

Kansas River Reservoirs Flood and Sediment Study (Watershed Study)

Kansas Regional Advisory Committee
18 February 2022



**US Army Corps
of Engineers.**





Study Schedule

Milestone	Key Tasks	Schedule
Shared Vision	PMP Development and Approval	May 2021
	Initial Round of Stakeholder Coordination and Public Outreach Meetings / Scoping	
	Review Plan Development and Approval	
	Decision Management Plan/Risk Register	
	Identify Problems and Opportunities	
	Shared Vision Statement / Goals, Objectives, Constraints	
	Initial Baseline and Existing Conditions and FWOP	
	Identify and Screen Conceptual Measures	
	Preparation of Study Report Summary	
	Shared Vision Milestone Meeting	
Recommendations	Opportunity Areas Identification and Measures Applied	May 2023
	Draft Existing Conditions and FWOP Complete	
	Draft Existing Conditions, FWOP, and Measures Refinement	
	Initial Draft Conceptual Plans	
	IPR with Vertical Team	
	Draft Recommendations	
	Recommendation Milestone	
Watershed Study Report	Develop Draft Watershed Study Report	January 2024
	District Quality Control	
	Agency Technical / Public / Policy Review	
	Response to Comments	
	Develop Final Watershed Study Report	



Study Scope

- The study will focus on 3 primary focus areas:
 - Flood risk management
 - Sediment management
 - Reservoir operations
- Also looking at opportunities related to:
 - Infrastructure investment
 - Water supply availability and sustainment
 - Water quality
 - Recreation
 - Ecosystem preservation and restoration



Shared Vision

*"Within the Kansas River Watershed there are **significant water resource challenges including increased flood risk, reduced water availability, reservoir sedimentation, water quality concerns, streambank erosion, increased demand for recreational opportunities, and loss of wetlands and riparian habitat.** Sustainable measures must be identified and developed to **reduce flood risk, improve sediment management, and mitigate drought, and to address additional existing water resource problems within the watershed.** Measures include those necessary to increase the **resiliency and sustainability** of the system, and identification of **viable opportunities for investment in critical infrastructure** throughout the basin, including existing reservoirs, to increase their resiliency and maintain capacity for water availability and sustainment, ecosystem restoration, water quality, and recreational amenities."*



Goals

The specific goal of this study is to assist in developing a comprehensive basin-wide management plan that will:

- Incorporate stakeholder and public input and involvement
 - Work at a sub-basin scale to identify more specific needs
- Assess existing watershed characteristics and conditions
 - Identify watershed issues and concerns
- Develop, evaluate, and prioritize conceptual plans including both structural and non-structural measures, in support of identified goals and objectives
- Identify potential “spin-off” and “off-shoot” projects that may fall under appropriate Federal, State, and/or local authorities, and
- Identify potential regional or locally funded projects.



