

# State of the Resource & Regional Goal Action Plan Implementation Report

August 2018

## Marais des Cygnes Regional Planning Area



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## Executive Summary

The Marais des Cygnes 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.

Surface and groundwater resources within the Marais des Cygnes Region suffered from lower than normal precipitation from 2010 to 2016. Due to very low precipitation in 2012, water use peaked at just under 44,000 acre-feet for the region, with surface water more than 42,000 acre-feet in 2012.

Water quality and related water resource issues are addressed through a combination of watershed restoration and resource protection efforts utilizing voluntary, incentive-based approaches, as well as regulatory programs. Currently, the federal reservoirs within the region with Total Maximum Daily Loads (TMDLs) are Pomona and Hillsdale reservoirs. Pomona Lake has both a siltation and an eutrophication TMDL, whereas Hillsdale Lake only has a TMDL for eutrophication. Watersheds with WRAPS projects currently underway encompass high priority areas for TMDL implementation, nutrient reduction, and wetland and riparian protection

Sediment reduction is ongoing within the region and the majority of achievements within the region to reduced sediment are due to the implementation of Best Management Practices (BMPs). Prior to 2017, 1% of the average annual sedimentation reduction occurred from implementing streambank stabilization projects, while 99% occurred from the implementation of BMPs. In 2017, 0% occurred from streambank stabilization projects and 100% from implementation of BMPs.

Given the projected sedimentation and water supply demands, results indicate the Marais des Cygnes River Basin and Hillsdale Lake supply will be insufficient to fully meet projected demands through a 1950s type drought by the years 2068 and 2050, respectively.

To reduce sediment, and ensure a safe and reliable source of water, coordination between federal, state, and local entities is being organized to match similar goals and work being accomplished in order to leverage funding. Working with the Conservation Districts, Watershed Restoration and Protection Strategy (WRAPS), Kansas Department of Health and Environment (KDHE), and Kansas Department of Agriculture-Division of Conservation (KDA-DOC), the Regional Advisory Committee (RAC) will assist in planning and facilitating cover crop and soil health field days.

The strategies of securing water supply for the demand in the region and reducing sedimentation are key components to ensure the Marais des Cygnes Region will have a safe and reliable water source for all its citizens, now and 50 years into the future.

## Water Use Trends

Surface water is the primary source of water within the Marais des Cygnes Region, accounting for approximately 99% of the total reported water use (Figure 2). Groundwater sources within the region are the alluvial deposits along major streams and are not a primary water source (<1%). Municipal use (49%) is the primary use for surface water sources within the region. Other reported surface water use within the region includes industrial (38%), recreation (7%), irrigation (6%) and stock water (<1%). Irrigation use (58%) is the primary use type for groundwater sources. Other reported groundwater use within the region includes municipal (40%), industrial (1%), and recreation (<1%). There is no reported stockwater use in this region from groundwater sources.

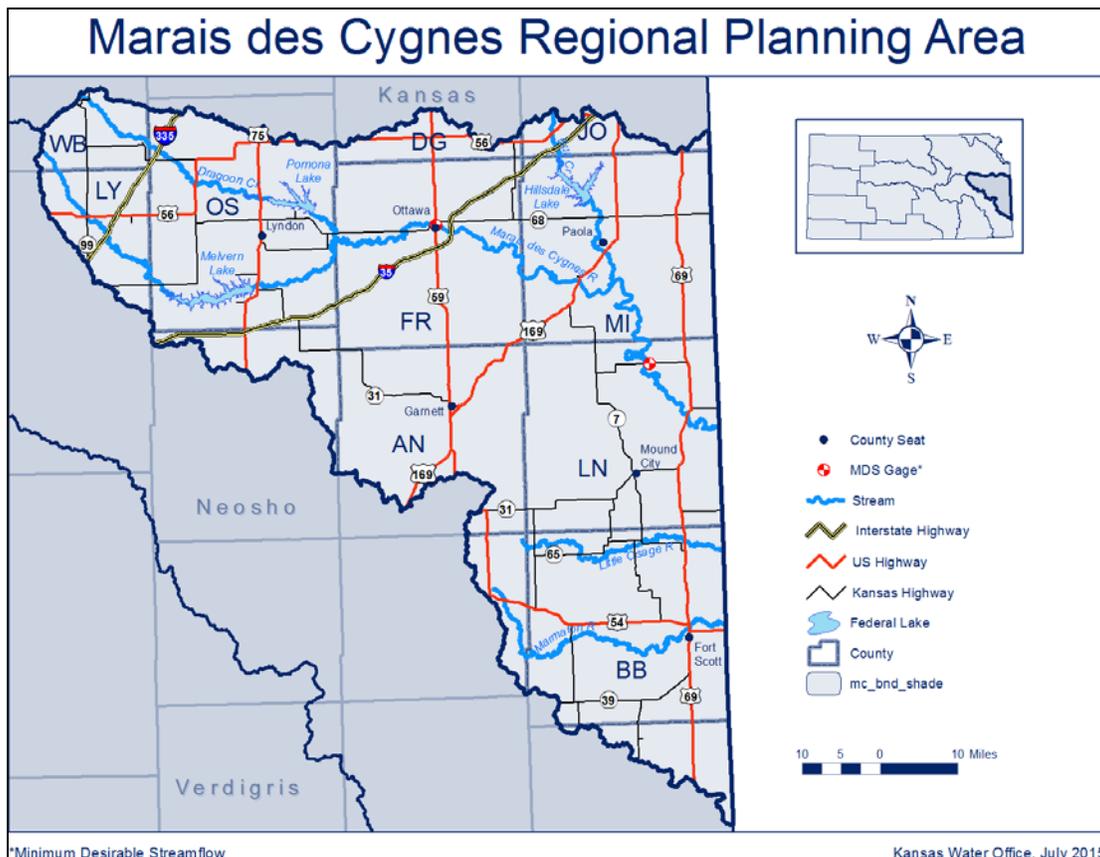


Figure 1: Marais des Cygnes Regional Planning Area

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 taking place during periods of cooler and/or wetter weather.

