

HOW RESERVOIR SEDIMENTATION CHANGES THE FUTURE OF WATER IN KANSAS: RESULTS FROM THE KANSAS RIVER RESERVOIRS FLOOD AND SEDIMENT STUDY

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US Army Corps
of Engineers®



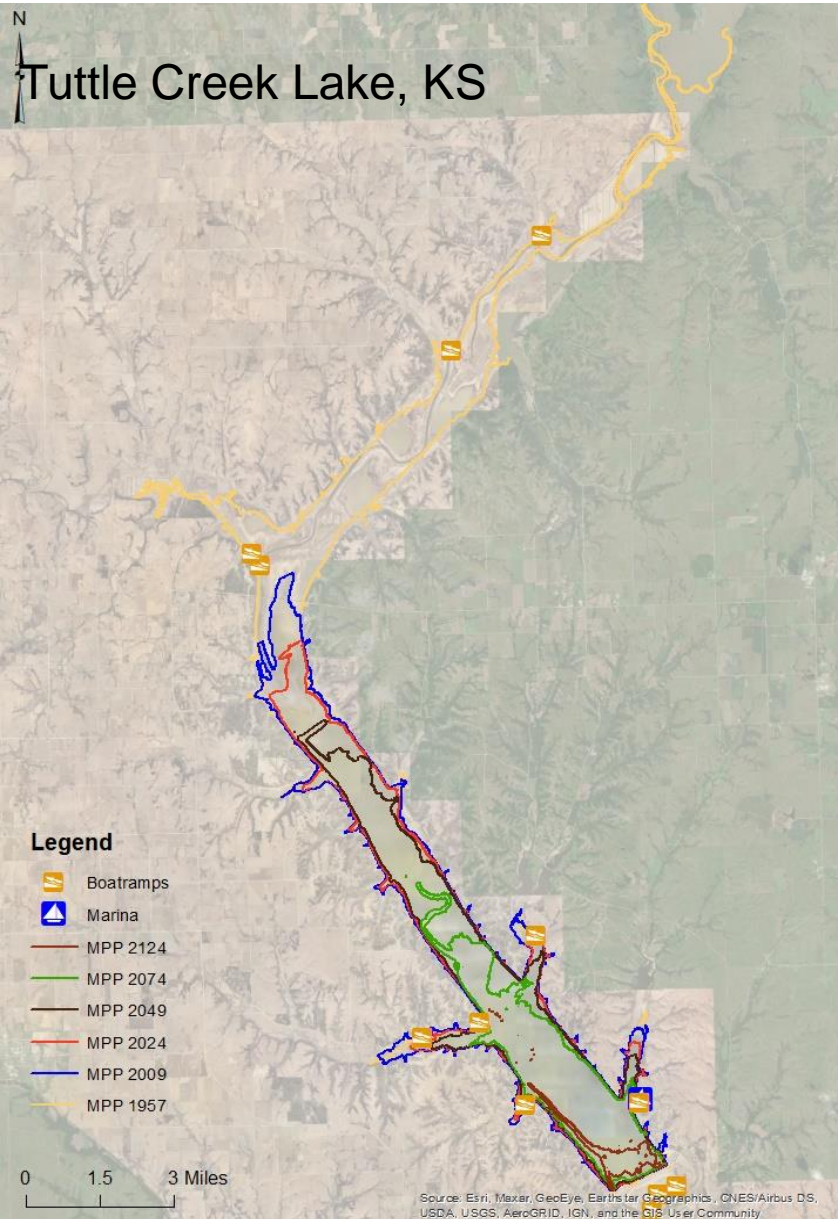


IF YOU FILL YOUR CUP WITH MUD, THERE'S LESS ROOM FOR THE WATER



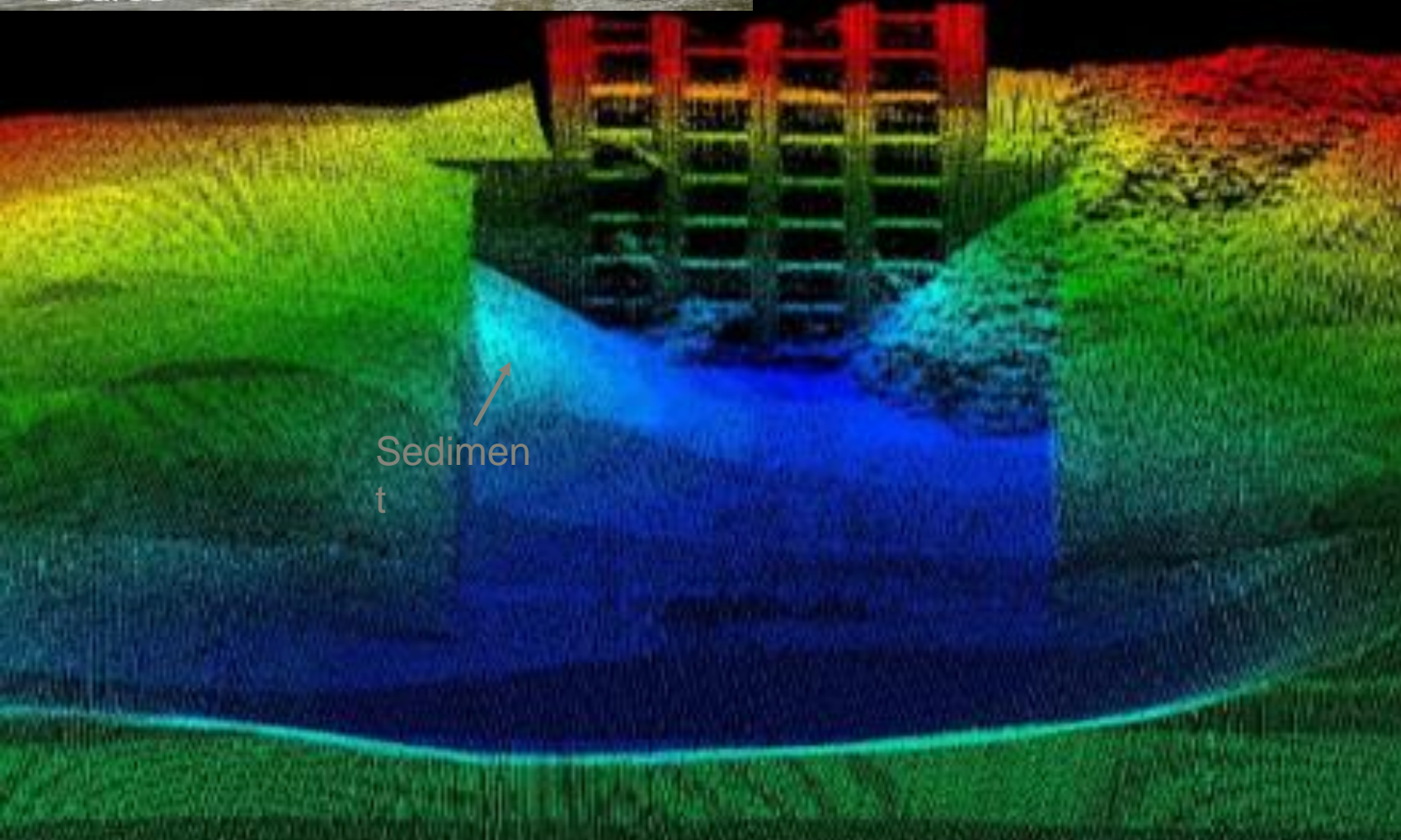


LOSS IN LAKE SURFACE AREA



Boat ramps silted in
Coves silted in
Campground abandoned

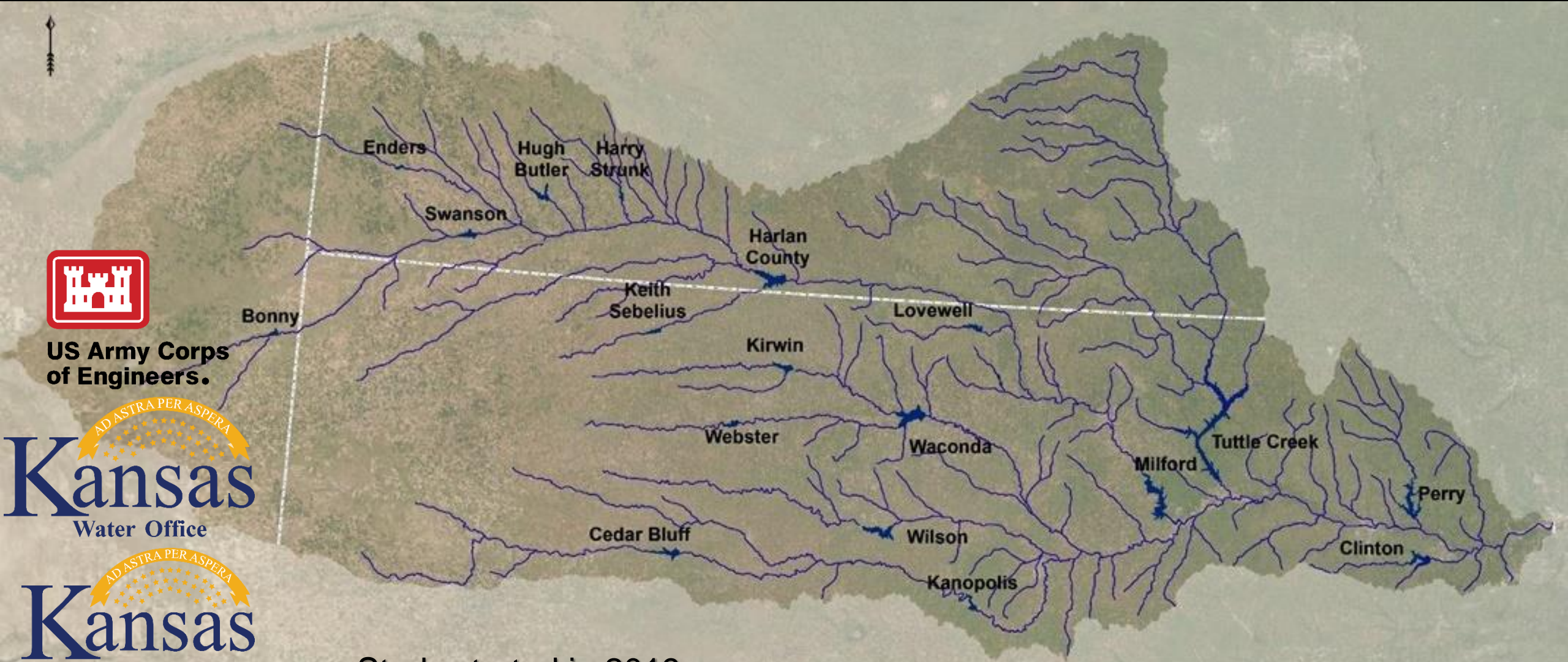
SEDIMENTATION IMPACTS ON OPERATIONS



Kanopolis Lake, February 2019



KANSAS RIVER RESERVOIRS FLOOD AND SEDIMENT STUDY (KRRFSS)

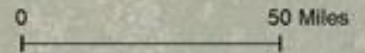


US Army Corps of Engineers.

AD ASTRA PER ASPERA
Kansas
Water Office

AD ASTRA PER ASPERA
Kansas
Department of Wildlife, Parks and Tourism

Study started in 2019