Objectives

Objective 1: Reduce risks to life safety

Objective 2: Reduce flood risk in the study area

Objective 3: Increase the reliability and availability of water

Objective 4: Reduce impacts associated with drought risk

Objective 5: Address adverse effects of sedimentation in the watershed

Objective 6: Identify watershed practices to address water resource problems

Objective 7: Protect critical water related infrastructure and investments

Objective 8: Protect and improve biological resources

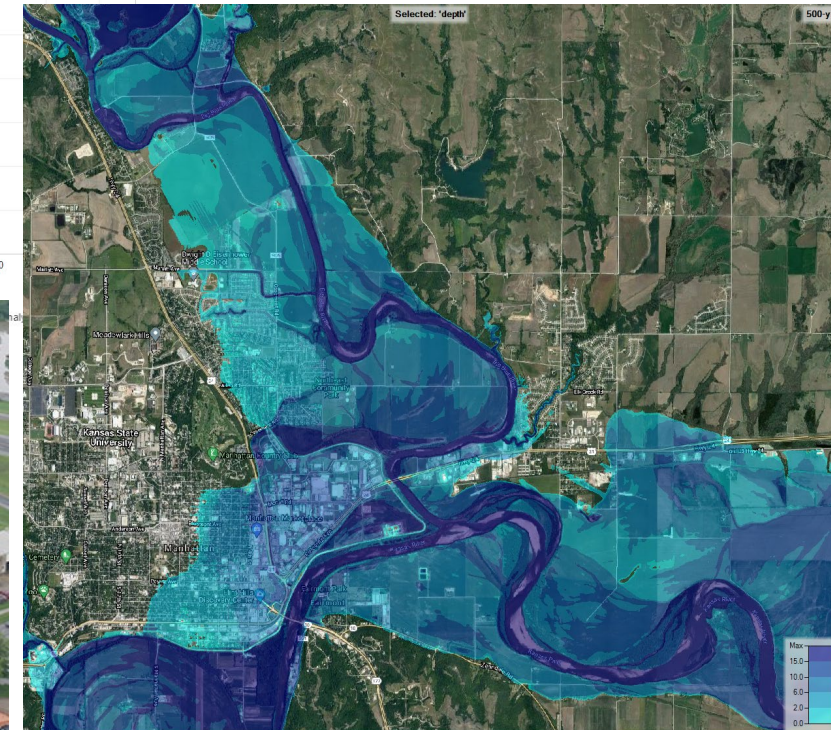
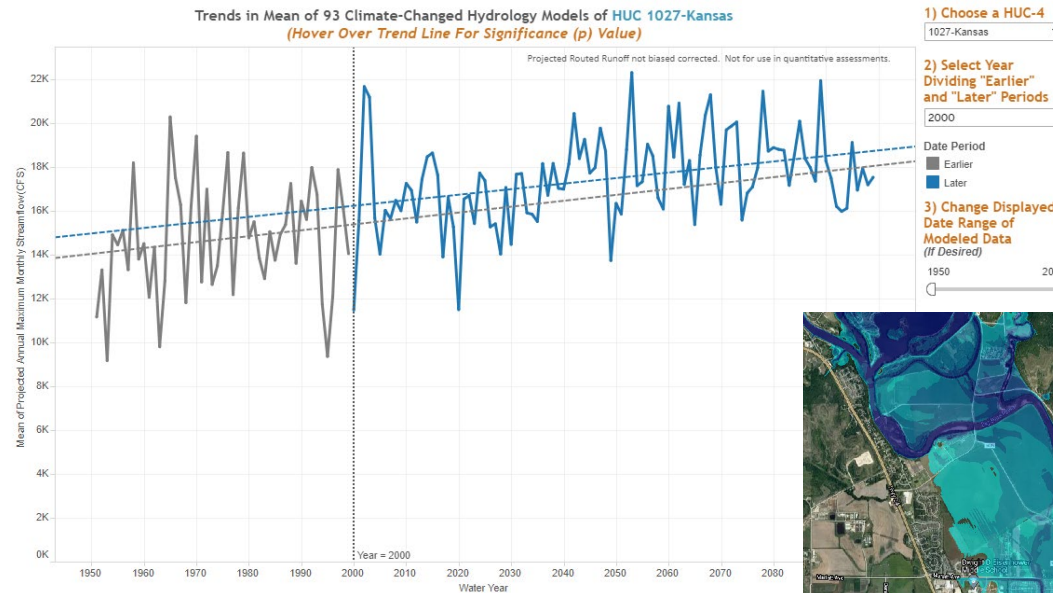
Objective 9: Protect, promote, and expand recreational opportunities

Objective 10: Incorporate climate change assessment into resource/focus areas

Future Without Project

Flood Risk Management

- Continued life safety risk and property damages from flood events with potential increase under climate change
- Continued emergency costs and loss of revenue
- High risk communities would remain at risk from a major flood event





Future Without Project

Flood Risk Management (cont'd)

- Increased risk from reduction of flood storage capacity from sedimentation

Reservoir	Original Volume	Year 100 (2124)	
	kac-ft	kac-ft	% Remaining
Perry	521.9	489.4	94
Tuttle Creek	1942.7	1678.1	86.4
Kanopolis	373.9	349.6	93.4



Future Without Project

Water Management

- Future reductions in reservoir multipurpose pool storage from sedimentation and increased drought
- Affects in the future of reduced storage:
 - Unable to meet releases for uses downstream (e.g., municipal and industrial water supply, water quality minimum release requirements, recreation)
 - Reduced recreation opportunities and reduction in economic benefits
 - Loss of fish and wildlife habitat
 - In-lake water quality concerns
- Loss of flood control storage may result in more frequent reservoir surcharge operations

