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**Before the
House Vision 2020 Committee
Missouri River Aqueduct Study Update
Earl Lewis, Assistant Director, Kansas Water Office
March 9, 2015**

Chairman Sloan and members of the Committee, thank you for the opportunity to provide information regarding the recent update of a 1982 Corps of Engineers Missouri River Aqueduct study.

I have provided two documents today regarding this study update. I will be talking from a printed slide presentation which covers the major points of the study as updated. The second is the executive summary of the full report. The executive summary provides more detail than is contained in the slides. If you would like to have a full copy of the report, we would be happy to provide one for your use. It is also available on the Kansas Water Office website at www.kwo.org/projects_programs/Aqueduct_Study.htm.

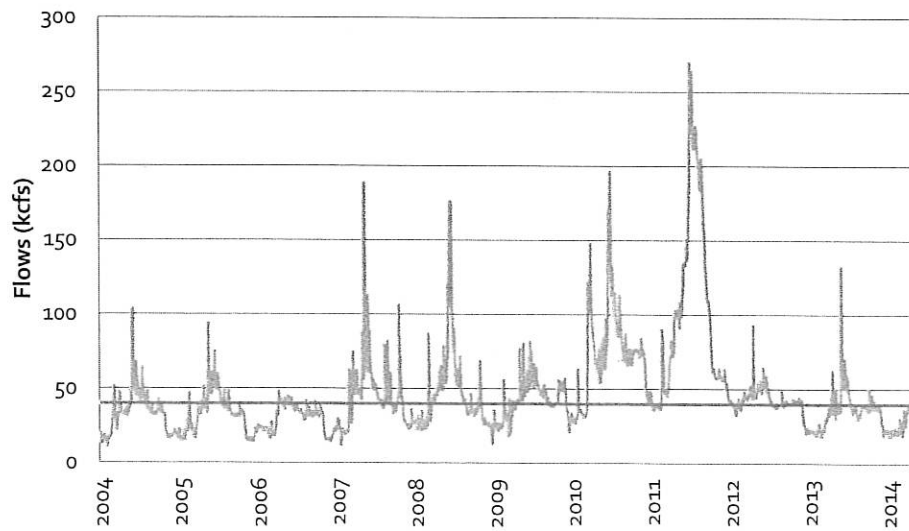
Thank you for the opportunity to appear before you here today. I will be happy to stand for questions at the appropriate time.

Vision 2020
3-9, 2015
Attachment 2

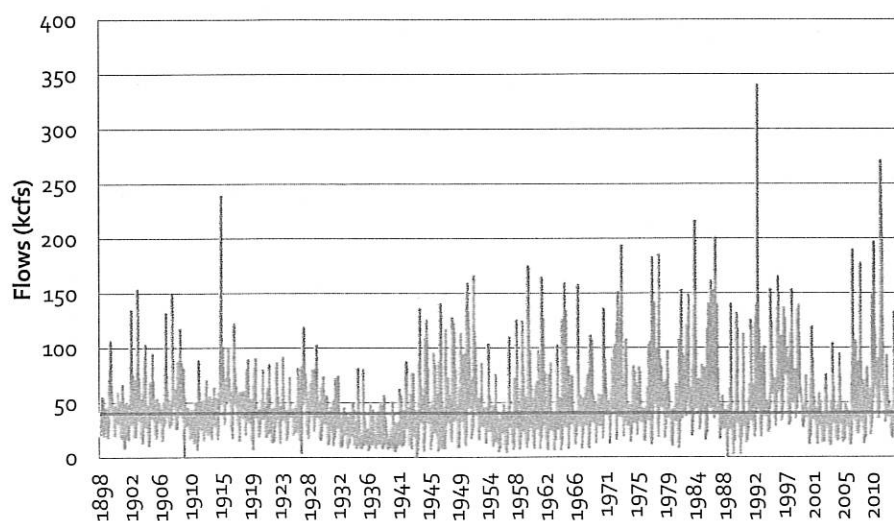
March 9, 2015

House Vision 2020 Committee Kansas Aqueduct Update

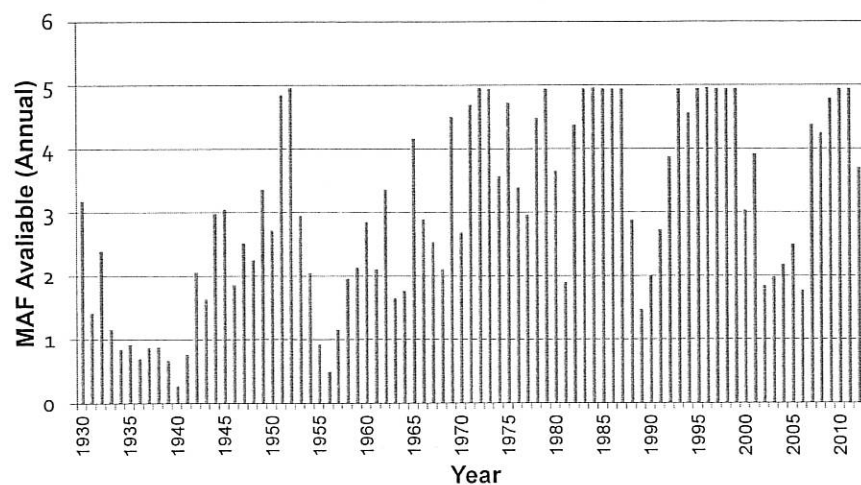
Flows above navigation targets (2004-2014)



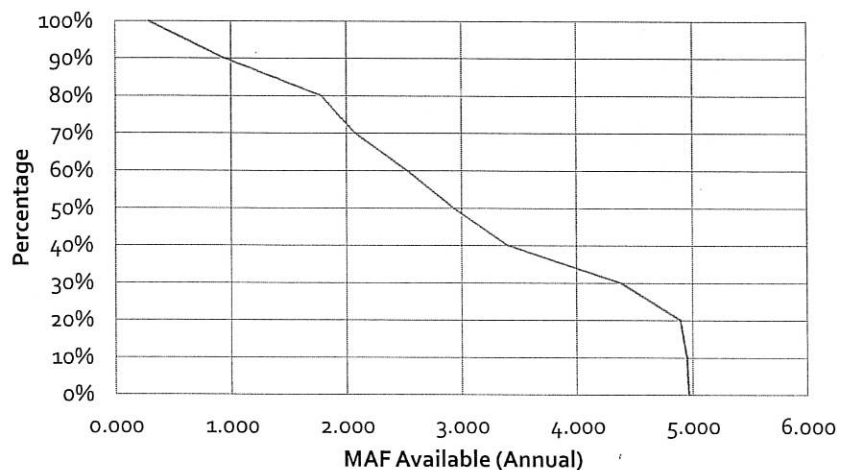
Flows above navigation targets (1898-2014)



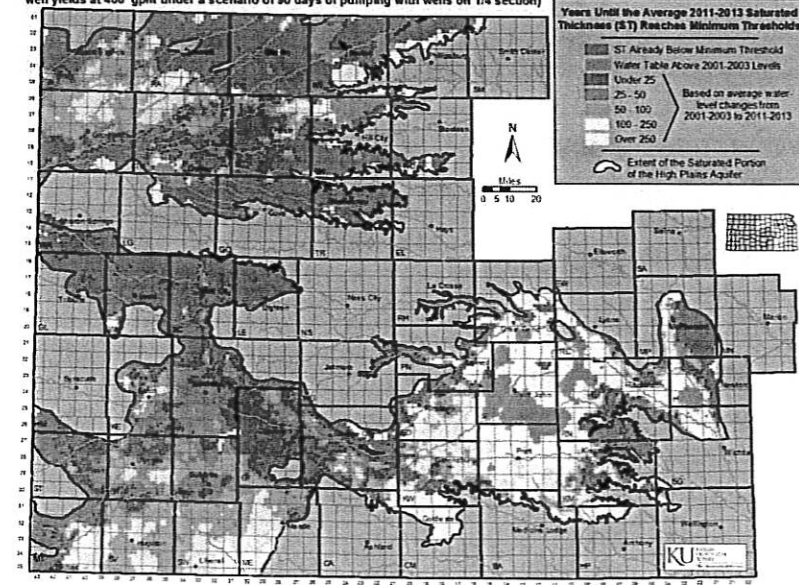
Availability Above Navigation Flows



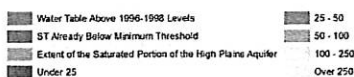
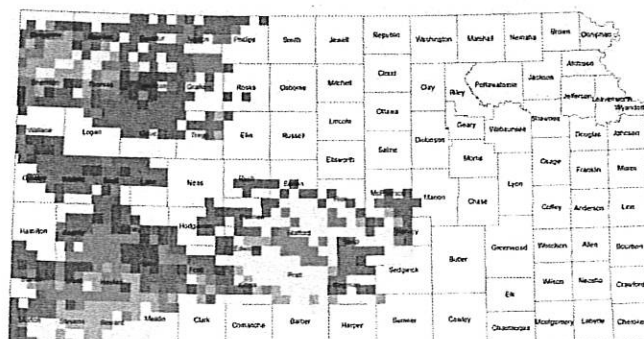
Frequency Distribution



