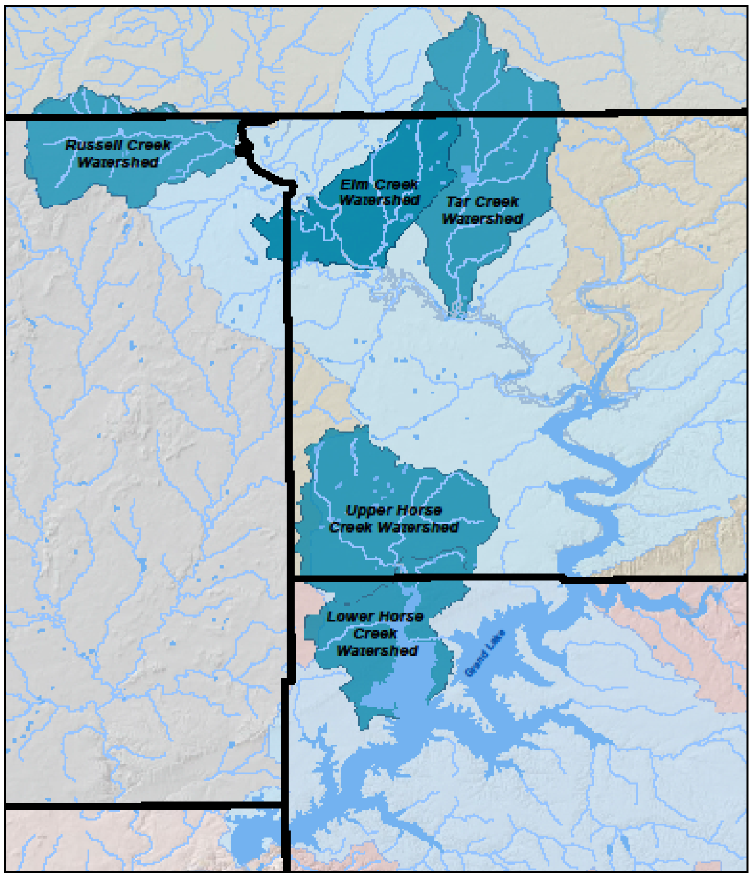
WATERSHED BASED PLAN

FOR

OKLAHOMA RCPP GRAND LAKE SUBWATERSHEDS

FY 2017 §319(h) C9-996100-19 Project 2 Sub-Task 2.4.3.d



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OKLAHOMA CONSERVATION COMMISSION

INTRODUCTION

The Grand Lake basin is located in portions of Arkansas, Kansas, Missouri, and Oklahoma, draining a total area of 10,298 square miles. Three major rivers, the Neosho River, the Spring River, and the Elk River, drain into the lake. The lake itself covers 46,500 surface acres and holds 1,672,000 acre-feet of water. Recently, concerns have arisen about the decreased water quality in Grand Lake which is affecting recreation in the area and the drinking water supply.

Grand Lake has become one of the top retirement spots in the nation due to the relatively low cost of living, abundant natural resources, and availability of lake front property. Not only is development on the rise, but existing residences are evolving from vacation properties into permanent residences. The reservoir supports a substantial tourist industry and is one of the few in Oklahoma where landowners can have waterfront homes. The Oklahoma Department of Tourism and Recreation estimates that recreation associated with Grand Lake brings over $44 million dollars in tourism-related revenues to the Grand Lake area each year (OTRD 2013).

Historically, water quality in Grand Lake has been excellent. The lake is noted for its clear waters and abundant fisheries. However, as early as the 1980s, algal blooms and other indicators of nutrient enrichment began to appear in certain areas of the lake. In the summer of 2011, a severe blue-green algae bloom led to closure of portions of Grand Lake, and high levels of bacteria have led to reports of human illness and caused beach closures in subsequent summers. Runoff from areas with high concentrations of confined animal operations, especially poultry production, has been shown to contribute significant quantities of nutrients to receiving streams. Nutrient loading in these streams has reduced their quality as well as that of downstream reservoirs. In addition, acidic waters seeping from abandoned mines in the region have contributed metals such as cadmium, lead, and zinc to tributaries and upper reaches of the lake.

Currently, segments of the lake and its tributaries are designated as impaired on the Clean Water Act Section 303(d) lists of impaired waters of Oklahoma, Missouri, and Kansas for causes ranging from nutrients, sedimentation, and low dissolved oxygen to lead, cadmium, and zinc. A fish flesh advisory has been placed on the upper reaches of the lake due to excessive lead levels in fish tissue. Lawsuits have been pursued between residents of the Grand Lake area and poultry producers over claims of irresponsible environmental degradation. Water quality and the environment are increasingly at the forefront of regional issues of concern, and the need for coordinated planning is increasingly apparent.

Grand Lake offers unique challenges for restoration and remediation efforts due to the fact that the watershed includes portions of four states and two EPA regions. While the bulk of the watershed lies in three other states, the terminal reservoir, Grand Lake, lies in Oklahoma. Kansas has developed TMDLs and watershed based plans for watersheds in the Grand Lake Basin and Missouri is working towards watershed plans. Oklahoma has produced TMDLs for some of the impairments in the watershed, including a total suspended solids (TSS) TMDL for the Verdigris Neosho Watershed in 2012, an organic enrichment/low DO TMDL for the Neosho Grand River and the Spring River in 1999, and bacteria TMDLs for multiple streams in the watershed in 2008.

The Nonpoint Source Program and Grants Guidelines for States and Territories for FY 2004 and Beyond requires a *Watershed Based Plan* (WBP) to be completed prior to implementation using Section 319 incremental funds. The guidance defines the nine key components to be addressed in a WBP: 1) identification of causes and sources that will need to be controlled to achieve load reductions, 2) estimate of load reductions expected from the management measures described, 3) a description of the management measures that will need to be implemented to achieve load reductions, 4) an estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources or authorities who will bear responsibility, 5) an information/education component that will be used to enhance public understanding of the project and encourage early participation in the overall program, 6) a schedule for implementing the NPS management measures identified in this plan that is reasonably expeditious, 7) a description of interim, measurable milestones for determining whether control actions are being implemented, 8) a set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made or whether the Watershed Plan or Total Maximum Daily Load (TMDL) needs to be revised, and 9) a monitoring component to evaluate the effectiveness of the implementation efforts over time.

This Watershed Based Plan (WBP) will focus on five HUC 12 watersheds within Oklahoma that have been selected for special funding through the Natural Resources Conservation Service (NRCS) Regional Conservation Partnership Program (RCPP). The Grand Lake RCPP is a cooperative project between the states of Kansas and Oklahoma and the NRCS in these states. Kansas has developed its own watershed plan for Grand Lake subwatersheds, so this WBP will focus on Oklahoma. One of the subwatersheds that will be part of the Oklahoma RCPP is Tar Creek, a superfund site in which federal funds have addressed concerns related to the impacts of the abandoned mining industry on the lake and environmental health in the watershed. Implementation of remedial efforts has included treatment wetlands to individual site cleanup, shaft closures, soil removal, relocation of an entire town and buyout of homeowners in the most contaminated areas. However, this watershed plan will currently focus on other causes of impairment in the watershed. Watershed plans will be developed separately or updated at a later time to address remaining metals contamination should current efforts be insufficient. The other watersheds that are part of the Oklahoma Grand Lake RCPP are Russell Creek, Horse Creek, Little Horse Creek, and Elm Creek. These subwatersheds were selected as targets for the RCPP project after Soil and Water Assessment Tool (SWAT) modeling conducted as part of an FY 2004 EPA Clean Water Act §319 project in indicated that they were among the top phosphorus contributing watersheds in the Oklahoma portion of the Grand Lake Watershed. Watershed selection also considered impairment listings on the 303(d) list,

The OCC conducted a watershed implementation project in Honey Creek, one of the subwatersheds of the lake, from 2006 through 2014. This project was quite successful in both education and implementation of conservation practices to improve water quality. Implementation and education efforts in the RCPP watersheds will be guided at least in part by the experiences from the Honey Creek project. This WBP for the Grand Lake Watershed has been developed as a dynamic document that will be revised, when necessary, to incorporate the latest information, address new strategies, and define new partnerships between watershed shareholders following this initial documentation. Also, it is understood that the water quality goals set forth in this WBP, as well as the technical approach to address the goals, may not be comprehensive, and it may be necessary to revise or expand them in the future. Federal and state funding allocations for future water quality projects designed to address the Grand Lake Watershed problems should not be based solely upon their inclusion in this WBP; rather, the WBP should be considered a focal point for initial planning and strategy development.

CAUSES AND SOURCES *(element a)*

Watershed Characterization

Grand Lake is located in northeastern Oklahoma, in Delaware, Ottawa, Mayes, and Craig Counties. Its watershed extends into Kansas, Missouri, and Arkansas (Figure 1). Grand Lake is the third largest reservoir in the Oklahoma in terms of both capacity and surface area. The drainage includes the Grand Neosho River, the Spring River, and the Elk River. The Grand Lake Watershed (HUC8: 11070206; part of Neosho subregion, HUC 110702) drains more than 10,298 square miles.

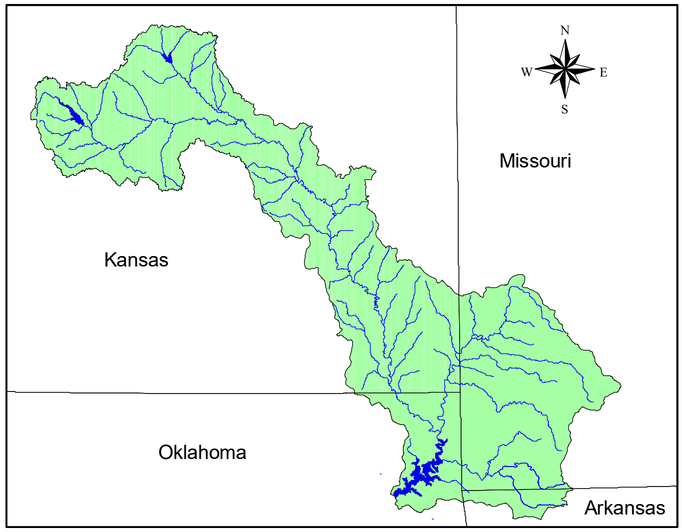

Figure 1. Grand Lake watershed.

<u>Physical / natural features:</u> The majority of the Grand Lake Watershed in Oklahoma lies in the Ozark Highlands and Central Irregular Plains Ecoregions. According to Woods et al. (2004): "The Ozark Highlands ecoregion is a level to highly dissected, partially forested, rich in Karst features ecoregion. The region has more irregular physiography and is generally more forested than adjacent ecoregions. The majority of this dissected limestone plateau is predominantly an oak-hickory forest, but stands of oak and pine are also common. Less than one fourth of the core of this region has been cleared for pasture and cropland, but half or more of the periphery, while not as agricultural as bordering ecoregions, is in cropland or pasture. The maximum elevation of the Ozark Highlands in Oklahoma is about 1500 feet and the maximum relief between hill crests and valley bottoms is about 400 feet.

