MISSOURI RIVER BASIN WATER MANAGEMENT

GOVERNOR'S WATER CONFERENCE

Ryan Larsen, P.E.
Reservoir Regulation Team Lead
Missouri River Basin Water Management

November 16, 2022

U.S.ARMY

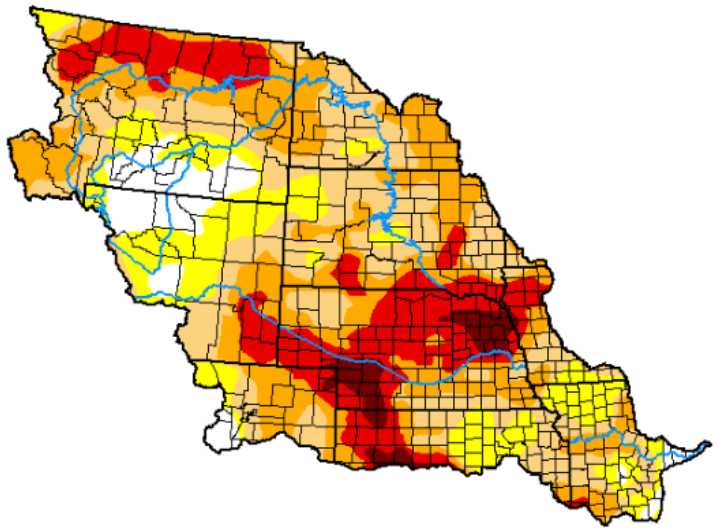
US Army Corps of Engineers®

OVERVIEW

- Current Drought Monitor and Outlook
- Missouri River Mainstem System
- Mainstem System Status
- Gavins Point Release Schedule
- Expected Winter Stages

DROUGHT MONITOR AND OUTLOOK

U.S. Drought Monitor
Missouri Basin RFC



November 8, 2022
(Released Thursday, Nov. 10, 2022)
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	6.97	93.03	76.99	47.97	20.19	3.06
Last Week 11-01-2022	6.59	93.41	78.35	48.57	18.94	2.51
3 Months Ago 08-09-2022	33.51	66.49	43.86	22.79	6.95	0.97
Start of Calendar Year 01-04-2022	15.77	84.23	62.18	43.33	20.54	3.80
Start of Water Year 09-27-2022	7.52	92.48	71.31	38.45	12.93	2.43
One Year Ago 11-09-2021	23.26	76.74	61.05	41.37	22.26	6.05

Intensity:

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

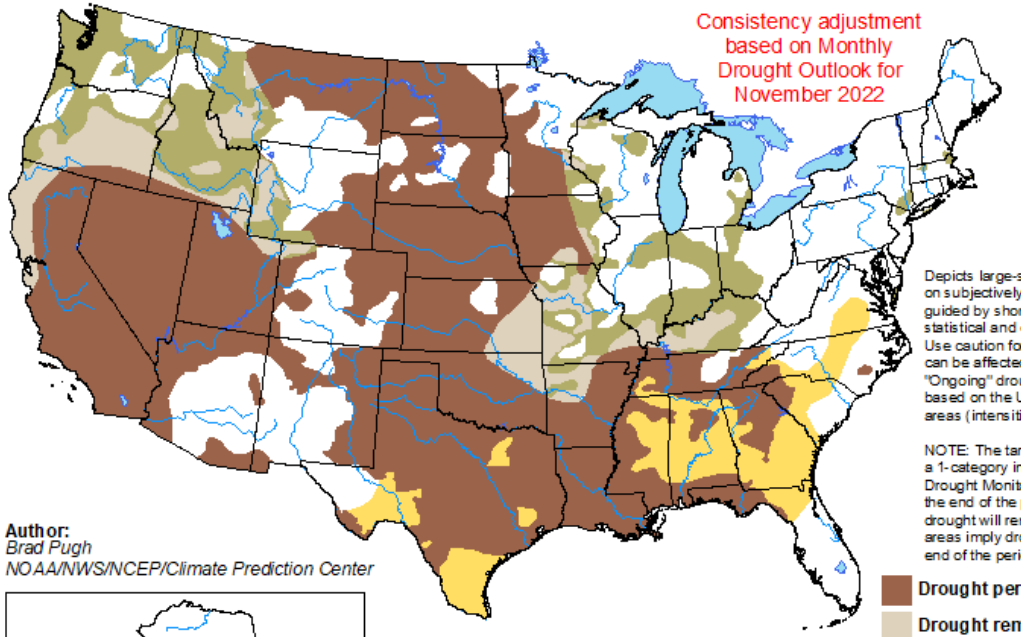
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to https://droughtmonitor.unl.edu/About.aspx

Author:
Brian Fuchs
National Drought Mitigation Center

droughtmonitor.unl.edu

U.S. Seasonal Drought Outlook
Drought Tendency During the Valid Period

Valid for November 1, 2022 - January 31, 2023
Released October 31, 2022



Author:
Brad Pugh
NOAA/NWS/NCEP/Climate Prediction Center

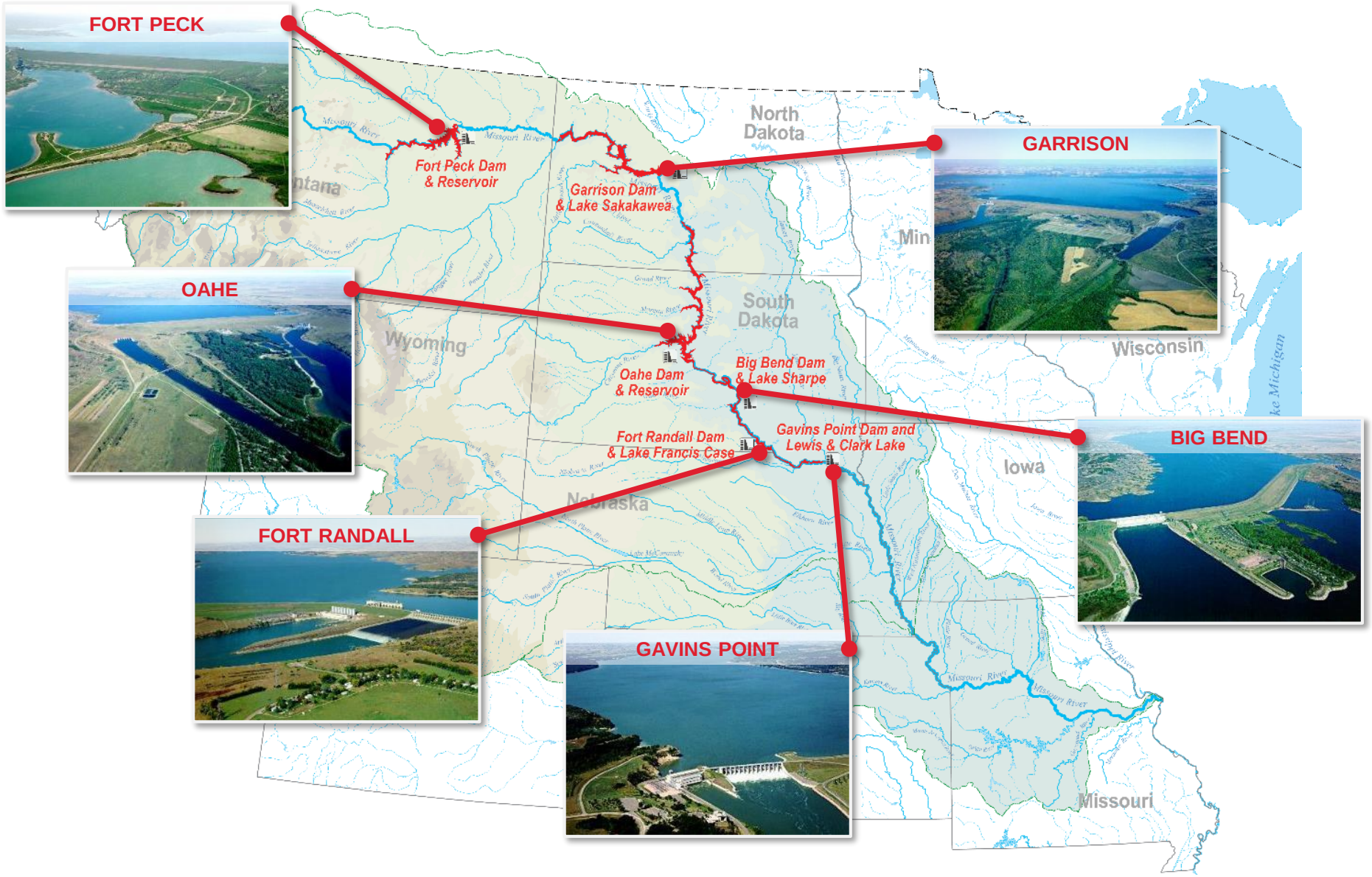
Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Use caution for applications that can be affected by short lived events. "Ongoing" drought areas are based on the U.S. Drought Monitor areas (intensities of D1 to D4).

NOTE: The tan areas imply at least a 1-category improvement in the Drought Monitor intensity levels by the end of the period, although drought will remain. The green areas imply drought removal by the end of the period (D0 or none).

- Drought persists
- Drought remains but improves
- Drought removal likely
- Drought development likely

http://go.usa.gov/3eZ73

MISSOURI RIVER MAINSTEM RESERVOIRS



MISSOURI RIVER MAINSTEM SYSTEM STORAGE ZONES AND ALLOCATIONS

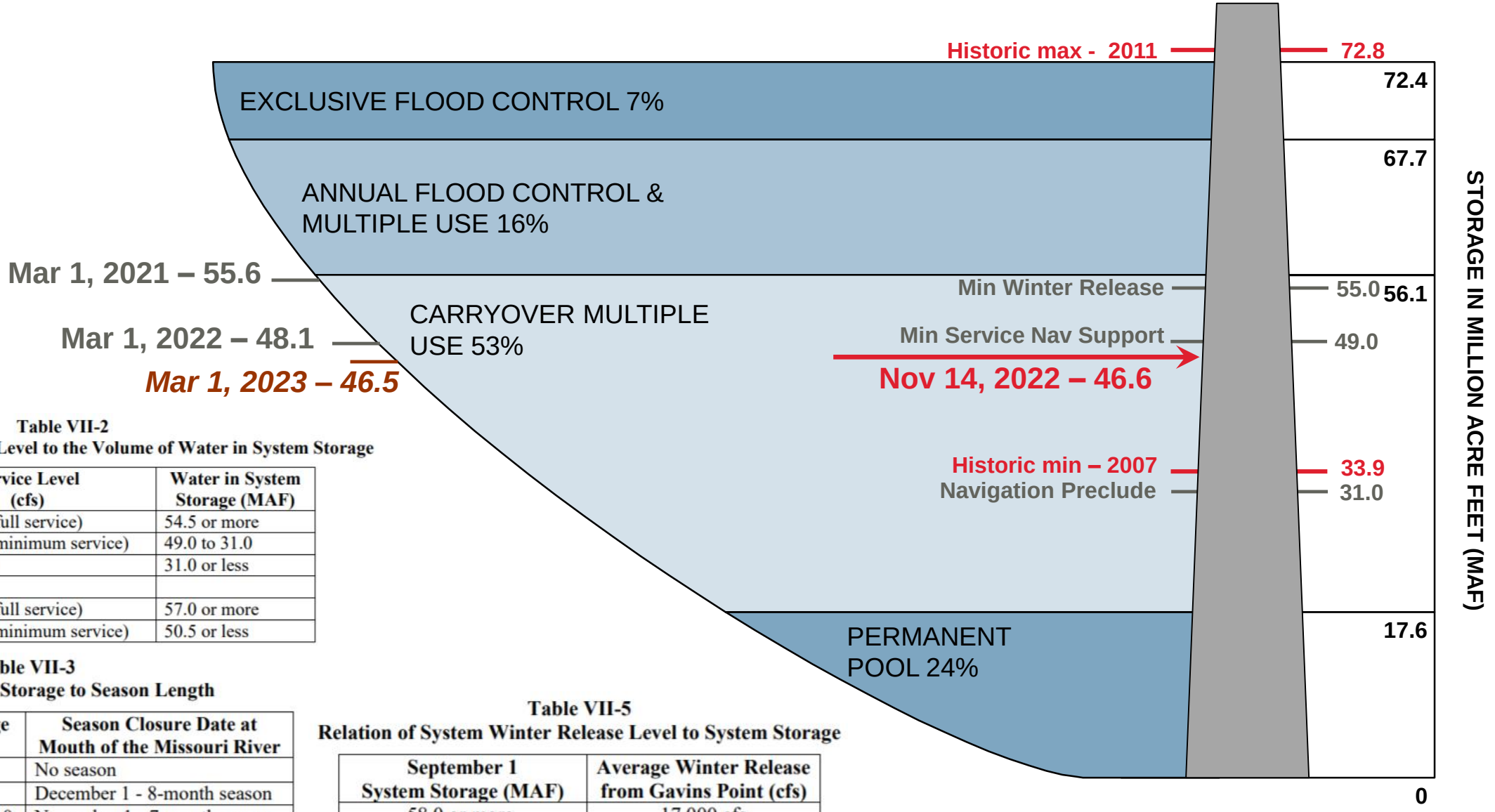


Table VII-2
Relation of Navigation Service Level to the Volume of Water in System Storage

Date	Service Level (cfs)	Water in System Storage (MAF)
March 15	35,000 cfs (full service)	54.5 or more
March 15	29,000 cfs (minimum service)	49.0 to 31.0
March 15	(no service)	31.0 or less
July 1	35,000 cfs (full service)	57.0 or more
July 1	29,000 cfs (minimum service)	50.5 or less