Estimated Usable Lifetime for the High Plains Aquifer in Kansas (Based on ground-water trends from 2001-2003 to 2011-2013 and the minimum saturated thickness required to support well yields at 400 gpm under a scenario of 90 days of pumping with wells on 1/4 section)



Source: Kansas Geological Survey

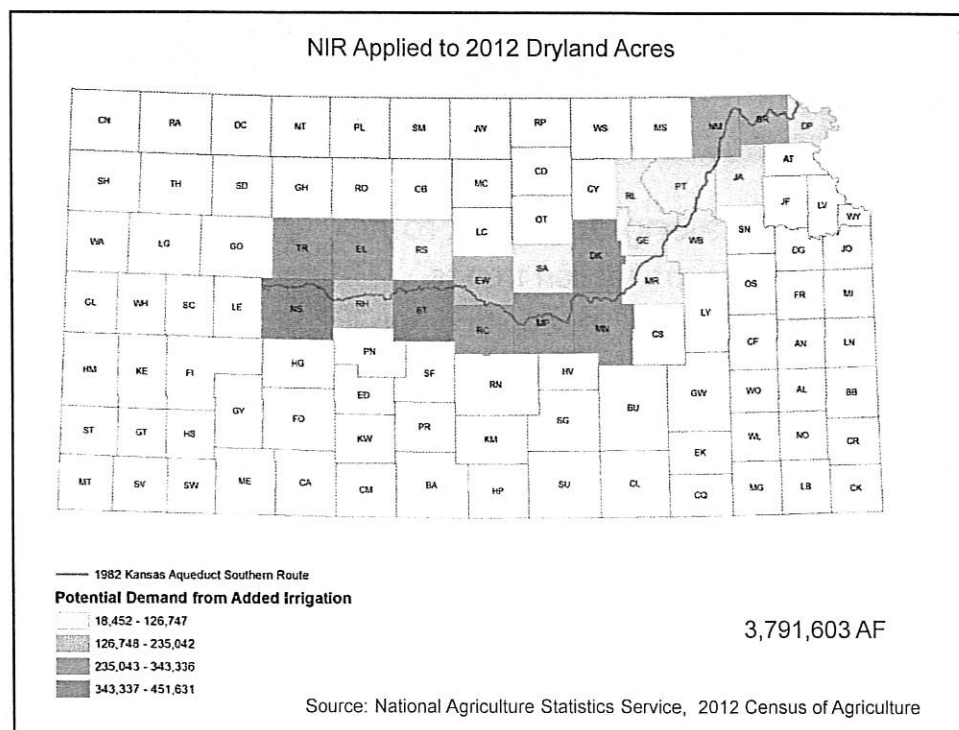
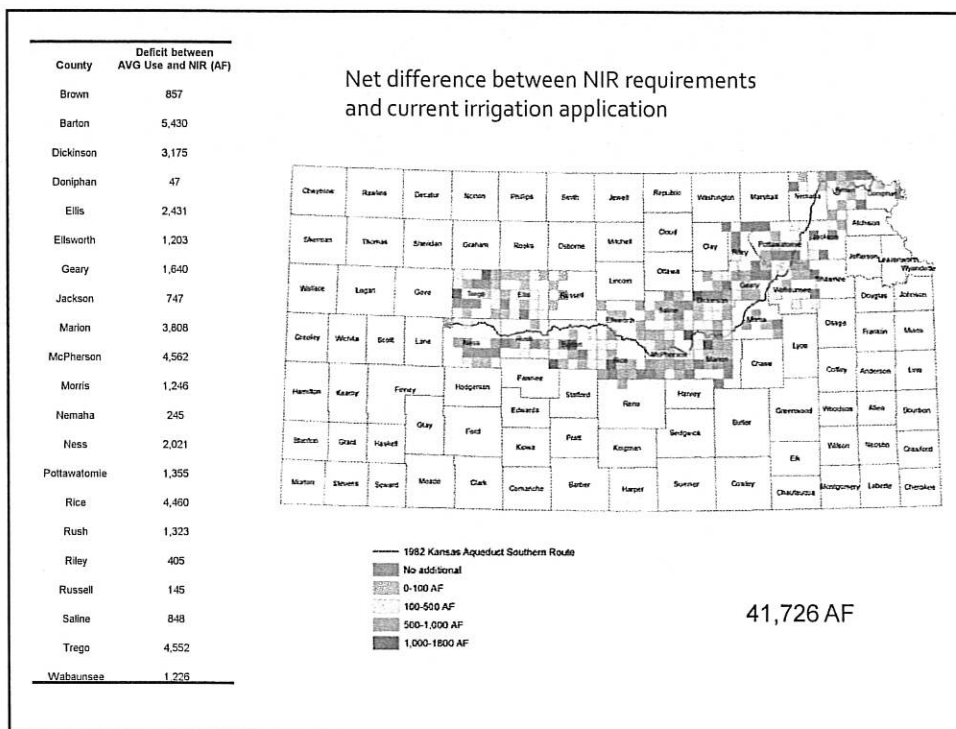


Years	Annual AF needed to replace current use
5	354,420
10	528,731
25	1,000,433
50	1,862,620
100	2,657,808

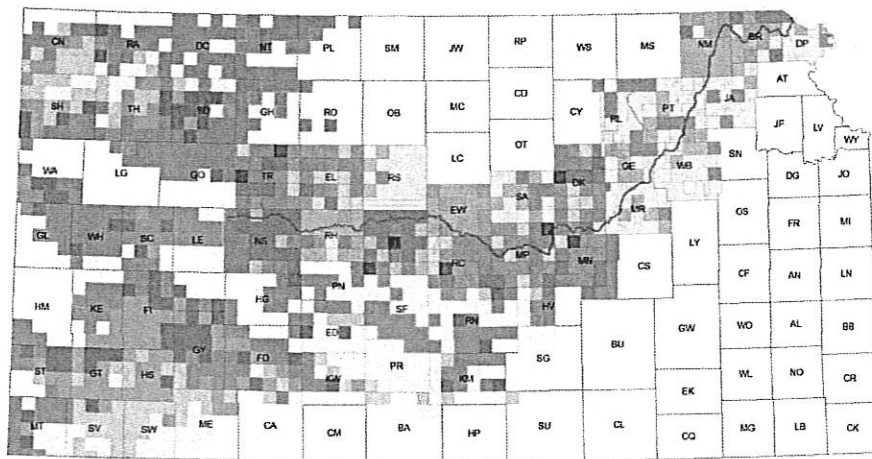
Net Irrigation Requirements

- Water need of specified crop over and above effective rainfall and carryover soil moisture.
- 50 percent chance rainfall (expected to be equaled or exceeded in 5 years out of 10)

K.A.R. 5-5-12. Net irrigation requirements (NIR). The following amounts shall be used as the net irrigation requirements (NIR). County	50% Chance Rainfall
Barton	12.0" = 1.00'
Brown	7.1" = 0.59'
Dickinson	9.4" = 0.78'
Doniphan	7.3" = 0.61'
Ellis	12.2" = 1.02'
Ellsworth	11.5" = 0.96'
Geary	8.4" = 0.70'
Jackson	7.4" = 0.62'
Marion	9.6" = 0.80'
McPherson	10.8" = 0.90'
Morris	8.5" = 0.71'
Nemaha	7.8" = 0.65'
Ness	13.3" = 1.11'
Pottawatomie	8.1" = 0.68'
Rice	11.5" = 0.96'
Riley	8.5" = 0.71'
Rush	12.6" = 1.05'
Russell	11.3" = 0.94'
Saline	10.8" = 0.90'
Trego	12.9" = 1.08'
Wabaunsee	7.8" = 0.65'



