-Funded Projects: Washington & Benton Counties

PROJECT NAME	DESCRIPTION	COUNTY	COST	STATUS
Benton County Water Authority 5	Water	Benton	$650,996	Ongoing
Cave Springs	Sewer	Benton	$4,200,000	Ongoing
Northwest AR Conservation Authority	Sewer	Benton	$61,070,000	Ongoing
West Fork #4	Sewer	Washington	$8,412,000	Ongoing
Washington County POID	Sewer	Washington	$5,783,450	Ongoing
Washington Water Authority	Water	Washington	$1,500,000	Completed
		TOTAL	$81,616,446	

WATER RESOURCE DEVELOPMENT PROJECTS (cont.)

NEW SEPTIC TANK REMEDIATION PROGRAM NRD is proposing to make available $1,000,000 for a pilot project to improve and protect water quality in three targeted watersheds by assisting residents in remediating their failing onsite septic systems. NRD will select a *Managing Organization* to administer the pilot project in each targeted watershed. Organizations interested in offering management assistance will apply for two types of assistance for: 1) personnel and promotional expenses, and 2) implementation of remediation projects. Personnel expenses may be awarded at the start of the three-year project term from a state program or the Clean Water State Revolving Fund. Implementation will be funded with monthly draws from the Clean Water State Revolving Fund to reimburse eligible septic tank remediation projects. Individuals who meet all eligibility requirements may qualify to receive financial assistance, not to exceed $30,000, in the form of grant/loan as reimbursement for repair or replacement of a failing septic system. The pilot program will be implemented in the following watersheds:

Watershed	Hydrologic Unit Code (HUC)
Beaver Reservoir Watershed	11010001
Illinois River Watershed	11110103
Buffalo River Watershed	11010005

BETHEL HEIGHTS ANNEXATION Benton and Washington County's Election Commission certified results of the Aug. 11, 2020 special election calling for the annexation of Bethel Heights into Springdale. Residents of both cities proposed the annexation to resolve the issue of Bethel Heights' failing sewer system. The proposed annexation measure passed by 70% of the approximate 1800 votes counted and former Bethel Heights residents will now receive sewer service from Springdale Water Utilities.

The Arkansas Department of Energy and Environment's Division of Environmental Quality (DEQ) investigated Bethel Height's mismanagement of its wastewater treatment system for more than a year, trying to bring the treatment system into compliance with state regulations. During this period, Bethel Heights discussed with the Arkansas Natural Resources Commission (ANRC) available options for borrowing $11,600,000 to help pay for a lift station and pipeline to carry Bethel Heights wastewater to neighboring treatment facilities. A loan of this amount would have resulted in a 66% increase in the cost of sewer services to Bethel Heights residents. This alternative proved too "pricey" for Bethel Heights when compared with the annexation option. Since the annexation measure passed, the ANRC has had no further discussions regarding wastewater treatment alternatives with either Springdale or Bethel Heights. In the short term, Springdale is hauling wastewater from the Bethel Heights plant to the nearest Springdale wastewater facility until permanent connecting lines between the two systems can be installed and become operational.

NONPOINT POLLUTION ABATEMENT PROGRAM

Water Quality Monitoring in the Upper Poteau River Watershed (17-300)

Project Is Ongoing **2020** Monitoring, data aggregation, and trends analyses of all water quality data will be completed in this project to determine downstream effectiveness of current and future nonpoint pollution reduction activities in the Poteau River watershed. This $727,350 effort includes sampling and collection of water quality data (36 samples per year) throughout the watershed for a three-year duration from 2017-2020. At least 10 monitoring sites representing the HUC 12 sub-watersheds across variable land uses within the Upper Poteau River Watershed will be sampled during base flow conditions. The Arkansas Water Resources Center is monitoring discharge via two roving discharge monitoring stations, relocated every two to three months to gather seasonal flow data during high and low flow conditions. Samples will be analyzed for nitrate-nitrogen, chloride, soluble reactive phosphorus, total phosphorus, total nitrogen, total suspended solids, turbidity and conductivity.

Project Results ***Information and data is being gathered and compiled. This effort along with Project 16-1100 will aid the development of a 9-element Watershed Management Plan for the Poteau River Watershed. This project will complete sampling in September 2020 and conclude in December 2020.***

Water Quality Monitoring in Upper Illinois & Upper White River Basins (19-1100)

Project Is Ongoing **2020** This project includes the collection and analysis of 30 water samples a year on average at thirteen sites in these two watersheds. Excessive nutrients and sediments have been cited as NPS pollution in northwest Arkansas, and this project will monitor these constituents and others which will add to the water quality database used by policy and decision makers of Arkansas. Constituents that will be monitored are as follows: nitrate-nitrogen (NO_3-N), chloride (Cl), sulfate (SO_4), soluble reactive phosphorus (SRP), total phosphorus (TP), total nitrogen (TN), total suspended solids (TSS), turbidity and conductivity. The Arkansas Water Resources Center will be the primary investigator for this $467,833 effort.

Project Results ***Project data and information are currently being collected and compiled. This project serves as a continuation of the many years of valuable data that we have collected in Northwest Arkansas.***

J. Pense Streambank Stabilization Project (20-600)

Project Will Begin **2020** This $228,024 project will reduce sediment loading into the Lake Fort Smith water supply reservoir by 21,500 ft^3 per year and limit, or reduce, water treatment costs by improving water quality within the receiving stream. This will be accomplished by stabilizing approximately 600 ft of stream bank through installation of Bendway weirs and longitudinal stone toe protection devices, re-sloping existing vertical banks, and establishing a 30 ft deep riparian zone. The Frog Bayou Watershed Management Plan lists this site as a high priority project for stream bank stabilization. An estimated 21,500 ft^3 per year of sediment will be prevented from entering the receiving stream.

Project Results ***This project will begin in October 2020.***

NONPOINT POLLUTION ABATEMENT PROGRAM (cont.)

Unpaved Roads BMP Demonstration Project: Illinois River Watershed (19-800)

Project Is Ongoing **2020** This $275,140 effort is currently implementing recommendations from the Upper Illinois River Watershed (UIRW) Based Plan to reduce non-point source sediment loads through the implementation of Best Management Practices (BMPs) for unpaved roads. Project goals are being met by installing unpaved roads BMP demonstration projects at high priority sites within the watershed, the success of which will be showcased at a subsequent demonstration field tour. There will also be an education component offered to county road crews, relevant county staff, and county elected officials on the importance of unpaved roads practices, including materials and resources. Attendees will have the opportunity to incorporate these practices into their future projects.

Project Results ***To date: a project site has been selected along Osage Hill Road in Benton County and the project design has been completed.***

Poteau River Sub-Watershed Project (17-800)

Project Completed 2020 This $256,225 project supported the Poteau River Conservation District's effort in developing a cost-share program for implementing Best Management Practices. The cost-share program promoted installation of filter and buffer strips, provided sources of water for livestock to aid in livestock exclusion from streams, and fortify problem areas that are easily eroded. Eligible cost-share items included fencings, ponds, watering facilities, pipelines, forage and biomass plantings as referenced in USDA's EQUIP program criteria. A project steering committee, consisting of Poteau River Conservation District Board Directors, coordinated with Arkansas Natural Resources Commission, Cooperative Extension Service, Arkansas Forestry Commission, Arkansas Game and Fish Commission, Arkansas Department of Environmental Quality, and the USDA Natural Resource Conservation Service to set priorities for eligible cost-share practices. Public outreach included technical assistance and quarterly newsletters to inform and educate landowners regarding this project, grazing management, and how to implement conservation practices which benefit their farm operation and the environment. Annual field days were held to demonstrate properly installed best management practices.

Project Results ***By providing 319 cost share funds to area landowners it allowed approximately 14,594 feet of exclusion and cross fencing combined, a gravity fed watering system consisting of four 500-gallon tire tanks, 1,096 feet of pipeline and 1,600 square feet of heavy use area to be installed. In other practices, landowners completed 850 acres of brush management improving forage and nutrient use in grazed and hay land. Forage and biomass planting assisted landowners with 79 acres of pasture establishment.***

NONPOINT POLLUTION ABATEMENT PROGRAM (cont.)

NPS Pollution Prevention through Direct Outreach and Digital Media (19-1400)

Project is Ongoing **2020** This $353,421 project will build upon the more successful elements of previous 319(h) grant projects implemented in the Illinois River and Beaver Lake watersheds by the University of Arkansas Cooperative Extension Service. Those projects include the following:

- **09-1700** - e-BMP Education,
- **14-1200** - Improving NPS Pollution Prevention In A Small Urban Community Watershed through Education and Demonstration, and
- **15-900** - Connecting NPS Management to Receiving Streams Through BMP Education and Demonstration.

These referenced projects have demonstrated effective techniques for more targeted watershed outreach and education, stronger collaboration with community partners, more BMP adoption through direct stakeholder interaction, and innovative NPS demonstration and education methods.

Video Podcasts Projects 09-1700, 14-1200, and 15-900 emphasized the use of video podcasting and showed delivering educational content through video is an effective method for today's ever-connected society, with social media serving as the most popular distribution channel. Lessons learned from previous projects indicated engagement tends to decrease with video length. In 2017, 56% of all videos produced were less than two minutes, and videos under 90 seconds had the highest average retention with 53% (Vidyard, 2017). Similarly, Twitter's #VideoOfTheDay hashtag for 2017 averaged 43 seconds in length (Hubspot, 2017). Internal analysis of the YouTube channel CleanWater@UAEX (13-1400; 14-900) showed significantly higher views (1,700) on short videos (~30 seconds) versus longer videos (720) ranging from 2 to 3 minutes. The average watch time for those videos was 1:47. Strategies shifted with Project 14-900 to the production of succinct, thought-provoking video content (~1 minute) to increase viewer retention and engagement, with an average view time of 1:11. Overall viewership for both previous projects was very positive, with over 4,000 views between the two projects. The video series remain online and continue to be viewed and shared. Because of these successes and the continuing rise of social and digital media platforms, improving and adapting a new video series is likely to result in continued adoption of NPS practices and BMPs by viewers.

The series developed in this project will elaborate on the collective implementation of NPS pollution prevention BMPs by residents and neighborhoods, low-impact development/green infrastructure for the average homeowner, urban forests, riparian enhancement, and local stewardship efforts. The goal will be to produce a minimum of 15 short videos emphasizing tangible actions to prevent NPS pollution with a series of calls-to-action (join a stream cleanup; install a rain barrel; let us know in the comments what actions you take to protect your local stream; etc.). Success will be determined by viewing analytics, engagement (shares/likes/reach), user feedback, and technology transfer.

Project Results ***Ongoing***

NONPOINT POLLUTION ABATEMENT PROGRAM (cont.)

Poteau River Watershed Management Planning (20-1100)

Project Will Begin 2020 This $217,049 project will develop a nine element Watershed Management Plan (WMP) for the Poteau River watershed in Arkansas. The WMP will include identification of critical sub-watersheds at a small scale (12 digit HUC and smaller) and ranked implementation measures to reduce non-point source pollution loading from key areas. Minor levels of additional monitoring and assessment data will be collected in key areas to fill existing data gaps, mostly in the northern section of the watershed in the James and Sugarloaf drainages. This data is anticipated to include high flow (storm) event samples and NPS identification assessment data, that will ensure an equal representation of the entire 8-digit HUC and allow the implementation priorities to be verified, load reductions for each recommended management measure to be estimated and aid to in establishment of a water quality baseline condition and a monitoring plan developed by which implementation success can be measured in the future. The project will also include a community involvement task that will be used to educate the community and acquire watershed information and gain support for WMP implementation, and a task designed to address funding for WMP implementation. The WMP will ultimately be used by the City of Waldron and its partners to direct watershed protection activities and watershed restoration activities with an ultimate goal of reducing pollutant loading and protecting the watershed into the future. Implementation of the WMP will reduce export of pollutants such as nitrogen, phosphorus, suspended sediments, minerals and metals into the Poteau River, and further into Oklahoma, Lake Wister and ultimately into the Arkansas River.

Project Results ***Project will begin in October 2020.***

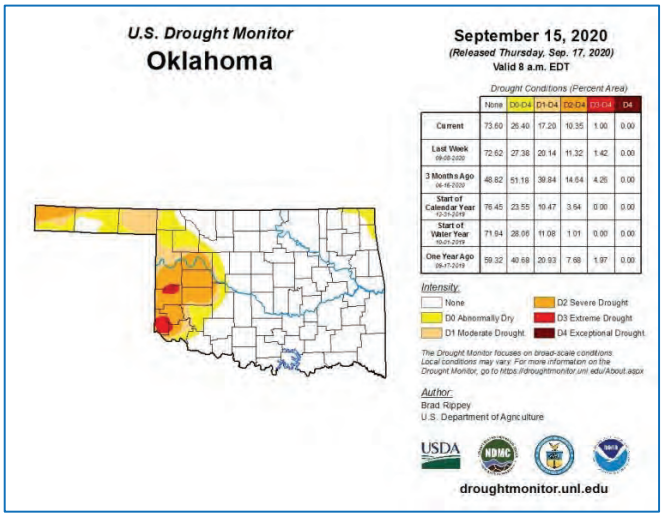
OKLAHOMA COMMISSIONERS' REPORT

Oklahoma-Arkansas
Arkansas River Compact Commission
Arkansas Virtual Host
September 24, 2020

CLIMATE

Throughout the summer, changes in drought severity have been highly variable, with areas of improvement intertwined with areas of intensification. Oklahoma Climate Survey reports for the past 30 days over 33% of state (western counties) is in moderate drought or above while the south central and southeast regions are experiencing the 1st and 2nd wettest ranking since 1921 when measurements began.

According to the latest U.S. Drought Monitor, as of September 15, 2020, the estimated Oklahoma population living in areas experiencing drought was 130,231.



COVID19 RESPONSE– CONTINUITY OF OPERATIONS

During the current public health situation, Oklahoma agencies have implemented "Continuity of Operations Plans" focused on the continued delivery of services and resources to all citizens. Agencies are adhering to the guidelines set forth by the Center for Disease Control and incorporated into guidance plans from the White House and Governor Kevin Stitt's office. This has included an expansion of digital services and a move to nearly 100 percent mobile operations through telework. The OWRB has modified operations and is assessing permanent changes, including increased online services for permitting, testing, and continuing education; optimizing administrative transactions and assistance; adopting virtual public meetings to mobile workforce model configuration.

OKLAHOMA COMPREHENSIVE WATER PLAN (OCWP) UPDATE

The OCWP is the defining water resource management guide for the state of Oklahoma. Plans for the 2025 decennial update were initiated in August, 2019 with execution of a letter agreement for Planning Assistance to States funding between the OWRB and U.S. Army Corp of Engineers and engineering contracts will be finalized in the coming months. New to the OCWP 2025 Plan will be an emphasis on infrastructure across the water spectrum, from public drinking water and water reclamation systems, to lake and groundwater

storage, to flood control and agricultural water conservation and recharge. The Plan will include a statewide assessment of water supply infrastructure, supply-demand-gap analyses, development of local and regional supply options, among other studies. Stakeholder engagement and water policy recommendation development will be conducted via live and virtual meetings with water sector and economic development groups and digital surveys to capture key water issues and concerns across the diverse areas of the state.

NEW STATEWIDE FLOOD RESILIENCY PLAN

Oklahoma Senate Bill 1269, a request bill from the OWRB, directing the agency to develop a Statewide Flood Resiliency Plan, was signed into law by Governor J. Kevin Stitt on May 18, 2020. In addition to the creation of a statewide flood mitigation plan, the law creates the State Flood Resiliency Revolving Fund to fund both the development of the Plan as well as future flood hazard mitigation projects.

The flood plan will examine flood risks, and potential flood mitigation projects beyond the local level, along an entire runoff area within a larger watershed. The plan will examine the need for additional flood risk information, such as flood maps, and will ultimately feature a State inventory of specific flood control infrastructure projects that will include cost-benefit analyses. Flood risk needs and assessments within watersheds could also be coordinated between communities in those watersheds.

The OWRB and other hazard mitigation and infrastructure agencies – including the Oklahoma Floodplain Managers Association, Oklahoma Emergency Management, Federal Emergency Management Agency, Oklahoma Conservation Commission, Oklahoma Department of Commerce, Oklahoma Department of Transportation, U.S. Army Corps of Engineers, and the Natural Resources Conservation Service – have already began initial collaboration for the plan.

OCWP INSTREAM FLOW WORKGROUP

Consideration of an ISF program is a priority recommendation of the 2012 OCWP Update. The OWRB conducted an ISF Pilot Study in the Upper Illinois River Basin in northeast Oklahoma. The pilot study included technical studies initiated by OWRB, following the Instream Flow Incremental Methodology (IFIM). In June 2019, the ISF team presented the draft IFIM Pilot Study with recommendations to the ISF Advisory Work Group and the group discussed various approaches other states have adopted. Although no consensus was reached by the group on a single approach, most members agreed that assessing potential economic impacts of various scenarios that promote consumptive and non-consumptive uses is warranted to promote long range economic development in the diverse areas of the state.

STRATEGIC PARTNERSHIP ALLIANCE

In September 2019, the Governor J. Kevin Stitt, Secretary Kenneth Wagner, the Oklahoma Water Resources Board, Oklahoma Department of Environmental Quality, and the Oklahoma Rural Water Association announced the formal creation of a Strategic Partnership Alliance between the organizations. The alliance agreement commits the organizations to collaborate and combine resources to improve the sustainability of Oklahoma rural and small community water and wastewater systems while meeting their own mission. Similar to systems across the nation, many of Oklahoma's rural communities struggle with aging, inadequate water and wastewater systems, many of which experiencing system losses upwards of 30 percent, reaching

60-70 percent as reveled the OWRA's Leak Detection Team. With an initial goal of reducing rural water leakage by half, most attempts have exceeded those expectations. The program also provides training and assistance to help small communities run local systems more sustainably drawing from modern business practices and principles.

2020 OKLAHOMA LEGISLATIVE SESSION

During the 2020 Oklahoma legislative session two bills related to Oklahoma water law and water resource management programs were approved.

SB 1269, or the Oklahoma Flood Resiliency Act, directs the OWRB to create a statewide flood mitigation plan. The law also creates the State Flood Resiliency Revolving Fund to fund both the development of the Plan and future flood hazard mitigation projects. This legislation was requested by the OWRB.

SB 1875, or the Oil and Gas Produced Water and Waste Recycling Act, establishes which parties are responsible for disposal or processing of oil and gas water and waste. The legislation was requested by parties who are interested in promoting the reuse of produced water for energy production in lieu of freshwater resources when feasible.

ARKANSAS RIVER BASIN INFRASTRUCTURE INVESTMENT

The OWRB approved funding for 34 water & wastewater projects totaling nearly $313,290,192 million in the Stream Compact basin from June 2019 to June 2020:

Wastewater System Projects

- $11,415,000 loan for Broken Arrow Municipal Authority
- $43,310 loan for Cameron Public Works Authority
- $505,000 loan for Carney Public Utilities Authority
- $11,373,000 loan for Coweta Public Works Authority
- $209,250 loan for Dewar Public Works Authority
- $36,130 loan for East Central Oklahoma Water Authority
- $10,431,584 loan for Enid Municipal Authority
- $440,000 loan for Haileyville Public Works Authority
- $580,000 loan for Hartshorne Public Works Authority
- $2,600,000 loan for Inola Public Works Authority
- $4,328,000 loan for Kingfisher Public Works Authority
- $6,280,000 loan for Miami Special Utilities Authority
- $78,000 loan for Meeker Public Works Authority
- $1,947,000 loan for Oklahoma City Water Utilities Trust
- $4,650,000 loan for Oklahoma City Water Utilities Trust
- $28,170,000 loan for Owasso Public Works Authority
- $99,999 grant for Porum Public Works Authority
- $740,000 loan for Roland Utility Authority
- $37,920,000 loan for Shawnee Municipal Authority
- $10,626,000 loan for the Tulsa Metropolitan Utility Authority
- $14,835,000 loan for Wagoner County RWSG & SWMD #4
- $37,575 loan for Westville Utility Authority
- $100,000 grant for East Central Oklahoma Water Authority
- $5,350,000 loan for Grove Municipal Services Authority

TOTAL: $152,794,848

- Water System Projects:
  - $8,291,000 loan for Collinsville Municipal Authority
  - $1,100,000 loan for East Central Oklahoma Water Authority
  - $40,000,000 loan for Edmond Public Works Authority
  - $9,675,000 loan for Locust Grove Public Works Authority
  - $490,000 loan for McIntosh County RWS & SWD #2
  - $2,785,000 loan for Miami Special Utilities Authority
  - $4,700,000 loan for Nicoma Park Development Authority
  - $21,750,014 loan for Oklahoma City Water Utilities Trust
  - $74,000,000 loan for Oklahoma City Water Utilities Trust
  - $700,000 loan for Okmulgee Municipal Authority
  - $2,359,000 loan for Roland Utility Authority
  - $95,330 loan Weleetka Public Works Authority
  - $1,261,000 for Atoka Municipal Authority

  TOTAL: $167,206,344

HYDROLOGIC INVESTIGATIONS IN THE ARKANSAS RIVER BASIN

The OWRB conducts statutorily mandated hydrologic investigations to determine the amount of fresh groundwater available for appropriation. Several of these investigations are currently underway in the Arkansas River basin including:

- The OWRB initiated a hydrologic investigation of the Salt Fork of Arkansas River aquifer in August 2018 through a contract with the United States Geological Survey (USGS).
- The OWRB also has an ongoing hydrologic investigation of the Boone minor aquifer and Roubidoux major aquifer through a contract with the USGS, initiated in 2017.
- Third, the OWRB is in the final stages of an in-house review for the hydrologic investigation report on the Cimarron Alluvial aquifer, which will then be peer-reviewed by the USGS prior to publishing.
- The OWRB has initiated a study on the Ada-Vamoosa aquifer. The Ada-Vamoosa aquifer is currently in the field work portion of the study and will be handled in-house and peer-reviewed by the USGS.

FLOODPLAIN MANAGEMENT – 2019 ARKANSAS RIVER BASIN FLOOD

Oklahoma experienced substantial flooding in the summer of 2019, particularly in the northeast region on the Arkansas River. Extreme releases of water from major reservoirs impacted communities throughout the Arkansas River basin.

- 489 NFIP claims from 5/7/2019 to 8/26/2019 totaling nearly $33.3 million
- 40 Disaster Declared Counties
- 27 Individual Assistance Counties
- 196 Impacted National Flood Insurance Program (NFIP) Participating Towns/Cities
- 210 Impacted non-NFIP Participating Towns/Cities
- 7 NFIP CRS Communities in Declared Counties: Enid, Bartlesville, Stillwater, Sand Springs, Tulsa, Broken Arrow, Dewey
- 10 Disaster Declared Counties NOT participating in NFIP
- 2,375 dams in Declared Counties (201 are High Hazard Class)

- The OWRB worked closely with communities throughout the state in 2019 to identify flood risks and update flood maps through FEMA's Cooperating Technical Partners program with six active mapping update and discovery projects.

The OWRB acts as the State Floodplain Board and NFIP coordinating agency, as directed by the Oklahoma Floodplain Management Act. The agency has begun identifying funding partners to initiate development of Oklahoma's first statewide flood plan, which will identify flood risks and potential flood mitigation projects on a watershed basis. The plan will also examine the need for additional flood risk information, such as flood maps, and will ultimately feature a state inventory of specific flood control infrastructure projects that will include cost-benefit analyses.

WATER RIGHTS PERMITTING

The OWRB appropriates fresh water resources as directed by Oklahoma statutes. Currently, there are 13,220 active long-term permits for more than 6.9 million acre-feet per year. The OWRB's permitting staff issued 35 groundwater permits in FY-2020 totaling 25,962.2 acre-feet, and 55 stream water permits totaling 25,568.2 acre-feet, along with 880 provisional temporary permits totaling 38.821 acre-feet. To support water rights administration, the agency conducted surface water allocation modeling and availability analyses, coordinated statewide water use reporting, and responded to public complaints.

DAM SAFETY PROGRAM

Last year, the Oklahoma Dam Safety Program contracted with Applied Weather Associates, in coordination with the Arkansas, Louisiana, and Missouri state dam safety programs, to complete a regional Probable Maximum Precipitation study. Information obtained from the study was used to update the OWRB's administrative rules (OAC 785 Chapter 25) for future spillway design, replacing precipitation values published by the National Weather Service in 1978. The rules governing dam inspections were also amended to clarify the minimum standards required for written dam inspection reports.

During past year, the OWRB Dam Safety staff worked closely with several high hazard dam owners to update and complete their Emergency Action Plans. Following FEMA's release of a Notice of Funding Opportunity for FY 2020 High Hazard Potential Dams Rehabilitation Grant, program staff began assisting dam owners that may be eligible for the grant with preparing and submitting the required documents.

WELL DRILLER AND PUMP INSTALLER PROGRAM

There are currently 379 well drilling and pump contractors licensed by the OWRB. The OWRB frequently provides technical assistance for water well drilling and pump contractors and for the public at large. The OWRB also assists drillers with required well log reporting, and to date, more than 200,000 well logs are available to the public online. Every year, the OWRB cooperates with the Oklahoma Ground Water Association to provide continuing education training, which is required for water well and pump contractors to maintain a license. The OWRB works with the Well Driller Advisory Council and stakeholders to develop, update, and advance water well drilling rules. Effective in September 2020, new rules were established to facilitate expedited licensing of transitioning military service members and spouses, simplify groundwater well plugging standards, and increase program fees that provide for continuing education and enforcement of well

drilling and pump installation standards. Additionally, in response to the ongoing public health situation, the program instituted online certification testing for firms and operators.

WATER QUALITY MONITORING, MAPPING AND WATER QUALITY STANDARDS

Beneficial Use Monitoring Program - The water data contained in the OWRB's 2019 Beneficial Use Monitoring Program (BUMP) reports is collected from 130 lakes and streams collected at approximately 600 sites throughout Oklahoma.. The Groundwater Monitoring and Assessment Program, added to BUMP in 2012, consists of a network of approximately 750 wells in Oklahoma's 21 major aquifers, where the OWRB monitors both water levels and water quality. For additional information, visit www.owrb.ok.gov/bump.

Water Quality Standards - The OWRB did not conduct a revision to the Oklahoma Water Quality Standards in 2020. In 2021, the OWRB will propose revisions to the scenic rivers total phosphorus criterion and implementation rules. These proposed revisions will apply to scenic rivers in the Illinois River watershed only and are an outgrowth of recommendations made by the Joint Phosphorus Study Committee in the 2016 Oklaoma Scenic Rivers Joint Posphorus Study. The OWRB worked extensively over an 18 month period with the Arkansas Department of Environmental Quality to develop the proposed rules, as well as Oklahoma sister environmental agencies and the Cherokee Nation.

Report of the Budget Committee

Arkansas Oklahoma Arkansas River Compact Commission

September 24, 2020

The 2021 Proposed Budget covering July 1, 2020 through June 30, 2021.

Beginning Cash Balance – July 1, 2020	**$ 41,051.46**
PROPOSED BUDGETED RECEIPTS	
Annual Dues – Arkansas and Oklahoma ($3,500/State)	$ 7,000.00
Total Gross Receipts	**$ 7,000.00**
TOTAL FUNDS AVAILABLE	**$ 48,051.46**
PROPOSED BUDGETED EXPENDITURES	
Chairman Hosting Expenses	$ 600.00
Report Printing/Reproduction	$ 2,000.00
Personnel Service & Office Expenses	$ 250.00
Audit	$ 400.00
Meeting Space Rental	$ 900.00
Security Bond/Insurance	$ 550.00
Stream Gage Reimbursement	$ 6,300.00
Total Expenditures	**$ 11,000.00**
Balance to be carried forward	**$ -4,000.00**
TOTAL	**$ 44,051.46**

ARKANSAS-OKLAHOMA ARKANSAS RIVER COMPACT COMMISSION
2020 BUDGET VERSUS ACTUALS
(7/1/2019 - 6/30/2020)

	ACTUAL FY - 2020 7/1/2019 6/30/2020	BUDGET FY - 2020 7/1/2019 6/30/2020	OVER/UNDER BUDGET FY - 2020 7/1/2019 6/30/2020	% OF BUDGET FY - 2020 7/1/2019 6/30/2020
Income				
State Annual Dues	$7,000.00	$7,000.00	$0.00	100.00%
Interest on Checking	$13.79	$0.00	$13.79	
Interest on Certificate of Deposit	$18.09	$0.00	$18.09	
Disputed Deposits	$375.00	$0.00	$375.00	
Total Income	$7,406.88	$7,000.00	$406.88	105.81%
Expenses				
Chairman Hosting Expenses	$0.00	$600.00	$600.00	0.00%
Report Printing/Reproduction	$1,819.76	$1,100.00	($719.76)	165.43%
Personnel Service & Office Expenses	$0.00	$250.00	$250.00	0.00%
Audit	$0.00	$300.00	$300.00	0.00%
Meeting Space Rental	$0.00	$900.00	$900.00	0.00%
Security Bond/Insurance	$165.00	$550.00	$385.00	30.00%
Stream Gage Reimbursement	$0.00	$6,300.00	$6,300.00	0.00%
Disputed Charges	$50.00	$0.00	($50.00)	
Total Expenses	$1,984.76	$10,000.00	$7,965.24	19.85%

ARKANSAS-OKLAHOMA ARKANSAS RIVER COMPACT COMMISSION
TRANSACTION SUMMARY - CHECKING ACCOUNT
(7/1/2019 - 6/30/2020)

Date	Category	Payee	Purpose	Payment	Deposit	Balance
6/30/2019		Beginning Balance				$24,541.57
7/31/2019	Interest	Regions Bank	Interest on Checking Account		$1.11	$24,542.68
8/31/2019	Interest	Regions Bank	Interest on Checking Account		$1.01	$24,543.69
9/25/2019	Refund	Regions Bank	Refund on Disputed Withdrawls		$375.00	$24,918.69
9/30/2019	Interest	Regions Bank	Interest on Checking Account		$1.05	$24,919.74
10/31/2019	Interest	Regions Bank	Interest on Checking Account		$1.06	$24,920.80
11/29/2019	Interest	Regions Bank	Interest on Checking Account		$0.99	$24,921.79
12/31/2019	Interest	Regions Bank	Interest on Checking Account		$1.09	$24,922.88
1/31/2020	Interest	Regions Bank	Interest on Checking Account		$1.06	$24,923.94
2/11/2020	Deposit	ANRC/OWRB	Annual Dues		$7,000.00	$31,923.94
2/28/2020	Interest	Regions Bank	Interest on Checking Account		$1.12	$31,925.06
3/30/2020	Disputed	Unknown(Cindy Beardon)	Disputed	$50.00		$31,875.06
3/31/2020	Interest	Regions Bank	Interest on Checking Account		$1.40	$31,876.46
4/30/2020	Security Bond/Insurance	The Bond Exchange	Security Bond	$165.00		$31,711.46
4/30/2020	Interest	Regions Bank	Interest on Checking Account		$1.31	$31,712.77
5/29/2020	Interest	Regions Bank	Interest on Checking Account		$1.26	$31,714.03
6/10/2020	Report Printing/Reproduction	Arkansas Graphics	Printing of Annual Report	$1,819.76		$29,894.27
6/30/2020	Interest	Regions Bank	Interest on Checking Account		$1.33	$29,895.60
		Ending Balance		$2,034.76	$7,388.79	$29,895.60

Arkansas River Basin Compact

Annual Compliance Report

September 2020

Submitted to the Arkansas-Oklahoma Arkansas River Basin Compact Commission

ARKANSAS RIVER BASIN COMPACT

ANNUAL REPORT

The Arkansas River Basin Interstate Compact (Compact) exists to promote interstate comity between the states of Arkansas and Oklahoma and provide for an equitable apportionment of the waters of the Arkansas River between the States of Arkansas and Oklahoma. Provisions in the Compact specify apportionment requirements for the Illinois River, Lee Creek and Spavinaw Creeks, Poteau River, and Arkansas River subbasins based on computation of annual runoff, yield, and depletion/accretions. In an effort to streamline computations and verify Compact compliance, an Excel-based data entry and analyses tool has been developed to standardize computation methods and annual reporting. The new report summary includes compilation of reservoir depletions and subbasin yields in single page, tabular formats. A description of computation methods and procedures is included as Appendix A.

COMPACT COMPLIANCE

For the water year 2019, annual yields in the Illinois River, Lee Creek, Spavinaw Creek, Poteau River, and Arkansas River subbasins exceeded apportionment requirements (no computed deficits) Results from compliance computations are summarized in Tables #1 and #2 on page 2.

Note:

- *Nutrient loading and water quality data for the Illinois River subbasin is reported in a separate publication entitled Water Quality Monitoring Report Illinois River Basin.*

USGS STREAM GAGE CALIBRATION

The following describes United States Geological Survey stream gage calibration as noted in Geological Survey Water-Supply Paper 2175: *Measurement and Computation of Streamflow: Volume 1, Measurement of Stage and Discharge, S. E. Rantz and others.*

> "Each gage will be equipped with data collection platforms that record stage (water-level) at 15-minute intervals and transmit these data to the USGS National Water Information System (NWIS) database and displayed in near real-time on the USGS web page (http://ar.water.usgs.gov). Water-level information from the gages will be used to develop discharge rating curves for calculation of instantaneous and daily discharge in accordance with methods as described by Rantz and others (1982)."

Arkansas River Basin Compact
2019 Computations Summary

Summary of Results for Water Year 2019

Table 1. Annual Depletion by Major Reservoirs in the Compact Area

ANNUAL DEPLETIONS BY MAJOR RESERVOIRS IN ACRE-FEET (AF)

RESERVOIR	CHANGE IN STORAGE	PRECIPITATION (P)	RUNOFF (p)	EVAPORATION (E)	PERMITTED DIVERSIONS (D)	RELEASES (O)	INFLOW (I)	DEPLETIONS (X)
Webber Falls	28,988	58,696	10,565	36,381	-	24,813,022	24,830,260	17,238
Tenkiller Ferry	98,418	69,456	12,502	42,011	745	1,628,116	1,712,336	84,220
Robert S. Kerr	71,261	167,006	30,061	143,465	1,149	60,240,787	60,319,717	78,930
Wister	(12,912)	34,541	6,217	22,824	7,118	1,186,502	1,175,208	(11,294)
						ANNUAL DEPLETIONS:		**169,094**

Table 2. Annual Yield from Sub-basins in the Compact Area

ANNUAL YIELD FROM SUB-BASINS IN ACRE-FEET (AF)

SUB-BASIN	RUNOFF	DEPLETIONS (+) ACCRETIONS (-)	ANNUAL YIELD[1]	STATE OBLIGATED	FLOW REQUIRED TO DELIVER		ACTUAL FLOW DELIVERED
					Percentage	Amount	
Spavinaw Creek	111,129	(1)	**111,128**	AR	50	55,564	**111,129**
Illinois River	856,624	203,799	**1,060,423**	AR	40	424,169	**856,624**
Lee Creek	354,708	2,155	**356,863**	AR	0	-	**354,708**
Poteau River	736,849	834	**737,683**	AR	40	295,073	**736,849**
Arkansas River	5,906,481	120,567	**6,027,048**	OK	40	2,410,819	**5,906,481**

[1] *Runoff which would occur from any specified area under unaltered conditions*

Arkansas River Basin Compact

2019 Reservoir Summary

WATER BALANCE FOR LARGE RESERVOIRS IN THE COMPACT AREA															
	Normal Storage	Surface Area	Month	Storage	Precipitation (P)		Runoff (p)	Evaporation (E)			Diversions (D)	Releases (O)		Inflow (I)	Depletions (X)
	AF	Acres		AF	in	AF	AF	in	in*	AF	AF	Total (DSF)	Total AF	AF	AF
Webbers Falls	170,100	11,600	Oct	161,239	4.38	4,234		3.17	2.22	2,145		1,559,000	3,092,277		
			Nov		1.88	1,817		2.25	1.58	1,523		564,687	1,120,057		
			Dec		5.72	5,529		1.83	1.28	1,238		685,948	1,360,578		
			Jan		3.67	3,548		1.57	1.10	1,062		1,584,146	3,142,154		
			Feb		2.67	2,581		1.82	1.27	1,231		717,170	1,422,507		
			Mar		3.75	3,625		3.36	2.35	2,276		1,060,753	2,104,004		
			Apr		4.21	4,070		6.09	4.26	4,120		766,941	1,521,227		
			May		8.98	8,681		5.62	3.93	3,801		7,871,630	15,613,378		
			Jun		6.72	6,496		7.22	5.06	4,888		4,538,525	9,002,164		
			Jul		1.91	1,846		8.51	5.95	5,755		2,910,930	5,773,830		
			Aug		11.18	10,807		6.59	4.62	4,462		1,648,286	3,269,375		
			Sep	190,227	5.65	5,462		5.74	4.02	3,881		905,006	1,795,079		
			TOTAL	28,988	60.72	58,696	10,565	53.77	37.64	36,381	-		24,813,022	24,830,260	17,238
Tenkiller Ferry	627,467	12,900	Oct	629,372	1.8	1,946		2.81	1.97	2,115		10,701	21,225		
			Nov		0.6	677		2.35	1.65	1,768		8,882	17,617		
			Dec		5.8	6,267		1.82	1.27	1,370		6,732	13,353		
			Jan		4.1	4,386		1.70	1.19	1,279		128,465	254,810		
			Feb		3.1	3,322		2.14	1.50	1,613		60,476	119,954		
			Mar		4.0	4,268		3.78	2.65	2,847		63,477	125,907		
			Apr		4.4	4,730		5.86	4.10	4,408		82,892	164,416		
			May		12.0	12,868		6.30	4.41	4,742		22,451	44,532		
			Jun		3.3	3,591		7.12	4.98	5,359		108,092	214,400		
			Jul		4.2	4,472		8.33	5.83	6,265		194,616	386,021		
			Aug		15.6	16,781		7.09	4.96	5,334		50,488	100,143		
			Sep	727,790	5.7	6,149		6.53	4.57	4,910		83,558	165,737		
			TOTAL	98,418	64.61	69,456	12,502	55.83	39.08	42,011	7,628		1,628,116	1,719,219	91,103
Robert S. Kerr	525,700	41,900	Oct	524,395	0.66	2,305		3.77	2.64	9,215		1,785,861	3,542,255		
			Nov		0.15	524		2.36	1.65	5,768		753,669	1,494,902		
			Dec		4.18	14,595		2.04	1.43	4,986		831,330	1,648,943		
			Jan		1.45	5,063		1.52	1.06	3,715		2,402,135	4,764,635		
			Feb		4.73	16,516		1.90	1.33	4,651		1,114,214	2,210,043		
			Mar		3.03	10,580		3.62	2.53	8,841		1,363,718	2,704,935		
			Apr		4.51	15,747		5.88	4.12	14,369		1,365,611	2,708,689		
			May		7.89	27,549		6.52	4.56	15,931		7,755,169	15,382,378		
			Jun		6.14	21,439		7.91	5.53	19,324		5,830,970	11,565,729		
			Jul		3.78	13,199		9.30	6.51	22,728		3,929,852	7,794,861		
			Aug		8.17	28,527		6.95	4.87	16,992		2,002,670	3,972,296		
			Sep	595,656	3.14	10,964		6.93	4.85	16,945		1,235,755	2,451,120		
			TOTAL	71,261	47.83	167,006	30,061	58.70	41.09	143,465	1,149		60,240,787	60,319,717	78,930
Wister	48,850	7,700	Oct	59,405	4.60	2,952		2.75	1.93	1,235		32,029	63,530		
			Nov		2.38	1,527		1.75	1.23	786		42,887	85,066		
			Dec		6.53	4,190		1.33	0.93	597		44,164	87,599		
			Jan		2.02	1,296		1.23	0.86	552		100,349	199,042		
			Feb		3.30	2,118		1.55	1.08	696		64,824	128,578		
			Mar		2.42	1,553		3.02	2.12	1,358		22,287	44,206		
			Apr		4.56	2,926		4.55	3.18	2,043		70,358	139,555		
			May		8.99	5,769		6.17	4.32	2,770		41,877	83,063		
			Jun		9.43	6,051		7.22	5.06	3,244		17,513	34,737		
			Jul		4.18	2,682		8.28	5.79	3,717		144,285	286,189		
			Aug		3.68	2,361		6.70	4.69	3,009		12,426	24,647		
			Sep	46,493	1.74	1,117		6.27	4.39	2,814		5,187	10,288		
			TOTAL	(12,912)	53.83	34,541	6,217	50.81	35.57	22,824	8,944		1,186,502	1,177,034	(9,468)

Arkansas River Basin Compact
Sub-basin Drainage Areas

Water Year 2019 - Additional Tables (refer to Drainage Areas for adjustment of flows)

USGS 07191220		
Spavinaw Creek near Sycamore, OK		
Drainage area:	133	sq.mi
Measured	61,410	cfs
	121,807	acre-feet
Adjusted to State Line		
Drainage Area:	121.34	sq.mi
Estimated	56,026	cfs
	111,129	**acre-feet**

USGS 07195855		
Flint Creek near West Siloam Springs		
Drainage area:	60	sq.mi
Measured	25,127	cfs
	49,840	acre-feet
Adjusted to StateLine		
Drainage Area:	55	sq.mi
Estimated	22,930	cfs
	45,481	acre-feet

USGS 07195500		
Illinois River near Watts, OK		
Drainage area:	635	sq.mi
Measured	375,795	cfs
	745,389	acre-feet
Adjusted to StateLine		
Drainage Area:	630	sq.mi
Estimated	372,576	cfs
	739,004	**acre-feet**

USGS 07196900		
Baron Fork at Dutch Mills, AR		
Drainage area:	41	sq.mi
Measured	23,423	cfs
	46,460	acre-feet
Adjusted to StateLine		
Drainage Area:	63	sq.mi
Estimated	36,370	cfs
	72,139	acre-feet

USGS 07249985		
Lee Creek near Short, OK		
Drainage area:	420	sq.mi
Measured	307,066	cfs
	609,065	acre-feet
Adjusted to StateLine		
Drainage Area:	245	sq.mi
Estimated	178,829	cfs
	354,708	acre-feet

USGS 07247015		
Poteau River at Loving, OK		
Drainage area:	269	sq.mi
Measured	227,661	cfs
	451,567	acre-feet
Adjusted to StateLine		
Drainage Area:	262	sq.mi
Estimated	221,399	cfs
	439,144	**acre-feet**

USGS 07247250		
Black Fork below Big Creek nr Page, OK		
Drainage area:	74	sq.mi
Measured	93,472	cfs
	185,402	acre-feet
Adjusted to StateLine		
Drainage Area:	18	sq.mi
Estimated	22,149	cfs
	43,933	**acre-feet**

USGS 07247250		
James Fork near Hackett, AR		
Drainage area:	147	sq.mi
Measured	120,375	cfs
	238,763	acre-feet
Adjusted to StateLine		
Drainage Area:	156	sq.mi
Estimated	127,941	cfs
	253,771	**acre-feet**

USGS 07250550		
AR River at James W Trimble L&D nr Van Buren		
Drainage area:	151,000	sq.mi
Measured	14,140,078	cfs
	28,046,845	acre-feet
Adjusted to StateLine		
Drainage Area:	149,954	sq.mi
Estimated	14,042,154	cfs
	27,852,612	**acre-feet**

USGS 07194500		
Arkansas River near Muskogee, OK		
Drainage area:	84,133	sq.mi
Measured	24,026,140	cfs
	47,655,849	**acre-feet**

USGS 07245000		
Askansas River near Whitefield, OK		
Drainage area:	37,876	sq.mi
Measured	3,812,494	cfs
	7,562,082	**acre-feet**

Arkansas River Basin Compact

Appendix A

Guidelines for the Computation of Annual Yields

This document provides details on the data sources and methods required for computation of the annual yields for the Spavinaw Creek, Illinois River, Lee Creek, Poteau River and Arkansas River Sub-basins of the Oklahoma-Arkansas River Compact.

Computation of Annual Yields

The Oklahoma-Arkansas River Compact states the required determinations for computation of annual yields (Appendix I, page 116), as follows:

1. **Measurement or computation of actual runoff from each Sub-basin**
2. **Computation of total depletions or accretions in each of the respective Sub-basins**
3. Sum of items (1) and (2) to obtain the "annual yield" for each basin
4. Multiply item (3) by 100 minus the percent depletion allowed in Article IV of the Compact
5. Compute deficiency, if any, by comparing item (4) to (1)

Items 1 and 2 are explained in this document, as these involve interpretation of the Compact, data collection and application of appropriate methods for computation of runoff, accretions, and depletions. Items 3 to 5 are not included herein as these are self-explanatory.

1. Measurement or Computation of Actual Runoff from each Sub-basin

- Runoff from the Sub-basins should be computed using the areas defined by the Compact in Article II (page 93), and further comments of the Committee presented in Appendix I, Item 1 (page 117-118). Active USGS streamflow gauges should be used to retrieve measured runoff as available. Since most gauges are not located right on the Oklahoma-Arkansas state border, estimates of runoff should account for the ungauged flows generated in the drainage area above or below the selected gauge.

  In the case of the Spavinaw Creek, Illinois River, Lee Creek and Poteau River Sub-basins, the runoff measured at the gauges needs to be adjusted using simple linear interpolation, as follows:

$$R = R_M * \left[\frac{A_T}{A_G}\right] \qquad \textbf{(Eq. 1)}$$

Where,

R *= Actual runoff at the OK-ARK state line*

R_M *= Measured runoff at the gauge*

A_G *= Contributing area at the gauge*

A_U *= Area ungauged above or below gauge*

A_T *= Total area including ungauged portion. Because water from these Sub-basins originates in the state of Arkansas, then:*

- *If gauge is located on the Oklahoma side:* $A_T = A_G - A_U$
- *If gauge is located on Arkansas side:* $A_T = A_G + A_U$

The report should include a brief description of the procedure used to compute actual runoff (R) in these Sub-basins, and should also include the measured ungauged drainage areas used for such computation.

In the case of the Arkansas River Sub-basin, the Compact specifies that the following formula be applied (Appendix I, Item 1, page 117):

$$Q_A = Q_V - [Q_M + Q_W + Q_2 + Q_3 + Q_4] \quad \textbf{(Eq. 2)}$$

Where,

Q_A = *Total annual discharge originating from the Arkansas River Sub-basin.*

Q_V = *Total annual discharge of the Arkansas River immediately below the mouth of Lee Creek presently measured at the Van Buren gaging station.*

Q_M = *Total annual discharge of the Arkansas River immediately below the mouth of the Grand Neosho River, presently measured at the Muskogee gaging station.*

Q_W = *Total annual discharge of the Canadian River at Eufaula Dam, presently measured at Whitefield gaging station.*

Q_2 = *Total annual outflow from the Illinois River Sub-basin.*

Q_3 = *Total annual outflow from the Lee Creek Sub-basin.*

Q_4 = *Total annual outflow from the Poteau River Sub-basin.*

Measured runoff should be retrieved from the USGS website (http://waterdata.usgs.gov/nwis) for the following gauges (Figure 1), as available:

Table 1. Current USGS gauges used for Computation of Runoff at Sub-basins in the Compact Area

Sub-basin	USGS Gauges Required	Drainage Area (mi^2)
Spavinaw Creek	07191220 - Spavinaw Creek near Sycamore, OK	133
Illinois River	07195855 - Flint Creek near West Siloam Springs, OK 07195500 - Illinois River near Watts, OK 07196900 - Baron Fork at Dutch Mills, AR	59.8 635 41
Lee Creek	07249985 - Lee Creek near Short OK	420
Poteau River	07247015 - Poteau River at Loving, OK 07247250 - Black Fork below Big Creek nr Page, OK 07247250 – James Fork near Hackett, AR	269[a] 74.4[b] 147[c]
Arkansas River	07194500 - Arkansas River near Muskogee, OK 07245000 - Canadian River near Whitefield, OK 07250550 - AR River at J. W. Trimble L&D nr Van Buren, AR	84,133 37,876 151,000[d]

[a] Does not include 25.1 sq. miles of ungauged drainage.

[b] Does not include 13.0 sq. miles of ungauged drainage.

[c] Does not include 35.2 sq. miles of ungauged drainage.

[d] Includes 22,200 sq. miles of drainage area in Kansas that "probably is noncontributing".

Data obtained from the eleven (11) above listed gauges is sufficient to accurately compute actual runoff from the Sub-basins but different gages could be used for the computation of runoff.

- Review of the Poteau River Sub-basin indicates that there are large portions of runoff that originates in Arkansas but is not included in the gaging. Calculations should be completed to estimate the runoff for these areas using the following equation.

$$R_U = R_M * \left[\frac{A_U}{A_G}\right] \quad \textbf{(Eq. 3)}$$

Where,

R_U *= Calculated runoff at the OK-AR state line from ungauged contributing streams*

R_M *= Measured runoff at the gauge*

A_G *= Contributing area at the gauge*

A_U *= Area contributing runoff for ungauged streams*

- Actual runoff should be computed on an annual basis, and monthly values should be included as appendices, instead of the daily time series that have been included in previous reports. Units should be consistent; preferably in Acre-feet (AF).Flows originated from outside the Compact area should not be included in the computation of actual runoff, unless specified in the Compact. Article II of the Compact defines the drainage areas for each Sub-basin as waters originating in the Compact area. In previous reports, return flows from the White River Basin have been removed from the flow originating in the Arkansas River Basin since the water is being transferred in from another basin. The return flow data is obtained from the water department/utilities for the Cities of Fayetteville, Rogers, and Springdale, AR.

2. Computation of Total Depletions or Accretions in each of the respective Sub-basins

In Supplement No. 1, Appendix I, Item 2, the Compact states that *"The total annual depletion in each sub-basin will be the sum of the following: **(a)** Total stream diversions minus return flows. **(b)** Depletions and/or accretions by major reservoirs. **(c)** Evaporation losses from other than major reservoirs. **(d)** Pumpage of ground water alluvium aquifers"*. Data sources and procedures suggested for computation of these items are described as follows:

a) Total stream diversions minus return flows

Diversions over the Oklahoma side of the Compact, i.e. the Arkansas Sub-basin and the Oklahoma portion of the Lee Creek Sub-basin, should be estimated using information from the OWRB. Likewise, diversions over the Arkansas side of the Compact should be obtained from ANRC. These agencies manage the surface water rights of their areas, and can provide information on the type of uses, allocated amounts, annual reported use, and estimates of return flows. Values of annual diversions for each sub-basin should be included in the report, along with a brief description of the methods and assumptions used in the calculation of return flows.

Depletions and/or accretions by major reservoirs

The Compact defines depletion as the difference between the inflow and outflow, using the following equation (Appendix I, item 2):

$$I - O = -P + p \pm \Delta S + E + D$$

in which

***I - O** = Depletion in the reservoir.*

***P** = Precipitation on reservoir surface.*

***p** = Runoff that would have occurred from area covered by reservoir, computed by a derived rainfall-runoff factor c times P, or cP.*

***ΔS** = Change in storage volume at beginning and end of period*

***E** = Evaporation from reservoir surface.*

***D** =Direct diversions from reservoir storage, not included in outflow; seepage from reservoir may also be a factor and, if not included in measured outflow as at gaging station below dam, should be estimated.*

Monthly data for the reservoirs of the Compact area should be obtained from the USACE web page, at http://www.swt-wc.usace.army.mil/. Available data includes reservoir contents, as well as evaporation and precipitation measured over the reservoir surface.

- **Precipitation on reservoir surface (P)**

  Monthly values of precipitation data measured over the lakes should be retrieved from the USACE webpage.

- **Runoff (p)**

  This component should be estimated as the product of precipitation (P) and a runoff coefficient as stated in the Compact, also known as the Rational Method. A runoff coefficient of 0.18 has been used since 1974 to determine the runoff quantity. It has been noted that the runoff coefficient value can vary depending on publications and that there is no way to know what existed in the area before the reservoirs were built. For these reasons it is agreed upon by the Engineering Committee to continue the use of 0.18 as the runoff coefficient since this is the value that has been used in all of the previous reports.

- **Change in Storage (ΔS)**

  Change in storage is defined in the compact as the *"Change in the storage volume at the beginning and end of a period",* which for the water year would be computed as the difference between the contents at the end of the period (September 30th) minus the contents at the beginning of the period (September 30th, previous calendar year).

- **Evaporation from reservoir surface (E)**

  Monthly values of evaporation strictly measured over the lakes should be retrieved from the USACE webpage. Pan evaporation is used to estimate the evaporation from lakes. There is a correlation between lake evaporation and pan evaporation. Evaporation from a natural body

of water is usually at a lower rate because the body of water does not have metal sides that get hot with the sun, and while light penetration in a pan is essentially uniform, light penetration in natural bodies of water will decrease as depth increases. Pan coefficients can vary depending on a number of different variables, including ground cover, levels of relative humidity, and 24 hour wind speed. Previous reports have used a pan coefficient of 0.70 for correlation between reservoir evaporation and pan evaporation.

Further discussion as to the coefficient value that should be used is required by the engineering committee.

- **Direct Diversions from reservoir surface (D)**

  Direct diversions from reservoir storage, not included in the outflow, can be computed using information from the OWRB water rights database. Previous reports only used data from the USACE, but did not include description of details such as the type of use, the year of the data, and if any return flows had been included in the computation.

b) Evaporation losses from other than major reservoirs

This item has not been addressed in previous reports. The Compact states that *"Evaporation from small lakes, such as those not designed for water supply, including flood-detentions structures, farm ponds, and recreation lakes, may be estimated on basis of average water surface area and appropriate data from evaporation-pan records"* (Appendix I, Item 2, page 119).

Further discussion about the data sources and feasibility of including this item in the computation of depletions needs to be discussed by the Engineering Committee. Inclusion of this item in the computation of depletions will be determined by the Engineering Committee.

c) Pumpage of ground water from alluvium aquifers

This item has not been included in previous reports. The Compact states that *Pumpage from stream alluviums may cause appreciable depletions in the stream flow. This is not believed to be a factor at the present (1969) time, but could conceivably be in the future for some stream reaches"* (Appendix I, Item 2, page 119).

Inclusion of this item in the computation of depletions will be determined by the Engineering Committee.

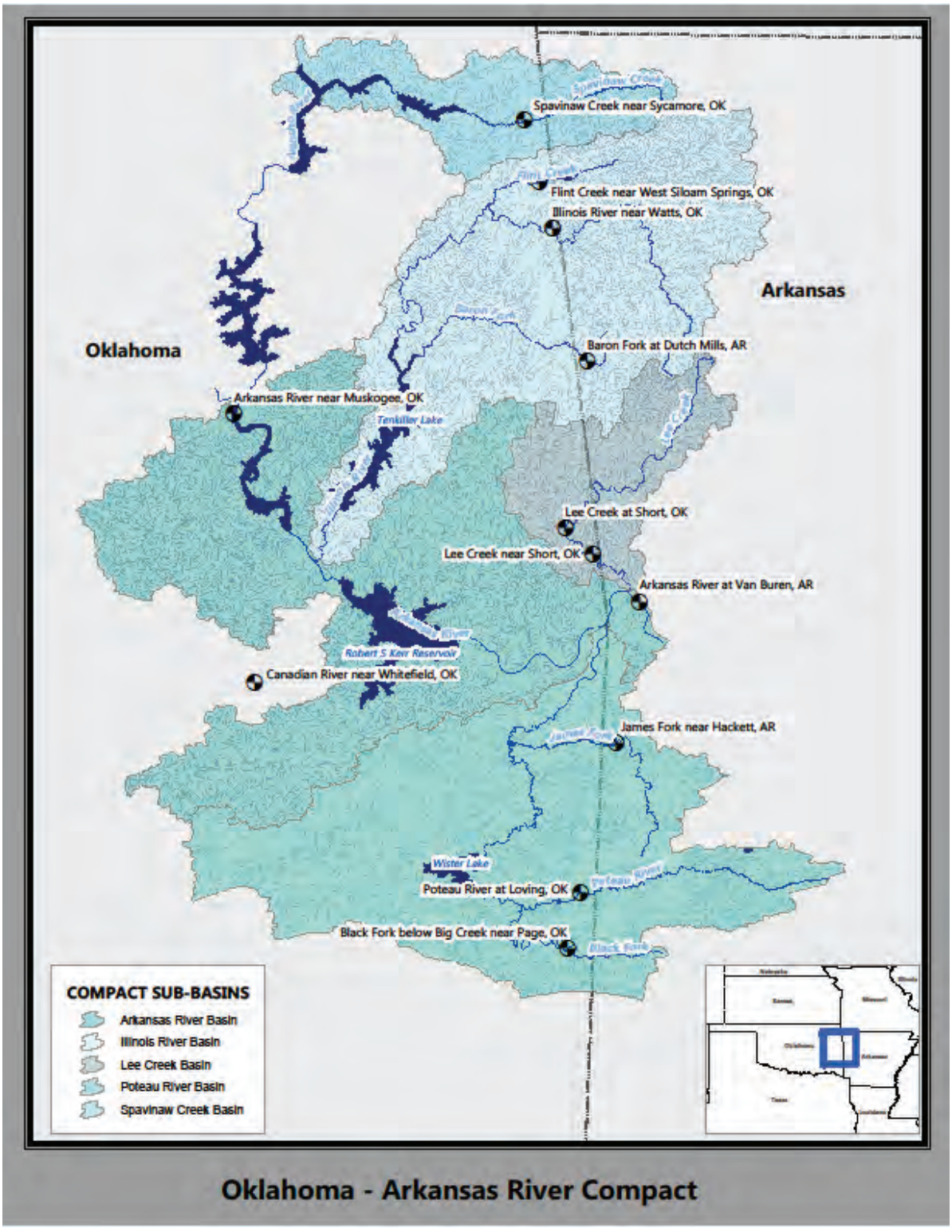
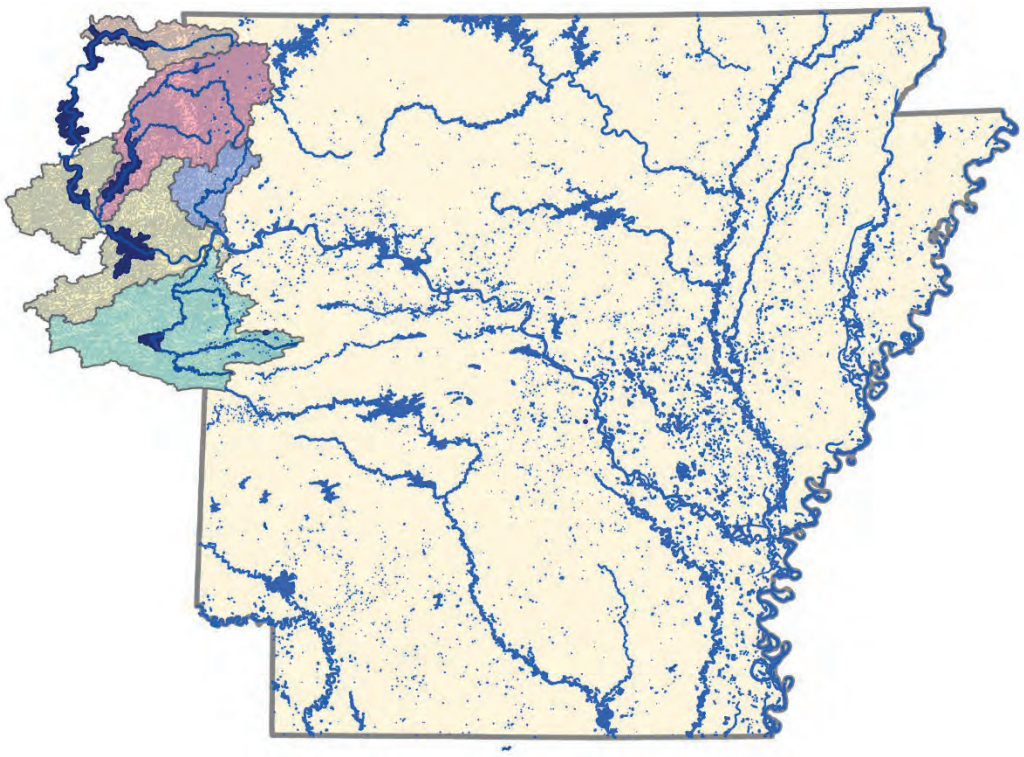


Figure 1. Map of the Oklahoma-Arkansas River Compact Area

Arkansas-Oklahoma
Arkansas River Compact Commission

State of Arkansas
Environmental Committee Report



September 24, 2020

Report Contents

2019 Climate Summary Illinois River Basin

Climate data is presented to identify factors which might have bearings on monitoring results for the Illinois River Basin. The monitoring station at Drake Field in Fayetteville, Arkansas, was chosen to represent the climate totals for the Illinois River watershed. The data is available for download from the Nation Weather Service at:

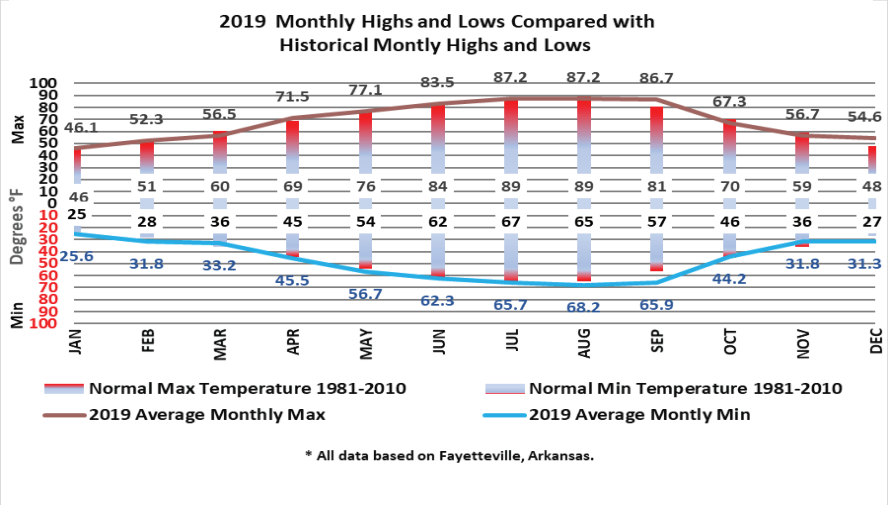
https://w2.weather.gov/climate/getclimate.php?wfo=LZK&sid=FYV&pil=CF6&specdate=2019-01-31+11%3A11%3A11

The actual mean, normal means, precipitation, and outliers are listed in table 1. Overall, 2019 was close to normal for temperatures with a 1.0° F difference in the daily mean temperature. This is further illustrated in figure 1 which also shows the monthly mean maximum (max) and minimum (min) compared to the normal monthly maximum (max) and minimum (min).

