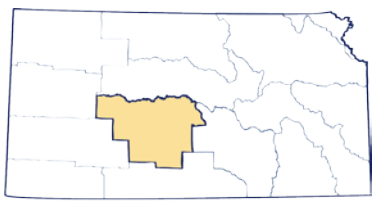
State of the Resource & Regional Goal Action Plan Implementation Report

August 2018

Great Bend Prairie Regional Planning Area



Kansas Water Office

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Executive Summary

The Great Bend Prairie 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 Great Bend Prairie Planning Region covers approximately 6,769square miles in central Kansas, including all of Big Bend Prairie Groundwater Management District #5 (GMD5) and a portion of the Arkansas River drainage area.

Surface and groundwater resources within the region suffered from lower than normal precipitation from 2009 to 2013. Due to very low precipitation in 2011, groundwater use peaked at just over 740,000 acre-feet for the region, with irrigation use from groundwater sources over 720,000 acre-feet in 2011.

The primary concern within the Great Bend Prairie Planning Region is to achieve a long term sustainable water supply. Groundwater, which supplies 97% of water used in the region, occurs in alluvial deposits along the streams and in the Great Bend Prairie Aquifer, part of the High Plains Aquifer system. The groundwater is interconnected with surface water in much of the region.

Groundwater quality remains an important component of water availability. Saline water is known to impact the region's groundwater and surface water quality in Stafford, Rice, Reno, and Pratt counties. The Kansas Geological Survey (KGS) has identified the source of the salinity as natural occurring salts.

The KGS and the Kansas Department of Agriculture - Division of Water Resources (KDA-DWR) measure water levels in about 1,400 wells in central and western Kansas. From 2007 through 2016, these water level measurements showed that average groundwater levels increased 5 times (2007, 2008, 2009, 2013, and 2016) and decreased 5 times (2010, 2011, 2012, 2014 and 2015).

In order to reach long term sustainability of water resources, the region is interested in a diverse set of actions to maintain water resources into the future which include voluntary water conservation programs, education, protection of water quality, less water intensive crop production, and watershed structures to aid in water management. Ultimately, all are components thought to help reach sustainable water use while not adversely affecting the regional economy.

Water Use Trends

Groundwater is the primary source (97%) of water used in the region (Figure 1), principally from the Great Bend Prairie Aquifer and alluvial deposits along major streams. Average reported water use in the region from 2007 through 2016 was 551,545 acre-feet (AF) from ground and surface water sources. Irrigation accounts for 94% of that reported water use, averaging 536,899 AF annually from 2007-2016. The remainder is accounted for by municipal (2%), industrial (1%), recreation (3%) and stock (1%). As anticipated during the drought of 2010 to 2012, overall usage increased; however as rainfall amounts moderated, water use dropped below pre-drought conditions (Figure 2).

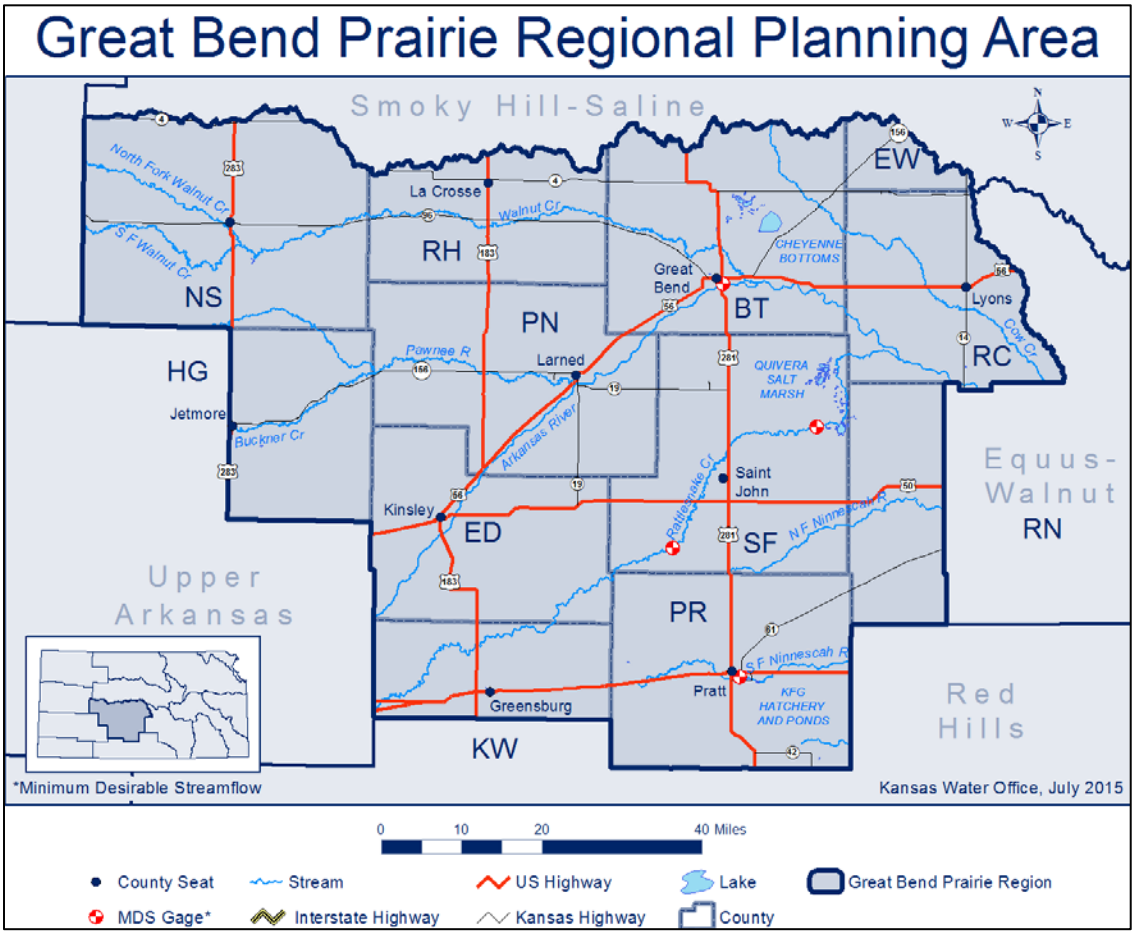
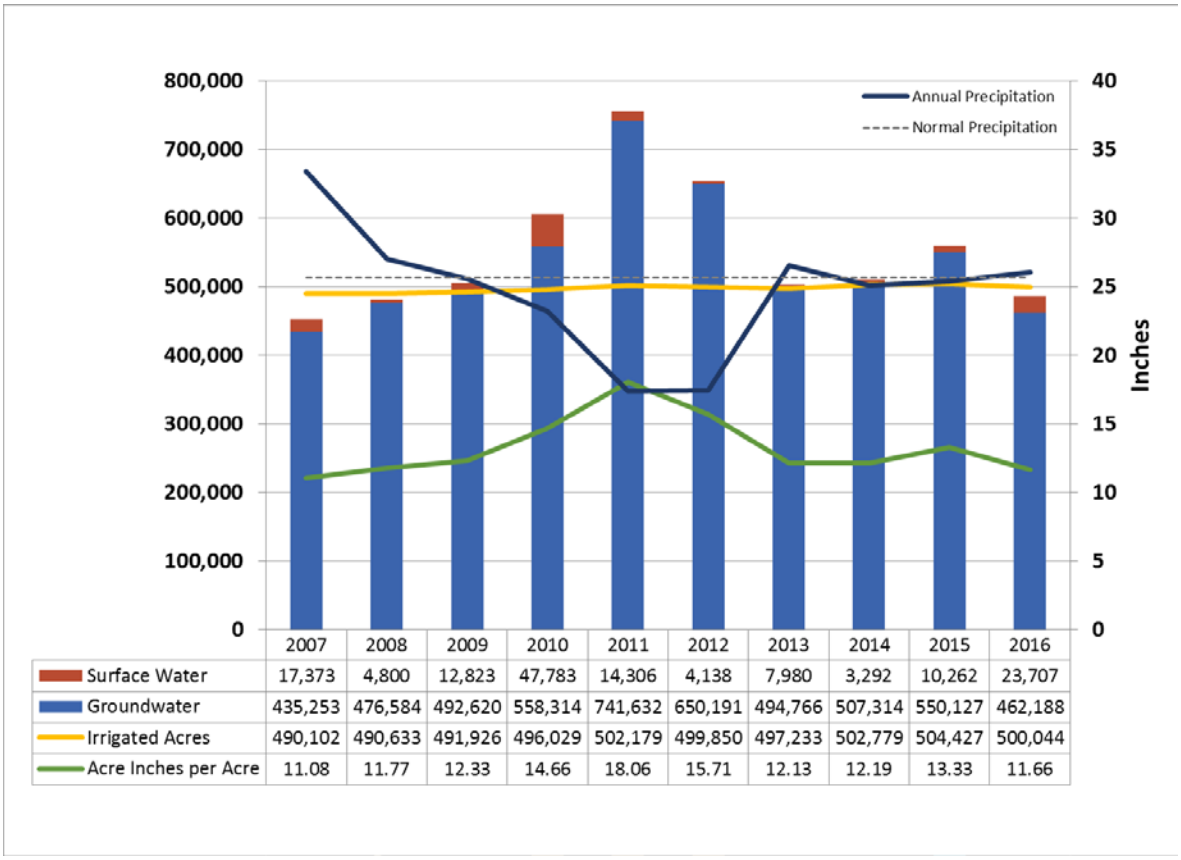