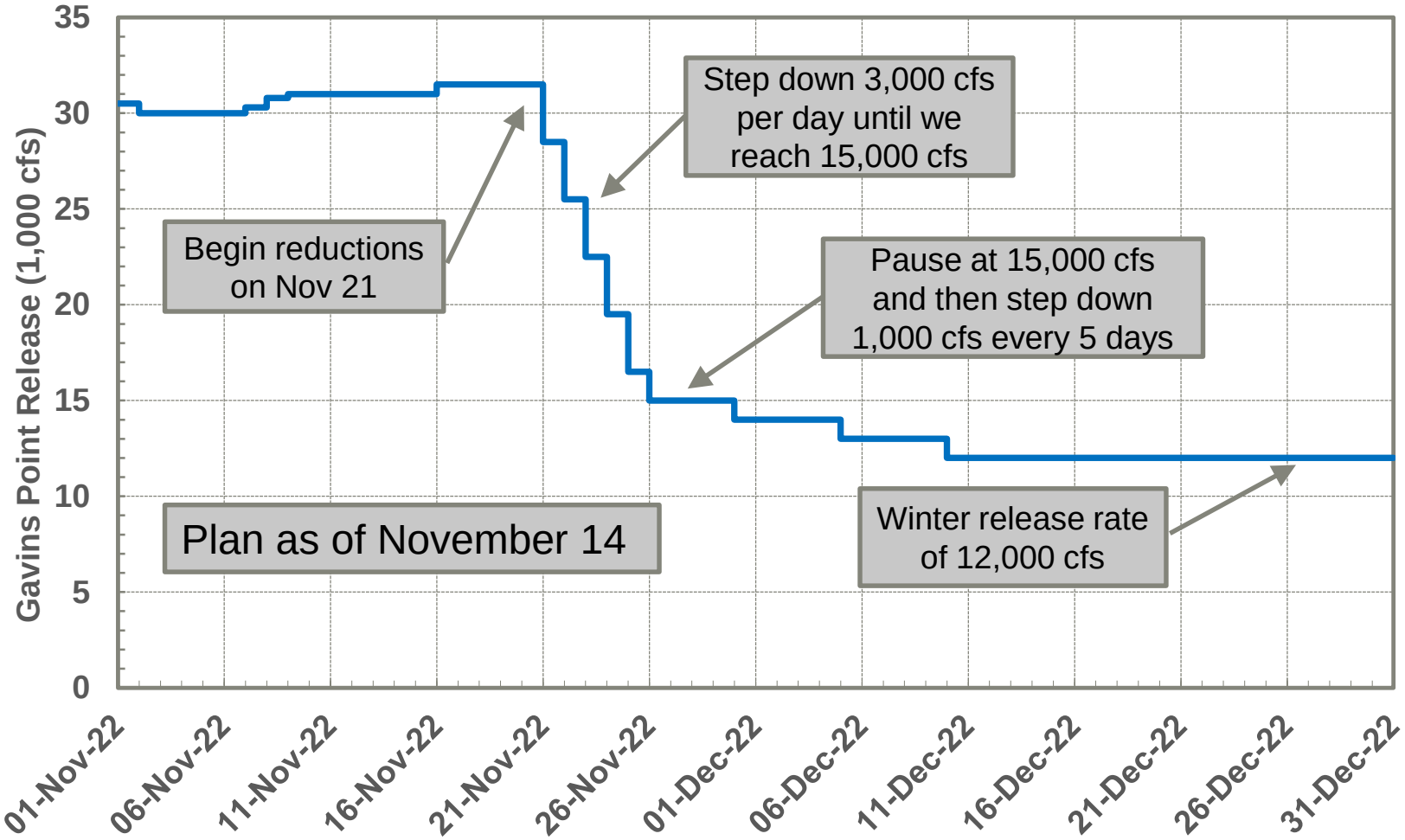
Table VII-3
Relation of System Storage to Season Length

Date	System Storage (MAF)	Season Closure Date at Mouth of the Missouri River
March 15	31.0 or less	No season
July 1	51.5 or more	December 1 - 8-month season
July 1	46.8 through 41.0	November 1 - 7-month season
July 1	36.5 or less	October 1 - 6-month season

Table VII-5
Relation of System Winter Release Level to System Storage

September 1 System Storage (MAF)	Average Winter Release from Gavins Point (cfs)
58.0 or more	17,000 cfs
55.0 or less	12,000 cfs

2022 Fall-Winter Gavins Point Dam Release Forecast



Location	Closing Date
Sioux City	November 19
Omaha	November 21
Kansas City	November 24
Mouth	November 28

MISSOURI RIVER – ESTIMATED STAGES AND FLOWS

Location		Fall		Winter	
	Flood Stage	Stage	Flow	Stage	Flow
Wolf Point	23 ft	9-10 ft	5-7 kcfs	14-17 ft	frozen
Culbertson	19 ft	2-3 ft	5-8 kcfs	10-15 ft	frozen
Bismarck	14.5 ft	4-6 ft	14-20 kcfs	9-11 ft	frozen
Sioux City	30 ft	11-13 ft	30-36 kcfs	5-7 ft	12-18 kcfs
Omaha	29 ft	14-16 ft	30-36 kcfs	7-9 ft	12-20 kcfs
Nebraska City	18 ft	10-12 ft	36-44 kcfs	5-7 ft	15-23 kcfs
St. Joseph	17 ft	6-8 ft	36-45 kcfs	1-3 ft	18-25 kcfs
Kansas City	20 ft	9-12 ft	40-55 kcfs	4-6 ft	20-27 kcfs
Boonville	21 ft	7-10 ft	43-60 kcfs	2-4 ft	23-30 kcfs
Hermann	21 ft	5-10 ft	48-80 kcfs	2-4 ft	33-43 kcfs

THANK YOU!

Ryan Larsen, P.E. **ryan.j.larsen@usace.army.mil** **402.996.3861**

Email: Missouri.Water.Management@usace.army.mil

Website: www.nwd-mr.usace.army.mil/rcc/

nwd.usace.army.mil/MRWM

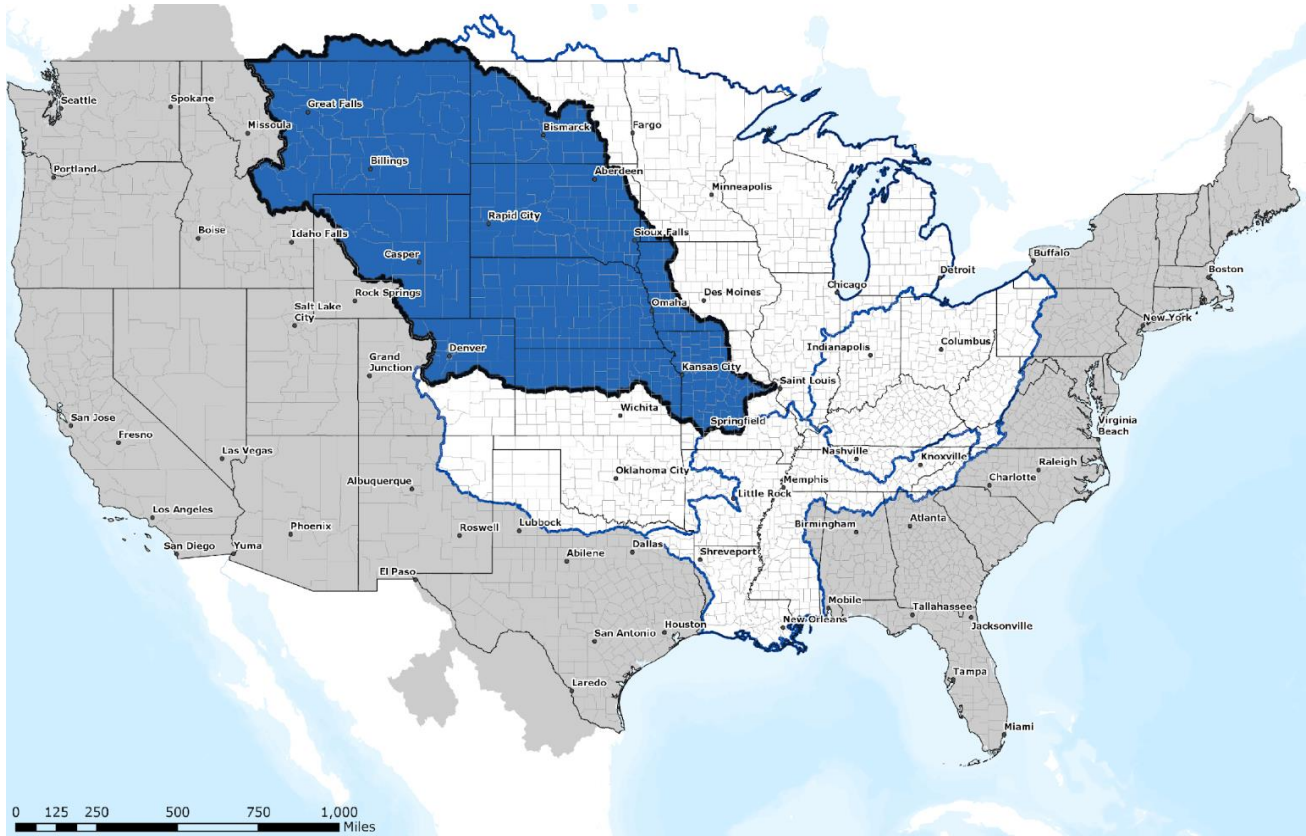
Search: Corps Missouri River

NATIONAL WEATHER SERVICE

Building a Weather-Ready Nation

National Weather Service Surface Water Forecasting

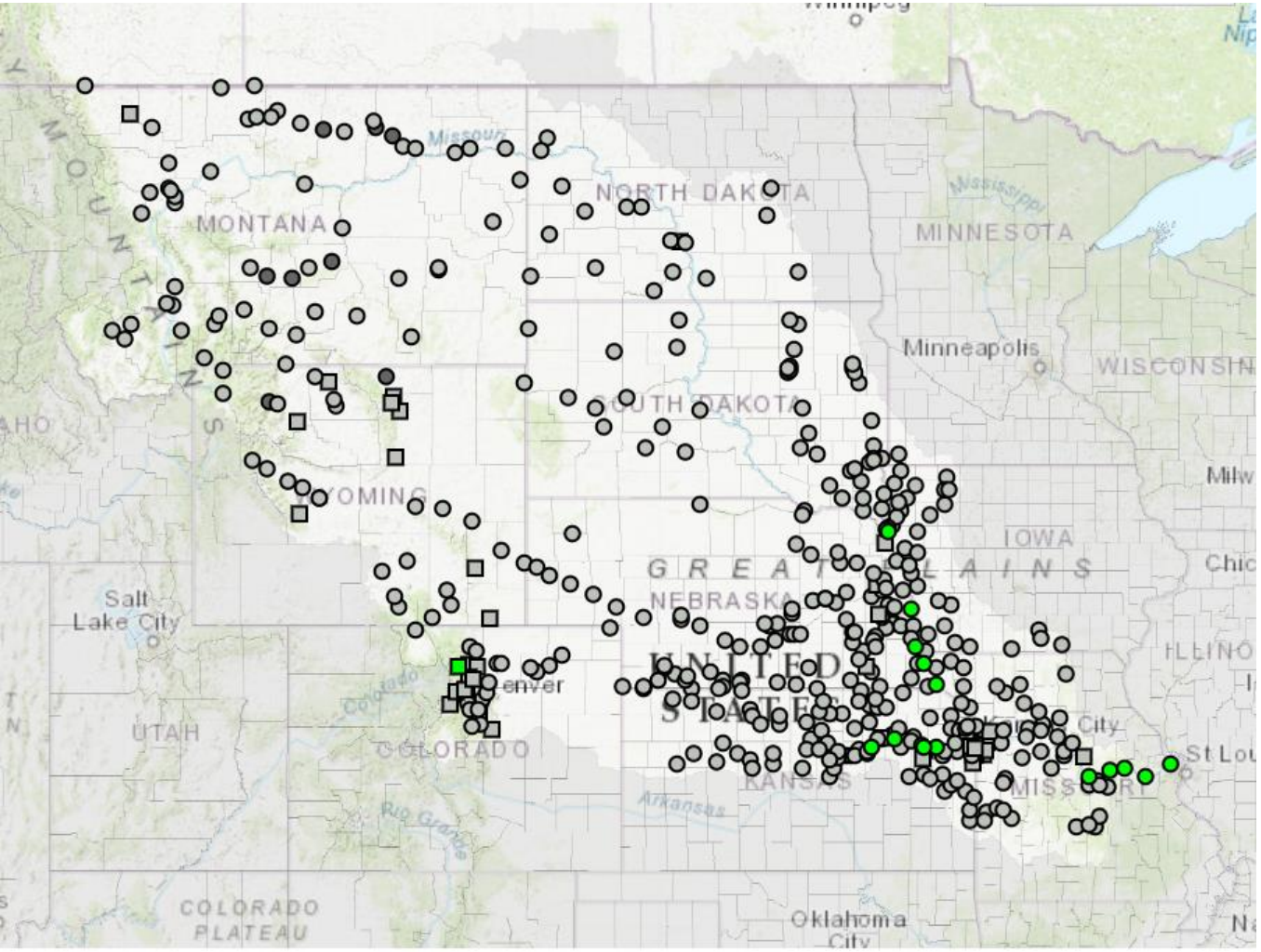
2022 Governor's Conference on the Future of Water in Kansas

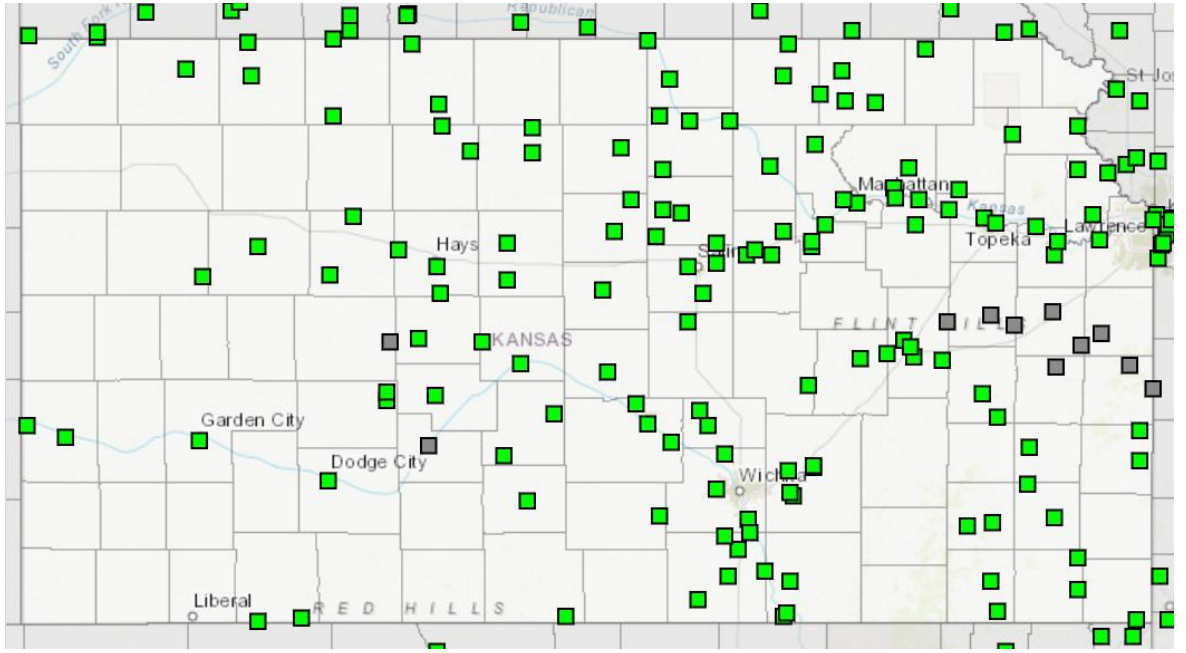


Kevin Low, P.E.
NOAA National Weather Service
Missouri Basin River Forecast Center
Kansas City