TABLE 1 - 2019 CLIMATE DATA

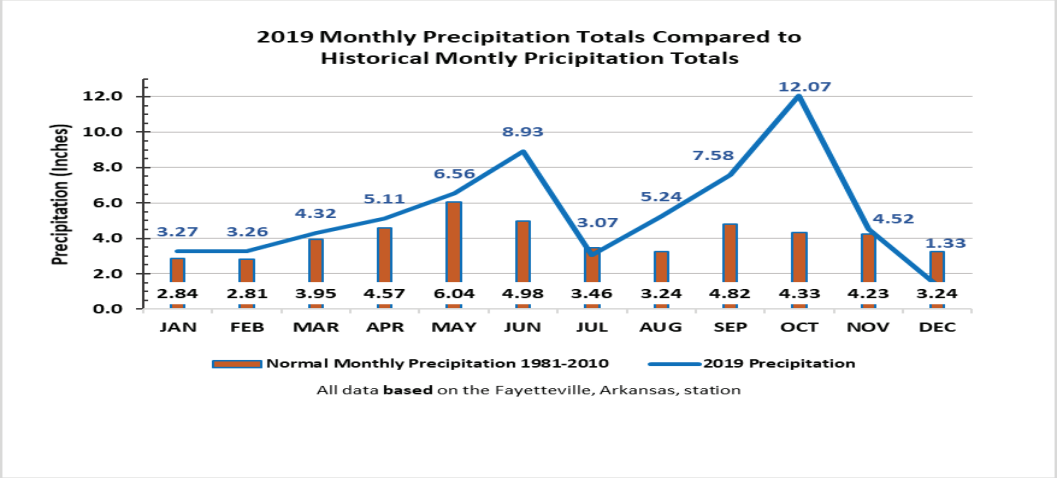
Daily Mean Temp 2019 (F°)	57.2 °	Normal	58.2 °
Daily Mean Max Temp 2019 (F°)	68.9 °	Normal	68.6 °
Mean Min Temp 2019 (F°)	46.9 °	Normal	47.7 °
Total Precipitation (In) 2019	65.26 “	Normal	45.53 “
Extreme Max Temp 2019 (F°)	95 °	August 20, 2019	
Extreme Min Temp (F°) 2019	7 °	March 4, 2019	
Extreme Precipitation (in) 2019	4.57 “	24 hours on Sept 24, 2019	

FIGURE 1 - 2019 MONTHLY TEMPERATURE AND HISTORICAL NORMALS



Precipitation for 2019 was well above normal. The year finished with an excess of 19.73 inches. The precipitation is illustrated in figure 2 which compares monthly normal totals to monthly recorded totals.

FIGURE 2 - 2019 MONTHLY TOTAL PRECIPITATION COMPARED TO HISTORICAL MONTHLY PRECIPITATION



The chart illustrates precipitation for two months (July and December) fell below normal and four months (June, August, September, and October) were well above normal. Knowing precipitation was above normal during these months is helpful in reviewing flow data and in understanding the total phosphorus sampling. Due to the higher overland flow and streamflow, higher phosphorus readings in the sampling are expected. The top six highest flows are discounted in the calculations for phosphorus loading. The top six flows for each of the four streams monitored by Arkansas are listed below in table 2.

TABLE 2 - 2019 TOP SIX FLOWS FOR EACH MONITORED STREAM

Flint Creek		Sager Creek		Illinois River		Baron Fork	
Date	Flow (cfs)	Date	Flow (cfs)	Date	Flow (cfs)	Date	Flow (cfs)
10/06/2019	2,960.00	06/23/2019	1,560.00	10/06/2019	18,600.00	06/23/2019	2,270.00
10/11/2019	1,430.00	10/06/2019	1,190.00	10/07/2019	12,400.00	10/24/2019	1,660.00
06/22/2019	1,260.00	05/01/2019	646.00	06/24/2019	11,100.00	11/07/2019	1,300.00
10/07/2019	711.00	11/30/2019	643.00	06/07/2019	9,940.00	10/11/2019	1,1170.00
11/07/2019	697.00	10/11/2019	597.00	10/11/2019	9,590.00	05/01/2019	1,100.00
05/01/2019	259.00	11/07/2019	578.00	05/01/2019	8,950.00	01/04/2019	972.00

Water Quality Monitoring Report
Illinois River Basin
Arkansas-Oklahoma Compact

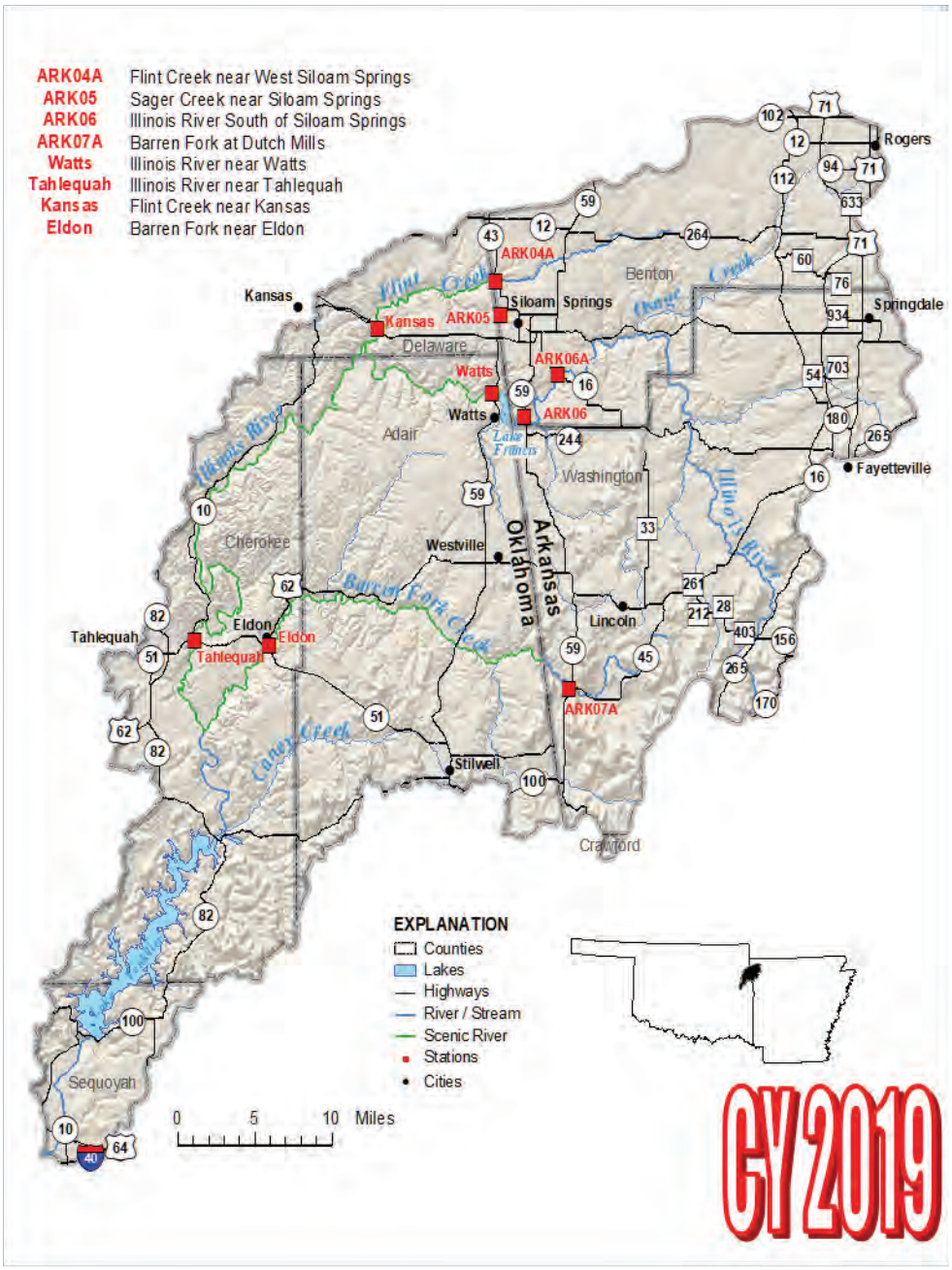
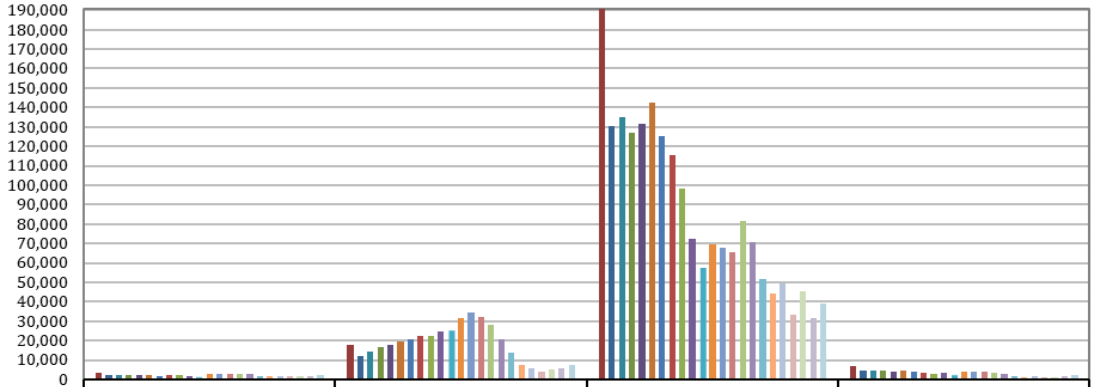


TABLE 3 - ARKANSAS 5-YEAR ROLLING AVERAGE TOTAL PHOSPHORUS LOADING

Arkansas

5-Year Rolling Average Total Phosphorus Loading

(excluding targeted high flows)



	Flint Ck ARK04A	Sager Ck ARK05	Illinois R. ARK06	Baron Fk ARK07A
Total P 80-93	3,267	17,566	190,577	7,160
Total P 94-98	2,488	12,133	130,567	4,519
Total P 95-99	2,555	14,284	134,951	4,874
Total P 96-00	2,187	16,796	126,713	4,571
Total P 97-01	2,213	18,008	131,495	4,002
Total P 98-02	2,043	19,332	142,446	4,354
Total P 99-03	2,019	20,798	125,156	3,792
Total P 00-04	2,106	22,418	115,417	3,661
Total P 01-05	2,049	22,616	98,479	2,777
Total P 02-06	1,855	24,905	72,654	3,274
Total P 03-07	1,707	25,113	56,817	3,062
Total P 04-08	2,848	31,649	69,349	4,145
Total P 05-09	2,723	34,345	67,883	4,237
Total P 06-10	2,762	32,462	65,668	4,267
Total P 07-11	3,102	28,313	81,467	3,678
Total P 08-12	2,919	20,984	70,853	3,156
Total P 09-13	1,794	13,856	51,777	1,898
Total P 10-14	1,551	7,661	44,170	1,347
Total P 11-15	1,825	5,710	49,406	1,559
Total P 12-16	1,761	3,789	33,473	1,276
Total P 13-17	1,946	5,083	45,502	1,193
Total P 14-18	1,901	6,007	31,343	1,483
Total P 15 -19	2,487	7,626	39,200	2,224

MONITORING STATION:
FLINT CREEK
NORTHWEST OF WEST SILOAM SPRINGS, OKLAHOMA

TABLE 4 -ANNUAL PHOSPHORUS LOADINGS

ARK04A Year	Flow (cfs)	Total P (mg/L)	Total P (kg/yr)
1981	19.8	0.149	2,635
1982	29.9	0.171	4,566
1983	19.0	0.073	1,239
1984	53.5	0.112	5,351
1985	91.3	0.063	5,137
1986	78.4	0.067	4,691
1987	58.3	0.049	2,551
1988	41.8	0.031	1,157
1989	38.0	0.050	1,697
1990	71.3	0.060	3,821
1991	51.6	0.054	2,489
1992	56.1	0.047	2,355
1993	88.2	0.045	3,545
1994	53.0	0.051	2,414
1995	61.3	0.075	4,106
1996	33.5	0.050	1,496
1997	37.3	0.074	2,448
1998	42.9	0.056	2,142
1999	63.5	0.045	2,578
2000	55.6	0.038	1,893
2001	39.4	0.047	1,636
2002	44.6	0.047	1,850
2003	21.4	0.075	1,438
2004	64.6	0.055	3,173
2005	43.0	0.046	1,772
2006	12.6	0.056	630
2007	22.4	0.059	1,180
2008	76.9	0.147	10,096
2009	55.6	0.054	2,681
2010	44.3	0.049	1,939
2011	48.5	0.042	1,798
2012	19.2	0.043	732
2013	45.1	0.049	1,973
2014	30.7	0.049	1,343
2015	78.5	0.048	3,365
2016	32.2	0.051	1,467
2017	39.9	0.044	1,554
2018	45.6	0.043	1,750
2019	99.3	0.050	4,433
Avg.	48.9	0.062	2,702

TABLE 5- FIVE-YEAR ROLLING AVERAGE PHOSPHORUS LOADINGS

Year	Pt (mg/l)	Flow (cfs)	Pt (kg/yr)	% Decrease
91-95	0.054	62.0	3,014	7.7%
92-96	0.054	58.4	2,797	14.4%
93-97	0.059	54.7	2,875	12.0%
94-98	0.061	45.6	2,488	23.9%
95-99	0.060	47.7	2,555	21.8%
96-00	0.053	46.6	2,187	33.1%
97-01	0.052	47.7	2,213	32.3%
98-02	0.046	49.2	2,043	37.5%
99-03	0.050	44.9	2,019	38.2%
00-04	0.052	45.1	2,106	35.5%
01-05	0.054	42.6	2,049	37.3%
02-06	0.056	37.2	1,855	43.2%
03-07	0.058	32.8	1,707	47.7%
04-08	0.073	43.9	2,848	12.8%
05-09	0.072	42.1	2,723	16.6%
06-10	0.073	42.4	2,762	15.5%
07-11	0.070	49.5	3,102	5.1%
08-12	0.067	48.9	2,919	10.7%
09-13	0.047	42.5	1,794	45.1%
10-14	0.046	37.6	1,551	52.5%
11-15	0.046	44.4	1,825	44.1%
12-16	0.048	41.1	1,761	46.1%
13-17	0.048	45.3	1,946	40.4%
14-18	0.047	45.4	1,901	41.8%
15-19	0.047	59.1	2,487	23.9%

FIGURE 3 – FIVE-YEAR ROLLING AVERAGEPHOSPHORUS LOADINGS CHART

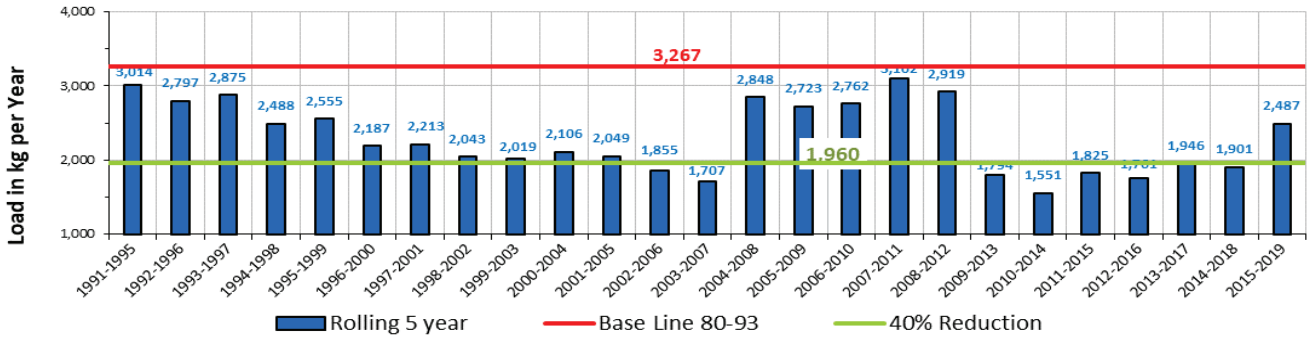


FIGURE 4 - FLINT CREEK TOTAL PHOSPHORUS VS 3 MONTH ROLLING MEAN

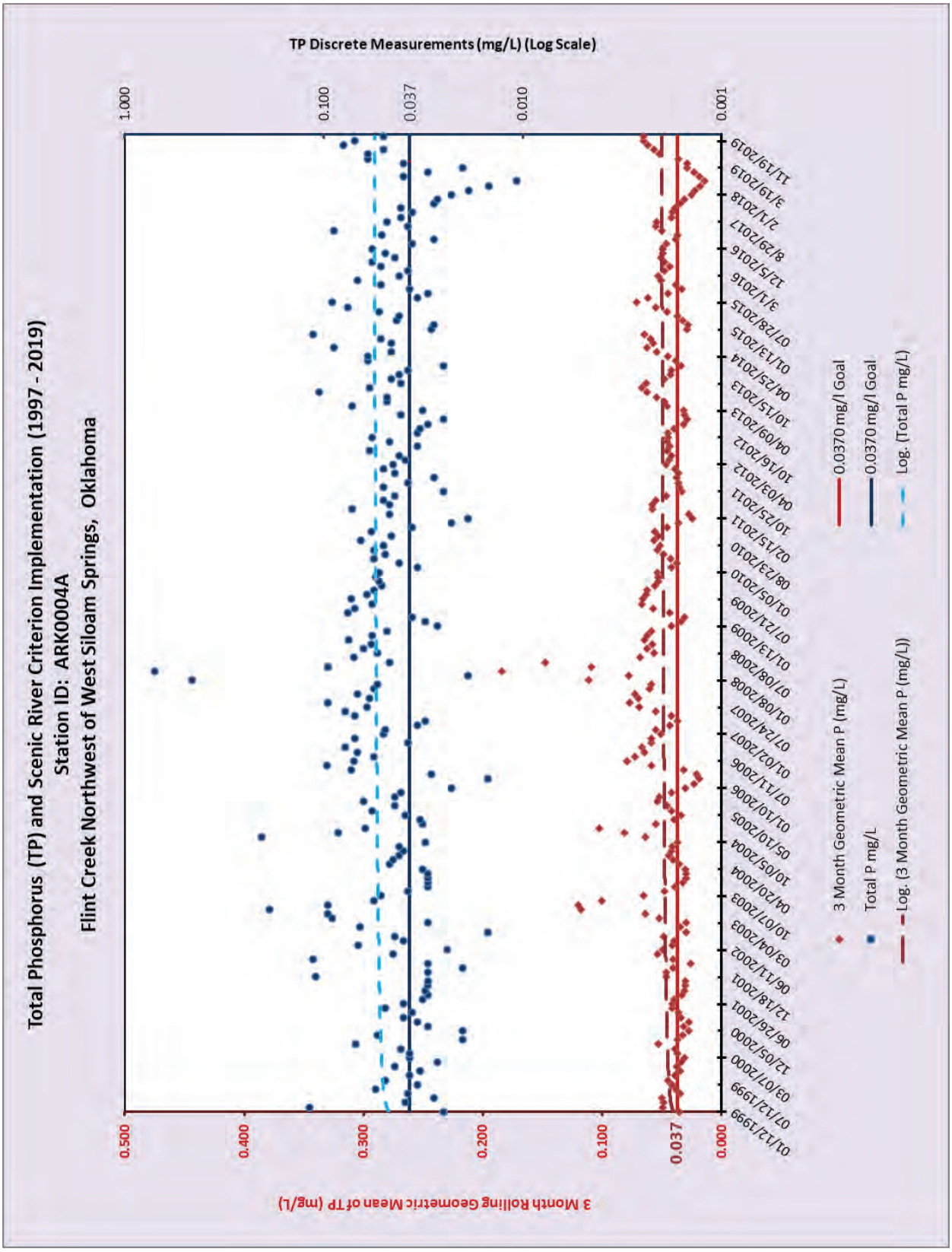


TABLE 6 - ANNUAL PHOSPHORUS LOADINGS

ARK05 Year	Flow (cfs)	Total P (mg/L)	Total P (kg/yr)
1981	6.5	2.125	12,336
1982	9.0	2.025	16,277
1983	6.3	1.964	11,050
1984	15.4	0.950	13,066
1985	24.8	1.736	38,450
1986	21.1	0.834	15,716
1987	16.7	0.948	14,136
1988	12.6	1.154	12,986
1989	11.7	1.227	12,821
1990	20.2	0.860	15,515
1991	15.5	0.914	12,653
1992	16.5	1.284	18,921
1993	24.6	0.637	13,995
1994	15.7	0.721	10,110
1995	17.8	0.697	11,080
1996	11.0	0.919	9,028
1997	17.8	1.029	16,354
1998	18.1	0.858	13,876
1999	24.5	0.979	21,429
2000	30.7	0.820	22,469
2001	21.2	0.803	15,201
2002	21.8	1.192	23,231
2003	11.7	1.503	15,700
2004	34.5	0.916	28,224
2005	18.5	1.461	24,200
2006	14.9	1.799	23,940
2007	21.0	1.306	24,494
2008	48.9	0.945	41,271
2009	38.1	1.286	43,759
2010	22.9	0.897	18,335
2011	27.4	0.573	14,027
2012	11.4	0.250	2,540
2013	20.2	0.228	4,105
2014	18.2	0.196	3,193
2015	39.1	0.128	4,470
2016	16.3	0.207	3,013
2017	21.7	0.473	9,179
2018	22.2	0.427	8,454
2019	46.4	0.230	9,531
Avg.	20.8	0.962	17,900

MONITORING STATION: SAGER CREEK NEAR WEST SILOAM SPRINGS, ARKANSAS

TABLE 7 - FIVE - YEAR ROLLING AVERAGE PHOSPHORUS LOADINGS

Year	Pt (mg/l)	Flow (cfs)	Pt (kg/yr)	% Decrease
80-93	1.363	14.7	17,566	0.0%
91-95	0.851	18.0	13,689	22.1%
92-96	0.852	17.1	13,021	25.9%
93-97	0.801	17.4	12,426	29.3%
94-98	0.845	16.1	12,133	30.9%
95-99	0.896	17.8	14,284	18.7%
96-00	0.921	20.4	16,796	4.4%
97-01	0.898	22.5	18,008	-2.5%
98-02	0.930	23.3	19,332	-10.1%
99-03	1.059	22.0	20,798	-18.4%
00-04	1.047	24.0	22,418	-27.6%
01-05	1.175	21.6	22,616	-28.7%
02-06	1.374	20.3	24,905	-41.8%
03-07	1.397	20.1	25,113	-43.0%
04-08	1.285	27.6	31,649	-80.2%
05-09	1.359	28.3	34,345	-95.5%
06-10	1.247	29.2	32,462	-84.8%
07-11	1.001	31.7	28,313	-61.2%
08-12	0.790	29.7	20,984	-19.5%
09-13	0.647	24.0	13,856	21.1%
10-14	0.429	20.0	7,661	56.4%
11-15	0.275	23.3	5,710	67.5%
12-16	0.202	21.0	3,789	78.4%
13-17	0.246	23.1	5,083	71.1%
14-18	0.286	23.5	6,007	65.8%
15-19	0.293	29.1	7,626	56.6%

FIGURE *5* – FIVE–YEAR ROLLING AVERAGE PHOSPHORUS LOADING CHART

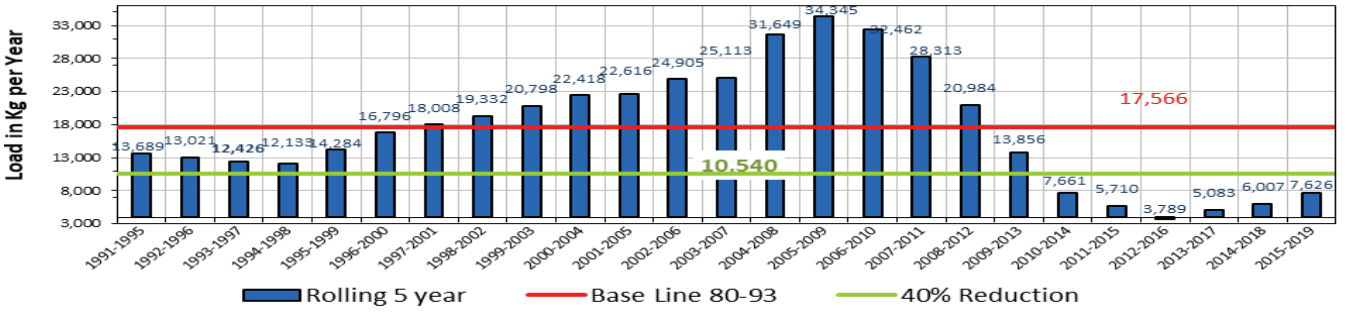
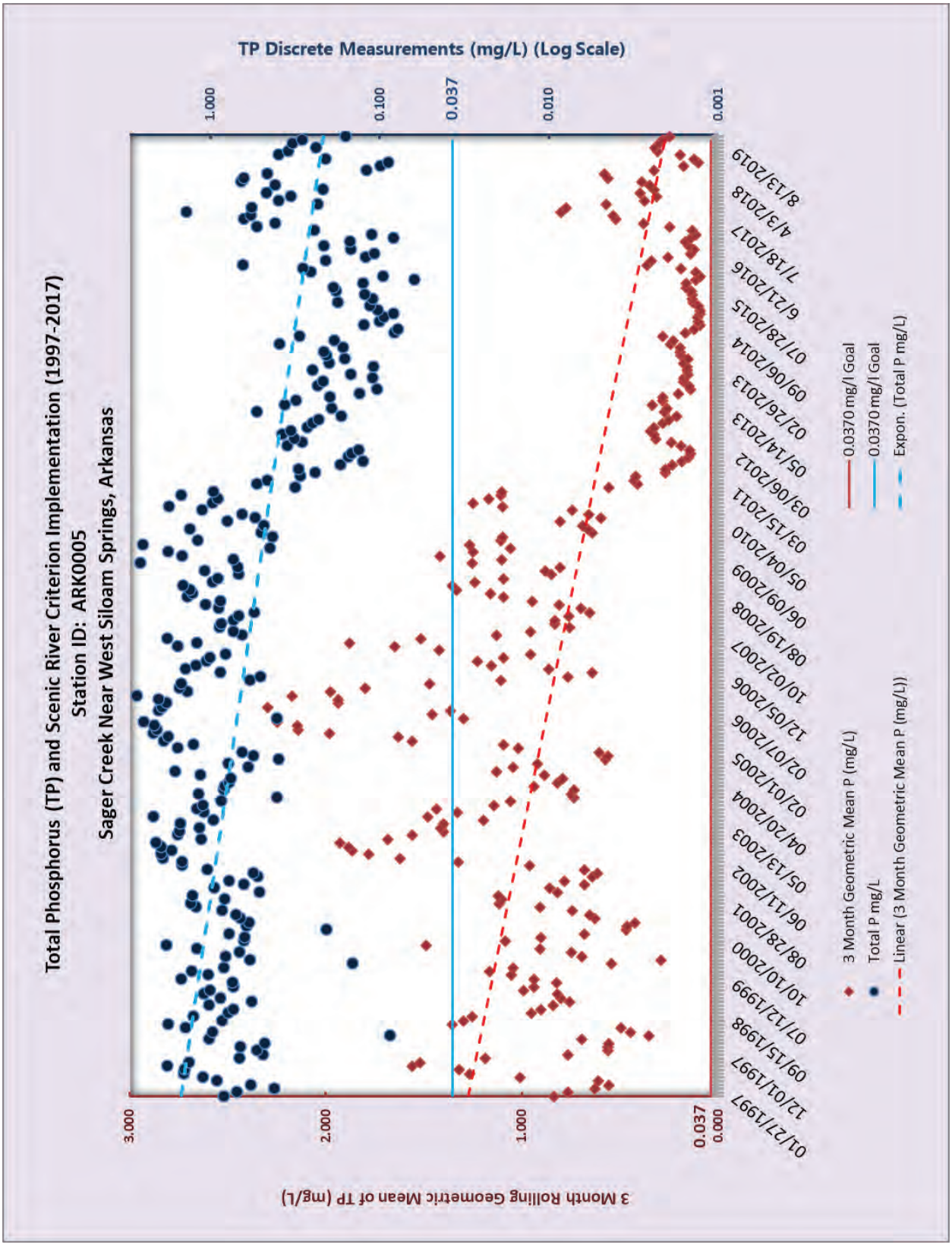


FIGURE 6 - SAGER CREEK TOTAL PHOSPHORUS VS 3 MONTH ROLLING MEAN



MONITORING STATION: ILLINOIS RIVER SOUTH OF SILOAM SPRINGS, ARKANSAS

TABLE 8 - ANNUAL PHOSPHORUS LOADINGS

ARK05 Year	Flow (cfs)	Total P (mg/L)	Total P (kg/yr)
1981	6.5	2.125	12,336
1982	9.0	2.025	16,277
1983	6.3	1.964	11,050
1984	15.4	0.950	13,066
1985	24.8	1.736	38,450
1986	21.1	0.834	15,716
1987	16.7	0.948	14,136
1988	12.6	1.154	12,986
1989	11.7	1.227	12,821
1990	20.2	0.860	15,515
1991	15.5	0.914	12,653
1992	16.5	1.284	18,921
1993	24.6	0.637	13,995
1994	15.7	0.721	10,110
1995	17.8	0.697	11,080
1996	11.0	0.919	9,028
1997	17.8	1.029	16,354
1998	18.1	0.858	13,876
1999	24.5	0.979	21,429
2000	30.7	0.820	22,469
2001	21.2	0.803	15,201
2002	21.8	1.192	23,231
2003	11.7	1.503	15,700
2004	34.5	0.916	28,224
2005	18.5	1.461	24,200
2006	14.9	1.799	23,940
2007	21.0	1.306	24,494
2008	48.9	0.945	41,271
2009	38.1	1.286	43,759
2010	22.9	0.897	18,335
2011	27.4	0.573	14,027
2012	11.4	0.250	2,540
2013	20.2	0.228	4,105
2014	18.2	0.196	3,193
2015	39.1	0.128	4,470
2016	16.3	0.207	3,013
2017	21.7	0.473	9,179
2018	22.2	0.427	8,454
2019	46.4	0.230	9,531
Avg.	20.8	0.962	17,900

TABLE 9 - FIVE-YEAR ROLLING AVERAGE PHOSPHORUS LOADINGS

91-95	0.210	821	153,942	19.2%
92-96	0.211	809	152,527	20.0%
93-97	0.209	757	141,386	25.8%
94-98	0.222	658	130,567	31.5%
95-99	0.225	670	134,951	29.2%
96-00	0.224	633	126,713	33.5%
97-01	0.238	619	131,495	31.0%
98-02	0.252	634	142,446	25.3%
99-03	0.246	569	125,156	34.3%
00-04	0.236	548	115,417	39.4%
01-05	0.214	516	98,479	48.3%
02-06	0.179	455	72,654	61.9%
03-07	0.149	428	56,817	70.2%
04-08	0.136	569	69,349	63.6%
05-09	0.122	624	67,883	64.4%
06-10	0.110	668	65,668	65.5%
07-11	0.110	830	81,467	57.3%
08-12	0.098	811	70,853	62.8%
09-13	0.081	718	51,777	72.8%
10-14	0.080	621	44,170	76.8%
11-15	0.081	686	49,406	74.1%
12-16	0.068	551	33,473	82.4%
13-17	0.080	591	42,442	77.7%
14-18	0.061	734	39,724	79.2%
15-19	0.060	734	39,200	79.4%

FIGURE 7 - FIVE-YEAR ROLLING AVERAGE PHOSPHORUS LOADINGS CHART

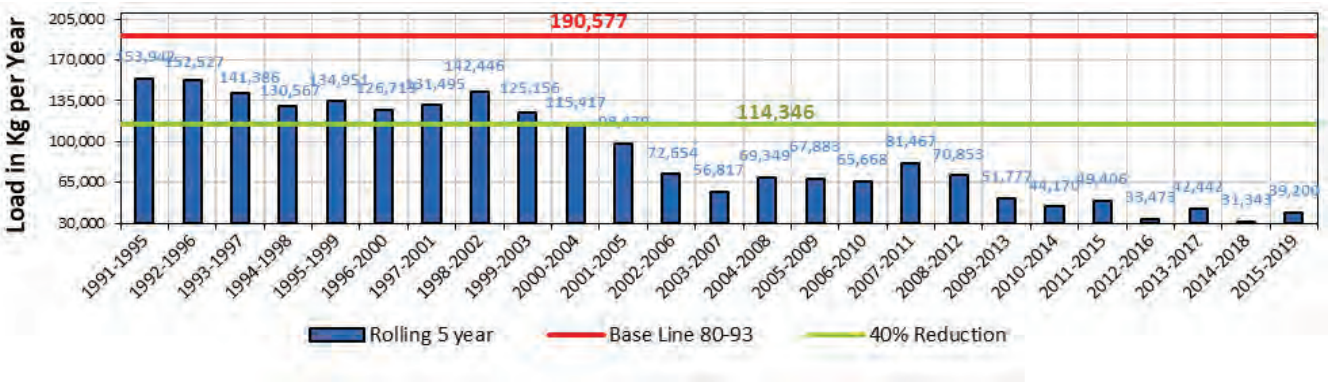


FIGURE 8 - ILLINOIS RIVER TOTAL PHOSPHORUS VS 3 MONTH ROLLING MEAN

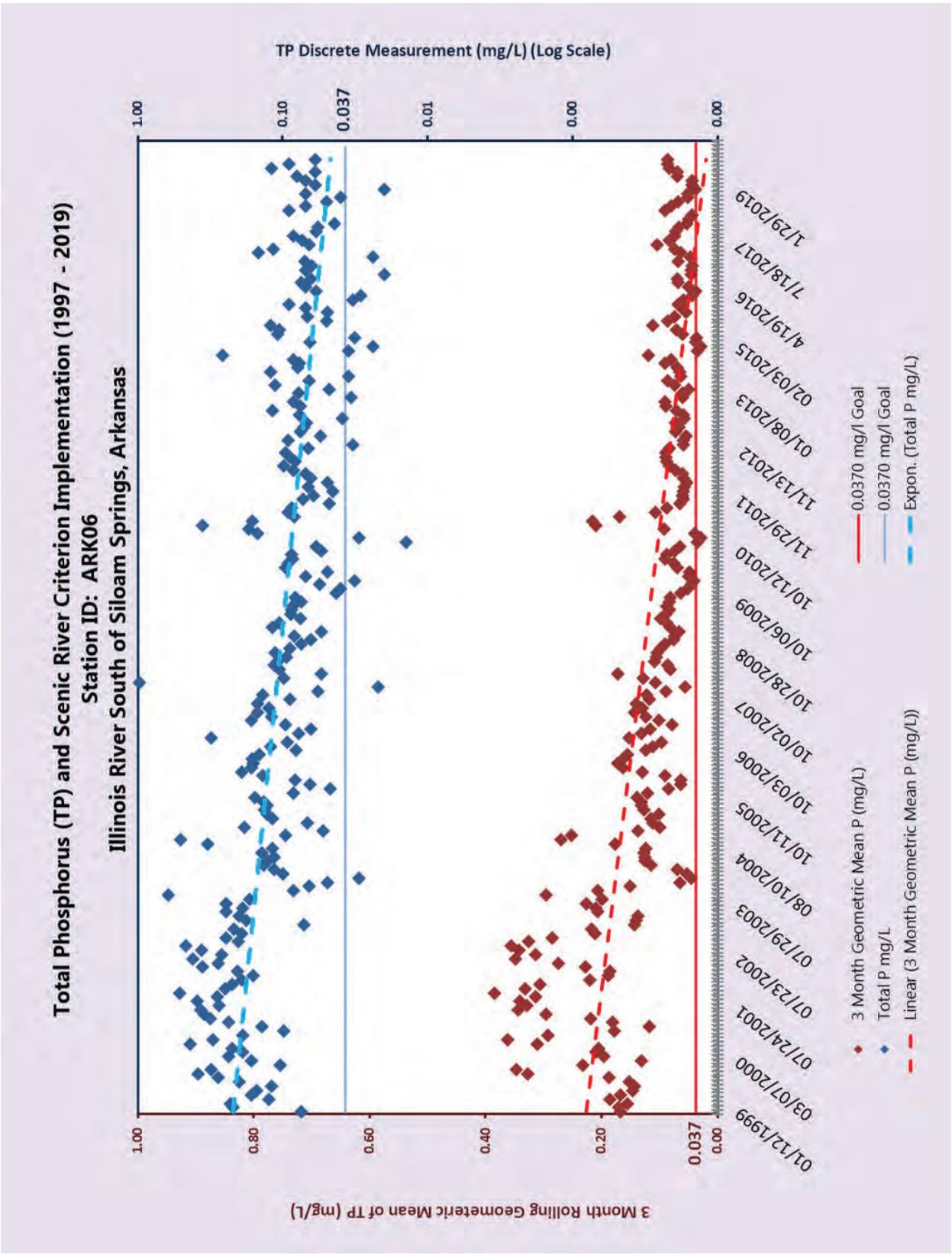


TABLE 10 - ANNUAL PHOSPHORUS LOADING

ARK06 Year	Flow (cfs)	Total P (mg/L)	Total P (kg/yr)
1981	197	0.420	73,895
1982	591	0.370	195,294
1983	352	0.386	121,347
1984	706	0.442	278,693
1985	947	0.289	244,426
1986	879	0.305	239,436
1987	815	0.294	213,996
1988	531	0.253	119,982
1989	558	0.291	145,020
1990	1127	0.204	205,331
1991	724	0.220	142,253
1992	760	0.222	150,684
1993	1163	0.181	188,000
1994	674	0.190	114,370
1995	783	0.237	165,733
1996	667	0.225	134,032
1997	497	0.213	94,504
1998	668	0.246	146,960
1999	737	0.206	135,413
2000	597	0.230	122,831
2001	598	0.293	156,581
2002	570	0.282	143,700
2003	344	0.219	67,422
2004	633	0.153	86,496
2005	436	0.120	46,785
2006	290	0.120	31,048
2007	436	0.131	51,022
2008	1,051	0.158	148,306
2009	907	0.080	64,782
2010	659	0.061	35,885
2011	1,097	0.120	117,154
2012	343	0.070	21,547
2013	583	0.073	37,984
2014	426	0.074	28,014
2015	984	0.066	57,990
2016	418	0.057	21,264
2017	547	0.043	21,003
2018	521	0.063	29,333
2019	1,200	0.070	75,030
Avg.	667	0.197	117,281

MONITORING STATION: BARON FORK AT DUTCH MILLS, ARKANSAS

TABLE 11 - FIVE-YEAR ROLLING AVERAGE PHOSPHORUS LOADINGS

Year	Pt (mg/l)	Flow (cfs)	Pt (kg/yr)	% Decrease
80-93	0.153	52.6	7,160	0.0%
91-95	0.108	58.5	5,632	21.3%
92-96	0.107	61.5	5,899	17.6%
93-97	0.095	59.1	5,036	29.7%
94-98	0.100	50.5	4,519	36.9%
95-99	0.104	52.3	4,874	31.9%
96-00	0.099	52.0	4,571	36.2%
97-01	0.095	47.4	4,002	44.1%
98-02	0.102	47.8	4,354	39.2%
99-03	0.107	39.6	3,792	47.0%
00-04	0.104	39.3	3,661	48.9%
01-05	0.091	34.0	2,777	61.2%
02-06	0.096	38.1	3,274	54.3%
03-07	0.093	37.0	3,062	57.2%
04-08	0.093	50.2	4,145	42.1%
05-09	0.088	53.7	4,237	40.8%
06-10	0.085	55.9	4,267	40.4%
07-11	0.080	51.6	3,678	48.6%
08-12	0.072	49.1	3,156	55.9%
09-13	0.057	37.1	1,898	73.5%
10-14	0.053	28.2	1,347	81.2%
11-15	0.052	33.4	1,559	78.2%
12-16	0.050	28.5	1,276	82.2%
13-17	0.048	27.6	1,193	83.3%
14-18	0.061	27.0	1,483	79.3%
15-19	0.108	37.8	3,644	49.1%

FIGURE *9* - FIVE-YEAR ROLLING AVERAGE PHOSPHORUS LOADING CHART

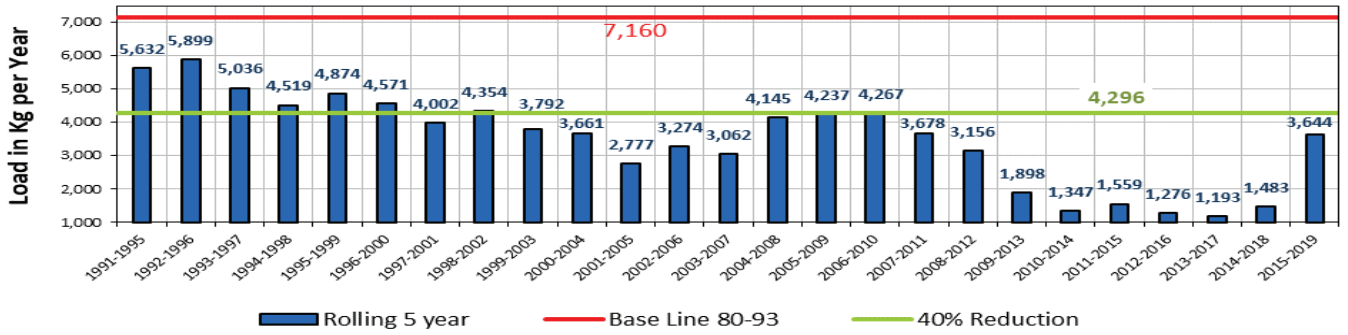
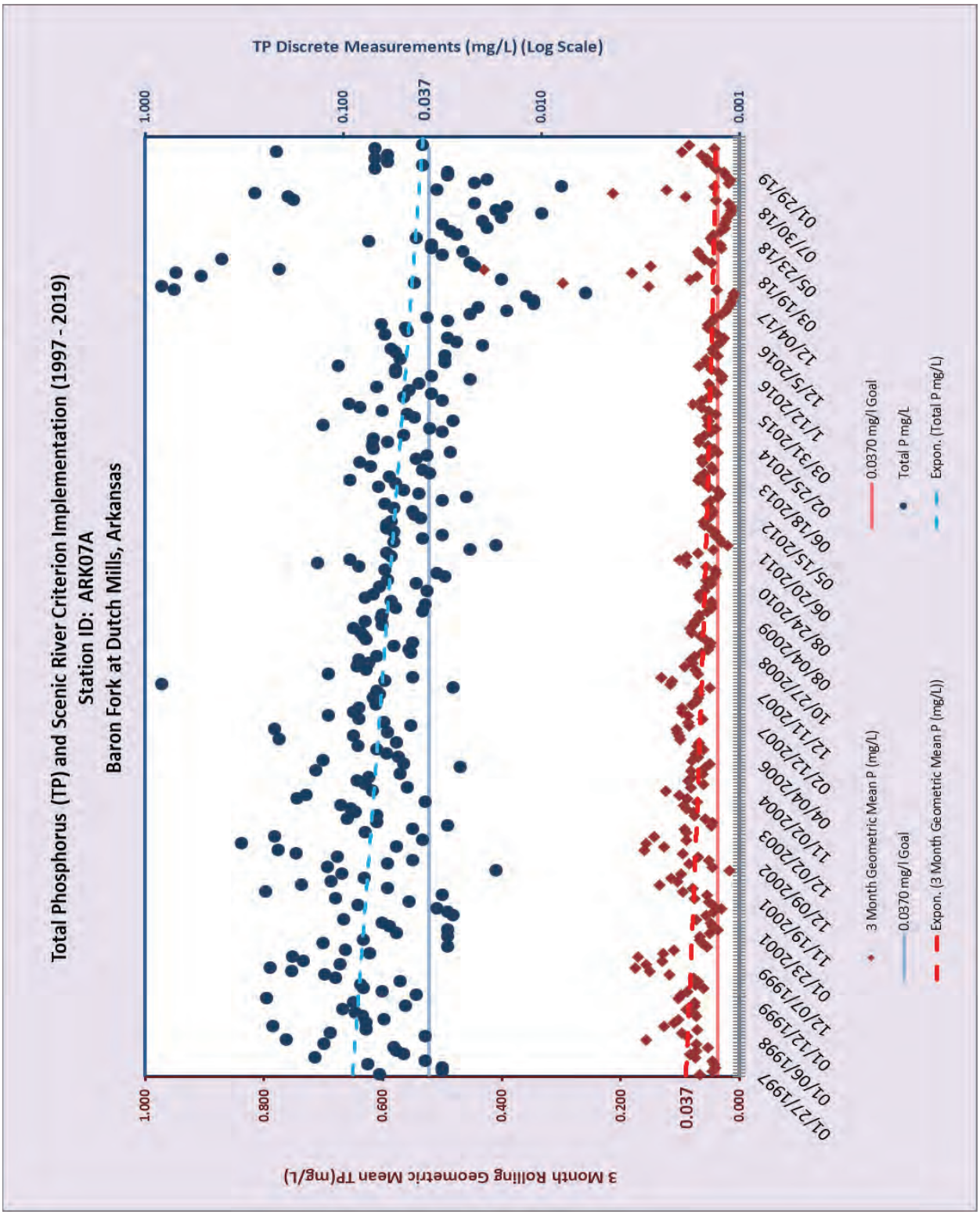


FIGURE 10 – BARON FORK TOTAL PHOSPHORUS VS 3 MONTH ROLLING MEAN



Arkansas 303 (d) List

The 2018 303 (d) list has been submitted to the U.S. Environmental Protection Agency (EPA). Correspondence to Arkansas Division of Environmental Quality dated May 15, 2020, EPA approved all impairments identified by the State of Arkansas but is taking no action and is requestion additional information from Arkansas regarding the development and application of water quality standards on the State's waterbodies subject to minerals Ecoregional Reference values as to those pollutants. In addition, EPA is requesting additional information on a number of waterbody/pollutant combinations for which the State's evaluation of data and information or application of water quality standards and assessment methodology is unclear. None of these areas are located within the Compact boundary. The final recommendation in the correspondence states that Arkansas's 218 Section 303(d) list meets the requirements of Section 303 (d) of the Clean Water Act *CWA) and the EPA's implementing regulations with regard to all the waterbody-pollutant combinations listed by the State. As a result, the EPA approves Arkansas's 2018 Section 303 (d) list with further action pending. As a review of the waterbodies listed in the 2018 list, table 12 on the following page is provided.

In keeping with the two-year rotation for producing the 303 (d) list, preparations have begun for the 2020 303 (d) list. The "2020 Assessment Methodology" is available for review online. The program is housed at the Department of Environmental Quality. Data, documents, and documentation for the program is available at the website listed below
https://www.adeq.state.ar.us/water/planning/integrated/303d/list.aspx

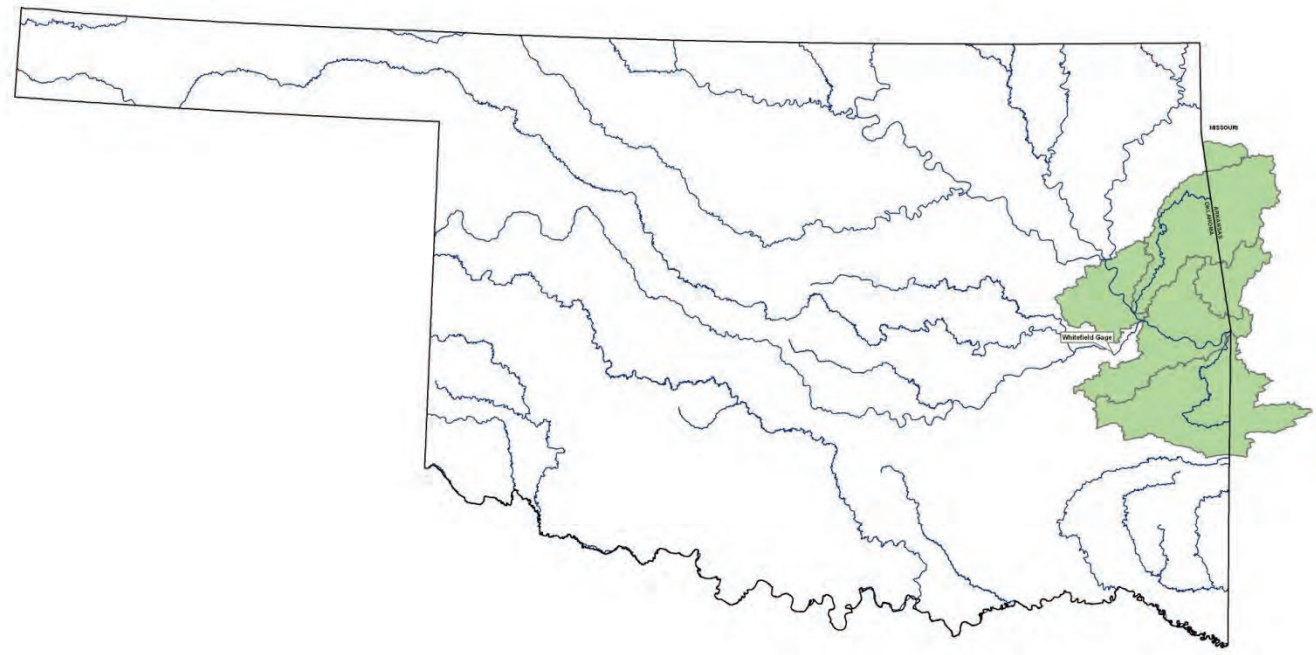
TABLE 12 - 2018 303 (D) LIST

2018 Impaired Waters within the Illinois River Basin			
Locater Map	**ADEQ Assessment Unit**	**Waterbody Name**	**Parameter(s)**
	AR_11110103_020	Illinois River	Chloride, Sulfate
	AR_11110103_024	Illinois River	Chloride, Sulfate
	AR_11110103_026	Moores Creek	Sulfate
	AR_11110103_027	Illinois River, Muddy Fork	Sulfate
	AR_11110103_4080	Fayetteville (Lake)	pH
	AR_11110105_001	Poteau River	Dissolved Oxygen
	AR_11110105_031	Poteau River	Turbidity, Sulfate
	AR_11110105_831	Unnamed Tributary to Poteau	Chloride, Total Dissolved Solids

	AR_11110104_4020	Lee Creek (Lake)	pH

Arkansas-Oklahoma Arkansas River Compact Commission

Environmental Committee Report



September 24, 2020

INTRODUCTION

This document is a compilation of data that has been collected within the Arkansas/Oklahoma Arkansas River Compact area. Items included for review;

	Introduction
	Water Quality Trends at Different Flow Regimes
	OWRB Beneficial Use Monitoring Program - Streams/Rivers
	OWRB Beneficial Use Monitoring Program – Lakes/Reservoirs
	Compact Waters included in the Oklahoma Water Quaity Integrated Report – 303(d)
	Water Quality Standards Revisions Relevant to the Arkansas-Oklahoma Compact Commission Area
	TMDL's Completed in the Compact Area
	Oklahoma's Phosphorus Loading Report for the Illinois River Basin
	Funding Provided by OWRB's Financial Assistance Program
	Permits Issued for Water Rights in the Illinois River Watershed
	Oklahoma Conservation Commission Efforts in the Illinois River Watershed

Table 1. Comparison of geometric means to the Oklahoma Scenic River total phosphorus criterion calculated from 1999-2019[1] and 2014-2019.

Station (see footnotes)	1999-2019 (3-month GM'S)			2014-2019 (3-month GM'S)		
	N (Period)	N< 0.037	% Exceeding 0.037	N (Period)	N< 0.037	% Exceeding 0.037
Illinois River near Watts[2]	335	11	97%	63	5	92%
Illinois River near Tahlequah[2]	336	23	93%	63	11	83%
Flint Creek near Kansas[2]	327	0	100%	63	0	100%
Barren Fork near Eldon[2]	327	193	41%	66	50	24%
Little Lee Creek near Nicut[1]	110	108	2%	44	44	0%
Lee Creek near Short	226	225	0%	47	47	0%
Mountain Fork River near Smithville	197	167	15%	46	42	9%

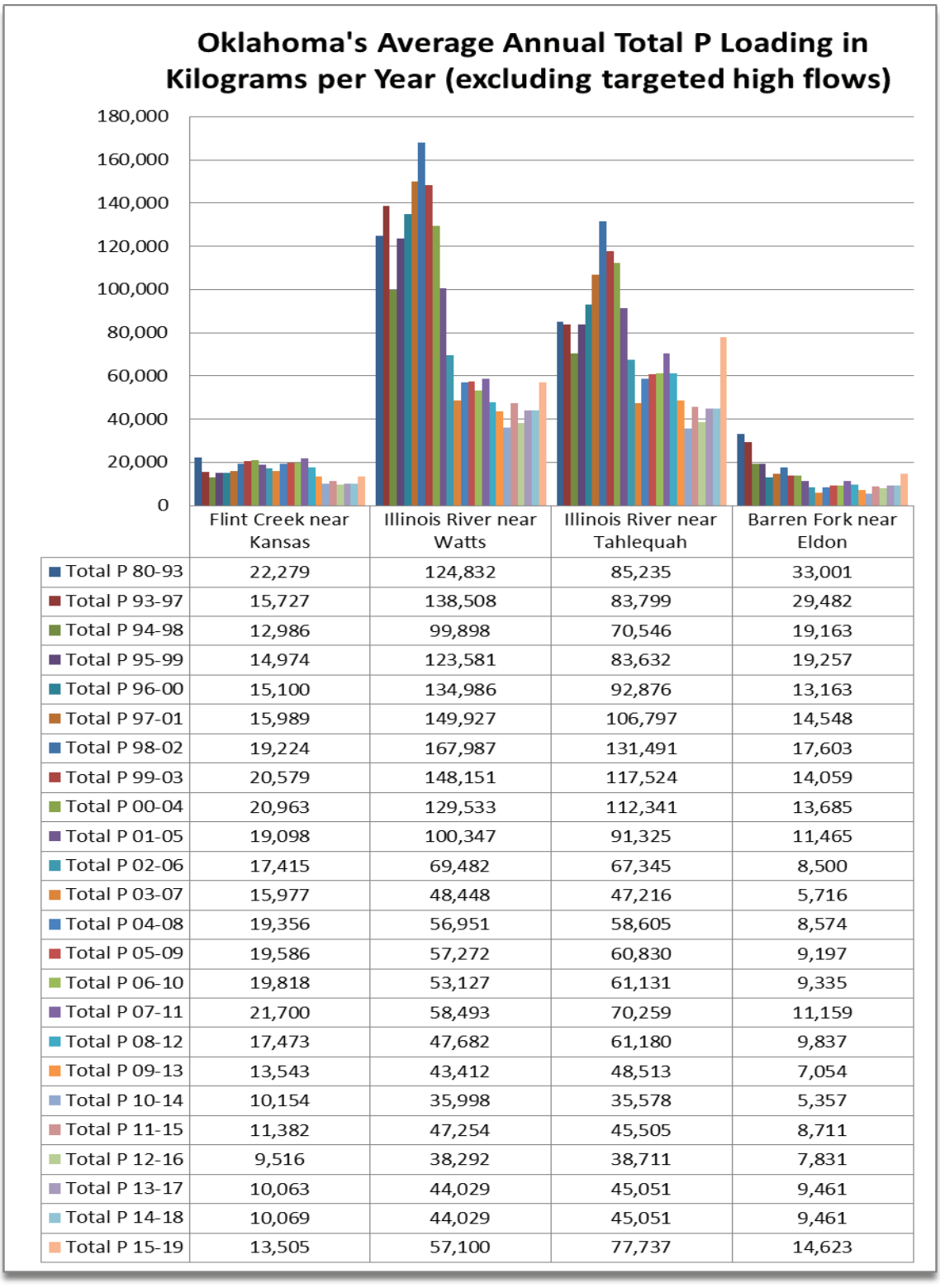
Table 2. Waters Listed on Oklahoma's 2018 303(d) List

Impaired Waters in the Illinois River Basin

OKWBID	Name	Listed on 303(d) for Impairments
121700020020	Tenkiller Ferry Lake	Dissolved Oxygen, TP
121700020110	Chicken Creek	Fish Bioassessment
121700020220	Tenkiller Ferry Lake, Illinois River Arm	Chlorophyll-a, TP
121700030010	Illinois River – Tahlequah	TP, Enterococcus
121700030040	Tahlequah Creek (Town Branch)	*Eschericia coli*
121700030080	Illinois River	TP, Lead, *Eschericia coli*,
121700030280	Illinois River – Chewey Bridge	TP, *Escherichia coli.* Turbidity, Enterococcus
121700030290	Flint Creek	TP,Dissolved Oxygen
121700030350	Illinois River – Watts	TP, Enterococcus, *Escherichia coli*
121700030370	Ballard Creek	Enterococcus
121700040010	Caney Creek	Enterococcus
121700050010	Illinois River - Baron Fork	TP, Enterococcus
121700050090	Tyner Creek	Enterococcus
121700050120	Peacheater Creek	Enterococcus
121700060010	Flint Creek	TP,Enterococcus
121700060040	Battle Creek (Battle Branch)	Enterococcus
121700060080	Sager Creek	DO, Sedimentation/Siltation, Enterococcus, Macro

Other Notable Impaired Waters in the Compact Area

OKWBID	Name	Listed on 303(d) for Impairements
220100010010	Poteau River (Below Wister)	Silver, Cadmium, Copper, Lead, Selenium, Turbidty
220100020020	Wister Lake	Chlorophyll-a, pH, Dissolved Oxygen, Turbidity TP, , listed as an NLW in the OWQS
220200050010	Lee Creek	Lead, Enterococcus
220200050040	Little Lee Creek	Lead



	Flint Creek near Kansas	Illinois River near Watts	Illinois River near Tahlequah	Barren Fork near Eldon
Total P 80-93	22,279	124,832	85,235	33,001
Total P 93-97	15,727	138,508	83,799	29,482
Total P 94-98	12,986	99,898	70,546	19,163
Total P 95-99	14,974	123,581	83,632	19,257
Total P 96-00	15,100	134,986	92,876	13,163
Total P 97-01	15,989	149,927	106,797	14,548
Total P 98-02	19,224	167,987	131,491	17,603
Total P 99-03	20,579	148,151	117,524	14,059
Total P 00-04	20,963	129,533	112,341	13,685
Total P 01-05	19,098	100,347	91,325	11,465
Total P 02-06	17,415	69,482	67,345	8,500
Total P 03-07	15,977	48,448	47,216	5,716
Total P 04-08	19,356	56,951	58,605	8,574
Total P 05-09	19,586	57,272	60,830	9,197
Total P 06-10	19,818	53,127	61,131	9,335
Total P 07-11	21,700	58,493	70,259	11,159
Total P 08-12	17,473	47,682	61,180	9,837
Total P 09-13	13,543	43,412	48,513	7,054
Total P 10-14	10,154	35,998	35,578	5,357
Total P 11-15	11,382	47,254	45,505	8,711
Total P 12-16	9,516	38,292	38,711	7,831
Total P 13-17	10,063	44,029	45,051	9,461
Total P 14-18	10,069	44,029	45,051	9,461
Total P 15-19	13,505	57,100	77,737	14,623

Values represent all available data, which is routinely collected and excludes targeted high flow events.

Water Quality Trends at Different Flow Regimes

Trend analyses were performed on total phosphorus concentrations as well as assessment geometric means at four BUMP permanent monitoring stations in the Arkansas River Compact area (Table 1). Using a Seasonal Kendall test, a series of trends were calculated for each station including all total phosphorus data from both 1993-2019 and 1999-2019, total phosphorus concentrations measured at both higher and lower flows from 1999-2019, and use assessment geometric means from 1999-2019. Furthermore, for each concentration data set, a trend was calculated using both unadjusted and flow-adjusted total phosphorus data. Graphical representations of these trends are not presented but may be obtained by contacting Monty Porter with the OWRB at 405-530-8933. Some general conclusions may be drawn from the data set.

1. When considering all total phosphorus data with a period of record (POR) beginning in 1993, no station demonstrated a significant upward trend regardless of flow adjusting data. The Barren Fork River demonstrated no significant trend in both flow adjusted and unadjusted data, while all other sites show a highly significant downward trend.
2. When all data from 1999-2019 are analyzed, all stations demonstrate a highly significant downward trend, except Barren Fork adjusted data which showed only a slightly significant downward trend.
3. All waterbodies show some significant downward trend when only higher flow total phosphorus concentrations are considered. The Barren Fork River shows no significant trend in unadjusted total phosphorus concentrations at higher flows.
4. When only lower flow data from 1999-2019 are analyzed, all stations except the Barren Fork demonstrate a highly significant downward trend. The Barren Fork River shows no significant trend in total phosphorus concentrations at lower flows.
5. All stations show a highly significant downward trend for use assessment geometric means. (Figures 1-4).