Figure 1: Great Bend Prairie Regional Planning Area



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Surface Water	17,373	4,800	12,823	47,783	14,306	4,138	7,980	3,292	10,262	23,707
Groundwater	435,253	476,584	492,620	558,314	741,632	650,191	494,766	507,314	550,127	462,188
Irrigated Acres	490,102	490,633	491,926	496,029	502,179	499,850	497,233	502,779	504,427	500,044
Acre Inches per Acre	11.08	11.77	12.33	14.66	18.06	15.71	12.13	12.19	13.33	11.66

Figure 2: Surface water and groundwater use for years 2007- 2016 within the Great Bend Prairie Region, with annual precipitation, irrigated acres, and acre inches per acre displayed

Water Resource Conditions

Groundwater

The principal aquifer within the region is the Big Bend Prairie Aquifer which is a portion of the High Plains Aquifer (Figure 3). Other aquifers present within the region include the Dakota Aquifer and alluvial aquifers along and near streams.

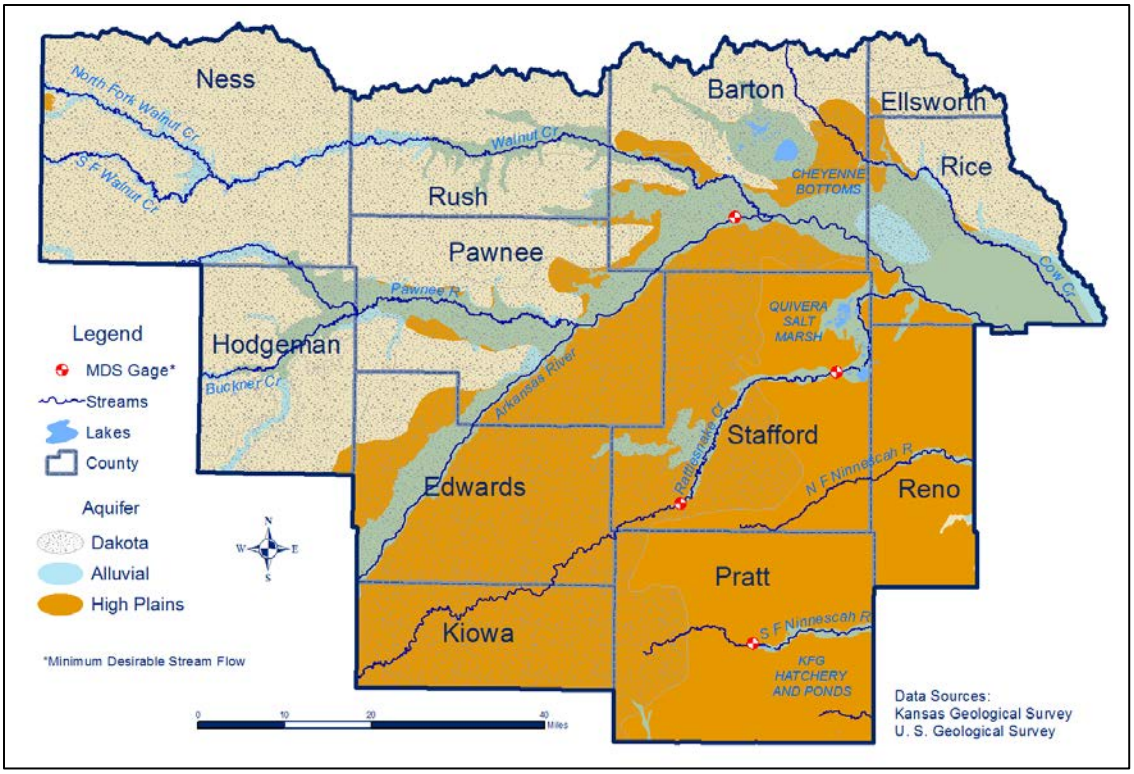


Figure 3: Aquifers the Great Bend Prairie Region

The Kansas Geological Survey (KGS) and the KDA-DWR measure water levels in about 1,400 wells in central and western Kansas. From 2007 through 2016, these water level measurements showed that average groundwater levels increased five times (2007, 2008, 2009, 2013, and 2016) and decreased five times (2010, 2011, 2012, 2014 and 2015) (Table 1, Figure 4).