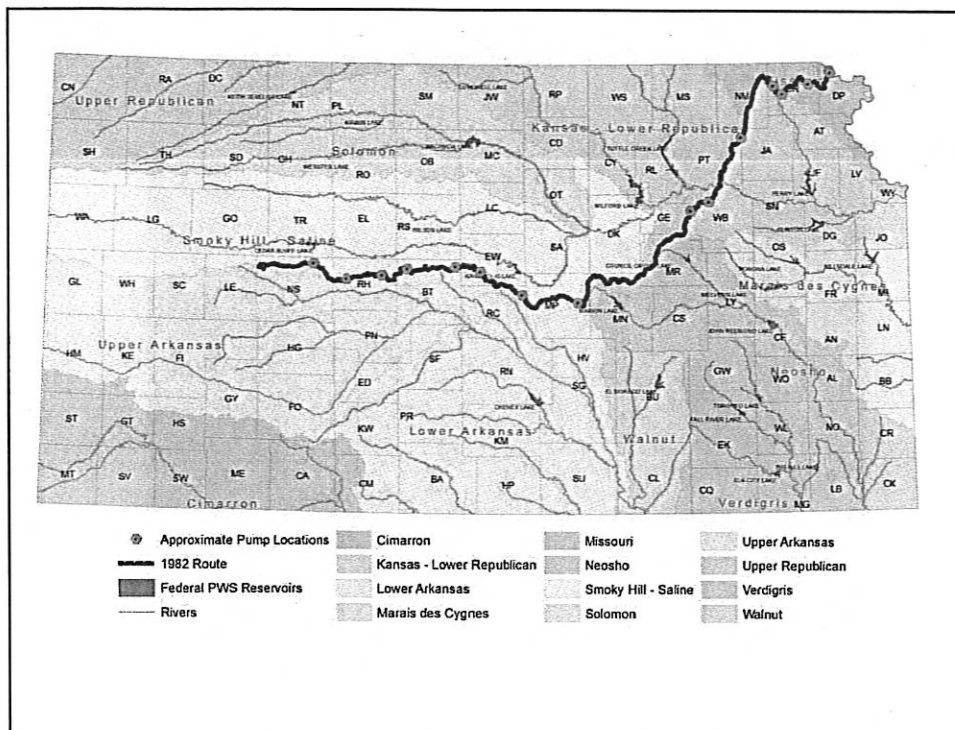
Total Irrigation Demand



Total demand ranges from 4.2-6.5 MAF.

Municipal Demand

- Counties along aqueduct route
 - Population projection trends
 - Average gallon per capita day (GPCD)
- Large municipalities
 - Wichita
 - Hays
 - McPherson
- Drought vulnerable suppliers

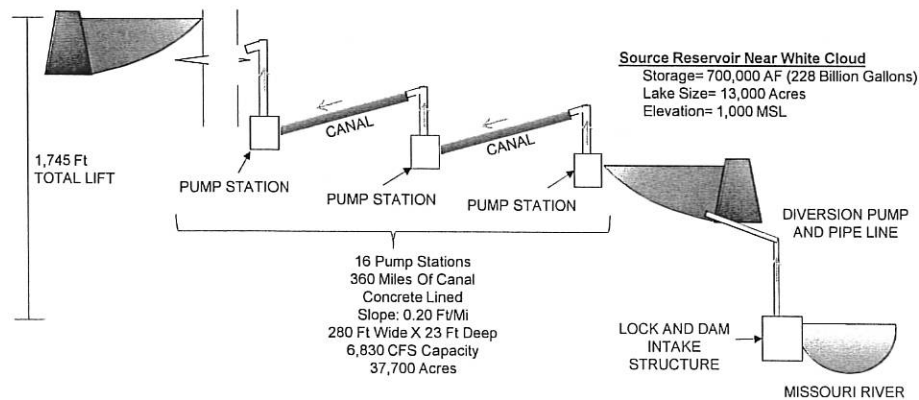


Kansas Aqueduct Schematic

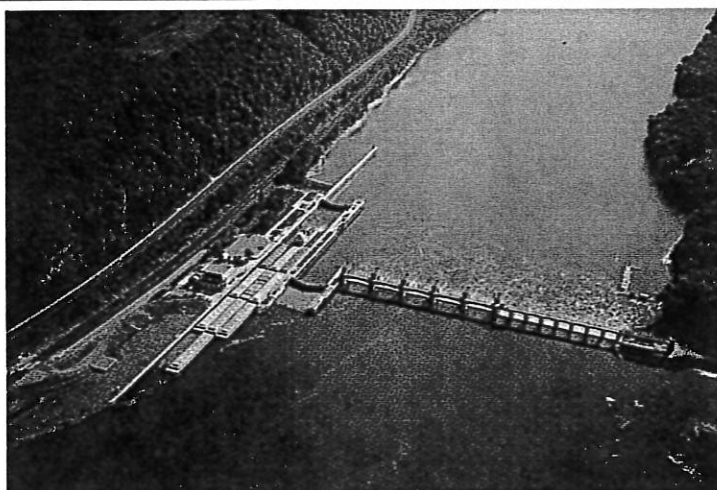
(Maximum Demand Sizing From 1982 Study)

Terminal Reservoir Near Utica

Storage= 1,586,000 AF (517 Billion Gallons)
 Lake Size= 25,000 Acres
 Elevation= 2,610 MSL
 Delivery= 3.4 Million Acre Feet per Year