Table 1. Trends calculated for total phosphorus concentrations and use assessment geometric means at certain BUMP permanent monitoring stations in the Compact area. (Boxes shaded in yellow represent changes from the 2019 report, and 2019 results are in superscript.)

Station	All Data (1993-2019)		All Data (1999-2019)		Higher Flow Data (1999-2019)		Lower Flow Data (1999-2019)		Geomtric Mean For Assessment (1999-2019)
	Unadj	Flow Adj	Unadj	Flow Adj	Unadj	Flow Adj	Unadj	Flow Adj	Unadj
Illinois River near Watts	↓↓↓	↓↓↓	↓↓↓	↓↓↓	↓↓↓	↓↓↓	↓↓↓	↓↓↓	↓↓↓
Illinois River near Tahlequah	↓↓↓	↓↓↓	↓↓↓	↓↓↓	↓↓	↓↓↓	↓↓↓	↓↓↓	↓↓↓
Flint Creek near Kansas	↓↓↓	↓↓↓	↓↓↓	↓↓↓	↓↓↓	↓↓↓	↓↓↓	↓↓↓	↓↓↓
Barren Fork near Eldon	NT	NT	↓↓↓(↓↓)	↓(↓↓↓)	NT	↓↓↓(↓↓)	NT	NT	↓↓↓

↓↓↓ = Decreasing Trend at the 95% Confidence Level
↓↓ = Decreasing Trend at the 90% Confidence Level
↓ = Decreasing Trend at the 80% Confidence Level
No Increasing Trends
NT = No Signficant Trend

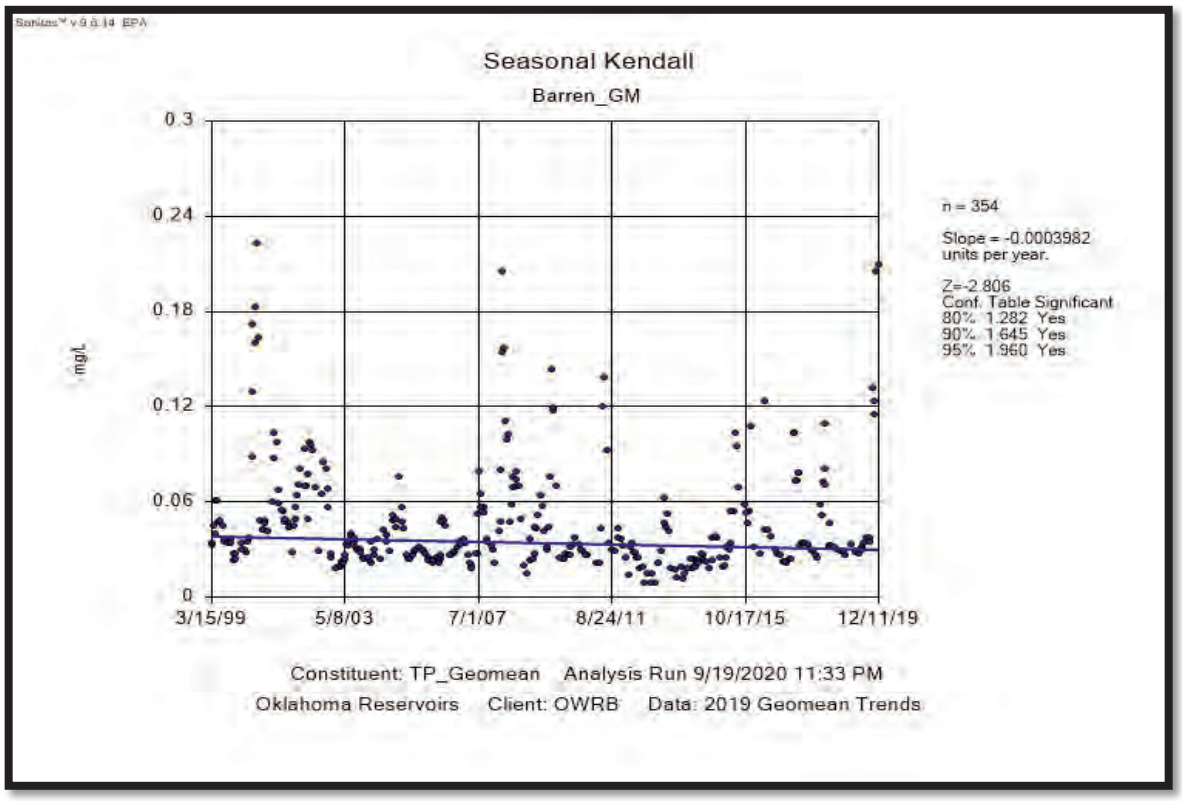


Figure 1. Trend for use assessment geometric means (1999-2019) on the Barren Fork River near Eldon.

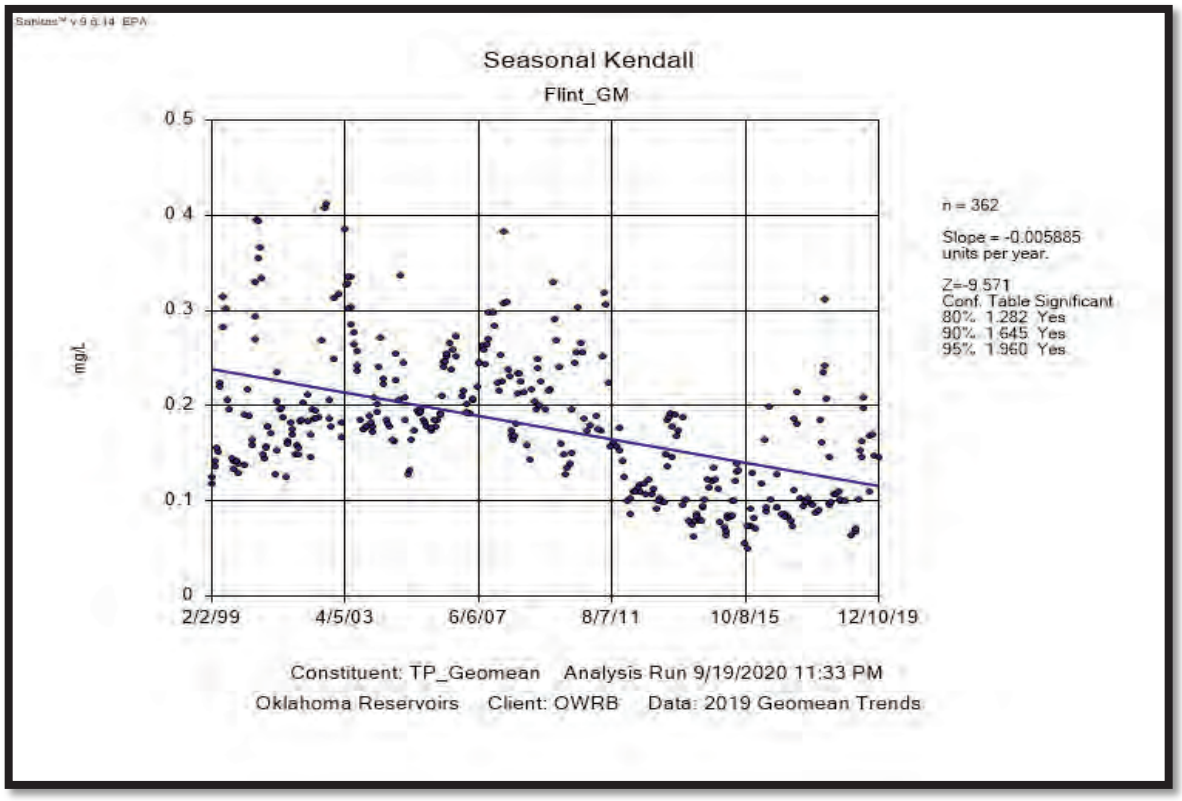


Figure 2. Trend for use assessment geometric means (1999-2019) on Flint Creek near Kansas.

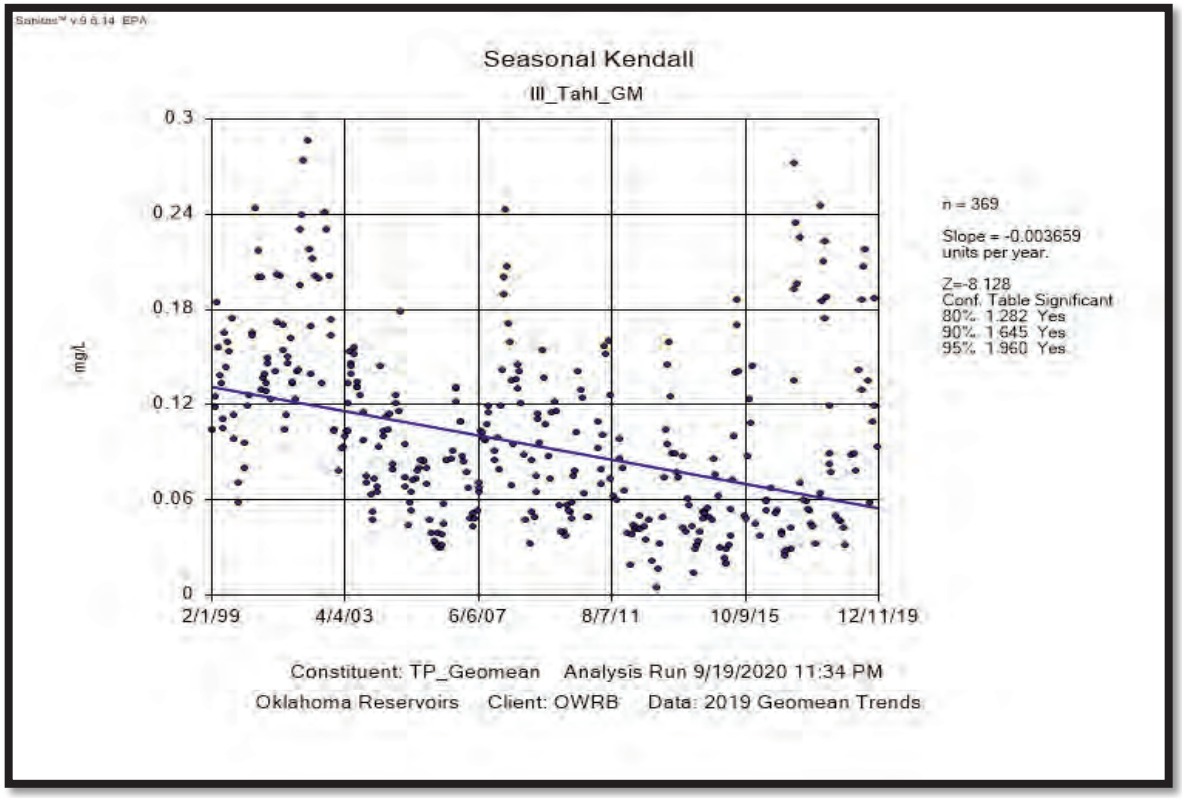


Figure 3. Trend for use assessment geometric means (1999-2019) on Illinois River near Tahlequah.

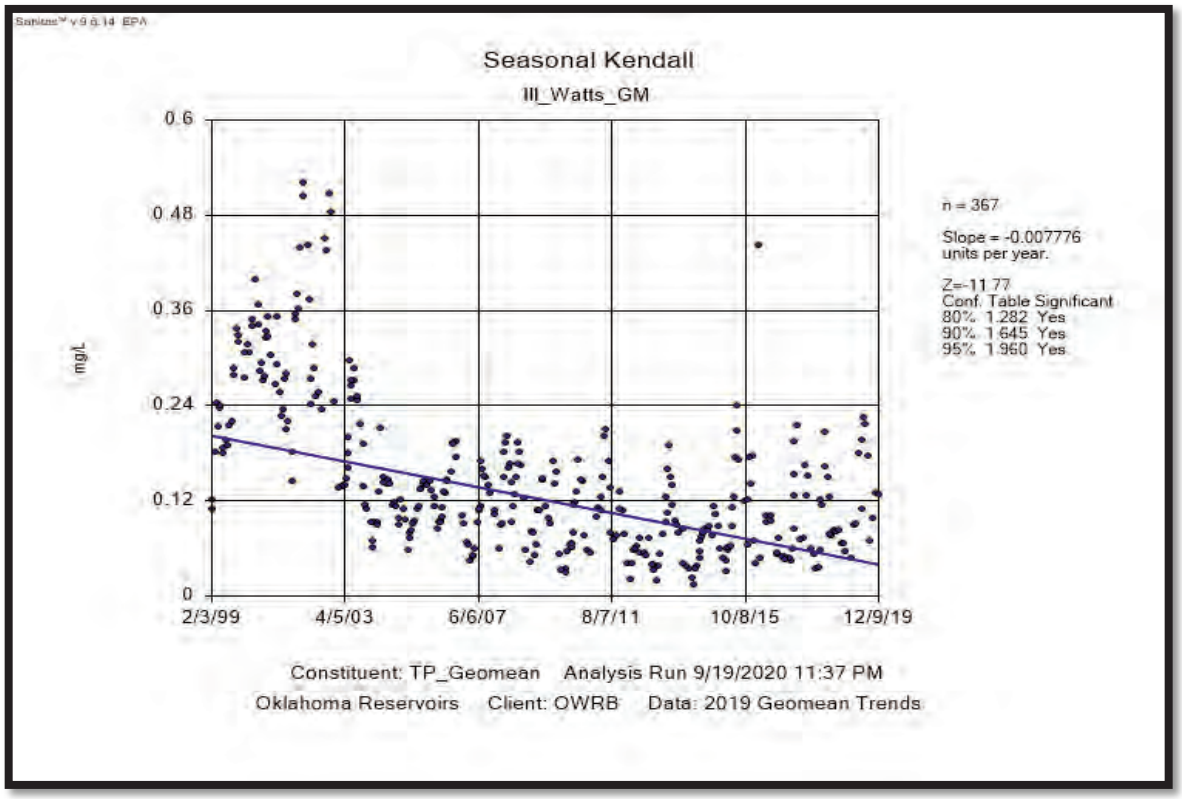


Figure 4. Trend for use assessment geometric means (1999-2019) on Illinois River near Watts.

Arkansas River at Moffett

Sample Record	Biological Collections	Station ID
November 1998 - Current	Gaging Data	220200010010-001AT

Stream Data

County	Sequoyah	Request Data By Email
Location	East of the Town of Moffett on US Highway 64	
Latitude/Longitude	35.39242903, -94.43267795	
Planning Watershed	Lower Arkansas (8-digit HUC - 11110104)	

Parameters

	Parameter (Descriptions)	n	Mean	Median	Min./Max	p25/p75	Comments
In-Situ	Water Temperature (°C)	79	19.2	20.1	1.7/32.6	12.7/26.3	
	Turbidity (NTU)	80	33	21	7/194	15/42	
	pH (units)	79	7.85	7.85	6.87/8.97	7.64/8.04	
	Dissolved Oxygen (mg/L)	78	9.48	9.09	5.35/16.48	7.67/10.54	
	Hardness (mg/L)	79	162	141	39/658	125/182	
Minerals	Total Dissolved Solids (mg/L)	107	357	341	<10/833	257/423	
	Specific Conductivity (uS/cm)	77	612	576	195/1333	482/737	
	Chloride (mg/L)	85	100	93	13/293	57/129	
	Sulfate (mg/L)	85	54	51	22/116	39/64	
Nutrients	Total Phosphorus (mg/L)	85	0.123	0.117	0.051/0.330	0.095/0.139	
	Total Nitrogen (mg/L)	84	0.96	0.92	0.45/2.82	0.71/1.12	
	Nitrate/Nitrite (mg/L)	43	0.26	0.22	<0.05/0.66	0.10/0.38	
	Chlorophyll A (mg/m^3)	44	13.0	10.2	<0.1/71.8	6.4/15.6	TSI=55.7
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	21	1089	<10	<10/12000	<10/20	
	E. Coli (cfu/100ml)(*-Geo. Mn.)	21	158	<10	<10/2035	<10/20	

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	Sulfates	Nitrates	Chlorides	Total Dissolved Solids	Bacteria	Bio. Fish	Bio. BMI	Sediment
Fish & Wildlife Propagation	S	S	S	S						U	S	S
Aesthetics												S
Agriculture					S		S	S				
Primary Body Contact Recreation									S			
Public & Private Water Supply				S		S			S			
Fish Consumption				S								

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

Notes *U = Assessment yielded undetermined supporting status*

Sampling and Assessment by the **Oklahoma Water Resources Board** – 3800 Classen Blvd, Oklahoma City, OK, 73118 – 405.530.8800 – http://www.owrb.ok.gov

Arkansas River at Muskogee

Sample Record	Biological Collections	Station ID
November 1998 - Current	Gaging Data	120400010260-001AT

Stream Data

County	Muskogee	Request Data By Email
Location	East of the Town of Muskogee on US Highway 62	
Latitude/Longitude	35.77016066, -95.30031102	
Planning Watershed	Middle Arkansas (8-digit HUC - 11110102)	

Parameters

	Parameter (Descriptions)	n	Mean	Median	Min./Max	p25/p75	Comments
In-Situ	Water Temperature (°C)	111	18.0	18.6	1.9/32.4	11.2/24.8	
	Turbidity (NTU)	110	42	23	5/387	15/40	
	pH (units)	110	8.04	8.04	7.09/9.48	7.77/8.30	
	Dissolved Oxygen (mg/L)	115	8.99	8.95	4.42/14.88	7.48/10.59	
	Hardness (mg/L)	109	179	167	91/399	143/211	
Minerals	Total Dissolved Solids (mg/L)	169	500	407	<10/1580	301/647	
	Specific Conductivity (uS/cm)	110	859	765	191/2462	460/1083	
	Chloride (mg/L)	116	160	133	<10/713	77/196	
	Sulfate (mg/L)	117	73	65	28/202	45/88	
Nutrients	Total Phosphorus (mg/L)	117	0.165	0.146	0.053/0.705	0.117/0.177	
	Total Nitrogen (mg/L)	116	1.15	1.10	0.40/2.82	0.92/1.36	
	Nitrate/Nitrite (mg/L)	62	0.37	0.32	<0.05/0.88	0.20/0.51	
	Chlorophyll A (mg/m^3)	58	17.9	13.7	<0.1/90.0	7.9/25.1	TSI=58.9
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	20	5232	17	<10/75000	<10/200	
	E. Coli (cfu/100ml)(*-Geo. Mn.)	20	546	25	<10/5492	<10/65	

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	Sulfates	Nitrates	Chlorides	Total Dissolved Solids	Bacteria	Bio. Fish	Bio. BMI	Sediment
Fish & Wildlife Propagation	S	S	S	S						S	S	S
Aesthetics												S
Agriculture					S		S	S				
Primary Body Contact Recreation									S			
Public & Private Water Supply				S		S			S			
Fish Consumption				S								

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

Notes

Barren Fork at Eldon

Sample Record	Biological Collections	Station ID
November 1998 - Current	Gaging Data	121700050010-001AT

Stream Data

County	Cherokee	Request Data By Email
Location	South of the Town of Eldon on State Highway 51	
Latitude/Longitude	35.92173377, -94.83726494	
Planning Watershed	Lower Arkansas (8-digit HUC - 11110103)	

Parameters

	Parameter (Descriptions)	n	Mean	Median	Min./Max	p25/p75	Comments
In-Situ	Water Temperature (°C)	145	17.3	17.8	3.1/29.9	11.3/22.9	
	Turbidity (NTU)	142	4	2	1/45	2/3	
	pH (units)	144	7.63	7.59	6.37/8.82	7.37/7.88	
	Dissolved Oxygen (mg/L)	148	9.67	9.80	4.40/14.53	8.19/11.05	
	Hardness (mg/L)	146	99	98	46/159	89/107	
Minerals	Total Dissolved Solids (mg/L)	164	128	124	13/545	110/137	
	Specific Conductivity (uS/cm)	145	200	199	20/713	178/215	
	Chloride (mg/L)	117	<10	<10	<10/44	<10/<10	
	Sulfate (mg/L)	117	<10	<10	<10/40	<10/<10	
Nutrients	Total Phosphorus (mg/L)	149	0.033	0.028	<0.010/0.217	0.022/0.034	
	Total Nitrogen (mg/L)	148	1.48	1.39	0.18/4.20	0.85/1.94	
	Nitrate/Nitrite (mg/L)	86	1.26	1.18	0.14/3.83	0.63/1.64	
	Chlorophyll A (mg/m^3)	89	1.4	1.1	<0.1/11.7	0.7/1.7	TSI=34.1
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	74	221	20	<10/3900	<10/80	
	E. Coli (cfu/100ml)(*-Geo. Mn.)	74	77	<10	<10/2420	<10/49	Mean>OWQS

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	Sulfates	Nitrates	Chlorides	Total Dissolved Solids	Bacteria	Bio. Fish	Bio. BMI	Sediment	Total Phosphorus
Fish & Wildlife Propagation	S	S	S	S						S	S	S	
Aesthetics												S	S
Agriculture					S		S	S					
Primary Body Contact Recreation									NS				
Public & Private Water Supply				S		S			S				
Fish Consumption				S									

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

Notes

Sampling and Assessment by the **Oklahoma Water Resources Board** – 3800 Classen Blvd, Oklahoma City, OK, 73118 – 405.530.8800 – http://www.owrb.ok.gov

Brushy Creek

Sample Period	Times Visited	Sampling Sites
December 2014 – September 2015	4	3

General

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

Parameters

	Parameter (Descriptions)	Result	Notes/Comments
In Situ	Average Turbidity	8 NTU	0% of values > OWQS of 25 NTU
	Average Secchi Disk Depth	79 cm	
	Water Clarity Rating	Good	
	Chlorophyll-a	13 mg/m3	
	Trophic State Index	56	Previous value = 53
	Trophic Class	Eutrophic	
Profile	Salinity	0.02 - 0.09 ppt	
	Specific Conductivity	52.3 – 179.6 µS/cm	
	pH	5.86 - 8.53 pH units	11 (11.6%) values < 6.5 units
	Oxidation-Reduction Potential	49 to 486.4 mV	
	Dissolved Oxygen	Up to 67% of water column < 2 mg/L in June	
Nutrients	Surface Total Nitrogen	0.42 mg/L to 0.89 mg/L	
	Surface Total Phosphorus	0.008 mg/L to 0.038 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	NS	NEI	S							
Aesthetics					S	*					
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

*Standards revision, true color is for permitting purposes only.

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

Sampling and Assessment by the Oklahoma Water Resources Board – 3800 Classen Blvd, Oklahoma City, OK, 73118 – 405.530.8800 – http://www.owrb.ok.gov

Caney Creek at Barber

Sample Record	Biological Collections	Station ID
September 1999 – November 2012	Gaging Data	121700040010-001AT

Stream Data

County	Cherokee	Request Data by Email
Location	North of the Town of Barber off State Highway 100	
Latitude/Longitude	35.785043, -94.856285	
Planning Watershed	Lower Arkansas (8-digit HUC - 11110103)	

Parameters

	Parameter (Descriptions)	n	Mean	Median	Min./Max	p25/p75	Comments
In-Situ	Water Temperature (°C)	99	18.1	17.6	4.1/29.3	13.1/23.3	
	Turbidity (NTU)	100	4	2	0/103	1/3	
	pH (units)	97	7.77	7.76	6.46/9.06	7.56/8.02	
	Dissolved Oxygen (mg/L)	99	9.66	9.42	3.94/15.60	8.31/11.11	
	Hardness (mg/L)	99	109	109	64/174	98/120	
Minerals	Total Dissolved Solids (mg/L)	111	142	140	78/254	129/156	
	Specific Conductivity (uS/cm)	99	219	218	123/391	200/243	
	Chloride (mg/L)	90	<10	<10	<10/37	<10/<10	
	Sulfate (mg/L)	90	<10	<10	<10/33	<10/<10	
Nutrients	Total Phosphorus (mg/L)	105	0.060	0.037	<0.010/1.532	0.030/0.046	
	Total Nitrogen (mg/L)	104	1.12	1.02	0.16/7.04	0.68/1.37	
	Nitrate/Nitrite (mg/L)	51	0.85	0.85	0.06/2.89	0.48/1.06	
	Chlorophyll A (mg/m^3)	53	1.3	0.8	<0.1/12.1	0.5/1.2	TSI=32.9
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	46	94	20	<10/1408	<10/52	Mean>OWQS
	E. Coli (cfu/100ml)(*-Geo. Mn.)	46	123	15	<10/2382	<10/39	Mean>OWQS

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	Sulfates	Nitrates	Chloride	Total Dissolved Solids	Bacteria	Bio. Fish	Bio. BMI	Sediment
Fish & Wildlife Propagation	S	S	S	S						S	NS	S
Aesthetics												S
Agriculture					S		S	S				
Primary Body Contact Recreation									NS			
Public & Private Water Supply				S		S			S			
Fish Consumption				S								

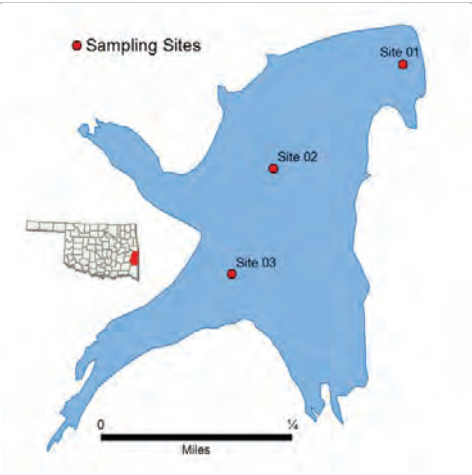
S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

Notes

Sampling and Assessment by the **Oklahoma Water Resources Board** – 3800 Classen Blvd, Oklahoma City, OK, 73118 – 405.530.8800 – http://www.owrb.ok.gov

Cedar

Sample Period	Times Visited	Sampling Sites
November 2015 – Sept. 2016	4	5



General

Location	Le Flore County
Impoundment	1937
Area	78 acres
Capacity	1,000 acre-feet
Purposes	Recreation

Parameters

	Parameter (Descriptions)	Result	Notes/Comments
In Situ	Average Turbidity	7 NTU	100% of values < OWQS of 25 NTU
	Average Secchi Disk Depth	92 cm	
	Water Clarity Rating	Excellent	
	Chlorophyll-a	25.3 mg/m3	
	Trophic State Index	62	Previous Value=56
	Trophic Class	Hypereutrophic	
Profile	Salinity	0.01– 0.08 ppt	
	Specific Conductivity	31.7 – 170.4 µS/cm	
	pH	5.92 – 7.36 pH units	51.56% < 6.5
	Oxidation-Reduction Potential	-58.9 – 416.9 mV	
	Dissolved Oxygen	Up to 40% of water column < 2 mg/L in summer	
Nutrients	Surface Total Nitrogen	0.56 mg/L to 0.98 mg/L	
	Surface Total Phosphorus	0.023 mg/L to 0.043 mg/L	
	Nitrogen to Phosphorus Ratio	24:1	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	NS	NS	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

*Standards revision, true color is for permitting purposes only.

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

Sampling and Assessment by the Oklahoma Water Resources Board – 3800 Classen Blvd, Oklahoma City, OK, 73118 – 405.530.8800 – http://www.owrb.ok.gov

Flint Creek at Flint

Sample Record	Biological Collections	Station ID
November 1998 - Current	Gaging Data	121700060010-001AT

Stream Data

County	Delaware	Request Data By Email
Location	North of the Town of Flint on D0581 Rd	
Latitude/Longitude	36.1867733, -94.70680493	
Planning Watershed	Lower Arkansas (8-digit HUC - 11110103)	

Parameters

	Parameter (Descriptions)	n	Mean	Median	Min./Max	p25/p75	Comments
In-Situ	Water Temperature (°C)	143	17.0	16.5	2.5/28.7	11.2/22.9	
	Turbidity (NTU)	140	2	1	0/58	1/2	
	pH (units)	142	7.69	7.68	6.44/8.79	7.44/7.93	
	Dissolved Oxygen (mg/L)	146	9.50	9.28	4.97/14.94	8.04/10.75	
	Hardness (mg/L)	145	115	115	<10/218	104/125	
Minerals	Total Dissolved Solids (mg/L)	160	185	182	98/552	159/205	
	Specific Conductivity (uS/cm)	141	292	295	152/452	259/326	
	Chloride (mg/L)	118	14	13	<10/43	<10/18	
	Sulfate (mg/L)	118	17	15	<10/69	12/19	
Nutrients	Total Phosphorus (mg/L)	150	0.182	0.152	0.055/1.450	0.098/0.187	See Notes
	Total Nitrogen (mg/L)	149	2.92	2.79	0.92/7.93	2.26/3.52	
	Nitrate/Nitrite (mg/L)	87	2.51	2.43	0.80/4.83	1.75/3.18	
	Chlorophyll A (mg/m^3)	89	1.0	0.8	<0.1/4.2	0.5/1.2	TSI=30.3
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	65	555	52	<10/18000	15/109	Mean>OWQS
	E. Coli (cfu/100ml)(*-Geo. Mn.)	65	194	31	<10/4611	<10/74	Mean>OWQS

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	Sulfates	Nitrates	Chlorides	Total Dissolved Solids	Bacteria	Bio. Fish	Bio. BMI	Sediment	Total Phosphorus
Fish & Wildlife Propagation	S	S	S	S						S	S	S	
Aesthetics												S	NS
Agriculture					S		S	S					
Primary Body Contact Recreation									NS				
Public & Private Water Supply				S					S				
Fish Consumption				S									

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

Notes

100%(72 of 72) of rolling Geo. Mean exceed OWQS criterion of 0.037 ppm

Sampling and Assessment by the **Oklahoma Water Resources Board** – 3800 Classen Blvd, Oklahoma City, OK, 73118 – 405.530.8800 – http://www.owrb.ok.gov

Fourche-Maline Creek at Red Oak

Sample Record	Biological Collections	Station ID
November 1998 - Current	Gaging Data	220100040020-001AT

Stream Data

County	Latimer	Request Data By Email
Location	Southeast of the Town of Red Oak off US Highway 270	
Latitude/Longitude	34.91232472, -95.15608416	
Planning Watershed	Lower Arkansas (8-digit HUC - 11110105)	

Parameters

	Parameter (Descriptions)	n	Mean	Median	Min./Max	p25/p75	Comments
In-Situ	Water Temperature (°C)	157	17.4	18.8	1.0/31.6	10.4/24.0	
	Turbidity (NTU)	157	38	27	5/390	17/42	
	pH (units)	158	7.11	7.02	5.77/8.76	6.82/7.43	
	Dissolved Oxygen (mg/L)	162	6.12	6.19	0.84/15.69	3.15/8.74	
	Hardness (mg/L)	158	53	49	<10/212	34/63	
Minerals	Total Dissolved Solids (mg/L)	191	103	96	<10/719	69/125	
	Specific Conductivity (uS/cm)	156	159	138	11/1106	101/196	
	Chloride (mg/L)	120	<10	<10	<10/22	<10/10	
	Sulfate (mg/L)	120	23	22	<10/65	17/26	
Nutrients	Total Phosphorus (mg/L)	159	0.083	0.070	<0.010/0.867	0.049/0.092	
	Total Nitrogen (mg/L)	157	0.77	0.73	0.16/1.79	0.56/0.94	
	Nitrate/Nitrite (mg/L)	101	0.14	0.12	<0.05/0.97	<0.05/0.22	
	Chlorophyll A (mg/m^3)	42	6.3	2.5	0.3/34.0	1.2/8.1	TSI=48.6
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	33	460	80	<10/8000	52/200	Mean>OWQS
	E. Coli (cfu/100ml)(*-Geo. Mn.)	33	208	74	<10/1986	29/148	

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	Sulfates	Nitrates	Chlorides	Total Dissolved Solids	Bacteria	Bio. Fish	Bio. BMI	Sediment
Fish & Wildlife Propagation	S	S	NS	NS						S	NS	S
Aesthetics												S
Agriculture					S		S	S				
Primary Body Contact Recreation									NS			
Public & Private Water Supply				NEI		NEI			NEI			
Fish Consumption				S								

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

Notes

Fish & Wildlife Propagation not supporting for Lead

Sampling and Assessment by the **Oklahoma Water Resources Board** – 3800 Classen Blvd, Oklahoma City, OK, 73118 – 405.530.8800 – http://www.owrb.ok.gov

Greenleaf

Sample Period	Times Visited	Sampling Sites
February 2019 – August 2019	4	5

General

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

Parameters

	Parameter (Descriptions)	Result	Notes/Comments
In Situ	Average Turbidity	7 NTU	100% of values < OWQS of 25 NTU (n=9)
	Average Secchi Disk Depth	97 cm	
	Water Clarity Rating	Good	
	Chlorophyll-a	17.76 mg/m3	
	Trophic State Index	59	Previous value = 58
	Trophic Class	Eutrophic	
Profile	Salinity	0.0– 0.09 ppt	
	Specific Conductivity	0.80 – 162 µS/cm	
	pH	6.26 – 8.11 pH units	33% of recorded values <6.5
	Oxidation-Reduction Potential	48.6 – 4440.5 mV	
	Dissolved Oxygen	Up to 61% of water column < 2 mg/L in August	
Nutrients	Surface Total Nitrogen	0.36 mg/L to 0.77 mg/L	
	Surface Total Phosphorus	0.021 mg/L to 0.037 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	Enterro. & E. coli	Chlor-a
Fish & Wildlife Propagation	NS	S	NEI	S							
Aesthetics					S	*					
Agriculture							N/A	N/A	S		
Primary Body Contact Recreation										S	
Public & Private Water Supply											NS

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

Notes

*Standards revision, true color is for permitting purposes only.
* 50-70% range is undetermined for DO.

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

Sampling and Assessment by the Oklahoma Water Resources Board – 3800 Classen Blvd, Oklahoma City, OK, 73118 – 405.530.8800 – http://www.owrb.ok.gov

Illinois River at Tahlequah

Sample Record	Biological Collections	Station ID
November 1998 - Current	Gaging Data	121700030010-001AT

Stream Data

County	Cherokee	Request Data By Email
Location	East of the Town of Tahlequah on US Highway 62	
Latitude/Longitude	35.92606447, -94.92380373	
Planning Watershed	Lower Arkansas (8-digit HUC - 11110103)	

Parameters

	Parameter (Descriptions)	n	Mean	Median	Min./Max	p25/p75	Comments
In-Situ	Water Temperature (°C)	144	17.6	17.3	0.8/31.7	11.0/24.0	
	Turbidity (NTU)	141	7	4	0/84	3/6	
	pH (units)	142	7.88	7.83	6.47/9.29	7.58/8.13	
	Dissolved Oxygen (mg/L)	147	10.06	10.05	4.66/15.88	8.01/11.97	
	Hardness (mg/L)	144	115	114	69/168	106/123	
Minerals	Total Dissolved Solids (mg/L)	163	170	170	30/565	149/186	
	Specific Conductivity (uS/cm)	144	268	271	66/713	240/293	
	Chloride (mg/L)	118	10	10	<10/24	<10/14	
	Sulfate (mg/L)	118	14	13	<10/48	11/16	
Nutrients	Total Phosphorus (mg/L)	151	0.080	0.066	<0.010/0.438	0.043/0.103	See Notes
	Total Nitrogen (mg/L)	150	1.77	1.71	0.38/3.76	1.19/2.26	
	Nitrate/Nitrite (mg/L)	88	1.53	1.46	0.24/3.61	0.93/1.98	
	Chlorophyll A (mg/m^3)	89	3.1	2.0	<0.1/46.4	1.5/3.1	TSI=41.8
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	64	151	20	<10/2500	<10/100	
	E. Coli (cfu/100ml)(*-Geo. Mn.)	64	61	<10	<10/884	<10/34	

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	Sulfates	Nitrates	Chlorides	Total Dssolved Solids	Bacteria	Bio. Fish	Bio. BMI	Sediment	Total Posphorus
Fish & Wildlife Propagation	S	S	S	S						S	S	S	
Aesthetics												S	NS
Agriculture					S		S	S					
Primary Body Contact Recreation									S				
Public & Private Water Supply				S		S			S				
Fish Consumption				S									

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

Notes

92.5%(74 of 80) of 3-month rolling Geo. Mean above OWQS criterion of 0.037 ppm

Sampling and Assessment by the **Oklahoma Water Resources Board** – 3800 Classen Blvd, Oklahoma City, OK, 73118 – 405.530.8800 – http://www.owrb.ok.gov

Illinois River at Watts

Sample Record	Biological Collections	Station ID
November 1998 - Current	Gaging Data	121700030350-001AT

Stream Data

County	Adair	Request Data By Email
Location	North of the Town of Watts on US Highway 59	
Latitude/Longitude	36.12994064, -94.57151225	
Planning Watershed	Lower Arkansas (8-digit HUC - 11110103)	

Parameters

	Parameter (Descriptions)	n	Mean	Median	Min./Max	p25/p75	Comments
In-Situ	Water Temperature (°C)	145	17.2	16.5	2.0/31.5	10.6/24.0	
	Turbidity (NTU)	141	10	7	1/95	4/12	
	pH (units)	144	7.90	7.92	6.51/9.03	7.72/8.12	
	Dissolved Oxygen (mg/L)	147	10.55	10.22	4.51/18.88	8.70/11.77	
	Hardness (mg/L)	146	127	127	<10/220	116/136	
Minerals	Total Dissolved Solids (mg/L)	164	195	196	95/566	171/215	
	Specific Conductivity (uS/cm)	145	307	310	149/713	273/339	
	Chloride (mg/L)	117	13	13	<10/28	<10/16	
	Sulfate (mg/L)	117	16	15	<10/97	12/19	
Nutrients	Total Phosphorus (mg/L)	150	0.141	0.091	<0.010/1.153	0.057/0.164	See Notes
	Total Nitrogen (mg/L)	149	2.52	2.47	0.84/5.06	2.08/2.87	
	Nitrate/Nitrite (mg/L)	88	2.20	2.20	0.72/3.96	1.71/2.52	
	Chlorophyll A (mg/m^3)	89	3.0	2.3	<0.1/15.3	1.4/3.4	TSI=41.3
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	65	559	20	<10/15531	<10/100	Mean>OWQS
	E. Coli (cfu/100ml)(*-Geo. Mn.)	65	368	20	<10/12997	<10/63	Mean>OWQS

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	Sulfates	Nitrates	Chlorides	Total Dissolved Solids	Bacteria	Bio. Fish	Bio. BMI	Sediment	Total Posphorus
Fish & Wildlife Propagation	S	S	S	S						S	S	S	
Aesthetics												S	NS
Agriculture					S		S	S					
Primary Body Contact Recreation									NS				
Public & Private Water Supply				S		S			S				
Fish Consumption				S									

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

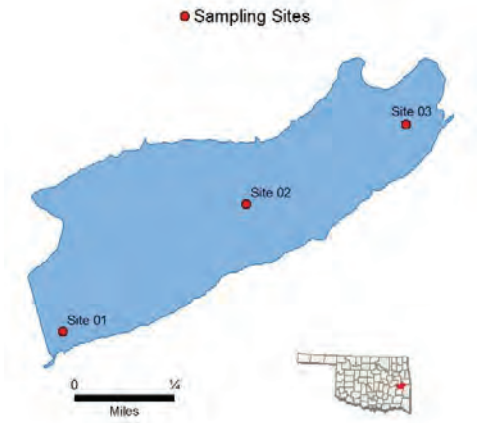
Notes

91.6%(76of 83) of rolling Geo. Mean exceed OWQS criterion of 0.037 ppm

Sampling and Assessment by the **Oklahoma Water Resources Board** – 3800 Classen Blvd, Oklahoma City, OK, 73118 – 405.530.8800 – http://www.owrb.ok.gov

John Wells

Sample Period	Times Visited	Sampling Sites
November 2016 – August 2017	4	5



General

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

Parameters

	Parameter (Descriptions)	Result	Notes/Comments
In Situ	Average Turbidity	4 NTU	100% of values < OWQS of 25 NTU (n=10)
	Average Secchi Disk Depth	146 cm	
	Water Clarity Rating	Excellent	
	Chlorophyll	5.2 mg/L	
	Trophic State Index	47	Previous value = 45
	Trophic Class	Mesotrophic	
Profile	Salinity	0.03 – 0.08 ppt	
	Specific Conductivity	75.2 – 165.2 µS/cm	
	pH	6.39 – 8.74 pH units	4.8% of values < 6.50 pH
	Oxidation-Reduction Potential	95.2 – 546.3 mV	
	Dissolved Oxygen	Up to 50% of water column < 2.0 mg/L in July	
Nutrients	Surface Total Nitrogen	0.42 mg/L to 0.55 mg/L	
	Surface Total Phosphorus	0.014 mg/L to 0.018 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	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							

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

Notes: Standards revision, true color is for permitting purposes only.

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

Sampling and Assessment by the **Oklahoma Water Resources Board** – 3800 Classen Blvd, Oklahoma City, OK, 73118 – 405.530.8800 – http://www.owrb.ok.gov

Bathy map available: http://www.owrb.ok.gov/maps/PMG/owrbdata_Bathy.html

Lloyd Church (Wilburton)

Sample Period	Times Visited	Sampling Sites
December 2018 – August 2019	4	3

General

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

Parameters

	Parameter (Descriptions)	Result	Notes/Comments
In Situ	Average Turbidity	10 NTU	100% of values < 25 NTU (n=12)
	Average Secchi Depth	99 cm	
	Water Clarity Rating	Excellent	
	Chlorophyll-a	5.3 mg/m3	
	Trophic State Index	47	Previous value = 46
	Trophic Class	Mesotrophic	
Profile	Salinity	0.02 – 0.04 ppt	
	Specific Conductivity	42.6 – 82.6 µS/cm	
	pH	6.05 – 7.48 pH units	40% of values <6.5 pH units
	Oxidation-Reduction Potential	76.1 -596.8 mV	
	Dissolved Oxygen	Up to 53% of water column < 2 mg/L in September	
Nutrients	Surface Total Nitrogen	0.27 mg/L to 0.44 mg/L	
	Surface Total Phosphorus	0.013 mg/L to 0.029 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	NS	NS	NEI	S							
Aesthetics					S	*					
Agriculture							S	S	S		
Primary Body Contact Recreation										S	
Public & Private Water Supply											

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

Notes

* Standards revision, true color is for permitting purposes only

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

Sampling and Assessment by the Oklahoma Water Resources Board – 3800 Classen Blvd, Oklahoma City, OK, 73118 – 405.530.8800 – http://www.owrb.ok.gov
Bathy map available: http://www.owrb.ok.gov/maps/PMG/owrbdata_Bathy.html

Lee Creek at Short

Sample Record	Biological Collections	Station ID
January 2003 - Current	Gaging Data	220200050010-001AT

Stream Data

County	Sequoyah	Request Data by Email
Location	West of the Town of Short on State Highway 101	
Latitude/Longitude	35.56589868, -94.53152717	
Planning Watershed	Lower Arkansas (8-digit HUC - 11110104)	

Parameters

	Parameter (Descriptions)	n	Mean	Median	Min./Max	p25/p75	Comments
In-Situ	Water Temperature (°C)	164	17.2	16.2	0.2/32.3	10.0/24.7	
	Turbidity (NTU)	164	9	5	1/124	4/9	
	pH (units)	164	7.60	7.58	6.31/8.70	7.36/7.84	
	Dissolved Oxygen (mg/L)	164	9.41	9.10	5.23/14.60	7.75/11.14	
	Hardness (mg/L)	162	46	42	<10/130	35/54	
Minerals	Total Dissolved Solids (mg/L)	167	61	60	<10/173	48/69	
	Specific Conductivity (uS/cm)	163	96	94	<10/266	77/107	
	Chloride (mg/L)	101	<10	<10	<10/11	<10/<10	
	Sulfate (mg/L)	101	<10	<10	<10/49	<10/<10	
Nutrients	Total Phosphorus (mg/L)	166	0.013	<0.010	<0.010/0.149	<0.010/0.016	
	Total Nitrogen (mg/L)	166	0.27	0.22	<0.10/1.67	0.13/0.33	
	Nitrate/Nitrite (mg/L)	144	0.12	0.06	<0.05/1.62	<0.05/0.14	
	Chlorophyll A (mg/m^3)	135	2.2	0.8	<0.1/92.0	0.4/1.6	TSI=38.3
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	52	437	<10	<10/7100	<10/53	
	E. Coli (cfu/100ml)(*-Geo. Mn.)	52	125	<10	<10/2359	<10/35	

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	Sulfates	Nitrates	Chlorides	Total Dissolved Solids	Bacteria	Bio. Fish	Bio. BMI	Sediment	Total Phosphorus
Fish & Wildlife Propagation	S	S	S	NS						S	S	S	
Aesthetics												NEI	NEI
Agriculture					S		S	S					
Primary Body Contact Recreation									S				
Public & Private Water Supply				S									
Fish Consumption				S									

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

Notes *Fish & Wildlife Propagation not supporting for Lead*

Little Lee Creek at Nicut

Sample Record	Biological Collections	Station ID
February 2008 - Current	Gaging Data	220200050040-001AT

Stream Data

County	Sequoyah	Request Data by Email
Location	West of the Town of Short on State Highway 101	
Latitude/Longitude	35.573236, -94.556816	
Planning Watershed	Lower Arkansas (8-digit HUC - 11110104)	

Parameters

	Parameter (Descriptions)	n	Mean	Median	Min./Max	p25/p75	Comments
In-Situ	Water Temperature (°C)	119	16.7	16.0	0.3/31.4	9.8/23.3	
	Turbidity (NTU)	121	8	3	0/223	2/5	
	pH (units)	120	7.61	7.57	6.30/8.56	7.43/7.85	
	Dissolved Oxygen (mg/L)	120	9.82	9.69	5.01/14.47	8.22/11.82	
	Hardness (mg/L)	118	64	61	36/140	53/71	
Minerals	Total Dissolved Solids (mg/L)	126	86	84	48/204	72/98	
	Specific Conductivity (uS/cm)	118	141	136	69/314	115/154	
	Chloride (mg/L)	61	<10	<10	<10/<10	<10/<10	
	Sulfate (mg/L)	61	<10	<10	<10/15	<10/<10	
Nutrients	Total Phosphorus (mg/L)	120	0.013	<0.010	<0.010/0.259	<0.010/<0.010	
	Total Nitrogen (mg/L)	120	0.22	0.17	<0.10/1.41	<0.10/0.25	
	Nitrate/Nitrite (mg/L)	120	0.10	<0.05	<0.05/0.96	<0.05/0.11	
	Chlorophyll A (mg/m^3)	98	0.8	0.6	<0.1/6.4	0.3/0.9	TSI=28.8
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	14	218	<10	<10/2420	<10/16	
	E. Coli (cfu/100ml)(*-Geo. Mn.)	14	531	<10	<10/6488	<10/33	

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	Sulfates	Nitrates	Chlorides	Total Dissolved Solids	Bacteria	Bio. Fish	Bio. BMI	Sediment	Phosphorus
Fish & Wildlife Propagation	S	S	S	S						S	S	S	
Aesthetics												NEI	NEI
Agriculture					S		S	S					
Primary Body Contact Recreation									NEI				
Public & Private Water Supply				S		S			S				
Fish Consumption				S									

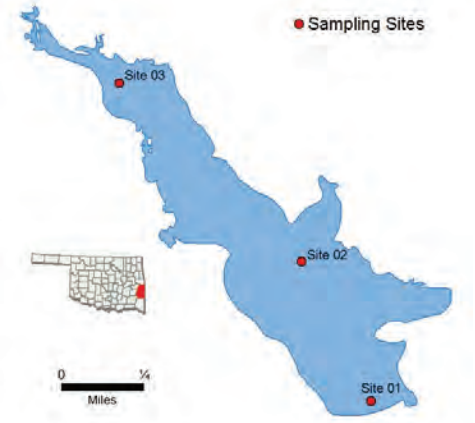
S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

Notes

Sampling and Assessment by the **Oklahoma Water Resources Board** – 3800 Classen Blvd, Oklahoma City, OK, 73118 – 405.530.8800 – http://www.owrb.ok.gov

New Spiro

Sample Period	Times Visited	Sampling Sites
November 2017 – July 2018	4	5



General

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

Parameters

	Parameter (Descriptions)	Result	Notes/Comments
In Situ	Average Turbidity	14 NTU	8% of values > OWQS of 25 NTU (n=12)
	Average Secchi Disk Depth	54 cm	
	Water Clarity Rating	Good	
	Chlorophyll-a	37.37 mg/m3	
	Trophic State Index	66	Previous value = 48
	Trophic Class	Hypereutrophic	
Profile	Salinity	0.05 – 0.09 ppt	
	Specific Conductivity	85.9 – 199.7 µS/cm	
	pH	5.91 – 7.84 pH units	39% < 6.5 pH & 8% > 9.0 pH
	Oxidation-Reduction Potential	29.8 – 577.3 mV	
	Dissolved Oxygen	Up to 47% of water column < 2.0 mg/L in July	Occurred at site 1
Nutrients	Surface Total Nitrogen	1.035 mg/L to 2.21 mg/L	
	Surface Total Phosphorus	0.068 mg/L to 0.229 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	En & E. coli	Chlor-a
Fish & Wildlife Propagation	S	S	NS	S							
Aesthetics					NEI	*					
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

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

*Standards revision, true color is for permitting purposes only

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

Sampling and Assessment by the Oklahoma Water Resources Board – 3800 Classen Blvd, Oklahoma City, OK, 73118 – 405.530.8800 – http://www.owrb.ok.gov

Bathy map available: http://www.owrb.ok.gov/maps/PMG/owrbdata_Bathy.html

Poteau River at Heavener

Sample Record	Biological Collections	Station ID
November 1998 – December 2012	Gaging Data	220100020010-001AT

Stream Data

County	Le Flore	Request Data By Email
Location	South of the Town of Heavener on US Highway 59	
Latitude/Longitude	34.85833476, -94.62923436	
Planning Watershed	Lower Arkansas (8-digit HUC - 11110105)	

Parameters

	Parameter (Descriptions)	n	Mean	Median	Min./Max	p25/p75	Comments
In-Situ	Water Temperature (°C)	117	19.1	19.8	1.8/35.9	12.2/26.3	
	Turbidity (NTU)	118	22	16	0/152	10/24	
	pH (units)	117	7.28	7.25	5.96/8.97	6.92/7.64	
	Dissolved Oxygen (mg/L)	120	8.21	7.88	3.77/16.00	6.58/9.77	
	Hardness (mg/L)	117	49	36	<10/188	22/63	
Minerals	Total Dissolved Solids (mg/L)	137	88	65	<10/311	39/117	
	Specific Conductivity (uS/cm)	117	136	101	<10/486	57/183	
	Chloride (mg/L)	76	<10	<10	<10/53	<10/<10	
	Sulfate (mg/L)	76	36	21	<10/146	16/40	
Nutrients	Total Phosphorus (mg/L)	112	0.075	0.054	<0.010/0.430	0.038/0.083	
	Total Nitrogen (mg/L)	110	0.66	0.62	0.17/1.62	0.46/0.76	
	Nitrate/Nitrite (mg/L)	55	0.16	0.10	<0.05/0.74	<0.05/0.23	
	Chlorophyll A (mg/m^3)	13	9.5	9.4	1.8/29.7	3.4/13.0	TSI=52.7
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	28	65	20	<10/400	<10/80	Mean>OWQS
	E. Coli (cfu/100ml)(*-Geo. Mn.)	28	58	31	<10/393	18/51	

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	Sulfates	Nitrates	Chlorides	Total Dissolved Solids	Bacteria	Bio. Fish	Bio. BMI	Sediment
Fish & Wildlife Propagation	S	S	S	S						S	NEI	S
Aesthetics												S
Agriculture					S		S	S				
Primary Body Contact Recreation									NS			
Public & Private Water Supply				NEI		NEI			NEI			
Fish Consumption				S								

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

Notes

Sampling and Assessment by the **Oklahoma Water Resources Board** – 3800 Classen Blvd, Oklahoma City, OK, 73118 – 405.530.8800 – http://www.owrb.ok.gov

Poteau River at Pocola

Sample Record	Biological Collections	Station ID
November 1998 - Current	Gaging Data	220100010010-001AT

Stream Data

County	Le Flore	Request Data By Email
Location	West of the Town of Pocola on E1220 Rd	
Latitude/Longitude	35.23864842, -94.52021262	
Planning Watershed	Lower Arkansas (8-digit HUC -11110105)	

Parameters

	Parameter (Descriptions)	n	Mean	Median	Min./Max	p25/p75	Comments
In-Situ	Water Temperature (°C)	164	18.5	19.0	2.9/34.6	11.7/25.8	
	Turbidity (NTU)	166	74	51	11/476	35/86	13% of values>OWQS
	pH (units)	166	7.27	7.22	5.39/8.99	6.97/7.61	
	Dissolved Oxygen (mg/L)	167	8.13	7.87	3.31/15.94	6.28/9.76	
	Hardness (mg/L)	169	48	46	<10/197	33/57	
Minerals	Total Dissolved Solids (mg/L)	188	95	88	<10/675	56/116	
	Specific Conductivity (uS/cm)	165	141	128	<10/530	84/178	
	Chloride (mg/L)	104	<10	<10	<10/33	<10/<10	
	Sulfate (mg/L)	104	36	34	<10/88	25/45	
Nutrients	Total Phosphorus (mg/L)	172	0.128	0.112	0.017/0.416	0.078/0.152	
	Total Nitrogen (mg/L)	169	1.07	0.92	0.17/6.45	0.77/1.21	
	Nitrate/Nitrite (mg/L)	110	0.32	0.20	<0.05/1.87	0.10/0.40	
	Chlorophyll A (mg/m^3)	85	16.6	14.6	1.9/77.3	8.6/19.3	TSI=58.1
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	38	142	31	<10/2420	20/59	
	E. Coli (cfu/100ml)(*-Geo. Mn.)	38	101	23	<10/2420	<10/49	

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	Sulfates	Nitrates	Chlorides	Total Dissolved Solids	Bacteria	Bio. Fish	Bio. BMI	Sediment
Fish & Wildlife Propagation	NS	S	S	NS						S	S	S
Aesthetics												S
Agriculture					S		S	S				
Primary Body Contact Recreation									S			
Public & Private Water Supply				NEI		NEI			NEI			
Fish Consumption				NS								

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

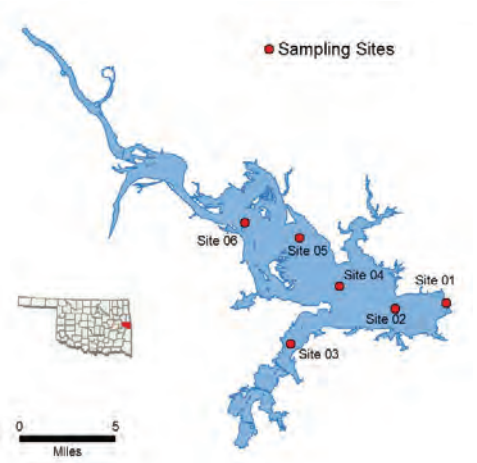
Notes

Fish & Wildlife Propagation not supporting for Lead
Fish Consumption not supporting for Lead

Sampling and Assessment by the **Oklahoma Water Resources Board** – 3800 Classen Blvd, Oklahoma City, OK, 73118 – 405.530.8800 – http://www.owrb.ok.gov

Robert S. Kerr

Sample Period	Times Visited	Sampling Sites
November 2015 – September 2016	4	6



General

Location	Sequoyah County
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	28NTU	42% of values > 25 NTU
	Average Secchi Depth	36 cm	
	Water Clarity Rating	Fair	
	Chlorophyll-a	17.9 mg/m3	
	Trophic State Index	59	Previous value = 56
	Trophic Class	Eutrophic	
Profile	Salinity	0.19– 0.44 ppt	
	Specific Conductivity	402.6 – 888.8 µS/cm	
	pH	7.66 – 8.26 pH units	Neutral to slightly alkaline
	Oxidation-Reduction Potential	-9.2.8 to 356.1 mV	
	Dissolved Oxygen	All data are above screening level of 2.0 mg/L	
Nutrients	Surface Total Nitrogen	0.61mg/L to 0.98 mg/L	
	Surface Total Phosphorus	0.062 mg/L to 0.172 mg/L	
	Nitrogen to Phosphorus Ratio	6:1	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	Enterro. & E. coli	Chlor-a
Fish & Wildlife Propagation	NS	S	S	NEI							
Aesthetics					S	*					
Agriculture							S	S	S		
Primary Body Contact Recreation										NEI	
Public & Private Water Supply				NEI							

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

Notes

*Standards revision, true color is for permitting purposes only

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

Sampling and Assessment by the Oklahoma Water Resources Board – 3800 Classen Blvd, Oklahoma City, OK, 73118 – 405.530.8800 – http://www.owrb.ok.gov

Sager Creek at West Siloam Springs

Sample Record	Biological Collections	Station ID
November 1998 – December 2012	Gaging Data	121700060080-001AT

Stream Data

County	Delaware	Request Data By Email
Location	West of the Town of West Siloam Springs off US Highway 412	
Latitude/Longitude	36.20164298, -94.60538182	
Planning Watershed	Lower Arkansas (8-digit HUC - 11110103)	

Parameters

	Parameter (Descriptions)	n	Mean	Median	Min./Max	p25/p75	Comments
In-Situ	Water Temperature (°C)	109	17.4	17.2	5.9/29.2	12.7/22.0	
	Turbidity (NTU)	107	3	1	1/55	1/2	
	pH (units)	108	7.71	7.72	6.59/8.65	7.47/7.97	
	Dissolved Oxygen (mg/L)	113	9.09	8.76	4.66/15.35	8.05/10.19	21% of values<OWQS and 13% of values<alt OWQS
	Hardness (mg/L)	108	132	134	<10/198	120/146	
Minerals	Total Dissolved Solids (mg/L)	129	269	269	<10/657	222/310	
	Specific Conductivity (uS/cm)	109	425	427	164/713	359/494	
	Chloride (mg/L)	100	36	34	<10/95	23/47	
	Sulfate (mg/L)	100	25	21	<10/64	16/29	
Nutrients	Total Phosphorus (mg/L)	114	1.117	1.040	0.012/3.965	0.649/1.485	
	Total Nitrogen (mg/L)	113	7.44	7.18	2.32/17.53	4.92/9.01	
	Nitrate/Nitrite (mg/L)	51	6.48	5.67	2.01/17.50	3.78/8.54	
	Chlorophyll A (mg/m^3)	54	1.6	0.7	<0.1/8.3	0.4/2.4	TSI=35.5
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	56	512	109	<10/9700	39/425	Mean>OWQS
	E. Coli (cfu/100ml)(*-Geo. Mn.)	56	217	31	<10/4360	<10/98	

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	Sulfates	Nitrates	Chlorides	Total Dissolved Solids	Bacteria	Bio. Fish	Bio. BMI	Sediment
Fish & Wildlife Propagation	S	S	NS	S						S	S	S
Aesthetics												NEI
Agriculture					S		S	S				
Primary Body Contact Recreation									NS			
Public & Private Water Supply				S		S			S			
Fish Consumption				S								

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

Notes

Sampling and Assessment by the **Oklahoma Water Resources Board** – 3800 Classen Blvd, Oklahoma City, OK, 73118 – 405.530.8800 – http://www.owrb.ok.gov

Stilwell City

Sample Period	Times Visited	Sampling Sites
December 2015 – October 2016	3	5

General

Location	Adair County
Impoundment	1965
Area	188 acres
Capacity	3,110 acre-feet
Purposes	Water Supply, Recreation, Flood Control

Parameters

	Parameter (Descriptions)	Result	Notes/Comments
In Situ	Average Turbidity	14 NTU	33% of values > OWQS of 25 NTU
	Average Secchi Disk Depth	69 cm	100% of values < OWQS of 70
	Water Clarity Rating	Average	
	Chlorophyll-a	9.6mg/m3	
	Trophic State Index	53	Previous value = 54
	Trophic Class	Eutrophic	
Profile	Salinity	0.06 – 0.12 ppt	
	Specific Conductivity	117.3 – 249.5 µS/cm	
	pH	6.74 – 8.03 pH units	
	Oxidation-Reduction Potential	64 – 459 mV	
	Dissolved Oxygen	Up to 54% of water column < 2 mg/L in October	Occurred at site 1, the dam
Nutrients	Surface Total Nitrogen	0.63 mg/L to 1.24 mg/L	
	Surface Total Phosphorus	0.027 mg/L to 0.281 mg/L	
	Nitrogen to Phosphorus Ratio	7:1	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	Enterro. & E. coli	Chlor-a
Fish & Wildlife Propagation	NS	S	NS	S							
Aesthetics					S	S					
Agriculture							S	S	S		
Primary Body Contact Recreation										S	
Public & Private Water Supply											

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

Notes: *Standards revision, true color is for permitting purposes only

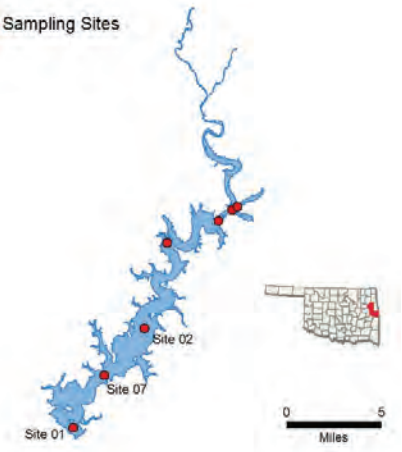
NTU = nephelometric turbidity units
µS/cm = microsiemens per centimeter
E. coli = Escherichia coli
OWQS = Oklahoma Water Quality Standards
mV = millivolts
Chlor-a = Chlorophyll-a
mg/L = milligrams per liter
µS/cm = microsiemens/cm
ppt = parts per thousand
En = Enterococci

Sampling and Assessment by the Oklahoma Water Resources Board – 3800 Classen Blvd, Oklahoma City, OK, 73118 – 405.530.8800 – http://www.owrb.ok.gov

Bathy map available: http://www.owrb.ok.gov/maps/PMG/owrbdata_Bathy.html

Tenkiller (1,2,7)

Sample Period	Times Visited	Sampling Sites
October 2016 – July 2017	4	7



General

Location	Sequoyah County
Impoundment	1953
Area	12,900 acres
Capacity	654,100 acre-feet
Purposes	Flood Control, Hydropower

Parameters

	Parameter (Descriptions)	Result	Notes/Comments
In Situ	Average Turbidity	3 NTU	100% of values < OWQS of 25 NTU
	Average Secchi Disk Depth	215 cm	
	Water Clarity Rating	Excellent	
	Chlorophyll-a	7.77 mg/m3	
	Trophic State Index	51	Previous value = 56
	Trophic Class	Eutrophic	
Profile	Salinity	0.08 – 0.12 ppt	
	Specific Conductivity	165.1 – 254.9 µS/cm	
	pH	6.48– 8.71 pH units	
	Oxidation-Reduction Potential	68.9-465.5 mV	
	Dissolved Oxygen	Up to 79% of water column < 2 mg/L	
Nutrients	Surface Total Nitrogen	0.25 mg/L to 0.99 mg/L	
	Surface Total Phosphorus	0.010 mg/L to 0.021 mg/L	
	Nitrogen to Phosphorus Ratio	31:1	Possibly co-limited for this sample year

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	NS	NEI							
Aesthetics					NEI	*					
Agriculture							N/A	N/A	S		
Primary Body Contact Recreation										S	
Public & Private Water Supply				NEI							

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

Notes

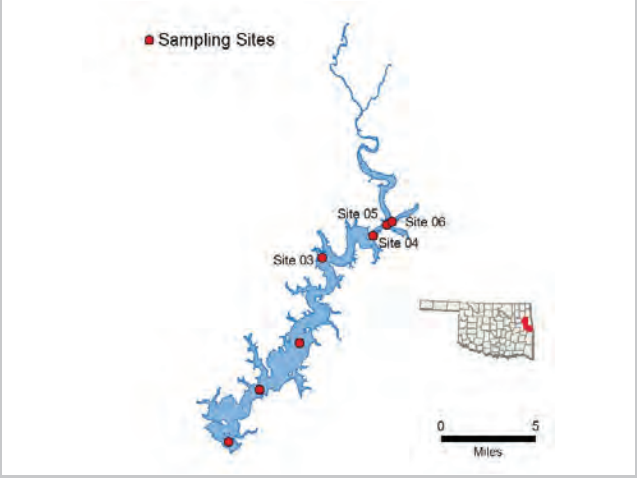
*The lake is listed in the WQS as a NLW indicating that the Aesthetics beneficial use is considered threatened by nutrients until studies can be conducted to confirm non-support status.
**N/A – parameters not collected in current sample year.*

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

Sampling and Assessment by the Oklahoma Water Resources Board – 3800 Classen Blvd, Oklahoma City, OK, 73118 – 405.530.8800 – http://www.owrb.ok.gov

Tenkiller, Illinois River Arm (3-6)

Sample Period	Times Visited	Sampling Sites
October 2016 – July 2017	4	7



General

Location	Sequoyah County
Impoundment	1953
Area	12,900 acres
Capacity	654,100 acre-feet
Purposes	Flood Control, Hydropower

Parameters

	Parameter (Descriptions)	Result	Notes/Comments
In Situ	Average Turbidity	28 NTU	19% of values > OWQS of 25 NTU
	Average Secchi Disk Depth	66 cm	
	Water Clarity Rating	Average	
	Chlorophyll-a	21.7 mg/m3	
	Trophic State Index	61	Previous value = 59
	Trophic Class	Hypereutrophic	
Profile	Salinity	0.07 – 0.15 ppt	
	Specific Conductivity	154.4 – 316 µS/cm	
	pH	6.81 – 8.9 pH units	
	Oxidation-Reduction Potential	98.2-422.3 mV	
	Dissolved Oxygen	Up to 70% of water column < 2 mg/L at site 3.	
Nutrients	Surface Total Nitrogen	0.33 mg/L to 2.49 mg/L	
	Surface Total Phosphorus	0.022 mg/L to 0.232 mg/L	
	Nitrogen to Phosphorus Ratio	14:1	Possibly co- limited for this sample year

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	NEI	NEI							
Aesthetics					NEI	*					
Agriculture							S	S	S		
Primary Body Contact Recreation										S	
Public & Private Water Supply				NEI							NS

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

Notes

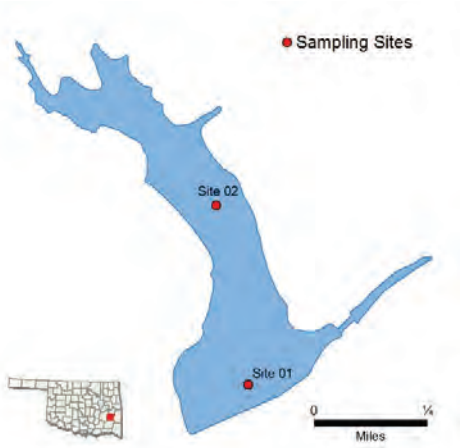
*The lake is listed in the WQS as a NLW indicating that the Aesthetics beneficial use is considered threatened by nutrients until studies can be conducted to confirm non-support status.

