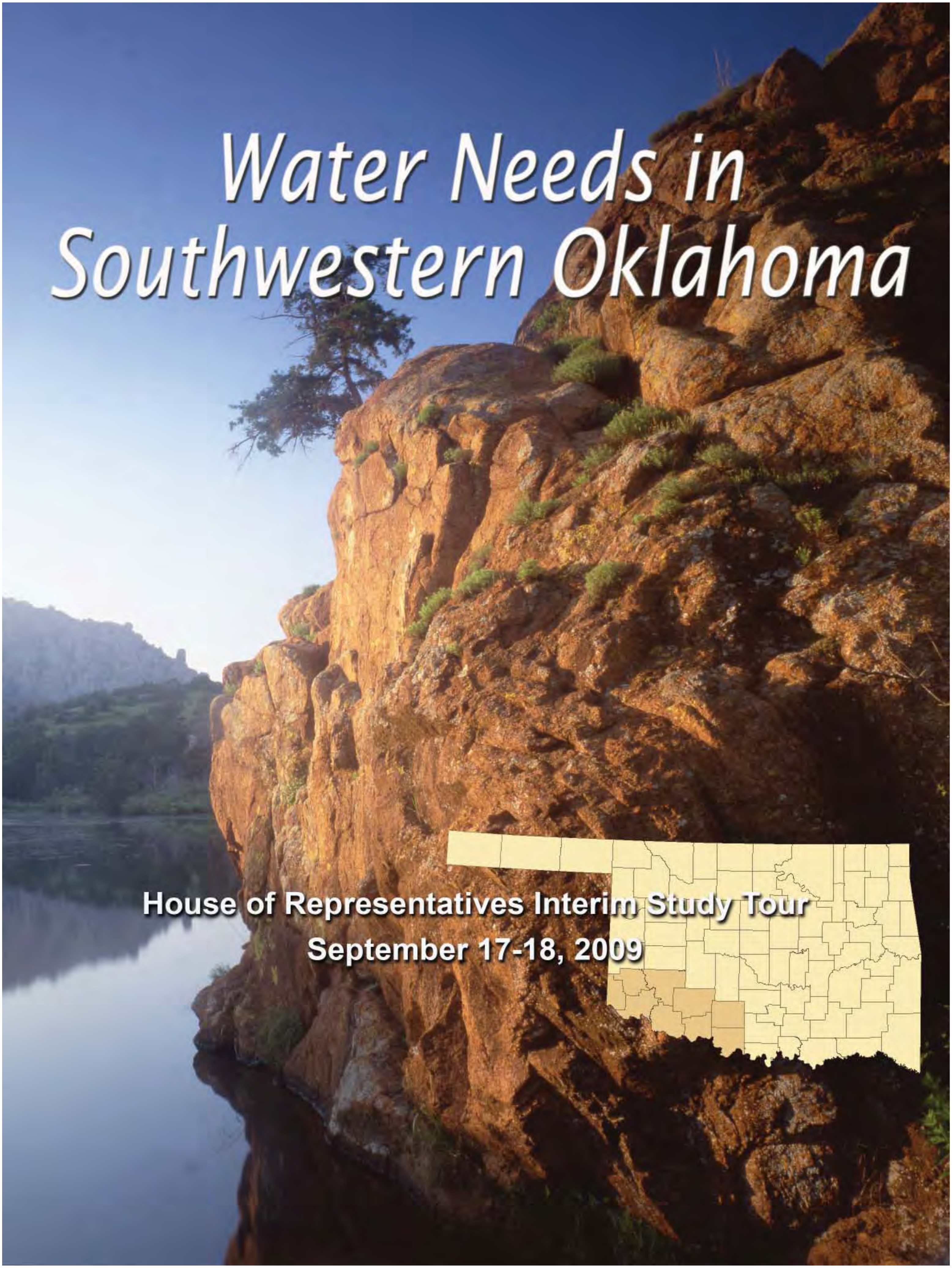
Water Needs in Southwestern Oklahoma



House of Representatives Interim Study Tour

September 17-18, 2009

Water Needs in Southwestern Oklahoma

House of Representatives Interim Study Itinerary

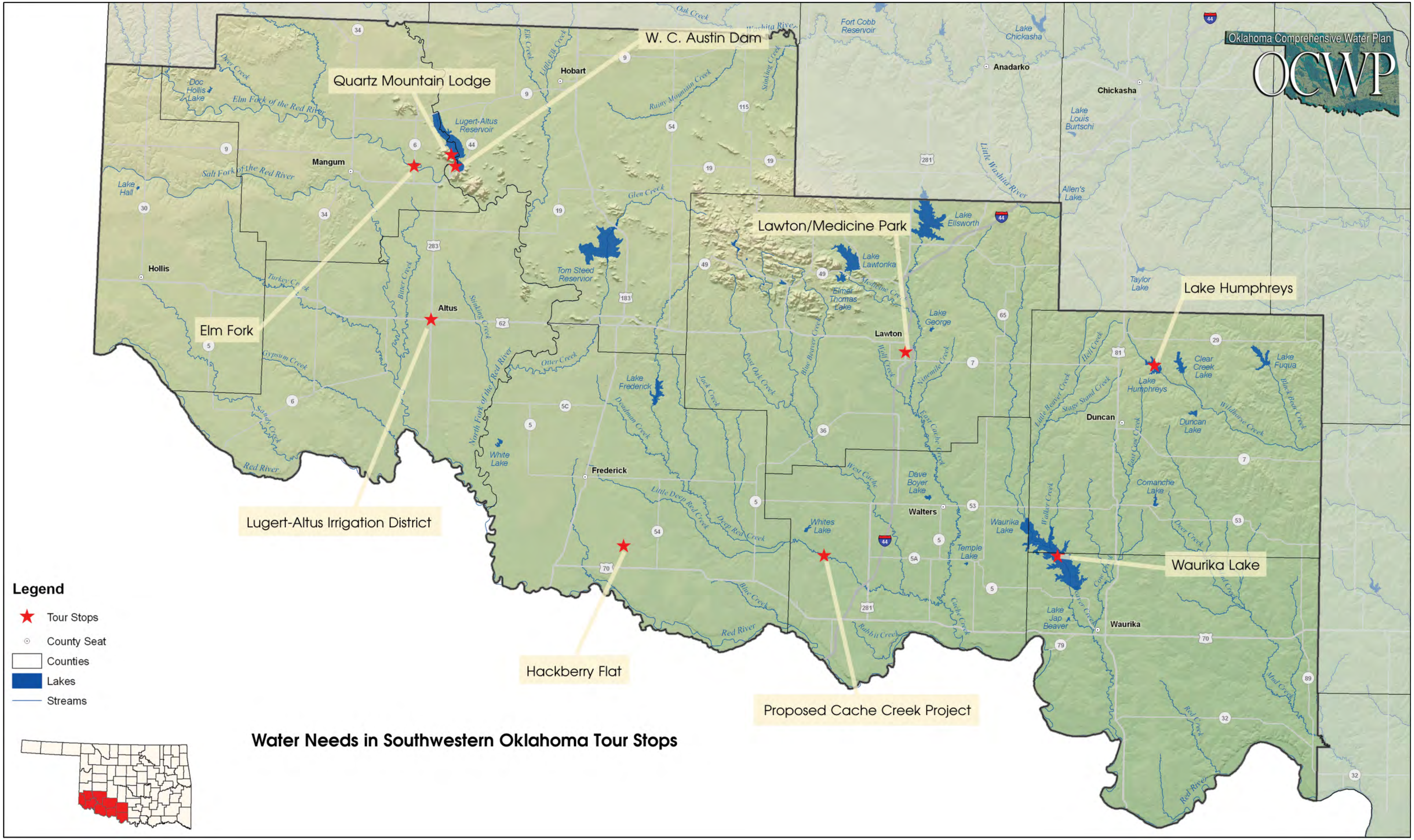
September 17-18, 2009

Thursday, September 17, 2009

8:00am	Depart State Capitol en route Lake Humphreys
9:15am	Arrive Lake Humphreys for discussion with Mike Thralls, Executive Director, Oklahoma Conservation Commission and Clay Pope, Executive Director, Oklahoma Association of Conservation Districts (Area A Pavilion, near end of Wilshore Drive) *From SH81/Main Street in Marlow; drive 1.6 miles East on SH29; South 2 miles on Plainsman Road; East 2 1/8 mile to Area A entrance; Drive south to Concession and Restaurant area.*
10:00am	Depart Lake Humphreys en route Waurika Lake
10:45am	Arrive Waurika Lake for discussion with David Taylor, District Manager, Waurika Lake Master Conservancy District (Waurika Lake Master Conservancy District Office) *3mi. West/6mi. South of Comanche School on SH53.*
11:15am	Depart WLMCD office for Corps of Engineers park
11:30am	Lunch and Discussion with U.S. Army Corps of Engineers staff at Kiowa Park I (South side of Waurika Lake, across dam)
12:15pm	Depart Waurika Lake en route Cache Creek proposed reservoir site (will not stop, just view location)
12:55pm	Detour slightly to view proposed site of Cache Creek Project.
1:05pm	Depart Cache Creek en route Hackberry Flat Wildlife Management Area
1:45pm	Arrive Hackberry Flat for tour/discussion led by Rod Smith, Southwest Region Supervisor, Oklahoma Department of Wildlife Conservation & Kelvin Schoonover, Hackberry Flat WMA Biologist, ODWC *6mi West/3mi North from US70/SH54, follow signs.*
2:30pm	Depart Hackberry en route Jackson County
3:15pm	Arrive Jackson County farm for irrigation tour/discussion with Tom Buchanan, Director, Lugert-Altus Irrigation District (U.S. Bureau of Reclamation regional director and staff will be in Altus to join this portion of tour)
4:00pm	Depart en route USGS/OWRB stream gauging site on Elm Fork of the Red River
4:30pm	Arrive Elm Fork site for stream gauging/water quality demonstration and discussion with Dr. Kim Winton, USGS District Chief; Steve Thompson, ODEQ Executive Director; Duane Smith, OWRB Executive Director; and other OWRB staff
5:00pm	Depart en route Quartz Mountain Lodge
5:15pm	Arrive Quartz Mountain Resort, Arts and Conference Center
6:00pm	Dinner/discussion in Lodge Pavilion with local ag/water industry leaders

Friday, September 18, 2009

8:00am	Depart Quartz Mountain Lodge en route W.C. Austin Dam for tour and discussion led by Tom Buchanan and Bureau of Reclamation staff
9:30am	Depart Lugert-Altus en route Medicine Park
11:00am	Arrive in Medicine Park for lunch/discussion of Lawton area water issues with local leaders and legislators/OCWP Update
1:00pm	Depart Medicine Park en route Oklahoma City
3:00pm	Arrive State Capitol



Oklahoma Comprehensive Water Plan
OCWP
W. C. Austin Dam
Quartz Mountain Lodge
Lawton/Medicine Park
Lake Humphreys
Elm Fork
Lugert-Altus Irrigation District
Hackberry Flat
Proposed Cache Creek Project
Waurika Lake
Legend
Tour Stops
County Seat
Counties
Lakes
Streams
Water Needs in Southwestern Oklahoma Tour Stops

Agency Contacts

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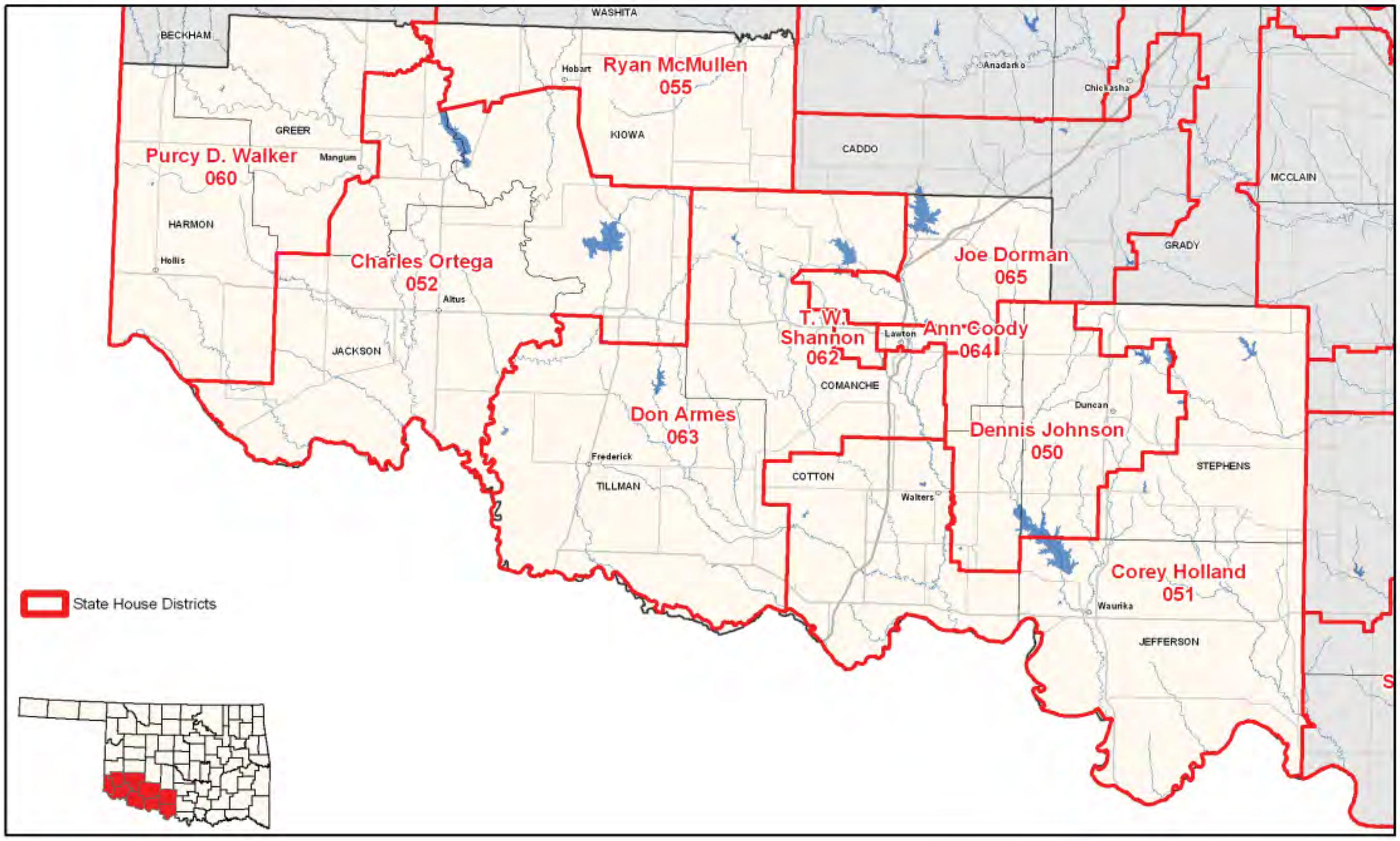
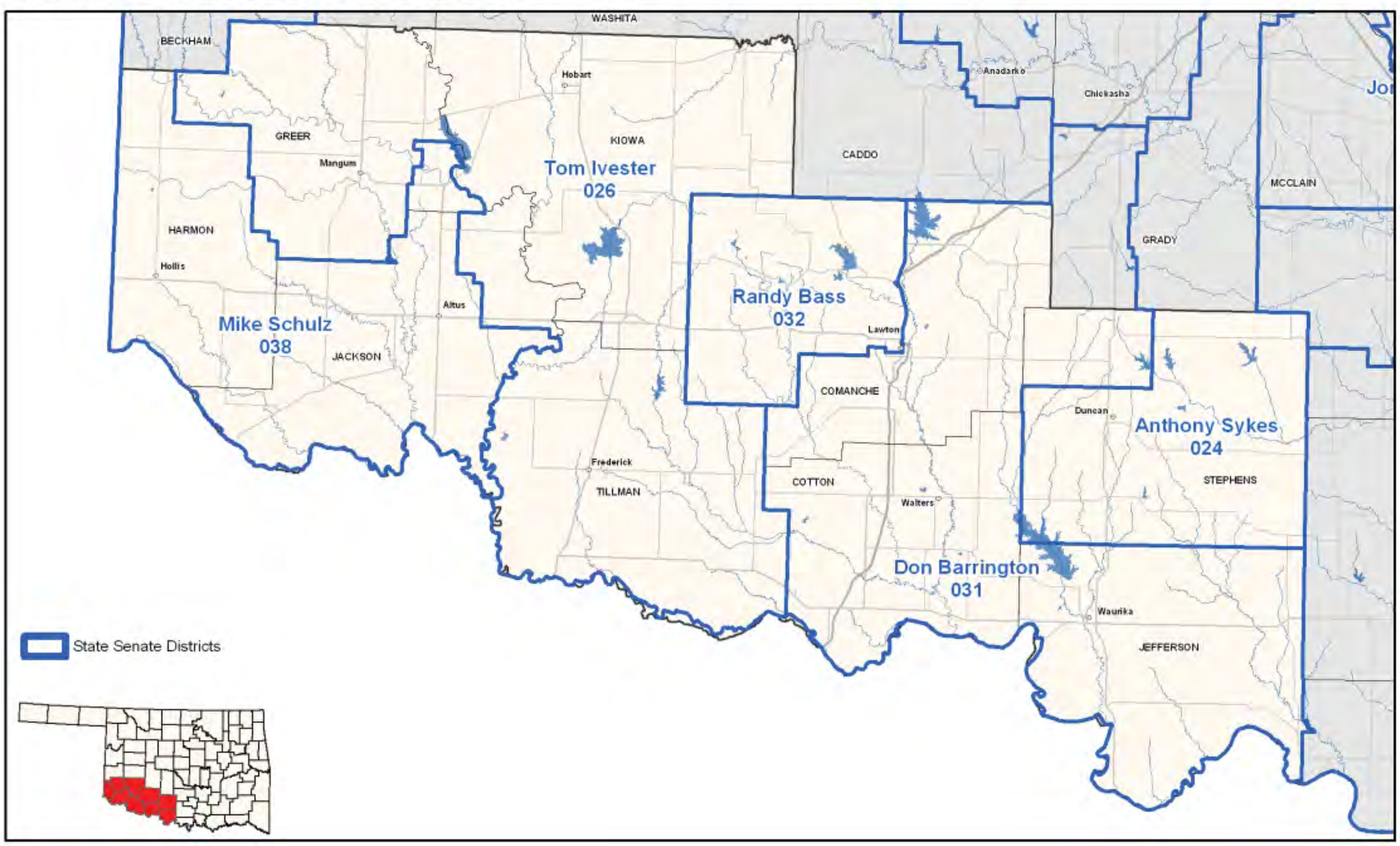
Contents

State House Districts



State Senate Districts



Welcome & Introduction

Welcome to the 2009 Water Needs in Southwestern Oklahoma Tour. Thank you for taking time out of your busy schedule to join us for the next two days as we travel through nine counties in southwestern Oklahoma to educate ourselves on the unique and pressing water issues facing this important region of our state.

The tour region includes the counties of Harmon, Greer, Jackson, Kiowa, Tillman, Comanche, Cotton, Stephens, and Jefferson. Major lakes in the region, including Waurika, Tom Steed, Ellsworth, Lugert-Altus, Lawtonka, Frederick, Fuqua, Humphreys, Clear Creek, Elmer Thomas, Duncan, Comanche, White, and Dave Boyer (all exceeding 100 acres in surface area), provide numerous agricultural, water supply, and recreational benefits. Several major aquifers (both bedrock and alluvium/terrace formations) also underlie the region, including Arbuckle-Timbered Hills, Blaine, North Fork of the Red River, Red River, Rush Springs, Tillman Terrace, and Washita River.

These nine counties have a combined estimated population of 218,770. Major permitted water use by residents of these counties includes irrigation (accounting for 61% of total surface and groundwater use) and public water supply (about 35% of total surface and groundwater use). Irrigated crops, including alfalfa, corn (grain and silage), cotton, horticulture crops, pasture, peanuts, wheat, other small grains, soybeans, and sorghum (grain and forage), occupy about 86,187 acres of farmland. Major public water supply systems are managed by two master conservancy districts (Waurika Lake and Mountain Park) and several major cities (including Lawton, Duncan, Altus, Frederick, and Waurika), along with 17 rural water districts.

Like many regions in the state, southwest Oklahoma faces unique and significant water quality challenges. In places, ancient mineral deposits mingle with groundwater, causing elevated levels of chlorides, sulfates and total dissolved solids to degrade fresh water resources. In some locations, these waters are saltier than the ocean. Although local aquatic communities have adapted to handle this increased mineralization, water remains too salty for most agricultural and water supply uses.

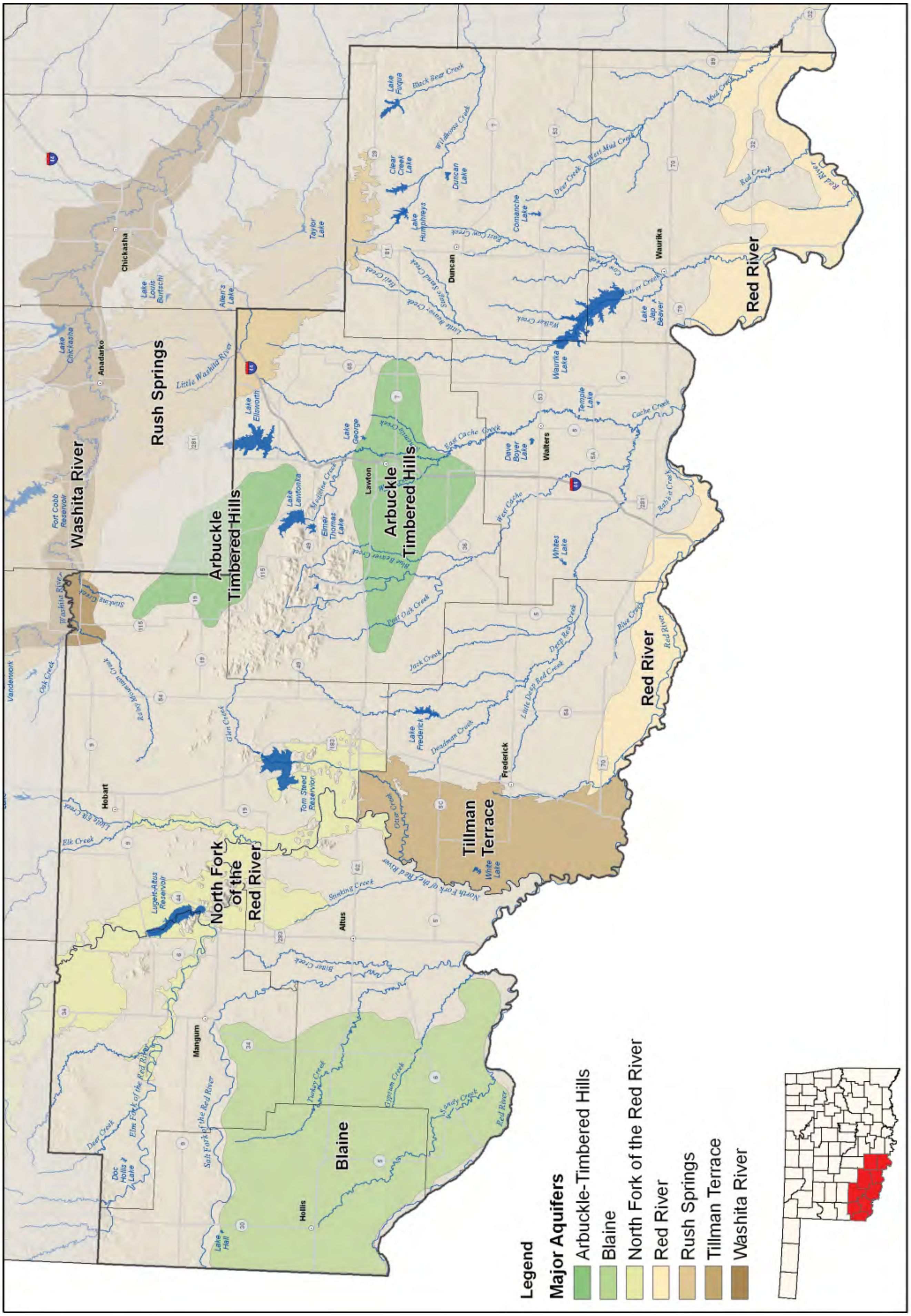
The Oklahoma Water Resources Board (OWRB) and other water-related agencies must balance protection of this unique and natural ecological environment while managing waters to maximize their benefits for agricultural and water supply needs. In addition, bacteria from myriad sources exceed criteria established in Oklahoma's Water Quality Standards. Consequently many waters are listed as impaired, and the Oklahoma Department of Environmental Quality (ODEQ), in partnership with multiple agencies and organizations, is working to reduce the bacteria threat and restore the potentially valuable uses of these compromised waters.

Critical to this effort is the use of science and the collection of timely and reliable data to inform both our water management agencies and our decision makers who establish our state's water policy. As part of its water quality and quantity monitoring responsibility, the OWRB currently maintains 24 water quality (Beneficial Use Monitoring Program) lake and stream sites in the tour region. In addition, there are 21 real-time U.S. Geological Survey stream and lake gages and 61 active water well level monitoring locations. This data has proven vital to many important water-related studies conducted in southwest Oklahoma by the OWRB, USGS, Bureau of Reclamation, U.S. Army Corps of Engineers, and other state and federal partners.

Since the inception of the OWRB's Financial Assistance Program (FAP) in 1979, 154 grants and low-interest loans totaling more than $262 million have been awarded to communities in the tour region for water and wastewater system improvements. Through use of FAP funding sources, communities have saved more than $100 million.

We hope you find this tour both educational and enlightening, and we encourage you to share your thoughts and concerns with the many state and federal water experts accompanying you on the tour.

Major Aquifers



Major Area Aquifers

Major Aquifers in the nine-county tour region include the Arbuckle-Timbered Hills, Blaine, North Fork of the Red River, Red River, Rush Springs, Tillman Terrace, and Washita River.

The **Arbuckle-Timbered Hills** occurs in two areas: the Limestone Hills north of the Wichita Mountains and in the Cache-Lawton area south of the Wichita Mountains. Availability of groundwater in the Limestone Hills is erratic because of faulting and folding. Most wells are at least 500 feet deep. Water generally is under artesian conditions. Flowing wells and springs yield as much as 100 gpm. In the Cache-Lawton area, well depths range from 350 feet to more than 2,000 feet. Yields up to 600 gpm have been reported. This aquifer is largely undeveloped. Water from the Limestone Hills area is very hard calcium bicarbonate water and sometimes contains hydrogen sulfide gas. Dissolved solids range from 195 to 940 mg/L. Water from the Cache-Lawton area is a soft, sodium chloride type water with dissolved solids ranging from 279 to 6,380 mg/L. Concentrations of fluoride range from 1.6 to 17 mg/L. Because fluoride concentrations generally exceed the drinking water standard, use for public water supply is limited.

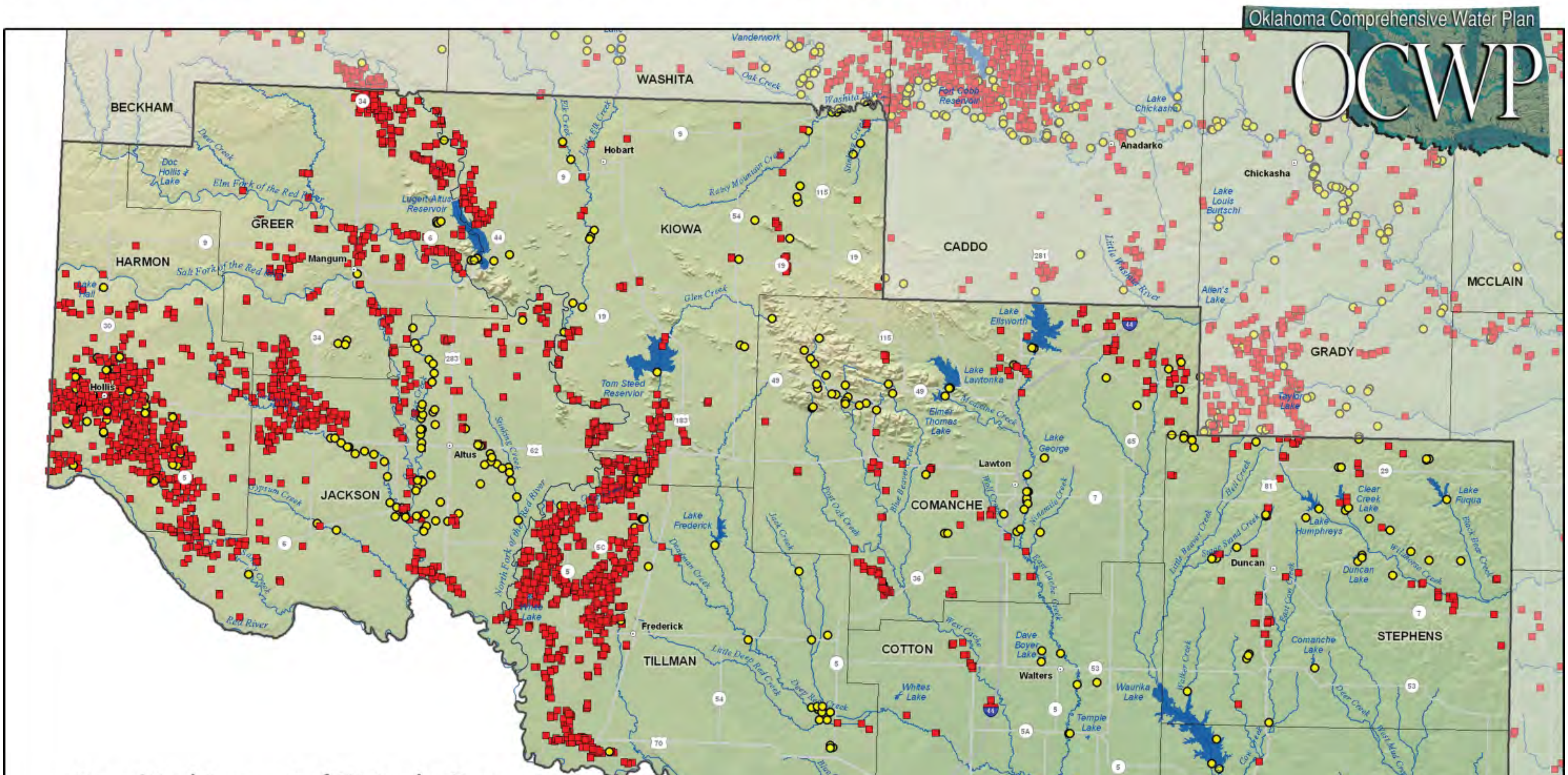
Water from the **Blaine** is of poor quality with dissolved solids ranging from 1,500 to 5,000 mg/L. The water has high concentrations of calcium and sulfate, reflecting dissolution of the gypsum beds. Locally, in southeastern and northwestern Harmon County, the water has a high sodium chloride content. Although the highly mineralized aquifer is unsuitable as a drinking water supply, it is a major source of irrigation water. Irrigation wells are typically 100 to 300 feet deep with yields between 100 and 500 gpm, although they can exceed 2,000 gpm. Natural recharge to the basin occurs from infiltration of precipitation and from streams that flow across sinkholes and solution openings. Average recharge is estimated at 1.5 inches per year. The Blaine Gypsum Groundwater Recharge Demonstration Project, completed in 1997 by the OWRB and U.S. Bureau of Reclamation, successfully utilized gravity-flow recharge wells to augment groundwater supplies. Today, local farmers channel runoff into artificial recharge wells to augment natural recharge.

In 2002 the OWRB and U.S. Bureau of Reclamation conducted an investigation of the Oklahoma portion of the watershed for Lake Altus on the **North Fork of the Red River**. The purpose of the study was to gather water quality and quantity data from the groundwater and surface waters associated with the watershed, which will help in understanding the interaction between surface and groundwater. A number of water management concerns pertain to the study area. One concern is upstream development of groundwater and surface water and how this will affect both the quality and quantity of water. With respect to surface water, the concerns include continued diversions from the North Fork of the Red River and continued development of impoundments on the river or its tributaries. Groundwater concerns are mostly related to how water use will affect base flow in the river. The quality of the groundwater and surface water in the region is also a concern. Due to high nitrate concentrations in the alluvium and terrace deposits, a new water treatment system was built east of Granite to serve a large portion of Southwestern Oklahoma, including the Oklahoma State Reformatory and the cities of Granite, Martha, and Lone Wolf. The plant, which began operating in the summer of 2002, uses reverse osmosis to reduce high nitrate levels and provides good quality water to over 1,750 rural homes and numerous businesses. The largest user of groundwater in the study area is the City of Elk City, which maintains 66 public water supply wells located in the alluvium and terrace deposits of the North Fork of the Red River.

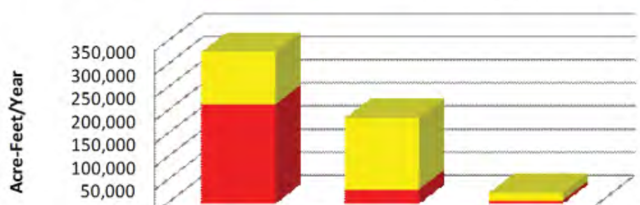
The **Rush Springs** aquifer is used primarily for irrigation, but it also supplies water for industrial, municipal, and domestic use. Most groundwater withdrawn from the Rush Springs aquifer is in Caddo County. Wells commonly yield 25 to 400 gpm while some irrigation wells are reported to exceed 1,000 gpm. Yields from the Marlow Formation are much smaller than from the Rush Springs Formation. Water from the Rush Springs aquifer tends to be very hard yet suitable for most uses. Levels of dissolved solids are generally less than 500 mg/L. Nitrate and sulfate concentrations exceed drinking water standards in some areas, limiting its use for drinking water.

Groundwater from the **Tillman Terrace** is used extensively for irrigation while minor amounts are withdrawn for public water supply and other purposes. In 1978, the OWRB issued its first Board order for the allocation of water rights in Oklahoma, approving a Maximum Annual Yield based on a hydrologic survey proportioned at 1 acre-foot per acre from the basin. This study was updated in 2002.

