

# State of the Resource

November 16, 2017

**Missouri**

**Regional Planning Area**

Prepared by the Kansas Water Office, in cooperation with multiple State of Kansas agencies.



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## Executive Summary

The long-term Vision for the Future of Water in Kansas and its statewide and regional goals and action plans are now in place. This State of the Resource document is intended to provide a background of the regional issues and record activities and progress toward regional goals and the Vision objectives.

The Missouri Region is attempting to establish the quantity and quality of ground water using existing data either electronic or driller logs. A study completed by the Kansas Geological Society (KGS) was completed in June of 2017 that estimated bedrock elevation and thickness of unconsolidated material. However only a few static water levels were available and one index well were documented for this large area. A Phase II is necessary to develop an index well system that will help determine ground water quantity.

This region is deeply concerned with the current water quality and for good reason. The Phase I KGS study also documented nitrate samples with an unexpected number of wells exceeding the 10 mg/l limit for nitrate. For the 371 wells that had been analyzed 142 were over the national standard, 25 wells over 50 mg/l, 4 over 100 mg/l and the highest sampled was 128 mg/l. The Phase II study would provide real-time on nitrate levels.

While issues related to the use of water from the Missouri river are complex, it potentially provides a very large water supply for use in Kansas. The Missouri River Bed Degradation Feasibility Study was completed in June by the USACE in conjunction with multiple partners. It is estimated that the bed of the river will degrade another 8 to 10 feet on average in the Kansas City area, with degradation in specific locations as high as 22 feet. This potentially impacts water suppliers from both the Missouri and Kansas Rivers with the head-cut exposing water intakes at low flows.

Only Leavenworth and Wyandotte Counties had near or above normal rainfall with the rest of the counties in the region experiencing drought conditions. Significant impacts were felt in corn and bean production in this area. Algal blooms are often seen when there is insufficient fresh water added to a body of water. This was the case this year for both Brown State Fishing Lake and Hiawatha City Lake. These lakes were sampled the week of August 21<sup>st</sup> and the lakes remained at warning level through the week of October 30<sup>th</sup>, impacting recreations use.

## **Purpose**

As stated within *A Long-Term Vision for the Future of Water Supply in Kansas*, “following the first year of the goal setting process and annually thereafter, the Kansas Water Authority will evaluate progress towards meeting milestones and overall goals and will assess the need for further action. Annual public meetings will be held in each water resource planning Region, highlighting the current groundwater, surface water, and water storage conditions. Additionally, progress towards achieving the goals will be assessed through the Kansas Water Plan every five years.” An important tool to be able to provide Regional groundwater, surface water, and water storage condition information on an annual basis is the State of the Resource Report.

The State of the Resource Report is intended to provide an inventory and an update of the Region’s water resources and their conditions. This Report is intended to inform and educate the members of the Regional Advisory Committees (RACs), as well as any and all members of the public, including those directly involved with water management, legislators, and/or those who may hold a deep interest and concern for our State’s water resources. As a comprehensive compilation of the Region’s water resources, this Report will serve as a document to assist RAC members in conversations and presentations that relate to water, specific to the Region.

## Resource Conditions

### Hydrology and Water Quantity

Surface water is the primary source for all uses in the region, accounting for more than 90% of the use. The Missouri River is a significant source of water supply to the Kansas City metropolitan area and other communities of northeast Kansas along the river and beyond (including water for cooling at power generation facilities). Flow in the Missouri River as it borders Kansas is greatly influenced by water releases from the six federal reservoirs located in Montana, North Dakota, South Dakota, and Nebraska. Currently the only other surface Public Water Supply source is Pony Creek Multipurpose Small Lake which serves as the water supply for the City of Sabetha, which is located just south of the Missouri region watershed divide. All the major streams in the region are open to new appropriations. There are no sites in the region where minimum desirable streamflow's (MDS) have been set.

