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Integrated Science to Support the Assessment of Conservation Practices in the Fort Cobb Watershed, Southwestern Oklahoma

Chapter 1 of

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Compiled by the U.S. Geological Survey and the Agricultural Research Service

Scientific Investigations Report 2010–5257

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Conversion Factors

SI to Inch/Pound

Multiply	By	To obtain
	Area	
square kilometer (km^2)	247.1	acre
square kilometer (km^2)	0.3861	square mile (mi^2)
	Load	
metric ton per year	1.102	ton per year (ton/yr)

Vertical coordinate information is referenced to the North American Vertical Datum of 1988 (NAVD 88).

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Integrated Science to Support the Assessment of Conservation Practices in the Fort Cobb Watershed, Southwestern Oklahoma

By Carol J. Becker[1] and Jean L. Steiner[2]

Introduction

The Fort Cobb Reservoir watershed encompasses about 813 square kilometers of rural farm land in Caddo, Custer, and Washita Counties in southwestern Oklahoma (fig. 1). The largest water body in the watershed is the Fort Cobb Reservoir with a surface area of 16.6 square kilometers at normal pool elevation. The reservoir was built in 1959 and is managed by the Bureau of Reclamation for drinking-water supply, flood control, recreation, and fish and wildlife habitat (Oklahoma Water Resources Board, 1990). The watershed supports several types of agricultural activities. Land cover in the watershed surveyed by Storm and others (2003) showed that cultivated crops cover about half (51 percent) and pasture about 40 percent of the land surface in the watershed. The combination of agricultural activities and the vulnerability of soils to erosion have caused water-quality problems in the three major tributaries that drain the watershed, Cobb Creek, Lake Creek, and Willow Creek, and the Fort Cobb Reservoir.

The reservoir and six stream segments were identified on the Oklahoma 1998 303(d) list required by the Clean Water Act, as not supporting designated beneficial uses because of impairment by nutrients, suspended solids, sedimentation, pesticides, and unknown toxicity (Storm and others, 2003). In 2002, the Fort Cobb Reservoir was listed on the Oklahoma 303(d) list for impairment from excessive phosphorus and sedimentation, Willow Creek for pathogens, and Lake Creek for unknown contaminants, low dissolved oxygen concentration, and turbidity (Oklahoma Department of Environmental Quality, 2002).

The Oklahoma Conservation Commission (OCC), in collaboration with conservation districts and landowners, started conservation efforts in 2001 to decrease the amount of sediment and phosphorus entering the reservoir. Initially, the most common best-management practices (BMPs) implemented were changing cropland to pastureland and grade-stabilization structures (Oklahoma Conservation Commission, 2005). However, preliminary total maximum daily load (TMDL) computations indicated that additional BMPs were needed, so additional emphasis was placed on programs protecting riparian areas and promoting no-till farming practices, and residue management, with the primary goal of those practices being to reduce phosphorus loading to the reservoir by decreasing erosion of the sandy soils in the watershed (Oklahoma Conservation Commission, 2007). The final TMDL computations for phosphorus issued in June 2006 showed that a 78-percent load reduction to the reservoir, equal to 15.4 metric tons per year of phosphorus with 3.5 metric tons per year for a margin of safety, was necessary to meet the goal (Yue, 2006, page 72).

BMPs have decreased erosion and the transport of phosphorus to the reservoir; from 1998 through 2005 phosphorus loading was reduced by 20 percent (Yue, 2006). Water quality in the tributary creeks also has improved. The Index of Biological Integrity score for Lake Creek improved from 1990 through 1998 and resulted in the removal of Lake Creek from the 303(d) list in 2002. These improvements were described as a Nonpoint Source Program Success Story by the U.S. Environmental Protection Agency (U.S. Environmental Protection Agency, 2008). Cobb Creek and Willow Creek were removed from the 303(d) list in 2006 because of improvements in water quality. The most important factors contributing to water-quality improvements have been identified as the educational programs promoting conservation techniques and reduction of fertilizer and chemical use.

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Figure 1. Location of the Fort Cobb Reservoir and watershed in the upper Washita River Basin, southwestern Oklahoma.

Success of the BMPs implemented in the Fort Cobb watershed is of interest to many parties because erosion and transport of sediment and associated phosphorus and pesticides are common problems in other agricultural watersheds. The Natural Resources Conservation Service (NRCS) and the Agricultural Research Service (ARS) selected the Fort Cobb watershed in 2003 as one of 14 Benchmark Watersheds under the Conservation Effectiveness Assessment Project (CEAP). CEAP is a multiagency effort established to quantify the environmental benefits resulting from agricultural conservation programs at a national level and in selected case-study projects where benefits of specific conservation practices can be evaluated at a watershed scale (Mausbach and Dedrick, 2004). The Fort Cobb Reservoir watershed was selected for CEAP because of long-term research efforts by ARS and collaborators in the Washita River Basin. Considerable research effort also has been focused on the watershed by Oklahoma State University (Storm and others, 2003), U.S. Geological Survey (USGS) (Becker, 2001; Fairchild and others, 2004), U.S. Fish and Wildlife (Martin, 2002), and the State of Oklahoma (Oklahoma Water Resources Board, 2003). Additionally, state and federal funding has supported the installation of conservation practices in the watershed (Steiner and others, 2008).