Permitted Groundwater and Surface Water Rights

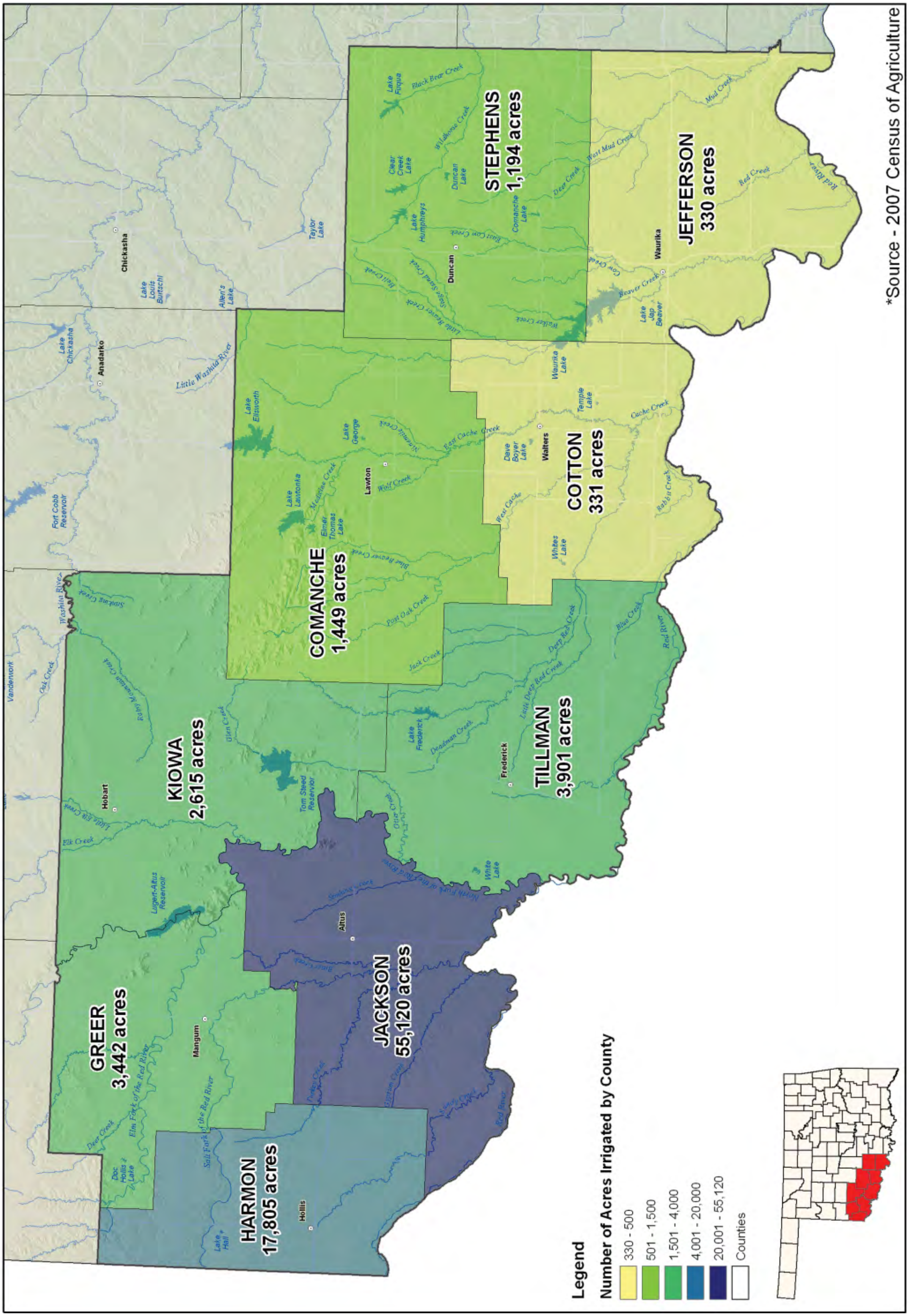


Permitted Amount of Water by Purpose

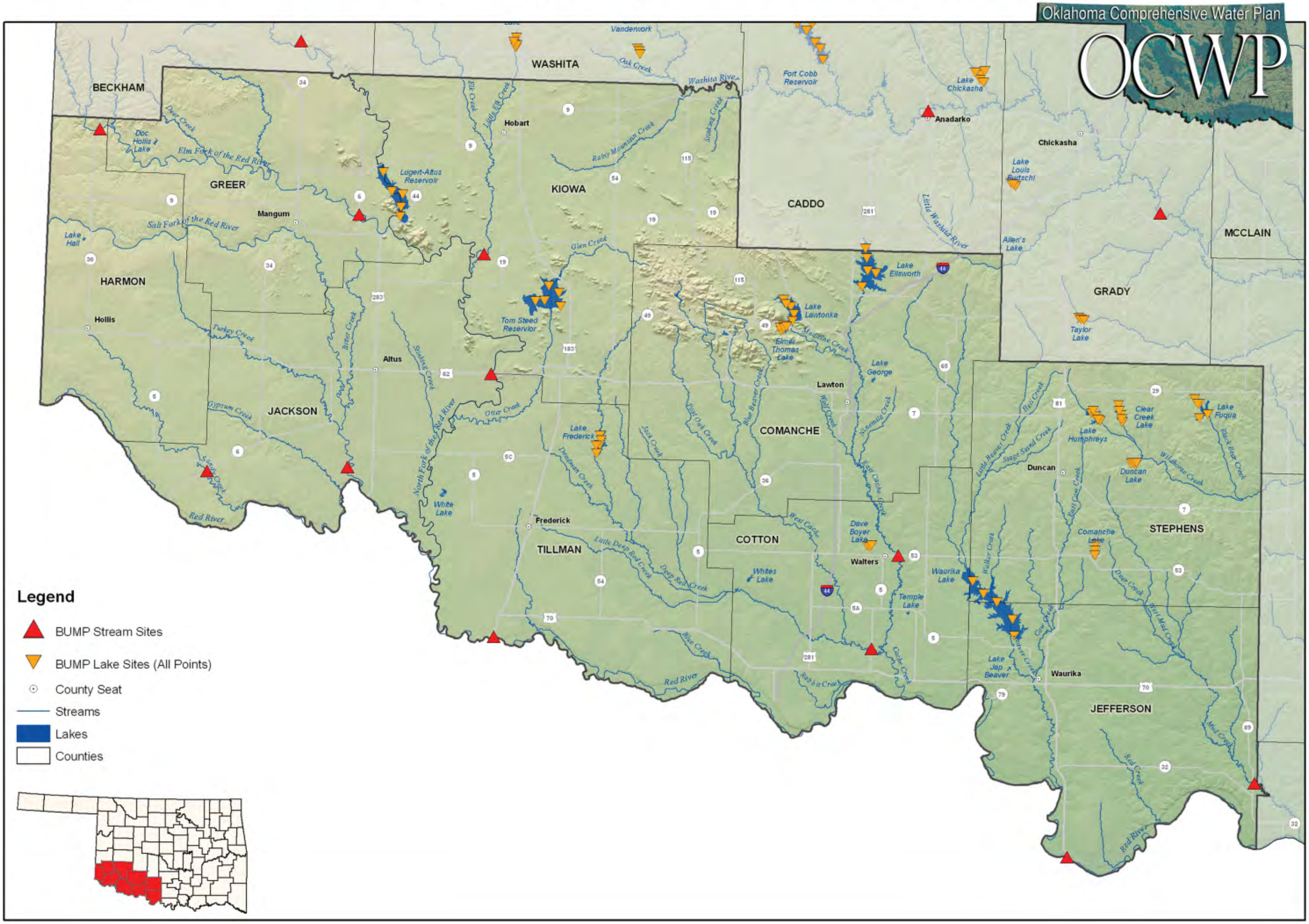


	Irrigation	Public Water Supply	Other	Total Amount (Acre-Feet/Year)
Surface Water	114,162	154,697	16,692	251,901
Groundwater	214,386	30,811	6,704	285,550

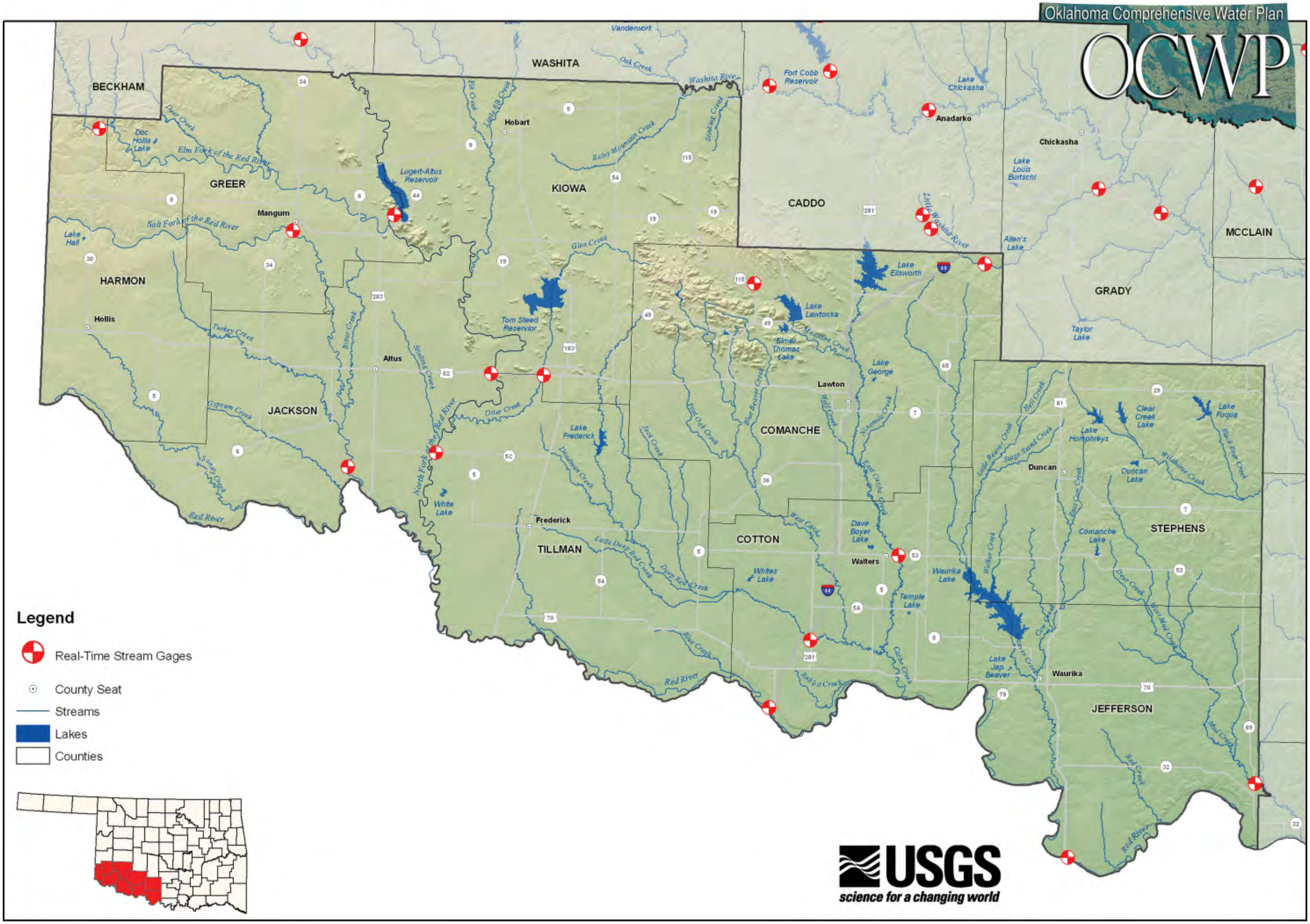
Amount of Land Irrigated by County



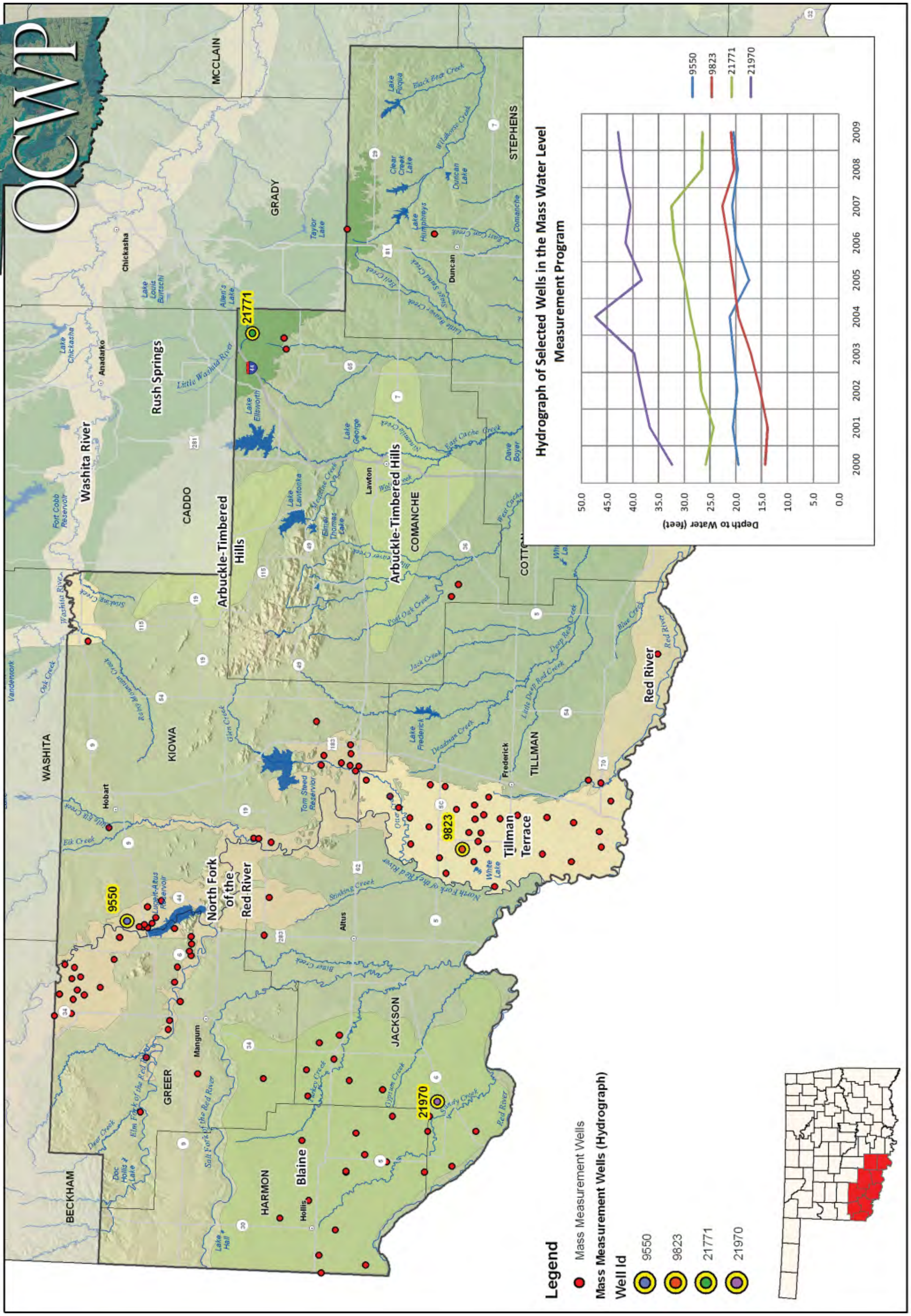
Beneficial Use Monitoring Program (BUMP) - Lake and Stream Sites



Real-Time Stream Gages



Mass Water Level Measurement Wells



Water Needs in Southwestern Oklahoma
September 2009 - OWRB Financial Assistance Program

Since 1979, the Oklahoma Water Resources Board has administered the largest and most popular financial assistance program for funding construction of water and wastewater infrastructure in Oklahoma. To date, the agency has issued more than $2 Billion in loans and grants for system improvements, construction and refinancing saving Oklahoma communities an estimated $709 Million. Additionally, the OWRB bonds have achieved the highest rating available from Standard & Poor's, Moody's and Fitch ratings. This was reiterated by the AAA rating that was given by Moody's again in their most recent review process.

Financial Assistance Programs

Emergency Grants
The Emergency Grant Program is point-based program designed to assist communities facing water/wastewater crises which threaten life, health, or property. The maximum grant available is $100,000. The applicant must contribute a minimum of 15% of the total project cost.

REAP Grants
The REAP Grant Program is a point-based program designed to assist smaller communities that lack sufficient fiscal capacity. Cities, towns, and municipalities with a population less than 1,750 are given priority. Rural water and/or sewer districts with less than 525 non-pasture customers are also given priority. Applications must be received by September 1 of the fiscal year for which funds have been appropriated.

Revenue Bond Loans (FA Loans)
The OWRB's long-term, low-interest revenue bond loan program offers a variable interest rate with a fixed rate conversion option. The application process normally takes 3 to 6 months once eligibility and funding are established.

DWSRF Loans
The Drinking Water State Revolving Fund (DWSRF) is a below market fixed rate loan program available to Public Trusts of Towns and Municipalities to address drinking water issues. Program funding comes from EPA capitalization grants, state matching funds, loan repayments, investment earnings, and bonds which allow the interest rate to be set at 70% of market rate. The payback period is up to 30 years. The DWSRF is administered cooperatively by the OWRB and the Oklahoma Department of Environmental Quality (ODEQ.)

CWSRF Loans
The Clean Water State Revolving Fund (CWSRF) is a below market fixed rate loan program available to Public Trusts of Towns and Municipalities to address wastewater and nonpoint source issues. Program funding comes from EPA capitalization grants, state matching funds, loan repayments, investment earnings, and bonds which allow the interest rate to be set at 60% of market rate. The payback period is up to 20 years. The CWSRF is administered by the OWRB.

Projects Eligible for OWRB Financial Assistance

Water Infrastructure/Improvements
- New intake/raw water lines
- Major distribution/storage system rehabilitation
- New storage
- Engineering
- New transmission/distribution systems
- Water treatment facilities

Wastewater
- Treatment
- Collection
- Storage
- Disposal infrastructure or equipment
- New construction or rehabilitation

Non Point Source
- Riparian Zone Protection
- Agriculture Best Management Practices
- Wetland restoration and protection
- Elimination/Upgrades of septic systems
- Conservation Tillage equipment

Land Conservation and Preservation
- Land acquisition for source water protection

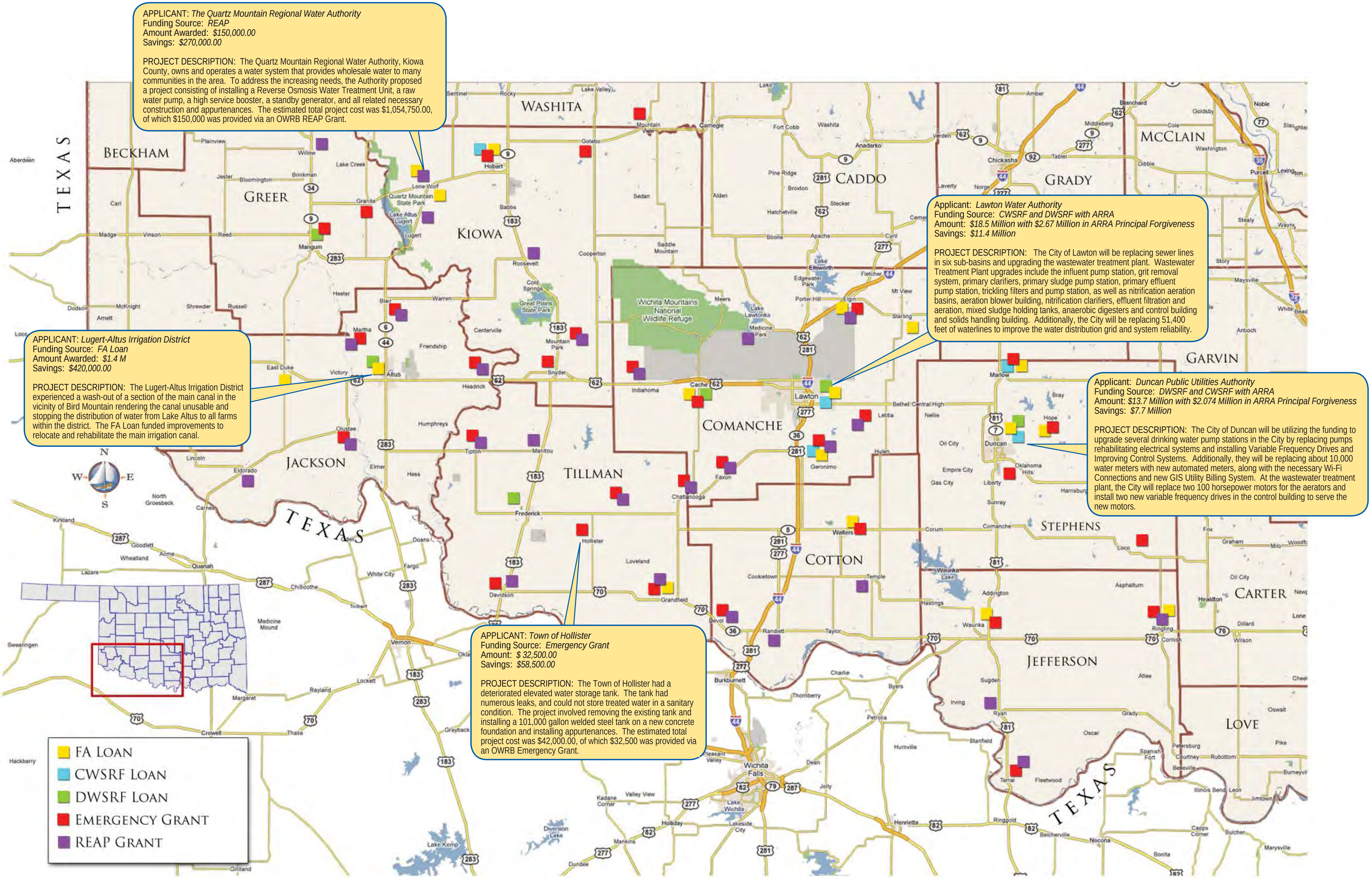
Urban Stormwater Projects
- Stormwater BMPs for homeowners
- Street Sweepers
- Catch Basins/Sediment Traps
- Structural erosion control projects

Brownfield Assessments and Remediation
- Phase I, II, and III site assessments (for brownfields with water quality impacts)
- Excavation and disposal of underground storage tanks
- Excavation, removal, and disposal of contaminated soil or sediments
- Capping of wells and well abandonment
- Construction of wetlands
- Monitoring of groundwater or surface water for brownfield contaminants

Water Conservation for Publicly Owned Facilities

Public Education Programs

TABLE OF FUNDED PROJECTS ➤



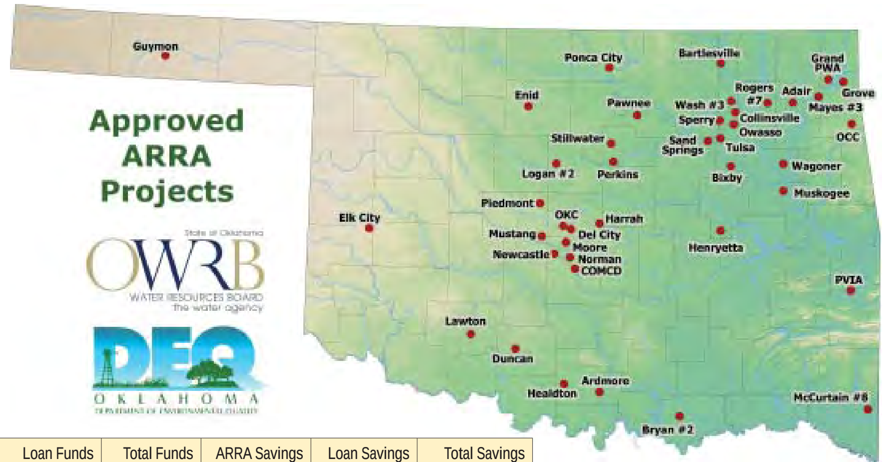
Projects in Southwestern Oklahoma
Funded by the OWRB Financial Assistance Program
(See Table on Following Page)

Projects in Southwestern Oklahoma Funded by the OWRB Financial Assistance Program

Entity	Application Type	Number of Grant/ Loans	Grant/Loan Amount	Savings
Altus MA	DWSRF	2	$14,648,700.00	$4,394,610.00
	FA Loan	3	$10,335,000.00	$3,100,500.00
Blair PWA	Emergency	1	$15,040.00	$27,072.00
	REAP	1	$97,270.00	$175,086.00
Cache PWA	DWSRF	1	$2,000,000.00	$600,000.00
	Emergency	1	$44,500.00	$80,100.00
	FA Loan	2	$815,000.00	$244,500.00
Chattanooga PWA	Emergency	1	$50,000.00	$90,000.00
	REAP	1	$94,660.00	$170,388.00
Comanche Co. RWD #2	FA Loan	1	$1,045,000.00	$313,500.00
Comanche Co. RWD #3	Emergency	1	$100,000.00	$180,000.00
Davidson PWA	Emergency	3	$256,280.00	$461,304.00
	REAP	1	$72,850.00	$131,130.00
Devol PWA	REAP	2	$158,501.00	$285,303.00
	Emergency	1	$99,900.00	$179,820.00
Duke MA	FA Loan	1	$200,000.00	$60,000.00
Duncan PUA	CWSRF	6	$25,972,804.00	$7,891,741.00
	DWSRF	5	$44,120,000.00	$13,236,000.00
	FA Loan	4	$14,310,000.00	$4,293,000.00
Eldorado PWA	REAP	3	$303,713.00	$546,684.00
Elgin PWA	Emergency	1	$100,000.00	$180,000.00
	FA Loan	1	$520,000.00	$156,000.00
	REAP	1	$99,270.00	$178,686.00
Empire School (Nr Duncan)	Emergency	1	$93,850.00	$168,930.00
Faxon	Emergency	1	$67,880.00	$122,184.00
	REAP	1	$97,718.00	$175,892.00
Frederick PWA	DWSRF	1	$4,100,000.00	$12,300,000.00
Geronimo PWA	Emergency	2	$105,880.00	$190,584.00
	CWSRF	1	$395,000.00	$118,500.00
	FA Loan	1	$285,000.00	$85,500.00
	REAP	2	$155,697.00	$280,254.00
Gotebo PWA	Emergency	1	$93,050.00	$167,490.00
	REAP	2	$162,530.00	$292,554.00
Grandfield PWA	Emergency	2	$99,916.00	$179,849.00
	FA Loan	1	$115,000.00	$34,500.00
	REAP	1	$99,500.00	$179,100.00
Headrick	Emergency	1	$77,000.00	$138,600.00
	REAP	2	$236,220.00	$425,196.00
Hobart PWA	Emergency	2	$30,327.00	$54,588.00
	CWSRF	2	$1,231,000.00	$369,300.00
	FA Loan	1	$1,070,000.00	$321,000.00
Hollister	Emergency	2	$112,469.00	$202,444.00
Indiahoma PWA	Emergency	2	$48,000.00	$86,400.00
	REAP	3	$227,248.00	$409,046.00
Kiowa Co. RWD #1	Emergency	1	$100,000.00	$180,000.00

Entity	Application Type	Number of Grant/ Loans	Grant/Loan Amount	Savings
Lawton WA	CWSRF	9	$53,267,589.00	$15,980,277.00
	DWSRF	3	$50,708,600.00	$15,212,580.00
	FA Loan	5	$16,040,000.00	$4,812,000.00
Lone Wolf PWA	FA Loan	1	$200,000.00	$60,000.00
	REAP	3	$225,825.00	$406,485.00
Lugert-Altus Irrigation Dist.	FA Loan	1	$1,400,000.00	$420,000.00
Mangum UA	DWSRF	1	$2,100,000.00	$630,000.00
	Emergency	1	$100,000.00	$180,000.00
Manitou	REAP	2	$144,350.00	$259,830.00
Marlow MA	CWSRF	1	$3,925,000.00	$1,177,500.00
	Emergency	1	$60,000.00	$108,000.00
	FA Loan	1	$2,500,000.00	$7,500,000.00
Martha Utilities Trust	Emergency	1	$25,000.00	$45,000.00
	REAP	1	$109,800.00	$197,640.00
Medicine Park PWA	REAP	3	$297,609.00	$535,696.00
Mountain Park	Emergency	2	$50,000.00	$90,000.00
	REAP	1	$32,800.00	$59,040.00
Mountain View	Emergency	2	$39,767.00	$71,581.00
Olustee PWA	Emergency	1	$41,900.00	$75,420.00
	REAP	2	$175,400.00	$315,720.00
Quartz Mtn. Regional Water	REAP	1	$150,000.00	$270,000.00
Randlett	REAP	1	$150,000.00	$270,000.00
Ringling MA	Emergency	2	$95,000.00	$171,000.00
	FA Loan	1	$420,000.00	$126,000.00
	REAP	1	$79,000.00	$142,200.00
Roosevelt	REAP	2	$134,850.00	$242,730.00
Ryan Utilities Authority	REAP	1	$149,000.00	$268,200.00
Snyder PWA	Emergency	1	$25,075.00	$45,135.00
Stephens Co. RWD #4	Emergency	1	$45,400.00	$81,720.00
	REAP	1	$79,999.00	$143,998.00
Stephens Co. RWSG & SWMD #5	Emergency	2	$175,000.00	$315,000.00
	FA Loan	1	$430,000.00	$129,000.00
Sterling PWA	FA Loan	1	$115,000.00	$34,500.00
Temple	REAP	2	$140,138.00	$252,248.00
Terral PWA	Emergency	2	$160,000.00	$288,000.00
	REAP	2	$177,930.00	$320,275.00
Tillman Co. RWD #1	Emergency	2	$192,100.00	$345,780.00
	REAP	2	$240,648.00	$433,166.00
Tipton PWA	Emergency	1	$240,648.00	$81,000.00
	REAP	3	$237,967.00	$428,341.00
Walters PWA	Emergency	1	$37,143.00	$66,858.00
	FA Loan	1	$1,200,000.00	$360,000.00
Waurika PWA	Emergency	1	$50,000.00	$90,000.00
	FA Loan	1	$1,700,000.00	$510,000.00
Willow	REAP	1	$85,000.00	$153,000.00
TOTAL		154	$262,415,311.00	$107,162,255.00

Oklahoma American Recovery and Reinvestment Act (ARRA) Water and Wastewater Projects



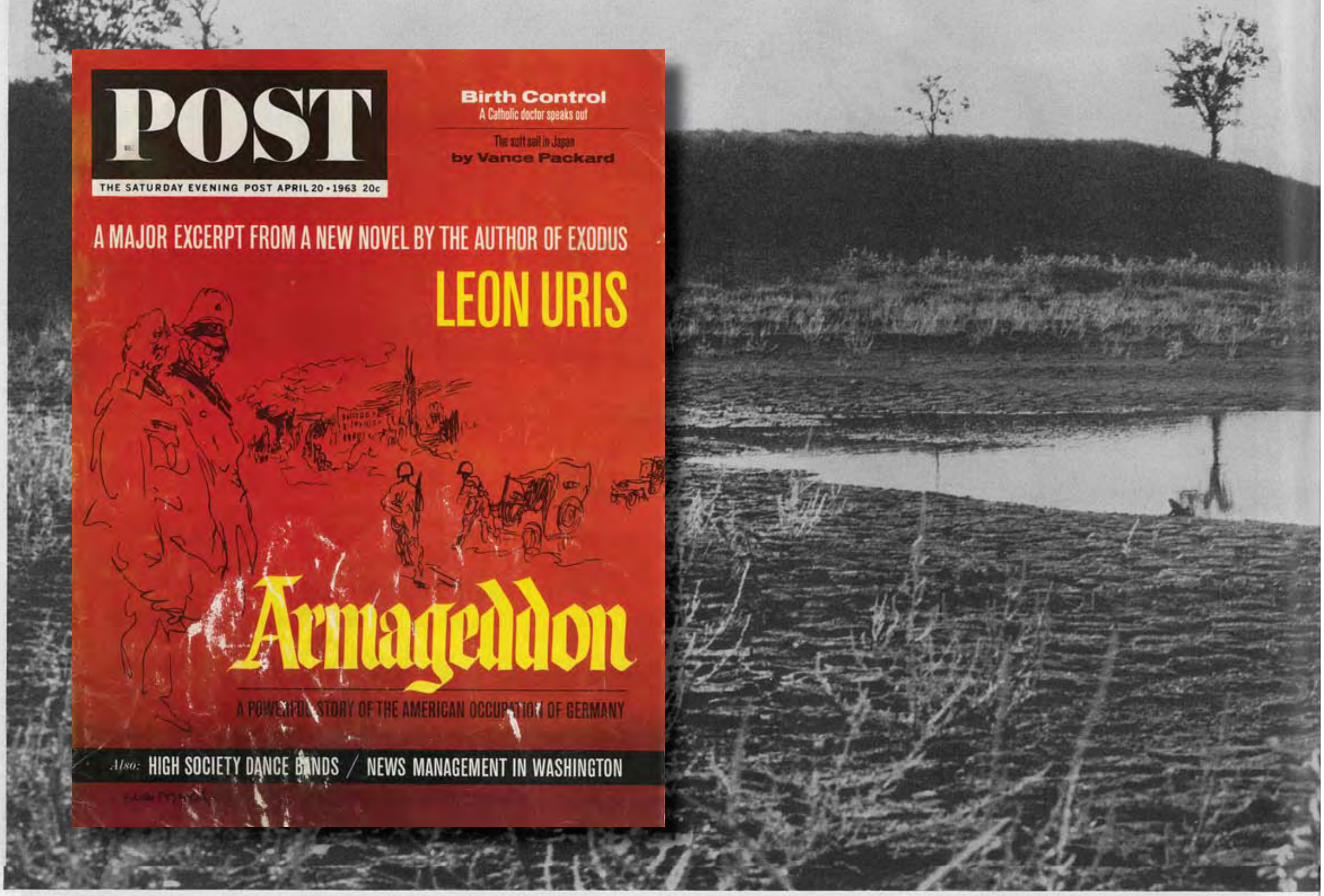
Entity	Approved	Project Type	ARRA Funds	Loan Funds	Total Funds	ARRA Savings	Loan Savings	Total Savings
Pawnee Public Works Authority	Apr-09	Wastewater	$255,000	$1,020,000	$1,275,000	$430,950	$306,000	$736,950
Harrah Public Works Authority	Apr-09	Wastewater	$386,000	$1,544,000	$1,930,000	$652,340	$463,200	$1,115,540
Mustang Improvement Authority	Apr-09	Wastewater	$1,318,000	$5,272,000	$6,590,000	$2,227,420	$1,581,600	$3,809,020
Tulsa Metropolitan Utility Authority	Apr-09	Wastewater	$1,675,000	$6,700,000	$8,375,000	$2,830,750	$2,010,000	$4,840,750
Moore Public Works Authority	Apr-09	Wastewater	$2,000,000	$30,000,000	$32,000,000	$3,380,000	$9,000,000	$12,380,000
Adair Municipal Authority	May-09	Wastewater	$280,000	$1,120,000	$1,400,000	$473,200	$336,000	$809,200
Perkins Public Works Authority	May-09	Wastewater	$1,445,000	$5,780,000	$7,225,000	$2,442,050	$1,734,000	$4,176,050
Norman Utilities Authority	Jun-09	Wastewater	$1,528,000	$6,112,000	$7,640,000	$2,582,320	$1,833,600	$4,415,920
Bryan County Rural Water, Sewer and Solid Waste Management District #2	Jul-09	Drinking Water	$108,411.60	$273,588.40	$382,000	$221,810.13	$82,076.52	$303,886.65
Collinsville Municipal Authority	Jul-09	Wastewater	$136,608	$546,432	$683,040	$230,867.52	$163,929.60	$394,797.12
Ponca City Utility Authority	Jul-09	Wastewater	$178,000	$712,000	$890,000	$300,820	$213,600	$514,420
Grove Municipal Services Authority	Jul-09	Wastewater	$380,000	$1,520,000	$1,900,000	$642,200	$456,000	$1,098,200
McCurtain County Rural Water District #8	Jul-09	Drinking Water	$1,997,500.76	$5,040,909.24	$7,038,410	$4,086,886.55	$1,512,272.77	$5,599,159.32
Bartlesville Municipal Authority	Jul-09	Drinking Water	$2,000,000	$7,820,000	$9,820,000	$4,092,000	$2,346,000	$6,438,000
Oklahoma City Water Utilities Trust	Jul-09	Wastewater	$2,000,000	$8,000,000	$10,000,000	$3,380,000	$2,400,000	$5,780,000
Norman Utilities Authority	Jul-09	Drinking Water	$2,000,000	$12,000,000	$14,000,000	$4,092,000	$3,600,000	$7,692,000
Washington County Rural Water District #3	Jul-09	Drinking Water	$2,000,000	$15,394,645	$17,394,645	$4,092,000	$4,618,393.50	$8,710,393.50
Logan County Rural Water District #2	Aug-09	Drinking Water	$269,610	$680,390	$950,000	$551,622.06	$204,117	$755,739.06
Healdton Municipal Authority	Aug-09	Drinking Water	$305,085	$769,915	$1,075,000	$624,203.91	$230,974.50	$855,178.41
Del City Municipal Services Authority	Aug-09	Wastewater	$238,000	$952,000	$1,190,000	$486,948	$285,600	$772,548
Wagoner Public Works Authority	Aug-09	Drinking Water	$340,560	$859,440	$1,200,000	$696,785.76	$257,832	$954,617.76
Muskogee Municipal Authority	Aug-09	Wastewater	$287,000	$1,148,000	$1,435,000	$485,030	$344,400	$829,430
Stillwater Utilities Authority	Aug-09	Wastewater	$513,000	$2,052,000	$2,565,000	$866,970	$615,600	$1,482,570
Stillwater Utilities Authority	Aug-09	Drinking Water	$2,000,000	$9,645,000	$11,645,000	$4,092,000	$2,893,500	$6,985,500
Piedmont Municipal Authority	Aug-09	Wastewater	$531,000	$2,124,000	$2,655,000	$897,390	$637,200	$1,534,590
Sand Springs Municipal Authority	Aug-09	Drinking Water	$1,986,600	$5,013,400	$7,000,000	$4,064,583.60	$1,504,020	$5,568,603.60
Enid Municipal Authority	Aug-09	Drinking Water	$2,000,000	$6,345,000	$8,345,000	$4,092,000	$1,903,500	$5,995,500
Henryetta Municipal Authority	Aug-09	Drinking Water	$2,000,000	$7,500,000	$9,500,000	$4,092,000	$2,250,000	$6,342,000
Oklahoma City Water Utilities Trust	Aug-09	Drinking Water	$2,000,000	$8,000,000	$10,000,000	$4,092,000	$2,400,000	$6,492,000
Owasso Public Works Authority	Aug-09	Wastewater	$2,000,000	$10,880,000	$12,880,000	$3,380,000	$3,264,000	$6,644,000
Duncan Public Utilities Authority	Aug-09	Drinking Water	$2,000,000	$11,355,000	$13,355,000	$4,092,000	$3,406,500	$7,498,500
Duncan Public Utilities Authority	Sep-09	Wastewater	$74,000	$296,000	$370,000	$125,060	$88,800	$213,860
Sperry Utility Services Authority	Sep-09	Wastewater	$78,000	$312,000	$390,000	$131,820	$93,600	$225,420
Rogers County Rural Water District #7	Sep-09	Wastewater	$151,800	$607,200	$759,000	$256,542	$182,160	$438,702
Lawton Water Authority	Sep-09	Drinking Water	$1,762,398	$4,447,602	$6,210,000	$3,605,866.31	$1,334,280.60	$4,940,146.91
Lawton Water Authority	Sep-09	Wastewater	$2,000,000	$10,270,000	$12,270,000	$3,380,000	$3,081,000	$6,461,000
Mayes County Rural Water District #3	Sep-09	Drinking Water	$276,988.80	$699,011.20	$976,000	$566,719.08	$209,703.36	$776,422.44
Grand Lake Public Works Authority	Sep-09	Wastewater	$198,500	$794,000	$992,500	$335,465	$238,200	$573,665
Ardmore Public Works Authority	Sep-09	Wastewater	$218,000	$872,000	$1,090,000	$368,420	$261,600	$630,020
Guymon Utilities Authority	Sep-09	Drinking Water	$543,477	$1,371,523	$1,915,000	$1,111,953.94	$411,456.90	$1,523,410.84
Newcastle Public Works Authority	Sep-09	Drinking Water	$699,063.82	$1,764,163.18	$2,463,227	$1,430,284.58	$529,248.95	$1,959,533.53
Bixby Public Works Authority	Sep-09	Drinking Water	$871,266	$2,198,734	$3,070,000	$1,782,610.24	$659,620.20	$2,442,230.44
Ponca City Utility Authority	Sep-09	Drinking Water	$952,149	$2,402,851	$3,355,000	$1,948,096.85	$720,855.30	$2,668,952.15
Tulsa Metropolitan Utility Authority	Sep-09	Drinking Water	$1,892,946	$4,777,054	$6,670,000	$3,872,967.52	$1,433,116.20	$5,306,083.72
Elk City Public Works Authority	Sep-09	Drinking Water	$2,000,000	$7,375,000	$9,375,000	$4,092,000	$2,212,500	$6,304,500
Poteau Valley Improvement Authority	Sep-09	Wastewater	$582,995	$582,995	$582,995	$985,261.55	$174,898.50	$1,160,160.05
Central Oklahoma Master Conservancy District	Sep-09	Wastewater	$692,773	$692,773	$692,773	$1,170,786.37	$207,831.90	$1,378,618.27
Oklahoma Conservation Commission	Sep-09	Wastewater	$2,000,000	$2,000,000	$2,000,000	$3,380,000	$600,000	$3,980,000
Total			$51,152,731.98	$217,642,626.02	$265,519,590	$97,215,000.98	$65,292,787.81	$162,507,788.78

The American Recovery and Reinvestment Act, signed into law by President Obama on February 17th, 2009, includes $62 million for “shovel ready” water and wastewater infrastructure projects in Oklahoma.

Specifically, the stimulus package appropriates more than $31 million each for Oklahoma’s Clean Water and Drinking Water State Revolving Fund loan programs (administered by the OWRB and ODEQ).

To date, the OWRB has approved 48 water and wastewater projects–all at least partially funded through ARRA funds–totaling more than $265 million.

WHAT HAPPENS WHEN A CITY'S



The people of Duncan, Oklahoma, found out a few years ago when a succession of droughts threatened the health—and the future—of the city. Ironically Duncan, a city plagued with water shortages, is located in a county which has suffered through 70 floods in just 20 years. Today—with abundant water assured—Duncan is one of the fastest growing communities in the Southwest.

Back in the long, hot summer of 1955, Lake Duncan, the city's chief reservoir, became little more than a mud flat. At one point reserves were down to a day and half's supply. The city's largest employers were notified that if the drought continued, water supplies would have to be cut.

To civic leaders like Lawrence L. Humphreys, banker and part-time rancher, the drought was bitter irony. Every spring Wildhorse Creek surged beyond its banks, ripping through the countryside near Duncan. It destroyed roads and bridges, covered rich bottomland with tons of silt and sand. Over the years it wiped out millions of dollars of oilfield equipment.

