

State of the Resource & Regional Goal Action Plan Implementation Report

August 2018

Upper Republican Regional Planning Area



Table of Contents

EXECUTIVE SUMMARY	2
WATER USE TRENDS.....	3
WATER RESOURCE CONDITIONS.....	5
GROUNDWATER	5
SURFACE WATER.....	9
WATER QUALITY	9
GROUNDWATER	9
SURFACE WATER.....	10
IMPLEMENTATION PROGRESS.....	11
LEMAS.....	11
CONSERVATION INCENTIVES	12
LIMITED IRRIGATION CROP INSURANCE	12
EDUCATION AND OUTREACH	14
WATER TECHNOLOGY FARMS	14
WATER CONSERVATION AREAS.....	15
IMPLEMENTATION NEEDS.....	16
REGIONAL GOALS & ACTION PLAN PROGRESS	17
REFERENCES	19

Executive Summary

The Upper Republican 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 Upper Republican Regional Planning Area includes all of Northwest Kansas Groundwater Management District #4 (GMD4), as well as parts of the Republican, Solomon and Saline River Basins. The principal aquifers in this region include the Ogallala-High Plains and alluvial aquifers. The High Plains Aquifer consists of several hydraulically connected aquifers, the largest of which is the Ogallala. The Ogallala-High Plains Aquifer is distinctive from other aquifers in Kansas due to the fact it generally has low annual recharge.

Groundwater resources within the region have continuously declined, including in years that received at or above normal precipitation. The Kansas Geological Survey (KGS) and the Kansas Department of Agriculture-Division of Water Resources (KDA-DWR) measure water levels in 1,400 wells in central and western Kansas, including 370 wells within the Upper Republican region. From 2007 through 2016, these water level measurements showed that the annual groundwater levels within the region experienced declines every year except in 2009, with an average annual decline of 0.48 feet per year and a 10-year cumulative decline of 4.77 feet.

In 2013 the first Local Enhanced Management Area (LEMA) in Kansas was established by GMD4 in Sheridan County. Located within high priority area SD6, the goal of the SD6 LEMA is to reduce water used for irrigation by 20% with the intent being to extend the life of the aquifer in the Sheridan County area where it has been drastically depleted. The SD6 LEMA has completed its first five year period and the local advisory group has voted to renew the SD6 LEMA for another five year term. In the 2013-2017 timeframe, water use and decline rates dropped, yet water levels continued to decline in the area as indicated by yearly water level measurements.

In summer 2017, the first public hearing was held on the proposed GMD4 district LEMA plan, with a proposed implementation for calendar year 2018. In April 2018 the GMD4 district LEMA went into effect per the order of designation from the Chief Engineer. The LEMA plan sets yearly allocations for water use for each Township within the district dependent on the water level declines seen within that Township. Establishing the framework to revise the allocations up or down as the aquifer reacts to the region's water use trends.

In 2017, ranking criteria within the Environmental Quality Incentives Program (EQIP) offered by the United States Department of Agriculture's Natural Resources Conservation Service (USDA-NRCS) were revised to incentivize water conservation. The year also saw the development of several Water Technology Farms (Tech Farms) through the Precision Agriculture Program at Northwest Kansas Technical College, and in February 2017, the first Water Talk Series meeting was held in Goodland, Kansas.

Water Use Trends

Groundwater is the primary source of water in the region, accounting for nearly 100% of the total supply, principally from the High Plains and Dakota aquifers as well as alluvial deposits along major streams (Figure 2). Surface water use accounts for less than one hundredth of a percent of water authorized for use in the region. All of the streams and alluvial corridors in the region are either closed to new appropriations or new appropriations are restricted.

Irrigation use accounts for 98% of the reported water use of the region (Figure 3). Municipal represents approximately 1%, with the remainder accounted for by stockwater, recreation, industrial, and other uses.