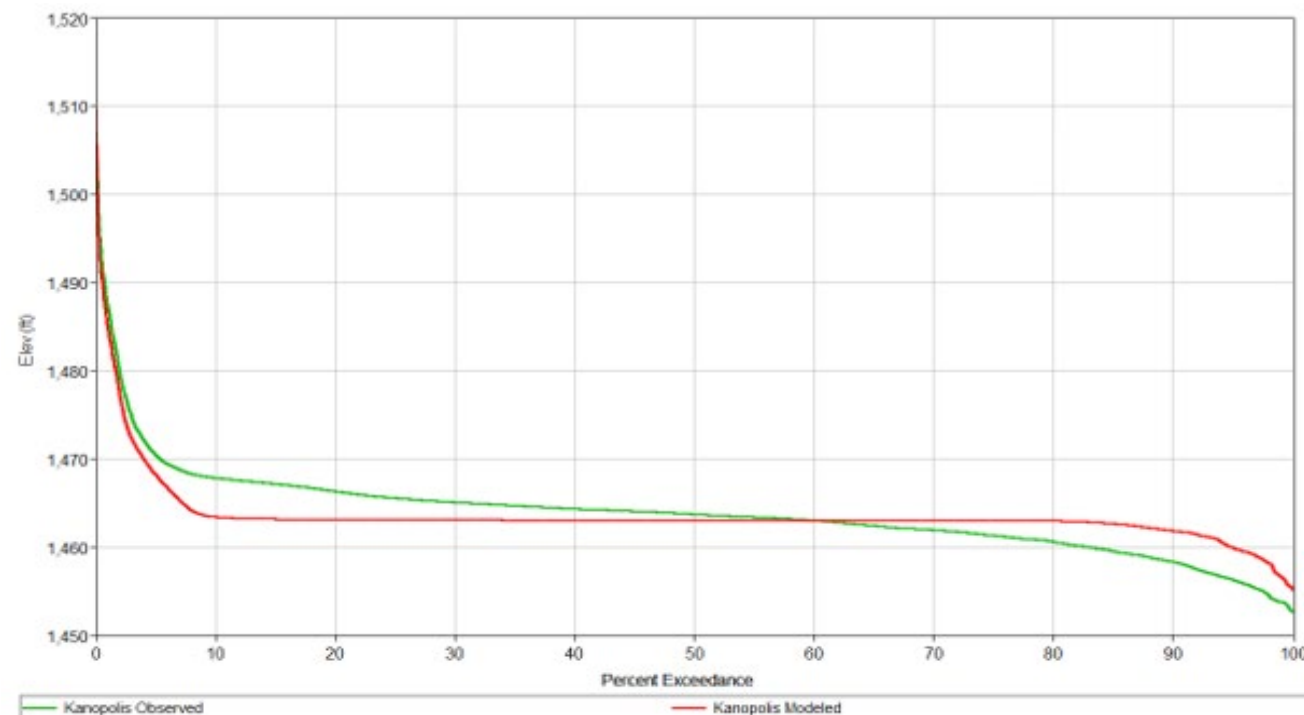




Future Without Project

FWOP Scenarios

- 2024 Storage Curves at the reservoirs with projected sedimentation.
 - Navigation Flows
 - No Navigation Flows
- 2049 Storage Curves at the reservoirs with projected sedimentation.
 - Navigation Flows
 - No Navigation Flows
- 2074 Storage Curves at the reservoirs with projected sedimentation.
 - Navigation Flows
 - No Navigation Flows
- 2124 Storage Curves at the reservoirs with projected sedimentation.
 - Navigation Flows
 - No Navigation Flows





Impacts of Future Conditions

General observations:

- Small impacts to flood operations
- Significant impacts to low-flow scenarios
- Reduced storage at Tuttle Creek leads to more releases from Milford and Perry to meet downstream target flows
- Water quality targets at Topeka and Desoto can be met through historic drought periods, but it takes most of the available storage