"YOU CAN'T FIGHT THE WILDHORSE ALONE"

"I found out a long time ago that you can't fight the Wildhorse alone," remembers Mr. Humphreys. "Everything I ever tried was ruined by flood." The droughts of the fifties convinced him that the people of Duncan and the farmers of Stephens County had to act—and act together.

The Stephens County Soil Conservation District—under the leadership of businessman Nolen J. Fuqua—had been working on a flood prevention plan to protect oilfields and ranches. With Humphreys and Fuqua leading the way, the plan was expanded to protect the entire 400,000-acre Wildhorse Watershed *and* to provide water storage for Duncan.

A BIG CHALLENGE FOR DUNCAN VOTERS

The cost of the plan for Duncan—including land cost, dam construction, building a new water plant and mains—totaled $2,500,000. It was the biggest bond issue ever submitted to Duncan voters. An intensive person-to-person campaign was organized to alert every citizen to the critical nature of the problem.

Results were dramatic: 13 to 1 in favor of the plan.

With abundant water assured, Duncan's industries began investing heavily in plant expansion. Refineries have spent more than $2,500,000 in the past few years for added capacity. Duncan's No. 1 employer, a world-wide oilfield service company, recently announced a $6,500,000 local expansion program.

Last year Duncan's cash registers rang up $42,000,000 in retail sales—7th highest among Oklahoma's cities, despite the fact that Duncan is only 16th in population. City property values are up. So are payrolls, bank deposits and personal savings. New home construction is at a high level—including some de luxe suburban developments which would have been labeled "too risky" a few years ago.

Flood protection, irrigation and sound soil conservation practices have increased the area's agricultural income by an estimated $1,000,000 annually. Crops are growing on more than 10,000 acres of previously willow-infested flood plain.

RESERVOIR BECOMES A MUD FLAT?

THE CRUCIAL TEST

Last spring 17 inches of rain poured down on the Wildhorse Watershed in just 10 days. Once this rush of water—half of the area's total annual rainfall—would have caused severe flood damage. But Wildhorse Creek never rose above its banks in the protected area. If these 22 dams had been built years ago, 45 minor floods would have been eliminated and 18 of the watershed's 25 major floods would have been minor ones.

Demonstrating their approval of the program—the first cooperative project between the Soil Conservation Service and a municipality—Duncan voters approved a second similar project. This will provide Duncan with a water supply large enough for a city of 40,000, twice the current population.

IS YOUR CITY PLAGUED WITH WATER PROBLEMS?

By 1980, we will need, as a nation, over twice as much water as we are using today. The water problem is one that must be attacked and solved community by community. The people of Duncan found out that individual citizens *can* do something to solve local water problems. But it takes energetic, civic-minded people like L. L. Humphreys and Nolen Fuqua.

Are you concerned enough to be the first voice for action in *your* city?

For information on our nationwide water problem, send for the booklet, "WATER CRISIS, U. S. A." Write Dept. P, Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

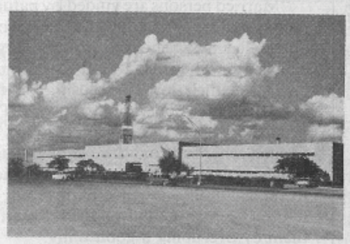
CATERPILLAR

REG. U. S. PAT. OFF.

MACHINES THAT BUILD FOR A GROWING AMERICA

In the big 1950 flood, damage to oilfields and ranches in Stephens County alone exceeded the total cost of all of the new protection structures. Area flooded by the rampaging Wildhorse: 55,000 acres.

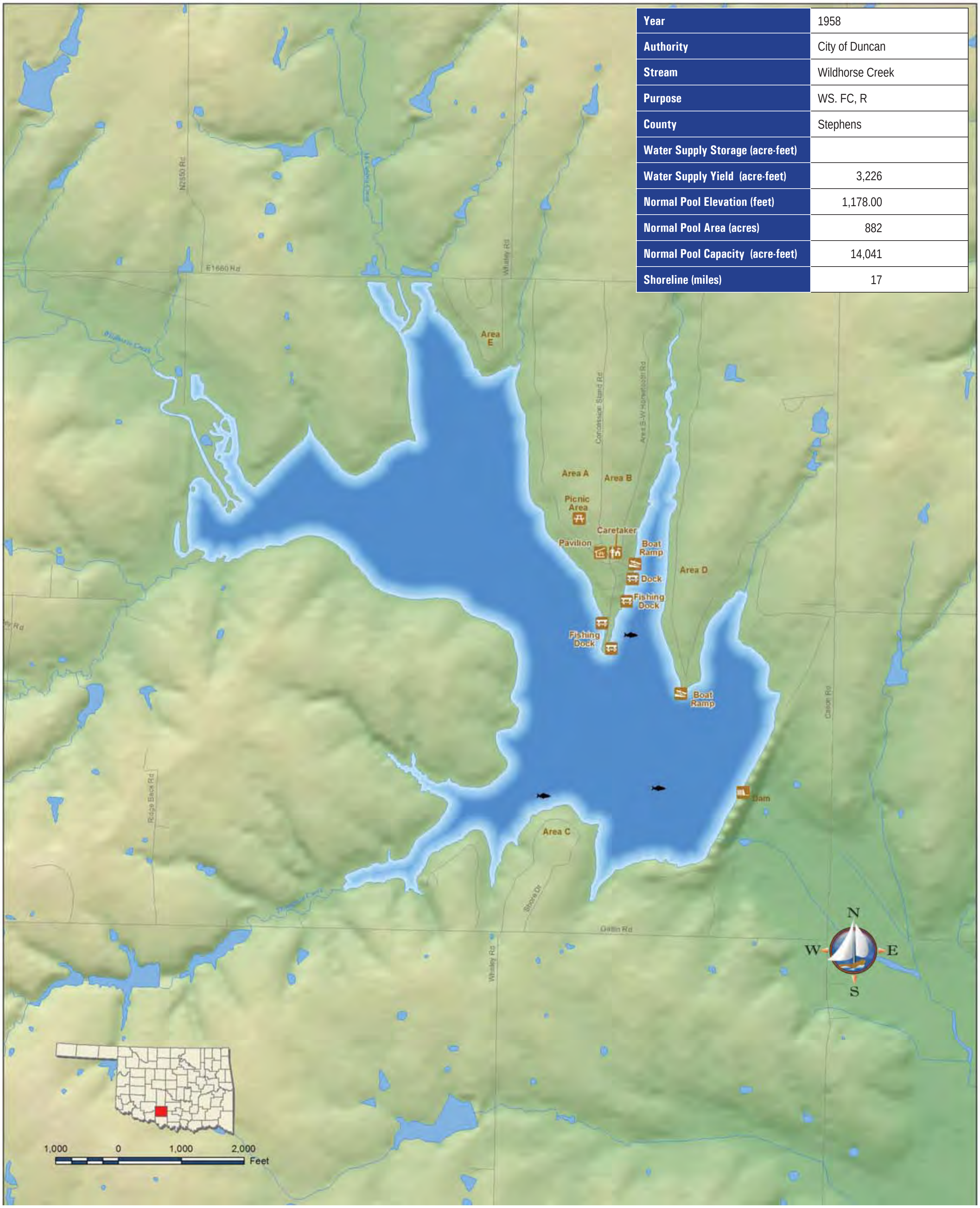
Nolen Fuqua and his "partner" in the Duncan-Wildhorse project, L. L. Humphreys, inspect progress on the second phase of Wildhorse construction. The dams have a benefit-to-cost ratio of 4 to 1.



Duncan's No. 1 employer, an oilfield service firm, recently announced a $6,500,000 expansion program. The city's refineries have already spent $2,500,000 for expanding and modernizing their facilities.

Last year cash registers in busy Duncan rang up $42,000,000 in retail sales—7th highest among Oklahoma cities, despite the fact that Duncan is only 16th in population. Future outlook? Even better.

Lake Humphreys

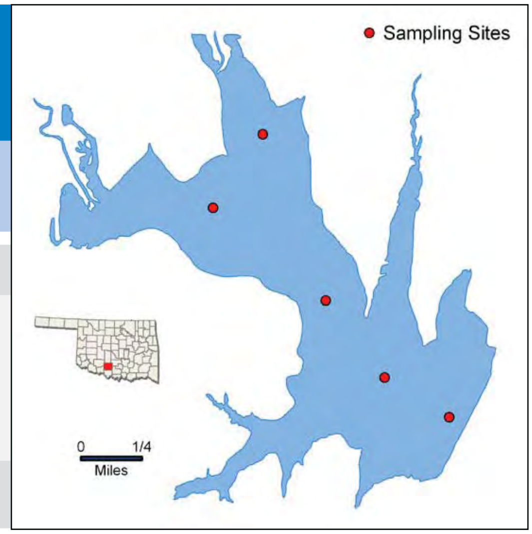


Year	1958
Authority	City of Duncan
Stream	Wildhorse Creek
Purpose	WS. FC, R
County	Stephens
Water Supply Storage (acre-feet)	
Water Supply Yield (acre-feet)	3,226
Normal Pool Elevation (feet)	1,178.00
Normal Pool Area (acres)	882
Normal Pool Capacity (acre-feet)	14,041
Shoreline (miles)	17

Beneficial Use Monitoring Program

Humphreys

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



Lake Data

Location	Stephens County
Impoundment	1958
Area	10,900 acres
Capacity	200,300 acre-feet
Purposes	Water Supply, Flood Control, Recreation

Parameters

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

Beneficial Uses

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

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

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

NTU = nephelometric turbidity units
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

The Watershed Program:

Flood Control and Much More

The watershed program helps communities and rural areas reduce flooding and collect sediment in 47 states. Since 1948 over 11,000 flood control dams have been built in over 2,000 watersheds covering 160 million acres nationwide. In Oklahoma 2,105 dams have been built in 121 watersheds.

In addition to flood control, the lakes formed by the dams provide millions of dollars in benefits each year for recreation, municipal water supplies, irrigation and fish and wildlife habitat.

Watershed lakes average from 5 to 25 acres in surface area. A few are larger, and some are designed as dry "lakes" with no permanent water retained.

How Watershed Projects Reduce Flooding

The concept of watershed projects is simple. upstream flood control dams are built across small tributaries to larger streams. The dams temporarily store water runoff after heavy rainstorms and slowly release it over several days through a pipe in the dam. This reduces the amount of water that reaches the main water course immediately after a rain, reducing flooding downstream.

Watershed projects consist of earthen dams constructed on tributaries to a river. The number of dams built in a watershed varies depending on the size of the watershed.

Permanent Pool and Flood Pool

During most periods of the year the dams maintain a water level known as the permanent pool. The level of water is controlled by the elevation of the principal spillway in front of the dam. During heavy rainfall events water will back up, covering a larger area of land known as the flood pool. This water will recede after a few days as water is released through the pipe.

The red line on the photo below indicates the extent that water can back up in the flood pool upstream.

When there is more water than the lake can store and the inlet can release, water will flow through the auxiliary spillway.

Project sponsors obtain easements from landowners to allow construction of the dams, storage of water in the permanent pool, and temporary storage of the water in the area that will be inundated during heavy rainfall events. Maps of the areas that will be temporarily flooded are available from the local office of the USDA Natural Resources Conservation Service.

A concrete tower connected to a pipe extending through the dam serves as a principal spillway for most dams, controlling the water level. A slide gate at the bottom can be opened to lower the water level even more to allow maintenence or repair.

Water is released through a pipe in the dam for several days after a heavy rainstorm.

Watershed Projects...

Helping Oklahoma Communities Solve Natural Resource Issues

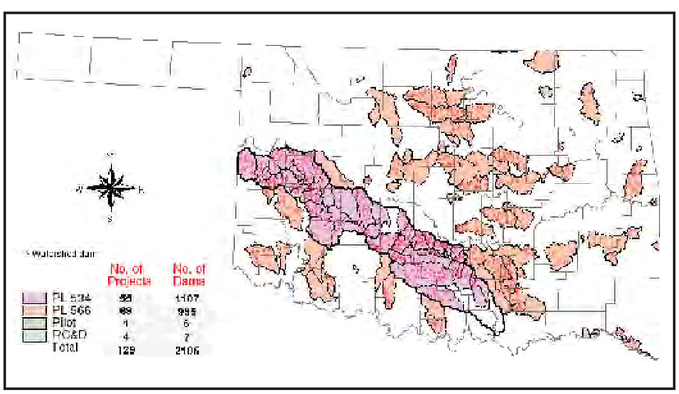
Sixty-four Oklahoma Counties Have Watershed Projects

Oklahoma has 129 Natural Resources Conservation Service assisted watershed projects in 64 counties.The projects provide flood control and include conservation practices that address a myriad of natural resource issues such as water quality, soil erosion, animal waste management, irrigation, water management, water supplies, and recreation.

The watershed projects have multiple community benefits. Many projects have been providing benefits for decades, but people are unaware that the projects even exist.

Watershed projects are planned and implemented by local people who serve as project sponsors, with assistance from the USDA Natural Resources Conservation Service.

The projects are authorized and funded through the Watershed Protection and Flood Prevention Act (Public Law 83-566) and the Flood Control Act of 1944 (Public Law 78-534). The program has been amended several times to address a broad range of natural resource and environmental issues.



Oklahoma has 129 watershed projects in 64 counties and 2,105 dams have been built in 121 of these watersheds.

This Sergeant Major Creek Watershed dam in Roger Mills County is one of 2,105 watershed dams built in Oklahoma by local project sponsors with assistance from NRCS.

Projects Provide Multiple Benefits

The 129 watershed projects' 2,105 floodwater retarding dams have established a $2 billion infrastructure in the state that is providing over $75 million in average annual benefits to Oklahomans.

Oklahoma's Watershed Program Annual Benefits

Agricultural flood damage reduction	$19,302,042
Agricultural non-flood benefits	$5,046,131
Non-Ag. flood damage reduction	$22,362,552
Non-Ag. non-flood benefits*	$29,073,917
*** Total Monetary Benefits**	**$75,784,861**

Number of bridges benefited	1,532
Number of farms/ranches benefited	20,541
Reduced sedimentation (tons/ac/yr)	9,152,225
Wetlands created or enhanced (acres)	44,399
Multipurpose lakes	42

*Estimated average annual benefits include reduced flood damages, sediment reduction, soil erosion control, irrigation, recreation, and municipal water supplies.

Watershed Projects Provide a Variety of Benefits

Municipal Water Supplies

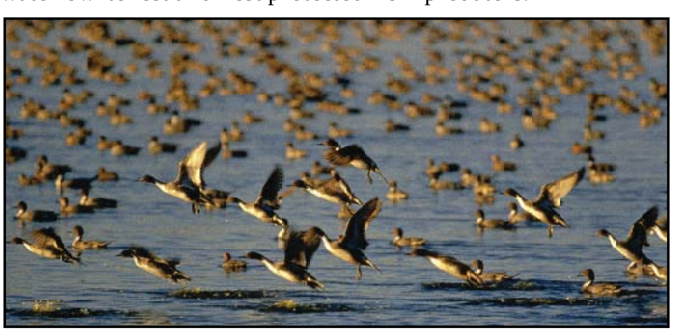
Forty-two Oklahoma communities are using watershed projects to provide municipal and industrial water supplies, or recreational areas. This Deer Creek Watershed Dam No. 1M in Pottawatomie County (known as Wes Watkins Lake) was built as a multipurpose structure to provide municipal water and a recreational area in addition to providing flood control.

Another example of multipurpose dams is Lake Humphreys near Duncan (Wildhorse Creek Watershed No. 22) which was the nation's first multipurpose dam built under the USDA Watershed Program.

The dam was constructed in 1957 at a cost of $743,058. The City of Duncan provided $505,244 of the cost to add an additional 10,681 acre feet of water storage for municipal water supply. The Stephens County Conservation District and the City of Duncan are local sponsors for the project and the Natural Resources Conservation Service provided financial and technical assistance in planning, design and construction of the dam.

Recreational and Fishing Areas

This Stillwater Creek Watershed dam in Payne County is providing recreational areas and fishing opportunities for thousands of people in Stillwater and adjoining communities. Project sponsors enhanced the fish habitat during construction by placing underwater structures in the lake for fish shelters. Several small peninsulas and fishing docks were constructed to make it more assessable for fishing and a small island was constructed in the middle of the lake for waterfowl to rest and nest protected from predators.



The 2,105 watershed dams in the state have created an estimated 50,000 acres of water that provide some of the best fish and wildlife habitat in the state. The conservation practices and proper land management in the watershed also provide great upland wildlife habitat.

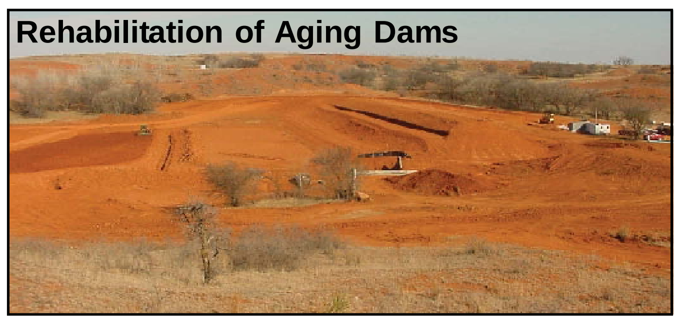
Conservation Practices

Most watershed projects in the state include dams built to control flooding. Conservation practices in the watershed are a required component of the projects. Thousands of practices such as grassed waterways, terraces, grass plantings, and ponds have been built in the 129 watershed projects in the state. These practices help control soil erosion which helps improve water quality and reduces the amount of sediment that flows into the watershed lakes.

Flood Control

Watershed dams reduce flood damages to both agricultural land and urban areas and they protect thousands of roads and bridges downstream. Protection of the downstream areas has allowed for the installation of smaller bridges and culverts and has meant less repair work on roads saving taxpayers millions of dollars.

Rehabilitation of Aging Dams



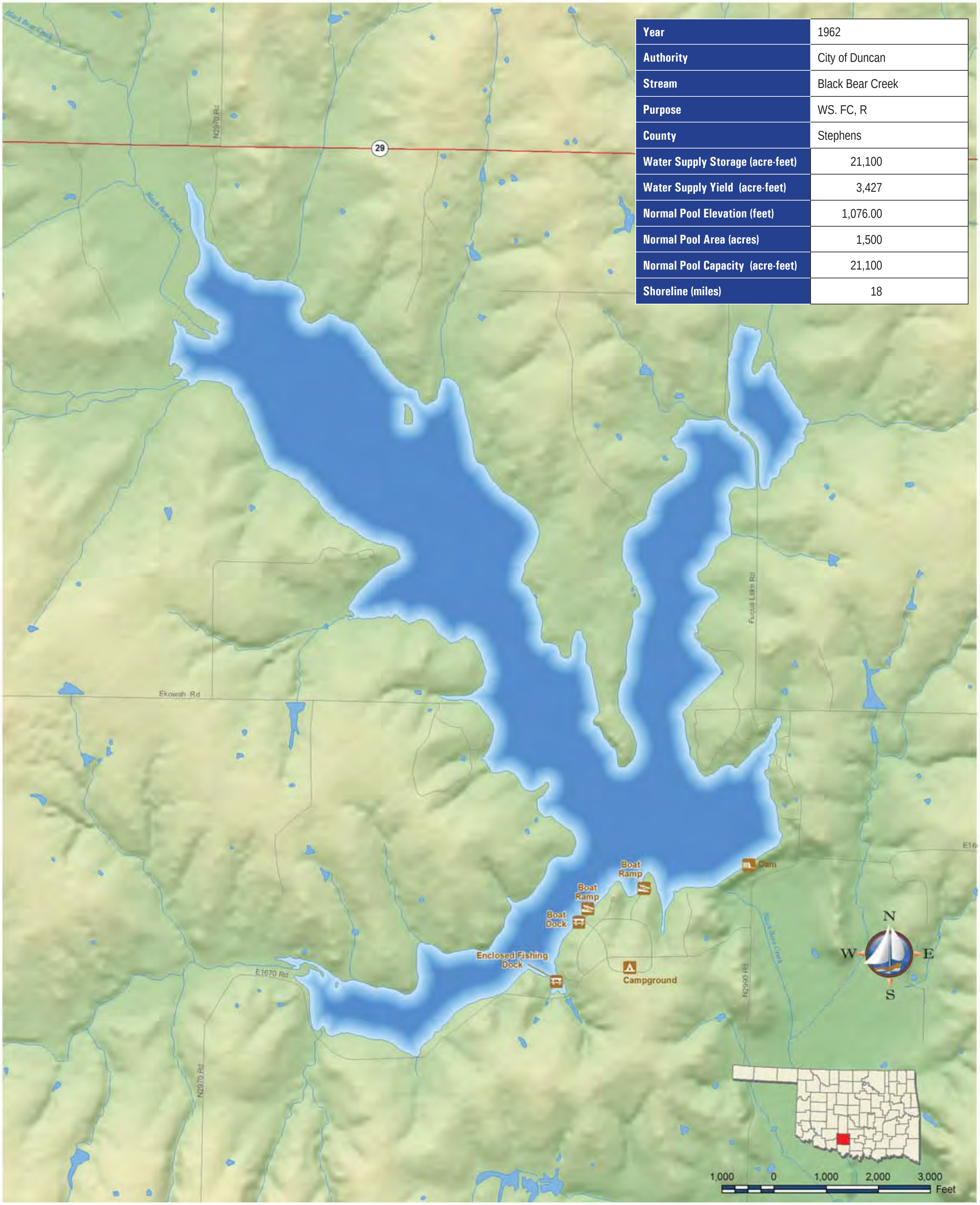
Some Oklahoma dams have reached the end of their planned designed life of 50 years and are being rehabilitated to extend the life of the dam for another 100 years. This Sandstone Creek dam in Roger Mills County was the first dam rehabilitated under the Small Watershed Amendments of 2000. This Act authorized funding and technical assistance from the Natural Resources Conservation Service to assist watershed project sponsors in rehabilitating aging dams. Several dams have been rehabilitated and several more in various stages of planning, design and construction.

For additional information about watershed projects and their benefits, visit the Oklahoma USDA Natural Resources Conservation Service website at: www.ok.nrcs.usda.gov and select "Programs" and then "Watershed Protection and Flood Prevention" or go to the Oklahoma Conservation Commission website at www.conservation.ok.gov and click on Flood Control, or visit a local NRCS or conservation district office.

Lake Fuqua

Oklahoma Comprehensive Water Plan OCWP

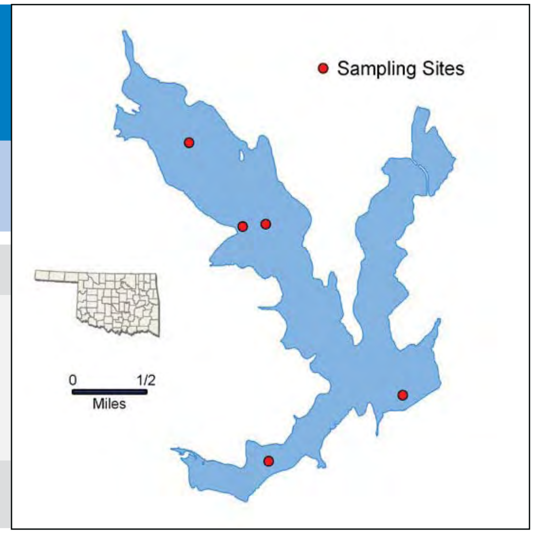
Year	1962
Authority	City of Duncan
Stream	Black Bear Creek
Purpose	WS. FC, R
County	Stephens
Water Supply Storage (acre-feet)	21,100
Water Supply Yield (acre-feet)	3,427
Normal Pool Elevation (feet)	1,076.00
Normal Pool Area (acres)	1,500
Normal Pool Capacity (acre-feet)	21,100
Shoreline (miles)	18



Beneficial Use Monitoring Program

Fuqua

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



Lake Data

Location	Stephens County
Impoundment	1953
Area	1,500 acres
Capacity	21,100 acre-feet
Purposes	Water Supply, Recreation and Flood Control

Parameters

	Parameter	Result	Notes/Comments
	Average Turbidity	25 NTU	45% of values > OWQS of 25 NTU
	Average True Color	51 units	25% of values >OWQS of 70
	Average Secchi Disk Depth	57 cm	
	Water Clarity Rating	average	
	Trophic State Index	52	
	Trophic Class	eutrophic	
Profile	Salinity	0.13– 0.32 ppt	
Profile	Specific Conductivity	272.6 – 616.3 µS/cm	
Profile	pH	7.29 – 8.44 pH units	Neutral to slightly alkaline
Profile	Oxidation-Reduction Potential	43-472 mV	
Profile	Dissolved Oxygen	Up to 40% of water column < 2 mg/L in August	
Nutrients	Surface Total Nitrogen	0.44 mg/L to 0.73 mg/L	
Nutrients	Surface Total Phosphorus	0.015 mg/L to 0.050 mg/L	
Nutrients	Nitrogen to Phosphorus Ratio	19:1	Phosphorus limited

Beneficial Uses

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

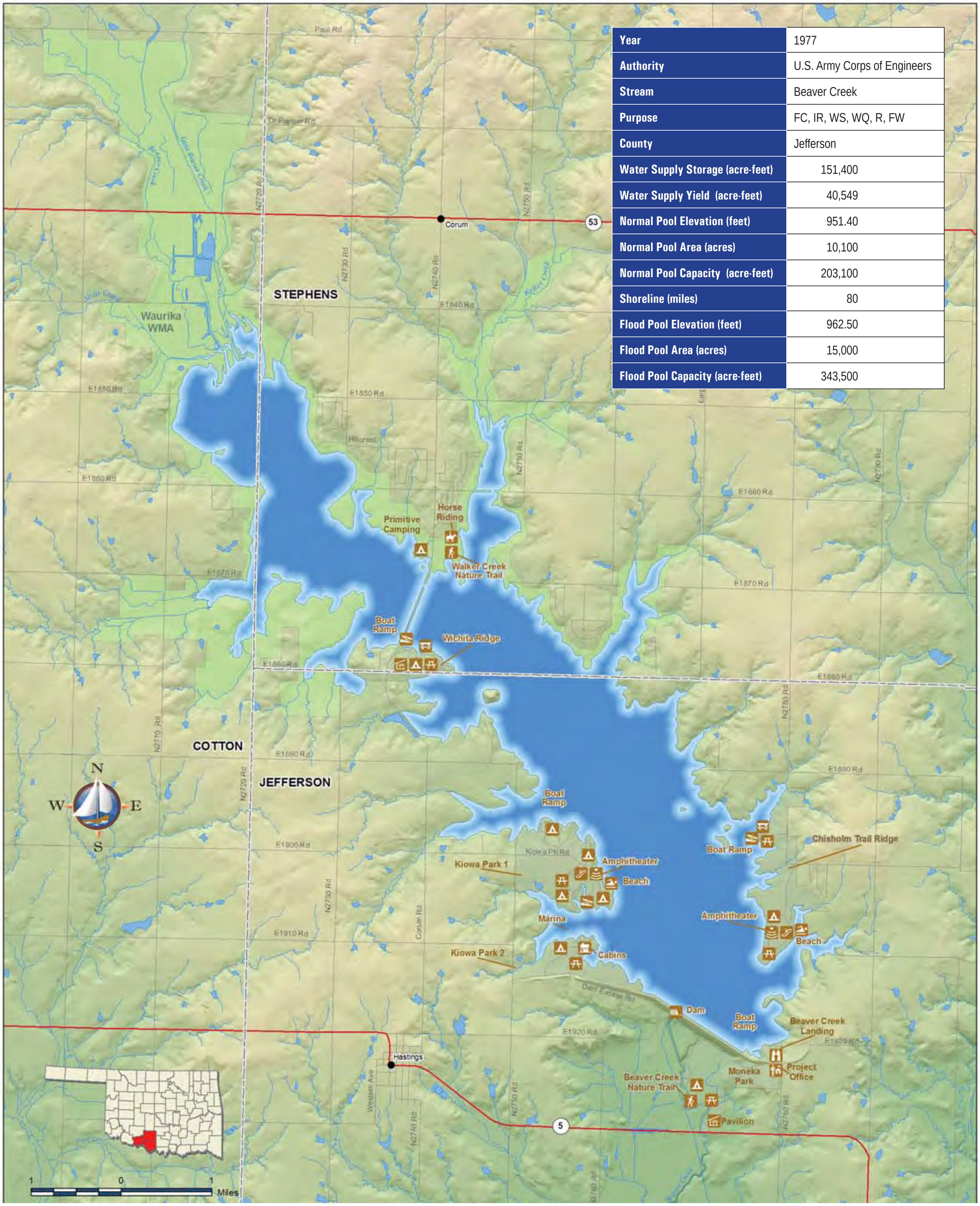
S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

Notes: Available flow and rainfall data suggest that the peak in turbidity and true color, which occurred in May and August is likely due to seasonal storm events, therefore Fuqua Lake will be listed as supporting its Fish & Wildlife Propagation (FWP) and Aesthetics beneficial use for these parameters.

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

Waurika Lake

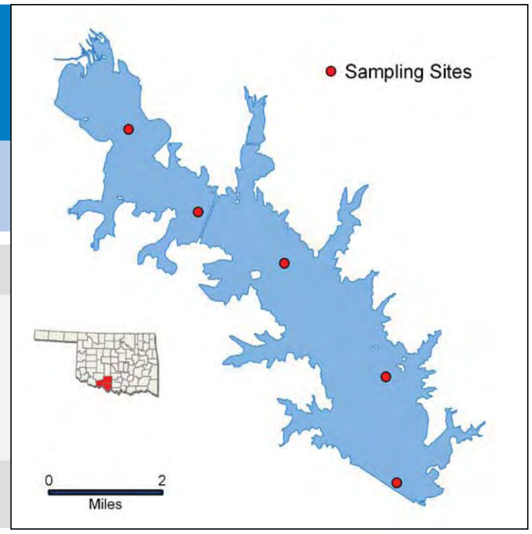
Year	1977
Authority	U.S. Army Corps of Engineers
Stream	Beaver Creek
Purpose	FC, IR, WS, WQ, R, FW
County	Jefferson
Water Supply Storage (acre-feet)	151,400
Water Supply Yield (acre-feet)	40,549
Normal Pool Elevation (feet)	951.40
Normal Pool Area (acres)	10,100
Normal Pool Capacity (acre-feet)	203,100
Shoreline (miles)	80
Flood Pool Elevation (feet)	962.50
Flood Pool Area (acres)	15,000
Flood Pool Capacity (acre-feet)	343,500



Beneficial Use Monitoring Program

Waurika

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



Lake Data

Location	Jefferson County
Impoundment	1977
Area	10,100 acres
Capacity	203,100 acre feet
Purposes	Flood Control, Irrigation, Water Supply, Water Quality Control, Fish and Wildlife, and Recreation

Parameters

	Parameter	Result	Notes/Comments
	Average Turbidity	34 NTU	45% of values > 25 NTU
	Average True Color	63 units	10% of values > OWQS of 70
	Average Secchi Disk Depth	51 cm	
	Water Clarity Rating	average	
	Trophic State Index	54	Previous value = 60
	Trophic Class	eutrophic	
Profile	Salinity	0.19 – 0.35 ppt	
Profile	Specific Conductivity	389.3 – 353 µS/cm	
Profile	pH	7.57 – 8.59 pH units	Neutral to slightly alkaline
Profile	Oxidation-Reduction Potential	228 to 507 mV	
Profile	Dissolved Oxygen	Up to 27% of water column , 2 mg/L in July	Occurred at site 1, the dam
Nutrients	Surface Total Nitrogen	0.53 mg/L to 1.09 mg/L	
Nutrients	Surface Total Phosphorus	0.063 mg/L to 0.154 mg/L	
Nutrients	Nitrogen to Phosphorus Ratio	8:1	Phosphorus limited

Beneficial Uses

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

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

Notes

NTU = nephelometric turbidity units
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mg/L = milligrams per liter
µS/cm = microsiemens/cm
ppt = parts per thousand
En = Enterococci

Waurika Lake Master Conservancy District

Purpose:
Water supply, Recreation, Flood Control and Irrigation

How was it built?

Through vision and perseverance. Don Morrision, Fred Funk, Dave and Fred Richardson shared a vision of flood control, water supply and delivery, and recreational use. They led the effort and engaged six cities to join. Waurika Lake was originally a Bureau of Reclamation project, and was handed to The Corps of Engineers in 1968.

The effort started in the early 1950s and the lake was in-service in 1977. The pumping facilities were all on line by 1981.

Who pays for it?

Total final costs were about $80 Million

Scope:
Cities of Comanche, Duncan, Lawton, Temple, Walters and Waurika.

Counties:
Comanche, Cotton, Jefferson and Stephens

Finished water from cites is piped into Carter, Love, Grady

Service	**Percentage**
Flood	14.16
Water supply, irrigation and conveyance	56.80
Recreation	28.43
Fish and Wildlife	0.61

Population:
Approximately 200,000

Replacement cost:
Approximately $300 Million in 2009 dollars.

Issues:
- Reinvestment for depreciation
- Water Rights
- Tarrant County
- Finalize Storage Purchase
- Vision for next large storage increase to serve population

Lake Specifics:
- Total Storage approaches 300,000 acre feet
- Conservation storage is 170,000 acre feet
- Water rights is 46,000 acre feet
- The dam is operated by the US Army Corps of Engineers
- Watershed about 900 sq miles
- Accountability for Beaver Creek to the Red River

Distribution and Conveyance specifics:
- Three large pumphouses
- Peak capacity is 47,000,000 gallons per day
- 100 Miles of pipe, up to 42 inch diameter
- Three electrical substations and several miles of power poles
- Controlled by radio and internet signal transmission

Organization:
- Pumping
- Pipeline
- Telecommunications and control

Contact:
David Taylor, District Manager
Rt. 1 Box 58A
Waurika, OK 73573
(580) 439-8838 Ext. 22

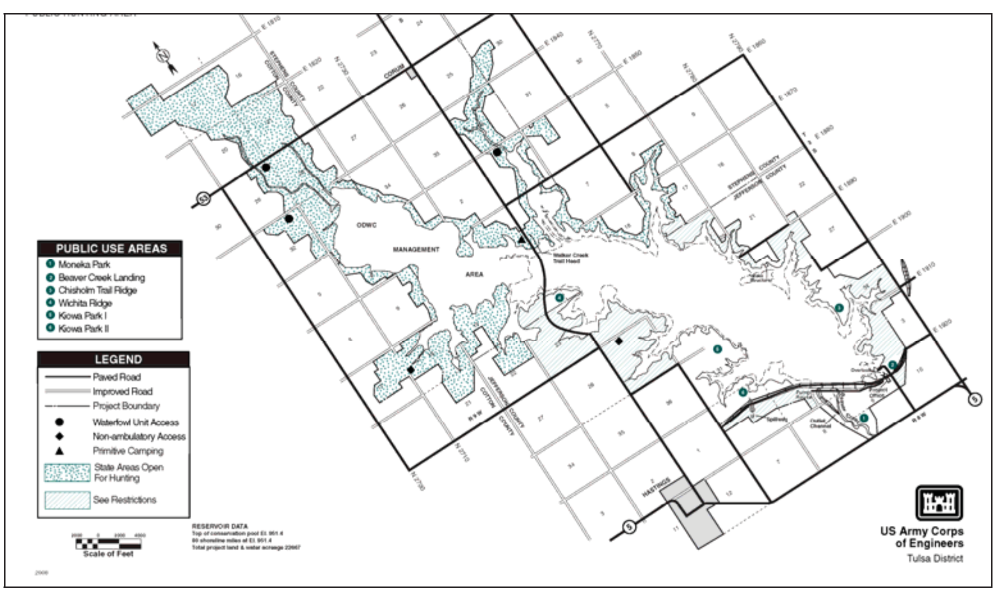
WAURIKA LAKE, OKLAHOMA
OPERATIONS & MAINTENANCE

Waurika Lake is located at river mile 27.9 on Beaver Creek, a tributary of the Red River, about 6 miles northwest of Waurika in Jefferson County, Oklahoma. The project was authorized for construction in P.L. 88-253. Construction of the dam and reservoir began in July 1971 and impoundment of water began in August 1977. In 1970, the WPMCD signed a water storage contract containing estimated costs to repay water storage investment costs. In June 1986, the water contract was revised to reflect final construction costs. Construction of three separate water supply conveyance facilities began in 1975 to transfer water to different members of the WPMCD. In 1978, the WPMCD signed three water conveyance facility contracts agreeing to repay all construction costs as provided by PL 88-253. A provision in the contracts stated all costs were tentative and based on estimates and the contract would be modified to reflect final costs when they were known. The water conveyance facility contracts could not be finalized until settlement of a construction claim by the Travelers Indemnity Company. The claim was ultimately settle by the Department of Justice in October 1991 for about $2.9M. Final construction costs included an additional $1.2M which was primarily interest during construction since the construction period ran longer than estimated. Construction costs were reviewed at the request of the WPMCD. It was discovered that lands purchased specifically for the water conveyance facilities, in the amount of about $1.14M, had been inadvertently charged to the reservoir and as a result an adjustment of costs was made to the water supply storage (reduced repayment obligation) and the three conveyance facilities (increased repayment obligation).

Public Law 88-253 requires the WPMCD to repay all costs associated with the construction of the water conveyance facilities. Section 375 of WRDA 1999 amended Public Law 88-253 to waive the requirement for the WPMCD to pay for the $2.9M Travelers Indemnity Company claim and $595K which represents one-half of the final construction costs for the water conveyance facilities.

All water supply costs are a non-Federal expense. The WPMC has requested costs associated with water supply that were inadvertently charged to all purposes for the Waurika Reservoir to be waived.

In accordance with Article 6 of the water conveyance contracts, title to these lands, along with the water conveyance facilities, will be transferred to the WPMCD when final payment is made.



Southwest Oklahoma Legislative Tour

Corps of Engineers, Tulsa District

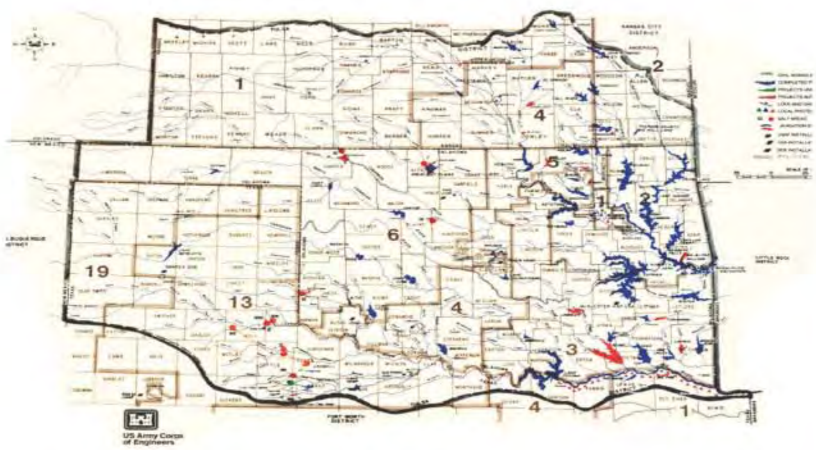
17-18 September 2009

US Army Corps of Engineers
BUILDING STRONG®

Civil Works Mission

The Civil Works programs include water resource development activities including flood control, navigation, recreation, and infrastructure and environmental stewardship. Our mission also includes emergency response.