Table 1: Annual average groundwater level changes for High Plains Aquifer region

Region	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	10 Year Change	Average Annual Change (2007-16)
Cimarron	-2.37	-2.90	-1.65	-2.52	-3.93	-3.63	-1.72	-1.90	-0.91	-1.29	-22.81	-2.28
Equus-Walnut	1.87	1.56	0.00	-0.80	-2.96	-1.48	2.44	-1.21	1.38	1.94	2.74	0.27
Great Bend Prairie	3.11	0.59	0.70	-0.46	-2.88	-1.89	0.55	-0.68	-0.26	0.51	-0.69	-0.07
Upper Arkansas	-1.47	-2.29	-1.28	-2.97	-2.64	-2.82	-2.40	-1.85	-0.70	-0.45	-18.86	-1.89
Upper Republican	-0.69	-0.20	0.18	-0.39	-0.42	-1.40	-0.64	-0.39	-0.53	-0.29	-4.77	-0.48
Upper Smoky Hill	-0.87	-0.41	-0.22	-0.52	-1.01	-1.41	-0.63	-0.44	-0.13	-0.32	-5.96	-0.60
ENTIRE HIGH PLAINS AQUIFER REGION	-0.09	-0.60	-0.24	-1.08	-1.93	-1.98	-0.65	-0.93	-0.39	-0.12	-8.00	-0.80
		Increase			Decrease			Unchanged				

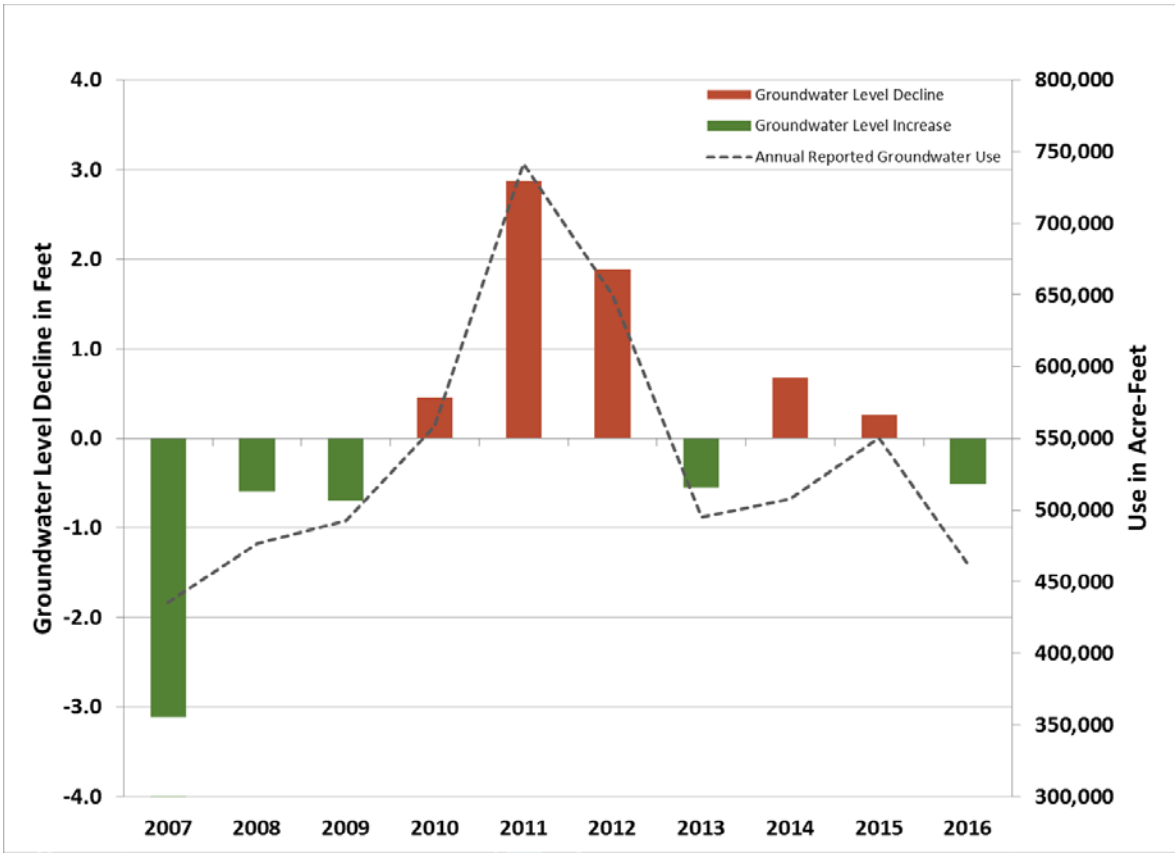


Figure 4: Yearly groundwater level change and groundwater use within the Great Bend Prairie Region