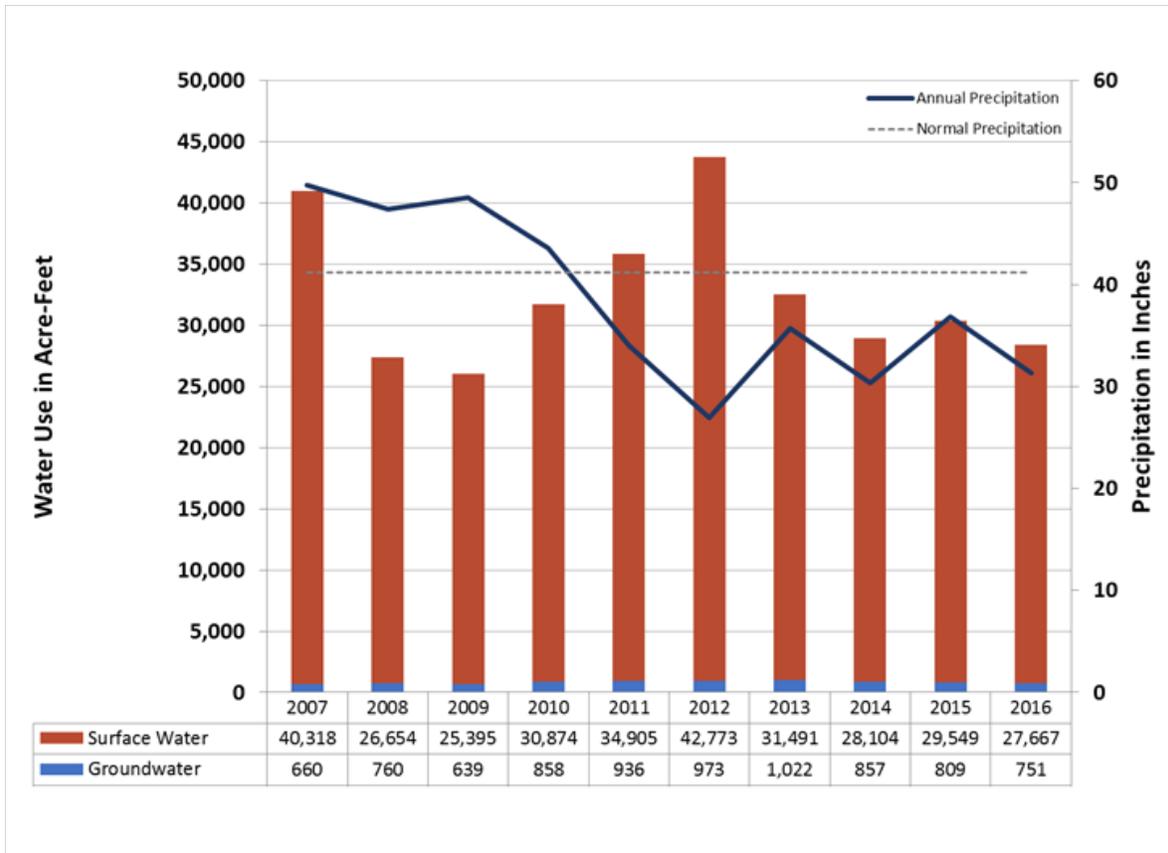


Figure 2: Annual surface and groundwater water reported use with precipitation data, Marais des Cygnes Region

## Water Resource Conditions

### Groundwater

Groundwater is not a major source of water supply for this region, accounting for <1% of water use reported for this region (Figure 3).

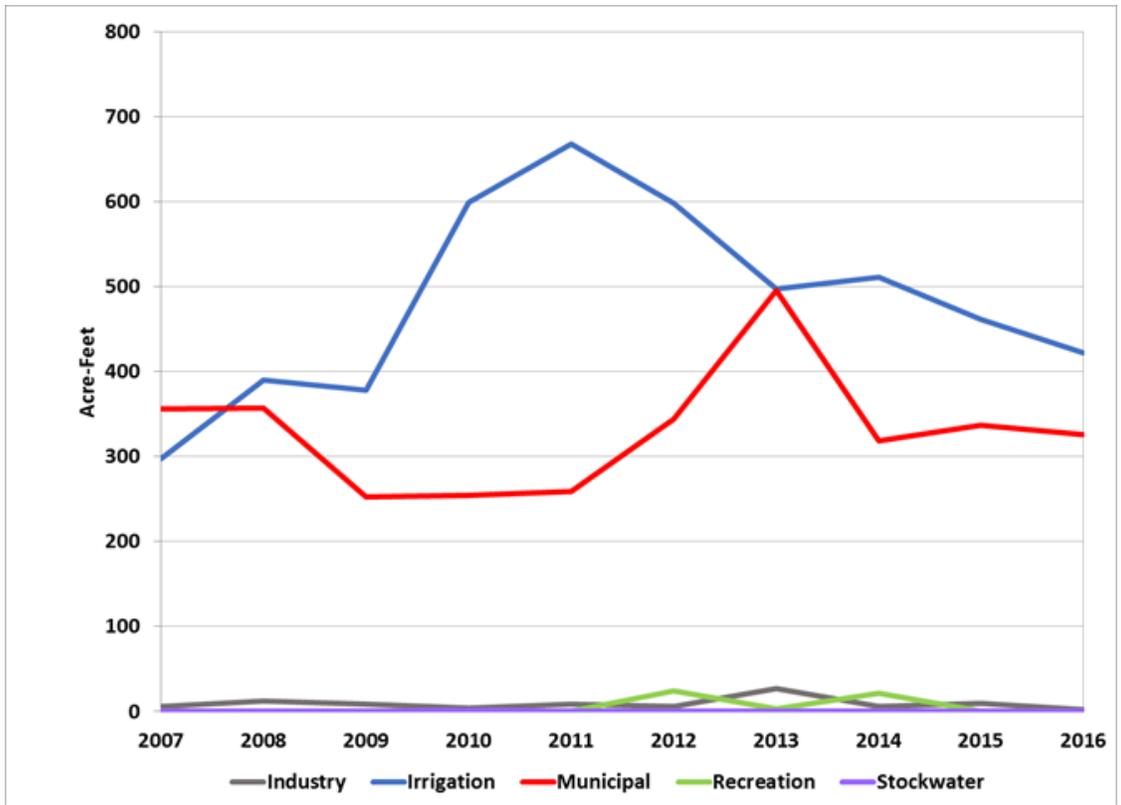


Figure 3: Annual reported groundwater use by type

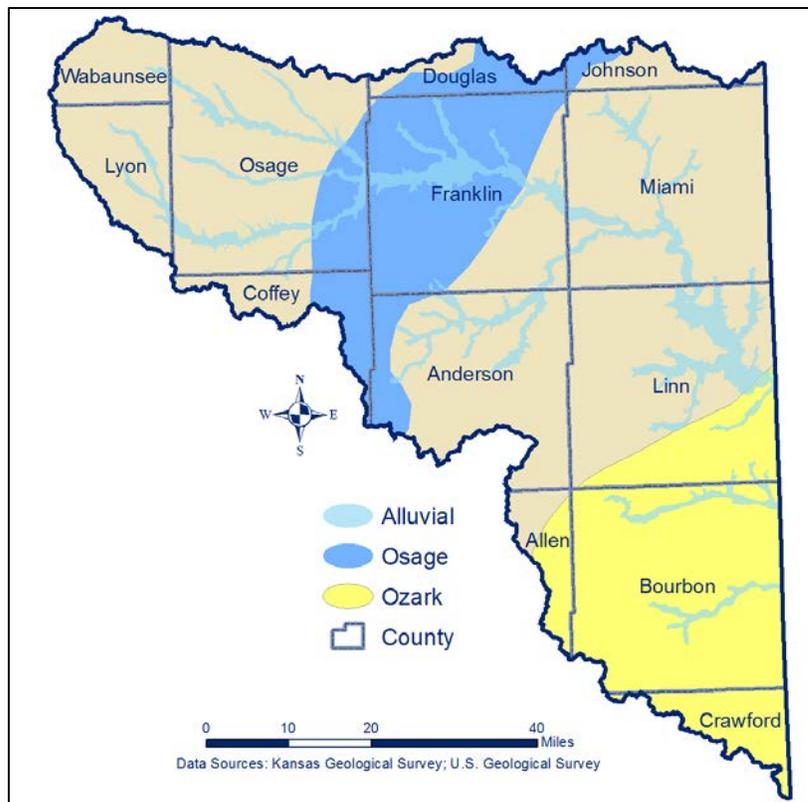


Figure 4: Aquifers of the Marais des Cygnes Region

## Surface Water

The Marais des Cygnes River begins in Wabaunsee County and flows east and south to join the Little Osage River in Bates County, Missouri. Dragoon Creek, Bull Creek, Pottawatomie Creek, and Sugar Creek are major tributaries in Kansas. The Marmaton and Little Osage Rivers originate in Kansas and join in Missouri just above their confluence with the Marais des Cygnes to become the Osage River.

Surface water accounts for 99% of the reported water use in the Marais des Cygnes Region, with almost 50% being used for municipal use and nearly 40% used for industrial purposes. As seen in Figure 5, municipal use is fairly steady from year to year. However, industrial use, mainly due to the La Cygne Power Generating Station's use for its cooling lake, tends to fluctuate based on climatic conditions.

