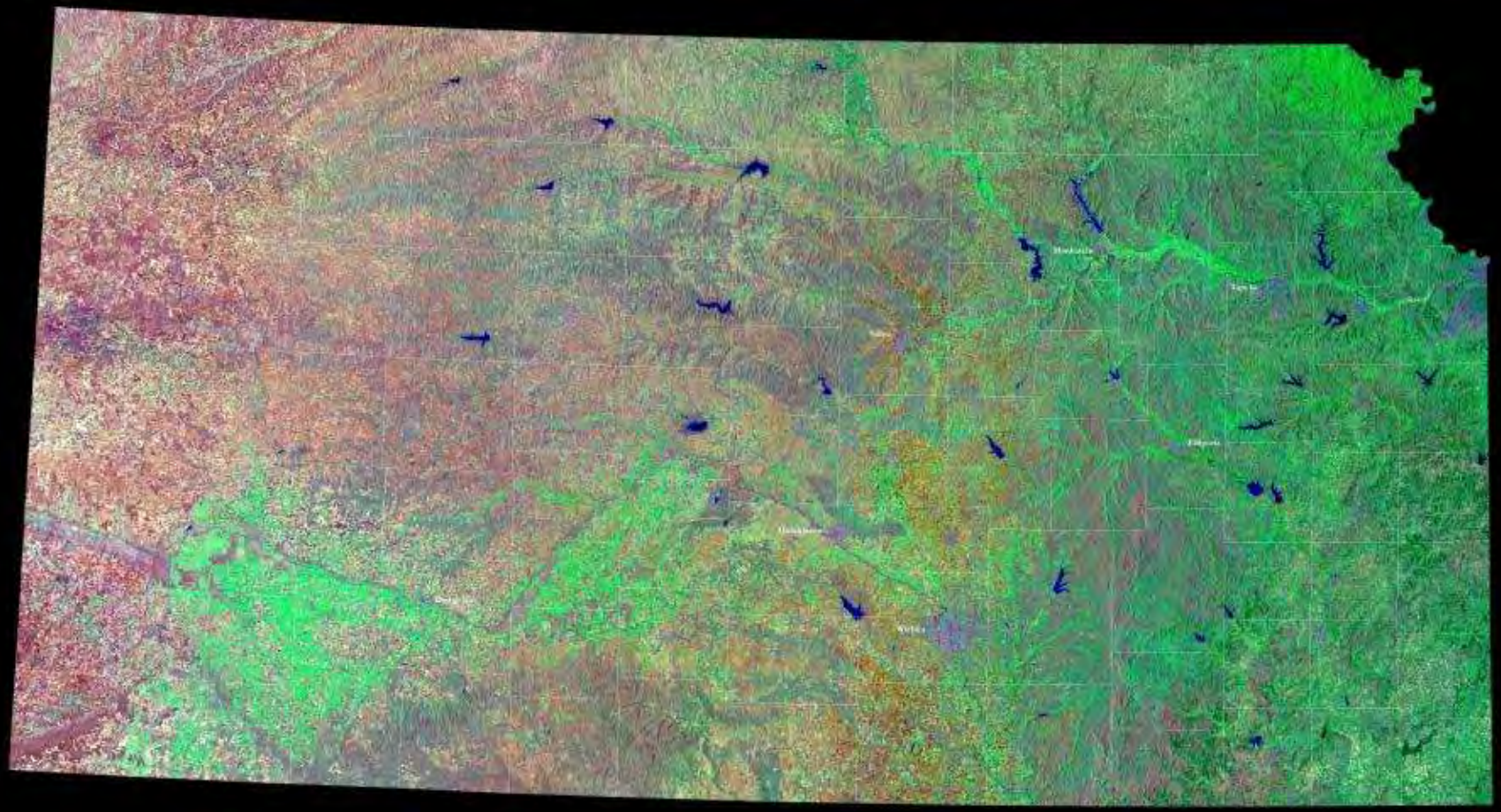
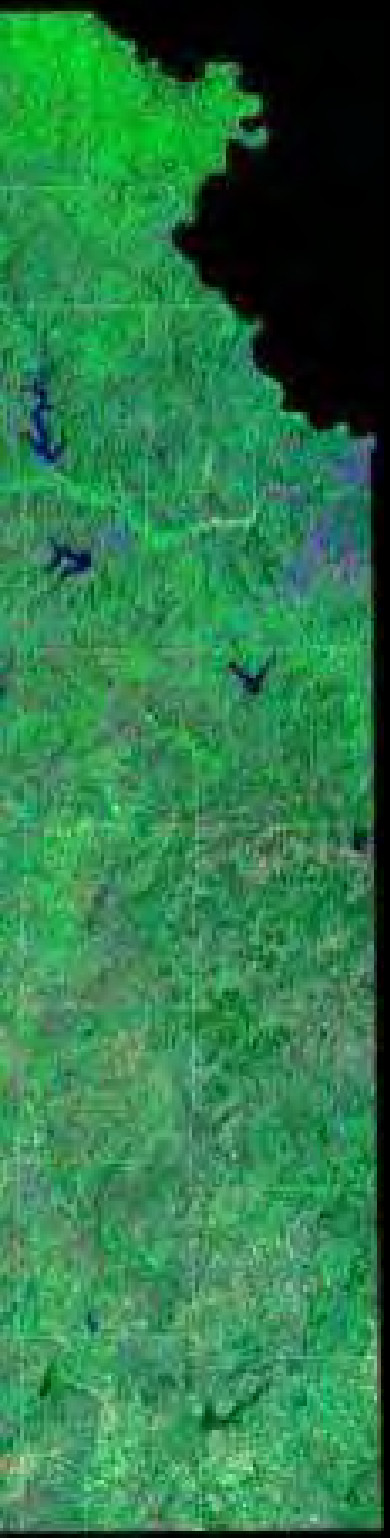
Collaboration for a Water West Project



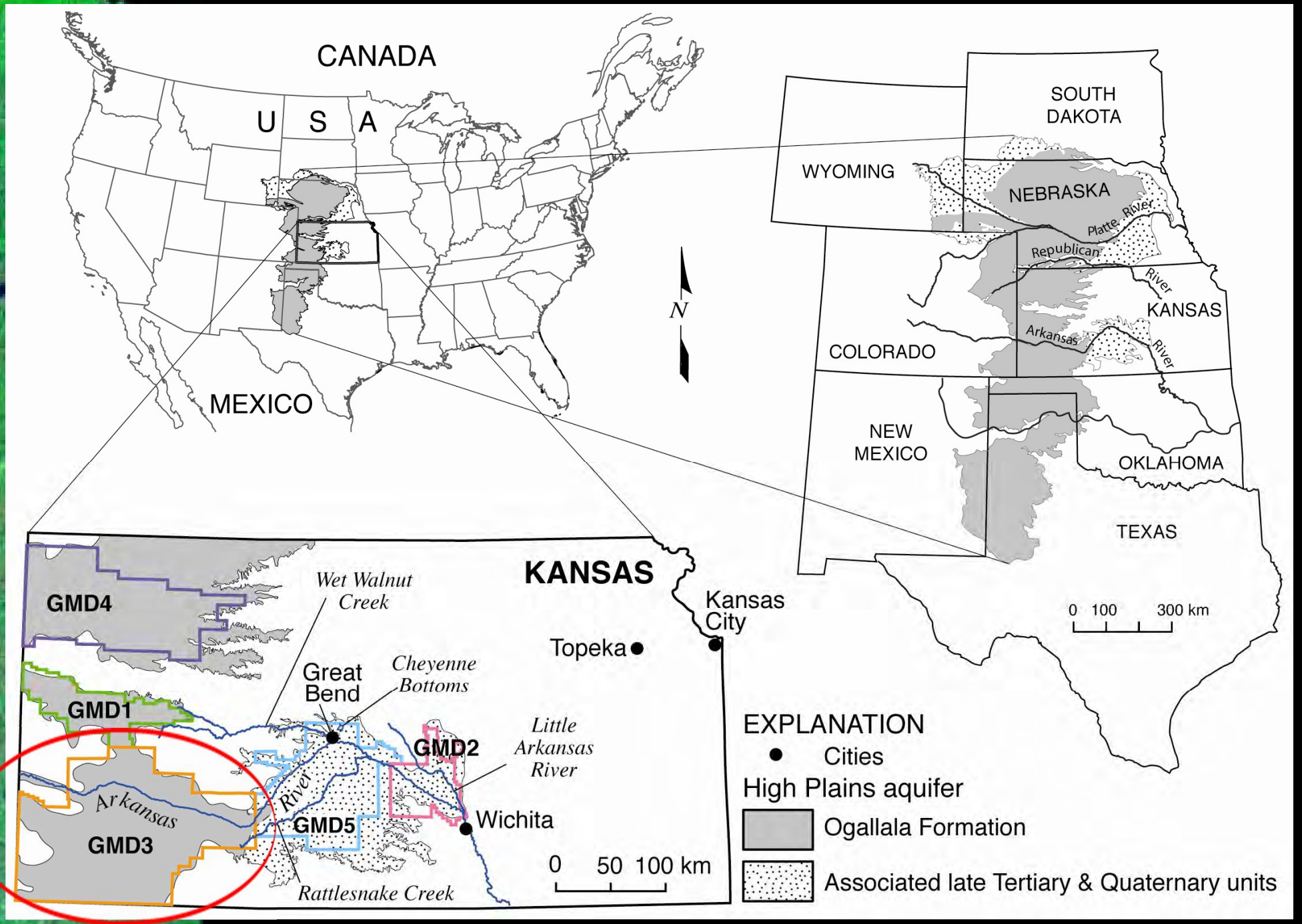
Mark Rude, Executive Director
Southwest Kansas Groundwater Management District No. 3
CRWUA Annual Conference
Las Vegas, NV, December 15, 2022

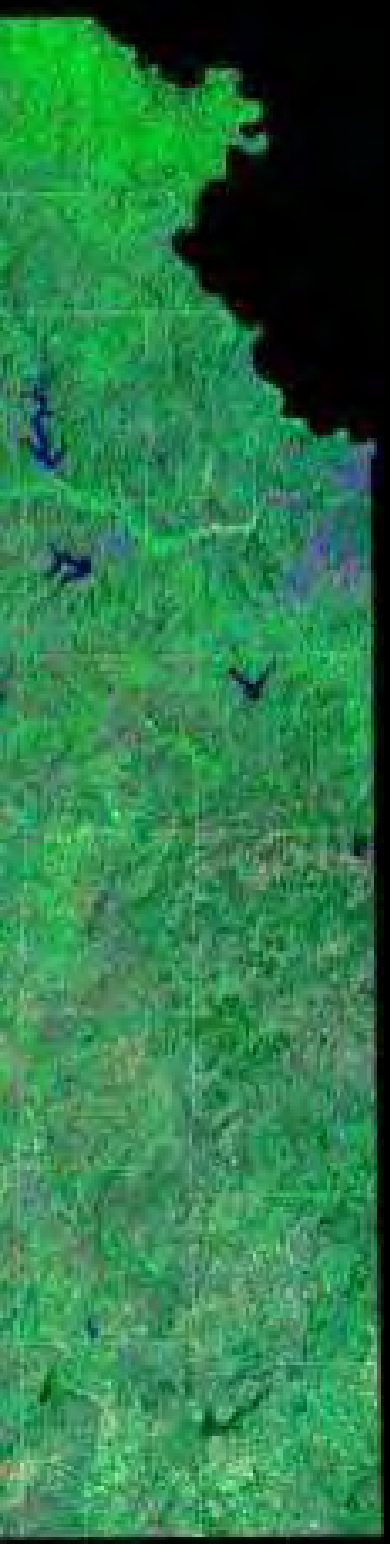


Outline of my comments

- Intro - SW Kansas water setting
- The Water Collaborative
- Imports to the Colorado River Basin
- Kansas Aqueduct concept update
- A Water West Project

