

# Marais des Cygnes Basin High Priority Issue Water Supply Management and Conservation January 2009

## Issue

Increasing [population](#) and development in portions of the [Marais des Cygnes basin](#) along with aging reservoirs and public water supply infrastructure indicates a need to evaluate the river/reservoir system capacity to meet future water supply needs in the basin.

In 2007, the Kansas Water Office (KWO) prepared an analysis of surface water supply and demand projections for selected basins in eastern Kansas.<sup>(1)</sup> The analysis utilized historic climate, streamflow and population information to predict the total water supply and demand in the basin over time. In those counties primarily served by the Marais des Cygnes River and supported by federal reservoirs, demand was predicted to exceed the total existing supply during a two percent probability drought in the year 2109. This estimate includes the current state-owned supply along with the purchase of water supply storage in Hillsdale Reservoir reserved for future state use. The analysis did not include that portion of the basin supplied by Marmaton and Little Osage Rivers or other areas not served by the mainstem of the Marais des Cygnes.

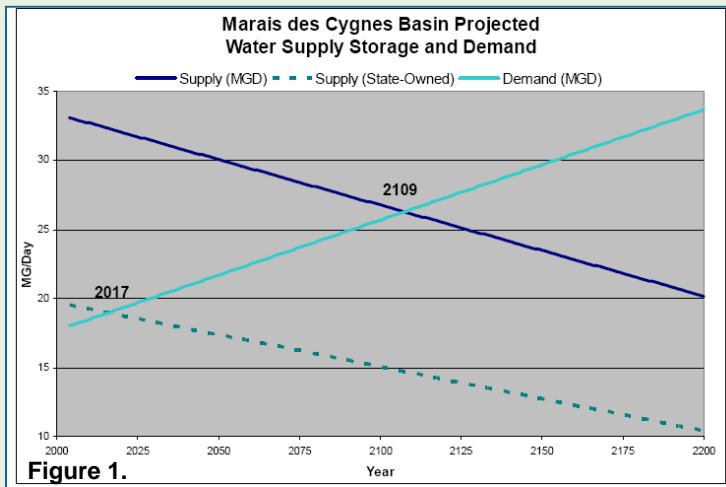


Figure 1.

Also in 2007, KWO released updated *Guidelines for Municipal Water Conservation Plans* for use by public water suppliers. While the supply and demand analysis did include implementation of some conservation practices during drought, demand management could extend water supplies. Controlling water loss and enhancing treatment efficiency could further enhance demand management.

In 2008, KWO initiated the Reservoir Sustainability Initiative (RSI) to conserve and restore reservoir storage capacity and provide for long-term public water supply

needs. Public water supply storage has been impacted by sedimentation in all the federal reservoirs in the basin. Maintaining this storage is critical to meeting future public water supply needs.

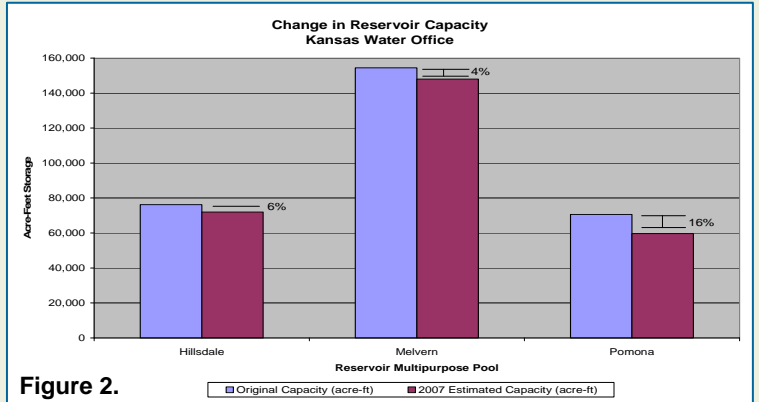


Figure 2.

## Description

### Water Supply

Water supply in the basin is primarily provided by three federal reservoirs: Pomona, Melvern and Hillsdale, along with four State Multipurpose Small Lakes, city-owned lakes, ground water wells and natural stream flows. All of the streams in this basin are restricted so that no new appropriation rights are available for the time period July through September (typically the irrigation season) unless there is an alternate source of water shown to be available.