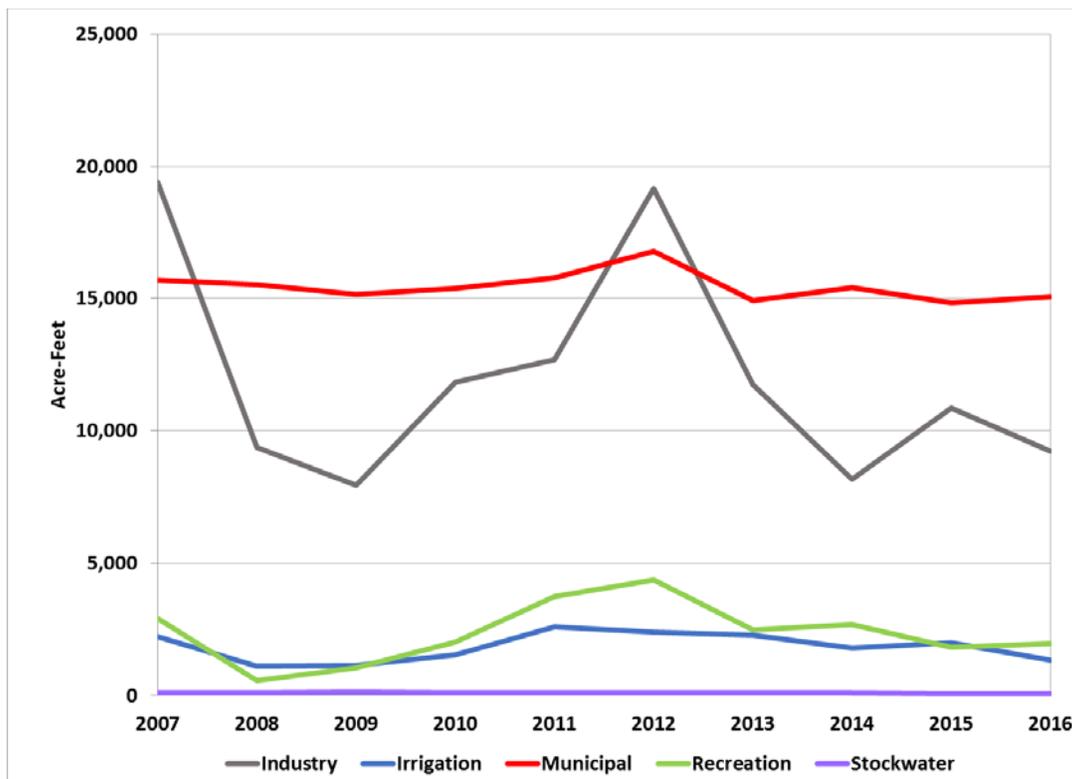


Figure 5: Annual surface water use by type of use

The Marais des Cygnes Region has three federal reservoirs which are operated by the United States Army Corps of Engineers (USACE). These reservoirs are Hillsdale Lake, Melvern Lake and Pomona Lake. Other significant impoundments include the La Cygne Power Generating Station Lake and impoundments within the Marais des Cygnes Wildlife Management Area and Refuge. Four state multipurpose small lakes have been constructed in the region: Bone Creek, Xenia, Cedar Creek and Little Sugar Creek.

Each of the three federal reservoirs have fluctuating water levels throughout the year, as can be seen in the past two years of recorded lake level elevations in Figures 6-8.

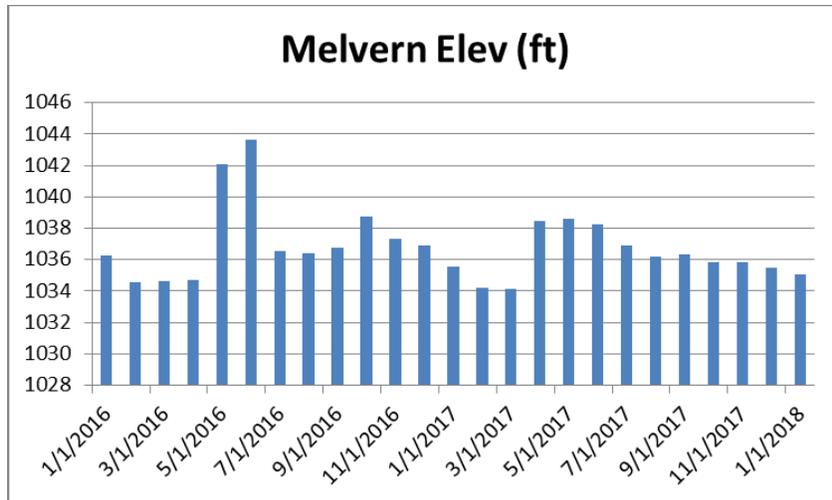


Figure 6: Elevation in Melvern Lake, conservation pool elevation: 1,036 feet

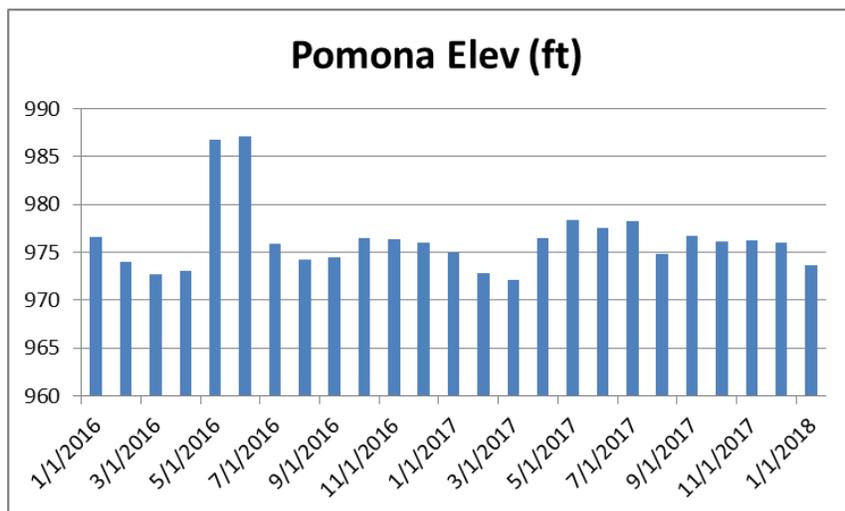


Figure 7: Elevation in Pomona Lake, conservation pool elevation: 974 feet

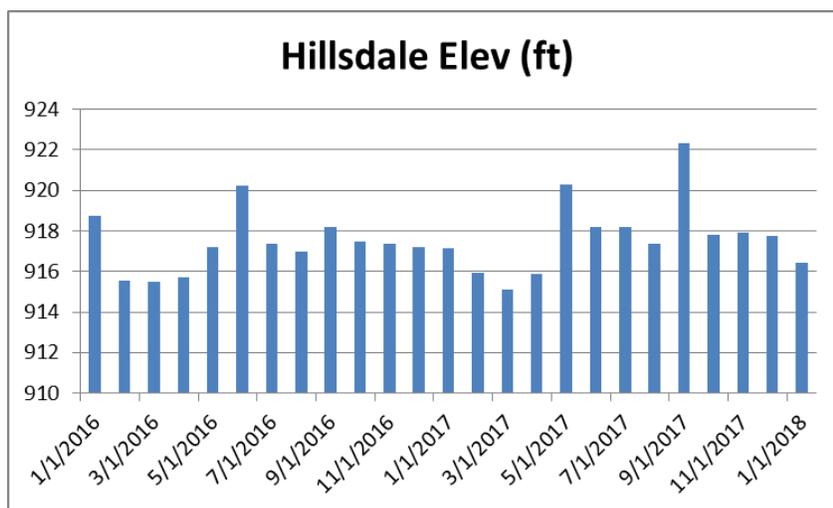


Figure 8: Elevation in Hillsdale Lake, conservation pool elevation: 917 feet

The fluctuation in lake levels is due to precipitation trends and water management strategies to operate the lakes for the [Water Assurance District and the Water Marketing Program](#). The [Lake Level Management Plan](#) dictates levels for Pomona and Hillsdale Lakes.