Intro -The High Plains Aquifer





2011 and this year,

~1/2 of Kansas GW use is in the southwest

3.6 MAF appropriated in SW Kansas resulting in Significant Groundwater Declines

2011 Kansas

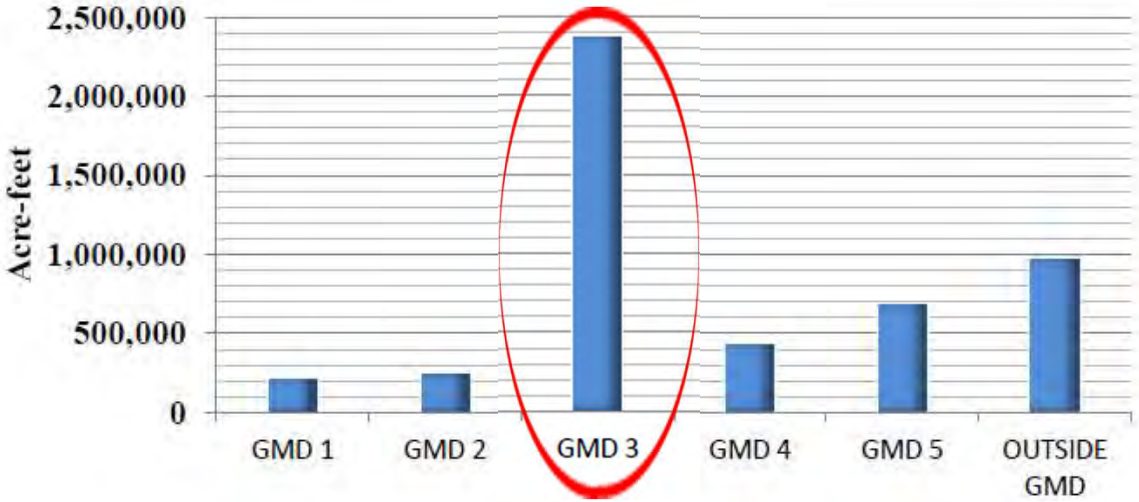
Total Water Diverted

KANSAS
WATER USE UNIT

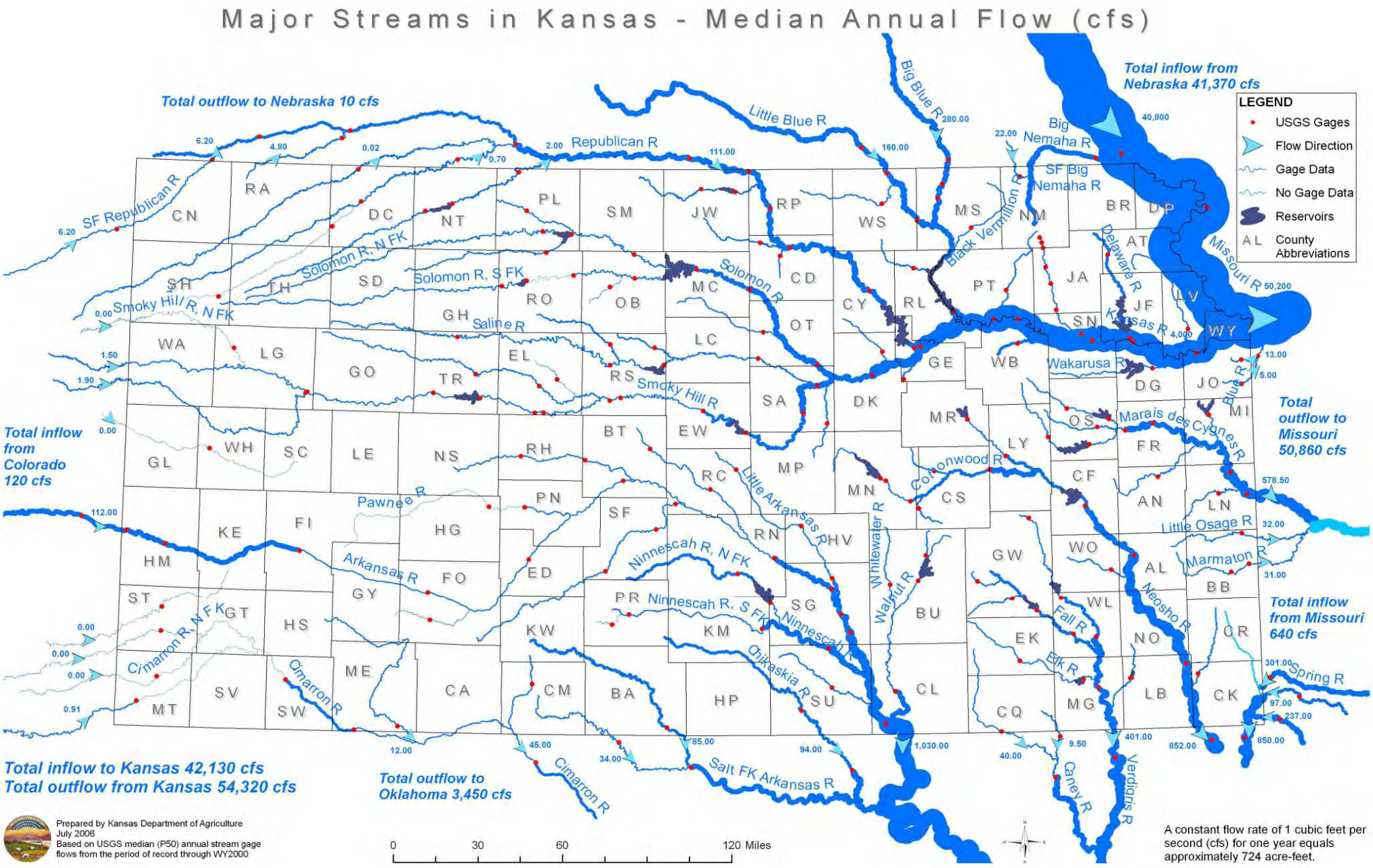
by Groundwater Management District
and outside GMD
All uses; all quantities in acre-feet

2011 Water Use by Groundwater Management District		
GMD 1	216,456	4.38%
GMD 2	246,978	5.00%
GMD 3	2,376,591	48.13%
GMD 4	434,545	8.80%
GMD 5	687,511	13.92%
OUTSIDE GMD	975,902	19.76%
Total	4,937,983	100.00%

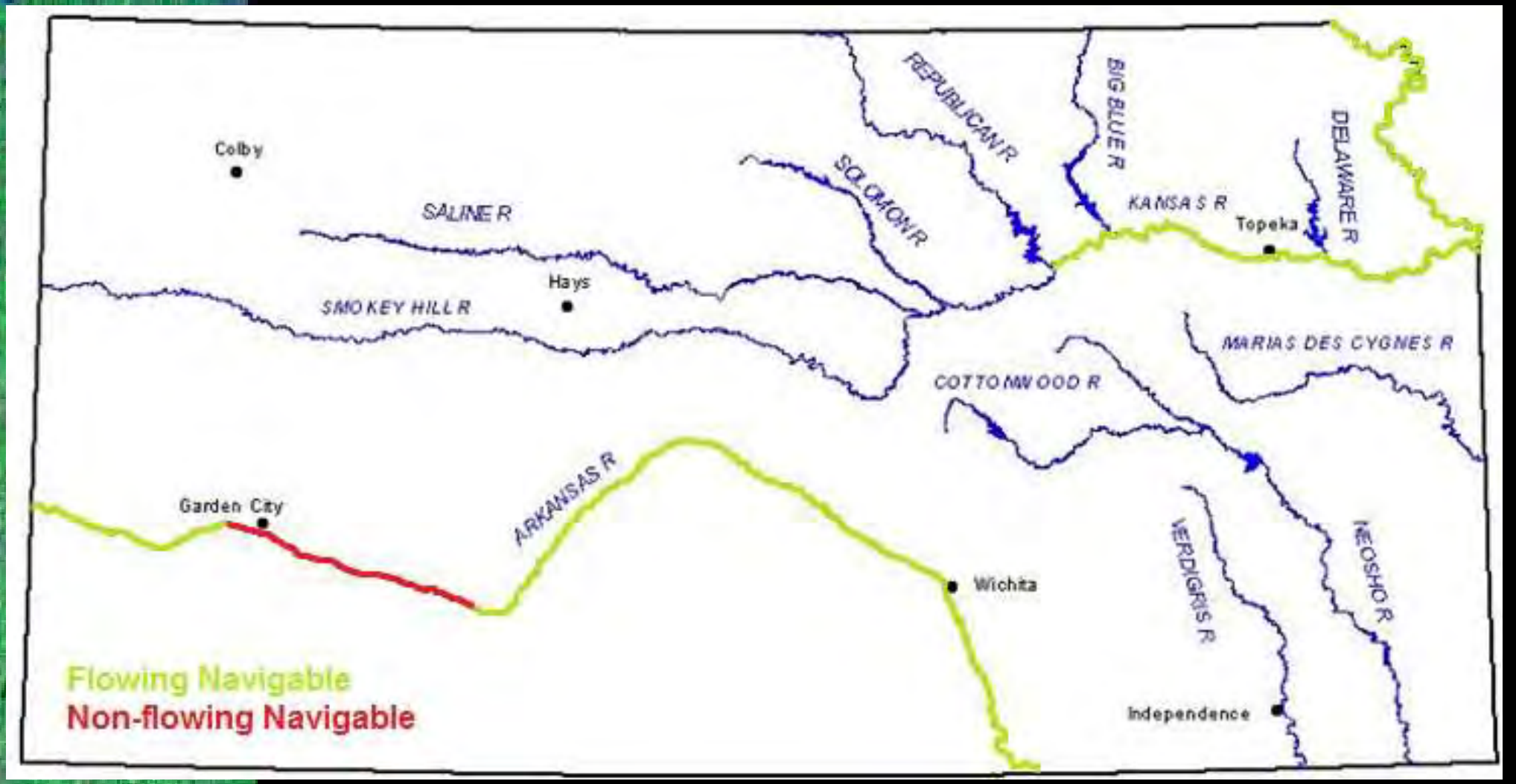
2011 Total Water Diverted by Groundwater Management District