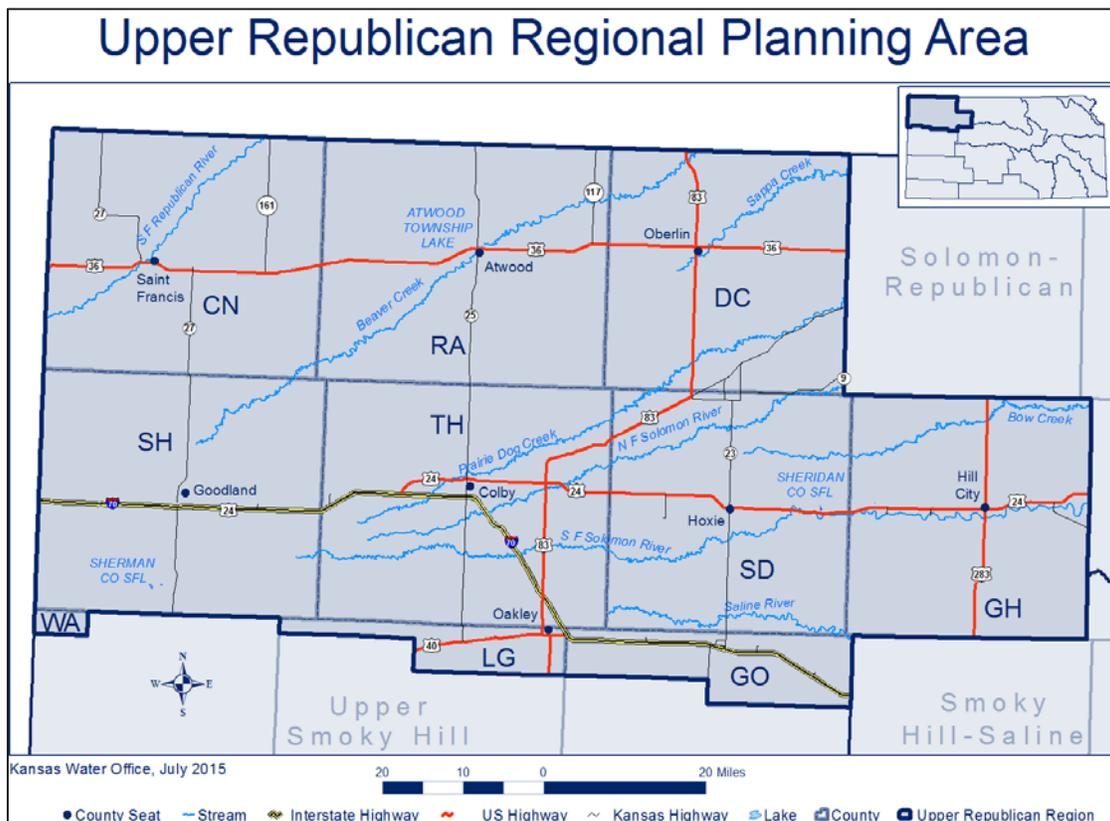


Figure 1: Upper Republican Regional Planning Area

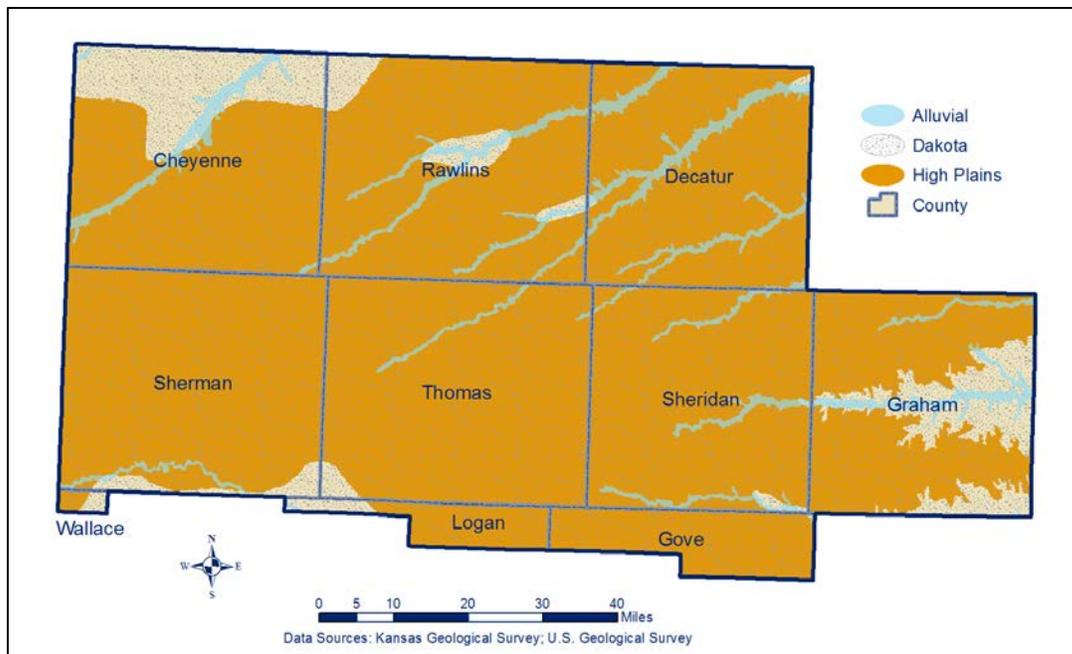


Figure 2: Upper Republican generalized aquifer extent

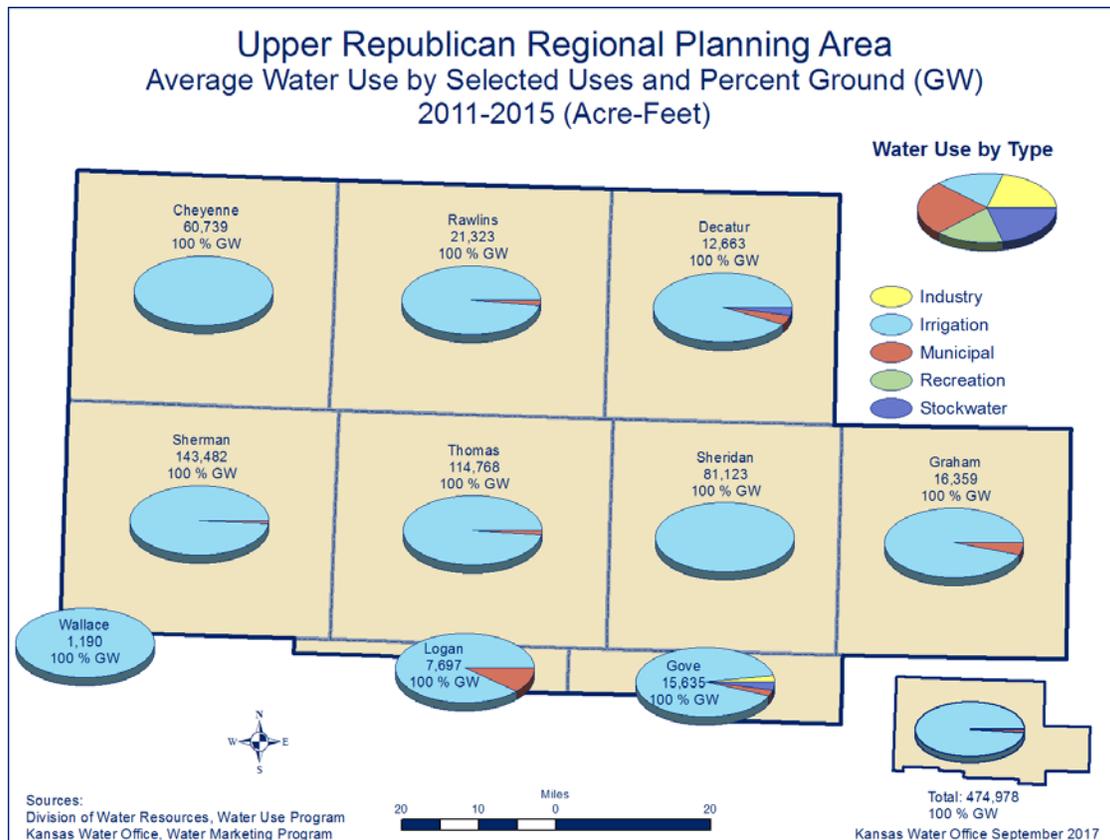


Figure 3: Water use by type of use for the Upper Republican Region

Water use has historically followed in relation to yearly precipitation, with years of below normal precipitation showing an increase in water use demand (Figure 4).