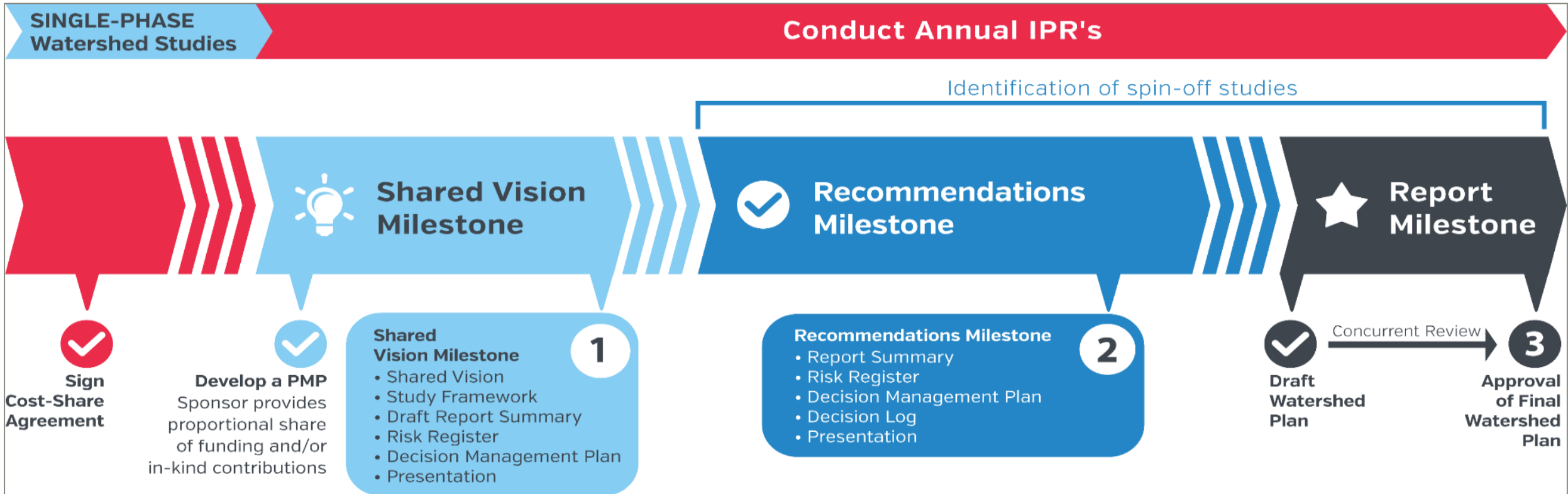




WATERSHED STUDY PROCESS



“Watershed studies should inform multiple audiences and decision makers at all levels of government, and provide a strategic roadmap to inform future investment decisions by multiple agencies”





THE STUDY ASSESSES



Reservoir sedimentation

- Water supply and water management implications
- Recreation implications
- Flooding implications

Other opportunities to improve flood control, water supply reliability, and ecosystem function not related to reservoir sedimentation



FOR THIS PRESENTATION



Reservoir sedimentation

- Water supply and water management implications
- Recreation implications
- Flooding implications

Other opportunities to improve flood control, water supply reliability, and ecosystem function not related to reservoir sedimentation