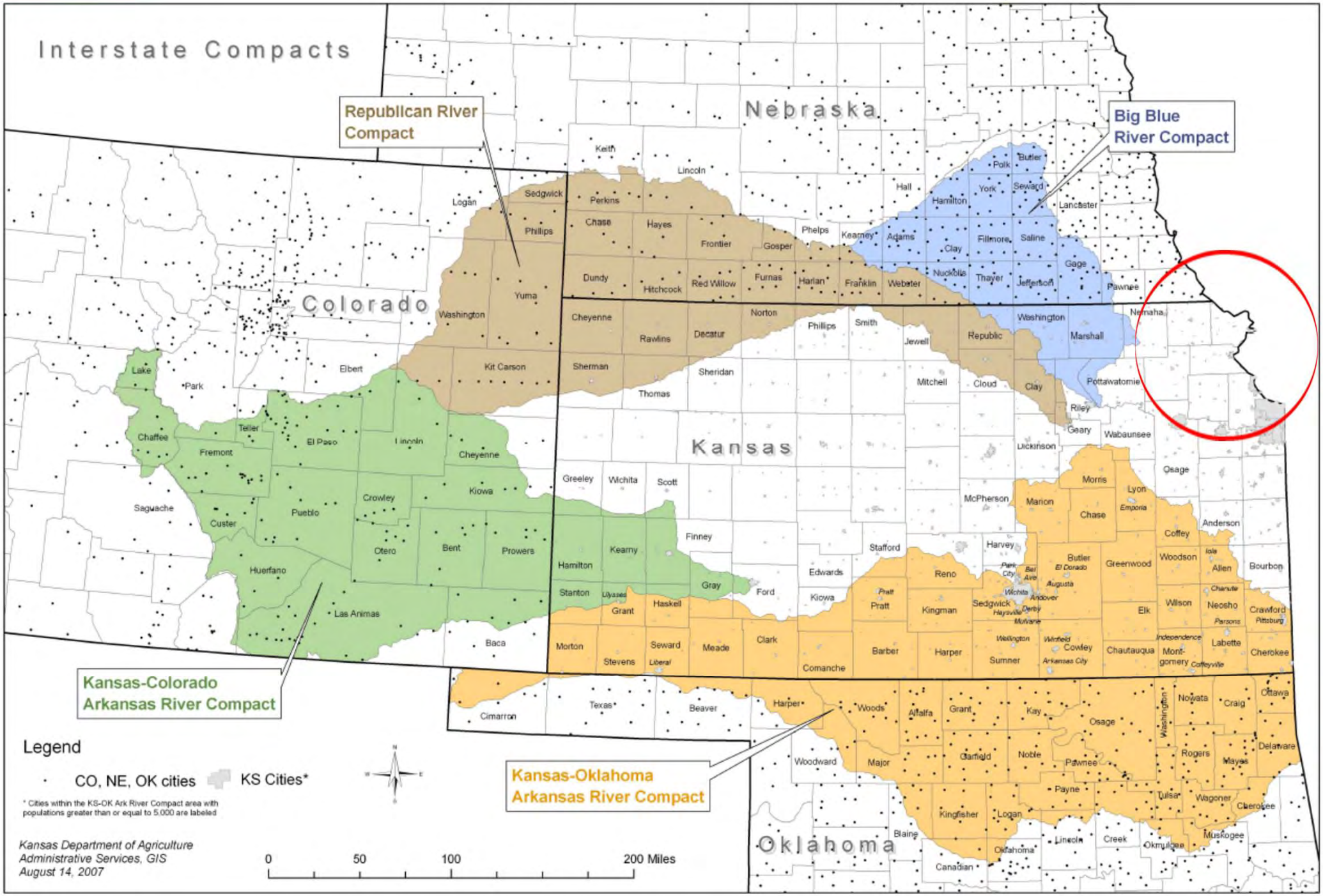
Available Source Water



Kansas Surface Water



Interstate River Compacts



Feast and Famine: Securing Kansas Water Needs

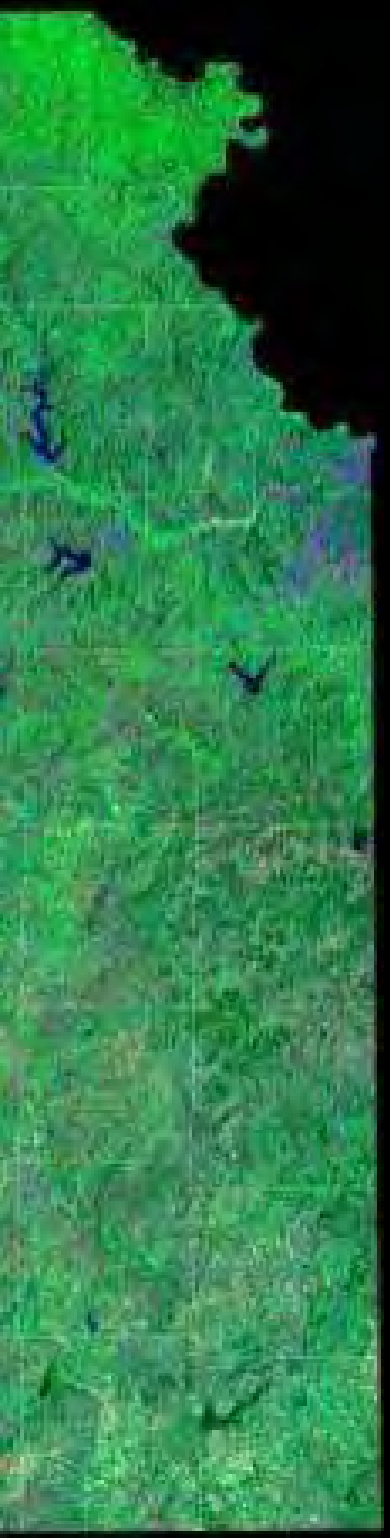
Kansas water users and officials discuss the dire need to collaborate now on water transportation projects before it's too late.

Documentary: General Education and Discovery.

- Garden City Co-op
- Skyland Grain
- GMD3

See: Kansasaqueductcoalition.com

Folks pooh-poohed this kind of stuff back in the 1960s.
Now they are taking another look – its no longer unrealistic.



The Water Collaborative

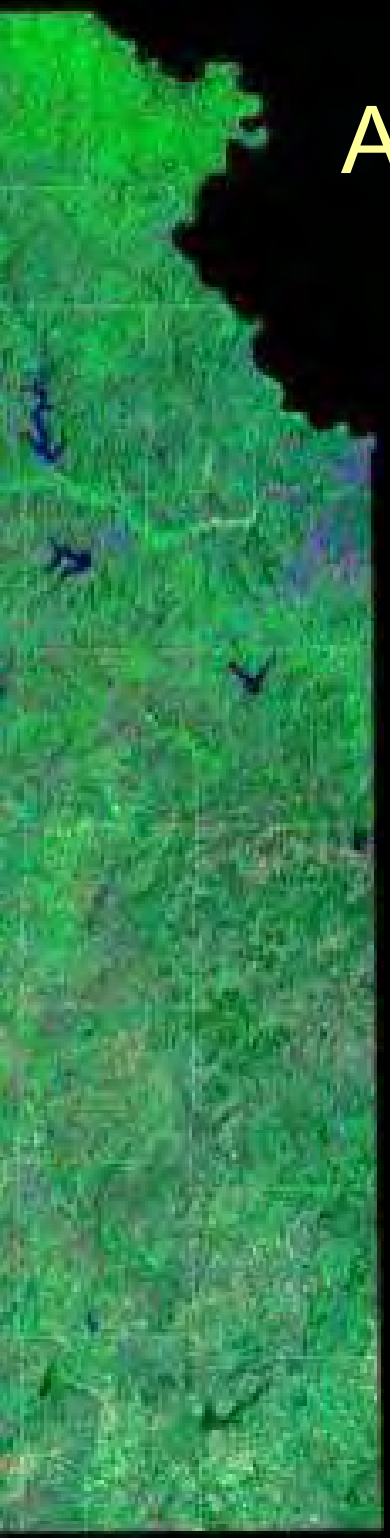
- (Aspire to) reach mutually acceptable solutions to mutually adopted problems.
  - Interest based bargaining
- Working for win-win-win outcomes.
- Collaboration can circumvent silos and allow people to join forces to tackle the same project.

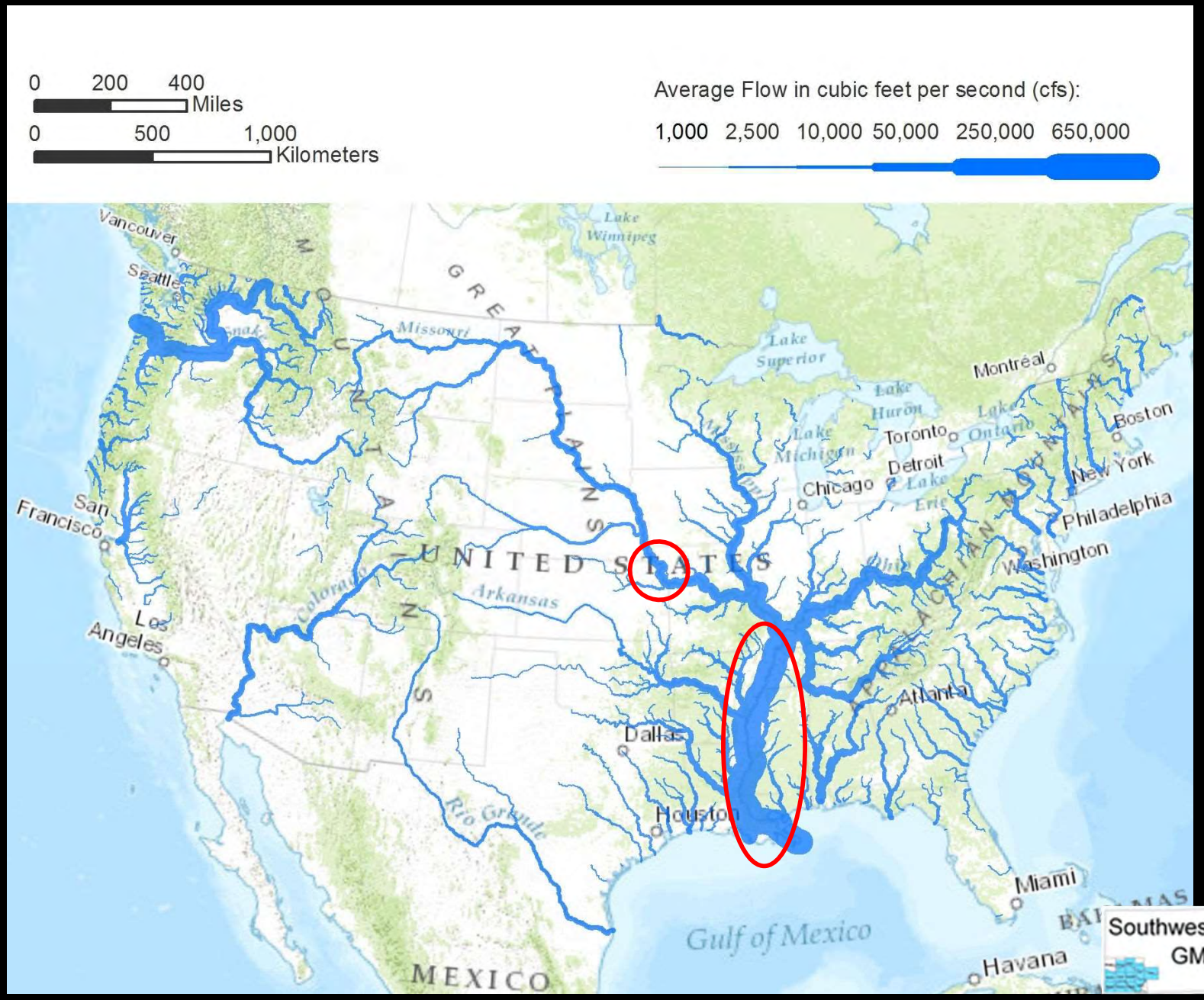
Sources of "New" Water in the West

Upstream Face, Hoover Dam, USBR

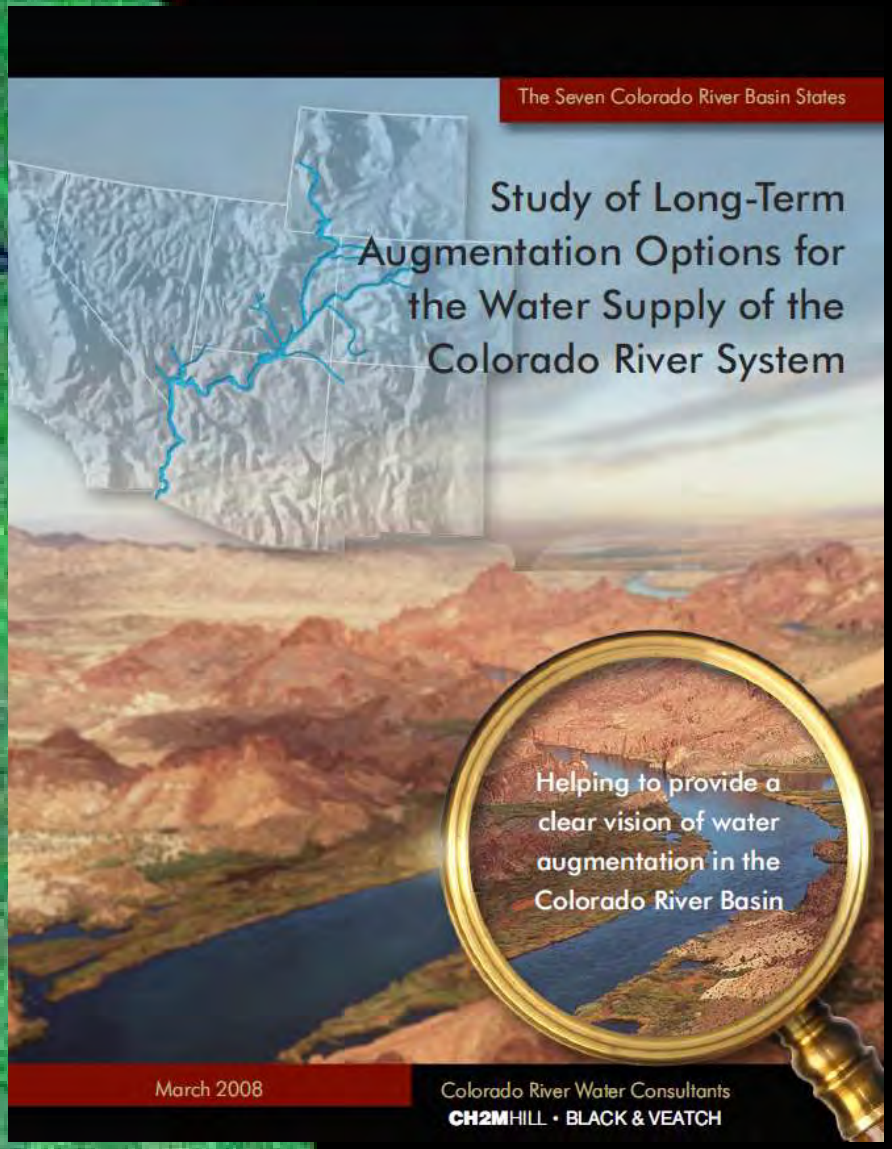
- Desalination
- Conservation & Reuse
- Agriculture Dry-Up
- Importation

Available water above navigation targets?