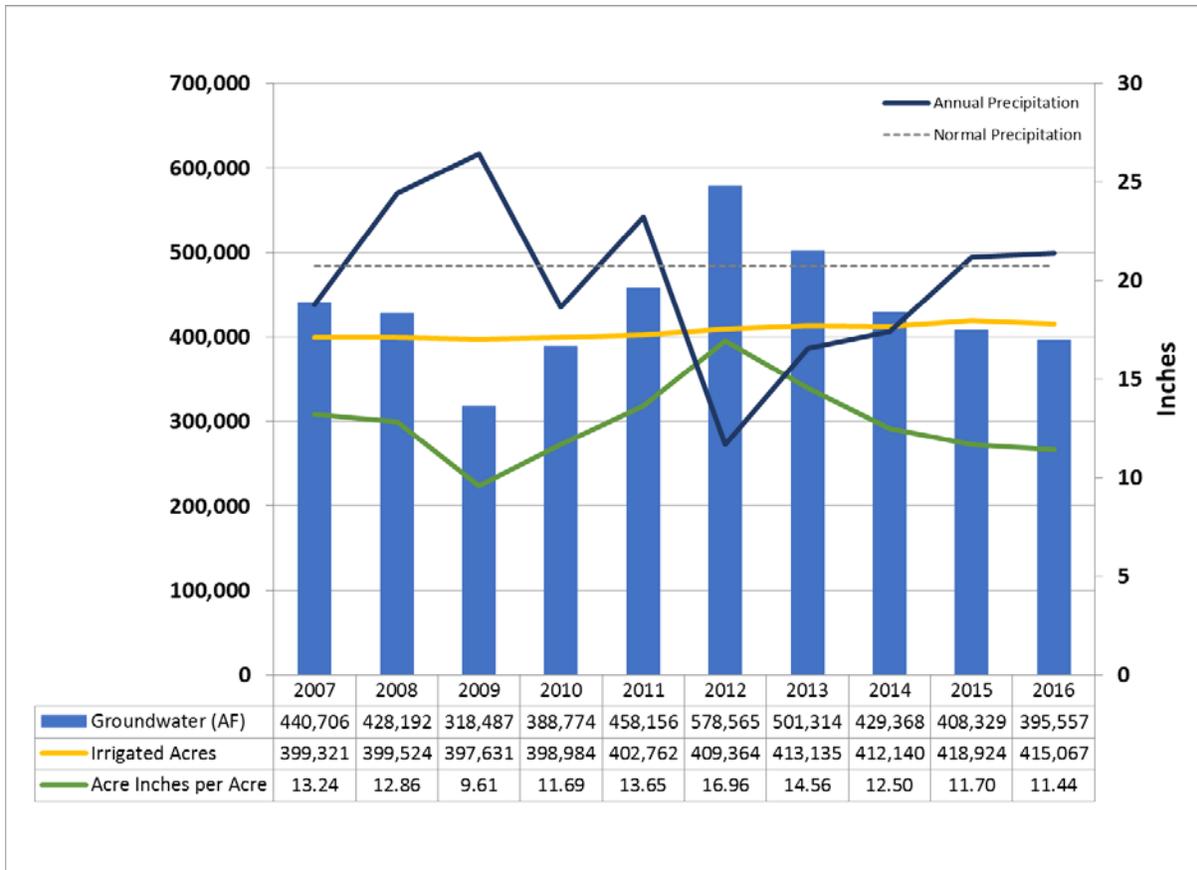


Figure 4: Groundwater use for years 2007 - 2016 within the Upper Republican Region, with annual precipitation irrigated acres, and acre inches per acre displayed

Water Resource Conditions

Groundwater

The principal aquifers in this region include the Ogallala-High Plains and alluvial aquifers. The High Plains Aquifer consists of several hydraulically connected aquifers, the largest of which is the Ogallala. The Ogallala-High Plains Aquifer is distinctive from other aquifers in Kansas in that it generally has low annual recharge. The Dakota Aquifer is present in the region but is seldom used due to high mineral content.

The KGS and the KDA-DWR measure water levels in 1,400 wells in central and western Kansas, including 370 wells within the Upper Republican region. From 2007 through 2016, these water level measurements showed the annual groundwater levels within the region experienced declines every year except in 2009 (Figure 5). The annual groundwater level declined an average of 0.48 feet per year for an overall decline of 4.77 feet in 10 years. Since the 1950s (predevelopment), water levels have declined as much as 45 percent in parts of Thomas, Sheridan and Graham counties.

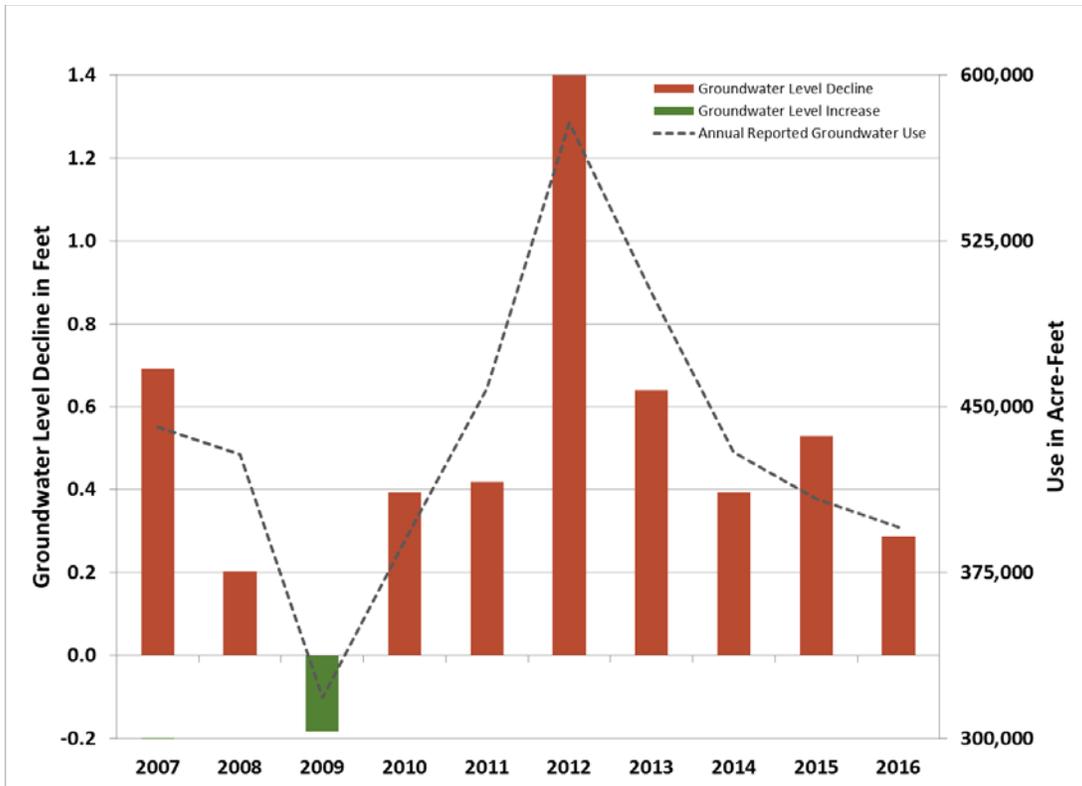


Figure 5: Groundwater level changes from 2007 to 2016

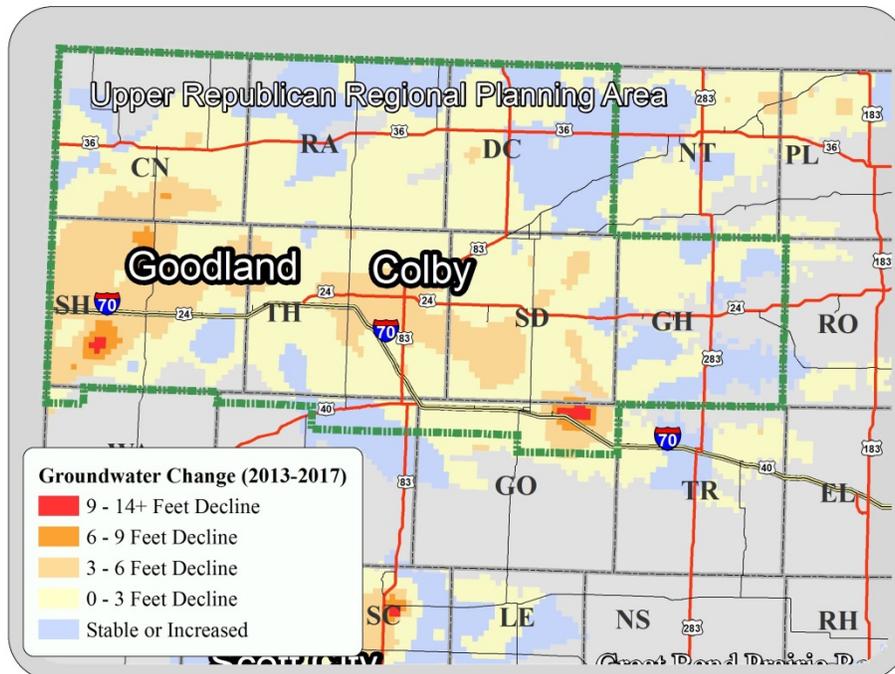


Figure 6: Groundwater level declines for 2013 - 2017, with data from the KGS water level monitoring program