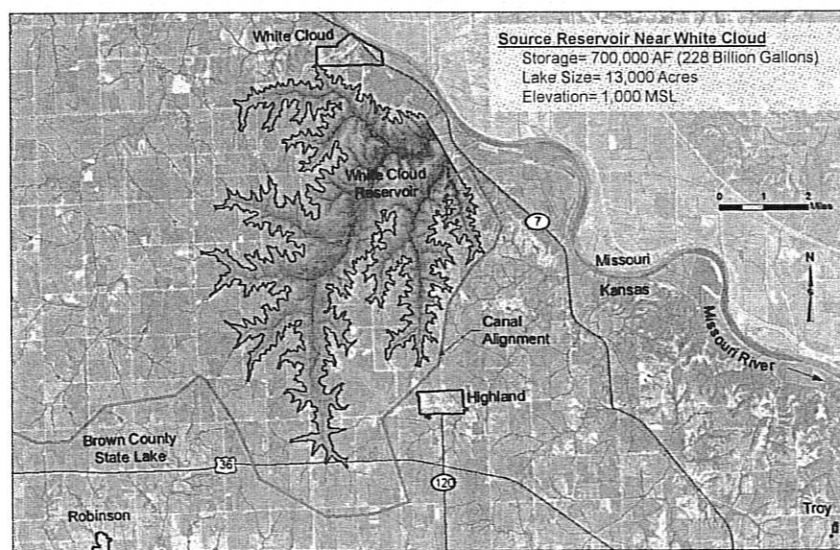


Example Lock & Dam



Lock & Dam 9, Mississippi River
Lynxville, Wisconsin

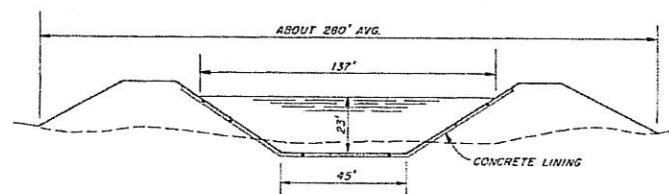
1982 Source Reservoir Location



Canal System



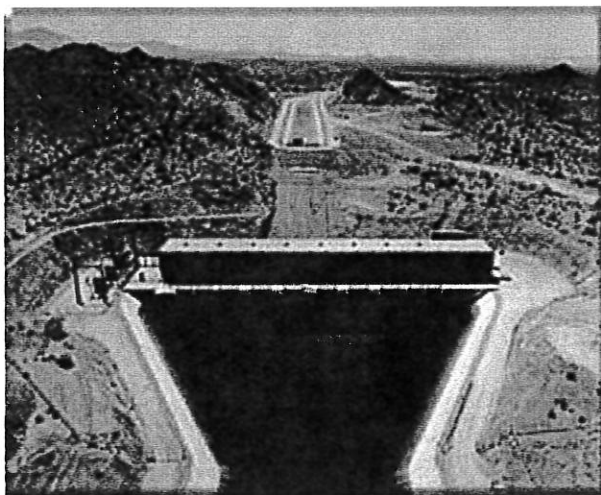
Kansas Aqueduct Canal Sizing



6,830 C.F.S. CANAL

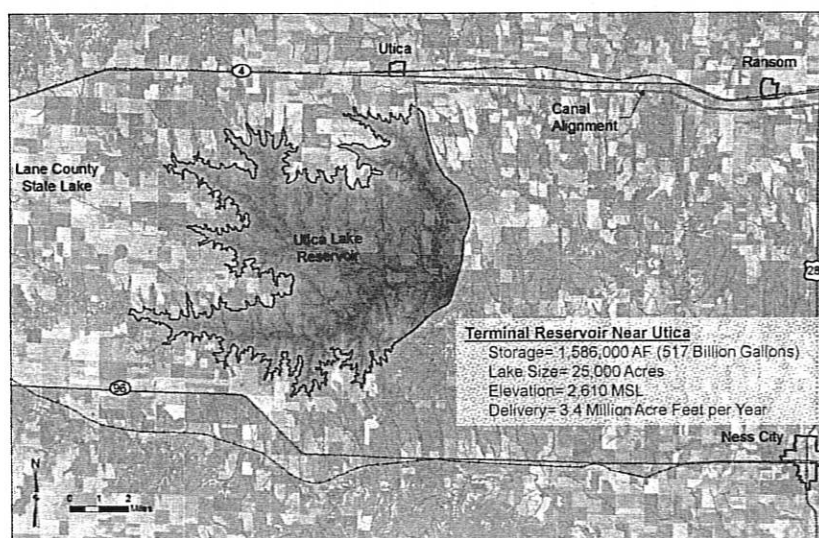
Capacity cfs	Top Width ft	Bottom Width ft	Depth ft
2,000	60	24	12
6,000	126	42	21
10,000	158	54	26

Pumping Plant Example



Central Arizona Project

1982 Terminal Reservoir Location



Preliminary Water Supply Findings

1982 Study Canal Sizing

Transfer Canal Capacity ⁽³⁾	Missouri River Diversion	Average Annual Volume of Water Available ⁽¹⁾	Average Annual Volume of Water Available Including Storage and Canal Limits ⁽²⁾	Average Annual Volume to Farm Headgate ⁽⁴⁾	Annual Volume to Farm Headgate 3 out of 4 years
cfs	cfs	MAF	MAF	MAF	MAF
2,000	10,000	3.7	1.4	1.0	1.0
6,000	20,000	5.8	3.4	2.4	1.8
10,000	30,000	6.9	4.5	3.2	3.1

- 1) Assumes no limitation on canal transfer or storage and Missouri River flow data from 1898-2013 (POR).
 2) Includes source reservoir storage limits (700,000 ac-ft), Missouri River diversion limits and transfer canal limits.
 3) Includes 15% down time for maintenance and weather impacts.
 4) Includes 10% seepage and evaporation transmission loss from the source reservoir to the terminal storage, 5% evaporation at the source and terminal reservoir and 10% seepage and evaporation from the terminal storage the farm headgate.

Year 2014 Cost Base Projected Investment Costs for Route B Water Transfer System

ITEM DESCRIPTION	ITEM COSTS FOR WATER TRANSFER SYSTEM SIZE		
	2,000 cfs	6,000 cfs	10,000 cfs
Lock & Dam	\$ 0	\$ 269,000,000	\$ 269,000,000
Source Reservoir	\$ 295,000,000	\$ 295,000,000	\$ 295,000,000
Pumping Stations and Power Plant	\$ 1,066,000,000	\$ 4,262,000,000	\$ 8,161,000,000
Canals	\$ 2,325,000,000	\$ 3,905,000,000	\$ 4,993,000,000
Pipelines (conduit)	\$ 551,000,000	\$ 1,380,000,000	\$ 2,262,000,000
Terminal Reservoir	\$ 180,000,000	\$ 459,000,000	\$ 843,000,000
Route Relocations	\$ 351,000,000	\$ 374,000,000	\$ 393,000,000
Automation & Communication	\$ 75,000,000	\$ 75,000,000	\$ 75,000,000
SUBTOTAL CONSTRUCTION	\$ 4,843,000,000	\$ 11,019,000,000	\$ 17,291,000,000
EDSA (@ 11%)	\$ 533,000,000	\$ 1,212,000,000	\$ 1,902,000,000
TOTAL FIRST COSTS	\$ 5,376,000,000	\$ 12,231,000,000	\$ 19,193,000,000
Interest During Construction (20 years)	\$ 2,544,000,000	\$ 5,788,000,000	\$ 9,083,000,000
TOTAL INVESTMENT COSTS	\$ 7,919,000,000	\$ 18,019,000,000	\$ 28,276,000,000

Year 2014 Delivered Water Projected Costs (\$/AF) for Route B Water Transfer System

ANNUAL COST ITEMS	WATER TRANSFER SYSTEM SIZE		
	2,000 cfs	6,000 cfs	10,000 cfs
OMRR&R	\$ 26,626,000	\$ 37,161,000	\$ 44,753,000
Energy Costs	\$ 176,000,000	\$ 395,000,000	\$ 522,000,000
Interest & Amortization	\$ 87,000,000	\$ 652,000,000	\$ 1,024,000,000
TOTAL ANNUAL COSTS	\$489,626,000	\$1,084,161,000	\$ 1,590,753,000
Annual Acre-Feet Delivered	1,000,000	2,400,000	3,200,000
TOTAL DELIVERED WATER COSTS (\$/AF)	\$ 490	\$ 452	\$ 497

Legal Issues in obtaining water at the source:

- Missouri River: Compacts between some States; no overall Mo River water allocation
- 28 Tribes - Federal Reserved Water Rights
- States and Tribes allocate in accordance with their laws and rights
- 1944 FCA and Pick Sloan Program

Legal Issues in obtaining water at the source:

- KS Water Appropriation Act:
- KS Water Transfer Act: Extra-ordinary process
- Alternative is some new form of water reservation right

Legal Issues in Transporting and use of water:

- Various potential uses along the way possible
- KS Stream Obstruction Act - permitting of dams and stream crossings
- KS Levee Law - requires approval of floodplain fills and modification of levees
- USACE permits needed, Section 10 & CWA 404

Institutional Issues:

- A special kind of public entity would be needed to finance, construct, operate and maintain
- Entity would need to hold water rights and contract with other entities and water users for delivery of water
- It will likely need bonding, taxing authority and power to purchase or condemn land
- The Kansas Turnpike Authority may serve as a conceptual example for the entity's structure

General Political Assessment:

- Extensive interstate coordination and public education will be necessary and ongoing
- Opposition may occur from other States and possibly Tribes due to the amount of water involved
- Local or regional opposition in the source area
- Landowner opposition should be anticipated if land is taken for reservoir sites and aqueduct right of way
- Opportunities may exist for municipal and industrial, wildlife, recreation and other uses from the project

Environmental Constraints

- NEPA Process
 - Environmental Impact Statement
- Stream Mitigation
- Threatened and Endangered Species
 - Terrestrial Habitat
 - Aquatic Habitat
- Road, Railroad, Pipeline, & Transmission Line Crossings

Stream & Wetland Mitigation

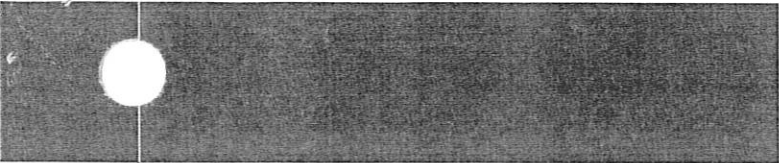
- Section 404 of the Clean Water Act requires entities to evaluate impacts to streams and wetlands
- Mitigation Sequence
 1. Avoid impacts to the extent appropriate and practicable
 2. Minimize impacts to the extent appropriate and practicable
 3. If impacts are unavoidable, they must be offset to so there is "no overall net loss"

Threatened & Endangered Species

- Kansas Nongame and Endangered Species Conservation Act of 1975
- Regulations require KDWPT to issue permits for activities that affect listed species
- Three categories:
 - Endangered – Immediate risk of local or complete extinction
 - Threatened – Rare and may be endangered soon
 - Species in Need of Conservation

Cultural, Historical & Tribal Resources

- Historic Tribal lands, remains, or cultural objects
- National Historic Preservation Act & Kansas Preservation Act
 - requires State Historic Preservation Office (SHPO) to review projects for potential effects on state's historic and archeological resources



January 2015

Kansas Water Office and the
U.S. Army Corps of Engineers,
Kansas City District

Executive Summary

Update of 1982 Six State High Plains Aquifer Study

Alternate Route B

Funded through Federal Planning Assistance to States Agreement (PAS) by the U.S. Army
Corp of Engineers, the Kansas Water Office and Southwest Kansas Groundwater
Management District No. 3

Introduction

The Water Resources Development Act of 1976 authorized the *Six-State High Plains-Ogallala Aquifer Regional Resources Study* (High Plains Study) to address the problem of depleting High Plains Ogallala aquifer water supplies. The U.S. Department of Commerce, in coordination with the U.S. Army Corps of Engineers (Corps) and other federal, state and private entities, examined the feasibility of various alternatives to provide adequate water supplies to "assure continued economic growth and vitality of the High Plains region." The High Plains study included state-level research completed by each of the six states (Colorado, Kansas, Nebraska, New Mexico, Oklahoma and Texas), regional economic and policy assessments and a study of interbasin water transfers.