Building on prior work



TECHNICAL EVALUATION OF OPTIONS FOR LONG-TERM AUGMENTATION OF THE COLORADO RIVER SYSTEM

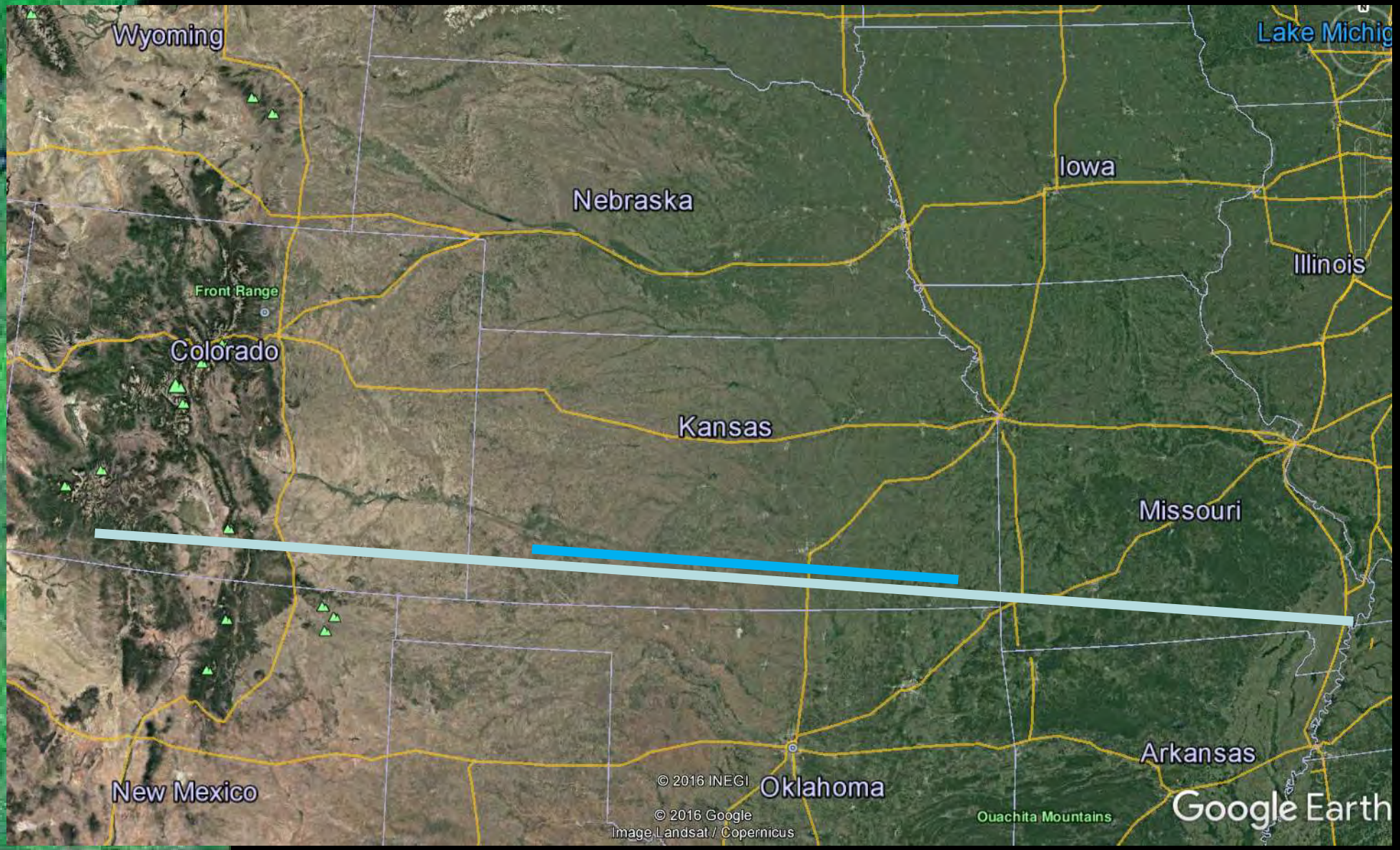
COLORADO RIVER BASIN
IMPORTS AND EXPORTS
TECHNICAL MEMORANDUM

BY:
KLINT REEDY, P. E.
BLACK & VEATCH

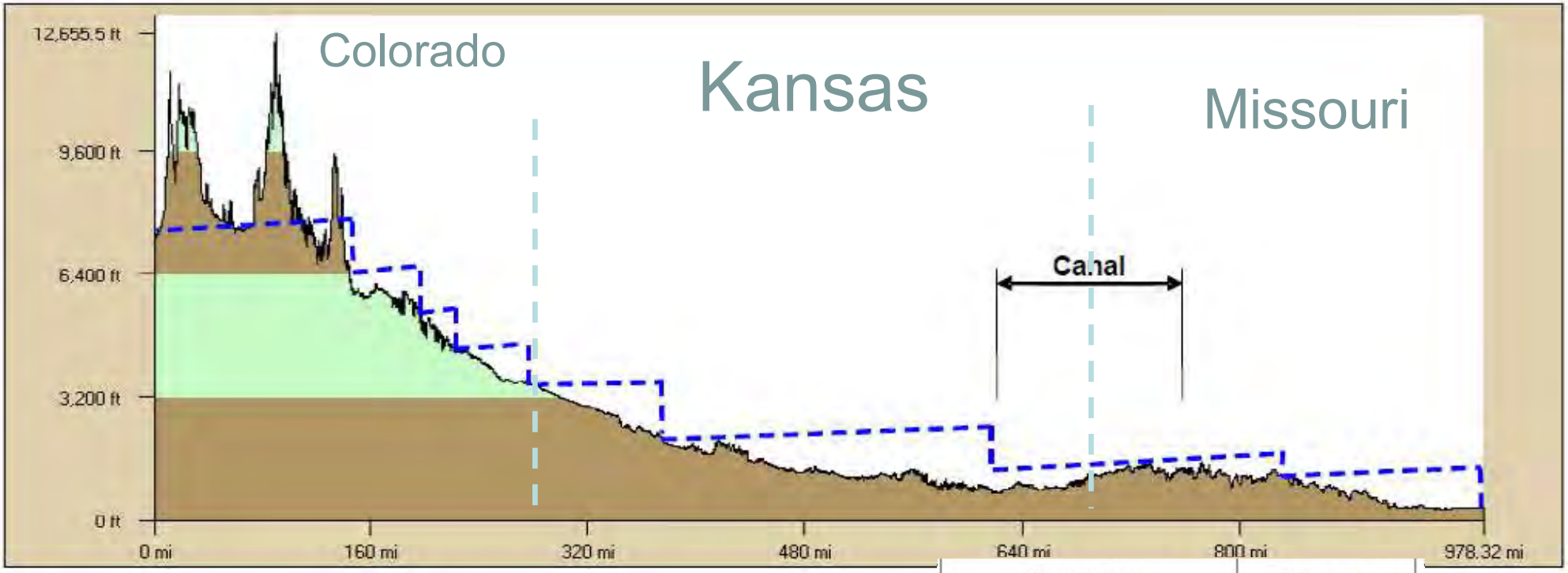
Q/C:
TED WAY, P. E.
CH2M HILL

Final: August 2007
Released: March 2008

Mississippi River to Navajo Res.



From Augmentation Technical Memo



Parameter	Mississippi River
Yield (AFY)	675,000
Capital Cost ($ Millions)	$11,367
O&M ($ Millions/yr)	$41.50
Electricity ($ Millions/yr)	$483.00
Unit Cost ($/AF)	$1,870

Alignment Features

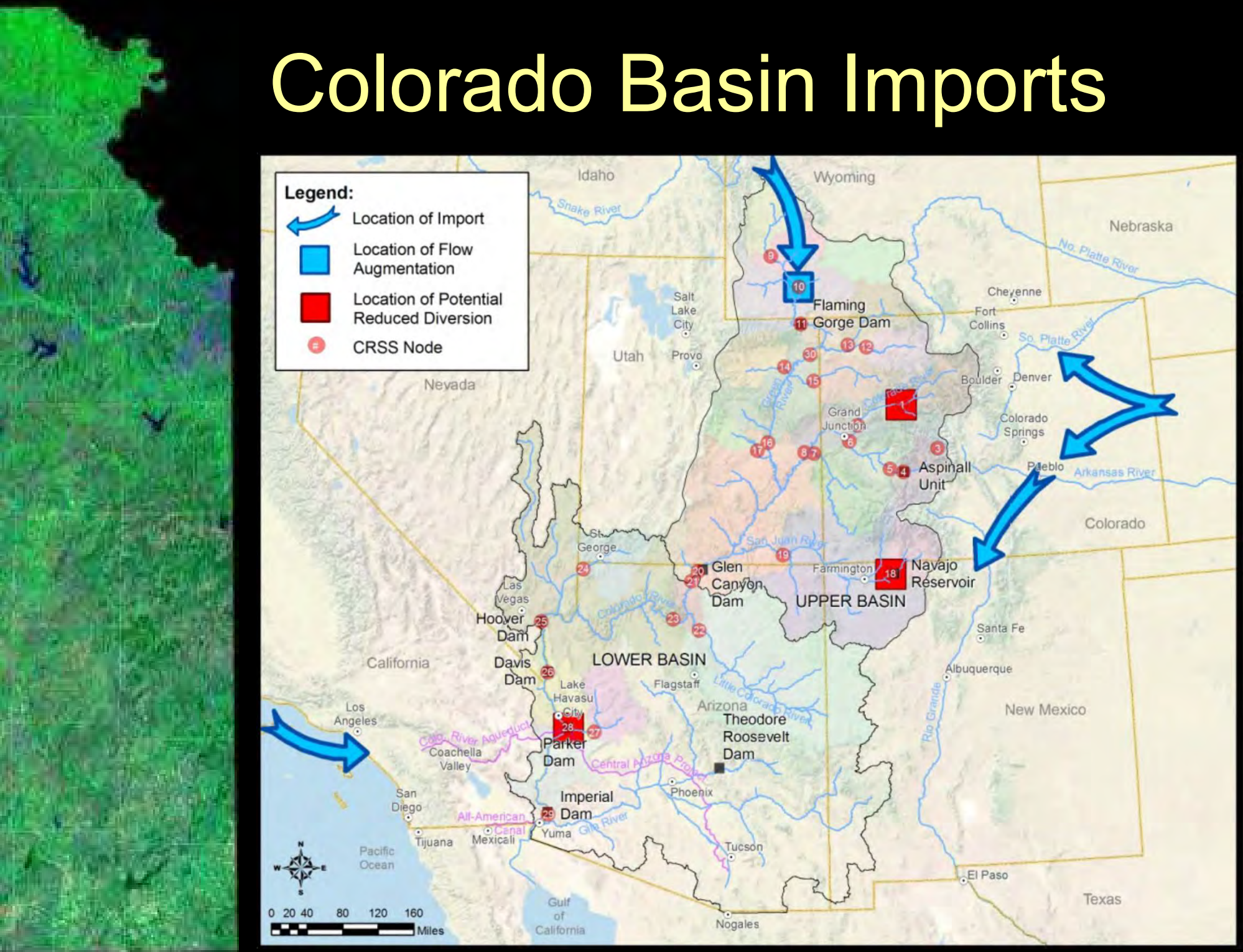
- 7 pump stations
- 110 miles of canal
- 85 miles of tunnel
- 775 miles of 144 -inch diameter pipe