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 7: Hydrograph showing the decline of the Ogallala aquifer through time, with well measurements near Goodland in Sherman County



Figure 8: Hydrograph showing the decline of the Ogallala aquifer through time, with well measurements near Colby in Thomas County (second)

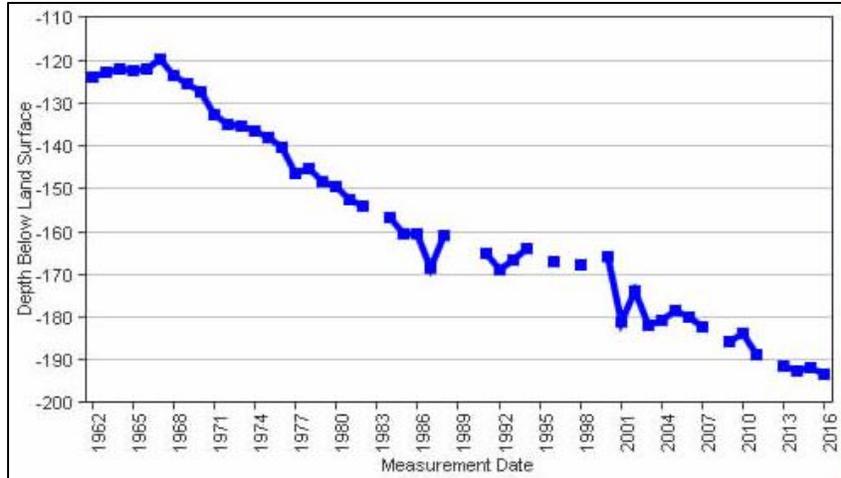


Figure 9: Hydrograph showing the decline of the Ogallala aquifer through time, with well measurements near Hoxie in Sheridan County

Groundwater level declines have been prevalent in the region since the proliferation of high volume pumps for irrigation use in the 1950s and 1960s.

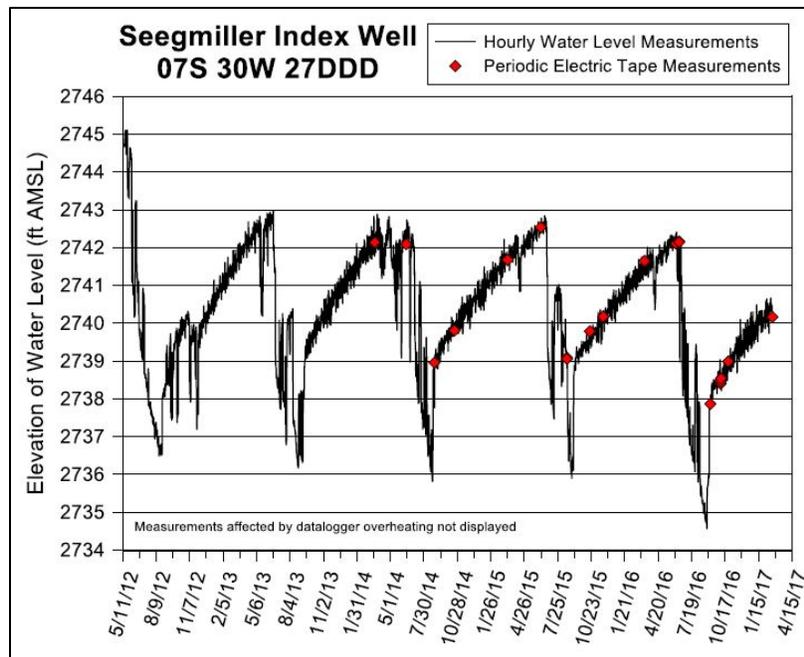


Figure 10: Kansas Geological Survey Seegmiller index well hydrograph

The KGS operates seven index wells within the region in addition to the annual water level measurement wells. These index wells provide near real time measurements of the aquifers water level status and allow for the study of the aquifer drawdown and recovery properties in different areas of the aquifer. The Seegmiller index well located within the SD6 LEMA boundary clearly shows the annual drawdown and recovery that occurs in relation to the area's irrigation pumping trends (Figure 10).

Surface Water

The principal streams in the Upper Republican Region are the South Fork Republican River; Beaver Creek; Sappa Creek; Prairie Dog Creek; North and South Fork Solomon Rivers; the Saline River; and Bow Creek. Planning and coordination is needed for the Republican River system in the Upper Republican Region for efficient water use, continued compliance with the Republican River Compact and the efficient use of compact settlement payments.

Surface water supplies account for less than one hundredth of a percent of water authorized for use in the region. As ground water levels decline, the aquifer loses hydraulic connection to the overlying alluvial aquifers and rivers, reducing the amount of stream flow in the surface water system. This reduction of hydraulic connection between surface and groundwater within the region has contributed to reductions and loss of stream flow in the region, with many streams now only flowing during and immediately after rainfall events. Soil conservation practices have further limited streamflow by holding more water on fields during precipitation events.

Water Quality

Groundwater

Groundwater quality issues in the region are variable and generally localized. Individual municipalities are left to address issues, primarily through pumping changes or blending processes in an effort to dilute any contaminants. A concern within the region is elevated levels of nitrates being picked up in public water supply wells.

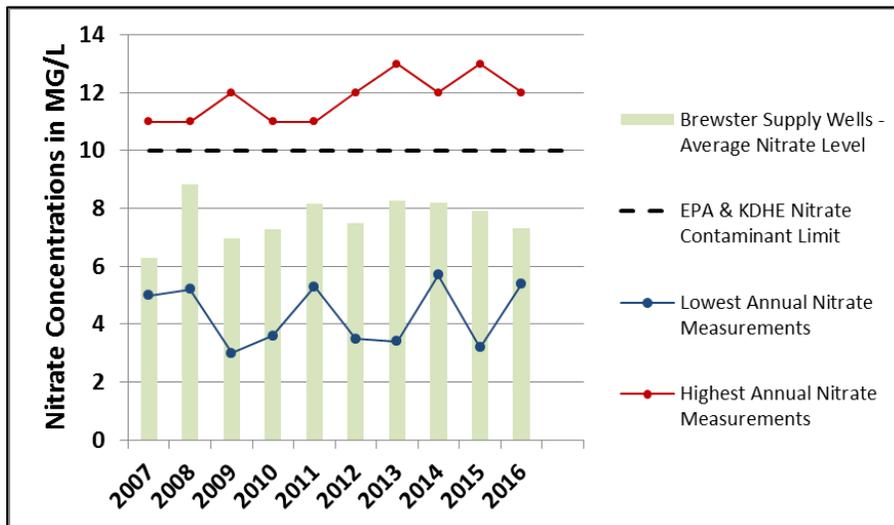


Figure 11: Nitrate concentrations reported from the City of Brewster public water supply wells. Data from KDHE Drinking Water Watch system

