



NONPOINT SOURCE SUCCESS STORY

Oklahoma

Bacteria and Turbidity Levels in Curl Creek are Reduced through Voluntary Agricultural Conservation Programs

Waterbody Improved

Elevated bacteria and turbidity levels resulted in the impairment of Curl Creek and placement on Oklahoma's Clean Water Act

(CWA) section 303(d) list of impaired waters in 2004. Grazing and hay production contributed to these impairments, and implementation of conservation practice systems (CPs) to promote better-quality grazing lands decreased bacteria and turbidity levels in the creek. As a result, Curl Creek was removed from Oklahoma's 2010 CWA 303(d) list for *Escherichia coli* and from the 2012 CWA 303(d) list for turbidity. Curl Creek now partially supports its fish and wildlife protection (FWP) and primary body contact (PBC) beneficial uses.

Problem

Curl Creek is a 17.27-mile stream that flows through Nowata and Washington counties in Oklahoma before discharging to the Caney River (Figure 1). Land use in the 30,896-acre watershed is primarily grasslands (83 percent of total) for beef cattle and hay production. About 5 percent of the watershed is developed land (primarily for highways and roads), 13 percent is forested, and less than 1 percent is cropland.

Grazing and hayland management contributed to excess bacteria and turbidity in Curl Creek. It was listed as impaired for turbidity in 2004 when 20 percent of assessed baseflow turbidity samples violated Oklahoma water quality standards. An Oklahoma stream is considered to violate the turbidity standard when more than 10 percent of baseflow samples are higher than 50 nephelometric turbidity units (NTU).

Curl Creek was also listed for *E. coli* bacteria in 2004 when 20 percent of individual samples violated the individual sample maximum of 406 colony-forming units per 100 milliliters of water (CFU/100 mL) during the recreation season. In 2004 the PBC designated use was considered impaired if more than 10 percent of individual samples violated the sample maximum. In 2008 the assessment method changed and streams were considered to be violating the standard if the geometric mean during the recreation season exceeded 126 CFU/100 mL for *E. coli*. On the basis of these assessment results, Oklahoma added Curl Creek (OK121400010270_00) to the 2004 303(d) list for nonattainment of the FWP and PBC beneficial uses.

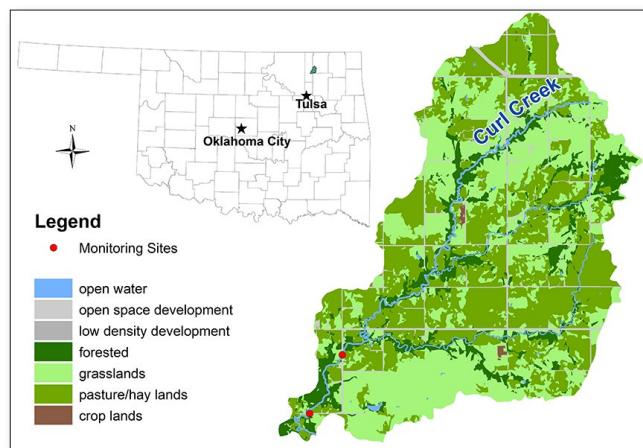


Figure 1. Curl Creek is in northeastern Oklahoma.

Project Highlights

Landowners in the watershed worked with the Nowata County and Caney Valley Conservation Districts, the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), and the Oklahoma Conservation Commission (OCC) to implement CPs through Oklahoma NRCS's Environmental Quality Incentives Program (EQIP), Conservation Stewardship Program (CStwP), and general conservation technical assistance program, as well as through the OCC's Locally Led Cost-Share Program (LLCP). From 2004 to 2012, landowners improved grasslands, pasture, hay meadows, and cropland, which reduced runoff of sediment and other pollutants by decreasing erosion and better using available grazing lands. From 2012 to 2017, landowners installed additional CPs that helped to maintain improved water quality. Many

Table 1. CPs installed in the watershed (2004–2017).