NWS-forecasted SURFACE WATER LOCATIONS

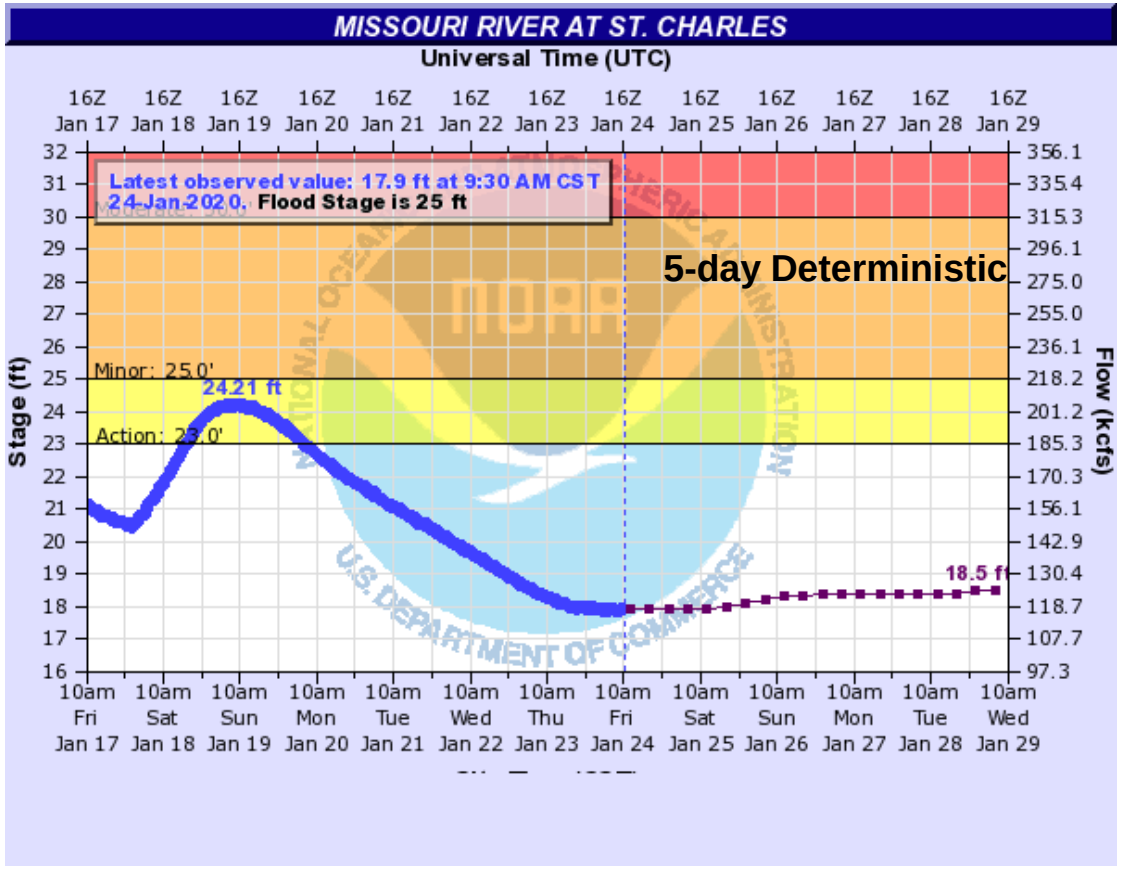
470 river points
82 reservoirs
~200 diversion/return reaches

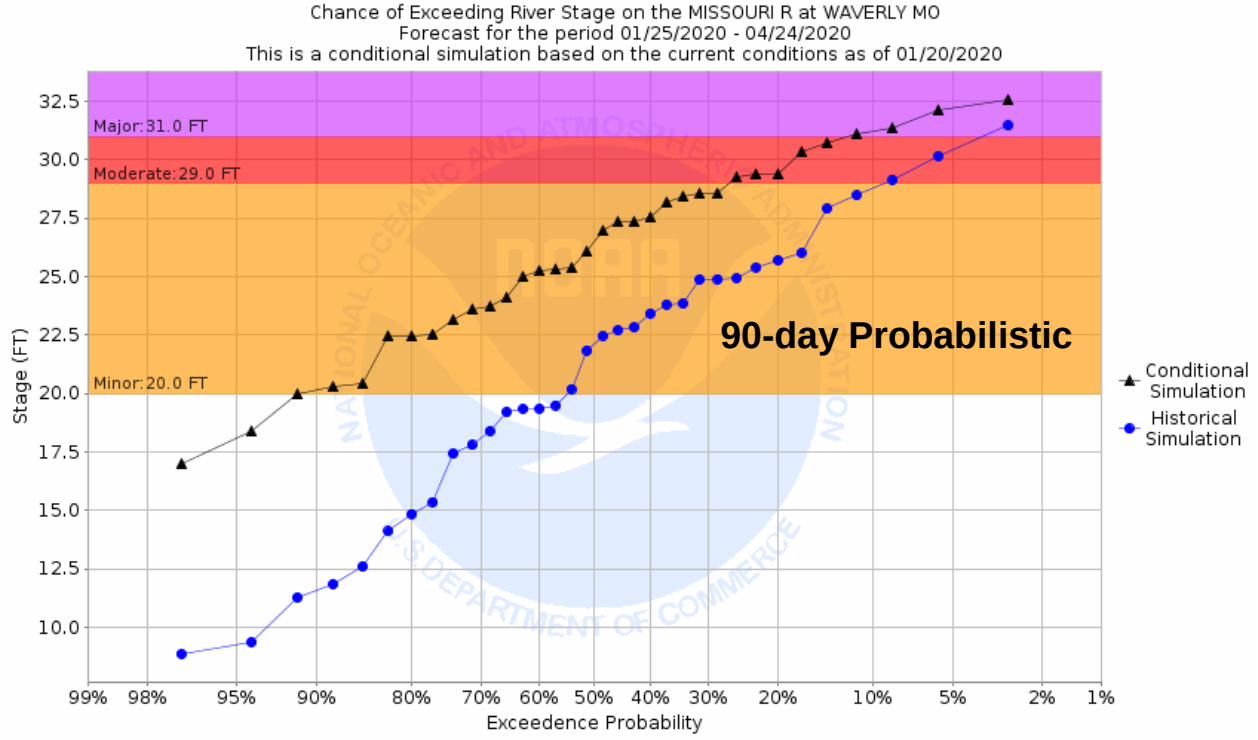




State of Kansas
258 river points (ABRFC & MBRFC)
14 reservoirs (MBRFC)
Smoky Hill & Republican div/returns