NTU = nephelometric turbidity units
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

Sampling and Assessment by the Oklahoma Water Resources Board – 3800 Classen Blvd, Oklahoma City, OK, 73118 – 405.530.8800 – http://www.owrb.ok.gov

Wayne Wallace

Sample Period	Times Visited	Sampling Sites
November 2016 – August 2017	4	5



General

Location	Latimer County
Impoundment	1969
Area	94 acres
Capacity	1,746 acre feet
Purposes	Flood Control and Recreation

Parameters

	Parameter (Descriptions)	Result	Notes/Comments
	Average Turbidity	6 NTU	100% of values < OWQS of 25 NTU (n=6)
	Average Secchi Disk Depth	90 cm	
	Water Clarity Rating	Good	
	Chlorophyll-a	13.75 mg/m3	
	Trophic State Index	56	Previous value = 63
	Trophic Class	Eutrophic	
Profile	Salinity	0.02 – 0.04 ppt	
Profile	Specific Conductivity	53.1 – 83.1 µS/cm	
Profile	pH	5.94 – 7.61 pH units	9.8% of recorded values are < 6.5 pH units
Profile	Oxidation-Reduction Potential	231.9 – 573.3 mV	
Profile	Dissolved Oxygen	Up to 40% of water column < 2 mg/L in August	
Nutrients	Surface Total Nitrogen	0.38 mg/L to 0.64 mg/L	
Nutrients	Surface Total Phosphorus	0.017 mg/L to 0.031 mg/L	
Nutrients	Nitrogen to Phosphorus Ratio	20:1	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	NS	S							
Aesthetics					S	*					
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 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. * Standards revision, true color is for permitting purposes only.

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

Sampling and Assessment by the Oklahoma Water Resources Board – 3800 Classen Blvd, Oklahoma City, OK, 73118 – 405.530.8800 – http://www.owrb.ok.gov

Webbers Falls

Sample Period	Times Visited	Sampling Sites
February 2019	1**	6

General

Location	Muskogee County	Click map for site data
Impoundment	1965	
Area	11,600 acres	
Capacity	170,100 acre-feet	
Purposes	Navigation, Hydropower	

Parameters

	Parameter (Descriptions)	Result	Notes/Comments
In-Situ	Average Turbidity	16 NTU	0% of values > OWQS of 25 NTU
	Average Secchi Disk Depth	56.2 cm	
	Water Clarity Rating	Poor	
	Chlorophyll-a	21.22 mg/m3	
	Trophic State Index	61	Previous value = 52
	Trophic Class	Hypereutrophic	
Profile	Salinity	0.26 – 0.49 ppt	
	Specific Conductivity	528.1 – 997.3 µS/cm	
	pH	8.07 – 8.20 pH units	
	Oxidation-Reduction Potential	395.5 – 409.0 mV	
	Dissolved Oxygen	All data are above screening level of 2.0 mg/L	
Nutrients	Surface Total Nitrogen	1.25 mg/L to 1.48 mg/L	
	Surface Total Phosphorus	0.144 mg/L to 0.154 mg/L	
	Nitrogen to Phosphorus Ratio	10:1	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					S	*					
Agriculture							S	S	S		
Primary Body Contact Recreation										NS	
Public & Private Water Supply											

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

Notes

*Standards revision, true color is for permitting purposes only.
**Only one visit in SY19 due to extreme flooding

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

Sampling and Assessment by the Oklahoma Water Resources Board – 3800 Classen Blvd, Oklahoma City, OK, 73118 – 405.530.8800 – http://www.owrb.ok.gov

Wister

Sample Period	Times Visited	Sampling Sites
November 2017 – July 2018	4	5

General

Location	LeFlore County
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	24 NTU	25% of values > OWQS 25 NTU
	Average Secchi Disk Depth	45 cm	
	Water Clarity Rating	Fair	
	Chlorophyll-a	22.13 mg/m3	
	Trophic State Index	61	Previous value = 62
	Trophic Class	Hypereutrophic	
Profile	Salinity	0.04 – 0.07 ppt	
	Specific Conductivity	66.6 – 158.7 µS/cm	
	pH	6.00 – 7.80 pH units	2 % of Values < 6.5 pH units
	Oxidation-Reduction Potential	26.9 to 557.3 mV	
	Dissolved Oxygen	Up to 62% of water column < 2 mg/L in July	
Nutrients	Surface Total Nitrogen	0.585 mg/L to 0.97 mg/L	
	Surface Total Phosphorus	0.042 mg/L to 0.108 mg/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	NS	NEI	S							
Aesthetics					NEI*	*					
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

*Standards revision, true color is for permitting purposes only.
*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.

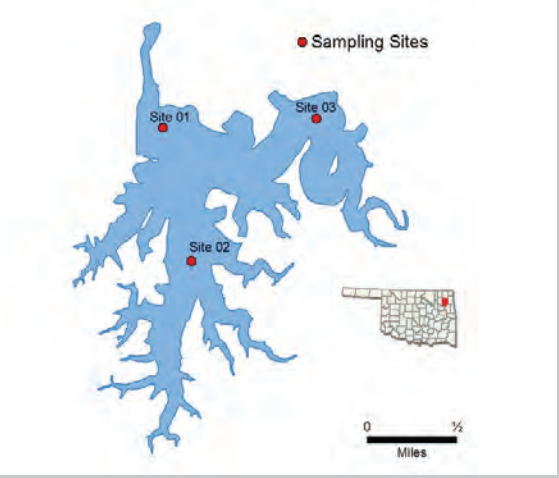
NTU = nephelometric turbidity units
µS/cm = microsiemens per centimeter
E. coli = Escherichia coli
OWQS = Oklahoma Water Quality Standards
mV = millivolts
Chlor-a = Chlorophyll-a
mg/L = milligrams per liter
µS/cm = microsiemens/cm
ppt = parts per thousand
En = Enterococci

Sampling and Assessment by the Oklahoma Water Resources Board – 3800 Classen Blvd, Oklahoma City, OK, 73118 – 405.530.8800 – http://www.owrb.ok.gov

Bathy map available: http://www.owrb.ok.gov/maps/PMG/owrbdata_Bathy.html

W.R. Holway

Sample Period	Times Visited	Sampling Sites
November 2015 – August 2016	4	5



General

Location	Mayes County
Impoundment	1968
Area	712 acres
Capacity	48,000 acre-feet
Purposes	Water Supply, Hydropower, Recreation

Parameters

	Parameter (Descriptions)	Result	Notes/Comments
In-Situ	Average Turbidity	2 NTU	100% of Values < OWQS of 25
	Average Secchi Disk Depth	147 cm	
	Water Clarity Rating	Excellent	
	Chlorophyll-a	18.9 mg/m3	
	Trophic State Index	59	Previous Value= 56
	Trophic Class	Eutrophic	
Profile	Salinity	0.09 – 0.22 ppt	
	Specific Conductivity	201.8 – 451.2 µS/cm	
	pH	6.66 – 9.00 pH units	
	Oxidation-Reduction Potential	128.5 to 514 mV	
	Dissolved Oxygen	Up to 48% of water column < 2 mg/L in summer	
Nutrients	Surface Total Nitrogen	0.41 mg/L to 0.59mg/L	
	Surface Total Phosphorus	0.042 mg/L to 0.067 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	Enterro. & E. coli	Chlor-a
Fish & Wildlife Propagation	S	S	NS	S							
Aesthetics					S	*					
Agriculture							S	S	S		
Primary Body Contact Recreation										S	
Public & Private Water Supply											

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

Notes

*Standards revision, true color is for permitting purposes only

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

Sampling and Assessment by the Oklahoma Water Resources Board – 3800 Classen Blvd. Oklahoma City, OK, 73118 – 405.530.8800 – http://www.owrb.ok.gov
Bathy map available: http://www.owrb.ok.gov/maps/PMG/owrbdata_Bathy.html

Oklahoma 2018 Integrated Report
Appendix B

Legend

Legend for Attainment	
Code	**Description**
F	Fully Supporting
N	Not Supporting
I	Insufficient Information
X	Not Assessed

USE ID	Description
124	Aesthetic
125	Agriculture
129	Emergency Water Supply
130	Cool Water Aquatic Community
131	Habitat Limited Aquatic Community
132	Trout Fishery
133	Warm Water Aquatic Community
134	Hydropower
135	Indus. & Muni. Process/Cooling Water
136	Navigation
137	Primary Body Contact Recreation
138	Public and Private Water Supply
139	Secondary Body Contact Recreation
1003	Fish Consumption
1004	Outstanding Resource
1005	Sensitive Water Supply
1006	High Quality Water

Category	Description
1	Attaining the Water Quality Standard and no use is threatened
2	Attaining some of the designated uses; no use is threatened; and insufficient or no data or information is available to determine if the remaining uses are attained or threatened
3	Insufficient or no data and information to determine if any designated use is attained
4 **4a** **4b** **4c**	Impaired or threatened for one or more designated uses but does not require the development of a TMDL • TMDL has been completed • Other pollution control requirements are reasonable expected to result in the attainment of the water quality standard in the near future • Impairment is not caused by a pollutant
5	The water quality standard is not attained. The waterbody is impaired or threatened for one or more designated uses by a pollutant(s), and requires a TMDL

ID	Description
91	Ammonia (Unionized) -Toxin
96	Arsenic
104	Barium
127	Cadmium
138	Chloride
153	Chlorpyrifos
154	Chromium (total)
163	Copper
187	Diazinon
198	Dieldrin
215	Enterococcus
217	Escherichia coli
230	Fishes Bioassessments
267	Lead
302	Nitrates
317	Oil and Grease
322	Oxygen, Dissolved
372	Selenium
375	Silver
385	Sulfates
398	Total Coliform
399	Total Dissolved Solids
400	Total Fecal Coliform
413	Turbidity
423	Zinc
441	pH
462	Total Phosphorus

ID	Description
2	Acid Mine Drainage
33	Discharges from Biosolids (SLUDGE) Storage, Application or Disposal
62	Industrial Point Source Discharge
68	Land Application of Wastewater Biosolids (Non-agricultural)
70	Leaking Underground Storage Tanks
82	Mine Tailings
84	Municipal (Urbanized High Density Area)
85	Municipal Point Source Discharges
92	On-site Treatment Systems (Septic Systems and Similar Decencentralized Systems)
100	Runoff from Permitted Confined Animal Feeding Operations (CAFOs)
102	Petroleum/natural Gas Activities (Legacy)
119	Silviculture Harvesting
124	Spills from Trucks or Trains
127	Surface Mining
140	Source Unknown
155	Natural Sources
156	Agriculture
157	Habitat Modification - other than Hydromodification

2018 Category 5 Waters for the Oklahoma/Arkansas Compact Area

TMDL Development Priority Schedule

TMDL Priority	Proposed Initiation of TMDL Development*
1	2020
2	2021-2023
3	2024-2026
4	2027-2029

*Dates are only estimates and subject to change

Waterbody ID	HUC8	Waterbody Name	Unit	Size	Causes	TMDL Priority	Potential Sources
OK120400010070_00	11110102	Webbers Falls Lake	11600	Acres	413	4	140
OK120400010120_00	11110102	Greenleaf Creek	15.31	Miles	105	3	140
OK120400010130_00	11110102	Greenleaf Lake	920	Acres	150, 274	3	140
OK120400010280_00	11110102	Bayou Manard	14.02	Miles	105	2	39, 140
OK120400020010_00	11110102	Dirty Creek	44.18	Miles	322	4	46, 59, 87, 92, 108, 111, 133, 136, 140
OK120400020030_00	11110102	Dirty Creek, South Fork	15.55	Miles	105, 385	4	39, 46, 49, 62, 85, 87, 92, 108, 111, 133, 136, 140
OK120400020110_00	11110102	Dirty Creek, Georges Fork	10.05	Miles	322, 441	4	39, 46, 87, 92, 108, 111, 133, 136, 140
OK120400020160_00	11110102	Butler Creek	10.34	Miles	322	4	46, 59, 87, 92, 108, 111, 133, 136, 140
OK120400020190_00	11110102	Elk Creek	13.96	Miles	322, 441, 385	4	46, 49, 59, 62, 85, 87, 92, 102, 108, 111, 133, 136, 140
OK120400020240_00	11110102	Shady Grove Creek	10.80	Miles	385, 399, 441	4	8, 49, 102, 140
OK121600010050_00	11070209	Fort Gibson Lake	12464	Acres	322	1	46, 108, 133, 136, 140
OK121600010060_00	11070209	Ranger Creek	7.94	Miles	441	2	140
OK121600010200_00	11070209	Fort Gibson Lake, Upper	4814	Acres	322	1	140
OK121600010280_00	11070209	Neosho River	14.26	Miles	322	2	46, 56, 62, 85, 87, 92, 108, 133, 136, 140
OK121600010430_00	11070209	Chouteau Creek	22.25	Miles	441, 322	2	46, 59, 87, 92, 108, 111, 133, 136, 140
OK121600020020_00	11070209	Hudson Lake, Lower	5802	Acres	322	1	140
OK121600020170_00	11070209	Neosho River	10.89	Miles	322, 267	3	46, 56, 62, 82, 85, 87, 92, 108, 133, 136, 140
OK121600030020_00	11070209	Grand Lake O' the Cherokees, Lower	10051	Acres	322, 267	1	82, 140
OK121600050020_00	11070209	Spavinaw Lake	1584	Acres	150	1	4, 46, 59, 92, 108, 133, 136, 140, 146
OK121600050060_00	11070209	Spavinaw Creek	3.96	Miles	322	1	140
OK121600050070_00	11070209	Eucha Lake (Upper Spavinaw)	2860	Acres	150, 322	1	4, 46, 59, 92, 108, 133, 136, 140, 146
OK121600050140_00	11070209	Brush Creek	16.51	Miles	441	2	140
OK121600050160_00	11070209	Beaty Creek	12.44	Miles	441	2	140
OK121600060060_10	11070209	Big Cabin Creek	4.16	Miles	385	3	49, 140
OK121600060200_00	11070209	Bull Creek	10.83	Miles	138, 399, 322, 385	4	4, 59, 62, 84, 85, 92, 140
OK121600060220_00	11070209	Big Cabin Creek	11.58	Miles	385	4	49, 97, 102, 140
OK121600060240_00	11070209	Pawpaw Creek	18.40	Miles	322, 385, 399	4	46, 59, 87, 92, 108, 111, 133, 136, 140, 156
OK121610000050_10	11070209	Pryor Creek	4.97	Miles	322, 441	3	8, 46, 59, 85, 87, 92, 102, 108, 111, 128, 133, 136, 140
OK121610000090_00	11070209	Pryor Creek	2.35	Miles	322	3	84, 85, 92, 140, 156
OK121610000090_10	11070209	Pryor Creek	12.12	Miles	322, 230	3	46, 49, 59, 87, 92, 102, 108, 111, 136, 140
OK121700010010_00	11110103	Illinois River	9.47	Miles	322	3	140
OK121700010020_00	11110103	Deep Branch	8.71	Miles	322, 441	3	39, 140
OK121700020020_00	11110103	Tenkiller Ferry Lake	8442	Acres	322, 462	1	140
OK121700020110_00	11110103	Chicken Creek	3.54	Miles	230	1	46, 59, 87, 92, 108, 111, 133, 136, 140
OK121700020220_00	11110103	Tenkiller Ferry Lake, Illinois River Arm	5032	Acres	150, 462	1	4, 59, 108, 136, 140, 146
OK121700020270_00	11110103	Park Hill Branch	6.86	Miles	105	3	46, 49, 59, 72, 87, 92, 102, 108, 111, 136, 140

OK121700030010_00	11110103	Illinois River	7.68	Miles	215, 462	1	4, 46, 59, 85, 92, 100, 108, 133, 136, 140, 146
OK121700030040_00	11110103	Tahlequah Creek (Town Branch)	6.21	Miles	217	1	46, 92, 108, 133, 136, 140
OK121700030080_00	11110103	Illinois River	31.68	Miles	462, 215	1	4, 46, 59, 85, 92, 100, 108, 133, 136, 140, 146
OK121700030110_00	11110103	Cedar Hollow Creek	3.60	Miles	105	1	39, 140
OK121700030280_00	11110103	Illinois River	15.65	Miles	217, 462, 413, 215	1	4, 46, 59, 85, 92, 100, 108, 133, 136, 140, 146
OK121700030290_00	11110103	Flint Creek	1.60	Miles	322, 462	1	4, 46, 59, 92, 108, 133, 136, 140, 146
OK121700030350_00	11110103	Illinois River	5.18	Miles	462	2	4, 34, 46, 59, 85, 92, 100, 108, 133, 136, 140, 146
OK121700030370_00	11110103	Ballard Creek	12.60	Miles	215	2	4, 46, 59, 92, 108, 111, 133, 136, 140
OK121700040010_00	11110103	Caney Creek	20.92	Miles	105, 215, 217	3	46, 59, 85, 92, 100, 108, 136, 140
OK121700050010_00	11110103	Illinois River, Baron Fork	25.15	Miles	462	2	4, 46, 59, 85, 92, 100, 108, 133, 136, 140, 146
OK121700050070_00	11110103	Walltrip Branch	6.90	Miles	105	2	140
OK121700050090_00	11110103	Tyner Creek	15.92	Miles	215	2	4, 46, 59, 92, 108, 136, 140
OK121700050120_00	11110103	Peacheater Creek	10.95	Miles	215	2	4, 46, 59, 92, 100, 108, 128, 136, 140
OK121700050170_10	11110103	Illinois River, Baron Fork	7.78	Miles	215	2	46, 59, 92, 108, 136, 140
OK121700060010_00	11110103	Flint Creek	7.75	Miles	462, 215	1	4, 46, 59, 85, 92, 100, 108, 111, 133, 136, 140, 146
OK121700060040_00	11110103	Battle Creek (Battle Branch)	5.43	Miles	215	1	4, 46, 59, 92, 108, 111, 133, 136, 140
OK121700060080_00	11110103	Sager Creek	4.15	Miles	105, 215, 371	1	4, 46, 59, 85, 92, 108, 133, 136, 140, 146
OK220100010010_00	11110105	Poteau River	23.89	Miles	215	2	46, 59, 85, 92, 100, 108, 136, 140
OK220100010010_10	11110105	Poteau River	1.55	Miles	215	4	46, 59, 85, 92, 100, 108, 136, 140
OK220100010010_40	11110105	Poteau River	21.35	Miles	27, 163, 267, 372, 3	2	140
OK220100010050_00	11110105	New Spiro Lake	254	Acres	322, 441, 150	1	46, 92, 108, 133, 136, 140
OK220100010160_00	11110105	Sugarloaf Creek	15.00	Miles	441	4	140
OK220100010180_00	11110105	Caston Creek	14.43	Miles	385	3	46, 49, 59, 87, 92, 102, 108, 111, 136, 140
OK220100010265_00	11110105	Rock Creek Tributary!	2.01	Miles	230	3	46, 49, 59, 87, 92, 102, 108, 111, 136, 140
OK220100020010_10	11110105	Poteau River	27.04	Miles	215, 217	1	46, 59, 85, 92, 100, 108, 136, 140
OK220100020020_00	11110105	Wister Lake	7333	Acres	60, 413, 462, 274, 4	1	140
OK220100020060_00	11110105	Cedar Lake	78	Acres	322, 274, 441	2	46, 92, 108, 133, 136, 140
OK220100020080_00	11110105	Big Creek	12.57	Miles	105, 441	2	39, 46, 62, 69, 85, 87, 92, 108, 111, 133, 136, 140
OK220100040020_00	11110105	Fourche Maline Creek	36.94	Miles	322, 441	2	46, 62, 69, 85, 87, 92, 108, 111, 133, 136, 140
OK220100040050_00	11110105	Red Oak Creek	10.95	Miles	322, 441	2	46, 85, 92, 108, 133, 136, 140
OK220100040080_00	11110105	Bandy Creek	12.44	Miles	230	2	46, 49, 59, 87, 92, 102, 108, 111, 136, 140
OK220100040100_00	11110105	Lloyd Church Lake (Wilburton City)	160	Acres	413, 441, 274	2	140
OK220100040140_00	11110105	Carlton Lake	52	Acres	274	2	140
OK220100040150_00	11110105	Wayne Wallace Lake	94	Acres	322, 274, 441	2	46, 92, 108, 133, 136, 140
OK220200010010_00	11110104	Arkansas River	20.59	Miles	215	4	46, 59, 92, 108, 136, 140
OK220200010030_10	11110104	Big Skin Bayou	18.51	Miles	441	4	39
OK220200020020_00	11110104	Robert S. Kerr Lake	43380	Acres	413	2	140
OK220200020130_10	11110104	Vian Creek	21.42	Miles	441, 322	4	39, 140
OK220200030010_10	11110104	Sallisaw Creek	9.00	Miles	215	2	140
OK220200030040_00	11110104	Brushy Creek Lake	358	Acres	413, 150, 441	2	140
OK220200030120_00	11110104	Stilwell City Lake	188	Acres	413, 322	2	46, 108, 133, 136, 140
OK220200040010_10	11110104	Sans Bois Creek	10.76	Miles	385	4	140
OK220200040010_40	11110104	Sans Bois Creek	27.80	Miles	322	4	4, 46, 59, 85, 92, 108, 133, 136, 140
OK220200050010_00	11110104	Lee Creek	1.87	Miles	215, 267	3	46, 49, 92, 108, 133, 136, 140, 146

Oklahoma Water Resources Board

Water Quality Standards Update

September 26, 2020

Water quality standards (WQS) define the goals for a waterbody and work to safeguard human health and aquatic life by establishing provisions to limit pollution to lakes and rivers. The Oklahoma Water Resources Board (OWRB) is the state agency responsible for developing and promulgating WQS to ensure water quality protection across the state of Oklahoma. OWRB staff, in cooperation with all stakeholders, work to develop and/or revise WQS, as necessary. The bullets below summarize recent program activities.

- OWRB staff have been completing the technical work to address the Illinois River Joint Study Committee Final Report recommendations and create proposed rule revisions to both the Oklahoma Water Quality Standards and the WQS Implementation Rules. This work has been done in collaboration with Oklahoma sister environmental agencies, the Oklahoma Office of the Secretary of Energy and Environment, the Cherokee Nation, and the Arkansas Department of Environmental Quality. The WQS proposed revisions include a revised total phosphorus criterion for the Illinois River, Barren Fork River, and Flint Creek. Additionally, proposed implementation revisions include critical condition language related to the criterion and revision of Oklahoma's assessment rules for the scenic river TP criterion. Staff have moved into informal stakeholder outreach. This outreach includes three public webinars scheduled (2 in September and one in early October), as well as meetings with stakeholders in both Arkansas and Oklahoma.

- A Biotic Ligand Model (BLM) is a metal bioavailability model that uses receiving water chemistry characteristics to develop water quality criteria on a site-specific basis. The copper BLM predicts toxic effect copper concentrations over a wide range of water chemistry conditions which improve precision in water quality protection, meaning aquatic life are not overprotected or under protected. A copper BLM project is currently underway for the Verdigris River directly downstream of Oologah Lake. The interested party for this project is Public Service Company of Oklahoma, Northeastern Power Plant. Water quality criteria rulemaking for this project is anticipated to be in 2021.

Additional information on Oklahoma's WQS is available on the OWRB site at http://www.owrb.ok.gov/quality/standards/standards.php or contact Monty Porter at monty.porter@owrb.ok.gov or Rebecca Veiga Nascimento at rebecca.veiga@owrb.ok.gov.

Completed TMDL's In the Arkansas-Oklahoma Compact Area: Provided by the Oklahoma Department of Environmental Quality

11070209 - Lower Neosho

Waterbody ID	Station Name	Parameter	Cause Code(s)	EPA TMDL ID	DATE
OK121600050020_00	Spavinaw Lake	Phosphorus	462	38670	6/9/2010
OK121600050070_00	Lake Eucha	Phosphorus	462	38667	6/9/2010
OK121600010430_00	Chouteau Creek	Enterococcus, E. coli	215,217	42585	9/24/2012
OK121600010440_00	Crutchfield Branch	Enterococcus, E. coli	215,217	34849	7/28/2008
OK121600010060_00	Ranger Creek	Enterococcus	215	34847	7/28/2008
OK121600010100_00	Fourteenmile Creek	Enterococcus	215	34848	7/28/2008
OK121600010010_00	Neosho River	Enterococcus	215	42581	9/27/2012
OK121600020030_10	Saline Creek	Enterococcus	215	58701	5/13/2014
OK121600020070_00	Little Saline Creek	Enterococcus	215	58702	5/13/2014
OK121600050150_00	Spavinaw Creek	Enterococcus	215	58705	5/13/2014
OK121600050160_00	Beaty Creek	Enterococcus	215	58707	5/13/2014
OK121600050180_00	Cloud Creek	Enterococcus	215	58708	5/13/2014
OK121600060080_00	Little Cabin Creek	Enterococcus, E. coli	215, 217	50980	10/1/2012
OK121610000050_10	Pryor Creek	Enterococcus, E. coli	215, 217	58709	5/13/2014
OK121610000090_00	Pryor Creek	Turbidity	413	58709	5/13/2014
OK121600010430_00	Chouteau Creek	Enterococcus, E. coli	215, 217	42582	

11110102 - Dirty-Greenleaf

Waterbody ID	Station Name	Parameter	Cause Code(s)	EPA TMDL ID	DATE
OK120400010260_00	Arkansas River	Enterococcus	215	42530	9/27/2012
OK120400020160_00	Butler Creek	Enterococcus, E. coli, Turbidity	215,217,413	42538	9/27/2012
OK120400010400_00	Coody Creek	Enterococcus, E. coli	215,217	42532	9/27/2012
OK120400020010_00	Dirty Creek	Enterococcus, Turbidity	215,413	42533	9/27/2012
OK120400020110_00	Dirty Creek, Georges Fork	Enterococcus	215	42536	9/27/2012
OK120400020030_00	Dirty Creek, South Fork	Enterococcus	215	42535	9/27/2012
OK120400020190_00	Elk Creek	Enterococcus	215	42537	9/27/2012
OK120400020240_00	Shady Grove Creek	Enterococcus	215	42539	9/27/2012

11110103 - Illinois

Waterbody ID	Station Name	Parameter	Cause Code(s)	EPA TMDL ID	DATE

11110104 - Robert S Kerr

Waterbody ID	Station Name	Parameter	Cause Code(s)	EPA TMDL ID	DATE
OK220200040010_40	Sans Bois Creek	Enterococcus, E. coli	215,217	35635	10/20/2008
OK220200040050_00	Sans Bois Creek, Mountain Fork	E. coli	217	35634	10/20/2008
OK220200030010_20	Sallisaw Creek	Enterococcus	215	58780	5/13/2014
OK220200040010_10	Sans Bois Creek	Enterococcus	215	58782	5/13/2014
OK220200040050_00	Sans Bois Creek, Mountain Fork	E. coli	217	35626	

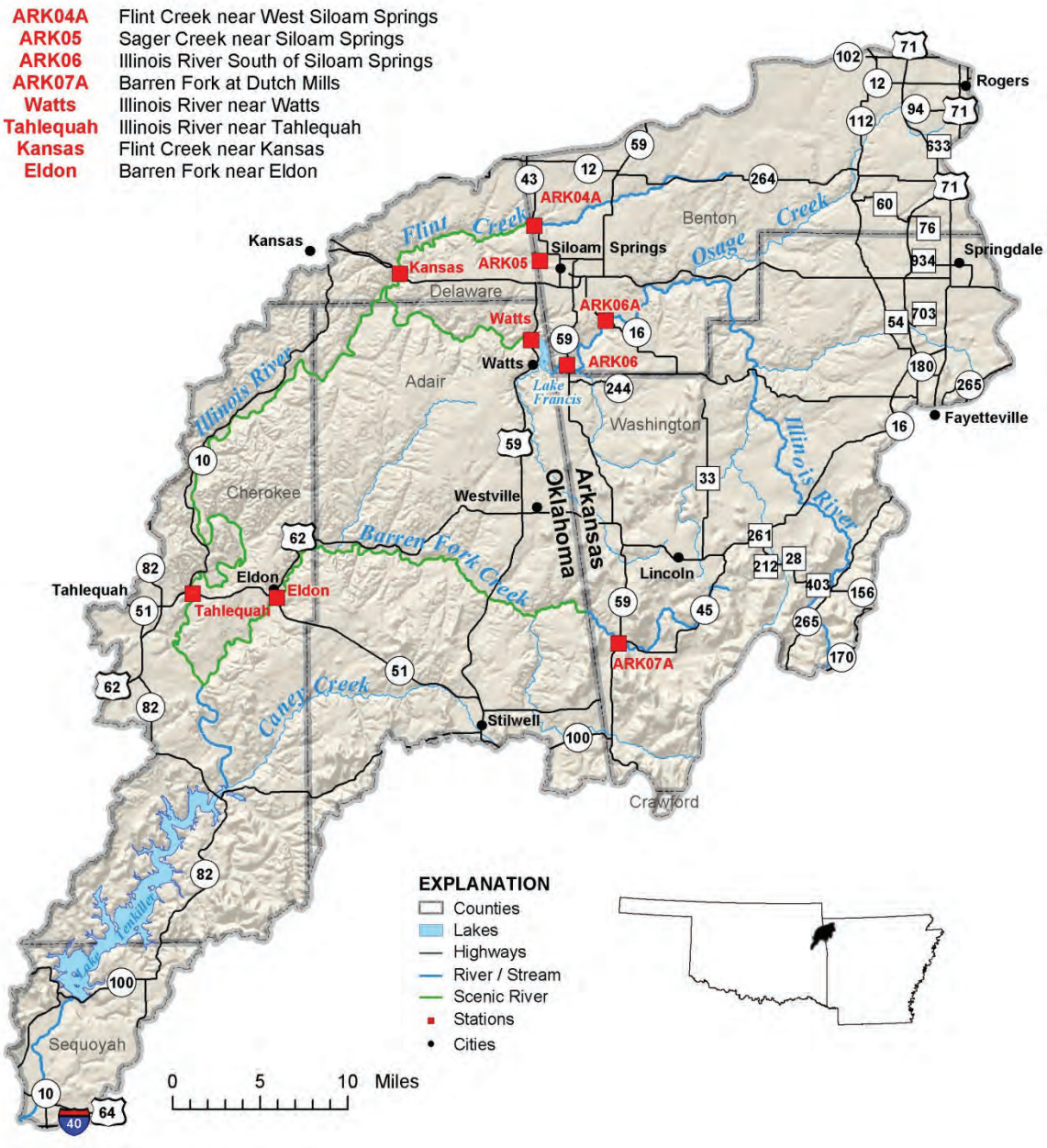
11110105 - Poteau

Waterbody ID	Station Name	Parameter	Cause Code(s)	EPA TMDL ID	DATE
OK220100040020_00	Fourche Maline Creek	Enterococcus	215	35634	10/28/2008
OK220100010010_00	Poteau River	Turbidity	413	58800	5/13/2014
OK220100010010_40	Poteau River	Turbidity	413	58820	5/13/2014
OK220100030010_00	Brazil Creek	Enterococcus	215	58760	5/13/2014

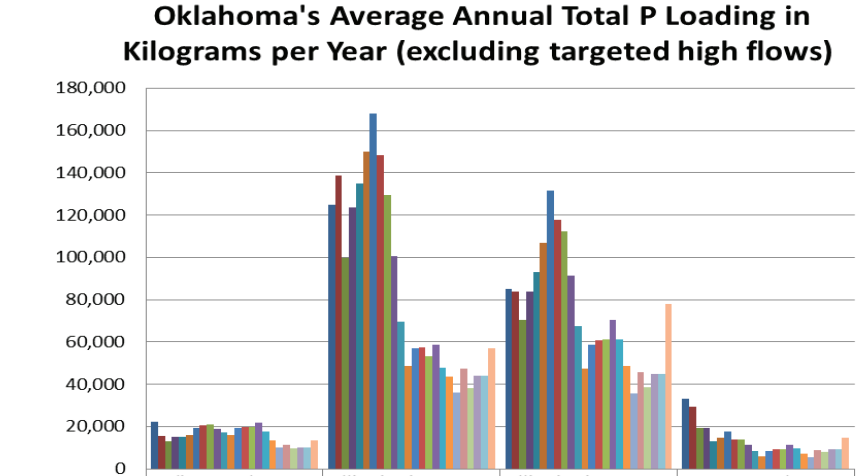
Water Quality Monitoring Report for the Illinois River Basin

Illinois River Basin

Arkansas – Oklahoma Compact



CY 2019



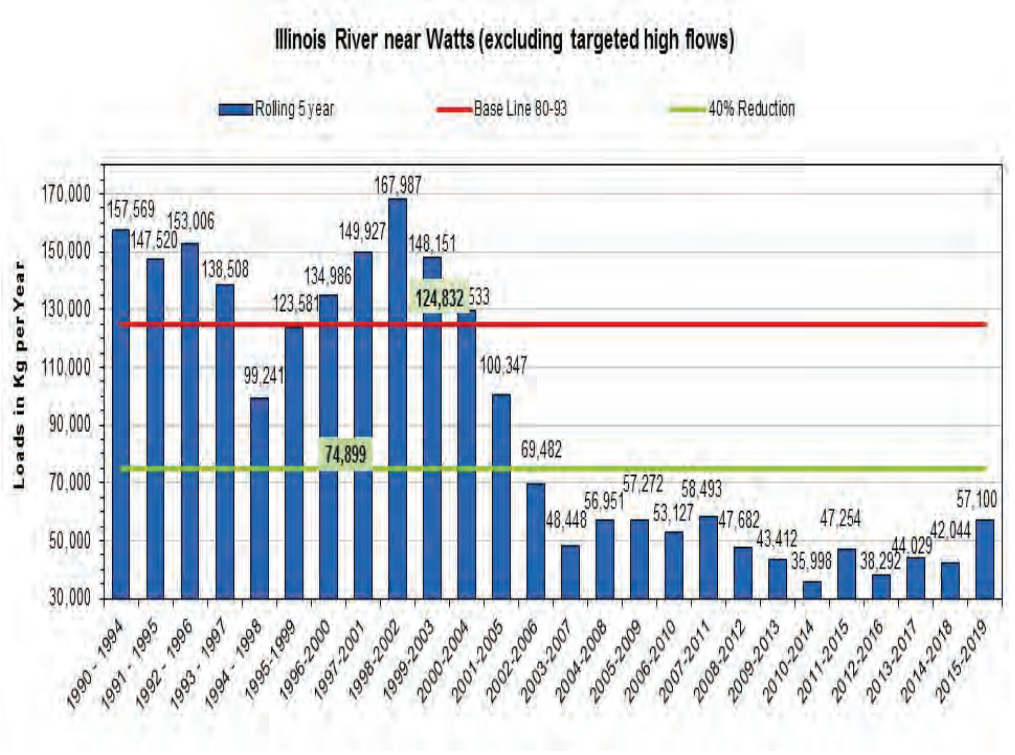
	Flint Creek near Kansas	Illinois River near Watts	Illinois River near Tahlequah	Barren Fork near Eldon
Total P 80-93	22,279	124,832	85,235	33,001
Total P 93-97	15,727	138,508	83,799	29,482
Total P 94-98	12,986	99,898	70,546	19,163
Total P 95-99	14,974	123,581	83,632	19,257
Total P 96-00	15,100	134,986	92,876	13,163
Total P 97-01	15,989	149,927	106,797	14,548
Total P 98-02	19,224	167,987	131,491	17,603
Total P 99-03	20,579	148,151	117,524	14,059
Total P 00-04	20,963	129,533	112,341	13,685
Total P 01-05	19,098	100,347	91,325	11,465
Total P 02-06	17,415	69,482	67,345	8,500
Total P 03-07	15,977	48,448	47,216	5,716
Total P 04-08	19,356	56,951	58,605	8,574
Total P 05-09	19,586	57,272	60,830	9,197
Total P 06-10	19,818	53,127	61,131	9,335
Total P 07-11	21,700	58,493	70,259	11,159
Total P 08-12	17,473	47,682	61,180	9,837
Total P 09-13	13,543	43,412	48,513	7,054
Total P 10-14	10,154	35,998	35,578	5,357
Total P 11-15	11,382	47,254	45,505	8,711
Total P 12-16	9,516	38,292	38,711	7,831
Total P 13-17	10,063	44,029	45,051	9,461
Total P 14-18	10,069	44,029	45,051	9,461
Total P 15-19	13,505	57,100	77,737	14,623

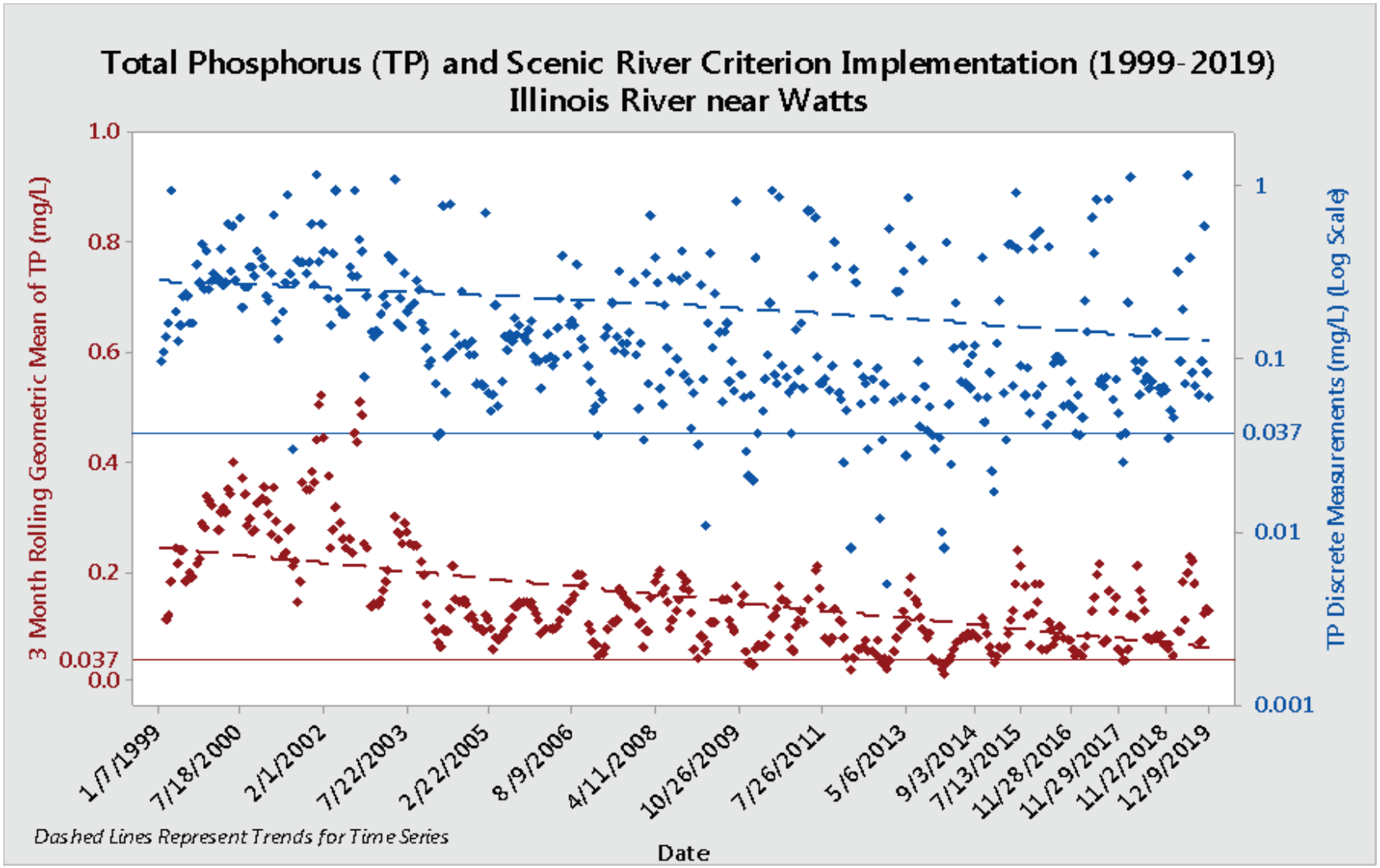
Values represent all available data, which is routinely collected and excludes targeted high flow events.

Illinois River near Watts

Illinois River near Watts			Loadings
Year	Flow (cfs)	Total P (mg/L)	Total P kg/year
1980	173	0.423	65,279
1981	260	0.190	44,119
1982	591		
1983	352		
1984	706		
1985	947		
1986	879		
1987	815		
1988	531		
1989	558	0.210	104,653
1990	1,127	0.181	182,432
1991	724	0.162	104,534
1992	760	0.161	109,571
1993	1,163	0.277	287,317
1994	674	0.168	101,127
1995	783	0.143	100,233
1996	693	0.188	116,542
1997	573	0.163	83,415
1998	713	0.138	87,876
1999	793	0.250	177,057
2000	648	0.309	178,827
2001	649	0.346	200,549
2002	619	0.316	174,694
2003	347	0.155	48,035
2004	688	0.104	63,903
2005	459	0.106	43,453
2006	349	0.116	36,156
2007	464	0.106	43,926
2008	1177	0.068	71,480
2009	915	0.069	56,386
2010	587	0.057	29,882
2011	1101	0.081	79,648
2012	336	0.052	15,594
2013	642	0.082	46,994
2014	448	0.056	22,412
2015	1364	0.061	74,303
2016	434	0.065	25,189
2017	918	0.064	52,481
2018	715	0.066	42,126
2019	1511	0.071	95,806
Average	705	0.152	95,427

Year	80-93	90-94	91-95	92-96	93-97	94-98	95-99	96-00	97-01	98-02	99-03	00-04	01-05	02-06	03-07	04-08	05-09	06-10	07-11	08-12	09-13	10-14	11-15	12-16	13-17	14-18	15-19
Pt (mg/l)	0.204	0.198	0.201	0.210	0.200	0.162	0.195	0.221	0.249	0.275	0.271	0.246	0.203	0.158	0.118	0.102	0.095	0.085	0.077	0.065	0.068	0.066	0.068	0.062	0.065	0.061	0.065
Flow (cfs)	685	890	821	815	777	687	711	684	675	684	611	590	552	492	461	627	673	698	849	823	716	746	778	690	761	776	988
Pt (kg/yr)	124,832	157,569	147,520	153,006	138,508	99,241	123,581	134,986	149,927	167,987	148,151	129,533	100,347	69,482	48,448	56,951	57,272	53,127	58,493	47,682	43,412	36,806	47,254	38,287	44,029	42,044	57,100
Decrease	0.0%	-26.2%	-18.2%	-22.6%	-11.0%	20.5%	1.0%	-8.1%	-20.1%	-34.6%	-18.7%	-3.8%	19.6%	44.3%	61.2%	54.4%	54.1%	57.4%	53.1%	61.8%	65.2%	70.5%	62.1%	69.3%	64.7%	66.3%	54.3%

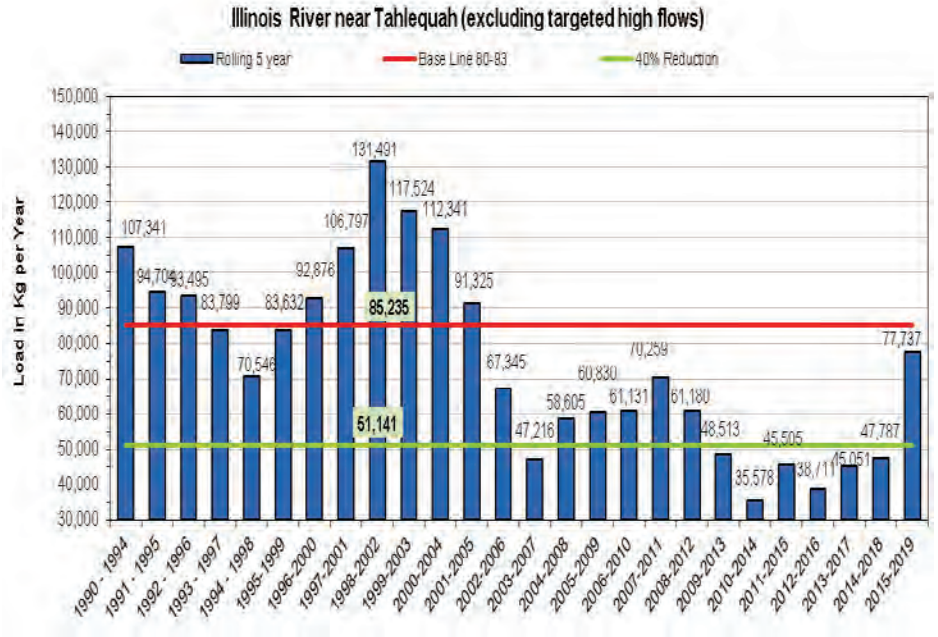


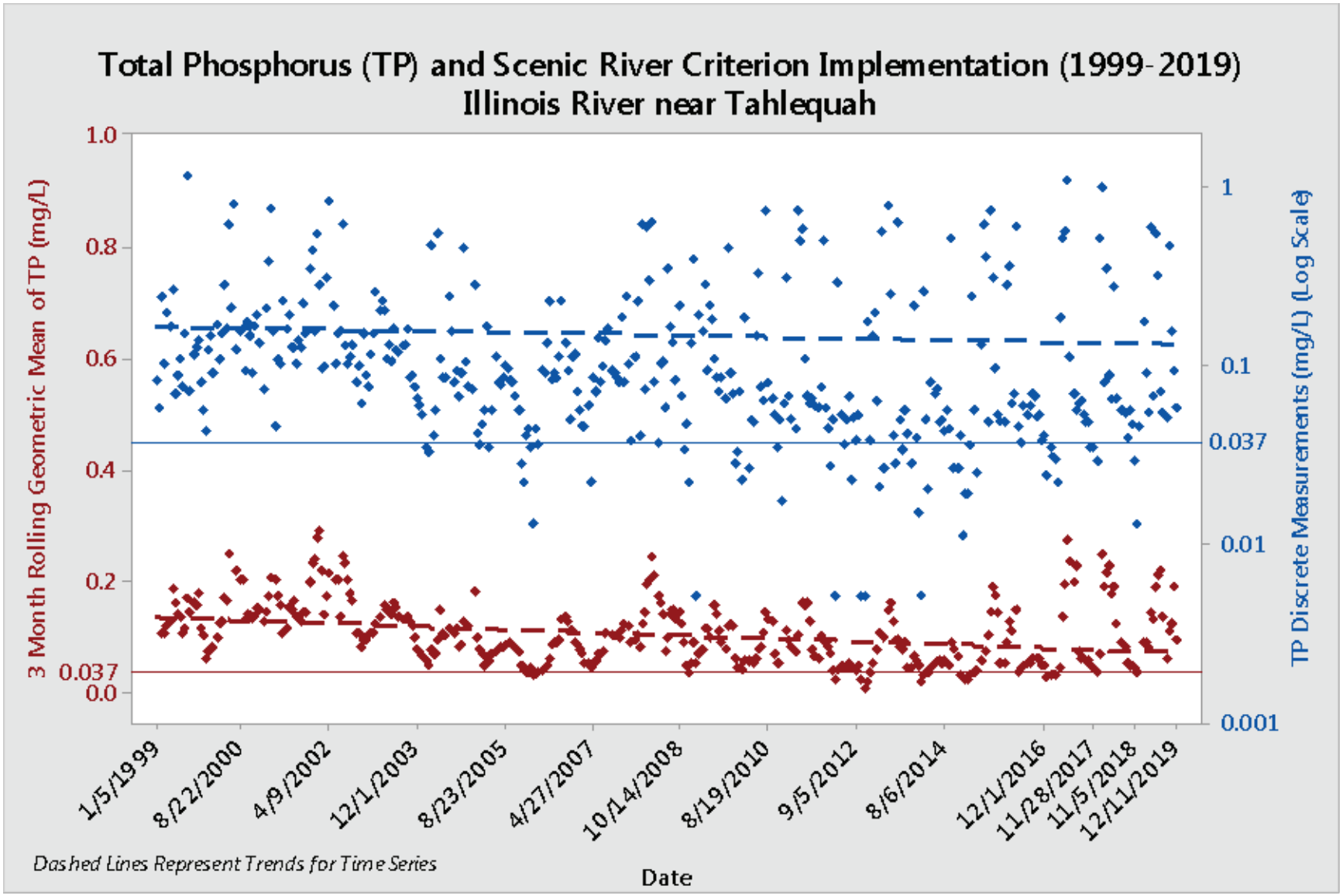

Total Phosphorus (TP) and Scenic River Criterion Implementation (1999-2019)
Illinois River near Watts
3 Month Rolling Geometric Mean of TP (mg/L)
TP Discrete Measurements (mg/L) (Log Scale)
1.0
0.8
0.6
0.4
0.2
0.037
0.0
1
0.1
0.037
0.01
0.001
1/7/1999
7/18/2000
2/1/2002
7/22/2003
2/22/2005
8/9/2006
4/11/2008
10/26/2009
7/26/2011
5/6/2013
9/3/2014
7/13/2015
11/28/2016
11/29/2017
11/2/2018
12/9/2019
Dashed Lines Represent Trends for Time Series
Date

Illinois River near Tahlequah

Illinois River Near Tahlequah			Loadings
Year	Flow (cfs)	Total P (mg/L)	Total P kg/year
1980	249		
1981	384		
1982	812		
1983	537		
1984	1,157		
1985	1,651		
1986	1,452		
1987	1,218		
1988	820		
1989	808		
1990	1,695	0.098	147,579
1991	1,094	0.079	76,796
1992	1,207	0.080	86,205
1993	1,751	0.099	154,647
1994	1,071	0.084	80,223
1995	1,123	0.080	80,229
1996	938	0.085	71,207
1997	812	0.069	49,797
1998	1,044	0.081	75,524
1999	1,143	0.121	123,518
2000	1,083	0.136	131,543
2001	1,033	0.158	145,766
2002	851	0.211	160,366
2003	478	0.100	42,690
2004	1,157	0.075	77,499
2005	712	0.060	38,148
2006	426	0.074	28,154
2007	736	0.066	43,383
2008	1,839	0.062	101,829
2009	1,407	0.072	90,475
2010	819.8	0.050	36,608
2011	1,540.8	0.058	79,813
2012	491.8	0.038	16,689
2013	946.1	0.043	36,331
2014	659.4	0.038	22,378
2015	2,174.6	0.041	79,628
2016	700.6	0.050	31,286
2017	1,219.7	0.050	54,465
2018	987.2	0.054	47,610
2019	2,308.0	0.100	206,129
Average	1,063	0.080	76,311

Year	80-93	90-94	91-95	92-96	93-97	94-98	95-99	96-00	97-01	98-02	99-03	00-04	01-05	02-06	03-07	04-08	05-09	06-10	07-11	08-12	09-13	10-14	11-15	12-16	13-17	14-18	15-19
Pt (mg/l)	0.090	0.088	0.085	0.086	0.082	0.079	0.093	0.104	0.117	0.143	0.143	0.137	0.121	0.104	0.075	0.067	0.067	0.065	0.062	0.056	0.052	0.046	0.045	0.042	0.044	0.047	0.059
Flow (cfs)	1060	1364	1249	1218	1139	998	1012	1004	1023	1031	918	920	846	725	702	974	1024	1046	1269	1220	1041	892	1163	994	1140	1148	1478
Pt (kg/yr)	85,235	107,341	94,704	93,495	83,799	70,546	83,632	92,876	106,797	131,491	117,524	112,341	91,323	67,345	47,216	58,605	60,830	61,131	70,259	61,180	48,513	35,578	45,505	37,303	45,051	47,787	77,737
Decrease	0.0%	-25.9%	-11.1%	-9.7%	1.7%	17.2%	1.9%	-9.0%	-25.3%	-54.3%	-37.9%	-31.8%	-7.1%	21.0%	44.6%	31.2%	28.6%	28.3%	17.6%	28.2%	43.1%	58.3%	46.6%	56.2%	47.1%	43.9%	8.8%

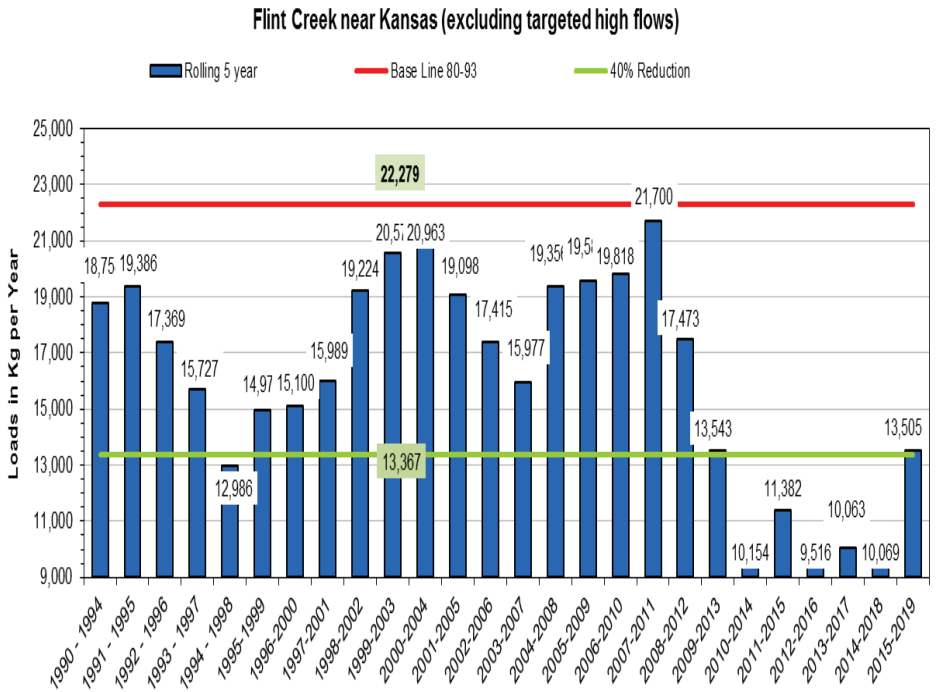


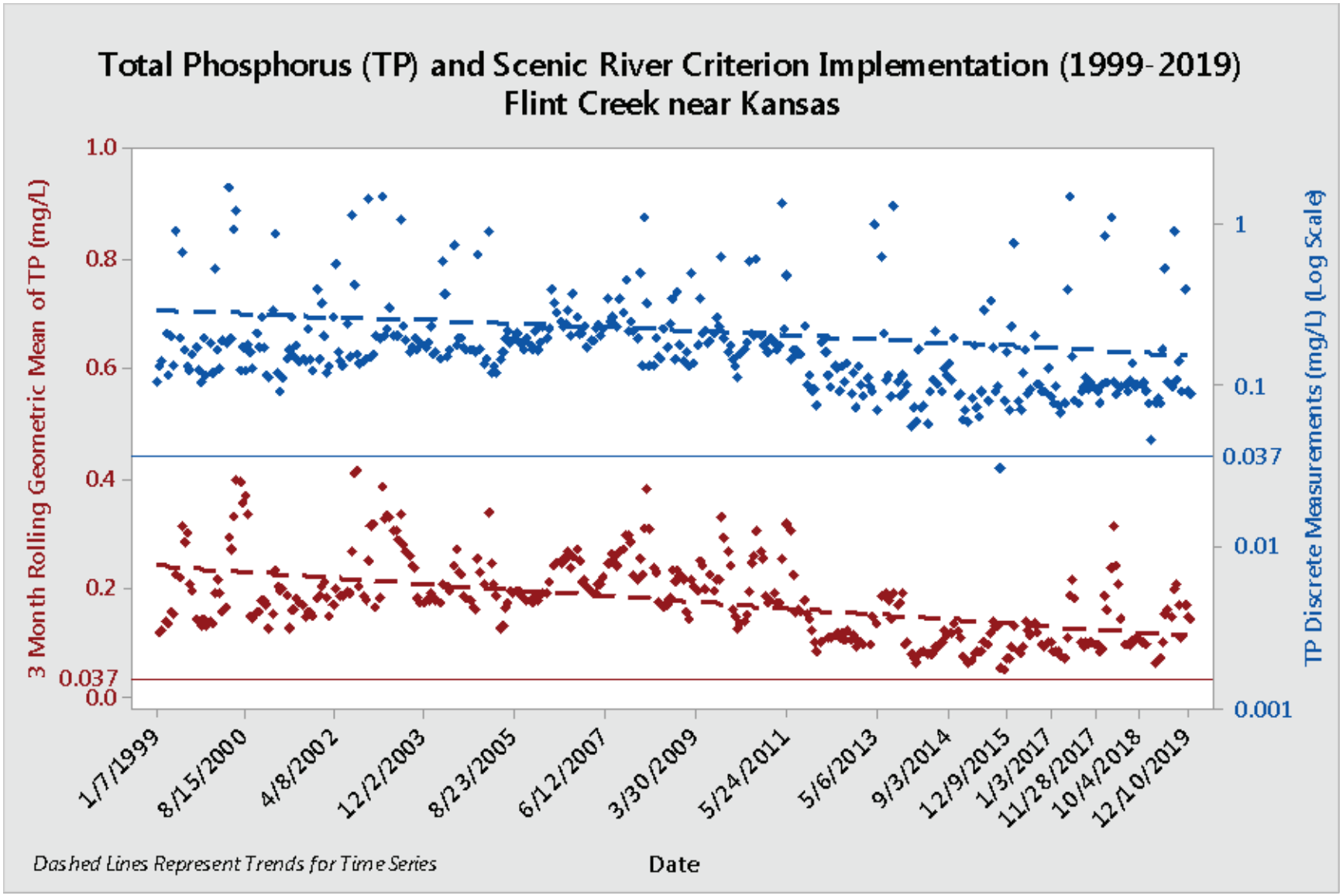

Total Phosphorus (TP) and Scenic River Criterion Implementation (1999-2019)
Illinois River near Tahlequah
3 Month Rolling Geometric Mean of TP (mg/L)
TP Discrete Measurements (mg/L) (Log Scale)
1.0
0.8
0.6
0.4
0.2
0.037
0.0
1
0.1
0.037
0.01
0.001
1/5/1999
8/22/2000
4/9/2002
12/1/2003
8/23/2005
4/27/2007
10/14/2008
8/19/2010
9/5/2012
8/6/2014
12/1/2016
11/28/2017
11/5/2018
12/11/2019
Dashed Lines Represent Trends for Time Series
Date