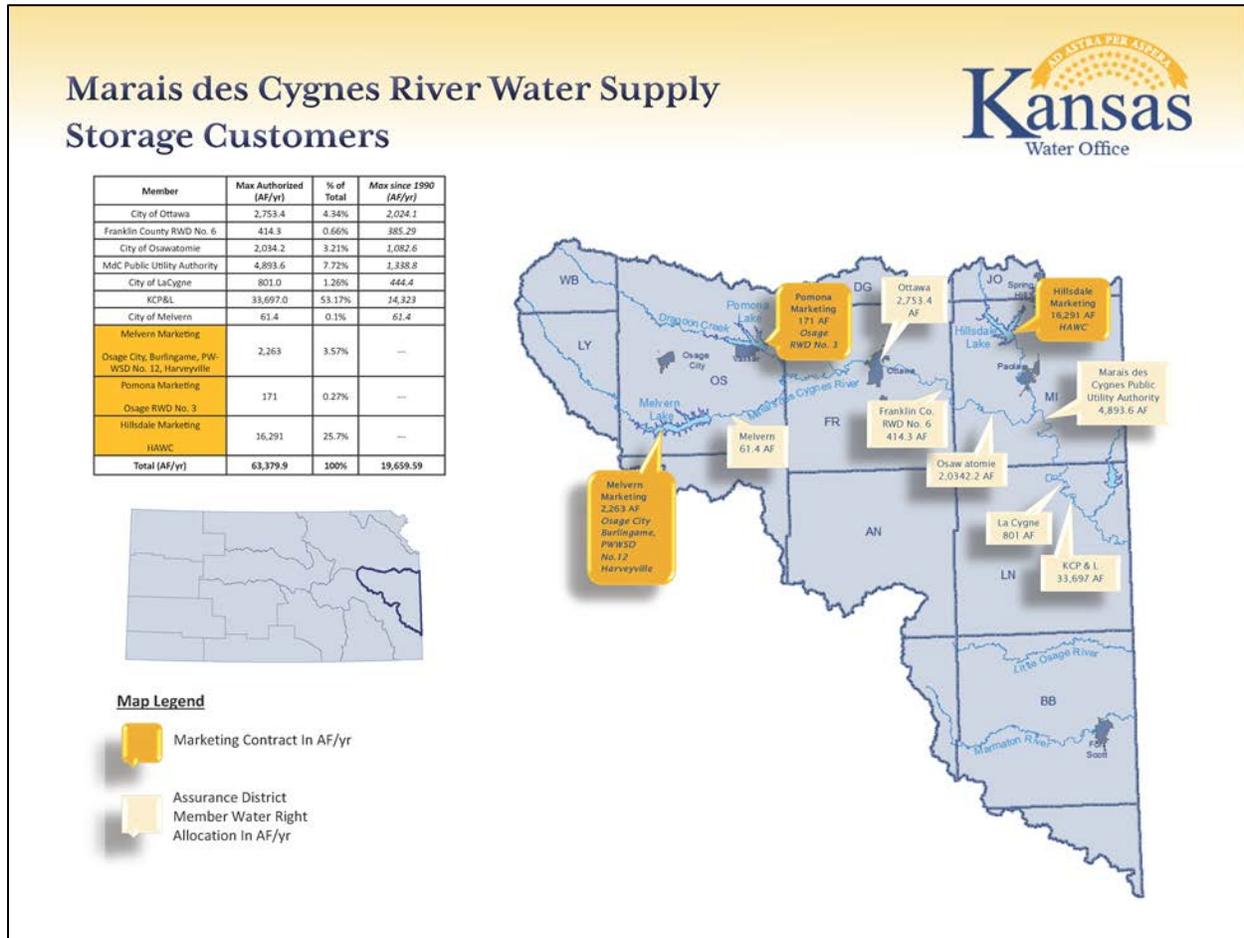


Figure 9: Marais des Cygnes River water supply storage customers

## Water Quality

### Surface Water

Water quality and related water resource issues are addressed through a combination of watershed restoration and resource protection efforts utilizing voluntary, incentive-based approaches, as well as regulatory programs. 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). Total Maximum Daily Loads are quantitative objectives and strategies needed to achieve the state’s surface water quality standards. A list of all impaired/potentially impaired water for the Marais des Cygnes Region can be found on the KDHE [impaired waters](#) website.

Table 1 includes the changes that occurred from the 2014 303d listing to the 2016 303d listing for the region.

Table 1: TMDLs in Marais des Cygnes Region with associated changes

HUC 8	Waterbody Name	Description of Change	Category	Impairment	Station
10290102	Middle Creek Near New Lancaster	Delisted in 2016	2	Zinc	SC697
10290101	Marais Des Cygnes River Near Quenem	Delisted in 2016	2	Copper	SC720
10290102	Middle Creek Near New Lancaster	Insufficient data to make use designation	3	E. coli	SC697
10290101	Pomona Lake	New TMDLs developed since 2014	4a	Eutrophication	LM028001
10290101	Pomona Lake	New TMDLs developed since 2014	4a	Siltation	LM028001
10290102	Hillsdale Lake	New TMDLs developed since 2014	4a	Eutrophication	LM035001

In the Marais des Cygnes Region, the federal reservoirs with TMDLs are Pomona and Hillsdale reservoirs. Pomona Lake has both a siltation and an eutrophication TMDL, whereas Hillsdale Lake only has a TMDL for eutrophication.

Watersheds with WRAPS projects currently underway encompass high priority areas for TMDL implementation, nutrient reduction, and wetland and riparian protection (Figure 10).

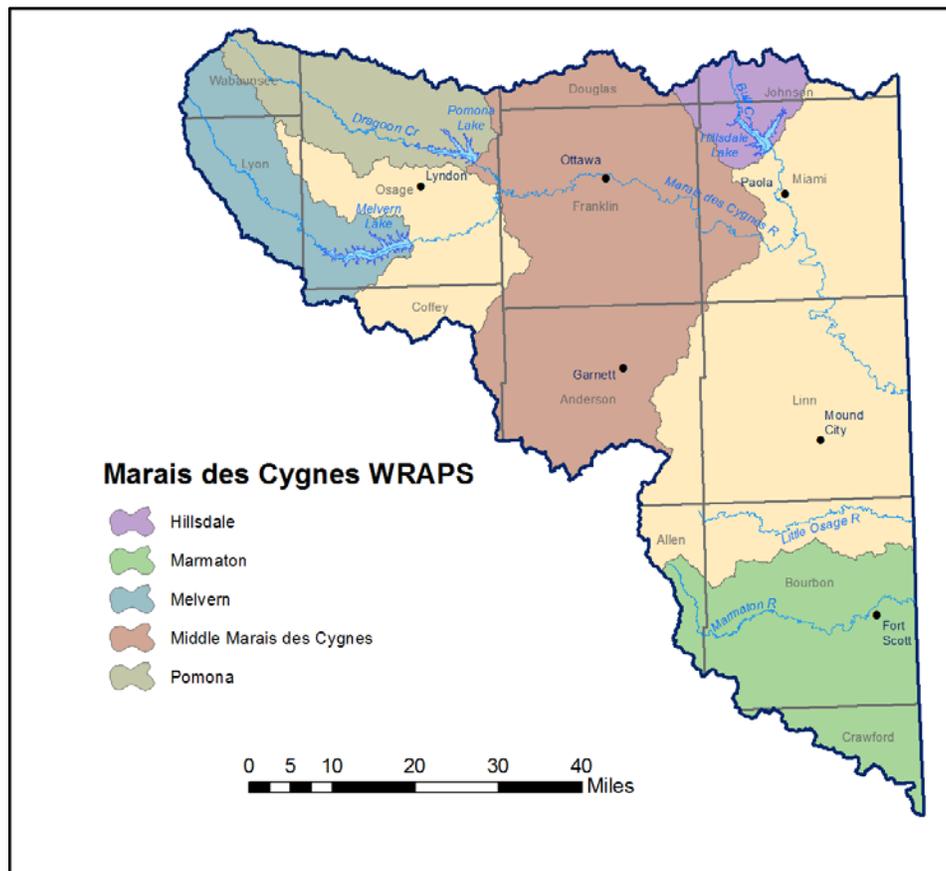


Figure 10: WRAPS projects within Marais des Cygnes Region

An important consideration for WRAPS in this region, particularly in the northern portion, is urbanization. Urban stormwater management programs can be implemented to manage the amount of impervious surface in urbanizing watersheds and properly control increased runoff resulting from urbanization. Programs that provide technical assistance and education to urban residents regarding

actions that can reduce or eliminate potential pollution sources also play an important role. These programs can be integrated with WRAPS projects to ensure a comprehensive approach to watershed management in urban areas. All conservation districts in the region have adopted nonpoint source pollution and wetland and riparian management plans. Among cities in the region, only Ottawa is subject to the Phase II Permitted Municipal Separate Storm Sewer System under the National Pollution Discharge Elimination System (NPDES) Stormwater Program.