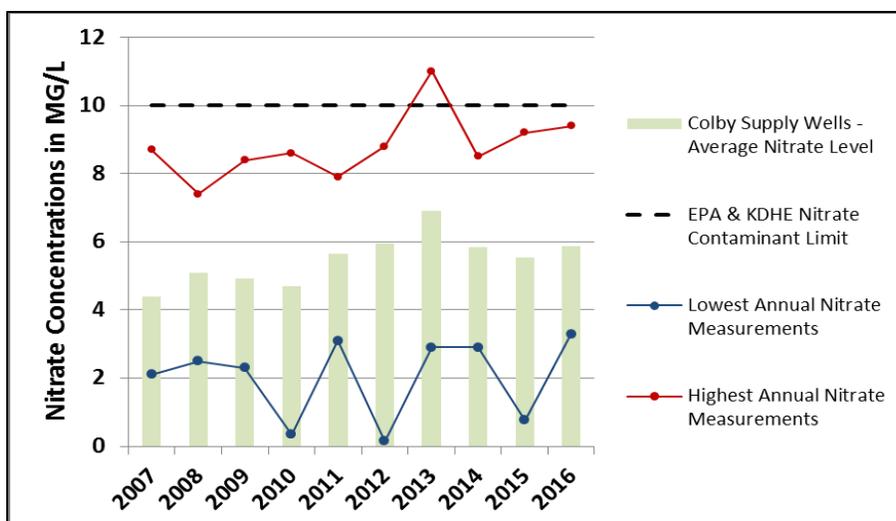


Figure 12: Nitrate concentrations reported from the Colby public water supply wells. Data from KDHE Drinking Water Watch system

The Environmental Protection Agency (EPA) Drinking Water Regulations set a limit of 10 mg/l for nitrate which is monitored and enforced by the Kansas Department of Health and Environment (KDHE). Long term exposure to drinking water that contains excess levels of nitrates can be a public health concern, with impacts to infants documented and other population groups being researched to understand impacts. Potential sources for excess nitrates in groundwater supplies include excessive fertilizer use, leaking from waste water treatment systems, and natural occurrence.

High levels of nitrates have been detected in samples taken from the City of Brewster’s public water supply wells. The municipality received violations every year from 2007 through 2016 for nitrate concentrations above the limit in one or more those wells (Figure 11). While the city is actively addressing these issues, cleanup is difficult and costly for such a small municipality. For other municipalities such as Colby that have not yet seen concentrations above the limit, nitrate is still of high concern (Figure 12). There is a desire from public water suppliers within the region to look at long-term water quality trends and annual fluctuations, including the time it takes for nitrate to reach the aquifer and projections of future water quality.

Surface Water

Despite the region’s lack of surface water flows, many of the surface water reaches have ongoing water quality concerns. 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). These are quantitative objectives and strategies needed to achieve the state’s surface water quality standards. In the Upper Republican Region, TMDLs have been developed to address dissolved oxygen, pH, fecal coliform bacteria, fluoride, selenium, total phosphorous, E. coli, arsenic, sulfate, gross alpha (bundled with uranium), biology, copper, lead and eutrophic conditions. With 21 TMDLs in place for the limited amount of surface water within the region, additional information on TMDLs and the Section 303(d) list of impaired waters can be found at the [Kansas Department of Health and Environment website](#).

Implementation Progress

Voluntary conservation programs are seen as key to reducing water withdrawals in the short-term and optimistically reaching a sustainable level over the long-term. Support for these types of programs will continue with educational events and meetings informing stakeholders of opportunities. Some tools and programs to aid in water use reduction and understanding the resource and options are in place and others may be developed to address these challenges.

After multiple years of negotiations among the States, the Republican River Compact Administration approved two resolutions on August 24, 2016 establishing long-term agreements among Kansas, Colorado and Nebraska related to Colorado's and Nebraska's compliance activities in the Republican River basin. These long-term agreements align Colorado's and Nebraska's compliance activities with Kansas water user's needs in both the South Fork Republican River of Northwest Kansas and main stem Republican River of Northcentral Kansas. As a part of this agreement Colorado has agreed to retire an additional 25,000 groundwater irrigated acres within the South Fork Republican River basin to improve surface water flows into Kansas.

Local Enhanced Management Areas

The GMD4 is pro-active in developing local water policy compatible with state laws. In 2013, GMD4 established the first LEMA in the state in Sheridan County. Located within high priority area SD6, the goal of the SD6 LEMA is to reduce water used for irrigation by 20% with the intent being to extend the life of the aquifer in the Sheridan County area where it has been drastically depleted. The SD6 LEMA has completed its first five year period and the local advisory group has voted to renew the SD6 LEMA for another five year term. In the 2013-2017 timeframe, water use and decline rates dropped, yet water levels continued to decline in the area as indicated by yearly water level measurements.