The Corps studied four alternative transfer routes and completed reconnaissance level designs and cost estimates for ranges of transfer quantities. The *1982 Alternative Route B Reconnaissance Study* (1982 Study) evaluated a route beginning on the Missouri River upstream of St. Joseph, Missouri and terminating in western Kansas. It is that route that was reevaluated in this update.

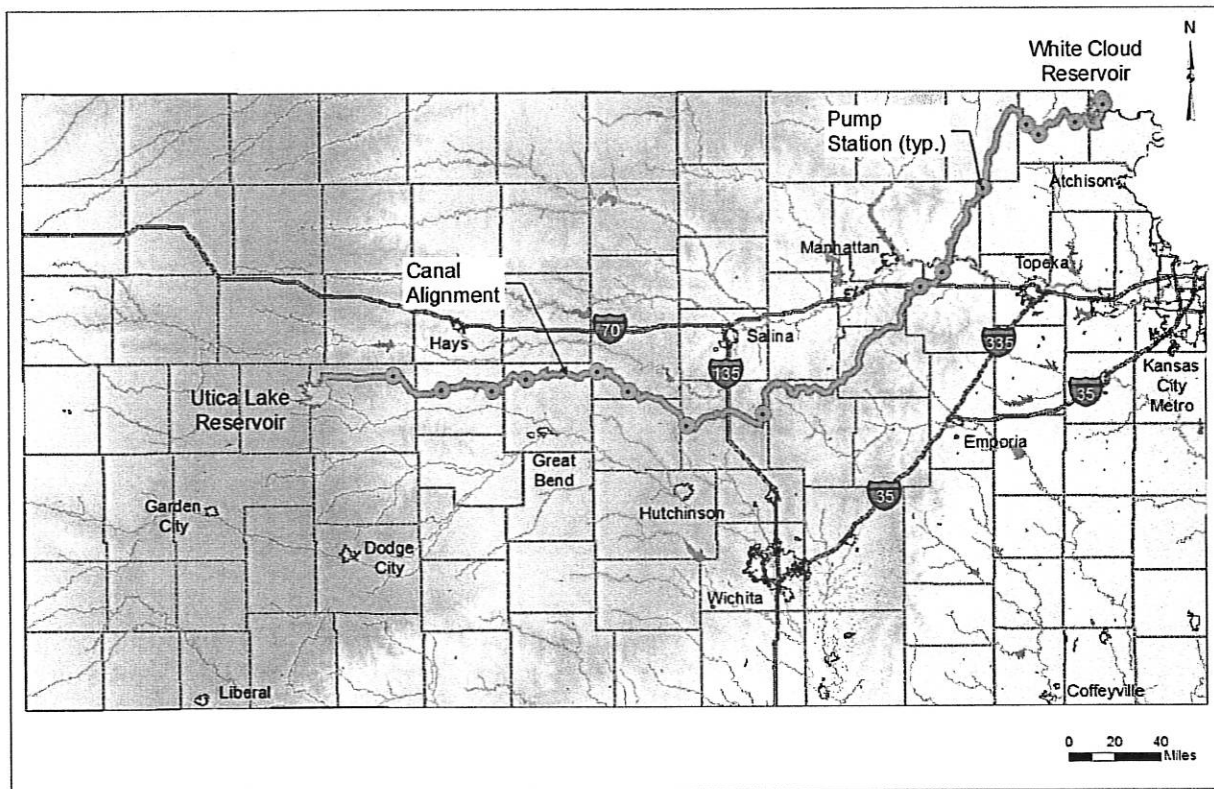


Figure ES (a). 1982 Study Alternate B major component locations.

Study Purpose and Authority

The Kansas Water Office (KWO) and the U.S. Army Corps of Engineers Kansas City District (Corps) entered into a Federal Planning Assistance to States (PAS) Agreement to update the 1982 Study. The KWO partnered with the Southwest Groundwater Management District No. 3 (GMD 3) for financial assistance, as well as coordination, public input and review. The Corps retained the services of HDR Engineering, Inc. to evaluate the engineering aspects of the water transfer system and cost estimates. The KWO and GMD 3 contracted with Popeconsulting,

LLC who subcontracted with Leland Rolfs Consulting, to complete the review of legal and legislative issues and provide a preliminary political assessment.

Updates include refinement and mapping of the proposed alignment, projections of water demand and estimation of the range of quantities of water available. Financial considerations include updates to the total estimated construction cost, project cost per unit of transferred water and annual cost of energy and maintenance. The current study does not address the water distribution systems that would be needed to supply end users from the terminal reservoir. The study does not provide an economic analysis of costs or benefits. The study also did not evaluate impact to local units of government in the project areas. The update provides a legal review and a preliminary political assessment.

This study is not a federal feasibility study or a federal interest determination. The purpose of this update is not to put forward a specific plan to construct the transfer system conceptualized in 1982, rather it is to evaluate the various merits and impacts such a project would have for the State of Kansas. Many assumptions and generalizations have been made to accomplish this update. Many topics were raised during the course of this study that would need to be addressed if a project of this nature were to move forward.

The full report from which this Executive Summary is taken is available from the KWO.

Stakeholder Coordination

A Stakeholder Advisory Committee was formed comprised of individuals located geographically within the Ogallala portion of the High Plains aquifer study area, in the area of the proposed source reservoir, in areas along the proposed project route and those that use the Missouri River. (For the purposes of this report, the High Plains – Ogallala aquifer and Ogallala aquifer are used interchangeably and refer to the region of Kansas where the Ogallala formation exists). Stakeholders represented various use and interest categories such as city, county and tribal governments; public utilities; groundwater management districts; industries; agriculture and financial institutions.

The Stakeholder Advisory Committee convened at meetings held throughout the state to review findings from the technical, environmental, financial and legal reviews. The Committee also assisted in identifying other issues impacting the feasibility of a Kansas aqueduct project and in providing recommendations on components of the study that would need further review. The Committee was not asked to approve the update.

Missouri River Background

The Missouri River is the largest river that flows through or adjacent to the State of Kansas. It is also the longest river in North America and its basin covers one-sixth of the lower 48 states. The mainstem reservoir system includes six large dams that have the capacity to store over 74 million acre feet (MAF), not counting exclusive flood control storage, about three times the river's average annual runoff above Sioux City, Iowa, located just downstream of the last reservoir on the mainstem reservoir system. The upper three reservoirs are the first, second and third largest Corps reservoirs in the country.

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

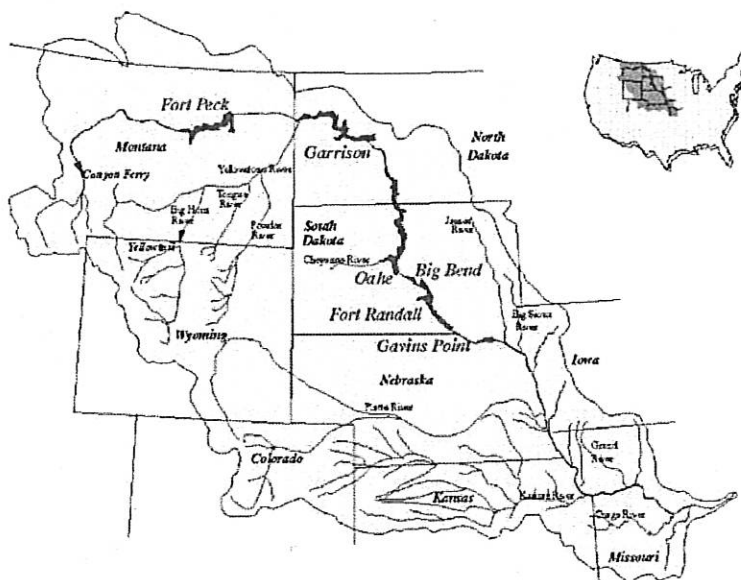


Figure ES (b). Missouri River Basin and States.