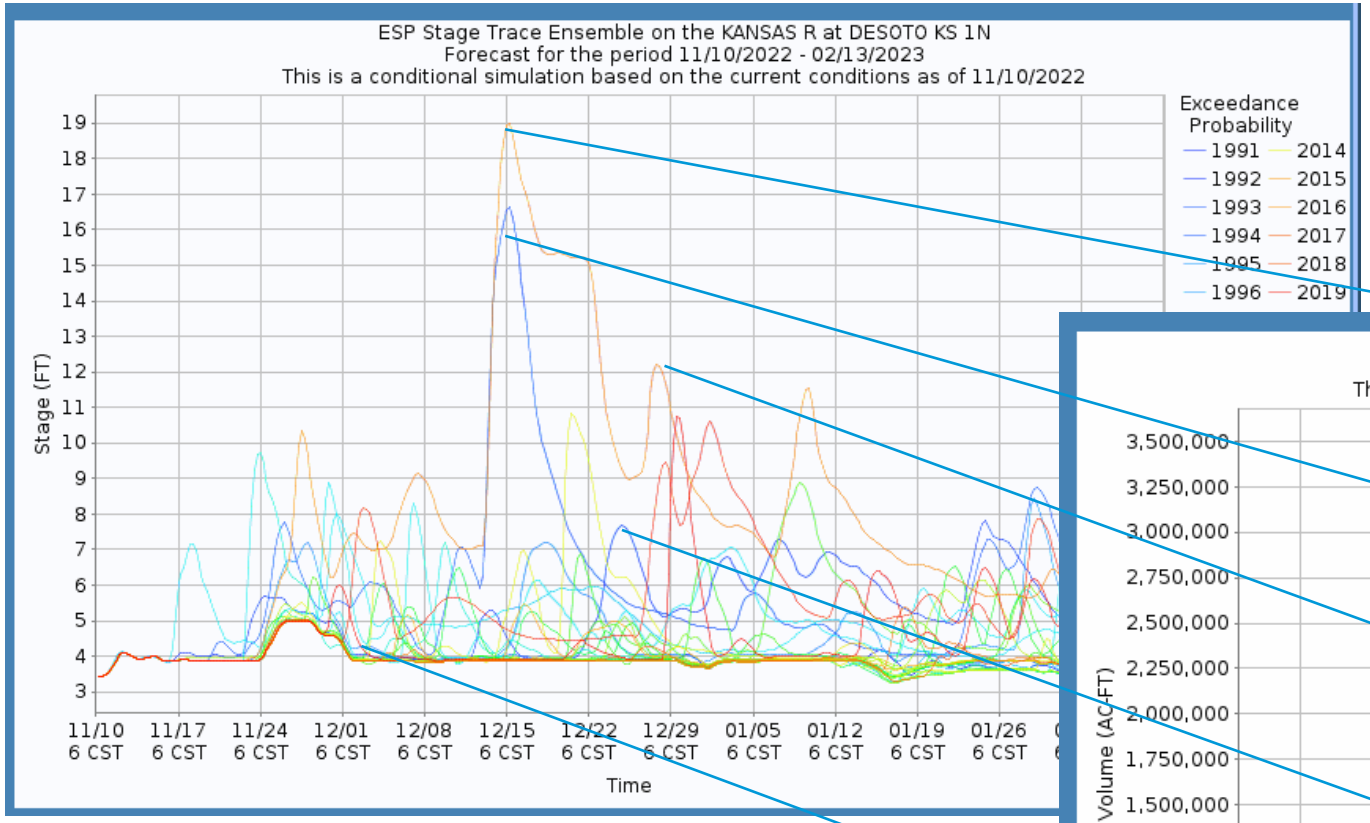
SOME KEY SURFACE WATER PRODUCTS PROVIDED

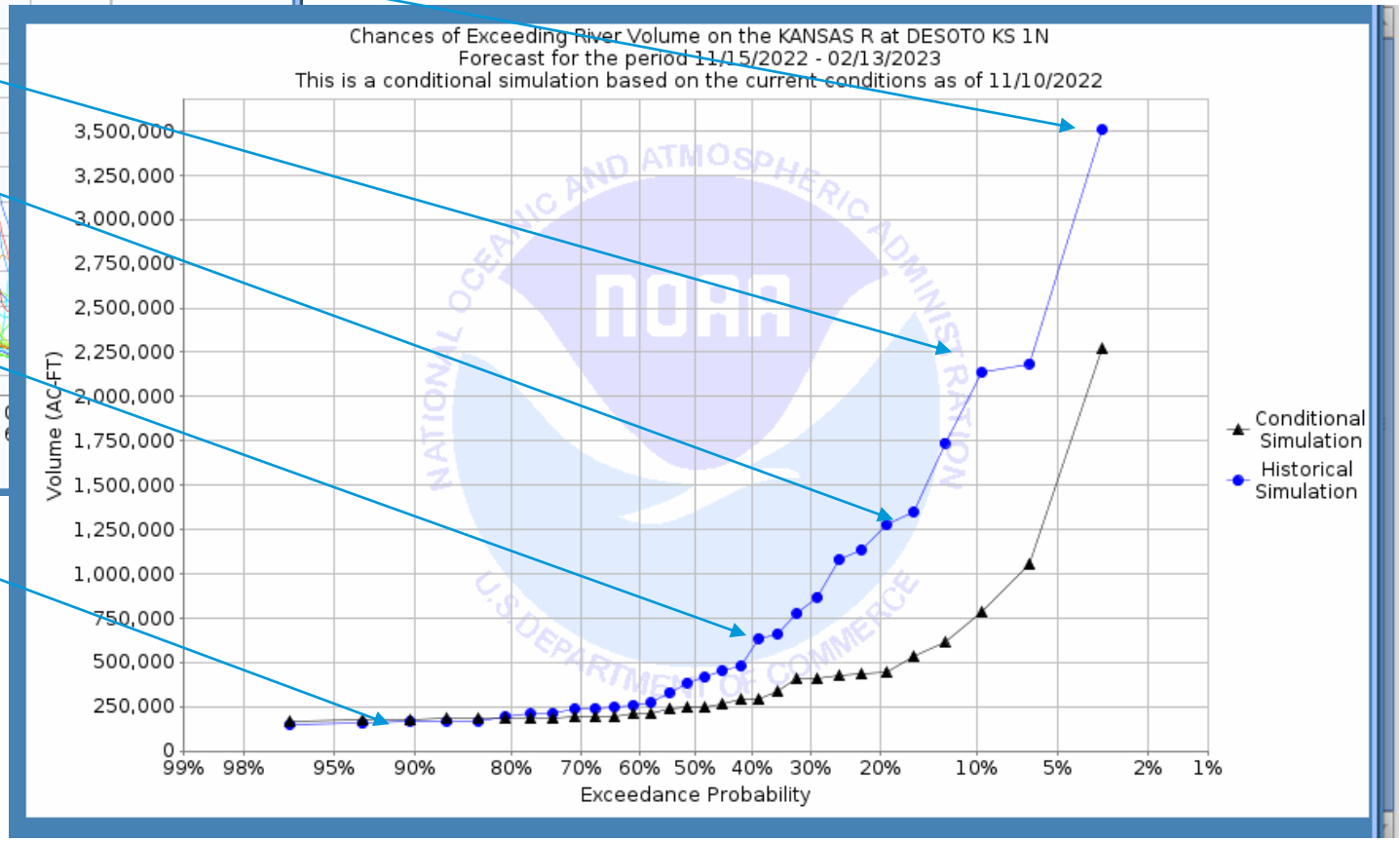




SURFACE WATER PROBABILISTIC PRODUCTS

Converting Ensemble Traces into Probabilities



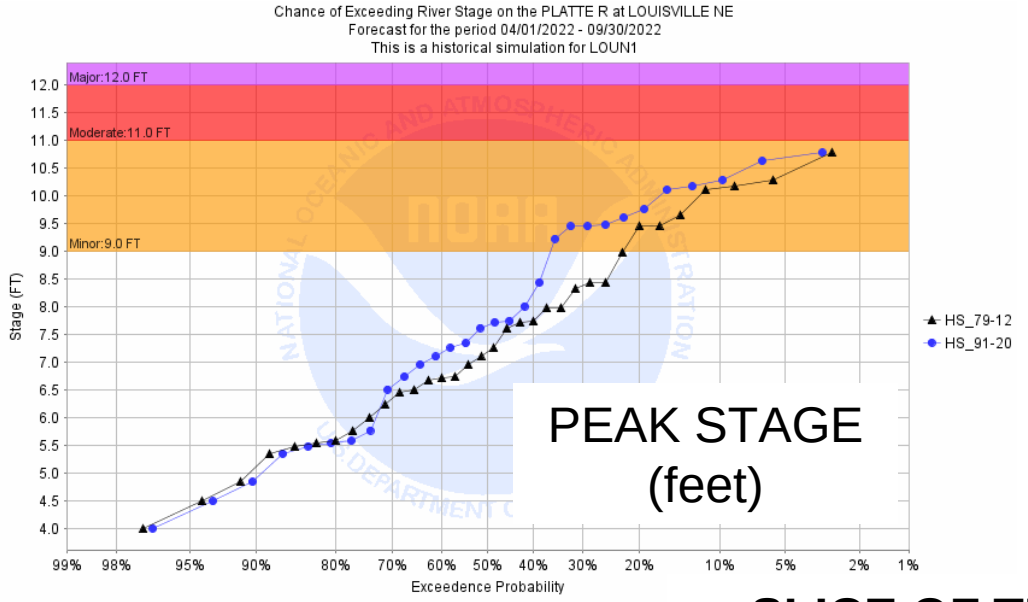


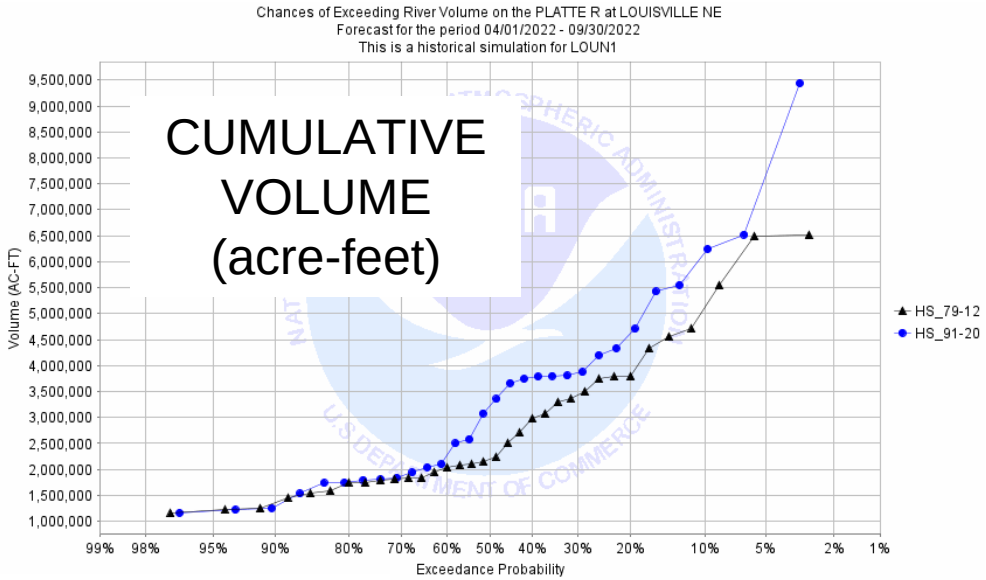
DENVER WATER

BUREAU OF RECLAMATION

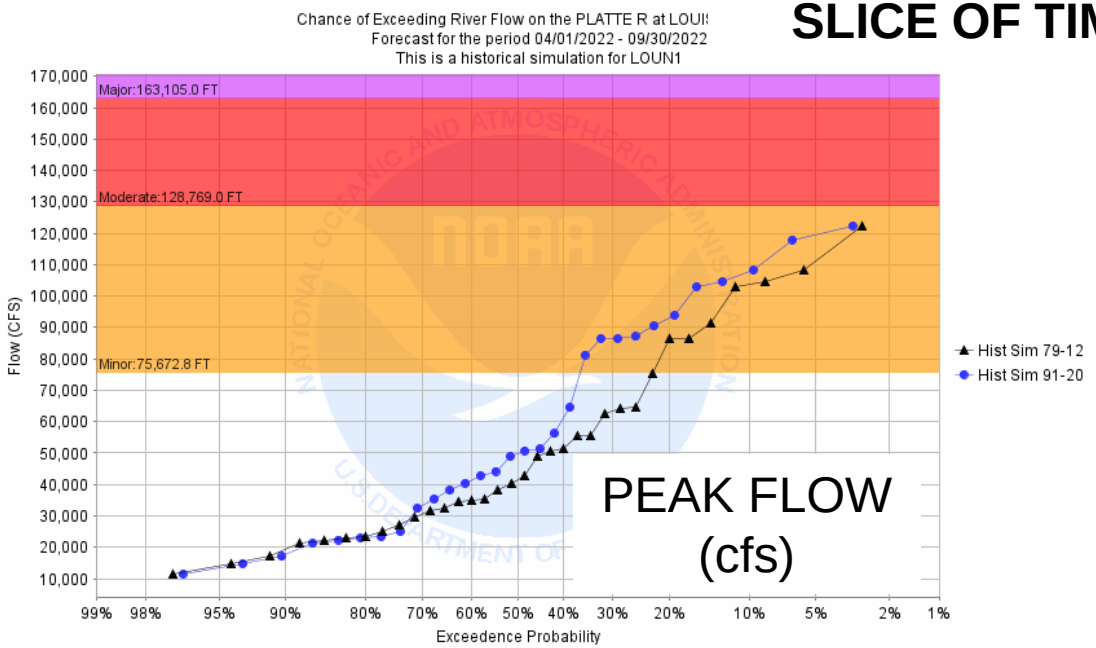
SURFACE WATER PROBABILISTIC PRODUCTS

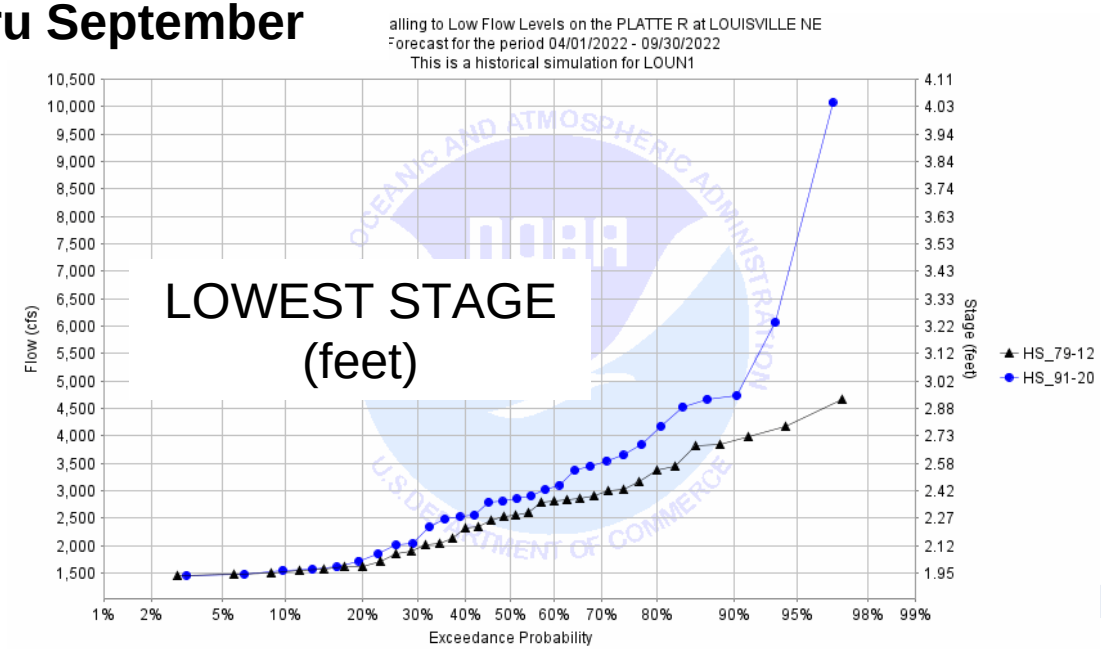
VARIOUS PARAMETERS, VARIOUS TIME SLICES





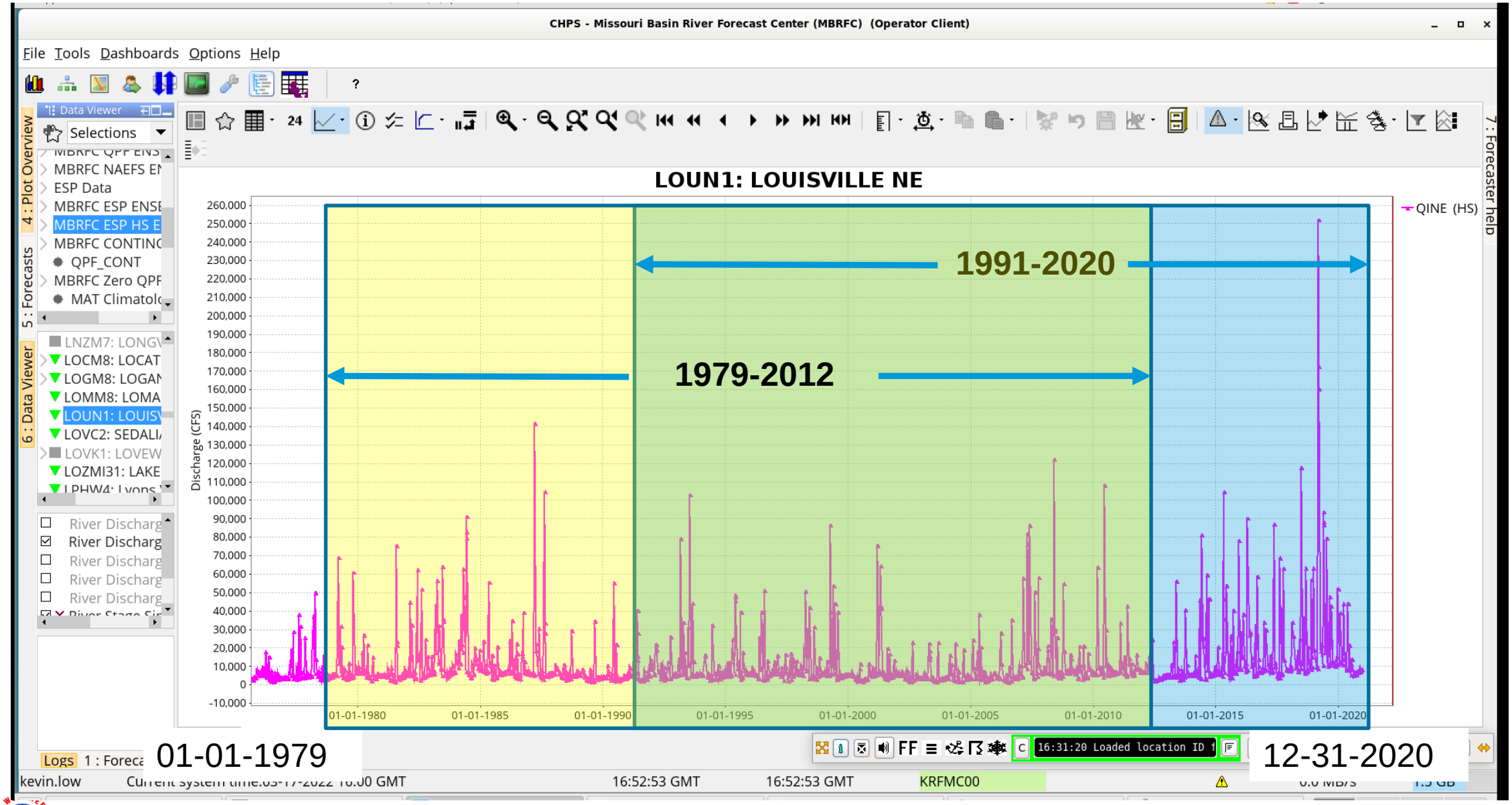
SLICE OF TIME April thru September