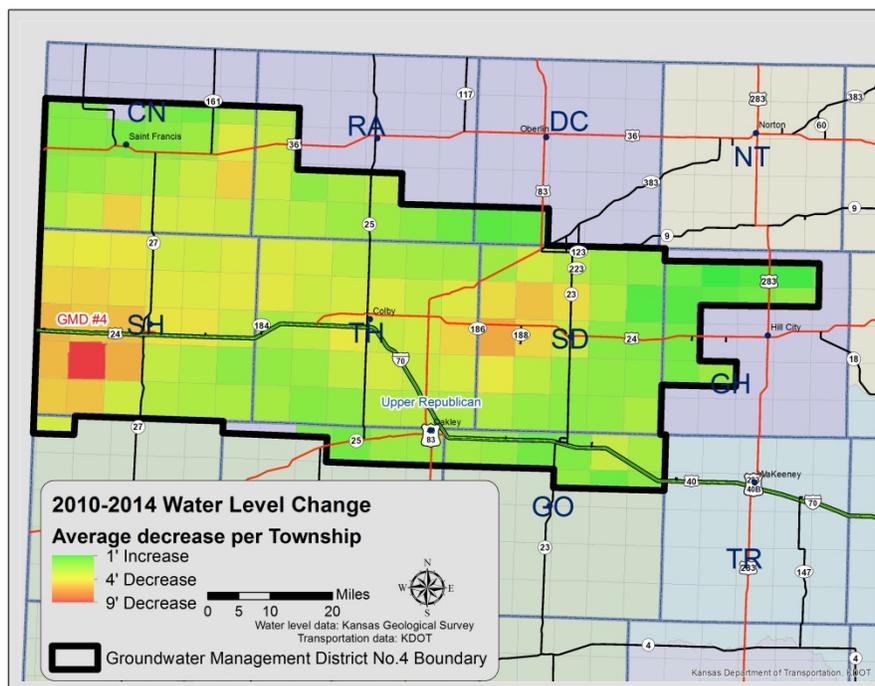


Figure 13: Groundwater level changes from 2010 to 2014

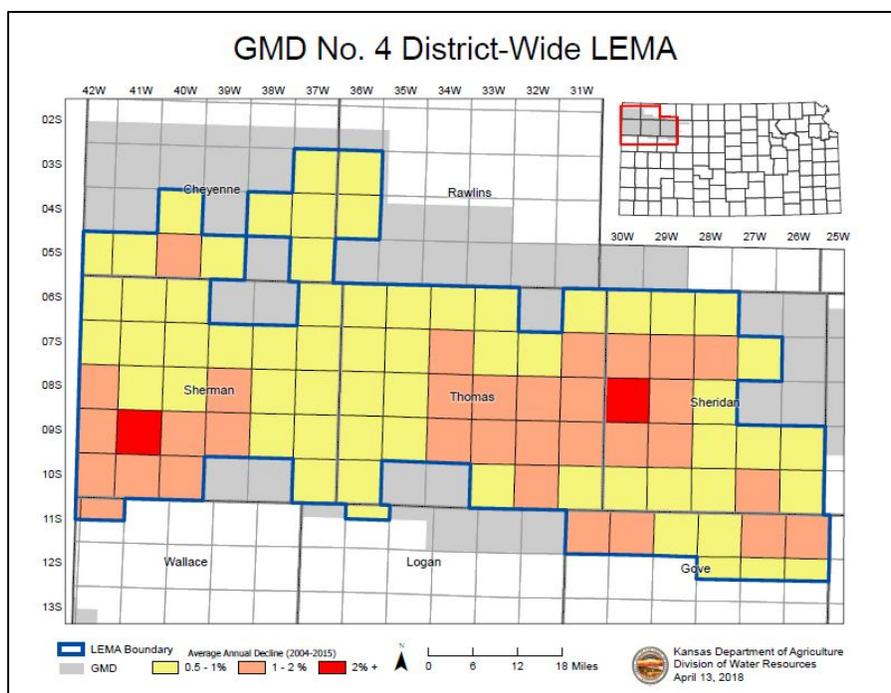


Figure 14: GMD4 District LEMA

In summer 2017, the first public hearing was held on the proposed GMD4 district LEMA plan, with a proposed implementation for calendar year 2018. In April 2018 the GMD4 district LEMA went into effect per the order of designation from the Chief Engineer. The LEMA plan sets yearly allocations for water use for each Township within the district dependent on the water level declines seen within that Township. Establishing the framework to revise the allocations up or down as the aquifer reacts to the region’s water use trends. This LEMA covers 330,249 acres of the 406,685 irrigated acres in the region, equating to over 81% of the average total of irrigated acres (Figure 14).

Conservation Incentives

The State of Kansas worked with the United States Department of Agriculture’s Natural Resources Conservation Service (USDA-NRCS) in 2017 to revise the ranking criteria within the Environmental Quality Incentives Program (EQIP) to further incentivize water conservation within the state. Starting in 2018, EQIP applications located within a LEMA, WCA, or Intensive Groundwater Use Control Area (IGUCA) shall be designated as high priority applications. Producers will have to show there will be a net water savings from the previous five years of water use.

Limited Irrigation Crop Insurance

A Phase I Statewide Action Item in *The Vision* includes working with the United States Department of Agriculture’s Risk Management Agency (USDA-RMA) to address crop insurance policies that disincentive water conservation. Working with the USDA-RMA, limited irrigation crop insurance coverage was expanded to 47 counties for corn and 28 counties for soybeans in Kansas, making Kansas the first and only state in the nation with a Limited Irrigation crop insurance option available to mitigate risk for those wishing to implement water conservation practices and reduce their historical water use. In September 2016, the Kansas Water Office (KWO) was awarded a USDA-RMA Education Partnerships

Program grant to build a limited irrigation crop insurance calculator and hold public awareness educational events.