Practice type installed	Amount	
	2004–2012	2012–2017
Contour farming (ac)	80	80
Integrated pest management (ac)	3,258	1,120
Prescribed grazing (ac)	2,978	4,054
Forage and biomass planting (ac)	155	23
Watering facility	1	1
Cross fencing (ft)	1,190	18,802
Brush management (ac)	2,226	2,103
Ponds	6	11
Nutrient management (ac)	184	23
Herbaceous weed control (ac)	1,023	3,684

Notes: ac = acres; ft = feet

CPs were installed during both time periods (Table 1). Some targeted CPs were installed only between 2004 and 2012, including critical area planting (1 acre [ac]), upland wildlife management (83 ac), forage harvest management (155 ac), heavy use area protection (2 ac), and riparian forest buffer (28 ac). CPs installed only between 2012 and 2017 included animal trails and walkways (33 feet), split nitrogen application (171 ac), better grazing management (461 ac), precision spraying (1,165 ac), livestock watering pipeline (835 ac), and rotation of supplement/feeding areas (583 ac).

Results

Through its statewide nonpoint source Rotating Basin Ambient Monitoring Program, the OCC documented improved water quality in Curl Creek due to landowners implementing CPs. The CPs decreased erosion and reduced turbidity and bacteria loading. Monitoring data compiled for the 2004 Integrated Report showed excessive turbidity in Curl Creek (when 20 percent of

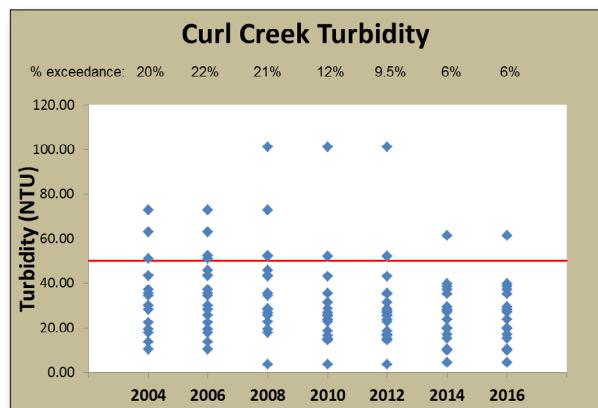


Figure 2. Turbidity decreased in Curl Creek as producers focused on improving pasture management.

baseflow samples exceeded 50 NTU). By 2012, turbidity values had decreased such that fewer than 10 percent of samples exceeded 50 NTU; this decreasing trend has continued (Figure 2). In 2004, *E. coli* bacteria violated state standards when 29 percent of samples were higher than the individual sample maximum of 406 CFU/100 mL. In 2008, when standards assessment was modified to consider the geometric mean, the creek's value of 151 CFU/100 mL still exceeded the criteria of 126 CFU/100 mL. However, by 2010, the geometric mean during the recreation season had dropped to 84 CFU/100 mL. It has remained supporting through 2016 (Figure 3).

On the basis of these data, Curl Creek was removed from the Oklahoma CWA section 303(d) list for *E. coli* in 2010 and for turbidity in 2012. This change resulted in partial support of its FWP and PBC beneficial uses. Monitoring in Curl Creek will continue in order to track progress towards full support of these beneficial uses.

Partners and Funding

The OCC monitoring program is supported by the U.S. Environmental Protection Agency's (EPA) CWA section 319 funds at an average annual statewide cost of \$1 million. Approximately \$500,000 in EPA 319 funds support statewide water quality educational efforts through Blue Thumb. Working in partnership with local conservation districts, NRCS supplied approximately \$525,000 for implementation of CPs in the watershed through NRCS EQIP. The LLCP provided \$15,517 matched by \$23,824 from landowners. A large number of practices were funded by landowners based on recommendations through NRCS general technical assistance and conservation planning.

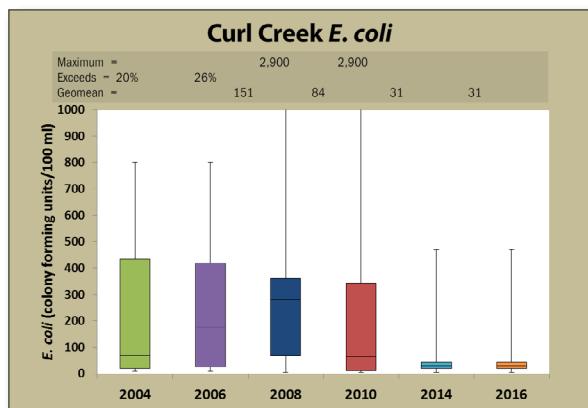


Figure 3. *E. coli* decreased as pasture conditions improved.



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