

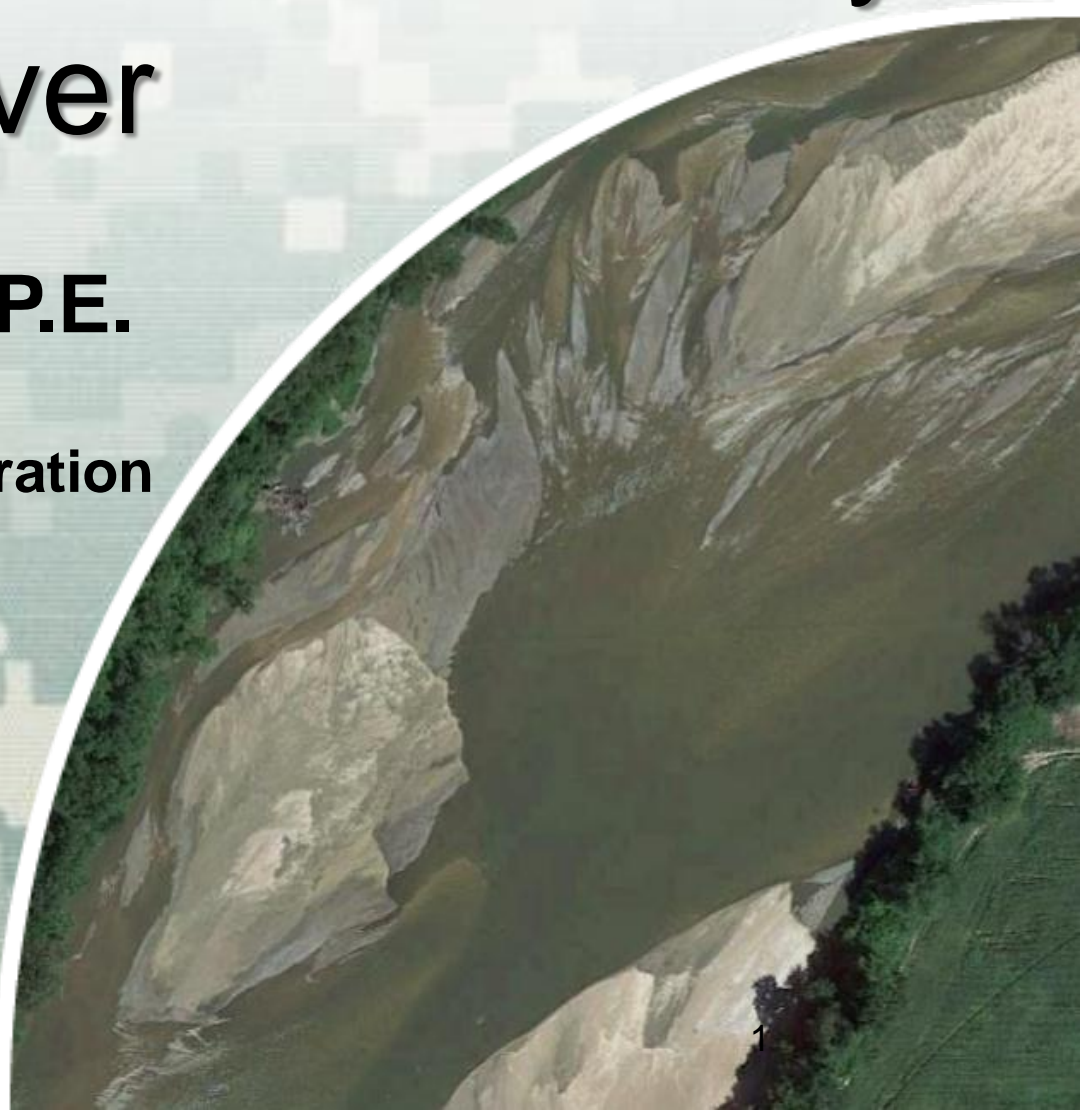
Environmental Benefits of Restoring Sediment Continuity to the Kansas River

John Shelley, Ph.D., P.E.

Kansas City District

**River Engineering and Restoration
Section**

November 2015



®

US Army Corps of Engineers
BUILDING STRONG®

Outline

- Dramatic changes to the Kansas River
- The need for turbidity
- The environmental problem with sediment accumulation in the lakes
- Removing the “dam footprint”
- One practical idea