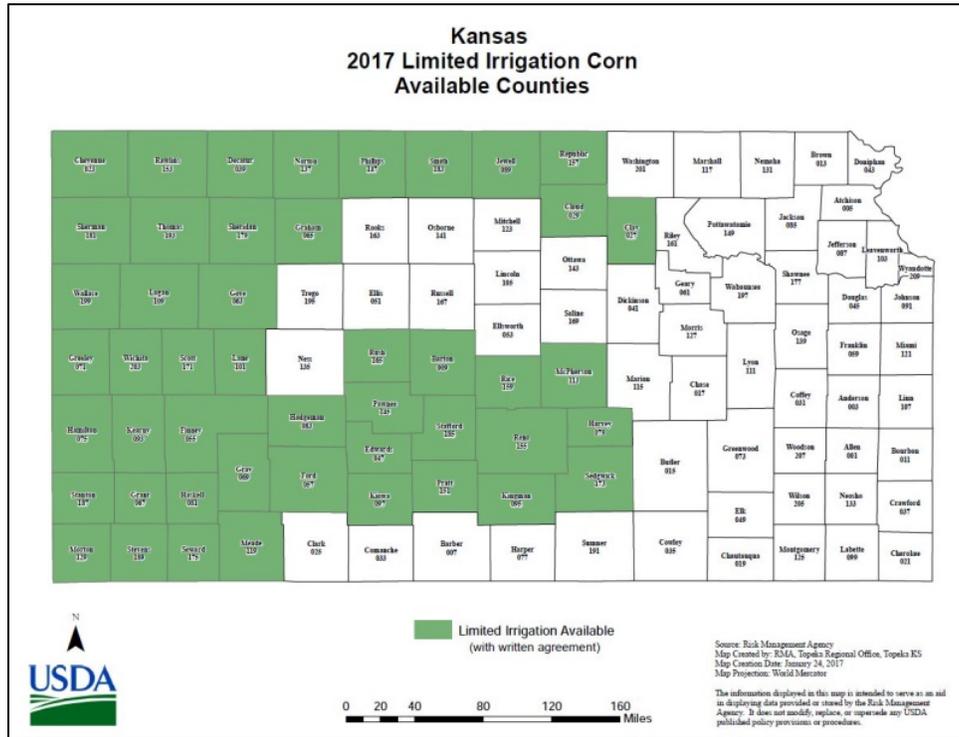


Figure 15: Counties where Limited Irrigation insurance is available for corn

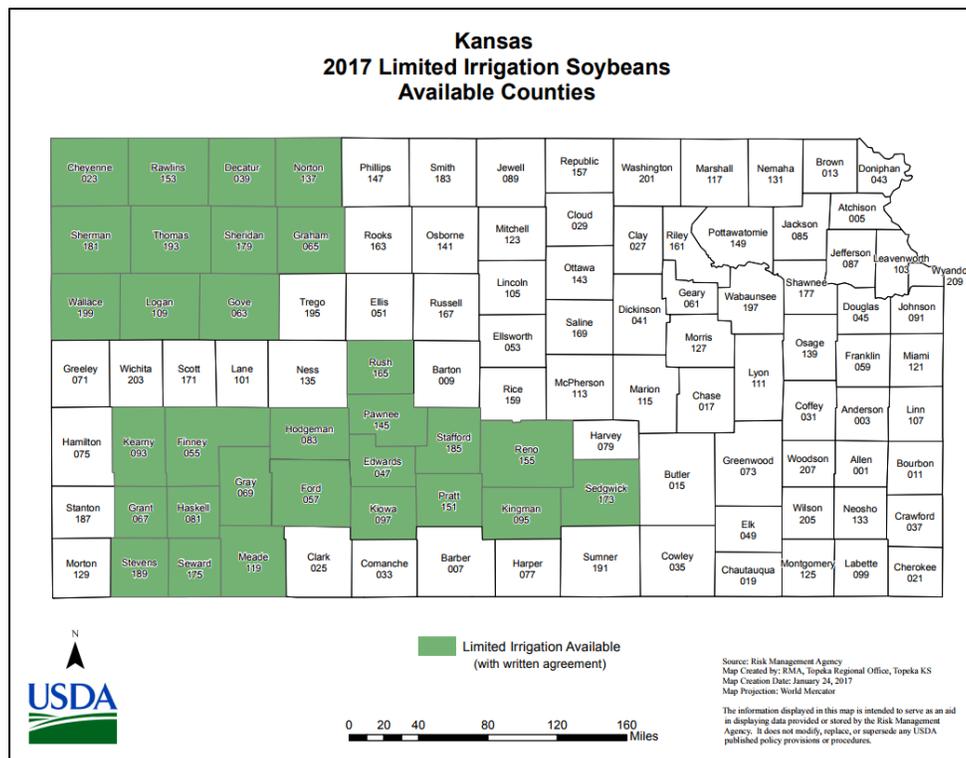


Figure 16: Counties where Limited Irrigation insurance is available for soybeans

Water Conservation Areas

Water Conservation Areas (WCAs) were signed into law in April 2015 and are a simple and flexible tool that allows any water right owner or group of owners the opportunity to develop a management plan to reduce withdrawals in an effort to extend the usable life of the Ogallala-High Plains Aquifer.

Currently two WCA plans have been adopted by landowners as a voluntary water conservation measure within this region; with two additional plans pending approval. These WCAs cover 1,760 acres of the 406,685 irrigated acres, covering less than 0.5% of the total irrigated acres; although this is due to the recently enacted GMD4 LEMA.

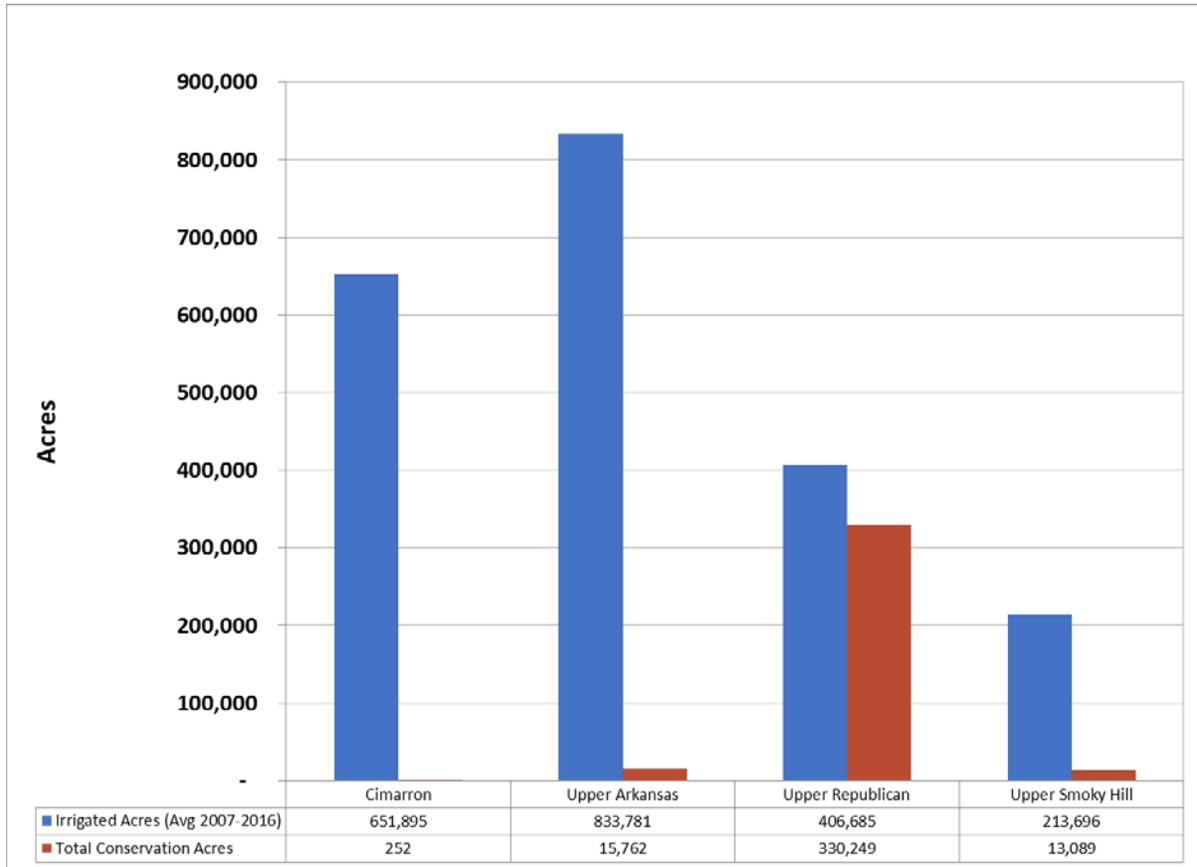


Figure 18: Total conservation acres compared to irrigated acres in the four western RACs

Implementation Needs

The Upper Republican Regional Advisory Committee has identified multiple needs to fully achieve the Region's Priority Goals in the Regional Action Plan that was developed through Advisory Committee meetings. The need for more water conservation education and incentives to increase utilization of efficient irrigation technologies has been stated repeatedly by the Regional Advisory Committee as a need. The needs identified by the Regional Advisory Committee are listed below:

- Water conservation education
 - Basic water education to start (where does their water come from/where is it going)
 - Education of teachers
 - Develop lesson plans
 - Work with established groups (4H, FFA, KS Corn, KHI)
 - Field trips to get out of classroom exposure (demo farms, tech college trip)
- Water conservation area and water efficient irrigation technology incentives
 - Make more irrigation technology qualify for cost share incentives
 - Communicate and promote LEMA & WCA EQIP ranking criteria changes
- More funding for education and demonstration projects
 - Seek more private funding partners and sponsorships
 - Request Water Plan Funds annually to fund education and demonstration projects
 - Continuation of Northwest Kansas Technical College - Water Technology Farm Project
- Improved communication methods, avenues, new partner groups
 - Work with other organizations for local outreach and communication events
 - Identify groups and settings that offer the chance to give presentations and continue to promote the RACs interest in providing informational opportunities to the public
 - Continue to promote via social media, especially with limited funding options
- Documentation of current conservation measures to develop baseline
 - Survey to identify and establish baseline of where we currently are at
 - Adoption of irrigation strategies
 - Cotton or alternative crops currently grown
 - Livestock water reuse – drinking water and irrigation
 - Boundaries to conservation
 - Ask for new “conservation project ideas or outside the box ideas”
- Increased focus and study of groundwater quality and trends
 - Identify contaminants of concern within the region
 - Look at historic trends of identified contaminants
 - Assess the impact the identified contaminants have on the region's groundwater supply
- Address small municipality system leaks
 - Identify which municipalities are encountering the most severe system leaks
 - Seek funding opportunities to assist in locating and repairing major leaks
- Supportive of funding a water law review as proposed to the 2018 Kansas Legislature

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 KWA in August of 2015 and at that same time members for the 14 Regional Advisory Committees (RAC) were appointed. The first task for the newly formed RACs was to develop action plans to correspond with the regional goals. The Upper Republican RAC completed action plans for their regional goals in 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
Develop and adopt a water conservation management plan that provides maximum flexibility while reducing overall actual use, in concert with GMD 4, to extend the aquifer life and economic well-being by January 1, 2017. Utilize a time-phased implementation approach, not less than 2 years or greater than 5 years, to phase in conservation measures to lessen economic impacts and allow user transition. Conservation Plan shall address all types of use while considering flexibility tools and overall actual reduction.	Water Conservation			--	--
Progress Legend	Not Started	In Progress	Delayed	Cannot Complete	Complete
2018 Update:					
<ul style="list-style-type: none"> • Renewal of the SD6 LEMA for another five years • Designation of GMD4 district LEMA from chief engineer for implementation beginning in 2018 • Two new WCA Plans in the region pending approval 					
Next Step(s):					
<ul style="list-style-type: none"> • Continue to support development and implementation of LEMAs and WCA plans within the region 					

Regional Goal #2	Goal Theme	Annual Progress			
		2017	2018	2019	2020

Enhance current efforts on education of all water users for all age groups on sources of supply, quantity of supply, Best Management Practices (BMPs), etc. to help stakeholders conserve and extend.	Education			--	--
Progress Legend	Not Started	In Progress	Delayed	Cannot Complete	Complete
2018 Update:					
<ul style="list-style-type: none"> Continuation of Water Technology Farm demonstration projects through Northwest Kansas Technical College's Precision Agriculture program Water Technology Farm Field Day event held at the Northwest Kansas Technical College Growth of Precision Agriculture workforce development with Northwest Kansas Technical College 					
Next Step(s):					
<ul style="list-style-type: none"> Continue to search for financial support to further develop demonstration projects, outreach events, and incentivize conservation Support the continued growth and expansion of the Northwest Kansas Technical College's Precision Agriculture program Extend efforts in providing education to high school aged students Provide support to KDA in the education of WCAs Create a fall event for education of water conservation involving agencies and schools 					

Regional Goal #3	Goal Theme	Annual Progress			
		2017	2018	2019	2020
Republican River Compact administration should be encouraged to maintain compliance in the South Fork Republican River.	Compliance			--	--
Progress Legend	Not Started	In Progress	Delayed	Cannot Complete	Complete
2018 Update:					
<ul style="list-style-type: none"> Republican River Compact Administration approved two resolutions on August 24, 2016 establishing long-term agreements among Kansas, Colorado and Nebraska related to Colorado's and Nebraska's compliance activities in the Republican River basin These long-term agreements align Colorado's and Nebraska's compliance activities with Kansas water user's needs in both the South Fork Republican River of Northwest Kansas in the main stem Republican River of Northcentral Kansas. As a part of this agreement Colorado has agreed to retire an additional 25,000 groundwater irrigated acres within the South Fork Republican River basin to improve flows into Kansas 					
Next Step(s):					
<ul style="list-style-type: none"> Maintain monitoring and compliance through the Compact to protect Kansan's interests 					

Regional Goal #4	Goal Theme	Annual Progress
------------------	------------	-----------------

		2017	2018	2019	2020
Increase utilization and adoption of water conservation technology and practices by 10% by 2020. Actively seek annual funding to ensure successful achievement of goal.	Irrigation Water Use Efficiency			--	--
Progress Legend	Not Started	In Progress	Delayed	Cannot Complete	Complete
2018 Update:					
<ul style="list-style-type: none"> Continuation of Northwest Kansas Groundwater Conservation Foundation's cost share for irrigation technology within the region Expansion of irrigation technology outreach with development of water technology farms within the region 					
Next Step(s):					
<ul style="list-style-type: none"> Utilize a producer survey to establish a baseline of conservation technology and practices in use within the region Continue to educate producers on available technologies and conservation programs Continued support of water technology farms and education initiatives 					

Regional Goal #5	Goal Theme	Annual Progress			
		2017	2018	2019	2020
Encourage the state to coordinate with the USDA Risk Management Agency (RMA), as well as our Congressional delegation and neighboring states, to develop common sense tools for crop insurance that encourage water conservation and have such tools and policies available by 2016.	Irrigation Reduction Incentives			--	--
Progress Legend	Not Started	In Progress	Delayed	Cannot Complete	Complete
2018 Update: No new progress.					
Next Step(s):					
<ul style="list-style-type: none"> Continued outreach to inform producers of a crop insurance option that is supportive of water conservation efforts 					

References

"2018 303(d) List of All Impaired & Potentially Impaired Waters." *Kansas Department of Health and Environment*,
[http://www.kdheks.gov/tmdl/2018/Approved_2018_303_d\)_List_of_All_Impaired_Waters.pdf](http://www.kdheks.gov/tmdl/2018/Approved_2018_303_d)_List_of_All_Impaired_Waters.pdf).

Butler, J.J., et al. "High Plains Aquifer Index Well Program: 2016 Annual Report." *Kansas Geological Survey*, www.kgs.ku.edu/Hydro/Publications/2017/OFR17_10/OFR2017-10.pdf.

"Drinking Water Watch." *Kansas Department of Health and Environment*, <http://165.201.142.59:8080/DWW/KSindex.jsp>.

"GMD4 LEMA Boundary Map." *Kansas Department of Agriculture – Division of Water Resources*, http://agriculture.ks.gov/docs/default-source/dwr-water-appropriation-documents/gmd4_lemma_map.pdf?sfvrsn=0.

"High Plains/Ogallala Aquifer Information." *Kansas Geological Survey (KGS) - High Plains / Ogallala Aquifer Information*, www.kgs.ku.edu/HighPlains/index.shtml.

"Kansas High Plains Aquifer Atlas." *Kansas Geological Survey*, www.kgs.ku.edu/HighPlains/HPA_Atlas/index.html.