BUILDING STRONG®



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FY10 Member Adds

INVESTIGATIONS

- Arkansas River Corridor 100 (H)
- Grand (Neosho) River Basin Watershed 162 (S)
- Grand Lake Comprehensive Study 190 (H)
- Oologah Lake Watershed 135 (S)
- SE Oklahoma Water Resource Study 300(H) 255(S)
- Washita River Basin 250(H) 215(S)

BUILDING STRONG®

FY10 Member Adds

Construction

- RRCC Area VI Elm Fork 1800 (H) 1000(S)

Operations and Maintenance

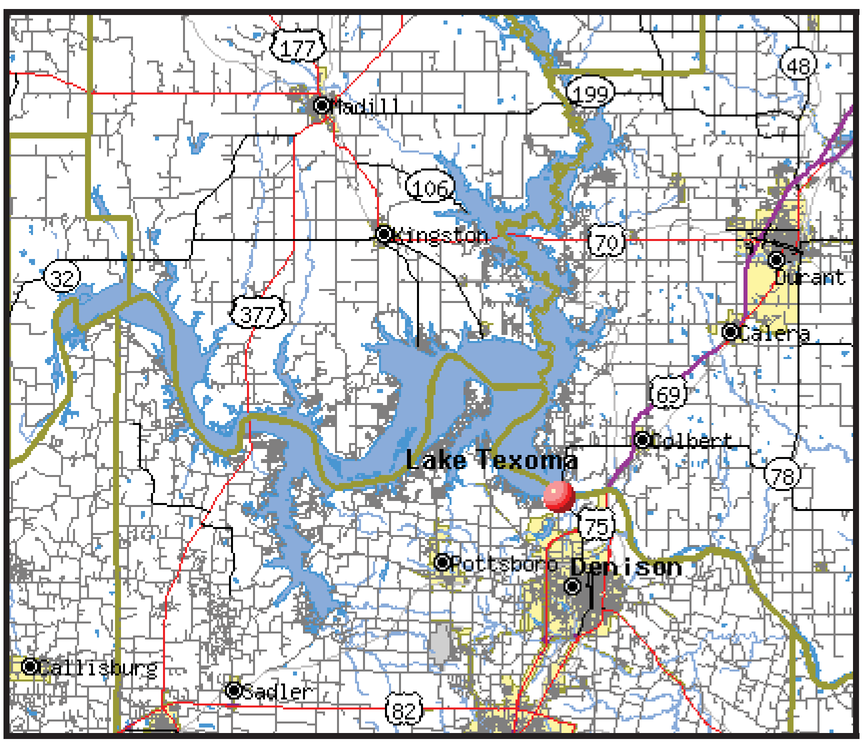
- ElDorado 700 (H)
- Denison Dam 3000 (H)

BUILDING STRONG®

Texoma Reallocation Study
Oklahoma and Texas

The reallocation study is in response to Section 838 of the Water Resources Development Act of 1986 (Public Law 99-662) authorized the Secretary "*to reallocate from hydropower storage to water supply storage, in increments as needed, up to an additional 150,000 acre-feet each for municipal, industrial, and agricultural water users in the State of Texas and up to 150,000 acre-feet for municipal, industrial, and agricultural water users in the State of Oklahoma*."; and in response to requests for storage by the North Texas Municipal Water District (NTMWD) of 100,000 acre-feet and the Greater Texoma Utility Authority (GTUA) for 50,000 acre-feet.

The Corps provided the final reallocation report to the Office of the Assistant Secretary of the Army for Civil Works (ASACW) on 22 May 09 and ASACW Staff completed their review on 13 June 09. A decision was rendered on hydropower compensation for Lake Texoma Reallocation (as defined by WRDA 86 Section 836) and concluded that compensation should be for replacement costs and extend as long as water storage is used for municipal and water supply purposes. The Corps will review policy for mitigation of hydropower losses and await policy guidance from HQ regarding options for hydropower compensation. Water supply agreements cannot be approved nor executed prior to the resubmission of the amended reallocation report containing hydropower compensation methodology.



Cookietown Lake

(POTENTIAL DEVELOPMENT SITE)

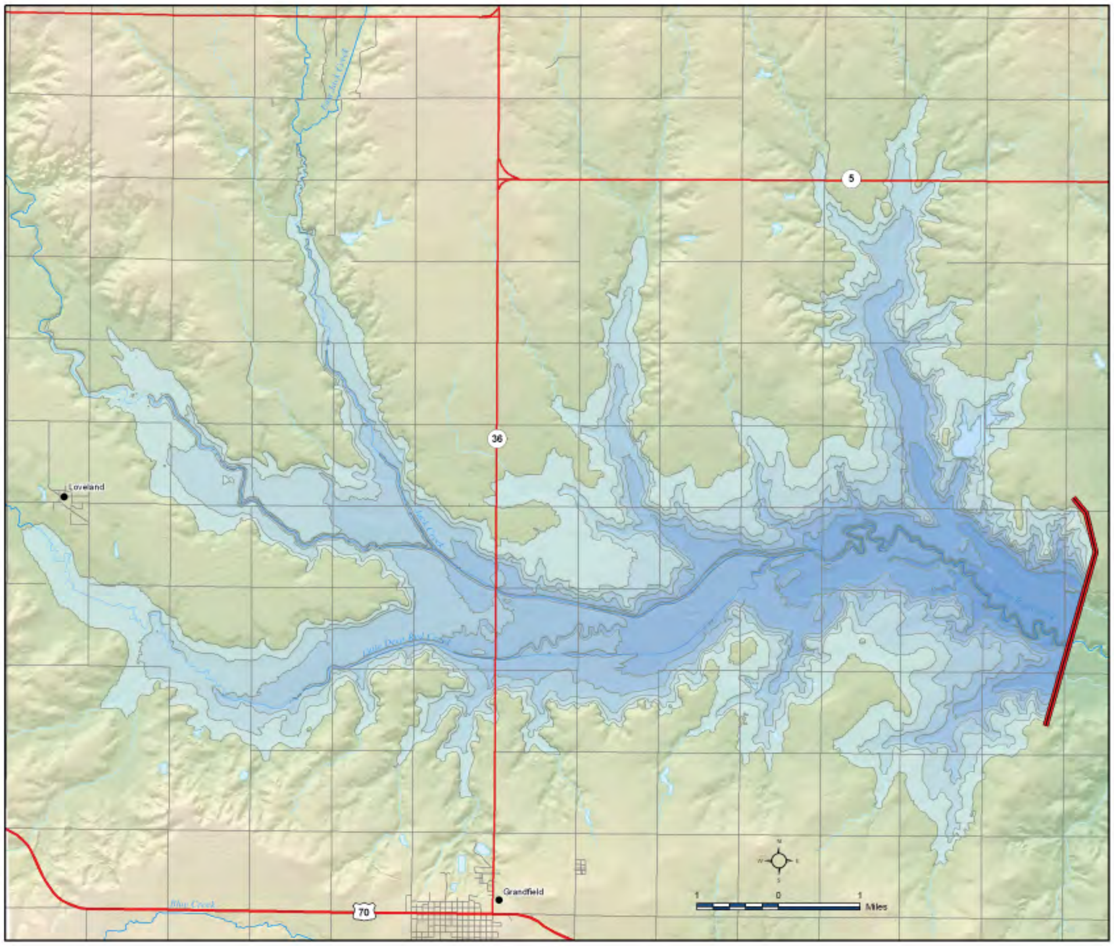
SURFACE AREA: 27,217 acres

DAM INFORMATION
LOCATION: T03S - R13WI - S22
Cotton County
HEIGHT: 65 feet
ELEVATION: 1,046 foot
LENGTH: 12,300 feet

WATER STORAGE AND YIELD

FLOOD CONTROL STORAGE (acre-feet)	WATER SUPPLY STORAGE (acre-feet)	WATER SUPPLY YIELD (ac-ft/year)
37,500	208,200	34.700

POTENTIAL PURPOSES
Municipal Water Supply,
Flood Control,
Recreation, Irrigation



Cache Creek Project, Oklahoma

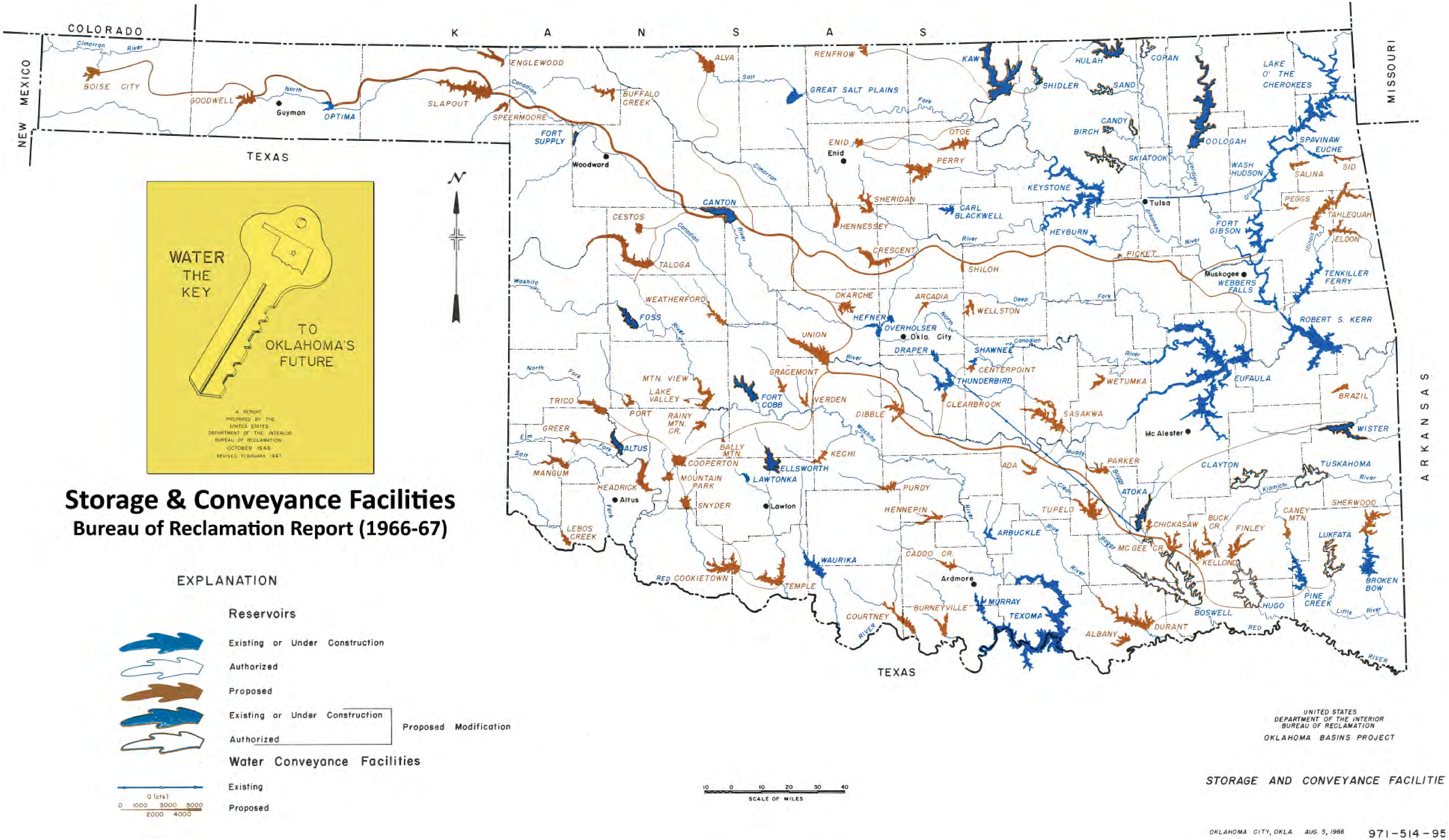
In the early 1970s, Congress authorized the U.S. Bureau of Reclamation to conduct a feasibility study to evaluate present and future needs and plans for the Cache Creek basin in southwest Oklahoma. A Reconnaissance Report was completed in April 1971 by Reclamation. Nine alternative dam and reservoir sites were evaluated in the Cache Creek Basin. The most favorable site was found to be Cookietown Reservoir on the Deep Red Run Creek, located in Cotton and Tillman Counties about 22 miles southwest of Lawton. Studies indicated that nominal flood control benefits would occur with Cookietown.

The Concluding Report on the Cache Creek Project was completed in September 1979 by Reclamation. This report indicated that the existing water supply in the area was sufficient to last beyond 2020. As such, the feasibility study was not completed. However, since it was determined that the Cache Creek Basin was one of the few remaining sources of good quality water in the area, subfeasibility-grade design and cost estimates were conducted for the two alternatives showing the most potential for future development: (Plan A) Cookietown Reservoir or (Plan B) Cookietown Reservoir with West Cache Creek diversion dam (also called Faxon Diversion Dam) and a conveyance canal to pump water to Cookietown Reservoir. A “Feasibility Geologic Report” was completed by Reclamation for the Cookietown dam and reservoir site in May 1978.

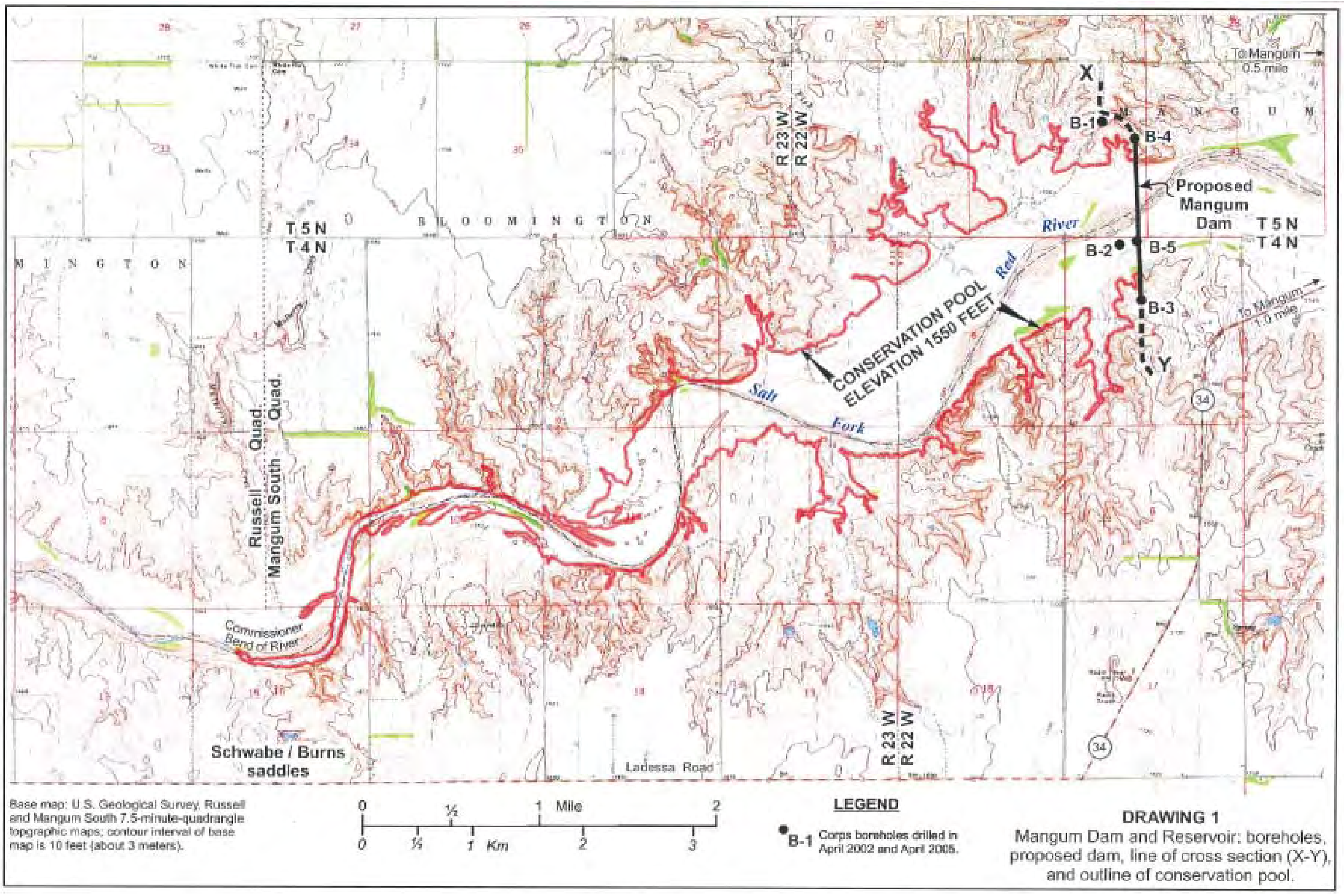
Plan A, Cookietown alone, would provide approximately 34,700 acre-feet of water supply yield. Plan B, Cookietown with Faxon Diversion Dam, would provide an additional 16,500 acre-feet at Cookietown for a total of 51,200 acre-feet. The estimated cost in January 1978 for Plan A was $99,000,000 and for Plan B was $115,507,000. Rights-of-way for the reservoir would require 33,300 acres and about 390 surface acres for the diversion site.

Storage & Conveyance Facilities

Bureau of Reclamation Report (1966-67)



Lower Mangum Reservoir Project



Lower Mangum Reservoir Project, Oklahoma

In an effort to supplement the W.C. Austin Irrigation project water supply, the U.S. Bureau of Reclamation conducted studies as early as 1941 characterizing several potential dam sites on the Salt Fork of the Red River upstream from Mangum. The initial investigations focused on a site approximately 8 miles southwest of Mangum consisting of a rolled earthfill dam structure 125 feet in height and about 11,000 feet in length. The project included a 4-mile long dike near the dam and a 23-mile long canal to carry supplemental water eastward to the W.C. Austin Project. However, subsequent studies by Reclamation and additional geotechnical work by the Corps of Engineers led to abandonment of the “Upper” Mangum site due to extensive gypsum karst features found throughout the impoundment area and concern over the ability of the structure to successfully hold water.

Further investigations located a more viable site, the “Lower” Mangum dam site, about 7 miles downstream and 2 miles southwest of Mangum. Studies completed in August 2002 and 2005 included field reconnaissance, hydrogeologic characterization of the reservoir area, pressure tests, streamflow characterization of the northern end of the reservoir and the drilling of exploratory core borings to investigate foundation conditions beneath the new proposed dam alignment. These studies indicated favorable geologic conditions for construction of the Lower Mangum site if the pool level was maintained at elevation 1,550 feet. Complex geology and karst conditions in the uppermost part of the reservoir near Commissioner Bend of Salt Fork Red River will impose limits on the elevation, size and capacity of the Mangum Reservoir. The elevation of the stream bed in the Salt Fork at Commissioner bend is 1,550 feet, and at this elevation would provide a lake surface area of about 1,863 acres, a storage volume of 26,080 acre-feet and a water supply yield of 11.07 mgd.

Proposed future studies include drilling an additional hole along the proposed dam alignment and developing cost estimates for project construction, including pertinent data, features and layout.

Mountain Park Project, Oklahoma

RECLAMATION
Managing Water in the West

The Mountain Park Project provides a supplemental municipal and industrial water supply to the Oklahoma cities of Altus, Snyder, Frederick, and the Hackberry Flat Wildlife Mangement Area (WMA). The project also provides flood control, recreation, fish and wildlife, and environmental quality benefits. Principal features are Mountain Park Dam, on West Otter Creek in Kiowa County about 6 miles northwest of Snyder, Oklahoma, two pumping plants, and a 38 mile aqueduct system to service the three cities and Hackberry Flat WMA. Mountain Park Dam forms Tom Steed Reservoir, and regulates natural flows of West Otter Creek and diverted flows from Elk Creek. Project facilities include Bretch Diversion Dam on Elk Creek in Kiowa County and Bretch Diversion Canal, which diverts and conveys Elk Creek flow into the watershed upstream from Mountain Park Dam to supplement the natural flow of West Otter Creek into Tom Steed Reservoir.

Facility Descriptions
Mountain Park Dam is located just upstream of Snyder Dam, on Otter Creek near Mountain Park, Oklahoma. The dam is described as a thin double-curvature concrete arch flanked by concrete thrust blocks. It is 535 feet in length with a maximum structural height of 133 feet. This dam and the rolled earth East and West Dike embankments, which extend 10,311 feet and 13,235 feet, respectively, form the Tom Steed Reservoir. The reservoir has a total capacity of 117,825 acre-feet, an active capacity of 109,276 acre-feet, and a surface area at the top of conservation pool of approximately 6,400 acres.

The outlet works for Mountain Park Dam are in the left thrust block and include three outlet pipes. A 42-inch-diameter, joint-use outlet pipe is provided to release water into the aquaduct system; an 84-inch-diameter flood outlet pipe and a 15-inch-diameter river outlet pipe are provided to release floodwater and small streamflows.

The concrete arch portion of Mountain Park Dam functions as an uncontrolled, overflow spillway. The crest is at the top of the exclusive flood control pool at elevation 1414.0, and is 320 feet long measured along the axis of the dam.

Bretch Diversion Dam is located on Elk Creek in Kiowa County about 24 miles northeast of Altus, Oklahoma, and about 15 miles northwest of Mountain Park Dam. The dam diverts flows from Elk Creek into Bretch Canal for conveyance into Tom Steed Reservoir by way of Noname Creek and West Otter Creek. Bretch Diversion Canal begins at Bretch Diversion Dam and runs generally south and southeast to Noname Creek. The concrete-lined canal is 9.5 miles long.

M&I Water Supply
The aquaduct system is designed to convey water from Tom Steed Reservoir to the cities of Altus, Snyder, Frederick, and the Hackberry WMA, Oklahoma, for municipal and industrial use.

Recreation
The Oklahoma Tourism and Recreation Department administers 6,100 acres on the east and south shores of the reservoir. Public recreation facilities on the east side include shelters, tables, grills, a comfort station, a boat launching ramp, and a swimming beach. The area south of the dam along Otter Creek offers picnic facilities and a bridge across the creek which leads to a nature trail through large cottonwood, ash, elm, walnut, and pecan trees.

The Oklahoma Department of Wildlife Conservation administers 5,150 acres of the west and north side of the reservoir area. Waterfowl and dove are plentiful, and other upland game species are increasing as more food and cover are developed. An extensive tree and shrub planting program continues to increase wildlife habitat. The reservoir is one of the best fishing areas in southwest Oklahoma, offering catfish, crappie, largemouth black bass, and other varieties.

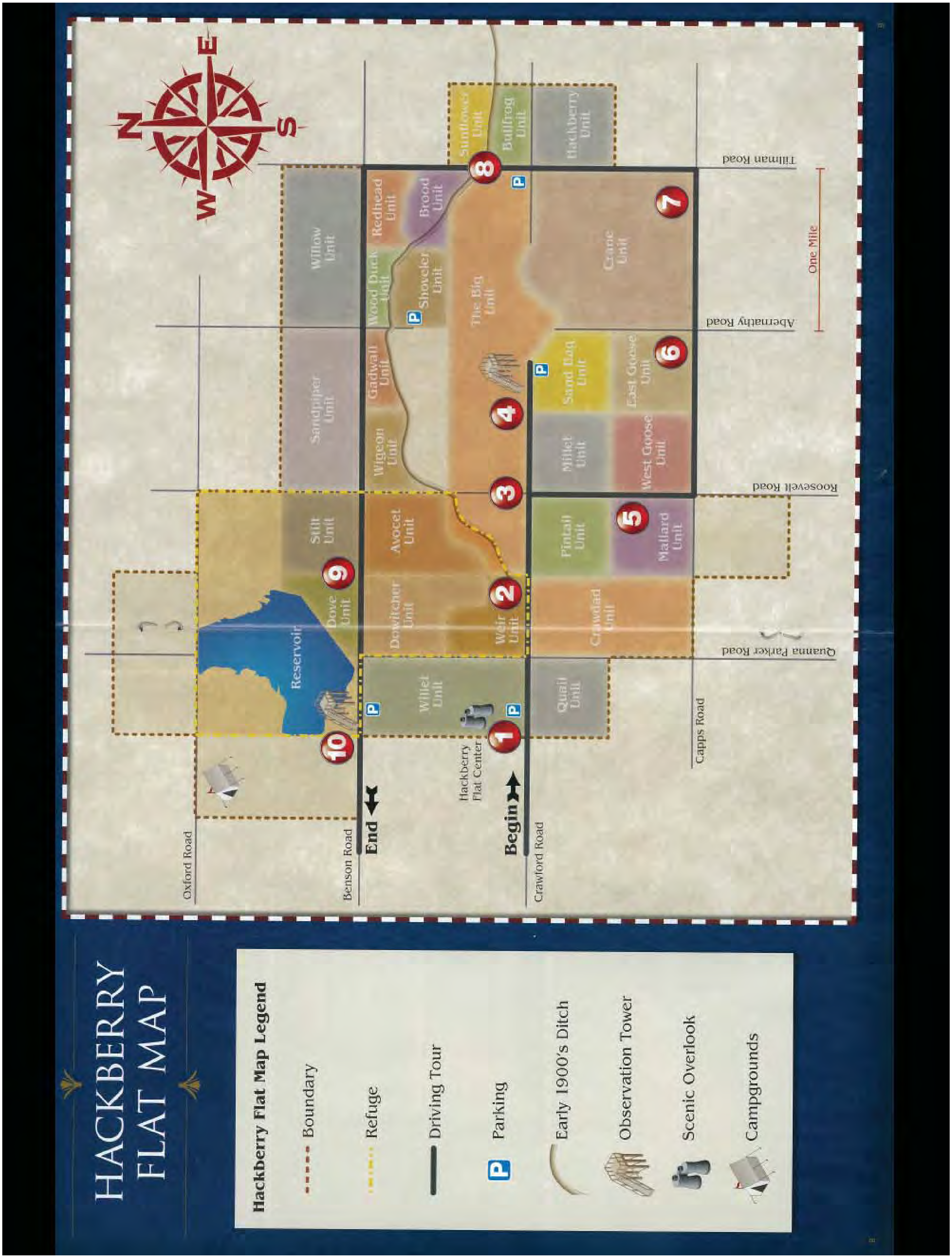
Flood Control
Tom Steed Reservoir will effectively control all floods of record at Mountain Park damsite and will protect areas downstream to the mouth of East Otter Creek. The Tom Steed Reservoir has 20,305 acre feet of capacity assigned to flood control. The Mountain Park Project has provided an accumulated $1,550,000 in flood control benefits from 1950 to 1999.

Operating Entities
The agency responsible for operation and maintenance of the project diversion, storage, and aqueduct system is the Mountain Park Master Conservancy District. The Oklahoma Tourism and Recreation Department administers the recreation areas and the Oklahoma Department of Wildlife Conservation administers the wildlife management areas.

Authorization
The Mountain Park Project was authorized by Public Law 90-503, September 21, 1968 (82 Stat. 853). This authorization included aqueducts to serve the cities of Altus and Snyder, Oklahoma. The authorization was amended to include an aqueduct to the city of Frederick, Oklahoma, by Public Law 93-493 (88 Stat. 1492), dated October 27, 1974. Public Law 103-434 dated October 31, 1994 added environmental quality as an authorized purpose to the project.

Construction
Construction began on Mountain Park Project in 1971 with the award of contracts for exploratory drilling, breaching Snyder Dam, warehouse and shop buildings, and minor contracts. Relocation contracts for power lines, highways, county roads, and railroads were initiated in 1972. Construction of Mountain Park Dam began with award of contract July 26, 1973, and was completed on June 20, 1975. Construction of Bretch Diversion Dam and Canal started with award of contract on September 12, 1975, and the work was essentially complete October 28, 1977.

Construction of the aquaduct system began with the award of contract for Altus Aquaduct and Pumping Plant on April 25, 1974; the contract was substantially completed on May 26, 1976. The contract for the Frederick Aquaduct and Pumping Plant was awarded August 5, 1976, and the contract was substantially completed at the end of calendar year 1979.


HACKBERRY FLAT MAP
Hackberry Flat Map Legend
Boundary
Refuge
Driving Tour
Parking
Early 1900's Ditch
Observation Tower
Scenic Overlook
Campgrounds
N
E
S
W
Oxford Road
Benson Road
Crawford Road
Capps Road
Quanna Parker Road
Roosevelt Road
Abernathy Road
Tillman Road
One Mile
Begin
End
Hackberry Flat Center
Reservoir
Willow Unit
Sandpiper Unit
Stilt Unit
Dove Unit
Redhead Unit
Brood Unit
Wood Duck Unit
Shoveler Unit
Gadwall Unit
Wigeon Unit
Avocet Unit
Dowitcher Unit
Weir Unit
Willet Unit
Quail Unit
The Big Unit
Sand Bag Unit
Millet Unit
Pintail Unit
Mallard Unit
Crawdad Unit
West Goose Unit
East Goose Unit
Crane Unit
Sunflower Unit
Bullfrog Unit
Hackberry Unit
1
2
3
4
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6
7
8
9
10

Hackberry Flat Driving Tour

To Start the Driving Tour: From the intersection of Hwy 5 and Hwy 183 in Frederick, go 1 mile south on 183. Turn east onto Airport Road and go 3 miles, then follow the blacktop road as it turns south and go 6 miles. Follow the signs to the parking lot of the Hackberry Flat Center.

Stop 1. Welcome to the Hackberry Flat Center. Restrooms are available and information about the area can be found on the back patio. From the patio you are overlooking most of the wetland area that comprises Hackberry Flat. The hills rising on the horizon are the eastern border of the Wildlife Management Area. From this point to the eastern border is about three miles. Feel free to walk down the trail to the bird blind at the end of the boardwalk. This trail provides a glimpse into the many components of a wetland in an arid region of the country and the wildlife dependent on it. Continue the driving tour to learn about how this wetland was restored. The design of this wetland consists of over 35 independently managed units. Each unit has been named and you will see the names of these units on signposts in corner of the units.

Stop 2. Turn left (east) when exiting the drive of the Center and go 9/10 of a mile. (Weir Unit is on your left.) The Hackberry Flat wetland is managed by a water distribution system that restores the functions and productivity of the original wetland. The structures on the south side (right) with a wheel on top floods the units. The steel box structure on the north side moves water in and out of wetland units. These structures control water distribution to achieve desirable water depths needed to create certain soil conditions for desirable plant germination, to provide mudflats for shorebirds during migration or to control invasive plant species.

Stop 3. Travel ½ mile to the corner of Pintail and Millet Units. During winter and spring these are two of several units that provide food for waterfowl and shorebirds. Notice the manmade islands scattered throughout both of these units. These islands help to provide areas of elevation that will create drier soil conditions allowing for the germination of different vegetation and, when the units are flooded, would be surrounded by water. Waterfowl in particular enjoy using these islands for “loafing” and some wetland birds will nest on these islands.

Stop 4. Follow this road until it dead ends into a parking lot at an observation tower. From the top of the tower, looking north you can see the Wichita Mountains. The white towers you see are the grain silos in the town of Hollister. The unit to the north, The Big Unit, is so named as it is the largest unit in Hackberry Flat. Feel free to walk east on the dike to observe more wildlife. To continue the driving tour, head back west for less than a mile and turn south (left) at the corner of Millet and Pintail units. (Stop 3).

Stop 5. Travel for ½ mile. You will see more water control structures at this stop. Which ones move water in and which structures move water out? The tall bunch grass growing along the ditches and edges of the dikes is switch grass (Panicum virgatum). This native grass not only protects the dike from erosion but provides cover and food for wildlife.

Stop 6. Travel ½ mile, turn east and continue for 1mile. You will be at the corner of Goose and Crane units on your left (north). Goose Unit will probably look different than Crane Unit. Each unit is independently managed to provide a “patchwork” of different soil and plant conditions in Hackberry Flat. In addition to flooding and drying out units, soil manipulation is needed to control undesirable and desirable vegetation. This is achieved through disking or plowing all or some of a unit.

Stop 7. Continue traveling east until you are alongside a row of willow and cottonwood trees. Trees in a prairie wetland are unique, and when found, these trees provide a microhabitat for some bird species. Orioles, grackles, flycatchers, kingbirds and nighthawks will sometimes nest in the trees. During fall and spring migrations, warblers can sometimes be found in these isolated trees.

Stop 8. Travel ½ mile and turn left (north). You are at the southeast corner of Hackberry Flat. Continue traveling north for 1 ½ miles. This concrete bridge crosses over the original ditch that was dug in the early 1900s to drain the wetland. This ditch represents an amazing feat by the local communities. At the beginning of the project digging was accomplished by the use of mule teams and completed with steam-powered equipment. The ditch is maintained by the Wildlife Department so that it can be used to discharge water quickly from the wetland if needed.

Stop 9. Travel ¾ mile and then turn left (west) at the Redhead Unit. Continue traveling for 2½ miles. To your left (south) you will see the main distribution canal for the Hackberry Flat wetland. Water from the Hackberry Flat reservoir, located north and west about ½ mile, flows into this canal and is distributed through the system of water control structures you’ve seen while driving the route. All together there are 35 miles of dikes and canals and over 95 water control structures that allow Hackberry Flat to provide habitat for wetland wildlife.

Stop 10. Continue west for ½ and turn in at the parking lot at the observation tower. The tower provides a view of the Hackberry Flat reservoir built by the Natural Resources Conservation Service in cooperation with the Tillman County Conservation District. A 17-mile pipeline from Tom Steed Reservoir has the capacity to deliver 2,800 gallons per minute to the Hackberry Flat Reservoir. Water stored in the reservoir is distributed to the wetland units through distribution canals and water control structures. Waterfowl and other waterbirds that prefer deeper water can be seen during the winter, spring and fall seasons. This area is in the Waterfowl Refuge. Please do not enter the refuge from October 15- January 31. Any other time feel free to walk on the top of the dam to get a better view of the birds.

"MAKING OF HACKBERRY FLAT"

The Making of Hackberry Flat

Restoration efforts began in 1993 when Wildlife Department personnel began purchasing land from willing sellers. Ground was broken in August 1995.

With the help of its many partners, the Department built nearly 40 miles of levees and ditches to form a honeycomb of wetland units that allow managers to flood any part of the area according to the needs of migrating birds. A 17-mile aqueduct connecting Hackberry Flat to Tom Steed Reservoir was a critical component in the process. The pipeline assures a dependable water supply even during dry years. More than 35 miles of dikes and canals and 99 different water control structures give managers a wide variety of management options.

It didn't take long for the restoration project to bear fruit either. Within the first year shorebirds that had not nested in southwest Oklahoma in decades were nesting on the restored wetland.

The project was dedicated in May 1999 and has taken on an enormous scope, including several key construction figures:

- 7,120 acres purchased from 30 willing sellers.
- 3,620 acres can be flooded
- 3,120 acres of upland habitat.
- 17-mile water delivery pipeline from Tom Steed Reservoir.
- Pipeline delivers 2,800 gallons of water per minute.
- 35 miles of dikes and canals
- 99 water control structures
- 35 wetland units
- $14 million cost, $10 million of which came from private and public partners.

Getting There

From Frederick, go south of town one mile on Hwy 183, then turn east on Airport Road and go three miles. Follow the blacktop road south, and go six miles. Watch for area signs, and enjoy!

The restoration of Hackberry Flat WMA would not have been possible without the support of organizations like the Hackberry Flat Foundation and other key funding partners. The Hackberry Flat Foundation is a non-profit organization established to promote the Hackberry Flat project and insure the promise of continued excellence in conservation, education and recreation.

Key Funding Partners

The Hackberry Flat Foundation

North American Wetlands Conservation Council

The Williams Companies, Inc.

Natural Resources Conservation Service

Wildlife Restoration

City of Frederick

Ducks Unlimited, Inc.

Bureau of Reclamation

U.S. Fish and Wildlife Service

Phillips Petroleum Co., Inc.

National Fish and Wildlife Foundation

Tillman County Commissioners

First Southwest Bank

Pioneer Trucking Company

Wildlife Forever

Arrow Trucking Company

Oklahoma Station Chapter of Safari Club International

Oklahoma City sportsman's Club

U.S. Geological Survey

For more information:

Frederick Chamber of Commerce:
(580) 335-2126 or frederickokchamber.org

Hackberry Flat Center:
To schedule a school field trip or for more information about scheduling events, call (580) 335-7057 or email mhickman@zoo.odwc.state.ok.us

Tillman County Game Warden:
(580) 305-1484

100 Years Ago

It was once just a headache for local farmers. An obstacle that stood in the way of spring planting and fall harvesting. Local lore says the flood-prone soils of Hackberry Flat could swallow up a tractor in just a heavy fog.

How times change. Today the Hackberry Flat Wildlife Management Area provides an important feeding and resting point for thousands of prairie birds and diverse recreational opportunities for people craving outdoor experience. Located in southwest Oklahoma near Frederick, the legendary wetland has been restored through the generous help of many partners and the Oklahoma Department of Wildlife Conservation.

Flock of waterfowl, including Gadwalls and Widgeons

Albert Lavallee

The history of Hackberry Flat is an example of the spirit of Oklahoma's people. When pioneers arrived on the plains of southwest Oklahoma more than a century ago, they encountered clouds of waterfowl so thick that they blackened the skies over the flood-prone Hackberry Flat. At times, the noise from the birds winging overhead was deafening, and the noise created by the calls of so many birds lasted from dawn to dusk. The area's abundant wildlife even earned the attention of President Theodore Roosevelt, who visited and hunted near Hackberry Flat. But for these rugged homesteaders, it wasn't the wildlife that drew them there, but rather, the valuable commercial potential of the soil.

"HISTORY IN THE MAKING"

ACKBERRY FLATS.

Extremely Fertile Soil is Being Reclaimed by Ditching.

of the settlers living near Hack- Flats told the ENTERPRISE man day that he saw about ten teams on the ditch which is to be built this big sweep of country. who are assisting in four miles

THE BIG DITCH

Work on Big Ditch in Hackberry Flats Expected to Begin in a Few Days.

o a con- lackberry ch which locality, hin a few try, con- sections

KBERRY FLATS TO BE RECLAIMED

But How to Reclaim the Soil?

In the early 1900s, locals drained the area by constructing a massive ditch — some four miles long, 20 feet deep and 40 feet across — using hand shovels, mule teams and later a steam shovel. For the next two generations, area residents maintained the area as farmland instead of the wetland it had been for so many years.