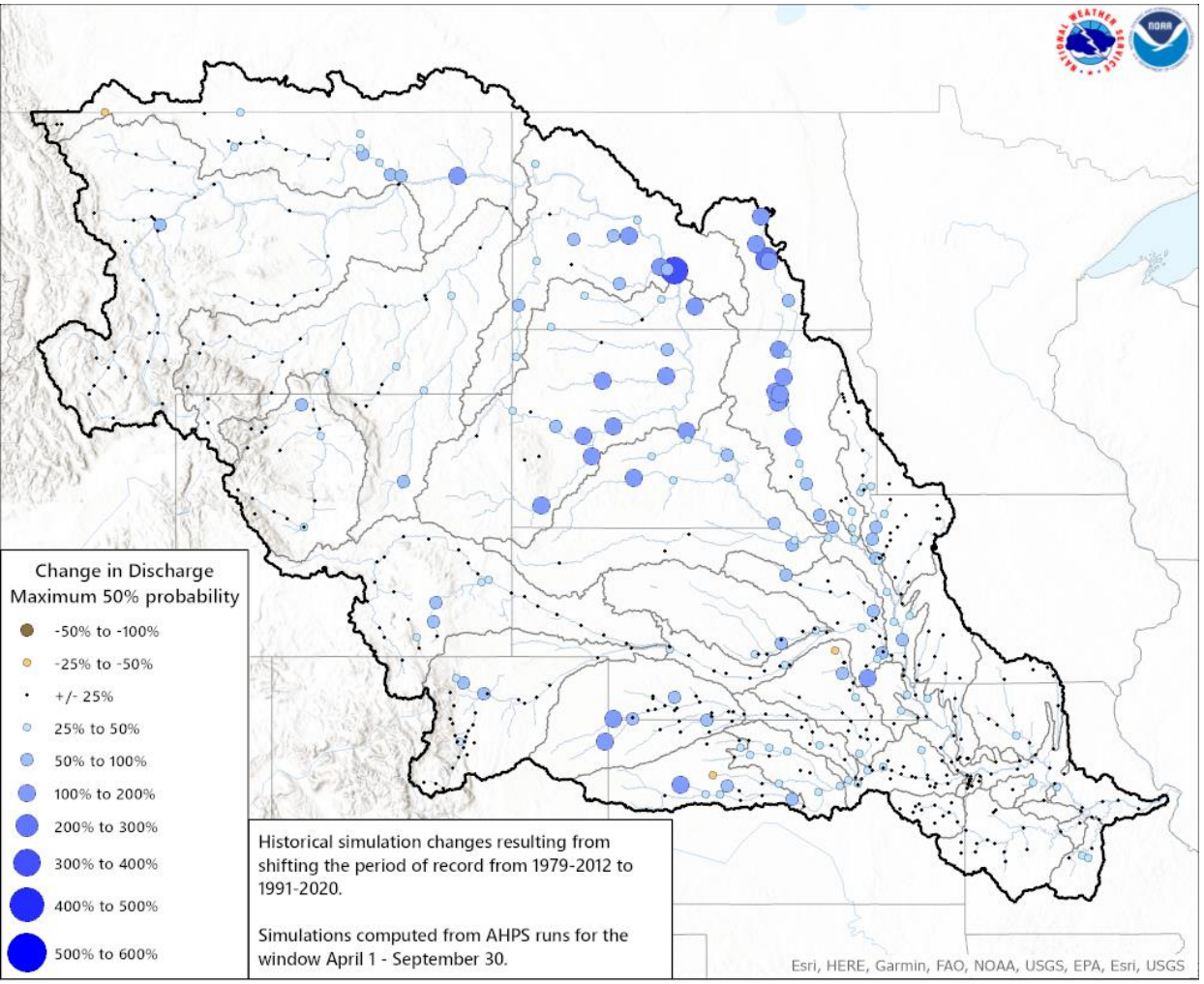
MISSOURI BASIN HYDROLOGIC TRENDS

MOVING 30-DAY PERIOD-OF-RECORD



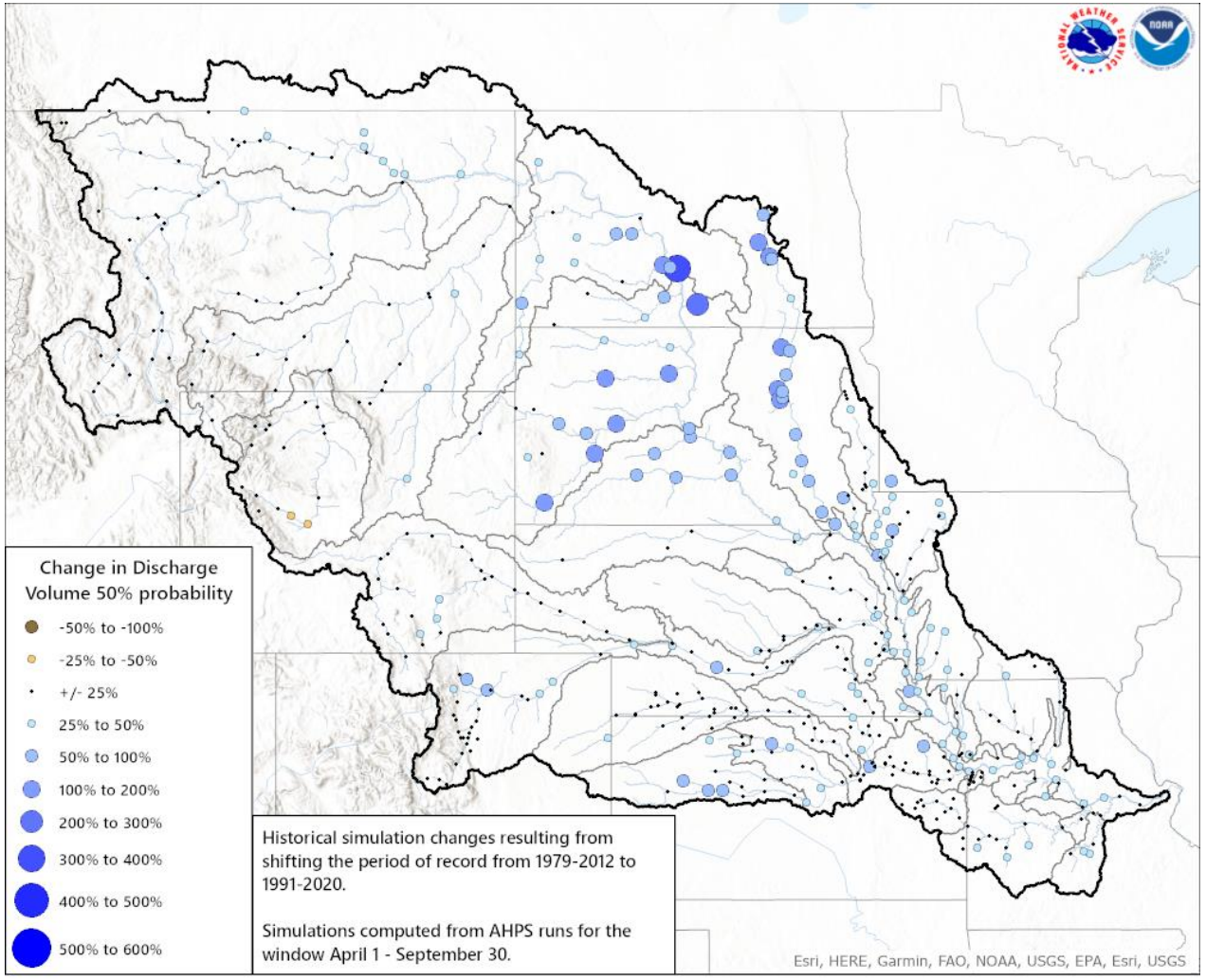
SURFACE WATER TRENDS

APRIL-SEPTEMBER: COMPARING '79-'12 To '91-'20



Change in Discharge Maximum 50% Probability

Expected peak discharges (50-50%) during April-September

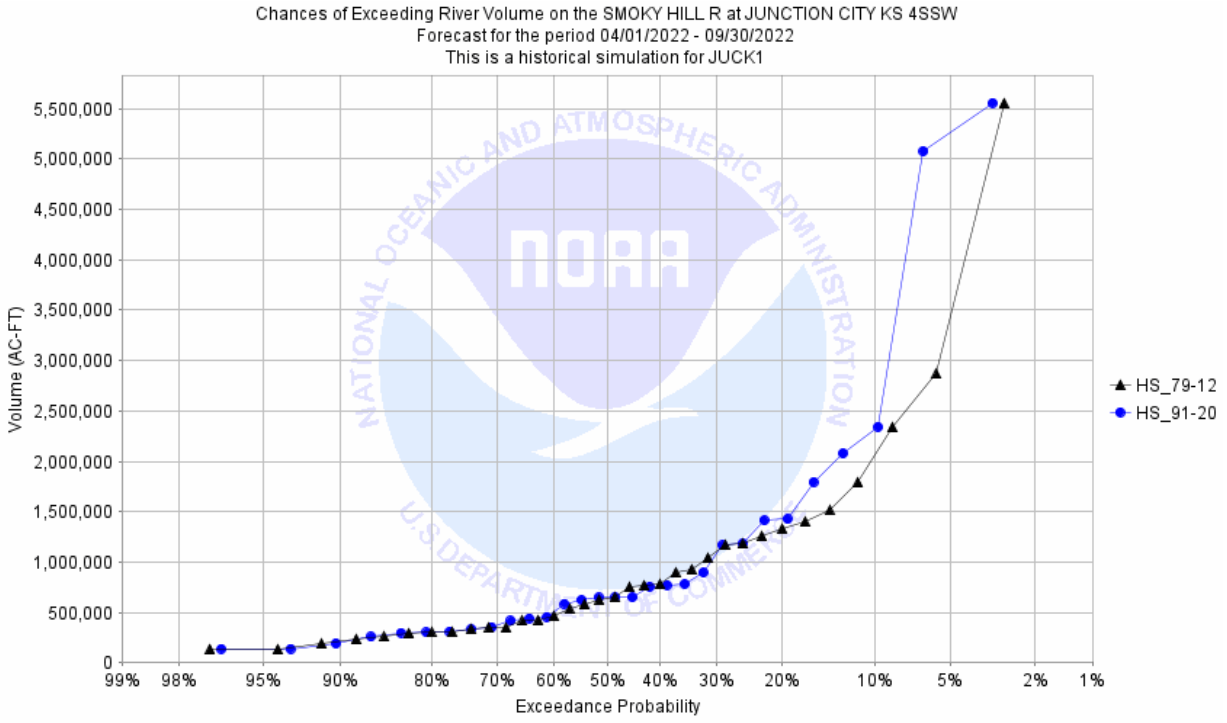


Change in Discharge Volume 50% Probability

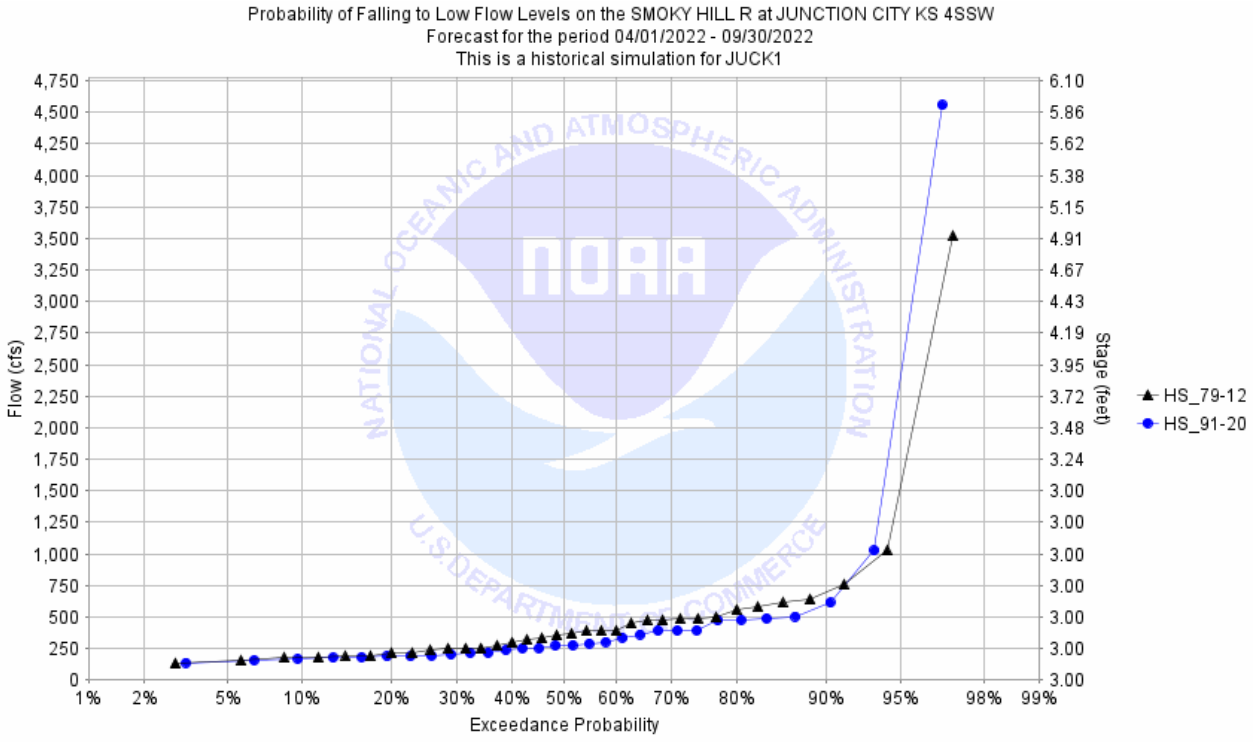
Expected volumes (50-50%) during April-September

SURFACE WATER TRENDS ('79-'12 to '91-'20)