Mississippi River to Navajo River Profile

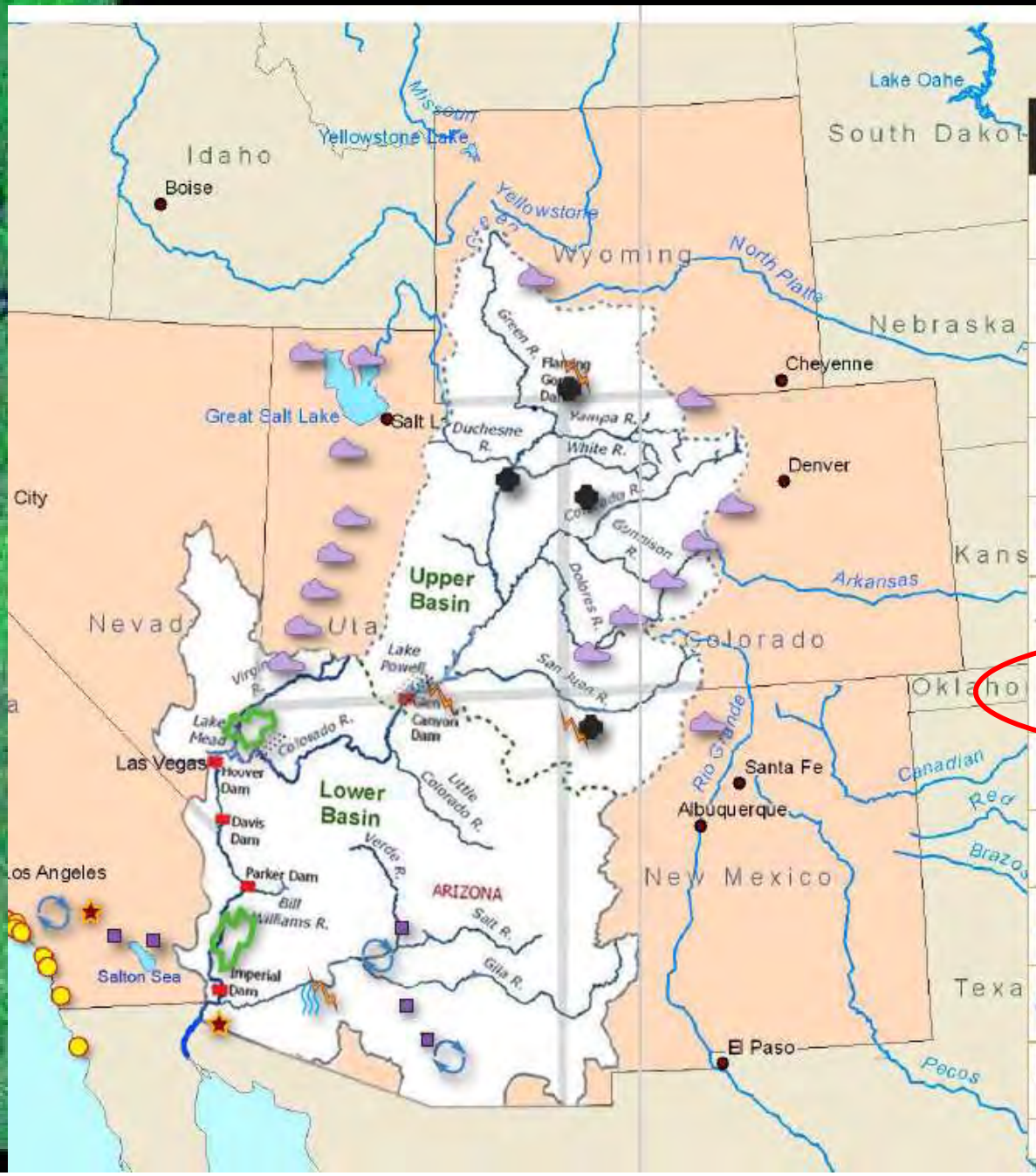
The Seven Colorado River Basin States

Figure 2-11
Modified

Colorado Basin Imports



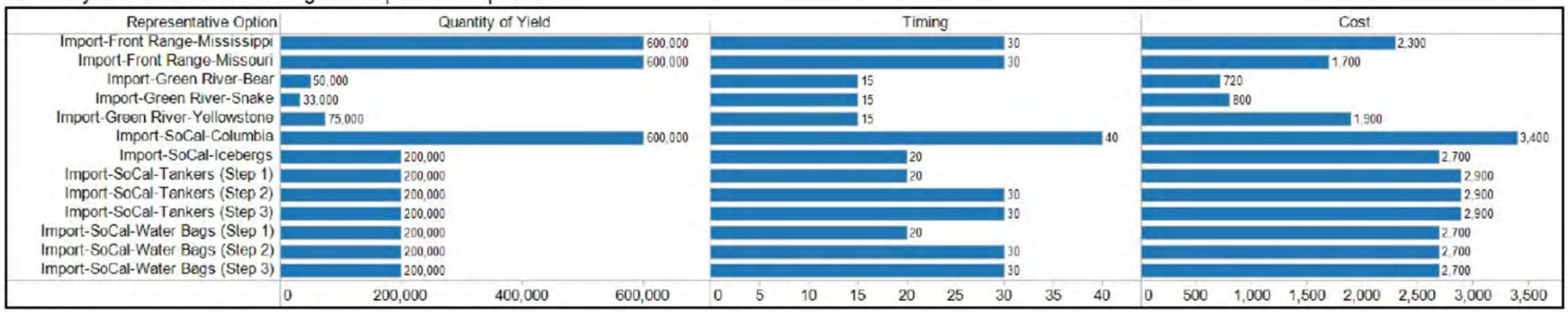
Imports – "Needs more refinement"



ALTERNATIVE	Quantity Evaluated (AFY)	Cost $ / AF
Brackish Water Desalination	4,000 – 50,000	$700 – $2,000
Coalbed Methane Produced Water	3,000 – 20,000	$900 – $4,600
Conjunctive Use	8,000 – 40,000	$400 – $700
Ocean Water Desalination	20,000 – 100,000	$1,100 – $1,800
Power Plants - Reduce Consumptive Use	1,500 – 160,000	$1,000 – $4,000
Reservoir Evaporation Control	0 – 270,000	$500 – $2,000
River Basin Imports	30,000 – 700,000	Needs more refinement
Stormwater Storage	0 – 100,000	$600 +
Vegetation Management	20,000 – 150,000 *	$30 – $100
Water Imports Using Ocean Routes	10,000 – 300,000	$1,400 – $4,000
Water Reuse	20,000 – 800,000	$900 – $1,700
Weather Modification	150,000 – 1,400,000	$20 – $30

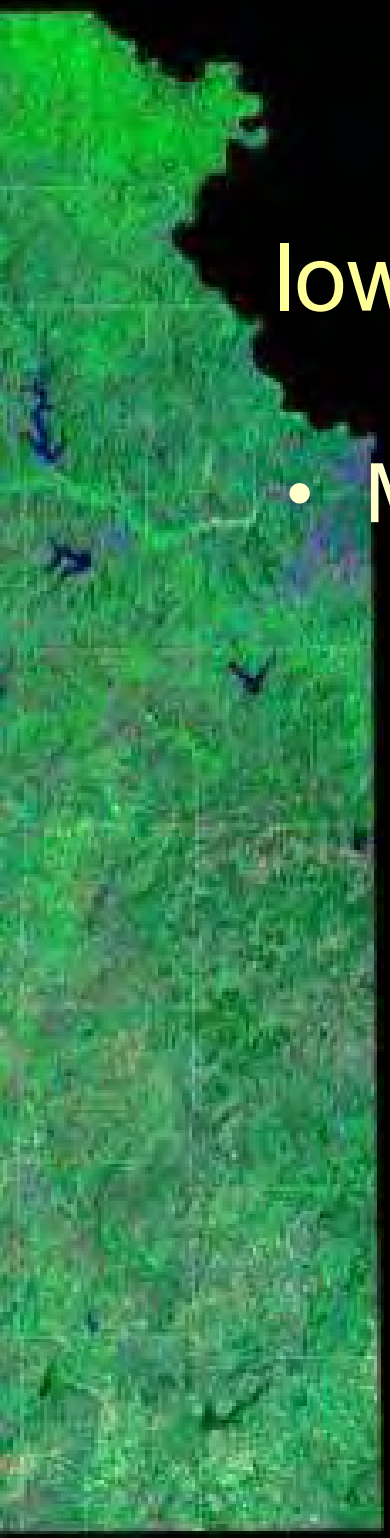
* Lower Basin Only

TABLE F4-1
Summary Characterization Ratings for Importation Options



Criteria

Representative Option	Quantity of Yield	Timing	Cost	Technical Feasibility	Implementation Risk	Long-Term Viability	Operational Flexibility	Permitting	Energy Needs	Energy Source	Other Environmental	Recreation	Socioeconomics	Policy	Legal	Hydropower	Water Quality
Import-Front Range-Mississippi	A	D	D	B	C	C	D	D	E	C	C	A	C	D	D	A	C
Import-Front Range-Missouri	A	D	C	B	C	C	D	D	E	C	C	A	C	D	D	A	C
Import-Green River-Bear	E	C	B	A	A	D	D	D	C	C	D	C	C	C	D	C	C
Import-Green River-Snake	E	C	B	A	A	D	D	B	D	C	C	C	C	C	E	C	C
Import-Green River-Yellowstone	E	C	C	A	A	D	D	B	E	C	C	C	C	C	D	C	C
Import-SoCal-Columbia	A	E	E	E	D	E	D	E	E	C	D	C	C	E	E	D	B
Import-SoCal-Icebergs	D	C	D	D	D	D	D	C	E	D	C	C	C	D	C	C	A
Import-SoCal-Tankers (Step 1)	D	C	D	D	D	D	D	C	E	D	C	C	C	D	C	C	A
Import-SoCal-Tankers (Step 2)	D	D	D	D	D	D	D	C	E	D	D	C	C	D	C	D	A
Import-SoCal-Tankers (Step 3)	D	D	D	D	D	D	D	C	E	D	D	D	C	D	C	D	A
Import-SoCal-Water Bags (Step 1)	D	C	D	D	D	D	D	C	E	D	C	C	C	D	C	C	A
Import-SoCal-Water Bags (Step 2)	D	D	D	D	D	D	D	C	E	D	D	C	C	D	C	D	A
Import-SoCal-Water Bags (Step 3)	D	D	D	D	D	D	D	C	E	D	D	D	C	D	C	D	A



17 criteria and associated ratings low scoring - pink or red (grades D or E):

- Missouri River
  - Timing
  - Operational flexibility
  - Permitting
  - Energy needs
  - Policy
  - Legal
- Mississippi River
  - Timing
  - Cost
  - Operational flexibility
  - Permitting
  - Energy needs
  - Policy
  - Legal