AGENDA



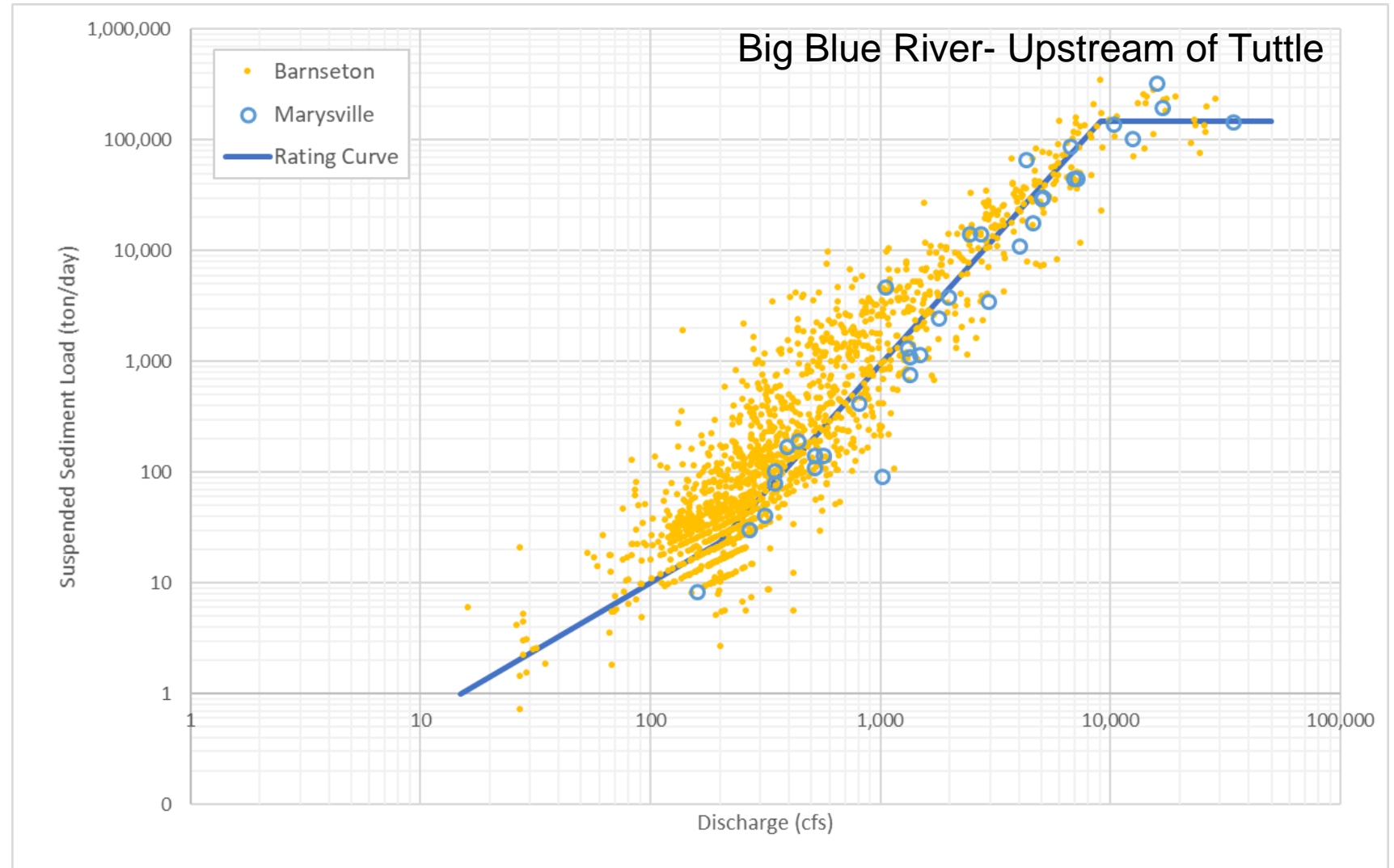
- How we made our sediment predictions
- The predictions
- The water implications



RESERVOIR SEDIMENTATION PREDICTION



1. Develop flow/load relationship

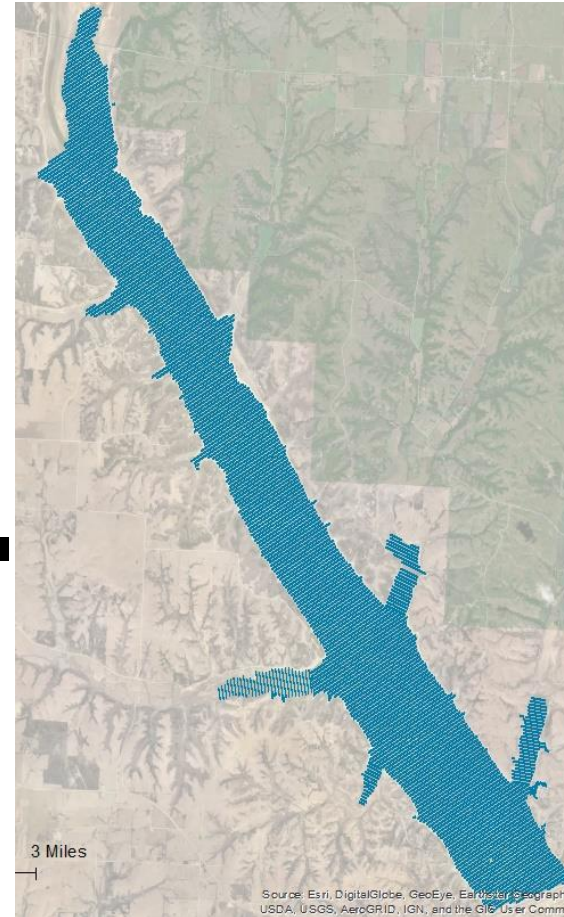




RESERVOIR SEDIMENTATION PREDICTION



2. Compile the history of storage loss in the lakes



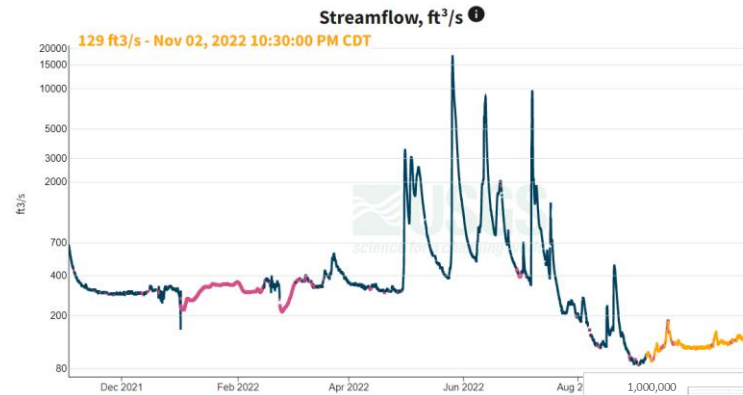
== Deposition



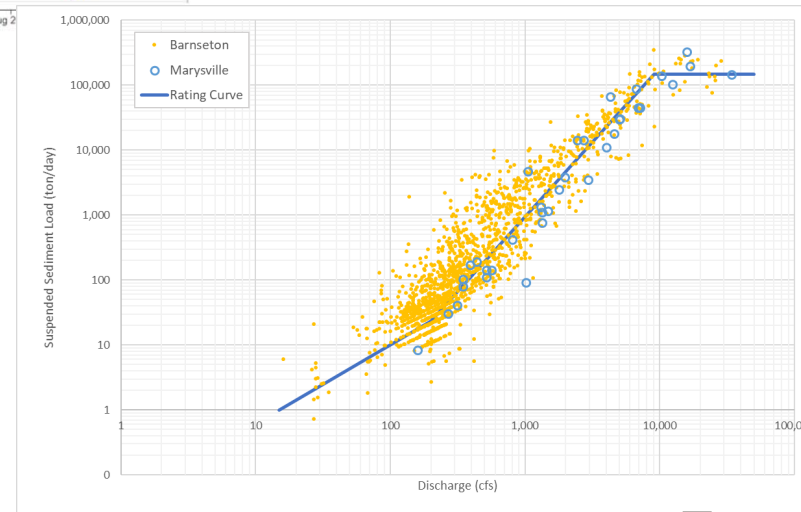
RESERVOIR SEDIMENTATION PREDICTION



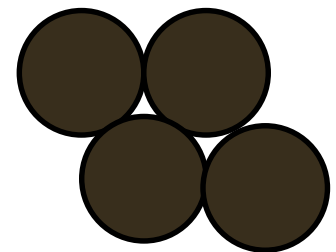
3. Run the time series of daily flows through the flow/sediment rating curve