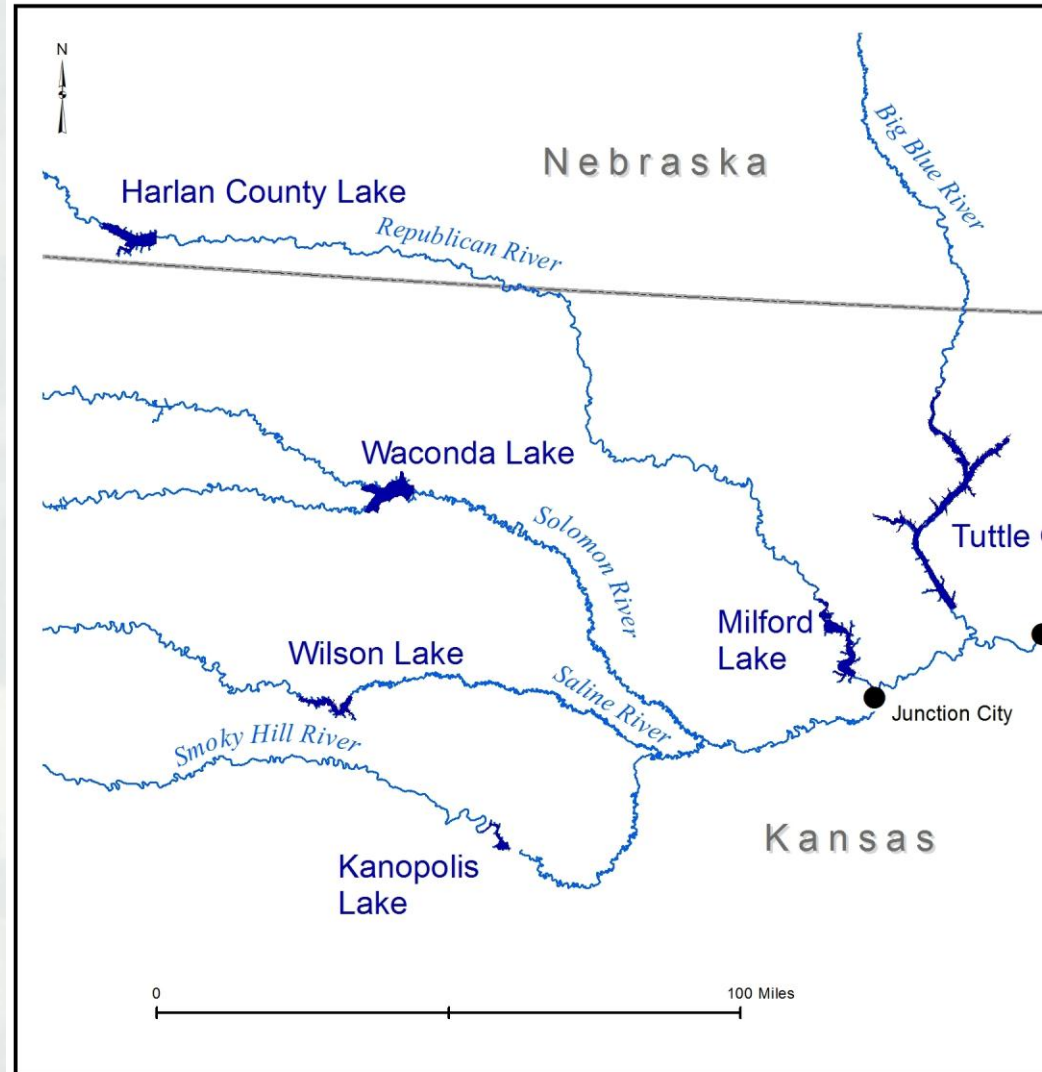


Dramatic Changes to the Kansas River

Pre-dam Sediment Load: 44 million tons per year

Post-dam Sediment Load: 13 million tons per year

A 70% reduction in sediment transport



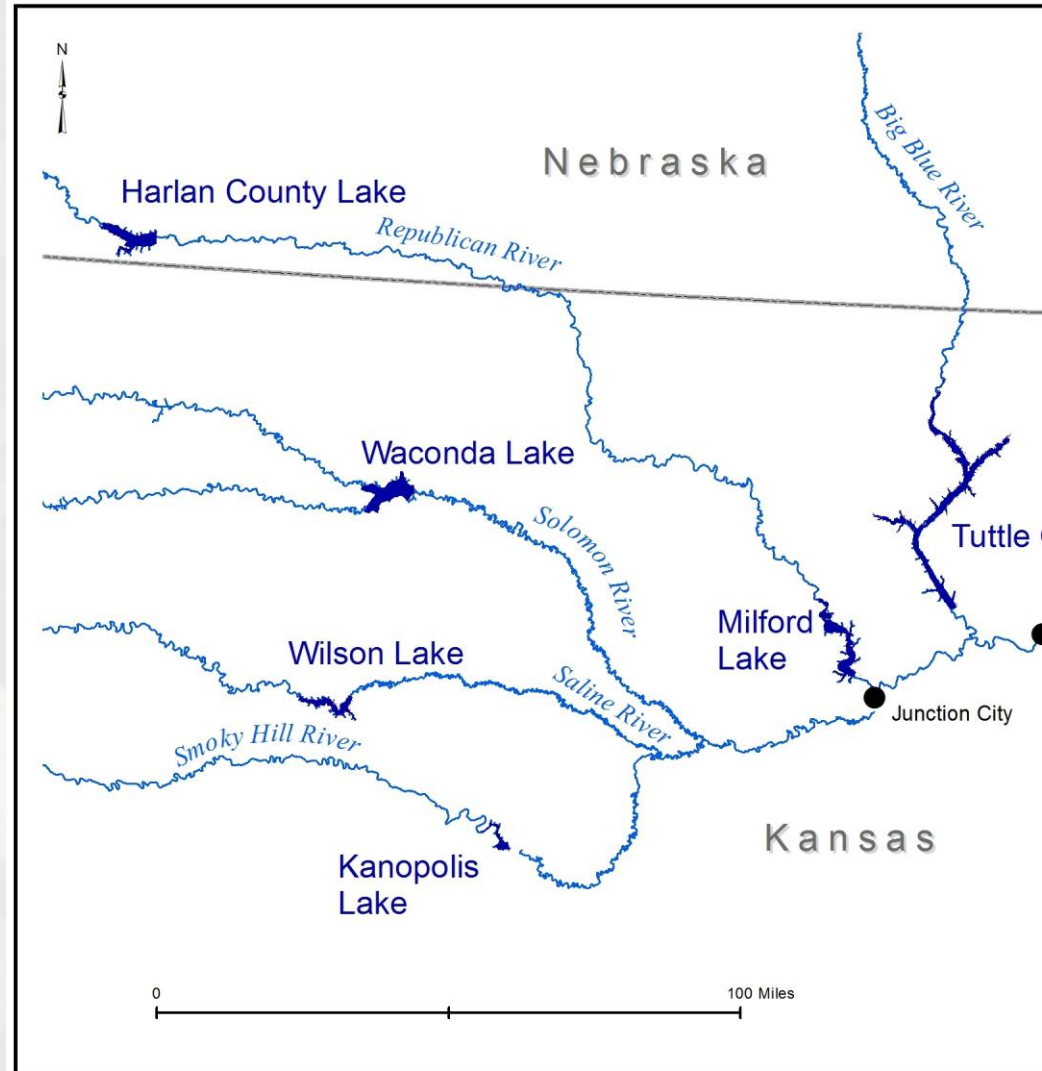
Dramatic Changes to the Kansas River

Pre-dam Sediment Load: 44 million tons per year

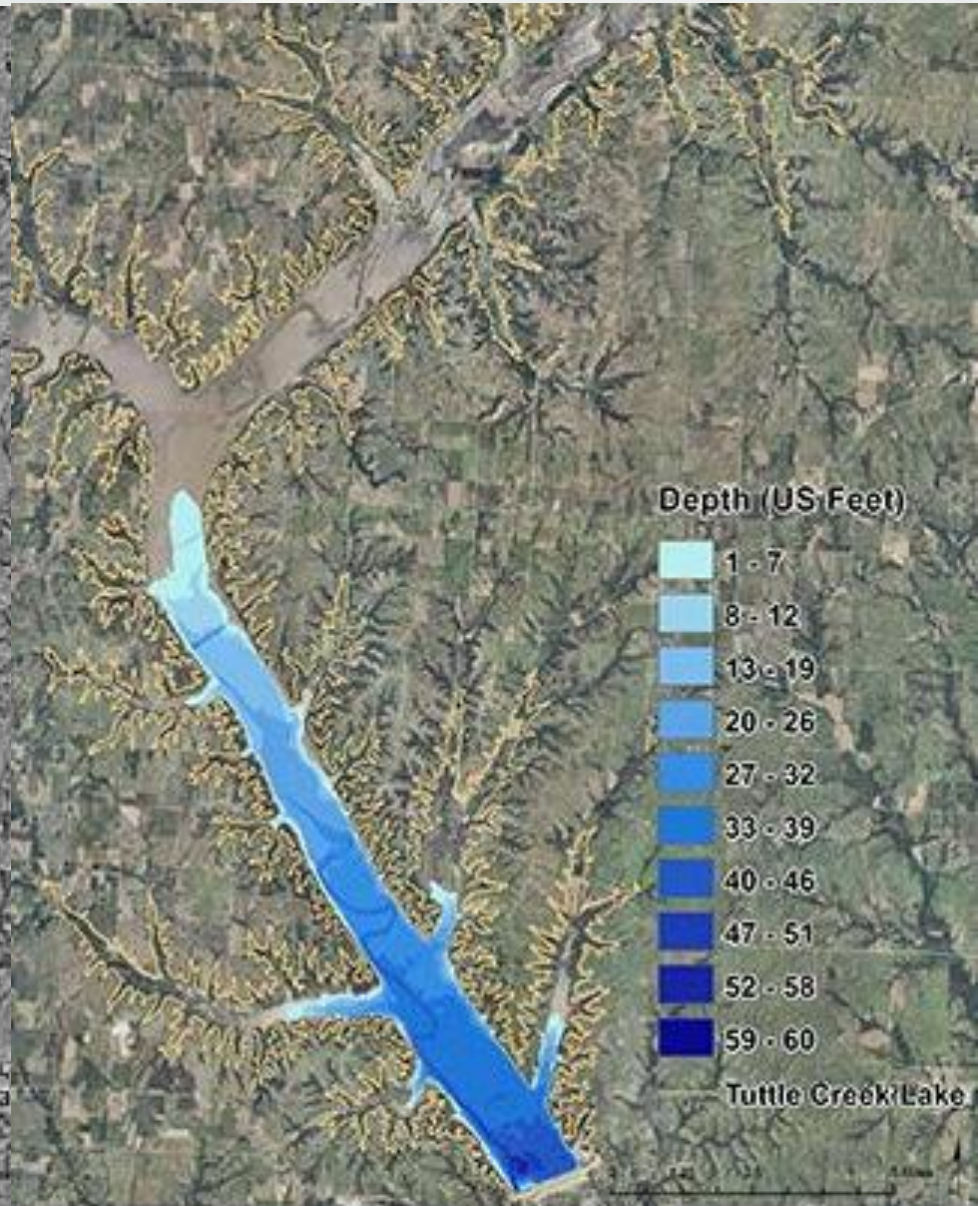
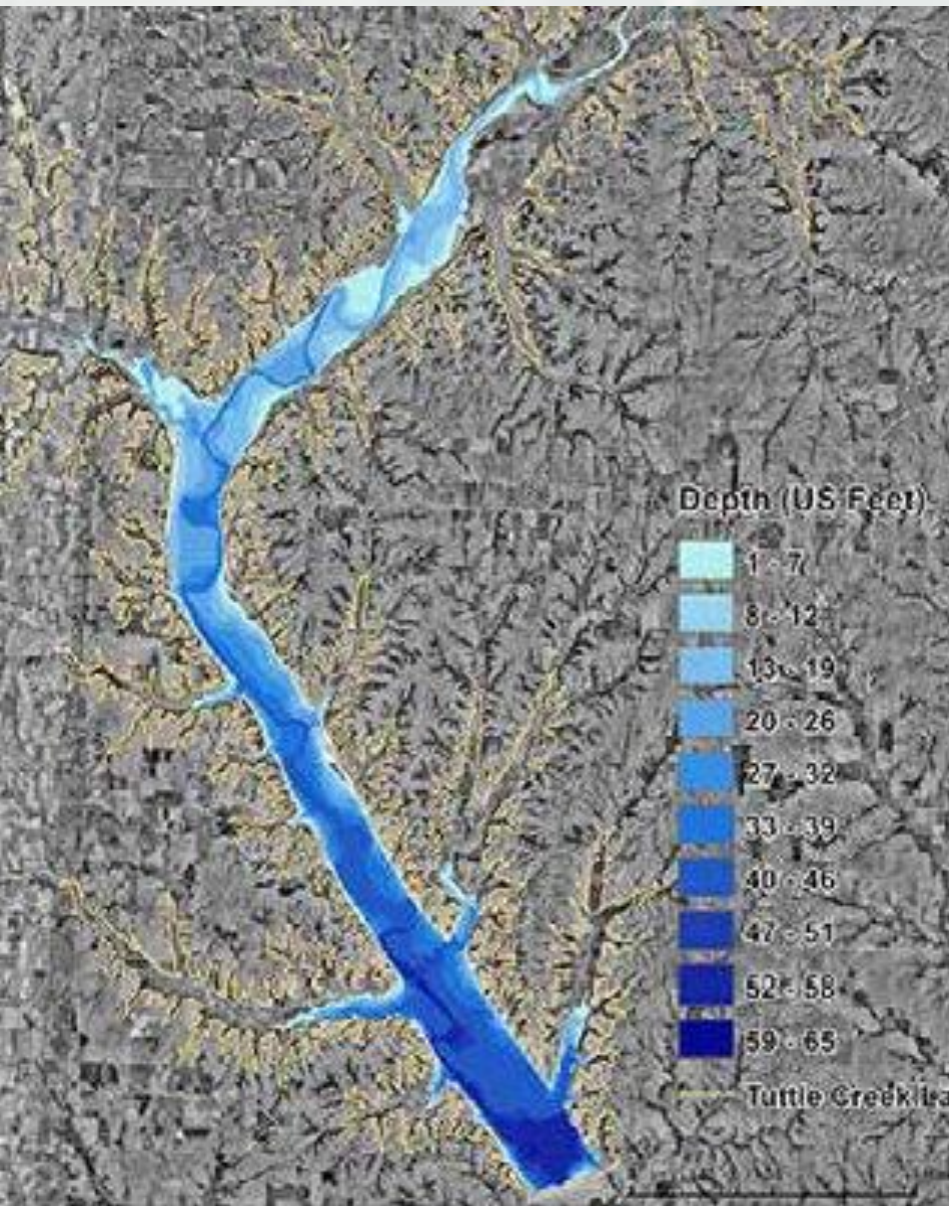
Post-dam Sediment Load: 13 million tons per year