The Central Irregular Plains Ecoregion is a band of tallgrass prairie separating the forested Ozark Highlands from the Cross Timbers that is broken by limestone and sandstone cuestas, buttes, hills, and nearby level areas underlain by shale. Fire is required to maintain the grasslands. In its absence, woody plants such as sumac, blackberries, and persimmons will invade the grasslands. Oklahoma's portion of this watershed was not glaciated in contrast to other areas of the country."

The Ozark Highlands in Oklahoma "…are largely underlain by highly soluble and fractured limestone and chert. Caves, sinkholes, and underground drainage occur, heavily influencing surface water availability, water temperature, and the potential for surface and groundwater pollution. Clear, cold, perennial spring-fed streams with gravel or bedrock bottoms are common. In addition, many small dry valleys occur where overland flow is entirely runoff-driven.

Geohydrology of the Central Irregular Plains portion of the watershed is characterized by soils derived from shale, sandstone, and limestone. In some nearly level areas, clay pan soils occur. On limestone slopes, exposed limestone slabs and gravels occur. Major streams have low gradients, meander considerably, and develop wide valleys except on areas of very hard rocks. Groundwater in the Central Irregular Plains tends to be saline and is more likely to be anoxic, as opposed to fresh, oxygenated groundwater generally found in the Ozark Highlands" (Woods et al. 2004).

Annual average precipitation is approximately 43 inches in this area. Precipitation is usually heaviest in June and October, with July and August generally the driest months. The region is noted for localized, torrential rain storms and, as a result, very "flashy" stream flows.

The principal streams in the Grand Lake Watershed are the Grand Neosho River, draining from eastern Kansas, and the Spring and Elk Rivers from Missouri. The Grand Neosho is impounded to form Grand Lake. The Neosho River drains approximately 5,800 sq. miles in Kansas and provides about half of the inflow to Grand Lake with a discharge of 5,491 cfs. The Spring River drains about 2,500 sq. miles in Missouri and Kansas with a discharge of 3,417 cfs, which is about thirty two percent of the inflow to Grand Lake. The Elk River drains about 900 square miles in Missouri and Arkansas with a discharge of 1,299 cfs to provide about twelve percent of Grand's hydraulic budget.

There are three major reservoirs in the Grand Lake Watershed. In addition to Grand Lake, these include John Redmond and Council Grove Reservoirs in Kansas (also on the Neosho River). John Redmond has a storage capacity of 56,660 acre-feet while Council Grove has a storage capacity of 38,310 acre-feet. Grand Lake has a storage capacity of 1,672,000 acre-feet. Based on the annual volume of water transported by the Neosho River (1,698,000 acre feet at Parsons, KS), water from the Neosho alone is sufficient to "refill" the volume of Grand Lake on an annual basis. Considering the volume of water also contributed by the Elk and Spring Rivers, the hydraulic residence time of Grand Lake is approximately 80 days.

The subwatersheds that are the focus of the RCPP in Oklahoma are listed in Table 1 below.

Table 1. Oklahoma Grand Lake RCPP waterbodies.

HUC 12 #	HUC 12 Name	Primary Tributary Name	State/County	Watershed Size (acres)
110702060101	Russell Creek	Russell Creek	KS/Labette OK/Craig	23,962
110702060104	Elm Creek- Neosho River	Neosho River	KS/Cherokee OK/Craig, Ottawa	23,909
110702060106	Tar Creek- Neosho River	Tar Creek	KS/Cherokee OK/Ottawa	33,767
110702060402	Upper Horse Creek	Horse Creek (Little Horse Creek)	OK/Ottawa	31,293
110702060403	Lower Horse Creek	Horse Creek	OK/Ottawa, Delaware	23,136

<u>Land Use</u>

In general, much of the land in the Oklahoma portion of the Grand Lake watershed is used for cattle production. Table 2, below, shows the dominant types of livestock and crop production in the Oklahoma Grand Lake watershed counties. Poultry production is a large industry, and farmers may raise both poultry and cattle. In the past, chicken litter was applied to the surrounding fields as fertilizer, which has resulted in high levels of phosphorus in the soil. Winter wheat and soybeans are the primary crops, apart from pasture/hay which is related to cattle production.

Table 2. County Livestock and Crop Production Statistics (USDA 2014).

County	Primary Livestock or Crop Type	# Animals	# Acres
Craig	Broilers / meat-type chickens	6,076,326	
	Cattle and calves	106,376	
	Forage for hay, silage, and greenchop		66,912
	Soybeans		12,145
	Winter wheat for grain		9,188
	Corn for grain		5,876
	Sorghum for grain		1,915
Delaware	Broilers / meat-type chickens	48,186,123	
	Layer chickens	833,998	
	Cattle and calves	73,003	
	Forage for hay, silage, and greenchop		49,078
	Winter wheat for grain		1,895
	Soybeans		1,208
	Corn for grain		1,037
Mayes	Broilers / meat-type chickens	7,298,236	
	Cattle and calves	64,218	
	Layer chickens	19,070	
	Forage for hay, silage, and greenchop		53,011
	Winter wheat for grain		6,495
	Soybeans		6,387
	Corn for grain		1,388
Ottawa	Broilers / meat-type chickens	13,564,613	
	Cattle and calves	42,166	
	Layer chickens	1,291	
	Forage for hay, silage, and greenchop		45,430
	Winter wheat for grain		18,643
	Soybeans		15,976
	Corn for grain		6,331

Joplin, Missouri and Tulsa, Oklahoma are the largest municipalities within 70 miles of Grand Lake, and the population of the Grand Lake Watershed is approximately 500,000, approximately half of which live in Missouri. Despite the popularity of Grand Lake for recreation and retirement, only a few, small-population Oklahoma towns are present in the watershed: Miami (population approximately 13,000), Afton (pop. approx. 1,000), Bernice (pop. approx. 500), and Quapaw (pop. approx. 900). In the RCPP watersheds, developed (high, medium, or low) landuse ranges from less than 1% to about 4%, except in the Tar Creek watershed, where it is 13% of the area.

The maps on this page and the following pages (Figures 2 – 5) indicate the landuse in each of the five RCPP watersheds, based on 2006 National Land Cover Data.

Elm Creek Landuse

Landuse	Sum (Acres)
Cultivated Crops	10,149
Pasture/Hay	9,328
Woody Wetlands	2,142
Deciduous Forest	733
Developed, Open Space	702
Open Water	321
Barren Land (Rock/Sand/Clay)	288
Grassland/Herbaceous	72
Developed, Low Intensity	70
Emergent Herbaceous Wetlands	55
Shrub/Scrub	23
Developed, Medium Intensity	21
Developed, High Intensity	4
Total	23,909

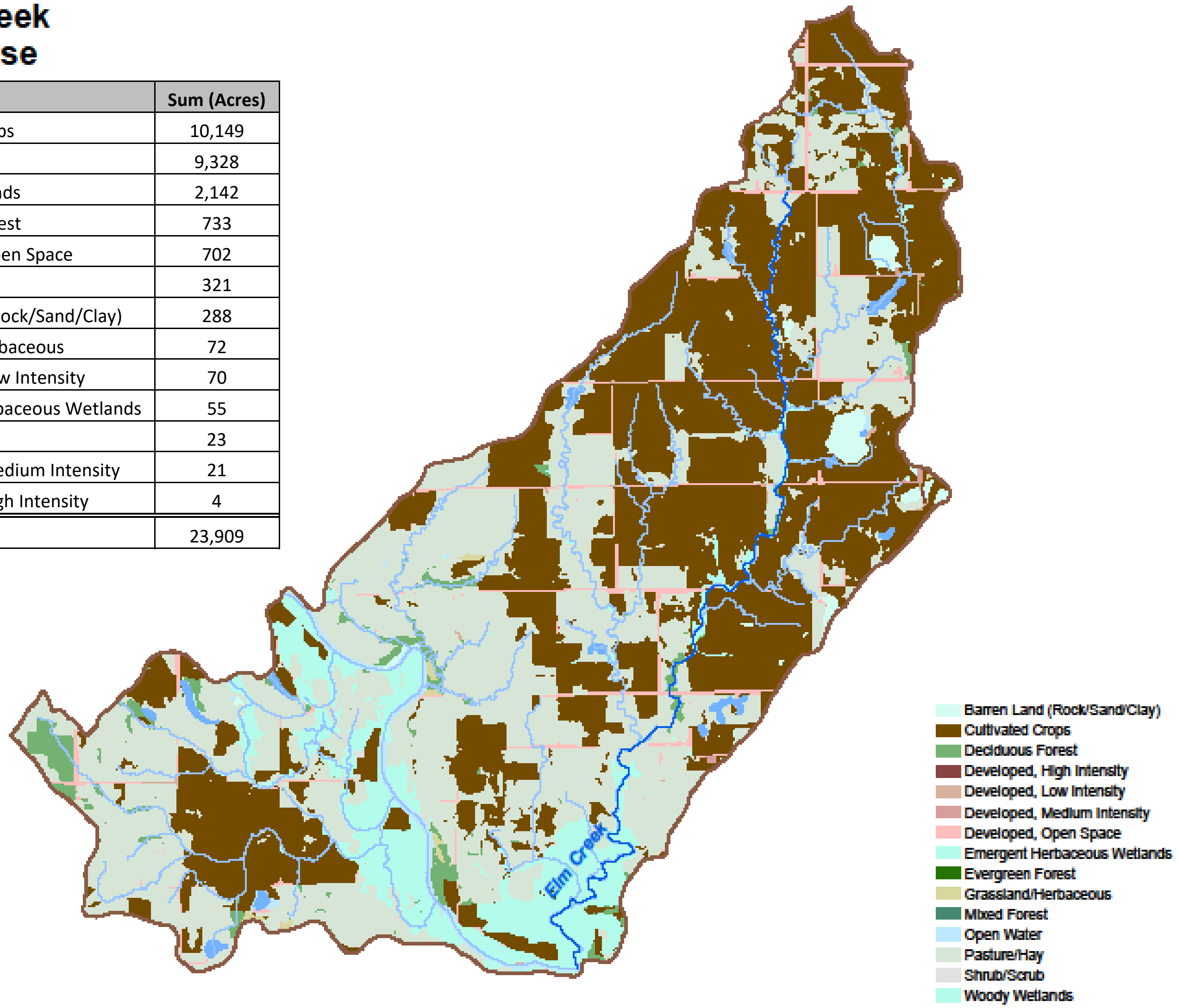

Figure 2. Landuse in the Elm Creek watershed.