Daily Water Inflow



Flow/Sediment Rating Curve



Daily Sediment Inflow

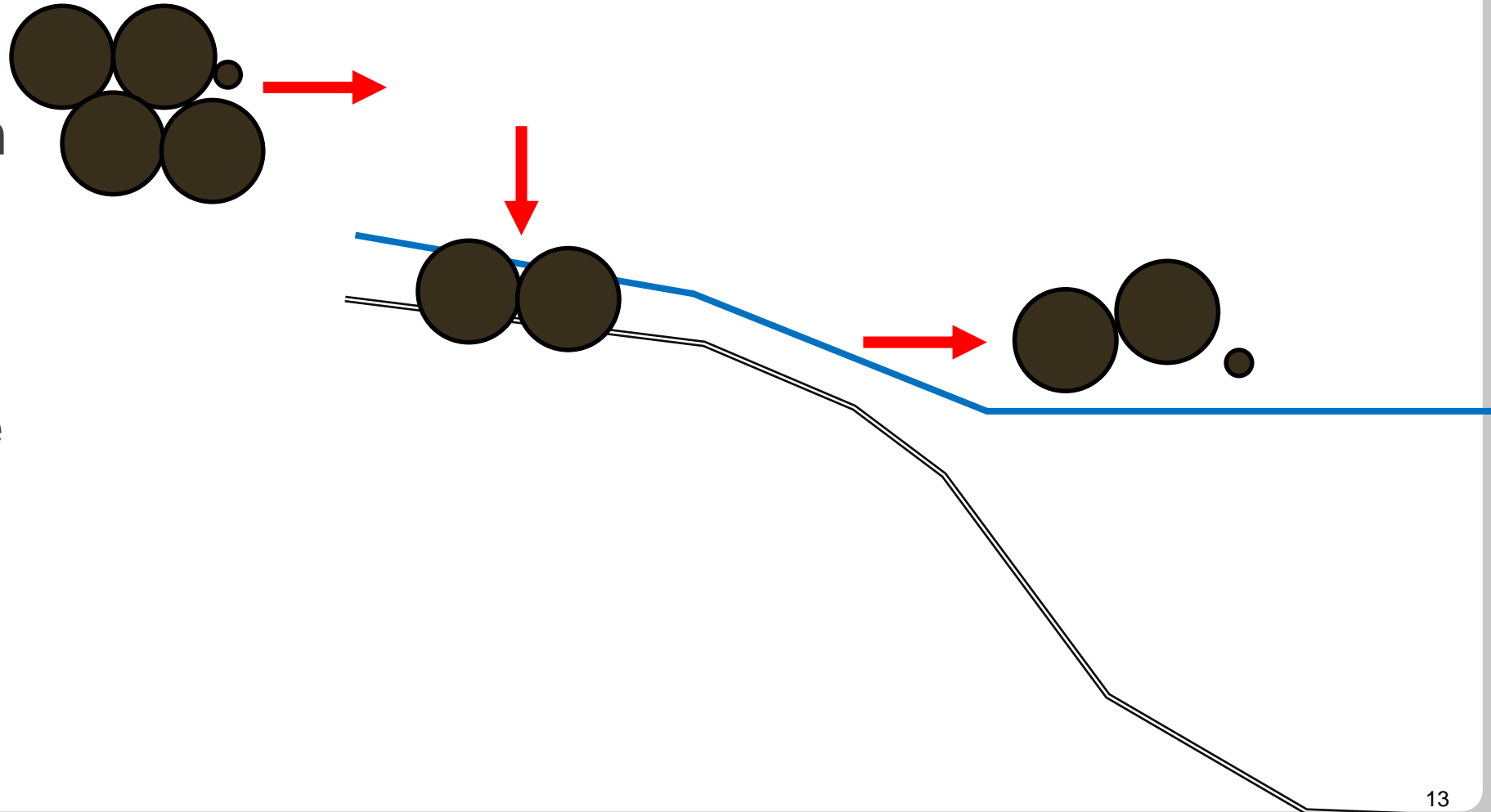


RESERVOIR SEDIMENTATION PREDICTION



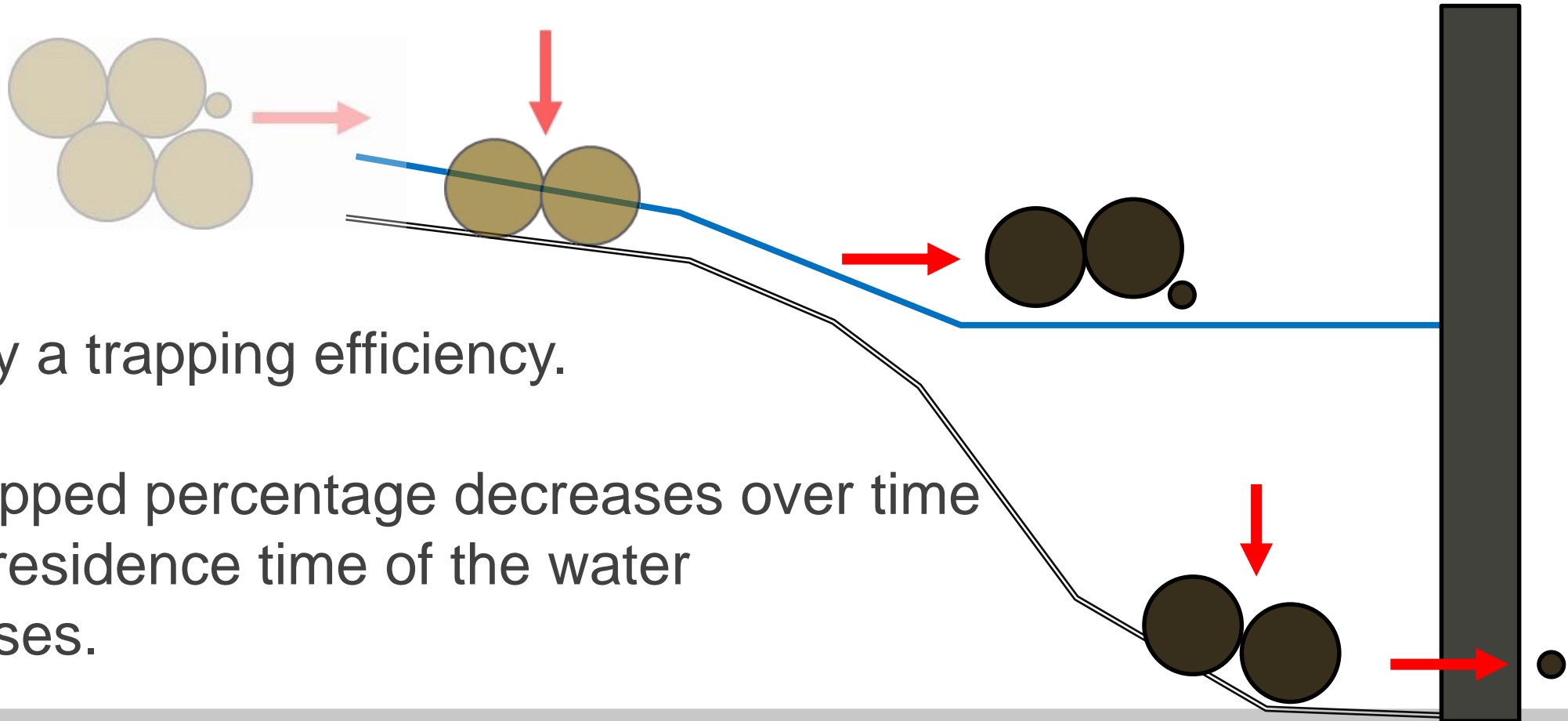
4. Apportion a percentage to the flood pool based on historic surveys.

This percentage increases over time as the delta grows and induces backwater.