A 70% reduction in sediment transport

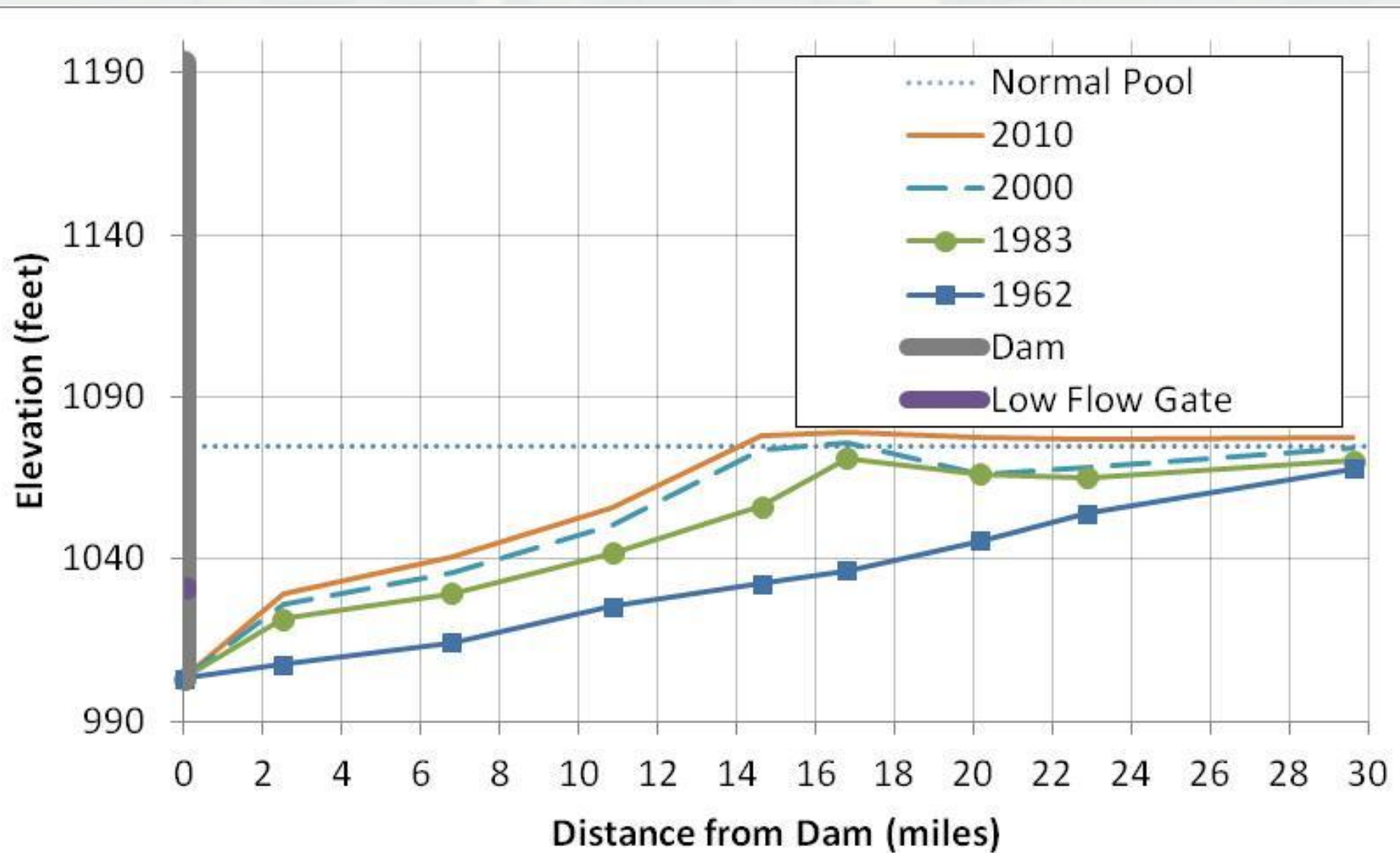
So what?



