Fort Cobb

Watershed Implementation Project

FY2001 319(h)
C9-996100-9, Project 4

Submitted to:
Environmental Protection Agency, Region VI

Submitted by:
Oklahoma Conservation Commission
2800 Lincoln Boulevard Ste., 160
Oklahoma City, Oklahoma 73105

Final Report

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INTRODUCTION

The Fort Cobb Watershed contains two streams and a water supply reservoir impaired by sediment and nutrients. The Fort Cobb reservoir and its tributaries have been of concern since water quality problems were first identified in 1981. The watershed is identified among Oklahoma's 25 priority watersheds for nonpoint source (NPS) control implementation under Oklahoma's NPS Management Program. The program is a collaboration of government agencies, organizations, education institutions, and landowners using assessment, planning, education, and implementation of best management practices to address NPS-derived causes and sources of water quality impairment.

The six year Fort Cobb watershed project, funded by the USEPA 319(h) grant monies, focused on achieving pollution load reduction goals established by the Oklahoma Department of Environmental Quality's (ODEQ) Total Maximum Daily Load (TMDL) to restore beneficial use support to Fort Cobb Reservoir and two tributaries, Lake Creek and Willow Creek.

Project Cost: State $803,702 + Federal $1,205,552 = Total $2,009,254

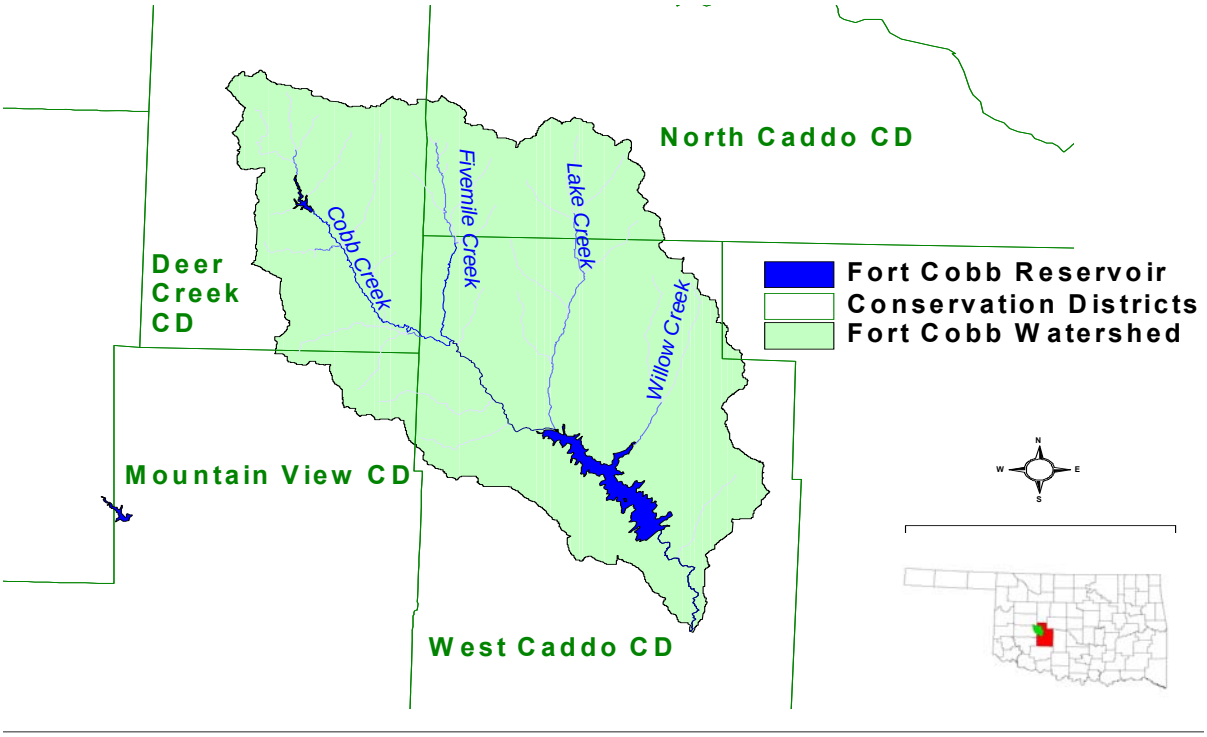

Figure 1. Fort Cobb watershed

PROJECT LOCATION

The Fort Cobb Watershed is located in the Central Great Plains Ecoregion in southwestern Oklahoma in Caddo, Washita, and Custer Counties in the Upper Washita sub-basin. The Fort Cobb watershed is 314 square miles and includes two Hydrologic Unit Code (HUC) 11 watersheds: 11130302120 & 11130302130. In the watershed is Fort Cobb reservoir, a 4100 acre water supply and recreation lake constructed by the Bureau of Reclamation in 1959 by impounding Cobb Creek three miles north of the town of Fort Cobb. The reservoir has 45 miles of shoreline with a flood pool capacity of 143,740 acre-feet, a mean depth of 19.48 feet, and maximum depth of 63 feet. The lake's designated beneficial uses include public and private water supply, warm water aquatic community, agriculture, municipal and industrial uses, primary body contact recreation, and aesthetics. The reservoir is the primary drinking water source for the cities of Anadarko and Chickasha, which have a combined population of 22, 495 (2000 Census). It is a popular recreational lake used for fishing, swimming, and boating. Land use in the watershed includes agricultural fields, cattle operations, rural communities, and one hog operation. Most soils in the watershed are highly erodible, sandy clays and loams underlain primarily by Permian sandstone, siltstone, and claystone.

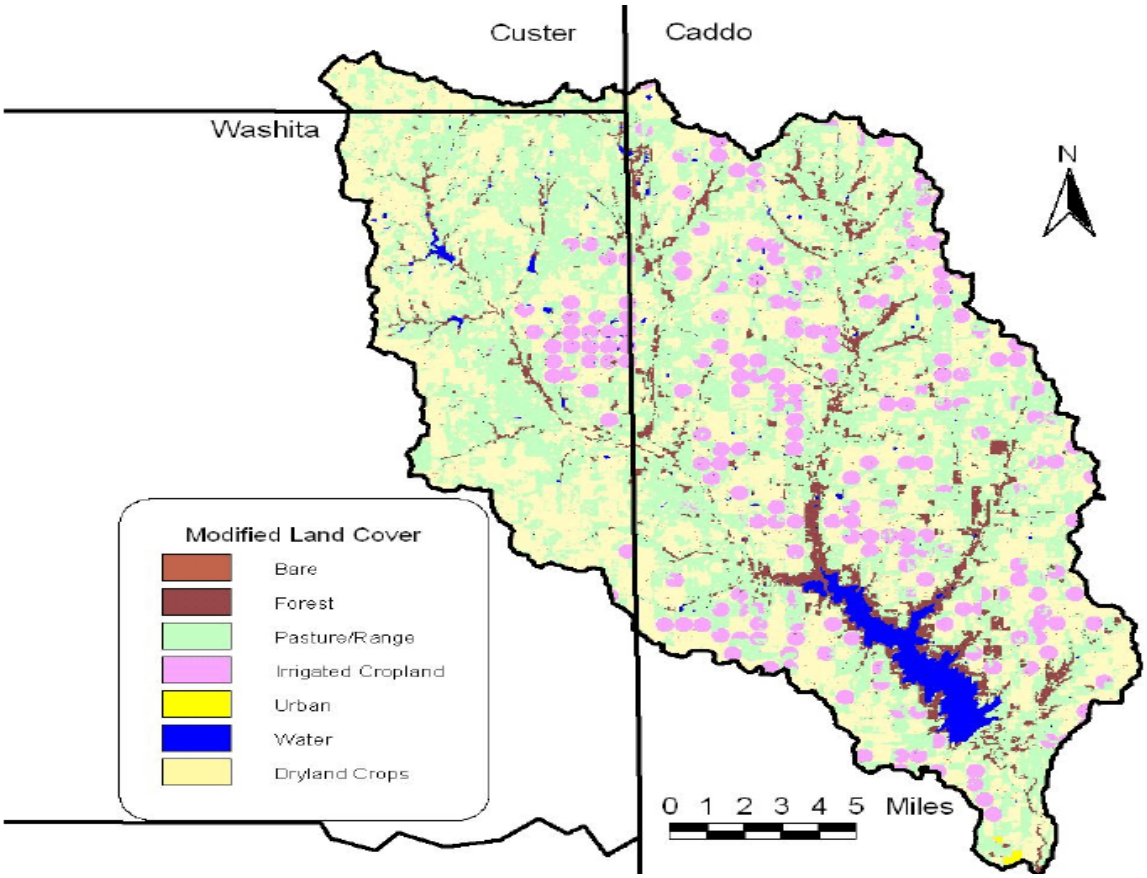

Figure 2. Land cover in the Fort Cobb watershed (Storm et al. 2003)

Table 1. Percentage of landcover within the Fort Cobb basin (Storm et al. 2003)

Landuse	Percent	Landuse	Percent
Urban	0.5	Planted/Cultivated 1	46.44
Pasture	39.72	Planted/Cultivated 2	5.01
Forest	6.68	Water	1.89
Barren	0.20		

PROBLEM STATEMENT

The major pollutants in the Fort Cobb watershed are sediment and nutrients. Oklahoma Water Quality Standards list Fort Cobb reservoir as a Nutrient Limited Watershed (due to high primary productivity) and a sensitive public and private water supply. In 1998 Oklahoma Water Resources Board (OWRB) data showed the lake was hypereutrophic and in 1999, eutrophic. Studies indicated biological, chemical, and habitat degradation within the Fort Cobb reservoir watershed. DDT was detected in fish flesh tissue in 1981. Fort Cobb Reservoir and six waterbody segments in its watershed were listed on the 1998 303(d) List as being impaired by nutrients, pesticides, siltation, suspended solids, and unknown toxicity. The reservoir and two tributaries, Willow and Lake Creek, are currently listed on the 2002 303(d) List as impaired by phosphorous, pathogens, low dissolved oxygen, turbidity, and for unknown causes (based on poor fish collection). Forty-one percent (41%) of the stream miles in the watershed and 97% of the lake acres are listed on the 303(d) List (OCC Workplan).

Table 2. 303(d) Listed waterbodies in the Fort Cobb watershed

303(d) list year	OK Waterbody ID	Name	Cause of Impairment
1998	OK 310830050020	Fort Cobb Reservoir	Pesticides, suspended solids, turbidity
1998	OK 310830060030	Willow Creek	Nutrients, siltation, suspended solids
1998	OK 310830060040	Lake Creek	Unknown toxicity, pesticides, Nutrients, siltation, other habitat alterations, suspended solids
1998	OK 310830060050	Cobb Creek	Pesticides, nutrients, siltation, suspended solids
1998	OK 31080060080	Fivemile Creek	Nutrients, siltation, suspended solids
1998	OK 31080060130	Crowder Lake	Nutrients, organic enrichment/D.O., suspended solids
2002	OK310830050020	Fort Cobb Reservoir	phosphorus
2002	OK 310830060030	Willow Creek	pathogens
2002	OK 310830060040	Lake Creek	Cause unknown, low dissolved oxygen1, turbidity

PLANNING THE PROJECT

Historical Water Quality Studies in the Fort Cobb Watershed

As stated in the workplan, the Fort Cobb watershed has been researched over the years by a number of agencies to document the nature and extent of water quality problems. Many of these historical studies are listed below and were consulted for this project.