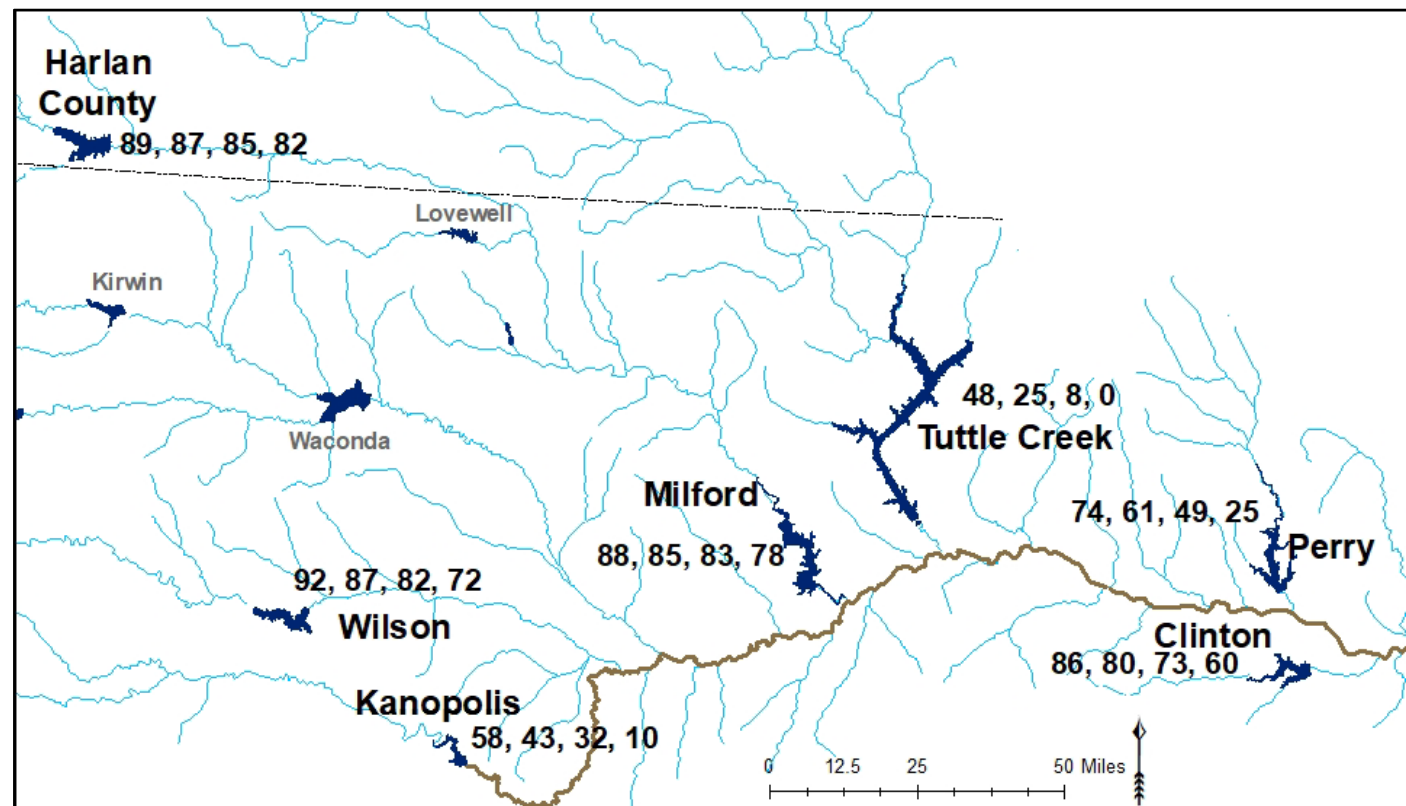




Future Without Project

Sediment Management

- Future sedimentation in reservoirs threatens:
 - Crucial flood risk management infrastructure (could impede the ability to maintain the function of flood control gates and other appurtenances)
 - Critical drinking water supply
 - Recreation
 - Irrigation
 - Environmental resources
 - Continued bed degradation and habitat impairment downstream of dams from lack of sediment
- And will result in increased operations and maintenance costs



% Remaining of MP at the end of 0, 25, 50, and 100 years



Future Without Project

Water Supply/Water Quality

- Increased future usage to satisfy the demands of growing populations
- Future sedimentation will reduce storage available to meet water supply demands
- Future shortages to meet all the 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



Future Without Project

Recreation

Continued impacts to recreation in the future from flooding, drought, and sedimentation

- Loss of visitation leading to lost revenue
- Cost of damage repairs from flooding or sedimentation
- Reduced opportunities
- Shift in the type of uses (i.e., water-based recreation to shore-based activities)
- River recreation impacts will continue - safety hazards and reduced opportunities



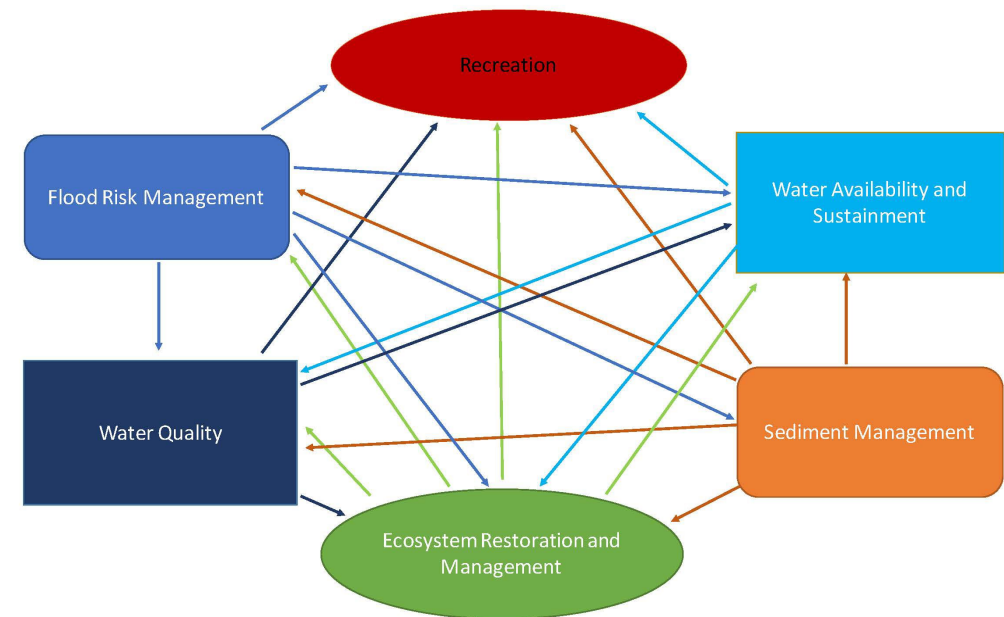
Future Without Project

Biological Resources

- Terrestrial and Aquatic Habitats, Fish and Wildlife, and Special Status Species
 - Overall a continued decline in the diversity of fauna and habitats from habitat loss, habitat degradation, fragmentation
 - Sedimentation in reservoirs will reduce aquatic habitat (e.g., cove habitat used for fisheries spawning and rearing) and affect the reproduction of fish species
 - Greater water level fluctuations in the future that would reduce habitat availability
 - Climate change could threaten aquatic ecosystems from sustained drought
 - Invasive species will continue to be a concern
 - Continuation of conservation measures, recovery actions, climate change adaptation strategies, and restoration projects to prevent or minimize declines of fauna and their associated habitats