Tuttle Creek Lake: 1957 to 2010



Tuttle Creek Lake

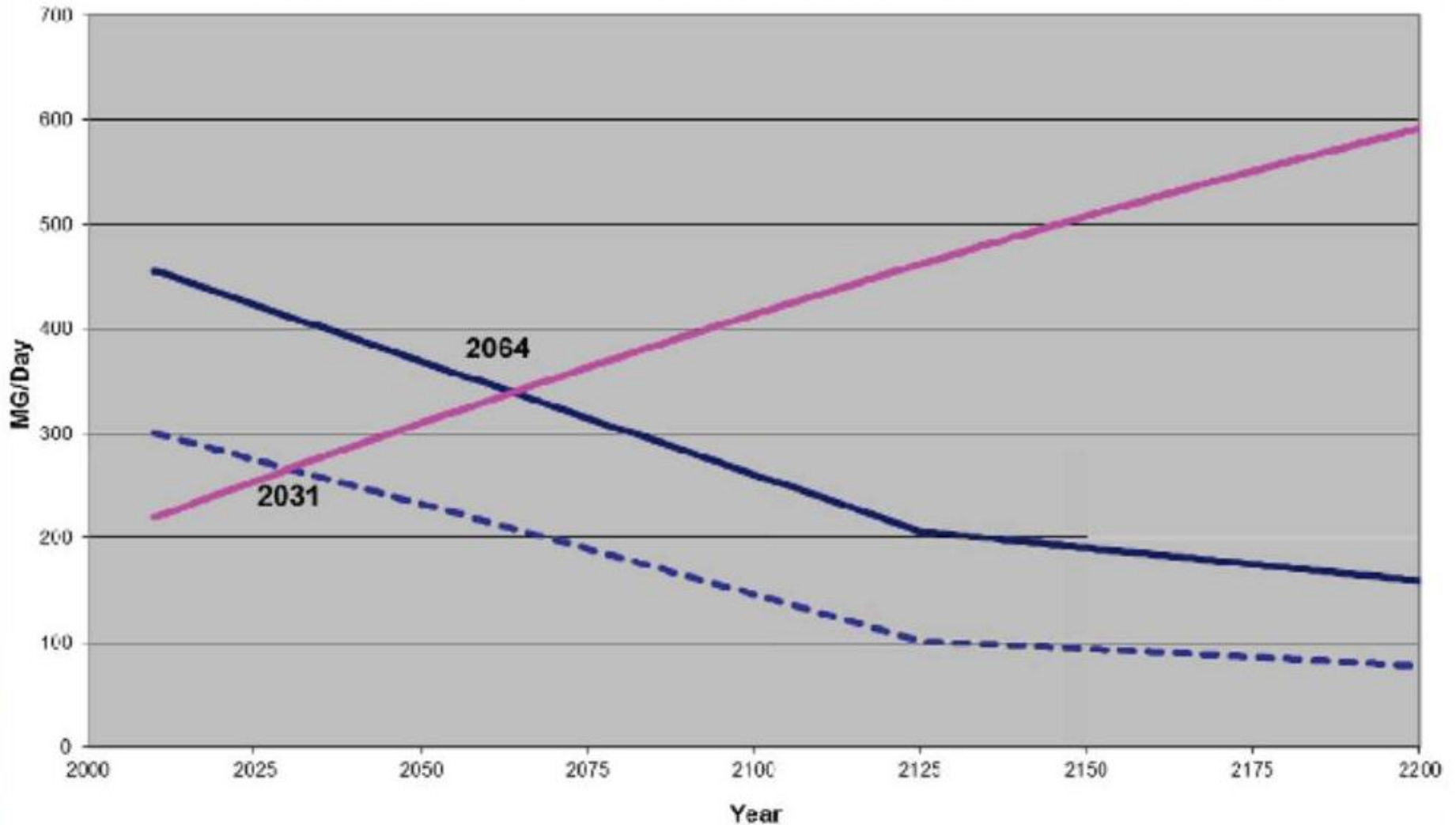


Supply – Demand Graphs

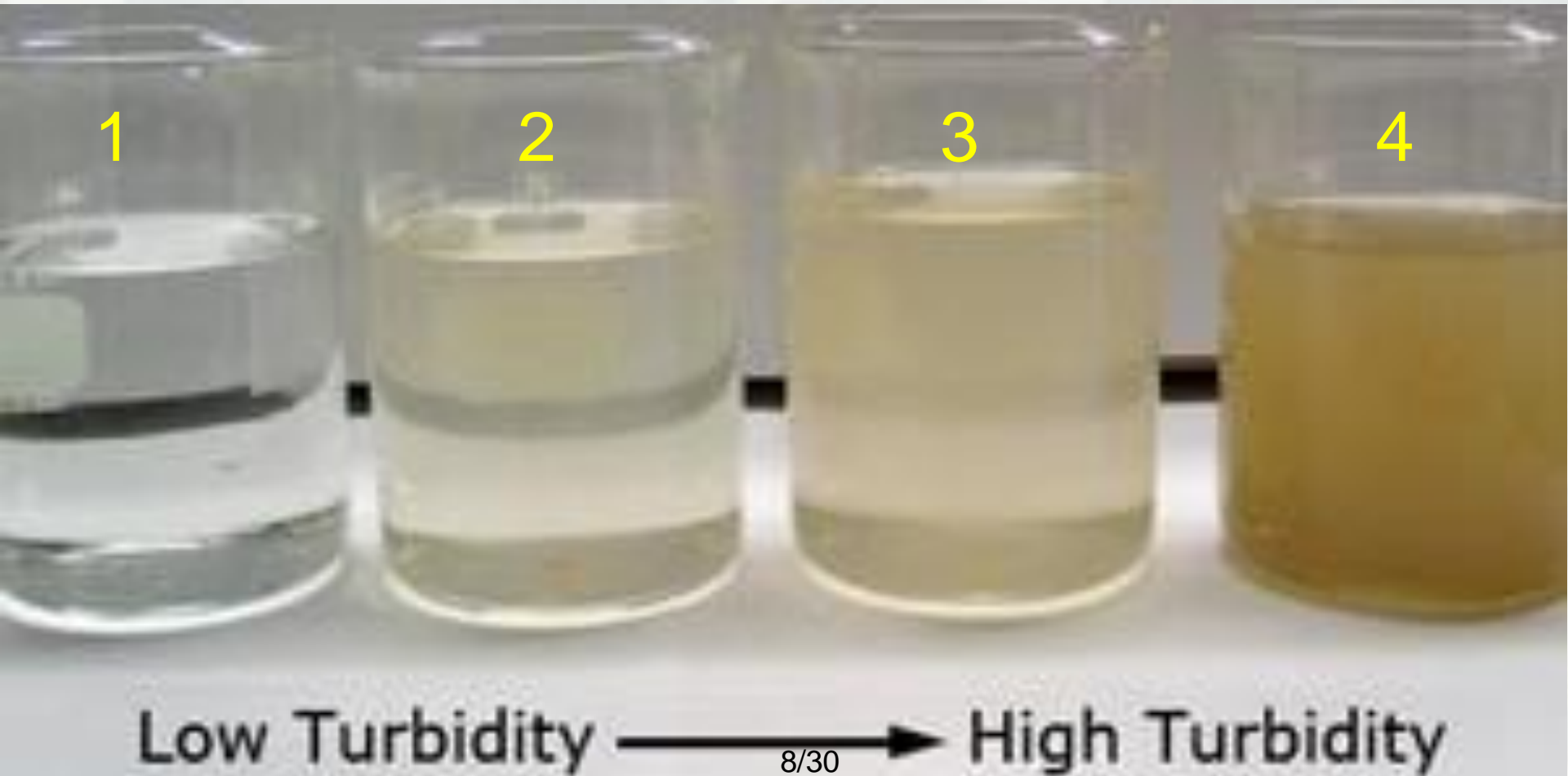
- 2% drought condition

Kansas Basin Projected Water Supply Storage and Demand

— Supply (Available - MGD) - - - Supply (State-Owned - MGD) — Demand (MGD)



Trick Question: Which is Better Water Quality for Riverine Environments?



- Sediment should not be universally considered as a pollutant, especially in historically-turbid river systems. To the contrary, the transport of sediment is a natural function in river ecosystems, and a lack of sediment can be deleterious to aquatic habitats and organisms.