SMOKY HILL AT JUNCTION CITY



Volume
during April-September



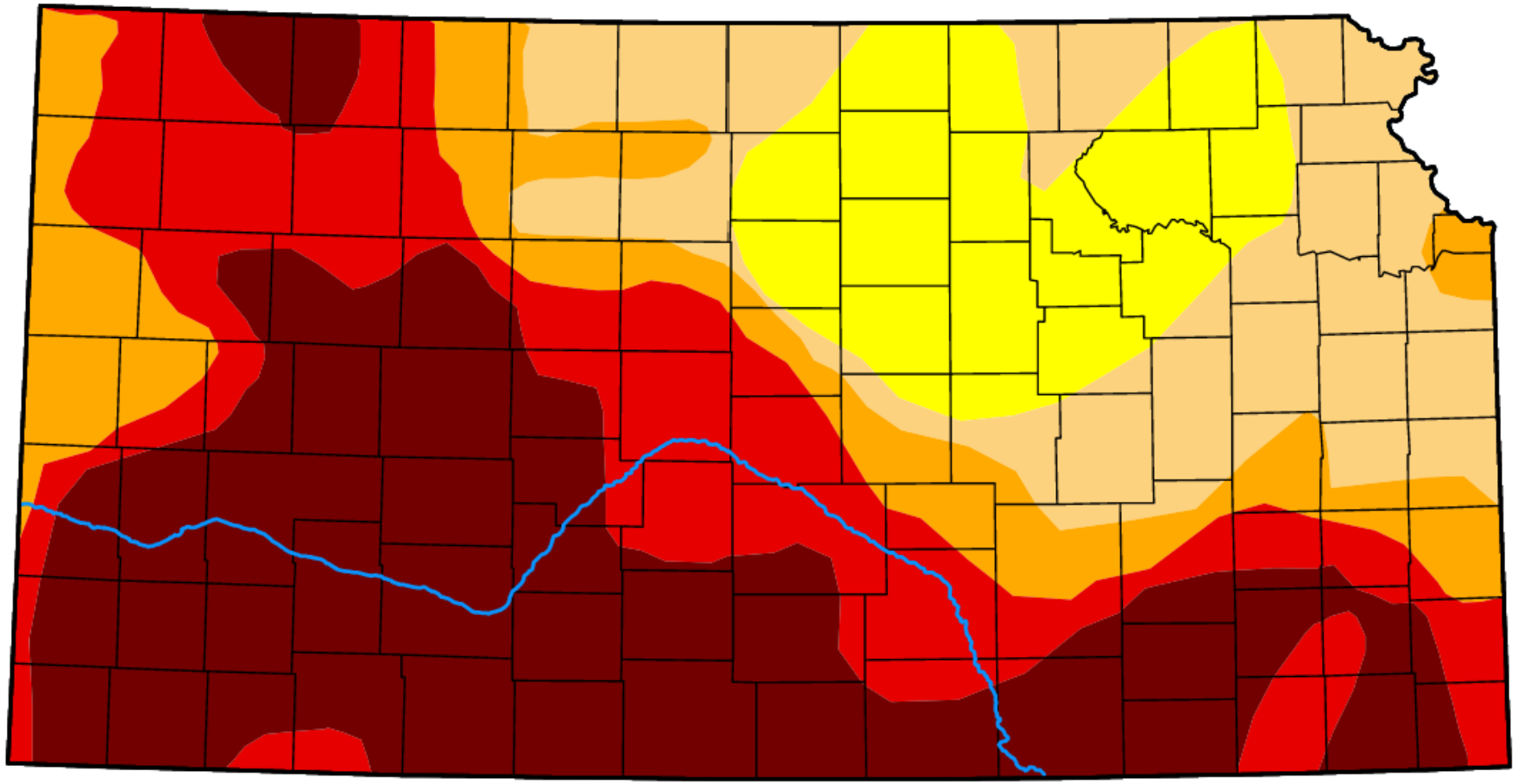
Low-Flow
during April-September

Kansas Aquifers and Drought

Jim Butler
Kansas Geological Survey
University of Kansas

Drought Panel
Governor's Conference on the Future of Water in Kansas

Manhattan, Kansas
November 16, 2022

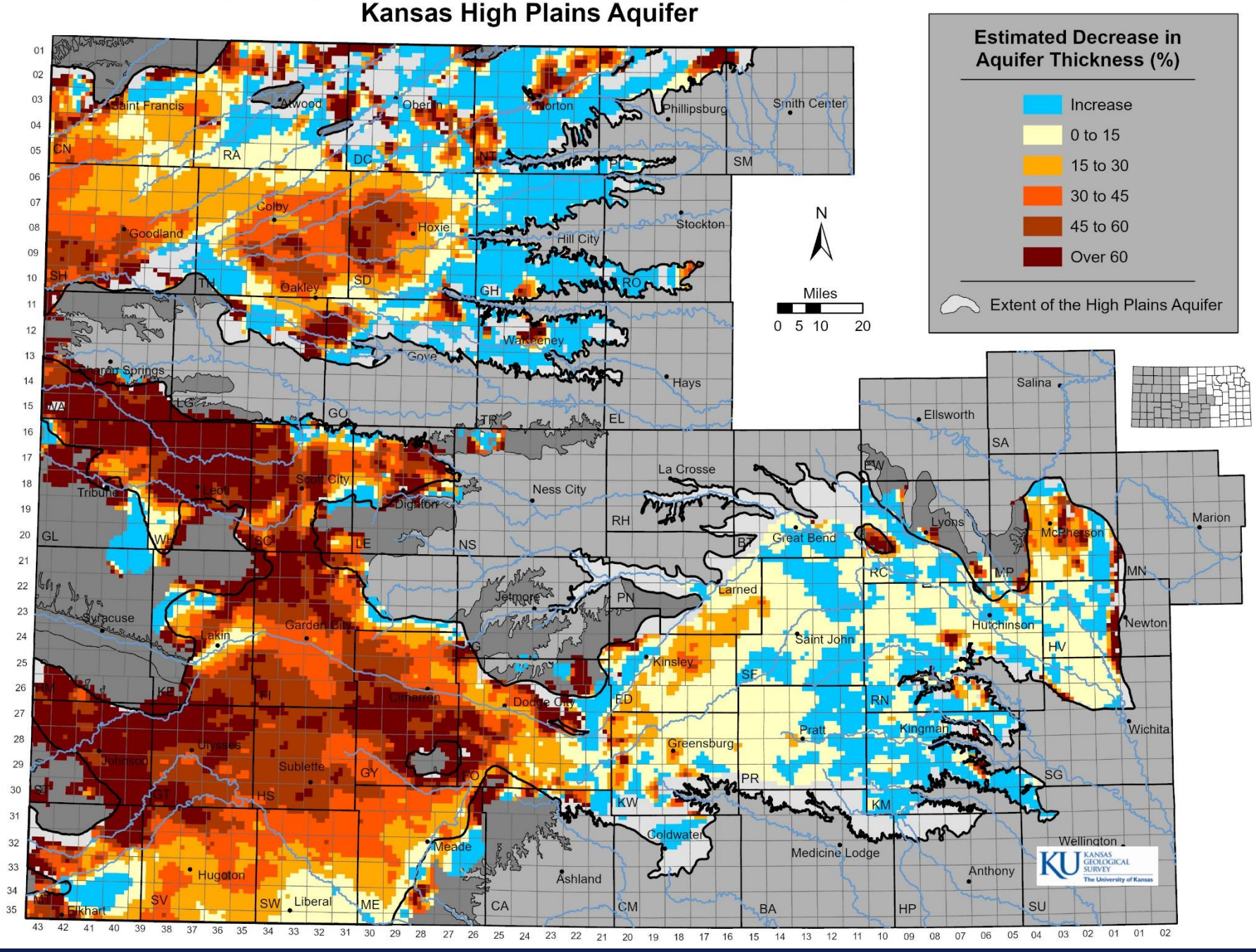


Kansas Drought Monitor
November 8, 2022

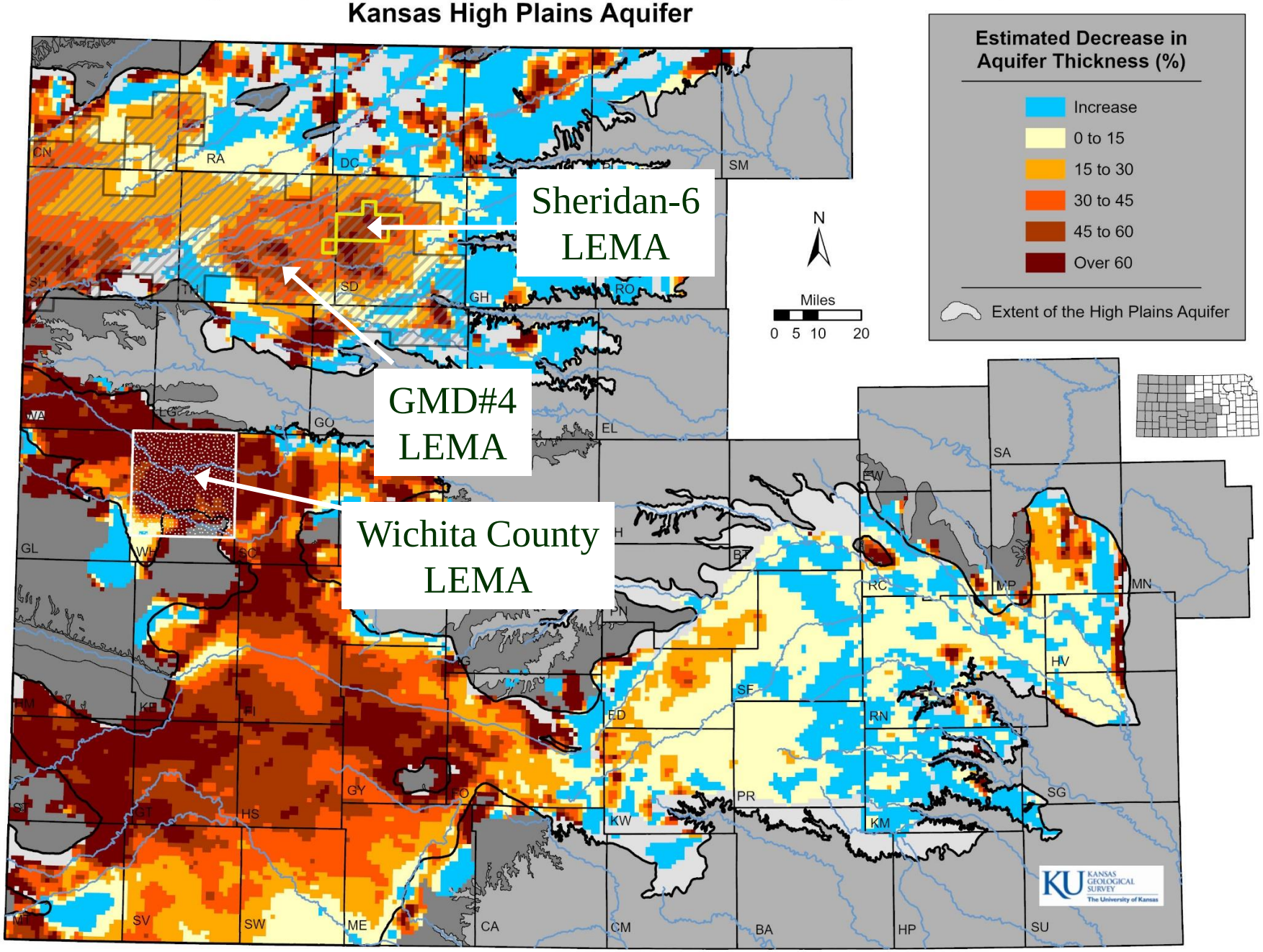
Intensity

- None
- D0 (Abnormally Dry)
- D1 (Moderate Drought)
- D2 (Severe Drought)
- D3 (Extreme Drought)
- D4 (Exceptional Drought)

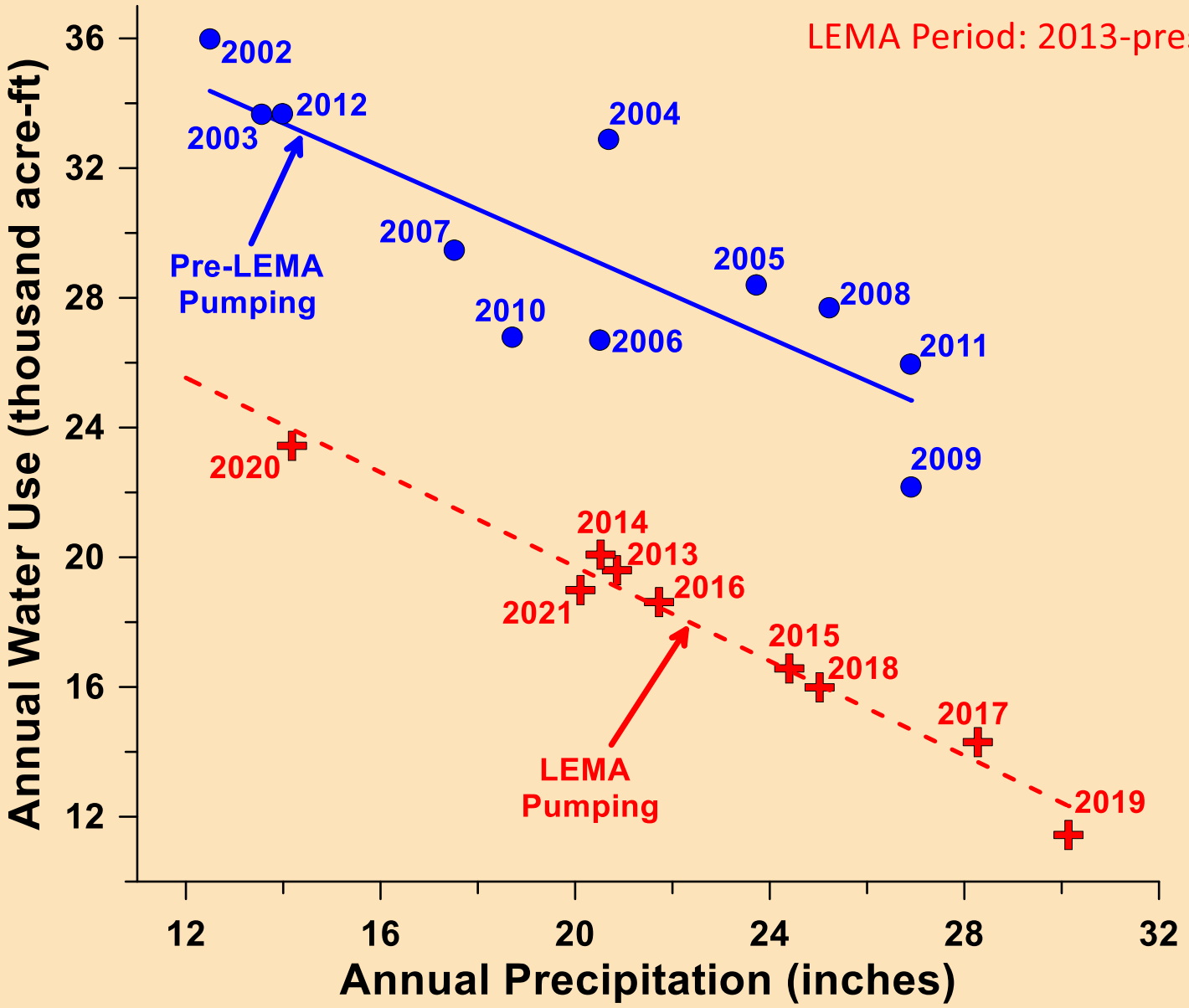
Percent Change in Aquifer Thickness, Predevelopment to Average 2020-2022, Kansas High Plains Aquifer



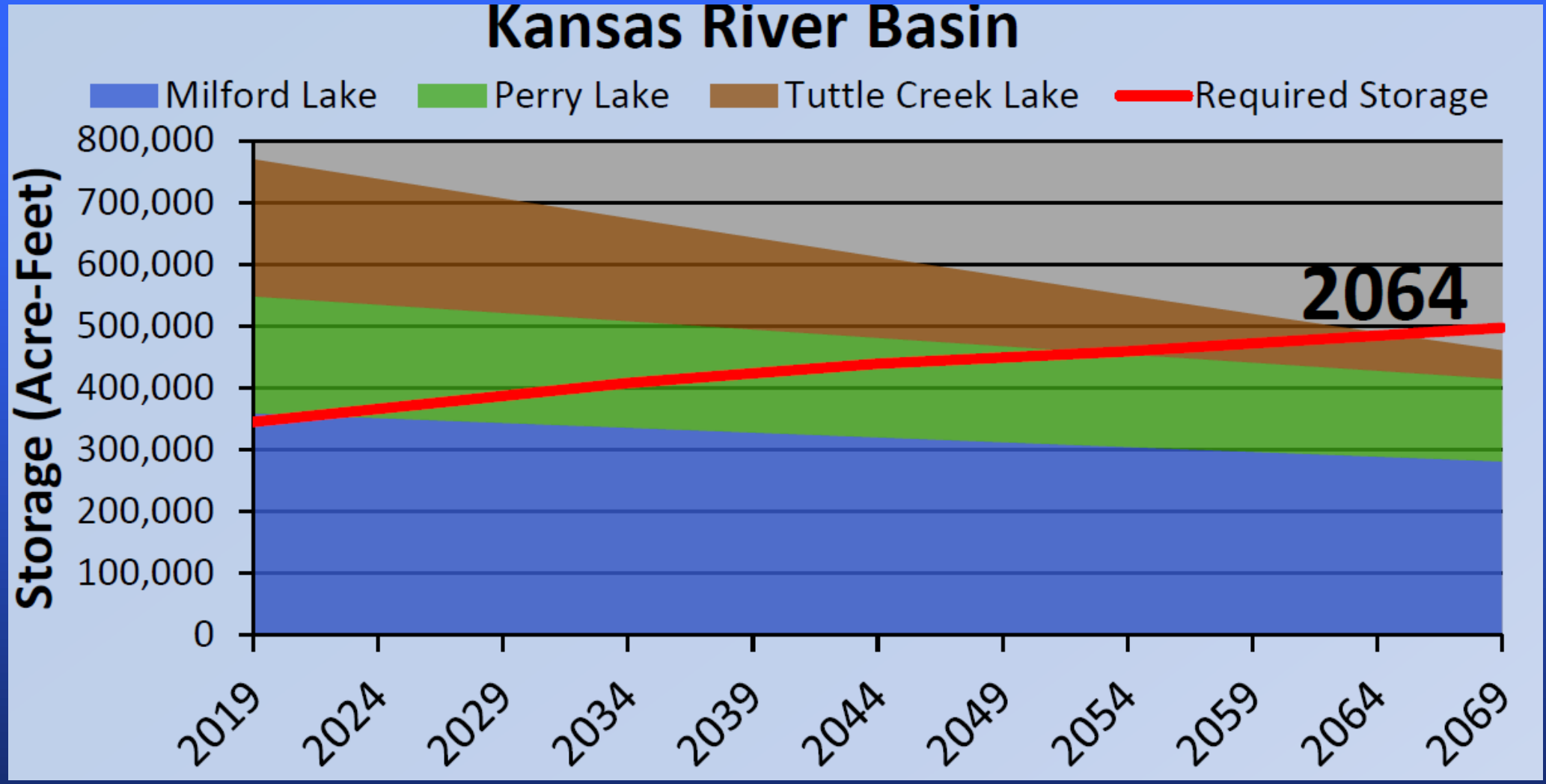
Percent Change in Aquifer Thickness, Predevelopment to Average 2020-2022, Kansas High Plains Aquifer