Areas for collaboration

Recent collaboration
1982 High Plains Study 2015 Update

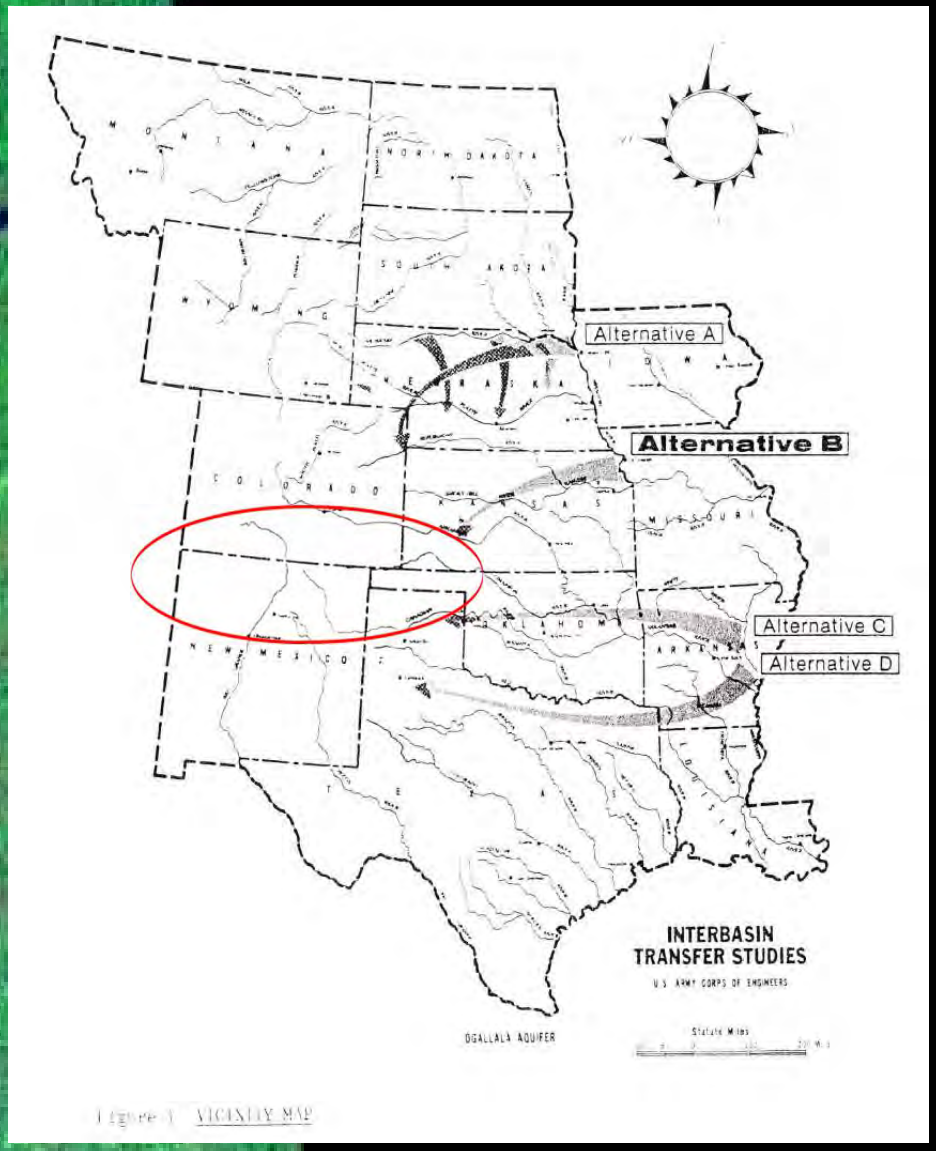


Figure 1 VICINITY MAP

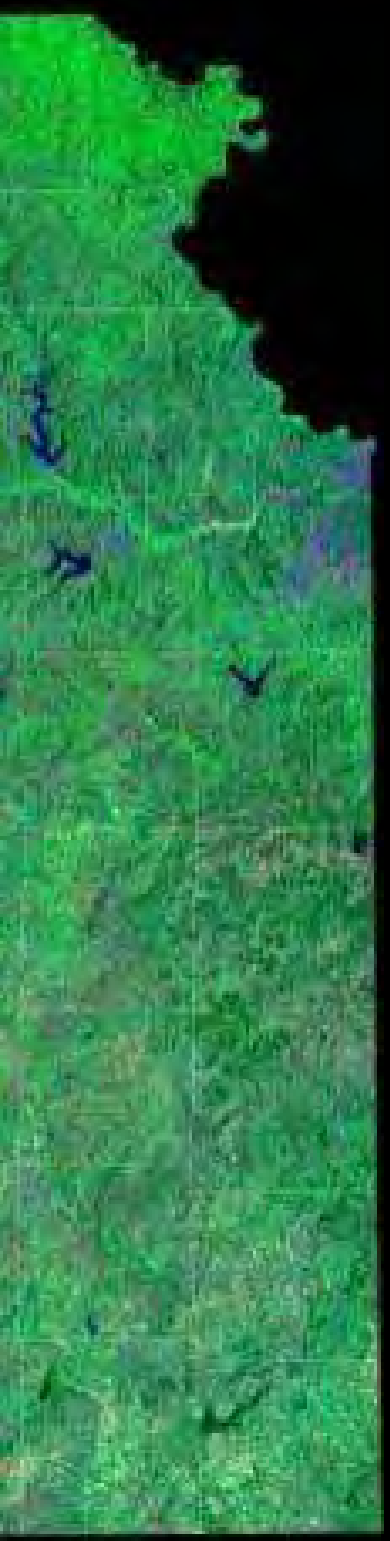
January 2015

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

Update of 1982 Six State High Plains Aquifer Study

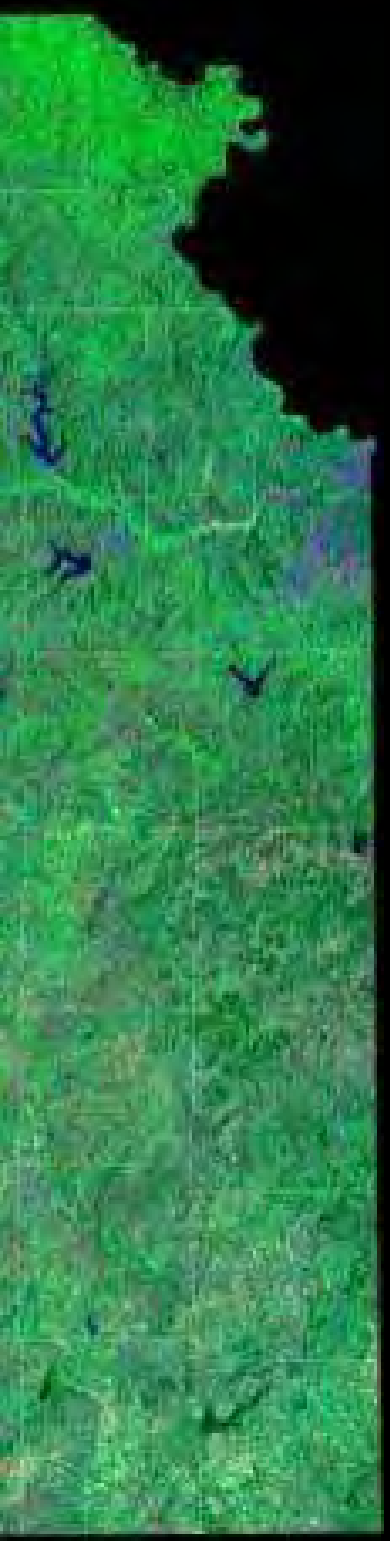
Alternate Route B

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



Kansas Aqueduct 2015 Update

Table of Contents



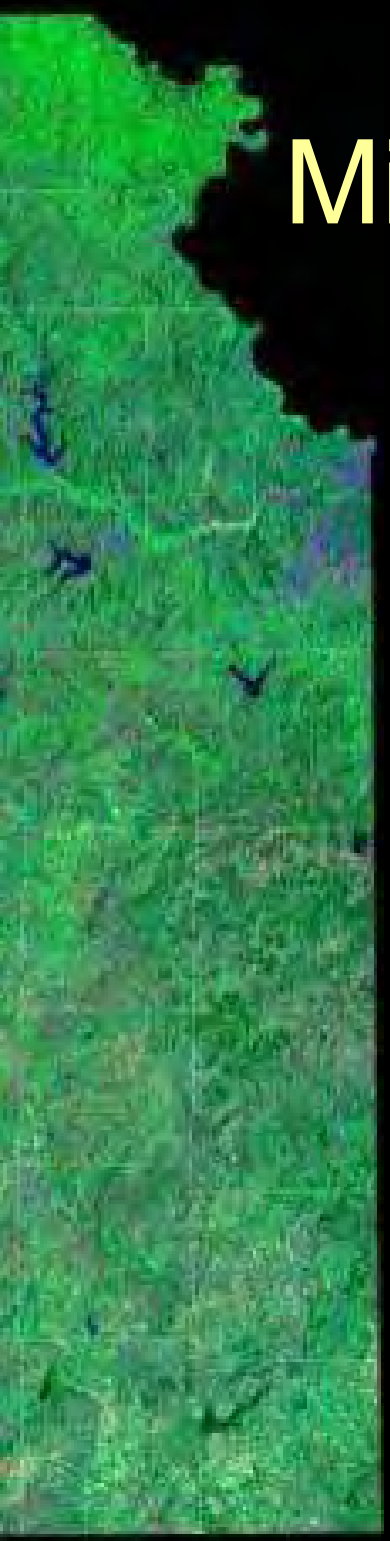
Kansas Legal and Legislative Review (Pope and Rolfs, 2014)

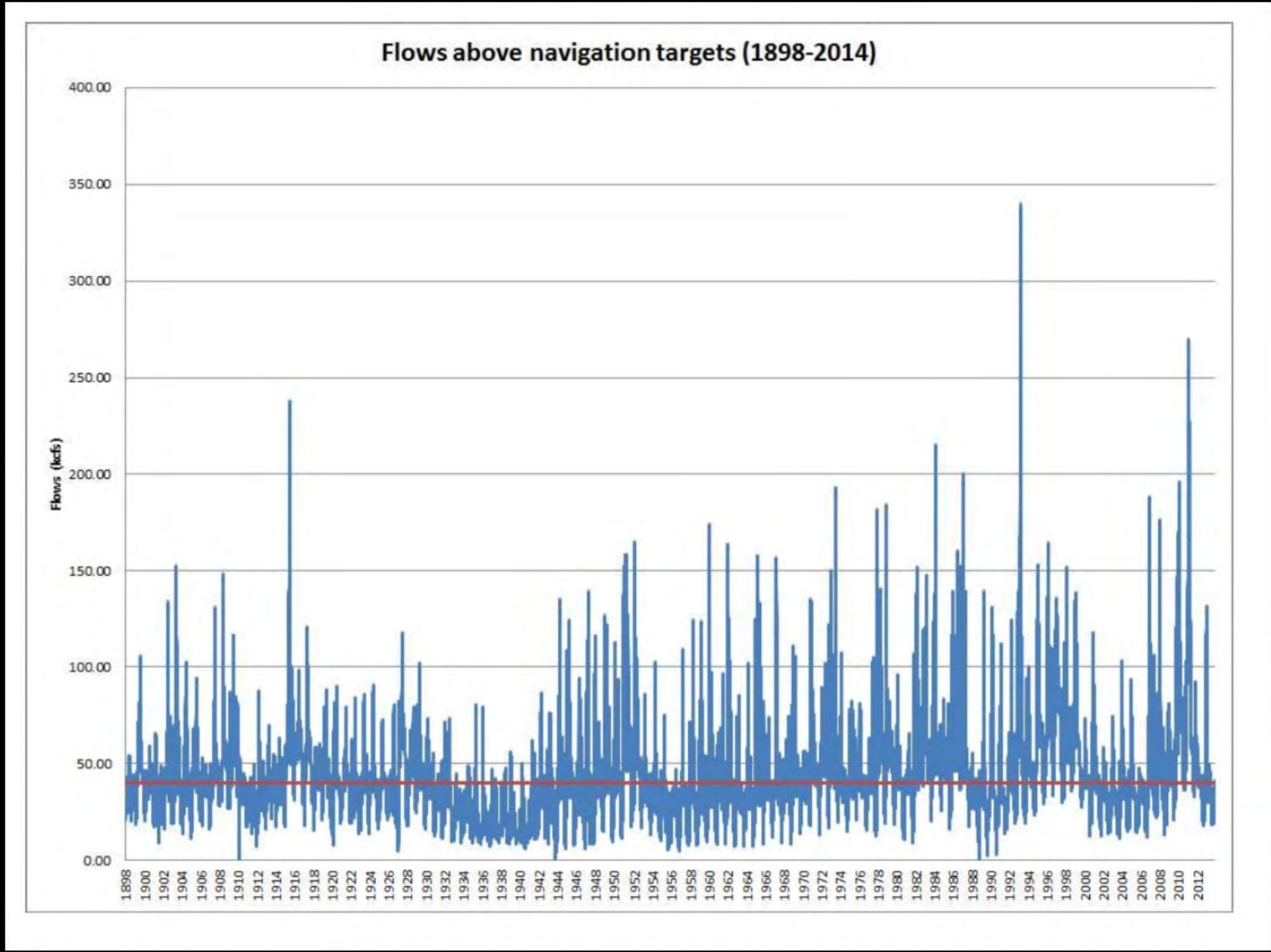
Evaluation was a part of the *Update of 1982 High Plains Ogallala Study by USACE, KWO and GMD3*

The Evaluation included:

- Legal Issues in obtaining water at the source
- Legal Issues in Transporting and Using water along the way
- Legal Issues at the Destination
- Institutional Issues
- Political Assessment