Flint Creek near Kansas

Flint Creek Near Kansas			Loadings
Year	Flow (cfs)	Total P (mg/L)	Total P kg/year
1980	32	0.189	5,454
1981	57	0.178	9,077
1982	69	0.186	11,537
1983	49	0.284	12,415
1984	143	0.240	30,532
1985	237	0.224	47,591
1986	183	0.223	36,430
1987	141	0.157	19,840
1988	97	0.265	22,946
1989	90	0.557	44,981
1990		0.114	
1991		0.120	
1992		0.118	
1993	182	0.156	25,359
1994	136	0.127	15,418
1995	140	0.185	23,207
1996	76	0.152	10,294
1997	95.7	0.117	9,964
1998	96.5	0.127	10,945
1999	137	0.186	22,758
2000	132	0.178	20,984
2001	101	0.164	14,793
2002	82	0.310	22,675
2003	49.8	0.316	14,055
2004	149.0	0.165	21,957
2005	91.8	0.168	13,774
2006	36.8	0.226	7,428
2007	70.3	0.240	15,068
2008	218.0	0.157	30,567
2009	141.6	0.187	23,649
2010	91.7	0.171	14,004
2011	137.8	0.152	18,707
2012	48.1	0.107	4,598
2013	121.2	0.093	10,070
2014	72.4	0.096	6,206
2015	253.8	0.070	15,864
2016	82.7	0.092	6,796
2017	130.1	0.085	9,877
2018	115.2	0.097	9,978
2019	289.9	0.090	23,299
Average	118	0.177	18,675

Year	80-93	90-94	91-95	92-96	93-97	94-98	95-99	96-00	97-01	98-02	99-03	00-04	01-05	02-06	03-07	04-08	05-09	06-10	07-11	08-12	09-13	10-14	11-15	12-16	13-17	14-18	15-19
Pt (mg/l)	0.214	0.132	0.142	0.146	0.140	0.133	0.154	0.157	0.159	0.196	0.230	0.228	0.226	0.238	0.225	0.191	0.196	0.199	0.184	0.154	0.140	0.121	0.101	0.090	0.085	0.086	0.087
Flow (cfs)	117	159	153	134	126	109	109	107	112	110	101	103	95	82	80	113	112	112	132	127	108	94	127	118	132	131	174
Pt (kg/yr)	22,279	18,758	19,386	17,369	15,727	12,986	14,974	15,100	15,989	19,224	20,579	20,963	19,098	17,415	15,977	19,356	19,586	19,818	21,700	17,473	13,543	10,154	11,382	9,513	10,063	10,069	13,505
Decrease	0.0%	15.8%	13.0%	22.0%	29.4%	41.7%	32.8%	32.2%	28.2%	13.7%	7.6%	5.9%	14.3%	21.8%	28.3%	13.1%	12.1%	11.0%	2.6%	21.6%	39.2%	54.4%	48.9%	57.3%	54.8%	54.8%	39.4%

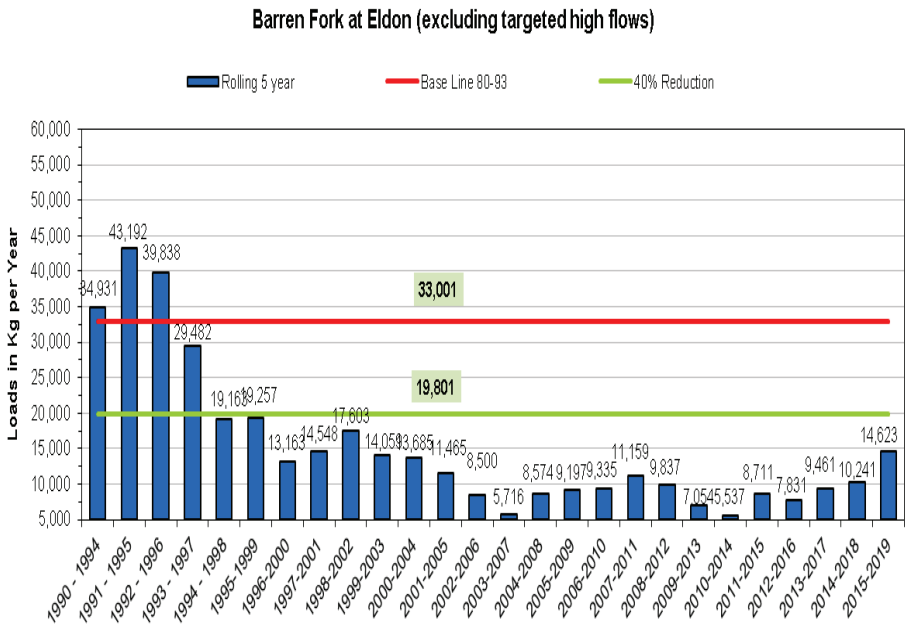


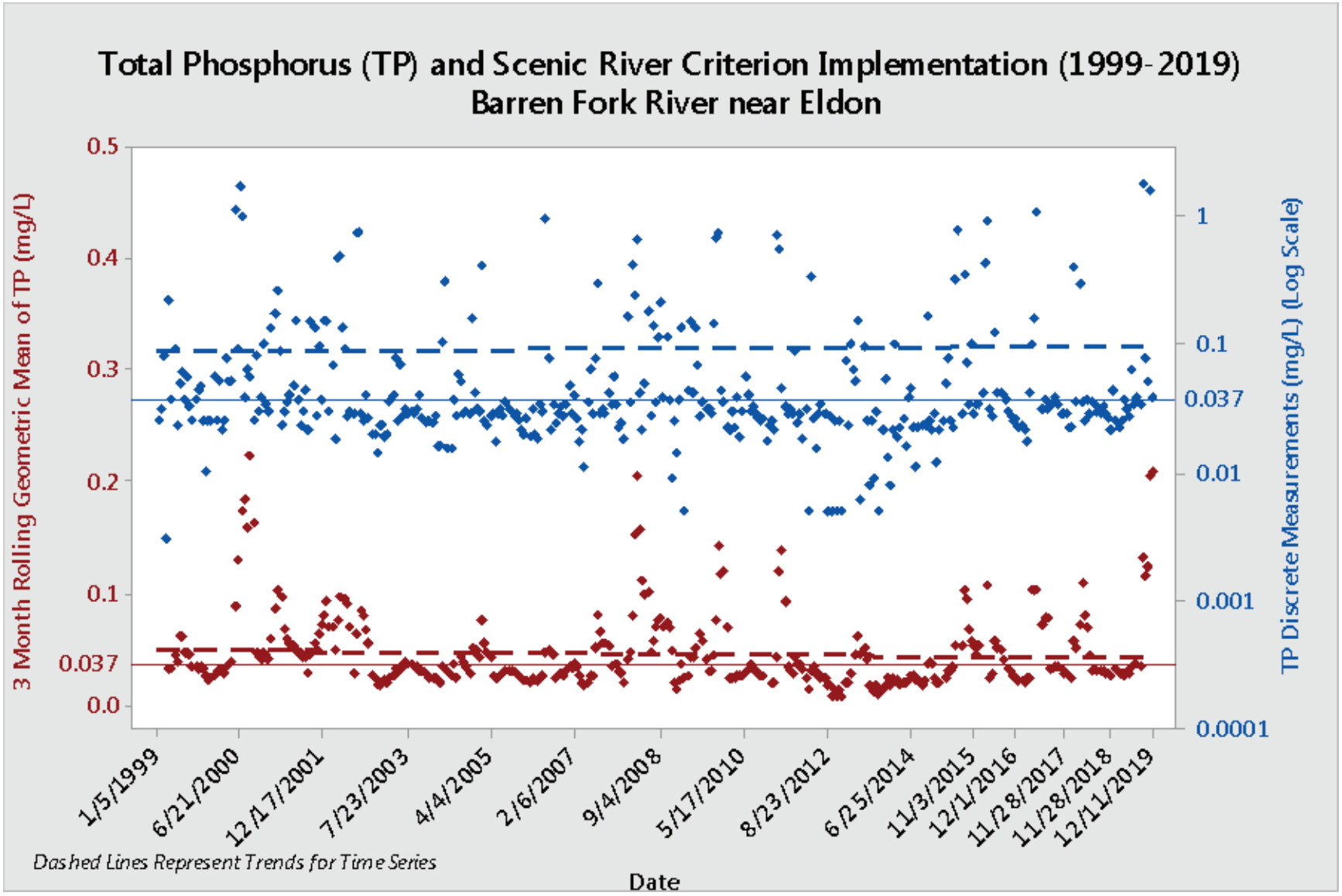

Total Phosphorus (TP) and Scenic River Criterion Implementation (1999-2019)
Flint Creek near Kansas
3 Month Rolling Geometric Mean of TP (mg/L)
1.0
0.8
0.6
0.4
0.2
0.037
0.0
TP Discrete Measurements (mg/L) (Log Scale)
1
0.1
0.037
0.01
0.001
1/7/1999
8/15/2000
4/8/2002
12/2/2003
8/23/2005
6/12/2007
3/30/2009
5/24/2011
5/6/2013
9/3/2014
12/9/2015
1/3/2017
11/28/2017
10/4/2018
12/10/2019
Dashed Lines Represent Trends for Time Series
Date

Barren Fork at Eldon

Barren Fork at Eldon			Loadings
Year	Flow (cfs)	Total Phos. (mg/L)	Total P kg/year
1980	77		
1981	201		
1982	296		
1983	184		
1984	364		
1985	593		
1986	536		
1987	491		
1988	269		
1989	320		
1990	666		
1991	451	0.060	24,145
1992	440	0.095	37,315
1993	700	0.108	67,234
1994	328	0.037	10,878
1995	422	0.263	98,819
1996	432	0.025	9,645
1997	332	0.023	6,671
1998	409	0.033	12,054
1999	361	0.048	15,476
2000	376	0.043	14,440
2001	343	0.064	19,605
2002	262	0.088	20,591
2003	145	0.025	3,237
2004	403	0.029	10,438
2005	228	0.027	5,498
2006	169	0.027	4,075
2007	254	0.026	5,898
2008	559	0.045	22,466
2009	460	0.033	13,557
2010	225	0.027	5,426
2011	471	0.028	11,783
2012	130	0.019	2,201
2013	219	0.026	5,083
2014	184	0.024	3,938
2015	872	0.040	31,154
2016	214	0.033	6,309
2017	320	0.028	8,013
2018	318	0.029	8,225
2019	761	0.038	25,816
Average	370	0.048	15,818

Year	80-93	90-94	91-95	92-96	93-97	94-98	95-99	96-00	97-01	98-02	99-03	00-04	01-05	02-06	03-07	04-08	05-09	06-10	07-11	08-12	09-13	10-14	11-15	12-16	13-17	14-18	15-19
Pt (mg/l)	0.093	0.076	0.103	0.096	0.075	0.056	0.055	0.039	0.045	0.056	0.053	0.050	0.046	0.039	0.027	0.030	0.031	0.031	0.032	0.030	0.026	0.024	0.026	0.027	0.029	0.030	0.033
Flow (cfs)	399	517	468	464	443	384	391	382	364	350	297	306	276	241	24	323	334	333	394	369	301	246	375	323	362	382	497
Pt (kg/yr)	33,001	34,931	43,192	39,838	29,482	19,163	19,257	13,163	14,548	17,603	14,059	13,685	11,465	8,500	5,716	8,574	9,197	9,335	11,159	9,837	7,054	5,357	8,711	7,831	9,461	10,241	14,623
Decrease	0.0%	-5.8%	-30.9%	-20.7%	10.7%	41.9%	41.6%	60.1%	55.9%	46.7%	57.4%	58.5%	65.3%	74.2%	82.7%	74.0%	72.1%	71.7%	66.2%	70.2%	78.6%	83.8%	73.6%	76.3%	71.3%	69.0%	55.7%




Total Phosphorus (TP) and Scenic River Criterion Implementation (1999-2019)
Barren Fork River near Eldon
3 Month Rolling Geometric Mean of TP (mg/L)
TP Discrete Measurements (mg/L) (Log Scale)
0.5
0.4
0.3
0.2
0.1
0.037
0.0
1
0.1
0.037
0.01
0.001
0.0001
1/5/1999
6/21/2000
12/17/2001
7/23/2003
4/4/2005
2/6/2007
9/4/2008
5/17/2010
8/23/2012
6/25/2014
11/3/2015
12/1/2016
11/28/2017
11/28/2018
12/11/2019
Dashed Lines Represent Trends for Time Series
Date

Funding for Cities and Districts In the Illinois River Basin Provided by the OWRB's Financial Assistance Program

Oklahoma Water Resources Board
Arkansas/Oklahoma Compact Report

Loan Number	Borrower	County	Closed Amount	Approved Date	App Type
FAP-00-0058-R	Adair County Rural Water District #5	Adair	$99,500.00	7/10/2001	REAP
FAP-97-0124-R	Adair County Rural Water District #5	Adair	$75,000.00	6/8/1999	REAP
FAP-89-0062-G	Adair County Rural Water District #5	Adair	$50,000.00	9/10/1991	Emergency
FAP-00-0071-R	Adair County Rural Water District #6	Adair	$146,875.00	4/9/2002	REAP
FAP-85-0155-G	Adair County RWS & SWMD #2	Adair	$100,000.00	6/11/1985	Emergency
FAP-06-0015-R	Adair County RWS & SWMD #2	Adair	$99,999.00	3/11/2008	REAP
FAP-83-0033-G	Cherry Tree Rural Water District	Adair	$10,000.00	1/10/1984	Emergency
FAP-01-0013-L	Stilwell Area Development Authority	Adair	$2,760,000.00	3/12/2002	FA Loan
FAP-93-0073-L	Stilwell Area Development Authority	Adair	$1,000,000.00	12/12/1995	FA Loan
ORF-98-0010-CW	Stilwell Area Development Authority	Adair	$4,000,000.00	8/10/1999	CWSRF
FAP-85-0129-G	Watts Public Works Authority	Adair	$10,000.00	2/12/1985	Emergency
FAP-88-0053-G	Watts Public Works Authority	Adair	$85,000.00	7/16/1990	Emergency
FAP-97-0125-R	Watts Public Works Authority	Adair	$149,750.00	2/10/1998	REAP
FAP-99-0080-R	Watts Public Works Authority	Adair	$99,800.00	11/16/1999	REAP
ORF-99-0020-CW	Westville Utility Authority	Adair	$430,400.00	12/11/2001	CWSRF
FAP-03-0019-R	Westville Utility Authority	Adair	$99,969.00	6/14/2005	REAP
FAP-05-0051-R	Westville Utility Authority	Adair	$0.00	7/16/2013	REAP
FAP-05-0013-G	Westville Utility Authority	Adair	$100,000.00	10/11/2005	Emergency
FAP-12-0006-L	Westville Utility Authority	Adair	$1,350,000.00	3/13/2012	FA Loan
ORF-20-0013-CW	Westville Utility Authority	Adair	$37,575.00	8/20/2019	CWSRF
FAP-83-0019-G	Burnt Cabin Rural Water District Incorporated	Cherokee	$24,000.00	11/2/1983	Emergency
FAP-98-0011-R	Burnt Cabin Rural Water District Incorporated	Cherokee	$65,427.00	6/9/1998	REAP
FAP-97-0110-R	Cherokee County Rural Water District #1	Cherokee	$100,000.00	12/14/1999	REAP
FAP-98-0029-L	Cherokee County Rural Water District #1	Cherokee	$380,000.00	12/12/2000	FA Loan
FAP-90-0055-G	Cherokee County Rural Water District #10	Cherokee	$27,000.00	3/12/1991	Emergency
FAP-08-0005-R	Cherokee County Rural Water District #12	Cherokee	$70,000.00	6/9/2009	REAP
FAP-95-0060-G	Cherokee County Rural Water District #13	Cherokee	$100,000.00	1/9/1996	Emergency
FAP-12-0010-L	Cherokee County Rural Water District #13	Cherokee	$1,600,000.00	3/13/2012	FA Loan
FAP-97-0098-R	Cherokee County Rural Water District #13	Cherokee	$80,000.00	3/14/2000	REAP
FAP-95-0031-L	Cherokee County Rural Water District #13	Cherokee	$170,000.00	1/9/1996	FA Loan
FAP-02-0026-R	Cherokee County Rural Water District #13	Cherokee	$135,000.00	6/8/2004	REAP
FAP-00-0007-L	Cherokee County Rural Water District #13	Cherokee	$1,810,000.00	6/11/2002	FA Loan
FAP-98-0081-R	Cherokee County Rural Water District #14	Cherokee	$54,000.00	2/10/1999	REAP
FAP-02-0004-L	Cherokee County Rural Water District #2	Cherokee	$645,000.00	8/13/2002	FA Loan
FAP-12-0002-D	Cherokee County Rural Water District #3	Cherokee	$26,870.00	9/18/2012	Drought

ORF-11-0002-DW	Cherokee County Rural Water District #3	Cherokee	$3,110,000.00	7/12/2011	DWSRF
FAP-98-0052-G	Cherokee County Rural Water District #3	Cherokee	$45,000.00	2/10/1999	Emergency
FAP-08-0033-R	Cherokee County Rural Water District #7 -- Welling	Cherokee	$39,069.00	12/9/2008	REAP
FAP-91-0057-G	Cherokee County Rural Water District #7 -- Welling	Cherokee	$23,180.00	9/10/1991	Emergency
FAP-91-0058-G	Cherokee County Rural Water District #8 -- Briggs	Cherokee	$23,180.00	9/10/1991	Emergency
FAP-83-0021-G	Cherokee County Rural Water District #8 -- Briggs	Cherokee	$53,000.00	1/10/1984	Emergency
FAP-02-0001-L	Cherokee County Rural Water District #8 -- Briggs	Cherokee	$285,000.00	6/11/2002	FA Loan
FAP-06-0011-R	Cherokee County Rural Water District #8 -- Briggs	Cherokee	$99,999.00	6/12/2007	REAP
FAP-09-0034-R	Cherokee County Rural Water District #8 -- Briggs	Cherokee	$34,914.00	4/13/2010	REAP
FAP-99-0072-R	Cherokee County Rural Water District #9	Cherokee	$69,900.00	11/14/2000	REAP
FAP-97-0126-R	Cherokee County Rural Water District #9	Cherokee	$99,900.00	1/13/1998	REAP
FAP-85-0152-G	Cherokee County Rural Water District #9	Cherokee	$13,465.00	10/16/1991	Emergency
FAP-99-0082-R	Hulbert Public Works Authority	Cherokee	$79,350.00	11/16/1999	REAP
FAP-01-0066-R	Hulbert Public Works Authority	Cherokee	$99,000.00	7/9/2002	REAP
FAP-09-0011-G	Hulbert Public Works Authority	Cherokee	$75,000.00	11/10/2009	Emergency
FAP-91-0120-G	Hulbert Public Works Authority	Cherokee	$25,000.00	9/15/1992	Emergency
ORF-09-0040-DW	Tahlequah Public Works Authority	Cherokee	$16,320,000.00	12/8/2009	DWSRF
ORF-11-0010-DW	Tahlequah Public Works Authority	Cherokee	$1,680,000.00	12/13/2011	DWSRF
ORF-18-0017-DW	Tahlequah Public Works Authority	Cherokee	$8,200,000.00	12/6/2018	DWSRF
ORF-19-0014-CW	Tahlequah Public Works Authority	Cherokee	$6,750,000.00	12/5/2019	CWSRF
FAP-83-0044-G	Town of Hulbert	Cherokee	$100,000.00	1/10/1984	Emergency
FAP-93-0047-L	Creek County Rural Water District #1	Creek	$2,255,000.00	1/11/1994	FA Loan
FAP-90-0097-G	Creek County Rural Water District #10	Creek	$40,000.00	12/8/1992	Emergency
FAP-00-0007-G	Creek County Rural Water District #11	Creek	$100,000.00	6/13/2000	Emergency
FAP-99-0001-L	Creek County Rural Water District #2	Creek	$1,345,000.00	10/10/2000	FA Loan
ORF-99-0002-DW	Creek County Rural Water District #7	Creek	$615,000.00	2/8/2000	DWSRF
ORF-08-0004-DW	Creek County Rural Water District #7	Creek	$3,230,000.00	8/12/2008	DWSRF
FAP-85-0208-G	Creek County Rural Water District #9	Creek	$90,800.00	8/12/1986	Emergency
FAP-85-0127-G	Creek County RWS & SWMD #79-1	Creek	$100,000.00	10/8/1985	Emergency
FAP-98-0093-R	Depew Public Works Authority	Creek	$38,000.00	3/14/2000	REAP
FAP-98-0094-R	Depew Public Works Authority	Creek	$79,000.00	11/16/1999	REAP
FAP-16-0003-G	Depew Public Works Authority	Creek		9/20/2016	Emergency
FAP-11-0015-R	Depew Public Works Authority	Creek	$0.00	7/16/2013	REAP
FAP-08-0023-R	Kellyville Public Works Authority	Creek	$99,990.00	7/14/2009	REAP
FAP-97-0108-R	Keystone Development Authority	Creek	$79,000.00	1/12/1999	REAP
FAP-90-0057-G	Kiefer Public Works Authority	Creek	$11,000.00	8/14/1990	Emergency

ORF-94-0008-CW	Kiefer Public Works Authority	Creek	$320,000.00	9/12/1995	CWSRF
FAP-00-0062-R	Kiefer Public Works Authority	Creek	$150,000.00	4/10/2001	REAP
ORF-14-0006-CW	Kiefer Public Works Authority	Creek	$320,000.00	12/17/2013	CWSRF
ORF-13-0012-CW	Oilton Public Works Authority	Creek	$2,850,000.00	8/20/2013	CWSRF
FAP-03-0035-R	Olive Public School	Creek	$50,000.00	12/13/2005	REAP
FAP-87-0148-L	Sapulpa Municipal Authority	Creek	$7,250,000.00	9/14/1988	FA Loan
ORF-18-0020-CW	Sapulpa Municipal Authority	Creek	$7,850,000.00	5/15/2018	CWSRF
FAP-85-0181-G	Shamrock Public Works Authority	Creek	$60,000.00	3/16/1987	Emergency
FAP-11-0023-R	Slick Public Works Authority	Creek	$81,825.00	7/17/2012	REAP
FAP-96-0132-R	Town of Depew	Creek	$59,000.00	1/14/1997	REAP
FAP-85-0131-G	Town of Drumright	Creek	$76,000.00	5/14/1985	Emergency
FAP-83-0027-G	Town of Drumright	Creek	$100,000.00	1/10/1984	Emergency
FAP-96-0186-R	Town of Mounds	Creek	$55,200.00	4/8/1997	REAP
FAP-83-0075-G	Town of Oilton	Creek	$28,420.00	4/10/1984	Emergency
FAP-09-0013-R	Town of Oilton	Creek	$78,400.00	7/13/2010	REAP
FAP-97-0009-R	Bernice Public Works Authority	Delaware	$99,500.00	12/11/2001	REAP
FAP-83-0080-G	Cherokee Housing Authority	Delaware	$64,000.00	1/10/1984	Emergency
FAP-97-0107-R	Colcord Public Works Authority	Delaware	$94,800.00	1/12/1999	REAP
FAP-13-0014-R	Colcord Public Works Authority	Delaware		7/15/2014	REAP
ORF-11-0007-DW	Delaware County Rural Water District #1	Delaware	$260,000.00	10/17/2011	DWSRF
FAP-96-0020-G	Delaware County Rural Water District #1	Delaware	$85,000.00	7/8/1997	Emergency
FAP-85-0229-G	Delaware County Rural Water District #1	Delaware	$63,000.00	9/8/1987	Emergency
FAP-97-0047-R	Delaware County Rural Water District #1	Delaware	$50,000.00	11/13/2001	REAP
FAP-97-0008-L	Delaware County Rural Water District #1	Delaware	$360,000.00	7/8/1997	FA Loan
FAP-90-0086-G	Delaware County Rural Water District #3	Delaware	$34,300.00	5/6/1991	Emergency
FAP-17-0006-L	Delaware County Rural Water District #3	Delaware	$1,040,000.00	1/17/2017	FA Loan
FAP-92-0079-G	Delaware County Rural Water District #7	Delaware	$25,000.00	7/12/1994	Emergency
FAP-07-0034-R	Delaware County RWSG & SWMD #10	Delaware	$98,653.20	5/14/2008	REAP
FAP-09-0013-G	Delaware County RWSG & SWMD #10	Delaware	$19,125.00	1/12/2010	Emergency
ORF-99-0004-DW	Delaware County RWSG & SWMD #10	Delaware	$4,865,193.00	4/9/2002	DWSRF
ORF-14-0003-DW	Delaware County RWSG & SWMD #11	Delaware	$950,000.00	4/15/2014	DWSRF
FAP-04-0025-R	Delaware County RWSG & SWMD #11	Delaware	$99,990.00	2/8/2011	REAP
FAP-95-0053-G	Delaware County RWSG & SWMD #6	Delaware	$100,000.00	10/8/1996	Emergency
FAP-92-0019-G	Delaware County RWSG & SWMD #6	Delaware	$75,000.00	4/12/1994	Emergency
FAP-96-0028-G	Delaware County RWSG & SWMD #9	Delaware	$100,000.00	8/13/1996	Emergency
FAP-96-0009-L	Delaware County RWSG & SWMD #9	Delaware	$635,000.00	8/13/1996	FA Loan
FAP-97-0068-R	Delaware County RWSG & SWMD #9	Delaware	$10,000.00	5/13/1997	REAP
FAP-99-0005-R	Grand Lake Public Works Authority	Delaware	$94,000.00	4/13/1999	REAP
FAP-00-0010-L	Grand Lake Public Works Authority	Delaware	$575,000.00	3/13/2001	FA Loan
ORF-99-0022-CW	Grand Lake Public Works Authority	Delaware	$2,700,000.00	3/13/2001	CWSRF
FAP-97-0044-L	Grand Lake Public Works Authority	Delaware	$655,000.00	12/9/1997	FA Loan

ORF-02-0020-CW	Grand Lake Public Works Authority	Delaware	$800,000.00	4/8/2003	CWSRF
FAP-01-0016-L	Grand Lake Public Works Authority	Delaware	$335,000.00	2/12/2002	FA Loan
ORF-09-0004-CW	Grand Lake Public Works Authority	Delaware	$992,500.00	9/8/2009	CWSRF
FAP-12-0016-L	Grand Lake Public Works Authority	Delaware	$1,000,000.00	7/17/2012	FA Loan
ORF-17-0007-DW	Grand Lake Public Works Authority	Delaware	$700,000.00	2/20/2018	DWSRF
ORF-17-0018-CW	Grand Lake Public Works Authority	Delaware	$1,825,182.60	6/20/2017	CWSRF
FAP-09-0001-L	Grand Lake Public Works Authority	Delaware	$1,990,000.00	9/8/2009	FA Loan
ORF-11-0003-DW	Grand Lake Public Works Authority	Delaware	$5,500,000.00	7/17/2012	DWSRF
FAP-18-0003-L	Grand Lake Public Works Authority	Delaware	$1,390,000.00	11/1/2017	FA Loan
ORF-13-0007-DW	Grove Municipal Services Authority	Delaware	$8,765,000.00	3/19/2013	DWSRF
ORF-07-0008-CW	Grove Municipal Services Authority	Delaware	$1,900,000.00	7/14/2009	CWSRF
ORF-02-0003-CW	Grove Municipal Services Authority	Delaware	$7,500,000.00	6/10/2003	CWSRF
ORF-99-0011-CW	Jay Utilities Authority	Delaware	$3,766,000.00	8/8/2000	CWSRF
ORF-07-0004-DW	Jay Utilities Authority	Delaware	$2,470,000.00	2/12/2008	DWSRF
ORF-18-0007-DW	Jay Utilities Authority	Delaware	$1,031,000.00	5/15/2018	DWSRF
FAP-97-0040-R	Kansas Public Works Authority	Delaware	$139,270.00	3/10/1998	REAP
FAP-02-0003-R	Kansas Public Works Authority	Delaware	$67,000.00	11/12/2002	REAP
FAP-97-0097-R	Kansas Public Works Authority	Delaware	$109,500.00	11/16/1999	REAP
FAP-86-0002-G	Kansas Public Works Authority	Delaware	$65,000.00	1/12/1988	Emergency
FAP-98-0017-G	Moseley School District 34	Delaware	$46,750.00	6/9/1998	Emergency
FAP-08-0004-R	Oaks Public Works Authority	Delaware	$0.00	6/18/2013	REAP
ORF-16-0004-DW	South Delaware County Regional Water Authority	Delaware	$3,000,000.00	4/18/2017	DWSRF
FAP-84-0015-G	Town of Colcord	Delaware	$95,816.00	4/10/1984	Emergency
FAP-83-0012-G	Town of Kansas	Delaware	$92,516.00	3/13/1984	Emergency
FAP-98-0044-R	West Siloam Springs	Delaware	$96,350.00	3/14/2000	REAP
FAP-84-0059-G	West Siloam Springs	Delaware	$100,000.00	6/10/1986	Emergency
FAP-94-0013-G	West Siloam Springs	Delaware	$18,315.00	7/12/1994	Emergency
FAP-01-0008-L	West Siloam Springs Municipal Authority	Delaware	$275,000.00	11/13/2001	FA Loan
FAP-00-0032-G	Boynton Public Works Authority	Muskogee	$81,591.00	1/9/2001	Emergency
FAP-91-0047-G	Boynton Public Works Authority	Muskogee	$50,000.00	2/8/1994	Emergency
FAP-90-0100-G	Braggs Public Works Authority	Muskogee	$70,000.00	2/12/1991	Emergency
FAP-97-0021-R	East Central Oklahoma Water Authority	Muskogee	$59,700.00	3/11/1997	REAP
FAP-96-0045-G	East Central Oklahoma Water Authority	Muskogee	$97,750.00	4/14/1998	Emergency
FAP-19-0009-G	East Central Oklahoma Water Authority	Muskogee	$0.00	8/20/2019	Emergency
ORF-20-0015-DW	East Central Oklahoma Water Authority	Muskogee	$1,000,000.00	8/20/2019	DWSRF
ORF-20-0015-DW	East Central Oklahoma Water Authority	Muskogee	$1,000,000.00	8/20/2019	DWSRF
FAP-17-0047-R	East Central Oklahoma Water Authority	Muskogee		8/21/2018	REAP
ORF-20-0011-CW	East Central Oklahoma Water Authority	Muskogee	$36,130.00	12/5/2019	CWSRF
ORF-11-0004-CW	Fort Gibson Utilities Authority	Muskogee	$980,000.00	4/12/2011	CWSRF
ORF-99-0017-CW	Fort Gibson Utilities Authority	Muskogee	$710,000.00	3/14/2000	CWSRF
ORF-97-0011-CW	Fort Gibson Utilities Authority	Muskogee	$445,100.00	5/12/1998	CWSRF

FAP-93-0005-L	Fort Gibson Utilities Authority	Muskogee	$820,000.00	3/9/1993	FA Loan
ORF-99-0015-CW	Haskell Public Works Authority	Muskogee	$320,000.00	12/14/1999	CWSRF
FAP-95-0064-L	Muskogee County Rural Water District #1	Muskogee	$430,000.00	8/12/1997	FA Loan
FAP-02-0058-R	Muskogee County Rural Water District #10	Muskogee	$99,999.00	4/8/2003	REAP
FAP-00-0060-R	Muskogee County Rural Water District #11	Muskogee	$150,000.00	12/12/2000	REAP
FAP-01-0075-R	Muskogee County Rural Water District #14	Muskogee	$150,000.00	8/31/2001	REAP
FAP-97-0064-R	Muskogee County Rural Water District #3	Muskogee	$65,800.00	5/13/1997	REAP
FAP-86-0059-G	Muskogee County Rural Water District #3	Muskogee	$50,000.00	12/13/1988	Emergency
FAP-02-0001-G	Muskogee County Rural Water District #3	Muskogee	$91,035.00	3/12/2002	Emergency
FAP-98-0014-R	Muskogee County Rural Water District #3	Muskogee	$91,992.00	6/13/2000	REAP
FAP-05-0023-R	Muskogee County Rural Water District #3	Muskogee	$99,999.00	6/8/2010	REAP
FAP-17-0008-L	Muskogee County Rural Water District #3	Muskogee	$1,595,000.00	5/16/2017	FA Loan
FAP-02-0011-G	Muskogee County Rural Water District #5	Muskogee	$100,000.00	6/8/2004	Emergency
FAP-02-0011-L	Muskogee County Rural Water District #5	Muskogee	$1,390,000.00	5/13/2003	FA Loan
FAP-92-0038-G	Muskogee County Rural Water District #6	Muskogee	$25,000.00	4/12/1994	Emergency
FAP-83-0041-G	Muskogee County Rural Water District #7	Muskogee	$90,000.00	4/10/1984	Emergency
FAP-91-0040-G	Muskogee County Rural Water Management District #12	Muskogee	$45,000.00	9/10/1991	Emergency
FAP-03-0005-L	Muskogee Municipal Authority	Muskogee	$4,575,000.00	6/10/2003	FA Loan
ORF-99-0007-CW	Muskogee Municipal Authority	Muskogee	$1,970,765.66	6/8/1999	CWSRF
ORF-99-0007-L	Muskogee Municipal Authority	Muskogee	$3,335,000.00	6/8/1999	FA Loan
ORF-98-0004-L	Muskogee Municipal Authority	Muskogee	$5,850,000.00	6/9/1998	FA Loan
ORF-98-0004-CW	Muskogee Municipal Authority	Muskogee	$3,480,000.00	6/9/1998	CWSRF
ORF-96-0017-CW	Muskogee Municipal Authority	Muskogee	$14,112,000.00	2/11/1997	CWSRF
ORF-90-0004-CW	Muskogee Municipal Authority	Muskogee	$11,553,000.00	2/11/1992	CWSRF
ORF-93-0001-L	Muskogee Municipal Authority	Muskogee	$3,670,000.00	3/9/1993	FA Loan
ORF-93-0001-CW	Muskogee Municipal Authority	Muskogee	$2,141,969.36	3/9/1993	CWSRF
ORF-94-0011-CW	Muskogee Municipal Authority	Muskogee	$2,479,230.64	7/12/1994	CWSRF
ORF-94-0011-L	Muskogee Municipal Authority	Muskogee	$4,390,000.00	7/12/1994	FA Loan
ORF-08-0007-DW	Muskogee Municipal Authority	Muskogee	$30,410,000.00	7/8/2008	DWSRF
ORF-09-0020-CW	Muskogee Municipal Authority	Muskogee	$1,435,000.00	8/11/2009	CWSRF
ORF-11-0008-CW	Muskogee Municipal Authority	Muskogee	$12,775,000.00	8/9/2011	CWSRF
ORF-17-0019-CW	Muskogee Municipal Authority	Muskogee	$27,360,000.00	4/18/2017	CWSRF
ORF-14-0012-CW	Muskogee Municipal Authority	Muskogee	$7,300,000.00	12/17/2013	CWSRF
ORF-17-0014-CW	Muskogee Municipal Authority	Muskogee	$110,000.00	2/21/2017	CWSRF
ORF-18-0012-DW	Muskogee Municipal Authority	Muskogee	$17,640,000.00	10/16/2018	DWSRF
ORF-18-0012-DW	Muskogee Municipal Authority	Muskogee	$17,640,000.00	10/16/2018	DWSRF
FAP-90-0019-G	Oktaha Public Works Authority	Muskogee	$19,700.00	4/10/1990	Emergency
FAP-94-0042-L	Porum Public Works Authority	Muskogee	$350,000.00	11/1/1994	FA Loan
FAP-88-0040-L	Porum Public Works Authority	Muskogee	$730,000.00	1/10/1989	FA Loan
FAP-19-0012-R	Porum Public Works Authority	Muskogee	$0.00	6/18/2019	REAP
ORF-18-0016-CW	Porum Public Works Authority	Muskogee	$496,117.00	11/1/2017	CWSRF

ORF-18-0016-CW	Porum Public Works Authority	Muskogee	$496,117.00	11/1/2017	CWSRF
FAP-14-0012-R	Porum Public Works Authority	Muskogee		12/16/2014	REAP
ORF-17-0008-CW	Porum Public Works Authority	Muskogee	$780,000.00	9/20/2016	CWSRF
FAP-10-0001-G	Town of Boynton	Muskogee	$13,607.53	3/9/2010	Emergency
FAP-83-0003-G	Town of Boynton	Muskogee	$27,695.00	8/12/1983	Emergency
FAP-96-0077-R	Town of Braggs	Muskogee	$36,995.00	1/14/1997	REAP
FAP-98-0049-G	Town of Council Hill	Muskogee	$100,000.00	3/9/1999	Emergency
FAP-04-0064-R	Town of Taft	Muskogee	$99,557.68	1/11/2005	REAP
FAP-83-0091-G	Town of Taft	Muskogee	$86,620.00	1/10/1984	Emergency
FAP-84-0020-G	Town of Warner	Muskogee	$100,000.00	5/8/1984	Emergency
FAP-00-0006-G	Warner Utilities Authority	Muskogee	$45,000.00	6/13/2000	Emergency
FAP-89-0016-L	Warner Utilities Authority	Muskogee	$240,000.00	2/13/1990	FA Loan
FAP-96-0051-L	Warner Utilities Authority	Muskogee	$435,000.00	4/8/1997	FA Loan
ORF-96-0022-CW	Warner Utilities Authority	Muskogee	$258,000.00	8/10/1999	CWSRF
FAP-01-0005-R	Gore Public Works Authority	Sequoyah	$60,000.00	11/13/2001	REAP
	Gore Public Works Authority	Sequoyah	$885,000.00	10/12/2016	DWSRF
ORF-11-0007-CW	Muldrow Public Works Authority	Sequoyah	$3,705,000.00	9/13/2011	CWSRF
FAP-12-0001-L	Roland Utility Authority	Sequoyah	$3,360,000.00	2/13/2012	FA Loan
FAP-95-0001-G	Roland Utility Authority	Sequoyah	$75,000.00	5/14/1996	Emergency
ORF-08-0003-CW	Roland Utility Authority	Sequoyah	$3,855,000.00	6/10/2008	CWSRF
ORF-20-0019-CW	Roland Utility Authority	Sequoyah	$740,000.00	10/15/2019	CWSRF
ORF-20-0021-DW	Roland Utility Authority	Sequoyah	$2,359,000.00	1/21/2020	DWSRF
FAP-95-0053-L	Roland Utility Authority	Sequoyah	$4,890,000.00	4/8/1997	FA Loan
ORF-09-0034-DW	Sallisaw Municipal Authority	Sequoyah	$5,360,000.00	11/10/2009	DWSRF
FAP-84-0067-G	Sequoyah County Rural Water District #3	Sequoyah	$18,000.00	8/14/1984	Emergency
FAP-86-0050-G	Sequoyah County Rural Water District #5	Sequoyah	$75,000.00	5/8/1990	Emergency
FAP-02-0025-G	Sequoyah County Rural Water District #5	Sequoyah	$49,384.91	11/12/2002	Emergency
FAP-98-0013-R	Sequoyah County Rural Water District #5	Sequoyah	$99,883.00	1/12/1999	REAP
FAP-01-0067-R	Sequoyah County Rural Water District #5	Sequoyah	$80,000.00	7/12/2011	REAP
FAP-99-0083-R	Sequoyah County Rural Water District #8	Sequoyah	$138,500.00	2/8/2000	REAP
FAP-83-0024-G	Sequoyah County RWS & SWMD #4	Sequoyah	$86,000.00	1/10/1984	Emergency
FAP-03-0003-R	Sequoyah County RWS & SWMD #4	Sequoyah	$99,950.00	3/13/2012	REAP
FAP-91-0069-G	Sequoyah County RWSG & SWMD #7	Sequoyah	$30,000.00	12/8/1992	Emergency
FAP-84-0090-G	Town of Gans	Sequoyah	$100,000.00	5/14/1985	Emergency
FAP-02-0064-R	Town of Gans	Sequoyah	$110,000.00	4/16/2006	REAP
FAP-83-0008-G	Town of Marble City	Sequoyah	$100,000.00	2/14/1984	Emergency
FAP-84-0043-G	Town of Muldrow	Sequoyah	$77,200.00	4/10/1984	Emergency
FAP-89-0071-G	Utility Service Authority	Sequoyah	$20,097.00	1/9/1990	Emergency
FAP-99-0081-R	Vian	Sequoyah	$59,500.00	11/16/1999	REAP
FAP-97-0089-R	Vian Public Works Authority	Sequoyah	$150,000.00	6/10/2003	REAP
ORF-98-0017-CW	Vian Public Works Authority	Sequoyah	$1,100,000.00	2/8/2000	CWSRF

FAP-07-0006-G	Vian Public Works Authority	Sequoyah	$75,000.00	1/8/2008	Emergency
ORF-11-0006-CW	Vian Public Works Authority	Sequoyah	$1,655,000.00	2/13/2012	CWSRF
FAP-10-0004-R	Vian Public Works Authority	Sequoyah	$99,999.00	2/8/2011	REAP

Permits for Water Rights in the Illinois River Watershed Issued by the OWRB's Planning and Management Division in CY 2019

			Permits Issues within the Illinois River Basin for Calendar Year 2019												
					Diversion Point Legal										
Permit #	LAST NAME	FIRST NAME	1/4	1/4	1/4	SECT	TWP	RNG	WATER TYPE	COUNTY	STREAM SYSYTEM	DATE FILED	DATE ISSUED	PURPOSE	AMT (af/yr)
20180575		New Moon Farm LLC	SE	NW	SE	30	19N	25EI	GW	Adair		7/16/2018	1/15/2019	Agriculture	70
20180575		New Moon Farm LLC	NE	NW	SE	30	19N	25EI	GW	Adair		7/16/2018	1/15/2019	Agriculture	70
20180606	Nhien	Ha	NW	NW	NE	32	19N	25EI	GW	Adair		10/26/2018	5/21/2019	Agriculture	36
20180606	Nhien	Ha	NE	NW	NW	32	19N	25EI	GW	Adair		10/26/2018	5/21/2019	Agriculture	36
20180598	Wick	Heidy	SW	NW	NW	36	16N	26EI	GW	Adair		9/21/2018	5/21/2019	Agriculture	30

OKLAHOMA CONSERVATION COMMISSION
Program Activities in the Illinois River Watershed
for the period of October 2019 through September 2020

For over twenty-five years the OCC has monitored water quality, implemented best management practices, and provided water quality education in the Illinois River watershed. The health of the watershed continues to be a priority despite funding challenges.

1) Illinois River Riparian Protection

a) Although the OCC no longer participates in the Conservation Reserve Enhancement Program (CREP), the Farm Services Agency continues landowner payments for easements protecting acres of riparian area in the Illinois River watershed. CREP provides these incentives to farmers and ranchers to remove streamside pasture or cropland from production activities for ten to fifteen years. The annual rental payment they receive for the ten/fifteen-year period is based on the average area rental rate for marginal pasture land.

b) Utilizing State funding, the OCC creates long term easements with landowners to exclude their riparian property from production, further lessening the amount of pollution entering the river. Currently 36 participants maintain 1,643 acres that are set aside at an annual cost of $92,092.40.

c) With EPA funding OCC contracted a study in the Tyner Creek watershed of the Illinois River watershed to determine which would better benefit the area: streambank stabilization or riparian easements. Easements proved to be the better use of funding. In partnership with the GRDA the OCC has made an additional $1,600,000 available for long-term riparian easement protection along the Illinois River. These riparian exclusions are funded with U.S. EPA §319 dollars. Currently, 1,094.26 acres are enrolled in this program; however, over 300 additional acres should be added to this list by September 30, 2020.

2) Rotating Basin Monitoring Program

Battle Branch, Ballard Creek, Peavine Creek, Peacheater Creek, Tyner Creek, Pumpkin Hollow Creek, Telemay Hollow Creek, and Steeley Hollow Creek, all of which join the Illinois River Watershed above Tenkiller Lake are monitored through the OCC's Rotating Basin Ambient Monitoring Program (RBMP). In addition, Elk Creek and Snake Creek, direct tributaries to Tenkiller Lake were monitored through the RBMP. Fish community assessments were completed in the summer of 2018. Macroinvertebrate collections were made at all sites in the summer of 2018, winter of 2019 and summer of 2019, and the winter of 2020. Water quality monitoring has occurred on a five week interval beginning in May 2018 through March 2020. Monitoring was paused with the two last episodes remaining due to the COVID-19 pandemic. The last two episodes are scheduled for the first week of August 2020 and the first week of September 2020. Monitoring may continue or pause for a period and resume in 2023. These sites were selected to represent Hydrologic Units within the Illinois River watershed to characterize water quality conditions and relate those conditions to manageable land units. OCC will continue to evaluate monitoring results and needs in the Illinois River Watershed and adjust monitoring efforts accordingly.

3) Blue Thumb Monitoring and Education

The OCC's Blue Thumb program supports citizen scientists who monitor four stream sites in the Illinois River watershed. Volunteers collect observational and chemical data approximately monthly. Macroinvertebrate collections are completed twice a year. Habitat assessments and fish collections are completed once every four to five years. The biological data (macroinvertebrates and fish) are submitted to the State of Oklahoma Integrated Report. The chemical data are used for education and screening purposes.

For several years, Blue Thumb has partnered with the Grand River Dam Authority (GRDA) to offer Riverology 101, a workshop for teachers focusing on the Illinois River and Grand Lake watersheds, and Journey to the Bottom of the Creek, a day camp for children in the Tahlequah area. Although we planned to support both events in 2020, both were cancelled out of concern for COVID-19.

Early in 2020, Blue Thumb began a partnership with the Illinois River Watershed Partnership (IRWP) to support monitoring and facilitate educational events in the Oklahoma portion of the Illinois River watershed. The sampling locations are on tributaries to the Illinois River and were selected by the IRWP. In April 2020, BT supported monitoring at twelve sites. At each site, BT and IRWP staff completed a macroinvertebrate collection with onsite identification to order, water quality sampling and a rapid habitat assessment. According to the project plan, GRDA was supposed to complete analysis of water quality samples. The GRDA lab was unable to analyze samples due to restrictions imposed in response to COVID-19. Because the lab was unable to analyze samples, Blue Thumb staff analyzed the water quality samples

using BT equipment, reagents and standard operating procedures. Sites are monitored three times a year in alternate years. A second sampling run will occur in August 2020, and the third sampling run will occur in November 2020. IRWP intended to involve local residents and school children in the sampling events, but chose not invite volunteers to participate during the April sampling events out of concern for COVID-19. Volunteers will be invited to participate in the August sampling events, but participation will be limited to one or two volunteers at each site. BT and IRWP also produced an educational video about the project that was posted on FB and on the IRWP website.

Volunteers collect a macroinvertebrate sample at Cedar Hollow (summer 2019).

Candice and Cheryl assist Casey Rector of the IRWP during an April 2020 sampling run.

4) Oklahoma/Arkansas Memorandum of Agreement

In November 2018, Oklahoma and Arkansas officials signed an agreement to continue working toward water quality improvement in the Illinois River Watershed, focusing on data and information sharing, monitoring and assessment, and implementation of strategies to continue nutrient reductions in the watershed. The OCC has been participating in agency coordination meetings to recruit stakeholders, agree upon a strategy and more fully develop a schedule to move this agreement forward. States continue to work on this agreement, with steps being taken to update watershed planning on both sides of the state line.

5) Upcoming programs in the Illinois River Watershed

The COVID pandemic has delayed onset of several planned efforts in the Illinois River Watershed that should begin within the next six months. These efforts include support for poultry litter transfer out of the watershed to non-nutrient limited areas in the state, soil health demonstration farms testing the efficiency of soil health-based conservation practices in reducing pollutant loss from poultry litter applications, and efforts to work with poultry growers and integrators to reduce the impacts neighbors of poultry facilities.

ILLINOIS River

WATERSHED PARTNERSHIP

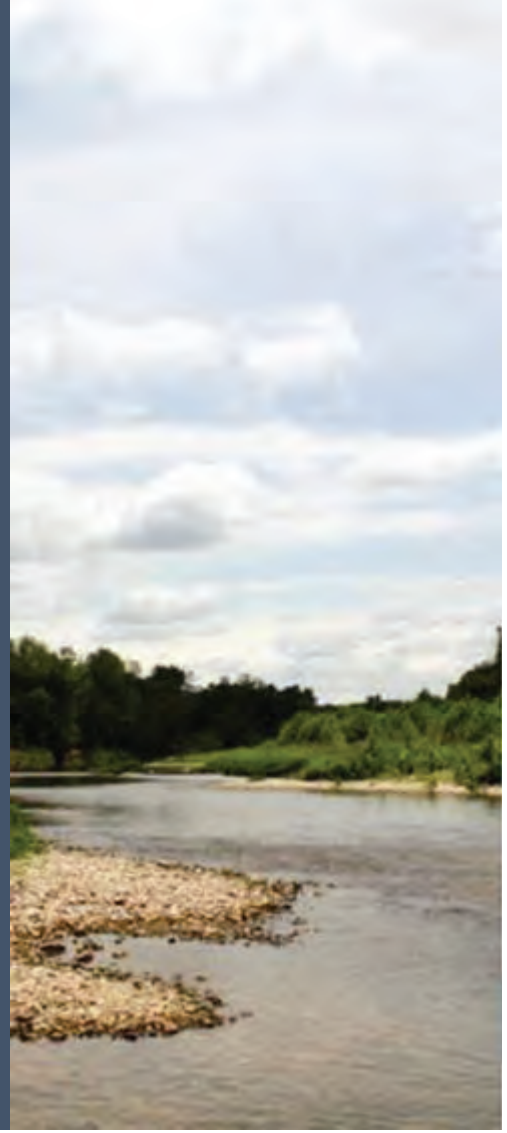
IRWP works to improve the integrity of the Illinois River through:

- public **education,** community **outreach**, and
- implementation of **conservation** and **restoration** practices throughout the watershed.

Our Message:

- Conserving and restoring our rural areas is cost effective, improves water quality, and preserves NWA heritage.
- Offer a “toolbox” of voluntary water quality management solutions to landowners
- Connect urban and rural landowners to organizations that provide these tools
- Find solutions that fit the short-term and long-term needs of the landowner

ILLINOIS River
WATERSHED PARTNERSHIP



Subwatershed	Impairment	*E. coli* (MPN/100 mL)
Sager Creek	Nitrate	
Moore's Creek	Sulfate, Pathogen	760.02
Lower Muddy Fork	Pathogen	1,255.67
Clear Creek at Lake Fayetteville	Pathogen	
Mud Creek at Clear Creek	Sulfate, Pathogen	
Upper Muddy Fork	Pathogen	
Illinois River	Chloride, Sulfate, Pathogens	316.23

Impaired Subwatersheds, ADEQ, 2016

- Average erosion rate of 5.2 feet/year
  - As high as 42 feet/year
- Sediment loading of study area = 37,500 tons/year
- Phosphorus loading of study area = 56,250 lbs/year
- P Loading of WWTF's in watershed = 24,196 lbs/year

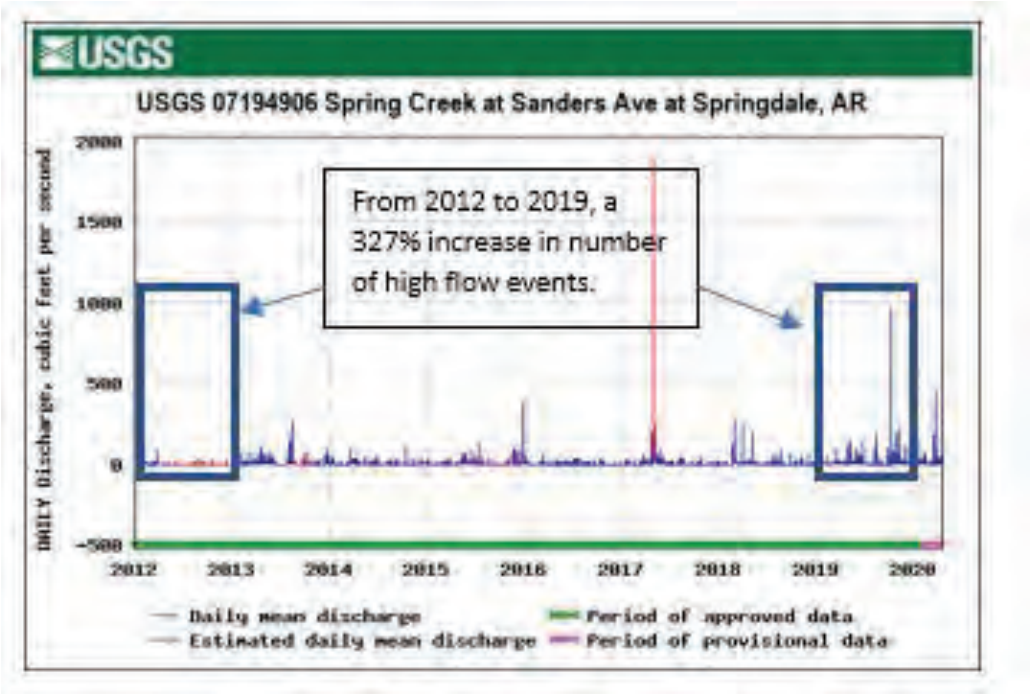
Streambank Erosion Assessment

ILLINOIS River WATERSHED PARTNERSHIP

Why is it happening?

- Loss of wetlands
- Straightening or trenching
- Loss of riparian forests
- Urbanization?
- Role of weather?

Increased velocity



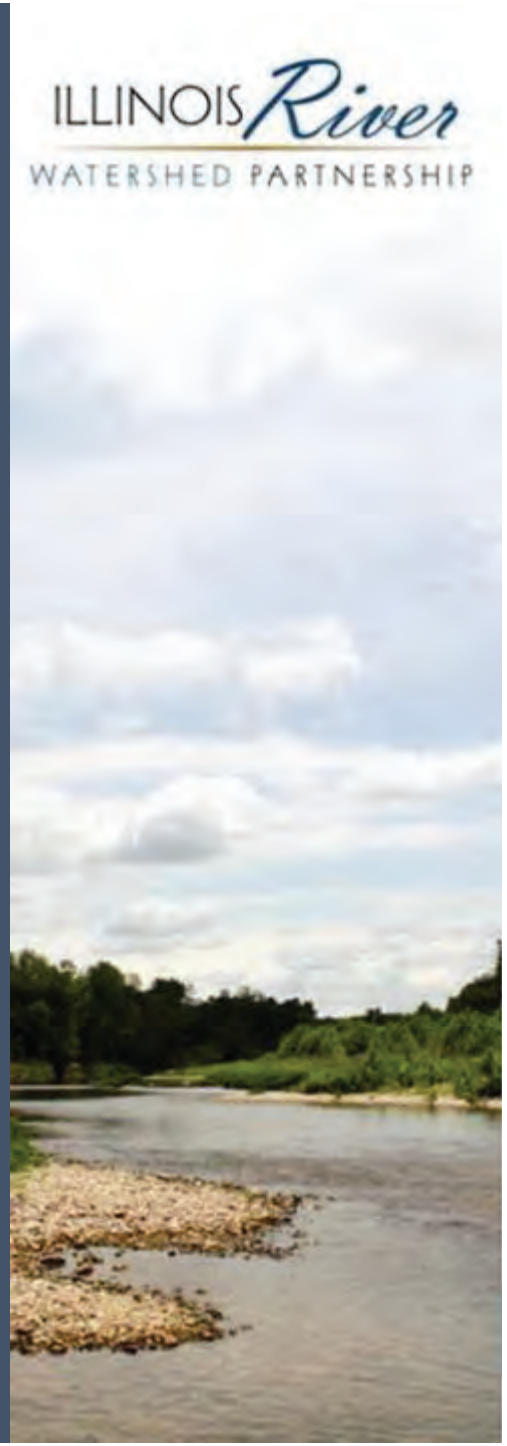
ILLINOIS River WATERSHED PARTNERSHIP

ILLINOIS River
WATERSHED PARTNERSHIP

Youth Education

Mobile Learning Labs

School Field Trips



In the Field

Farm Bureau at the IRWP Sanctuary

School Field Trips

In 2019:

- 3,533 students educated
- Seventeen local schools
- Kids from 2nd to 12th grade

Youth Education: In the Community

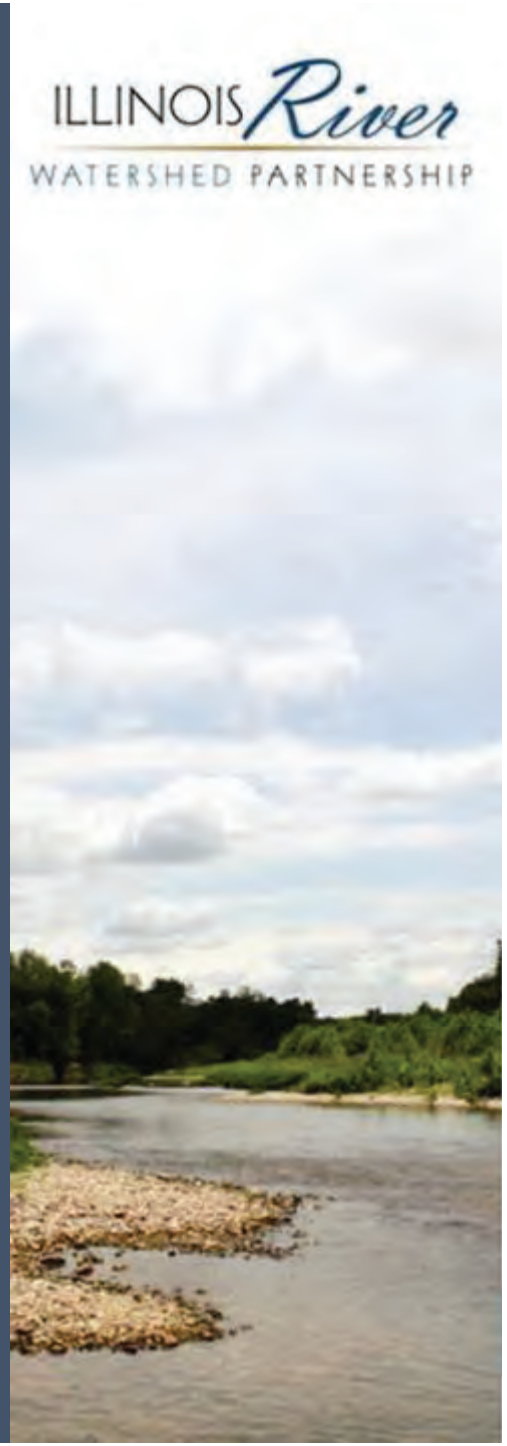
ILLINOIS River WATERSHED PARTNERSHIP

ILLINOIS River
WATERSHED PARTNERSHIP

Stakeholder Education

Field Tours and Workshops

Landowner Services Program



Residential LID Field Tour

Riparian Buffer Field Tour

Grazing School

Land Conservation Field Tour

Commercial LID Field Tour

In 2019, 991 individuals participated in 2,226 hours of learning

Stakeholder Education Events

ILLINOIS River WATERSHED PARTNERSHIP

For all watershed landowners:

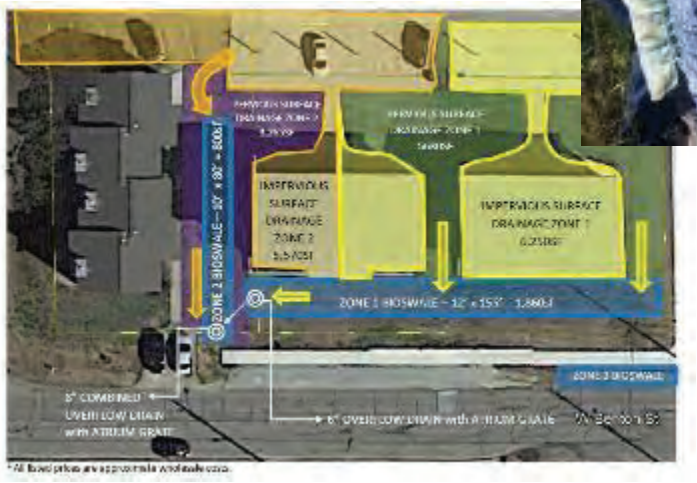
- Educational newsletters
- One-on-one consultation
- Customized conservation plans
- Liaison between landowners and agencies

CONSERVATION PLAN

GRAND VALLEY NEIGHBORHOOD

ILLINOIS River WATERSHED PARTNERSHIP

Submitted by:
Travis Chaney, Restoration Specialist
Illinois River Watershed Partnership
221 S. Main Street
Cave Springs, AR 72718
travis@iriwp.org
(479) 531-7707



In 2019:

- Technical guidance to 83 watershed landowners
- Conservation plans prepared for 19 landowners
- 4,827 received educational newsletter

ILLINOIS River WATERSHED PARTNERSHIP

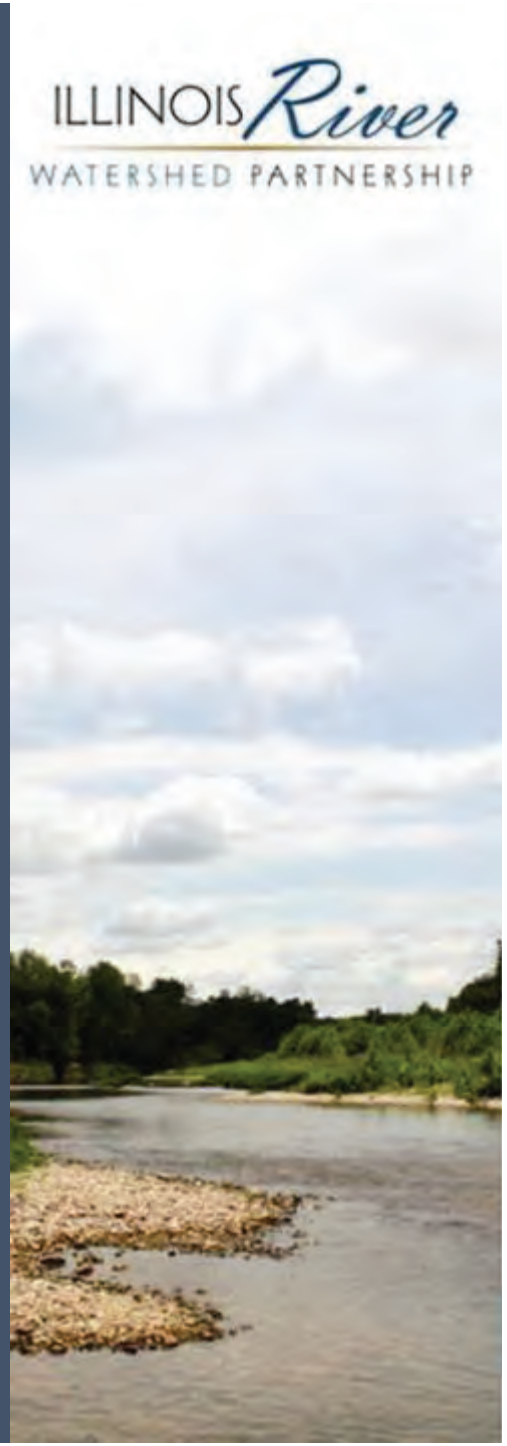
ILLINOIS River
WATERSHED PARTNERSHIP

Restoration Projects

Riparian Restoration

Unpaved Roads

Septic Remediation



Goals:

- Protect riparian areas with no to low erosion, public and private lands
- 20 miles of riparian restoration
- Two square miles of new rotational grazing systems

Eligible projects:

- Grassed and forested riparian buffers
- Alternative watering
- Fencing
- Streambank stabilization
- Wetland construction/restoration
- Prescribed burning
- Stream habitat improvement
- Forest stand management

Launched in 2018: Riparian Restoration Program

ILLINOIS River WATERSHED PARTNERSHIP

- 11.96 miles of riparian restoration projects
  - Forest stand improvement
  - Native, warm-season grass establishment
  - Forested and herbaceous riparian buffer
  - Wetland improvement
  - Prescribed burning

- 608 acres of new rotational grazing systems
  - Fencing
  - Alternative water facilities
  - Stabilized crossings
  - Heavy use areas

Riparian Restoration Program “By the Numbers”

ILLINOIS River WATERSHED PARTNERSHIP

Sager Creek

- 1.7 acres of riparian reforestation:
  - Black Walnut
  - Hickory
  - Redbud
  - Spicebush
  - Native Holly
  - Flowering Dogwood

- Working with landowner to ensure establishment and regular maintenance.