Russell Creek Landuse

Landuse	Sum (Acres)
Pasture/Hay	15,411
Cultivated Crops	3,133
Grassland/Herbaceous	2,131
Deciduous Forest	2,028
Developed, Open Space	981
Woody Wetlands	122
Open Water	77
Mixed Forest	42
Developed, Low Intensity	25
Evergreen Forest	7
Emergent Herbaceous Wetlands	4
Developed, Medium Intensity	1
Total	23,962

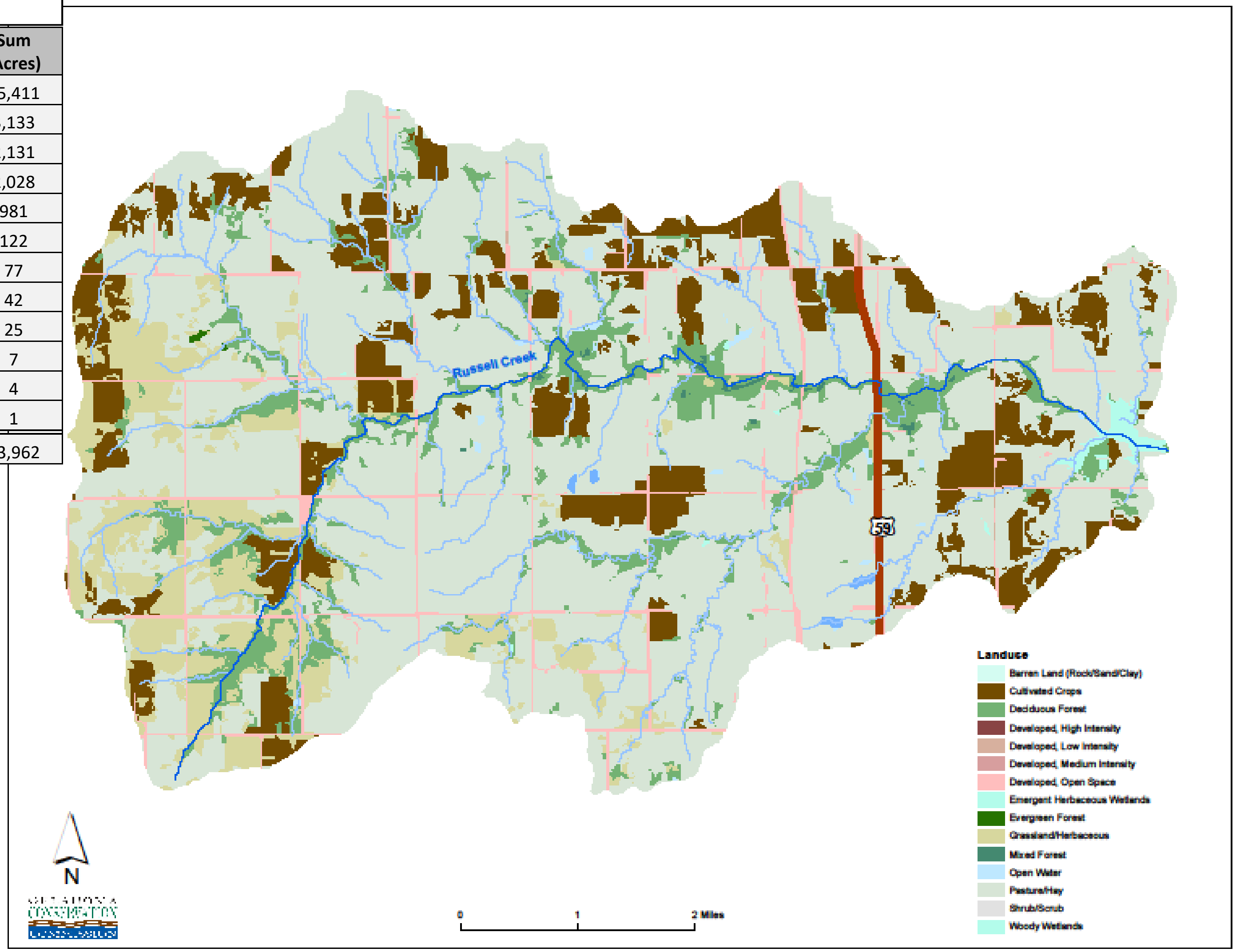

Figure 3. Landuse in the Russell Creek watershed.

Horse Creek Landuse

Landcover	Sum (Acres)
Pasture/Hay	28,198
Deciduous Forest	7,542
Cultivated Crops	5,971
Open Water	5,615
Developed, Open Space	3,402
Grassland/Herbaceous	2,248
Developed, Low Intensity	963
Developed, Medium Intensity	261
Woody Wetlands	96
Shrub/Scrub	63
Developed, High Intensity	43
Emergent Herbaceous Wetlands	21
Barren Land (Rock/Sand/Clay)	6
Total	54,429

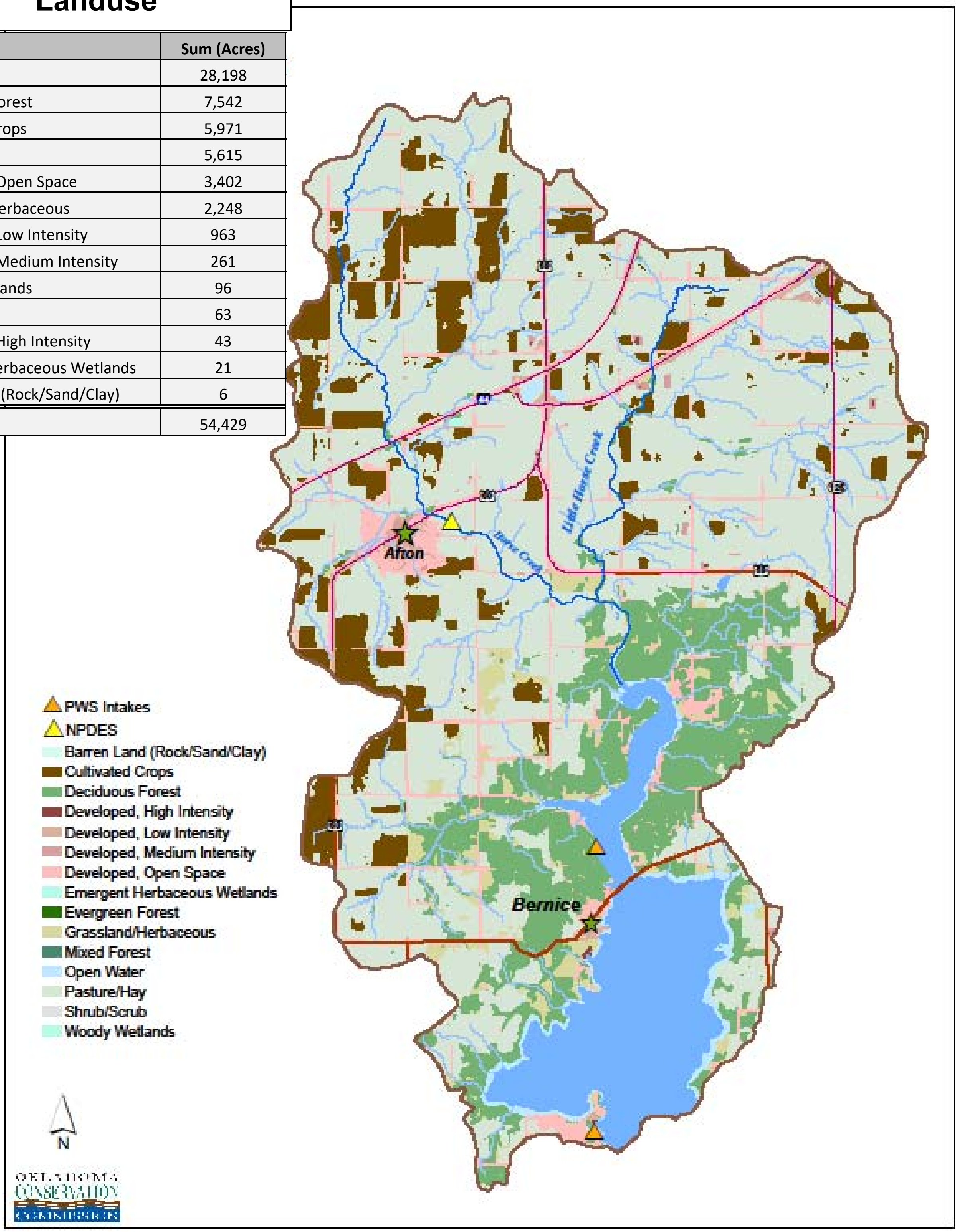

Figure 4. Landuse in the Horse and Little Horse Creek watersheds.

Tar Creek Landuse

Landcover	Sum (Acres)
Cultivated Crops	13,404
Pasture/Hay	9,035
Developed, Low Intensity	2,993
Barren Land (Rock/Sand/Clay)	2,045
Developed, Open Space	1,930
Deciduous Forest	1,375
Developed, Medium Intensity	1,115
Woody Wetlands	875
Developed, High Intensity	408
Open Water	378
Grassland/Herbaceous	125
Emergent Herbaceous Wetlands	72
Shrub/Scrub	8
Evergreen Forest	2
Total	33,767

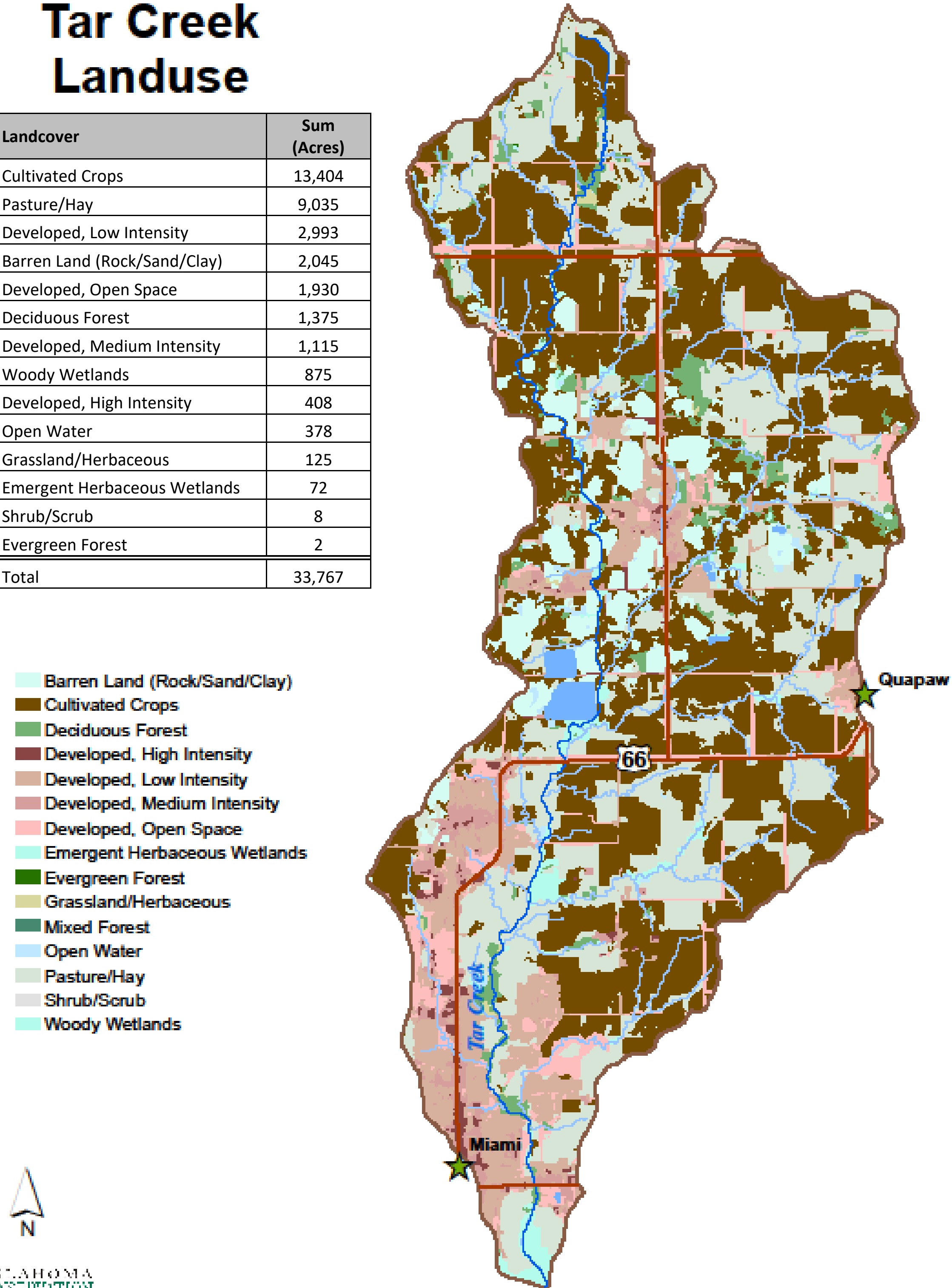

Figure 5. Landuse in the Tar Creek watershed.