■ Turbid-water Fish

- ▶ Smaller eyes
- ▶ Smaller optic lobes of brain
- ▶ Electro-sensory and chemo-sensory organs
- ▶ Non-sight feeding
- ▶ Thrive in naturally high-turbidity environments

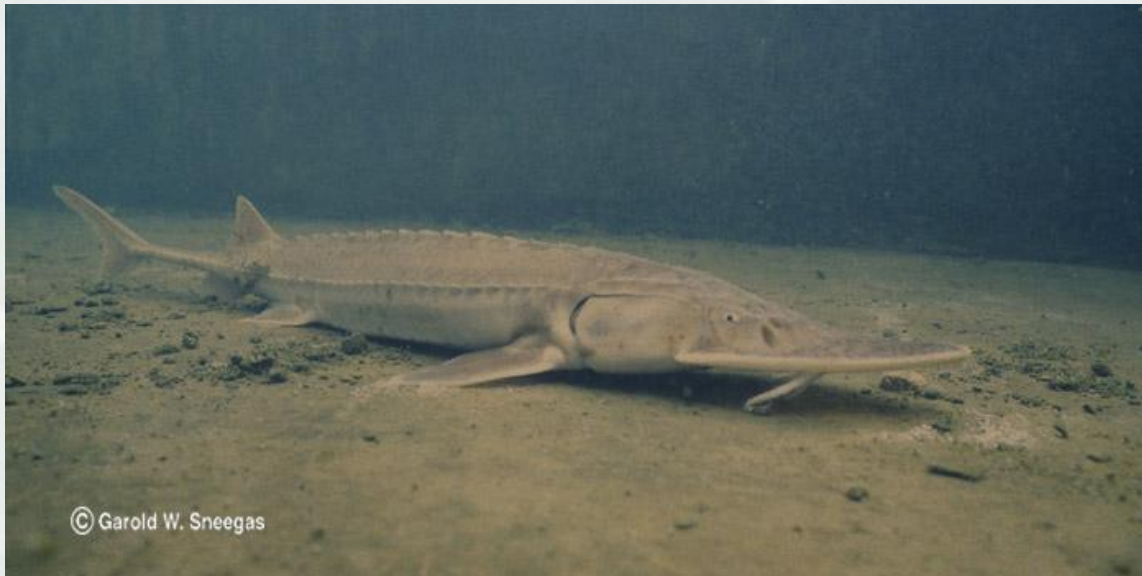
■ Clear-water Fish

- ▶ Larger eyes
- ▶ Larger optic lobes of brain
- ▶ Site-feed
- ▶ Out-compete native Kansas River fish in the current, unnaturally clear Kansas River environment



Shovelnose Sturgeon

- Once abundant in the Kansas River, no longer present in much of Kansas



Identified in *Current status of native fish species in Kansas*,
Transactions of the Kansas Academy of Science, Vol 108, 2005.



Imperiled Due to Increased Water Clarity and Predation and Competition from Sight-Feeding Fish

- Formerly found in the lower Kansas River. Not found for 20 years. Considered “extirpated, or nearly so, in Kansas.”



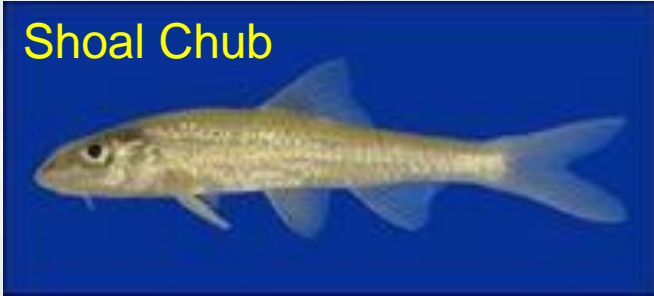
- Significantly reduced in abundance

Identified in Current status of native fish species in Kansas, Transactions of the Kansas Academy of Science, Vol 108, 2005.



Imperiled Due to Increased Water Clarity and Predation and Competition from Sight-Feeding Fish

Shoal Chub



Significantly reduced
in range or abundance

Flathead Chub



Other impacted species showing significant decline or complete extirpation: Silver Chub, Flathead Chub, River Shiner, Carmine Shiner, Sturgeon Chub



- The State of Kansas has designated critical habitat in the Kansas River for several state-listed threatened and endangered species including the plains minnow, shoal chub, sturgeon chub, and silver chub.
- High clarity = poor quality for Kansas River habitat