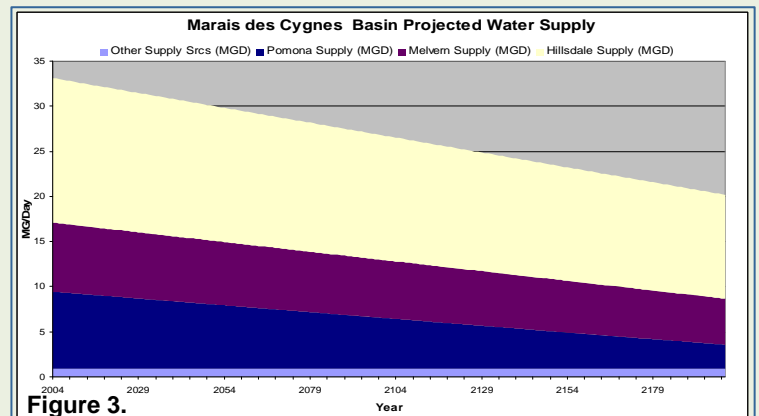


Figure 3.

Based on bathymetric survey information and projected sedimentation rates, reservoir water supply storage and yield was calculated over time in the basin by KWO in 2002.<sup>(4)</sup> The 2007 analysis of supply and demand in the Marais des Cygnes basin used the previously calculated yield available from the federal reservoirs in the basin along with natural flows to calculate the total available

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water supply in a severe drought similar to the 1950s. While the analysis showed adequate water supply in the basin into the next century, efforts are being made to reduce the rate of sedimentation in the reservoirs to extend the existing supply further.

The 2007 analysis was not structured to account for the quantity of water supply available in specific stream reaches under different conditions. A more refined modeling process using a computer model to identify water supply and demand at specific points in the basin has been initiated by the KWO in the Marais des Cygnes basin. Through the computer model, the available water supply at specific demand points and under various conditions in the basin can be estimated. KWO staff will work directly with water supply utilities, industry, other water users and the Marais des Cygnes Basin Advisory Committee (BAC) to obtain detailed information on expected water demand in the future. Minimum desirable streamflows (MDS) to support water quality along with aquatic life would be accounted for in the model.

### **Marketing and Assurance**

Reservoirs provide dependable water supplies in streams with highly variable flow in addition to providing flood control, recreation and other benefits. The 1958 Federal Water Supply Act made storage in federal reservoirs available to local governments if they agreed to repay the cost of construction, operation and maintenance of the water supply storage. The State of Kansas has purchased water supply storage in each of the federal reservoirs in the basin. The state gave a commitment to the federal government in 1969 that the water supply storage in Hillsdale Lake would be purchased if it was included during development of the reservoir.<sup>(4)</sup> Only a portion of this storage is currently being utilized; ultimately, all of the storage will be needed.

**Table 1.**

**Storage Capacity Estimated for year 2035\*\***

<b>Reservoir</b>	<b>Water Assurance*</b>	<b>Water Marketing</b>	<b>Reserve Capacity</b>	<b>Future Use</b>	<b>Total Storage</b>
Hillsdale	0	7,500	0	45,500	53,000
Melvorn	7,700	14,350	27,950	0	50,000
Pomona	7,700	0	24,800	0	32,500

\*Storage expressed in acre-feet

\*\* as per contract with Corps of Engineers

In 1985, through a Memorandum of Agreement (MOA) between the State of Kansas and the U.S. Army Corps of Engineers (Corps), water quality storage in Pomona

and Melvern Lakes was reallocated to water supply storage and purchased by the state at the original development cost.<sup>(4)</sup> The state purchased the maximum amount made available in the reallocation. In exchange for the significant reduction in cost, the state agreed to obtain water reservation rights for water quality storage and to protect water quality releases from diversion by water right holders.

The Water Marketing Program provides long-term (10-40 years) contracts for water supply for municipal and industrial uses only. [Customers of the Marketing Program](#) pay for water on a per 1,000 gallon basis and the state pays costs of the capital investment along with the annual operation and maintenance. The marketing rate is based on the combined costs for the 10 reservoirs where the state has purchased storage. The state currently has storage in Hillsdale and Melvern Lakes committed to the Water Marketing Program in the Marais des Cygnes basin. Hillsdale storage will be brought into service incrementally only as additional water supply is needed under the Water Marketing Program.

Prior to the KWO entering into negotiation for a contract under the Water Marketing Program, a determination is made by the Kansas Water Authority (KWA) that the proposed withdrawal and use of water is in the interest of the people of the State of Kansas. The amount of water that can be contracted is limited to a quantity that is estimated to be available during a significant drought. Water not needed to meet long-term contract obligations can be acquired annually under a surplus contract. Surplus contracts are only good for one calendar year. To date, there have been no surplus contracts in the Marais des Cygnes basin.