Causes

The activities described in this WBP will take place in high priority watersheds in these HUCs: 110702060101, 110702060104, and 110702060106 in the Russell Creek and Tar Creek watersheds in Kansas and Oklahoma and 110702060402 and 110702060403 in the Horse Creek watershed in Oklahoma.

Grand Lake's designated uses include public and private water supply (PPWS), fish and wildlife propagation--warm water aquatic community (FWP--WWAC), agriculture, primary body contact recreation (PBCR), fish consumption, and aesthetics. Grand Lake is divided into three sections which are assessed separately as part of the Oklahoma Integrated Report, represented by these Oklahoma waterbody IDs: OK121600030020_00 (Lower), OK121600030030_00 (Middle), and OK121600030040_00 (Upper). The fish consumption use is not attaining for all three sections of the lake due to lead, according to the State's 2014 303(d) list. The lower section is also impaired by low dissolved oxygen (DO), and the upper section is impaired by turbidity, both of which make the WWAC use non-attaining (ODEQ 2014).

Tar Creek (OK121600040060_00) has the designated uses of fish and wildlife propagation—habitat limited aquatic community (HLAC), fish consumption, and secondary body contact recreation (SBCR). These are downgraded designations reflecting the past pollution of this waterbody due to mining and the expectations that this stream will always be impacted to some degree and unable to meet more stringent designations. Much of the barren land in this watershed is associated with mine waste sites from the historical cadmium, lead and zinc mining which occurred in the watershed. This land has been the subject of an EPA Superfund Project for the past several decades which has recently wrapped up surface remediation. Most of these formerly barren sites have been reclaimed and revegetated. For the 2014 Oklahoma Integrated Report, Tar Creek is not attaining its HLAC use due to high levels of lead, and the fish consumption use has not been officially assessed (ODEQ 2014). However, as stated earlier, this watershed plan will focus on nutrient, sediment and bacteria-related causes and sources and be modified at a later date to focus on metals. Reduction of nutrients and other causes of eutrophication will help reduce anoxic conditions that can pull metals back into solution and increase metals transport downstream.

The other four subwatersheds that will be the focus of the RCPP have the default designated uses of FWP-WWAC, agriculture, PBCR, fish consumption, and aesthetics. Additionally, Horse Creek has an emergency water supply designation. According to the 2014 Integrated Report, Horse Creek (OK121600030160_00) is not attaining its PBCR use due to *Escherichia coli* (*E. coli*) impairment, not attaining the agriculture use due to chloride impairment, and not attaining its WWAC use due to pH, ammonia, and DO impairments (ODEQ 2104).

Little Horse Creek (OK121600030190_00) is not attaining its PBCR use due to Enterococcus and *E. coli* impairments and not attaining its WWAC use due to DO and macroinvertebrate impairments. Russell Creek (OK121600040200_00) is not attaining its WWAC use due to DO impairment and not attaining its agriculture use due to sulfates impairment (ODEQ 2014). Elm Creek (OK121600030310_00) has not been assessed for attainment of its designated uses.

Sources

Tar Creek has two minor NPDES-permitted facilities, the City of North Miami Waste Water Treatment Plant (WWTP) and the City of Commerce lagoon. The Horse Creek watershed contains the City of Afton WWTP. The WWTPs are continuous dischargers, however, according to a 2008 bacteria TMDL for this basin, "point sources are relatively minor and for the most part tend to meet instream water quality criteria in their effluent, so nonpoint sources are considered to be the major origin of bacteria loading. Given the number of dischargers and the Municipal separate storm sewer system (MS4) area in the Tar Creek watershed, point source loading may be significant but is still likely to be less than the overall nonpoint source loading contribution" (ODEQ 2008). Tar Creek's lead impairment is a direct result of mining activities, and a great deal of work has gone into cleaning up the contaminants in the soil in that watershed.

Since there are no point sources in the other watersheds, all of the sources contributing to the water quality impairments are nonpoint. Nonpoint sources are those which deliver pollutants to surface waters diffusely, rather than as a definite, measurable quantity from a single location. These sources typically result from land activities that contribute pollutants such as sediment, nutrients, and/or bacteria to surface water as a result of runoff during and following rainfall. Potential sources of concern in this area include grazing in riparian or shoreline zones, on-site treatment systems (septic systems and similar decentralized systems), rangeland grazing, and land application of poultry litter.

In Russell Creek, the primary landuse is pasture, comprising approximately 73% of the landuse in the watershed. Poor pasture management, including improper fertilizer application and overstocking, can increase erosion potential and lead to nutrient-laden soils washing into streams. Livestock grazing in pastures often have direct access to waterbodies, and streambank trampling/destabilization and trail formation serve as direct conduits of pollutants through the little riparian area that might be present. In areas of depauperate riparian area, streambank erosion is a likely contributor of sediment and associated nutrient loads, which can then lead to low DO. Similarly, 56% of the landuse in the Horse Creek watershed is pasture/grassland, and so the same issues exist and are likely contributing to low DO there. In addition, livestock with direct access to streams can contribute fecal bacteria directly into the streams, and poorly maintained pastures can enable bacteria to wash off quickly when it rains.

Sources and causes continue to evolve in a watershed. As one cause/source is addressed, other, previously lesser sources/causes can become more significant. For those reasons, information on causes and sources will continue to be collected and updated in future iterations of the watershed plan.

CRITERIA *(element h)*

Designated uses for Grand Lake and the five Oklahoma RCPP HUCs were described in the previous section. The impairments of the waterbodies were also listed, as indicated in the State's 2014 Integrated Report. Restoration goals of this project will be set in accordance with criteria necessary to achieve a fully attaining status for these waterbody impairments. The criteria and procedures used to assess the impaired uses are presented below (adapted from both the *2012 Oklahoma Continuing Planning Process (CPP)* (ODEQ 2012) and the *2013 Implementation of Oklahoma's Water Quality Standards* (OWRB 2013)). Only the criteria for the non-attaining parameters are listed here. Refer to the CPP and WQ Standards for details on data collection and analysis.

To attain Fish and Wildlife Propagation--Warm Water Aquatic Community use for lakes:

- Dissolved oxygen (DO) (based on a minimum of 20 samples for a lake greater than 250 acres)
  a) 10% or less of the samples from the epilimnion during periods of thermal stratification, or the entire water column when no stratification is present, are less than 6.0 mg/L from April 1 through June 15 and less than 5.0 mg/L during the remainder of the year
  AND
  b) Less than 50% of the volume or 50% or less of the water column of all sample sites in the lake are less than 2.0 mg/L during periods of thermal stratification
- Turbidity (based on a minimum of 10 samples collected under seasonal base flow conditions)
  10% or fewer of the samples exceed 25 Nephelometric Turbidity Units (NTUs)

To attain Fish and Wildlife Propagation--Warm Water Aquatic Community use for streams:

- Dissolved oxygen (DO) (based on a minimum of 10 samples)
  10% or less of the samples have a DO concentration of less than 6.0 mg/L from April 1 through June 15 and less than 5.0 mg/L during the remainder of the year
- pH (based on a minimum of 10 samples)
  10% or less of the samples fall outside the screening range of 6.5 (minimum) and 9.0 (maximum).
- Ammonia (based on a minimum of 5 samples)
  10% or less of the samples exceed the temperature- and pH-dependent screening values given in Table 13 of the CPP
- Macroinvertebrates (based on a minimum of 4 collections over at least a 2 year period)
  At least 2 collections must have an Index of Biological Integrity (IBI) score of more than 80% of the reference IBI score, and no collections can have IBI scores of less than 50% of the reference IBI score

To attain the Primary Body Contact Recreation use in streams:

- *E. coli* (based on a minimum of 10 samples taken during recreational season)

The geometric mean should not exceed 126 colonies/100 mL.

- Enterococcus (based on a minimum of 10 samples taken during recreational season)
  The geometric mean should not exceed 33 colonies/100 mL.

To attain the Agriculture use in streams:

- Sulfate (based on a minimum of 10 samples)
  a) No sulfate value exceeds 250 mg/L
  OR
  b) The mean of all samples does not exceed the yearly mean standard for sulfates as listed in the Oklahoma Water Quality Standards Appendix F
  AND
  10% or fewer samples exceed the sample standard for sulfates as listed in the Oklahoma Water Quality Standards or site-specific criteria.

All data collected from the RCPP streams and the lake will be assessed to determine attainment of designated uses in accordance with State standards. At least biannual assessment will occur as part of the Integrated Reporting process, and the published criteria in the State's Standards (OWRB 2013) will be the values to determine progress toward improved water quality. The ultimate goal of implementation of any project in this watershed is to attain all designated uses, so these criteria are the target values to attain.

LOAD REDUCTIONS *(element b)*

A Soil & Water Assessment Tool (SWAT) model was produced in 2007 to target critical source areas of phosphorus and sediment in the Oklahoma portion of the Grand Lake watershed. The goal was to use these results to prioritize select areas in which to focus BMP implementation based on where they are needed the most and where the environmental benefit would be maximized. This watershed model incorporated the landuse in the watershed, weather, hydrology, soil information, and data such as amount of poultry waste litter applied (AMEC 2007).

The figures below show estimates of relative phosphorus and sediment loads from Grand Lake subwatersheds. Figure 6 provides targeted areas in the Grand Lake watershed in terms of phosphorus loss per unit area as predicted by the SWAT model. Sub-basin load predictions are mapped from highest phosphorus loss to lower phosphorus loss using a color-coding format. Specifically, the top 5% of sub-basins in predicted phosphorus loss per unit area were color coded red; the top 5 to 10% loss sub-basins were colored dark orange; and the top 10 to 20% sub-basins were colored light orange. The Oklahoma RCPP watersheds are within the pink circles. Figure 7 provides targeted areas in the Grand Lake watershed in terms of sediment loss as predicted by the SWAT model. Sub-basin load predictions are mapped from highest sediment loss to lower sediment loss using the same color-coding format as described for Figure 6. All of the chosen Oklahoma RCPP watersheds ranked in at least the top 20% of sub-basins for high phosphorus and sediment loss.