Water Demand

The 1982 Study demand analysis was for irrigation and without consideration of new irrigated areas. This current study updated the irrigation demands; municipal needs were also considered in this update. Municipal use includes industrial uses supplied through a city or rural water district. It does not include industrial use water with individual water appropriations, the largest of those generally being energy related.

Irrigation is the largest water use in Kansas, accounting for an average of 85% of reported water use between 1991 and 2011. For this study update, current reported water use for irrigation in the areas overlying the Ogallala - High Plains aquifer was summarized and projections were made to determine how much water is needed to sustain current levels as the aquifer continues to be depleted. Irrigation demands in the counties adjacent to the 1982 aqueduct route were also evaluated, recognizing that demands may increase in these counties if a supplemental water source is made available. Additionally, farm acreage in counties adjacent to the 1982 route was evaluated for potential conversion from dry land farming to irrigated farming.

An update of demand assumed replacement of current irrigation levels once 400 gallons per minute could not be supported. Full replacement would require over 1.8 million acre feet (MAF) in 50 years and over 2.6 MAF in 100 years. Adding potential demand for irrigation along the route would increase to a total for irrigation ranging from 4.2-6.5 MAF. The estimated annual requirement in 1982 was only 862,000 acre feet (AF). Consideration is given in the study to the possibility of supplementing reservoir storage in surface water basins along the route that are expected to have shortages in the next 50 years, however this amount has not yet been quantified.

For this study update, municipal demand was estimated using average gallons per capita per day (GPCD) multiplied by population estimates. The GPCD was compared to actual reported water use for calibration.

Projected demand for 2040 totals 16,480 million gallons (MG) for municipal use in the 21 counties along the proposed aqueduct; the annual quantity authorized totals 31,185 MG. The five counties along the I-135 corridor is an area of significant economic importance that has looked at transporting water into the region as early as

1982. The projected annual demand for these five counties (Harvey, McPherson, Reno, Saline and Sedgwick) is 31,256 MG for 2040 of an authorized annual quantity of 92,080 MG. The annual quantity authorized for municipal use in Ellis, Rush and Trego counties, the counties that experienced issues during the recent drought (2011 – 2014), totals 3,331 MG; projected annual demand in 2040 totals 1,777 MG. While sufficient water appropriations exist to meet estimated 2040 demand, as demonstrated by the recent drought, actually obtaining that water can be problematic.

The total projected municipal demand for 2040 for all three areas evaluated totals 44,513 MG (0.1 MAF). (The total is not equal to the sum of the three areas due to overlap of counties).

Water Availability

Under the Corps 1982 Study, quantification of water availability was simplified through assumptions. This update continues this simplified assumption. Availability is assumed when Missouri River flows exceeded the navigation and water supply intake structure targets; 41,000 cfs during navigation support season and 15,000 cfs outside of the navigation support season. It is important to recognize that this assumption probably overestimates the quantity that could be available, because it does not include the overall operation of the Corps' Bank Stabilization and Navigation Project. That analysis is beyond the scope of this study.

The amount of water available for transfer is dependent not only on what is in the river, but on the engineered components of the water transfer system. For this study update, an Excel model was developed to assist with evaluating the different components of the Kansas Aqueduct to optimize the transfer and beneficial use of the available water.

The update assumes diversion rates of 6,000; 10,000; 20,000 and 30,000 cfs. Transfer rates of 2,000; 6,000 and 10,000 cfs were evaluated. The amount of water available for transfer is dependent on the engineered components of the water transfer system. The diversion pumping rates, the source and terminal storage reservoir size and transfer canal capacity all impact the amount of water that could be transferred.

The model estimates that flows above navigation and water supply intake structure targets over the period of record using a maximum diversion rate of 30,000 cfs results in an average annual yield of 6.9 million acre feet (MAF). However, this does not account for the limitations of storage capacity and transfer capabilities. Therefore, the model was used to determine the range of water available with different transfer system components. The results show the average annual yield that can be expected to be available at least fifty percent of the time ranges from 0.9 MAF at the lowest end to 3.2 MAF at the highest end of pumping and storage capacity.

Water Transfer System

The water transfer system formulated in the 1982 Study is shown in Figure ES (c). The engineering aspects of the project are interdependent with the yield of the system. Diversion rates of 6,000; 10,000; 20,000 and 30,000 cfs were evaluated.

Terminal Reservoir Near Utica

Storage= 1,586,000 AF (517 Billion Gallons)
 Reservoir Surface Area= 25,000 Acres
 Elevation= 2,610 AMSL
 Delivery= 3.4 Million Acre Feet per Year

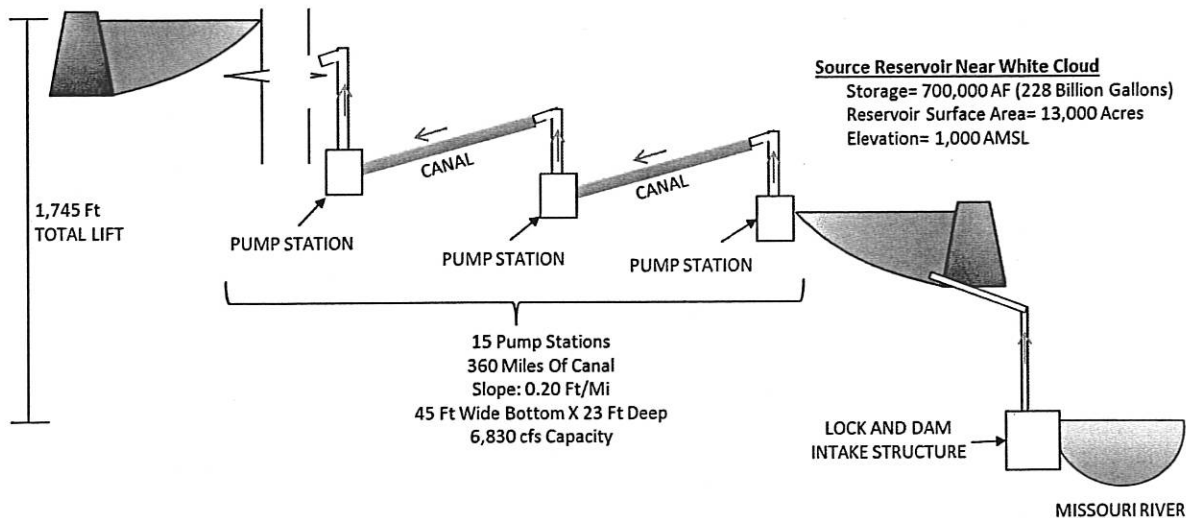


Figure ES (c). The Kansas aqueduct system schematic based on the 1982 Study Alternative Route B (south) with 6,830 cubic feet per section (cfs) canal capacity.

A 360 mile long concrete-lined canal and 15 pump stations would be required to transfer the water to western Kansas which is 1,745 feet uphill (net). Canal capacities of 2000, 6000 and 10,000 cfs were evaluated for consistency with the 1982 Study. The canal would follow a ridge line generally along the southern watershed divide of the Kansas River. The canal route would transect a large portion of the state and multiple infrastructure relocations would be required. The pumps would be electrically driven and would have a large electrical load. A hydroelectric plant near the Kansas River was proposed in the 1982 Study to partially offset the external electrical usage.

The irrigation demand is seasonal whereas the canal will flow at a uniform rate. The difference between the canal capacity and peak demand during irrigation season results in a need to construct a terminal reservoir. The 1982 Study included a terminal reservoir near Utica, Kansas. A range of yields to the farm head gates were calculated ranging from 0.9 to 3.2 MAF annually depending on the component sizing. The stated yields include source reservoir, canal, terminal reservoir and distribution system seepage and evaporation losses.