Sheridan-6 LEMA

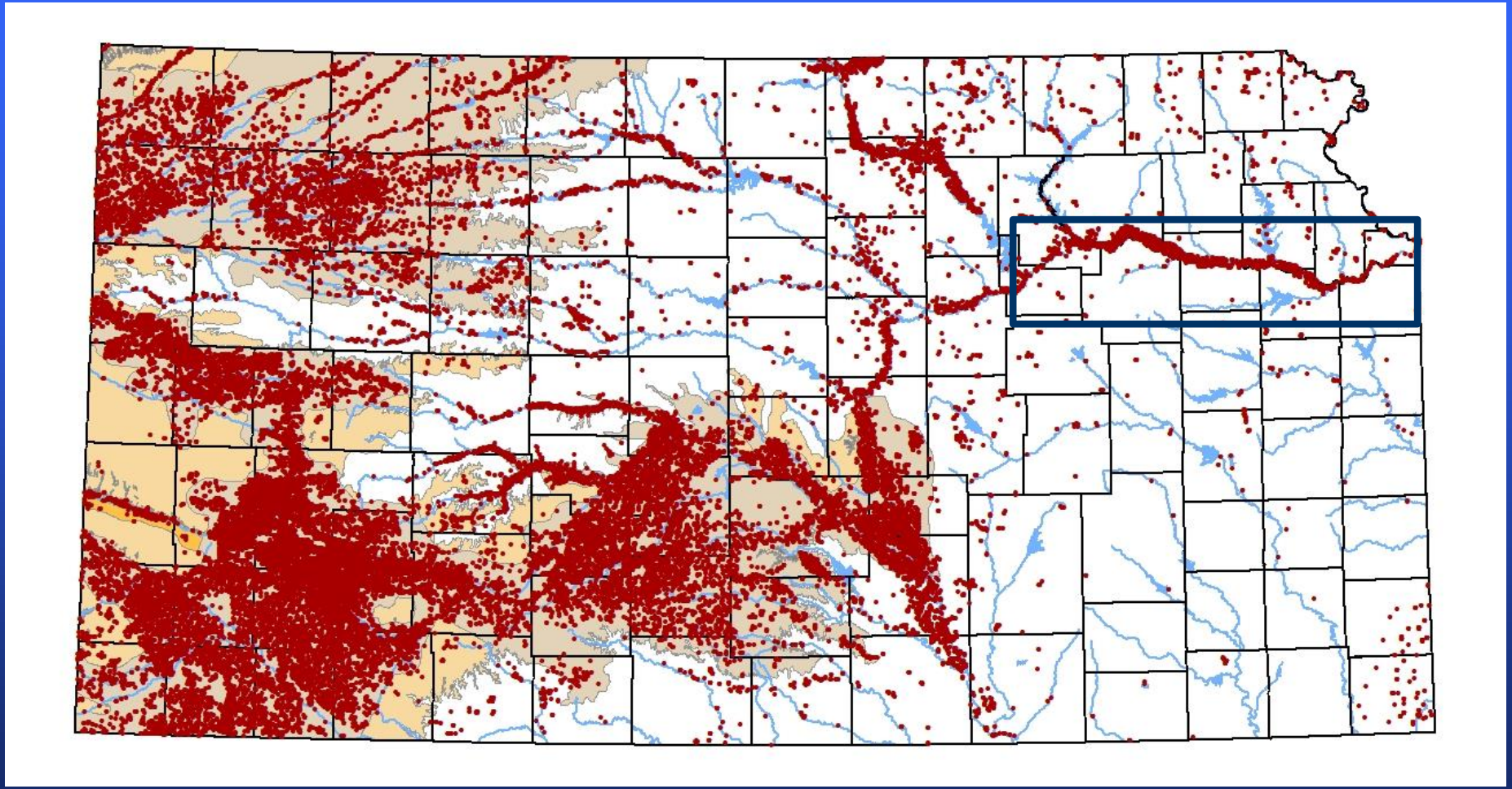


≈ 30% reduction in pumping for similar climatic conditions.



Where are we going to get the storage?

Annual Groundwater Use Data



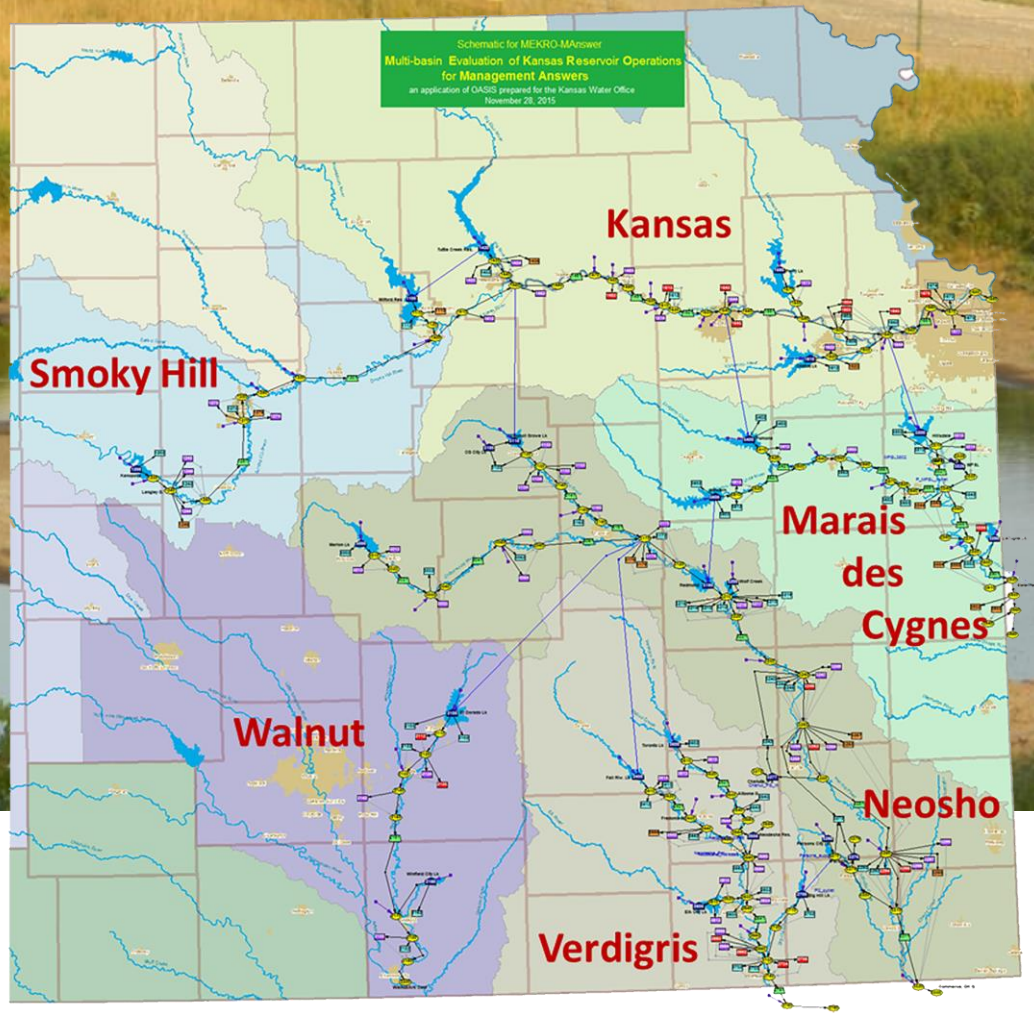
How do the Kansas River Alluvial Aquifer and Kansas River interact?

Kansas River Index Well Network: 16 wells

Data → Insights → Model

Paths Forward

Hazen



The Tools of Successful Drought Management

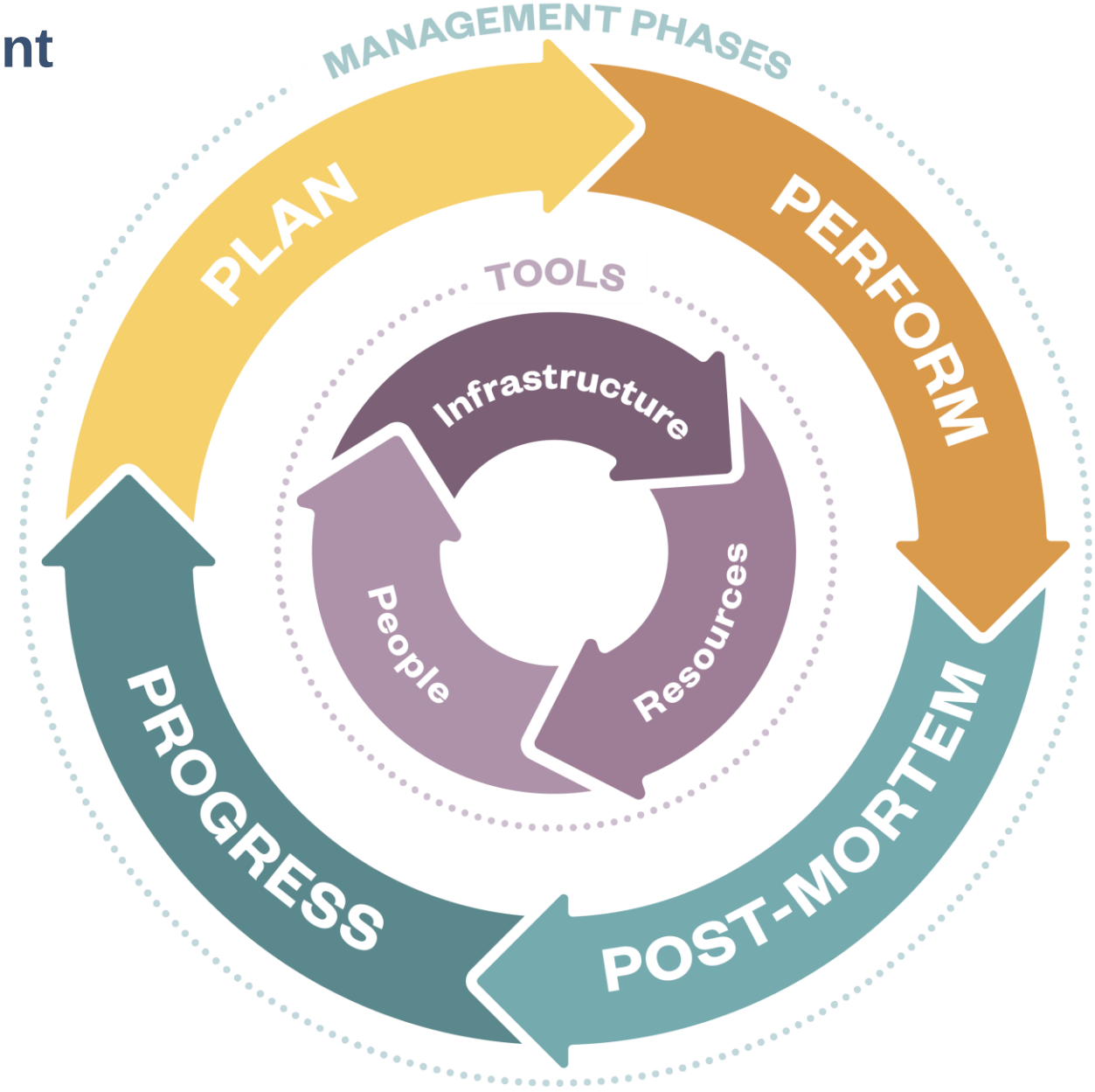
Governor's Conference on the Future of Water In Kansas
A. Michael Sheer

Manhattan, KS | November 16, 2022

AD ASTRA PER ASPERA
Kansas
Water Office

Successful Drought Management

Four steps, three factors, One shared toolbox



Phase 1: Plan

Explore, Test, Engage

Explore

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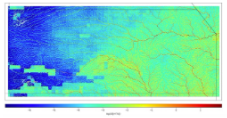


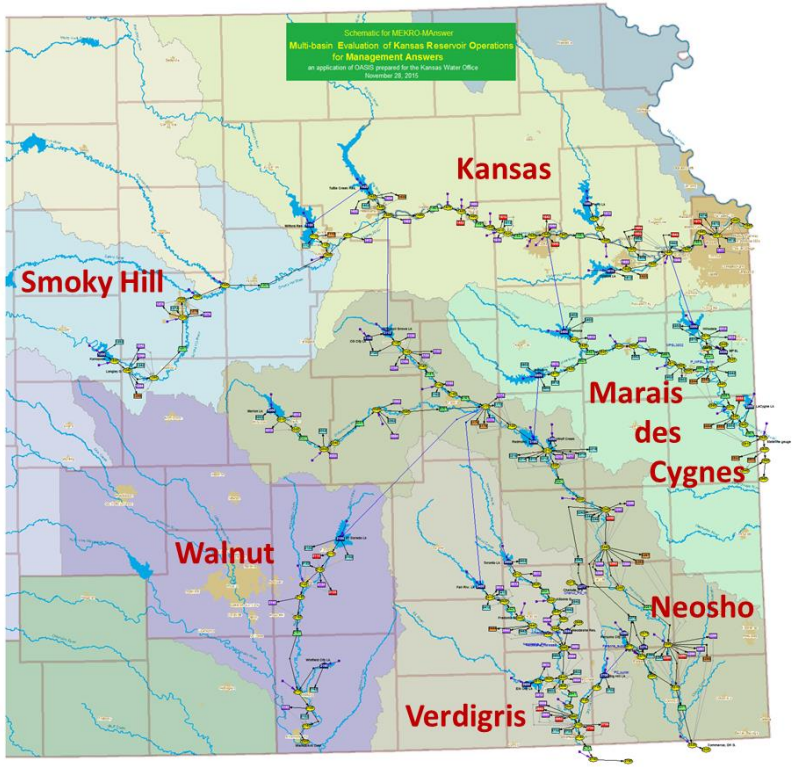
RESEARCHERS TO DEVELOP NEW MODELS FOR FORECASTING WATER AVAILABILITY AND ALLOCATION IN KANSAS

Tue, 11/09/2021

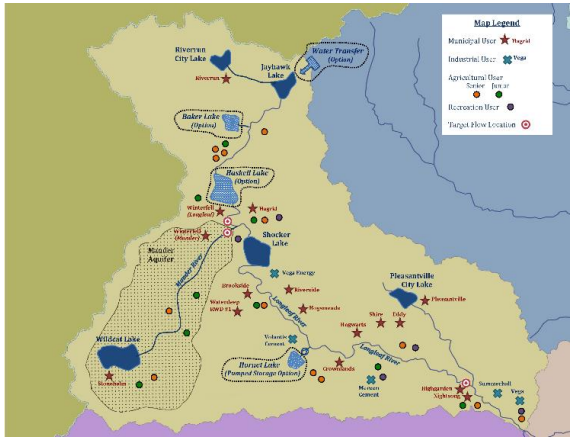
The new modeling effort will focus on central and eastern sections of Kansas that depend on surface water, incorporating six river basins, 21 reservoirs, 51 inflows and 163 sources of consumptive water use.

"The Kansas Water Office is looking forward to working with the University of Kansas on this WaterSmart grant project, developing more tools and resources to incorporate climate variability to future water supply planning for the state of Kansas," said Richard Rockel, KWO water resource planner. "This project will allow for a more comprehensive analysis of climate variability as applied to regional water supply issues the state is facing."