- OCC's FY 1988 205 (J) Task 500, "Results of Inventory Work and Water Quality Sampling in Small Watersheds in the Fort Cobb Drainage, Caddo County, Oklahoma."
- OCC's FY 1993 319 (h) "Technical Assistance for Ground-Surface Water Interaction."
- OCC's FY 1997 319 (h) "Stream Assessment to fill the Gaps for Southwestern Oklahoma." Willow Creek is being monitored under this project.
- OWRB's Beneficial Use Monitoring Program monitored Fort Cobb Reservoir from 1998-1999.
- Oklahoma Department of Agriculture sampled for Atrazine in 1990.
- USGS's 1999-2000 "A Compilation of Existing Data for Aquifer Sensitivity and Ground-Water Vulnerability Assessment for the Caddo Indian Tribe in Parts of Caddo and Canadian Counties, Oklahoma."
- USGS's 1998-2000 "Ground-Water Conditions and Quality Near the Fort Cobb Reservoir."
- USGS's Biological Division "An Integrated Assessment of the Eutrophication of Fort Cobb Reservoir, Caddo County, Oklahoma".
  - -Sampling focused on: 1) determining the quality of the water resources of Fort Cobb; 2) determine the sources of contaminants entering the reservoir; 3) developing a long-term management plan to protect the water quality of the Fort Cobb Reservoir.
- USFWS and Bureau of Reclamation Study of Fort Cobb Reservoir
  - -Sampling focused on: 1) evaluating the extent of water quality problems in Fort Cobb Reservoir and 2) determining sources of those water quality problems.

Watershed Modeling and Land Use Classification

In addition to a review of historical studies, the Fort Cobb watershed was intensively assessed and modeled for this project to determine high priority areas in need of NPS loading reductions. This was done because available resources are inadequate to blanket the entire watershed with best management practices. Therefore, the project focused demonstration efforts in areas where they were needed the most and where the environmental benefit would be maximized.

As planned, two primary targeting techniques were used for this watershed. The first utilized remotely-sensed and electronically mapped data. A **geographic information system (GIS) data layer** was created to represent hydrology, soils, and distribution of land use. This information was used to target producers with close proximity to water bodies. **Aerial photography** was evaluated to identify critical problem land-use areas such as those without any riparian vegetation. Production areas close to waterbodies with degraded riparian areas were actively targeted for BMP implementation and inclusion in the program. **Watershed reconnaissance** identified critical areas of in-field and streambank erosion. In addition, **soil surveys** were used to assist in targeting. One or two specific soils types are known to be highly erosive within the watershed. Locations of highly erodible soil and degraded riparian areas were overlayed in an electronic environment to target likely sources of sediment loading.

The OCC also used an internalized targeting mechanism similar to the USDA NRCS EQIP Program. Individuals who expressed interest in participating in the project received a preliminary site visit from the project coordinator. The coordinator conducted a **preliminary site investigation** to assess the extent the particular landowner was likely contributing to the water quality problems in the watershed. He then **assigned a ranking index** based on the practices that would need to be implemented, the cost for implementation, and the expected impact on water quality improvement. In this manner, OCC effectively targeted areas where the greatest water quality benefit would result from each dollar spent.

Targeting efforts were coordinated with the local NRCS offices actively assisting with the program; this leveraged funds for mutual benefit. When landowners did not meet the requirements of the 319 project, they were directed to NRCS for potential enrollment in one of the many **USDA programs** in the watershed. For example, EQIP provides funding for many practices that the 319 program does not. If a landowner cannot participate in 319, then they may choose to accept an EQIP contract.

Estimated Erosion from County Roads

Two separate modeling components were performed by Oklahoma State University. The first task was estimating erosion from county roads using the Water Erosion Prediction Project (WEPP) Model. The second task was modeling nutrient and sediment

loads from upland areas using the Soil and Water Assessment Tool (SWAT) Model (Storm et al. 2003).

The density of unpaved county roads was estimated using available Geographic Information Systems (GIS) data and ground truth data. A USGS Digital Elevation Model (DEM) was used to estimate slope and slope length along these roads, applied in **Figure 3**, which shows distribution of road types in the watershed. The WEPP Roads Model (WEPP: Road, Elliot, William et al.., USDA, Forest Service Rocky Mountain Research Station, 1999) was applied to estimate average annual erosion (Storm et al. 2003).

The WEPP roads model estimated the annual sediment loading from roads in the Fort Cobb basin to be 6,030 metric tons per year (**Table 3**). This represents 2.2% of the 280,000 metric tons per year of sediment loading predicted by the SWAT Model for the entire basin.

Table 3. Road and bar ditch erosion by road surface type and bar ditch condition as predicted by the Water Erosion Prediction Project (WEPP) Model

Average Sediment Yield (Mg/km/yr)				
	Stable	Eroding	Flume	All Ditch Types
Paved	2.1	10.2	0.0	3.2
Gravel	7.7	14.9	13.1	10.0
Gravel and Paved	6.5	18.0	24.2	13.8
Dirt	4.9	9.0	11.5	7.9
All Surfaces	3.6	12.8	6.2	6.6

Total Annual Sediment Yield (Mg/yr)				
	Stable	Eroding	Flume	All Ditch Types
Paved	898	689	0	1587
Gravel	763	657	11	1430
Gravel and Paved	340	1539	39	1917
Dirt	180	910	4	1095
All Surfaces	2180	3795	54	6029

SWAT predicted sediment load to Fort Cobb Reservoir is 245,000 metric tons per year. The difference [between the two estimates] is due to the small portion of Cobb Creek between the Fort Cobb reservoir and the Washita River, which is included in the entire basin estimate. SWAT model predictions combined with high resolution GIS data indicate several sediment “hot spots” indicated in red in **Figure 4**. These areas contribute sediment loads more that ten times the basin average on a per hectare basis (Storm et al. 2003). However, since unpaved roads contribute only a small percentage of the overall sediment load to the reservoir, **OCC decided not to allocate funds for road BMPs during this 319 project**.

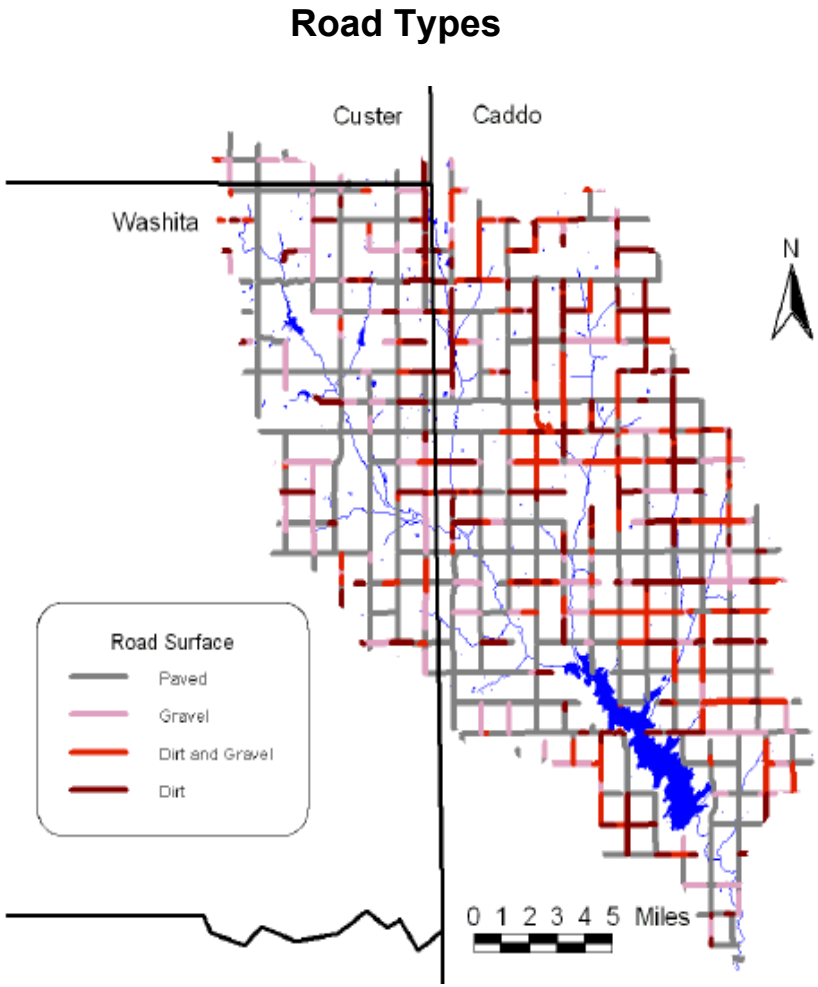

Figure 3. Road surface conditions in the Fort Cobb basin derived from US Census Bureau Topologically Integrated Geographic Encoding and Referencing system TIGER data and ground truth collected by Oklahoma Conservation Commission personnel (Storm et al.)

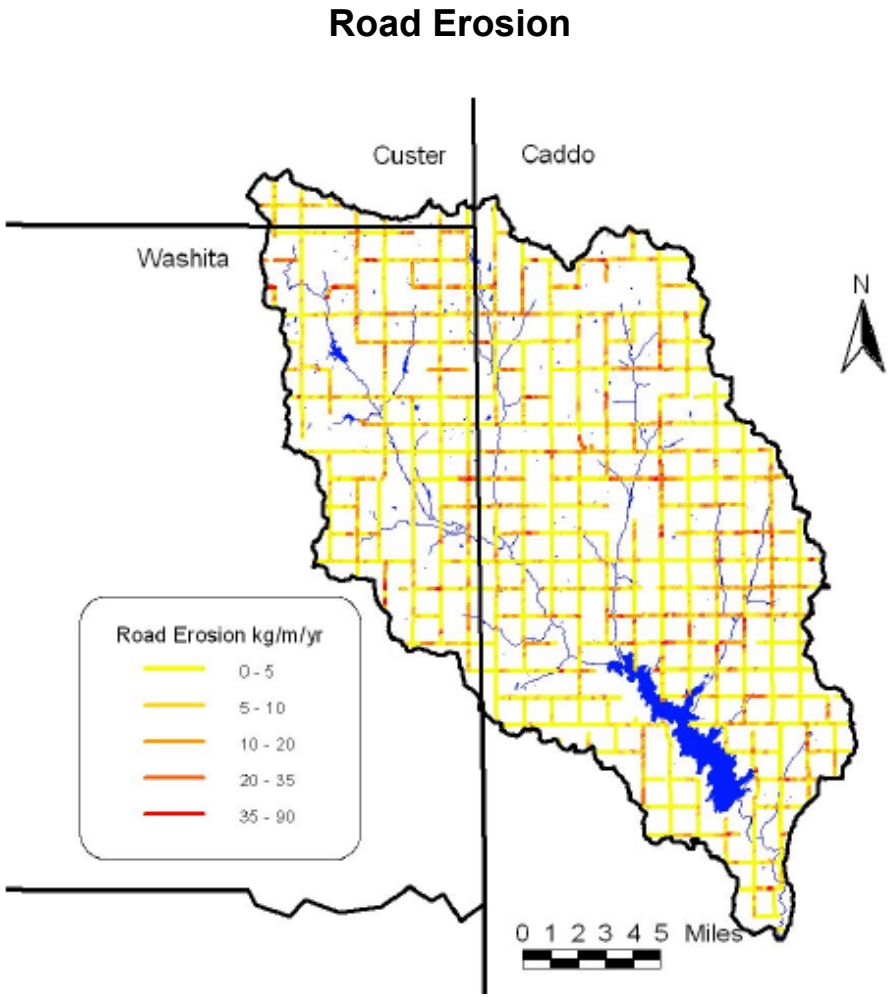

Figure 4. Predicted road erosion in the Fort Cobb basin derivied from Water Erosion Prediction Project (WEPP) (Storm et al.)

Estimated Nutrient and Sediment Loading Using SWAT

The SWAT 2000 model was used to estimate erosion and nutrient loading from the upland areas of the basin. SWAT is a distributed parameter basin scale model developed by the USDA Agricultural Research Service at the Grassland, Soil and Water Research Laboratory in Temple, Texas. SWAT is included in the Environmental Protection Agency's (EPA) latest release of Better Assessment Science Integrating Point and Nonpoint Sources (BASINS) (Storm et al. 2003).