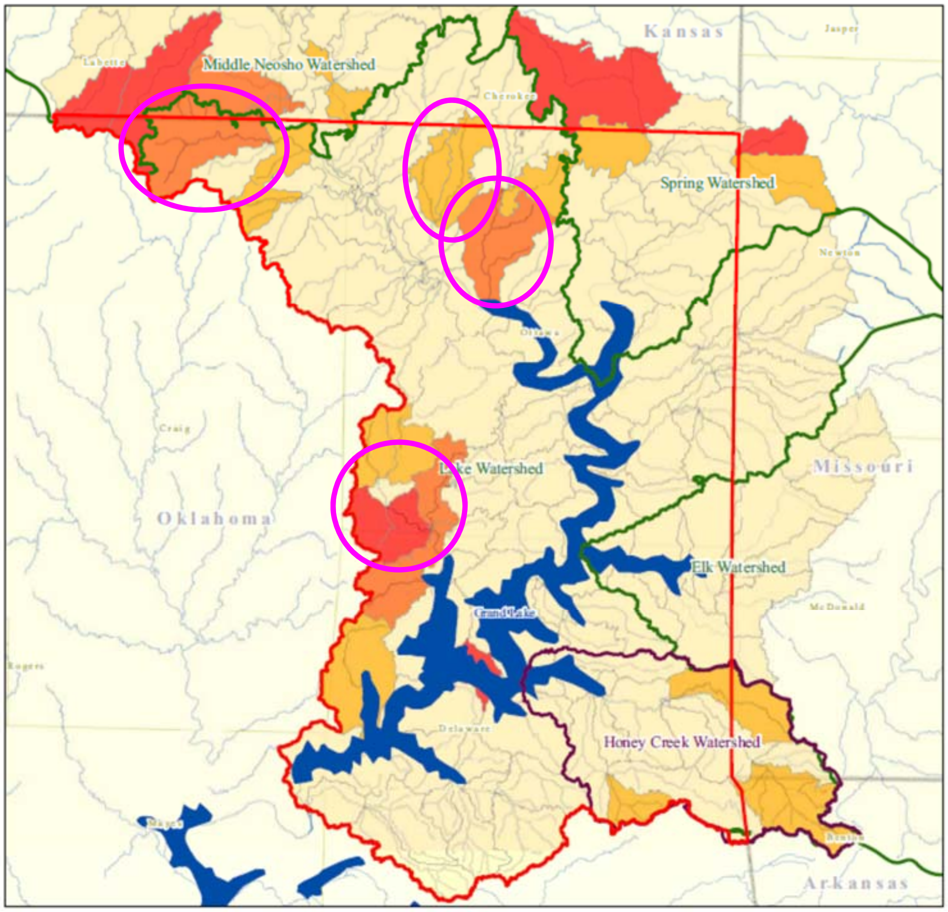

Figure 6. Relative phosphorus loads as estimated from SWAT model (from AMEC 2007). RCPP watersheds are circled in pink.

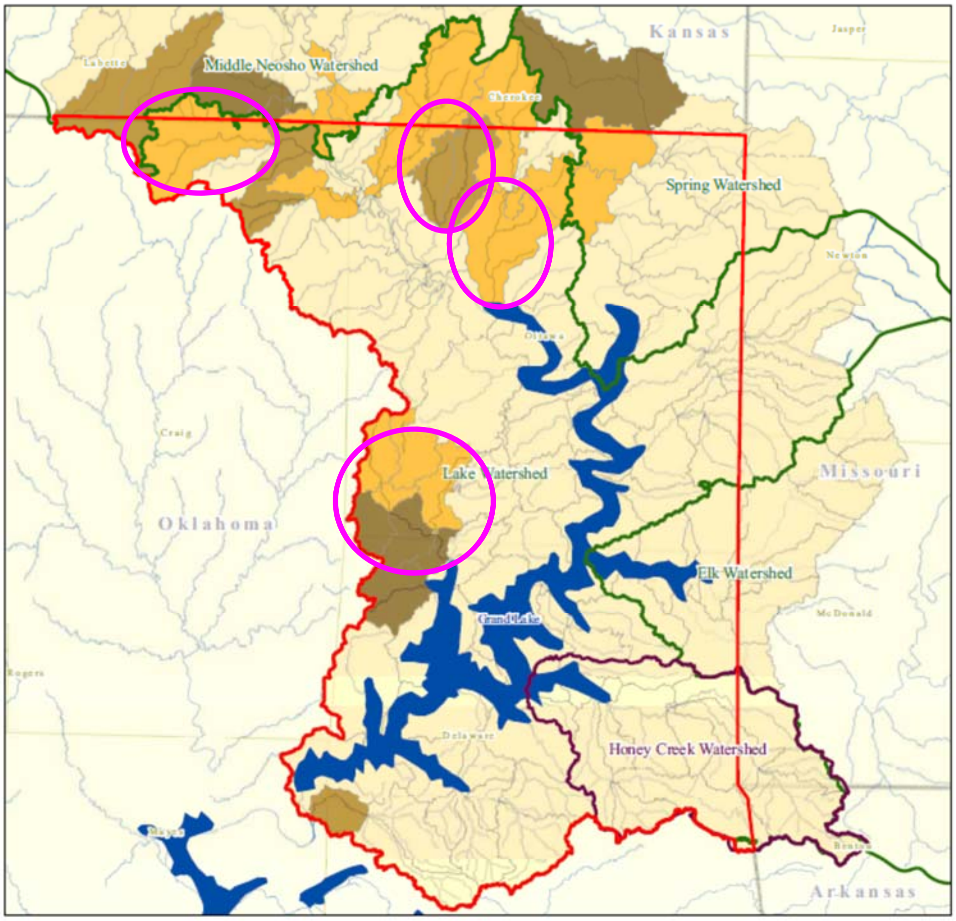

Figure 7. Relative sediment loads as estimated from SWAT model (from AMEC 2007). RCPP watersheds are circled in pink.

In 2008, the ODEQ produced a bacteria TMDL for impaired streams in the Neosho River basin, which included all of the Oklahoma RCPP watersheds except Elm Creek (ODEQ 2008). Table 3 is an excerpt from the TMDL showing the predicted load reductions required to attain the PBCR use for bacteria. These load reductions were based on data collected from 1997 to 2006. Since the publication of this TMDL, the PBCR standards have changed so that only the geometric mean is used, so only these reductions are presented here as compared to the TMDL report. Also, Tar Creek is not on the 303(d) list anymore, since it has a SBCR designation; the TMDL report gave load reductions for the stream based on PBCR designation, which is not applicable.

Table 3. Bacteria load reduction estimates from TMDL (ODEQ 2008).

Waterbody ID	Waterbody Name	Percent Reduction Required		
		Fecal coliform (instantaneous)	*E. coli* (geomean)	Enterococcus (geomean)
OK121600030160_00	Horse Creek	86%		
OK121600030190_00	Little Horse Creek	49%	84%	77%
OK121600040060_00	Tar Creek		84%	80%
OK121600040200_00	Russell Creek	49%		

The load reduction goal cited in the RCPP proposal is to achieve at least a 30% reduction in all pollutants related to impairment in these subwatersheds in order to restore designated use support to the waterbodies in the project areas. Based on past experience, this goal should be obtainable with the financial resources that will be allocated for planned BMP implementation. Similar Oklahoma programs in watersheds have resulted in measurable water quality improvement and delisting from impaired waterbody lists as documented on the EPA NPS success story webpage (http://water.epa.gov/polwaste/nps/success319/).

Load reduction goals will be further clarified with completion of the Total Maximum Daily Load for Grand Lake for which a lake and watershed model is currently in development. The watershed plan will be updated with additional information either as that process is completed, or as iterations of implementation help clarify the need for further reductions.

NPS MANAGEMENT MEASURES *(element c)*

Multiple waterbodies in the Grand Lake basin are impaired according to state standards, with impairment causes related to excess nutrients, sediment, and bacteria. Actions to protect and improve water quality in this watershed are rooted in soil health, since water quality impairments measured in Oklahoma streams and Grand Lake are related to nutrient loss from soils, washing of bacteria from soils, erosion and compaction due to poor land management, soil erosion caused by wind and water due to poor land use practices, and soil health degradation caused by loss of organic matter. Therefore, primary concerns to address in the watershed include sedimentation, streambank stabilization, fertilizer and nutrient runoff from livestock and poultry manure, fecal coliform bacteria, and erosion of grasslands and rangeland. The conservation practices which can improve water quality in this watershed will do so largely by also improving soil health. The primary participants in BMP implementation in the RCPP will be row-crop agriculture and cattle producers. Dairy operators, poultry producers, or specialty crop producers may also be involved, but in smaller numbers.

Program activities are expected to be completed over a five year period. BMP installation will occur throughout the program period, following the traditional EQIP enrollment process. Kansas and Oklahoma State staff assigned to the project will assist NRCS with outreach and enrollment of eligible landowners, as well as conservation planning, as appropriate. Conservation District Boards, NRCS, and stakeholder groups will work together to ensure that the conservation practices enrolled through the program are most heavily focused on addressing the resource concerns of water quality and soil health. In addition, state resources for cost-share (i.e., Sec. 319 funds) may be used to ensure that the most beneficial practices are installed by providing a supplementary incentive payment which traditional EQIP cannot offer or by paying a percentage of the landowner cost-share to otherwise reduce the cost to the cooperator and increase participation.

Independent studies of landuse and other watershed activities most likely contributing significantly to the problem in both states suggests that conservation practices needed include those which most effectively reduce erosion of soil, nutrients, and bacteria from cropland and grasslands. For cropland, these include practices such as conversion to no-till, field buffers or filter strips, riparian buffers, conversion of cropland to grass, diversions, grassed waterways, water and sediment control basins, and nutrient management (including grid soil sampling to inform precision farming).

A significant portion of the watershed is also grassland, and better management of grazing lands has been identified as a resource need in the watershed. Practices such as prescribed grazing or grazing management, rotational grazing, riparian buffers, limited access and livestock exclusion from streams, alternative water supplies, heavy use area protection, and cross-fencing will help address this concern. Finally, the Grand Lake basin includes and is adjacent to some of the largest poultry producing areas in the U.S. Lawsuits and regulation have reduced litter application in these adjacent watersheds, meaning that much of the remaining litter produced now travels north to be applied to land in the Middle and Lower Neosho watershed as a soil additive and fertilizer. Therefore, practices such as nutrient management and animal waste management should be included in the program activities to help reduce potential impacts from these activities.