Did it Work?

Yes…and no. The soil was indeed fertile, but the area remained prone to flooding and farming it was difficult.

H A C K B E R R Y F L A T

Today

Since then, we've learned that wetlands are extremely beneficial to wildlife and serve as "purifiers" for the natural environment. In the case of Hackberry Flat, there is now the additional benefit of the tourism dollars from visitors enjoying the sheer numbers of waterfowl and wetland birds attracted to this unique and historical wetland. At any time of the year, if there is water, whether during the warm days of spring or the bitter cold of winter one can find visitors at Hackberry Flat, both avian and human. It is a cyclical ebb and flow. In the fall and winter months, hunters chase their winged quarry across the Flat. During spring and summer, birdwatchers travel from around the nation to see an incredible diversity of birds and wildlife.

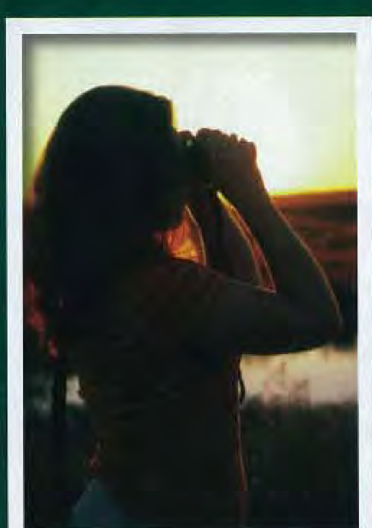
Northern Pintails

Russell Graves

Flock of shorebirds, including Long-billed Dowitchers and Wilson's Phalaropes

Bill Horn

"IF YOU BUILD IT, THEY WILL COME"



Wildlifedepartment.com

And they did!

From thousands of doves descending on a sunflower field, to less common species like the black-necked stilt, stilt sandpiper and snowy plover, sheer numbers of birds make this area one of the premier birding destinations in the state.

- 36 shorebird species
- 31 waterbird species (grebes, rails, cranes, herons, egrets, gulls)
- 23 waterfowl species
- 22 grassland species
- 15 wetland-dependent songbird species
- 15 raptor species

HACKBERRY FLAT

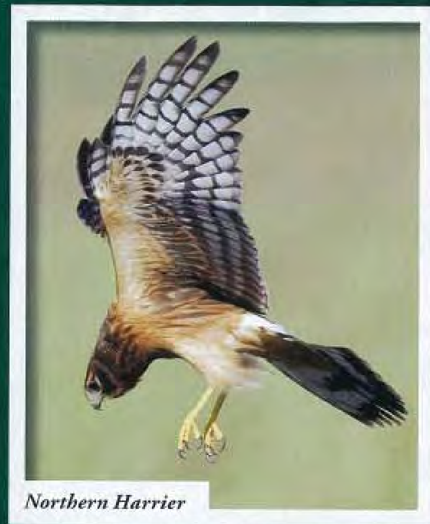
Birdwatching

Hackberry Flat is a premier destination for birders. More than 190 species have been identified during surveys.

Birding Tips

- Even though shorebirds are present year round, the best months for observing them are March through May. The best months for viewing waterfowl are February and March.
- Use your car as a blind. From all the roads you can observe a patchwork of wetland habitats.
- Feel free to walk the dikes to get in deeper to the wetlands.

Hackberry Flat helps sustain populations of over 100 wetland-dependent bird species.

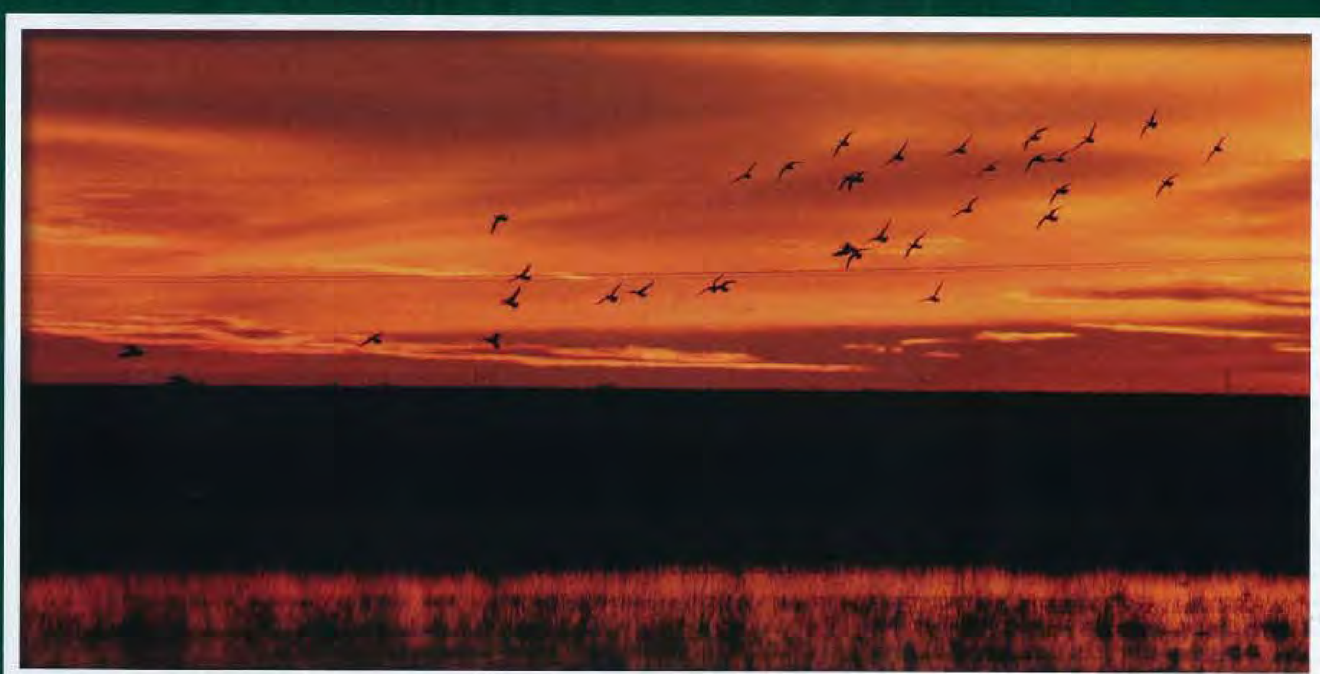


Northern Harrier

Bill Horn

Dickcissel

Bill Horn



Albert Lavallee

H A C K B E R R Y F L A T

Wildlife Restoration

Many wildlife habitat projects, such as those at Hackberry Flat, are funded through the Wildlife Restoration program. Sporting goods like firearms, bows and arrows and other outdoor related equipment are subject to special federal excise taxes that help fund conservation efforts around the country.

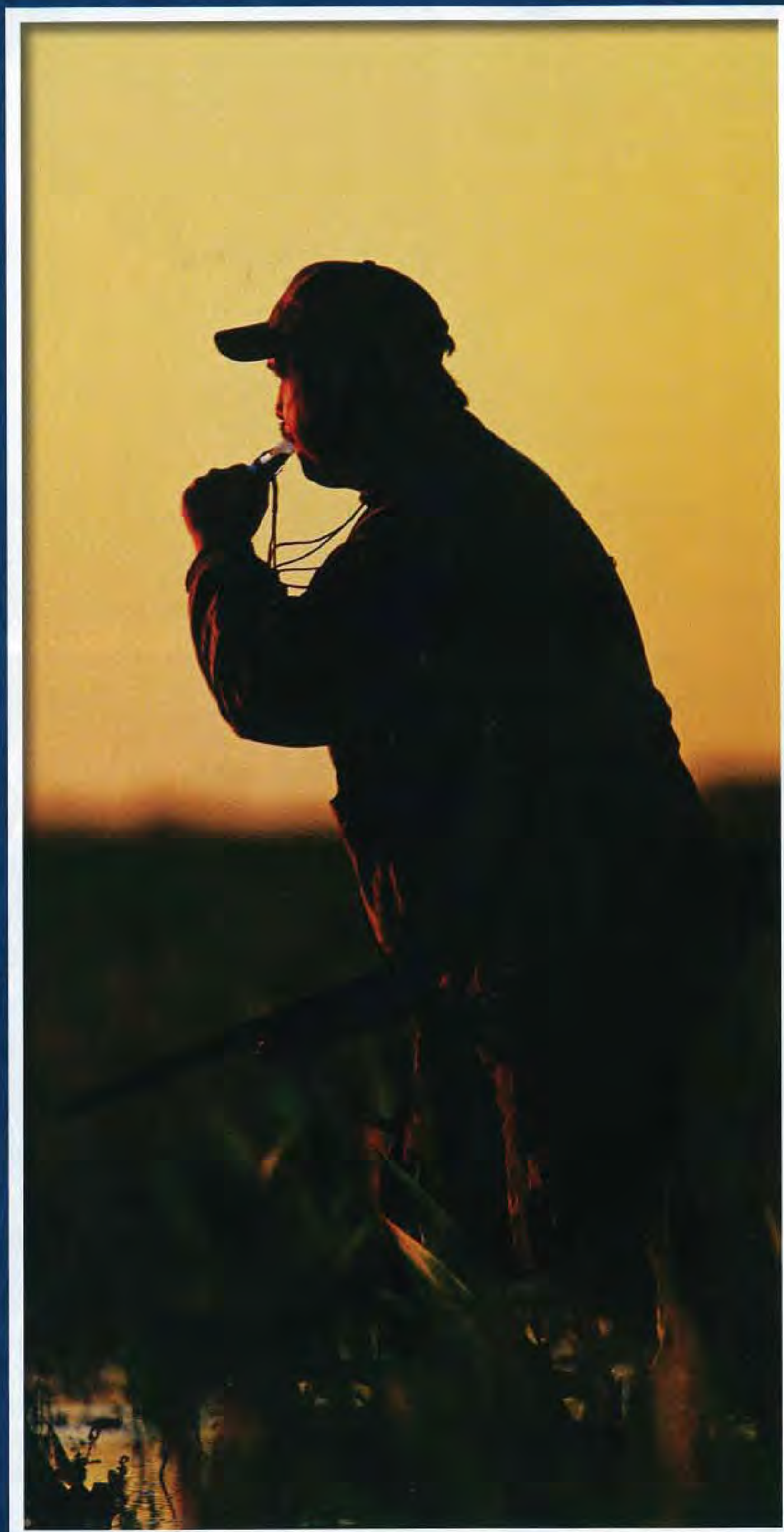
The Wildlife Restoration program is a tremendous examples of a true partnership between hunters, private industries and state and federal governments. The federal government collects these taxes from manufacturers, and the U.S. Fish and Wildlife Service administers and provides the funds to the state fish and wildlife agencies like the Oklahoma Department of Wildlife Conservation.

Hunters and shooters ultimately pay these taxes through the purchase of products. These same groups benefit from the funds, as states must spend the money on wildlife habitat restoration/development, populations management, user access and facilities and education.

The funds are used by the Oklahoma Department of Wildlife Conservation for a wide range of important activities, including the purchase and maintenance of wildlife management areas, construction of research laboratories and user facilities, surveying and managing wildlife populations, training volunteer instructors and educating young hunters in safe firearms handling, wildlife resources and ethics afield.

WILDLIFE RESTORATION

Federal Aid Project
funded by your purchase of
hunting equipment



Albert Lavallee

"HUNTERS PLAY THE MOST SIGNIFICANT ROLE IN CONSERVING OKLAHOMA'S NATURAL RESOURCES"

Hunters Pay

Hunters play a significant role in conserving Oklahoma's natural resources, including species that are not hunted in the state.

Not only is their enthusiasm for wildlife an important fuel for making projects such as the Hackberry Flat restoration project possible, but they also are the primary source of funding for the Oklahoma Department of Wildlife Conservation.

In Oklahoma, on average, there are some 250,000 hunters spending some $465 million on equipment, travel, food, lodging, etc. (US Fish and Wildlife Service 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation).

The Wildlife Department receives no general state tax revenues and is funded by sportsmen through the purchase of hunting and fishing licenses and special federal excise taxes on sporting goods.

Hunting at Hackberry Flat

Since the area is a wetland, all shotgun hunting at Hackberry Flat is restricted to federally approved non-toxic shot only.

DOVE

The area offers some of the best dove hunting in Oklahoma. On a good day, you'll see thousands of doves. If you're coming during the opening week of the season, plan ahead—area motels fill up quickly.

WATERFOWL

Duck and goose hunting are some of Hackberry Flat's best draws. Southwest Oklahoma is known by serious waterfowlers as one of the nation's best kept hunting secrets. Countless mallards, pintails, teal, Canada geese and other waterfowl descend on Hackberry every fall. As with all western wetlands, the amount of water in the area will vary from year to year.

SANDHILL CRANES

The wingshooter's big game, sandhill cranes use Hackberry Flat and the surrounding agricultural fields throughout the fall migration.

DEER

Although there may not be many trees in which to hang a treestand, the deer herd at and around Hackberry Flat is growing and flourishing, and archery hunting opportunities are available to offer sportsmen a unique deer hunting challenge.

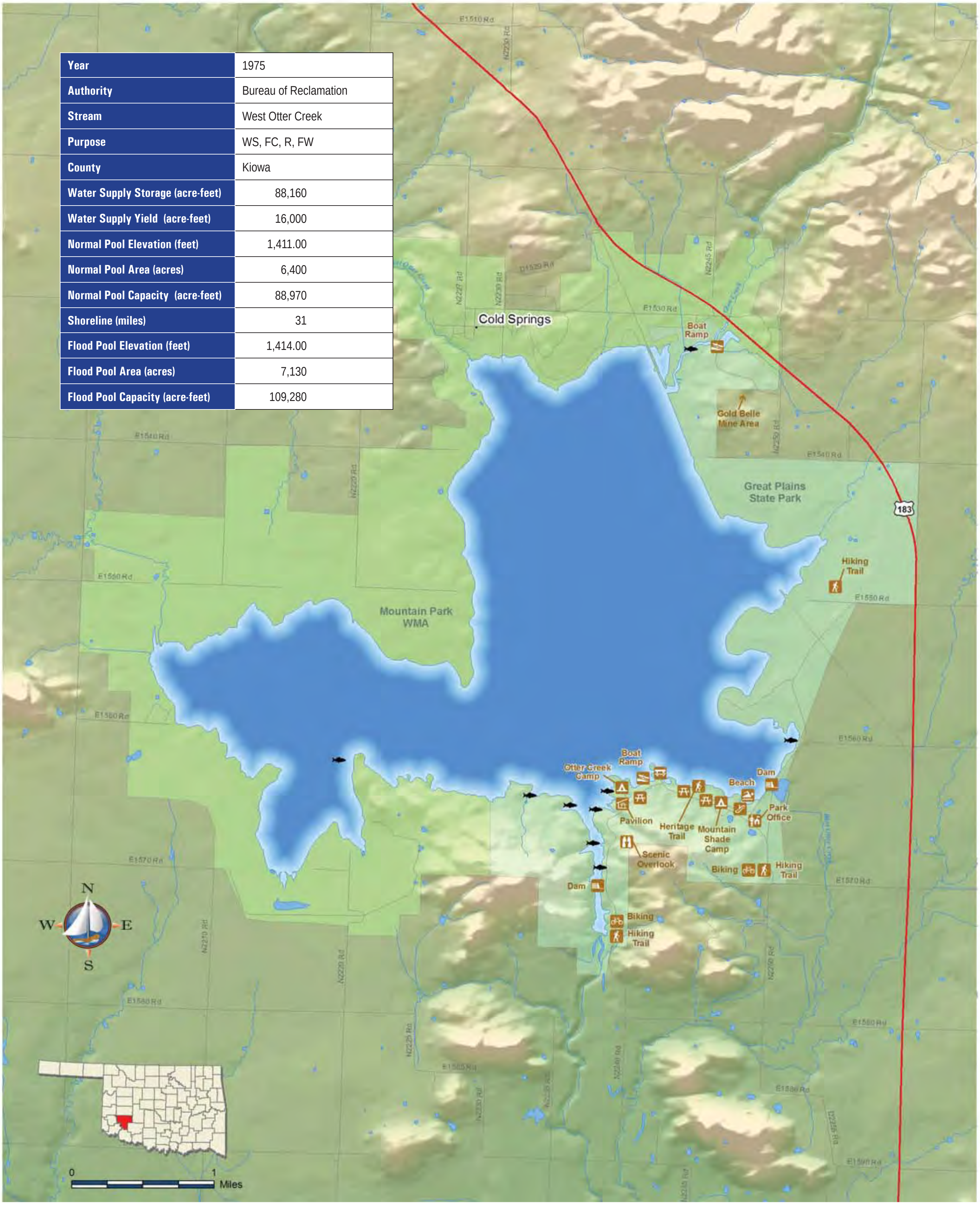
RABBITS AND QUAIL

Hunting for both species can be good. An exciting mixture of upland cover and agricultural cropland produces habitat for both quail and rabbits.

Tom Steed Reservoir

Oklahoma Comprehensive Water Plan
OCWP

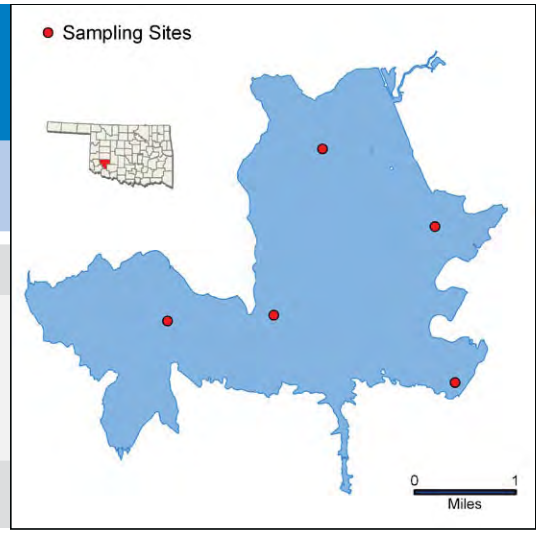
Year	1975
Authority	Bureau of Reclamation
Stream	West Otter Creek
Purpose	WS, FC, R, FW
County	Kiowa
Water Supply Storage (acre-feet)	88,160
Water Supply Yield (acre-feet)	16,000
Normal Pool Elevation (feet)	1,411.00
Normal Pool Area (acres)	6,400
Normal Pool Capacity (acre-feet)	88,970
Shoreline (miles)	31
Flood Pool Elevation (feet)	1,414.00
Flood Pool Area (acres)	7,130
Flood Pool Capacity (acre-feet)	109,280



Beneficial Use Monitoring Program

Tom Steed

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



Lake Data

Location	Kiowa County
Impoundment	1975
Area	6,400 acres
Capacity	88,970 acre-feet
Purposes	Flood Control, Water Supply, Recreation, Fish & Wildlife

Parameters

	Parameter	Result	Notes/Comments
	Average Turbidity	30 NTU	50% of values > OWQS of 25 NTU
	Average True Color	40 units	100% of values < OWQS of 70
	Average Secchi Disk Depth	57 cm	
	Water Clarity Rating	average	
	Trophic State Index	55	
	Trophic Class	eutrophic	
Profile	Salinity	0.37 – 0.52ppt	
Profile	Specific Conductivity	722.9 – 1001 µS/cm	
Profile	pH	7.70 – 8.55 pH units	Neutral to slightly alkaline
Profile	Oxidation-Reduction Potential	277 to 399 mV	
Profile	Dissolved Oxygen	Up to 25% of water column < 2 mg/L in July	Occurred at sites 1, the dam
Nutrients	Surface Total Nitrogen	0.59 mg/L to 1.04 mg/L	
Nutrients	Surface Total Phosphorus	0.038 mg/L to 0.108 mg/L	
Nutrients	Nitrogen to Phosphorus Ratio	12:1	Phosphorus limited

Beneficial Uses

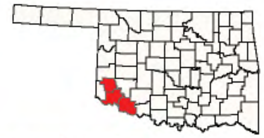
	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates, Chlorides & TDS	En,ecal coli, & E. coli	Chlor-a
Fish & Wildlife Propagation	NS	S	S	S					
Aesthetics					S	S			
Agriculture							S		
Primary Body Contact Recreation								S	
Public & Private Water Supply									

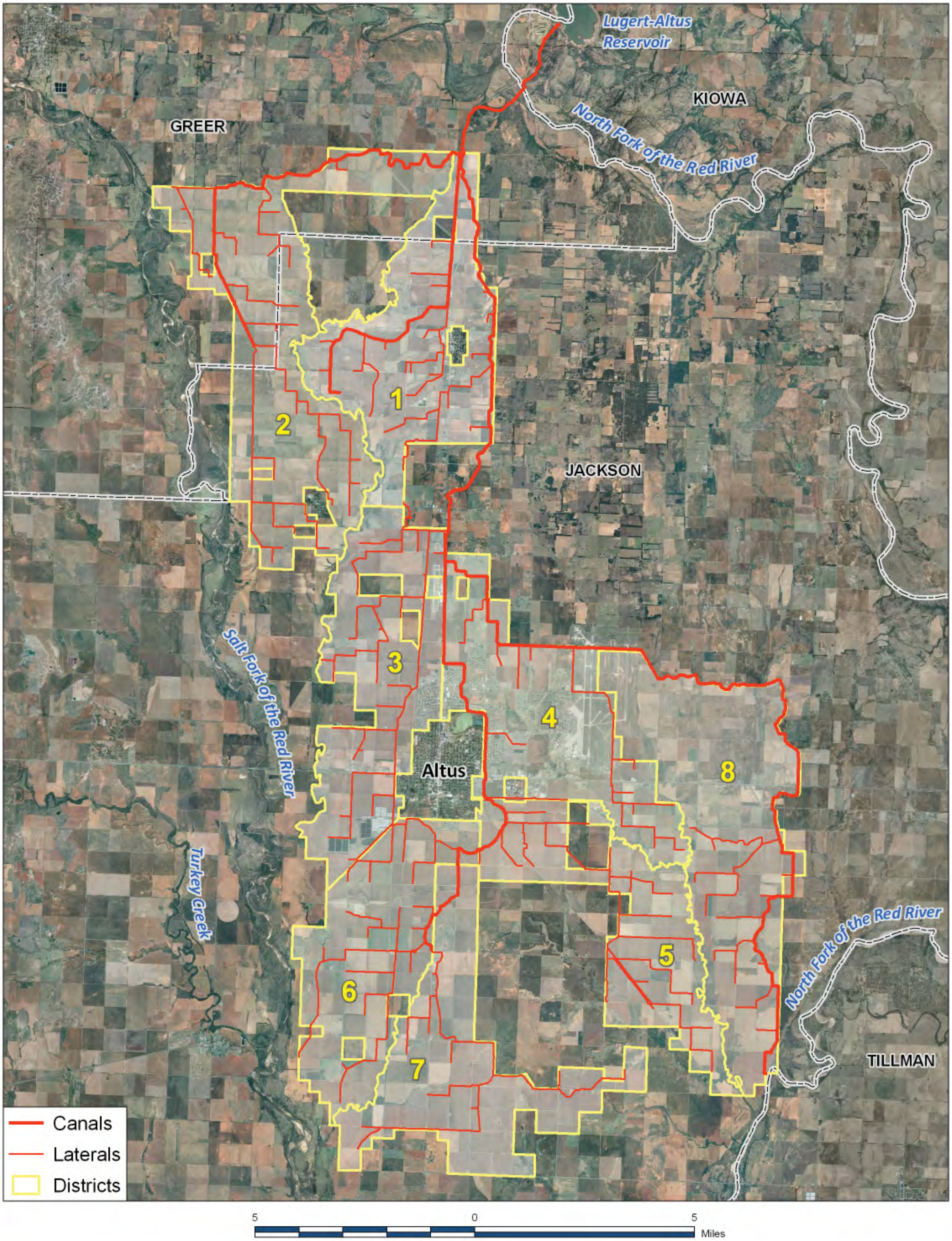
S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

Notes

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

Lugert-Altus Irrigation District





RECLAMATION
Managing Water in the West

Statistical Summary of Great Plains Region Projects in Oklahoma

Reclamation Project / Unit	State	Date Authorized	Reservoir Names	Storage Dam Names	Project Flood Benefit through 2006 ($1000)	Diversion Facility Names	Number of Pumping Plants	Irrigated Acres	Canals & Laterals (m)	drains (m)
Norman	OK	1960	Lake Thunderbird	Norman Dam	35,964		2	-	30.5 pipe	-
Washita Basin	OK	1956	Fort Cobb Reservoir	Fort Cobb Dam	6,235		3		71.7 aqueduct	-
			Foss Reservoir	Foss Dam	7,097					
Arbuckle	OK	1962	Lake of the Arbuckles	Arbuckle Dam	2,065				17.87 aqueduct	
Mountain Park	OK	1968	Tom Steed Lake	Mountain Park Dam	1,605	Bretch Diversion Dam	2		9.5 C/38 pipe	-
McGee Creek	OK	1976	McGee Creek Reservoir	McGee Creek Dam	2,776		1		16.7 pipe	
W.C. Austin	OK	1938	Lake Altus	Altus Dam	12,817			47,971	273	26
******		******	******	******	******	******		******	******	******
OKLAHOMA-TEXAS AREA OFFICE TOTALS			**7 reservoirs**	**7 storage dams**	**68,559 flood $**	**1 diversion dams**	**7 Pumping Plants**	**47,971 acres**	**457 mi ***	**65 mi**

NOTES:
* figure includes aquaducts, pipelines and canals.
n/a indicates that there is no flood control assigned to the project and the Corps of Engineers does not compute flood benefits.

Images of Great Plains Region Dams in Oklahoma


Altus


Arbuckle


McGee Creek


Fort Cobb


Foss


Mountain Park


Norman

Record high flow, June 3rd,1995; 62,300 cubic feet per second (100 yr flood value is 41,500 cfs)

Elm Fork of the North Fork of the Red River Gage – Station number 07303400

Normal low flow, April 6, 1994

USGS science for a changing world

USGS IN OKLAHOMA

The U.S. Geological Survey Water Resources Discipline (USGS) assists the State of Oklahoma by providing real-time, relevant, high-quality data and reports for a wide range of water-resource issues. USGS water-resource activities in Oklahoma are comprised primarily of two activities: data collection (stream gage data and water quality), and research.

Stream gaging is a field- and computer-intensive activity that monitors river elevations and discharges and water quality, with provision of real-time data available to all on the world-wide web. Stream gaging data is used to predict and determine the extent of floods, evaluate the severity of droughts, allocate water resources, and monitor and manage effluent discharges from cities and industries.

As of 2009, the USGS operated 194 stream gages from offices in Woodward, Oklahoma City, and Tulsa, Oklahoma, in cooperation with other Federal agencies, state agencies, local governments, and Native American Tribal governments. USGS also operated 12 real-time water-quality stream gages in central and eastern Oklahoma to measure the effects of urban, industrial, and agricultural discharges on water quality in Oklahoma streams and potential effects of water quality on downstream users of that water. In addition to collecting real-time data, USGS staff collects surface-water samples for water-quality analysis for the evaluation of water-quality conditions, trends, and annual flow-weighted load estimations of water-quality parameters.

USGS conducts regional and local investigations of water resources in Oklahoma. Through the Cooperative Water Resources Program, the National Water Quality Assessment Program, and the Toxic Substances Hydrology Program, USGS staff conducts between 15-20 studies per year on water resource availability, water use, water quality, hydrologic problems, and hydrologic trends that can affect the health and welfare of Oklahomans and the diverse native biota of Oklahoma.

Statewide and Regional Studies

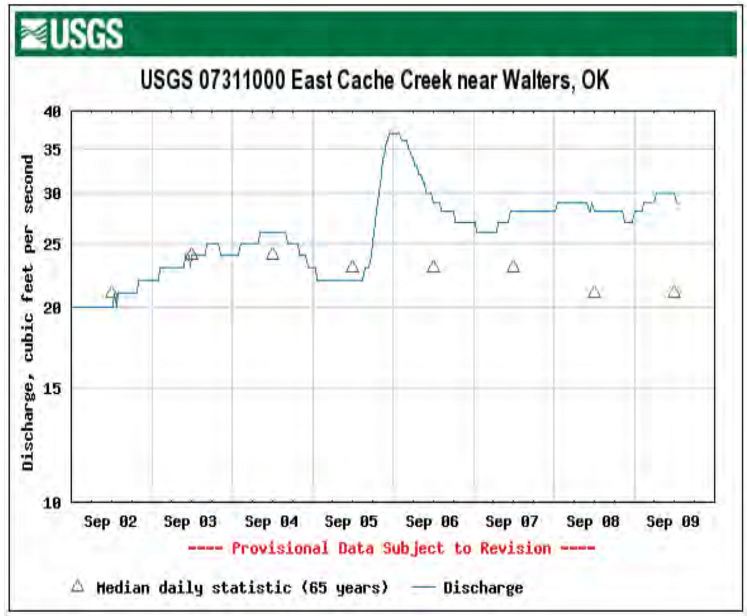
The USGS Oklahoma Water Science Center (OK-WSC) is conducting a number of statewide and regional studies in cooperation with other USGS offices in the mapping, geologic, and biologic disciplines--

1. National Water-Quality Assessment Program (NAWQA)--OK-WSC staff has provided assistance with the High Plains and Ozark Plateaus study units of this intensive water-quality assessment program.
2. Toxic Substances Hydrology Program—OK-WSC staff has provided site support for dozens of researchers from the USGS and other agencies and universities at the Norman Landfill and Osage-Skiatook Petroleum Environmental Research Sites.
3. Streamflow Statistics—OK-WSC staff is analyzing streamflow statistics at gaged streamflow sites to produce equations that relate 95-, 90- 80-, 50-, and 20-percent exceedances of annual, monthly, and seasonal daily mean streamflow to basin characteristics. This information will be provided on an Oklahoma Streamflow Statistics Web Application and a hardcopy report to assist agencies in Oklahoma with water-resource planning and interstate compacts.
4. Water Use— OK-WSC staff is compiling a comprehensive report of historic water use in
5. Oklahoma. This report will compare water use on a statewide basis from 1950-2005 and by county, major river basins, and major aquifers from 1990-2005. The information will assist agencies in the State of Oklahoma by providing an understanding of water use withdrawal data required water resource planning, and for interstate compacts, and the comprehensive state water plan.
6. Arbuckle Simpson Aquifer Assessment—USGS Hydrologists, Geologists, and Geographers are working with the Oklahoma Water Resources Board to determine ground-water flow, recharge, and sustainable water yields.
7. Tribal Water-Quality, Watershed Assessment, and Riparian Habitat Training— In the summer of 2009, USGS staff will conduct a 3-day class for Tribal Environmental staffs from the south-central U.S. as a follow up to several previous water-quality-training classes. New training elements include design of watershed sampling networks, collaboration with tribes and other agencies in adjoining lands, and evaluation of the quality of riparian aquatic habitat.
8. State Comprehensive Water Plan—USGS Hydrologists serve on technical panels for the Comprehensive State Water Plan that is in development.
9. Oil and Gas Shale Assessment—USGS Hydrologists and Geologists are working on assessments of the oil and gas reserves and effects of development of those reserves for the Woodford Shale and the Anadarko Basin.
10. Tribal Work—USGS Hydrologists are working with Tribes to evaluate water-quality issues and vulnerability of ground-water resources to contamination.

Stream Gaging—The USGS works in cooperation with Federal, State, Tribal, and local governments to operate 194 gages on streams across Oklahoma and parts of adjoining. Streamflow and continuous water-quality data collected at USGS stream gages are used for flood prediction, highway and bridge construction, floodplain mapping for flood insurance, wastewater discharge permitting, and for water recreation.

USGS Hydrologic Technicians periodically measure discharge to determine relations between stream stages and stream discharges.

USGS Gages contain pressure transducers or radar gages that measure stream stage. Stream stage data is transmitted by satellite to USGS data servers.



Stream stages, discharges, and other data such as rainfall and water quality are available in real-time in the internet.

OKLAHOMA'S CRITICAL WATER ISSUES

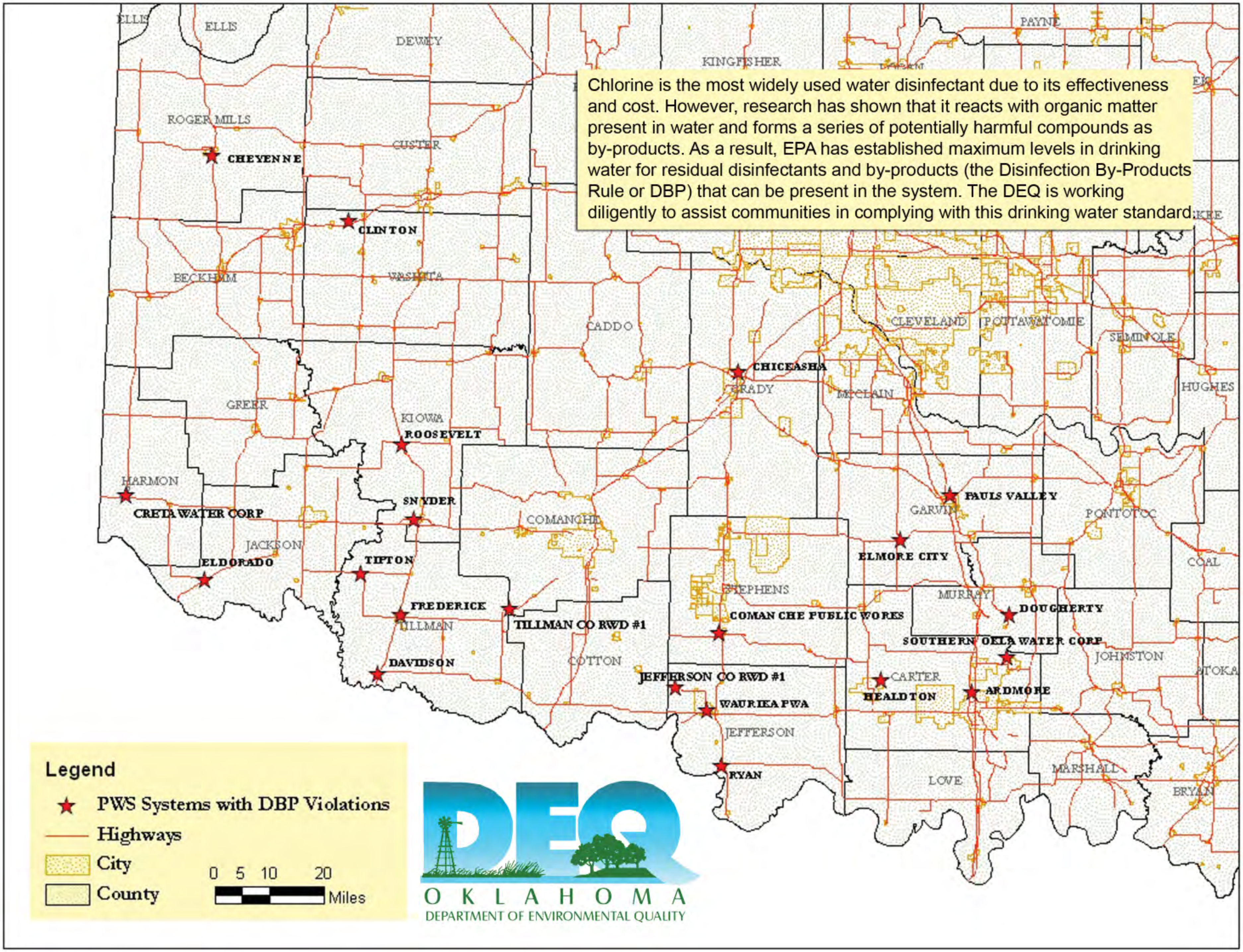
Oklahoma faces several critical water issues as it enters the 21st century—

1. Below-normal rainfall and increased irrigation in western Oklahoma have led to decreased streamflows, affecting aquatic habitat and decreasing ground-water levels. Large pumping projects in the Texas panhandle to supply needs for irrigation and the City of Amarillo may exacerbate this problem.
2. Eutrophication of streams in eastern Oklahoma may be increasing due to rapid growth in populations of livestock and humans in areas adjoining Arkansas and Missouri.
3. Naturally-occurring contaminants such as arsenic, uranium, selenium, and high salinity occur in some
4. There is potential for degradation in the quality of ground and surface water from large-scale confined animal feeding operations.
5. Decreasing streamflows and ground-water levels in the Arbuckle-Simpson aquifer of south-central Oklahoma due to increases in agricultural and domestic uses of water are a concern. Potential transfers of water by pipelines to other parts of the state might exacerbate this problem.
6. Continuing growth in the Dallas-Fort Worth Metroplex may increase demand for Oklahoma surface water in southern and southeastern Oklahoma.
7. Native American Tribes are expressing greater concerns about the quantity and quality of ground and surface waters associated with Tribal lands.
8. Fracing for gas shale development will increase demand for fresh water.
9. Petroleum production and natural brine seeps can contribute large concentrations of chloride to Oklahoma's water.
10. Toxic metals in water draining from the Tar Creek Superfund site are a continuing concern.

HOW USGS WILL HELP TO ADDRESS OKLAHOMA'S WATER ISSUES

- USGS Staff will continue to work with cooperators to collect, analyze, and disseminate high-quality, consistent hydrologic data through real-time on-line data serving and through production of high quality, timely reports about Oklahoma's water resources.
- USGS Staff will participate on State technical committees and working groups to share USGS data and expertise on water-resource issues to help solve these problems.
- USGS Staff will be trained on new analytical methods, equipment, and tools that can improve the quality of hydrologic data collected in Oklahoma.
- The USGS Oklahoma Water Science Center will consult with USGS specialists and experts from across the Nation to bring the most advanced scientific methods to the solution of Oklahoma's water issues.
- USGS staff will continue to provide training in data collection and analysis to staffs of state, local agencies and Tribes in Oklahoma.
- USGS staff will investigate new means of data analysis to better define trends in water availability and water quality from the large historical hydrologic databases maintained by USGS.

Chlorine is the most widely used water disinfectant due to its effectiveness and cost. However, research has shown that it reacts with organic matter present in water and forms a series of potentially harmful compounds as by-products. As a result, EPA has established maximum levels in drinking water for residual disinfectants and by-products (the Disinfection By-Products Rule or DBP) that can be present in the system. The DEQ is working diligently to assist communities in complying with this drinking water standard.