Loading to the reservoir was estimated as well as loading from different portions of the basin using SWAT 2000 (Arnold, Jeff. et al., USDA Agricultural Research Service. Grassland, Soil, and Water Research Laboratory, 2002). Land cover specific loading was simulated to show the fraction of the total load to the reservoir originating from each land cover type (**Table 4**). A nutrient load summary for the basin is shown in **Table 5**. Areas that contribute a disproportionate amount of sediment were identified to target OCC water quality programs (Storm et al. 2003).

Table 4. SWAT simulated loads by land cover for the Fort Cobb basin for the period 1/1990-10/2001 (Storm et al.)

Land Cover	Total Phosphorus (kg/ha)	Total Surface Nitrogen (kg/ha)	Total Surface Nitrogen (mg/l)	Total P (mg/l)	Soluble P (mg/l)	Surface NO3 (mg/l)	Sediment Yield (mt/ha)
Forest	0.01	2.12	1.18	0.00	0.00	0.20	0.01
Pasture/Range	0.54	3.16	3.00	0.51	0.01	0.27	1.29
Peanut	1.94	7.87	5.35	1.32	0.02	0.30	4.00
Sorghum	1.54	8.23	5.10	0.95	0.01	0.37	4.17
Urban	0.08	1.13	1.12	0.08	0.02	0.72	0.04
Water							
Wheat for Grain	2.12	10.62	8.73	1.74	0.02	0.38	6.38
Wheat for Other	1.99	9.29	7.82	1.67	0.02	0.29	5.57
Average	1.25	6.40	5.40	1.05	0.01	0.32	3.44

Table 5. Nutrient and Load Summary for the Fort Cobb/Cobb Creek Basin as Predicted by the SWAT Model for the Period 1/1990 – 10/2001 (Storm et al.)

Constituents	Total P	Total N	Sediment	Total Surface Nitrogen*
Units	(kg/yr)	(kg/yr)	(Mg/yr)	(kg/yr)
Fort Cobb Reservoir Load	102,000	734,000	245,000	N/A
Cobb Creek Basin Load	106,000	N/A	293,000	546,000

*Does not include nitrogen contributions from sub-surface flows.

The SWAT model was used to estimate the loading to the reservoir and how the loading varies spatially across the basin. Using information shown in **Figures 5 through 9**, OCC was able to focus BMP dollars in areas contributing higher pollutant loads.

Mineral Phosphorous

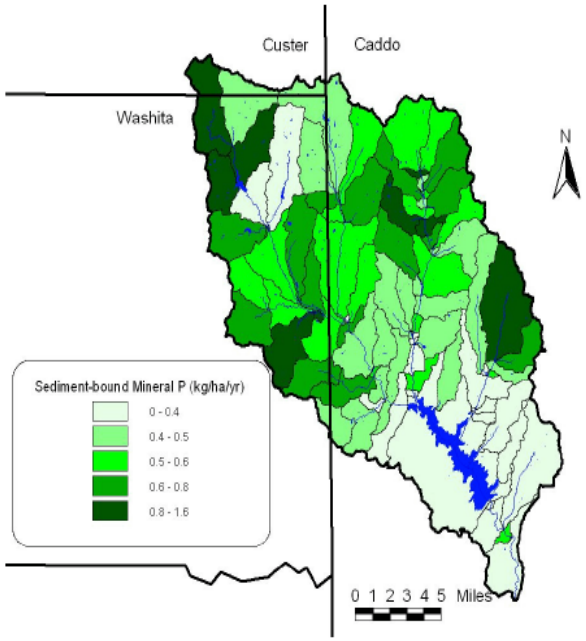

Figure 5. Sediment-bound mineral phosphorous loading across the Fort Cobb basin as predicted by the Soil and Water Assessment Tool (SWAT) model. Does not include sediment-bound organic forms (Storm et al.)

Nitrate

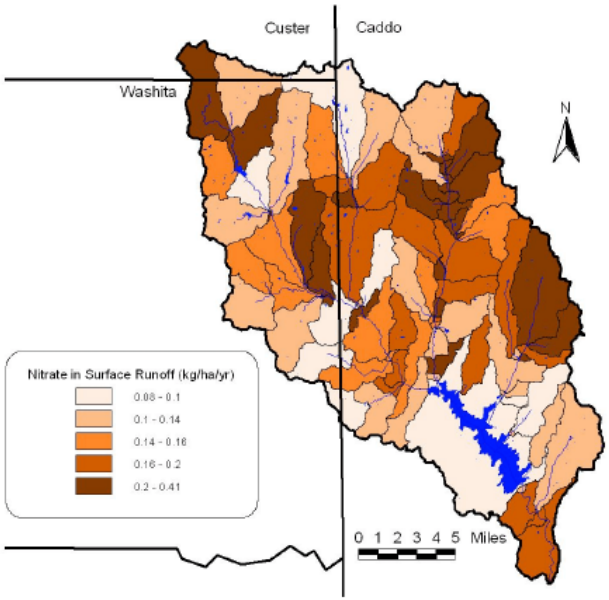

Figure 6. Nitrate in runoff across the Fort Cobb basin as predicted by the Soil and Water Assessment Tool (SWAT) model (Storm, et al.)

Organic Nitrogen

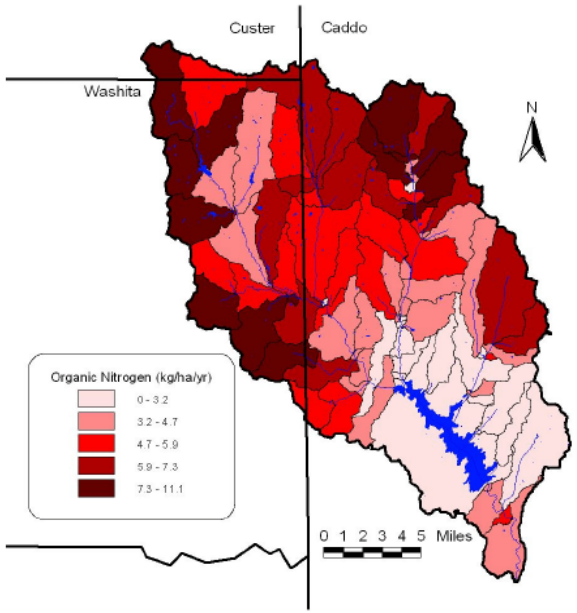

Figure 7. Organic nitrogen yield across the Fort Cobb basin as predicted by the Soil and Water Assessment Tool (SWAT) model. (Storm et al.)

Relative Erosion

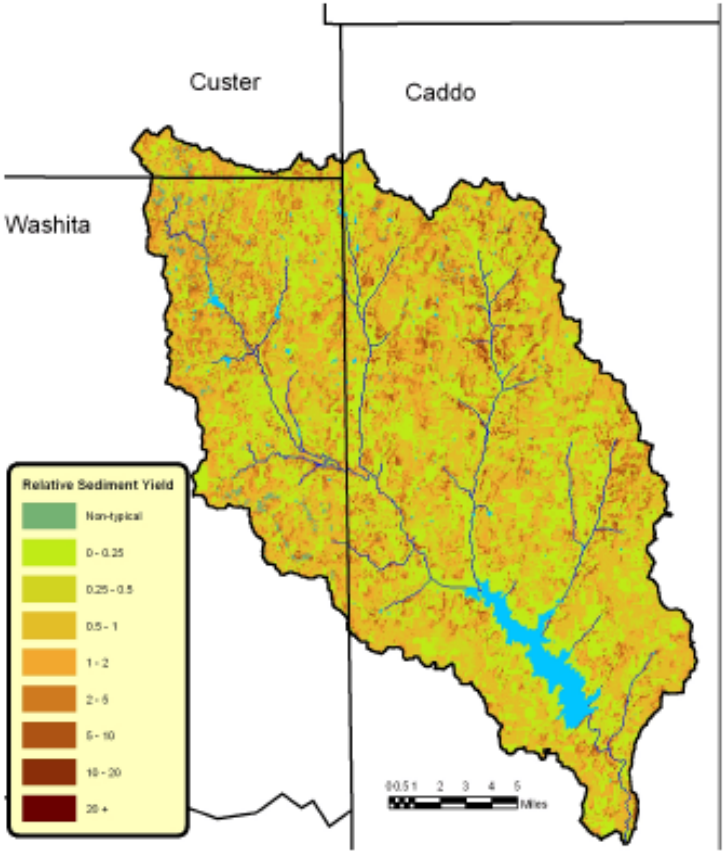

Figure 8. High resolution relative erosion in the Fort Cobb basin. Based on SWAT model simulations (Storm et al.)

Erosion Priority Areas

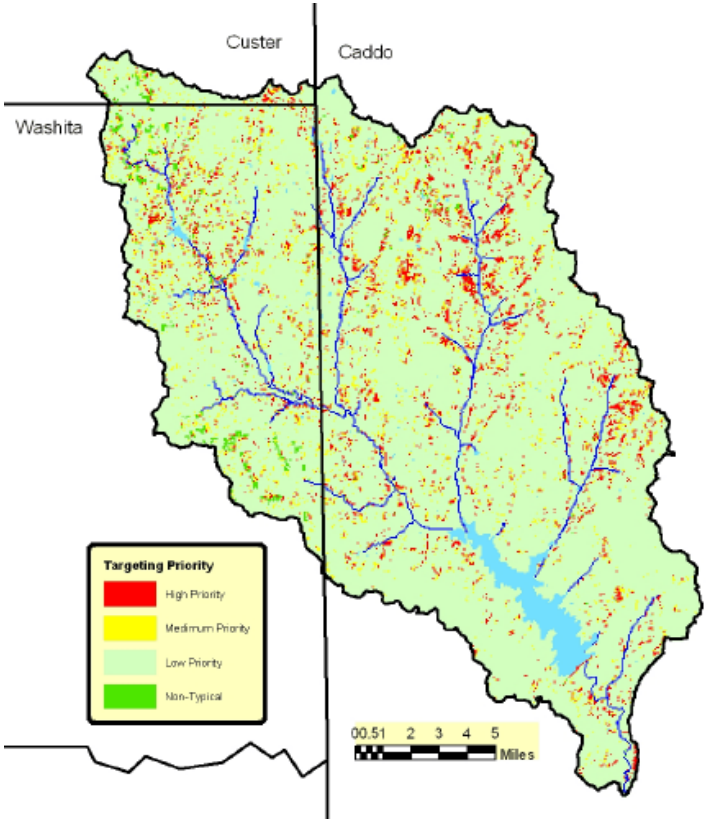

Figure 9. Erosion targeting map. High priority is 5% of the basin with the highest predicted erosion. Medium priority includes the next highest eroding 5%. Low priority covers the remainder. Non-typical areas are suspected mis-classifications in land cover including agricultural fields with slopes greater than 15%, gypsum outcroppings, or rough broken land. Derived from Soil and Water Assessment Tool 2000 (Storm et al.)

Total Maximum Daily Load Recommendations

The roads, nutrient, and sediment modeling studies were used in conjunction with historical studies data to develop a Total Maximum Daily Load (TMDL) for the Fort Cobb watershed. The data from these studies was incorporated into the TMDL to set a target goal for reduction necessary to improve water quality. The TMDL was written by the Oklahoma Department of Environmental Quality (ODEQ).

As stated in the workplan, the 2000 NPS Management Program established a loading reduction goal for the Fort Cobb reservoir watershed based on the need to restore beneficial use support to all impaired (303(d) listed) waterbodies in the watershed. Because approximately 41% of the stream miles in the watershed and 97% of the lake acres are listed on the 303(d) list, the **goal of the Fort Cobb Project was to reduce loading from nonpoint sources of pollution in 41% of the stream miles and 97% of the lake acres to a level which no longer violates Oklahoma Water Quality Standards**.