Missouri River source passing KS





Water lifted west concept

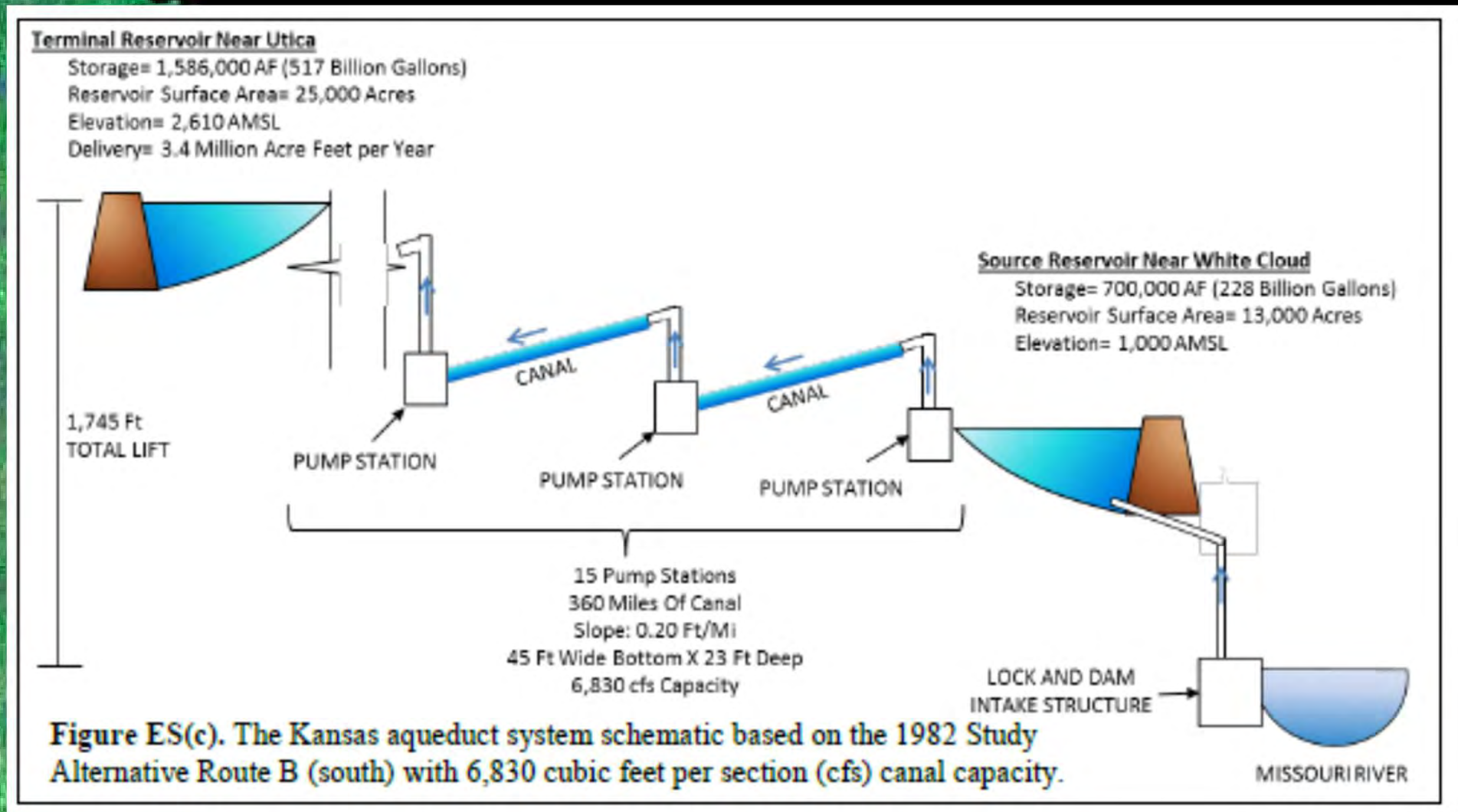
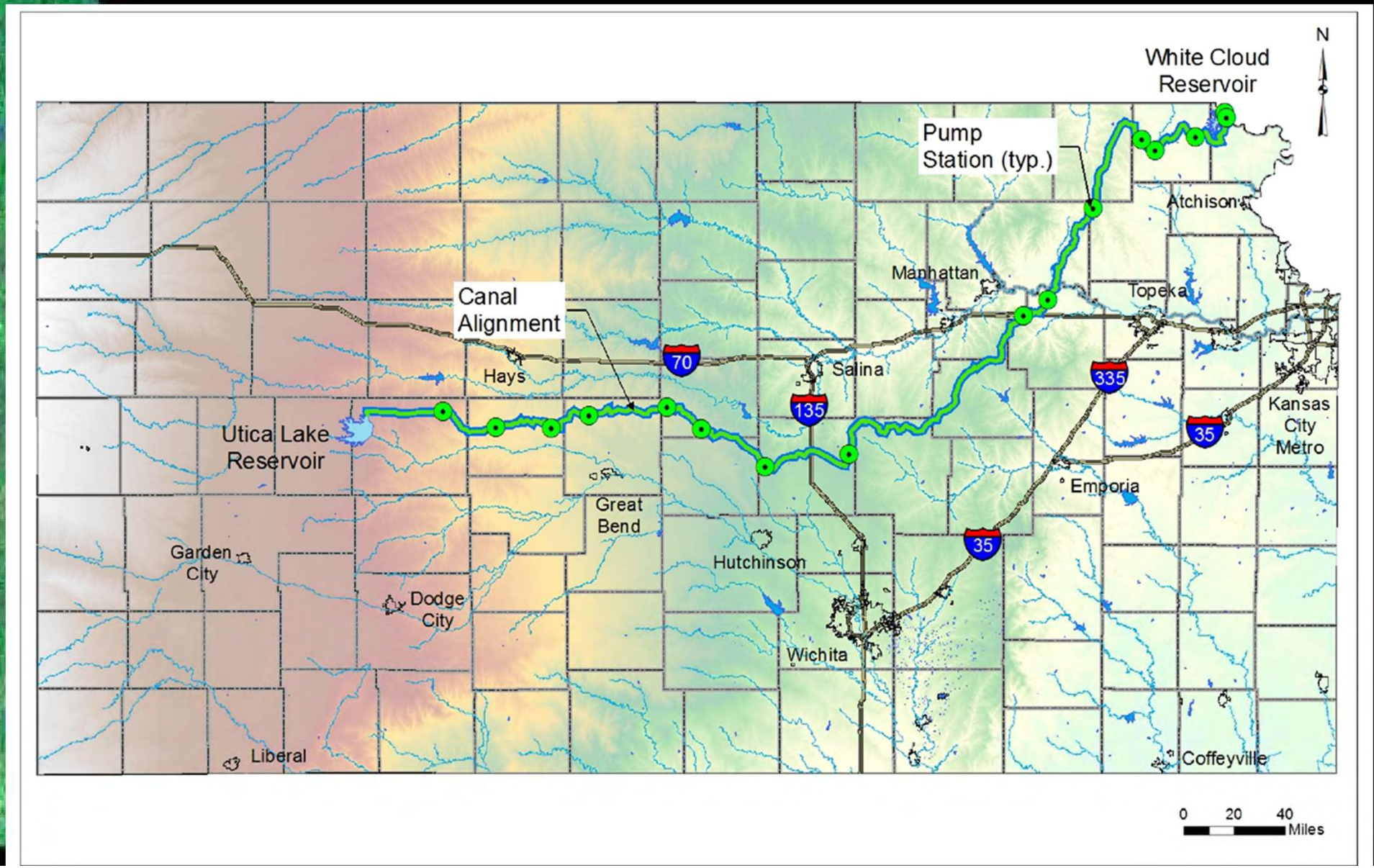


Figure ES(c). The Kansas aqueduct system schematic based on the 1982 Study Alternative Route B (south) with 6,830 cubic feet per section (cfs) canal capacity.

Canal System

Concept canal alignment with 16 pump stations



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 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.
5) Current study assumes future depletions upstream of St. Joseph will be the same as 2010 levels. Current study includes Missouri River supply limitations.
6) 1982 Study assumed between 1.3 to 1.9 MAF of future depletions upstream of St. Joseph.

KS Aqueduct 2015 update

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.

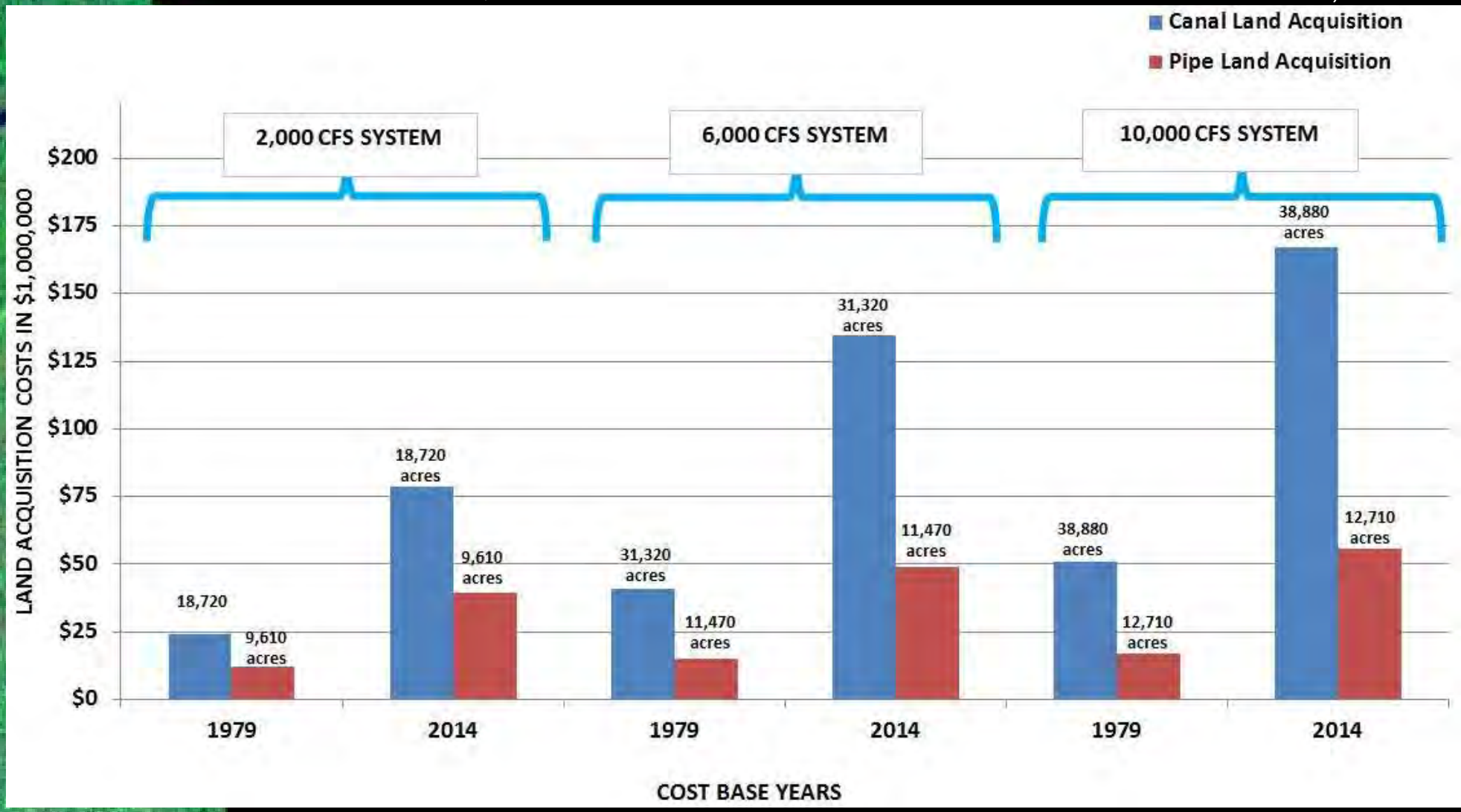
The very preliminary estimate of the 2014 delivered water costs is approximately $450 per acre foot.

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

Time Adds Land Costs

Pipeline vs. Canal Conveyance System over time

FROM 1982 STUDY, INDEXED TO OTHER YEARS USING ENR *Historical Construction Cost Index*)



Kansas High Plains Study update

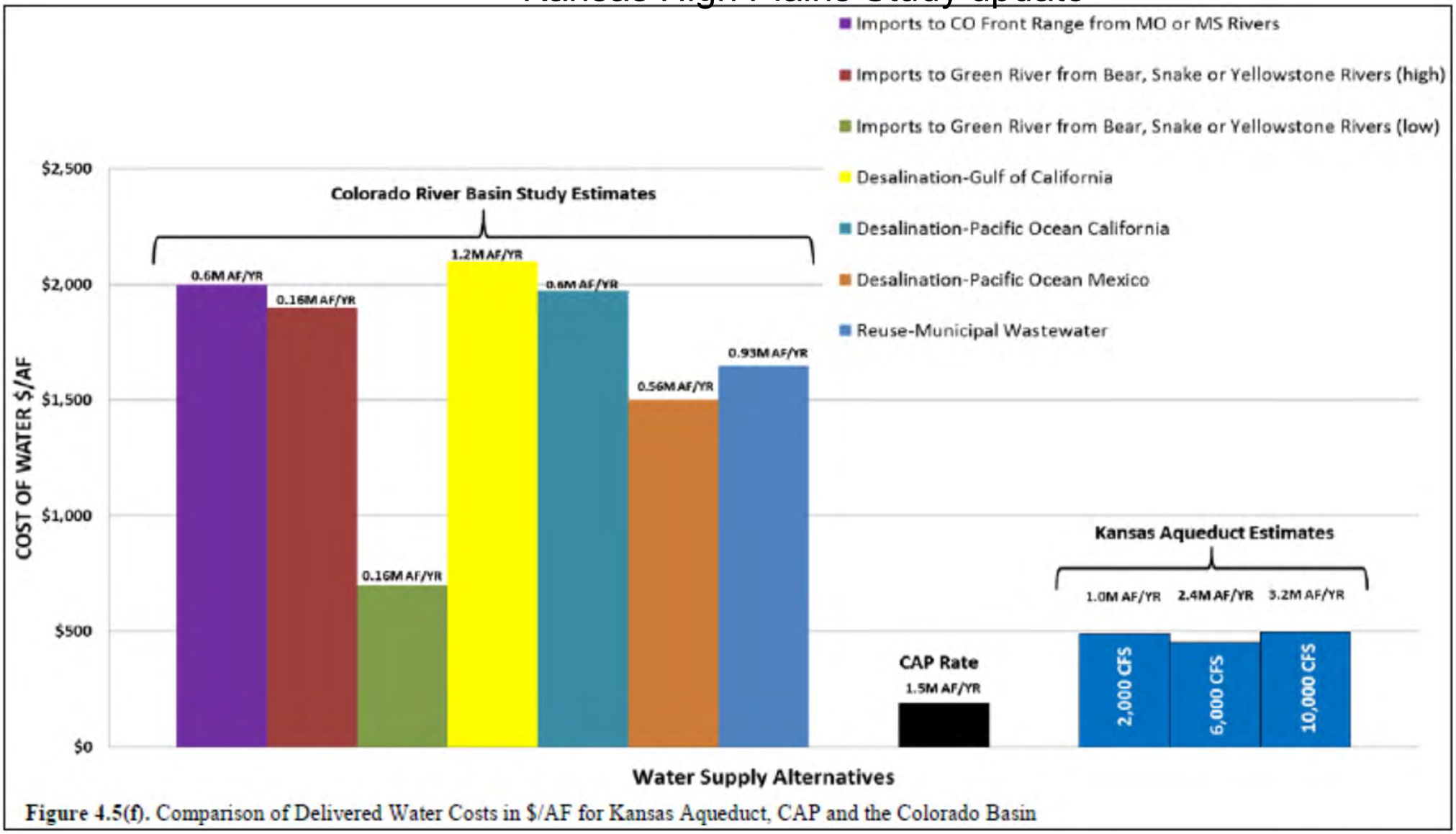
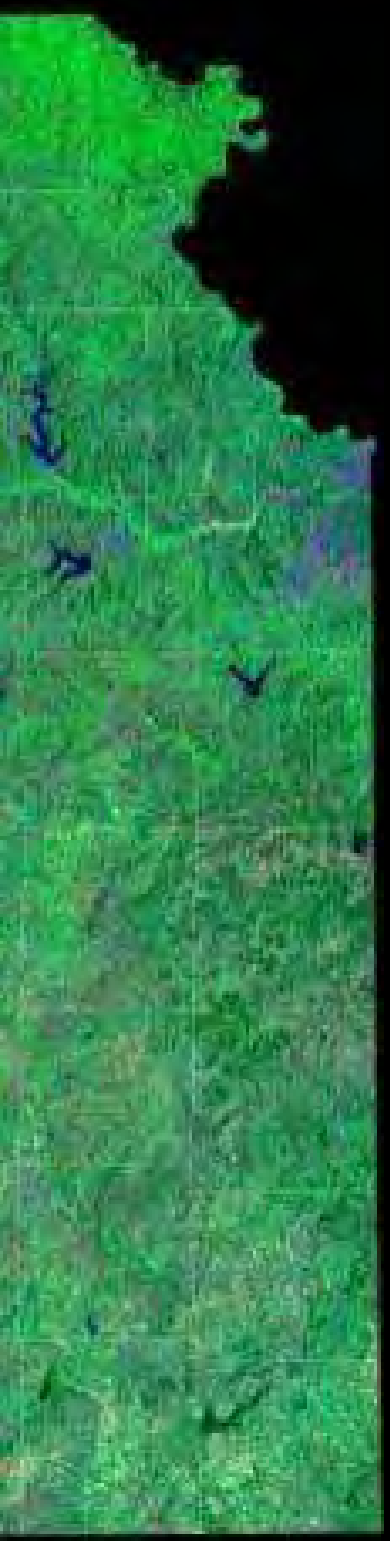


Figure 4.5(f). Comparison of Delivered Water Costs in $/AF for Kansas Aqueduct, CAP and the Colorado Basin

Note: Refer to report text for assumptions and limitations regarding cost data.