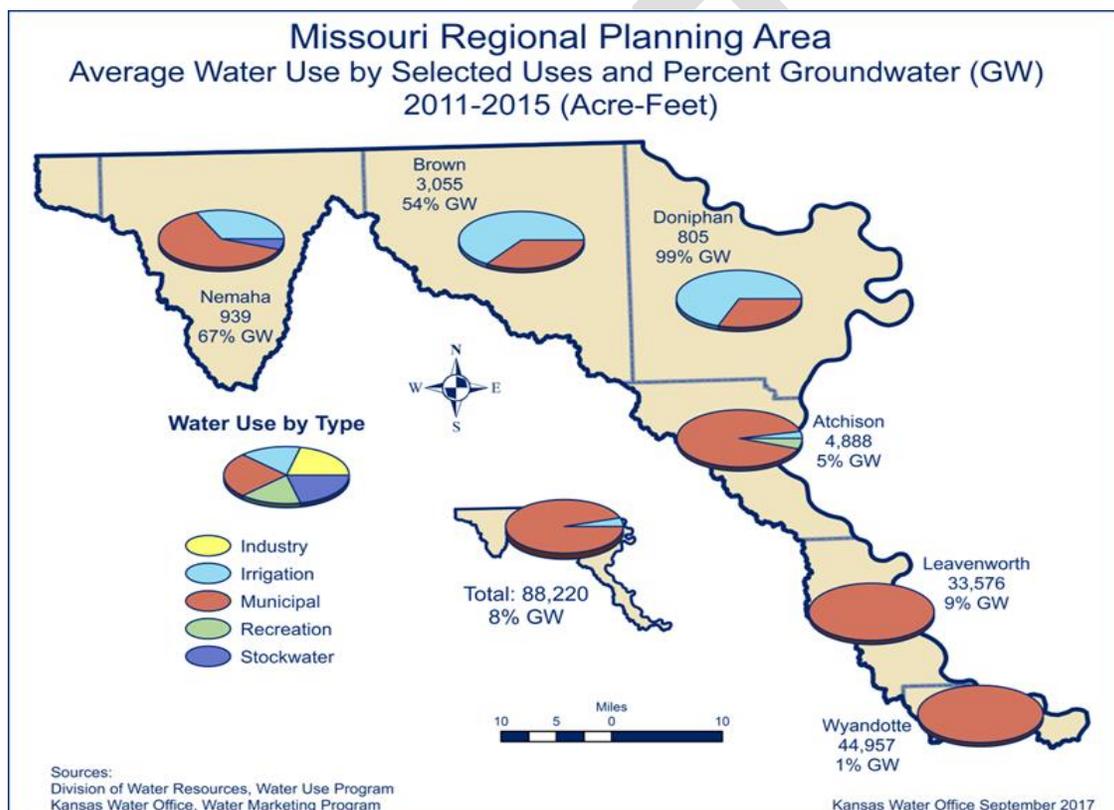


Figure 1: Average Water Use in the Missouri Region.

Groundwater sources available in the region include alluvial and glacial deposits. Groundwater development by private individuals for irrigation has increased recently, particularly since 2009.

Municipal water supply (92%) accounts for the majority of water used in the region. Irrigation was almost 5% of reported water use in 2013; as recently as 2011, reported use for irrigation was only 1%). Industrial use in 2013 represented only 0.2% of total reported use.

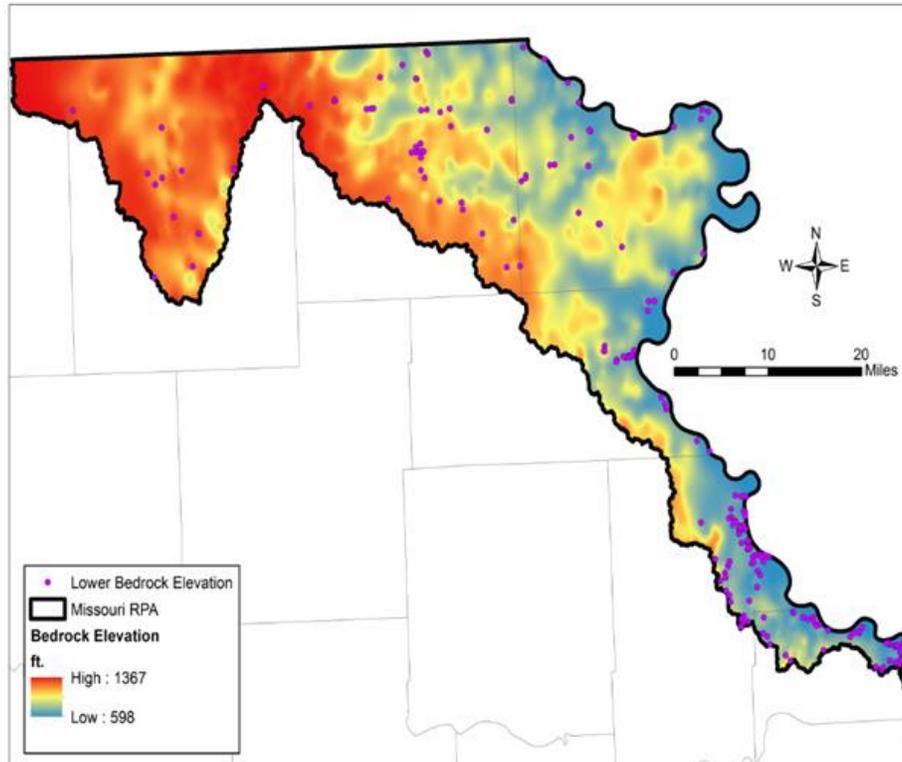


Figure 2: Map of bedrock elevation. A total of 1,027 wells and 994 test holes were used to build the map.