The OCC worked with local conservation districts to assemble a Watershed Advisory Group (WAG) of landowners and agricultural producers representing the major types of agriculture in the watershed. The WAG also included members of the Grand River Dam Authority, the Grand Lake Watershed Alliance Foundation, local NRCS representatives, and members of local tribes were also invited to attend. The WAG reviewed the water quality impairments in the watershed and discussed potential and likely sources. The WAG also discussed options for conservation practices that could be used to address these impairments and barriers that prevented or discouraged landowners from implementing these conservation practices. Finally, the WAG discussed restoration measures and conservation practices that were possible through the current RCPP funding versus those that were needed but should be funded through another vehicle or those that might need supplemental funding in addition to USDA funding in order to be adopted. The main needs identified by the WAG that could not be addressed through the RCPP funding (due to EQIP guidelines) are streambank/stream channel restoration and septic system remediation.

The WAG agreed that water quality and soil health were the primary resource concerns for the RCPP project. To address those concerns, they agreed to prioritize the installation of the following types of conservation practices:

- Riparian area protection, livestock exclusion fencing, alternative water supplies
- No-till
- Cover crops for cropland and grazing lands
- Nutrient and animal waste management
- Improving grazing lands management

The WAG suggested that those primary practice types should be the ones to receive highest priority and therefore to be the focus of the program. However, they also indicated that other practices that improve water quality, reduce water usage, improve soil health, improve air quality, and improve wildlife habitat would also be eligible for the RCPP program. Copies of the ranking and screening tools developed by RCPP partners in response to the WAG input are seen in Appendix A.

Following practice selection, partners began to publicize program availability with meetings and advertisements and began the process of enrolling cooperators. Implementation of conservation practices will follow the typical NRCS model, where a local NRCS conservation planner or authorized technical service provider (OCC personnel) will work with landowners to design conservation plans to meet the resource needs on each particular farm. These landowners will be enrolled in the RCPP project, screened for eligibility, and ranked according to the priority ranking. The annual program enrollment will be based on available funding per year; however, waiting lists will be maintained to help speed the prioritization up once new funds become available. Conservation Districts will assist in implementation of the program by reviewing and approving applications and conservation plans as they do in traditional NRCS program implementation.

Pasture land will be the primary focus of the conservation efforts, followed by cultivated land. These two primary landuses have been identified in independent watershed modeling and evaluation efforts conducted by the two states as most significantly contributing areas to nutrient, sediment, and bacteria water quality problems. These landuses are also where poultry litter moved from neighboring watersheds would most likely be land-applied, so they represent the most significant threat to water resources related to runoff from animal waste as well.

Program partners will focus conservation practice implementation towards pasturelands and croplands bordering streams in the watershed, as these have some of the greatest potential to transport pollutants to waterbodies. Extra efforts will be made to contact these landowners and inform them of the project opportunities through phone calls, letter writing, and, potentially, door-to-door visits. Next, focus will be given to pasturelands with the greatest need for improved management, including grasslands which are most frequently overgrazed or heavily compacted, those which have heavy infestations of invasive species, and those with poor grass cover for some other reason. Focus will also be given toward croplands on the most erosive soils which show evidence of soil loss or which do not yet practice some degree of reduce tillage. Oklahoma lags behind Kansas in adoption of no-till, and therefore, conversion to no-till will be a priority practice for Oklahoma.

The outreach and prioritization efforts will focus first on situations where the landuses, proximity to streams, soil types, and history of land management suggest the highest potential to contribute to waterbody degradation. Focusing on these potential cooperators with the most significant natural resource needs should help maximize the benefits of the program. Landowners closer to a stream generally have a greater potential to impact that waterbody than a landowner further in the headlands. In addition, producers with poor management are likely contributing more significantly per unit area to downstream water quality problems than producers who follow their conservation plan. The primary conservation practices intended for this project (Table 4) are well developed and many have been extensively implemented in both states.

Table 4. Conservation practices and relative prioritization.

Type of Prioritization	NRCS Practice Number	Practice Name
Primary	327	Conservation Cover
	329	Residue and Tillage Management – No-till
	332	Contour Buffer Strips
	340	Cover Crop
	342	Critical Area Planting
	355	Well Water Testing
	378	Pond
	386	Field Border
	391	Riparian Forest Buffer
	393	Filter Strip
	472	Access Control
	516	Livestock Pipeline
	528	Prescribed Grazing
	561	Heavy Use Area Protection
	578	Stream Crossing
	580	Streambank and Shoreline Protection
	584	Channel Bed Stabilization
	614	Watering Facility
	642	Water Well
Secondary	345	Residue and Tillage Management – Reduced
	350	Tillage
	362	Sediment Basin
	382	Diversion
	410	Fence*
	412	Grade Stabilization Structure
	472	Grassed Waterway
	512	Access Control
	548	Forage and Biomass Planting
	550	Grazing Land Mechanical Treatment**
	590	Range Planting
	600	Nutrient Management
	638	Terrace
		Water and Sediment Control Basin
Other	313	Waste Storage Facility
	314	Brush Management
	338	Prescribed Burning
	442	Herbaceous Weed Control
	511	Forest Stand Improvement
	575	Animal Trails and Walkways

*Fencing may be a secondary priority practice, but only when it is paired with a prescribed grazing plan, riparian forest buffer, or streambank and shoreline protection. Otherwise, fencing is an “other” practice and will not be used to prioritize applications.

** Grazing land mechanical treatment should be used in combination with prescribed grazing to be considered as a secondary prioritization practice; otherwise, it should be considered an “other” practice.

Conservation practices are most effective if installed and maintained in accordance with NRCS standards and specifications. This maintenance will help best insure that practices

survive and are effective for their intended lifespan. All practices have a lifespan of 1 – 25 years after which they typically require upgrades or may lose some of their effectiveness, either due to the senescence of materials or some other factor. Information about conservation practice lifespans can be found in the USDA Conservation Practice Standards Database at:
https://cps.sc.egov.usda.gov/CPSEntry.aspx

The practices selected and utilized in the effort to address impairments in these watersheds will continue to evolve as new information becomes available and as impacts of initial conservation practices delineated with the RCPP program become detectable. Additional practices may also become possible that target the primary resource concerns as alternative sources of funding become available. The watershed plan will continue to be updated as new information becomes available relative to the most critical practices necessary to restore beneficial use support in these waterbodies.

PUBLIC OUTREACH *(element e)*

Outreach is necessary to educate potential cooperators of the need for the program, as well as the potential benefits to them. Outreach to the end water users and society in general is also critical so that the homeowner on Grand Lake realizes that agricultural producers are taking significant steps, voluntarily, to protect the resource. Legislators and policymakers must be informed about the importance of and results from such programs in order to continue to receive necessary financial support. Examples of this outreach will include natural resource days, farm tours, local outreach meetings, presentations to local stakeholder groups, presentations to civic groups, reports to legislators, press events, and other opportunities. In addition, local stakeholder groups, armed with information about the program will conduct their own outreach activities. For example, Tar Creek is monitored by a group of volunteer monitors at Miami High school in Oklahoma. These volunteers have been collecting data for many years and report on improvements to their civic leaders. Their monitoring efforts will be able to supplement state efforts to track water quality progress, but more importantly, their local voices will lend greater credibility towards state efforts to document success

This section identifies those agencies, organizations, and services that are active in the Oklahoma Grand Lake watershed (in no particular order) and will contribute to project outreach. To varying degrees, these groups have been, and will continue to be, active in development and expansion of the WBP and other planning efforts in the watershed. Kansas entities will also work in partnership with Oklahoma to ensure that outreach crosses state boundaries, as necessary, to provide a complete, effective program for the Grand Lake watershed.

Oklahoma Conservation Commission (OCC)

The OCC is the primary agency responsible for development of the WBP for the Grand Lake Watershed. The OCC is also the technical lead agency for the NPS Program in the State and, as such, oversees numerous efforts to address NPS pollution across the State. These efforts include water quality monitoring, education programs, and implementation efforts that put practices on the ground to reduce NPS pollution.

In the RCPP watersheds, OCC staff will work in cooperation with NRCS to help promote and oversee implementation of BMPs to reduce NPS pollution. The Watershed Advisory Group will help educate program partners about local concerns, but will also serve as audiences for education efforts to help agricultural leaders in the watersheds understand the importance of and their role in water quality protection. Partners will focus on outreach to reach producers who may be having the greatest influence on the resource. In many cases, this will include producers who are closest to streams and tributaries. In other cases, this will include beginning and historically underserved producers. The OCC, NRCS, and conservation districts will work with area tribes and farming groups such as Cattleman's Associations to help identify and target these sectors of the population who need additional assistance.

Outreach events such as field days, rainfall simulator demonstrations, as well as individual meetings will help ensure that these sectors of the population are made aware of the program opportunities and benefits. This mechanism has been very effective in similar projects in the area. Within the first five years of a similar program, 60% of the eligible cooperators in the watershed were enrolled in the program, including many tribal members and other historically underserved farmers. Education and outreach can be used to help new cooperators appreciate the potential for these practices to benefit their operation. The rainfall simulator is a very effective tool at demonstrating the impacts of grazing management, conventional tillage, and other more intensive land management compared to management supported through many of the primary priority conservation practices offered through this program.

The OCC also directs the State Blue Thumb Program, a NPS Education Program, focused on volunteer monitoring, which is active in the watershed. Blue Thumb staff will provide stream monitoring workshops to solicit new volunteers and may attend local events such as county fairs and earth day events to promote education about healthy streams. OCC will also provide information about activities and BMP signup in the watershed through contact with the Grand Lake Alliance, which has a newsletter and website, and the local media. Landowner education and support will be essential to successful implementation of BMPs in the watersheds.

NRCS Local Offices

The United States Department of Agriculture Natural Resource Conservation Service (USDA/NRCS) in Oklahoma has been involved with promoting practices to preserve water quality through the Environmental Quality Incentives Program (EQIP) in counties in the Grand Lake Watershed. Each county, through a locally-led process, identifies resource concerns for the program to focus on. In this area, these have generally been related to water quality, soil erosion, and nutrient management. Applications for participation in the program are ranked based on their fit within the local area goals and available funds are awarded based on ranking. Applications almost always outnumber the funds available. NRCS also works with the local conservation district offices to provide technical assistance to landowners and to assure that practices recommended to protect the environment are correctly designed and installed.

Delaware, Ottawa, Craig, and Mayes County Conservation Districts
Conservation Districts (CDs) are locally governed agencies that work with landowners to protect the natural resources of an area, particularly soil and water resources. This mission is accomplished through technical assistance, education, and cost-share programs that promote conservation of natural resources. CDs, together with local NRCS offices, are often the primary contact between an agricultural producer and state and federal government. In addition, CDs may offer technical support to project staff in the form of office space and extra help at outreach events.

Grand Lake Association (GLA)
Active since 1953, the GLA has served as a forum for communication between individuals and businesses in the Grand Lake area. The GLA role goes beyond that of a local department of commerce, however, and includes sponsorship of numerous programs and events that work to protect Grand Lake. The GLA has participated as a major partner in the Honey Creek Sec. 319 project, primarily focused on educational efforts and in efforts to install BMPs and other load reduction efforts. The GLA has been heavily involved in the development of the local GLWA (see below).

