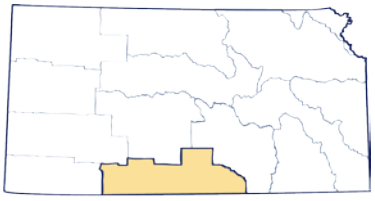
State of the Resource & Regional Goal Action Plan Implementation Report

August 2018

Red Hills Regional Planning Area



Kansas Water Office

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Executive Summary

The Red Hills State of the Resource & Regional Goal Action Plan Implementation Report is intended to provide a background of the regional issues and record activities and progress toward regional goals and the *Long-Term Vision for the Future of Water Supply in Kansas (The Vision)* objectives utilizing the most up to date data available at the time of report development.

The Red Hills Region covers approximately 5,825 square miles in south-central Kansas bordering Oklahoma. Agriculture is the base for the local economy with oil and gas production also playing an important role. The climate of the region is characterized by moderate to low precipitation, relatively high wind velocities, rapid rates of evaporation, and a wide range of temperatures. Average annual precipitation amount varies from 18" in the west to 41" in the east.

Surface and groundwater resources within the region suffered from lower than normal precipitation from 2009 to 2015. Due to very low precipitation in 2011, groundwater use peaked at nearly 70,000 acre-feet for the region, with irrigation use from groundwater sources at nearly 60,000 acre-feet in 2011.

The State of Kansas is required to conduct Total Maximum Daily Load (TMDL) studies and develop TMDLs for water bodies identified on the state's List of Impaired Waters (Section 303(d) List). These are quantitative objectives and strategies needed to achieve the state's surface water quality standards. In the Red Hills Region, the most common TMDLs developed address E. Coli bacteria, dissolved oxygen, eutrophication, sulfate, and chloride.

Four new impairments were added to the 2016 Section 303(d) list that were not in place in 2014, including arsenic on Cow, Slate, and Bluff creeks and atrazine on Slate.

The region's unique water resource conditions are a challenge to economic stability and growth that might be eased through conservation, as well as cooperation and partnerships among water user groups. Ensuring that water management tools and programs are accessible is key to helping individual water users, landowners, industrial users, and public water suppliers manage their resources effectively.

Drought conditions and the energy production boom in 2010 created concern for the availability of fresh water for future uses in the region, especially with the already limited fresh water supplies. The increased water demand, both for industrial use and increased municipal water demands, brought up concerns from local water suppliers regarding their ability to meet the region's needs. These concerns are reflected in regional goals for the Red Hills Region. Evaluations of water resources in the region do not indicate resources are declining over the long term, but they do remain limited.

Two efforts are under evaluation to add to the usable water supply. The use of poor quality waters, including those produced in oil and gas production, are seen as an opportunity to help meet water needs for the future. Partial funding for a Pilot Treatment project has been obtained and a suitable site arranged. A regional lake is viewed as another means to meet multiple needs and enhance quality of life in the future. The characterization of a lake and means to support such a project are under discussion.

Water Use Trends

Groundwater is the primary source of water within the Red Hills Region (Figure 2), accounting for approximately 95% of the total reported water use. Groundwater sources within the region are the fringes of the Great Bend Prairie portion of the High Plains Aquifer and alluvial deposits along major streams). Annual reported water use for the region fluctuates based on climate conditions present, with higher water use resulting from periods of hot and dry weather during the growing season and lower water use during periods of cooler and/or more wet weather.

Irrigation accounts for 84% of the reported water use of the region, averaging more than 48,000 acre-feet (AF) per year for the period of 2007 to 2016 (Figure 3). Municipal use was approximately 12% of the water use, with the remainder accounting for 3% industrial and 1% each for stock water and recreation uses. In 2013, an additional 6,013 gallons (0.02 AF) were authorized for industrial purposes, primarily oil and gas well development.