Preliminary Opinion of Probable Costs

This study presents updates to various components of the 1982 Study, including a high-level conceptual update of potential costs based on available information. The projected costs use the 1982 Study cost items and industry recognized escalation factors and costs indices. Costs from the 1982 study were multiplied by a factor of 3.27872, the engineering standard construction cost index (CCI). Using this methodology may underestimate certain costs, such as land values, however the development of detailed construction quantities and associated cost estimating is beyond the scope of this study.

The project was evaluated for water transfer delivery systems of 2,000, 6,000 and 10,000 cfs. It is assumed that construction would occur over a 20 year period. The updated total construction costs for the system found to be the most cost efficient (6,000 cfs transfer capacity) is \$12,231,000,000. The interest during a 20 year construction period is estimated to be \$5,788,000,000 bringing the total investment cost to \$18,019,000,000. Interest during the 20 year construction period was 7 3/8 % in the 1982 study but only 3 1/2 % for this update.

This change was made during the course of the study and changed the initial cost of water that was discussed. It is recognized that interest rates are variable and can have a significant impact on project costs.

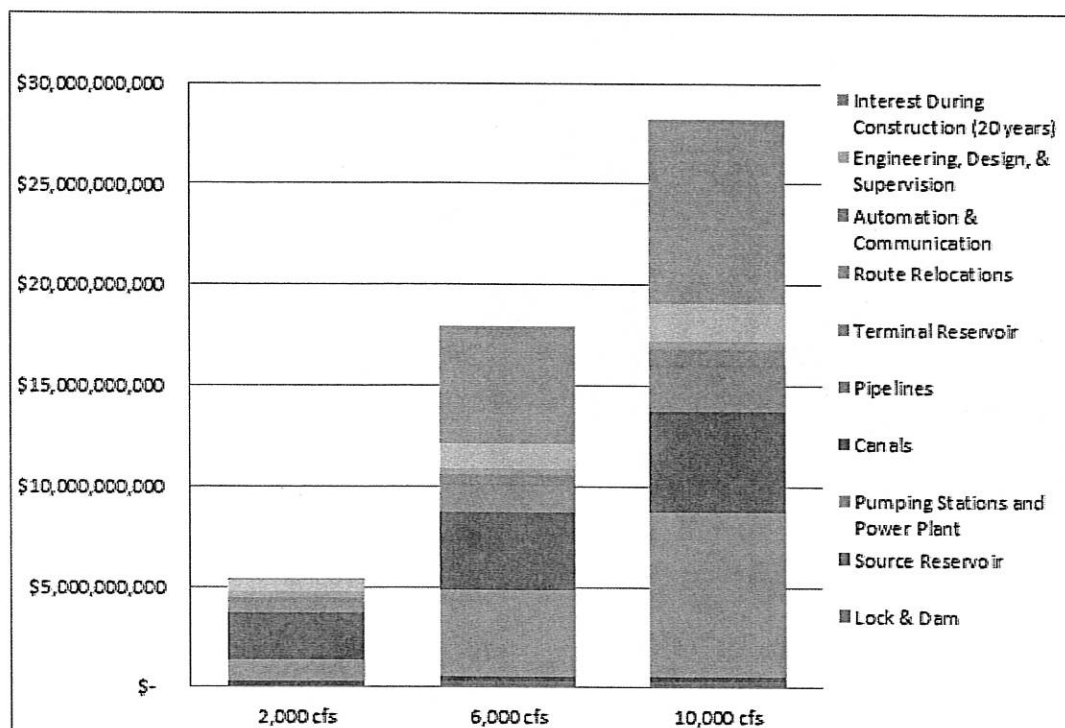


Figure ES (d). Estimated Construction Costs.

Assuming the 6,000 cfs diversion rate, the annual costs including operation and maintenance, interest and amortization and energy costs were determined to be \$1,084,161,000. The annual energy costs were estimated to be \$395,000,000, which assumes a total of 8.78 million megawatt hours needed to operate the system annually. No attempt is made to determine where that energy would come from.

The very preliminary estimate of the 2014 delivered water costs is approximately \$450 per acre foot.

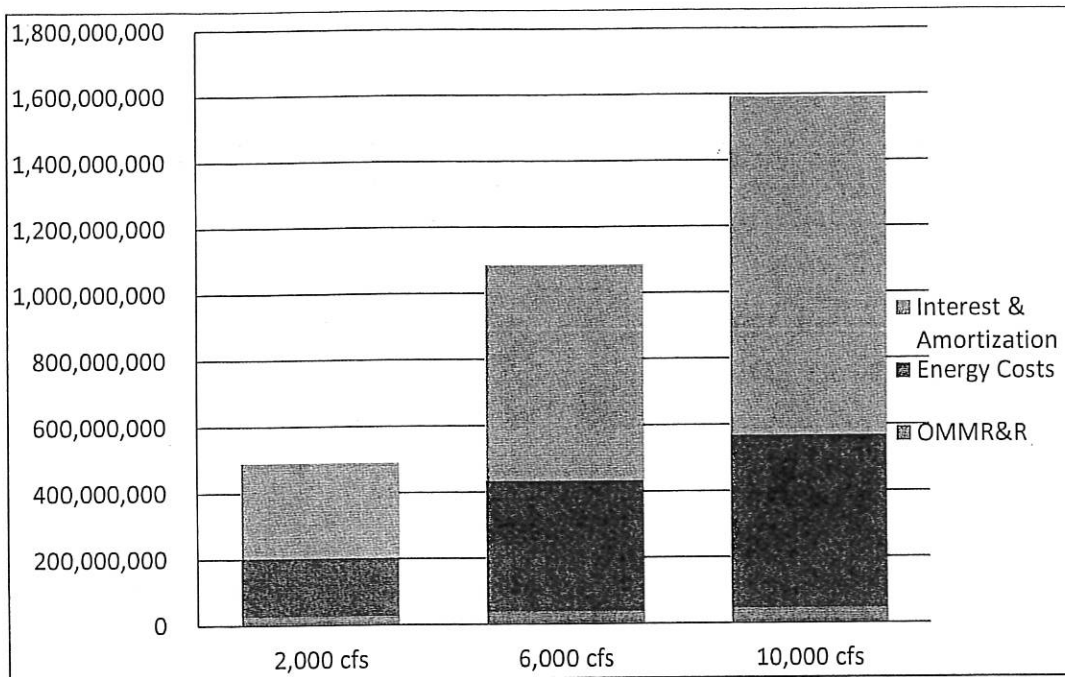


Figure ES (e). Annual Operation and Maintenance Costs.

Review of Legal and Legislative Issues

This section is organized into legal issues in obtaining water at the source, transporting and delivering water along the route and to the destination. In addition, the type of entity that could build and operate a project is addressed. The Missouri River basin ranges in general application of the Prior Appropriation Doctrine in the seven states located partially or totally west of the 98th meridian in the drier portions of the basin, to the general application of the Riparian Doctrine in the State of Missouri and a permit system in Iowa and Minnesota, all located in the wetter, eastern and southern part of the basin.

Federal Reserved Water Rights exist for Indian Tribes throughout the Missouri River basin under a 1908 Supreme Court ruling called the Winter's Doctrine. At this time, however, many of them remain undetermined as to rate and quantity, including the reserved water rights for the four Indian reservations in Kansas: the Sac and Fox Nation of Missouri in Kansas and Nebraska; the Iowa Tribe of Kansas and Nebraska; the Kickapoo Tribe in Kansas and the Prairie Band Potawatomi Nation. The ultimate determination of the extent of these rights will affect the rate and quantity of water available to the state of Kansas from the Missouri River. Several federal laws have also been passed to help protect historic and cultural resources of the American Indian Tribes. This is also briefly addressed in Chapter 6, Environmental Considerations.

A brief review of the Missouri River Basin Project authorized by the 1944 Flood Control Act is included due to its extremely important impact to the flows of the Missouri River, operation of most of the tributary reservoirs operated by the Federal government and the impact to the potential water supply for the Kansas Aqueduct Study being evaluated in part herein. The Act recognizes the interests and rights of the states in determining the development of the watershed within their borders and in water utilization and control.

There is not a basinwide compact, congressional allocation or U.S. Supreme Court Equitable Apportionment that fully allocates the waters of the Missouri River among the states and tribes. Until this is done, the State of Kansas cannot be guaranteed any specific percentage, flow or quantity of the Missouri River. This matter should be resolved prior to the state investing significant study dollar amounts in any such major transfer project. The Flood Control Act of 1944, other Federal statutes, the Corps Master Manual and Annual Operating plans, are

considered the Law of the Missouri River and could have significant bearing on what Kansas' equitable share of the Missouri River is whenever the decision is made. The four interstate water compacts to which Kansas is a party probably would not play a major role in building an aqueduct as described, unless an out of basin transfer of water is proposed from the Big Blue Compact area.