General Political Assessment:

- Potential Interstate opposition
- Potential source area opposition
- Potential opposition for land taken
- May be concerns regarding costs & financing
- May be support for multiple uses in a broad area
- Public education and coordination important

Collector wells considered

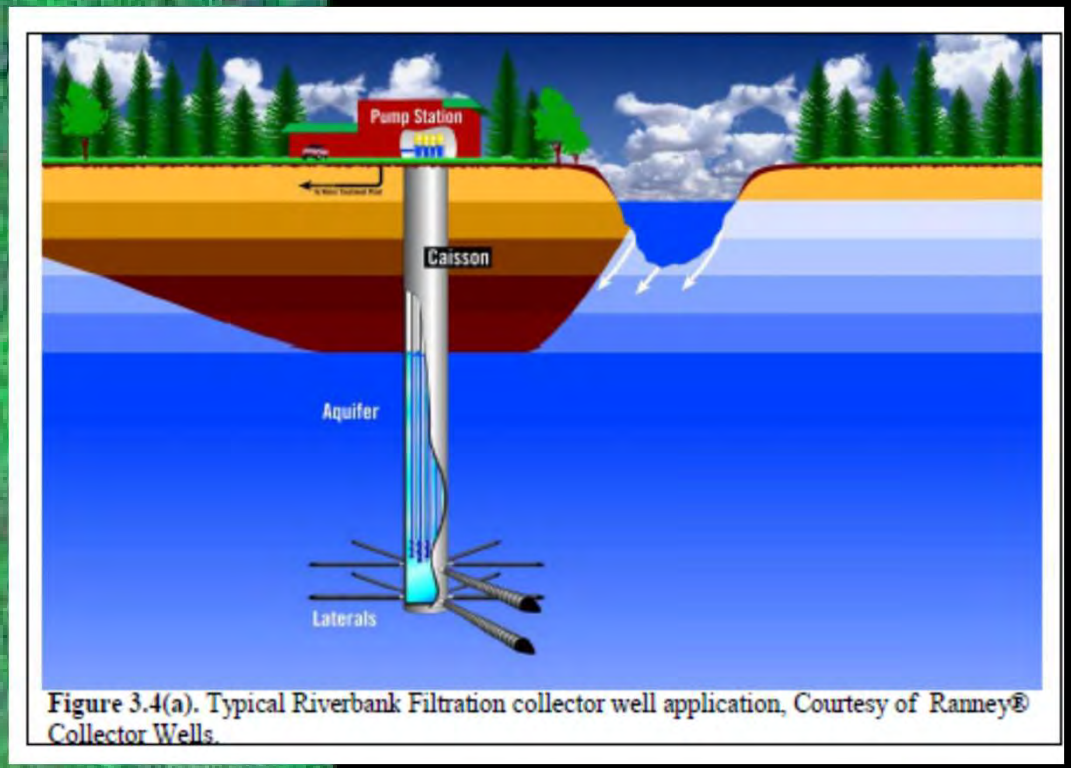
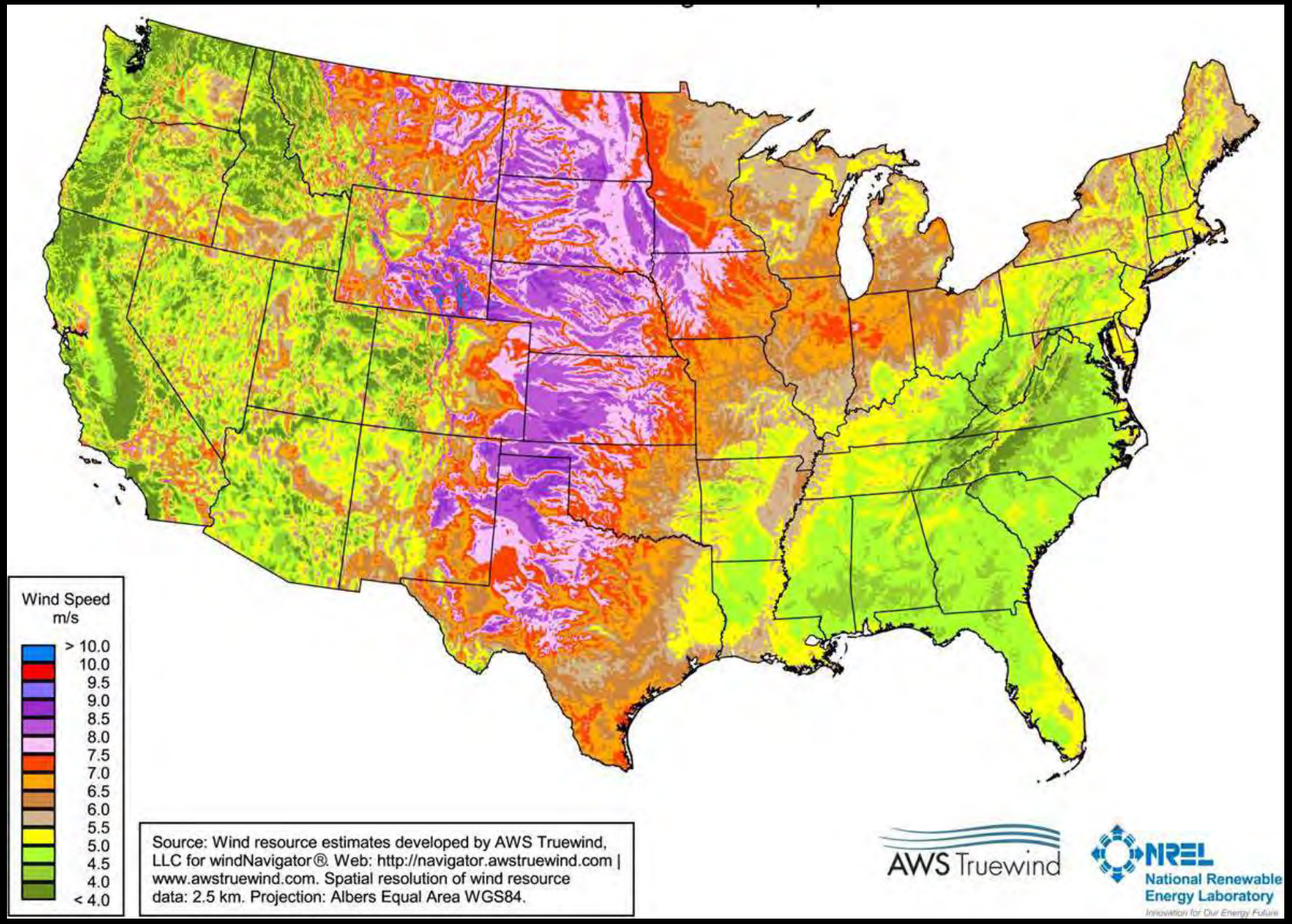
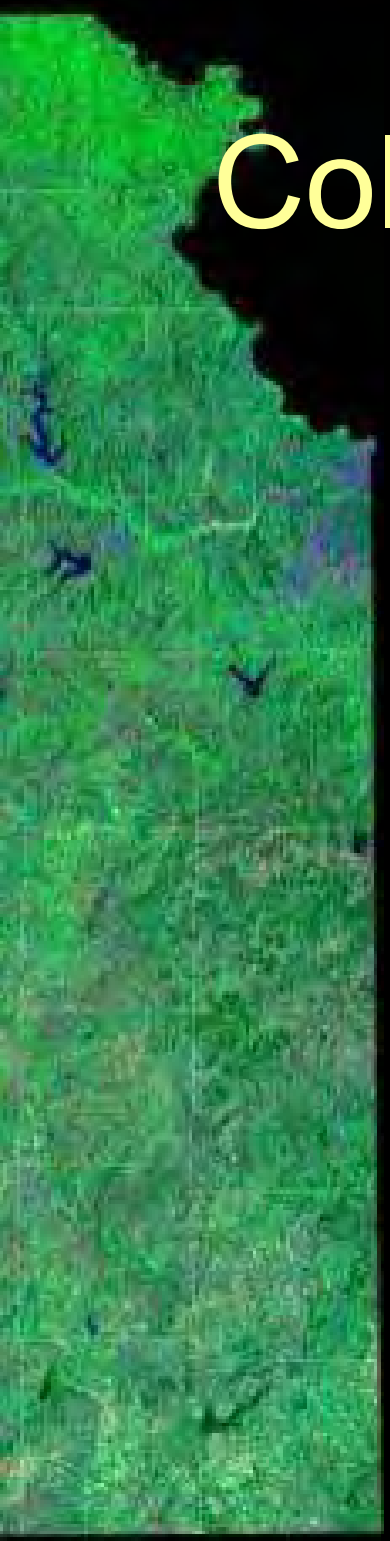


Figure 3.4(a). Typical Riverbank Filtration collector well application, Courtesy of Ranney® Collector Wells.

- Compared to direct Surface Water intake:
  - Better quality water
  - Constant diversion possible
  - Distributed stream depletion
  - No river channel modification
  - Less habitat impact
  - No ANS or frazil ice

Ridgeline aqueduct - green energy transmission and rural Wi-Fi corridor?



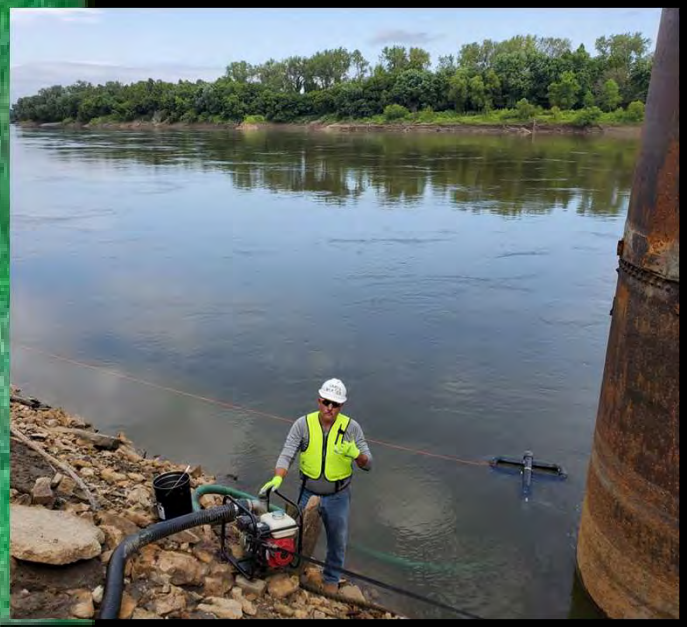


Collaboration beyond Kansas

- An original part of the High Plains Study.
- Other states have significant demands and may be able to subsidize agriculture use, like the pricing structure for CAP.
- May also find leveraging from other sources outside of Kansas.

Water West Project

- Build a large water transfer system that sustainably addresses declining water supply, over appropriation and drought in southwest Kansas and areas outside the state.



KANSAS AQUEDUCT

COALITION

Kansas Grows where water flows

Questions?
Collaboration?

Mark Rude, Executive Director

Southwest Kansas Groundwater Management District No. 3

620-272-3001

mrude@gmd3.org