The major pollutants in the watershed include sediment and nutrients. Because no specific numerical water quality standard exists for sediment in the watershed and turbidity in the watershed is largely inorganic, suggesting a relationship between turbidity and sedimentation, the goal will be based on reducing instream and inlake turbidities and nutrient concentrations. The **turbidity goal for the streams** is less than and average of 40 NTU during baseflow conditions. The **turbidity goal for the lake** is less than 25 NTU. **Nutrient goals for the streams** will vary based on stream order, but will generally be less than 0.15 mg P/l and less than 0.24 mg/l of nitrate + nitrite. **Nutrient goals for the lake** are related more closely to algal production through a trophic state index (TSI). The nutrient-related goal for the lake is a TSI < 62, which equates to a nutrient concentration of approximately 0.08 mg P/l.

In June 2004, the ODEQ released the draft TMDL for phosphorous loading to Fort Cobb Reservoir. The TMDL is based on watershed data collected between 1990 and 2001; therefore, loading reduction recommendations were based upon loading during that period. This data will continue to be used as baseline to evaluate progress in the Fort Cobb watershed and specifically includes watershed data from primarily the period between 1998 and 2001. **Table 6** shows the TMDL recommended practices to achieve a **70% phosphorous load reduction** to restore beneficial use support to the reservoir.

Table 6. TMDL recommended practices to attain 70% phosphorous reduction and restore beneficial uses

TMDL Recommended Practice
No-till 50% of row crops and wheat pasture
Convert 20% worst cultivated land to pasture
Riparian buffers in 60% of watershed
Nutrient management plans for 90% of producers
Grade Stabilization Structures

The phosphorous **reduction needed to come entirely from nonpoint sources in the watershed** because there are no point source dischargers in the watershed. To quantify reductions, it was determined that the project would rely upon existing monitoring programs in the watershed. This decision was based on knowledge that the agricultural Research Service (ARS) was beginning a Conservation Effectiveness Assessment Program (CEAP) in the watershed during the project period. After learning the specifics of the CEAP monitoring and securing an informal data sharing agreement with ARS, OCC decided to focus monies on education and installation of BMPs instead of establishing a redundant monitoring program. In addition to ARS, the Oklahoma Water Resources Board, U.S. Geological Survey, and OCC also have monitoring programs ongoing in the watershed that are unaffiliated with this project. Relevant data from these programs will also be analyzed.

IMPLEMENTING THE PROJECT

As stated in the project workplan, “The intent of this project is to demonstrate the benefits of NPS implementation on the water resources of the Cobb Creek/ Fort Cobb Reservoir watershed. Objectives of the project are to:

- promote protection and re-establishment of buffer zones and riparian areas,
- demonstrate practices necessary to achieve the sediment, nutrient, and pesticide control needed to protect the Cobb Creek and Fort Cobb Reservoir,
- implement practices and programs identified by the Watershed Restoration Action Strategy and TMDL to improve water quality.”

Fort Cobb 319 Project goals were reached through numerous partnerships. The project was a collaborative effort of many different groups including OCC, Conservation Districts, Oklahoma Department of Agriculture, Oklahoma State University Cooperative Extension Service, and the Natural Resources Conservation Service. These groups’ efforts will be discussed later in the report. Most importantly, success of the program relied heavily upon interaction with and buy-in from the local watershed residents, the people who had to change their behaviors for the program to make a difference.

Organizing at the Local Level

The project sought local support in several ways. The first was to **partner with the local Conservation Districts**. Conservation Districts and their boards consist largely of local agriculture producers or persons with a strong tie to the local agricultural industry. The districts are well known to the local producers and have worked with many of them in the past and will into the future. Districts also have a well-established partnership with local NRCS offices and are the most effective means to involve and coordinate with NRCS and producers at a local level.

Secondly, the project **hired a *local* project coordinator** rather than someone from outside the area. The coordinator was familiar with the landowners and the issues in the watershed. This person lives in the area so landowners would see him at local restaurants and church, for example, rather than just at meetings about the project. In this manner, the local landowners would be more likely to place their trust in this person than with a stranger. This local project coordinator was responsible for:

- Identifying and scheduling landowners in need of conservation planning
- Assisting with local landowner meetings held in the watershed
- Coordinating the tracking of conservation plans and practices recommended
- Working with NRCS to ensure that water quality concerns were addressed
- Holding periodic meetings with the various groups working in the watershed
- Participating in watershed education activities
- Coordinating demonstration watershed implementation activities as outlined in the work plan
- Coordinating the Watershed Advisory Group

The project coordinator worked out of two conservation district offices in the watershed. He **assembled a Watershed Advisory Group (WAG)** that recommended practices to be offered through the program and the cost-share rates at which to fund the practices. The WAG was a group of individuals, recommended by the Conservation District Boards, selected to represent local interests in the watershed.

The WAG considered the NPS problems and **recommended three groups of best management practices** aimed at the major NPS problems in the watershed: nutrients (primarily phosphorous), fecal bacteria, and sediment. They chose different priorities for the three major groups of practices, based on what they felt would be most beneficial for the watershed. They then **assigned cost-share rates** to those groups of practices based on priority and rates they believed would be necessary to get landowners to participate. The recommendations of the WAG were then evaluated and approved by the Oklahoma Conservation Commission.

Cost-Share of Best Management Practices

All agriculture producers and individual rural residents in the Cobb Creek/Fort Cobb watershed in the counties of Caddo, Washita, and Custer were eligible for cost-share assistance regardless of size of land ownership. There was no minimum cost-share

payment to any applicant. The maximum cost-share assistance to any one participant was $20,000. Because of the large size of the watershed compared to the funding available for implementation, the Watershed Advisory Group (WAG) recommended practices and cost-share rates that would maximize the amount of implementation that could occur with the project, focusing on practices with the greatest potential to improve water quality. These practices and cost-share rates are shown in **Table 7**.

Table 7. Best management practice cost-share rates for the Fort Cobb project

Cost-Share Practice	Cost-Share Rate
Priorty #1. **Riparian Area/Buffer Zone Establishment/Management**	**80%**
(1) Vegetative Planting	
(2) Stream Crossing	
(3) Fencing	
(4) Off Site Watering	
Priority #1a. **Cropland Erosion**	**80%**
(1) Vegetative Planting	
(2) Field Border	
(3) Residue Management	
(4) Structural Practices	
Priority #2. **Pastureland Management**	**75%**
(1) Prescribed Grazing	
(2) Cross Fencing	
(3) Vegetative Establishment	
(4) Watering Facilities	
(5) Heavy Use Areas	
(6) Nutrient Management	
(7) Structural Practices	
Priority #3. **Roadside Erosion and Special Projects**	**75%**
(1) Vegetative Planting	
(2) Site Preparation	
(3) Structural Practices	
Priority #4. **Animal/Human Waste**	**70%**
(1) Heavy Use Areas	
(2) Filter Strips	
(3) Use Exclusions	
(4) Off Site Watering	
(5) Fencing	

More than 200 interested landowners visited conservation district offices in the watershed to learn more about the program. The Project Coordinator then **visited the property**, interviewed the landowner about their operation, detailing current and, as possible, future management plans, and discussed conservation needs with the landowner. The coordinator and landowner then discussed implementation options to meet conservation needs and agreed upon the recommended practices to address those needs. Then the coordinator used the information to **write a farm plan**. The individual **farm plans were ranked** based on the types of practices in the plan (Table 8). Plans with practices that would achieve the greatest load reductions received the highest points. **128 contracts were entered into**.

Table 8. Ranking point distribution for BMPs used in the Cobb Creek/Fort Cobb watershed project

Suite of Practices	Points Awarded
Riparian Areas/Buffer Zone[1]	
Fencing: total exclusion	50 points/acre
Vegetation Establishment: hay production	40 points/acre
Alternate Water Source: limited grazing	30 points/acre
Heavy Use Area: regeneration	10 points/acre
Cropland Erosion[2]	
Soil loss before – soil loss after = tons of sediment saved	1 point/ton/acre
Pastureland Management	
Permanent cross fences on grazing lands	.5 points/acres enhanced
Regeneration of grazing lands[3]	.25 points/acre
Roadside erosion and special projects	
Based on NRCS Gully Erosion Worksheet and/or total amount of soil loss	5 points/ton lost/year
Animal/Human Waste[4]	
Septics, watering lanes, heavy use areas, etc.	50 points

[1]Acres are calculated from the area inside buffer fences. [2]Includes sheet & rill, ephemeral, gully, and wind erosions if applicable. [3]The regeneration is only available on degraded grasslands that are contributing sediment through erosion. Cooperators must be willing to cross fence to qualify for these points. Erosion points are based on the NRCS Gully Erosion Worksheet for soil loss. [4]The points earned in this priority are granted at a fixed rate.

Plans that received the highest point rankings were funded first. As is typical, not all interested landowners who initially signed-up and went through the planning process were initially funded. However, as the project progressed and landowners that initially signed up were unable to complete their agreements due to lack of funding, or other reason, landowners lower on the list were offered the opportunity to participate. Ultimately, 128 landowners successfully installed BMPs on their land. Only five landowners never installed the BMPs they agreed upon.

To analyze BMP distribution within the watershed, farm plans will be converted from paper copies to digital records by OCC personnel. The digital records of implemented practices are used to create maps and may be used in future targeting exercises to pinpoint areas still in greatest need of BMPs. These maps will be available on the OCC

website at http://www.ok.gov/okcc/Agency_Divisions/Water_Quality_Division/WQ_Projects/index.html by February 10, 2008.

Installation of Best Management Practices

Practices installed during this project were based on the Watershed Based Plan, modeling, the TMDL, and recommendations by the Watershed Advisory Group with input from multiple state and local stakeholder groups.

Practices were prioritized and grouped into five major categories: (1) riparian area/buffer zone establishment and management, (1a) cropland erosion control, (2) pasture and cropland management, (3) roadside erosion and special projects, and (4) animal and human waste. The focus of the practices was to implement nutrient and sediment reductions to Lake Creek, Willow Creek, and Fort Cobb Reservoir, with the ultimate goal of achieving beneficial use support. The project foremost focused implementation in the targeted areas identified with SWAT targeting.

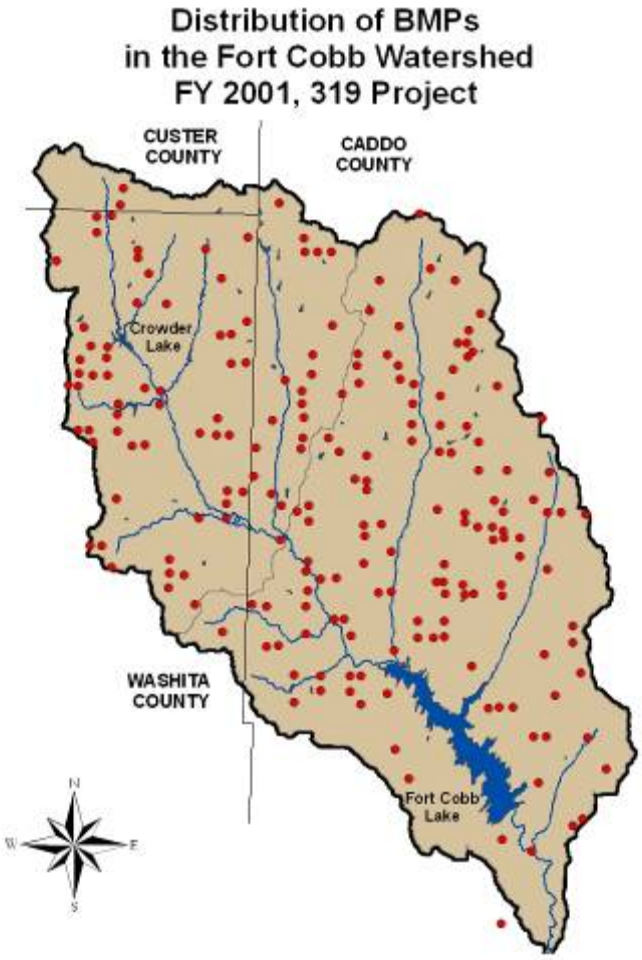

Figure 10. Distribution of BMPs installed for the FY01 Fort Cobb 319 Project

A total of $1,386,611 was spent on implementation of best management practices associated with this project. This amount represents a little more than half of the total project expenditure. Implementation funding included $498,054 Federal dollars, $365,650 State dollars, and $522,907 in match from landowners. This amount was far short of the amount needed to address all sources of NPS pollution in the watershed; therefore, a second 319 project began in FY2005. Specific funding by practice for the FY2001 project is shown in **Table 9**.