Clear Creek

- 12 acres: converstion of pasture to native, warm-season prairie grasses
- 12 acres: Riparian reforestation
- Wetland improvement
- Mowed pathways and signage for public access and education

Muddy Fork

- Installed 3 tire tanks
- Added over 2,000’ of fence for rotational grazing.

Note:
ANHC identified a sedge (Carex willdenowii) in the upland forest on the Phillips property that had never been documented in Washington County.

40 acres of rotational grazing.

The Course at Sager's Crossing

- Over 4,000' of stream to be restored.
- 8 acres of floodplain and upland grass buffer created.
- 6,000 livestakes planted.

Note:
City if seeking certification from the Audubon Cooperative Sanctuary Program

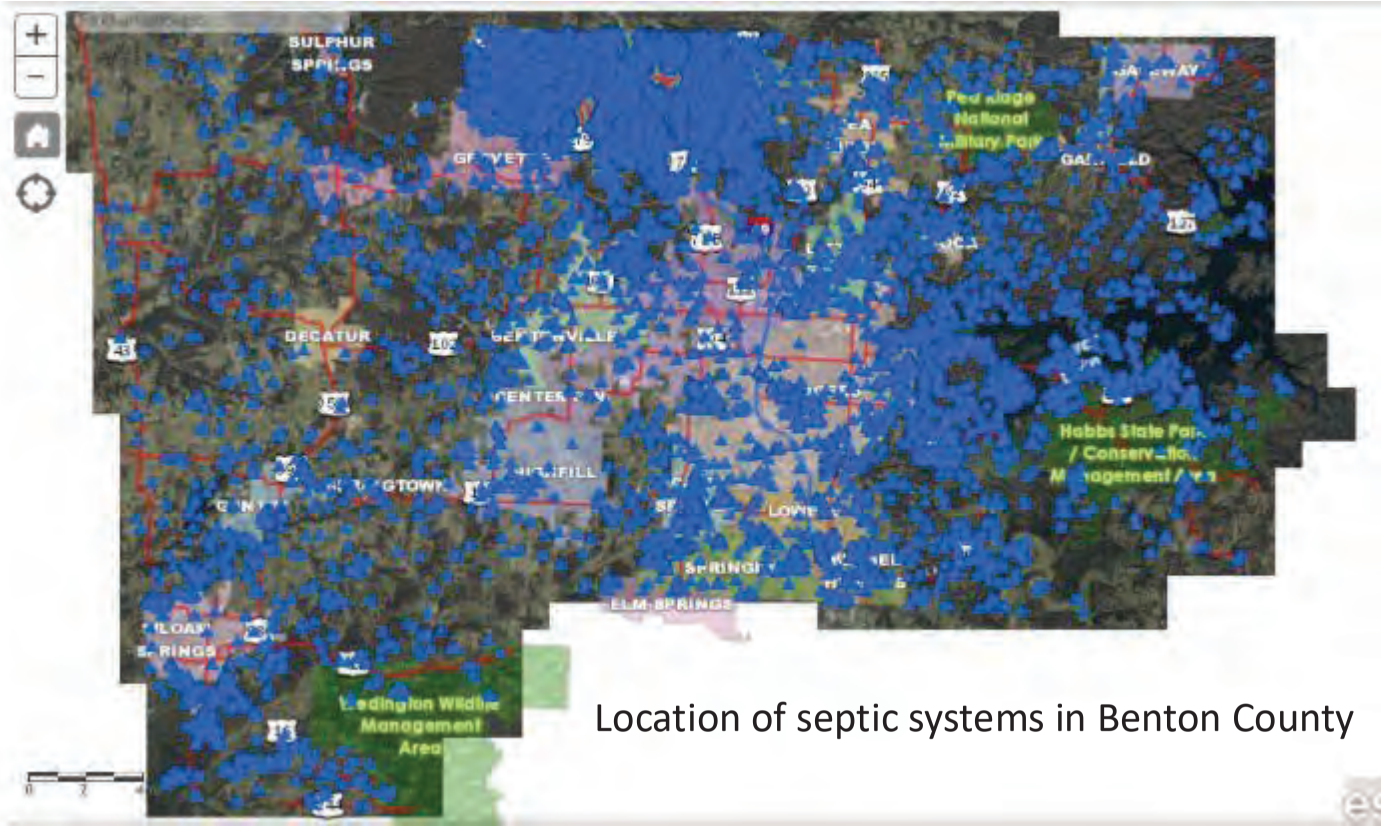
- In Lake Wedington subwatershed study, found to contribute 39% of sediment
- Impacts: sediment and nutrient loading, species of conservation concern
- Can achieve 50 to 90% reduction
- Reduced maintenance requirements

Unpaved Roads Demonstration and Education Program

ILLINOIS River
WATERSHED PARTNERSHIP

Project Goals:

- Replace failing septic systems
- Address nutrient loading and pathogen impairment
- Grant/loan proportion based on % below poverty line
- Partner with Ozarks Water Watch to cover most of Northwest Arkansas



Location of septic systems in Benton County

Septic Remediation Program

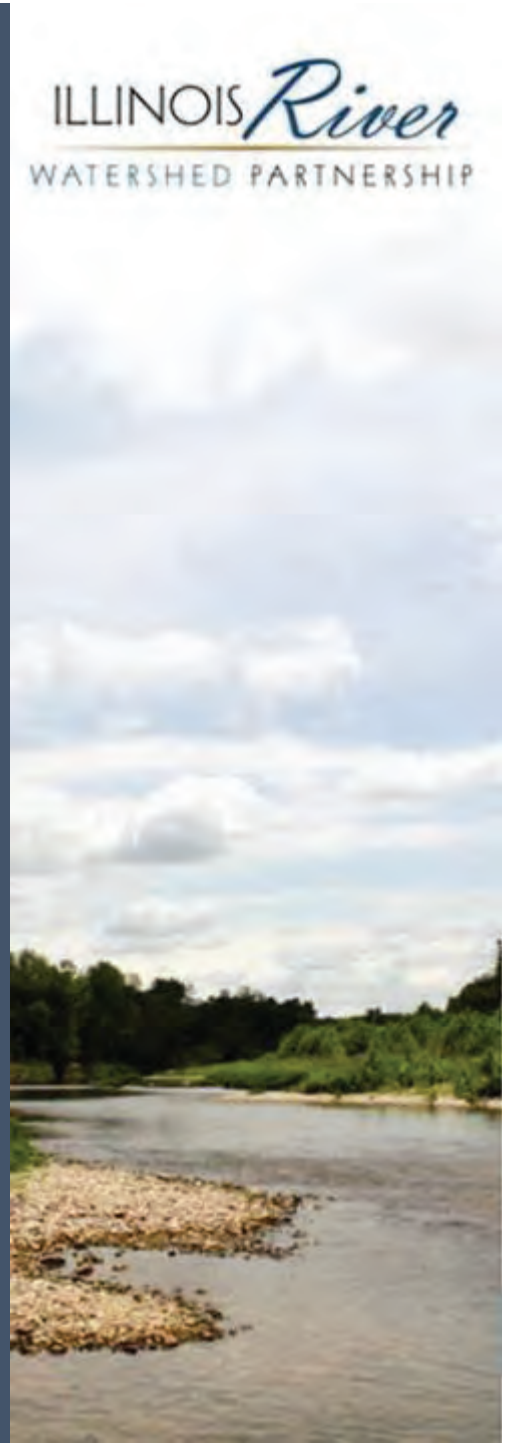
ILLINOIS River
WATERSHED PARTNERSHIP

ILLINOIS River
WATERSHED PARTNERSHIP

Thank you for your time!

Nicole Hardiman, Ph.D.
director@irwp.org
479-422-1014

www.irwp.org

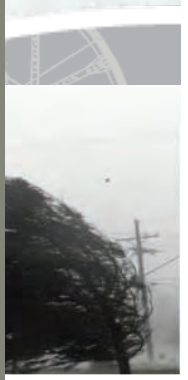


FLOOD ANALYSIS OF THE ILLINOIS RIVER IN NORTHWEST ARKANSAS AND NORTHEAST OKLAHOMA

Cherokee Nation;
Grand River Dam Authority---Scenic River Operations;
U.S. Army Corps of Engineers, Little Rock and Tulsa Districts

Special thanks to Mr. David Pickle

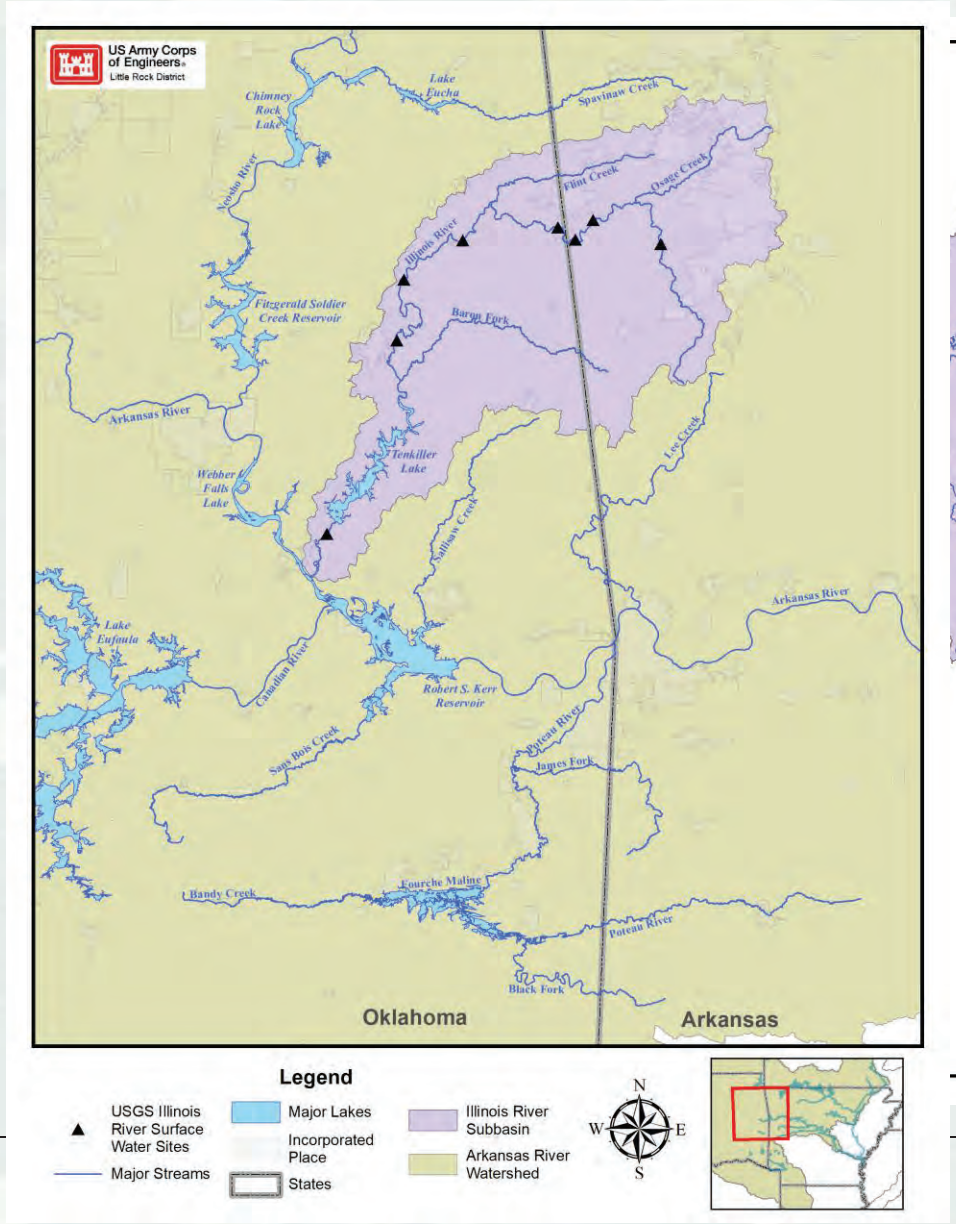
24 Sept 2020



U.S.ARMY

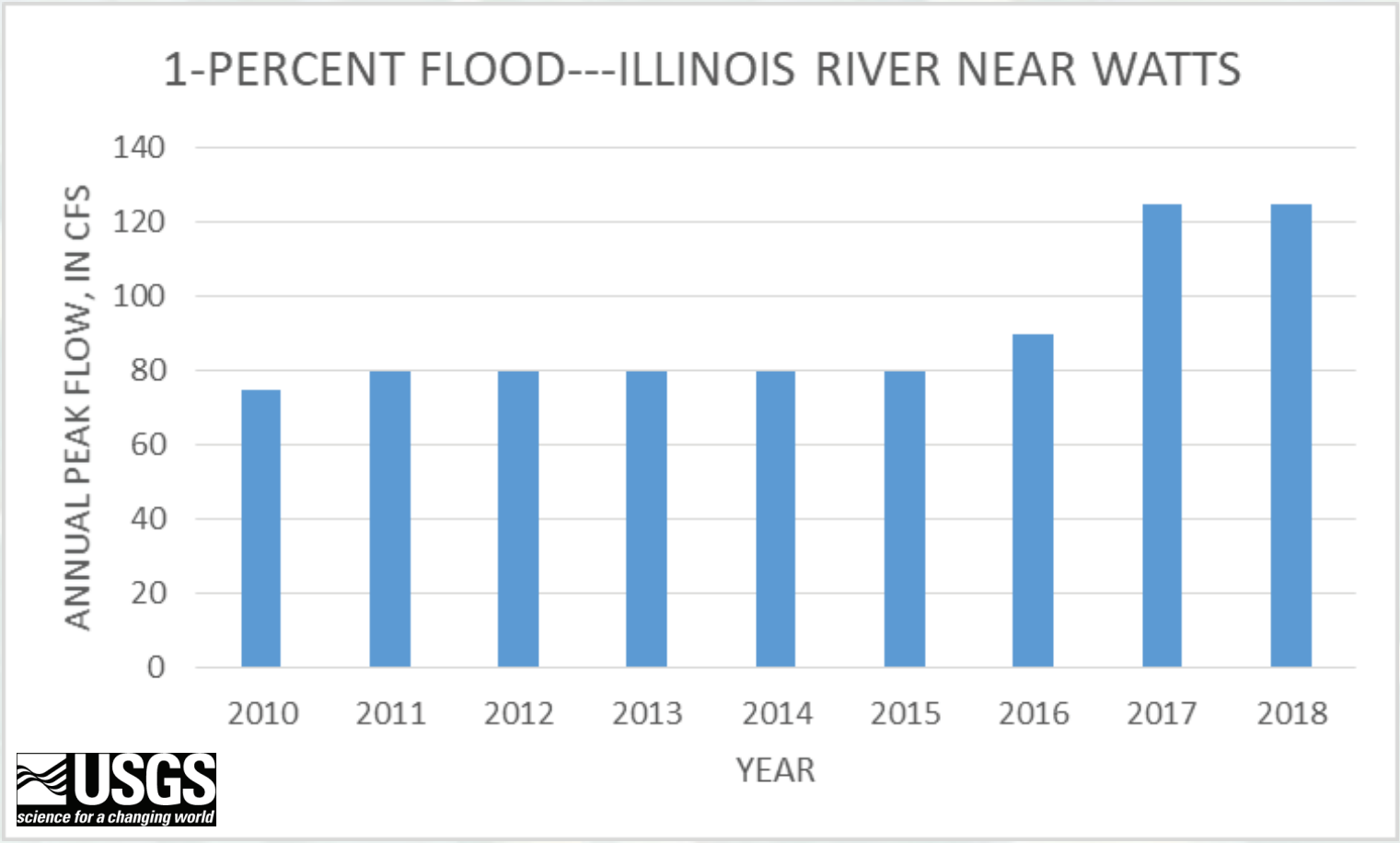
US Army Corps of Engineers
BUILDING STRONG®

STUDY AREA



STUDY AREA

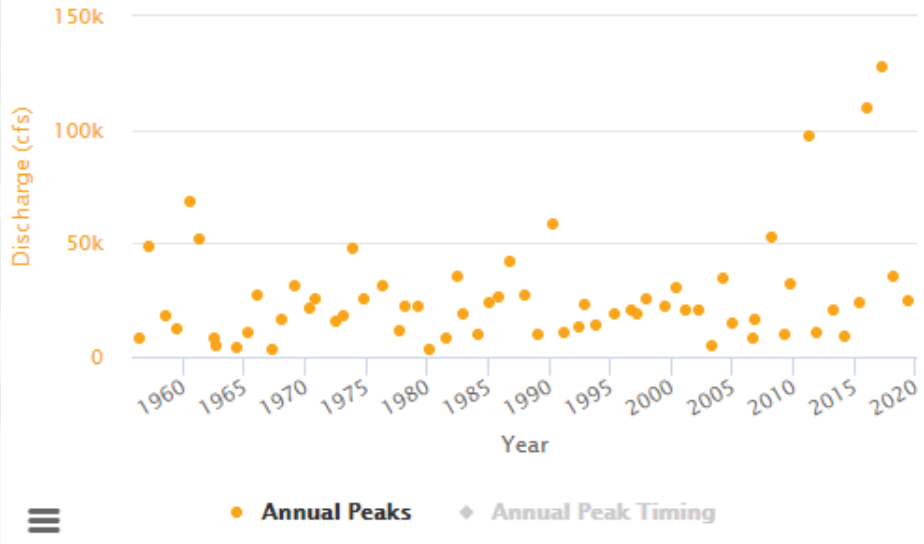
ILLINOIS RIVER FLOODING



ILLINOIS RIVER FLOODING

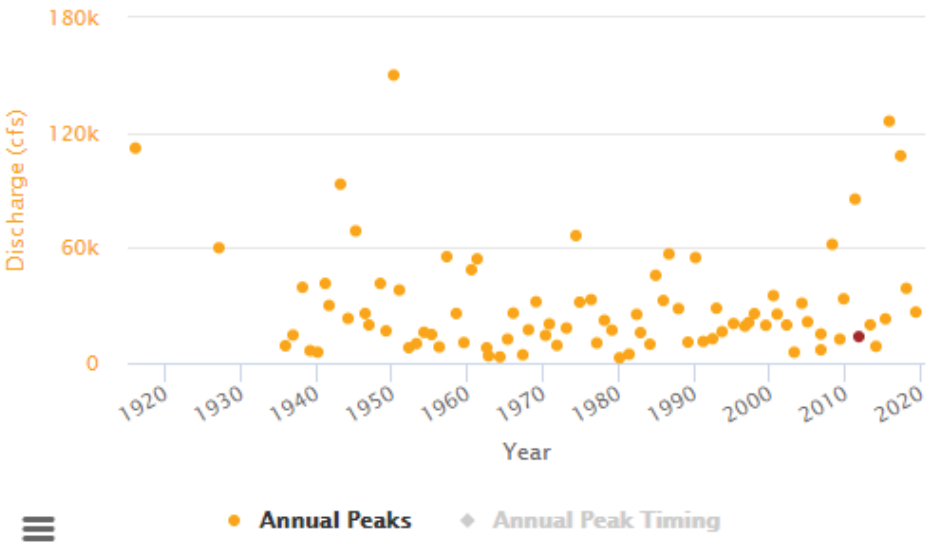
USGS Site Name	Illinois River near Watts, OK
USGS Site Number	07195500
Drainage Area	630 sq. mi. Contrib:630 sq. mi.
USGS Gage Datum	893.78 ft (NGVD29) Level or other surveyed method (+- .01 ft)

Select Annual Peak Q flow between 10-1 and 9-30 Load

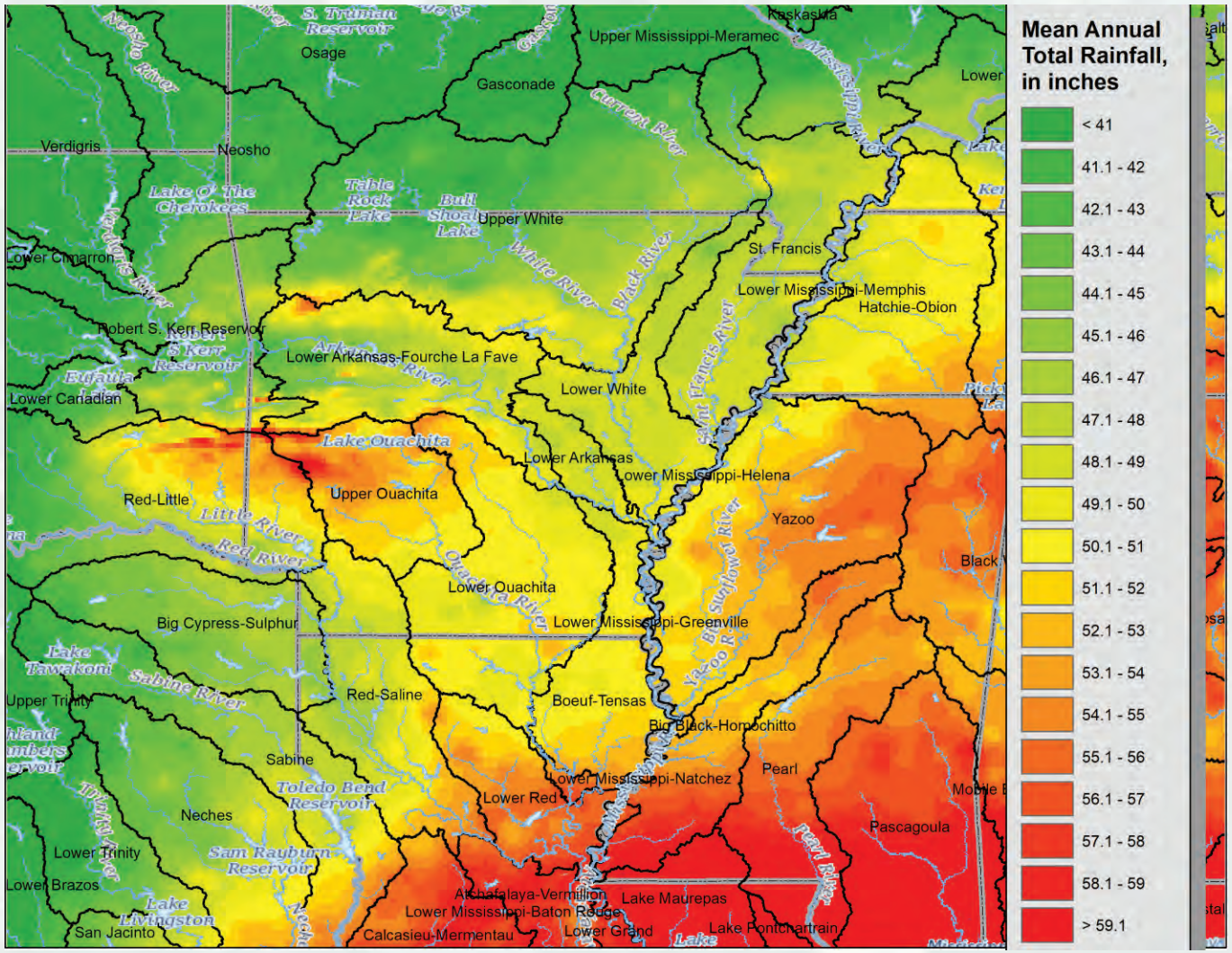


USGS Site Name	Illinois River near Tahlequah, OK
USGS Site Number	07196500
Drainage Area	950 sq. mi. Contrib:950 sq. mi.
USGS Gage Datum	664.14 ft (NGVD29) Level or other surveyed method (+- .01 ft)

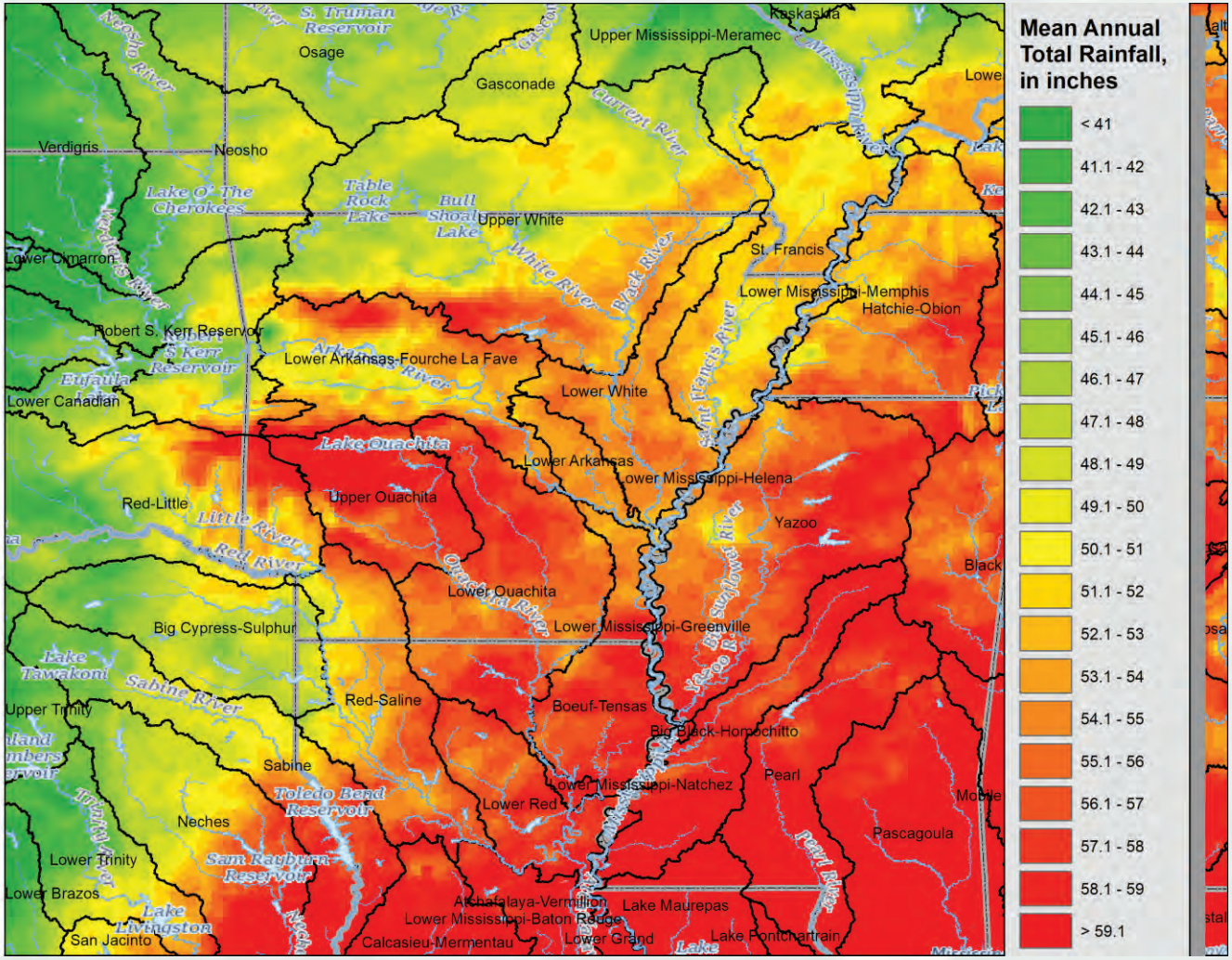
Select Annual Peak Q flow between 10-1 and 9-30 Load



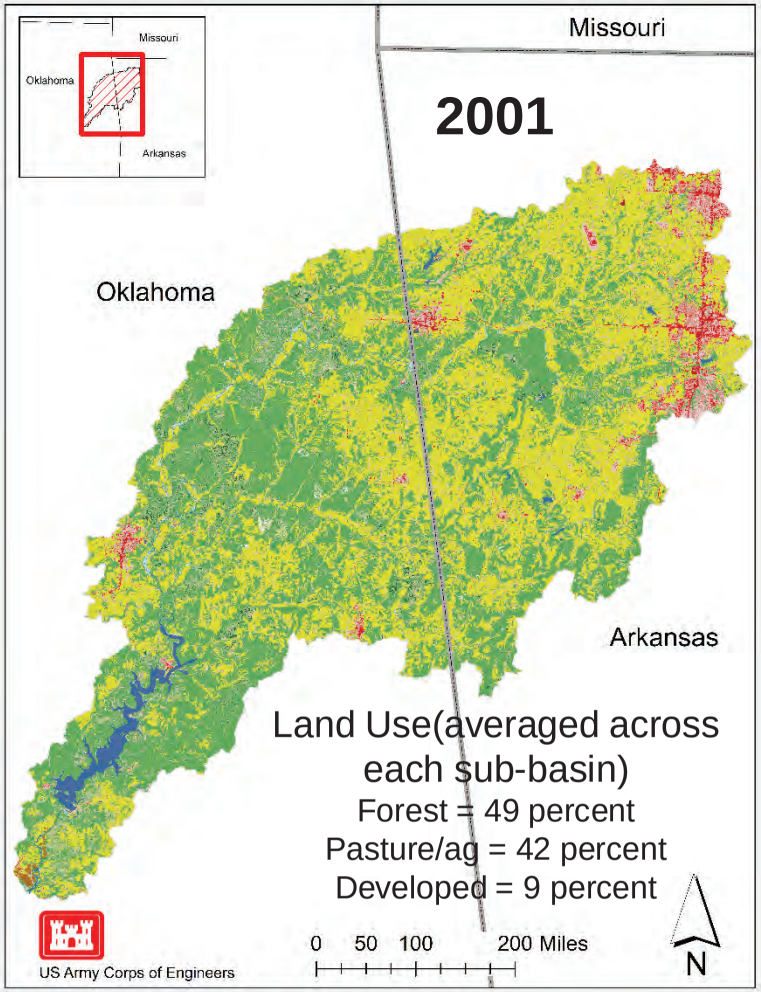
PRISM Data: 1959-1973

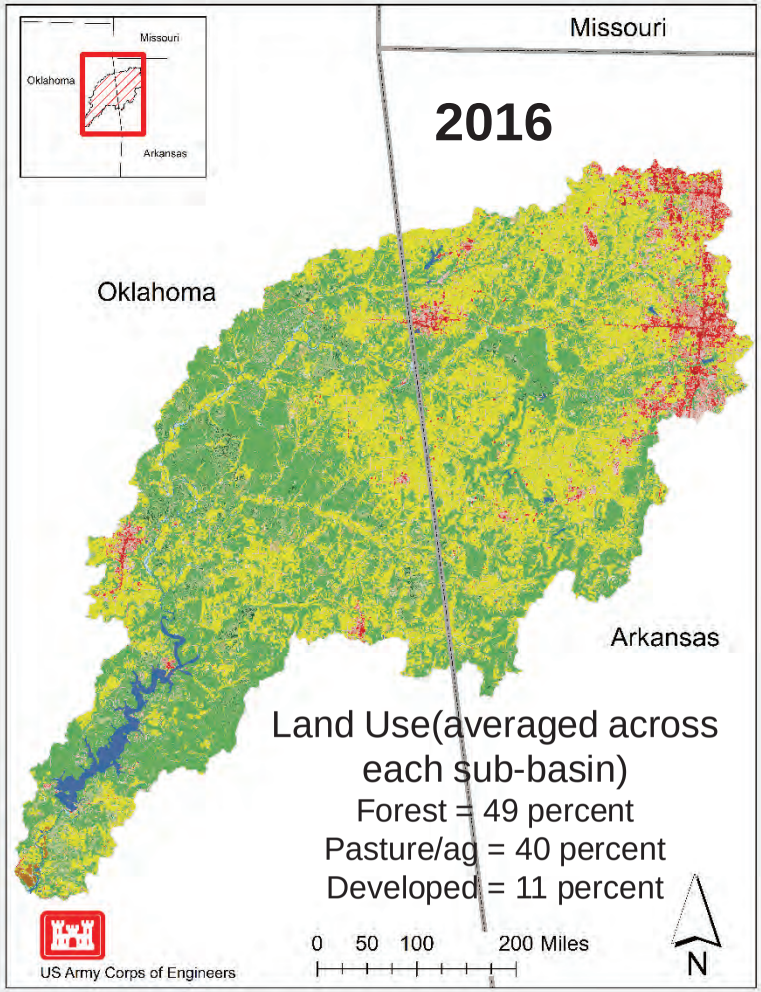


PRISM Data: 2004-2018

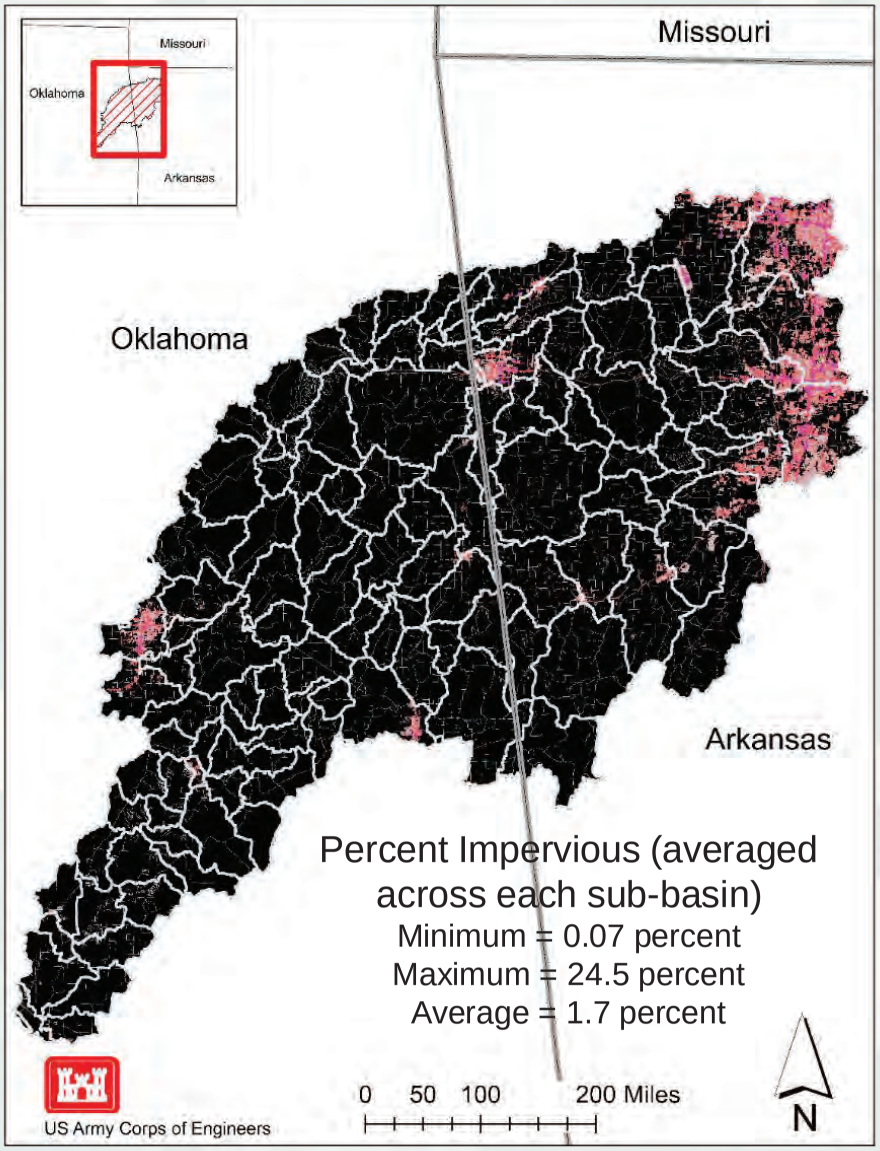


Land Use


Missouri
Oklahoma
Arkansas
2001
Oklahoma
Arkansas
Land Use(averaged across each sub-basin)
Forest = 49 percent
Pasture/ag = 42 percent
Developed = 9 percent
US Army Corps of Engineers
0 50 100 200 Miles
N


Missouri
Oklahoma
Arkansas
2016
Oklahoma
Arkansas
Land Use(averaged across each sub-basin)
Forest = 49 percent
Pasture/ag = 40 percent
Developed = 11 percent
US Army Corps of Engineers
0 50 100 200 Miles
N

Land Use



ILLINOIS RIVER FLOOD RISK MANAGEMENT OBJECTIVES

- Flood Analysis (Hydrology)
  - Illinois River Gage Analysis
    - Understand approximately when and explore why the stream capacity has changed
    - Cross section data collection and comparison (when survey data is available)
  - Climate Variability (existing data/info already exists for locations close by, code is already developed)
    - Trends in streamflow, runoff and precipitation
  - Land Use Changes
    - Analyze development in the basin, primarily in NWA
    - Base-flow analysis
  - HMS Model
    - Identify the significant sources (locations) of runoff

ILLINOIS RIVER FLOOD RISK MANAGEMENT OBJECTIVES

- Flood Risk Management (hydraulics)
  - Work with OK USGS to determine cross-section locations for hydraulic model
  - Surface water
    - Hydraulics (simulate up to 10 changes to identify impacts from flooding)
      - Big picture ideas to narrow down the list of possibilities to pursue
  - Generate 1-Percent Floodplain Maps
    - Can be used to understand if “big picture” ideas help lower the 1% floodplain maps
    - Can be used to lessen the risks associated with flooding to communities along the Illinois River
    - Can be used by local agencies to help with floodplain management policies

STUDY TIMELINE

Task	June 20 – Dec 20	Jan 21 – June 21	June 21 – Dec 21	Jan 22 – June 22
Gage Analysis and USGS Cross Sections				
Climate Variability, Land Use Analysis, Base Flow Analysis, HMS Modeling				
Hydraulic Modeling, map production, alternatives analyses				
Draft Report				
Report Review				
Issue Final Report (estimated Summer 2022)				

FEDERAL UPDATE:

TULSA DISTRICT US ARMY CORPS OF ENGINEERS

ARKANSAS – OKLAHOMA ARKANSAS RIVER COMPACT COMMISSION

2020 ANNUAL MEETING

Mike R. Abate, PPM

Chief Civil Works Branch, PPMD

Tulsa District Corps of Engineers

24 September 2020

Military

Multipurpose Reservoirs

Hydropower

Interagency and International Support

MKARNS

US Army Corps of Engineers ®

U.S.ARMY

Civil Works Mission Areas

Water Supply

- 39.6% of Corps water supply contracts
- 28 lakes, 143 water supply customers
- 1.9 million acre-feet under contract
- 0.29 million acre-feet not under contract

Sardis Lake

Flood Risk Management

- 38 Corps dams + 12 others
- 15,950,000 acre feet of flood storage
- Arkansas River Basin: $26.8B in cumulative flood damage reductions
- Red River Basin: $2.8B in cumulative flood damage reductions

Denison Dam, Lake Texoma

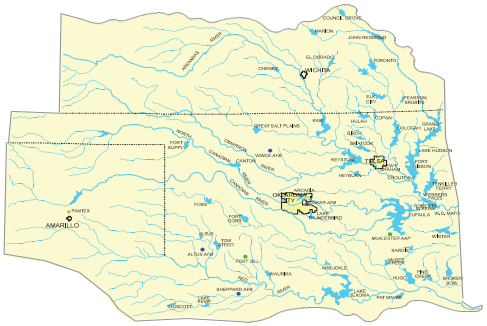
Environmental Stewardship

- 1.15 million acres of Federal land
- 660,000 acres of wildlife management areas

Water Quality

- Enhances municipal, industrial, irrigation usage
- Protects endangered species
- Improves degraded streams

Red River Chloride, Area VI



Least Terns Nesting on Arkansas River

Denison Dam Turbine

Hydroelectric Power

- 8 power plants produce 585,000 kw capacity
- Generates power to 8 million customers

Hawthorn Bluff Beach, Oologah Lake

Recreation

- 510 recreation areas at 33 projects
- 18.3 million visitors
- $770.6 million in total spending around Corps Projects

McClellan-Kerr Arkansas River Navigation System

- 5 locks & dams
- 3 major ports

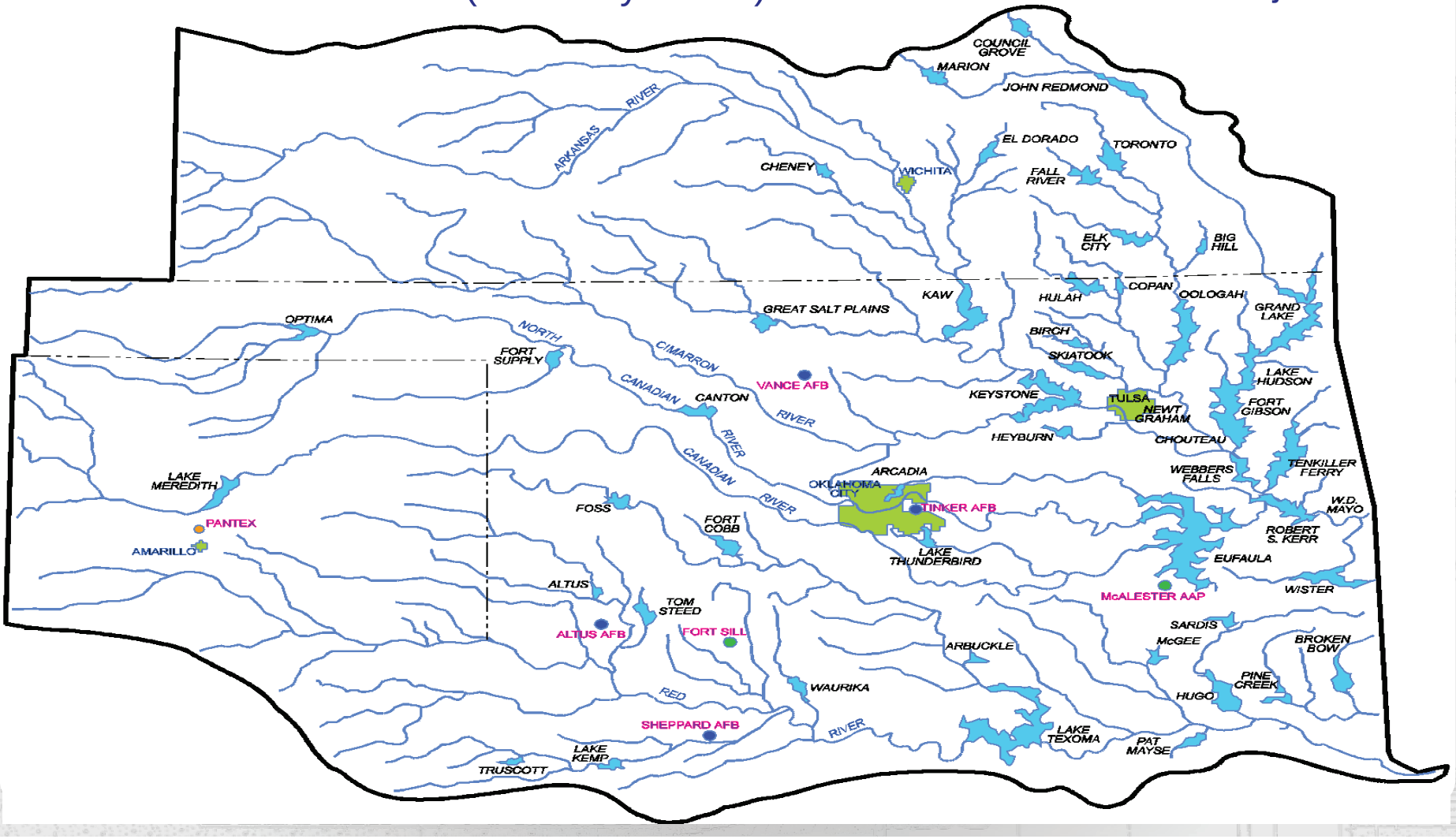
Tulsa District
US Army Corps of Engineers

US Army Corps of Engineers ®

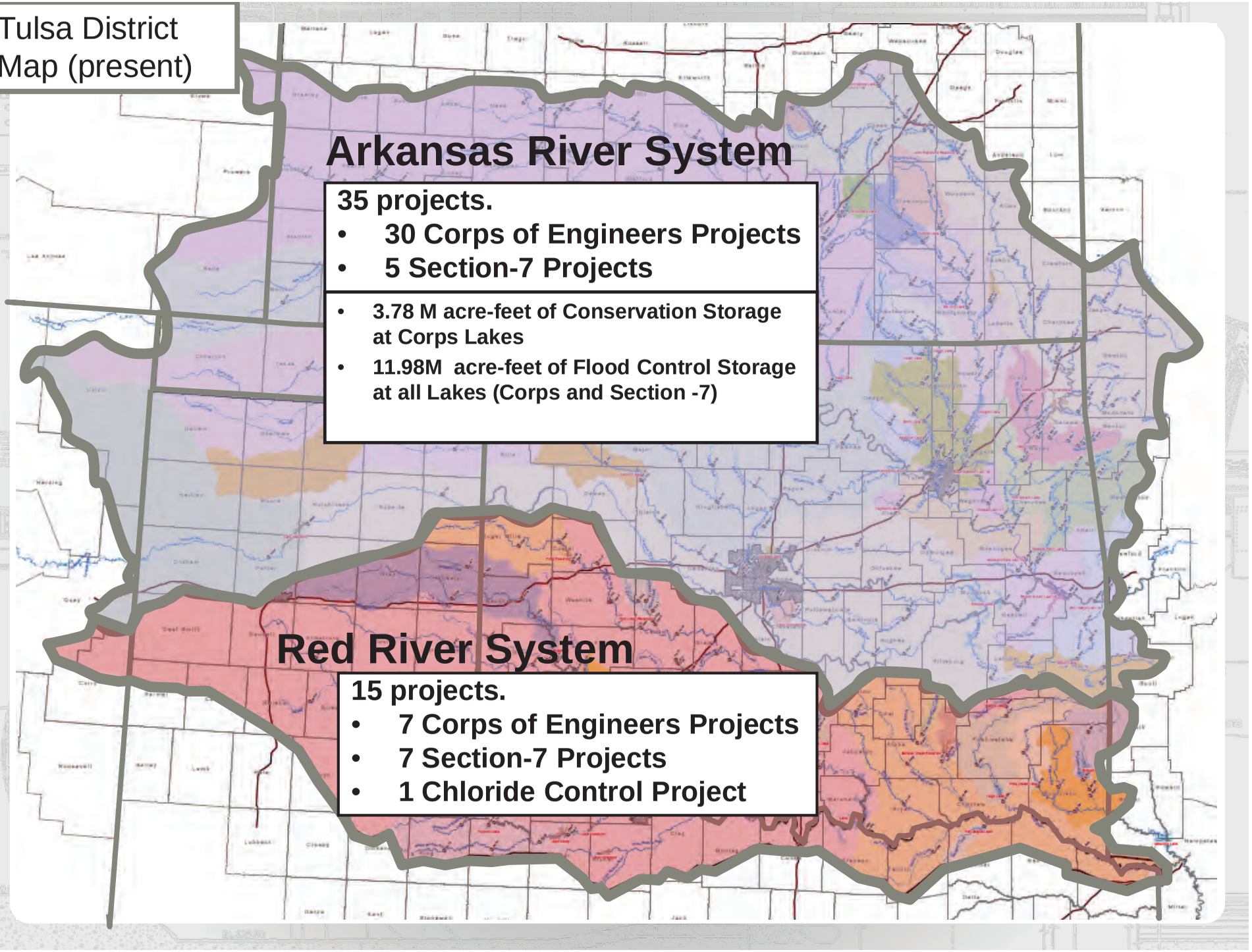
U.S.ARMY

Tulsa District Water Management

- 50 Projects
  - 15 in the Red River Basin
  - 35 in the Arkansas River Basin
- 12 Section-7 lakes (owned by others)
- 23 lakes with gated spillways
- 8 COE Hydropower
- 5 Navigation Locks
- 1 Chloride Control Project



Tulsa District
Map (present)



Planning Assistance to States (PAS)

Purpose

- ✓ Section 22, Water Resources Development Act (WRDA) of 1974, as amended, authorizes the Corps of Engineers to assist Tribes, States, local governments, and other non-federal entities with preparation of comprehensive water resources development plans
- ✓ Section 208, WRDA 1992, amended WRDA 1974 to include Native American Tribes as equivalent to States

Tulsa District PAS Program

SWT Leverages funds to support:

- ✓ Updates to and implementation of the Oklahoma Comprehensive Water Plan (OCWP)
- ✓ Kansas Reservoir Sustainability Initiatives (KRSI)
- ✓ Tribal Water Resources Studies

FY 2019 PAS Funding Request $633k

OKLAHOMA:

KANSAS:

TRIBAL NATIONS:

- Chickasaw and Choctaw Water Study ($440k)
- Otoe-Missouria Regional Study ($200,000)

FY 2020 PAS Funding Request $283k

OKLAHOMA:

- OCWP: Update ($250,000)

KANSAS:

- Bull Creek McPherson, KS ($100,000)

TRIBAL NATIONS:

- Chickasaw and Choctaw Water Study ($15k)

US Army Corps of Engineers ®

U.S.ARMY

SWT'S CIVIL WORKS HIGH PRIORITY PROJECTS

Keystone Dam Safety Modification Study

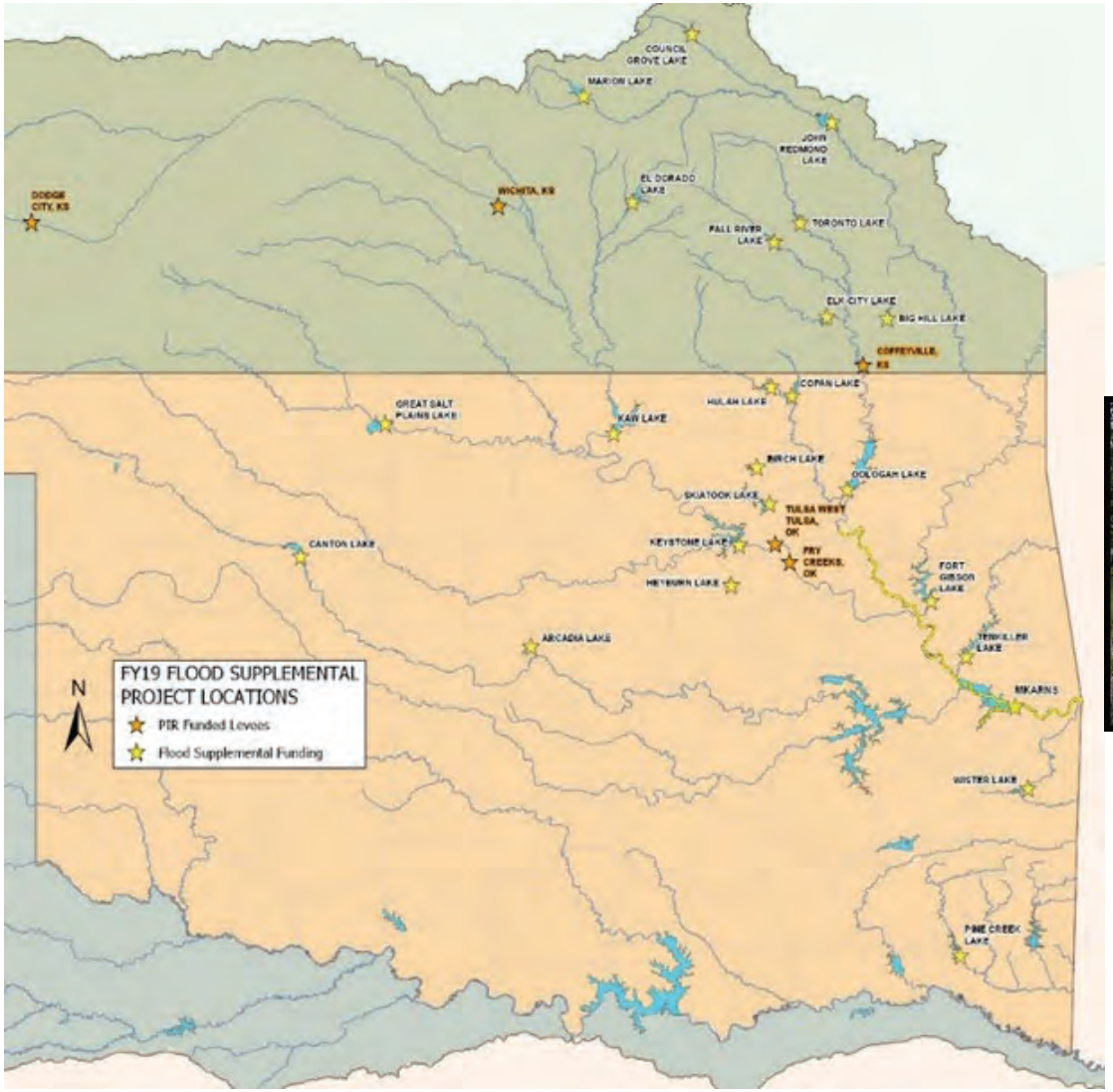
Arkansas River Corridor Feasibility

Tulsa West-Tulsa Levees Feasibility

US Army Corps of Engineers ®

U.S.ARMY

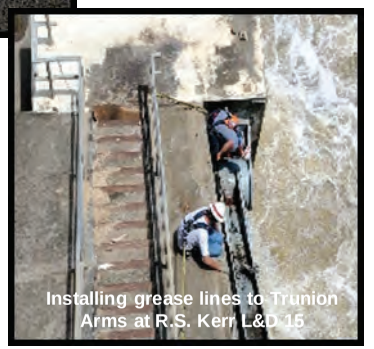
SWT Flood Supplemental Program



(147) Funded Work Packages

Total: $82,303,200

New Picnic Tables for Snake Creek PUA at Tenkiller Lake

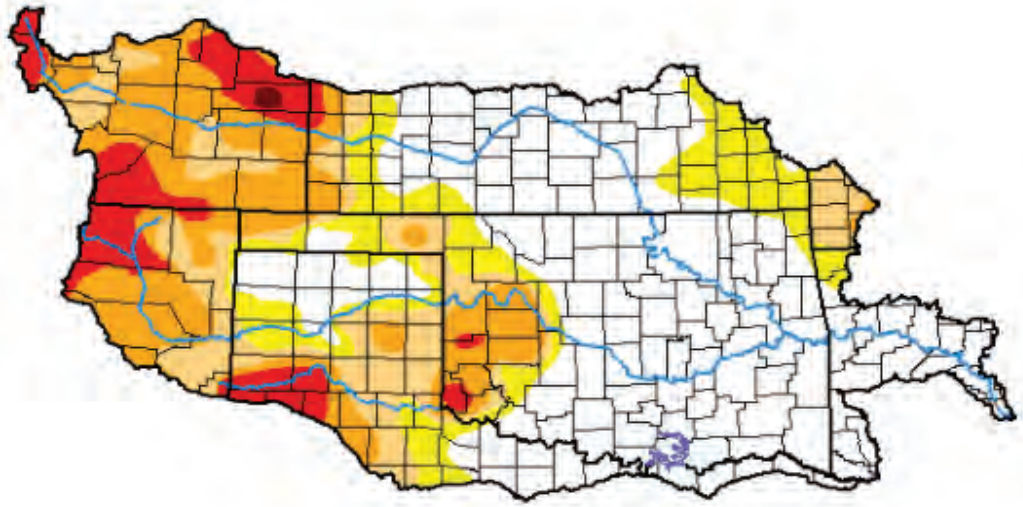


Installing grease lines to Trunion Arms at R.S. Kerr L&D 15

US Army Corps of Engineers ®

U.S.ARMY

U.S. Drought Monitor
Arkansas Red Basin RFC



September 22, 2020
(Released Thursday, Sep. 24, 2020)
Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	49.26	50.74	38.31	24.91	7.50	0.19
Last Week 09-15-2020	50.63	49.37	37.26	24.74	7.50	0.19
3 Months Ago 06-23-2020	30.72	69.28	51.68	35.24	18.88	0.00
Start of Calendar Year 12-31-2019	56.79	43.21	22.10	6.27	0.00	0.00
Start of Water Year 10-01-2019	63.31	36.69	10.43	1.00	0.00	0.00
One Year Ago 09-24-2019	65.28	34.72	10.36	1.69	0.00	0.00

Intensity:

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to https://droughtmonitor.unl.edu/About.aspx

Author:

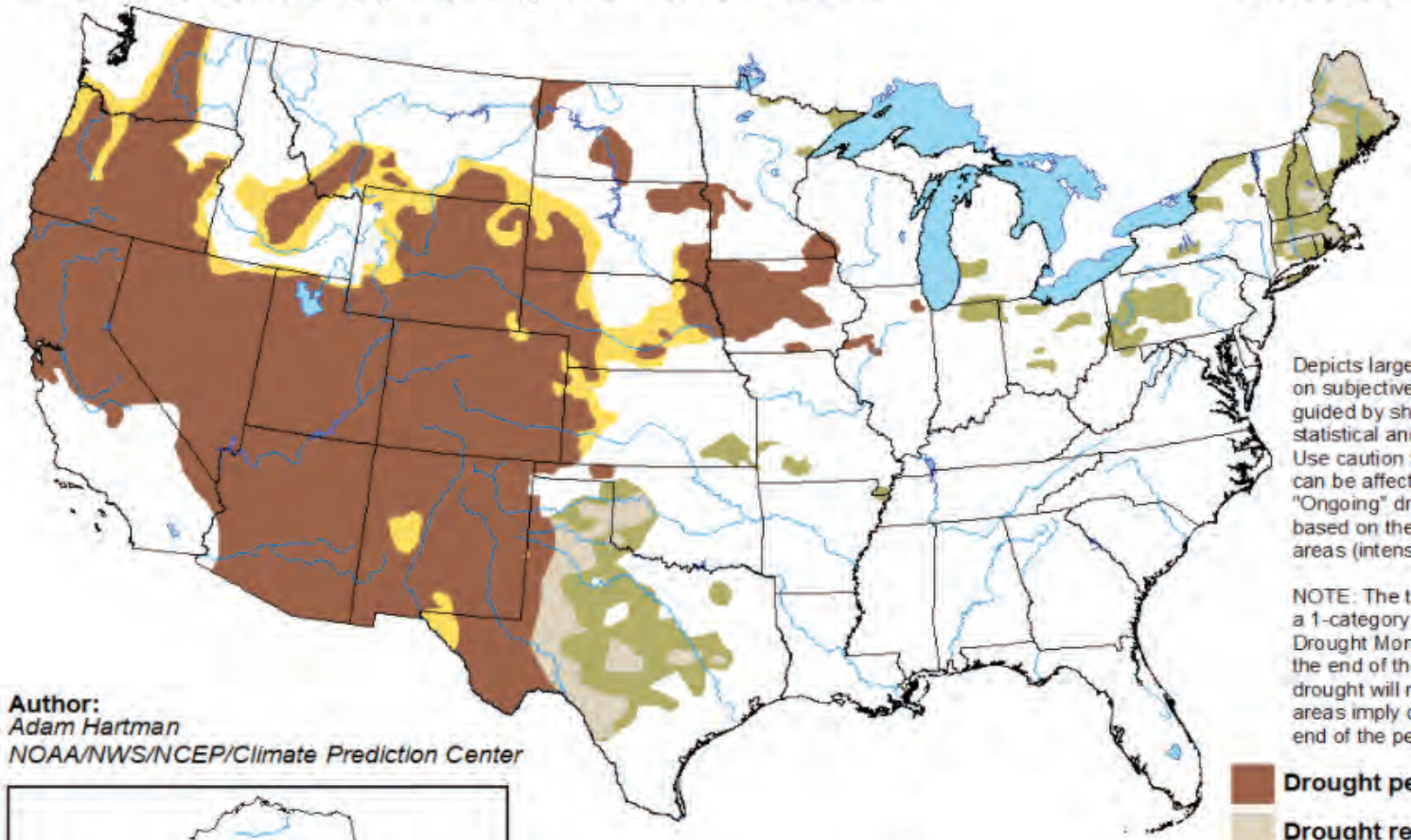
Brad Rippey
U.S. Department of Agriculture

droughtmonitor.unl.edu

U.S. Monthly Drought Outlook

Drought Tendency During the Valid Period

Valid for September 2020
Released August 31, 2020



Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Use caution for applications that can be affected by short lived events. "Ongoing" drought areas are based on the U.S. Drought Monitor areas (intensities of D1 to D4).