### Harmful Algal Blooms

Harmful Algal Blooms (HABs) are common in bodies of water when nutrient loading is excessive and during periods of elevated temperatures. In the Marais des Cygnes Region, HABs are not extremely prevalent, but have occurred in some water bodies. In the past six years, Hillsdale Lake and Crystal Lake have experienced HABs once and the Melvern Outlet pond has experienced them three times (Table 2).

Table 2: Hillsdale Lake, Crystal Lake, and Melvern Outlet Pond HABs from 2011-2017

Water Body Name	2011	2012	2013	2014	2015	2016	2017
Hillsdale Lake	x						
Crystal Lake					x		
Melvorn Outlet Pond					x	x	x

Health effects of HABs are well documented, from flu like symptoms in humans to the death of pets, mainly dogs. Water supplies are often shut down during the blooms and beaches are closed and 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.

Two levels of public health may be issued by KDHE for protection notifications: a Public Health Watch or Public Health Warning. These notification levels are determined by the concentration of a harmful toxin(s) or the concentration of cyanobacteria cell counts. For 2017, HAB conditions were reported on Overbrook City Lake from June 29 to November 2 and for the Melvern Outlet Pond August 3 to November 28 (Figure 11). More information can be found through [KDHE's website](#).

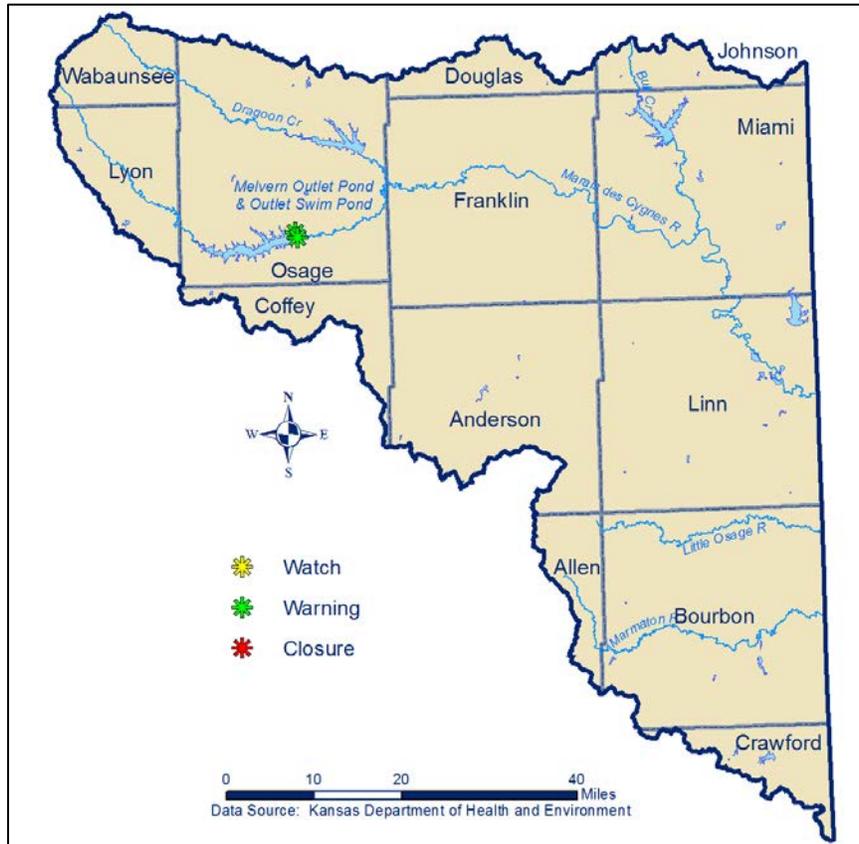


Figure 11: HABs in Marais des Cygnes Region

### Sedimentation

Sedimentation is a major issue in the eastern regions of the state and creates many challenges to managing reservoir water supplies. As reservoirs age, they accumulate sediment, reducing the reservoir's capacity to hold water supply for municipal and industrial customers, meet in lake recreation, and downstream water quality and habitat needs. The reservoirs in this region are all affected by sedimentation and loss of storage capacity is a concern.

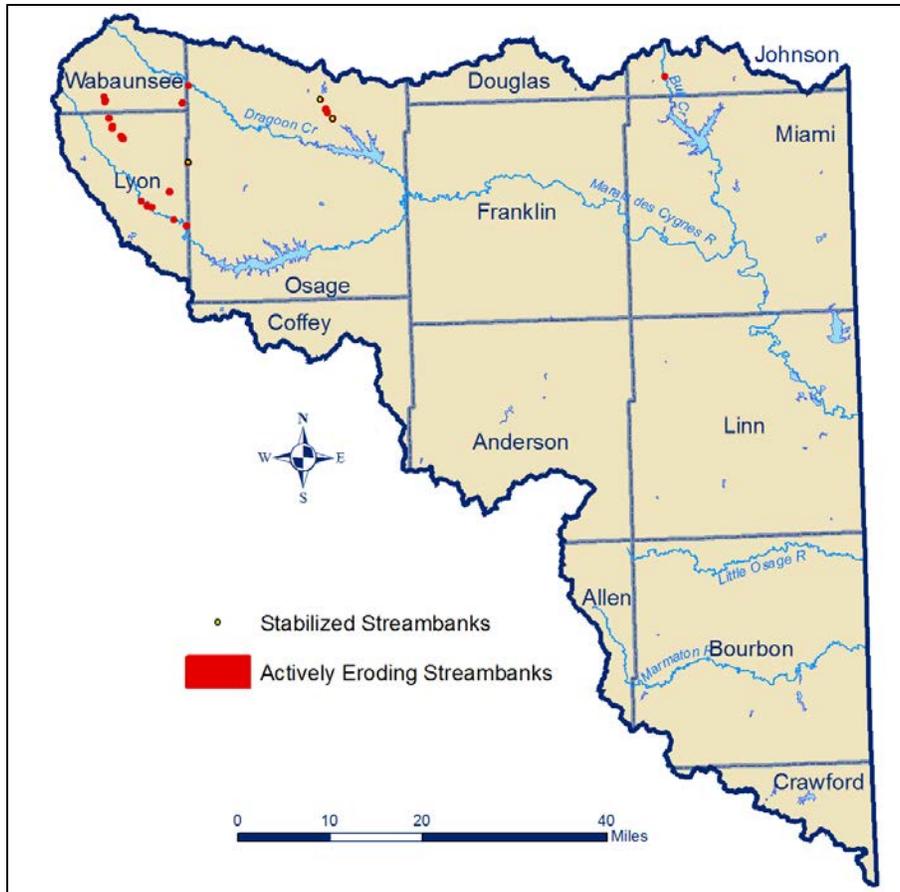


Figure 12: Marais des Cygnes Regional Planning Area streambank stabilization projects

The sedimentation rate within in the Marais des Cygnes Region is partly due to streambank erosion above each reservoir. Currently, there are 23 streambank hotspots above the three federal reservoirs in the region (Figure 12) and three of these 23 sites have been stabilized, reducing the sediment load by an estimated 157 tons per year. There are 20 sites that remain to be completed and if completed, will reduce the sediment load by an additional estimated 5,074 tons per year.