The Missouri River is the largest river that flows through or adjacent to the State of Kansas. It is also the longest river in North America and its basin covers one-sixth of the lower 48 states. The mainstem reservoir system includes six large dams located in Montana, North Dakota, South Dakota and Nebraska. Section 9 of the 1944 Flood Control Act authorized the System to be operated for the purposes of flood control, navigation, irrigation, power, water supply, water quality control, recreation, and fish and wildlife. These reservoirs have the capacity to store over 74 million acre feet (MAF), not counting exclusive flood control storage, about three times the river’s average annual runoff above Sioux City, Iowa, located just downstream of the last reservoir on the mainstem reservoir system. The upper three reservoirs are the first, second, and third largest Corps reservoirs in the country.

While issues related to the use of water from the river are complex, it potentially provides a very large water supply for use in Kansas. The history and the hydrological record indicate that the flows of the Missouri River are highly variable, experiencing large floods and major droughts in the basin. In 2007, the system was at record low levels; in 2011, a record flood occurred. Figure 3 shows the flow for the Missouri River at Atchison, a relatively normal year.

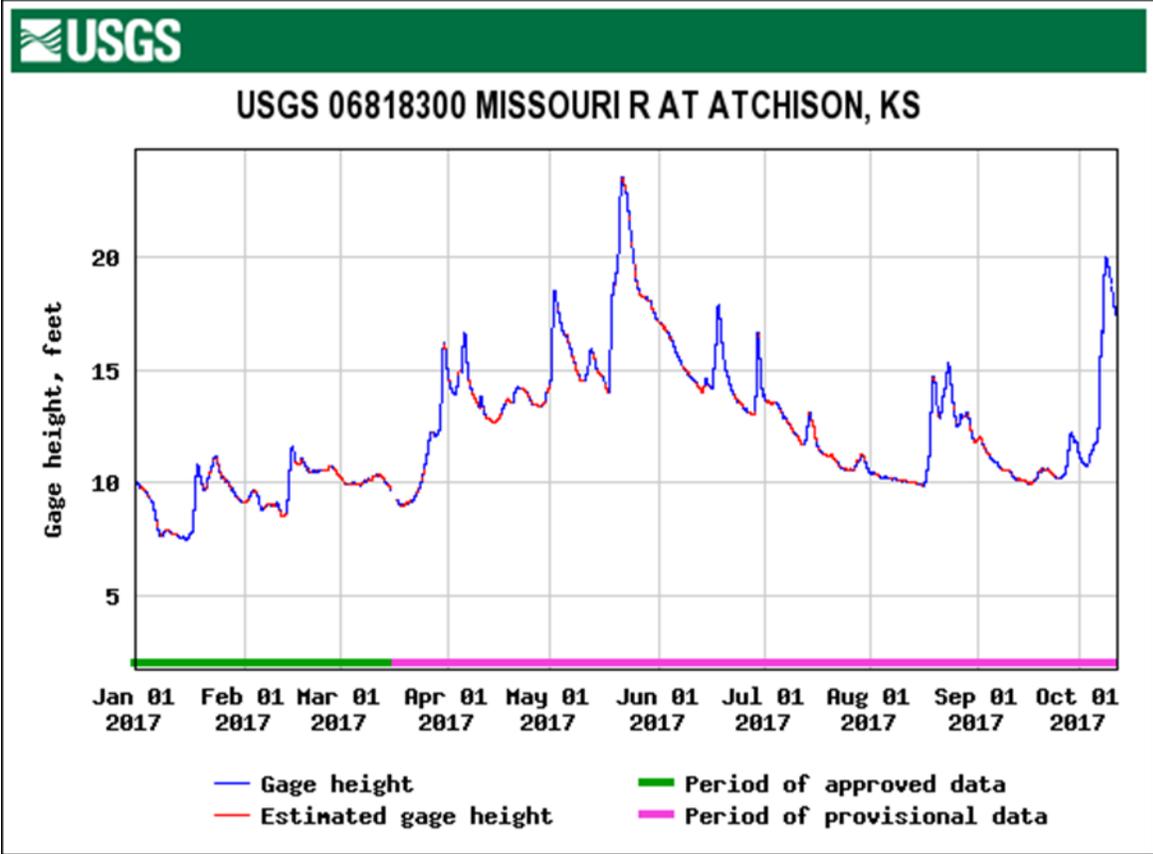


Figure 3: Missouri River at Atchison, KS, streamflow data. (Data source U.S. Geological Survey)