RESERVOIR SEDIMENTATION PREDICTION

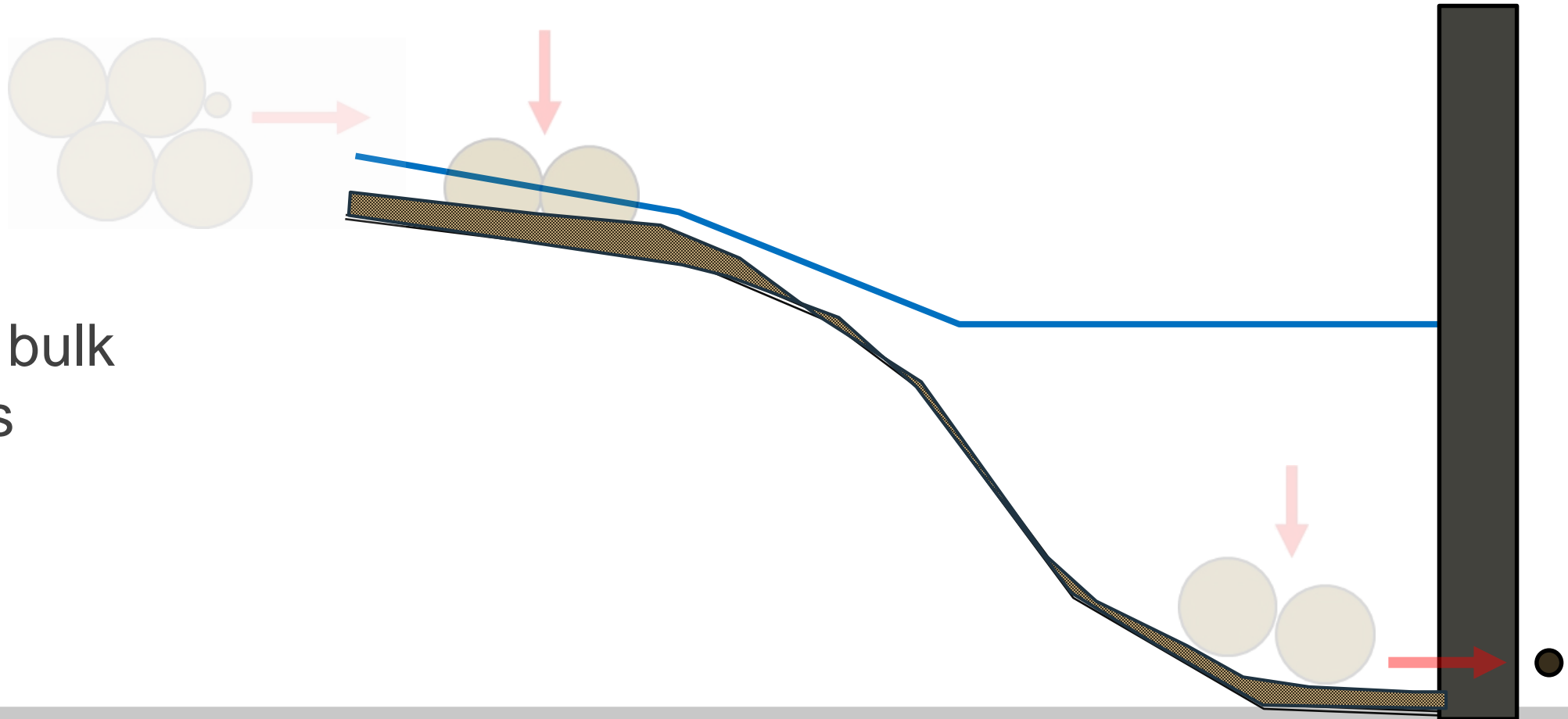


5. Apply a trapping efficiency.

The trapped percentage decreases over time as the residence time of the water decreases.



RESERVOIR SEDIMENTATION PREDICTION



6. Apply bulk densities



RESERVOIR SEDIMENTATION PREDICTION



7. Compare to measured sediment volumes

8. Calibrate the sediment rating curve so the computed deposition = the measured over many time periods

Time Period	Surveyed (ac-ft)	Computed (ac-ft)	Calculated / Surveyed
1963-1972	40,898	42,907	1.05
1972-1983	68,773	61,557	0.90
1983-2000	124,411	126,015 ^a	1.01
2000-2009^b	23,123	23,367	1.01
Total (1963-2000)	234,082	230,479	0.98

Surveyed and Computed Deposition at Tuttle Creek Lake

^aFP deposition calculated using mean bulk density

^bSurveyed and computed are for the MPP. Change in survey method makes FP deposition unreliable.



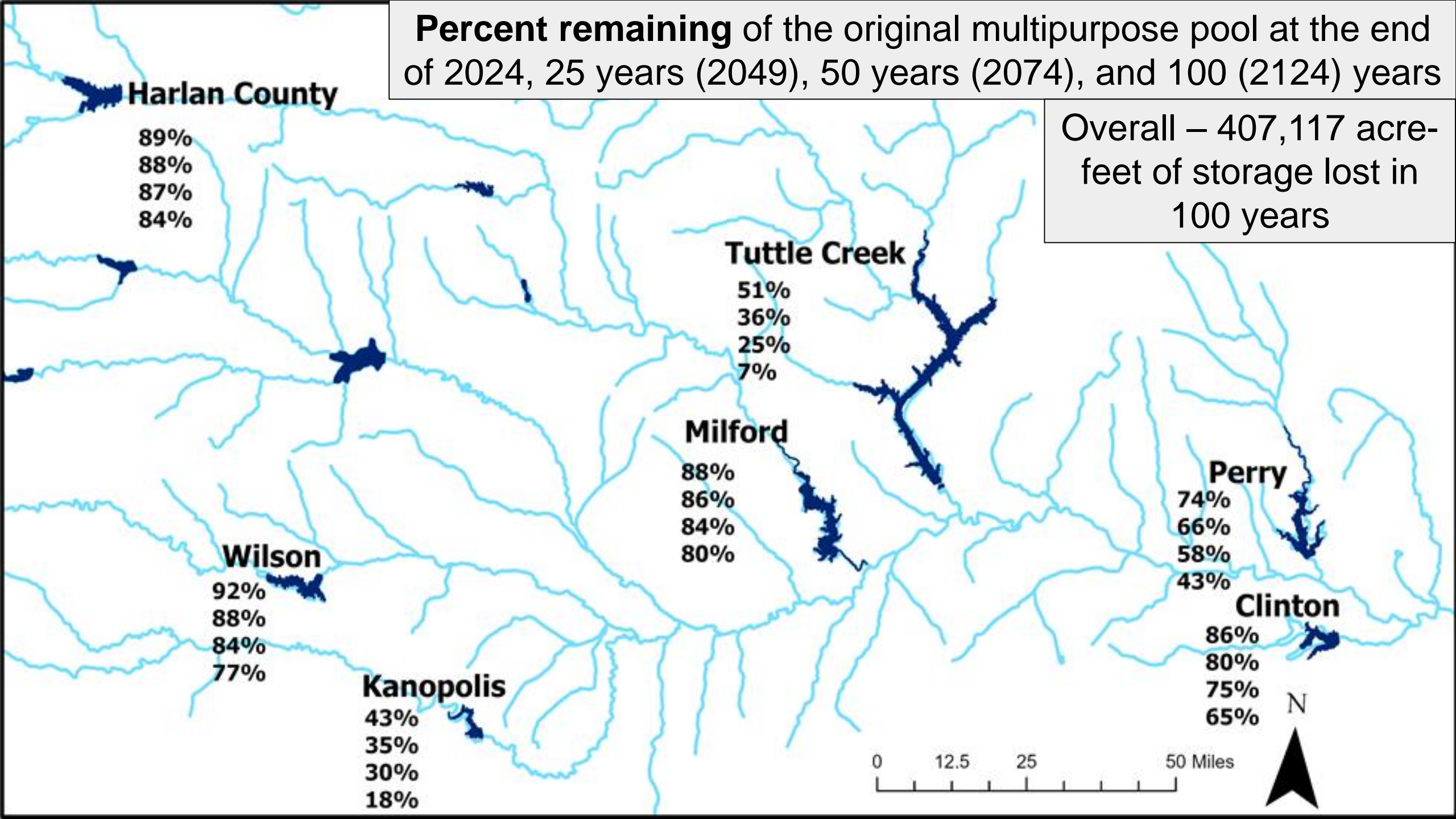
OUTLINE



- How we made our sediment predictions
- The predictions**
- The water implications

Percent remaining of the original multipurpose pool at the end of 2024, 25 years (2049), 50 years (2074), and 100 (2124) years