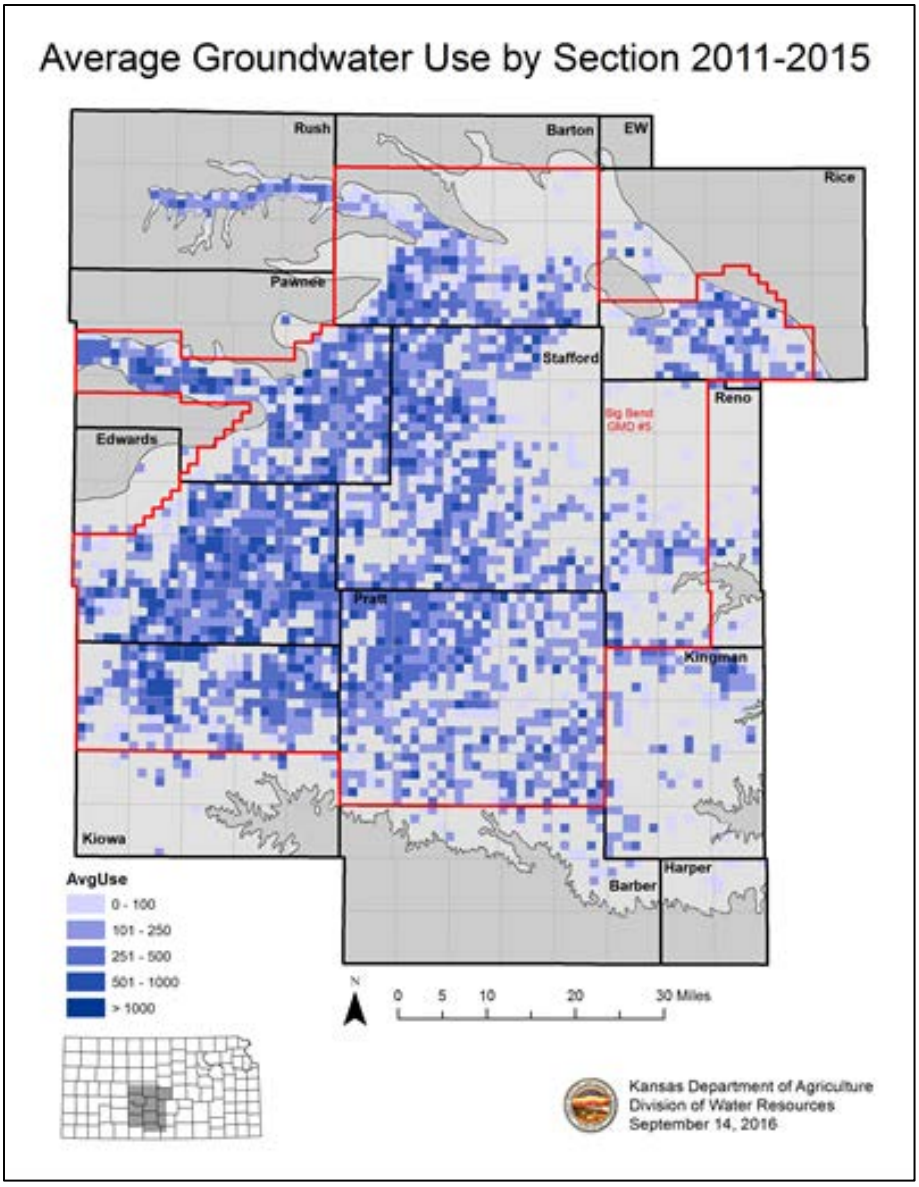


Figure 5: 2011-2015 average groundwater use by section in/around GMD5 area

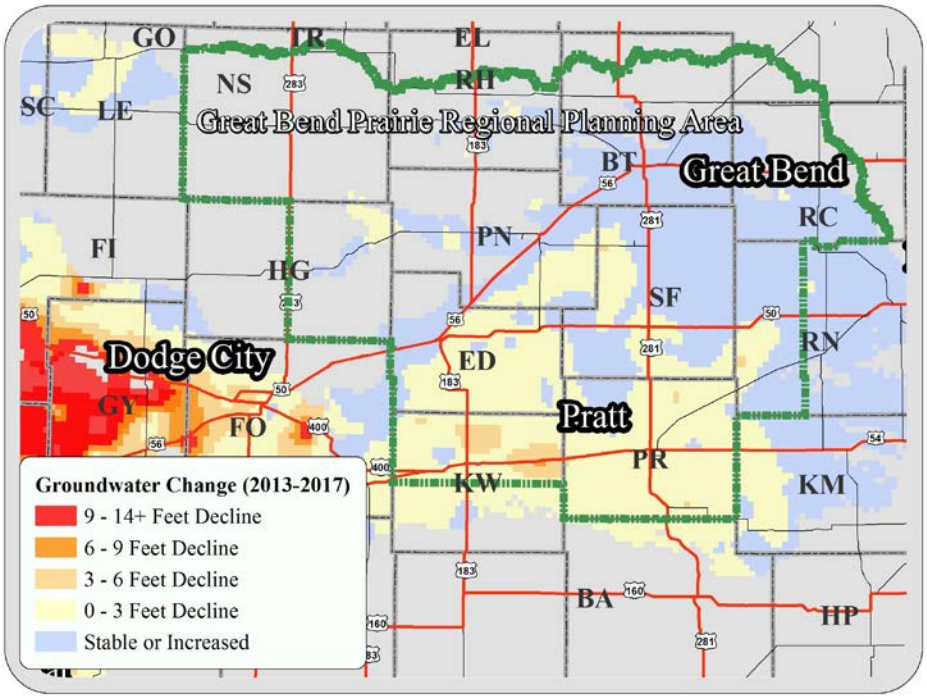


Figure 6: Groundwater level declines for 2013 to 2017, with data from KGS water level monitoring program

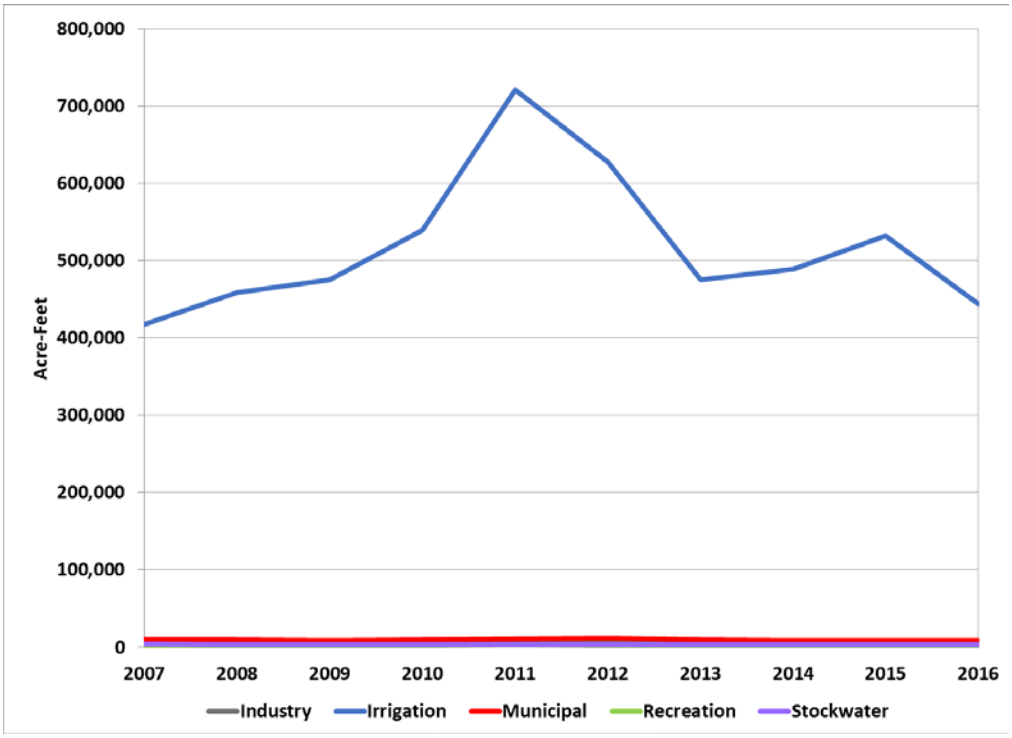


Figure 7: Groundwater use by type, Great Bend Prairie Region

Surface Water

Major rivers and streams in the Great Bend Prairie Region include the Arkansas River, Rattlesnake Creek, Walnut Creek, Pawnee River, and Cow Creek. Important surface water features are Cheyenne Bottoms in Barton County and Quivira National Wildlife Refuge in Stafford County. Cheyenne Bottoms is owned by the State of Kansas and managed by the Kansas Department of Wildlife, Parks, and Tourism (KDWPT). The federally owned Quivira National Wildlife Refuge is managed by the U.S. Fish and Wildlife Service (USFW). Both hold water rights that allow for management of the areas as wetlands, a recreational water use.