**Climate & Land Use**

The climate of the region in Kansas is classified as humid continental with cold winters and hot summers. Normal mean temperature generally increases from northwest to southeast across the region. The average annual mean temperature of the region is 54°. Most of the precipitation falls in the growing season, with June typically being the wettest month with a region wide average annual precipitation of 38 inches. Only Leavenworth and Wyandotte Counties had near or above normal rainfall with the rest of the counties experiencing drought conditions, see Table 1. Significant impacts were felt in corn and bean production in this area.

County	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Total (in.)	Annual Avg. (in.)	Departure
Atchison	0.48	0.52	0.89	0	2.87	4.01	4.89	3.83	2.61	6.49	1.29	3.88	31.76	36.87	-6.12
Brown	1.08	0.81	1.35	0.33	3.48	5.75	4.07	2.74	0.9	5.23	1.19	3.89	30.82	35.87	-6.97
Doniphan	0.89	1.07	0	0.12	3.02	4.01	3.53	2.07	1.39	0.93	1.51	4.09	22.63	37.23	-16.56
Leavenworth	0.21	1.38	1.23	0.01	2.82	7.04	3.53	6.94	4.44	6.92	3.84	5.25	43.61	41.11	0.12
Marshall	1.13	0.62	1.36	0.39	3.26	4.1	4.55	3.52	1.32	1.51	2.08	5.15	28.99	33.24	-6
Nemaha	1.39	0.81	0.96	0.38	3.63	4.99	4.11	2.17	1.39	3.88	1.59	4.56	29.86	33.98	-6.32
Wyandotte	1.01	0.98	1.23	0.01	3.08	6.14	4.18	6.61	4.96	10.81	3.06	4.92	46.99	40.73	4.27

Table 1: Monthly Estimated Precipitation by County, Missouri Region. (Data source Kansas Office of the State Climatologist, <http://climate.k-state.edu/precip/county/>)

The predominant land use in the region is cultivated crop at over 53%, with hay/pasture a distance second at 14%. Deciduous forest accounts 12% and Herbaceous for 10%. Classes of developed land total collectively equal about 8% of the land cover.

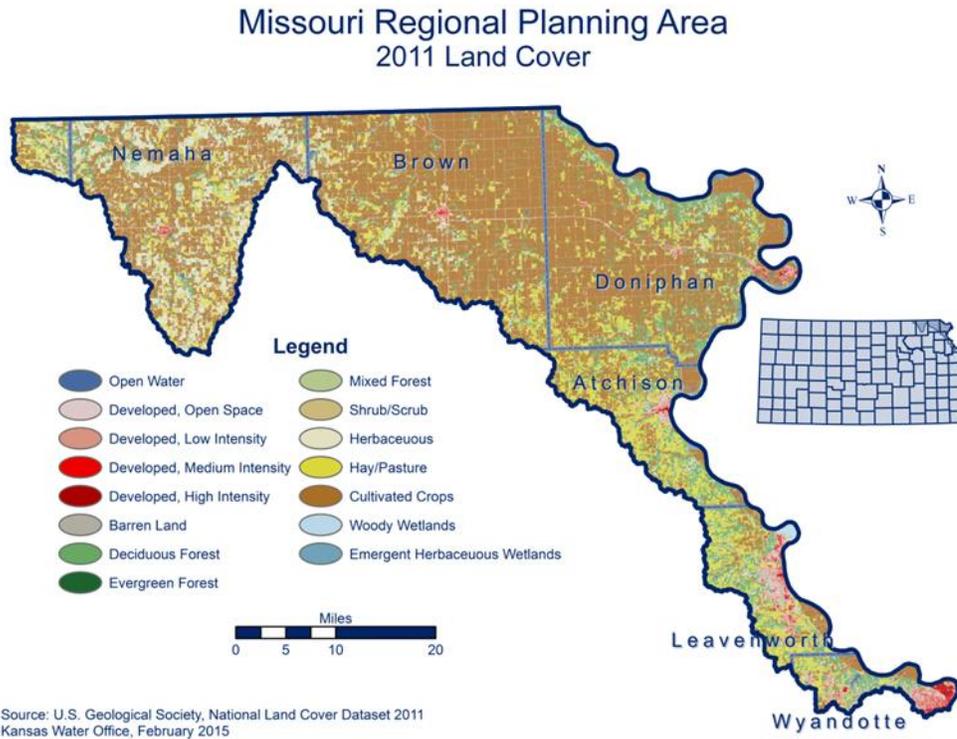


Figure 4: Land cover map for Missouri Region.