Table 9. Distribution of project funds among BMP categories

Practice	Total # Cooperators	319 and State Funds
Riparian management		
Total use exclusion	6	28,437.50
Stream crossing – excavation / embankment	1	1,198.08
Stream crossing – Creek jack	1	3,600.00
Fencing – 4 wire permanent	7	21,294.23
Offsite watering – well	1	478.88
Erosion control		
Vegetative establishment – Bermuda sprig	78	280,815.74
Vegetative establishment – Bermuda seed	1	437.76
Vegetative establishment – other grass seed	5	2,398.37
Vegetative establishment – liming	3	1,281.23
Vegetative establishment - Fertilizer (N,P,K)	75	82,332.86
Vegetative establishment – fertilizer (other)	51	10,123.99
Gully shaping	3	1,476.00
Critical area planting (sprigging)	2	1,422.00
Seedbed preparation (use of tractor/drill)	41	22,375.45
Vegetation less than 1 acre	1	70.00
Grade stabilization structure – trash guard	13	3,379.20
Grade stabilization structure – barrel	13	50,827.00
Grade stabilization structure – excavation or embankment	13	25,136.60
Grade stabilization structure – Concrete	13	3,424.00
Grassed waterway	7	9,012.00
Terrace – removal of ridge	2	849.76
Terrace – Reconstruction	1	100.80
Diversion	2	1,203.20
Pastureland Management		
Vegetative establishment – other	2	816.57
Vegetative establishment – Bermuda sprig	13	17,944.73
Vegetative establishment – seedbed prep.	6	2,026.63
Vegetative establishment – liming	2	635.66
Vegetative establishment - fertilizer (N,P,K)	15	6,969.40
Vegetative establishment - Fertilizer (other)	12	991.65
Cross fencing – 4 wire permanent	5	11,487.16
Watering facility – PVC pipeline	3	3,788.20
Watering facility – well	3	2,477.48
Grade stabilization structure – trash guard	9	2,708

Grade stabilization structure – barrel	9	49,400.50
Grade stabilization structure – excavation or embankment	11	38,032.66
Grade stabilization structure – Concrete	10	3,681.75
Terrace – ridge or channel	1	541.20
Diversion	4	5,185.63
Roadside erosion and special projects		
Fertilizer – N,P,K	2	176.25
Fertilizer – other	2	69.00
Critical area planting – sprigging	3	887.25
Gully shaping (critical area treatment)	8	4,948.00
Grade stabilization structure – trash guard	5	858
Grade stabilization structure – barrel	5	14,729.4
Grade stabilization structure – excavation or embankment	5	8,427.18
Grade stabilization structure – Concrete	5	1,719.38
Diversion	2	1,166.24
Waste management		
Septic system – tank	4	1,183.00
Septic system – installation of tank	4	280.00
Septic system – installation of lateral lines	4	3,724.35
Septic system – test	3	189.00
Septic system – certification	2	84.00
No-Till		
No-till – incentive	13	62,190.00
No-till – drill rental	10	25,561.00
No-till – purchase assistance	4	39,150.00
TOTAL COST		**863,704.02**

Riparian Area Establishment and Protection

The number one priority BMP for this project was Riparian Areas/Buffer Zones establishment and protection. With relatively low capital investments required (mainly fencing and alternative water supply costs) and an extremely high efficiency for phosphorous removal (as high as 75-80%), this is the most cost-effective method to reduce nonpoint source pollution in watersheds like Fort Cobb. In addition to filtering nutrients, sediment, and other pollutants from runoff, riparian vegetation also help stabilize streambanks and can, over time, improve channel stability and instream habitat.

Aside from environmental benefits, restricting cattle access to streams and allowing riparian vegetation to develop can also improve herd health, reduce the amount of near-stream land lost to erosion, and help retain nutrients onsite that can eventually be exported from the farm as a product such as hay, milk, or beef. Unfortunately, these benefits directly to the producer are not as obvious as those from a practice such as pasture planting or as well known as those from a practice such as terracing. As such,

farmers are more reluctant to implement riparian protection than more traditional practices. Landowners look upon the riparian areas as critically needed, highly productive pasture. However, heavily grazed riparian areas function poorly as nutrient traps, and cattle trails become channels for direct transport of nutrients to the stream. Fencing to exclude cattle from a certain area along a stream was recommended to control these problems. In order to encourage landowners to implement this practice, a **cost-share rate of 80% was offered** requiring a 20% match from the landowner. Even with this high assistance rate, fewer than twenty cooperators erected riparian fencing.

Erosion Control

The second highest priority BMPs targeted Cropland Erosion. Poorly managed pastures and croplands can contribute a great deal of sediment to a stream, so establishing good vegetative cover on the land is an important BMP. Seventy-eight (78) cooperators sprigged Bermuda and 13 installed grade stabilization structures to prevent erosion.

Pastureland Management

The third priority group of BMPs, and the most popular offered through the project, was pastureland management. This was the most commonly adopted practice, even at the lower cost-share rate, because cattle ranchers can easily understand the economic benefits. Pastureland management improves their bottom line by improving forage quality and therefore beef production. They see higher weight gain with lower inputs of supplemental feed or they can stock higher densities of cattle. However, that increased forage quality also improves the filtering capacity of the pastureland and allows more pollutants to remain onsite rather than being washed off. Alternative water supplies and heavy use feeding areas encourage cattle to spend more time away from stream channels, which reduces the pollutant load reaching water. Thirteen (13) cooperators planted Bermuda sprigs, 5 installed cross fencing, 3 installed wells, and 9 installed grade stabilization structures.

Roadside Erosion Control

The fourth priority was roadside erosion, but once modeling showed roads only contribute 2.2% of the load, the decision was made not to spend project funds on erosion from roads.

Waste Management

The fifth priority was animal and human waste management. Although the human population in the watershed does not likely contribute significantly to watershed loading through septic tanks, the WAG felt it was important for the program to demonstrate

BMPs to address even potential NPS pollution in the watershed. Four (4) tanks with lateral lines were installed.

No-Till

The FY2005 project is focusing on no-till agriculture to reduce erosion from croplands so interest in no-till is currently peaked in the watershed. Unallocated FY2001 project funds were used to cost-share for no-till: 13 cooperators received incentive payments; 10 received drill rental cost-share assistance, and 4 received assistance to purchase no-till equipment.

ASSESSMENT

Water Quality Monitoring

As stated in the Work Plan, effectiveness of project BMPs was to be evaluated primarily with secondary data collected by the USDA Agricultural Research Service (ARS). The ARS began monitoring in the Fort Cobb watershed in 2004 under the USDA Conservation Effects Assessment Program (CEAP). The program monitors at 2 week intervals at 15 sites along the main tributaries into Fort Cobb Reservoir. The data collection started in December, 2004 and will continue for a total of at least 5 years (Steiner personal communication). However, data will not be made available to OCC until approximately 2010, after ARS scientists have published their findings. Due to the unavailability of this monitoring data, OCC is not able to determine or discuss in this report water quality improvements that may have resulted from the Ft. Cobb project. However, OCC has demonstrated through past watershed projects that BMPs reduce NPS loading to streams, and are optimistic that this project will show similar results when data are analyzed.

Additional secondary data collected by OWRB, USGS, and OCC programs concurrent with project efforts will be analyzed in tandem with CEAP data when it becomes available, as there is not enough stand alone data from these programs to accurately assess water quality improvements. These programs are summarized in **Table 10** below. When available, all relevant secondary data from these programs will be used to determine whether project activities resulted in measurable water quality improvements.

Table 10. Ongoing water quality monitoring programs in the Fort Cobb watershed

Oklahoma Conservation Commission (OCC)
The OCC collects water quality data from Cobb Creek, Fivemile Creek, Spring Creek, and Willow Creek 20 times per year for two years every five years as part of the Rotating Basin Monitoring Program in the Washita and Upper Red basin. Data was collected in 2004 and 2005 and will be collected again in 2009 and 2010. Measurements taken include: pH, dissolved oxygen, conductivity, salinity, total dissolved solids, temperature, turbidity, oxygen reduction potential, nitrate concentration, ammonia concentration, suspended sediment, and phosphorus.

Oklahoma Water Resources Board (OWRB)
The OWRB has been monitoring Ft. Cobb Reservoir since 1994. Under the Beneficial Use Monitoring Program (BUMP) the agency also monitors 100 stream and river sites around the state approximately every five weeks. Collections are made for a variety of parameters. The streams program conducts comprehensive biological monitoring, which includes collecting fish, benthic macroinvertebrates, and habitat data. The BUMP program provides an assessment of the attainment of beneficial uses for all sites monitored.

U.S. Geological Service Data (USGS)
The Agricultural Research Service (ARS) is contracted with USGS to collect sediment and water quality data for 6 base flow and 6 storm flow events each year for an expected duration of 5 years. Samples are collected at stream gauging stations on Cobb Creek, Lake Creek, and Willow Creek. Measurements taken include: pH, dissolved oxygen, conductivity, salinity, total dissolved solids, temperature, turbidity, oxygen reduction potential, nitrate concentration, ammonia concentration, suspended sediment, and phosphorus. Data is expected to be collected through 2010.

Oil and Gas Field Evaluations and Education Project

The OCC contracted with the OK Corporation Commission to evaluate the presence of pollutants from oil and gas activities in the Ft. Cobb watershed.

The Oklahoma Corporation Commission (Corp. Comm.) is the state agency with jurisdiction over oil and gas mining activities. Efforts by Corp. Comm. included locating and GIS mapping all oil and gas sites drilled in the watershed (**Figure 11**); identifying the location and severity of erosion related to well sites and pipelines, and initiating cleanup by the operators and pipeline companies. The Corp. Comm. visually examined over 219 oil and gas sites, which is most of the sites in the watershed, and found no unplugged wells. The few problem sites were referred to counseling and enforcement as needed. No sites needed cleanup. It was determined that few sites had significant erosion, eroded areas were small, and no sediment was apparently washing into streams. Additionally, the agency reported no significant impact on area streams or Fort Cobb Lake from sediment eroded off oil and gas sites. Field screening found no impacts over state standards in the streams in the oilfield areas (Corp. Comm.).