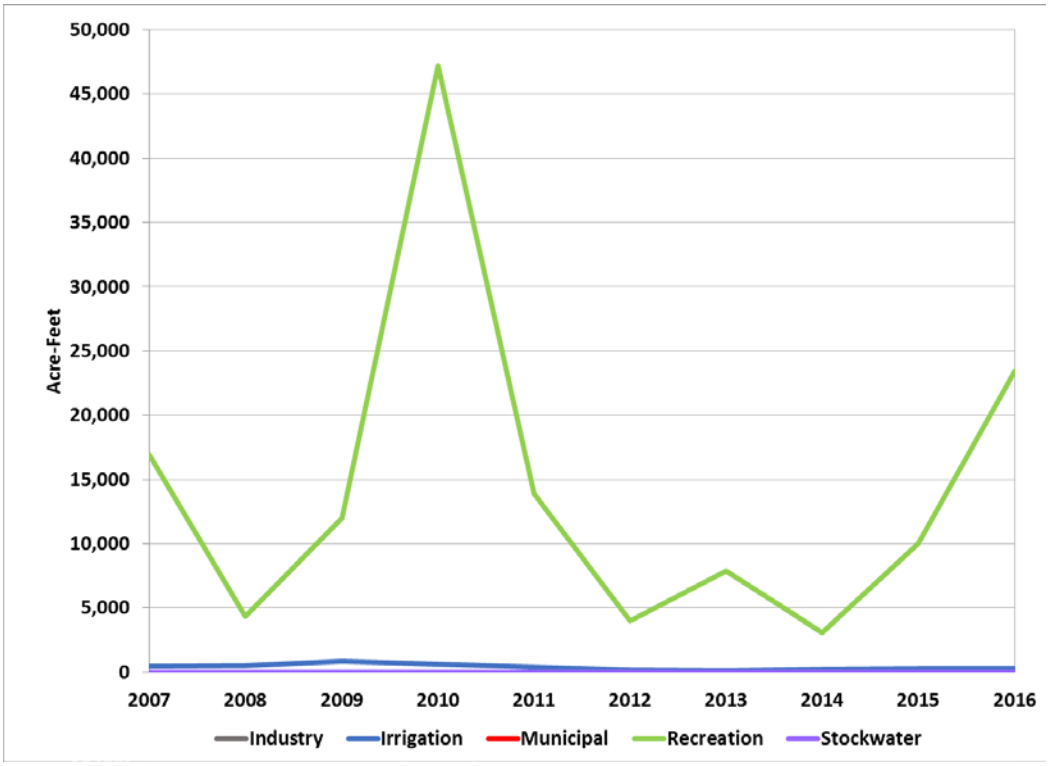


Figure 8: Surface use by type, Great Bend Prairie Region

Minimum Desirable Streamflow (MDS) have been set at four U.S. Geological Survey (USGS) gages in the region: near Great Bend on the Arkansas, near Zenith on Rattlesnake Creek, near Macksville on Rattlesnake Creek, and on the south fork of the Ninnescah near Pratt (Figure 4). Streamflow has often been insufficient to meet the MDS goals at these locations. Figure 10 indicates the number of days the mean daily streamflow was below MDS at that gage. Data was derived from USGS streamflow data for each gage. In the Great Bend Prairie Region, most of the days with lower flow have occurred in May followed by June.

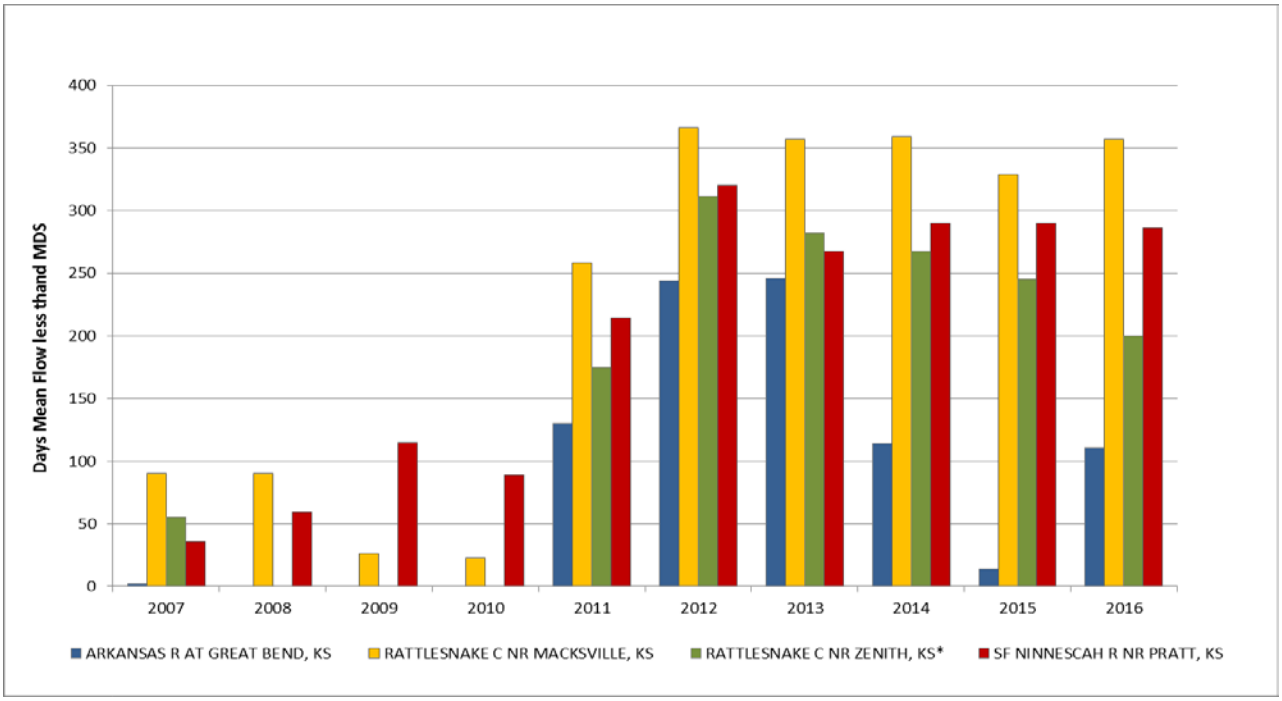


Figure 9: Annual days when minimum daily streamflow (MDS) was not met (USGS stream gage data)

Water Quality

Groundwater Quality

Groundwater quality remains an important component of water availability. Saline water is known to impact the region's groundwater and surface water quality in Stafford, Rice, Reno, and Pratt counties. The KGS has identified the source of the salinity as natural occurring salts (Figure 10).