Additional research efforts in the Fort Cobb watershed were initiated by ARS and research collaborators under CEAP. This research involved surface-water-quality sampling at two USGS streamflow-gaging stations on Cobb Creek and Willow Creek and construction of and water-quality sampling at a USGS streamflow-gaging station on Lake Creek in collaboration with the Oklahoma Water Resources Board and the USGS; 15 weather stations were constructed in collaboration with Oklahoma State University and the Oklahoma Mesonet, (a network of environmental monitoring stations throughout Oklahoma (Oklahoma Climatological Survey, 2008)); and in collaboration with the Oklahoma Conservation Commission and the Oklahoma State Office of NRCS, information was compiled about agricultural conservation practices implemented in the watershed and arrangements were established with numerous landowners for the creation of monitoring and research sites (Steiner and others, 2008).

In November 2004, the USGS Biologic, Geographic, Geologic, and Water Disciplines, in collaboration with ARS Grazinglands Research Laboratory in El Reno, Oklahoma, began an inter-disciplinary investigation to support CEAP. The goal was to utilize the diverse resources of the USGS to complement the ongoing research efforts in the watershed and produce an integrated publication that could be used to assist with the planning, implementing, and monitoring the success of BMPs. This publication is the result of the effort and includes 10 report chapters describing climate, soils, geology, land uses, surface materials affecting water quality, and water quality in streams and the reservoir. Also included is a compilation of environmental data collected by state and federal agencies (other than USGS) in a spatial format. A USGS Data Series report by Becker and others (2007) complements this publication by providing historical environmental data collected by the USGS in the Upper Washita River Basin. The data in a spatial format include USGS sampling sites and associated water-quality, biological, water-level, and streamflow data collected from 1903 through 2005.

References Cited

Becker, C.J., 2001, Ground-water quality, levels, and flow direction near Fort Cobb Reservoir, Caddo County, Oklahoma, 1998-2000: U.S. Geological Survey Water-Resources Investigations Report 01-4076, 20 p.

Becker, C.J., Masoner, J.R., and Scott, J.C., 2007, Digital atlas of the upper Washita River Basin, southwestern Oklahoma: U.S. Geological Survey Data Series DS-270, 3 DVDs.

Fairchild, J.F., Lakish, Ben, Echols, Kathy, Chapman, Duane, Johnson, Thomas, and Jones, Susan, 2004, An integrated assessment of the trophic status of Fort Cobb Reservoir, Oklahoma: U.S. Geological Survey, Columbia Environmental Research Center, Columbia, Missouri, 89 p.

Martin, D.B., 2002, Fort Cobb Reservoir water quality investigations: U.S. Fish and Wildlife Service, Ecological Services, Agreement no. 97-AA0-60-09790, 112 p.

Mausbach, M.J., and Dedrick, A.R., 2004, The length we go—Measuring environmental benefits of conservation practices: Journal of Soil and Water Conservation, v. 59, no. 5, p. 96A-103A.

Oklahoma Climatological Survey, 2008, Oklahoma Mesonet; Oklahoma Climatological Survey (available online at http://www.mesonet.org.

Oklahoma Conservation Commission, 2005, Policies and approved conservation practices for Cobb Creek/Fort Cobb Reservoir Watershed—319 nonpoint pollution cost-share FY2001 319(h), Project 4, C9-996100-09-0, 25 p.

Oklahoma Conservation Commission, 2007, Fort Cobb Watershed TMDL Implementation project; FY2005-2006 319(h) Project 5, 18 p.

Oklahoma Department of Environmental Quality, 2002, Water quality assessment integrated report, 2002: Oklahoma Department of Environmental Quality, available online at http://www.deq.state.ok.us/WQDnew/305b_303d/2002_integrated_report_final.pdf (accessed June 5, 2007).

Oklahoma Water Resources Board, 1990, Oklahoma Water Atlas: Oklahoma Water Resources Board, Publication 135, p. 96-97.

Oklahoma Water Resources Board, 2003, Beneficial Use Monitoring Program (BUMP) Report, available online at http://www.owrb.ok.gov/studies/reports/bump/2003/bump2003.php (accessed June 5, 2007).

Steiner, J.L., Starks, P.J., Harrison, Joel, Garbrecht, J.D., Moriasi, D.N., McIntyre, Sherwood, and Chen, J.S., 2008, Environmental effects of agricultural conservation: a framework for research in two watershed in Oklahoma's Upper Washita River Basin: Journal of Soil and Water Conservation, v. 63, no. 6, p. 443-452.

Storm, D.E., White, M.J., and Stoodley, Scott, 2003, Fort Cobb Basin—Modeling and land cover classification, final report to the Oklahoma Conservation Commission, available online at http://storm.okstate.edu/reports/Fort%20Cobb%20report%20Final%20Report%202_26_2003.pdf (accessed June 5, 2007).

U.S. Environmental Protection Agency, 2008, Section 310 nonpoint source success stories Oklahoma—Lake Creek, available online at http://www.epa.gov/owow/nps.Success219/state/ok_lake.htm (accessed January 23, 2008).

Yue, Paul, 2006, TMDL Development for Fort Cobb Creek Watershed and Fort Cobb Lake—Final Report: Oklahoma Department of Environmental Quality, 133 p.