### Water Quality

Sedimentation, bacteria, and eutrophication due to nutrient loading are the primary water quality problems affecting streams and small reservoirs in this region. Surface waters not meeting water quality standards in the region are included on the 303d list of impaired waters. As part of the Phase I study completed by Kansas Geological Survey (KGS) in July of 2017, nitrate levels were compiled for 371 wells in the Missouri Region with 142 over the national standard of 10 mg/l and 25 wells over 50 mg/l, figure 5. These levels are adversely affecting small communities in the region; in an effort to combat the nitrate problem, millions of dollars are being spent to provide safe drinking water, such as \$4.5 million dollar water treatment plant in Hiawatha.

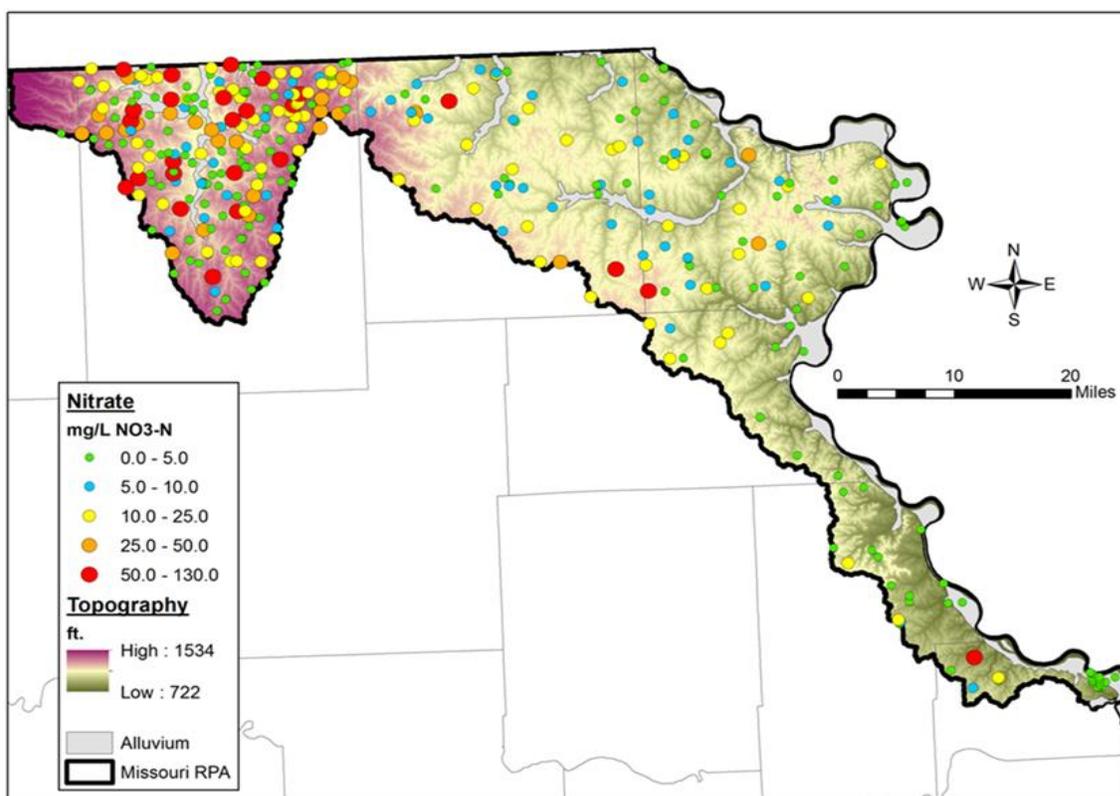


Figure 5: Groundwater Samples within Missouri Region.

Total Maximum Daily Loads (TMDLs) are developed to address the causes of impairments. A TMDL is the maximum amount of a pollutant that a water body can receive without violating water quality standards. Since pollution can arrive via point and non-point sources, the TMDL development process identifies contributing sources for the pollutant loads. High priority TMDL watersheds are identified to target technical and financial assistance for implementation of non-point source pollution management practices to address designated pollutants.