Framework for Defining Problem Areas and Initial Measures

- Initial measures development ***identifies possible management measures*** that ***support shared vision statement and address the planning objectives***.
- ***Many measures benefit multiple purposes***
- Measures will be divided into ***geographic focus or opportunity areas*** (i.e., HUC 8, river reaches) within which specific measures can be identified and assessed for ***effectiveness and efficiency***.
 - Evaluate each measures and strategy against effectiveness (benefits) and efficiency (cost magnitude)
 - Use of qualitative scoring based on expert knowledge and judgement
 - Evaluate magnitude of costs – Implementation, Monitoring, AM Cost; OMRR&R Costs; Mitigation Cost





Problem Areas / Initial Measures

	Flood Risk Management
Operational measures / Dams and reservoirs upgrades	Lower Kansas River Basin Master Manual and/or Individual Reservoir Project Water Control Manuals Update
	Missouri River Control Point Modification
	New Reservoir/Dam Construction or Detention Basins
Levee upgrades	New or Modified Levees/Dikes/Floodwalls
Flow improvements	Channel Modifications
	High Flow Diversions
Floodplain improvements	Authority for Land Acquisition or Easement Purchase for Flood Control
	Floodplain Management Plans
Non-structural measures	Comprehensive Climate Plan/Extreme Event Planning/Drought Resiliency Plan
	Kansas Flood Center/Flood Information System
	Floodplain Regulations
	Flood and Drought Forecasting
	Flood Warning/Emergency Plans
	Floodplain Mapping



Problem Areas / Initial Measures

Water Availability and Sustainment	
Operational Measures	Study to Investigate Removal of Navigation Releases at Tuttle, Perry, and Milford Reservoirs
	Modification of Low Flow Target Values to Extend Period of Low Flow Support
	Drought Contingency Plan Updates
Resiliency Planning	Comprehensive Climate Plan/Extreme Event Planning/Drought Resiliency Plan
Sediment Reduction	Bank Stabilization
	Stabilize Headcuts
	Induced Deposition on Upstream Floodplain in Composition with Grade Control
	Promote and Incentivize the Adoption of Watershed Practices
	Repurpose Upper Reservoir Areas to Capture Sediment
	Coordination with the State of Nebraska on Sedimentation from Interstate Sources and Potential BMPs
Sediment Removal	Drawdown Flush at Tuttle Creek Lake
	Water Injection Dredging
	In-lake Hydraulic Dredging with Downstream Discharge
	Sediment Mining
New Water Storage	Kansas River Alluvial System as a Filtration and Storage System
	Reallocation to Water Supply at Harlan County Reservoir



Problem Areas / Initial Measures

Ecosystem Restoration and Management	
Reservoir Habitat Improvements	Lake Level Management Plans
	Habitat Development Projects/Partnerships
In-channel Habitat Improvements	Lake Level Management Plans
	Support of Sustainable Rivers Project Environmental Flow Proposals
	Habitat Development Projects/Partnerships
	Bank Stabilization
	Stabilize Headcuts
Off-channel/Upper Watershed Improvements	Promote and Incentivize the Adoption of Watershed Practices
	Habitat Development Projects/Partnerships
	Construct and Maintain Wetlands and Rehabilitate Old Oxbows
	Floodplain Management Planning



Problem Areas / Initial Measures

Ecosystem Restoration and Management	
Invasive species management	Watercraft Decontamination and Inspection
	Invasive/Non-native Species Control
	Invasive Species Control
Monitoring/Surveys/Stocking	Riverine Fisheries Monitoring (species management, recruitment, habitat variables)
Other types of improvements	Communications/Outreach



Problem Areas / Initial Measures

Water Quality	
Nutrient and Sediment Reduction	Promote and Incentivize the Adoption of Watershed Practices
	Construct and Maintain Wetlands and Rehabilitate Old Oxbows
Water Management	Improved Operation of Perry, Milford, and Tuttle Creek Reservoirs as a System
	Repurposing of Water Supply Storage to Water Quality Storage at Perry and Milford Reservoirs
Harmful Algal Blooms	Operational Strategies for HAB Management in Inland Reservoirs
	HAB Treatment
	HAB Research