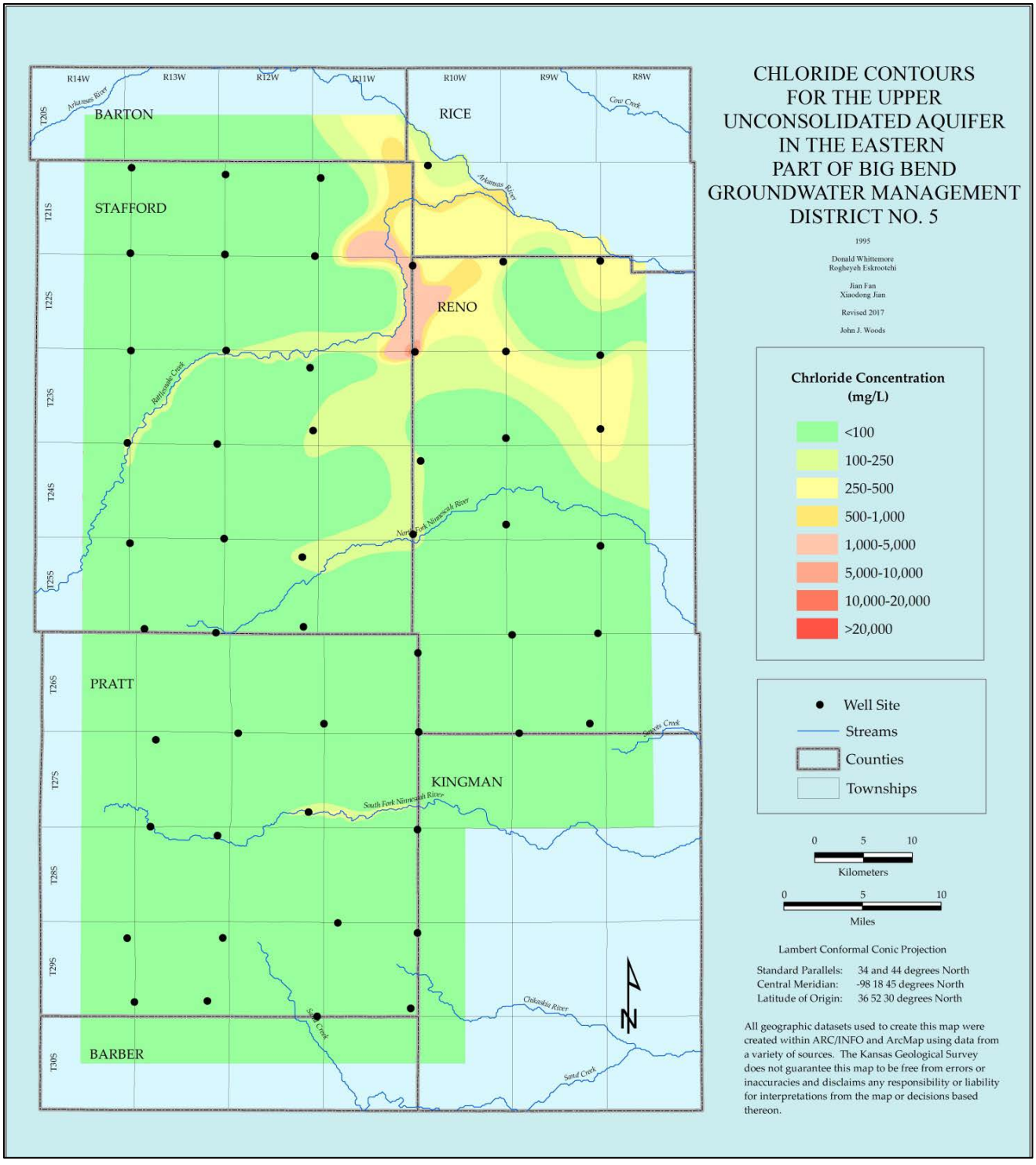


Figure 10: 2017 Chloride monitoring in part of the Great Bend Prairie Region

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 surface 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. The most prevalent impairments in this region are chloride, sulfate, dissolved oxygen, and E. coli in streams and eutrophication for lakes.

Six additional impairments were added in the 2016 Section 303(d) list as needing TMDL development, including arsenic on Walnut Creek and atrazine and gross alpha on the Arkansas River (Table 2). Additional information on TMDLs and a complete list of impaired and potentially impaired waters can be found on the Kansas Department of Health and Environment (KDHE) website.

Table 2: KDHE 2016 303(d) list of impaired waters summary

Great Bend Prairie Region 2016 303(d) List Summary	
Total Number of Impairments	85
Lake Impairments	23
Most Common Impairments	
Eutrophication	11
Selenium	10
Siltation/TSS	8
Total Phosphorus	7
Dissolved Oxygen	7
E. Coli	7

Table 3: Impaired waters status in Great Bend Prairie Region

Impaired Waters Listing Changes 2014 to 2016 - Total Maximum Daily Loads (TMDLs)					
HUC 8	**Waterbody Name**	**Description of Change**	**Category***	**Impairment**	**Station**
11030008	Walnut Creek Near Heizer	Delisted in 2016	2	Nitrate	SC597
11030007	Walnut Creek At Ness City	New Category 5 Listing	5	Arsenic	SC595
11030008	Walnut Creek Near Alexander	New Category 5 Listing	5	Arsenic	SC596
11030008	Walnut Creek Near Heizer	New Category 5 Listing	5	Arsenic	SC597
11030004	Arkansas River Near Great Bend	New Category 5 Listing	5	Atrazine	SC284
11030004	Arkansas River Near Great Bend	New Category 5 Listing	5	Gross Alpha	SC284
11030011	Cow Creek Near Lyons	New Category 5 Listing	5	Arsenic	SC657

***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
4b	Waters that have addressed their impairment by other means than a TMDL
5	Waters requiring development of a TMDL because of impairment

Harmful Algal Blooms (HABs) are common in bodies of water when nutrient loading is excessive and during periods of elevated temperatures. Health effects of HABs are well documented, from flu like symptoms in humans to the death of pets. Water supplies are often shut down during the blooms and beaches are closed because contact by both humans and animals with the water is discouraged. These blooms cause water quality issues, threats to public health, increased costs for water supply treatment, and economic loss in the region.

Public health advisories have been issued for six lakes in the region since 2010 (Table 4). More information can be found on KDHE's website.

Table 4: Record of harmful algae blooms

Confirmed Harmful Algae Blooms - Public Health Advisories in Great Bend Prairie Region									
		Weeks in Advisory							
Lake	County	2010	2011	2012	2013	2014	2015	2016	2017
Buhler City Lake	Reno	-	-	-	2	-	-	-	-
Hodgeman County SFL	Hodgeman	-	-	-	-	-	-	-	7
KFG Hatchery & Ponds	Pratt	-	-	-	-	-	1	-	-
McKinley Lake	Barton	7	-	-	-	-	-	-	-
Memorial Park Lake	Barton	Confirmed	Confirmed	Confirmed	Confirmed	Confirmed	-	-	7
Stone Lake	Rush	-	-	-	-	7	-	-	-
Wolfs Pond	Barton	-	-	-	-	-	-	-	3

Implementation Progress

Conservation Strategies

Voluntary conservation programs are seen as the key to reducing water withdrawals in the short–term and optimistically reaching a sustainable level over the long-term. Conservation programs may address different water use types, but of the most important are those that reduce irrigation and improve municipal efficiency.