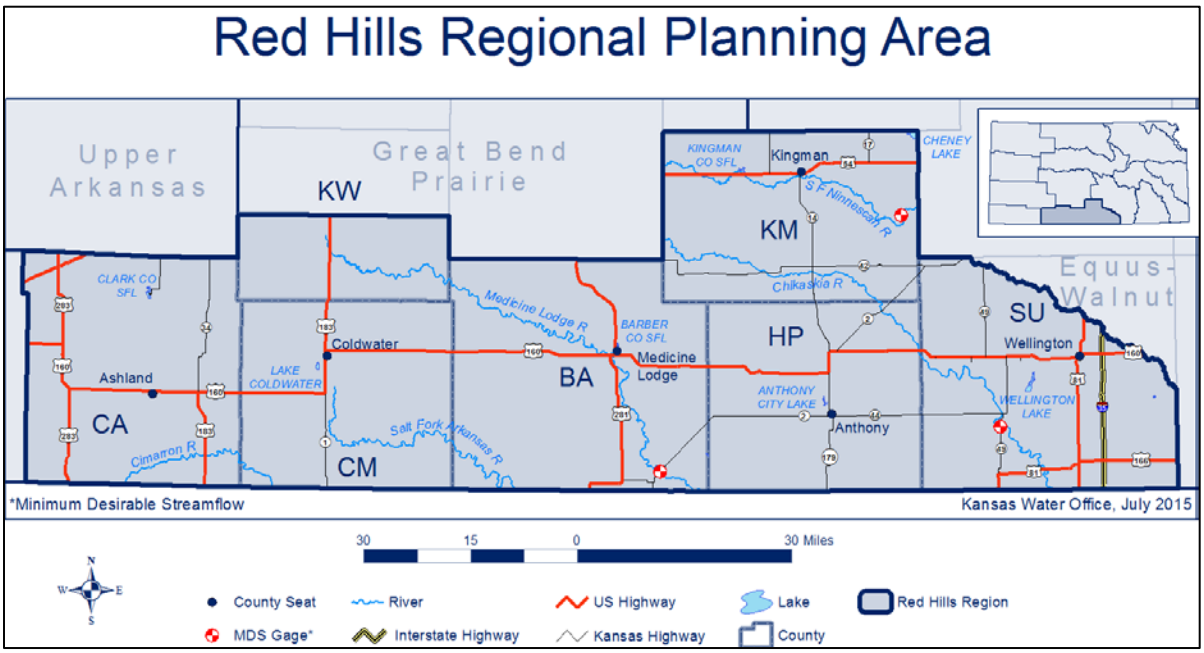

Figure 1: Red Hills Regional Planning Area

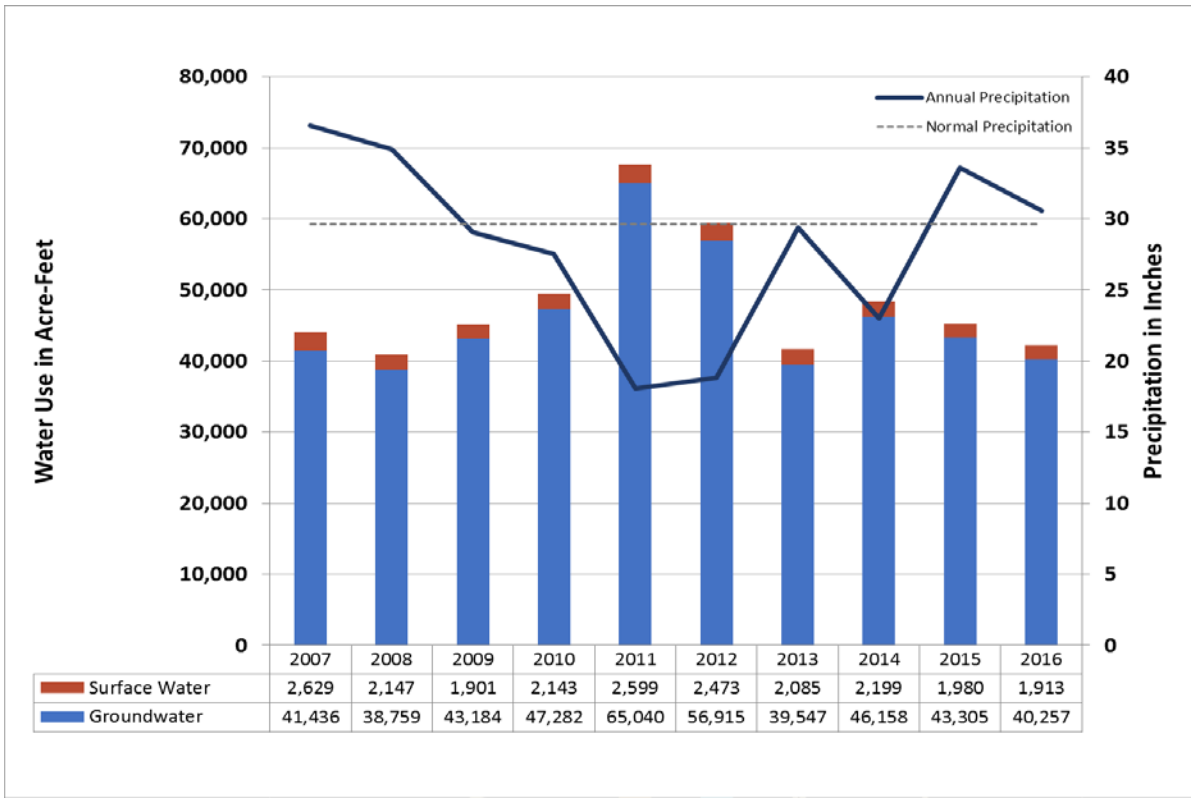

Figure 2: Reported water use in Red Hills Region by source

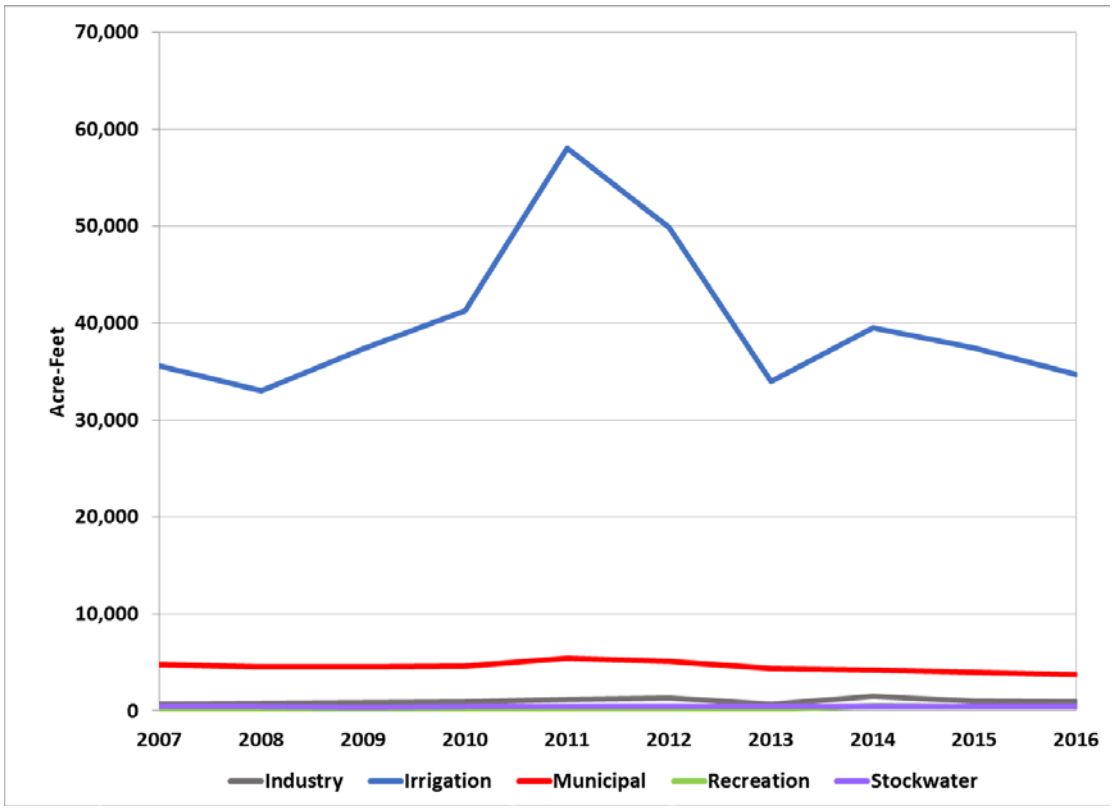

Figure 3: Annual reported water use by type from groundwater sources, Red Hills Region

Water Resource Conditions

Groundwater

The principle groundwater sources in the Red Hills Region are the alluvial aquifers along the regions streams and rivers and the High Plains- Aquifer (Figure 4). The alluvial aquifers supply water for most uses, including irrigation. However the alluvial water supply is limited as these aquifers are relatively small in extent and saturated thickness. The High Plains Aquifer is productive in portions of Kiowa and northern Barber and Kingman counties, other portions do not have sufficient saturated thickness to support most uses. Due to the nature of groundwater occurrence in all but the northern parts of the region, groundwater levels fluctuate in the alluvial aquifers based on recharge from associated streams and precipitation occurrence and intensity.

Dry times result in groundwater level declines, and in turn, the hydraulic connection with streams and the overlying alluvial aquifers may be lost, no longer able to contribute groundwater to base stream flow. Recharge does occur (3.8 inches/year), allowing recovery during wet years. The Dakota Aquifer nears the surface in Clark, Comanche and Kiowa counties, which generally means the water is of higher quality. More information can be found on the Kansas Geological Survey website.