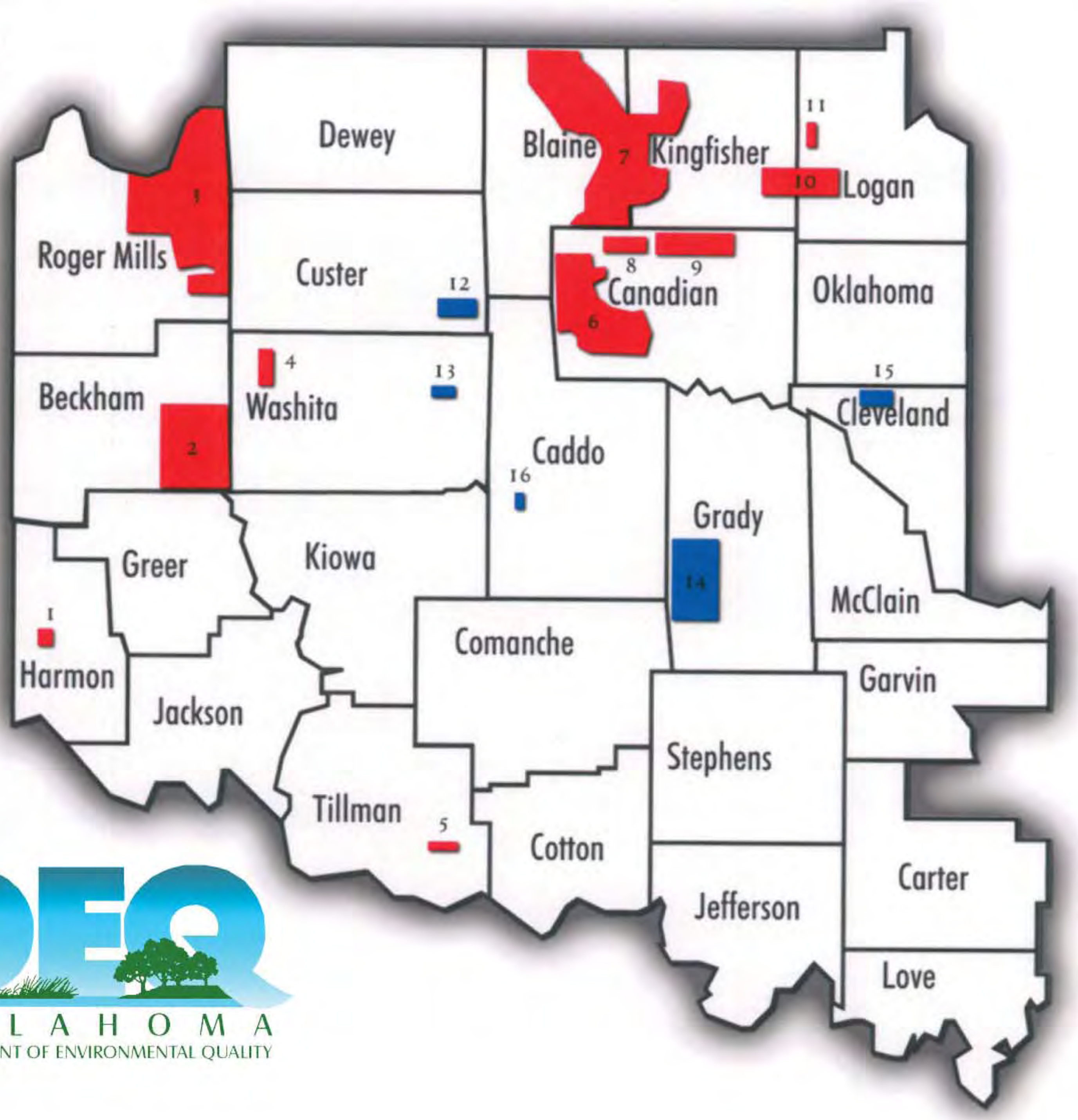
Nitrates and Arsenic

Nitrates:

1 Hollis
2 Beckham Co. RWD #1
3 Roger Mills RWD #2
4 Canute
5 Grandfield
6 Canadian Co. RWD #1
7 North Blaine Water
8 Okarche RWD
9 Okarche
10 Logan Co. RWD #2
11 Loyal

Arsenic:

12 Weatherford
13 Eakly
14 Grady Co. RWD #7
15 Moore
16 Corn



OKLAHOMA
DEPARTMENT OF ENVIRONMENTAL QUALITY

Oklahoma Water Resources Board—Water Quality Monitoring

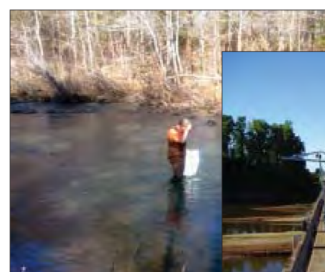
The overall program goal of the Oklahoma Water Resources Board's Beneficial Use Monitoring Program (BUMP) is to provide quality, relevant data to facilitate a broad range of water quality management decisions. The BUMP data provide information critical to the decision-makers across a variety of federal and state government agencies, municipalities, industry, and researchers. The design of the program allows for quality data to be used in determination of impairments, design and implementation of point and non-point source controls, formulation of water quality discharge permits, detection of long-term trends, revision of water quality standards, and numerous other applications that are watershed dependent. The program accomplishes this through various tasks related to both stream/river and lakes monitoring. Additionally, all monitoring is conducted under the auspices of a quality control document guided by documented data quality objectives and detailed standard operating procedures.

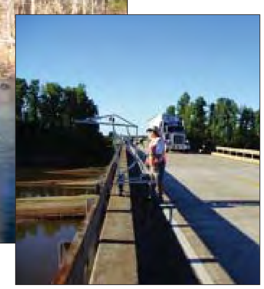
The OWRB is currently monitoring approximately one hundred thirty-five (135) stream/rivers stations annually. These sites are segregated into two discrete types of monitoring activities. The first monitoring activity is focusing on fixed station monitoring. For this program, staff visits ninety-one (91) stations across the state on a bimonthly basis. Also, supplemental data are collected one or two times during periods of higher than normal discharge. In addition to the collection of water quality variables, the program also maintains continuous discharge records at all but a handful of sites. The second stream/river monitoring activity focuses on a number of sample sites whose locations rotate on an annual basis. These sites are selected at random and allow a general determination of the overall condition of the state's waters on a biannual basis. Additionally, OWRB staff conducts quarterly sampling of approximately 35 lakes annually with repeat sampling occurring every three to four years. Fixed station lakes monitoring goal is designed to facilitate sampling on the 130 largest lakes in Oklahoma.

General Water Quality Monitoring

Why? Chemical and physical monitoring provide real data to support real world water quality management strategies including detailed assessments of status, trend analysis, and permitting and other pollution control activities. Much of water quality standards are based on the chemical composition of water.

When? Sampling frequency depends on the program and waterbody type. In general, stream/river stations are visited 6-12 times annually while lakes are visited quarterly. So that long-term status and trends can be calculated, stations are maintained in a network that is active over many years.





How? OWRB staff use a variety of methods to collect water quality information, each of which is explicitly defined in Standard Operating Procedures (SOP).

- For nutrients, minerals, and metals, staff use a combination of methods including depth-integrated composites, grab composites, and point grabs (depending on waterbody type, flow, and depth). Samples are returned to the State Environmental Laboratory for analysis.
- Other parameters (e.g., hardness, turbidity and ammonia) are measured in-field using Hach instrumentation and EPA approved methodology.
- For in situ parameters (such as dissolved oxygen, temperature, pH, and conductivity), field staff use YSI multiprobe instruments. Instruments provide great accuracy and repeatability of measure.

- In some parts of the state, multiprobe instruments have been deployed to collect real-time data. Depending on the task, continuous dissolved oxygen, pH, and conductivity have been collected. Deployed instrumentation have assisted the Grand River Dam Authority with relicensing efforts, provided information for southwest Oklahoma chloride control activities, and determined that low pH in southeastern Oklahoma was due to naturally-occurring conditions (saving the states millions of dollars in un-needed pollution control activities).

Biological Monitoring

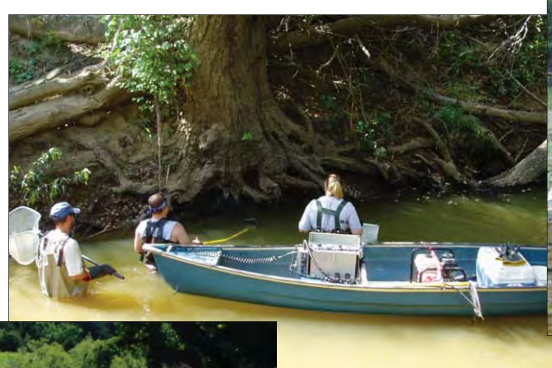
Why? Biological data also supports multiple water quality management strategies including detailed assessments of status, trend analysis, and permitting and other pollution control activities. Biomonitoring provides the link between water quality and ecology because organisms integrate perturbance over time, and can also be harbingers of broader water quality issues.

When? Sampling frequency depends on the program and biological group. Water column algae are collected year round during general sampling activities, while benthic algae are only collected during the growing season (late spring through summer) as part of biological collections. Benthic macroinvertebrate (bugs) sampling occurs biannually during defined index periods during both the summer and winter, while fish are collected during spring/summer months once every 4-5 years.

How? Collection methodology depends on the organism being sampled. Generally, all collections occur over a defined reach (typically 40x the average wetted width), with minimum and maximum reach lengths set at 150 and 4000 meters, respectively. Over the entire reach, sampling occurs in a systematic fashion according to available habitat and reach size, allowing samples from one stream to be compared to another.

- Benthic algal sampling is done at equidistant transects throughout the sampling reach. Staff randomly choose either loose or hard substrates and collect a defined area of algae using an aspirator and scrubber. Samples are composited over the reach and filtered for analysis.


- Fish sampling occurs as a single or double pass over the entire reach with all habitats sampled. Effort is often defined by the gear used, which is turn defined by stream size and conductivity. For all waters with conductivity below 2,500 uS/cm, electrofishing is standard protocol. The OWRB uses a variety of transport methods including backpacks, prams, boats, and ATVs.
- For waters with conductivities greater than 2,500 uS/cm, seining is typically the preferred gear. In large rivers with high conductivity, staff sometimes uses a larger, more powerful boat electrofishing unit.

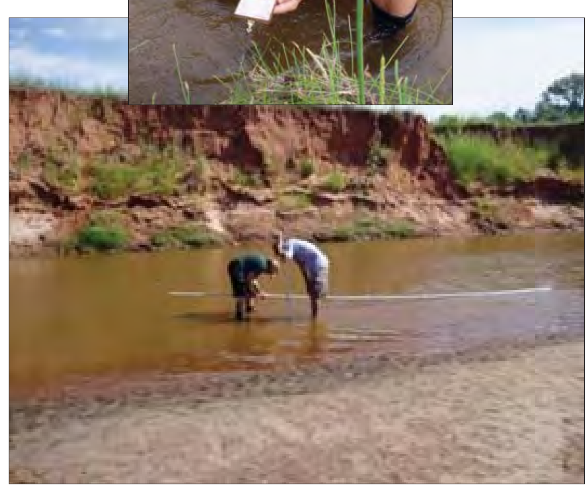




- Most fish are typically processed in the field, with voucher specimens returned or photo documented and more difficult to ID fish preserved.

- Benthic macroinvertebrates are collected reach-wide from a variety of habitats including woody debris, streamside vegetation, and riffles. Crews use either D-frame nets or kick nets, and composite collections into habitat types. Bugs are post-processed in the lab with a set number "picked" to represent the sample as a whole.

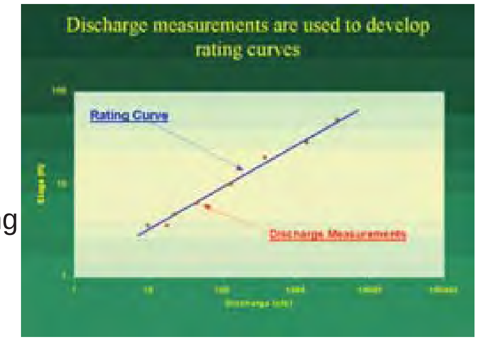
- Supplemental to all biomonitoring are detailed measurements of the available habitat. These measurements include streamflow, depth, width, substrate type, habitat type, canopy, bank stability, and riparian classification. Data are collected both at equidistant transects over the entire reach as well as between transects.



Streamflow Monitoring and Gaging

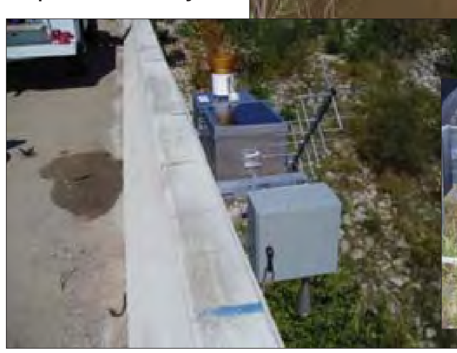
Why? Streamflow is directly related to both water quality and quantity planning. Without streamflow information much of the use of water quality data is limited. Streamflow allows for nutrient loadings to be calculated and is important for fully understanding changes in water quality over time. Streamflow information is also vitally important to understanding the amount of habitat available for biological organisms. Gaging provides an additional piece of information by directly relating streamflow (discharge) to stream depth (i.e., stage). Gaging creates greater efficiency in field activities because streamflow can be interpolated from stage, and can also provide a continuous streamflow record which allows for water quality information to be considered over broader timeframes (e.g., annual loads) and for broader purposes such as discharge permits. Gaging data are also vitally important to water planning activities because the information is often the only source of concrete data available for determining stream water allocation models. The water permitting process relies heavily on this information for timely and accurate allocation of water to users around the state.

When? Streamflow monitoring occurs in some fashion during each sampling event. Nearly all of the OWRB's permanent monitoring locations have either a recording (data collection platform or DCP) or a non-recording gage (wire-weight box or staff gage) installed. At these locations, discharge/stage rating curves are maintained by the USGS, USACE, or OWRB. If these gages are accurate and have adequate data to establish a well-maintained rating curve, streamflow can be extrapolated from stage, making crews more efficient during water quality sampling events. At other monitoring locations, streamflow is often taken as an instantaneous measurement while at the site.



How? As was stated above, streamflow is either an extrapolated or a direct measurement. Each is described below.

- Instantaneous measures of streamflow occur across a single transect of the waterbody at a single point in hydrologic time. Obtaining an accurate streamflow requires multiple measures of depth and velocity at various points along the transect. These are then composited and value of "total Q" is calculated.
- Stream gaging adds an additional dimension to the streamflow measurement by relating it to stage. This relationship, commonly known as a discharge/stage rating, requires regular maintenance through measurements and surveying. However, if maintained accurately and fully, the rating curve can provide a continuous streamflow record, or at the very least, allow staff to extrapolate a streamflow value (Q) through an indirect measurement of stage.



Chloride Control Monitoring

In southwest Oklahoma, the OWRB is active in nearly every county with sampling stations located across the major watersheds as well as a number of lakes. As was mentioned before, the flexibility of the BUMP allows it to be utilized for a wide variety of purposes. In addition to BUMP activities, the OWRB has played an active role in chloride control management activities throughout the North Fork watershed. In coordination with the US Army Corp of Engineers (USACE) and the Lugert-Altus Irrigation District (LAID), the OWRB has maintained six real-time water quality monitoring stations for the past three years (Figure 1). The goals of the monitoring include:

1. Collect basin wide minerals (i.e., chloride and sulfate) and specific conductivity data to assist the USACE in future chloride control modeling efforts.
2. Develop a relationship between chloride and specific conductivity so that chloride concentrations may be tracked on a continuous basis.
3. Determine the baseline biological condition in the drainage.

Data collection efforts have provided information to assist in the water quality management activities of region. The concentrations of salts throughout the North Fork watershed are illustrated in Figure 2. This graphic uses specific conductivity as a surrogate for salt concentration. Included are a station along the mainstem of the North Fork River as well as stations representing the two major tributaries—the Elm Fork River (Carl and Granite) and Elk Creek. The graph clearly demonstrates several characteristics of the basin. First, the majority of salt entering the basin is emanating from near the upper end of the Elm Fork tributary (Carl station), and second, salt concentrations in the North Fork River are greatly reduced by the fresher water entering from Elk Creek.

Excessive salt concentrations affect several beneficial uses of the flowing waters in the basin. First, high salinity produces chloride concentrations that impair the agricultural beneficial use on both the Elm Fork and the North Fork Rivers. Both segments are listed for chlorides in Oklahoma's Integrated Water Quality Report. This relationship is illustrated in Figure 3 by the direct correlations between chloride and conductivity in both rivers. Second, fish collections throughout the watershed demonstrate the effect of high salt concentrations on the biological community. In Figures 4 and 5, the relationship between conductivity and biological health is explored.

In Figure 4, an index of biological integrity (IBI) commonly used by the OWRB is compared conductivity. IBIs are used to determine biological integrity because they combine a variety of community characteristics into one score. This score is then compared to an acceptable baseline in order to determine community health—the higher the IBI percentage, the healthier the community. This graph clearly demonstrates that a highly correlated, inverse relationship exists between community health and conductivity. In Figure 5, this relationship is further explored by comparing conductivity to one of the characteristics used to create the IBI, total number of fish species. Again, a strong, inverse relationship is demonstrated between number of species and conductivity.

Figure 1. Southwest Oklahoma Chloride Control Water Quality Stations

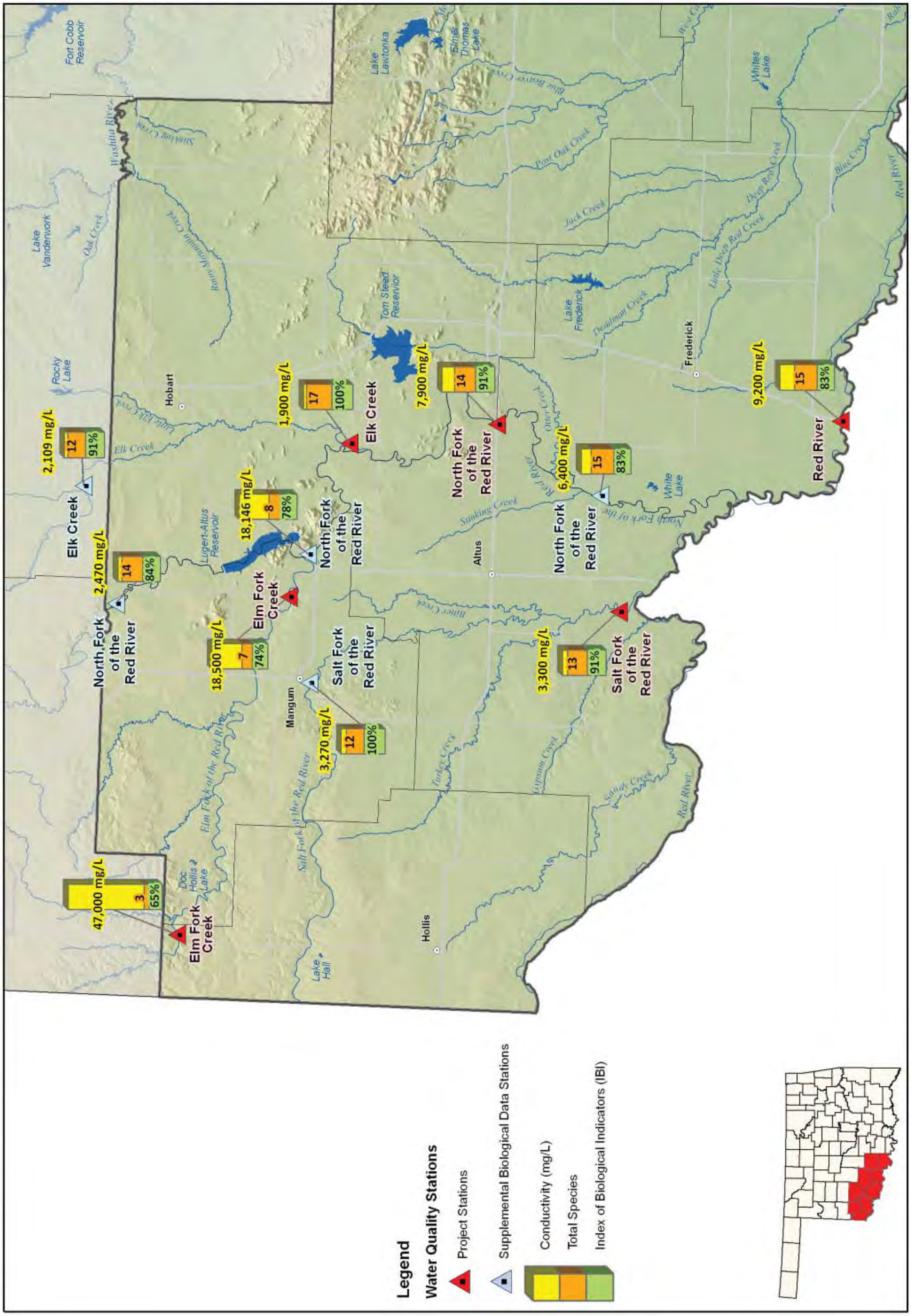


Figure 2. Mean and maximum conductivity values for the North Fork of the Red River and its major tributaries—the Elm Fork River and Elk Creek.

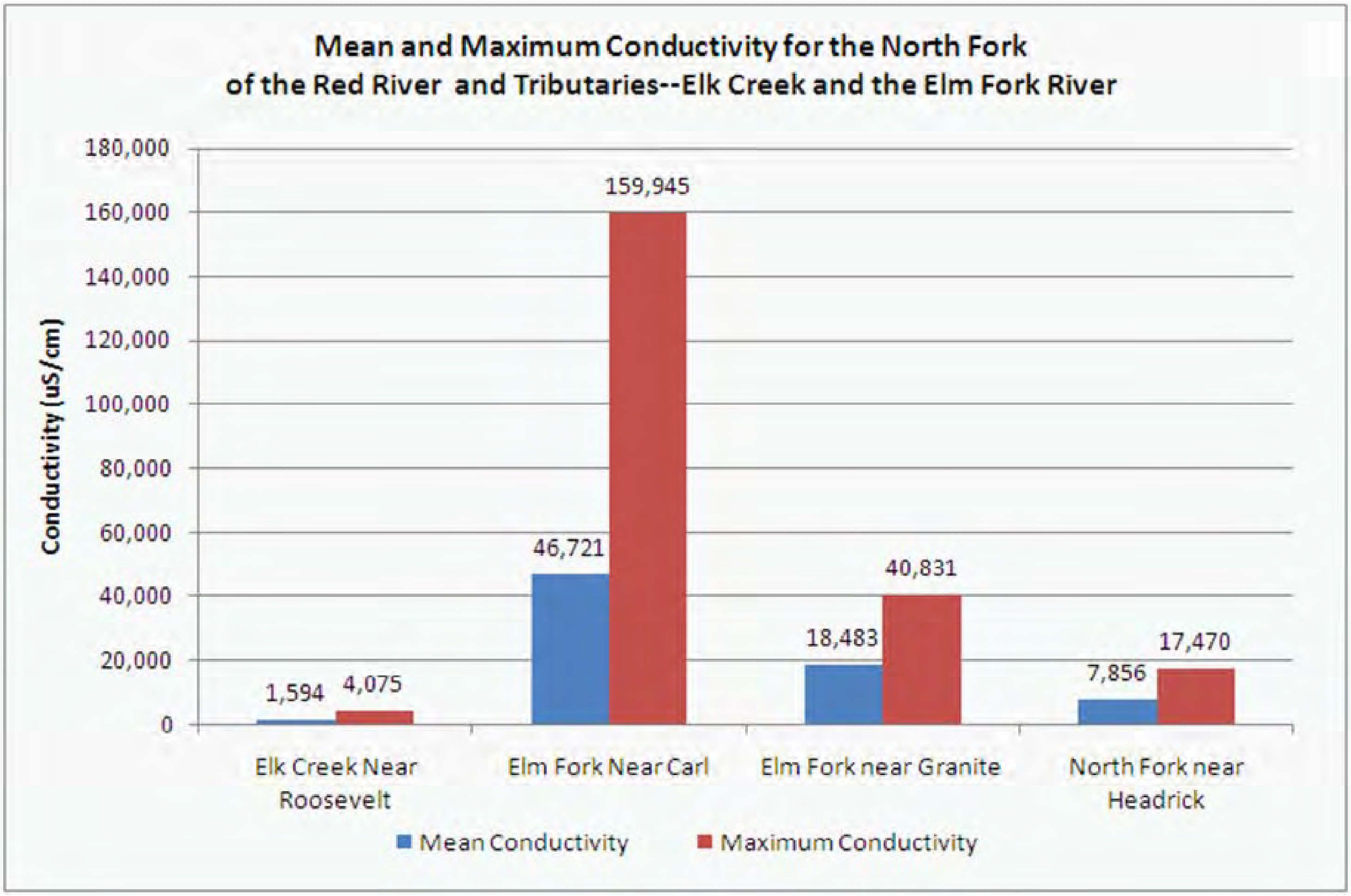
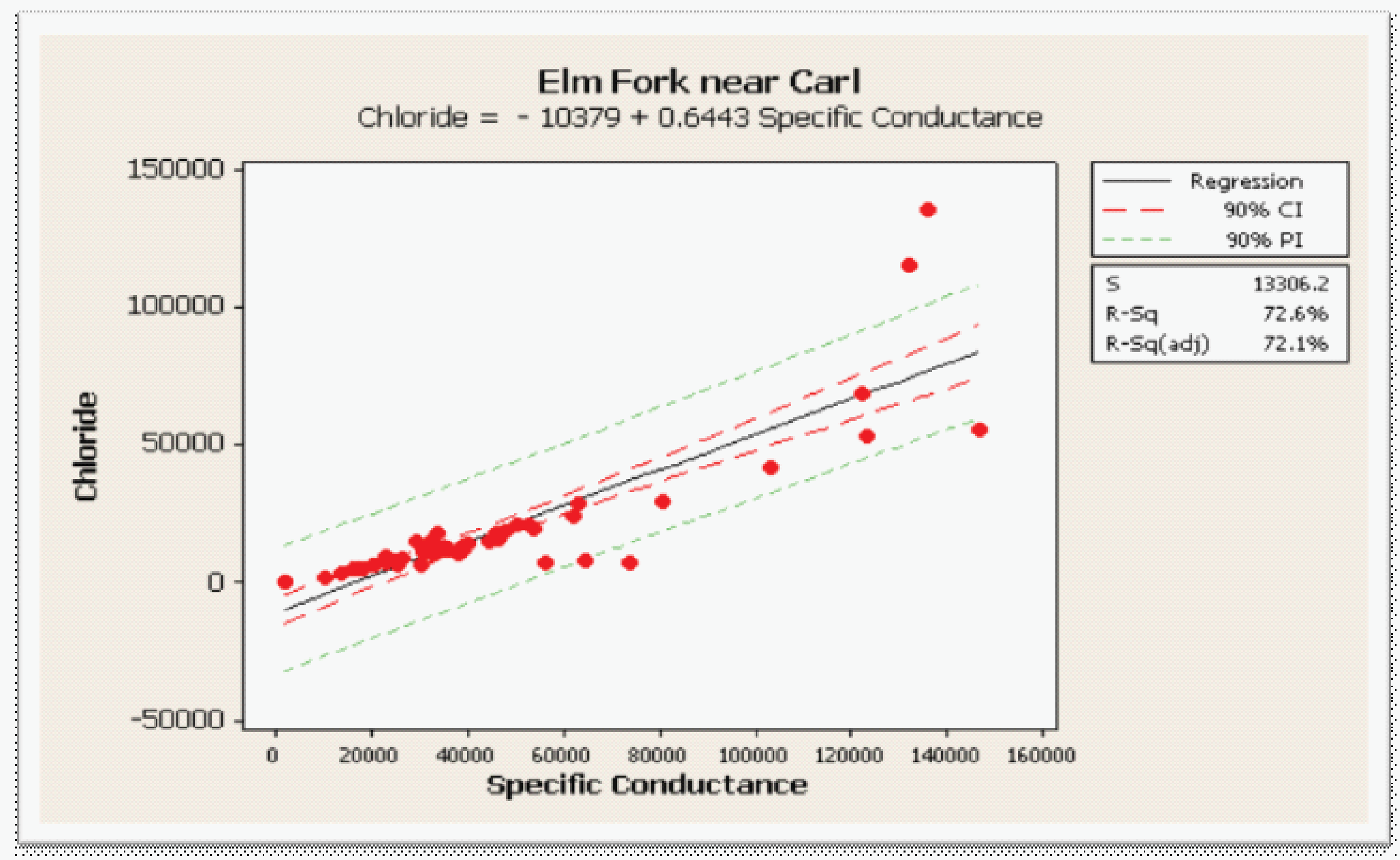


Figure 3. Graphs illustrate the relationship between conductivity and chloride concentrations in the North Fork and Elm Fork Rivers. Higher r2 values indicate better relationship.



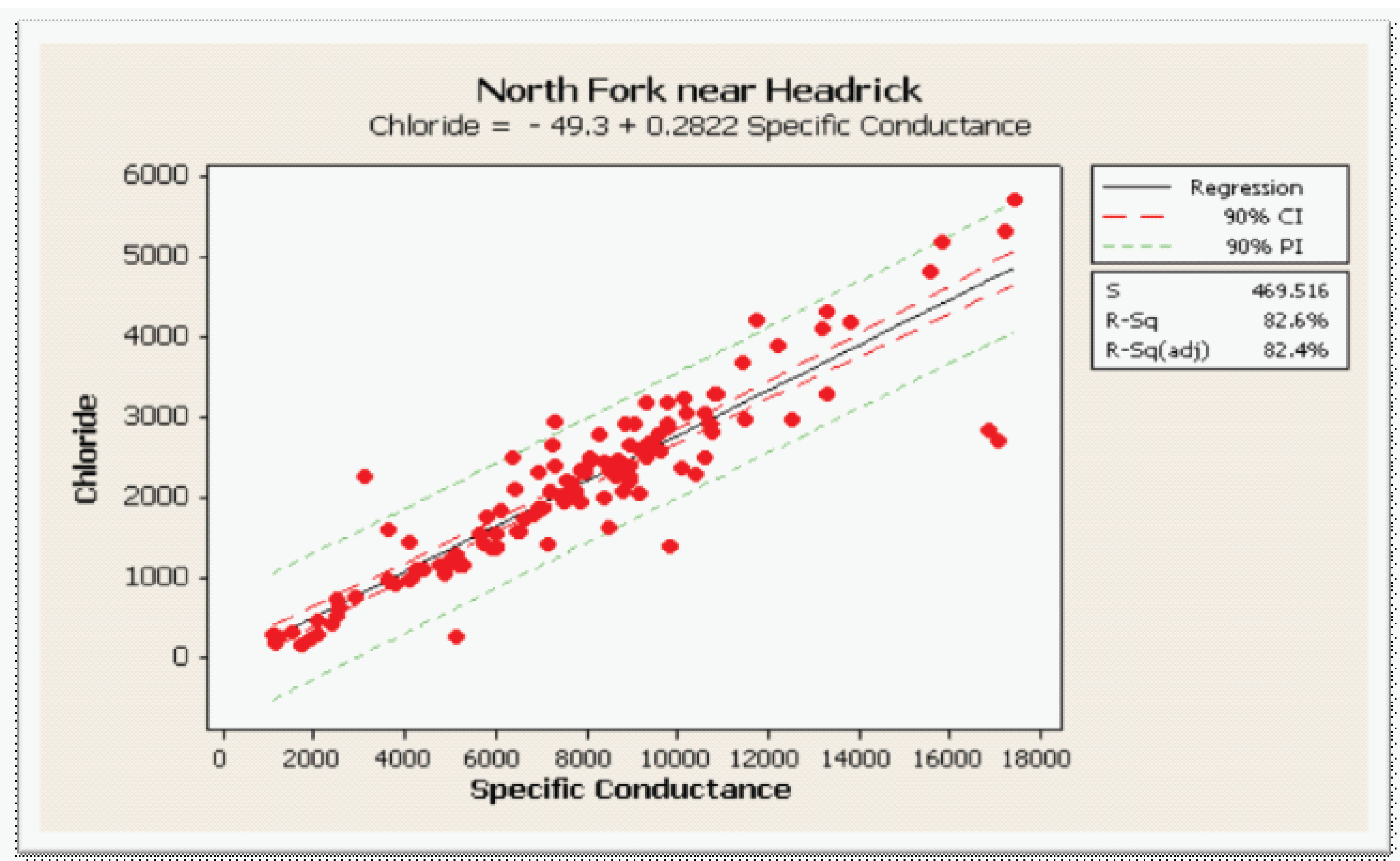


Figure 4. Graph illustrates the relationship between conductivity and IBI percent score for biological collections in the North Fork River watershed. Higher r2 values indicate better inverse relationship.

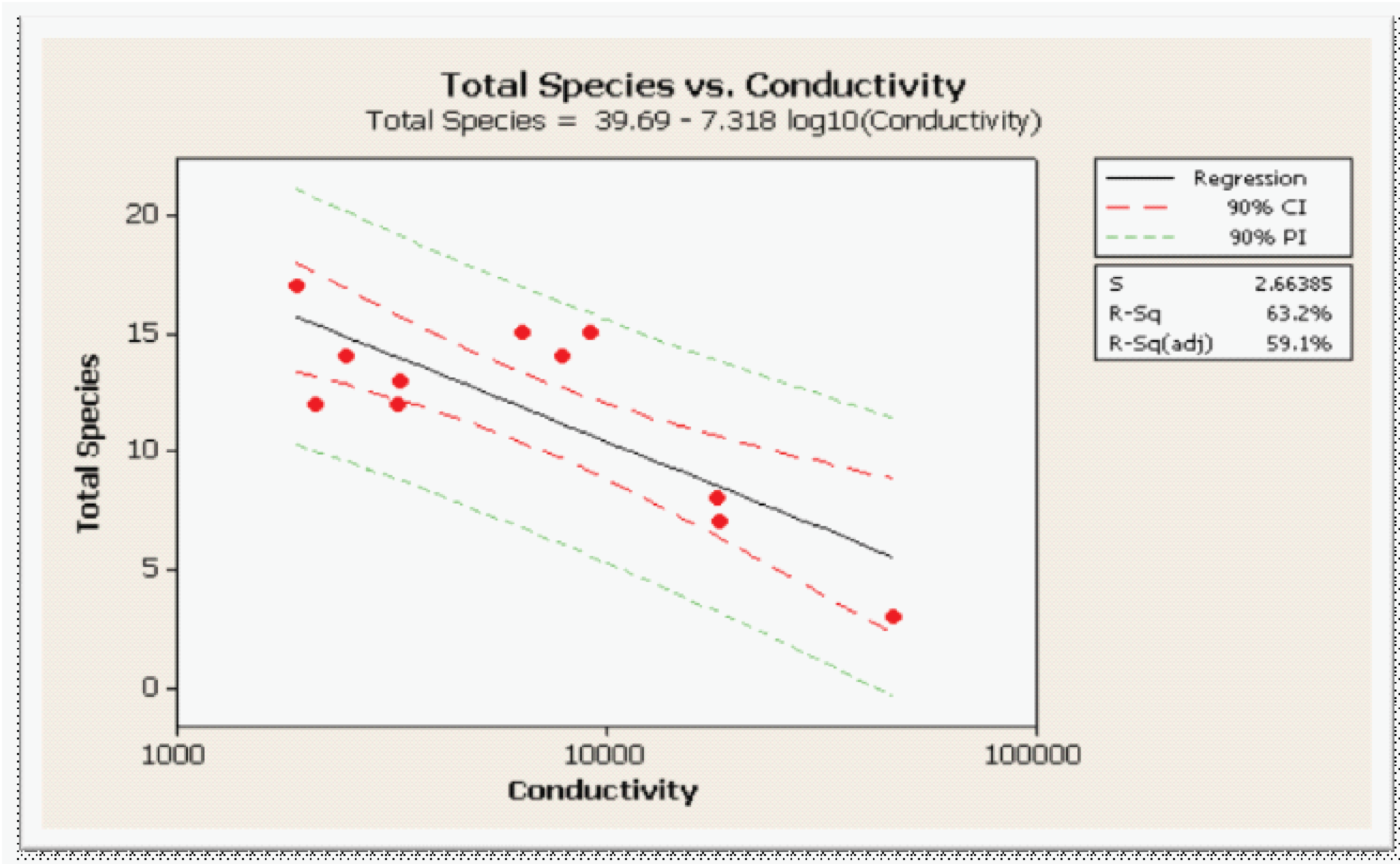
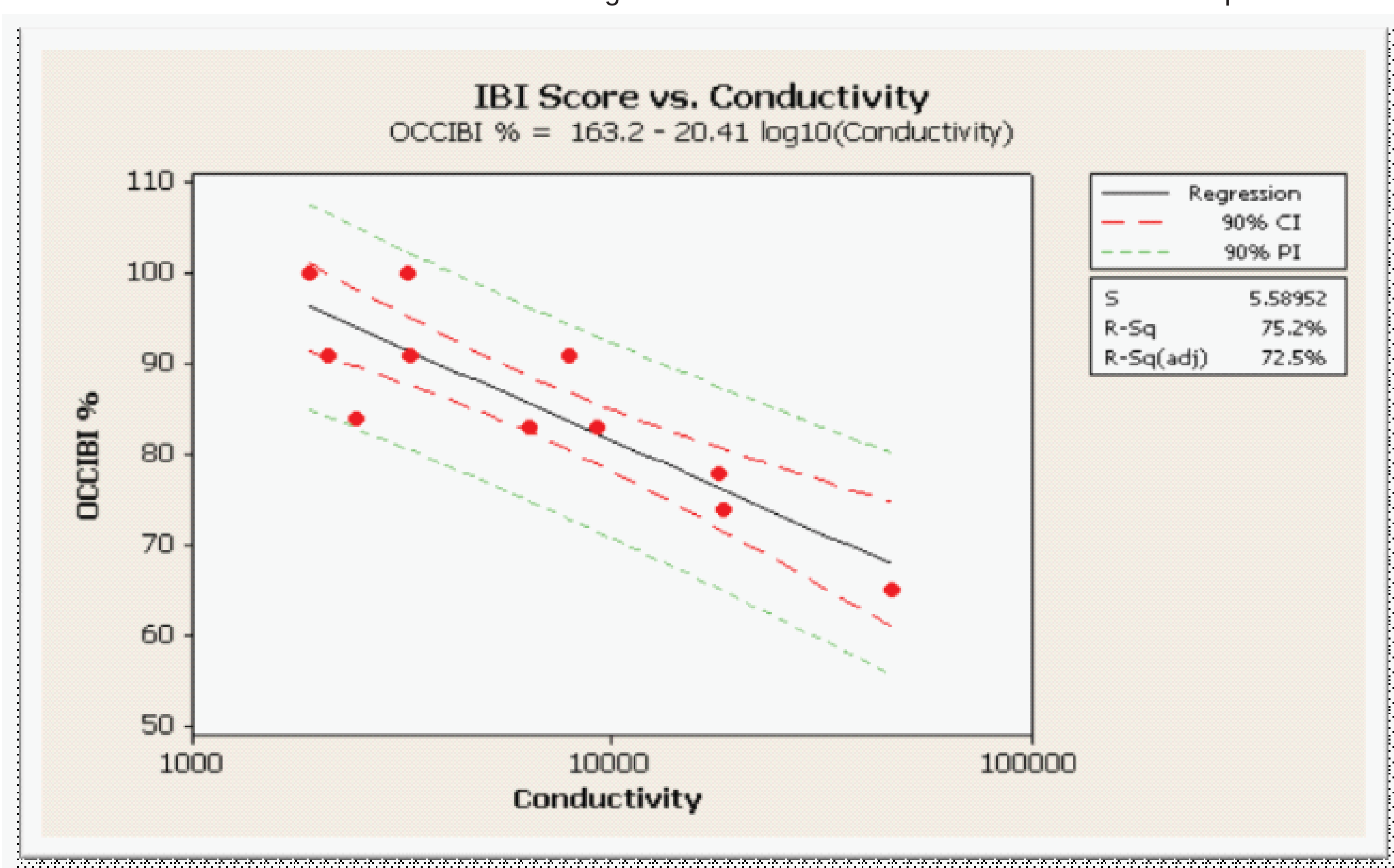


Figure 5. Graph illustrates the relationship between conductivity and number of total species for biological collections in the North Fork River watershed. Higher r2 values indicate better inverse relationship.