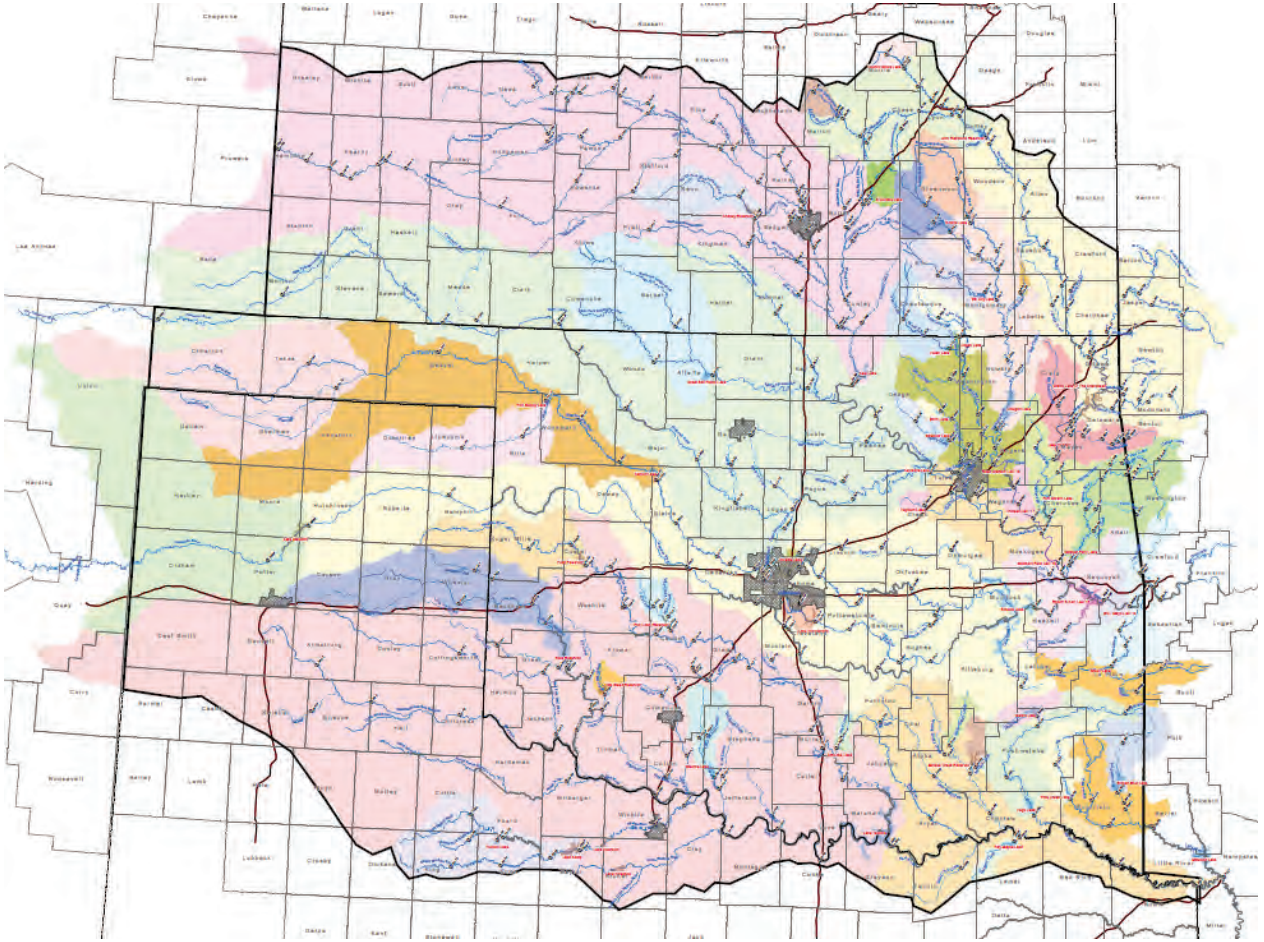
NOTE: The tan areas imply at least a 1-category improvement in the Drought Monitor intensity levels by the end of the period, although drought will remain. The green areas imply drought removal by the end of the period (D0 or none).

Drought persists
Drought remains but improves
Drought removal likely
Drought development likely

Author:
Adam Hartman
NOAA/NWS/NCEP/Climate Prediction Center

http://go.usa.gov/3eZGd

Questions?



US Army Corps of Engineers ®

U.S.ARMY

BUREAU OF RECLAMATION

Summary of Current and Recently Completed Activities

Planning, Construction Assistance, and Grant Programs

Oklahoma-Texas Area Office

Mission Statements

The mission of the *Department of the Interior* is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the *Bureau of Reclamation* is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Table of Contents

Introduction

The Bureau of Reclamation (Reclamation) is an agency within the Department of the Interior with a primary mission designated to manage, develop, and protect water and related resources in an environmentally and economically sound manner within the 17 western states. The Oklahoma-Texas Area Office (OTAO) is responsible for administering 11 reservoir projects and associated water distribution systems in southern Kansas, Oklahoma, and Texas. The combined water delivery is more than 680,000 acre-feet (ac-ft) of Municipal and Industrial (M&I) water annually to approximately three million water users, providing additional fish and wildlife, recreation, and flood control benefits. The OTAO supports two Irrigation Districts, one in Oklahoma and one in Texas.

Reclamation works in conjunction with other Federal and state agencies, Indian Tribes, and local entities in performing these responsibilities. Significant areas of activity include providing oversight of operations and maintenance of existing facilities and water resources planning along with construction assistance.

The purpose of this activity report is to provide a summary of current and recently completed activities under the Planning, Construction Assistance, and Grant Programs.

Native American Affairs Program

The Native American Affairs Program, which is a formal program funded through the Native American Affairs line item in Reclamation's budget, is small but integral part of the overall Native American Program. The Native American and International Affairs Office in the Commissioner's Office serve as the central coordination point for the Native American Affairs Program and lead for policy guidance for Native American issues in Reclamation.

Two new projects were recently awarded in FY 19 totaling $397,610 in Federal funding:

- **Choctaw Nation**
  Water treatment processes for regional water service providers
- **Osage Nation**
  Water infrastructure assessment project

Two projects were awarded in FY 18 totaling $375,869 in Federal funding:

- **Chickasaw Nation**
  Water Supply for the City of Tishomingo
- **Choctaw Nation**
  Improvements for Failing Water/Wastewater Treatment Plants in Choctaw Territory

Four projects were awarded in FY 17 totaling $277,900 in Federal funding:

- **Cherokee Nation**
  Hydraulic and Water Loss Assessment of Cherokee Rural Water District #2
- **Chickasaw Nation**
  Davis to Sulphur Pipeline Feasibility Study
- **Kickapoo Tribe of Oklahoma**
  Establishing Reference Conditions for the Northern Cross Timbers EcoRegion Using Macroinvertebrate Assemblages
- **Miami Tribe of Oklahoma**
  Water Assessment of Tribal Land

Water Conservation Field Services (WCFS) Program

One new project was awarded in FY 17 totaling $100,000 in Federal funding:

- **Central Oklahoma Master Conservancy District (COMCD)**
  Evaluate the Effectiveness of Floating Wetland/Breakwater Unit Designs to Reduce the Energy of Wave Action before Contacting the Lake's Shoreline

WaterSMART Program

Reclamation's WaterSMART (Sustain and Manage America's Resources for Tomorrow) Program aims to leverage Federal (up to 50 percent cost-share) and non-Federal funds to improve water management, increase energy efficiency in water delivery, facilitate water marketing projects, protect threatened and endangered species, and carry out activities to address potential climate-related impacts on water resources. Eligible entities include irrigation and water districts, river authorities, tribes, states and other entities with water or power delivery authority.

Basin Study Program

This program addresses water needs on a basin-wide scale through development of future supply/demand projections that include state-of-the-art data on climate variability; an analysis of how infrastructure and operations will perform in the face of changing realities; and development of mitigation strategies and management solutions. Studies are cost-shared on a 50/50 basis with willing state, tribal, and local partners and generally take two years to complete. Reclamation's share of study costs are used to support work done by Reclamation or its contractors.

Upper Washita Basin Study
A Basin Study on the Upper Washita Basin in Oklahoma was awarded $350,000 in FY 12 Federal funds to partner with the Oklahoma Water Resources Board (OWRB) and Fort Cobb and Foss Reservoir Master Conservancy Districts to identify sustainable solutions to infrastructure issues and existing and projected imbalances between water supply and demand.

Substantial progress has been made on the UWBS, including but not limited to the development of five hydrologic models (two numerical groundwater models, two reservoir yield models, and a basin-wide network stream model), as well as supply and demand climate risk assessments. OWRB is in the process of completing review of the Washita River Alluvium groundwater model and the Rush Springs Aquifer groundwater model has been completed and publication is out for review. Also, the calibration for the Surface Water Allocation Model (SWAM) is complete. Completion of these models is critical toward being able to evaluate the reliability of existing infrastructure and options under current and future climate conditions, as well as evaluating adaptation and mitigation strategies. A legal review of adaptation strategies is currently in progress. The Fort Cobb Reservoir Master Conservancy District has been working closely with Reclamation to develop conveyance alternatives to address aging infrastructure issues. Designs and cost estimates are under development.

Upper Red River Basin Study
A Basin Study on the Upper Red River Basin in Oklahoma was awarded $640,000 in FY 14 Federal funds to partner with the OWRB, Lugert-Altus Irrigation District, and Mountain Park Master Conservancy District to identify sustainable solutions to infrastructure issues and existing and projected imbalances between water supply and demand. The study will evaluate infrastructure and permitting options complimented by a legal review of adaptation strategies that will help ensure long-term reliability of water supplies during critical drought periods.

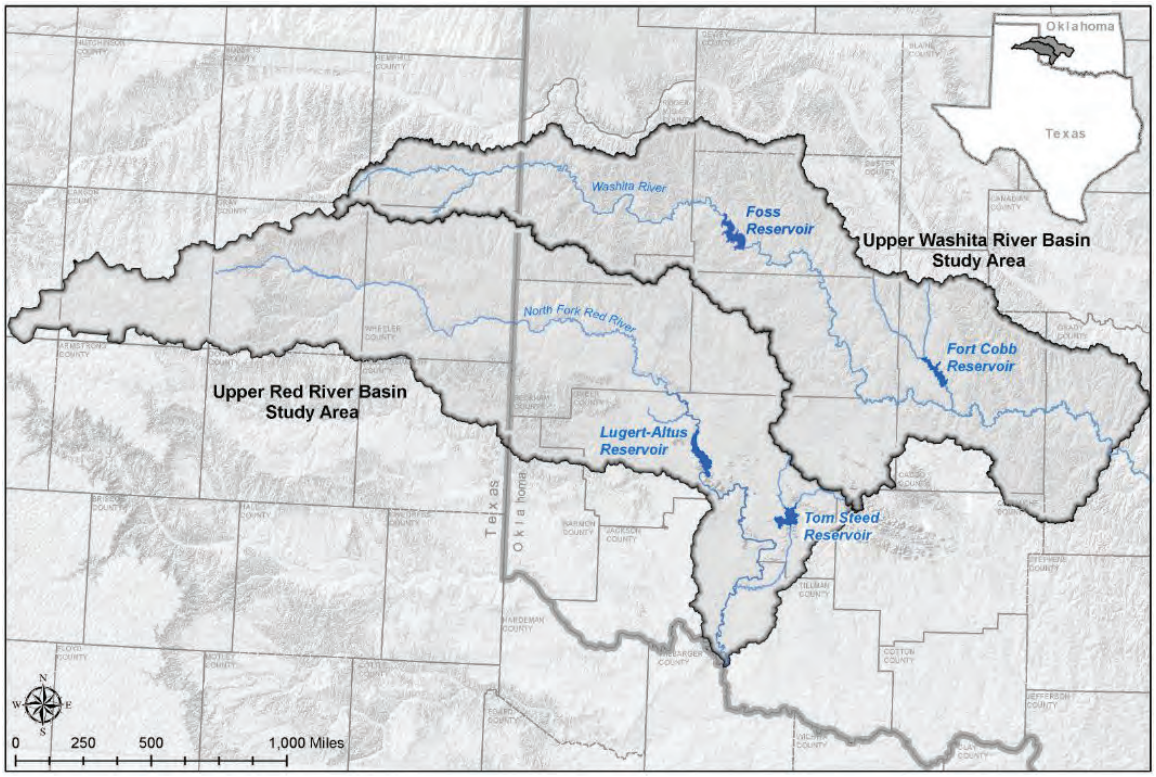


Figure 1: Upper Washita and Upper Red River Basin Study area map.

Substantial progress has been made on the URBS, including the development of four hydrologic models (a numerical groundwater model, two reservoir yield models, and a basin-wide network stream model); supply and demand analyses; climate and hydrologic risk assessments; engineering design and costs of infrastructure alternatives; and most recently, modeling runs of various "status quo" scenarios evaluating a future under existing operations and management.

Applied Science Grants

This relatively new program, which is a component of Reclamation's WaterSMART Basin Study Program, seeks to develop tools and information that will inform and support water management decisions. Project results must be readily applicable by water managers and include tools and information that can be used to support water supply reliability, management of water deliveries, water marketing activities, drought management activities, conjunctive use of ground and surface water, water rights administration, ability to meet endangered species requirements, watershed health, conservation and efficiency and other water management objectives. Since the program's inception in FY19, four projects in Texas and Oklahoma have been selected and awarded about $418,476.

Texas Water Trade
Texas Water Trade was awarded $150,000 in FY 20 for studying the elucidating aquifer properties in the contributing zone of Comanche Springs.

Oklahoma State University, OK
OSU was awarded $150,000 in FY 19 for applying unmanned systems for water quality monitoring.

Oklahoma State University, OK
OSU was awarded $88,476 in FY 19 for improving seasonal streamflow forecasting for irrigation districts by incorporating soil moisture information derived from remote sensing.

Gulf Coast Water Authority, TX
Texas Coast Water Authority was awarded $30,000 in FY 19 for the enhancement of water availability models of the Lower Brazos Basin.

Water and Energy Efficiency Grants

This program seeks to conserve and use water more efficiently, increase the use of renewable energy, improve energy efficiency, benefit endangered and threatened species, facilitate water markets, carry out activities to address climate-related impacts on water or prevent any water-related crisis or conflict. Since 2010, Reclamation has awarded about $16.6 million to 42 projects in Texas and Oklahoma with a cumulative project cost of $57,332,148 million. The estimated total amount of water saved or better managed is about 35,463 acre-feet per year.

City of Eufaula, OK
The City of Eufaula is selected to receive $1,500,000 in FY 20 for major water system improvements comprised of installation and replacement of water lines, installation and replacement of service connections, installation and replacement of gate and pressure valves, and installation and replacement of fire hydrants. The improvements are expected to result in water savings of 265 acre-feet annually.

Cameron County Irrigation District #6 (CCID6), TX
CCID6 is selected to receive $300,000 in FY 20 for multiple projects within the District. The project is expected to result in water savings of 1,040 acre-feet annually.

Harlingen Irrigation District Cameron County No. 1
Harlingen Irrigation District No. 1 is selected to receive $300,000 in FY 20 for piping of the Wyrick Canal (Phase II). The project is expected to result in water savings of 92 acre-feet annually and energy savings of 2,733 kwh annually.

City of Wilmer, TX
City of Wilmer is selected to receive $198,802 in FY 20 for Smart Meter Conversion and SCADA System Implementation Project. The project is expected to result in water savings of 53 acre-feet annually.

City of Durant, OK
The City of Durant, OK was awarded $1,500,000 in FY 19 to replace 5,999 manual read meters with smart meters and associated advanced metering infrastructure network

software. The project is expected to result in water savings of 1,003 acre-feet annually that is currently lost to leaks.

Bayview Irrigation District No. 11, TX
The Bayview Irrigation District #11 was awarded $300,000 in FY 19 to convert 2,550 feet of the Main Canal, a concrete-lined open canal, to a 48-inch polyvinyl chloride pipeline. The project is expected to result in water savings of 120 acre-feet annually that is currently being lost to seepage and evaporation.

Cameron County Irrigation District No. 2 (CCID2), TX
CCID2 was awarded a total of $175,841 in FY 19 comprised of conversion of open an unlined open canal in a segment of Lateral 8 to a buried 36-inch polyvinyl chloride pipeline to pipelines and slip gate upgrades. Water savings of 3,440 ac-ft per year and energy savings of 55,950 kilowatt hours per year is expected.

Harlingen Irrigation District Cameron County No. 1, TX
Harlingen Irrigation Dist. No. 2 was awarded $300,000 in FY19 comprised of converting 6,750 feet of the concrete Wyrick Canal to a 48-inch pressurized polyvinyl chloride pipe. The project is expected to result in water savings of 112 acre-feet annually, currently lost to seepage and evaporation.

Small-Scale Water Efficiency Grants

Since 2017, Small-Scale Water Efficiency Projects (SWEP) have been awarded $1.36 million to 19 projects in Texas and Oklahoma totaling over $2.97 million in cumulative project costs. Eligible projects include installation of flow measurement or automation in a specific part of a water delivery system, lining of a section of canal to address seepage, small rebate programs that result in reduced residential water use, or other similar projects that are limited in scope.

Chickasaw Nation, OK
The Chickasaw Nation is selected to receive $75,000 in FY 19 to install automatic meter reading (AMR) smart meters within Murray State College (MSC) water distribution system. Installation of these meters will significantly reduce water losses currently experienced within the MSC water distribution, enhance management of current water supplies and make the most efficient use of limited water supplies from Pennington Creek, the community's sol source of water.

McCurtain County Rural Water District No. 2, OK
McCurtain County RWD No. 2 is selected to receive $75,000 in FY 20 to purchase and install 350 smart water meters and associated hardware and software to replace existing conventional meters. The installation of these meters will serve to significantly reduce water losses currently experienced within the district's water distribution system while also enhancing the management of the community's water supply.

City of Blue Ridge, OK
City of Blue Ridge is selected to receive $75,000 in FY 20 to upgrade approximately 500 water meters to automated meters allowing for real-time data collection. The project will modernize their infrastructure and provide for accurate and detailed leak and billing data.

El Paso County Water Improvement District No. 1, TX
The El Paso County Water Improvement District Number One, located in El Paso, Texas,is to receive $75,000 in FY 20 to install concrete lining along 3,700 linear feet of the earthen Isla Lateral. The project will reduce water lost due to seepage and will help ensure consistent water deliveries. The water conserved from this project will help meet shortfalls in water supply during times of drought. The project is supported by the District's 2019 Water Conservation Plan and the 2016 Region E Far West Texas Water Plan.

Guadalupe-Blanco River Authority (GBRA), TX
GBRA in selected to receive $75,000 in FY 20 to complete a reinforcement project to harden the east levee on Hog Bayou. A total of 250 linear feet will be repaired, preventing the loss of freshwater that has been diverted from the Guadalupe River to serve municipal, industrial, and agricultural customers. It is estimated that repair of the levee would eliminate up to 10% of freshwater loss in the diversion canal system – or up to 36,200 acre-feet on an annual basis.

Harlingen Irrigation District Cameron County No. 1, TX
Harlingen Irrigation District Cameron County No. 1 is selected to receive $74,767 in FY 20 to construct a fully automatic checkgate on the District's main canal to improve the deliveries, system efficiency, and add storage capacity ot the Adams Garden Reservoir.

City of Elk City Public Works Authority, OK
Elk City was awarded $75,000 in FY 19 to continue replacing existing water meters with AMR water meters as since 2016 Elk City has replaced 3,500 of their 5200 water meters and anticipates replacing 970 meters.

City of Tishomingo, OK
The City of Tishomingo was awarded $28,600 in FY 19 in install automated irrigation systems, including pipes, sprinkler heads and rain sensors, for three Murray State College athletic facilities to replace the portable water cannons that are currently being used in addition to installing a water meter on the City of Tishomingo water line.

Red River Authority of Texas, TX
Red River Authority was $75,999 in FY 19 to install 550 new advanced metering infrastructure meters, including radio and computer reading equipment and a smart meter software system, for residential and commercial customers. The project will improve water use data collection and the ability to identify leaks.

Sharyland Water Supply Corporation (SWSC), TX
SWSC was awarded $73,656 in FY 19 for an advanced metering infrastructure project where all SWSC service connections will have an AMI meter (approx.. 18600).

Wichita County Water Improvement District No. 2, TX
Wichita County Water Improvement District No. 2 was awarded$74,924 in FY 19 for a project to replace 3,200 feet of open concrete ditches and canals with 24-inch buried plastic pipeline to reduce water losses from seepage and evaporation, thereby increasing efficiency and improving reliability.

City of Durant, OK
The City of Durant in Oklahoma was awarded $75,000 in FY 18 for a project to purchase and install 300 Smart Meters that will serve subdivisions and an apartment complex, assisting in reducing significant water loss currently experienced within the distribution system.

Thomas Public Works Authority, OK
Thomas Public Works Authority in Oklahoma was awarded $75,000 in FY 18 for a project to purchase and install 12 Smart Meters at important city-owned locations. The new meters will allow TPWA to effectively monitor water loss and identify areas of concern.

City of Tishomingo, OK
The City of Tishomingo in Oklahoma was awarded $75,000 in FY 18 for a project to purchase and install 27 Automatic Meter Reading (AMR) water meters and the associated software throughout the distribution system in order to address the significant water loss, promote water conservation and inform future water planning.

Water Marketing

This program provides assistance to states, tribes, and local governments to conduct planning activities to develop water marketing strategies that establish or expand water markets or water marketing activities between willing participants, in compliance with state and Federal laws. Reclamation has awarded over $700,000 to projects in the Oklahoma-Texas Area Office jurisdiction million to three projects since the inception of this program.

In FY 19, McLennan County, TX was awarded $75,000 to develop a water marketing strategy focused on conjunctive use of groundwater and surface water to stem groundwater depletions and stabilize water supplies in a five-city area. Implementation of the water marketing strategy was designed to meet the Groundwater Replenish Goal identified in the County's 2017 WaterSMART Drought Contingency and Water Supply Resiliency Plan.

In FY 19, City of Garden City was awarded $139,900 to establish a Water Marketing Strategy where the plan was designed to identify potential users of the wastewater effluent and develop a rate structure for the purchase of this new supply.

In FY 18, the Chickasaw Nation was awarded $149,288 to establish a water bank framework for the Arbuckle-Simpson Aquifer (AS) that will allow for voluntary, market-based transfers of groundwater pumping rights across the region. The Arbuckle-Simpson

Aquifer covers approximately 500 square miles and is the principal source of water for more than 100,000 people, supplies water for mining and irrigation, and is the source for nearly 100 known springs that are culturally important. In response to Oklahoma's groundwater regulatory changes, this water marketing strategy will allow landowners in the ASA to deposit water rights, while allowing permitted groundwater users to withdraw those water rights.

Cooperative Watershed Management Program

This program contributes to the WaterSMART strategy by providing funds to watershed groups to encourage diverse stakeholders to form local solutions to address their water management needs. Reclamation is promoting the sustainable use of water resources and improving the ecological resilience of rivers and streams using collaborative conservation efforts. Funding is provided for: 1) Development of Watershed Groups (Phase I) and 2) Implementation of Watershed Management Projects (Phase II). Seven CWMPs totaling more than $628,000 have been awarded since 2016.

In FY 20, City of Norman, OK is selected to receive an award of $85,000 to collaboratively improve the water quality in the Lake Thunderbird Watershed.

In FY 20, Blue River Foundation, OK is selected to receive an award of $99,536 for watershed planning for the Blue River.

In FY 20, Rio Grande International Study Center, TX is selected to receive $100,000 for watershed restoration planning for Laredo and upstream affected stakeholders.

In FY 20, Texas A&M Agrilife Extension Service is selected to receive $100,000 for Arroyo Colorado/Llano Grande restoration planning.

In FY 19, Lake of the Arbuckles Watershed Association Inc. (LAWA), OK was awarded $89,000 to implement the Lake of the Arbuckles Watershed Restoration Plan that was developed through in earlier CWMP award.

In FY 18, Grand River Dam Authority (GRDA) was awarded $100,000 to develop a stakeholder group and restore the Lake O' the Cherokees Sub-Watershed.

Title XVI and Desalination WINN Act Programs

The Water Infrastructure Improvements for the Nation Act (WIIN), P.L. 114-322, was enacted in 2016 to address water resources infrastructure that is critical to the Nation's economic growth, health, and competitiveness. Two important components of the WIIN Act affect the Title XVI Program:

Section 4009(c) of Subtitle J of WIIN amends Reclamation's Title XVI Water Reclamation and Reuse Program (Title XVI), originally established by P.L. 102-575 in 1992. Prior to the enactment of WIIN, funding for water recycling project construction

could only be provided for congressionally authorized Title XVI projects. The WIIN amendments now provide Reclamation with blanket authority to fund any new eligible "WIIN Title XVI Project"

Section 4009(a) of Subtitle J of WIIN includes amendments to the Water Desalination Act of 1996 and authorizes Reclamation to provide funding for "Desalination Projects", both ocean and brackish.

To date, approximately $6.6 million has been awarded to 19 studies within the Oklahoma-Texas Area Office (OTAO) comprised of Feasibility Study and Construction and Research studies.

City of Norman, OK
The City of Norman was recently selected to receive a reward over $700,000 in FY 19 for a field research project on inland indirect potable reuse (IPR). By expanding its existing water reclamation and reuse with an IPR project, the City of Norman will address reliability concerns at Lake Thunderbird, trim the usage/demand placed on its marginal groundwater supply, and potentially eliminate a need to purchase water from Oklahoma City.

Oklahoma Water Resources Board
The Oklahoma Water Resources Board was awarded a $150,000 grant in FY 17 for a feasibility study of potential impacts of select alternative produced water management and reuse scenarios. This study responds to both of Oklahoma Governor Mary Fallin's recent mandates to the OWRB to search for ways to use produced water as a benefit to the state as part of the Water for 2060 Initiative and to find solutions that deep-well injection volumes and thereby reduce the threat of seismicity within the state.

City of Ada, OK
The City of Ada, Oklahoma was awarded a $136,193 grant in FY 17 for a feasibility study within the "Assessment of the Potential for Recycled Water Development to Offset Potable Water Demands with Non-Potable Supply and Reducing Negative Water Quality Impacts in the Receiving Streams within Tribal Territory" Phase II Reuse Study. This study will provide the City with the means to continue down the path of a sustainable water supply future.

City of Bartlesville, OK
The City of Bartlesville, Oklahoma was awarded a $150,000 grant in FY 17 for a feasibility study to augment Bartlesville water supply with drought-resilient reclaimed water. This feasibility study will determine the environmental, technical and cost viabilities of reclaiming wastewater effluent by relocating the existing Caney River effluent discharge approximately 5 to 7 miles upstream, which places the effluent

City of Garden City, KS
The City of Garden City, Kansas was awarded a $65,369 grant in FY 17 for a feasibility study to gather information regarding the current state of the fragile water supply and long-term supply outlook with eminent reuse opportunities. The scope of the study will provide the City with information to develop or enhance several policies including

enhancing the most cost-effective method to reuse the maximum quantity of water with the lowest cost impact and maximum benefit for long-term water availability.

North Alamo Water Supply Corp. (NAWSC), TX
North Alamo Water Supply Corporation in Texas was awarded a $90,000 grant in FY 17 for a feasibility study of energy-effluent alternatives for brackish groundwater desalination. This study will build on work recently completed by Reclamation, the Lower Rio Grande Regional Water Planning Group (region M), the Texas Water Development Board and the Rio Grande Regional Water Authority.

Kansas Water Office
The Kansas Water Office (KWO) was awarded a $199,175 grant in FY 17 for a research study to pilot test produced water near Hardtner, Kansas. The project will involve the treatment of produced oil field water to a quality standard acceptable for agricultural irrigation and the watering of livestock.

Drought Response Program

Reclamation's Drought Response Program aims to provide competitive grants for drought contingency planning, as well as mitigation actions that build long-term drought resiliency. This program focuses on leveraging Reclamation funds to avoid drought-related crises in the short term, while laying a foundation for climate resiliency in the long term. Since FY 15, over $4.3 million in funding was provided to support 13 drought contingency plans and drought resiliency projects in Oklahoma and Texas.

Drought Resiliency

Projects awarded in FY 19:

City of Celina, TX was awarded $750,000 in FY 19 to build a six-million gallon ground storage tank at the Celina Pump Station. This tank will more than double the City's capacity to retain water for drought and emergency water storages.

Texas Water Development Board was selected to be awarded for approximately $360,631 in FY 19 for development of a multi-prolonged approach to enhance surface water evaporation monitoring in Texas using start-of-the-art technology for measuring actual evaporation, installing a float pan evaporation station, upgrading Class A pan evaporation stations managed by TWDB, installing new Class A pans and deriving computed evaporation for all upgraded and new sites, identifying currently unmonitored regions and estimating computed evaporation.

Projects awarded in FY 18:

Mountain Park Master Conservancy District was awarded $300,000 in FY 18 to build a well field and tie in directly to existing infrastructure to pipe directly to a water treatment plant. This project will increase the amount of water available to District customers

during all-to-frequent episodes in southwest Oklahoma. This supplemental and redundant supply, acquired through proposed development of alluvial groundwater immediately below Mountain Park dam, will be relied upon during drought, thus slowing inevitable lake level declines and augmenting yield.

Projects awarded in FY 16:

Altus City Reservoir East Basin Improvements for Drought Preparedness
The City of Altus in Oklahoma was awarded $300,000 in FY 17 to redirect available raw water from Tom Steed Reservoir, a Reclamation project and the City's principal source of supply, to Altus City Reservoir, a largely unused municipal supply originally constructed in 1940. This two-year project also includes the installation of sluice gates and weirs and renovation of the original pump station, built almost 80 years ago but currently unused.

Little Elm Improvements for Drought Preparedness
The Town of Little Elm, Texas was awarded $200,000 in FY 16 to construct a 100,000-gallon water reuse storage tank adjacent to their wastewater treatment plant. This two-year project will provide a consistent supply of treated wastewater available for irrigation and other uses during times of drought, saving the imported potable water supply for culinary purposes. This project is also supported by the city's drought plan, which specifically identifies the expanded reuse of treated effluent as a drought mitigation action.

Research and Development Program

Reclamation's R&D Program provides technical and financial assistance to internal and external research projects that help Reclamation accomplish its mission of developing water supplies in a sustainable manner.

Science and Technology Program

Internal research is funded under Reclamation's Science and Technology (S&T) Program. Through S&T, Reclamation can investigate new and innovative solutions on important issues where there may be a unique or unknown risk and for which capital investment may not occur otherwise. Recent research priorities have focused on addressing challenges associated with climate change, invasive zebra/quagga mussels, and advanced water treatment. Over the last seven years, the R&D program has awarded $50 million to more than 800 research projects. To date, about nearly $1 million has been awarded to research activities in Texas and Oklahoma. Active projects are listed below:

Cost Modeling of Membrane Desalination Process (Foss Reservoir)
This project will focus on improving Reclamation's Water Treatment Estimation Routine (WaTER) so that it can be used to better understand the costs associated with implementing water treatment technologies and to be able to quantify the cost/benefit of R&D advancements in the field of water treatment. Partnering with Texas A&M and the OTAO on a recent DWPR project that evaluated the fouling control and water quality improvements of an electrocoagulation (EC) and microfiltration (MF) process compared to MF alone as pre-treatment to Nanofiltration (NF) on brackish surface will further enhance this project.

Investigating Biochar as a Water Treatment Filtration Media for Adsorption and Biological Reduction of Dissolved Metals and Fluoride
As climate change and drought continue to negatively impact freshwater availability and quality in the western US, impaired water sources are becoming more attractive to supplement existing freshwater supplies. However, these water sources can be expensive to treat, highlighting the need for more economical forms of treatment. Biochar is gaining attention as a less expensive and more sustainable alternative to granular activated carbon (GAC) for use as an adsorbent and biological filtration (biofilter) media. This project will focus on three case studies in the Mid-Pacific and Great Plains Regions and the use of biochar for the treatment of waters within these Regions contaminated by selenium, metals, and fluoride. Partners include Reclamation Regional Offices. Please use the following link for additional information:
https://www.usbr.gov/research/projects/detail.cfm?id=1785

Research Opportunities to Treat Impaired Water Sources Associated with Reclamation Projects: A Case Study in the Great Plains Region
By using a survey-based approach to gather information on water quantity and quality challenges associated with Reclamation projects, can we better inform future investments under programs such as the Title XVI and Research & Development that address core, mission-related needs involving treatment of impaired water sources? This activity has been identified as a high-priority need by the Regional Director for the Great Plains Region. Please use the following link for additional information: https://www.usbr.gov/research/projects/detail.cfm?id=1715

Beneficial Reuse and Waste Minimization of Hexavalent Chrome Ion Exchange Brine
Hexavalent chromium occurrence in potable water sources is of concern to water utilities due to undetermined human carcinogenicity and toxicological effect. EPA is currently reviewing health assessments to determine if new federal standards need to be set for chromium. Minimizing the brine waste generated by ion exchange processes for beneficial purposes through membrane filtration with and without additional chemical addition allows for simpler regeneration processes and decreased operator expertise requirements. The research question to be answered is: Can a system that is simple to operate and inherently contains multiple barriers to chrome release be used to address chromium contamination in potable water sources? Please use the following link for additional information: https://www.usbr.gov/research/projects/detail.cfm?id=9085

Refining Interpretation Techniques for Determining Brackish Aquifer Water Quality
This project will define specific research areas required to support geophysical log interpretation for water quality in brackish aquifers. The project will build on the state of practice and methods outlined in the previous scoping level effort by delineating the confounding factors identified by that work and presenting research topics to resolve those factors. This work will be a collaborative effort supported and enhanced by key stakeholders identified in the scoping level effort, including the USGS, Texas Water Development Board, Brackish Water Work Group, and other state and federal agencies. The report produced by this project is intended to supplement the Reclamation S&T Advanced Water Treatment Roadmap and to aid stakeholders in securing funding for and directing future research efforts. Please use the following link for additional information: https://www.usbr.gov/research/projects/detail.cfm?id=2924

Development of Methodologies to Evaluate the Environmental, Financial and Social Benefits of Water Reuse Projects
The TWDB's Texas Water Reuse Research Agenda (2011) identified "triple bottom line" analyses as a top priority research area for Texas. Both water providers and rate payers alike often question whether reuse is worth the financial investment relative to other strategies. In fact, many water reuse projects in Texas have been halted due to a lack of funding or inability to justify the required capital expenditures. Reclamation is coordinating with TWDB and other state and local water suppliers to evaluate the state-of-the science of TBL analyses, and to develop a clear, well-defined economic and financial evaluation approach that can be used by entities to evaluate the merits of water

reuse projects. Please use the following link for additional information: http://www.usbr.gov/research/projects/detail.cfm?id=4180.

Concentrate Management Toolbox and Selected Case Studies
Concentrate management is an important component driving the cost and feasibility of desalination. The understanding necessary to optimize inland desalination facilities and associated concentrate management solutions is still being improved through detailed assessments, especially as technology advances and provides more flexibility in treatment. A wide variety of concentrate management methodologies exist, and many water purveyors are overwhelmed when considering which technology is the best for their situation. This Concentrate Management Toolbox will inventory existing technologies and identify practical and economical strategies to optimize concentrate management based on various feed water quality parameters, so water planners can more rapidly assess concentrate management options. Reclamation is partnering with the North Texas Municipal Water District in Texas and the Eastern Municipal Water District in California to then apply the Toolbox to a set of site-specific saline source waters and recommend an optimal array of concentrate management technologies. Please use the following link for additional information: http://www.usbr.gov/research/projects/detail.cfm?id=5239.

Desalination and Water Purification Research Program

External research is funded under Reclamation's Desalination and Water Purification Research (DWPR) Program. DWPR was established to facilitate partnerships with academia, private industry, and local communities to develop more cost-effective, technologically efficient means by which to desalinate water. Just over the past six fiscal cycles (FY 19-20), ten new research projects totaling $1,095,625 dollars were funded within the Oklahoma-Texas Area Office jurisdiction.

Treatment of High Salinity Produced Water to Reduce Freshwater Utilization for Oil and Gas Operations Using a Novel Thermo Desalination – FY 20
Texas A&M Engineering Experiment Station has a goal develop and optimize low cost, efficient, scalable, and easily implementable processes to reuse some of the 300 million gallons of produced water generated daily in the Permian Basin. This project will look at combining aluminum chemical and electrocoagulation with polymers to induce extremely high rate sedimentation of suspended solids to produce clean brine for reuse in hydraulic fracturing and desalinate clean brine via novel humidification-dehumidification process. This project will bring in partners from industry and international academic institutions.

Building a Multi-Level , Multi-State Modeling Framework for the Analysis and Design of Seawater Desalination Using Renewable Energy – FY 20
Texas A&M University-Kingsville expected outcomes of this research will include an expanded knowledge base of a technological field and an emerging industry as well as a modeling tool to improve the understanding and design of seawater desalination using renewable energy systems which may contribute to accelerated adoptions of technology. The seawater desalination plant currently under permitting phase in the City of Corpus Christi, TX will be used as a location to test the model.

Study of Enhanced Water Recovery by a Combination of Photobiological Process and Secondary RO Lifecycle Cost Analysis and Mini-Pilot Study – FY 20
Texas State University will test a new photobiological treatment method for RO concentrate has been developed to enable more water recovery using the secondary RO. This project proposes to demonstrate the continuous, long-term operation of diatom-based photobiological treatment of OR concentrate at full-scale and investigate the secondary RO desalination of photobiologically treated RO concentrate to determine proper pre-treatment requirements. The project will also include a lifecycle cost analysis to evaluate the economic feasibility of the proposed enhanced water recovery scheme.

Forensic investigation of reverse osmosis membranes in potable reuse applications: fouling characterization and implications for cost and performance – FY 19
Texas A&M Engineering Experiment Station will focus on characterizing the surfaces of virgin, fouled, and cleaned membranes by state-of-the-art microscopy and spectroscopy techniques to determine major foulants and its mechanisms. The information obtained can be used to quantify fouling impacts on life-cycle costs filling an important knowledge gap for long-term planning in wastewater treatment.

Solar Thermal Distillation Technology Development for Desalination and Produced Water Treatment Applications – FY 19
Oklahoma State University's primary objective of this research is to develop a cost-effective high-energy solar thermal distillation technology for desalination and produced water treatment applications. This novel solar energy powered thermal distillation system in intended to reduce energy consumption, potentially lower the cost of desalination, as well as reduce the environmental impacts by reducing the volume of produced disposal.

Expanding Water Resources Through Efficient Waste Management in Arsenic Treatment Processes – FY 19
University of Colorado's objective of this project that will involve field activities with City of Norman, Oklahoma is to improve the economics of treating arsenic-impaired water using ion exchange by reducing the operating costs associated with on-site treatment of spent brine and reusing recovered regenerant salt without adversely impacting treatment performance. The work will focus on developing a novel treatment process to reduce the operating costs and waste produced from arsenic ion exchange processes, which currently present an economic barrier to utilizing arsenic-impaired water sources.

Summary of Programs and Funding Opportunities

All Reclamation program Funding Opportunity Announcements (FOAs) for Grants or Cooperative Agreements to utilize Reclamation funding are posted on the Grants.gov website: http://www.grants.gov/

The following is a list of specific weblinks for each of the Reclamation programs mentioned above:

Native American Affairs Program: http://www.usbr.gov/native/

Water Conservation Field Services Program: http://www.usbr.gov/waterconservation/

WaterSMART Program:

- Drought Response Program: http://www.usbr.gov/drought/
- Water and Energy Efficiency Grants: http://www.usbr.gov/watersmart/weeg/
- Small-Scale Water Efficiency Grants: https://www.usbr.gov/watersmart/swep/index.html
- Cooperative Watershed Management Program: https://www.usbr.gov/watersmart/cwmp/index.html
- Water Marketing Strategy Grants: https://www.usbr.gov/watersmart/watermarketing/index.html
- Title XVI: http://www.usbr.gov/watersmart/title/index.html
- Basin Studies: http://www.usbr.gov/watersmart/bsp/
- Applied Science Grants: https://www.usbr.gov/watersmart/appliedscience/index.html

Research and Development:

- Science and Technology Program: https://www.usbr.gov/research/st/index.html
- Desalination and Water Purification Research Program: https://www.usbr.gov/research/dwpr/
- Water Prize Challenges: http://www.usbr.gov/research/challenges/

Contact Information

Collins K. Balcombe
Manager, Planning and Project Development
Bureau of Reclamation
Oklahoma-Texas Area Office
5316 Hwy 290 West, Suite 110
Austin, TX. 78735
Work: 512-899-4162; 899-4179 (fax)
Cell: 512-922-0525

ARKANSAS RIVER BASIN COMPACT

ARKANSAS-OKLAHOMA, 1972, WITH

SUPPLEMENTAL INTERPRETIVE

COMMENTS

SUPPLEMENT NO, 1

ARKANSAS RIVER COMPACT COMMISSION

MARCH 16, 1970
REVISED MARCH 3, 1972

ARKANSAS RIVER BASIN COMPACT ARKANSAS-OKLAHOMA, 1972, WITH SUPPLEMENTAL INTERPRETIVE COMMENTS

SUPPLEMENT NO. 1

Approved by the

ARKANSAS RIVER COMPACT COMMITTEE

FOR ARKANSAS:

S. Keith Jackson
Committee Member

John Luce
Committee Member
(alternate)

FOR OKLAHOMA:

Glade R. Kirkpatrick
Committee Member

Milton Craig
Committee Member
(alternate)

FOR UNITED STATES OF AMERICA:

Trigg Twichell
Federal Representative and Chairman of Committee

March 16, 1970
Revised March 3, 1972

PREFACE

In 1955, the Congress of the United States by Public Law 97, 84th Congress, 1st Session, granted consent to the States of Arkansas and Oklahoma to negotiate and enter into a Compact for the apportionment of the waters of the Arkansas River and its tributaries between the two States. With this authorization and the appointment of a Federal Representative to act as Chairman, the States created the Arkansas-Oklahoma Arkansas River Compact Committee on March 14, 1956, for the purpose of drafting a proposed Compact for the apportionment of the waters of the Arkansas River and its tributaries as they affect those States.

From the beginning the Committee was deliberate in its operations. Two important subcommittees: engineering and legal, were appointed early for the purpose of assembling, analyzing, and interpreting essential engineering and legal data needed by the Compact Committee.

The engineering subcommittee made hydrologic studies which were utilized in determining that portion of the Arkansas River Basin that should be covered by the interstate Compact, analyzed the quantity, quality, and mode of occurrence of the water resources of the area in question and made long-range estimates of the quantities of water that would be needed by the States in future years, recognizing existing water rights and water uses.

The legal committee researched existing Interstate Water Compacts and continuously advised the Compact Committee on legal matters that related to Compact negotiations.

The work of these subcommittees and their reports were invaluable to the Compact committee in reaching its unanimous agreement of the proposed Compact.

The Federal Representative employed a consulting engineer in the field of interstate compacts, and received legal counsel from the U.S. Department of Justice on matters that were of concern to the Federal agencies.

The Arkansas River Compact Committee approved its first formal interstate Compact draft March 16, 1970.

The State of Arkansas ratified this Compact draft through its Act No. 16, 1971, as passed by the Arkansas General Assembly and signed by Governor Dale Bumpers, January 26, 1971.

The State of Oklahoma ratified the interstate Compact draft through H. B. No. 1326, as passed by the Oklahoma Legislature and signed by Governor David Hall, April 24, 1971. This ratification, however, carried the following amendment:

> "SECTION 2. This ratification is subject to the State of Oklahoma and the State of Arkansas, acting through their duly authorized compact representatives, amending said 'Arkansas River Basin Compact' in the particulars as set forth hereinafter, and further, that ratification of said amendment of said compact by the Legislature of the State of Arkansas. Said amendment being expressed as follows:
>
> "The following language shall be added to Article VI, Section A of said compact, to-wit: 'Provided however that nothing contained in this compact or its ratification by Arkansas or Oklahoma shall be interpreted as granting either State or the parties hereto the right or power of eminent domain in any manner whatsoever outside the borders of its own state.'"

The Arkansas River Compact Committee unanimously approved the Oklahoma amendment as an appropriate clarification statement in the Compact. The Federal member of the Committee was formally advised that the Federal agencies had no objections to this amendment.

The State of Arkansas adopted the State of Oklahoma's amendment to the Arkansas River Compact draft through Act No. 40, as passed by the Arkansas General Assembly and signed by Governor Dale Bumpers, February 17, 1972.

The Arkansas River Basin Compact, Arkansas-Oklahoma, 1972, as revised March 3, 1972, contains the amendment as approved by both States and corrections of typographical errors found in the March 16, 1970 draft.

ARKANSAS RIVER BASIN COMPACT
ARKANSAS-OKLAHOMA, 1972

with

SUPPLEMENTAL INTERPRETIVE COMMENTS
Prepared by the Compact Committee

Compact

The State of Arkansas and the State of Oklahoma, acting through their duly authorized Compact representatives, S. Keith Jackson of Arkansas and Glade R. Kirkpatrick of Oklahoma, after negotiations participated in by Trigg Twichell, appointed by the President as the representative of the United States of America, pursuant to and in accordance with the consent to such negotations granted by an Act of Congress of the United States of America (Public Law 97, 84th Congress, 1st session), approved June 28, 1955, have agreed as follows respecting the waters of the Arkansas River and its tributaries:

Comment

On November 25, 1969, the authorized representatives of the States of Arkansas and Oklahoma approved the language of a draft of a Compact relating to the apportionment of the waters of the Arkansas River Basin originating in the two States between Muskogee, Oklahoma, and Van Buren, Arkansas; including Spavinaw Creek, a tributary to the Grand River upstream from Muskogee; and except the Canadian River above Eufaula Dam, a tributary to the Arkansas River between Muskogee and Van Buren.

The Compact is the result of negotiations between the parties over a period of years. The Compact Committee had the cooperation and advice of all interested Federal agencies, including the counsel of representatives of the United States Department of Justice. Its activities were supported by the water resources agencies of the States. In addition, extensive studies were conducted for the benefit of the Committee by the engineering departments of the University of Arkansas and Oklahoma State University under the federal Water Resources Research program.

These interpretive comments on the approved draft of November 25, 1969, have been prepared so that members of the respective legislatures, congressional committees, Federal agencies, and subsequent Compact administrators might be fully appraised of the intent of the Compact negotiating Committee with regard to each Article of the Compact.

ARTICLE I

Compact

The major purposes of this Compact are:

A. To promote interstate comity between the States of Arkansas and Oklahoma;

B. To provide for an equitable apportionment of the waters of the Arkansas River between the States of Arkansas and Oklahoma and to promote the orderly development thereof;

C. To provide an agency for administering the water apportionment agreed to herein;

D. To encourage the maintenance of an active pollution abatement program in each of the two States and to seek the further reduction of both natural and man-made pollution in the waters of the Arkansas River Basin; and

E. To facilitate the cooperation of the water administration agencies of the States of Arkansas and Oklahoma in the total development and management of the water resources of the Arkansas River Basin.

Comment

Article I is self-explanatory.

ARTICLE II

Compact

As used in this Compact:

A. The term "State" means either State signatory hereto and shall be construed to include any person or

persons, entity or agency of either State who, by reason of official responsibility or by designation of the Governor of that State, is acting as an official representative of that State.

B. The term "Arkansas-Oklahoma Arkansas River Compact Commission," or the term "Commission" means the agency created by this Compact for the administration thereof.

C. The term "Arkansas River Basin" means all of the drainage basin of the Arkansas River and its tributaries from a point immediately below the confluence of the Grand-Neosho River with the Arkansas River near Muskogee, Oklahoma, to a point immediately below the confluence of Lee Creek with the Arkansas River near Van Buren, Arkansas, together with the drainage basin of Spavinaw Creek in Arkansas, but excluding that portion of the drainage basin of the Canadian River above Eufaula Dam.

D. The term "Spavinaw Creek Sub-basin" means the drainage area of Spavinaw Creek in the State of Arkansas.

E. The term "Illinois River Sub-basin" means the drainage area of Illinois River in the State of Arkansas.

F. The term "Lee Creek Sub-basin" means the drainage area of Lee Creek in the State of Arkansas and the State of Oklahoma.

G. The term "Poteau River Sub-basin" means the drainage area of Poteau River in the State of Arkansas.

H. The term "Arkansas River Sub-basin" means all areas of the Arkansas River Basin except the four sub-basins described above.

I. The term "water year" means a twelve-month period beginning on October 1, and ending September 30.

J. The term "annual yield" means the computed annual gross runoff from any specified sub-basin which would have passed any certain point on a stream and would have originated within any specified area under natural conditions, without any man-made depletion or accretion during the water year.

K. The term "pollution" means contaimination or other alterations of the physical, chemical, biological or radiological properties of water or the discharge of any liquid, gaseous, or solid substances into any waters which creates, or is likely to result in a nuisance, or which renders or

is likely to render the waters into which it is discharged harmful, detrimental or injurious to public health, safety, or welfare, or which is harmful, detrimental or injurious to beneficial uses of the water.

Comment

This is the Article of specific definition of terms as they apply to this Compact.

Subsections A and B are self-explanatory.

Subsection C defines the "Arkansas River Basin" as it pertains to this Compact. (See figure 1). It isolates that portion of the overall Arkansas River drainage basin in which the States of Arkansas and Oklahoma are primarily and mutually concerned. All of the area above the gaging station on the main stem of the Arkansas River near Muskogee, Oklahoma, and the Eufaula Dam in the Canadian River except the Spavinaw Creek Basin in the State of Arkansas, has been excluded from consideration.

The intent of the Committee has been to deal with the water originating within the area delineated by this definition and no attempt has been made to define the rights, if any, of either State in waters originating outside the defined area which might flow into and through the area in the main stem of the Arkansas River or the Canadian River.

Waters of the Arkansas River Basin originating above Muskogee and Eufaula Dam have been allocated in part by Compacts between the States of Kansas and Oklahoma, and in the upper reaches of the basin between the States of Colorado and Kansas. The State of Arkansas was not a party to either of those Compacts, and the State of Oklahoma was not a party to the Colorado-Kansas Compact. Waters originating above

Eufaula Dam have been allocated in part by Compact between the States of New Mexico, Oklahoma and Texas; and the State of Arkansas was not a party to that Compact.

Both States recognize that storage has been constructed in the State of Oklahoma above Muskogee for the impounding and release of water to aid navigation in both the States of Oklahoma and Arkansas; and that such waters will in whole or in part flow through the Compact area. It is recognized also that power releases from reservoirs upstream of Muskogee will flow through the Compact area in the main stem of the Arkansas River, and may be subject to diversions and/or impoundment and use in either State. Flood control releases from upstream reservoirs will fall in the same category as power releases.

The drainage area in the State of Arkansas of Spavinaw Creek, a tributary of the Neosho River, has been included in this Compact area. The portion of Spavinaw Creek Basin lying in the State of Oklahoma was included in the physical delineation of the Grand-Neosho River Basin in the Kansas-Oklahoma Arkansas River Basin Compact. In the Kansas-Oklahoma Compact, Spavinaw Creek was excluded from the conservation storage limitation provisions which were the basis of that Compact.

The Spavinaw Creek Sub-basin has been included in this Compact, even though it is not directly tributary to the rest of the Compact area, because (1) the headwaters are in the State of Arkansas and the stream flows into the State of Oklahoma as is the case with all the other tributaries under consideration; (2) the rights of the State of Arkansas were not considered in the Kansas-Oklahoma Compact; and (3) the State of Oklahoma already has substantial development and interest in water supply of the stream.

The lower cutoff point of the Compact area has been placed immediately below the confluence of Lee Creek with the Arkansas River near Van Buren, Arkansas. Lee Creek is the farthest downstream tributary having headwaters in the State of Arkansas and flowing into the State of Oklahoma. It re-enters the State of Arkansas and flows into the Arkansas River in that State. There is interest in the Van Buren-Fort Smith area in Lee Creek as a source of municipal water supply.

Subsections D through H define the various sub-basins which, for purposes of this Compact, have been designated on Spavinaw Creek, Illinois River, Lee Creek and Poteau River, as well as for the Arkansas River main stem. These sub-basins differ from the sub-basins outlined in the Report of the Engineering Advisory Committee, dated January 1969, except for Lee Creek Sub-basin which remains consistent with the original report. It also differs from the Engineering Committee's original recommendations to the Compact Committee concerning the delineation of sub-basins. (See figure 1).

Subsection I is self-explanatory.

Subsection J defines "annual yield," which is a term basic to the allocations of this Compact. It refers to the runoff originating within any area and which would occur under unaltered natural conditions, i.e., where there would be no artificial man-made depletions of, or additions to, the original supply and no regulation of that supply.

The only time this could be measured absolutely would be before any facilities to utilize, import or impound water were constructed. After the first such facility is introduced, the measurement becomes something of an approximation relative to how accurately depletions can be computed

and their ratio to water yield. An excellent opportunity exists in this Compact area to establish relationship of "annual yield" and run-off at key points or with precipitation, or a combination of runoff and precipitation. This is true since depletions are small in relation to the average yield of this basin.

Subsection K is self-explanatory.

ARTICLE III

Compact

A. The physical and other conditions peculiar to the Arkansas River Basin constitute the basis of this Compact, and neither of the States hereby, nor the Congress of the United States by its consent hereto, concedes that this Compact establishes any general principle with respect to any other interstate stream.

B. By this Compact, neither State signatory hereto is relinquishing any interest or right it may have with respect to any waters flowing between them which do not originate in the Arkansas River Basin as defined by this Compact.

Comment

Subsection A confirms the principle that each Compact area has its own special problems and solutions thereto, and cannot provide per se the solutions for other compacting areas.

Subsection B is an affirmation of the principle of equitable apportionment between States of the water of interstate streams (Kansas v. Colorado, 206 U.S. 46; Colorado v. Kansas, 320 U.S. 383).

ARTICLE IV

Compact

The States of Arkansas and Oklahoma hereby agree upon the following apportionment of the waters of the Arkansas River Basin:

0203

A. The State of Arkansas shall have the right to develop and use the waters of the Spavinaw Creek Sub-basin subject to the limitation that the annual yield shall not be depleted by more than fifty percent (50%).

B. The State of Arkansas shall have the right to develop and use the waters of the Illinois River Sub-basin subject to the limitation that the annual yield shall not be depleted by more than sixty percent (60%).

C. The State of Arkansas shall have the right to develop and use all waters originating within the Lee Creek Sub-basin in the State of Arkansas, or the equivalent thereof.

D. The State of Oklahoma shall have the right to develop and use all waters originating within the Lee Creek Sub-basin in the State of Oklahoma, or the equivalent thereof.

E. The State of Arkansas shall have the right to develop and use the waters of the Poteau River Sub-basin subject to the limitation that the annual yield shall not be depleted by more than sixty percent (60%).

F. The State of Oklahoma shall have the right to develop and use the waters of the Arkansas River Sub-basin subject to the limitation that the annual yield shall not be depleted by more than sixty percent (60%).

Comment

This Article apportions the available water resources of the Basin between the two States. Although large quantities of good quality water are available in the Basin, flows fluctuate widely, and provisions for storage will be essential to any substantial development of water use.

The record of Compact negotiations will show that early consideration was given to the possibility of writing a compact based on allocation of conservation storage. Near the end of negotiations and after careful deliberation and study, the consideration of conservation storage allocations was dropped and it was agreed to make allocations on the basis of percentages of annual yield.

It is realized that problems of deficient low flows presently exist and will no doubt continue in the future. Base flows of tributary streams in the Basin are generally low and most streams recede to no flow during dry periods. It is anticipated that future developments of storage facilities will provide for low flow augmentation but it is considered infeasible to specify minimum flows for any stream system. Release of flows from the system of major reservoirs presently constructed and planned for flood control, hydroelectric power and navigation should assure the maintenance of adequate flows throughout the main stem of the Arkansas River in the Compact area.

The percentages of annual flows apportioned between the States are based on the assumptions that the "upstream" State should generally have first call on available waters. Engineering studies have shown it is generally infeasible to develop over sixty percent (60%) of the long-term yield of any Basin in this area.

The division of water is on the basis that forty percent (40%) of the annual yield would be delivered from the upstream State. Exceptions to this have been made in the cases of Spavinaw and Lee Creek Basins.

The City of Tulsa has developed 96,000 acre-feet of conservation storage on lower Spavinaw Creek in the State of Oklahoma for municipal water supply. These reservoirs collect flows from 386 square miles, of which 120 square miles are in the State of Arkansas. In recognition of these existing developments, it was agreed to limit the State of Arkansas allocation to fifty percent (50%) of the annual yield from the area in that State.

The Lee Creek Basin roughly parallels the Arkansas-Oklahoma stateline. The drainage area is approximately sixty percent (60%) in the State of Arkansas and forty percent (40%) in the State of Oklahoma. The main stem rises in the State of Arkansas, but some small tributaries in the upper reaches rise in the State of Oklahoma and flow into the State of Arkansas. The main stem first crosses the Arkansas-Oklahoma stateline at mile 24.6, and then flows back into the State of Arkansas at mile 9.0, crossing and recrossing the stateline until entering the State of Arkansas for the last time at mile 7.6. This watershed is an excellent source of water for the Fort Smith metropolitan area, including nearby areas in the State of Oklahoma, and for which there is a large potential need for future water supplies. In order to permit the full development of this Basin, it was agreed that waters of this Basin be allocated on the basis of origin. This will permit either State to fully develop, use and consume a quantity of water equal to the total annual yield of the Lee Creek Basin in each State.