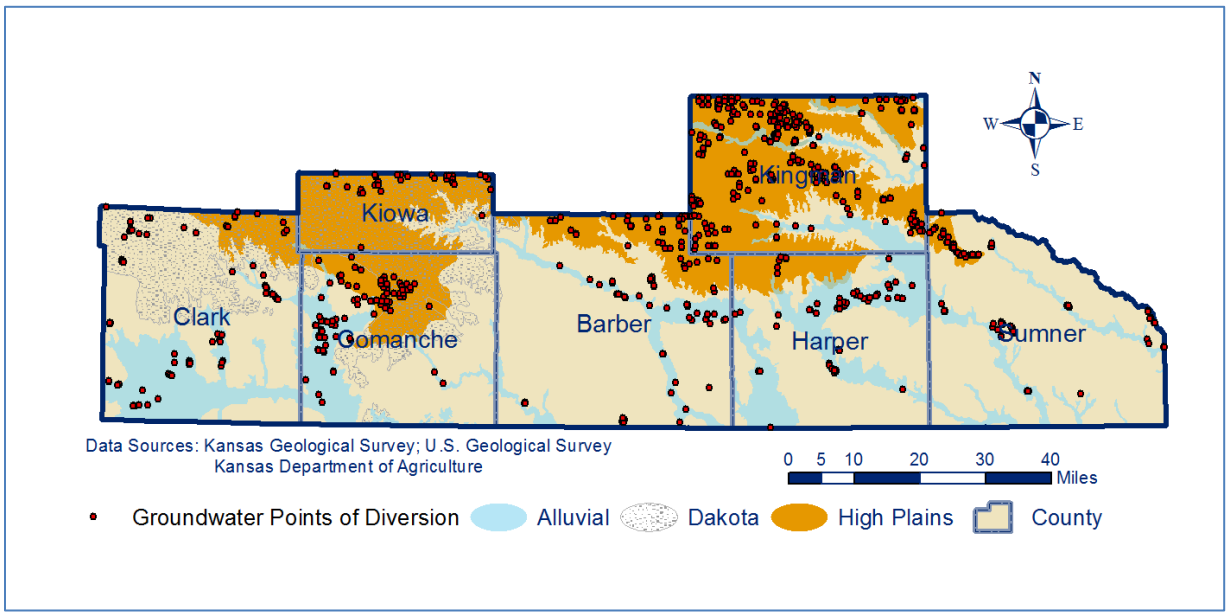

Figure 4: Groundwater sources and well locations in Red Hills Region

The Red Hills RAC has no goals or action plans directly related to groundwater quality and there is very little data available in this region. The major quality concern in this region is the increasing nitrate concentrations affecting some public water supply wells.

Surface Water

Major rivers and streams in the Red Hills Region include the Cimarron, Medicine Lodge, Salt Fork Arkansas and the Chikaskia rivers. The tributaries of these rivers include Crooked Creek, two Bluff

Creeks, Bear Creek, Mule Creek and Sandy Creek. These rivers flow into the Arkansas River in Oklahoma. The northern part of Kingman County is drained by the south fork of the Ninnescah River.

Surface water use for the period of 2007 through 2016 averaged over 2,000 AF annually (Figure 5). Reported irrigation use accounted for 19%, municipal 52%, industrial 17%, and recreation 12% of surface water used.

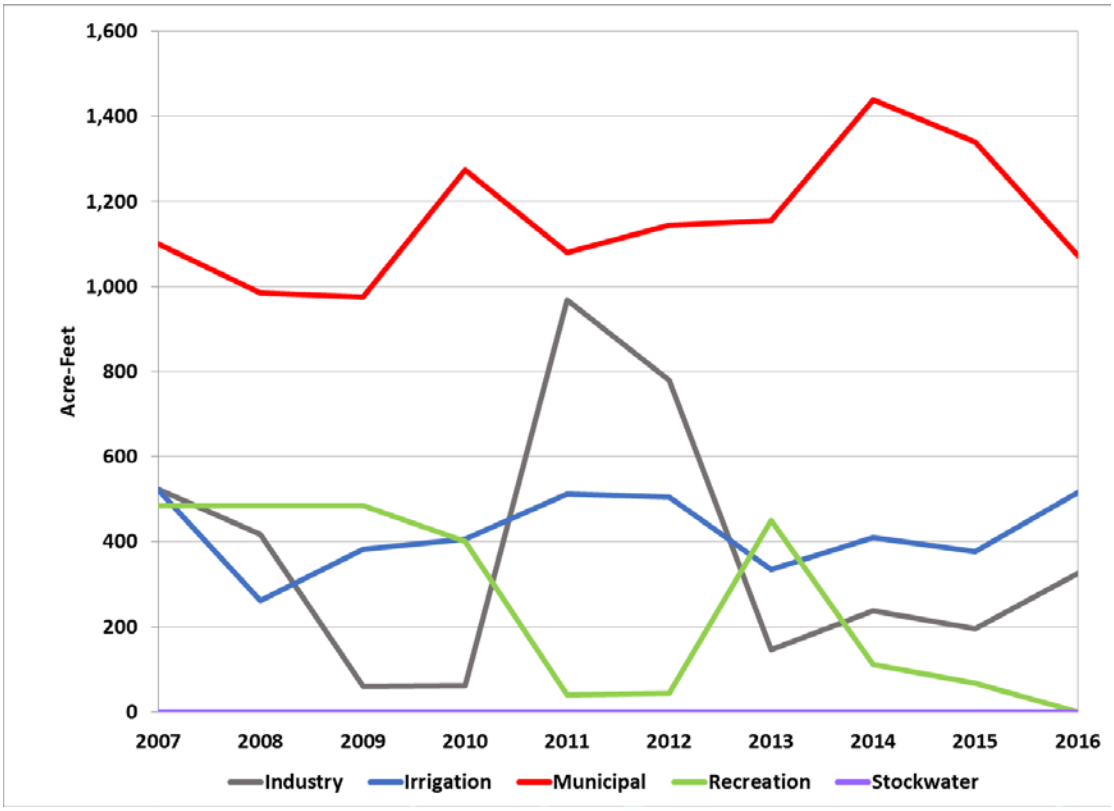

Figure 5: Surface water use by type, Red Hills Region

Minimum desirable streamflow (MDS) is set at three of the five USGS gages in the region; the Chikaskia, the south fork of the Ninnescah, and the Medicine Lodge rivers (Figure 6). How often flows are below MDS may provide insights as to the condition of the streams in the region (Figure 7).