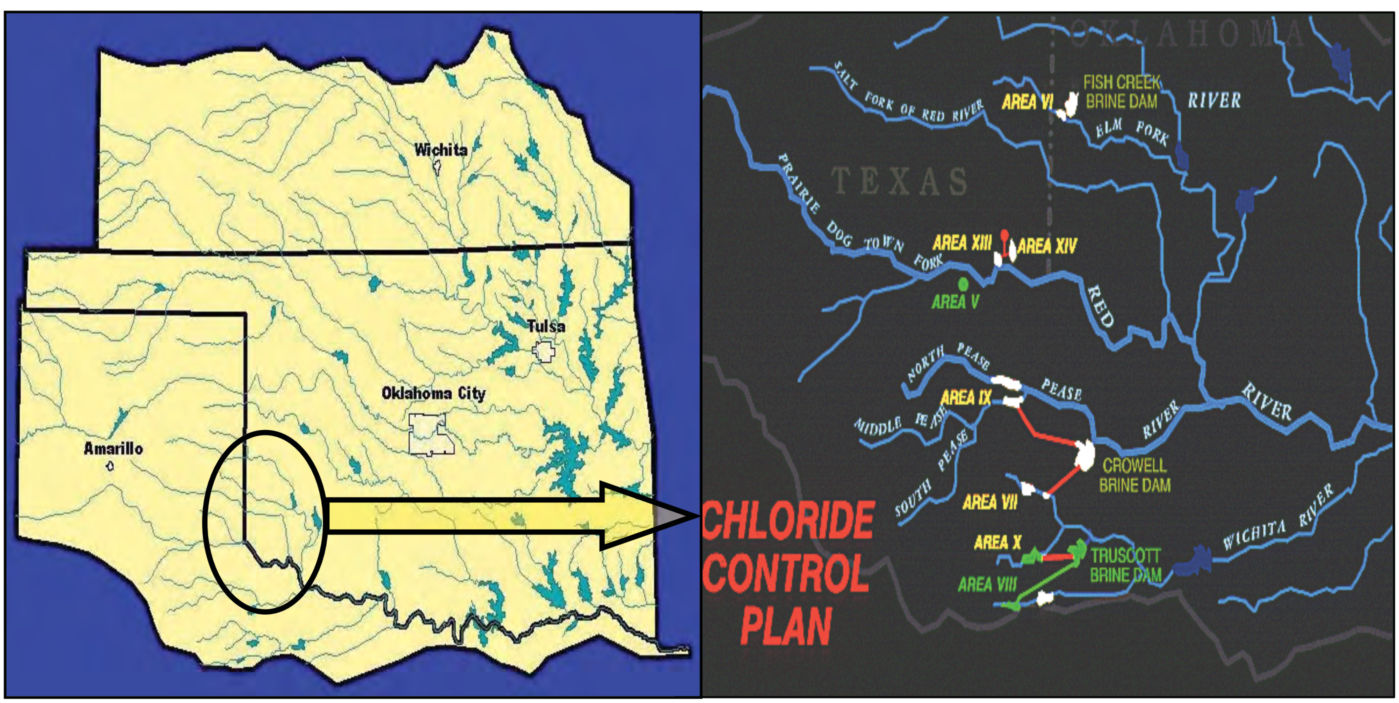


Red River Chloride Control Project
Texas and Oklahoma

The project is to reduce naturally occurring chlorides and total dissolved solid concentrates in the Upper Red River Basin to allow economical use of water for municipal, industrial, and agricultural purposes. The project is authorized under the Flood Control Acts of 1966 (PL 89-789) & 1970 (PL 91-611); Water Resources Development Act of 1974 (PL 93-251), 1976 (PL 94-587), 1986 (PL 99-662) and Sec 3136 of WRDA 2007 (PL 110-114).

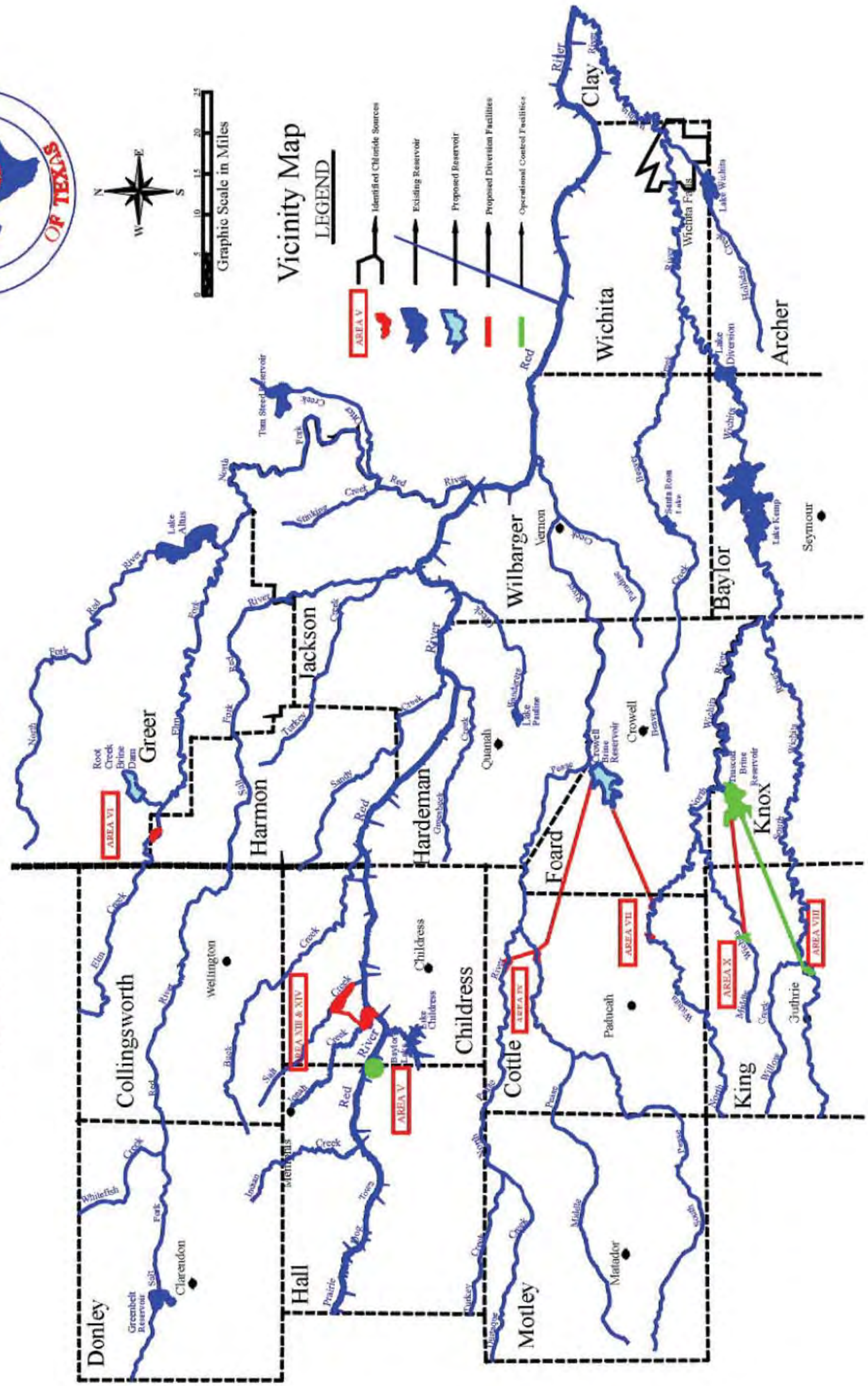
The Red River Basin Chloride Control project is located in northwest Texas and southwest Oklahoma. This project is designed to control natural chloride brine emissions at ten major source areas to improve water quality for municipal, industrial, and agricultural use. Improvements include construction of low flow dams, pump stations, and diversion pipelines to impoundment facilities.

This project is a select major water strategy of the 2007 Texas Water Plan for the region -“The Chloride Control Project strategy would provide a total of 26,500 acre-feet per year to agricultural producers . . . And steam-electric power generation …” Proposed activities include resumption of construction efforts, acquisition of the remaining rights of way, continued reevaluation efforts on the Elm Fork, Area VI element of the project and continued environmental monitoring activities.

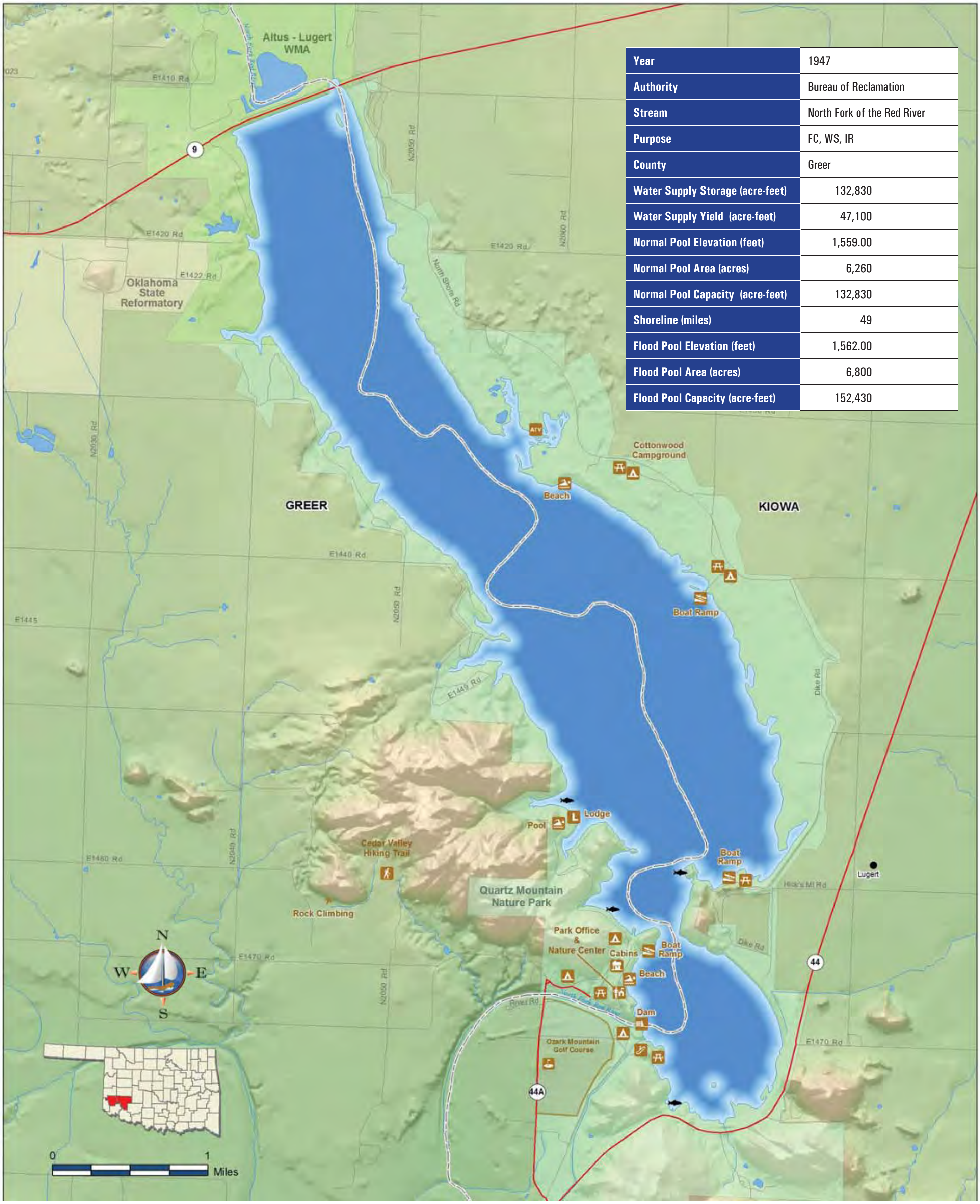


Red River Basin Chloride Control Project

Oklahoma & Texas



Lugert-Altus Reservoir

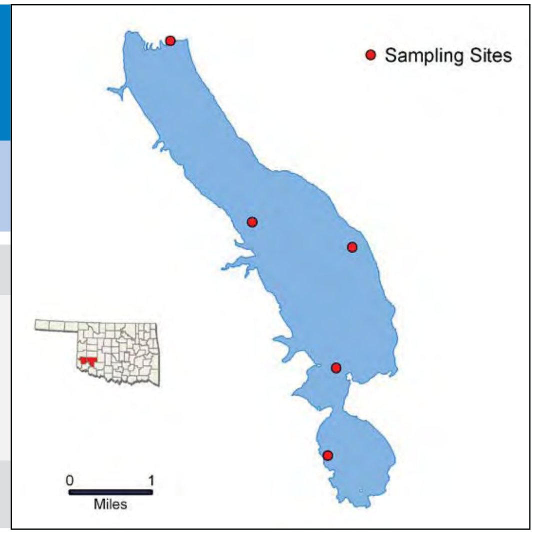


Year	1947
Authority	Bureau of Reclamation
Stream	North Fork of the Red River
Purpose	FC, WS, IR
County	Greer
Water Supply Storage (acre-feet)	132,830
Water Supply Yield (acre-feet)	47,100
Normal Pool Elevation (feet)	1,559.00
Normal Pool Area (acres)	6,260
Normal Pool Capacity (acre-feet)	132,830
Shoreline (miles)	49
Flood Pool Elevation (feet)	1,562.00
Flood Pool Area (acres)	6,800
Flood Pool Capacity (acre-feet)	152,430

Beneficial Use Monitoring Program

Lugert-Altus

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



Lake Data

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

Parameters

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

Beneficial Uses

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

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

Notes

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

*Metals not collected this sample period.

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

W.C. AUSTIN PROJECT, OKLAHOMA

The W. C. Austin (formerly Altus) Project is in southwestern Oklahoma. The project is designed to provide water for irrigation to approximately 48,000 acres of privately owned land in southwestern Oklahoma, flood control on the North Fork of the Red River, and an augmented municipal water supply for the city of Altus. Additionally the project provides fish and wildlife conservation benefits and recreation facilities. Project features include Altus Dam and a 270-mile distribution system.

Facility Descriptions
Altus Dam is a concrete gravity, partially curved structure faced with granite masonry except on the downstream face of the overflow section. The dam is 110 feet above the foundation and is 1,104 feet long. It contains 70,200 cubic yards of concrete and masonry. Incorporated within the dam section are both controlled and uncontrolled overflow-type spillways and an irrigation outlet works which delivers water into the project canal system. The 58,000-cubic-foot-per-second spillway is regulated by nine radial gates. Lake Altus has a total capacity of 162,526 acre-feet, of which 633 acre-feet are dead storage, 19,626 acre-feet are flood control storage, and 128,286 acre-feet are conservation storage. 10,000 acre-feet of conservation storage is reserved for municipal water for Altus. Appurtenant reservoir structures are Lugert, East, North, and South Dikes, located at low places on the reservoir rim. Lugert Dike, the largest, is 4,245 feet long and has a maximum height of 45 feet.

Canal and Lateral System
Altus water is delivered into the 1,000-cubic-foot-per-second-capacity Main Canal, which transports the water 4.2 miles to the northern boundary of the project`s irrigable lands. This canal crosses the North Fork of the Red River by means of a 10-foot 3-inch-diameter siphon, 1,920 feet long. Approximately 270 miles of canals and laterals, including the Main Canal, are required to serve project lands. The terminus of the Main Canal forms a bifurcation for diverting into the 21.7-mile Altus and the 11.1-mile West Canals, which serve the main delivery system. The 14.8-mile Ozark Canal branches off from Altus Canal.

Operating Agencies
The Lugert-Altus Irrigation District is responsible for the operation and maintenance of the project.

History
Greer County was formed in 1886 by an act of the Texas legislature. At that time, the State of Texas contended that the North Fork of the Red River was the boundary between Oklahoma and Texas. The U.S. Supreme Court decreed in 1896 that Greer County belonged to Oklahoma. The present counties of Jackson, Greer, and Harmon were formed later from the original Greer County. The area was largely homesteaded prior to 1890. Most of the project lands were dry-farmed for many years prior to the construction of Altus Dam. Crop yields were good in wet years and poor in dry years. Irrigation of small tracts by private interests after 1927 demonstrated the value of irrigation.

Investigations
Engineering investigations to determine the feasibility of developing an irrigation project in the area began in 1902, and continued periodically until 1937. During 1937, renewed interest in irrigation by local civic leaders and the State of Oklahoma resulted in further investigations by several Federal agencies. The efforts of these agencies were coordinated and the remaining investigations and construction preliminaries were conducted by the Bureau of Reclamation. A project planning report issued in December 1937 recorded the results of the investigations.

Authorization
Construction of the W. C. Austin Project was authorized by the Rivers and Harbors Act of June 28, 1938 (52 Stat. 1215, 1219), and specifically by the President on February 13, 1941.

Construction
Construction began on April 21, 1941, but was interrupted by World War II. Work resumed on May 12, 1944, when the War Production Board lifted restrictions. The first section of canal lying within the project lands was completed on April 30, 1946. First water deliveries to project lands were made on June 19, 1946. Construction of the distribution system was completed in 1949. Main drainage features were completed during 1953. Several additional miles of drains have been constructed by the Lugert-Altus Irrigation District.

Irrigation
The mean annual rainfall in the project area, although sufficient to grow fairly good crops, often is so poorly distributed that droughts are frequent. Irrigation supplements the inadequate rainfall, stabilizes the economy of the area, and permits a more diversified agriculture. Cotton is a major crop under irrigation, as it was under dry farming in the project area. Wheat, another major dry land crop, is being replaced by alfalfa, grain sorghums, potatoes, onions, and other specialty crops.

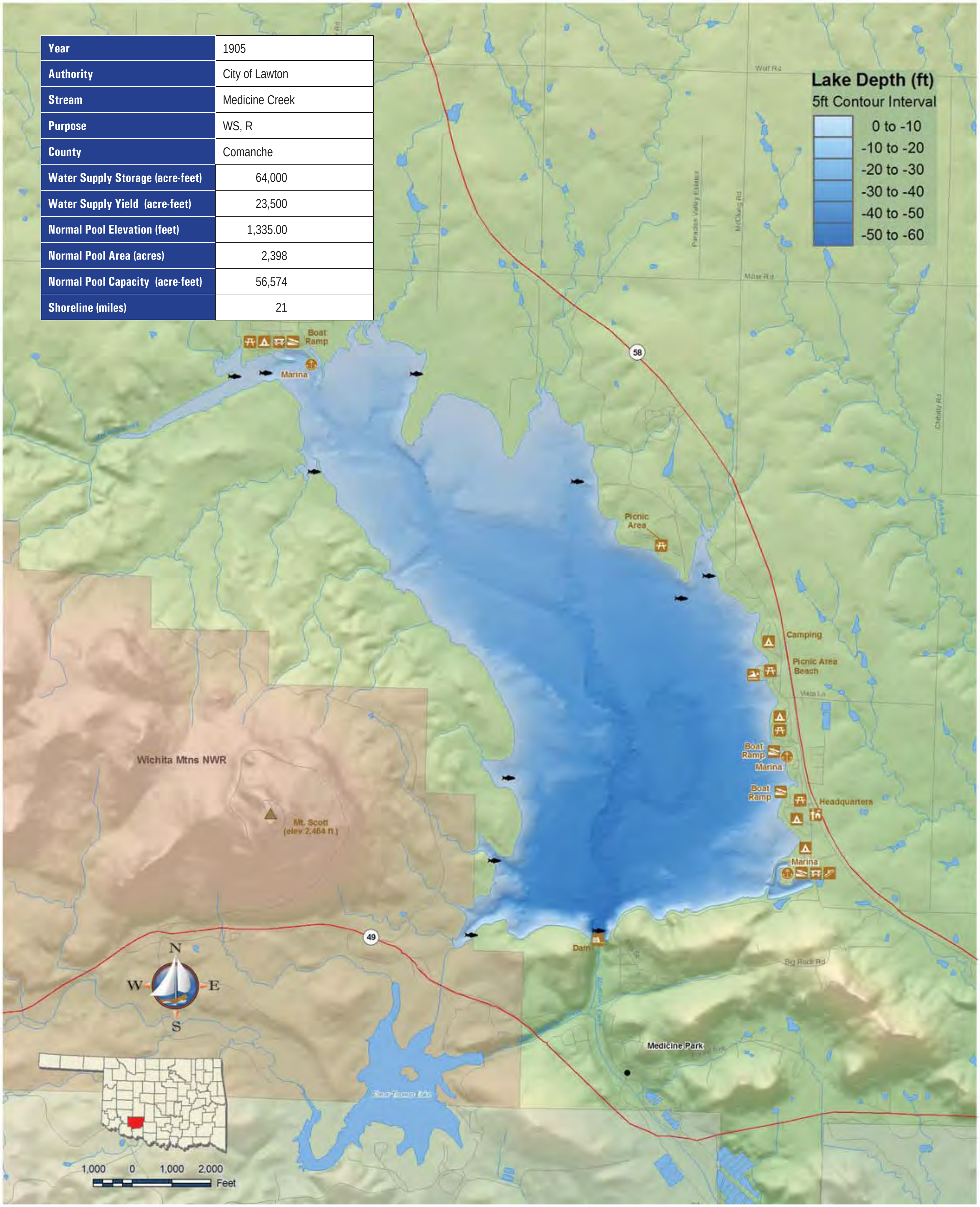
Recreation
Lake Altus, in the scenic Quartz Mountains, offers year-round recreation. The south portion of the area adjacent to the reservoir is managed for recreation purposes by the Oklahoma Department of Higher Education. The north portion of the reservoir area is managed for wildlife benefits by the Oklahoma Department of Wildlife Conservation. This includes a total water surface area of over 6,500 acres, and a land area of over 4,000 acres.

The Quartz Mountain Recreation Area is located at the west edge of the reservoir. Public recreation facilities of all types are available, including an 18-hole golf course, lodging, organized group camps, recreation-vehicle and tent camping, swimming, boating, picnic areas with shelters and tables, restrooms, and hiking trails. Fishing and hunting are popular, as well as picnicking, sightseeing, and many water sport activities. The Department of Higher Education also operates a performing arts theatre adjacent to the lodge.

Flood Control
Lake Altus, the primary storage unit for Altus Dam, has 19,626 acre feet of capacity assigned to flood control. The W.C. Austin Project provided an accumulated $11,225,000 in flood control benefits from 1950 to 1999.

Lake Lawtonka

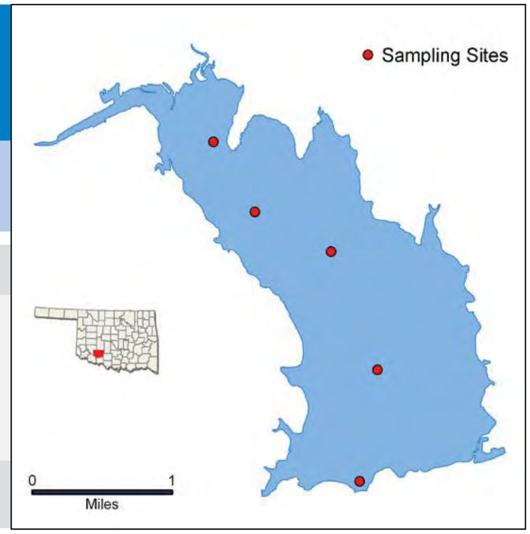
Year	1905
Authority	City of Lawton
Stream	Medicine Creek
Purpose	WS, R
County	Comanche
Water Supply Storage (acre-feet)	64,000
Water Supply Yield (acre-feet)	23,500
Normal Pool Elevation (feet)	1,335.00
Normal Pool Area (acres)	2,398
Normal Pool Capacity (acre-feet)	56,574
Shoreline (miles)	21



Beneficial Use Monitoring Program

Lawtonka

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



Lake Data

Location	Comanche County
Impoundment	1905
Area	2,398 acres
Capacity	56,574 acre-feet
Purposes	Water Supply, Recreation

Parameters

	Parameter	Result	Notes/Comments
	Average Turbidity	8 NTU	100% of values <OWQS of 25 NTU
	Average True Color	26 units	100% of values < OWQS of 70
	Average Secchi Disk Depth	108 cm	
	Water Clarity Rating	Good	
	Trophic State Index	60	
	Trophic Class	eutrophic	
Profile	Salinity	0.11– 0.24 ppt	
Profile	Specific Conductivity	225.2 – 469.7 µS/cm	
Profile	pH	6.76 – 8.60 pH units	
Profile	Oxidation-Reduction Potential	42 - 419 mV	
Profile	Dissolved Oxygen	Up to 67% of water column < 2 mg/L in July	Occurred at sites 1 and 2
Nutrients	Surface Total Nitrogen	0.59 mg/L to 0.81 mg/L	
Nutrients	Surface Total Phosphorus	0.015mg/L to 0.058 mg/L	
Nutrients	Nitrogen to Phosphorus Ratio	23:1	Phosphorus limited

Beneficial Uses

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

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

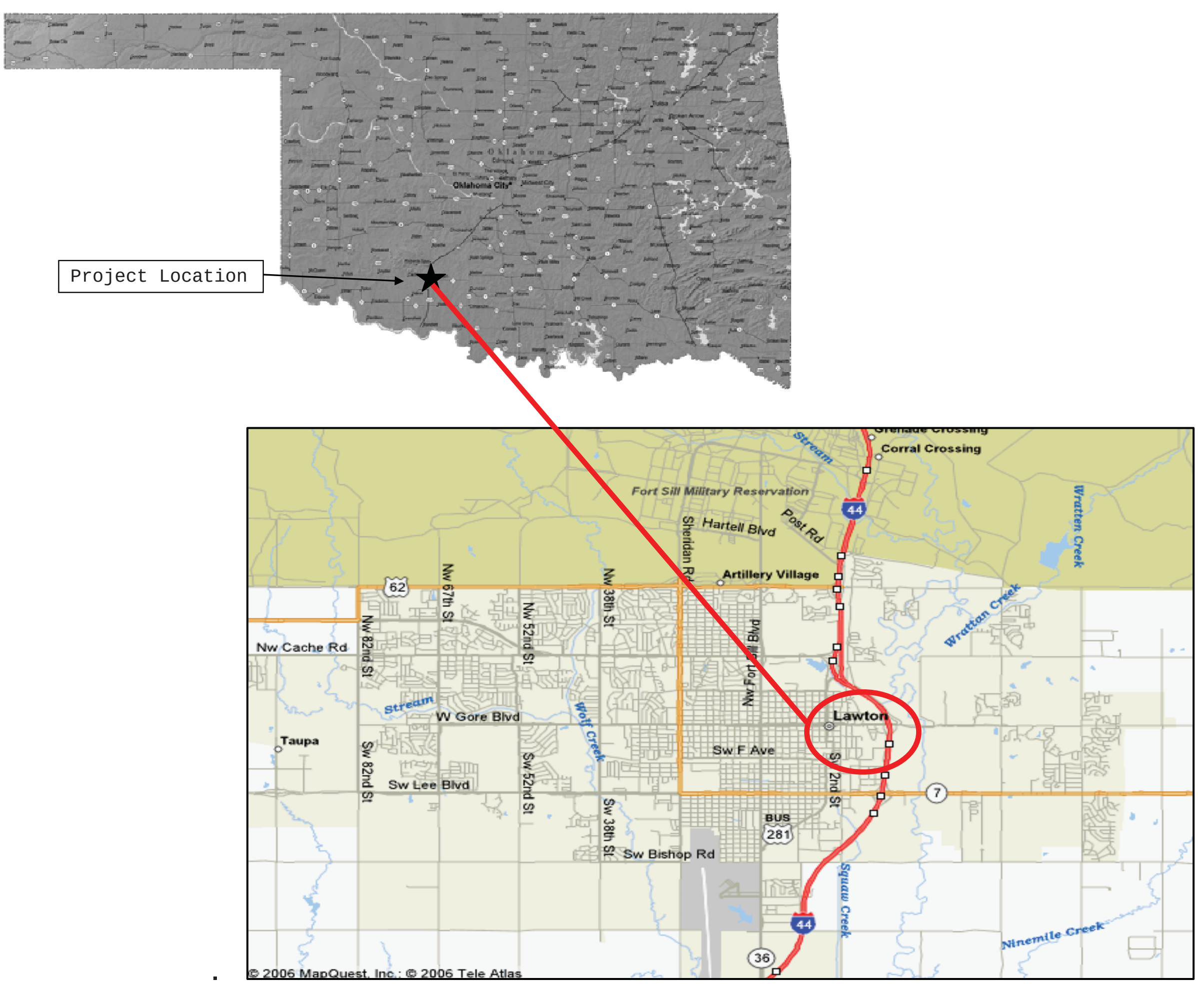
Notes

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

WASTEWATER INFRASTRUCTURE REHABILITATION
LAWTON, OK
SEC. 219 CONSTRUCTION

The City of Lawton is located approximately 100 miles southwest of Oklahoma City in Comanche County, Oklahoma. The project consists of constructing wastewater infrastructure for the City of Lawton, Oklahoma. Funds could be used to complete the project construction. The city is conducting a 20-year, three-phase sewer rehabilitation program in response to a consent order from the Oklahoma Department of Environmental Quality. The program involves a total replacement of sewer pipelines and upgrading of other components. The services provided by the city's infrastructure include off-base housing for the Army Command at Fort Sill. Since the project consists essentially of the construction of linear feet of sewer line, the additional funds means those additional feet of line can be constructed. For this reason, the Sponsor desires to have the project funded at the full authorized amount.

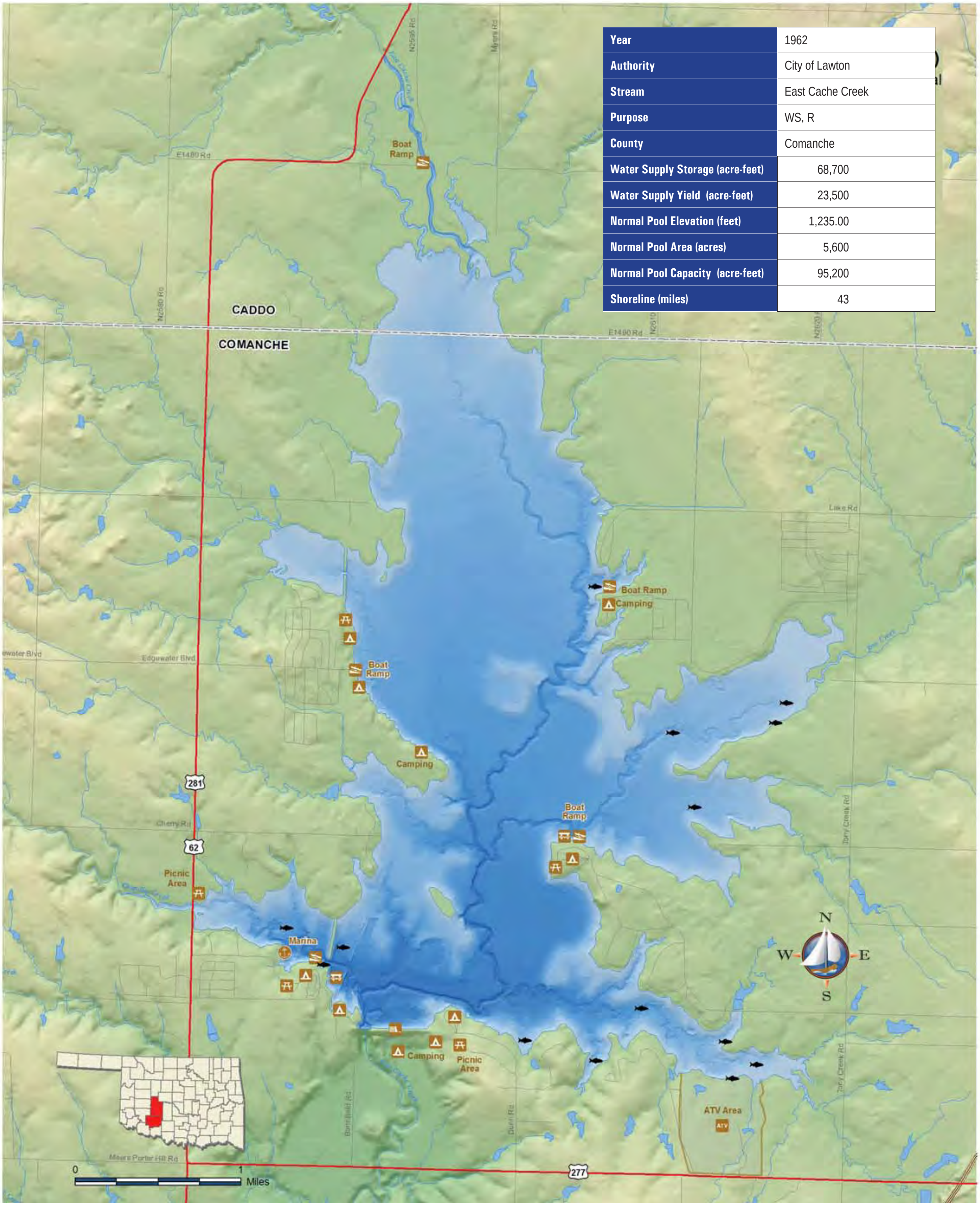
LOCATION MAP
LAWTON ENVIRONMENTAL INFRASTRUCTURE, LAWTON, OK
CONSTRUCTION



Lake Ellsworth

Oklahoma Comprehensive Water Plan OCWP

Year	1962
Authority	City of Lawton
Stream	East Cache Creek
Purpose	WS, R
County	Comanche
Water Supply Storage (acre-feet)	68,700
Water Supply Yield (acre-feet)	23,500
Normal Pool Elevation (feet)	1,235.00
Normal Pool Area (acres)	5,600
Normal Pool Capacity (acre-feet)	95,200
Shoreline (miles)	43



Beneficial Use Monitoring Program

Ellsworth

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

Lake Data

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

Parameters

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

Beneficial Uses

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

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

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

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

Water Plan Goals

- Provide safe and dependable water supply for all Oklahomans while improving the economy and protecting the environment.
- Provide information so that water providers, policy makers, and water users can make informed decisions concerning the use and management of Oklahoma's water resources.

The current update of the Oklahoma Comprehensive Water Plan, originally published in 1980, seeks to establish reliable water supply for all Oklahomans through at least the next 50 years. The OCWP's carefully designed process has received considerable attention as a national model and affirmation as the new future trend in water resources planning.

The update is utilizing an innovative two-pronged approach: inclusive and robust public participation to build sound water policy complimented by expert technical evaluation utilizing state and national authorities on water management. This approach ensures broad public input, comprehensive analysis, and realistic management strategies that will result in an effective and opportunistic plan for Oklahoma's water future.

Policy Development & Public Participation

The public participation process has now entered its third phase, planning workshops, where water resources management strategies are being developed based on information gathered through eleven regional input meetings (held in 2008) and 42 local input meetings (held in 2007) . During the workshops, participants are divided into groups focusing on the following 10 themes:

- Balancing Supply and Demand in the Face of Change
  Responding appropriately to changes in population projections, economic conditions, water uses, and climate so that water supply and demand are balanced.
- Water Conservation
  Improving water use efficiency and reducing water waste.
- Water Availability During and After Hazards
  Enhancing the safety and reliability of water supplies.
- Surface Water-Groundwater Interaction
  Coordinating the management of surface and groundwater resources.
- Land Use Practices
  Protecting and enhancing water quality and quantity through land stewardship.
- Water Sales and Transfers
  Transferring water within the state and selling water to neighboring states.
- Intergovernmental Water Resources Management
  Effective cooperation between Oklahoma and neighboring states, tribal governments, local governments, and the federal government.
- Inter-Agency Water Resources Management
  Effective cooperation among State water management agencies.
- Stakeholder Involvement and Conflict Management
  Effectively involving citizens and non-government organizations in implementing water plan programs so that the goals of the plan will be realized.
- Local and Regional Issues in the State Plan
  Defining the appropriate role of the State in local and regional planning while respecting regional and local differences and preserving as much local autonomy as possible.

The final planning workshop will be held on October 22 at the Metro-Tech Springlake Campus in Oklahoma City. The morning session will begin at 8:00 and the afternoon session at 2:00. Members of the public are welcome to attend as observers. Experts will be available to answer questions that arise during these workshops. The resulting recommendations will be passed on to a three-day Town Hall meeting in 2010.

Planning Workshop Participants from Southwest Oklahoma

Jackson County: Tom Buchanan, Bob Howard, Robert Stephenson
Harmon County: Tommy Coomes
Stephens County: Brett Kimbro, Dave Taylor, R. Scott Vaughn, Dan Lowrance;
Comanche County: Thomas Flood, Jerry Pettijohn, Bill Cunningham, Robert Tippeconnie, Larry Cofer, George Lodes, Larry Mitchell
Greer County: None
Cotton County: John Sheppard, Jimmy Kinder, Robert Smith
Tillman County: Terry Wyatt, Ricky Strecker
Jefferson County: Bill Smith
Kiowa County: Sue McCoy, Wilt Brown, Randy Archer, Lee Horton, John Swihart

Technical Studies and Research

Development continues on statewide and county-level water demand projections for all major consumptive uses (municipal/industrial, which includes public water supply; self-supplied industrial; thermoelectric; and agricultural) through 2060. Municipal/industrial projections will be estimated down to the water provider level. A major aspect of this task is development of a sophisticated computer model for use in identifying areas of potential water shortages, or “gaps.” This flexible, highly configurable tool, which utilizes Geographic Information System (GIS) technology, is able to compare available supply to projected demand on-the-fly for each stream system in Oklahoma. Planners are working to better integrate groundwater supply, use, and needs into the model.