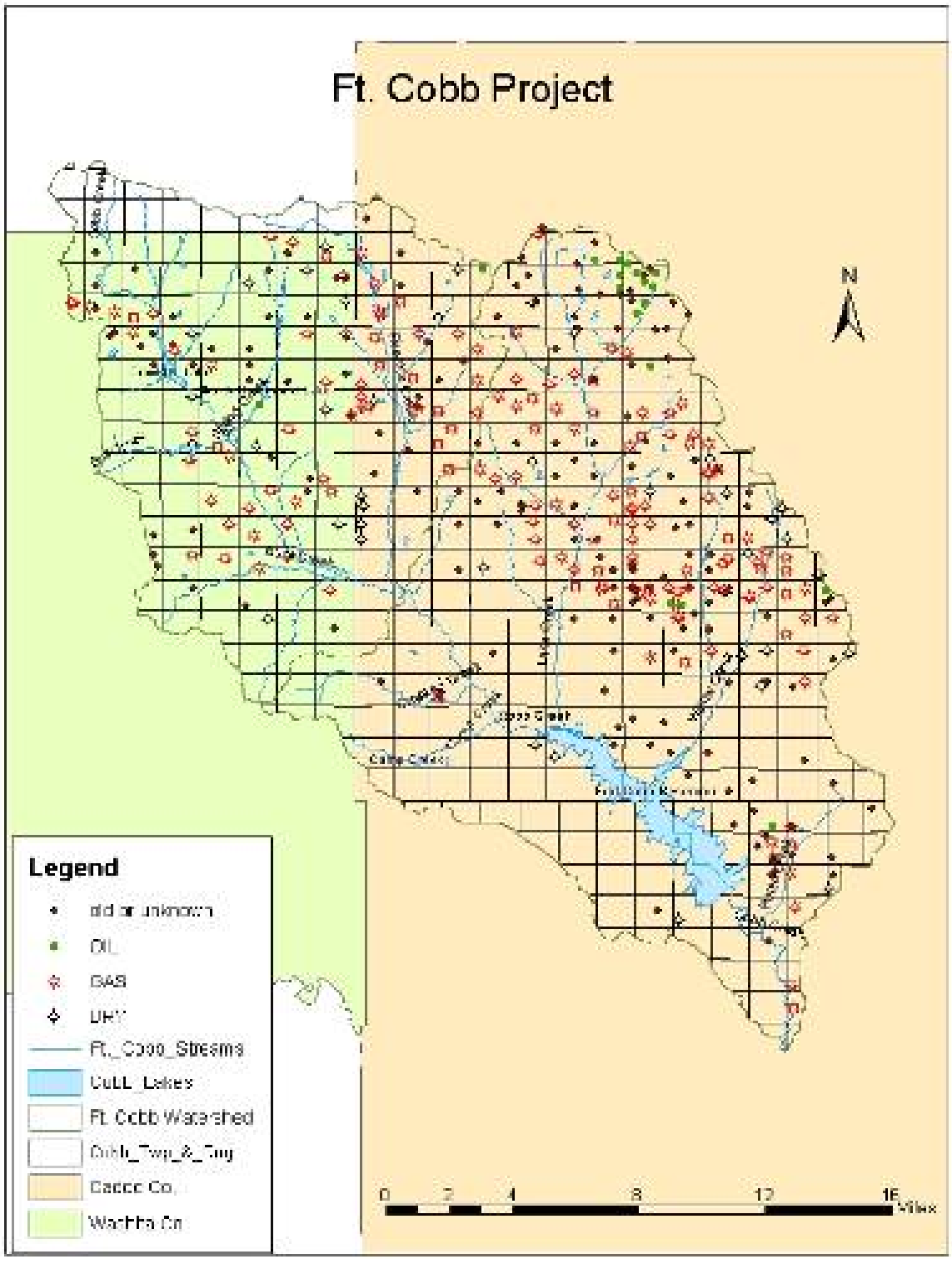

Figure 11. Oil and gas sites in the Fort Cobb watershed (Corp. Comm. 2005)

Pesticide Monitoring and Education Project

OCC contracted with the OK Department of Agriculture, Food and Forestry to evaluate the presence of pesticide pollution from land uses in the watershed. In February and May 2004, ODAFF conducted monitoring to determine if any pesticides were reaching Fort Cobb Reservoir from surrounding agricultural land and, if so, to determine sources. The ODAFF provided OCC with the monitoring data to determine what types of BMPs to install to reduce or prevent agricultural chemicals from entering Fort Cobb Reservoir.

Due to increased laboratory costs, ODAFF decided not to monitor 10 of the planned sites. Of the remaining 29 sampling sites selected throughout the watershed (**Figure 12**), 23 were water sites and 5 were sediment sites. One site had water flowing in February and was dry in May. The samples were analyzed for the presence of organochloride/ organophosphate pesticides and for herbicides. The sampling sites were selected based on likelihood of being able to identify the source of pesticides if they were detected (ODAFF 2004).

The presence of any pesticide in a sample was used to indicate that NPS pollution was occurring in the watershed. According to ODAFF, the Oklahoma State University Extension Agents Handbook lists over 50 different pesticides labeled for use on the numerous crops grown in the watershed. “These include herbicides, insecticides and fungicides used in the production of peanuts, alfalfa hay, cotton, soybeans, corn and other crops, There are others listed for weed control in pastures and pest control on livestock” (ODAFF 2004).

An herbicide scan and an organophosphate/organochloride scan were conducted on samples from each site. It was thought that these scans would detect the majority of the pesticides used on the crops and livestock grown in the watershed. The pesticide P,P’–DDE, a metabolite of the insecticide DDT, was detected in the sediment at site 34 in both February (9.1 ppb) and May (4.1 ppb). The DDT detection is likely the result of historic applications. Even in the absence of farm chemicals in most samples, ODAFF turned their attention to pesticide pollution prevention and education.

ODAFF audited records of restricted use pesticide dealers and collected the names of 145 private pesticide applicators that had purchased restricted use pesticides within the last two years. The restricted use pesticide dealers are the only ones licensed in the state of Oklahoma to sell these restricted pesticides. ODAFF focused on the private applicators farming or ranching around the Fort Cobb Reservoir watershed area. Face-to-face on-site education visits were made with 100% of the individuals identified as having purchased restricted use pesticides, which far exceeds the 50% goal identified in the work plan to educate applicators in the watershed.

During these face-to-face on-site visits, certified private applicators were provided brochures on 1) protecting groundwater (developed by ODAFF), 2) fact sheets developed by Oklahoma State University Cooperative Extension Service, and 3) a brochure developed by ODAFF specifically for this project (*Protecting Fort Cobb*

Reservoir from Pesticides and Nutrient Pollution). Information was also provided for pesticide container disposal.

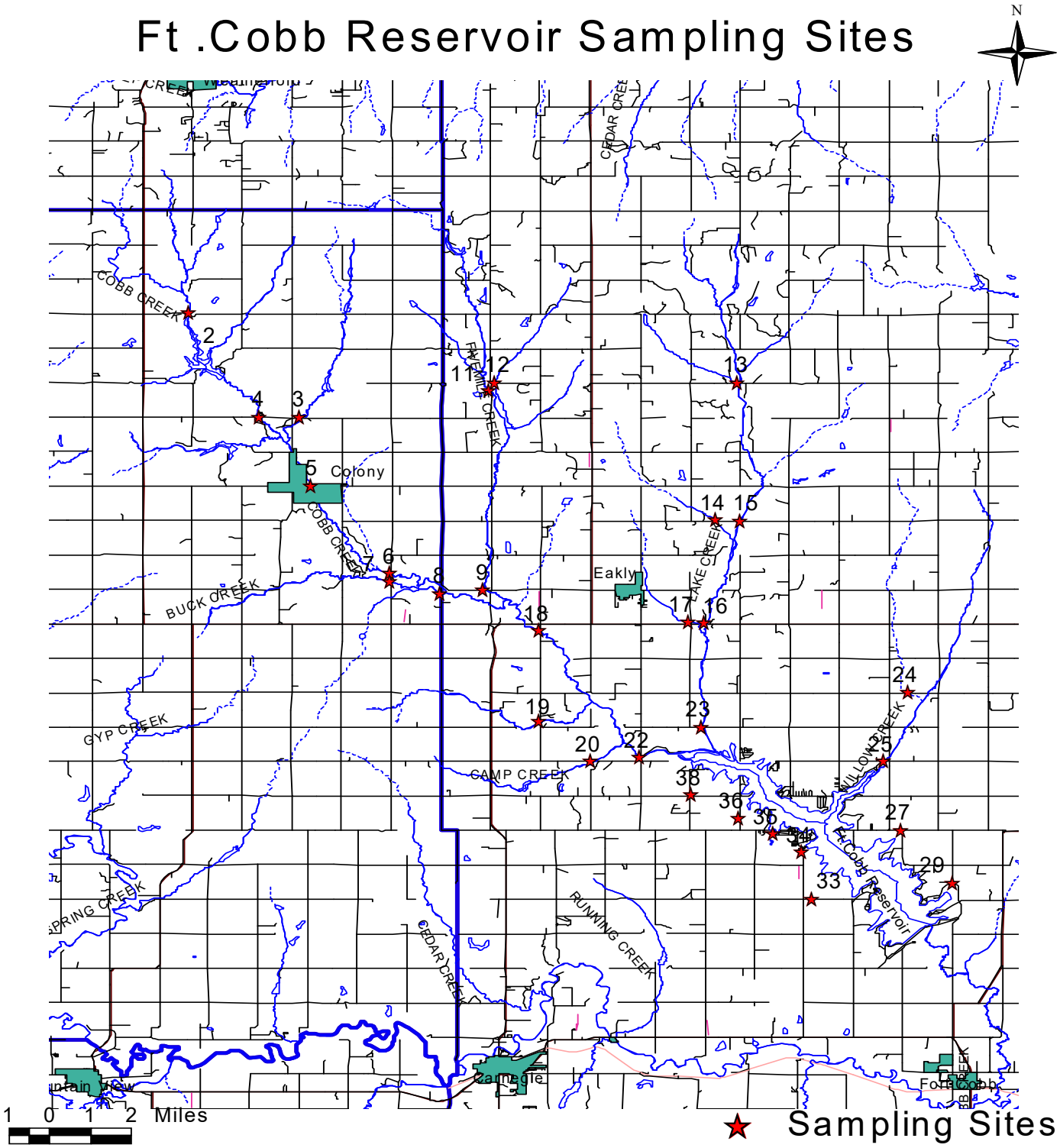

Figure 12. ODAFF monitoring sites in Fort Cobb watershed. Note: These sites were eliminated due to budget constraints: #1, 10, 21, 26, 28, 30, 31, 32, 34, and 37.

EDUCATION PROGRAM FOR THE FORT COBB PROJECT

The intent of this 319 project was to install practices necessary to achieve the sediment, nutrient, and pesticide control needed to protect Cobb Creek and Fort Cobb Reservoir and to raise the awareness of watershed residents.

While BMP implementation coupled with modeling, monitoring, and data analysis is a quantifiable way to reduce NPS pollution, one of the most important components of this project revolved around education. The 319 projects are designed as demonstration projects; money is not available to holistically solve the water quality problems, rather it is used to demonstrate effective methods of solving the problem. The intent is that once people become educated about what the problem is and what they can do to fix it, they will begin to adopt those strategies on their own or through similar programs such as NRCS's EQIP or CRP. The intent is to get people to change their behaviors by educating them about the problems and solutions. Therefore, a large educational component of this project was the demonstration of best management practices selected to best reduce NPS pollution originating on agricultural lands in the watershed. Groups in the watershed that were targeted for water quality education outreach included:

- Vocational Agriculture teachers at their meetings.
- Local building contractors.
- The community around the lake.
- Owners of small acreages.
- 4-H Clubs
- County Commissioners and their employees
- The Native American Tribes
- HCE organizations
- Cattlemen
- Peanut Growers
- Wheat Growers

The Leadership

The education program was led by a local education coordinator who offices at the Deer Creek Conservation District (CD) Office. The CD has a very active education program through its outdoor classroom, and so was an ideal hub for project educational activities. The coordinator was also charged with chairing the Education Watershed Advisory Group (EdWAG).