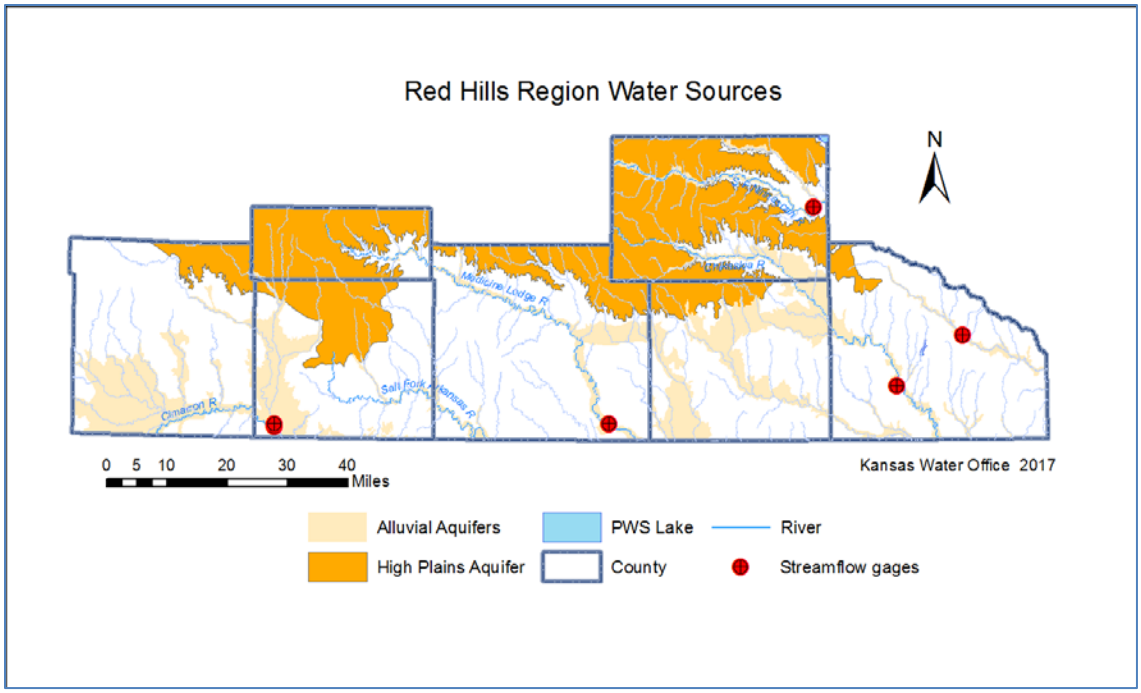

Figure 6: Streamflow gages, Red Hills Region

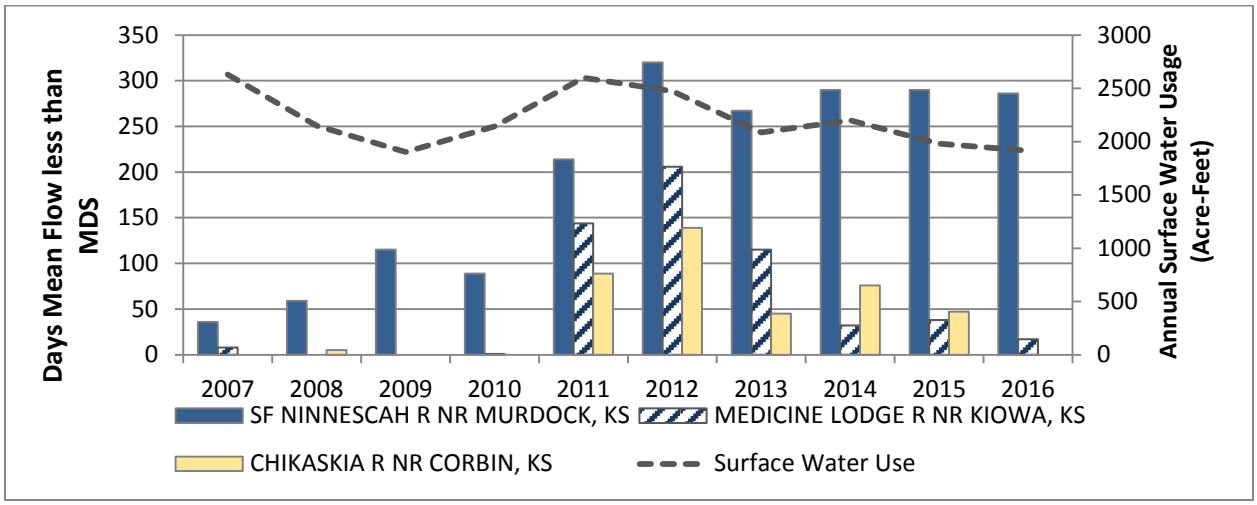

Figure 7: Surface water use and days below Minimum Desirable Streamflow (MDS)

Water Quality

Surface Water

All the counties within the region have adopted and are enforcing sanitary codes to help manage bacteria and nutrient inputs into surface and groundwater. All conservation districts in the region have adopted nonpoint source pollution management plans.