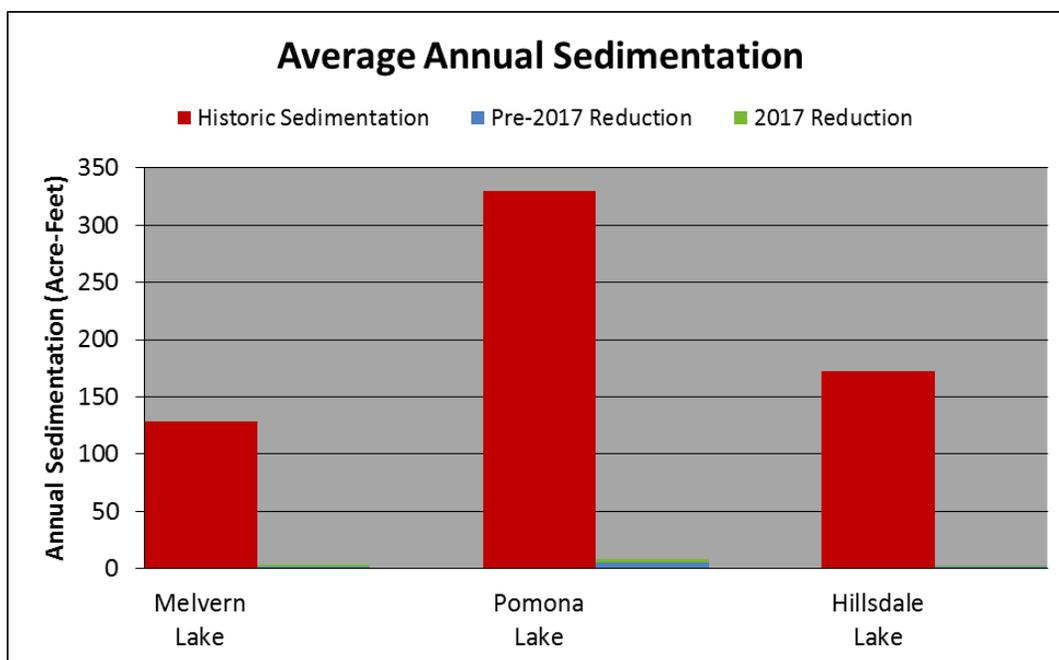


Figure 13: Average annual sedimentation in Marais des Cygnes Region reservoirs

Figure 13 shows the average annual sedimentation, estimated using the change in conservation storage between bathymetric surveys, compared to the estimated sediment load reduction due to BMPs and stream stabilization project implementation in the watersheds above the federal reservoirs in the region.

The estimated annual reductions compare total implementation prior to 2017 (beginning in 2004) to reduction in 2017. The results show Pomona Lake has the highest historical sedimentation rate of 330 acre-feet per year, higher than Melvern Lake and Hillsdale Lake combined.

Nearly all sediment reduction has been achieved through BMP implementation. Prior to 2017, 1% of the average annual sedimentation reduction occurred from implementing streambank stabilization projects, while 99% occurred from the implementation of BMPs. In 2017, 0% occurred from streambank stabilization projects and 100% from implementation of BMPs.

Figure 14 shows the change in reservoir sedimentation from the implementation of load reduction practices. Results show the estimated load reduction from implemented practices for all lakes only accounts for a small fraction of the total historical sedimentation.

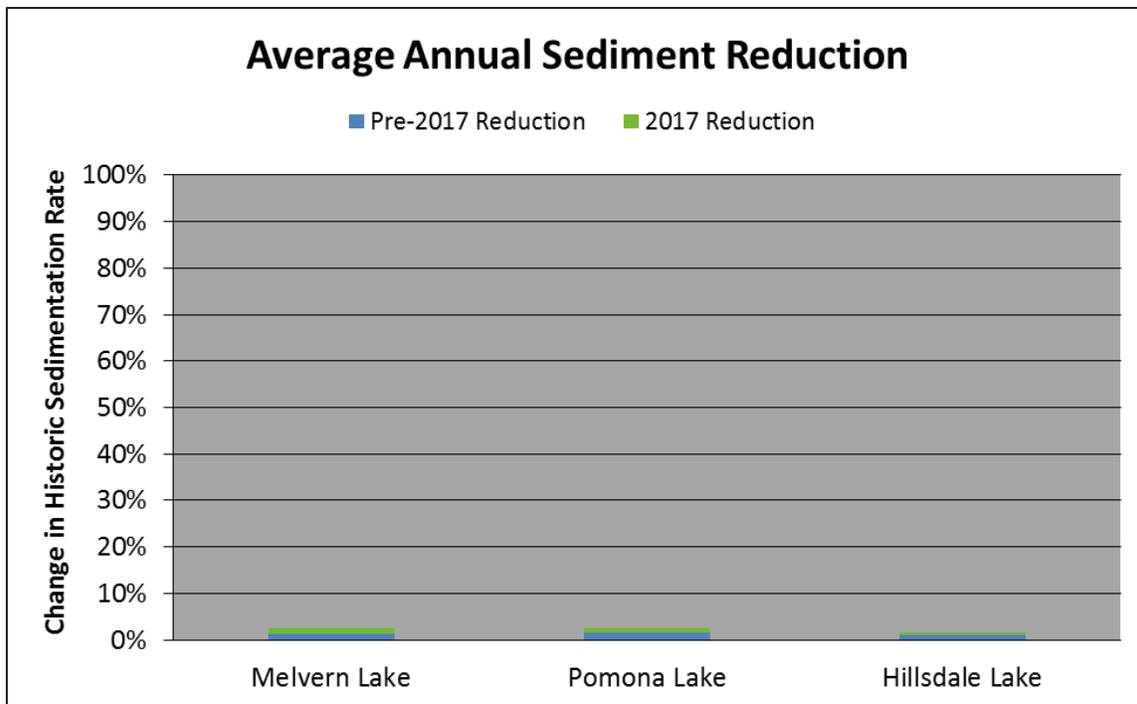


Figure 14: Average annual sediment reduction in Marais des Cygnes Region reservoirs

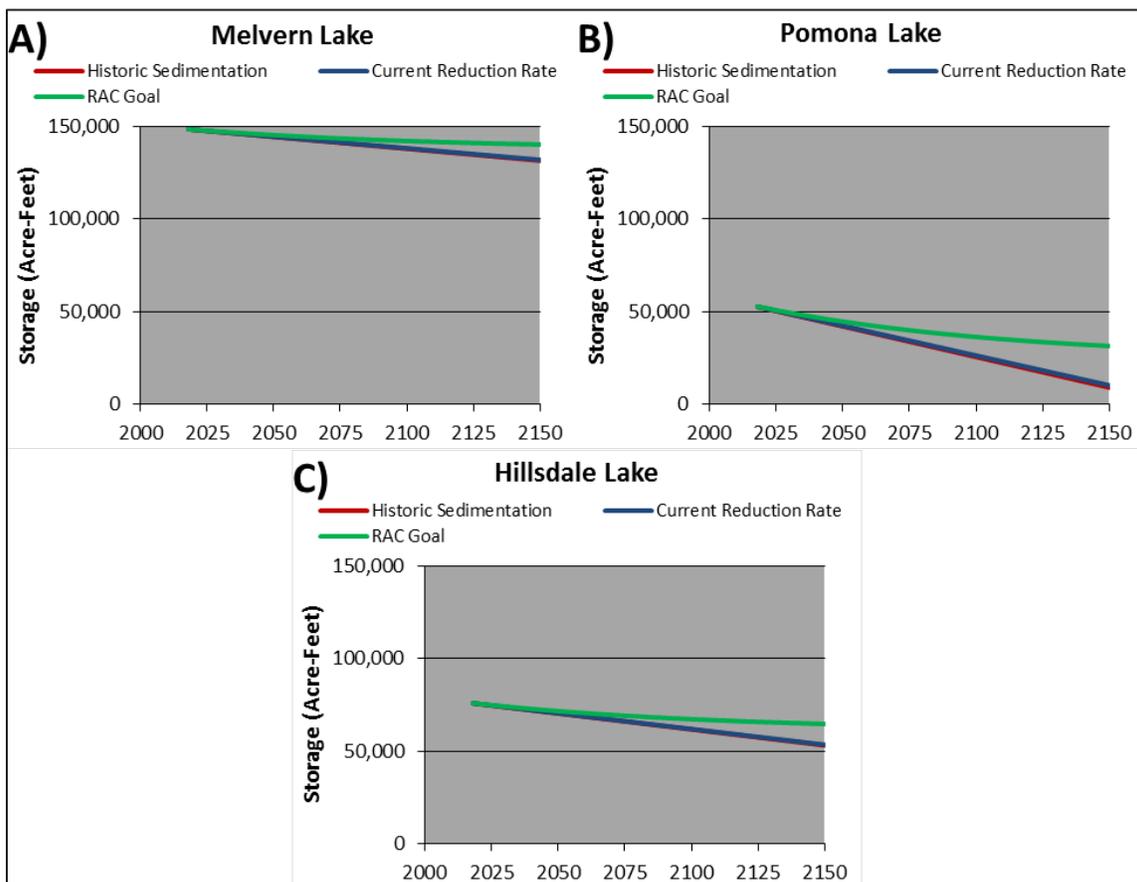


Figure 15: Reservoir capacity at conservation pool for Marais des Cygnes Region reservoirs

There is almost a non-detectable difference between the historic sedimentation rate and the estimated current rates with the projected sedimentation over time in Figure 15. This clearly illustrates the inadequacy of current sediment control practices.