Test



Engage



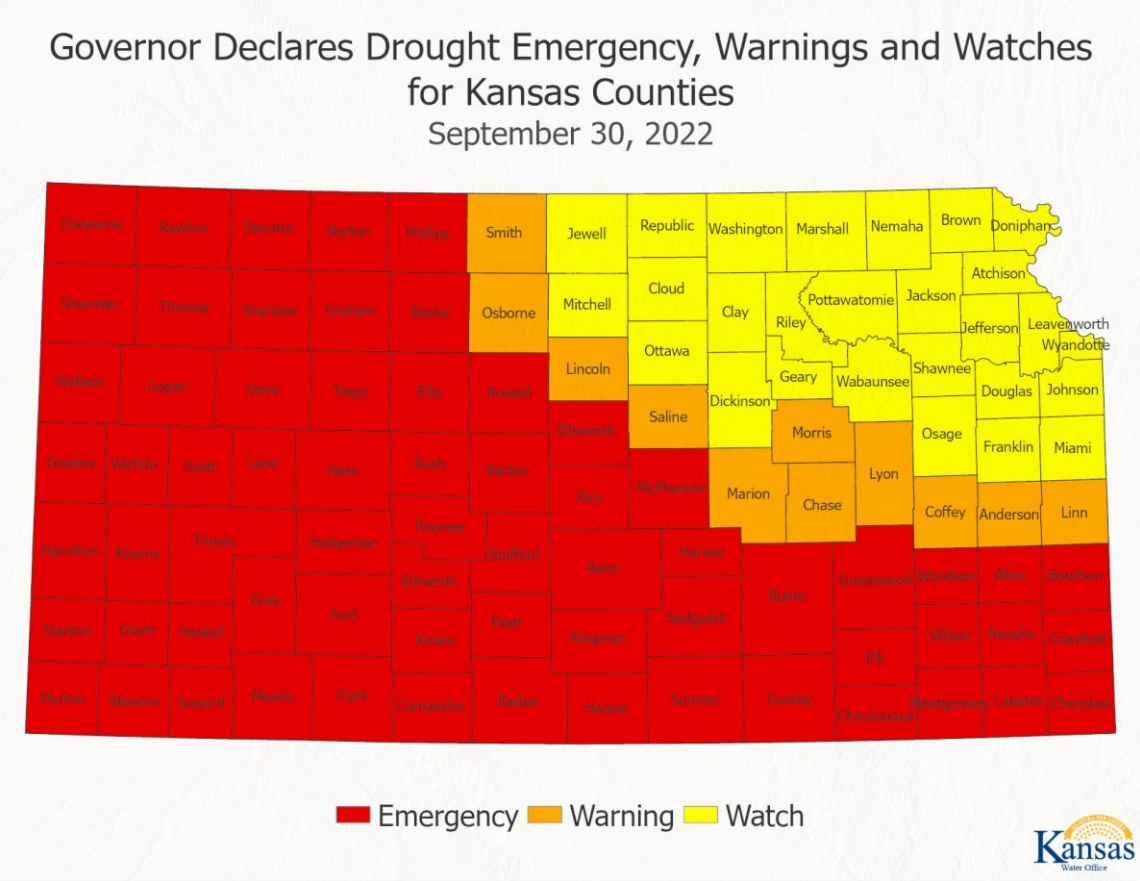
1st Place: The Grasshoppers

The Grasshoppers followed a plan more similar to the approach taken by several other groups, combining a mix of better utilization of existing storage alongside conservation and minimum flow reduction. This alternative came in at $13,863,800, still considered cheap relative to the other plans.

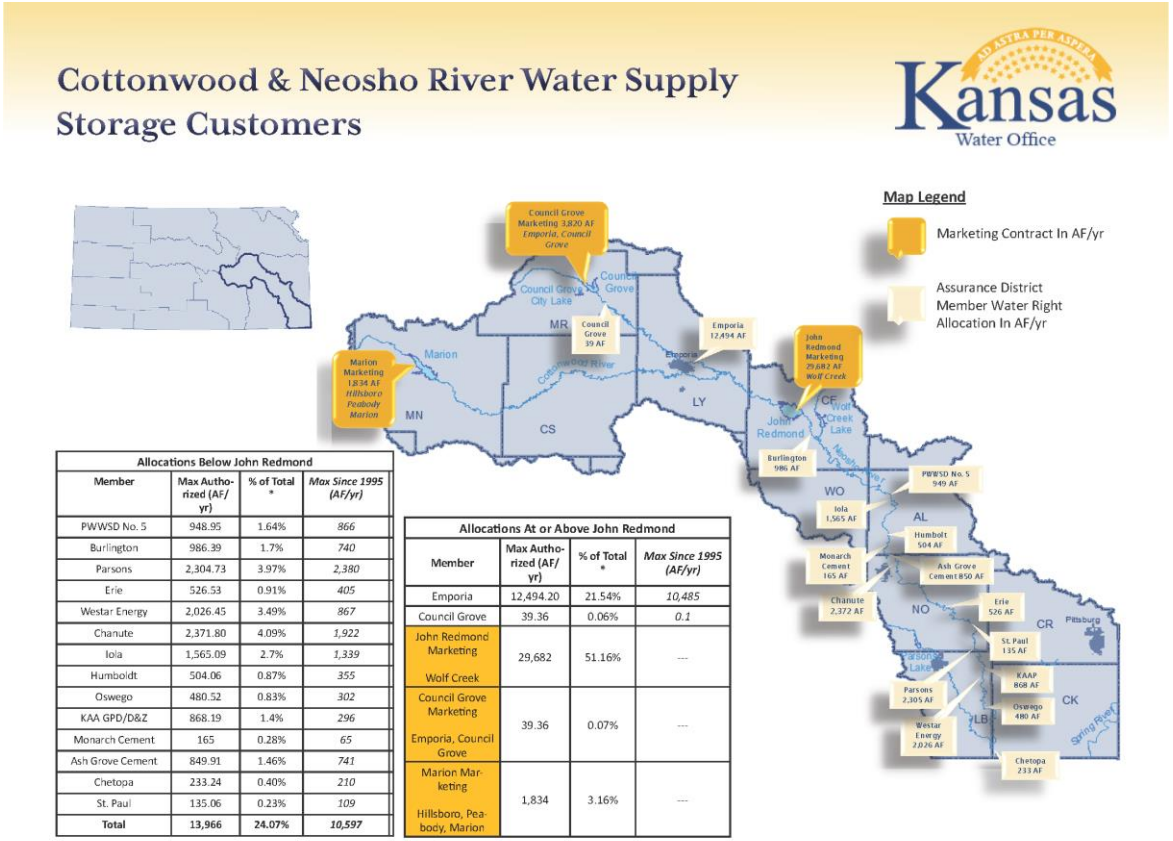
Phase 2: Perform

Communicate & Manage

Communicate



Manage



Allocations Below John Redmond

Member	Max Authorized (AF/yr)	% of Total *	*Max Since 1995 (AF/yr)*
PWWSD No. 5	948.95	1.64%	*866*
Burlington	986.39	1.7%	*740*
Parsons	2,304.73	3.97%	*2,380*
Erie	526.53	0.91%	*405*
Westar Energy	2,026.45	3.49%	*867*
Chanute	2,371.80	4.09%	*1,922*
Iola	1,565.09	2.7%	*1,339*
Humboldt	504.06	0.87%	*355*
Oswego	480.52	0.83%	*302*
KAA GPD/D&Z	868.19	1.4%	*296*
Monarch Cement	165	0.28%	*65*
Ash Grove Cement	849.91	1.46%	*741*
Chetopa	233.24	0.40%	*210*
St. Paul	135.06	0.23%	*109*
Total	**13,966**	**24.07%**	***10,597***

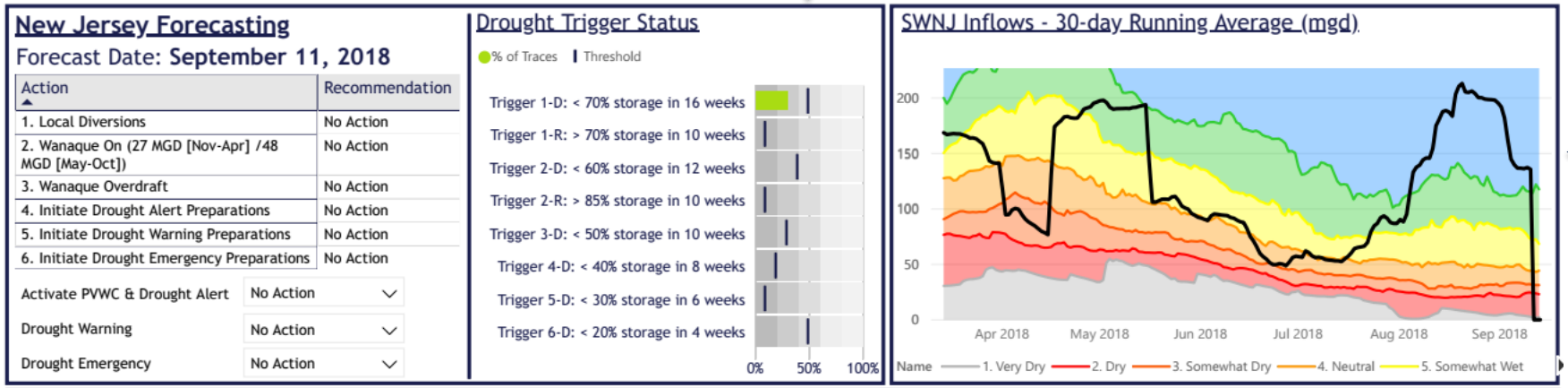
Allocations At or Above John Redmond

Member	Max Authorized (AF/yr)	% of Total *	*Max Since 1995 (AF/yr)*
Emporia	12,494.20	21.54%	*10,485*
Council Grove	39.36	0.06%	*0.1*
John Redmond Marketing Wolf Creek	29,682	51.16%	---
Council Grove Marketing Emporia, Council Grove	39.36	0.07%	---
Marion Marketing Hillsboro, Peabody, Marion	1,834	3.16%	---

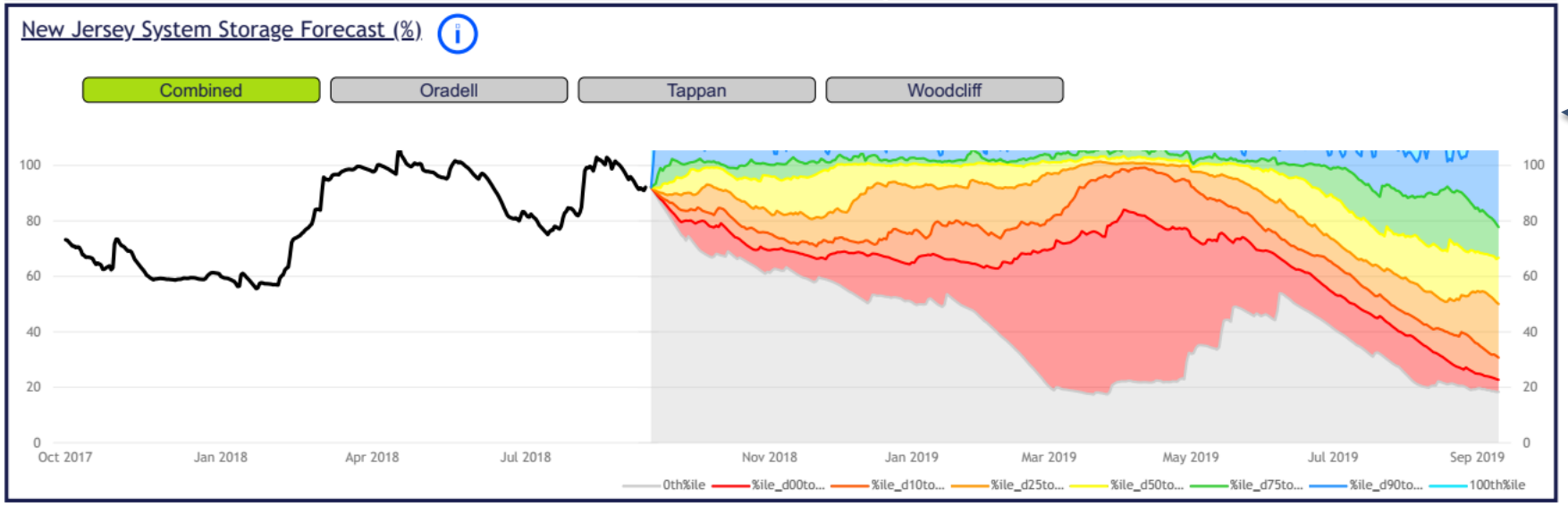
Phase 2: Perform

Forecast Informed Operations & Operation Support Tools

How close are we to triggering action?



← Inflow forecasts

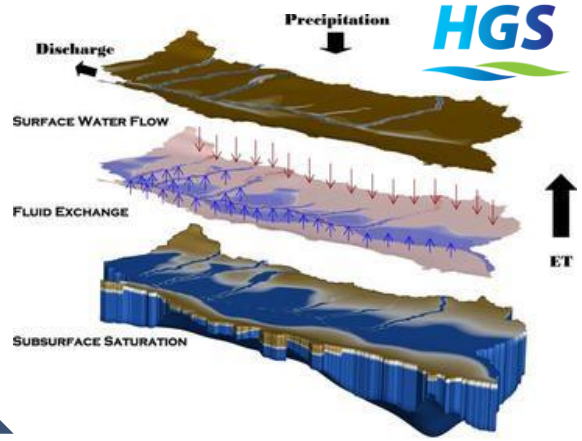


← Storage forecasts

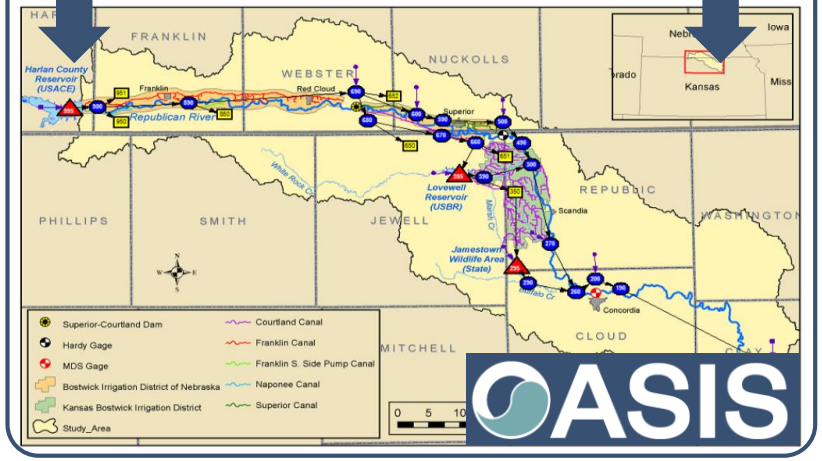
Phases 3 & 4: Post-Mortem & Progress

Review and Improve, Find new solutions

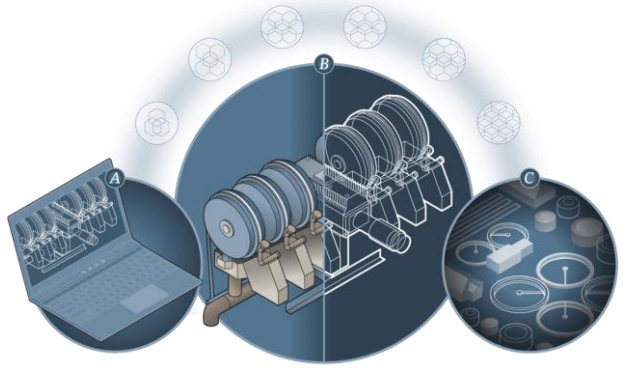
Explore & Link



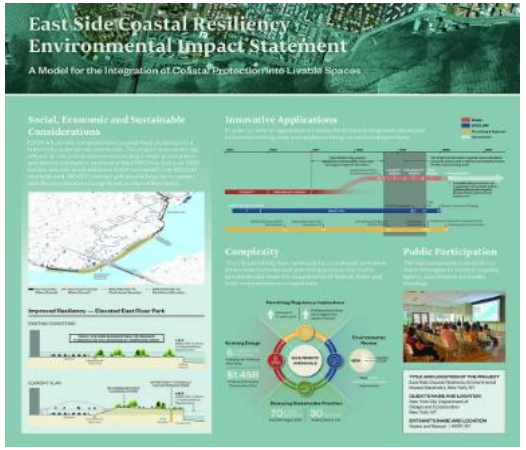
Groundwater Model Linkage



Design



Permit



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