The Clean Water Act requires states to conduct Total Maximum Daily Load (TMDL) studies and develop TMDLs for water bodies identified on the state's List of Impaired Waters (Section 303(d) List). TMDLs are quantitative objectives and strategies needed to achieve the state's surface water quality standards. In the Red Hills Region, the most common TMDLs developed address E. Coli bacteria, dissolved oxygen, eutrophication, sulfate, and chloride.

Four new impairments were added to the 2016 Section 303(d) list that were not in place in 2014, including arsenic on Cow, Slate, and Bluff creeks and atrazine on Slate. Table 1 provides an overview of the impairments within the Red Hills Region. Table 2 lists the changes from the 2014 to the 2016 303(d) lists for the region. Additional information on TMDLs and the Section 303(d) list of impaired waters can be found on the Kansas Department of Health and Environment (KDHE) website.

Table 1: KDHE 2016 303(d) list of impairments summary, Red Hills Region

Red Hills Region 2016 303(d) List Summary	
Total Number of Impairments	62
Lake Impairments	25
Most Common Impairments	
Eutrophication	8
E. Coli	7
Sulfate	5
Chloride	6
Dissolved Oxygen	6

Table 2: Surface water impairments, Red Hills Region

Impaired Waters Listing Changes 2014 to 2016 - Total Maximum Daily Loads (TMDLs)					
HUC 8	**Waterbody Name**	**Description of Change**	**Category**	**Impairment**	**KDHE Station**
11060005	Chikaskia River Near Corbin	Delisted in 2016	2	Copper	SC529
11030011	Cow Creek Near Willowbrook	Insufficient data to make a use designation	3	Atrazine	SC522
11030013	Slate Creek Near Wellington	Insufficient data to make a use designation	3	Biology	SC528
11060002	Salt Fork Arkansas River Near Hardtner	Previous delisted, go back to 4a	4a	Chloride	SC591

Impaired Waters Listing Changes 2014 to 2016 - Total Maximum Daily Loads (TMDLs)					
HUC 8	**Waterbody Name**	**Description of Change**	**Category**	**Impairment**	**KDHE Station**
11060005	Bluff Creek Near Bluff City	Previous delisted, go back to 4a	4a	Selenium	SC618
11030011	Cow Creek Near Willowbrook	New Category 5 Listing	5	Arsenic	SC522
11030013	Slate Creek Near Wellington	New Category 5 Listing	5	Arsenic	SC528
11060005	Bluff Creek Near Caldwell	New Category 5 Listing	5	Arsenic	SC530
11030013	Slate Creek Near Wellington	New Category 5 Listing	5	Atrazine	SC528

*Categories	Description
2	Waters delisted from the 303(d) lists in 2016
3	Waters requiring additional information in order to make listing decisions for future 303(d) lists
4a	Waters that now have a TMDL because of impairments identified from the 1998, 2002, 2004, 2008, 2010, 2012, and 2014
5	Waters requiring development of a TMDL because of impairment

Implementation Progress

Water Quantity

Eastern Red Cedar trees have been identified as possibly adversely affecting water resources in the region. Anecdotal observations attributed the recovered streamflows in the region to the clearing of cedars at multiple locations from 2008 to 2015. Recovered streamflow was also noted after major fires destroyed thousands of trees in 2016 (Anderson Creek) and 2017 (Clark and Comanche counties fires). A Regional Conservation Partnership Program (RCPP) project is underway, led by The Nature Conservancy and includes Kansas State University performing hydrology research to better quantify the changes in stream base flows following eastern red cedar removal.

The Kansas Water Office (KWO) has obtained a WaterSMART grant from the Bureau of Reclamation (BOR) to fund the evaluation of the potential for reuse of produced oil field water. The project is located near Hardtner, Kansas in Barber County and will potentially treat produced water for 60 days using electrocoagulation, reverse osmosis (RO), and desalination to bring the water quality down to acceptable levels for irrigation or stockwater (Figure 8). A sample collected in August of 2016 had chlorides at 120,000 ppm and boron at 17 ppm. These measurements need to be reduced to 250 ppm and 4 ppm respectively. The pilot project has been delayed due to contractor and budget issues.