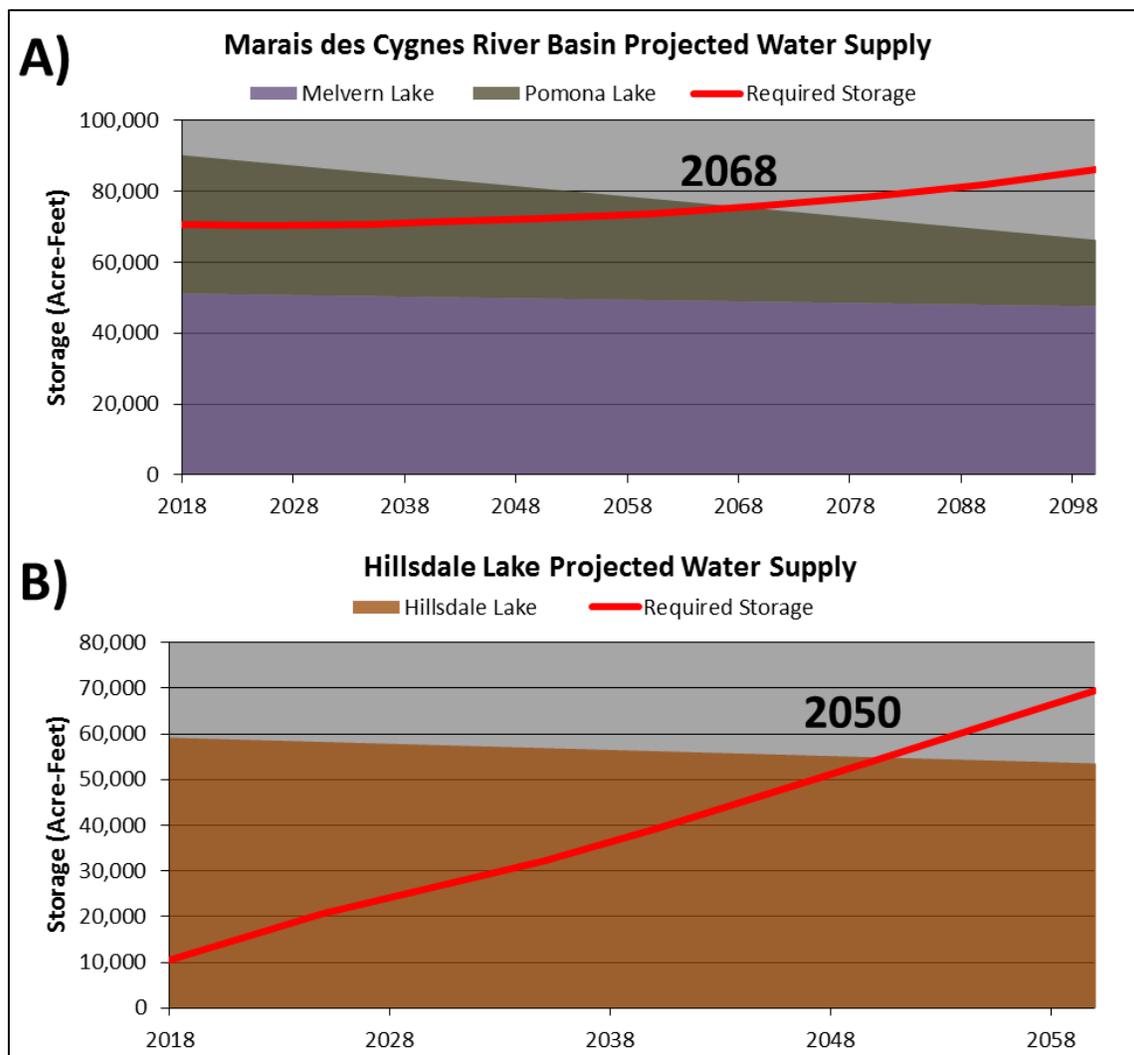


Figure 16: Marais des Cygnes Region projected water supply storage

Figure 16 shows the projected water supply storage given the historic rate of reservoir sedimentation based on the change in bathymetric surveys (earliest survey versus most recent survey). It also shows the storage required to meet the system’s demands and targets. The supply/demand analysis was separated into two sub-basins, the Marais des Cygnes River Basin and Hillsdale Lake, given their separate operations and water users.

The analysis was performed with current system operations using a Marais des Cygnes Region model which simulated historic hydrologic conditions between 1950 and 2014, allowing for an estimate of required storage. Given the projected sedimentation and demands, results indicate the Marais des Cygnes River Basin and Hillsdale Lake supply will be unable to fully meet projected demands through a 1950s type drought by the years 2068 and 2050, respectively.

## Zebra Mussels

Zebra mussels, one of the Aquatic Nuisance Species (ANS) affecting Kansas waters, are found in all the federal reservoirs within the Marais des Cygnes Region. Smaller county and public water supply lakes are mostly infested as well. Aquatic Nuisance Species affect the quality of water and recreational opportunities within the State of Kansas. The Kansas Department of Wildlife, Parks, and Tourism (KDWPT) has worked diligently on their ANS education and management plan in order to mitigate the ANS problem and work to slow the migration. The final Kansas ANS Plan is located on the [KDWPT website](#).

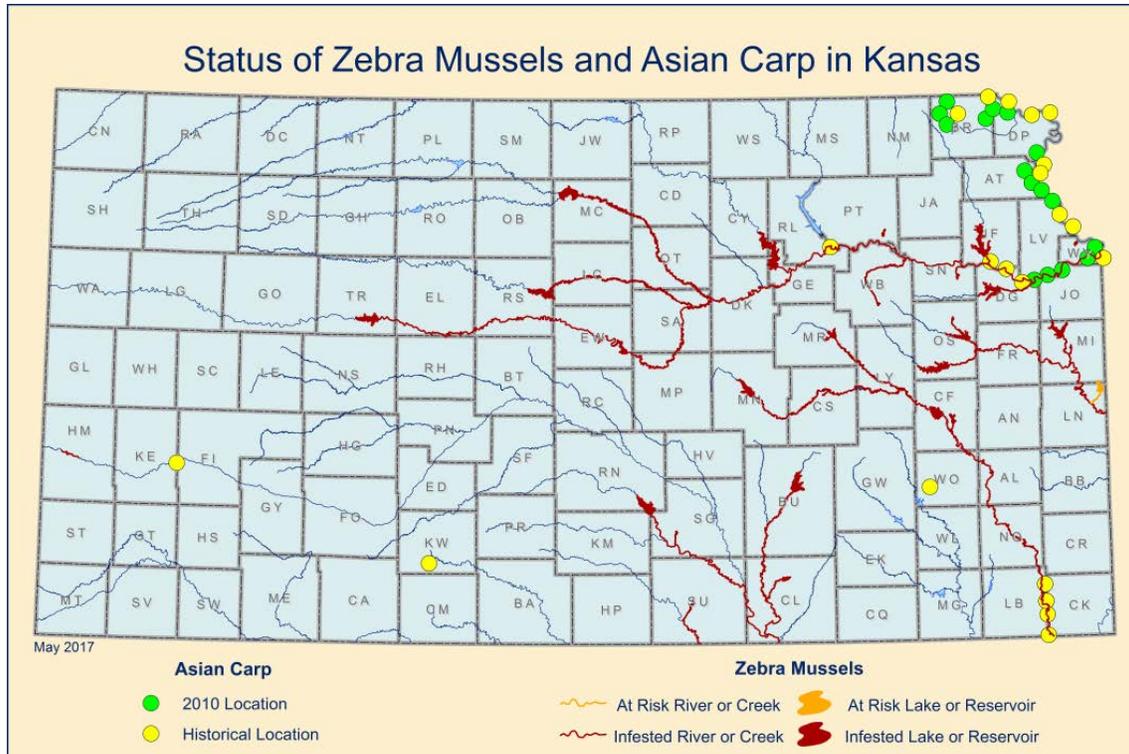


Figure 17: Status of Zebra mussels and Asian carp in Kansas

## Implementation Progress

As noted in the goals for the Marais des Cygnes Region, implementation of the RAC's plans is critical. In order to reduce sediment loads entering public water supply reservoirs and ensure adequate supply for the region, progress must be made in the efforts to accomplish these goals. In the past year, the following actions have been taken.