Access to water in storage is also available through the Water Assurance Program that operates the Marais des Cygnes basin reservoirs as a system, maximizing the availability of water. Through this program, municipal and industrial water right holders that have formed a district can purchase storage in federal reservoirs. Under agreements negotiated with the state, water in the purchased portion of reservoir storage is released during dry periods to support the water rights of assurance district members. These releases are protected from diversion by other users.

The Marais des Cygnes Water Assurance District was formed in 1990 with seven municipal and industrial water right holders.<sup>(4)</sup> The District has purchased a portion of the water supply storage in Pomona and Melvern Lakes. Additional reserve storage at Melvern and Pomona is

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owned by the state but is not currently committed to either the Water Marketing or Assurance programs. This storage will be sold to the Assurance District or committed to the Water Marketing Program incrementally as demand requires.

The key difference between the Water Assurance Program and the Water Marketing Program is that the water assurance districts own the storage in the reservoirs in the particular basin and pay only the principal and interest and operation and maintenance costs associated with that reservoir storage, as well as costs of the administration and enforcement dedicated to the program. These costs are pooled in the Water Marketing Program for all state-owned reservoir storage and customers pay a statewide averaged rate.

### Water Demand

In the 2007 KWO supply and demand analysis, demand was combined for the basin in the same manner as water supply.<sup>(1)</sup> Population estimates were developed from the Kansas Division of Budget projections to the year 2027. These trends were further projected as necessary in the supply and demand analysis. Entire counties were assigned to the basin based upon predominance of area and existence of larger incorporated areas. The Marais des Cygnes corridor in the analysis included Osage, Franklin, Miami, Anderson and Linn counties.



Figure 4. Counties Supplied by the MDC River Corridor

### Municipal and Industrial Demand

Water demand associated with population projections is based on municipal water use as gallons per capita per day (gcpd) usage reported to the Kansas Department of

Agriculture-Division of Water Resources (DWR), for 2000 through 2004 by suppliers in the basin.<sup>(6)</sup> The quantity of water that municipalities sold for non-domestic use is not included in those gpcd calculations but was added to the total. To develop the projected water use from industry, commerce, agriculture and recreation, all non-municipal surface water points of diversion within five miles of the mainstem of each basin were included.

The estimated surface water demand increase in the Marais des Cygnes River corridor is primarily associated with the population growth projected to occur in Miami County. While a significant increase in demand was demonstrated in the recreational sector in Linn County over the last 12 to 15 years,<sup>(1)</sup> recreation water use (waterfowl marshes) was limited to current levels since there is little to no suitable land remaining near the mainstem in the county that has not already been developed.

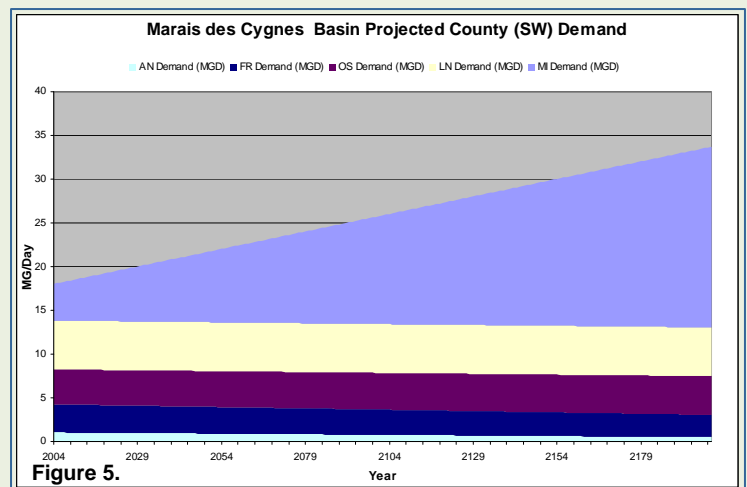


Figure 5.

The Kansas Division of Budget projections from the 2000 U.S. Census did not indicate significant future growth for Franklin County. There has been development of new industry and distribution centers in Ottawa since the last census and Franklin County is anticipated to show population growth in the next census. Updated growth projections can be incorporated in the OASIS model to more accurately reflect these changes as described below.

### Refining Supply and Demand Projections

The KWO is currently using the simulation of Operational Analysis and Integrated Systems (OASIS) computer software product to further analyze the supply and demand in the Neosho and Marais des Cygnes basins. OASIS models the operations of the river/reservoir sys-

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tem by simulating the routing of water through a system represented by nodes (reservoirs, cities, etc.) and arcs (rivers). OASIS can account for physical constraints such as reservoir capacity, evaporation and sedimentation. The model can also account for system management issues such as minimum release requirements and lake level management plans.