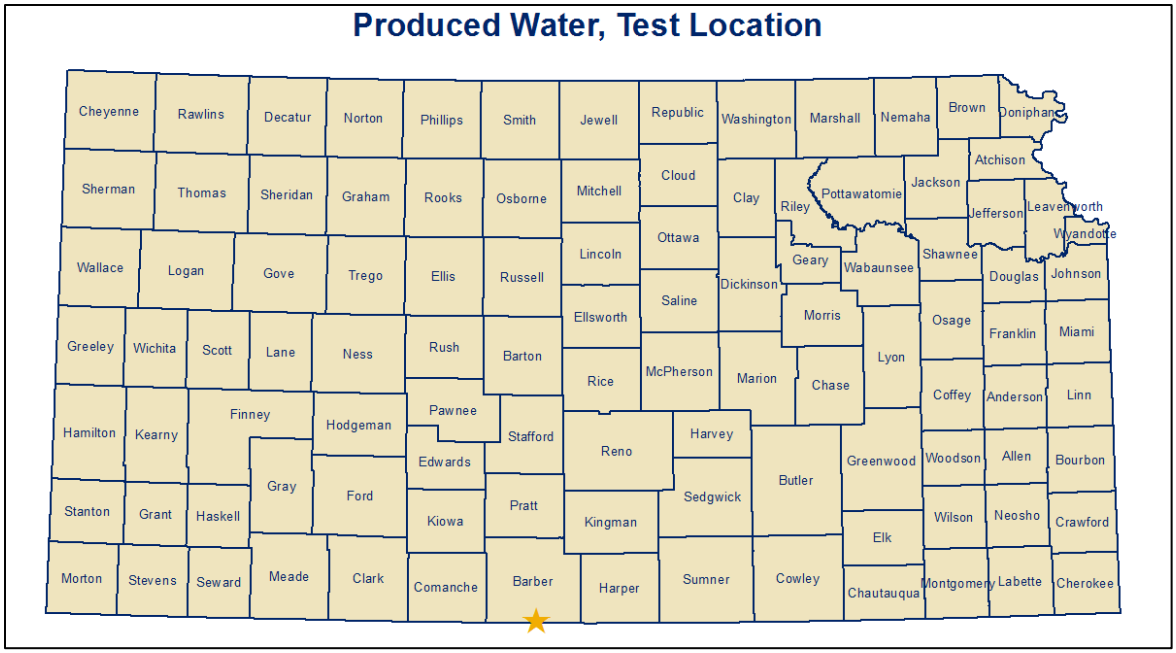

Figure 8: Produced water test location

Development of a lake project was initiated by the formation of a local stakeholder group. Preliminary discussions determined the project will not qualify for existing state or federal funding. Characterization of the lake and investor interest is currently being determined.

Conservation Incentives

There is a RCPP project in the region, Native Grazing Lands Protection in the Plains, (Figure 9) which includes incentives for rangeland management and associated water conservation practices. Approved Environmental Quality Incentive Program (EQIP) conservation practices include a prescribed burning plan; brush management; herbaceous weed control; prescribed burning; woody residue treatment; firebreak; access control; and prescribed grazing.

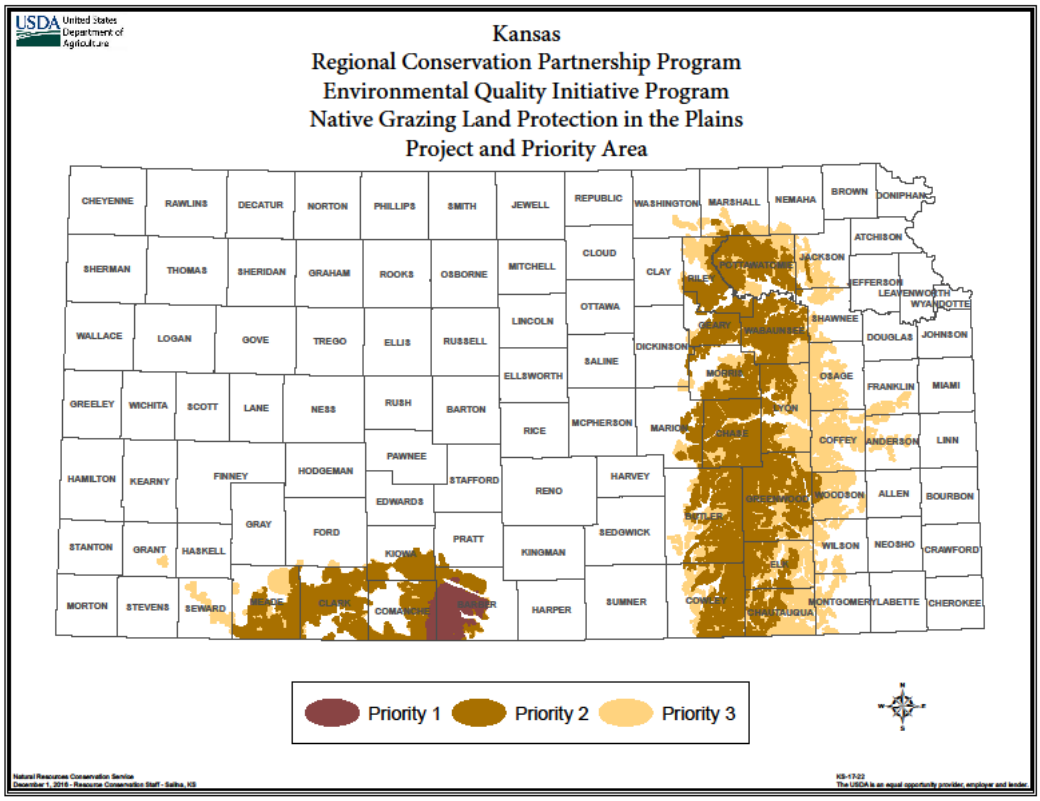

Figure 9: Rangeland assistance target areas for NRCS programs

For Federal FY2015 through FY2017, the United States Department of Agriculture - Natural Resources Conservation Services (USDA-NRCS) has compiled information summarizing conservation practice implementation efforts through their EQIP and RCCP for surface water resources within the Red Hills Region. There were a total of 66 contracts with a total obligation of nearly $1.4 million benefiting over 13,400 acres within the region (Table 3). Over this same time period, the top conservation practices contracted included prescribed grazing, terraces, residue management, no-till, woody residue treatment, crop rotation, tillage management, and reduced tillage.