The modeling of the region by KWO has begun using the Multi-basin Evaluation of Kansas Reservoir Operations (MEKRO) model. It's a hydrologic model utilized by KWO to assess the operational capability and physical adequacy of the reservoir and surface water systems in Kansas. Inputs to the model include historic inflows, reservoir storage capacities, system demands, and downstream target flows. The model is a planning tool that enables KWO staff and others to evaluate the effects operational changes,

reservoir improvements, reservoir sedimentation and demand modifications could have on the individual basin systems in Kansas.

To showcase the capabilities of the model and to receive RAC input, a Drought Workshop was held in September. Based on this workshop and continued use and refinement of the model, drought scenarios can be evaluated to create plans and strategies to mitigate and manage drought conditions. The Marais des Cygnes RAC has initiated work with the KWO, and will continue to use the model, in order to evaluate calling-in the unallocated storage in Melvern Lake and evaluate pool rises at Pomona and Hillsdale Lakes. In using this model, to ensure the best possible information is used as inputs, the region's population projections will be evaluated for their supply needs to ensure the demand can be met and exceeded by 10% through the year 2050.

Additionally, smaller, non-federal lakes are being evaluated within the region to better understand the available supply and demand need in all areas of the region not being served by the mainstem Marais des Cygnes River and/or one of the federal reservoirs. This evaluation will allow for areas that are underserved to be identified. The evaluation will also help to identify possible locations that could benefit from the construction of a small public water supply lake.

To reduce sediment loads within the region in order to help protect water supply and water quality, the RAC has started working with KDHE and KDA-DOC to align matching goals and plans contained in the WRAPS groups' 9-Element plans, the conservation districts, and the RACs action plans. Aligning the goals and plans will help leverage work done and funds available.

Part of the work to reduce sedimentation and improve water quality is the implementation of BMPs. As part of the RACs goals and action plans, the RAC is evaluating the reduction of sediment loads that have occurred through the work done by the WRAPS groups and the conservation districts. This evaluation is looking at the BMPs implemented in both urban and rural settings and includes BMPs such as; cover crops, No-Till, terraces, grass waterways, etc. Table 6 shows a summary of the load reductions in 2017.

Table 6: 2017 load reductions by region and reservoir

Region & Watershed	Nitrogen (lbs/yr)	Phosphorus (lbs/yr)	Sediment (tons/yr)
<b>Marais des Cygnes</b>	<b>30,454</b>	<b>16,699</b>	<b>4,623</b>
Not above a federal reservoir	21,632	11,659	563
Hillsdale Lake	1,063	581	263
Melvern Lake	2,344	1,372	1,027
Pomona	5,414	3,086	2,770
<b>Grand Total</b>	<b>30,454</b>	<b>16,699</b>	<b>4,623</b>

## Implementation Needs

While the Marais des Cygnes RAC has begun to address the water supply and water quality concerns within the region, continued work needs to be completed. With the Kansas Water Authority's (KWA)

approval of the RAC's plans of action, the following items need to be addressed or continued to be addressed:

- **WRAPS, conservation districts, and RAC collaboration to compare plans and goals in order to leverage funding.** The initial stages were started by KDHE. Once matching goals and plans are identified, then strategies to leverage funding throughout the next year need to be developed. In conjunction with this, evaluation of BMPs that have been implemented will take place to understand the amount of sedimentation reduced to date, as well as future load reductions needed.
- **MEKRO modeling of the region looks at supply and demands during drought conditions.** The RAC and KWO have started utilizing the model to evaluate supply and demand by region. Continued development of the model's capabilities will need to be addressed. The evaluation of calling-in unallocated storage and pool raises will be evaluated for feasibility and cost.
- **Evaluation of nonfederal public water supply lakes within the region to determine if all areas have access to a reliable water source.** The RAC and KWO have initiated this evaluation. New demand and population projections continue to be evaluated. As areas are identified to have increased population and/or demand, the amount of water supply available to them will be evaluated. Evaluation of the location and available supply of the nonfederal public water supply lakes will need to be completed. Identifying and evaluating both the supply and demand will allow a full view of water supply needs within the region.

Conservation practice implementation continues to be necessary to reduce nutrient and sediment runoff impacting the surface waters of the Marais des Cygnes Region. Progress made within the region can be compared to the remaining needs identified to quantify the overall financial need to fully implement watershed plans in this region (Table 7). These figures include costs associated with conservation practice implementation, as well as technical assistance needs to help landowners implement conservation practices. Overall, the total remaining need to fully implement WRAPS watershed plans for the region is \$15 million.

Table 7: 2017 costs by region

RAC Area	Number of plans	State Interest Priority Score Rank	Updated Information and Education Costs	Updated Total Livestock and Cropland Plan Costs	Updated Technical Assistance Plan Costs	Updated Total Implementation Plan Costs
	(5) Plans					
<b>Marais des Cygnes</b>	Hillsdale	20	\$1,976,987.70	\$3,312,298.80		\$1,330,083.90
	Marmaton	18	\$2,028,980.70	\$1,446,892.20		\$7,000,848.90
	Melvern	29	\$156,000.00	\$191,559.00	\$70,337.00	\$219,060.00
	Middle Marais des Cygnes	33	\$1,354,500.00	\$1,680,264.90		\$100,822.50
	Pomona	15	\$1,398,717.60	\$7,701,077.07	\$846,689.00	\$6,660,557.87
<b>Total</b>			<b>\$6,915,186.00</b>	<b>\$14,332,091.97</b>	<b>\$917,026.00</b>	<b>\$15,311,373.17</b>

## 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 Marais des Cygnes 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
Reduce cumulative sediment loads entering public water supply impoundments by 10% in the Marais des Cygnes Region every 10 years to extend the life of existing infrastructure.	Sedimentation and Water Supply and Storage			--	--
Progress Legend	Not Started	In Progress	Delayed	Cannot Complete	Complete
2018 Update:					
<ul style="list-style-type: none"> <li>WRAPS, Conservation Districts, and the RAC are collaborating with each other, as well as KDHE and DOC to plan and attend field days that focus on cover crops and soil health</li> <li>KWO is modeling the region to see if a reallocation study will need to be conducted or if changes in reservoir management need to be made</li> </ul>					
Next Step(s):					
<ul style="list-style-type: none"> <li>Plan and conduct a cover crop and soil health field day to demonstrate the benefits of these and how they can reduce sedimentation</li> <li>Determination will need to be made to engage in a reallocation study with the USACE or if it is more feasible to hold off on this study until future needs necessitate this</li> </ul>					

Regional Goal #2	Goal Theme	Annual Progress			
		2017	2018	2019	2020
Increase sources of supply, at a minimum of one multipurpose structure, to meet increased demand in specific growth areas by 2035. In addition, ensure water supply available from storage exceeds projected demand by at least 10% through the year 2050.	Water Supply and Storage			--	--
Progress Legend	Not Started	In Progress	Delayed	Cannot Complete	Complete
2018 Update: KWO has begun to evaluate the small PWS lakes within the region and determine if demand is being met.					
Next Step(s): Finish the small PWS lake evaluation and review to see if there are unmet demands within the region.					

## References

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