Overall – 407,117 acre-feet of storage lost in 100 years





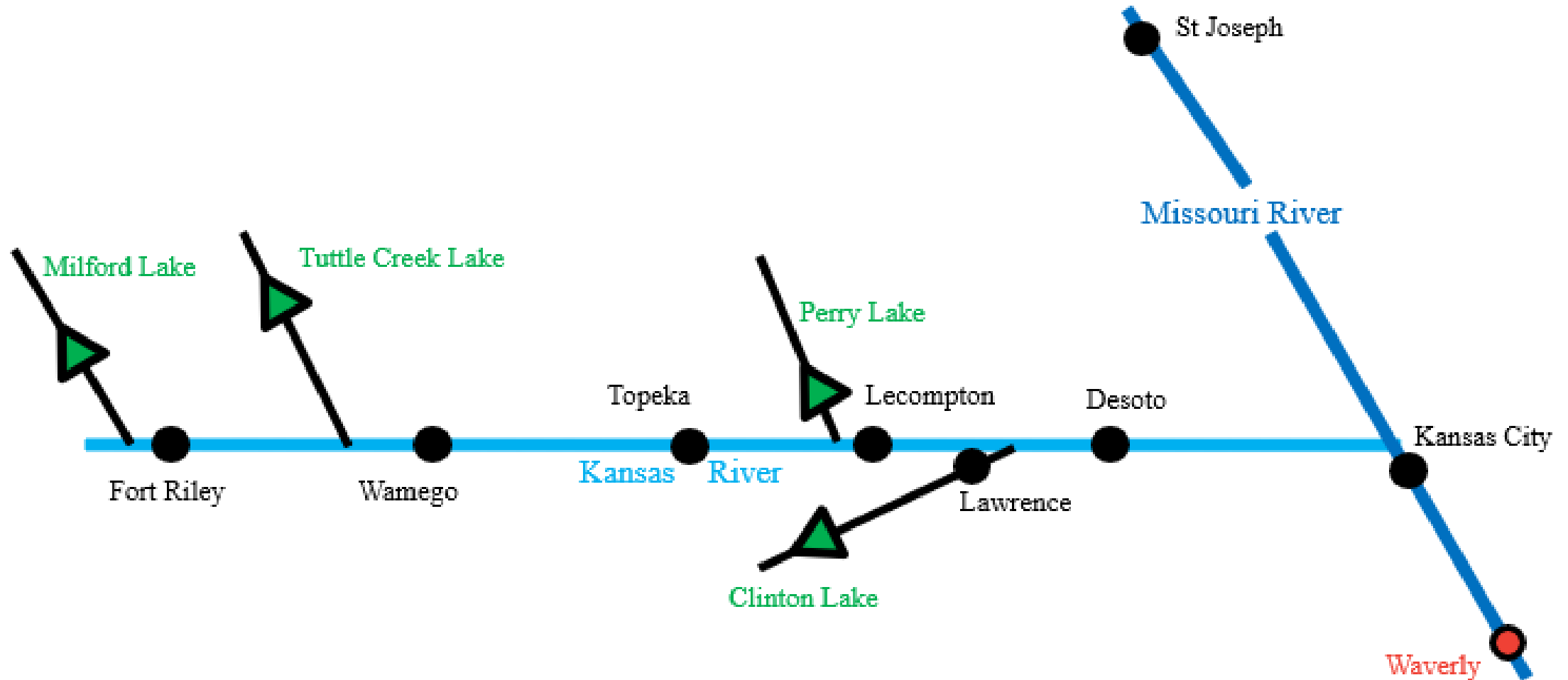
OUTLINE



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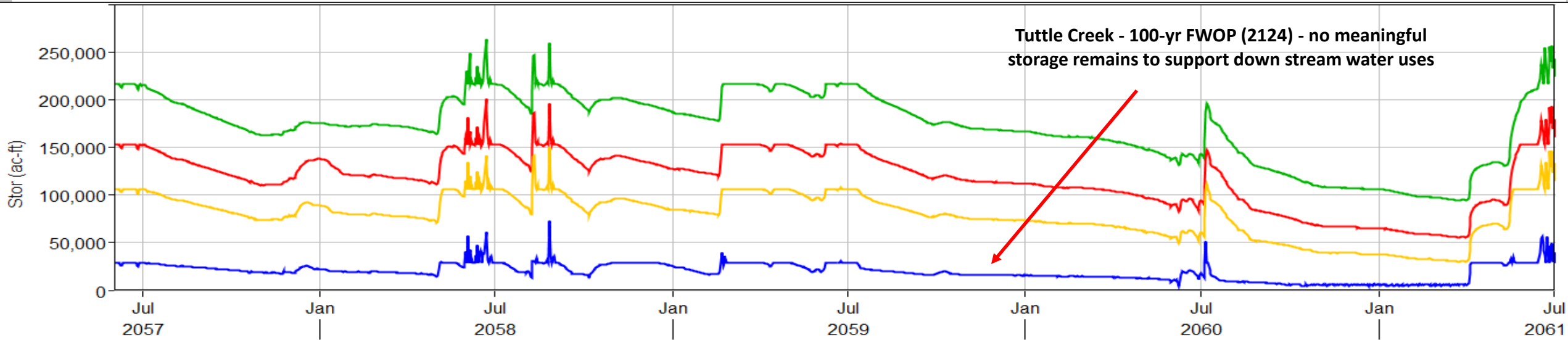
KANSAS RIVER SYSTEM



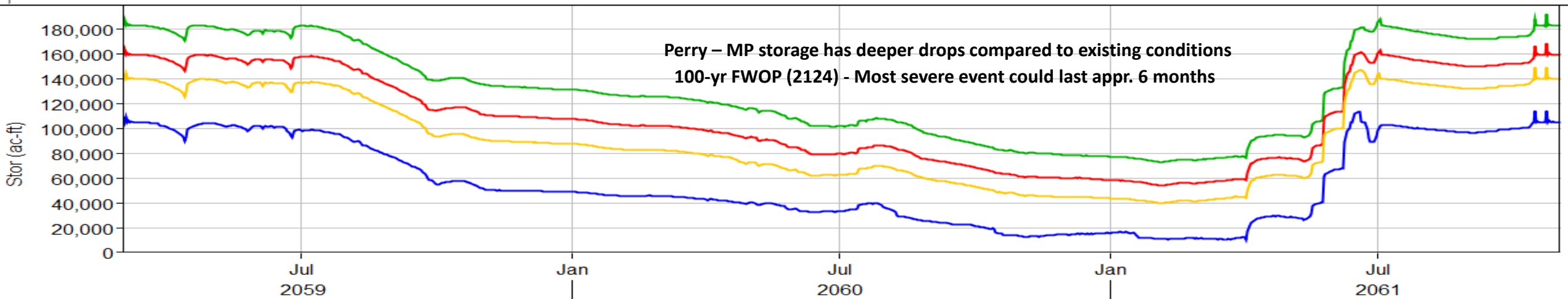


MULTIPURPOSE POOL FUTURE CONDITIONS

LOW STORAGE EXAMPLES – DROUGHT COMPARISON



— Tuttle Creek 0 Year FWOP Elevation — Tuttle Creek 25 Year FWOP Elevation — Tuttle Creek 50 Year FWOP Elevation — Tuttle Creek 100 Year FWOP Elevation
— Tuttle Creek 0 Year FWOP Storage — Tuttle Creek 25 Year FWOP Storage — Tuttle Creek 50 Year FWOP Storage — Tuttle Creek 100 Year FWOP Storage