Since irrigation is the largest water use in the region, conservation related to irrigation use will have the most impact on resources in the region. Local Enhanced Management Areas (LEMAs) are a conservation tool available to reduce water use. Discussions began in 2017 towards the development of a LEMA in the Rattlesnake Creek portion of Big Bend Groundwater Management District 5 (GMD5).

The Central Kansas Water Bank Association (Water Bank) is in place in the Great Bend Prairie Region to promote water conservation with increased water use flexibility within the banking area. Water can be sold (deposited) on an annual basis up to five years so others can lease it; these transactions require a

minimum of 10% water savings. Contracts for transactions made within 2014 to 2017 are credited with conserving over 315 AF. More information can be found through the Central Kansas Water Bank website. An evaluation of the Water Bank is underway.

There are two other water conservation programs available to producers: The Upper Arkansas Conservation Reserve Enhancement Program (CREP) which includes the Arkansas River corridor in Edwards, Pawnee, Stafford and Barton counties; and the Water Rights Transition Assistance Program (WTAP) that covers the Rattlesnake Creek watershed. These offer federal or state assistance to retire eligible water rights in portions of the region.

Within this region, the Upper Arkansas CREP recorded its first enrollments from Barton and Edwards counties in 2017, retiring a total of 300 AF of water. Previously, 586 AF were retired in Pawnee County.

Table 5: Enrollment in CREP in Great Bend Prairie Region (FY2017 Annual Report-Upper Arkansas CREP)

County	2007 – 2008	2008 – 2009	2009 – 2010	2010 – 2011	2011 – 2012	2012 – 2013	2013 – 2014	2014 – 2015	2015 – 2016	2016 – 2017	Total Acres Approved
Barton										107.7	107.7
Edwards										127.5	127.5
Pawnee	241.7				130.7						372.4
Rice											
Stafford											
TOTAL	241.7				130.7					235.2	607.6

Water Technology Farms

Water Technology Farms (Tech Farms) are a Phase II action item from the Ogallala-High Plains Aquifer section of *The Vision*. These demonstration projects allow irrigation technology options to be implemented and tested on a field scale with the oversight of Kansas State University Southwest Extension personnel. One Tech Farm has been established within the region.

The WaterPACK/ILS Farm began its public-private partnership in 2015 and is focusing on evaluating the performance of MDI on a higher volume well in an area outside of the Ogallala Aquifer, but with sandy soils. The north field was planted in circular rows of corn as a contrast to the south field which is planted in the typical straight rows of corn.

The rationale for the circular versus straight planting, other than recommended to optimize benefit of MDI, is to detect difference in efficiency through planting configurations. Another focus on this farm is better irrigation scheduling using KanSched, an ET-based scheduling tool developed by K-State. To validate the schedule, neutron soil water readings and gravimetric methods of soil water measurements are done on a bi-weekly basis. AquaSpy soil moisture sensors were installed in both fields.

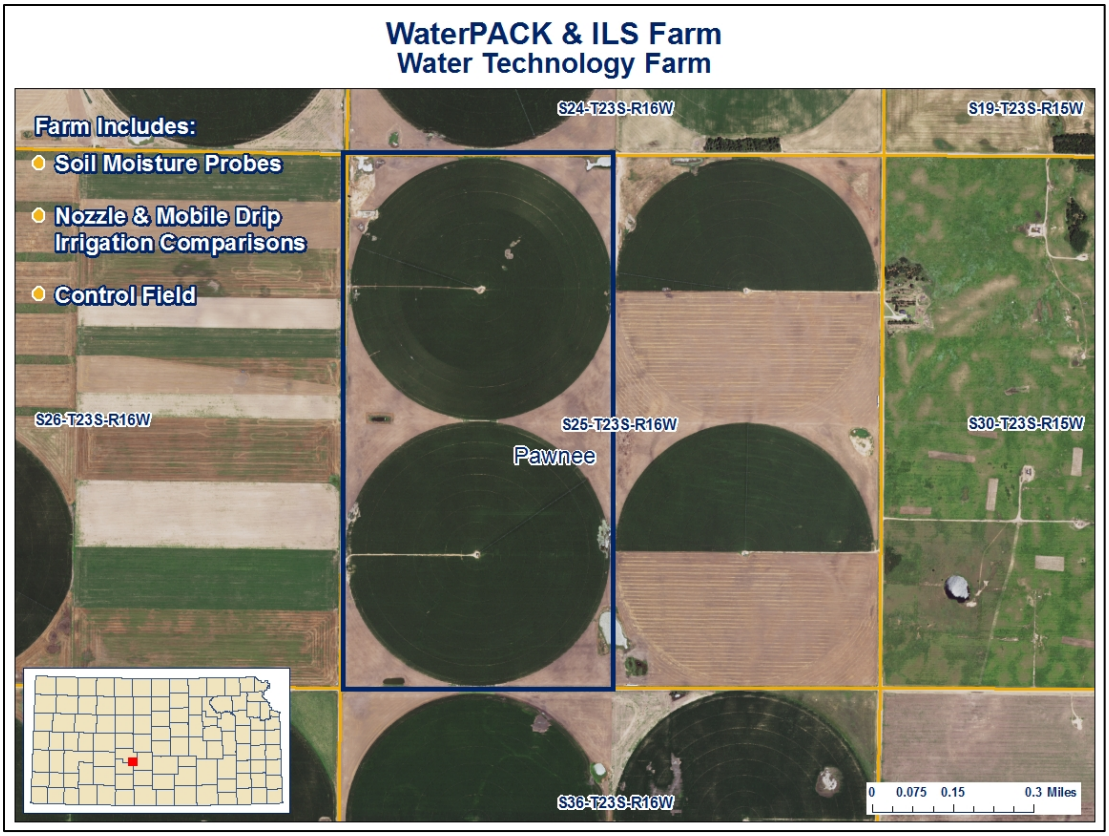


Figure 14: WaterPACK/ILS Farm Water Technology Farm layout for 2017

Conservation Incentives

Conservation practice implementation is considered an important tool to reach sustainable groundwater use. Conservation practices can be used to reduce consumptive water use while maintaining the production of crops and economic stability. Implementation of conservation practices is often a joint effort among United States Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS), the KDA - Division of Conservation (KDA-DOC), local conservation districts, groundwater management districts, and others. The USDA-NRCS provided assistance through the Environmental Quality Incentive Program (EQIP) and the Resource Conservation Partnership Program (RCPP) related to irrigation water use efficiency and conservation. Three federal cost share programs addressed water management and efficiency while another addressed water quality for FY2015 thru FY2017 in the region (Table 6).

Table 6: Conservation practice summary for Great Bend Prairie Region

FY2015 thru FY 2017 EQIP and RCPP Contracts Great Bend Prairie Region			
Fund Code	**Number of Contracts**	**Contract Acres**	**Contract Obligation**
Advanced Irrigation Water Management on the High Plains	17	2,118	$107,803
Ogallala Aquifer Initiative	13	1,981	$1,356,935
Water Quantity	8	745	$539,407
TOTAL WATER QUANTITY/MANAGEMENT	**38**	**4,844**	**$2,004,145**
Water Quality	12	1,127	$758,391
TOTAL GREAT BEND PRAIRIE REGION	**116**	**20,939**	**$4,705,729**

Education and Information

A Water Talk Series was held in 2017 providing producers with information on tools for water conservation and management in their operations.