TMDLs that have been approved by the United States Environmental Protection Agency for the Missouri Region and deemed as High Priority by KDHE are listed below:

- Wolf River for elevated levels of fecal coliform bacteria
- Wolf River for biological impairment: biological demand (BOD), organic materials and nutrients, nitrates and total suspended solids (TSS)
- South Fork Big Nemaha River for elevated levels of fecal coliform bacteria
- South Fork Big Nemaha River for biological impairment: biological demand (BOD), organic materials and nutrients, nitrates and total suspended solids (TSS)
- Walnut Creek for elevated levels of fecal coliform bacteria
- Pony Creek Lake for Eutrophication - elevated levels of Phosphorus inputs
- Atchison County Lake for Siltation

- Wyandotte County Lake for Eutrophication – elevated levels of Phosphorus inputs

A list of all Impaired/potentially impaired water for the Missouri Basin can be found at ([impaired waters](#)). From the 2014 list to the 2016 list there has been 1 body of water requiring more information to make a decision on future listing and 6 waters requiring development of a TMDL because of impairment.

Harmful Algal Blooms (HAB’s) are common in bodies of water when nutrient loading is excessive, especially phosphorus, and during periods of elevated temperatures. Health effects of HAB’s are well documented from flu like symptoms in humans to the death of pets and livestock. A combination of conditions; including nutrient rich waters coupled with elevated temperatures provided ideal conditions for blooms in two small lakes within the Missouri Region this year. Algal problems were reported on both Brown State Fishing Lake and Hiawatha City Lake the week of August 21<sup>st</sup> and the lakes remained at warning level through the week of October 30th, see Figure 6. Both of these lakes and also Sabetha Pony Creek often experience warning level blooms in the lake summer.

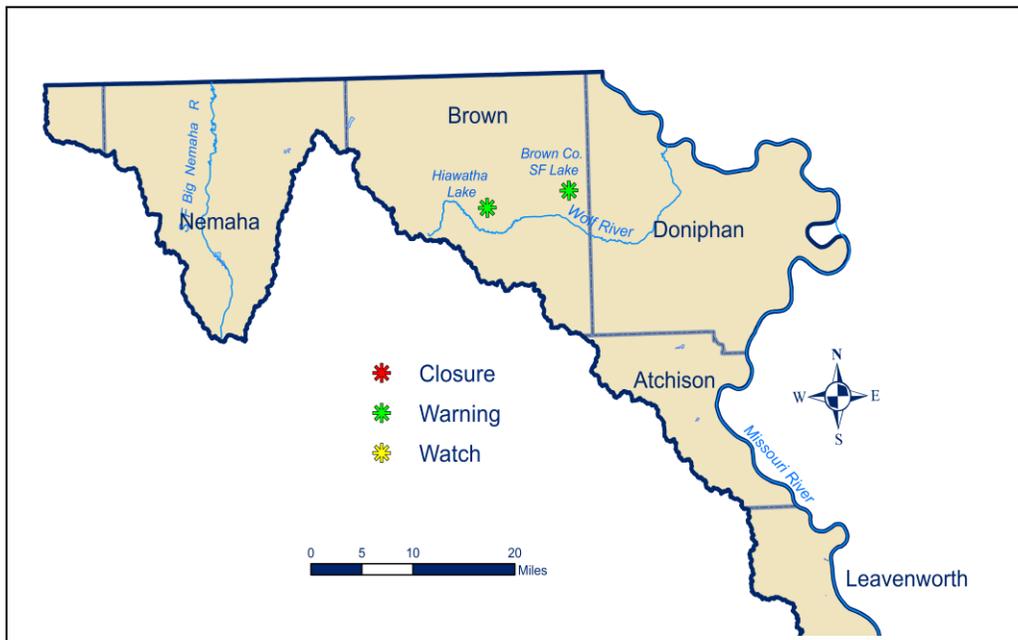


Figure 6: Harmful Algal Blooms in the Missouri Region.

Best Management Practices (BMP’s) are vegetative, structural, or management practices that reduce the pollutants in the surface and ground waters. BMP’s may be incorporated independently or in combination with other BMP’s compounding their positive effects. The 2017 load reductions, Table 2, are below the 12 year average for all three constituents.

Region	Nitrogen (lbs./yr)	Phosphorus (lbs./yr)	Sediment (tons/yr)
Missouri	2,513	1,615	1,356

## Regional Goal #1 & Progress

While the 50-year Vision for the Future of Water in Kansas provides a framework for the management of the State’s water supply overall, Regional Goals identify and address issues at a more local level. In 2015, each of the 14 Regions consisted of a Regional Goal Leadership Team comprised of local water users, along with input from area stakeholders, to help develop goals. These goals were adopted by the KWA for development by the Regional Advisory Committees (RACs). The Missouri RAC completed Action Plans for their Regional Goals in late 2016.