Table 3: NRCS contract program summary for Red Hills Region for surface water resources, FFY2015-17

FY2015 thru FY2017 EQIP and RCPP Contracts by Fund Code – Surface Water			
Fund Code	**# of Contracts**	**Contract Acres**	**Contract Obligation**
Water Quality	66	13,414	$ 1,376,864
TOTAL	66	13,414	$ 1,376,864

Funding toward practices such as the removal of red cedar trees and other invasive vegetation, grazing plans, and prescribed burning were also available for targeted areas through EQIP. Funding was used to clear dead cedar trees after the 2016 Anderson Creek wildfire in the Red Hills Region. Without removal, new cedar trees grow up under the dead trees. As of summer 2018, there are two more years of funding to assist with removal of burnt trees under the Anderson Creek Wildfire Initiative.

Implementation Needs

The Red Hills Regional Advisory Committee (RAC) has identified multiple needs to fully achieve the region's priority goals in the regional action plan that was developed. The needs identified by the RAC are listed below:

- Conservation practice implementation, including rangeland management, will need to be available into the future to make the most effective use of the water resources in the region
- Regional evaluations of technologies, crops, management practices, and conservation efforts will further the education of the citizens to better understand their water resources and their effective use
- Approximately $125,000 in additional funds is needed to conduct the Produced Water Treatment Pilot Project with the original contractor. The project is currently considering contractor alternatives

Regional Goals & Action Plan Progress

While *The Vision* provides a framework for the management of the state's water supply overall, regional goals identify and address issues at the local level. In 2015, Regional Goal Leadership Teams were developed for each of the 14 regional planning areas which were comprised of local water users along with input from area stakeholders to help develop regional water supply goals. These goals were adopted by the Kansas Water Authority in August 2015 and 14 RAC members were appointed. The first task for the newly formed RACs was to develop action plans to correspond with the regional goals. The Red Hills RAC completed action plans for their regional goals in the fall of 2016. Information included within this section highlights recent progress made on regional goal action plan implementation.

Regional Goal #1	Goal Theme	Annual Progress			
		2017	2018	2019	2020
Reduce the rate of water use by 10% throughout the region collectively by 2025. Conservation should be voluntary and encouraged to use incentive based policies and programs.	Conservation			--	--

Progress Legend	Not Started	In Progress	Delayed	Cannot Complete	Complete

2018 Update:

- Evaluated water conservation practices available in region
- Support RCPP rangeland project that includes evaluation of eastern red cedar tree effect on water resources
- General evaluation of water resource trends, gathered existing research on streamflow and water levels
- Funding toward practices such as removal of red cedar trees and other invasive vegetation, grazing plans, and prescribed burning available for targeted areas through the EQIP

Next Step(s):

- Work with USGS and others to determine appropriate streamflow monitoring locations to access flows in the region
- Ensure appropriate water conservation practices are available to landowners

• Develop Water Technology Farms (WTF), which evaluate less water intensive crops, as well as management systems to improve water quality

Regional Goal #2	Goal Theme	Annual Progress			
		2017	2018	2019	2020
Increase sources of supply through the use of a multipurpose small lake to meet increased demand in specific growth or need areas by 2035.	Long Term Water Supply Planning			--	--

Progress Legend	Not Started	In Progress	Delayed	Cannot Complete	Complete

2018 Update:
- Local leadership in place
- Discussions underway to develop partnerships, identify support, and characterize lake

Next Step(s):
- Determine local support and investors for a lake in the region
- Complete characterization of lake project and scope of work for feasibility study

Regional Goals #3 & 4	Goal Theme	Annual Progress			
		2017	2018	2019	2020
Reduce the amount of freshwater used in oil and gas completion operations by 4% annually. Work with oil and gas industry, beginning in 2040, to have 10,000 barrels a day of fresh water to be recycled from oil production for regional use in the Red Hills.	Reduce freshwater use by oil and gas industry			--	--

Progress Legend	Not Started	In Progress	Delayed	Cannot Complete	Complete

2018 Update:
- Joint RAC Lower Quality Water Summit held in Hutchinson to discuss lower quality water-related issues with Great Bend Prairie, Red Hills and Smoky Hill-Saline RACs
- Pilot produced water treatment project developed and scope of work defined
- WaterSMART funding obtained for pilot treatment project
- Coordinated research with KU for water quality evaluation of the pilot project

Next Step(s): Complete Pilot project- additional funds needed to complete project with original contractor, seeking alternatives

References

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