The 23 member EdWAG was created to identify and guide the specific educational goals for this project and to draft an education plan for the watershed project to meet those goals. The education coordinator insured that the goals were met. The Fort Cobb EdWAG also recognized a need for special awareness of minorities and those with limited economic resources in the watershed, so the education coordinator made repeat visits to tribal headquarters encouraging tribal participation. The EdWAG was composed of individuals from many stakeholder groups, including a representative from one tribe:

Robert Beene	DEQ
Dale Beerwinkle	Caddo County Cattlemen's
Cheryl Cheadle	Oklahoma Conservation Commission
Ed Crall	Fort Cobb Project Education Coordinator
Sheila Curtis	Lookeba Sickles Science Teacher
Dennis Slagell	NCCD Director
Larry Edmison	OKCC Water Quality Division
Michael Entz	Oklahoma Wildlife Federation
Carol Gaunt	DCCD Director
G.R. Green	ODAFF-WQS
Sue Harper	DCCD Manager
Karla Beatty	Oklahoma Conservation Commission
Alveta Taylor	NRCS Earth Team Volunteer
Beverly Harvey	Caddo Electric Cooperative
Russ Jackson	MVCD District Director
Gary King	WCCD Director
Ranel Lasley	OSU Extension service
Hammond Motah	Apache Tribe
Don Recker	Caddo County Commissioners
Ken Fruitiger	Water Superintendent
Ernie Walker	Hinton Vo-Ag Teacher
Thomas Weichel	Landowner from MVCD
Monty Ramming	Fort Cobb Project Coordinator

The Plan

The EdWAG education plan was constructed to support the 319 program and included activities that already existed and/or will be continued in the watershed by the conservation districts long after the 319 project ends, such as conservation day events. The education plan targeted peanut farmers, landowners, ranchers, and rural homeowners by **framing the education and outreach around awareness** of the following:

- The water quality problem in Fort Cobb Lake,
- The effects their actions have on water quality in Fort Cobb Lake,
- The potential their actions have to improve the water quality and increase the life expectancy of Fort Cobb Lake, and
- The awareness of how management practices that are beneficial to water quality are also beneficial to wildlife, property values, aesthetics, and soil conservation.

The Outreach

Outreach efforts focused demonstration, awareness, and education. The demonstration outreach focused on sediment, which is the primary nonpoint source water quality pollutant in the Fort Cobb watershed. The education program addressed the sources of sediment by demonstrating to local farmers how the use of buffer strips, field borders, riparian area establishment, no-till production, grass planting, grazing management, grade stabilization structures, and additional conservation practices can effectively reduce the amount of non-point source pollution in the Fort Cobb Reservoir watershed. Many other outreach activities focused on increasing awareness and educating the public about NPS pollution cause and effects. **Table 11** lists the outreach activities performed in the watershed.

Table 11. Educational outreach activities during the Fort Cobb watershed project

3 Informational meetings
150+ One on one outreach with individual farmers in the watershed
19 One on one outreach meetings with five tribes in the watershed
3 Tours of demonstration projects for more than 30 people
5 Educational workshops attended by 198 people
5 Groundwater screening events
9 Watershed newsletters
10 + Articles written for area news media coverage
12 + Posters, flyers, and pamphlets to advertise events
2 Displays
10 Presentations to over 500 people
12 Natural Resource Conservation Day events with 1500 children and adults
4 Radio broadcasts of a news article with taped comments of coordinator

An important strength that the education coordinator brought to this project was his ability to relate to and reach out to the farmers, the target audience, in the watershed. Because of his farm experience, because he installed many of the recommended practices on his own farm before starting the project, including exclusion fencing and riparian re-establishment, he enjoyed an enormous amount of credibility and acceptance by the farmers. This acceptance made the following outreach activities more successful:

Farm tours on private property displayed installed BMPs recommended for the watershed, what they look like, and how they work. Tours also highlighted design and maintenance. Tours were done for individuals and small groups. Sometimes tours were “piggy-backed” with events co-sponsored by the OSU extension service. This provided the advantage of a larger crowd and reduced event cost.

Workshops discussed BMP effectiveness with presentations by researchers, industry, and producers experienced with BMP implementation results. More than 350 people attended workshops during the project. A No-till workshop at the Caddo/Kiowa Technology Center drew an audience of 198 people.

One on one visits were conducted with potential cooperators in the watershed. The education coordinator held 19 meetings with representatives from five tribes in the watershed.

Newsletters with helpful advice about reducing NPS pollution, meeting reminders, and cost-share incentive programs kept lines of communication open between project staff and producers. Nine newsletters were completed and distributed with the help and input of the WAG and EdWAG members. Topics included reasons for water quality monitoring, soil test guidelines, riparian area protection, the importance of streambank stabilization, and benefits of conservation tillage.

Presentations were made at places where residents congregate, such as local farm supply outlets, the Caddo Electric Cooperative annual meeting, county fairs, AARP meetings, Southern Plains Ag Resource Coalition meetings, and the Apache Tribal Youth Camp.

Informational displays at county fairs reached patrons at the Tulsa Farm Show, KNID Agrifest in Enid, the OK Ag Expo OKC, and the Women in Ag Conference at Fort Cobb.

Natural resource days provided opportunities for schools in all counties in the watershed to get involved. These events reached over 1500 students and adults. Topics covered included water quality monitoring, groundwater education, critters found in creeks, and how NPS pollution travels in a watershed.

Volunteer water quality monitoring did not get off the ground during the project. Efforts were made by holding an open house and informational meeting. While over 30 people showed up at the meetings, no monitoring group formed.

Groundwater screenings were the most powerful outreach that generated excitement about the Fort Cobb 319 water quality project. Landowners were very interested in information about the connections between surface and groundwater, and how reducing NPS is beneficial to groundwater as well as to the surface water. Groundwater screenings were an effective tool for outreach in the Fort Cobb Reservoir watershed because almost all the residents of the watershed consume groundwater and are concerned about the possibility of excessive nutrients in their groundwater supply. A total of 205 water samples were screened.

Media articles and broadcasts stirred the community's attention and increased the number of landowners interested in the project. Local newspapers cooperated by publishing more 15 articles written by the education coordinator to promote project

activities in the watershed. One of the published press releases is shown in **Figure 13**.

The topic of illegal dumping was addressed as a part of the overall adult education program targeted to reach the general population of the watershed using the tools of a traveling watershed display, the local news media, civic organization presentations, public meetings, educational brochures, and other avenues as they presented themselves.

For immediate release
August 13, 2002
Contact: Ed Crall (580) 772-0327
EdC@okcc.state.ok.us

Conservation Districts working to improve water quality in Fort Cobb Lake

Fort Cobb Reservoir and the six streams in the watershed are listed by the Environmental Protection Agency as being impaired by silt, nutrients, pesticides, and unknown toxins. Fort Cobb Reservoir provides drinking water for the cities of Chickasha, Anadarko, and Fort Cobb as well as industrial water for Western Farmers Electric Coop and Public Service of Oklahoma.

The Oklahoma Conservation Commission Water Quality Division in cooperation with Deer Creek, North Caddo, West Caddo, and Mountain View conservation districts has begun working on a water quality program to reduce the flow of pollutants into the Cobb Creek/Fort Cobb Lake watershed. Monty Ramming has been named Project Coordinator and is located at Fort Cobb in the West Caddo Conservation District office; Ed Crall has been named Education Coordinator and is located in Weatherford at the Deer Creek Conservation District office.

Ed Crall explained that the purpose of this project is to start watershed scale efforts to reduce nonpoint source pollution in the Fort Cobb Lake watershed and eliminate threats to Fort Cobb Lake. Nonpoint source pollution is the combined pollution coming from many people doing what seem to be minor or harmless activities. Nonpoint source pollution is then picked up and carried by runoff to Fort Cobb Lake. The Cobb Creek/Fort Cobb Lake watershed is the entire land area that drains into Fort Cobb Lake and includes 314 square miles.

The primary focus of the work plan is to demonstrate Best Management Practices (BMPs) that will focus on reduction of nutrient and sediment runoff. Approved practices are expected to be concentrated in riparian zones, which are the areas immediately adjacent to the water, including fencing, vegetative establishment, and providing water for livestock away from the stream. Other demonstration practices are expected to include animal waste management, pasture establishment, and grazing management. The goal is to demonstrate practices that can protect water quality and reduce pollution.

Currently a local watershed advisory group, a local education advisory group are being organized, target areas for the demonstration are being identified, best management practices will be recommended to the Oklahoma Conservation Commission, and cost share rates to encourage the development of these pollution controls will be established. Additional measures needed to achieve water quality improvements in the watershed may also be identified.

In conclusion Crall recommended producers, homeowners, and others with an interest in the quality of water in the Fort Cobb Lake watershed to contact their local conservation district for more information. The Oklahoma Conservation Commission and Oklahoma's 88 Conservation Districts are responsible for conservation of all renewable natural resources in the state. The Oklahoma Conservation Commission through its Water Quality Division is the lead agency in Oklahoma for water quality improvement.

Figure 13. Sample press release for the Ft. Cobb watershed project

Obstacles Encountered

The education program needed to make a special effort to alleviate concerns that made some producers reluctant to participate in the program. Such concerns included a reluctance to participate in cost share programs because of the extra “1099” the participants might receive for reporting with their income taxes. The education plan called for including the local tax preparers and eliciting their support for the program; however, due to staffing issues discussed later in the report, this outreach did not happen.

Another concern of some potential cooperators was the fear of being included in some onerous wetland conversion rules. This concern was addressed by emphasizing during one on one meetings that the Ft. Cobb watershed project was not about replacing wetlands or building artificial wetlands. The BMPs for this program only carry with them the responsibility of maintenance once they are installed.

While the vast majority of landowners and residents value Fort Cobb Reservoir and wish to see it improve, for many of these landowners the cost, or the perceived cost of applying BMPs had kept them from doing the work independently. This project showed that cost-share monies definitely encouraged landowner participation and installation of BMPs where otherwise there is reluctance to do so.

According to the education coordinator, the biggest disappointment of the education program was the inability to recruit Blue Thumb volunteer monitors. Many people in the watershed have a pet stream that runs through their field, behind their house, or beneath their favorite deer hunting stand. Finding a person with the interest is easy; however, finding one who has both the interest and the time to commit to volunteer monitoring was extremely difficult.

The project was unable to engage the tribes in the watershed even though the education coordinator repeatedly called on environmental directors and/or water quality directors from all 6 of the tribes in the watershed. All were receptive and interested, but only the Apache tribe participated in any water quality activities, which included the Tribe’s environmental director’s membership in the EdWAG until he changed jobs. The Apache tribe has an ongoing annual environmental day camp for both their children and other children in the neighborhood. The camp was strong when the Fort Cobb project first started, but interest and participation dwindled to nearly

nothing by the final project year. One of the good things about the Apache day camp was the involvement of the parents. The education coordinator estimates that more than two-thirds of parents attended during some years and heard his presentation about water quality and the Fort Cobb project.

A final source of difficulty with outreach in the watershed was a lack of attendance and educational booths at fairs. Caddo County has a county fair in the county seat of Anadarko, which is outside of the watershed. All of the smaller towns in the watershed host their own small fair in the fall. Most of these events consist of barbeque, beer, and maybe a small livestock show; however, exhibits and educational booths are unheard of. The majority of the few people who participate in these local fairs do not participate in the county fair and county fairs in Western Oklahoma are not well attended as a whole. This is unfortunate because during other projects such fairs have been an important platform to bring attention to the project and make initial contact with hundreds of landowners in the watershed.

For the FY2005 project underway in the watershed, it is recommended that successful outreach activities during the FY2001 project be expanded.