Information and issues related to salt waters and monitoring them were discussed at a Low Quality Water Summit held in August 2017. The summit provided a summary of low quality waters that could be treated for use if substituted for freshwater use as suggested in *the Vision*. The meeting also marked the beginning of discussions with the Kansas Corporation Commission (KCC) on existing authorities to require location of potential contamination sources, such as disposal lines to protect groundwater quality.

The ILS Tech Farm was host to field demonstration days in 2017 and 2018 with multiple irrigation technology companies participating and sharing information on their products with local producers. At these field days, area water users are able to discuss how new irrigation technologies can be used to maintain economic levels of production while reducing water use.

Technical assistance continues to be available to public water suppliers through Kansas Rural Water Association for leak detection, water conservation plan development and water conservation and management review.

Implementation Needs

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

- Update the existing groundwater model in the region with current data to quantify sustainability needs across the region
    - Ideal outcomes will also include potential management units and pumping scenarios to achieve long term sustainable pumping levels
- Monitor and track water quality and salt water disposal lines to protect fresh water from contamination and reduce existing problems
- Coordinate with KDA for field trials for feed wheat and other alternative crops in the region
- Conservation practice implementation now and into the future continues to be necessary to reduce nutrient and sediment runoff impacting Cheney Reservoir, in the neighboring region, as well as reduce overall water use to reach sustainable pumping levels
- Watershed dam construction of planned, or alternative, structures should reach 50% of watershed district area

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 Great Bend Prairie 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
Achieve water use sustainability within the Great Bend Prairie Regional Planning Area by 2025 with a starting point being no new net depletions that includes a reasonable raising or lowering of the water table based on average weather conditions.	Water Use Sustainability			--	--

Progress Legend	Not Started	In Progress	Delayed	Cannot Complete	Complete

2018 Update:

- February 2017, a Water Talk Series was held in the region to provide an overview of programs and technologies available
- Risk Management Agency Limited Irrigation Crop Insurance program in 2017
- NRCS provided assistance through the EQIP and the RCPP
- Three programs addressed water management and efficiency another addressed water quality for federal FY2015 thru FY2017
- Central Kansas Water Bank is in place to promote water conservation and the wise use of groundwater with increased water use flexibility within the banking area
- WTF in place. A three year pilot public-private partnerships where irrigation technology is demonstrated, related research is conducted on the field scale and water conservation is supported
- Water Talk Series held Feb. 13, 2017 provided program, tool, and technology information to producers to manage and conserve water
- A WTF field day was held August 14, 2017 and August 7, 2018 to share information

Next Step(s):

- Increase participation in local, state and federal water management and conservation practices and programs
- Quantify reductions needed to reach sustainability

Regional Goal #2	Goal Theme	Annual Progress			
		2017	2018	2019	2020
Maintain annual training funds of 15% from Clean Water Drinking Fee and increase technical training support to Public Water Supply (PWS) systems to enhance new technology and increase	Public Water Supply Training and Technology			--	--

water efficiently and effectively, thus reducing water loss. Utilize available municipal/residential/commercial irrigation training programs provided by the Irrigation Association.						
Progress Legend	Not Started	In Progress	Delayed	Cannot Complete	Complete	
2018 Update: PWS efficiency continues to be supported through public water supply training opportunities and technical assistance as budgets are approved for state agencies.						
Next Step(s): • Continue to support training of PWS operators. • Reach out to public water suppliers to develop water conservation plans • Provide technical assistant to bring above average water use systems closer to the regional average						

Regional Goal #3	Goal Theme	Annual Progress			
		2017	2018	2019	2020
Enhance the monitoring of poor quality water in areas which have salt water disposal lines, disposal wells and areas with high salt sources to ensure that contamination of fresh water sources does not occur as well as to stop and reverse further contamination of fresh water sources. Establish a self-reporting program under penalty of law if a problem is observed to ensure the problem does not get worse. Start using mapping techniques and disposal line maintenance and replacement to ensure this goal is met. Set up a review program by 2020.	Monitoring of Industrial Salt Water and Protection of Fresh Waters			--	--
Progress Legend	Not Started	In Progress	Delayed	Cannot Complete	Complete	
2018 Update: • Sensitive groundwater areas are designated by KCC where industry must protect usable freshwater resources from oil and gas activities • Routine permitting and testing of UIC wells in place through KCC • RAC workshop August of 2017 discussion included location of saline and mineralized waters in central Kansas and monitoring in these areas • Initiated discussions with KCC with intent to determine needs to further protect from salt water contamination • KCC developing information on extent of salt pipeline water leaks in the region						
Next Step(s): • Evaluate KCC information • Identify authorities and programs in place to protect fresh waters and soils from salt water contamination.						

Regional Goal #4	Goal Theme	Annual Progress			
		2017	2018	2019	2020
Initiate research and development of feed wheat as an alternative feed source within the Great Bend Prairie Planning Region. Technology transfer from this research would have benefits in areas of Kansas where water is not available for production of water-intensive crops. Dual research program: plant breeding and livestock feeding. Achieve large scale feeding trials by 2025.	Research and Development: Alternative Crops and Feed			--	--
Progress Legend: Not Started | In Progress | Delayed | Cannot Complete | Complete					
2018 Update: • Feed wheat as an alternative feed source has been discussed as a research need with KDA • K-State Research and Extension feedlot specialists have endorsed feed wheat, estimating wheat normally has a nutritional feeding value approximately 5 to 10 percent higher than corn for growing and finishing cattle					
Next Step(s): Conduct feed wheat trial in region.					

Regional Goal #5	Goal Theme	Annual Progress			
		2017	2018	2019	2020
Work towards sustainability of watersheds so that flood control capacity is maintained while maintaining streamflow to meet downstream water needs. Progress towards sustainability would be to have 50% of the drainage area within watershed districts controlled by watershed structures by 2065. Best available information/data will be evaluated every 10 years to track progress towards meeting this goal.	Watershed Sustainability			--	--
Progress Legend: Not Started | In Progress | Delayed | Cannot Complete | Complete					
2018 Update: • Two organized Watershed Districts cover part of the region providing flood control and management of watersheds • Structures control approximately 33% of the watershed district areas					
Next Step(s): • Work with landowners, watershed boards and community leaders to promote the role of watershed dams • Complete planned structures or others to reach at least 50% control within Districts					

References

"Map of Real-Time Streamflow Compared to Historical Streamflow for the Day of the Year (Kansas)." *USGS WaterWatch – Streamflow Conditions*, waterwatch.usgs.gov/?m=real&r=ks.

"Monthly Precipitation Maps." *Kansas Office of the State Climatologist · Kansas Drought*, climate.k-state.edu/precip/county/.