Regional Goal #1	Goal Theme	Annual Progress			
		2017	2018	2019	2020
Since groundwater quality is not well known, compile existing and collect additional data over the next 5 years to establish a baseline. Within 3 years after the baseline is established, a plan to implement best management practices will be developed to maintain and improve existing conditions. Monitoring and reevaluation of groundwater quality conditions should continue at 5 year intervals.	Groundwater Quality		--	--	--
<b>Progress Legend</b>	<b>Not Started</b>	<b>In Progress</b>	<b>Completed</b>		
<p>2017 Update:</p> <ul style="list-style-type: none"> <li>• The Kansas Geological Survey (KGS) was contracted to extract and compile digital and non-digital data relevant to water quality in the Missouri Region as part of the Phase I project. Nitrate levels were compiled for 371 wells in the region with 142 over the national standard of 10 mg/l and 25 wells over 50 mg/l. Phase I was completed in July of 2017 and the entire report can be seen <a href="#">here</a>.</li> <li>• Regional Conservation Partnership Program (RCPP) submitted by Doniphan County Conservation District, if approved, would use EQIP dollars to fund sediment control structures. Holding sediment in the fields will help protect groundwater quality.</li> <li>• In cooperation with Missouri several RAC members participated in Healthy Watershed meetings for the Independence-Sugar Creek Watersheds. The most recent meeting brought forward the idea of using a RCPP to fund improvements to the watersheds for both states.</li> <li>• Continued engagement with the Tile Outlet Terrace work that is being completed as part of an EPA wetland grant.</li> </ul> <p>Next Step(s): Utilize Phase I KGS data and pursue funding for Phase II KGS study which will use index wells to establish and monitor groundwater quality.</p> <p>Continue to look towards participating in a soil health workshop in the region.</p>					

## Regional Goal #2 & Progress

Regional Goal #2	Goal Theme	Annual Progress			
		2017	2018	2019	2020
To ensure a reliable surface water supply in the future, best management practices will be implemented so surface water quality in identified drainages is maintained or improved using goals and milestones as identified in the Missouri Watershed Restoration and Protection Area 9 Element Plan.	Surface water Quality		--	--	--
Progress Legend	Not Started	In Progress	Completed		
<p>2017 Update:</p> <ul style="list-style-type: none"> <li>Regional Conservation Partnership Program (RCPP) submitted by Doniphan County Conservation District, if approved, would use EQIP dollars to fund sediment control structures. Holding sediment in the fields will help protect groundwater quality.</li> <li>In cooperation with Missouri several RAC members participated in Healthy Watershed meetings for the Independence-Sugar Creek Watersheds. The most recent meeting brought forward the idea of using a RCPP to fund improvements to the watersheds for both states.</li> <li>Continued engagement with the Tile Outlet Terrace work that is being completed as part of an EPA wetland grant.</li> </ul>					
<p>Next Step(s): Fully support annual WRAPS funding and the submitted RCPP to help meet load reductions.</p>					

### Regional Goal #3 & Progress

Regional Goal #3	Goal Theme	Annual Progress			
		2017	2018	2019	2020
Collect additional information to improve safe yield estimate of groundwater and tributary streams within 3 years. Place a moratorium on additional permits until safe yield is identified. Once determined, only issue permits that do not exceed that yield. Safe yield should then be continuously monitored.	Groundwater Quantity		--	--	--
Progress Legend	Not Started	In Progress	Completed		
<p>2017 Update:</p> <ul style="list-style-type: none"> <li>The Kansas Geological Survey (KGS) was contracted to extract and compile digital and non-digital data and produce a digital map of bedrock elevations. Phase I was completed in June of 2017 and the entire report can be seen <a href="#">here</a>.</li> <li>The Missouri River Bed Degradation Feasibility Study was completed in June by the USACE in conjunction with multiple partners. It is estimated that the bed of the river will degrade another 8 to 10 feet on average in the Kansas City area, with degradation in specific locations as high as 22 feet. The entire report can be seen <a href="#">here</a>.</li> </ul>					
<p>Next Step(s): Utilize Phase I KGS data and pursue funding for Phase II KGS study which will use index wells to establish and monitor groundwater quantity.</p>					