PROJECT PARTNERS / ACCOMPLISHMENTS AND OBSTACLES

This project was greatly enhanced by the cooperation of the local conservation districts. Their local efforts, as well as work by state and federal agencies and other groups, collectively contributed to the project. The major accomplishments and obstacles encountered by each partner are summarized below:

1. Deer Creek, West Caddo, North Caddo, and Mountain View Conservation Districts

These agencies were critical to ensuring participation of local landowners in water quality improvement programs. Local agencies often have the most accurate knowledge concerning current land management practices and local needs, so the districts recommended potential members for the Watershed Advisory Groups, participated in those groups, and worked with landowners to insure that they received their cost-share reimbursements and incentive payments. In addition, these districts continued ongoing programs, including those addressing proper fertilizer and herbicide application, working with landowners to improve water quality in their respective counties within the watershed.

2. Watershed Advisory Group (WAG)

The Fort Cobb WAG guided the direction of the project--a locally led effort to solve local problems. The WAG was made up of watershed stakeholders including various industries, civic groups, and landowners. The purpose of the WAG was to give guidance to the 2001 319 Program, and the WAG's recommendations continue with the current FY 2005 319 Program. Both of these OCC 319 programs are demonstration and

implementation projects that give landowners the opportunity to implement BMPs to protect water quality. Accordingly, the Educational WAG (EdWAG) put into place an educational program that used the "show and tell" approach to educating the public in the watershed. The program demonstrated working BMPs, a successful approach that has become a consistent component of OCC 319 projects.

3. NRCS Local Offices and FSA (USDA)

The United States Department of Agriculture Natural Resources Conservation Service (USDA/NRCS) and Farm Services Agency (FSA) in Oklahoma have several programs active in the Fort Cobb Watershed. These programs include the Environmental Quality Incentives Program (EQIP), Conservation Reserve Program (CRP), Wildlife Habitat Incentives Program (WHIP), and the Wetlands Reserve Program (WRP). These programs offer financial incentives to landowners to protect natural resources.

4. Oklahoma Corporation Commission (Corp. Comm.)

Major accomplishments. The Oklahoma Corporation Commission, successfully identified impacts from oil and gas activities in the Fort Cobb watershed. The visual examinations found few problem sites.

Problems or obstacles encountered. The Corp. Comm. manager overseeing the project in Fort Cobb was promoted and not quickly replaced, which significantly delayed Corp. Comm.'s work on the project. The agency planned to do additional work in the watershed to further identify problem areas, to conduct tours of demonstration sites, and to hold educational seminars to further reduce the impacts of oil and gas operations. However, the staff shortage brought an early end to the agency's work on this 319 project, and not all of the work originally planned could be done. Since few problem sites were found, the early termination of this project likely had no impact on the overall 319 project and water quality improvements. The remaining funds from the Corp. Comm. contract were used for implementation in the FY2001 Fort Cobb project.

5. Oklahoma Department of Agriculture, Food & Forestry (ODAFF)

Major accomplishments. ODAFF monitored to determine if any pesticides and nitrate pollution was reaching Fort Cobb Reservoir from surrounding agriculture land, to determine its source if it was occurring, and to provide the Oklahoma Conservation Commission with information they need to initiate a long-term watershed scale effort to reduce NPS loading to Cobb Creek and Fort Cobb Reservoir (ODAFF 3). ODAFF performed pesticide sampling and developed an educational pamphlet, *Protecting Fort Cobb Reservoir from Pesticides and Nutrients*, for distribution to farmers in the Ft. Cobb watershed.

Problems or obstacles encountered. Due to increased laboratory costs, ODAFF decided not to monitor 10 sites. Perhaps because of budget cuts, the frequency of nutrient

monitoring was insufficient and the resulting data set was not large enough to be statistically valid; therefore, nutrient data was not analyzed for this report.

6. U.S. Environmental Protection Agency (USEPA)

The USEPA provided grant funds for this project under Section 319 of the Clean Water Act. Funds are allocated to priority watershed projects with the goal of helping waterbodies meet water quality standards set for public health, wildlife, aesthetics, and recreational purposes.

7. Agricultural Research Service (ARS)

Major accomplishments. During the last three years of the project, the Agricultural Research Service (ARS) collected water quality data in the Fort Cobb watershed for the USDA Conservation Effects Assessment Project (CEAP). In response to the 2002 Farm Bill, the CEAP was initiated to assess and quantify the effects and benefits of USDA conservation programs (Starks et al. 1). The objective of the ARS Fort Cobb CEAP study is to assess the effects and benefits of selected conservation practices as they relate to reducing inputs of suspended sediments to surface water and the reduction of phosphorus and nitrogen in surface and ground water (Starks et al. 2). While the 2004 – 2009 CEAP project is specifically evaluating effects of NRCS BMPs, ARS will attempt through SWAT modeling to determine the water quality effects from the respective NRCS and OCC BMPs installed in the watershed.

Problems or obstacles encountered. Complete ARS CEAP data sets were not available to OCC for this report. However when they become available in 2010 they will provide five years of data to evaluate trends from project implementation to post-implementation.

8. Oklahoma Cooperative Extension Service (OCES)

The OCES worked closely with the conservation districts and the NRCS to promote water quality awareness in the watershed. They provided one on one meetings and education with landowners as well as technical assistance. OCES also used test plots and demonstration sites to educate landowners about the effectiveness of certain BMPs. One test plot demonstrated methods of integrated pest management and effectiveness of more managed fertilizer application in wheat production.

9. Bureau of Reclamation

Fort Cobb Reservoir is owned by the Bureau of Reclamation, which cooperated with water quality monitoring, land management, and education efforts in the watershed.

10. Master Conservancy

The Master Conservancy actively participated on the Watershed Advisory Group and funded some parallel BMPs near the Fort Cobb reservoir.

11. The Oklahoma Conservation Commission (OCC)

Major accomplishments. The OCC devoted almost $1 million to the Fort Cobb 319 project. A portion of these funds supported the WAG, a portion was devoted to identifying the major sources of NPS pollution with targeting, and some went toward education. The majority of the funds provided cost-share assistance to farmers to implement WAG-recommended and OCC approved BMPs to protect the water resources of the watershed.

The OCC's main function was to provide oversight for successful completion of the program. To do this, OCC provided administrative support for the 319 Project and worked with NRCS and FSA to implement a future CREP in the watershed. OCC provided technical guidance and final approval to the WAG and local conservation districts for implementation of the BMPs. The OCC also implemented an education program targeted toward citizens of the watershed. The OCC implemented the FY2005 319 Project in the watershed to continue the work of the FY2001 Project. The FY05 Project is focusing on no-till agriculture as a primary BMP necessary to reach the goals of the TMDL.

Problems or obstacles encountered. The **Project Coordinator became severely ill** in January 2007 for six months during the final year of the project. This slowed planning and implementation of BMPs during a critical period. Meanwhile, the project's education coordinator, Ed Crall, had been temporarily reassigned, March to October 2006, to the Stillwater Creek project after the original coordinator for that project quit. When Ed returned to the Fort Cobb project, he almost immediately had to fill the role of both project coordinator and education coordinator. During this time the WAG and EdWAG continued to meet, but the intermittent absence of the coordinators resulted in lapses in recording meeting minutes.

Lack of access to USDA's national Toolkit database posed a problem. Fort Cobb project coordinators were officed in "quiet presence districts." These are conservation district offices with no connection to the restricted-use national USDA/NRCS Toolkit computer network. Access to the USDA data server is necessary for authoring and archiving farm plans. Lack of access delayed completion of farm plans and maps that would otherwise be included in the project's final report. OCC expects to have the farm plans completed and posted to the OCC website by February 10, 2008.

Access to secondary data was not granted in time for this report. While not having ARS data is a negative from a reporting standpoint, the delay means that when the data become available analysis will show trends between project implementation and post-implementation. As established in the workplan, primary data gathering was never an intended component of the Fort Cobb project. OCC expects to have possession of the data and have it analyzed by 2010.

Five-year contracts were a problem. OCC determined that five year contracts do not allow enough time pull back and reallocate project funds from landowners who fail to install agreed upon BMPs. Because this was OCC's first large-scale project in the Fort Cobb watershed, it was expected that landowners would be cautious and slow to participate in a government program with which they weren't familiar. Experience has shown that many landowners wait for their neighbors to participate and supply feedback on their success before signing up. For projects, including Fort Cobb, this means there is more interest in later years of the project, after word has traveled, than during the first three years. This results in last minute scrambling by the project coordinator to install BMPs and consequent difficulty finding contractors to work with numerous landowners all trying to get BMPs installed at the same time. Changing to one- and two-year contracts should prevent this problem on future projects.

Weather also impacted the project. Severe drought during 2005-2006 delayed conversion of cropland to pastureland, the most popular BMP selected by landowners. NRCS requires plantings be done between March and June to allow an adequate root structure to develop before fall. Drought conditions in March and April meant there wasn't enough rain to support plantings. In June, the state was hit with historic rainfall amounts, which made the fields too wet to plant. As a result, planting was delayed until late July and August 2007, mere months before the closing date of the project.

The drought-deluge weather cycle also affected installation of grade stabilization structures, which require specific soil compaction during installation. During the drought the ground was too dry and hard for compaction. After the rain, the ground was too wet. Subsequent flooding resulted in the total loss of many wheat crops standing ready in fields too wet to accommodate heavy harvesting equipment. The healthy inundated crops had to be left to die in the fields. On top of all the spring flooding, Oklahoma was hit by Tropical Depression Erin in August 2007. Floods from this storm destroyed many recently installed BMPs and denuded the topsoil from hundreds, perhaps thousands, of acres of agricultural land in the watershed, making them unfarmable. The OCC is in the process of seeking help for these farmers.

While such difficulties, staff changes, illnesses, and unpredictable weather are to be expected over a 6 year span, it is most difficult to encounter all these obstacles within one year--the last year--of the project. It is impossible to predict what the results would have been in the absence of these problems. One could make the assumption that the number of cooperators would have been higher, more money would have been spent, more BMPs would have been installed, and perhaps even greater load reductions would have been the result.

MEASURES OF SUCCESS

The overall measure of success for activities in the Cobb Creek/Fort Cobb Reservoir Watershed is reversal of anthropogenic effects that have accelerated the eutrophication

of Fort Cobb Reservoir and restoration of beneficial use support to the waterbodies of the watershed. Another measure is the continued efforts by the conservation districts and other local groups to sustain the efforts of the project beyond the project period. These successes are beyond the scope of this project and report, but will likely begin to be apparent by the end of the FY2005 project, which ends in 2009.

CONCLUSION

The Fort Cobb Reservoir Watershed Implementation Project was intended to demonstrate and implement practices to reduce phosphorous loading to the reservoir and its watershed by 70%. To achieve load reductions, the Fort Cobb project promoted best management practices and provided technical and educational assistance to landowners who implemented practices.

The project focused on the most significant sources of pollution in the watershed: cropland erosion, riparian degradation, and pasture and waste management. The project used targeting, planning, education, demonstration, implementation, and monitoring to address sources and reduction goals. The ongoing FY2005 Fort Cobb project is in progress and is expected to further reduce nutrient and sediment loading in target streams within the watershed.

While OCC personnel have seen behavioral changes of citizens in the watershed during the project, water quality improvements will not be discernable until monitoring data are analyzed at the end of the FY2005 project. However, past projects have shown that BMPs reduce NPS pollutant runoff from agricultural lands, and OCC is optimistic that the Fort Cobb 319 Project will have similar success.

As stated in the workplan, education, implementation, and monitoring activities are only the first step in what should be a long term effort to achieve NPS load reductions in the Fort Cobb watershed. Looking to the future, OCC is in the process of securing funding to match a CREP in the watershed. The agency is also developing a carbon trading program that could help secure match for the CREP. Another possibility is, as success of the current Oklahoma CREP is documented, the state legislature will be persuaded to obligate additional funds, which will support additional water quality programs in the watershed. In the meantime, the FY2005 Fort Cobb 319 project is underway, promoting no-till agriculture to further reduce sediment and nutrient loading in the Fort Cobb watershed.

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APPENDICES

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