Each State recognizes that waters are now being transported from one basin to another and that these transbasin diversions could increase in the future. It is also recognized that such transbasin diversion of water is a charge against the apportionment to the respective States.

ARTICLE V

Compact

A. On or before December 31 of each year, following the effective date of this Compact, the Commission shall determine the stateline yields of the Arkansas River Basin for the previous water year.

B. Any depletion of annual yield in excess of that allowed by the provisions of this Compact shall, subject to the control of the Commission, be delivered to the downstream State, and said delivery shall consist of not less than sixty percent (60%) of the current runoff of the basin.

C. Methods for determining the annual yield of each of the sub-basins shall be those developed and approved by the Commission.

Comments

Subsection A provides for the computation of "annual yield" before the end of the calendar year, while the computation itself is based on data available for the water year ending September 30 of that same calendar year. This means that necessary hydrologic data (such as stream flow, water quality, precipitation, etc.) will be required in less than three months after the end of the water year.

Subsection B provides for adjustment of annual depletions so that a depletion in excess of the allocation to either State during the previous water year shall be delivered (restored to the downstream State) as soon as practicable consistent with proper water management.

It is anticipated that each State should control its water management so that consumptive-use depletions will not exceed its allocation. Excess stream-flow depletions, which would be a withholding of water by any means (consumptive uses or storage) could possibly occur in low yield years, but could be made up in subsequent periods of high runoff.

No provisions are made in this Compact for credits for over-deliveries nor for continuing debits for under-deliveries. As a practical manner the water resources of the area are of such a magnitude, and the physical conditions limiting storage facilities are such that complete utilization of the allocated quantities might never be reached.

The allocations are of such magnitude in relation to these factors that the States essentially will be unrestricted in the control and use of the water resources of the Compact area. The Compact does, however, protect against the possibility of either State encroaching upon the rights of the other at some future time when maximum utilization could be approached. (There is a distinct possibility in this area that such a condition might never occur). Or, in a period of extreme drought, it would provide an equitable distribution of a limited water supply.

Subsection C is intended as a directive for determining annual yield. Appendix I attached to these comments outlines procedures for this purpose. Present depletions are small in relation to the original yield and an opportunity exists to establish correlations of yield at agreed-to points in both States. As developments occur in the future, it may be necessary to refine procedures and make arrangements for the collection of additional basic data. It is anticipated that a technical advisory group will be available to the Commission and will develop adequate procedures and make recommendations for the collection of necessary basic data as required for the proper administration of the Compact.

ARTICLE VI

Compact

A. Each State may construct, own and operate for its needs water storage reservoirs in the other State; provided, however, that nothing contained in this Compact or its ratification by Arkansas or Oklahoma shall be interpreted as granting either State or the parties hereto the right or power of eminent domain in any manner whatsoever outside the borders of its own State.

B. Depletion in annual yield of any sub-basin of the Arkansas River Basin caused by the operation of any water storage reservoir either heretofore or hereafter constructed by the United States or any of its agencies, instrumentalities or wards, or by a State, political sub-division thereof, or any person or persons shall be charged against the State in which the yield therefrom is utilized.

C. Each State shall have the free and unrestricted right to utilize the natural channel of any stream within the Arkansas River Basin for conveyance through the other State of waters released from any water storage reservoir for an intended downstream point of diversion or use without loss of ownership of such waters; provided, however, that a reduction shall be made in the amount of water which can be withdrawn at point of removal, equal to the transmission losses.

Comment

This Article recognizes the possibilities of special problems arising and sets forth general provisions for handling some of these problems.

In Subsection A, the Committee recognizes that storage capacity may be constructed by one State in the other and that the Compact creates no bar to such construction. Each State, either individually or the two States jointly, may construct, own and operate for their needs water storage reservoirs in either State.

Subsection B makes it quite clear that depletions resulting from storage constructed at any point in the Basin by the United States, the States or individuals shall be charged against the State in which the benefits of the depletion are realized. Although the Compact is silent as to what part the Commission might take in the event that storage is constructed in one State for the benefit of the other State, it is the view of the Committee that such matters would be worked out at State level so long as the provisions of the Compact are complied with.

Subsection C allows either State to use the channel as a conveyor to transport water from a structure in one State to a point in the other State where it can be used. The only restriction is that a carriage or transmission loss will be charged against the State utilizing the natural channel in the other State. The amount of such transmission loss will be determined by the Compact Commission whenever the need arises.

ARTICLE VII

Compact

The States of Arkansas and Oklahoma mutually agree to:

A. The principle of individual State effort to abate man-made pollution within each State's respective borders, and the continuing support of both States in an active pollution abatement program;

B. The cooperation of the appropriate State agencies in the States of Arkansas and Oklahoma to investigate and abate sources of alleged interstate pollution within the Arkansas River Basin;

C. Enter into joint programs for the identification and control of sources of pollution of the waters of the Arkansas River and its tributaries which are of interstate significance;

D. The principle that neither State may require the other to provide water for the purpose of water quality control as a substitute for adequate waste treatment;

E. Utilize the provisions of all Federal and State water pollution laws and to recognize such water quality standards as may be now or hereafter established under the Federal Water Pollution Control Act in the resolution of any pollution problems affecting the waters of the Arkansas River Basin.

Comment

The States recognize that there is no serious interstate pollution problem in the Basin at present; and that the States are obligated to maintain adequate water quality in the Arkansas River Basin through

whatever means is available to them. An important provision is that neither State may require the other to provide water for the purpose of water quality control as a substitute for adequate waste treatment.

Through active pollution abatement programs the States hope to avoid the conflict over future problems, but have provided that, if necessary, they may utilize the provisions of the Federal Water Pollution Control Act in cases which cannot be resolved within the provisions of the Compact.

ARTICLE VIII

Compact

A. There is hereby created an interstate administrative agency to be known as the "Arkansas-Oklahoma Arkansas River Compact Commission." The Commission shall be composed of three Commissioners representing the State of Arkansas and three Commissioners representing the State of Oklahoma, selected as provided below; and, if designated by the President or an authorized Federal agency, one Commissioner representing the United States. The President, or the Federal agency authorized to make such appointments, is hereby requested to designate a Commissioner and an alternate representing the United States. The Federal Commissioner, if one be designated, shall be the Chairman and presiding officer of the Commission, but shall not have the right to vote in any of the deliberations of the Commission.

B. One Arkansas Commissioner shall be the Director of the Arkansas Soil and Water Conservation Commission, or such other agency as may be hereafter responsible for administering water law in the State. The other two Commissioners shall reside in the Arkansas River drainage area in the State of Arkansas and shall be appointed by the Governor, by and with the advice and consent of the Senate, to four-year staggered terms with the first two Commissioners being appointed simultaneously to terms of two (2) and four (4) years, respectively.

C. One Oklahoma Commissioner shall be the Director of the Oklahoma Water Resources Board, or such other agency as may be hereafter responsible for administering water law in the State. The other two Commissioners shall reside within the Arkansas River drainage area in the State of Oklahoma and shall be appointed by the Governor, by and with the advice and consent of the Senate, to four-year staggered terms, with the first two Commissioners being appointed simultaneously to terms of two (2) and four (4) years, respectively.

D. A majority of the Commissioners of each State and the Commissioner or his alternate representing the United States, if they are so designated, must be present to constitute a quorum. In taking any Commission action, each signatory State shall have a single vote representing the majority opinion of the Commissioners of that State.

E. In the case of a tie vote on any of the Commission's determinations, orders, or other actions, a majority of the Commissioners of either State may, upon written request to the Chairman, submit the question to arbitration. Arbitration shall not be compulsory, but on the event of arbitration, there shall be three arbitrators:

(1) One named by resolution duly adopted by the Arkansas Soil and Water Conservation Commission, or such other State agency as may be hereafter responsible for administering water law in the State of Arkansas; and

(2) One named by resolution duly adopted by the Oklahoma Water Resources Board, or such other State agency as may be hereafter responsible for administering water law in the State of Oklahoma; and

(3) The third chosen by the two arbitrators who are selected as provided above.

If the arbitrators fail to select a third within sixty (60) days following their selection, then he shall be chosen by the Chairman of the Commission.

F. The salaries and personal expenses of each Commissioner shall be paid by the Government which he represents. All other expenses which are incurred by the Commission incident to the administration of this Compact shall be borne equally by the two States and shall be paid by the

Commission out of the "Arkansas-Oklahoma Arkansas River Compact Fund," initiated and maintained as provided in Article IX(B)(5) below. The States hereby mutually agree to appropriate sums sufficient to cover its share of the expenses incurred in the administration of this Compact, to be paid into said fund. Disbursements shall be made from said fund in such manner as may be authorized by the Commission. Such funds shall not be subject to the audit and accounting procedures of the States; however, all receipts and disbursements of funds handled by the Commission shall be audited by a qualified independent public accountant at regular intervals, and the report of such audit shall be included in and become a part of the annual report of the Commission, provided by Article IX(B)(6) below. The Commission shall not pledge the credit of either State and shall not incur any obligations prior to the availability of funds adequate to meet the same.

Comment

This Article creates the administrative agency which will administer the terms of this Compact after it becomes effective through ratification by the States and approval by the Congress. The provisions are similar to those adopted in a number of other interstate stream compacts.

The Article provides for three members for each of the signatory States as Commission members and staggers the terms of those members in order to insure some degree of continuity in its membership.

Subsection D defines a quorum and provides that each State shall have only one vote which represents the majority decision of each State in conducting the business affairs of the Commission.

Subsection E sets forth arbitration procedures for the Commission in the event of a tie vote on important matters. Arbitration is not to be compulsory but is provided in the event that some matter of extreme concern to one of the States requires such action.

0004

Subsection F sets forth the procedure for paying the salaries and expenses of the Commissioners and costs incurred by the Commission in the administration of the Compact. This subsection together with Article IX(B)(5) creates a Compact fund which is essential to flexibility of operation. It also provides for auditing procedures and the report of such audit.

ARTICLE IX

Compact

A. The Commission shall have the power to:

(1) Employ such engineering, legal, clerical and other personnel as in its judgment may be necessary for the performance of its functions under this Compact;

(2) Enter into contracts with appropriate State or Federal agencies for the collection, correlation, and presentation of factual data, for the maintenance of records and for the preparation of reports;

(3) Establish and maintain an office for the conduct of its affairs;

(4) Adopt and procure a seal for its official use;

(5) Adopt rules and regulations governing its operations. The procedures employed for the administration of this Compact shall not be subject to any Administrative Procedures Act of either State, but shall be subject to the provisions hereof and to the rules and regulations of the Commission; provided, however, all rules and regulations of the Commission shall be filed with the Secretary of State of the signatory States;

(6) Cooperate with Federal and State agencies and political subdivisions of the signatory States in developing principles, consistent with the provisions of this Compact and with Federal and State policy, for the storage and release of

0204

water from reservoirs, both existing and future within the Arkansas River Basin, for the purpose of assuring their operation in the best interests of the States and the United States;

(7) Hold hearings and compel the attendance of witnesses for the purpose of taking testimony and receiving other appropriate and proper evidence and issuing such appropriate orders as it deems necessary for the proper administration of this Compact, which orders shall be enforceable upon the request by the Commission or any other interested party in any court of competent jurisdiction within the county wherein the subject matter to which the order relates is in existence, subject to the right of review through the appellate courts of the State of situs. Any hearing held for the promulgation and issuance of orders shall be in the county and State of the subject matter of said hearing;

(8) Make and file official certified copies of any of its findings, recommendations or reports with such officers or agencies of either State, or the United States, as may have any interest in or jurisdiction over the subject matter. Findings of fact made by the Commission shall be admissible in evidence and shall constitute prima facie evidence of such fact in any court or before any agency of competent jurisdiction. The making of findings, recommendations, or reports by the Commission shall not be a condition precedent to instituting or maintaining any action or proceeding of any kind by a signatory State in any court, or before any tribunal, agency or officer, for the protection of any right under this Compact or for the enforcement of any of its provisions;

(9) Secure from the head of any department or agency of the Federal or State government such information, suggestions, estimates and statistics as it may need or believe to be useful for carrying out its functions and as may be available to or procurable by the department or agency to which the request is addressed;

(10) Print or otherwise reproduce and distribute all of its proceedings and reports; and

(11) Accept, for the purposes of this Compact, any and all private donations and gifts and Federal grants of money.

B. The Commission shall:

(1) Cause to be established, maintained and operated such stream, reservoir or other gaging stations as may be necessary for the proper administration of this Compact;

(2) Collect, analyze and report on data as to stream flows, water quality, annual yields and such other information as is necessary for the proper administration of this Compact;

(3) Continue research for developing methods of determining total basin yields;

(4) Perform all other functions required of it by the Compact and do all things necessary, proper or convenient in the performance of its duties thereunder;

(5) Establish and maintain the "Arkansas-Oklahoma Arkansas River Compact Fund," consisting of any and all funds received by the Commission under the authority of this Compact and deposited in one or more banks qualifying for the deposit of public funds of the signatory States;

(6) Prepare and submit an annual report to the Governor of each signatory State and to the President of the United States covering the activities of the Commission for the preceding fiscal year, together with an accounting of all funds received and expended by it in the conduct of its work;

(7) Prepare and submit to the Governor of each of the States of Arkansas and Oklahoma an annual budget covering the anticipated expenses of the Commission for the following fiscal year; and

(8) Make available to the Governor or any State agency of either State or to any authorized representative of the United States, upon request, any information within its possession.

Comment

Article IX sets forth the powers and duties of the administrative Commission. It provides the Commission with the necessary latitude and flexibility for carrying out the provisions and purposes of the Compact.

0204

Subsection A enumerates the powers of the Commission while Subsection B sets out certain specific duties of the Commission. Other duties not specifically stated in Subsection B are implied in the inherent powers granted in Subsection A.

Subsection A(2) enables the Commission to obtain data which is important to the Commission's work and findings. Most of the data useful to the Commission will be gathered by other agencies. However, there could be times when necessary engineering or other data is not gathered by any other agency, and it might be desirable for the Commission to collect the data.

Subsection A(6) gives the Commission the power to cooperate directly and closely with Federal agencies in its administrative activities as they relate to interstate phases of project operation. This subsection deals with all types of storage and release of water whether it is under Federal or State control. Essentially it gives the Commission the power to manage the water resources of the Basin in the best possible manner.

In Subsection A(9) "secure" means that the Commission may obtain information, of whatever nature, by request or purchase if necessary, and is not intended to infer that the Commission will have the power to obtain such information by adverse means from any agency or such information as any agency is prevented by law from releasing. It is not the intent of the subsection that the Commission shall compete with other data collecting agencies of either State or Federal government, but rather that the Commission will utilize these available sources to the extent possible. It is necessary this Commission be given authority to do such work when it is not able to obtain needed information from other agencies due to budget or personnel limitations.

0201

Subsections B(6) and (7) provide for annual reports and annual budgets to be submitted to the respective Governors of the signatory States and to the President of the United States, but sets no date for the submission of these reports. Therefore, it is incumbent upon the Compact Commission to set such a date in the rules and regulations of the Commission. This provides some flexibility in the preparation of the annual report permitting the date to be changed if and when it should become necessary.

All other subsections are self-explanatory.

ARTICLE X

Compact

A. The provisions hereof shall remain in full force and effect until changed or amended by unanimous action of the States acting through their Commissioners and until such changes are ratified by the legislatures of the respective States and consented to by the Congress of the United States in the same manner as this Compact is required to be ratified to become effective.

B. This Compact may be terminated at any time by the appropriate action of the legislature of both signatory States.

C. In the event of amendment or termination of the Compact, all rights established under the Compact shall continue unimpaired.

Comment

This Article affirms the rather obvious fact that no action can be taken to modify the provisions of the Compact without unanimous action of the States and until the changes are ratified by the legislatures and the Congress. It also recognizes the right to terminate by the appropriate action of the States, and the protection of vested rights in the case of such an event.

ARTICLE XI

Compact

Nothing in this Compact shall be deemed:

A. To impair or affect the powers, rights or obligations of the United States, or those claiming under its authority in, over and to the waters of the Arkansas River Basin;

B. To interfere with or impair the right or power of either signatory State to regulate within its boundaries the appropriation, use and control of waters within that State not inconsistent with its obligations under this Compact.

Comment

This Article is a general declaration whereby the States disclaim any intention of impairing or affecting the powers, rights, or obligations of the United States, as they apply to the Arkansas River Basin.

It clearly states that the Compact is not intended to interfere with or impair the rights or powers of either signatory State to regulate the waters within its own boundaries.

ARTICLE XII

Compact

If any part or application of this Compact should be declared invalid by a court of competent jurisdiction, all other provisions and applications of this Compact shall remain in full force and effect.

Comment

This Article is self-explanatory.

ARTICLE XIII

Compact

A. This Compact shall become binding and obligatory when it shall have been ratified by the legislature of each

State and consented to by the Congress of the United States, and when the Congressional Act consenting to this Compact includes the consent of Congress to name and join the United States as a party in any litigation in the United States Supreme Court, if the United States is an indispensable party, and if the litigation arises out of this Compact or its application, and if a signatory State is a party thereto.

B. The States of Arkansas and Oklahoma mutually agree and consent to be sued in the United States District Court under the provisions of Public Law 87-830 as enacted October 15, 1962, or as may be thereafter amended.

C. Notice of ratification by the legislature of each State shall be given by the Governor of that State to the Governor of the other State, and to the President of the United States, and the President is hereby requested to give notice to the Governor of each State of consent by the Congress of the United States.

IN WITNESS WHEREOF, the authorized representatives have executed three counterparts hereof each of which shall be and constitute an original, one of which shall be deposited with the Administrator of General Services of the United States, and one of which shall be forwarded to the Governor of each State.

DONE at the City of Tulsa, State of Oklahoma, this 3rd day of March, A.D., 19 72.

Comment

The Committee wishes to stress the importance of this Article. The utilization of the water resources of this Basin is in large part dependent upon storage facilities. Regulatory works are needed to control and to put the water to use. This area is a single unit within a larger area, the Arkansas-Red-White River Basins in which the pattern of development has been well established. It is now being and must in the future be achieved largely with the assistance and cooperation of the United States government. It is the hope of this Committee that there will be no need to exercise the consent authority which is sought in this Article. As a practical matter, however, should interstate litigation arise out of

the Compact or its application in which the United States is an indispensable party, no satisfactory solution can be reached unless the United States is made a party thereto.

The members of the Arkansas-Oklahoma Arkansas River Compact Committee agree March 3, 1972, that the foregoing statement expresses the intent of the Committee with regard to the draft of the Arkansas-Oklahoma Arkansas River Basin Compact dated November 25, 1969.

FOR ARKANSAS:

S. Keith Jackson
Committee Member

John Luce
Committee Member
(Alternate)

FOR OKLAHOMA:

Glade R. Kirkpatrick
Committee Member

Milton Craig
Committee Member
(Alternate)

Approved: Trigg Twichell

Trigg Twichell, Representative
United States of America

Attest: Willard B. Mills

Willard B. Mills, Secretary

ARKANSAS RIVER BASIN COMPACT

ARKANSAS-OKLAHOMA

APPENDIX I

Computation of Annual Yield

Article II J of the Arkansas River Compact - Arkansas-Oklahoma described "annual yield," which is a term basic to the allocations of this Compact. It refers to the runoff which would occur from any specified area under unaltered natural conditions - i.e., where there would be no artificial man-made depletions of or additions to the original supply and no regulation of that supply.

The only time this could be measured absolutely would be before any facilities to utilize, import or impound water were constructed; and before any of man's activities altered rainfall-runoff relations. Land management practices, while possibly significant for some areas, are difficult to evaluate and will be disregarded, at this time, in the computations to meet the requirements for the administration of this Compact. The accuracy of annual yield determinations will be dependent upon how accurately depletions, and their ratio to total water yield, can be computed. Fortunately, present depletions for most of the compact area are small in relation to the original yield and, until such time that additional developments are made, only reasonable estimates will suffice to assure that terms of the Compact are being met.

Basically, the determinations that are required are as follows: (1) the measurement or computation of the actual runoff from each of the several "sub-basins" as defined by the Compact for each water

year; (2) the computation of the corresponding total depletions and/or accretions in each of the respective sub-basins; (3) the sum of items (1) and (2) to obtain the "annual yield" for each basin; and (4) multiply item (3) by 100 minus the percent depletion allowed in Article IV of the Compact; and (5) compute deficiency, if any, by comparing item (4) with item (1). The following outlines procedures for computing each of these items:

Item 1. Reliable estimates to meet this requirement can be readily made for the several sub-basins on the basis of the existing (1970) stream-gaging stations. (See figure 1 for location of stations). All of the larger streams draining from the State of Arkansas into the State of Oklahoma are gaged in or near the stateline, and acceptable estimates for the total outflow from each sub-basin can be made on the basis of these records plus estimated flows from ungaged areas.

The computation of actual runoff from the Arkansas River Sub-basin will need to take into account both the inflow and outflow from the area. This computation can be made by application of the following equation:

$$Q_A = Q_V - [Q_M + Q_W + Q_2 + Q_3 + Q_4]$$

in which

Q_A = Total annual discharge originating from the Arkansas River Sub-Basin.

Q_V = Total annual discharge of the Arkansas River immediately below the mouth of Lee Creek presently measured at Van Buren gaging station.

Q_M = Total annual discharge of the Arkansas River immediately below the mouth of the Grand Neosho River, presently measured at the Muskogee gaging station.

Q_W = Total annual discharge of the Canadian River at Eufaula Dam, presently measured at Whitefield gaging station.

Q_2 = Total annual outflow from the Illinois River Sub-basin.

Q_3 = Total annual outflow from the Lee Creek Sub-basin.

Q_4 = Total annual outflow from the Poteau River Sub-basin.

Item 2. The total annual depletion in each sub-basin will be the sum of the following:

(a) Total stream diversions minus return flows.
(b) Depletions and/or accretions by major reservoirs.
(c) Evaporation losses from other than major reservoirs.
(d) Pumpage of ground water from alluvium aquifers.

The following comments relate to each of the above:

(a) Reliable data on this item are not generally available at this time but will need to be firmed up as development of the area's resources progresses. The principal items will be diversions for irrigation and for municipal and industrial water supplies. In the case of small irrigation uses, satisfactory estimates of consumption can be made on basis of acres and types of crops irrigated. Withdrawals for municipal and industrial uses are generally available but estimates of return flows may be necessary. So long as these diversions are small in relation to total runoff no high degree of accuracy will be required.

(b) Depletions caused by major reservoirs will probably be most significant. The depletion from such reservoirs for a given period will be the difference between inflow and outflow and can be determined from the following (all terms expressed in acre-feet):

The inflow, I, at damsite that would have occurred if reservoir had not been in place, can be computed by the following:

$$I = O \pm \Delta S + E + D - P + p,$$

in which

O = Outflow as measured at gaging station below dam, or from gate and spillway ratings.

ΔS = Change in storage volume at beginning and end of period.

P = Precipitation on reservoir surface.

p = Runoff that would have occurred from area covered by reservoir, computed by a derived rainfall-runoff factor, c times P, or cP.

E = Evaporation from reservoir surface.

D = Direct diversions from reservoir storage, not included in outflow; seepage from reservoir may also be a factor and, if not included in measured outflow as at gaging station below dam, should be estimated.

As the depletion is inflow minus outflow, this can be written:

$$I - O = -P + p \pm \Delta S + E + D.$$

(c) Evaporation from small lakes, such as those not designed for water supply, including flood-detention structures, farm ponds, and recreation lakes, may be estimated on basis of average water surface area and appropriate data from evaporation-pan records.

(d) Pumpage from stream alluviums may cause appreciable depletions in stream flow. This is not believed to be a factor at the present (1969) time, but could conceivably be in the future for some stream reaches.

CONCLUSION

The Arkansas River Compact Commission, with the assistance of a Technical Advisory Group, should include, as part of their annual

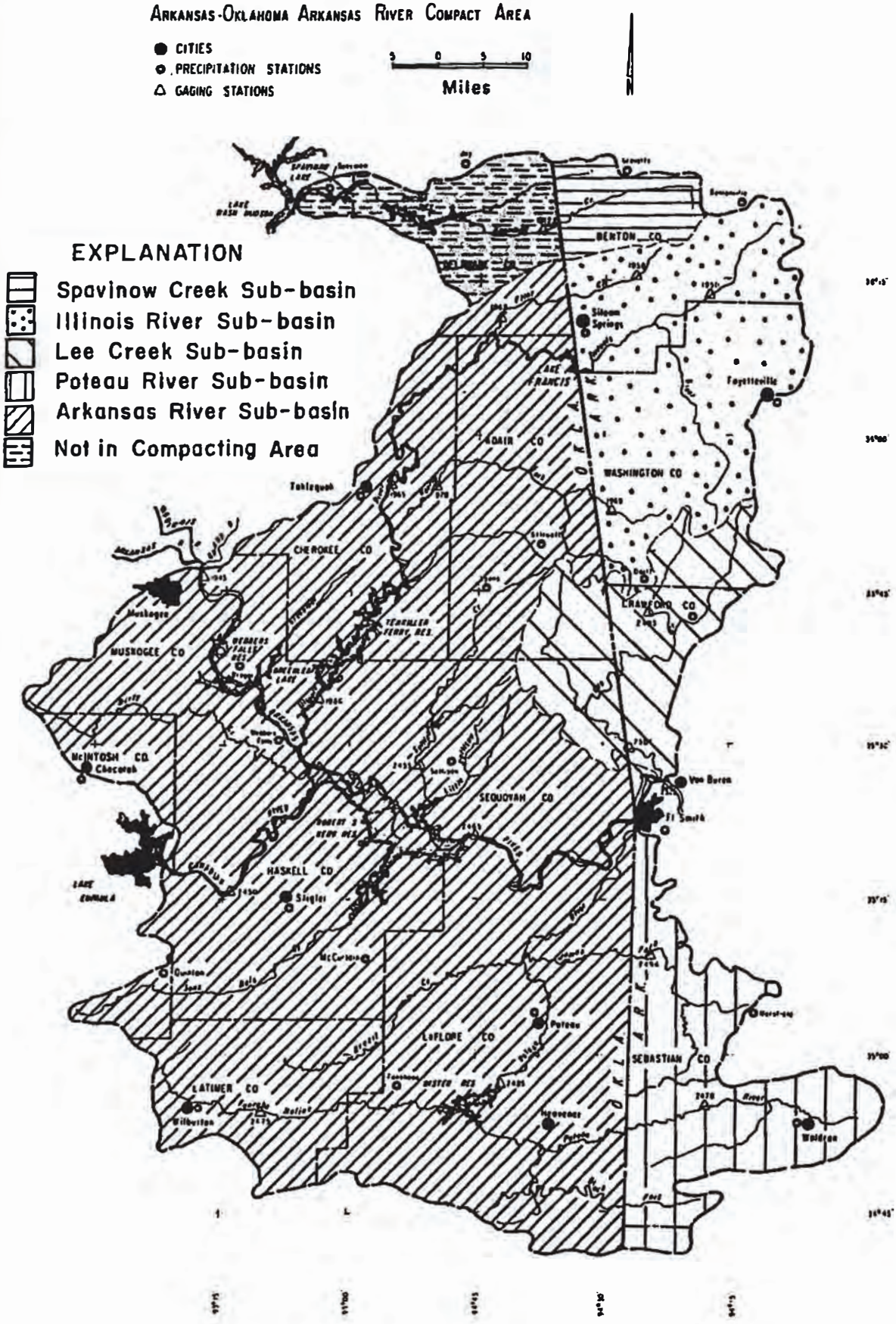
report, information on basin yields and depletions. Until such time as available data reveal that allocations between the States for any of the several sub-basins is in prospect of not being met, only generalized information will be adequate. As additional developments occur, the Commission should take steps to assure that the collection of basic data will be adequate to meet the needs of administration. As a minimum, the Commission should require the installation of instrumentation at such new reservoirs as will permit accurate determination of sub-basin inflow-outflow records.

Although allocations are to be based on annual yields, to be determined by December 31 of each year, current records will be required in the event provisions of Article V(B) need to be met, i.e., the delivery of sixty percent of current runoff to make up a deficiency.

The Commission should make continuing studies of the hydrology of the Basin for improvements or expansions in the collection of basic data as are needed to meet the changing needs for the administration of the Compact.

FIGURE 1

ARKANSAS-OKLAHOMA ARKANSAS RIVER COMPACT AREA



Revised March 3, 1972

NOVEMBER 25, 1969

ARKANSAS-OKLAHOMA
ARKANSAS RIVER COMPACT COMMISSION

RULES, REGULATIONS AND MODES OF PROCEDURE

(As Amended September 25, 1985, September 25, 1991, September 24, 1993, September 27, 2012, and September 24, 2015)

ARTICLE I
THE COMMISSION

1.1 The "Commission" is the "Arkansas-Oklahoma Arkansas River Compact Commission" referred to in Article VIII of the Arkansas River Basin Compact, Arkansas-Oklahoma.

1.2 The credentials of each Commissioner shall be filed with both the Chairman and the Secretary of the Commission. When the credentials of a new Commissioner are received, the Secretary shall promptly notify all other Commissioners of the name and address of the new Commissioner.

1.3 Each Commissioner shall advise the Commission in writing of the address to which all official notices and other Commission communications shall be sent for their receipt and shall further promptly advise in writing the office of the Commission of any changes in address.

ARTICLE II
COMMISSION OFFICERS

2.1 The officers of the Commission shall be a Chairman, a Secretary and a Treasurer.

2.2 The Commissioner (or "alternate") representing the United States shall be the Chairman of the Commission. The Chairman shall preside at meetings of the Commission. His duties shall be those usually imposed upon such officers and as may be assigned by these rules or by the Commission from time to time.

2.3 The Secretary shall be selected by the Commission. The Secretary shall serve for the term, and shall perform the duties, as the Commission shall direct. In case of a vacancy in the office of the Secretary, the Commission shall select a new Secretary as expeditiously as possible.

2.4 The Treasurer shall be selected by the Commission. The Treasurer shall receive, hold and disperse all funds of the Commission which shall come into his hands, and shall furnish a fidelity bond in an amount satisfactory to the Commission. The cost of the bond shall be paid by the Commission.

2.5 As the Commission may determine and direct, the various Commission officer positions may be joined and simultaneously held by the same person.

ARTICLE III
PRINCIPAL OFFICE

3.1 The principal office of the Commission shall be the office of the Chairman or the Secretary, as the Commission shall direct.

3.2 All official files, books and records of the Commission shall be kept and maintained in the principal office of the Commission. All such files, books and records shall be open to inspection by the public at the principal office of the Commission.

ARTICLE IV
COMMISSION MEETINGS

4.1 The annual meeting of the Commission shall be held on the fourth Thursday in September of each year. By prior agreement of all Commissioners, the Commission may select and designate a different date for holding the annual meeting.

4.2 Special meetings of the Commission may be called by the Chairman at any time. Upon written request of a majority of the Commissioners of either of the signatory states setting forth the matters to be considered at a special meeting, it shall be the duty of the Chairman to call a special meeting. Notice of all special meetings shall be sent by the Secretary to all members of the Commission by ordinary mail at least ten days in advance of the meeting and such notice shall state the purpose thereof.

4.3 Emergency meetings of the Commission may be called by the Chairman at any time upon request of either signatory state. For purposes of this rule, an "emergency" situation, for which an emergency meeting may be called, is understood to mean a situation involving an imminent threat of injury to persons or injury and damage to public or personal property or threat of imminent financial loss when time requirements make prior notice procedures impractical and, if adhered to, would increase the likelihood of injury, damage or financial loss.

4.4 Except as otherwise provided herein, prior notice of all Commission meetings shall be given by the Secretary to all Commissioners. Such notice shall advise of the date, time and place of the meeting and shall include an agenda for the meeting or, as may be applicable, a statement of the purpose of or matters to be considered at the meeting. Upon receipt of such notice, it shall be the responsibility of the signatory state to, in-turn, furnish notice to the public in its state such as may be required or provided under the laws of that state. Except as may be otherwise required under the laws of a signatory state, no advance public notice shall be required for the calling and conducting of emergency meetings. At the earliest possible time following any emergency meeting, the public will be notified of any Commission action taken at the meeting.

4.5 Meetings of the Commission shall be held at such places as shall be agreed upon by the Commissioners.

4.6 Minutes of Commission meetings shall be made and preserved in a suitable manner. Until approved by the Commission, minutes shall not be official and shall be furnished only to members of the Commission, its employees and committees.

4.7 A majority of the Commissioners of each state, and the Commissioner (or alternate) representing the United States, must be present to constitute a quorum.

4.8 In taking any Commission action, each signatory state shall have a single vote representing the majority opinion of the Commissioners of that State. The Commissioner (or alternate) representing the United States shall not have the right to vote in any of the deliberations or actions of the Commission.

4.9 In the case of a tie vote on any of the Commission's determinations, orders, or other actions, a majority of the Commissioners of either state may, upon written request to the Chairman, submit the question to arbitration. Arbitration shall not be compulsory, but, in the event of arbitration, there shall be three arbitrators chosen as follows:

(1) One named by resolution duly adopted by the Arkansas Soil and Water Conservation Commission, or such other State agency as may be hereafter responsible for administering water law in the State of Arkansas; and

(2) One named by resolution duly adopted by the Oklahoma Water Resources Board, or such other State agency as may be hereafter responsible for administering water law in the State of Oklahoma; and

(3) The third chosen by the two arbitrators who are selected as provided above.

If the two arbitrators fail to select a third within sixty (60) days following their selection, then the third arbitrator shall be chosen by the Chairman of the Commission.

4.10 At each annual meeting of the Commission, the order of business, unless agreed otherwise, shall be as follows:

1. Call to Order;
2. Introductions and Announcements;
3. Approval of Agenda;
4. Reading, Correction and Approval of the Last Meeting;
5. Report of the Chairman;
6. Report of Secretary;
7. Report of Treasurer;
8. Report of Commissioners;
9. Report of Committees;

10. Unfinished Business;
11. New Business; and
12. Adjournment.

4.11 All meetings of the Commission, except executive sessions, shall be open to the public. Executive sessions shall be open only to members of the Commission and such advisers as may be designated by each member and employees as permitted by the Commission; provided, however, that the Commission may call witnesses before it when in executive session. The Commission may hold executive sessions only for the purposes of discussing:

(1) The employment, appointment, promotion, demotion, disciplining or resignation of a Commission employee or employees, members, advisers, or committee members;

(2) Pending or contemplated litigation or litigation settlement offers, and matters where the duty of the Commission's counsel to its client, pursuant to the Code of Professional Responsibility, clearly conflicts with the public's right to know; or

(3) The report, development, or course of action regarding security, personnel, plans, or devices.

No executive session may be held except on a vote, taken in public, by a majority of a quorum of the members present. Any motion or other decision considered or arrived at in executive session shall be voidable unless, following the executive session, the Commission reconvenes in public session and presents and votes on such motion or other decision.

ARTICLE V
COMMITTEES

*** **5.1** There shall be the following standing committees:
(a) Budget Committee;
(b) Engineering Committee;
(c) Environmental and Natural Resources Committee; and
(d) Legal Committee.

*** **5.2** The Committees shall have the following duties:
(a) The Budget Committee shall prepare the annual budget and advise the Commission on all fiscal matters that may be referred to it.
(b) The Engineering Committee shall advise the Commission on all engineering matters that may be referred to it.
(c) The Environmental and Natural Resources Committee shall advise the Commission on all environmental and natural resource matters including:
(1) the identification of common areas of environmental concerns and potential solutions to shared environmental and natural resource problems;
(2) the promotion of environmental awareness and sustainable economic development; and

(3) other environmental and natural resource matters that may be referred to it.

(d) The Legal Committee shall advise the Commission on all legal matters that may be referred to it.

5.3 Members of the standing committees shall be appointed by the Commission. The number of members of each committee shall be determined by the Commission. Each state shall be represented by an equal number of members on each committee with the Chairmanship for each committee alternating annually between the States of Arkansas and Oklahoma. Each state shall nominate the member or members representing the state to serve on each committee.

5.4 Formal committee reports shall be made in writing by the Chairman thereof, and shall be filed with the Commission at least ten days prior to the meeting scheduled for its discussion.

ARTICLE VI
RULES AND REGULATIONS

6.1 So far as is consistent with the Arkansas-Oklahoma Arkansas River Basin Compact, the Commission may adopt rules and regulations and may amend them from time to time. Amendments and/or revisions to the rules, regulations and modes of procedure may be made at any meeting of the Commission.

6.2 Rules and regulations of the Commission may be compiled and copies may be prepared for distribution to the public under such terms and conditions as the Commission may prescribe.

ARTICLE VII
FISCAL

7.1 All Commission funds shall be deposited in a depository, or depositories, designated by the Commission under the name of the "Arkansas-Oklahoma Arkansas River Compact Fund." Such funds shall be initiated and maintained by equal payments of each state into the fund.

**** **7.2** Disbursements of funds in the hands of the Treasurer shall be made by check signed by the Treasurer and another authorized signatory upon voucher approved by and reported to the Commission. All Commissioners are authorized signatories.

7.3 At each annual meeting of the Commission, the Commission shall adopt and transmit to the Governors of the two states the budget covering an estimate of its expenses for the following fiscal year. For purposes of this rule and requirement, the signatory states may individually assume and carry-out the responsibility of transmitting the Commission's adopted budget to that state's respective Governor.

** **7.4** All Commission receipts and disbursements shall be audited at least once every two years by a qualified independent certified public accountant to be selected by the Commission, and the report of the audit shall be included in, and become a part of, the annual report of the Commission.

7.5 An up-to-date inventory of all Commission property shall be kept at the principal office of the Commission.

7.6 The fiscal year of the Commission shall begin July 1 of each year and end June 30 of the next succeeding year.

ARTICLE VIII
ANNUAL REPORT

8.1 The Commission shall annually make and transmit as soon as available to the Governors of the signatory states, and to the President of the United States, a report covering the activities of the Commission for the preceding fiscal year.

*** **8.2** The annual report shall include the following:

(a) Minutes of all regular, special or emergency meetings held during the year;

(b) All findings of facts made by the Commission during the preceding year;

(c) Recommendations for actions by the signatory states;

(d) Statements as to any cooperative studies made during the preceding year;

(e) All data which the Commission deems pertinent;

(f) The budget for current and future years;

(g) The most recent audit or financial statement of the Arkansas-Oklahoma Arkansas River Compact Fund;

(h) Name, address and phone number of each Commissioner and each member of all standing committees; and

(i) Such other pertinent matters as the Commission may require.

ARTICLE IX
MISCELLANEOUS

9.1 The Commission shall on request make available to the Governor of each of the signatory states any information within its possession at any time.

9.2 All contracts or other instruments in writing to be signed for and on behalf of the Commission, except matters related to the receipt or disbursement of funds, shall be signed by the Chairman when authorized by the Commission and attested to by at least one Commissioner from each State.

9.3 The Commission shall have the power to employ such engineering, legal, clerical and other personnel as in its judgment may be necessary for the performance of its functions under the Compact.

ARTICLE X
HEARINGS BEFORE THE COMMISSION

***** **10.1(A)** As the Commission may determine and direct, the Commission may hold hearings for the purpose of taking testimony and receiving evidence for the identification of interstate problems within the purposes of this Compact and issuing such appropriate orders as it deems necessary for the proper administration of the Arkansas-Oklahoma Arkansas River Basin Compact. Any interested person or entity may make application to the Commission requesting that a hearing be held on any matter arising under, or otherwise within the purview of, the Compact, provided, such applications must meet the following requirements:

(a) The application must be in writing and filed with the Chairman, with a copy thereof being simultaneously furnished, by the applicant, to all Commissioners.

(b) The application must state and describe the identity and address of the applicant(s) and, where appropriate, the applicant's representatives in pursuit of the application; the interest of the applicant(s) in presenting the application and requesting that a hearing be held; the purpose, subject matter, issues, concerns and/or allegations sought to be entertained and considered through the hearing applied for; and, as may be appropriate to the purposes of the hearing sought, the relief or other official Commission action being requested through the hearing.

Unless determined and directed otherwise by the Commission, applications for Commission hearings shall be placed, for Commission review and consideration, on the agenda for the next regularly scheduled annual meeting of the Commission following the filing of the application. Applicant(s) shall be notified, in advance by the Chairman, of the date, time and place of the meeting at which the application will be considered and acted upon by the Commission.

10.1(B) All hearings shall be open to the public and may be scheduled and conducted as part of an annual or special meeting of the Commission or as may be determined otherwise by the Commission. The presiding officers at such hearings shall be one Commissioner from each state designated and appointed to serve as presiding officer by the respective state.

10.2 Orders of the Commission shall be enforceable upon the request of the Commission or any other interested party in any court of competent jurisdiction within the county wherein the subject matter to which the order relates is in existence, subject to the right of review through the appellate courts of the state of situs.

10.3 Any hearing held for the promulgation and issuance of orders shall be in the county and state of the subject matter of said hearing.

10.4 In the event the Commission directs that a hearing be held, all interested parties shall be afforded an opportunity to be heard after reasonable notice. Such notice shall include, among other matters deemed appropriate:

(a) A statement of the date, time, place, and nature of the hearing;

(b) A statement of the legal authority and jurisdiction under which the hearing is to be held;

(c) A reference to any particular matter or any statute or rules involved; and

(d) A short and plain statement of the matters asserted or which are the subject or purpose of the hearing.

If the Commission, or any other interested party, is unable to state the matters in detail at the time the notice is served, the initial notice may be limited to a statement of the issues. Thereafter, and upon application, a more definite and detailed statement shall be furnished.

10.5 A record of the hearing shall be kept and maintained and shall include:

(a) All pleadings, motions and intermediate rulings;

(b) Evidence received or considered;

(c) A statement of matters officially noticed;

(d) Questions and offers of proof, objections, and rulings thereon;

(e) Proposed findings and exceptions thereto;

(f) Any decision, opinion or report by the officers presiding at the hearing; and

(g) All staff memoranda or data submitted to the Commission in connection with their consideration of the matter before such hearing.

10.6 Findings of facts shall be based exclusively on the evidence and on the matters officially noticed by the Commission.

10.7 Oral proceedings or any part thereof shall be transcribed on request of any party and the cost of transcription shall be paid by the requesting party.

10.8 At its hearings, the Commission may admit and give probative effect to evidence which possesses probative value commonly accepted by reasonably prudent men in the conduct of their affairs. It shall give effect to the rules of privileged communications recognized by law. No greater exclusionary effect shall be given any such rule or privilege than would be obtained in an action in court. The Commission may exclude incompetent, irrelevant, immaterial and unduly repetitious evidence. Objections to evidentiary offers may be made and shall be noted in the record. Subject to these requirements, when a hearing will be expedited and the interest of the parties will not be prejudiced substantially thereby, any part of the evidence may be received in written form.

***** **10.9** Documentary evidence may be received in the form of copies or excerpts if the original is not readily available. Upon request, the parties shall be given an opportunity to compare the copy with the original. The record of hearings may be held open for a reasonable length of time to afford either party time to submit additional written statements ~~and/~~or evidence. An original and two copies (or three copies) of each document sought to be introduced into

evidence by a party at a Commission hearing must be presented to the officers presiding over the hearing by the party desiring and moving its admission.

10.10 A party may conduct cross-examination required for a full and true disclosure of the facts.

10.11 Notice may be taken of judicially recognized facts. In addition, notice may be taken of generally recognized technical or scientific facts within the Commission's specialized knowledge. Parties shall be notified, either before or during the hearing or be referenced in preliminary reports or otherwise, of the material noticed, including any staff memoranda or data, and they shall be afforded an opportunity to contest the material so noticed. The Commission's experience, technical competence and specialized knowledge may be utilized in the evaluation of the evidence.

10.12 In the case of hearings involving alleged or apparent violations of the Compact, the following procedures shall apply:

(a) If there is an alleged or apparent violation of the Compact, it should be made known to the Commission;

(b) Alleged violators shall submit an explanation for, or response to, the alleged violation to the Commission within thirty days of receipt of written notification of said violation from the Commission;

(c) The Commission shall refer the alleged violation to the Engineering and/or Legal Committee for investigation and review;

(d) After due investigation has been made, the Engineering and/or Legal Committee shall refer the matter to the Commission with recommendations concerning the action to be taken.

10.13 Any party shall at all times have the right to counsel, provided that such counsel must be duly licensed to practice law in one of the signatory States, or associated with an attorney thereof.

ARTICLE XI
PUBLICITY

11.1 Prior to the close of each meeting, the Chairman may draft a press release as directed by the Commission and submit it to the Commission for approval. All approved releases may be made available to the press by any member of the Commission.

11.2 The Commissioners shall not be restricted from participation in a press conference or interview, conducted at the request of a member of the press or other news media, but may not speak on behalf of the Commission without the prior approval of the Commission.

ARTICLE XII
POLLUTION

12.1 The Commission may provide a forum for the identification and discussion of pollution occurring in the Arkansas River Basin to the end that the signatory states will cooperate with each other and jointly encourage the maintenance of an active pollution abatement program in each of the two states.

12.2 The Commission shall encourage each individual state to take positive steps in the abatement of pollution identified by the Commission to exist in the Arkansas River Basin; provided however, neither state may require the other to provide water for the purpose of water quality control as a substitute for adequate waste treatment.

12.3 The Commission shall collect, analyze and report on data pertaining to water quality within the basin. For this purpose the Commission may enter into contracts as provided by Article IX, A(2) to be approved at a Commission meeting. Unless formally approved by the Commission, no such report shall be published or have any validity.

ARTICLE XIII
PROCEDURE FOR DISAGREEMENT ON CALCULATION OF ANNUAL YIELD*****

13.1 The Arkansas Natural Resources Commission and the Oklahoma Water Resources Board representatives of the Engineering Committee will calculate the annual yield using the following data:

- **(a)** Stream flows (USGS);
- **(b)** Precipitation on reservoir surface (USACE);
- **(c)** Evaporation from reservoir surface (USACE);
- **(d)** Diversions from streams (OWRB and ANRC);
- **(e)** Diversions from reservoir (USACE); and
- **(f)** Return flows (State's DEQ).

13.2 The most recent data available will be used for all calculations. Each state agency shall have free access to the other state agency's data. The states should review, investigate, and possibly include historical data and averages if current year reported data is significantly different from previous years. If there is disagreement regarding the data used in the

calculations, the agencies may schedule a conference call for clarification and resolution of the disagreement.

13.3. Current computation methods used to calculate the annual yield have been agreed to by both state agencies and are attached to these rules as A-1.

13.4 Any state proposing a change to the "Guidelines for the Computation of Annual Yields" for calculating the annual yield for a certain water year must bring the proposed change to the engineering committee for review. If the changes are deemed important enough to be included in the current year's report, the engineering committee members shall hold a conference call to discuss the topic. Prior to adopting the method for usage in the yield report, the engineering committee must agree upon a defined process for using the changed methodology to consistently obtain and calculate data.

13.5 Any grievances regarding the calculation of the annual yield should be presented to the Commission with supporting evidence.

*As amended at the annual meeting, September 25, 1985.
**As amended at the annual meeting, September 25, 1991.
***As amended at the annual meeting, September 24, 1993.
****As amended at the annual meeting, September 27, 2012.
*****As amended at the annual meeting, September 24, 2015.

ARKANSAS RIVER BASIN COMPACT

Guidelines for the Computation of Annual Yields

September 24, 2015

This document describes methods developed and approved by the Arkansas River Basin Compact Commission to compute the annual yields for the Spavinaw Creek, Illinois River, Lee Creek, Poteau River and Arkansas River Sub-basins of the Oklahoma-Arkansas River Compact.

General Description of Computation of Annual Yields

To compute annual yields for the Sub-basins identified above, one must take the following steps:

1. Determine the computation of actual runoff from each Sub-basin.
2. Determine the computation of total depletions or accretions in each of the respective Sub-basins**.**
3. Combine items (1) and (2) to obtain the "annual yield" for each basin.
4. Multiply item (3) by 100 minus the percentage of depletion allowed in Article IV of the Compact.
5. Compute deficiency, if any, by comparing item (4) to (1).

Items 1 and 2 are explained in this document, as these involve interpretation of the Compact, data collection and application of appropriate methods for computation of runoff, accretions, and depletions. Items 3 to 5 are not included herein as these are self-explanatory.

1. Computation of Actual Runoff from each Sub-basin

- The Engineering Committee will compute runoff data from the Sub-basins using the areas defined by the Compact in Article II. Active USGS streamflow gauges should be used to retrieve measured runoff as available. Since most gauges are not located on the Oklahoma-Arkansas state border, estimates of runoff should account for the ungauged flows generated in the drainage area above or below the selected gauge.

  The Engineering Committee will adjust the runoff measured at the gauges for the Spavinaw Creek, Illinois River, Lee Creek,and Poteau River Sub-basins-using simple linear interpolation, as follows:

$$R = R_M * \left[\frac{A_T}{A_G}\right] \qquad \textbf{(Eq. 1)}$$

Where,

R *= Actual runoff at the OK-ARK state line*

$\boldsymbol{R_M}$ *= Measured runoff at the gauge*

$\boldsymbol{A_G}$ *= Contributing area at the gauge*

$\boldsymbol{A_U}$ *= Area ungauged above or below gauge*

$\boldsymbol{A_T}$ *= Total area including ungauged portion. Because water from these Sub-basins originates in the state of Arkansas, then:*

- *If gauge is located on the Oklahoma side:* $A_T = A_G - A_U$
- *If gauge is located on Arkansas side:* $A_T = A_G + A_U$

The annual yields report should include a brief description of the procedure used to compute actual runoff (R) in these Sub-basins, and should also include the measured ungauged drainage areas used for such computation.

The Engineering Committee will use the following formula to calculate runoff for the Arkansas River Sub-basin:

$$Q_A = Q_V - [Q_M + Q_W + Q_2 + Q_3 + Q_4] \quad \textbf{(Eq. 2)}$$

Where,

Q_A = *Total annual discharge originating from the Arkansas River Sub-basin.*

Q_V = *Total annual discharge of the Arkansas River immediately below the mouth of Lee Creek presently measured at the Van Buren gauging station.*

Q_M = *Total annual discharge of the Arkansas River immediately below the mouth of the Grand Neosho River, presently measured at the Muskogee gauging station.*

Q_W = *Total annual discharge of the Canadian River at Eufaula Dam, presently measured at Whitefield gauging station.*

Q_2 = *Total annual outflow from the Illinois River Sub-basin.*

Q_3 = *Total annual outflow from the Lee Creek Sub-basin.*

Q_4 = *Total annual outflow from the Poteau River Sub-basin.*

- The Engineering Committee will obtain data, as available, from the USGS website (http://waterdata.usgs.gov/nwis) for the following gauges (Table 1):

Table 1. Current USGS gauges used for Computation of Runoff at Sub-basins in the Compact Area

Sub-basin	USGS Gauges Required	Drainage Area (mi^2)
Spavinaw Creek	07191220 - Spavinaw Creek near Sycamore, OK	133
Illinois River	07195855 - Flint Creek near West Siloam Springs, OK 07195500 - Illinois River near Watts, OK 07196900 - Baron Fork at Dutch Mills, AR	59.8 635 41
Lee Creek	07249985 - Lee Creek near Short OK	420
Poteau River	07247015 - Poteau River at Loving, OK 07247250 - Black Fork below Big Creek nr Page, OK 07247250 – James Fork near Hackett, AR	269[a] 74.4[b] 147[c]
Arkansas River	07194500 - Arkansas River near Muskogee, OK 07245000 - Canadian River near Whitefield, OK 07250550 - AR River at J. W. Trimble L&D nr Van Buren, AR	84,133 37,876 151,000[d]

[a] Does not include 25.1 sq. miles of ungauged drainage.

[b] Does not include 13.0 sq. miles of ungauged drainage.

[c] Does not include 35.2 sq. miles of ungauged drainage.

[d] Includes 22,200 sq. miles of drainage area in Kansas that "probably is noncontributing".

Data obtained from the eleven (11) above listed gauges is sufficient to accurately compute actual runoff from the Sub-basins, but different gauges could be used for the computation of runoff.

- Review of the Poteau River Sub-basin indicates that there are large portions of runoff that originate in Arkansas but are not included in the gauging. Calculations should be completed to estimate the runoff for these areas using the following equation.

$$R_U = R_M * \left[\frac{A_U}{A_G}\right] \quad \textbf{(Eq. 3)}$$

Where,

R_U *= Calculated runoff at the OK-AR state line from ungauged contributing streams*

R_M *= Measured runoff at the gauge*

A_G *= Contributing area at the gauge*

A_U *= Area contributing runoff for ungauged streams*

- Actual runoff should be computed on an annual basis, and monthly values should be included in the annual yields report as appendices, instead of the daily time series that has been included in previous reports. Units should be consistent, preferably in acre-feet (AF). Flows originating from outside the Compact area should not be included in the computation of actual runoff, unless specified in the Compact. Article II of the Compact defines the drainage areas for each Sub-basin as waters originating in the Compact area. In previous reports, return flows from the White River Basin have been removed from the flow originating in the Arkansas River Basin since the water is being transferred in from another basin. The return flow data is obtained from the water departments of the cities of Fayetteville, Rogers, and Springdale, AR.

2. Computation of Total Depletions or Accretions in each of the respective Sub-basins

The total annual depletion in each Sub-basin will be the sum of the following: **(a)** Total stream diversions minus return flows, **(b)** Depletions and/or accretions by major reservoirs, **(c)** Evaporation losses from other than major reservoirs, and **(d)** Pumpage of ground water alluvium aquifers. Data sources and procedures suggested for computation of these items are described as follows:

a) Total stream diversions minus return flows

Diversions from the Oklahoma side of the Compact, i.e. the Arkansas Sub-basin and the Oklahoma portion of the Lee Creek Sub-basin, should be estimated using information from the Oklahoma Water Resources Board (OWRB). Likewise, diversions from the Arkansas side of the Compact should be obtained from the Arkansas Natural Resources Commission (ANRC). These agencies manage the surface water rights in their respective states, and can provide information on the type of uses, allocated amounts, annual reported use, and estimates of return flows. Values of annual diversions for each sub-basin should be included in the report, along with a brief description of the methods and assumptions used in the calculation of return flows.

b) Depletions and/or accretions by major reservoirs

The Compact defines depletion as the difference between the inflow and outflow, using the following equation:

$$I - O = -P + p \pm \Delta S + E + D$$

in which

***I - O** = Depletion in the reservoir.*

***P** = Precipitation on reservoir surface.*

***p** = Runoff that would have occurred from area covered by reservoir, computed by a derived rainfall-runoff factor c times P, or cP.*

***ΔS** = Change in storage volume at beginning and end of period*

***E** = Evaporation from reservoir surface.*

***D** =Direct diversions from reservoir storage, not included in outflow; seepage from reservoir may also be a factor, and if not included in measured outflow as at ~~gaging~~ gauging station below dam, should be estimated.*

The Engineering Committee will obtain monthly data for the reservoirs of the Compact area from the USACE web page, at http://www.swt-wc.usace.army.mil/. Available data includes reservoir contents, as well as evaporation and precipitation measured over the reservoir surface.

- **Precipitation on reservoir surface (P)**

  The Engineering Committee will obtain monthly values of precipitation data measured over the lakes from the USACE webpage.

- **Runoff (p)**

  This component should be estimated as the product of precipitation (P) and a runoff coefficient. A runoff coefficient of 0.18 has been used since 1974 to determine the runoff quantity. It has been noted that the runoff coefficient value can vary depending on publications and that there is no way to know what existed in the area before the reservoirs were built. For these reasons it is agreed upon by the Engineering Committee to continue the use of 0.18 as the runoff coefficient since this is the value that has been used in all of the previous reports.

- **Change in Storage (ΔS)**

  Change in storage is defined in the compact as the *"Change in the storage volume at the beginning and end of a period"*, which for the water year would be computed as the difference between the contents at the end of the period (September 30th) minus the contents at the beginning of the period (October 1, previous calendar year).

- **Evaporation from reservoir surface (E)**

  The Engineering Committee will obtain monthly values of evaporation strictly measured over the lakes from the USACE webpage. Pan evaporation is used to estimate the evaporation from lakes. There is a correlation between lake evaporation and pan evaporation. Evaporation from a natural body of water is usually at a lower rate because the body of water does not have metal sides that get hot with the sun, and while light penetration in a pan is essentially uniform, light penetration in natural bodies of water will decrease as depth increases. Pan coefficients can vary depending on a number of different variables, including ground cover, levels of relative humidity, and 24 hour wind speed. Previous reports have used a pan coefficient of 0.70 for correlation between reservoir evaporation and pan evaporation.

Further discussion as to the coefficient value that should be used is required by the engineering committee.

- **Direct Diversions from reservoir surface (D)**

  Direct diversions from reservoir storage, not included in the outflow, should be computed using information from the OWRB water rights database. Previous reports only used data from the USACE, but did not include details such as the type of use, the year of the data, and if any return flows had been included in the computation.

c) Evaporation losses from other than major reservoirs

This item has not been addressed in previous reports. The Compact states that *"Evaporation from small lakes, such as those not designed for water supply, including flood-detentions structures, farm ponds, and recreation lakes, may be estimated on basis of average water surface area and appropriate data from evaporation-pan records."*

Further discussion about the data sources and feasibility of including this item in the computation of depletions needs to be discussed by the Engineering Committee. Inclusion of this item in the computation of depletions will be determined by the Engineering Committee.

d) Pumpage of ground water from alluvium aquifers

This item has not been included in previous reports. The Compact states that *Pumpage from stream alluviums may cause appreciable depletions in the stream flow. This is not believed to be a factor at the present (1969) time, but could conceivably be in the future for some stream reaches"* (Appendix I, Item 2, page 119).

Inclusion of this item in the computation of depletions will be determined by the Engineering Committee.

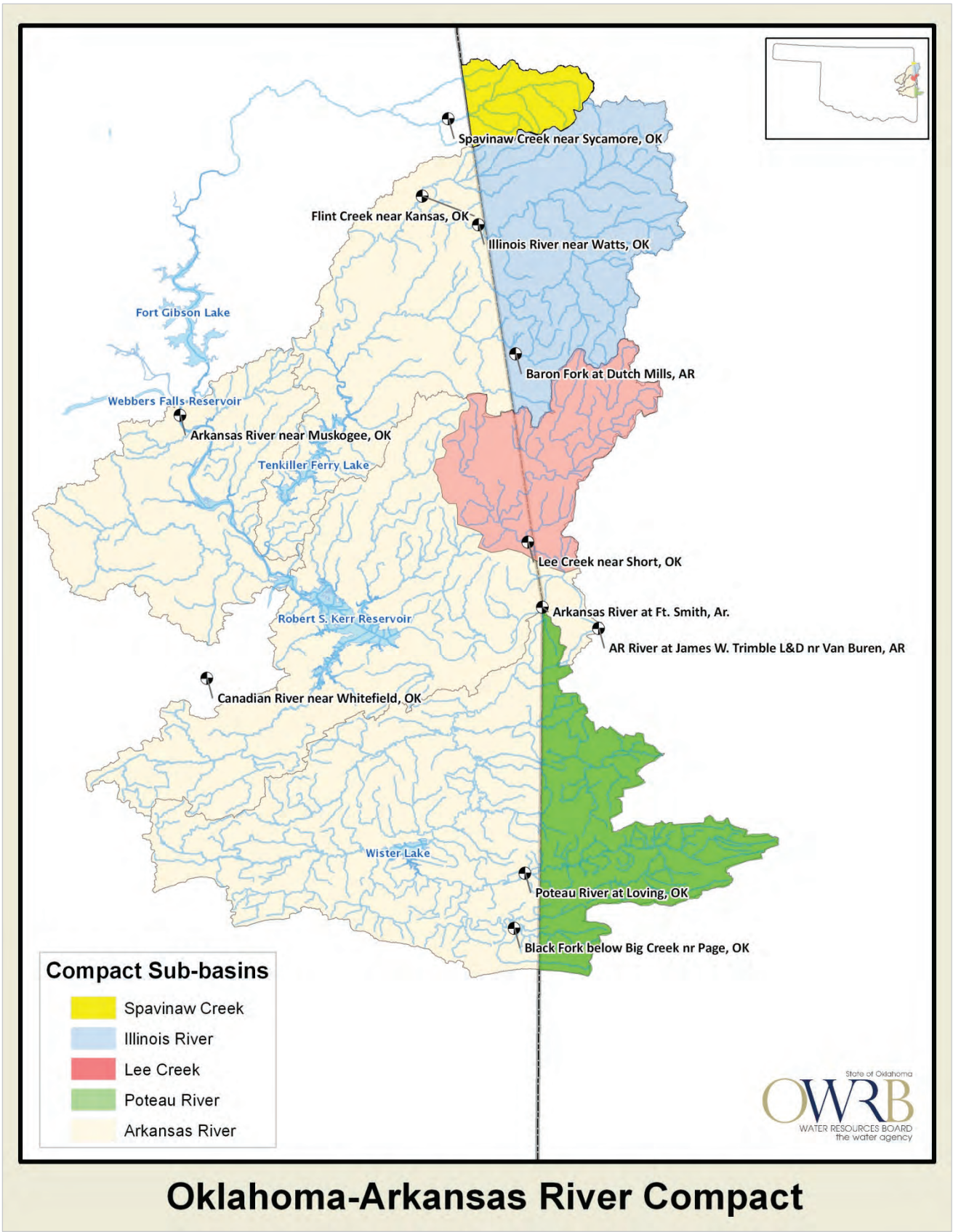


Figure 1. Map of the Oklahoma-Arkansas River Compact Area