Under the Kansas Water Appropriation Act (KWAA) at least three applications to appropriate water for beneficial use would have to be filed and approved by the Chief Engineer, Kansas Department of Agriculture, Division of Water Resources (Chief Engineer) to allow appropriation of water from the Missouri River, by the source reservoir, and by the terminal reservoir. The application to appropriate water from the Missouri River could require a filing fee of up to one million dollars depending on the quantity applied for.

After permits are obtained from the Chief Engineer under the KWAA, or alternatively before water is diverted pursuant to a water reservation right, the entity constructing the aqueduct project must apply for, and receive approval for, a water transfer under the Water Transfer Act. This will involve lengthy public hearings concerning all of the impacts that might be caused by construction and operation of an aqueduct.

This review found that although the aqueduct does not exactly fit the definition of a traditional water right, there are many similarities. The items most out of the ordinary are a) an extremely long time to complete the project, b) an extremely long perfection period, c) an indefinite place of use, d) the requirement that the water right be perfected within a certain definite period of time and e) a large filing fee. Alternative options seem to be: 1) make the project fit under the KWAA; 2) modify the State Water Plan Storage Act so that it can be used to permit this project or 3) have the legislature create an entirely new type of water right.

An entity or entities would have to be created to finance, build, maintain and operate an aqueduct. This could include having the legislature create a new type of entity based on the model of the Kansas Turnpike Authority. A decision will also need to be made as to whether such an operating entity for an aqueduct will also deliver water from the terminal reservoir, or whether existing entities, such as public wholesale water supply districts, irrigation districts, water districts, municipalities and groundwater management districts should be given the responsibility of distributing the water from the terminal reservoir. Issues will arise concerning the delivery of the water from the terminal reservoir to either aquifer recharge projects or end users, such as the need for additional easements for pipelines or canals to deliver the water.

Permits would need to be obtained from the Chief Engineer under the Kansas Obstructions in Streams Act and Kansas Levee Law for the alteration of the course, current or cross-section of any stream in Kansas, including the construction of the source reservoir and terminal reservoir dams, and the construction of any levee or any project that has the effect of a levee. The Obstructions in Streams Act in turn requires compliance with the Water Projects Environmental Review Act which requires review of the project to determine if the proposed project will have detrimental environmental impacts. In addition, federal permits would need to be obtained under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act.

Easements must be obtained for the entire route of the aqueduct and reservoirs, including where it will cross existing infrastructure, such as roads, highways, power lines, pipelines, railroads and other public and private property. Reasonably adequate provisions must be made for local crossings of the aqueduct for individual landowners who need to get to town or access their property on the other side of the aqueduct. Another law that would be triggered would require an act to be passed by the Kansas legislature and approved by the Governor of Kansas to allow facilities to be constructed on any state owned property, such as roads, highways and the bed and banks of navigable streams in the state of Kansas, including the Missouri River, the Kansas River and the Arkansas River.

Water quality and endangered species issues would have to be resolved prior to construction. This may involve methods to prevent introduction of invasive species or degradation of water quality of other Kansas streams and aquifers. National Pollution Discharge Elimination Permits may be needed for the discharge of aqueduct water

to streams or other water bodies. Several of these issues are also addressed in under Environmental Considerations.

Environmental Considerations

A large-scale project such as that envisioned in the 1982 Study would require a comprehensive environmental review, an extensive permitting process and mitigation of the impacts to wildlife and habitat. The costs of these processes and mitigation are not included in the estimates of costs.

The construction of the lock and dam and intake facilities on the Missouri River, construction of the source and terminal reservoirs and the construction of the canal would all be subject to Section 404 of the Clean Water Act 404, which regulates the discharge of dredged or fill material in all waters of the United States and Section 10 of the Rivers and Harbors Act of 1889, which regulates any work or structure in, over or under navigable waters of the United States. The process for consideration of such permits is extensive and would require detailed analysis, review and public comment in compliance with the National Environmental Policy Act (NEPA). A large project such as the aqueduct would require the development of an Environmental Impact Statement and the project in its entirety would be reviewed to assess the cumulative impacts.

The environmental review would include an evaluation of the impacts to federal or state listed threatened or endangered species. There are at least three currently listed threatened species known to inhabit areas along the 1982 aqueduct route as well as federally listed threatened or endangered species on the Missouri River. Any future project will require an extensive review of its impact on threatened and endangered species and a permit placing special conditions to incorporate specific mitigation measures designed to significantly reduce or eliminate a project's adverse impacts to the protected species will be required.

Compensatory mitigation will be necessary to offset the impacts to streams and wetlands using permittee - responsible mitigation, mitigation banking or in-lieu fee mitigation. Stream and wetland mitigation costs for a water transfer system such as this would be substantial with recent projects costs ranging from approximately half of the overall construction costs, to surpassing the total cost of the project.

Water quality issues will have to be addressed under both state and federal laws related to the transfer of water from the Missouri River into other receiving bodies and potential risk of introducing invasive species and disrupting the nutrient and sediment balances.

From an environmental standpoint, some of the most significant challenges to address for a project like this would likely be the threatened and endangered species on the Missouri River and throughout Kansas, and the compensatory mitigation requirements under Section 404 of the Clean Water Act.

Preliminary Political Assessment

The Missouri River Basin covers one-sixth of the lower 48 states. The mainstem of the river flows through or adjacent to seven states – Montana, North Dakota, South Dakota, Nebraska, Iowa, Kansas and Missouri. The basin also includes portions of Colorado, Wyoming and Minnesota, and a small portion of Canada. In addition to the ten states located partially or totally in the basin, twenty eight American Indian Tribes are located in the basin, generally on reservations established by the treaties with the United States or congressional action. As mentioned in the Legal review section, there is not a basinwide compact, congressional allocation or U.S. Supreme Court Equitable Apportionment that fully allocates the waters of the Missouri River among the states and tribes. Until this is done, the state of Kansas, nor any other state or tribal nation, can be guaranteed any specific percentage, flow or quantity of the Missouri River.

Possible objectors to the an aqueduct project will be: 1) other states; Indian tribes or federal agencies in the Missouri River Basin; 2) landowners in Kansas who are concerned about having their land taken to build and

operate the project; 3) environmental groups who are concerned about such issues as the potential degradation of water quality in Kansas streams and aquifers, the introduction of invasive species across Kansas and destruction of wildlife and fish habitat and 4) those concerned with how the project will be financed and who will pay any new taxes or fees, versus who is expected to receive the benefits.

However, given the potential to meet important water needs in a broad area of the state, provide a sustainable supply of water to maintain the local, regional and state economy generated by the productive irrigated agricultural and related agri-business in High Plains – Ogallala aquifer area, as well as to provide water for economic development and stability in Kansas, the project may also receive a large amount of support.

Conclusions and Recommendations for Future Study

This study update provided an opportunity to reevaluate the concept of a large-scale water transfer system for the State of Kansas. Through participation of stakeholder committee members representing diverse areas and interests, a dialogue was opened about what a project like this would look like today in terms of the engineering feasibility, costs, legislative issues, political acceptability and environmental constraints. The stakeholder committee provided input on components of the study and identified issues that would require more attention.

Some of the positive outcomes of the study voiced by the committee members included the opportunity to learn about other parts of the state and getting local perspectives on the project concepts, getting started on a process to find a long-term solution to diminishing water resources in Kansas and preparing for future regional planning processes with other states.

The study update also shed light on negative aspects of the project, particularly the potential future impacts to landowners in the areas of the reservoirs and aqueduct route. Some felt that the study update did not go far enough to identify the willingness of consumers to pay for the water that would be delivered by such a system, nor did it address the cost to the state economy to not do the project. Others felt that the study did not go far enough to provide a path forward.

Many topics were identified as needing further study in the future including a more indepth look at the cost and willingness to pay by future users, the costs of the end user distribution network, the issue of tribal reserved water rights and economic impacts to landowners and localities if such a project were ever constructed. Much, but not all, of the committee voiced the need to explore the ability to access the Missouri River as the first necessary step. Working through the apportionment process with other Missouri River states and ensuring Kansas laws will allow such a water transfer are areas that will definitely need further exploration.