Grand River Dam Authority (GRDA)
GRDA is a state agency created in 1953 to be a conservation and reclamation district for the waters of the Grand River. Primary GRDA responsibilities are 1) to control, store, and preserve the waters of the Grand River and its tributaries for any useful purpose and to use, distribute, and sell the same within the boundaries of the district and 2) to develop and generate water power and electric energy within the boundaries of the district. GRDA has an on-site laboratory for conducting water quality analysis and is responsible for collecting water quality data on the lake year-round. This agency will assist with water quality monitoring and education pertinent to the project.

Grand Lake Watershed Alliance Foundation (GLWAF)
This organization was initiated in 2004 through the Grove, Oklahoma, Chamber of Commerce to promote environmental improvements within the city of Grove and the surrounding communities. This organization's goal is to protect and restore water quality within the watershed. The group includes local representatives of watershed interests such as homeowners, agricultural producers, local department of commerce, GLA, GRDA, and other groups. This group has established alliances with citizens groups and agencies in neighboring states, organized training for volunteer water quality monitoring organizations in order to standardize methods, and developed a strategic plan for water quality improvement. This group will insure that local issues and concerns are considered in developing the WBP and that the local community remains informed about the multiple programs ongoing in the watershed to address environmental concerns. In addition, this group may make recommendations for watershed restoration practices and implementation cost-share rates, monitoring needs, possible changes to local and State codes and regulations, and enforcement necessary to reach environmental goals for the region.

Oklahoma Department of Agriculture, Food, and Forestry (ODAFF) Agricultural Environmental Management Services (AEMS) Division
The ODAFF AEMS Division was created to help develop, coordinate, and oversee environmental policies and programs. The division's mission is to work with producers and concerned citizens in protecting the state's soils, air, and waters from animal wastes primarily related to poultry, cattle, and swine. Its primary responsibilities are to implement the Oklahoma Agriculture Pollutant Discharge Elimination System Act, the Oklahoma Concentrated Animal Feeding Operations Act, the Swine Feeding Operations Act, the Oklahoma Registered Poultry Feeding Operations Act, and the Oklahoma Poultry Waste Applicators Certification Act. These programs include the licensing, registration, and inspection of poultry, beef, and swine growing and feeding facilities. Additionally, AEMS is responsible for licensing agricultural compost facilities.

ODAFF is also the technical lead for NPS pollution related to the silvicultural industry. ODAFF's Forestry Office in Jay, Oklahoma provides technical assistance such as forest management, tree planting, and wildlife habitat improvements to landowners in the area.

Oklahoma State University (OSU)

OSU has developed numerous fact sheets including: (1) "Using Poultry Litter as Fertilizer", (2) "Soil Quality and Animal Manure", and (3) "Manure and Raising Soil pH". Other publications include a water quality driven soil handbook, "Oklahoma Soil Fertility Handbook", and information on poultry litter management and utilization to support the marketing and export of poultry litter. Several professors have conducted research in the northeastern part of Oklahoma to address the water quality issues typical of the area.

Oklahoma Cooperative Extension Service (OCES)
OSU hosts the OCES. As required by Oklahoma legislation on poultry production, all poultry growers must receive annual training that focuses on water quality protection, and OCES provides much of this training. Their website on Animal Waste Nutrient Management provides background information needed for developing Nutrient Management Plans and Animal Waste Management Plans, and their training includes general background on water quality and NPS impacts as well as descriptions of BMP options and implementation resources. OCES also provides citizens, communities, youth, farmers, and ranchers with an education program to increase awareness of practices that cause environmental degradation as well as methods to modify those detrimental practices to protect and preserve resources in the watershed.

Integrators
The poultry industry in the Oklahoma portion of the watershed is actively represented by officials from Peterson Foods, Tyson Foods, and Simmons Foods. All three have actively pursued public outreach and education initiatives through their relationships with their contract growers. All three integrators have established dialogue with their contract growers concerning Oklahoma legislative and regulatory requirements on animal production and poultry waste issues. The integrators have agreed to fund education programs for growers as required by Oklahoma legislation.

Poultry Federation
The Poultry Federation, representing Missouri, Oklahoma, and Arkansas, has been involved with education of integrators and growers about legislative and water quality issues dealing with poultry production. This organization has become an important voice for the poultry industry. The Poultry Federation relies upon an effective education program for its members, and it is an important partner in the Grand Lake Watershed program.

Quad-State Poultry Dialogue
This organization has representatives of poultry integrators and contract growers, as well as state and federal agencies that represent Oklahoma, Arkansas, Missouri, and Kansas. Like the Poultry Federation, the primary focus of this group is education of the public, particularly those in the poultry industry, about issues that affect their operations and businesses. This organization conducts regional meetings and shares data with the three work groups.

Oklahoma Department of Environmental Quality (ODEQ)
The ODEQ Water Quality Division has several efforts in place related to the Grand Lake Watershed. The first is the NPDES permitting program, a primary responsibility of ODEQ. Current records suggest that Oklahoma facilities represent less than ten percent of the permitted facilities in Grand Lake and less than five percent of the total discharge flow. The ODEQ also manages the TMDL program for the State. In addition, ODEQ has a local office in the Grand Lake Watershed. Staff housed in this office have an excellent working relationship with local communities and local government.

Oklahoma Water Resources Board (OWRB)
The OWRB has numerous efforts ongoing in the Grand Lake Watershed, most of which center around water quality monitoring with the Beneficial Use Monitoring Program (BUMP). Water quality in the lake and a few of its tributaries is assessed through the BUMP in order to ascertain whether or not beneficial uses are being supported. Another important OWRB program in the watershed is the State Revolving Fund (SRF) Program which offers low-interest loans for upgrades of water and wastewater treatment facilities and related infrastructure. This program helped finance a regional treatment works around the Monkey Island Area of the lake that upgraded numerous septic systems into a secondary treatment facility. Water from the facility is now also used to irrigate the golf course at Monkey Island, which has dramatically reduced the amount of commercial fertilizer used by the golf course. In total, OWRB SRF funds helped finance over $30 million worth of sewage treatment upgrades in the watershed from 1993 to 2004.

Additional OWRB efforts include; 1) working with the GRDA to demonstrate a more protective lakeshore development strategy and trying to establish a more natural, vegetated community both above and below the waterline and 2) updating the bathymetric information on the lake to ascertain sedimentation rate and update storage capacity.

Outreach efforts in the watershed continue to be developed and modified and as additional information becomes available, the watershed plan will be updated accordingly.

TECHNICAL and FINANCIAL ASSISTANCE NEEDED *(element d)*

Funding for implementation of BMPs in the RCPP watersheds from December 2014 through

December 2019 will primarily be through the NRCS, with matching and supporting funds from the State. These funds will be used as cost-share for BMP implementation, so the landowners will be providing a portion of all implementation monies. OCC Section 319 funds will be used to provide additional incentive rates for BMPs with the greatest environmental benefit to reduce the cost and risk to the cooperator and, thus, encourage enrollment in the practices with the greatest benefits. Limited state funding is also available to landowners through the locally-led cost-share program, administered through the conservation districts and the OCC.

The OCC will be providing technical assistance and staff to aid with program management, landowner outreach, and perform monitoring, as well as training and support for the Blue Thumb educational program in the watershed. Since the RCPP is a joint project with the state of Kansas, Kansas will be providing matching funds, staff/technical assistance, and monitoring within selected Grand Lake watersheds in that state. Tables 5 and 6, below, specify the amounts of financial and technical assistance that each state will provide and that the NRCS will provide to accomplish implementation and monitoring. NRCS state and local offices will also assist the program with oversight of traditional EQIP roles related to administration and financial delivery of the program along with technical assistance to landowners such as developing engineering practices and general program oversight and assistance.

Table 5. RCPP funding by fiscal year (FY). Financial assistance (FA) and technical assistance (TA) match will be provided by Kansas and Oklahoma as indicated, and Environmental Quality Incentive Program (EQIP) funds will be paid to the states and NRCS as indicated to oversee the project.

Program Year	Type of Assistance	Amount Partner Provided Funding (State or 319 Funding) for FA or TA		EQIP Funding for either TA or FA Paid to:		Total Funding
		KS	OK	State	NRCS	
FY 2016	FA	$164,275	$417,000		$690,000	$1,653,444
	TA	$121,369	$135,800	$125,000		
FY 2017	FA	$125,000	$417,000		$690,000	$1,619,169
	TA	$126,369	$135,800	$125,000		
FY 2018	FA	$150,000	$417,000		$690,000	$1,619,169
	TA	$101,369	$135,800	$125,000		
FY 2019	FA	$175,000	$417,000		$690,000	$1,644,169
	TA	$101,369	$135,800	$125,000		
FY 2020	FA	$200,000	$417,000		$690,000	$1,669,169
	TA	$101,369	$135,800	$125,000		
Total	**FA**	**$814,275**	**$2,085,000**		**$3,450,000**	**$6,349,275**
Total	**TA**	**$551,845**	**$679,000**	**$625,000**		**$1,855,845**
Totals		**$1,366,120**	**$2,764,000**	**$4,075,000**		**$8,205,120**

Table 6. Specification of funding amounts for primary activities in the RCPP.
KDHE=Kansas Department of Health and Environment, KFS=Kansas Forestry Service, KDA=Kansas Department of Agriculture

Fiscal Year	Activity	Lead Partners	Federal Financial Assistance	Federal Technical Assistance	Non-Federal Resources (in-kind)		Non-Federal Resources (Cash)	
					State	319	State	319
FY2016	Staffing	KDHE, KFS, OCC		$125,000	$15,000	$31,369	$46,000	$89,800
FY2016	Monitoring	KDHE, OCC					$65,000	$10,000
FY2016	Cost-Share	KDA, OCC	$690,000			139,275	$292,000	$150,000
FY2017	Staffing	KDHE, KFS, OCC		$125,000	$15,000	$31,369	$46,000	$89,800
FY2017	Monitoring	KDHE, OCC					$45,000	$35,000
FY2017	Cost-Share	KDA, OCC	$690,000			$75,000	$317,000	$150,000
FY2018	Staffing	KDHE, KFS, OCC		$125,000	$15,000	$31,369	$46,000	$89,800
FY2018	Monitoring	KDHE, OCC					$45,000	$10,000
FY2018	Cost-Share	KDA, OCC	$690,000			$75,000	$342,000	$150,000
FY2019	Staffing	KDHE, KFS, OCC		$125,000	$15,000	$31,369	$46,000	$89,800
FY2019	Monitoring	KDHE, OCC					$45,000	$10,000
FY2019	Cost-Share	KDA, OCC	$690,000				$367,000	$150,000
FY2020	Staffing	KDHE, KFS, OCC		$125,000	$15,000	$31,369	$46,000	$89,800
FY2020	Monitoring	KDHE, OCC					$45,000	$10,000
FY2020	Cost-Share	KDA, OCC	$690,000			$75,000	$392,000	$150,000
Total	Staffing			$625,000	$75,000	$156,845	$230,000	$449,000
Total	Cost-Share		$3,450,000			$364,275	$1,710,000	$750,000
Total	Monitoring						$245,000	

Technical and financial assistance currently summarized represents funding available for the currently funded RCPP program. Additional funding and technical assistance will be needed to restore beneficial use support; however further information is needed to better describe this additional need. For instance, the completed TMDL could help better inform the additional financial and technical assistance needs for the watershed. Future iterations of the watershed plan will include further detail regarding technical and financial assistance needs as information becomes available.