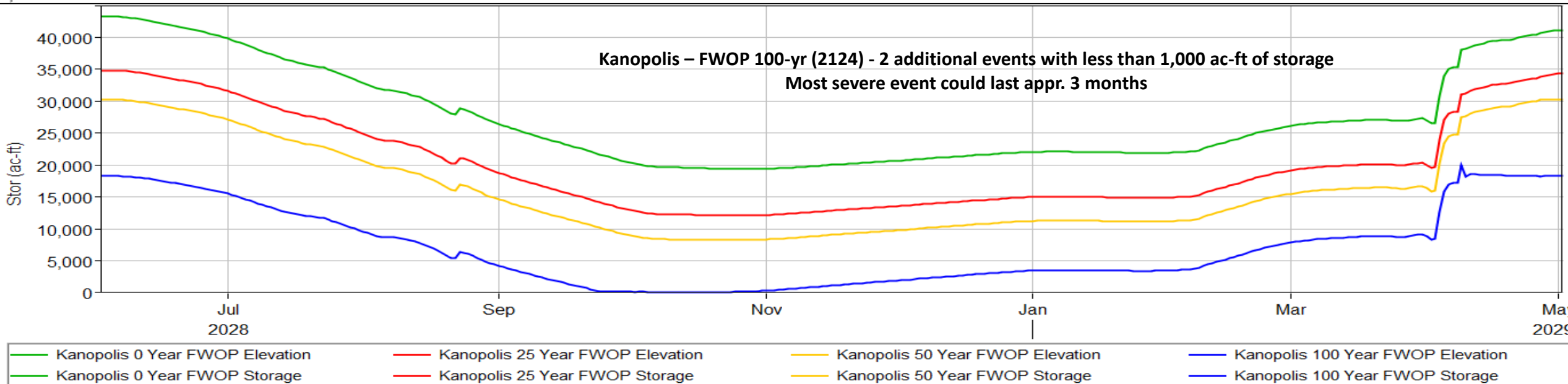
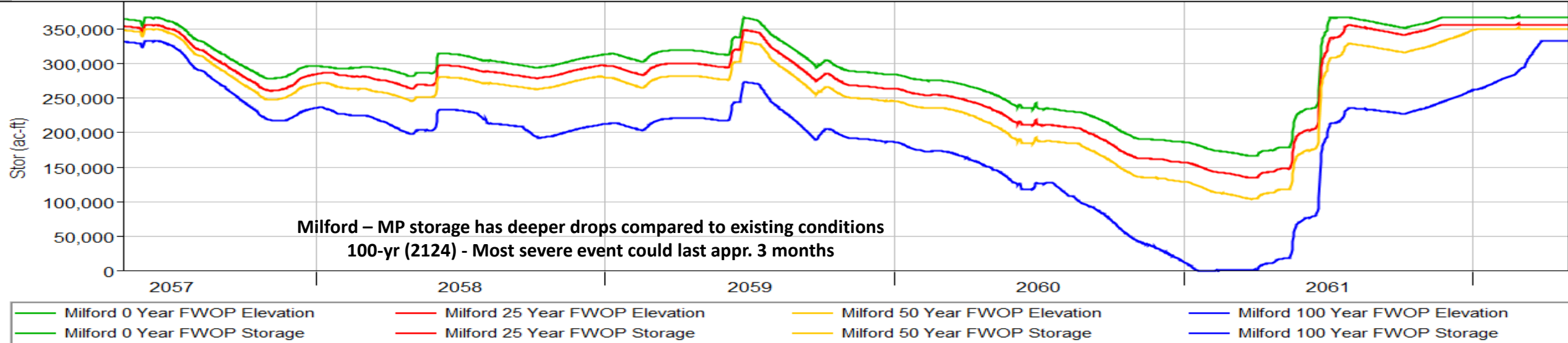


— Perry 0 Year FWOP Elevation — Perry 25 Year FWOP Elevation — Perry 50 Year FWOP Elevation — Perry 100 Year FWOP Elevation
— Perry 0 Year FWOP Storage — Perry 25 Year FWOP Storage — Perry 50 Year FWOP Storage — Perry 100 Year FWOP Storage



MULTIPURPOSE POOL FUTURE CONDITIONS

LOW STORAGE EXAMPLES – DROUGHT COMPARISON



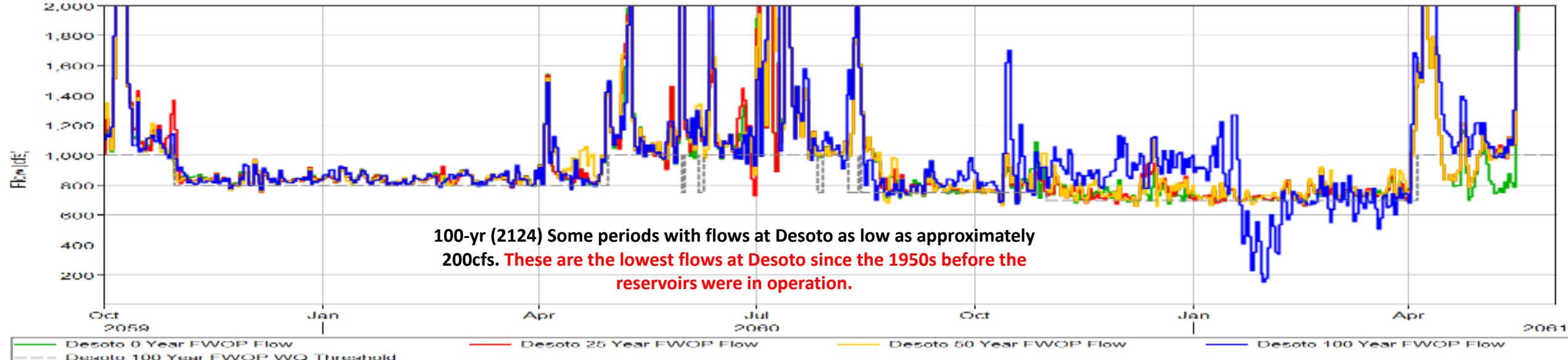
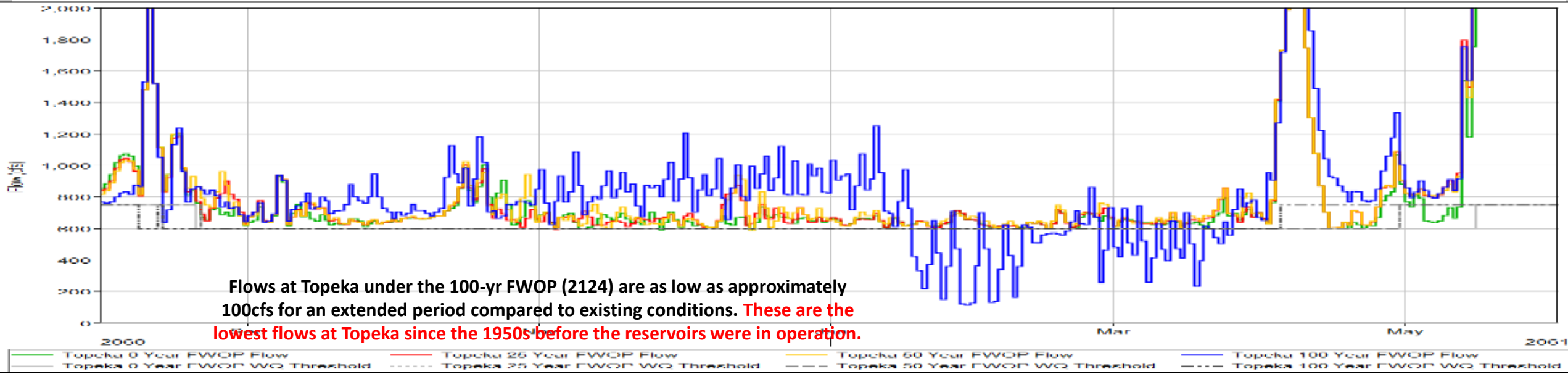