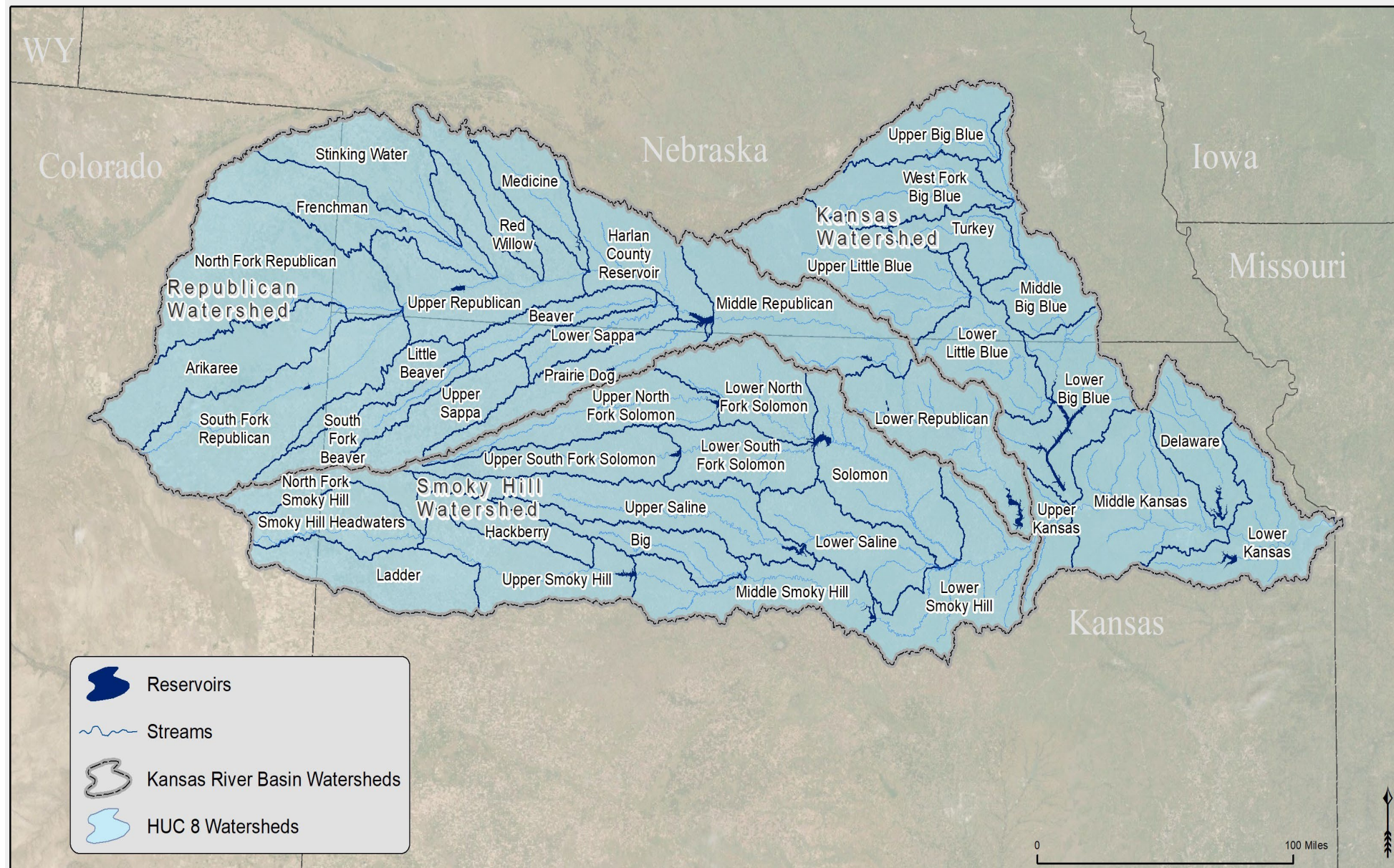



Problem Areas / Initial Measures

Recreation	
Reservoir Recreation	Construct New Boat Ramps or Extend Existing Boat Ramps
Riverine Recreation	Public Access Points Along the Kansas River Mainstem
Other Recreation Needs	Expansion/Improvement of Visitation Data
	Recreation Dashboard (general info related to opportunities, amenities, opportunities, warnings)

Opportunity/Focus Areas

- 43 HUC 8 Watersheds
- Application of measures as needed
- Measures would have independent benefits and costs
- Strategies at watershed scale using a holistic approach





Study Outcomes

- Comprehensive evaluation of the Kansas River Basin baseline and future conditions for various focus/resource areas (e.g., flood risk, drought, hydrology and hydraulics, sediment, ecosystems, recreation)
- Recommendations for actions to address identified problems
- Strategic roadmap/planning document that identifies the sequencing of priorities
 - The screening of measures in the final report will help identify these priorities
 - Will note where federal authorities and appropriations are available OR where new ones are needed
- Presents the findings and recommendations for future efforts, including potential future projects and studies both near-term and long-term
- The KRRFSS will not directly initiate a project (e.g., approval for sediment removal, or authority for levee construction, etc.)