IMPLEMENTATION SCHEDULE and INTERIM MILESTONES *(elements f and g)*

The RCPP will run for five years, from December 2014 through December 2019, although delays could extend the project by a few months. Table 7 below indicates the duration of the planned activities.

Table 7. Chart of Program Activities for RCPP.

Task	Calendar Year																				
	2015	2016				2017				2018				2019				2020			
Quarter	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Stakeholders finalize practice selection,	X																				

payment rates, and develop prioritization																					
Education and Outreach	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Stakeholder update meetings	X				X				X				X				X				X
Water Quality Monitoring	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Cooperator Enrollment and Conservation Practice Installation		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Soil Sampling		X	X	X	X	X	X	X	X									X	X	X	X
Carbon Verification				X	X			X	X			X	X			X	X			X	X
Pollutant Load Reduction Estimates						X				X				X				X			X
Annual and Final Reporting				X				X				X				X					X

Intensive BMP implementation will be accomplished through the RCPP from 2015 through 2019. The OCC will work in partnership with the NRCS to accomplish these tasks. Annual fourth-quarter review of stakeholder signup, carbon verification, and pollutant load reduction estimates will serve as interim measures of success and will facilitate any adjustments to outreach and implementation efforts if necessary to improve participation.

Additional actions will likely be necessary to restore full beneficial use support to waterbodies in these watersheds; however, until we collect information about the success of the currently planned practices, the degree to which additional work is necessary is unknown. Therefore as the need for additional work becomes clearer, the watershed plan will be modified to add additional milestones to track progress.

Once the status of the RCPP project and its effects are known, it may be necessary to update the watershed plan (beginning in 2020) if significant progress has been made or if a change in direction is called for. Based upon watershed interest and demand for additional conservation work, watershed partners will work together to identify additional sources of funding to support ongoing work including, but not limited to GRDA and other state funds, USDA farm bill programs, 319, and other sources of funding to continue the installation of conservation practices. Other activities that may follow are detailed in Table 8.

Table 8. Timeline for activities following RCPP Project.

Timeframe	Project Actions	Agency Responsible	Status	Outcome
2020-2021	Update Watershed Plan (as necessary)	OCC	Upcoming	Updated Plan
2020-2021	Seek alternative funding to implement conservation in the watershed	OCC and partners	Upcoming	Additional resources to support conservation practice installation
2020-2030	Water Quality Monitoring	OCC	Upcoming	Report on progress
2020, 2025, 2030	Analyze water quality data	OCC	Upcoming	Evaluate progress in conservation results
2020-2030	Implement conservation practices in watershed	OCC and partners	Upcoming	Delisting of stream for bacteria impairment;

				continued protection of stream
2020-2030	Annual Pollutant Load Reduction Estimates	OCC	Upcoming	Report in GRTS
2020-2030	Water quality education programs	OCC and partners	Upcoming	Outreach to producers and other stakeholders

MONITORING PLAN *(element i)*

Water quality monitoring efforts will be focused on in-stream monitoring. Program results will be assessed by comparing water quality monitoring data from stream sites which previously have been monitored as baseline data. With the exception of Elm Creek, all of the RCPP streams have historical data. Data historically collected at these sites have been used for assessment of streams for the state's Integrated Report. During the RCPP period, monitoring will occur once a month within each of the five watersheds, at a site as far downstream in the basin as possible (Table 9). This monitoring approach has been used to document water quality improvement due to conservation practice installation in similar watersheds across the state.

Table 9. Monitoring sites in RCPP watersheds.

Site Name	WBID	County	Latitude	Longitude
Elm Creek	OK121600-04-0150G	Ottawa	36.9217	-94.9181
Russell Creek	OK121600-04-0200F	Craig	36.9879	-95.0650
Horse Creek	OK121600-03-0160G	Ottawa	36.6830	-94.9273
Tar Creek	OK121600-04-0060D	Ottawa	36.8748	-94.8620
Little Horse Creek	OK121600-03-0190A	Ottawa	36.6850	-94.9135

The *in-situ* parameters that will be recorded include water temperature, dissolved oxygen, pH, specific conductance, alkalinity, hardness, turbidity, and instantaneous discharge. Grab samples will be collected and analyzed for the following parameters: nitrate (NO_3), nitrite (NO_2), orthophosphate (PO_4), total phosphorus (TP), total Kjeldahl nitrogen (TKN), ammonia (NH_4), chloride (Cl), sulfate (SO_4), total suspended solids (TSS), and total dissolved solids (TDS). Bacteria will be assessed from grab samples during the recreation period of May 1 through September 30.

Benthic macroinvertebrate samples will be collected twice annually and fish will be collected once during the project period for comparison to ecoregion-specific reference streams.

<u>Baseline data</u>

Monitoring at Horse Creek and Russell Creek took place from 1999 through 2001 as part of a program to monitor streams in the eastern half of the state. Water quality monitoring at Little Horse Creek and Tar Creek has occurred on a monthly basis during a two-year period every five years as part of the state's Rotating Basin program, initiated in 2001. The following tables (Tables 10 - 14) show the average values of the assessed parameters for each Rotating Basin cycle for Little Horse and Tar Creeks and the average values for the collected data from Horse and Russell Creeks.

Table 10. Average water quality chemical values for each two-year monitoring cycle.

Site Name	Years Monitored	Dissolved Oxygen (mg/l)	Turbidity (NTU)	Conductivity (uS/cm)	Discharge (cfs)	Chloride (mg/l)	Sulfate (mg/l)	TDS (mg/l)	Ammonia (mg/l)	Nitrate (mg/l)	Nitrite (mg/l)	TKN (mg/l)	Ortho-Phosphate (mg/l)	Total Phosphorus (mg/l)	TSS (mg/l)	Hardness (mg/l as CaCO3)
Little Horse Creek	2001-2003	7.3	14.6	359	0.93	19	28	204	0.18	1.27	0.62	0.69	0.11	0.16	13	144
	2006-2008	7.0	43.9	311	6.14	15	24	202	0.06	0.57	0.03	0.85	0.28	0.36	48	129
	2011-2013	5.8	18.0	297	2.11	13	29	197	0.33	0.51	0.04	1.26	0.18	0.24	11	184
Tar Creek	2001-2003	9.2	16.6	1294	7.17	37	633	1126	0.18	1.64	0.02	0.63	0.25	0.33	18	749
	2006-2008	9.4	27.6	1194	7.54	34	567	1096	0.08	0.36	0.02	0.42	0.06	0.09	20	756
	2011-2013	10.4	13.4	1381	8.06	30	801	1236	0.08	0.39	0.03	0.83	0.05	0.09	12	753
Horse Creek	1999-2001	8.6	63	339		26	32		0.43	0.71		1.63	0.12	0.33	41	104
Russell Creek	1999-2001	8.2	12	376		20	72		0.04	0.39		0.53	0.02	0.08	11	208

Table 111. Percent of DO samples below state standard within each two-year monitoring cycle. None of Tar Creek's DO samples were below criteria for HLAC designation.

Site	Years Monitored	% DO Samples under 5.0 mg/l
Little Horse Creek	2001-2003	20%
	2006-2008	17%
	2011-2013	45%
Horse Creek	1999-2001	19%
Russell Creek	1999-2001	19%

Table 12. Geometric means for bacteria samples collected during each Rotating Basin cycle.

Site Name	Years Monitored	*Enterococcus*	*E. coli*
Little Horse Creek	2001-2003	55.743	121.98
	2006-2008	415.17	135.9
	2011-2013	25.61	153.39
Tar Creek	2001-2003	518.91	190.4
	2006-2008	251.99	146.89
	2011-2013	44.3	222.33

Table 13. Fish collection data, one collection within each monitoring cycle.
2006 results were affected by an extreme drought, so they were not representative of normal conditions and are not included here.

Site Name	Year	Total Individuals	Total Species	# Darter Spp.	# Sunfish Spp.	# Intolerant Spp.	Proportion Tolerant Individuals	Proportion Insect. Cyprinid Individuals	Proportion Lithophylic Spawners	Total Score IBI	IBI % reference	Condition
Little Horse Creek	2001	428	22	2	5	10	0.1	0.47	0.88	31	1.19	excellent
	2011	716	21	2	7	1	0.56	0	0.41	23	0.98	excellent
Tar Creek	2001	160	16	0	5	0	0.74	0.09	0.03	15	0.58	poor
	2011	498	16	0	6	1	0.88	0	0.08	19	0.81	good
Horse Creek	1999	418	14	1	8	0	0.4	0	0.01	15	0.58	poor
Russell Creek	1999	764	25	2	6	2	0.39	0.04	0.21	23	0.98	excellent

Table 14. Condition of macroinvertebrate communities based on four collections per Rotating Basin cycle.

Site Name	Years Monitored	Average Condition (based on 4 collections)
Little Horse Creek	2001-2003	no data
	2006-2008	slightly impaired
	2011-2013	severely impaired
Tar Creek	2001-2003	moderately impaired
	2006-2008	slightly impaired
	2011-2013	slightly impaired

<u>Other assessment</u>

In addition to assessing in-stream water quality and biological data, geospatial data coupled with the amount and intensity of conservation practices installed can be evaluated to estimate potential nutrient, sediment, and bacteria load reductions due to implementation. These load reduction estimates are typically calculated in STEPL and reported to EPA as part of the State's NPS Program in February of each year. These estimates will serve as an interim measure of progress toward the ultimate goal of water quality restoration. Other methods which might be used include the Soil and Water Assessment Tool (SWAT) and similar watershed models. This information will also be reported on as part of the annual and final reports for the program.

Soil samples will also be collected from approximately 10% of participating cooperator operations in Oklahoma (based on voluntary cooperation) from landowners early in the program, with follow-up monitoring being completed later in the program. The purpose of this soil monitoring, which will be accomplished in collaboration with Oklahoma State University, will be to assess select indicators of soil health, including carbon content, percent organic matter, compaction, and other indicators. In addition, a percentage of willing landowner contracts will also be verified for carbon sequestration rates according to the State's carbon sequestration verification protocols for grasslands and no-till.

Edge-of-field monitoring is another method which could be used to document success of these programs. However, it is usually more expensive to complete than instream monitoring, and it generally indicates that one particular landowner has successfully reduced their inputs rather than suggesting whether adequate implementation has occurred throughout the watershed to address the concerns or whether than implementation addressed the most significant sources contributing to the problem.

The monitoring plan designed for the RCPP program is a type that has been successful in documenting water quality improvement associated with previous watershed remedial efforts. Nonetheless, as the program evolves, it may be necessary to modify or amend the existing monitoring plan. In that case, the watershed plan will be updated as necessary to detail modifications to the monitoring design and scope.

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Appendix A: Screening and Ranking Tools for RCPP