U.S. ARMY

KANSAS RIVER FUTURE TOPEKA/DESOTO FLOWS



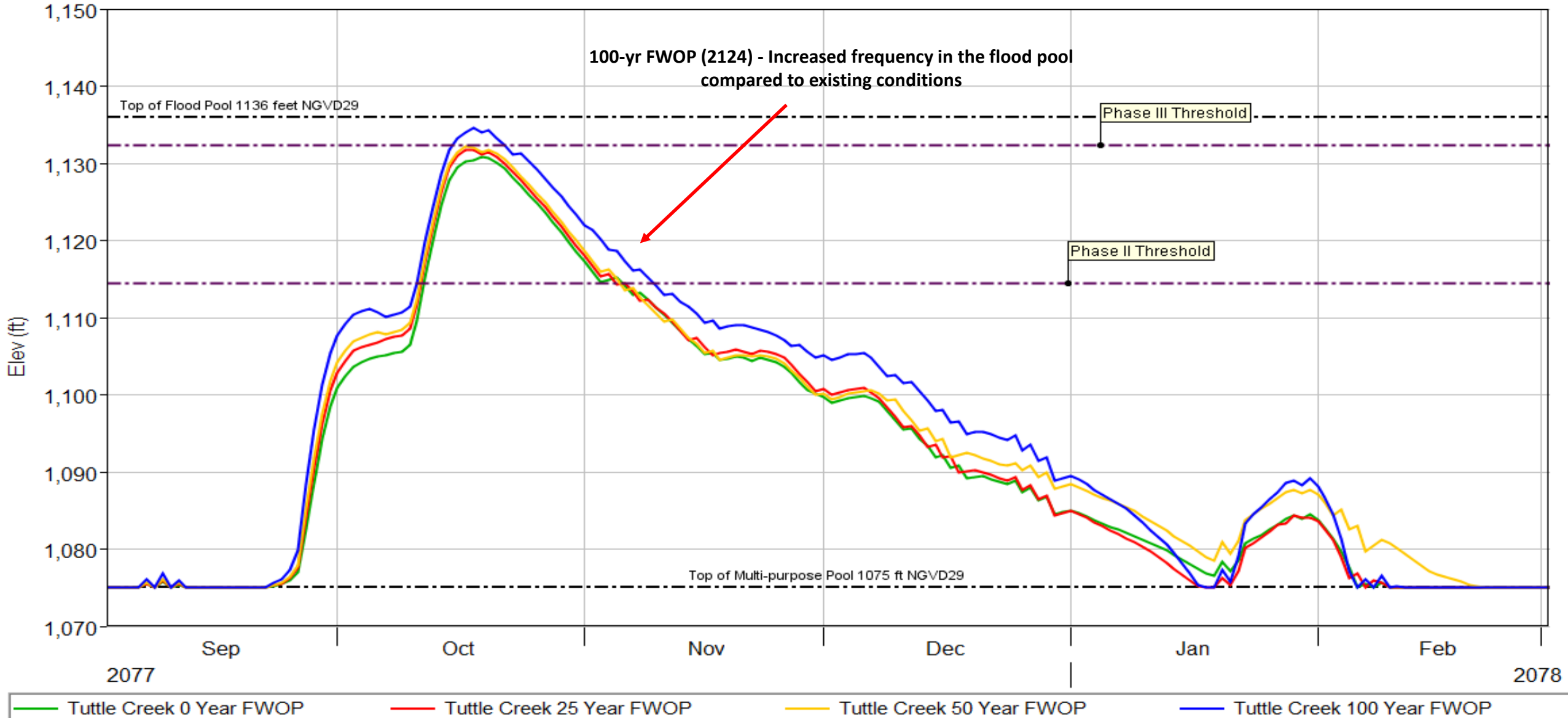
LOW FLOW EXAMPLES – DROUGHT COMPARISON





FLOOD POOL FUTURE CONDITIONS

HIGH POOL ELEVATIONS EXAMPLE – 1973 EVENT COMPARISON





WATER SUPPLY/WATER QUALITY

FUTURE CONDITIONS



- Increased future usage to satisfy the demands of growing population
- The sedimentation will reduce storage available to meet water supply demands
- Future shortages to meet water quality and supply demands within the basin during times of extended drought
- Future shortages to maintain a base level of streamflow
- Continued water quality impairment from agricultural runoffs at reservoirs and in river/stream reaches (17 of the 18 lakes in the basin “impaired”)
- Increase in turbidity, warm-season water temperatures, and harmful algal blooms in reservoirs
- Decreased chemical buffering due to loss of reservoir storage



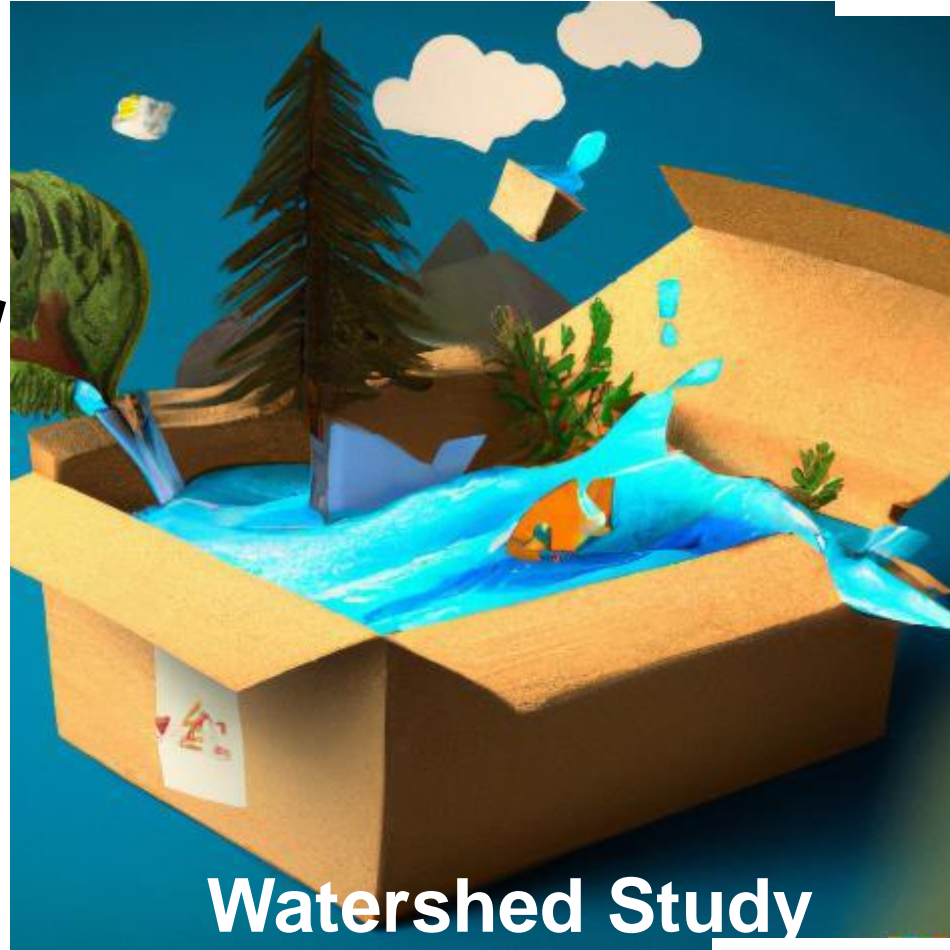
COMING SOON



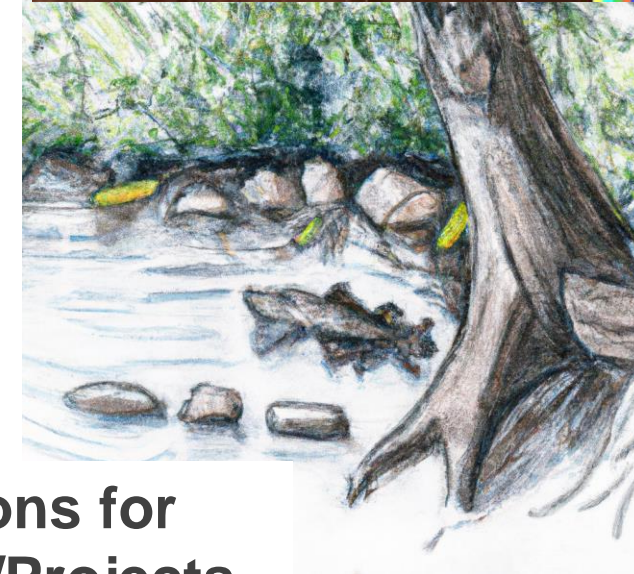
Recommendations to be considered in water control manual updates



Strategic Roadmap with Priorities and Sequencing



Watershed Study



Recommendations for Spinoff Studies/Projects



QUESTIONS ?

US Army Corps of Engineers
Kansas City District