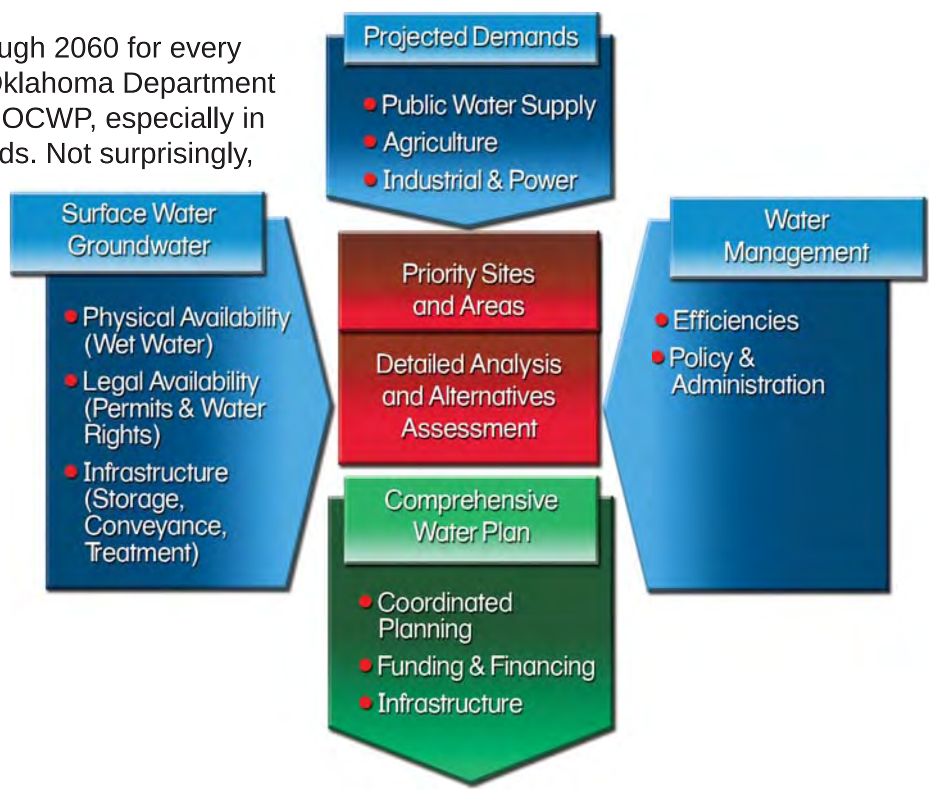
Areas with projected gaps will be studied in more detail utilizing a separate, more precise GIS water allocation model that takes into account both current and future local water management issues, such as rainfall/runoff data, reservoir storage, existing water rights, lake level requirements, potential interbasin transfers, interstate compact requirements, and other factors. The water allocation model also has significant promise for use in the OWRB’s day-to-day water use permit administration.

In addition, utilizing the latest USGS National Hydrography Dataset (NHD) and the Watershed Boundary Dataset (WBD), OWRB GIS specialists have reviewed and updated the state’s stream system (watershed) boundaries, which form the basis for both OCWP supply/demand modeling and agency water rights administration. Existing stream gages have also been inventoried to identify surface water data gaps and future data requirements.

Preliminary statewide water withdrawal statistics, courtesy of an inventory conducted every five years by the OWRB and U.S. Geological Survey, indicate that total water usage in Oklahoma amounted to approximately 1,779 million gallons per day (1,992,413 acre-feet) in 2005. About 57 percent of that water came from surface water sources and 43 percent from groundwater sources. Total withdrawals increased by about 7 million gallons between 2000 and 2005. Public water supply, which accounted for about 36 percent of total withdrawals in 2005, was the number one use of water. Irrigation, for which about 28 percent of water was withdrawn, was second.

Exemplifying the importance of irrigated agriculture in Oklahoma, especially in the west, Texas County used far more water than any other county, approximately 194,712 acre-feet, virtually all (more than 99.8 percent) from groundwater sources. Elsewhere, intense use was largely centered around more populated regions in the state. The largest surface water user in 2005 was Mayes County (119,784 ac-ft) followed closely by Muskogee County (118,866 ac-ft).

Data on projected population growth through 2060 for every county in Oklahoma, assembled by the Oklahoma Department of Commerce, is a key component of the OCWP, especially in estimating future public water supply needs. Not surprisingly, areas of greatest use are expected to experience the largest growth. Some areas in the state have already exhibited limitations in supply. A focus of the OCWP is to assist water supply systems in developing sound plans for meeting future demands.

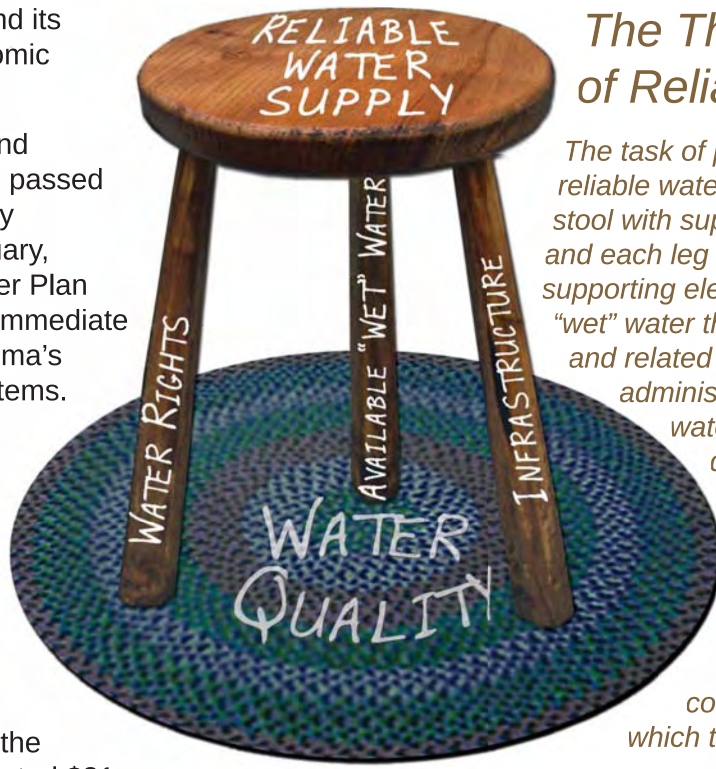


Infrastructure: A Key Limiting Factor to Economic Development

Reliable water supply is dependent upon the infrastructure required to deliver it as well as the financing opportunities to build and maintain that infrastructure. As a result, the Oklahoma Comprehensive Water Plan will build upon existing state and federal funding programs, including the OWRB's Financial Assistance Program, to meet the growing needs of water providers in Oklahoma.

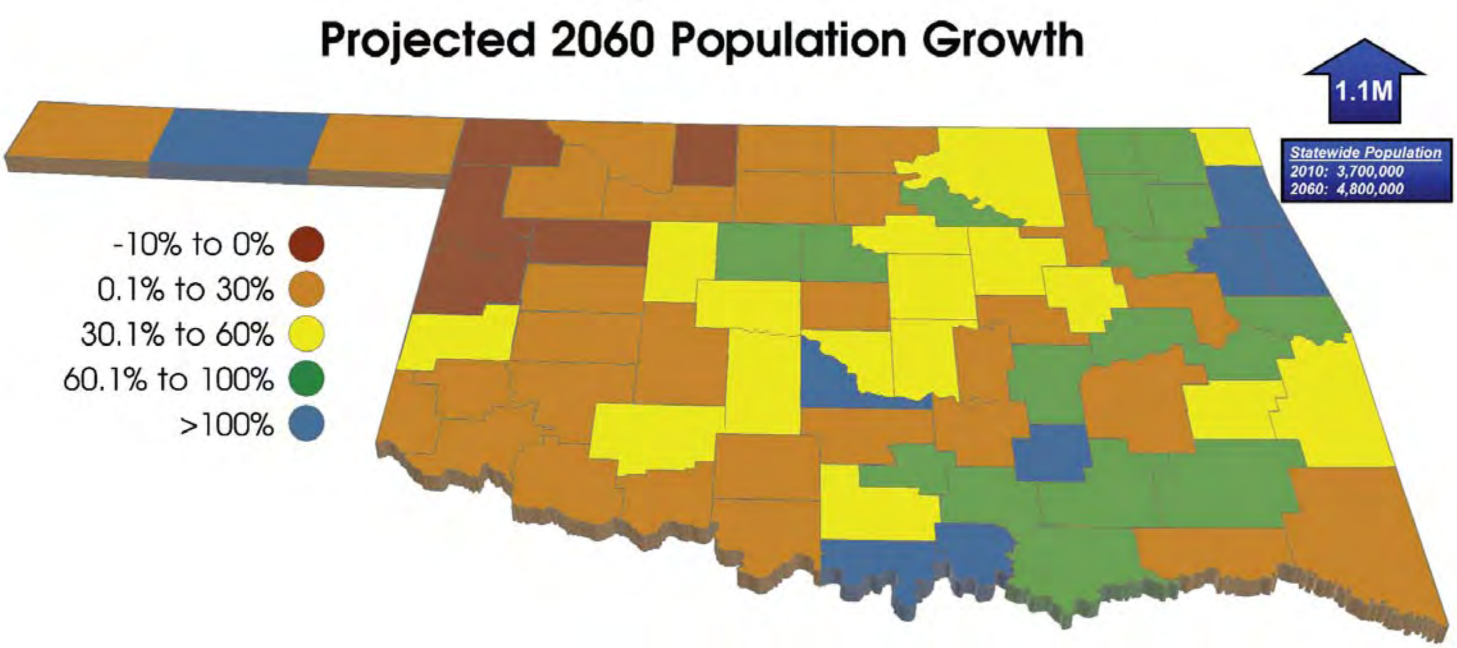
The OCWP update will assist in providing vital information to better understand Oklahoma's water and wastewater infrastructure needs. Furthermore, the OCWP will help planners and financiers prioritize critical need areas where inadequate treatment and/or delivery create a barrier between water and its users and limit local economic development.

The American Recovery and Reinvestment Act of 2009, passed by Congress and signed by President Obama in February, compliments ongoing Water Plan initiatives by providing an immediate shot-in-the-arm for Oklahoma's water and wastewater systems. The Act, part of the Administration's stimulus package to promptly energize the nation's economy and create jobs, included $62 million for "shovel ready" water and wastewater infrastructure projects in Oklahoma. Specifically, the stimulus package appropriated $31 million each for Oklahoma's Clean Water and Drinking Water State Revolving Fund loan programs. Congress also set aside $70 million in stimulus funds for USDA Rural Development's Water and Wastewater Loans and Grants.

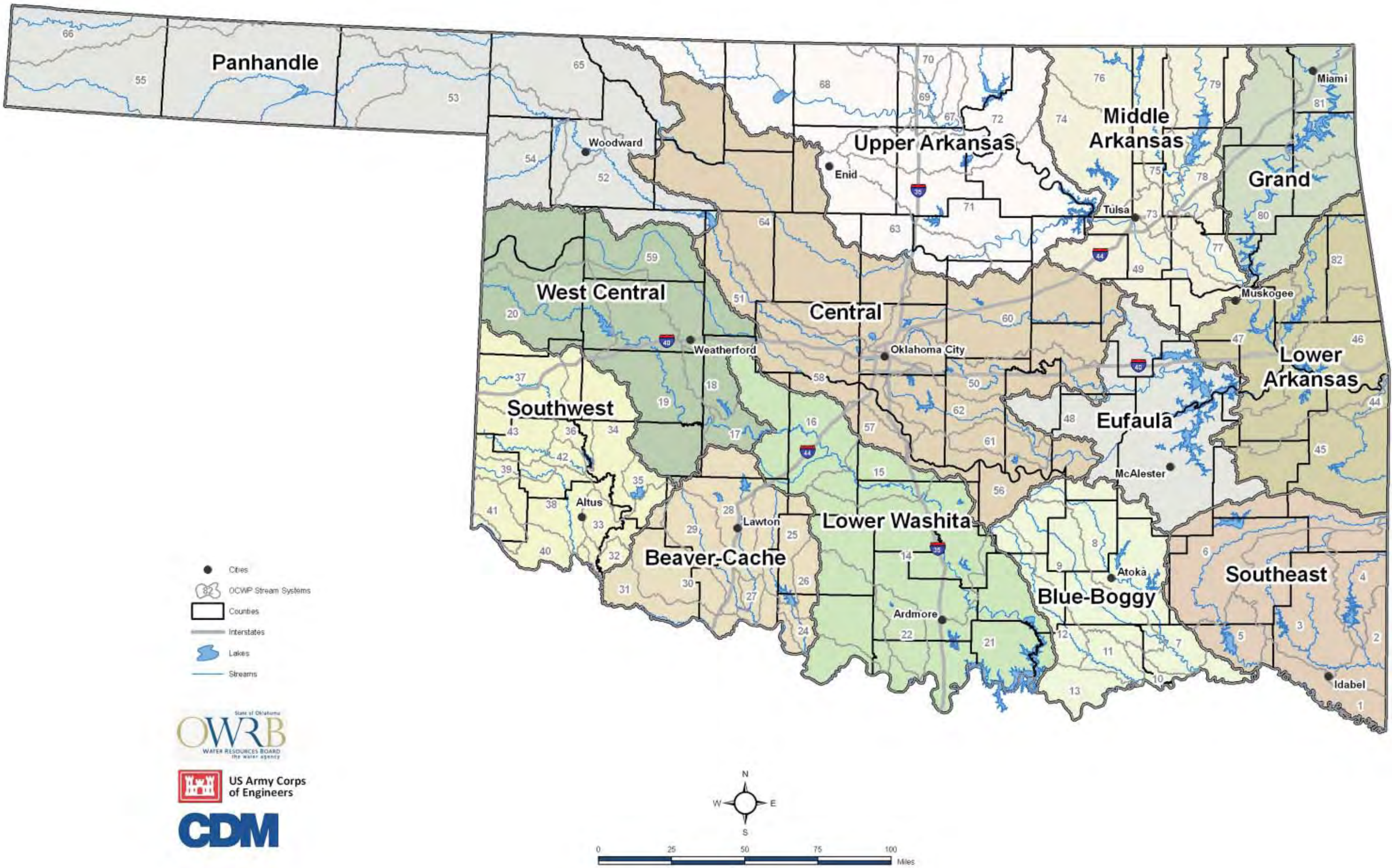


The Three-Legged Stool of Reliable Water Supply

The task of providing Oklahomans with reliable water supply is like a three-legged stool with supply symbolizing the seat and each leg represented by three primary supporting elements: determining available "wet" water through technical studies and related means, fair and efficient administration of water rights, and water/wastewater infrastructure development. Each of the legs not only supports our reliable supply goal, but each supports and is dependent upon the other in Oklahoma's water management scheme. Water quality, another vital component, could be considered the rug upon which the stool sits.



Planning Regions for the Oklahoma Comprehensive Water Plan



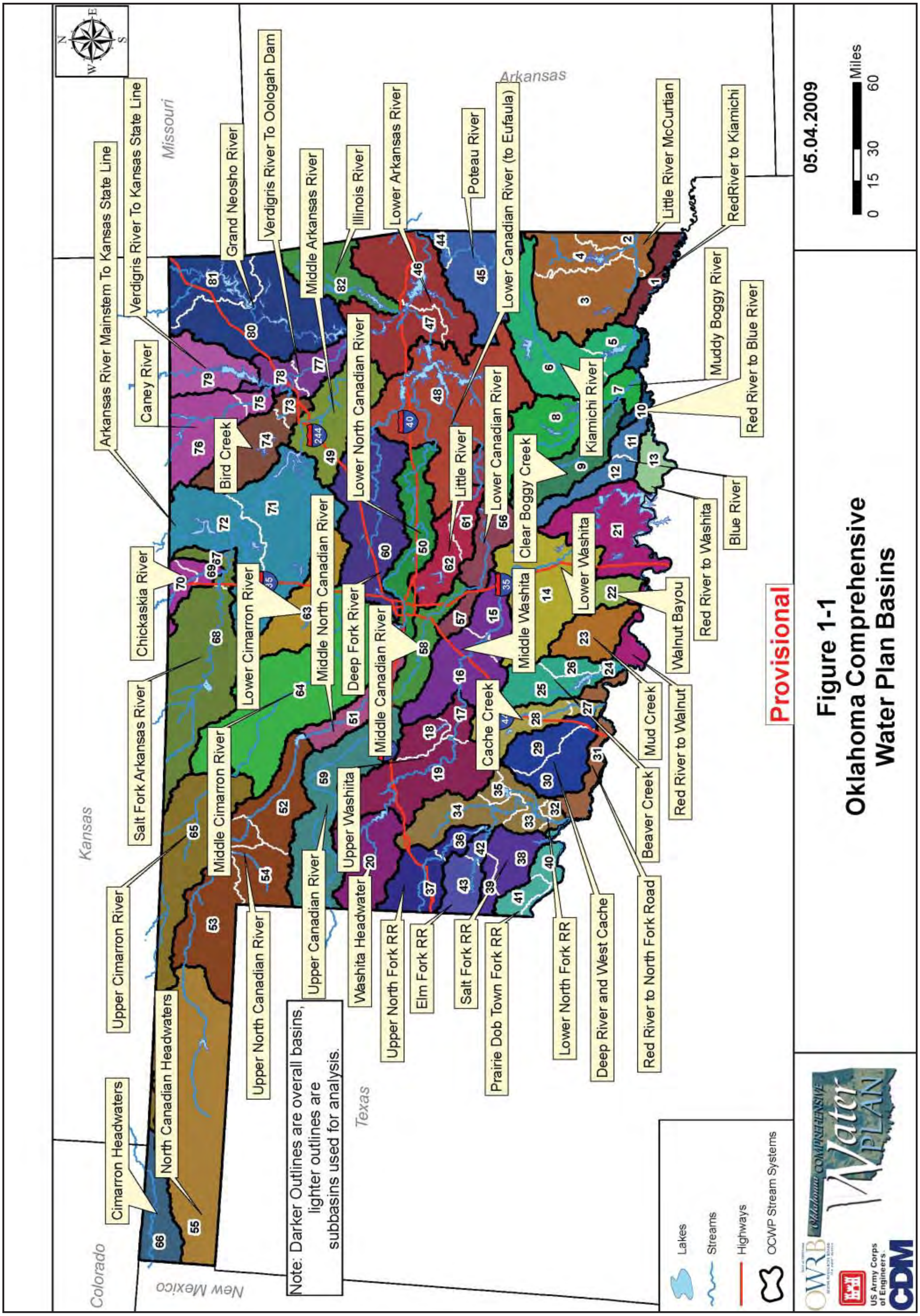


Figure 1-1
Oklahoma Comprehensive
Water Plan Basins

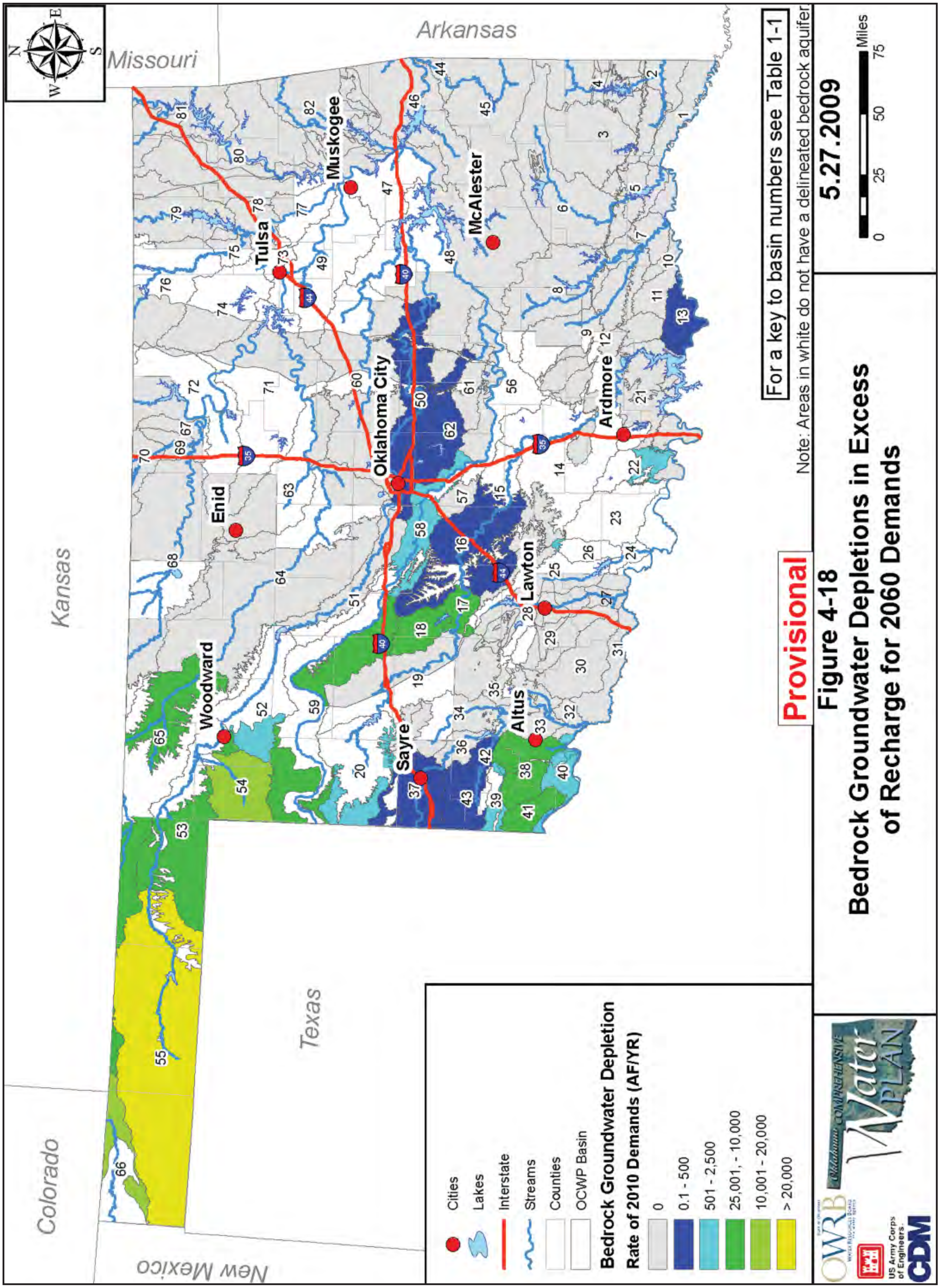


Figure 4-18
Bedrock Groundwater Depletions in Excess of Recharge for 2060 Demands

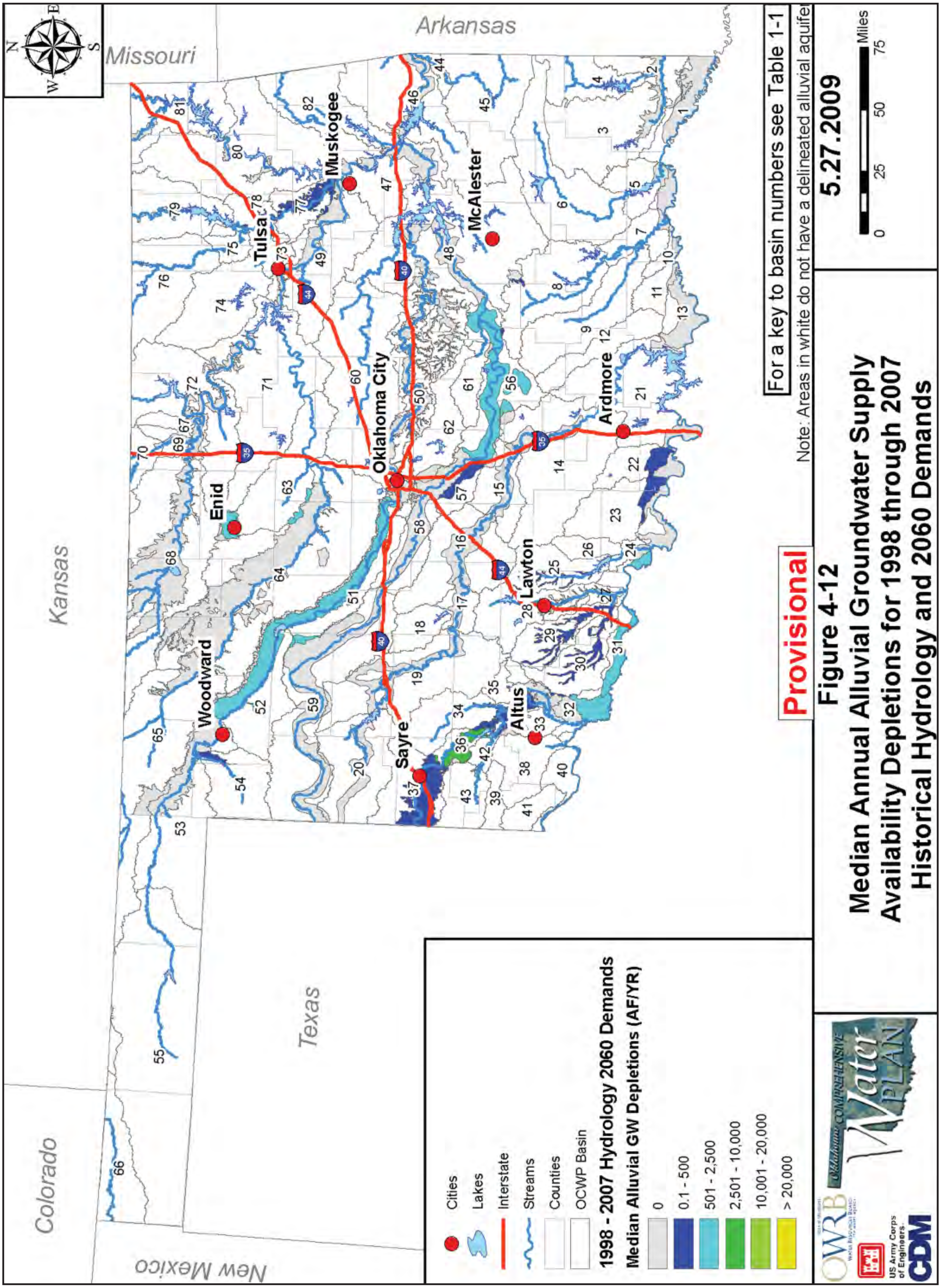


Figure 4-12
Median Annual Alluvial Groundwater Supply Availability Depletions for 1998 through 2007 Historical Hydrology and 2060 Demands

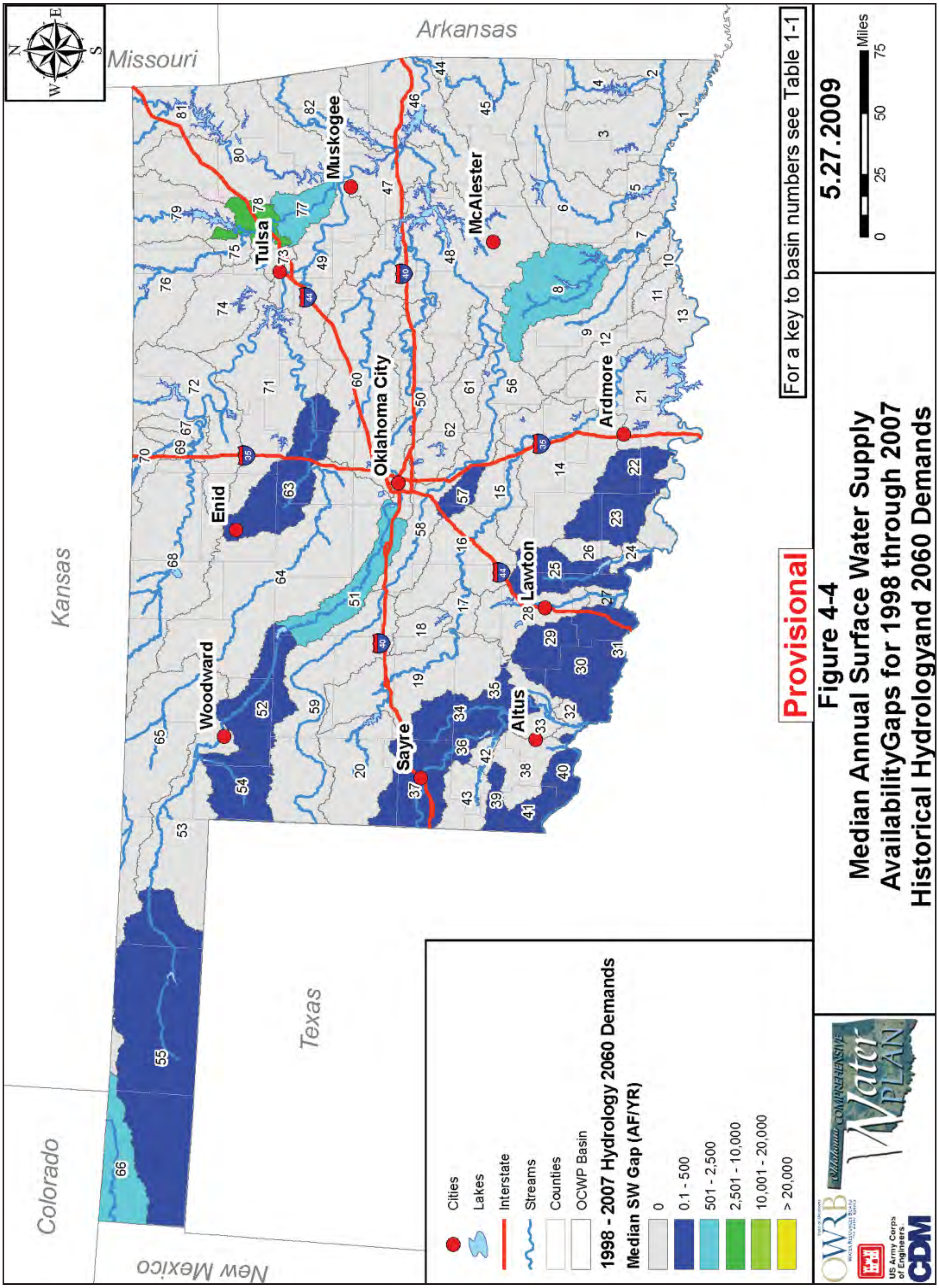
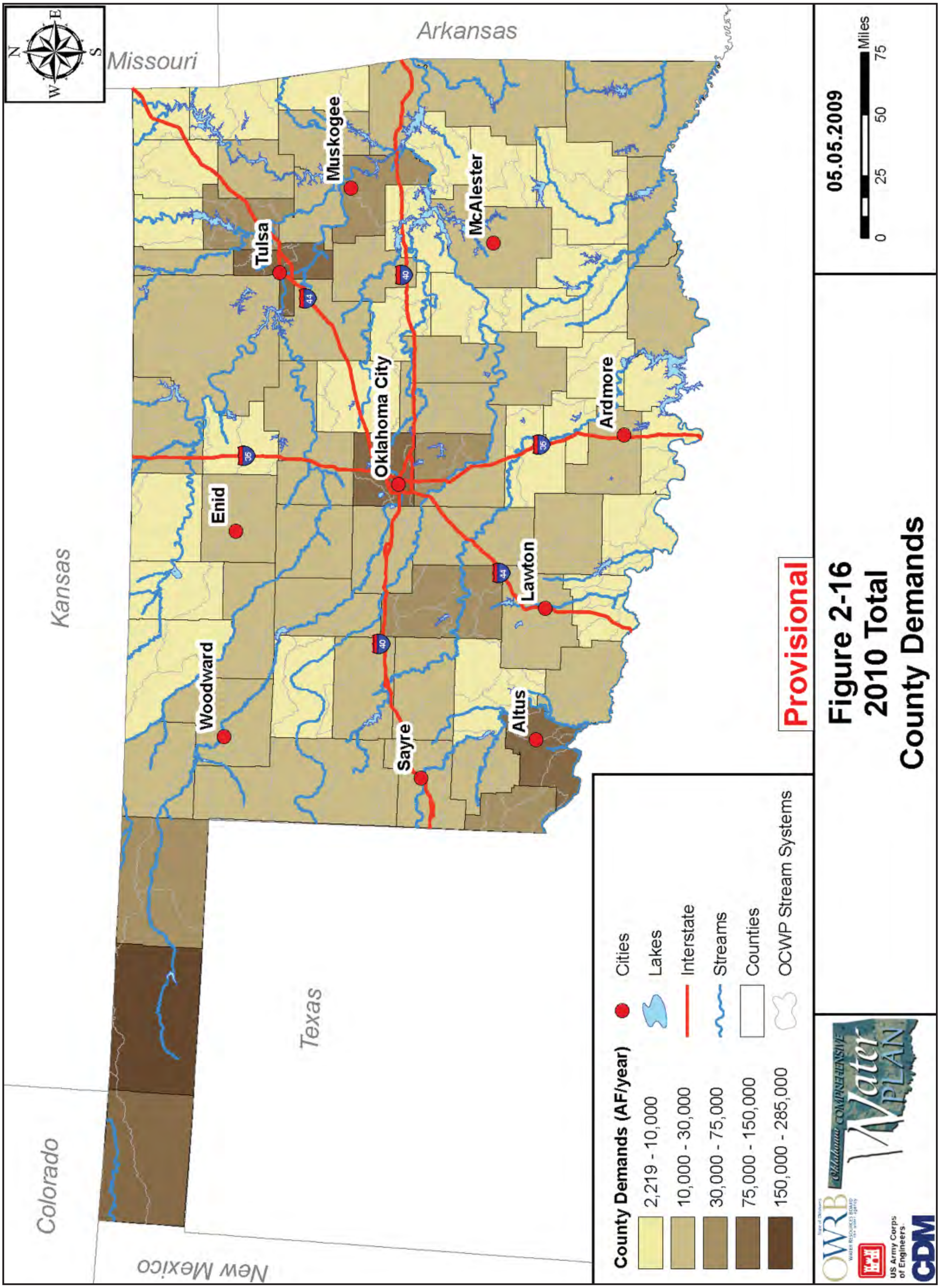


Figure 4-4
Median Annual Surface Water Supply AvailabilityGaps for 1998 through 2007 Historical Hydrologyand 2060 Demands


Colorado
New Mexico
Kansas
Missouri
Arkansas
Texas
Woodward
Enid
Tulsa
Muskogee
McAlester
Oklahoma City
Ardmore
Lawton
Altus
Sayre
Provisional
Figure 2-16
2010 Total
County Demands
05.05.2009
0 25 50 75 Miles
County Demands (AF/year)
2,219 - 10,000
10,000 - 30,000
30,000 - 75,000
75,000 - 150,000
150,000 - 285,000
Cities
Lakes
Interstate
Streams
Counties
OCWP Stream Systems
Oklahoma Comprehensive Water Plan
US Army Corps of Engineers
CDM

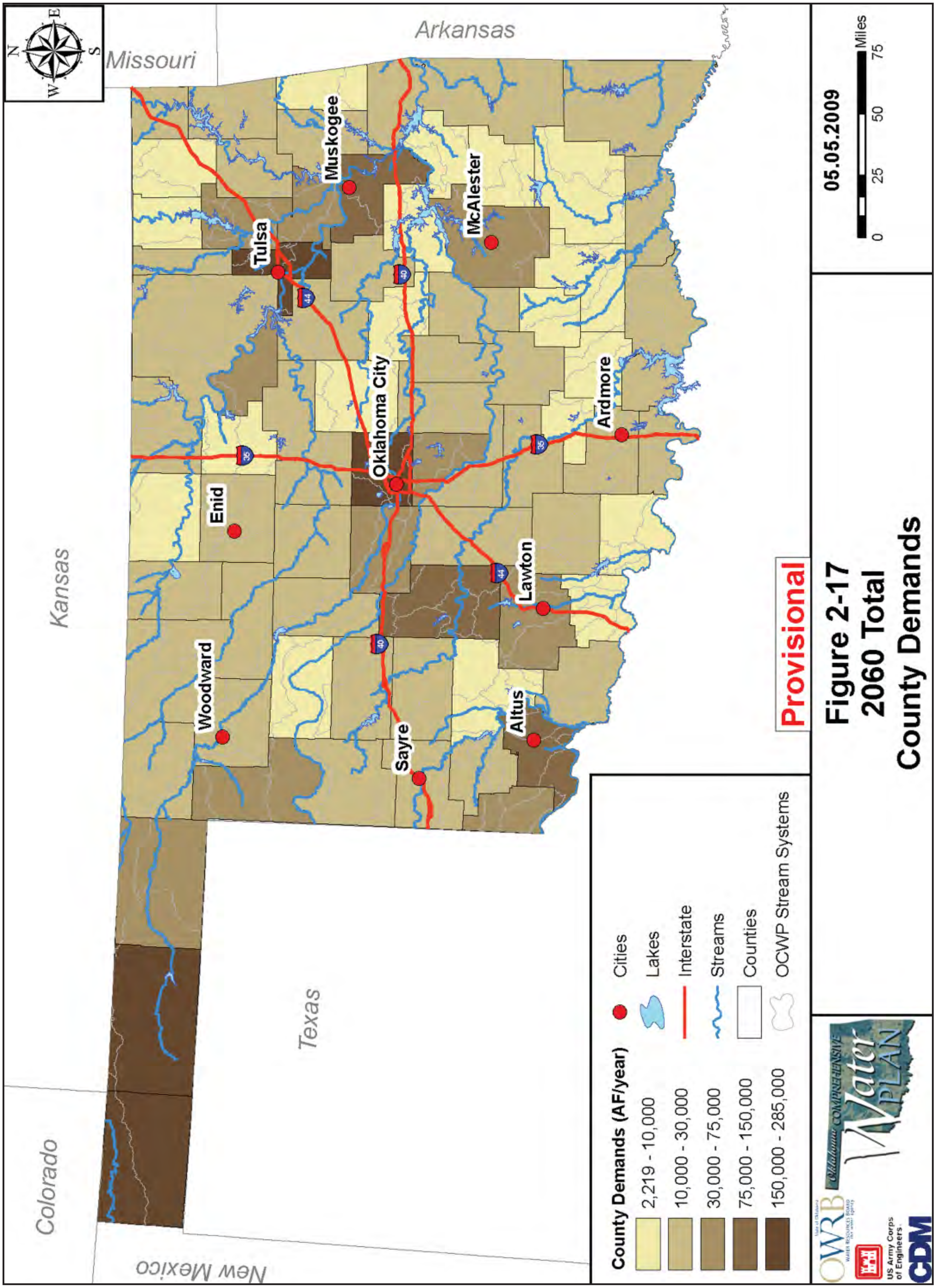


Figure 2-17
2060 Total
County Demands