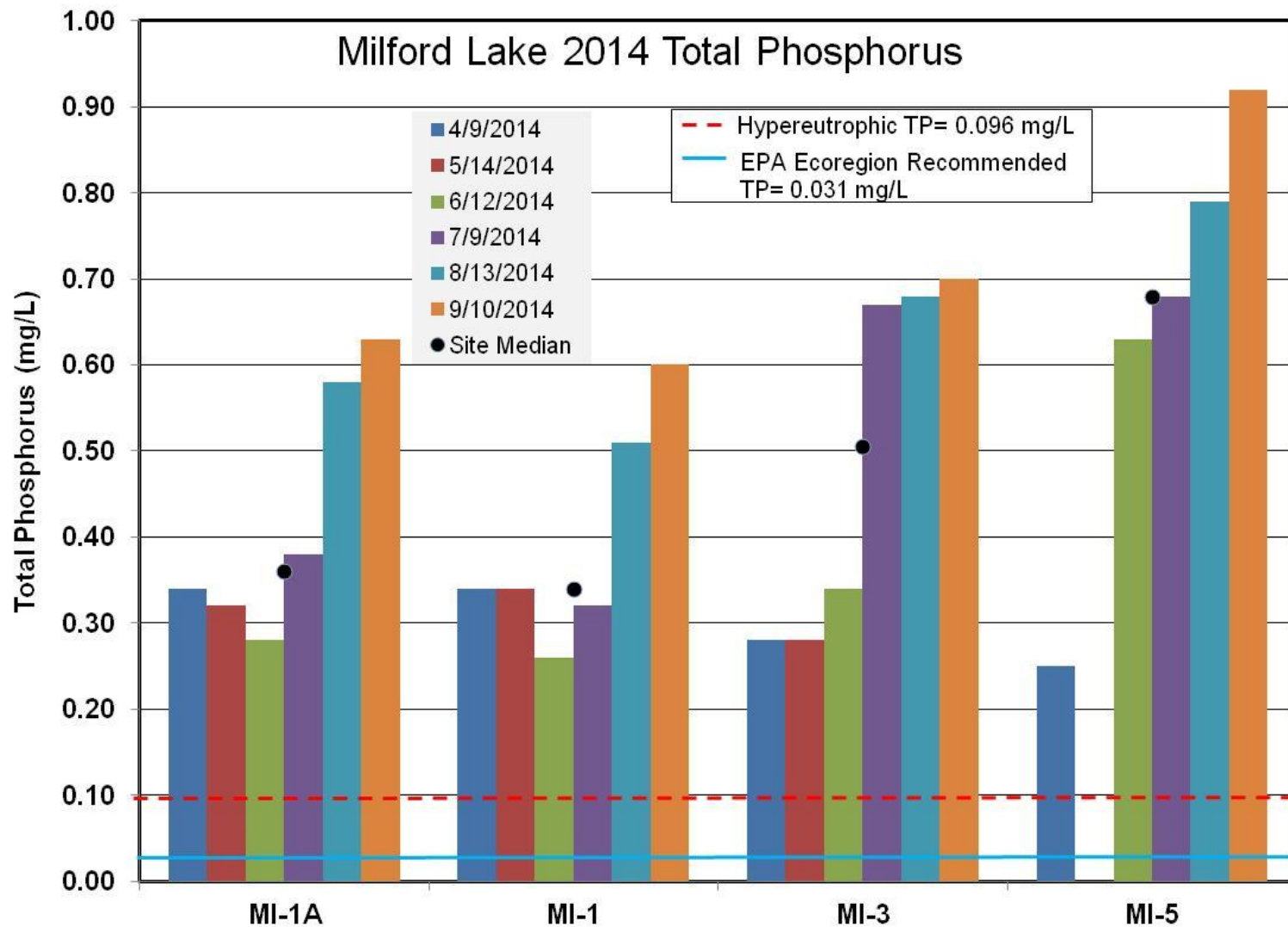


Outline

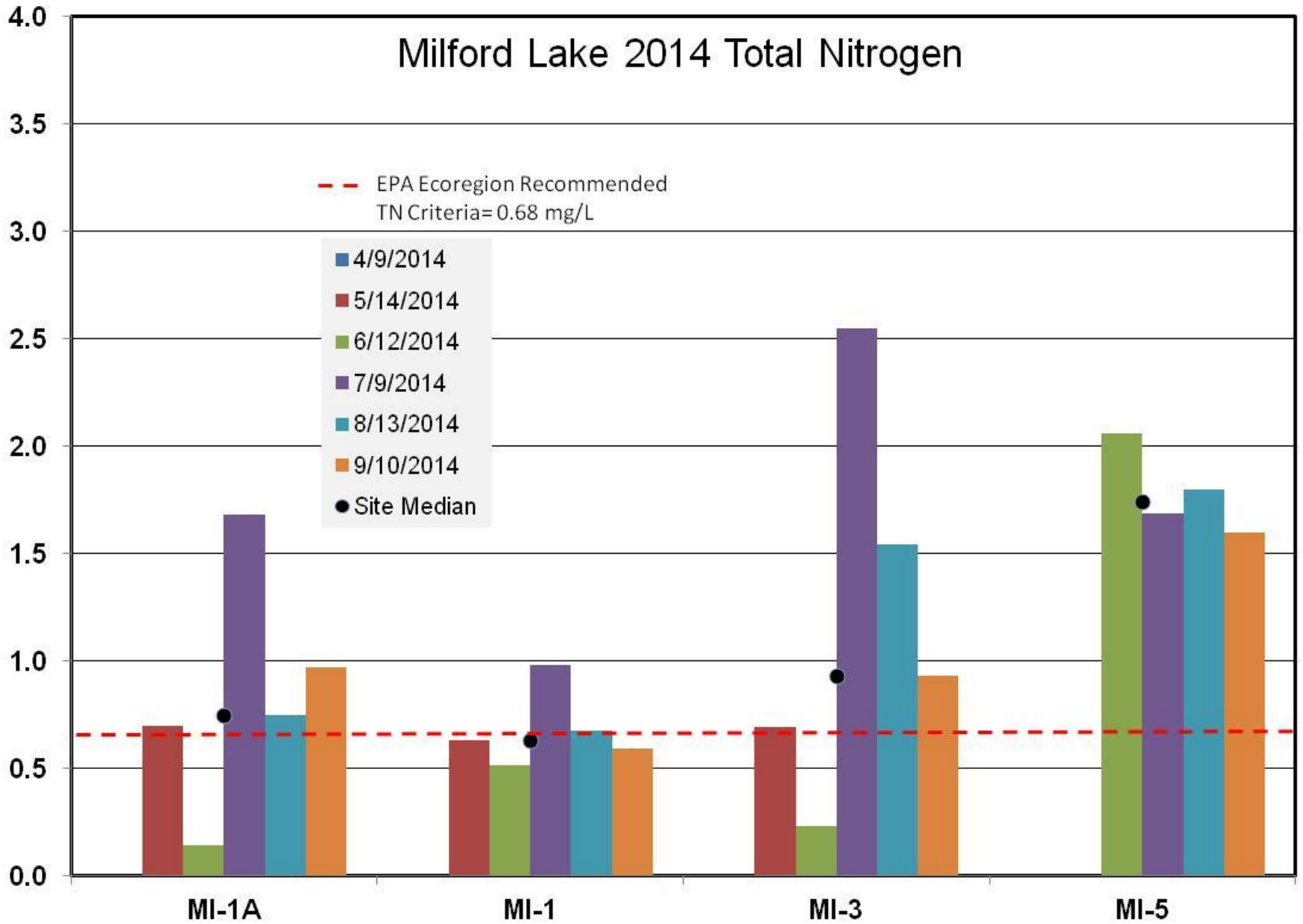
- Dramatic changes to the Kansas River
- The need for turbidity
- The environmental problem with sediment accumulation in the lakes
- Removing the “dam footprint”
- One practical idea



In-reservoir Effects of Sediment Accumulation



Milford Lake 2014 Total Nitrogen



Effect over time...

- Phosphorus binds to sediment, concentration increases as the sediment accumulates in the reservoir
- Nitrogen dissolves in the water, residence time decreases as the sediment accumulates in the reservoir
- TN:TP ratio = VERY LOW





In-reservoir Effects of Sediment Accumulation

- Shift in fish species composition from desirable sport fish (primarily piscivores) to less desirable benthivores (Egertson and Downing 2004)
- Increased biomass of common carp