Backup Slides



Opportunities

- Ensure a robust System that meets the needs of the Region and the Nation for the next 50-100 years
- Optimize the System benefits and improve system flexibility
- Reduce flood and drought risks
- Increase the reliability and availability of water supply
- Increase resiliency and sustainability of the System
- Improve the ecological and aquatic habitat in the Kansas River and its tributaries
- Maintain strong partnerships between state, local, and federal agencies
- Protect the availability of high-quality water for residential, commercial, and industrial uses
- Improve quality of recreation and provide increased recreation opportunity
- Improve water-based recreation economic activity



Whose Sediment is it Anyway?

Tuttle Creek Lake	Deposition 1965 - 2019 (ac-ft)	% of Total
Total Deposition	302,110	100 %
Enters During Multipurpose Operations	16,039	5%
Enters During Flood control Operations	286,070	95%

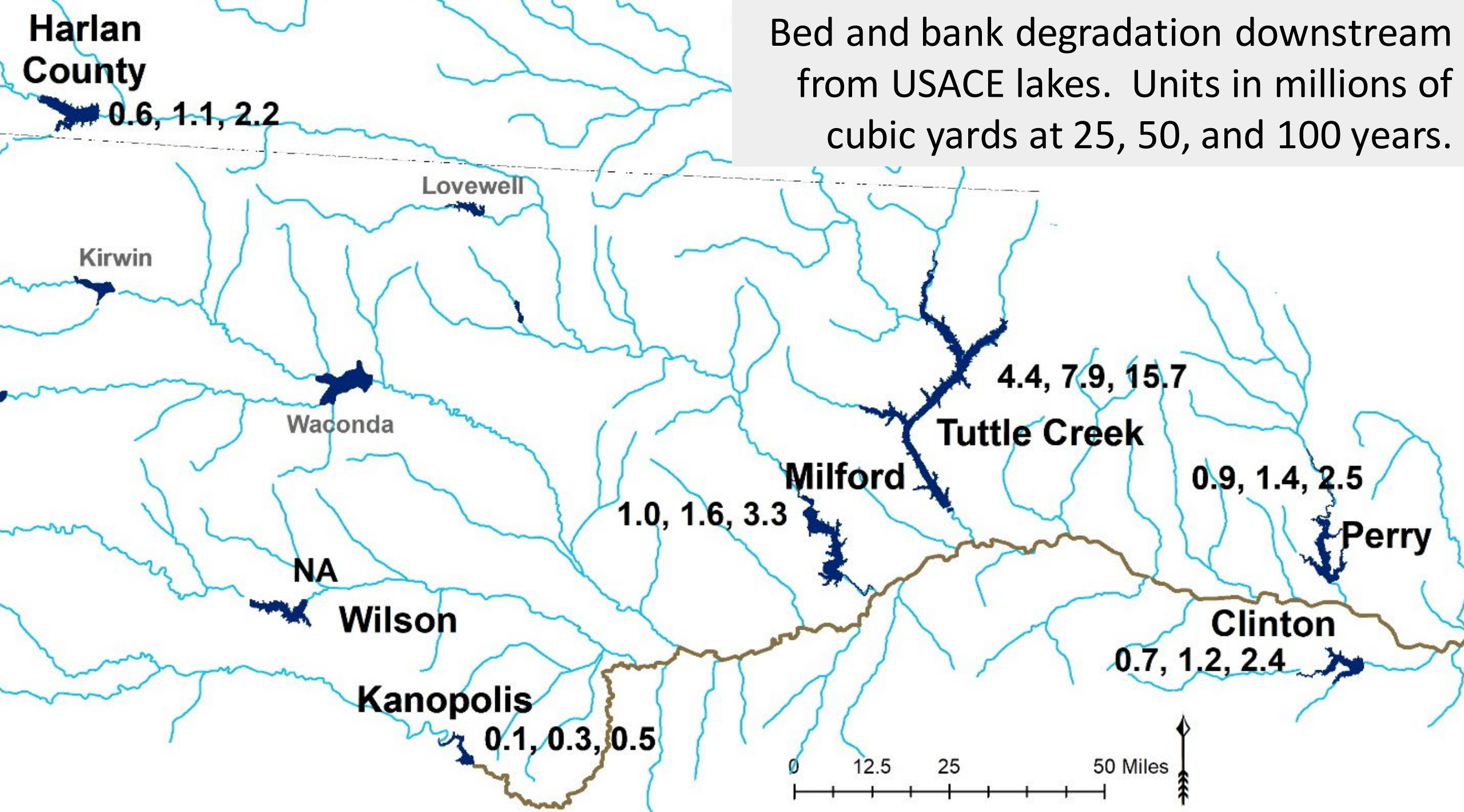


Whose Sediment is it Anyway?