The advantage of OASIS modeling is that it can simulate the interaction of multiple reservoirs and rivers in a system. OASIS can also identify “problem areas” in a system and evaluate alternative improvements (off-stream storage, new reservoirs, dredging, reallocation, etc.). The KWO will be working with all users in the Marais des Cygnes River corridor to identify supply and demand options. These options will be tested through the OASIS model and the results shared with basin stakeholders.

#### ***In-Reservoir Demand***

Water held in storage at federal reservoirs supports water-based recreation and associated economic activity. In 2007, the Corps performed an economic analysis of recreation at their lake projects.<sup>(7)</sup> Four components were analyzed to estimate economic effects: recreation spending, visitor use estimates, capture rates and economic multipliers. Hillsdale, Melvern and Pomona Reservoirs had a combined 1,075,471 visits in 2006. These visits were estimated to produce \$26.25 million in total direct sales along with \$13.12 million in value added through wages, salaries, payroll benefits, profits, rents and taxes. The three reservoirs were estimated to support 376 jobs in local communities.

Recreation use varies by season and reservoir condition with activity reduced during periods of flood storage and low water conditions. Lake level management plans for each reservoir are designed to maximize fish, wildlife and recreation benefits during periods of adequate inflow. Storage contracted under the Water Marketing and Assurance Programs is designated for municipal and industrial water supply.

#### ***Water Conservation***

Water conservation and demand management are essential components of extending water supplies. Demand management is not a concept that has been routinely incorporated in water utility operations. With the recognition of the potential for future water supply shortages, water suppliers and communities should begin to incorporate this concept into their planning. Demand management may include less water-intensive landscap-

ing, low water use plumbing, conservation design for urban areas, water reuse and other elements.<sup>(3)</sup> A movement beyond excessive use of water into more sustainable long-term management is needed.

Local [land use](#) planning and zoning authorities provide cities and counties with effective tools to minimize the impacts of development on water resources. Counties with planning and zoning regulations often require landscape plans for new development. While landscaping can provide aesthetic and environmental benefits, heavily irrigated landscape designs can increase demand on public water supplies. Of the counties either partly or wholly within the Marais des Cygnes basin, all are zoned with the exception of Bourbon County.

Conservation of reservoir storage has received attention as the impacts of sedimentation become increasingly apparent. While supply in the basin is adequate in the near term, the closures of recreation areas and algae blooms due to siltation in reservoirs in other areas of the state are indicators of a general loss of water supply. Research has been conducted on the causes of reservoir storage loss and on identifying solutions.<sup>(5)</sup> Solutions generally fall into short-term measures such as more efficient reservoir operations and longer-term strategies to restore storage. Examples of reservoir operations include pool reallocation, raising dams/pools, modification of operational rules. Restoration includes dredging, reservoir flushing, treatment of the upstream watershed to limit erosion or other means of removing accumulated sediment. Protection and restoration of streams, wetlands and riparian areas in the watershed and also measures to reduce sedimentation.



**Pomona Reservoir Outlet Channel. Photo by Corps.**

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### **Recommended Actions**

1. Work with stakeholders to identify options for supply and demand management including: reservoir pool raise, pool reallocation, dredging, new supplies, modification of reservoir operations, operation of Water Marketing and Water Assurance Programs and conservation measures.
  - a. Test various options through the OASIS model.
  - b. Share information with stakeholders from the basin model including supply and demand information for specific stream segments.
  - c. Implement the most beneficial and cost-effective options.
2. Encourage incorporation of water demand management into utility operating plans. Demand management should include education and interaction with the development community and existing local authorities.
3. Compare annual Corps visitation figures to pool conditions during the primary recreation seasons. Determine when high and low pool levels create impacts on recreational use.

### **Resources**

1. Kansas Water Office, 2007, *Surface Water Supply and Demand Projections for Selected Basins in Eastern Kansas*.
2. Kansas Water Office, 2006, *Kansas Municipal Water Use*.
3. Kansas Water Office, 2007, *Kansas Municipal Water Conservation Plan Guidelines*.
4. Kansas Water Office, 2002, *Status Report: State of Kansas, Water Marketing and Assurance Programs, Multipurpose Small Lakes Program*.
5. Various authors, 2008, *Sedimentation in Our Reservoirs: Causes and Solutions*, Kansas Center for Agriculture and the Environment, Kansas Water Office, Kansas State University.
6. Division of Water Resources, 2006, *Public Water Suppliers: Sources and Purchasers*, Kansas Department of Agriculture.
7. U.S. Army Engineer Research and Development Center, 2007, *National and Regional Economic Effects of Corps of Engineers Recreation Visitor Spending: An Update*.