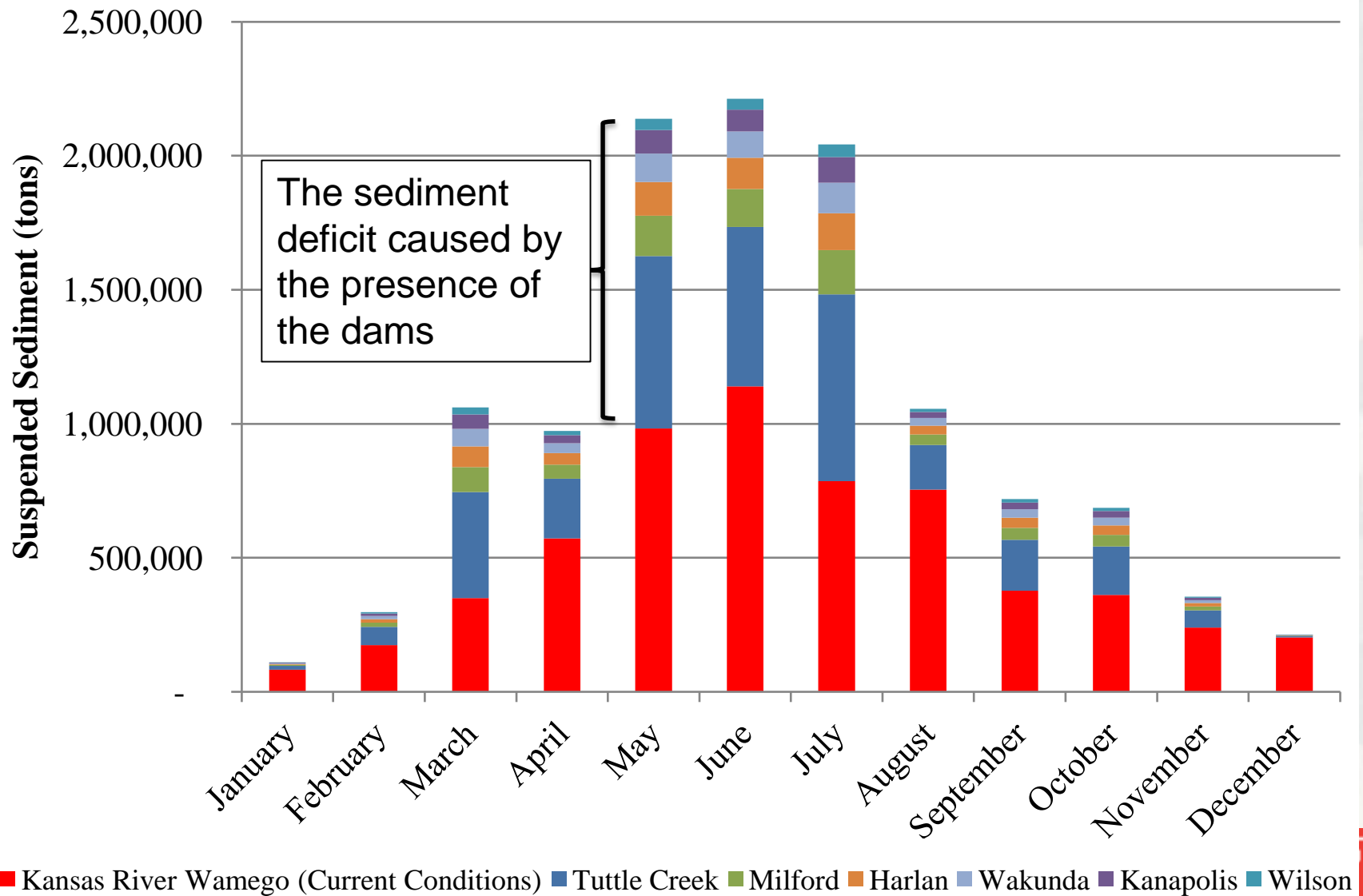


Outline

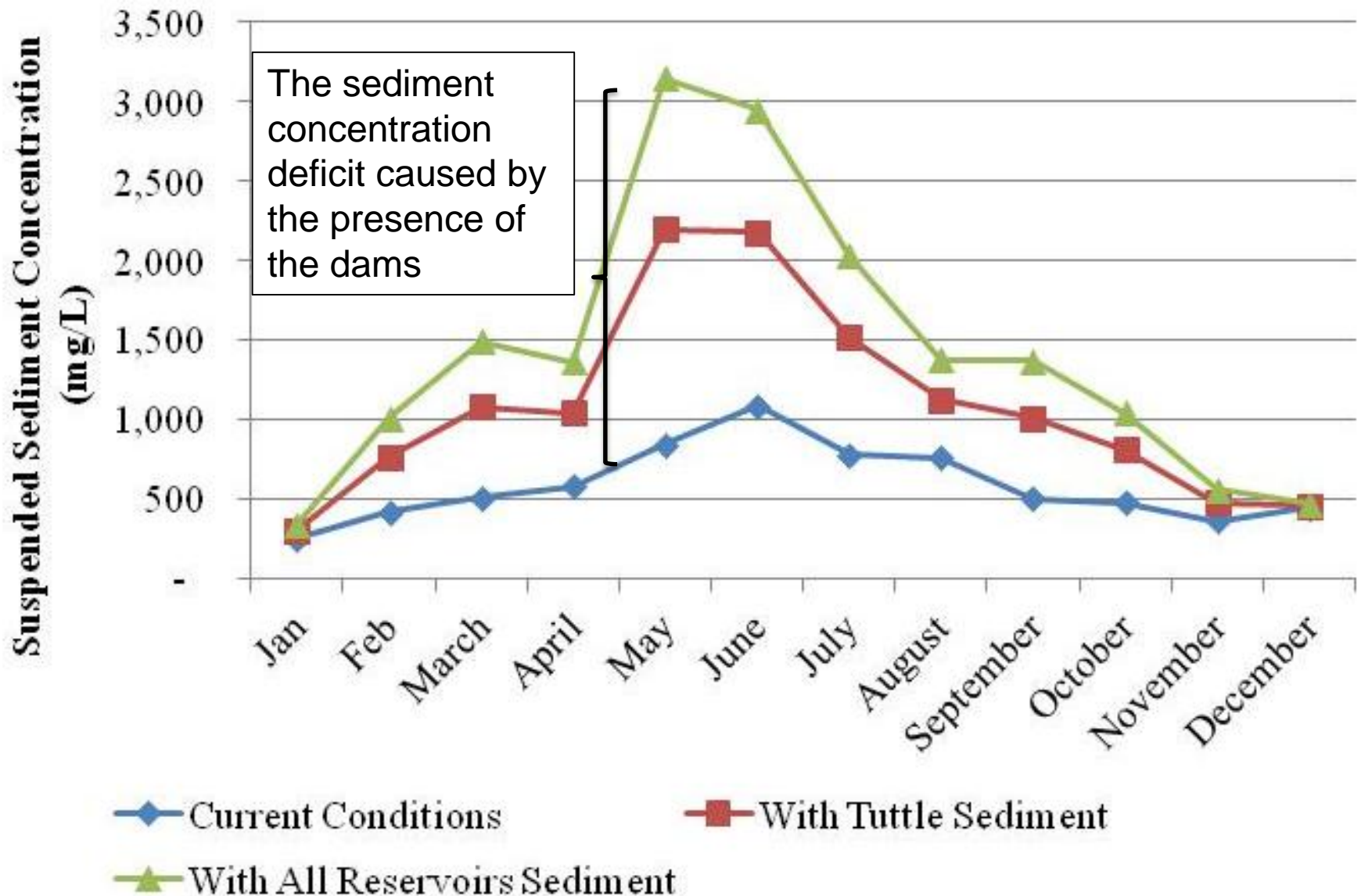
- Dramatic changes to the Kansas River
- The need for turbidity
- The environmental problem with sediment accumulation in the lakes
- Removing the “dam footprint”
- One practical idea



What is the dam footprint?



What is the dam footprint?



Removing the “dam footprint”

- An environmental lift for the Kansas River
- An environmental lift for the reservoirs
- Benefits human uses of the reservoirs (water supply, recreation, etc.)
- But is it practical?



Dredging

- Dredging Tuttle Creek Lake at the natural rate of incoming sediment and recharging sediments to the downstream channel
 - ▶ Costs estimated at \$40 million/year
 - ▶ Tremendous fuel consumption



Option employed on Fall Creek Reservoir in Oregon



Option employed on Fall Creek Reservoir in Oregon

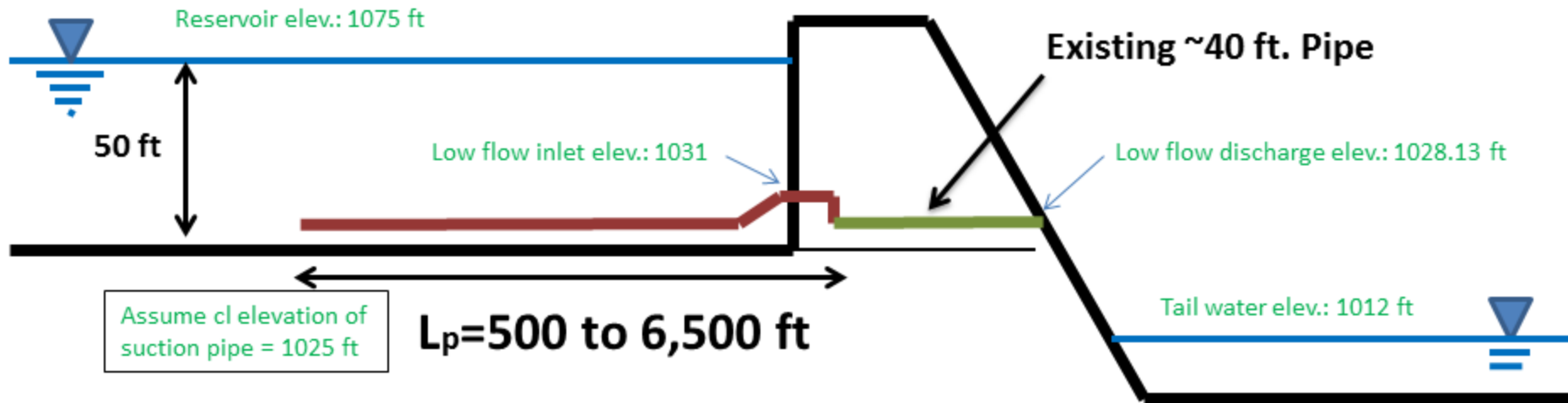
“The entire food web downstream of the reservoir will see a great benefit over time from the liberation of the trapped material.”