## Regional Goal #4 & Progress

Regional Goal #4	Goal Theme	Annual Progress			
		2017	2018	2019	2020
<p>Within 3-5 years the state should initiate a comprehensive education and outreach program. By the time of 8<sup>th</sup> grade graduation, students should know where their water comes from, understand the basics of the water cycle, know basic water conservation principles and understand that their actions impact water quality and quantity. Adult education should also be a component of this. As consumers that make decisions that could have far reaching impacts, adults must be given the knowledge to make wise choices. Schools, water providers and conservation districts should be the primary deliverers. A component of the comprehensive program should include enhancing information and outreach on research, technology and management practices using social media and public information outlets.</p>	Education		--	--	--
Progress Legend	Not Started	In Progress	Completed		
<p>2017 Update:</p> <ul style="list-style-type: none"> <li>• The Education piece of the Vision was completed, link.</li> <li>• Education coordinator position has been established and the Kansas Department of Agriculture is looking to fill the position.</li> <li>• A marketing firm has been hired to facilitate discussions with multiple groups gaining wisdom on how the education program will be structured.</li> <li>• A Legislative tour facilitated by The Kansas Geological Survey (KGS) in mid-September helped raise awareness of the issues within the Missouri Region.</li> <li>• Continued effort by RAC members to educate young people of the Region through Water Festivals, Earth Day Activities on water issues occurring in the region.</li> <li>• A Farm Agriculture Education Day and a teacher education conference were also held, with a focus on Cover Crop Education and the Missouri River respectively.</li> </ul>					
<p>Next Step(s): RAC members continue to engage groups in region on water issues. Utilize the developing education piece to promote water issues in the region.</p>					

## Implementation Needs

The State Water Plan Fund was established in 1989 to help implement the Kansas Water Plan. For nearly a decade, the State Water Plan Fund (SWPF) has been under funded due to the State's budget difficulties. To achieve and maintain the goals set by the RAC and participating agencies and partners, the SWP would need to be fully funded. Fully funding the SWP would help to provide programs and incentives that have been shown to improve water quality. Although the movement of \$1.2 million to the KWO for streambank stabilization projects, bathymetric surveys, and creation of a study on the Kansas River alluvium is a start to help implementation of the RAC Action Plans, continued funding needs to occur.

While the Missouri Region has begun to address the water quality and quantity concerns, a significant effort is necessary to complete the items in their Action Plan. The following items need to be addressed:

- Promote funding for Phase II of the Ground water monitoring by KGS, estimated to be \$87,700 - \$121,700 over a 5 year period. Fund a study that would establish a monitoring network capable of collecting current nitrate information and ground water levels and drill new wells in areas of limited spatial distribution of existing wells. This project will directly addresses priority goals #1 & 3.
- The Missouri Region is the only part of state that is touched by the Missouri River so the issues of the river could have substantial impact. The RAC will continue to use the established sub-committee to monitor the progress of the Draft EIS for the Missouri River and provide input as needed.
- Review tile outlet terrace systems within the Missouri Region. Prior to proposing any design changes to outlets of tile terraces in the Missouri Region, conduct research on cropland field input amounts (rates, dates applied, how it was applied, etc.) and collect water samples to evaluate the water runoff into the streams in the region. Collect data working with interested local landowners with assistance of area conservation districts, Kansas Department of Health and Environment (KDHE), Natural Resources Conservation Service (NRCS) and other existing agencies. Collection sites will be: tile terrace runoff, waterway runoff, land with no conservation work or no conservation tillage, and land with no conservation work but using no-till.
- Promote a project that would collect data on the number and size of irrigation ponds that have been constructed in the past 10 years. Use this information to formulate data on the benefits of capturing and reusing water on a producer's property. This should be coupled with standard water quality monitoring data.
- Gather existing information on the impact of extreme events (droughts and floods) on water quality and availability of water resources into the future in the Missouri Region. Solicit a speaker from the National Weather Service to provide some insight into how these events have changed over the period of record. Use the tools available to compile this information in a useful format.
- Assess what other interest groups, agencies and individuals locally and from states with similar topography and precipitation (Iowa, South Dakota, Nebraska, and Missouri,) can provide on alternative projects that could contribute to water quality in the Missouri Region. Similar to

Healthy Watershed meetings, have a seat at the table to ensure that good ideas or projects in the general topography are given an opportunity to succeed.

- Focus on finding local volunteers that are willing to adopt and promote new practices and support a soil health workshop in the region. With more emphasis on being good stewards soil health seems to solve several problems. Recent articles promoted savings to the producer, the bottom line can have an impact on how a business is run.

## References

<https://kwo.ks.gov/docs/default-source/regional-advisory-committees/meeting-materials/missouri-rac-presentations/jordi's-presentation.pdf?sfvrsn=4>

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[https://waterdata.usgs.gov/ks/nwis/uv?site\\_no=06818300](https://waterdata.usgs.gov/ks/nwis/uv?site_no=06818300)

<http://climate.k-state.edu/precip/county/>