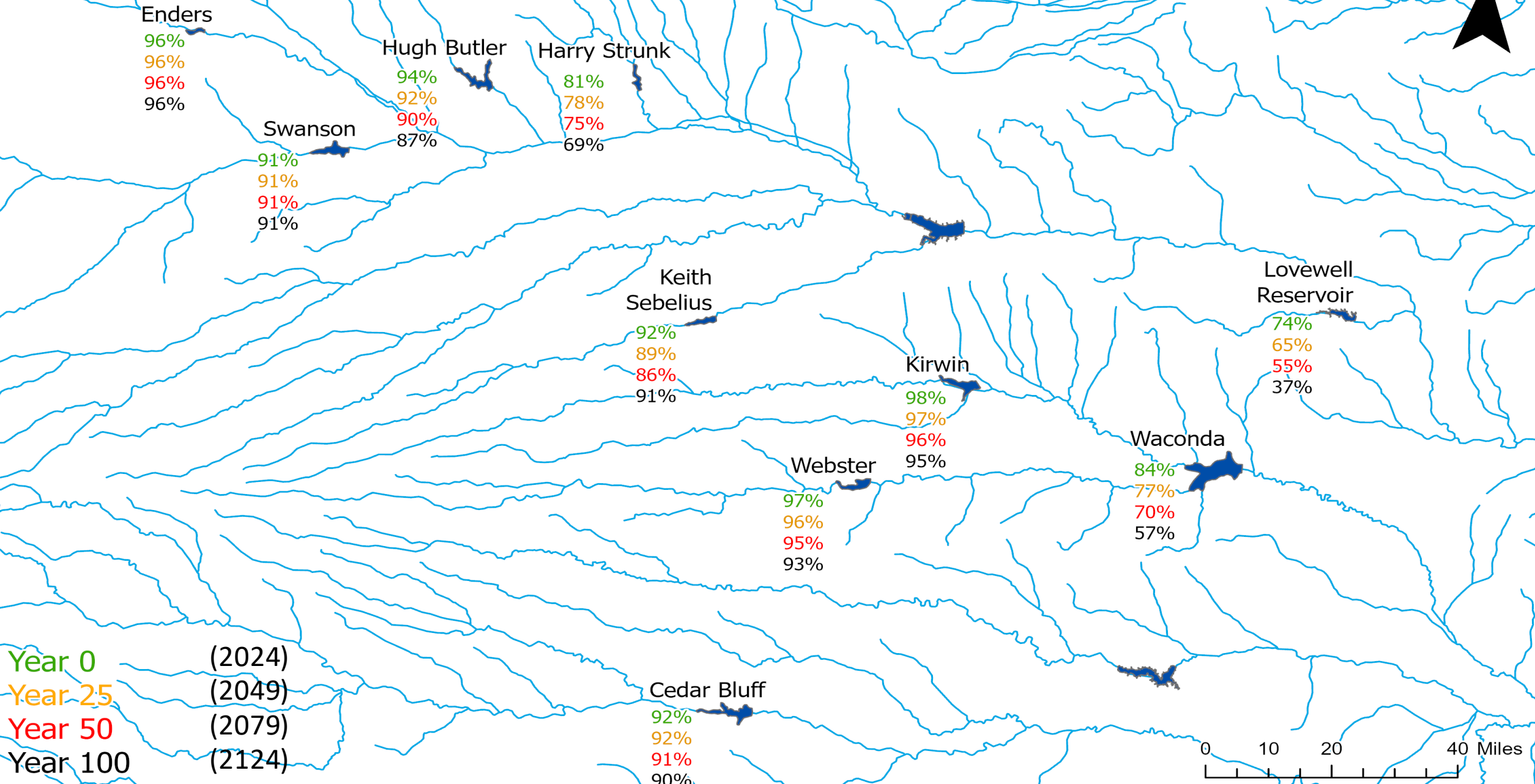
Lake	Deposition Years	Total Deposition (ac-ft)	% At/below MPP	% Above MPP	% At/Below WLMP	% Above WLMP
Clinton	1977-2019	23,812	9	91	17	83
Perry	1969-2009	100,864	7	93	24	76
Tuttle Creek	1965-2019	302,110	5	95	5	95
Milford	1967-2019	62,517	10	90	5	95
Kanopolis	1969-2019	21,598	3	97	23	77
Wilson	1973-2019	23,235	18	82	33	67
Harlan County	1957-2019	20,006	30	70	No WLMP	

Harlan County

Bed and bank degradation downstream from USACE lakes. Units in millions of cubic yards at 25, 50, and 100 years.



% of MPP Remaining at the end of 0, 25, 50, and 100 years at USBR Reservoirs



Year 0 (2024)
Year 25 (2049)
Year 50 (2079)
Year 100 (2124)

0 10 20 40 Miles



Sediment - Tuttle Creek Lake Depth

Maps at end of 25, 50, 75, and 100 years