<http://www.nwp.usace.army.mil/Missions/Current/FallCreekdrawdown.aspx>

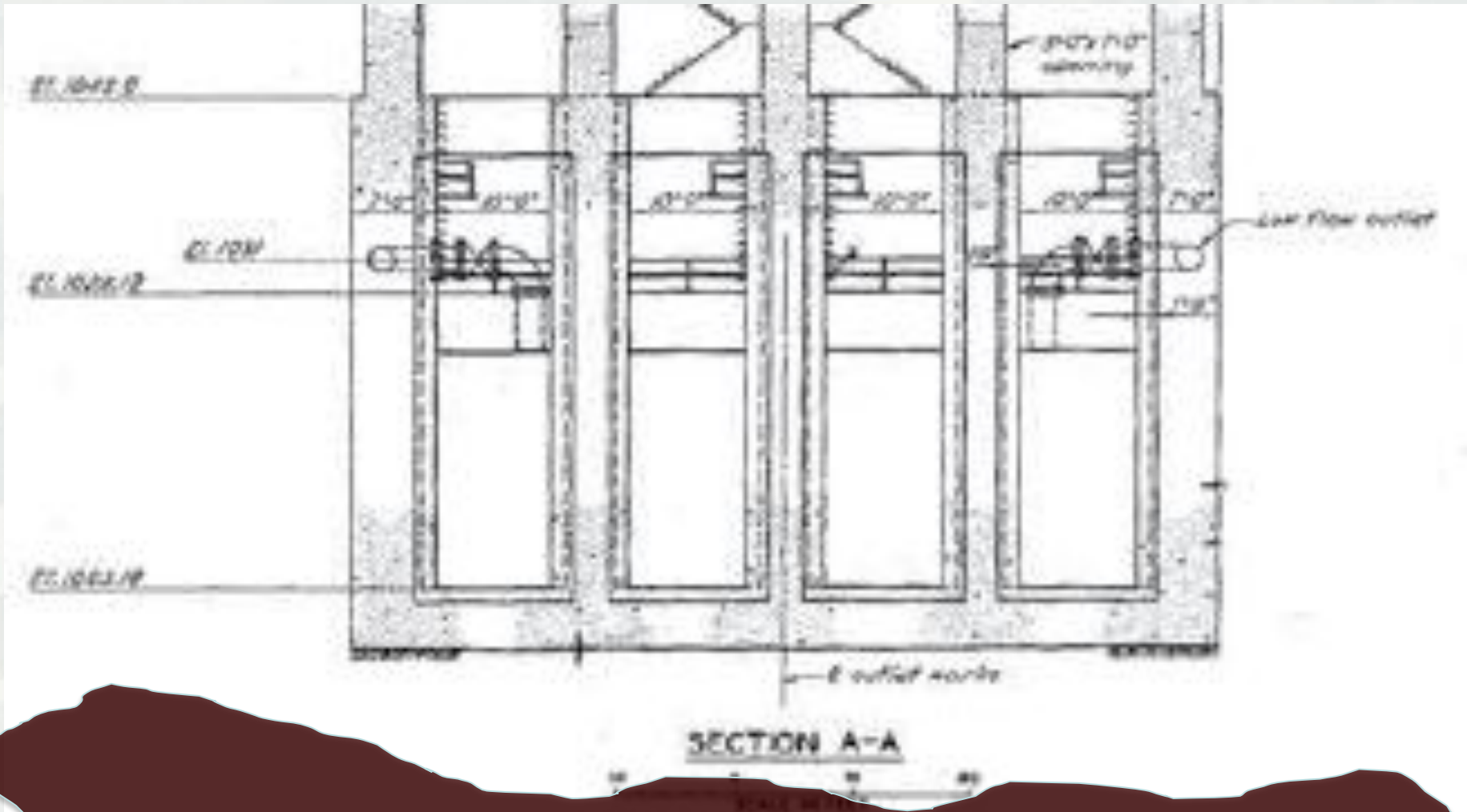


Removing the “dam footprint”

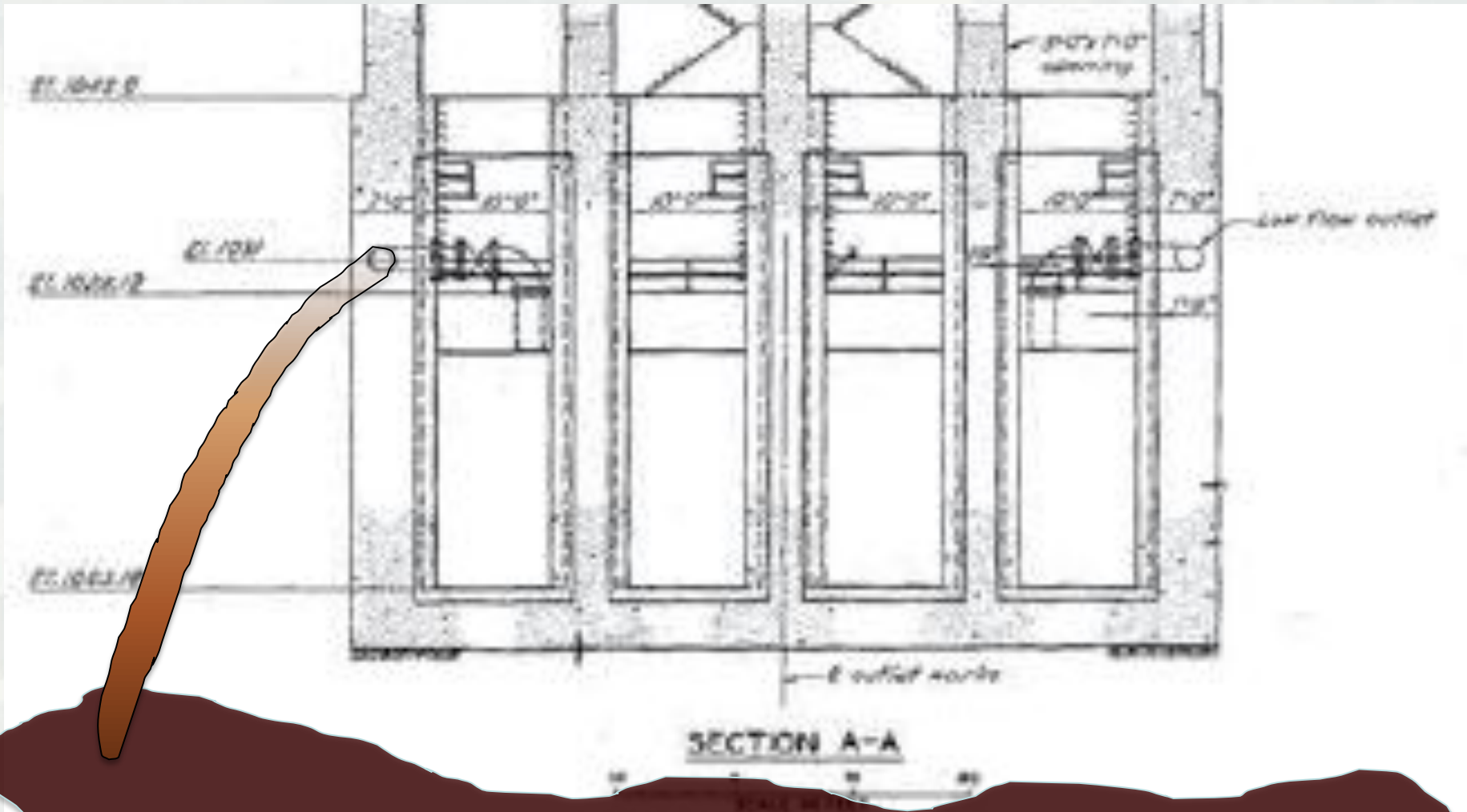
- A novel, less-expensive idea...



A novel, less expensive idea...



A novel, less expensive idea...



Demonstration



Summary

- Connecting the Kansas River with it's watershed is a good thing
- Practical, cost-effective methods are available for accomplishing this objective



Questions?

