INOVATIVE METHODS FOR RESERVOIR SEDIMENT MANAGEMENT

JOHN SHELLEY, PH.D., P.E.  
U.S. ARMY CORPS OF ENGINEERS  
KANSAS CITY DISTRICT
Regional Sediment Management
Established 1999, CERB Charge

“A systems approach using best management practices for more efficient and effective use of sediments in coastal, estuarine, and inland environments for healthier and more resilient systems.”

- Recognizes sediment as a valuable resource
- Work across business lines, projects, and authorities to create short and long-term economically viable and environmentally sustainable solutions
- Improve operational efficiencies and natural exchange of sediments
- Consider regional implications of project scale actions and benefits
- Apply/Enhance tools and technologies for regional approaches
- Share lessons learned, information, data, tools, and technologies
- Communicate and collaborate
Purpose

To inform about the innovative ways sediment is or can be managed at reservoirs in order to motivate you, the dredging industry to engage with this issue.
Tuttle Creek Lake: 1962 - 2010
Tuttle Creek Lake: 1962

- Normal Pool
- 2010
- 2000
- 1983
- 1962
- Dam
- Low Flow Gate

Open Water

Elevation (feet)

Distance from Dam (miles)
Sediment Accumulation in the Multipurpose Pool

5.8 M CY/year

US Army Corps of Engineers
Downstream on the Kansas River

Shoal Chub

Plains Minnow

Flathead Chub

Western Silvery Minnow
“The only way to sustainably manage the nation’s reservoirs is to pass the sediment downstream.”

-- Dr. Rollin Hotchkiss, USACE Environmental Advisory Board, Speaking at the Kansas Water Conference
Pressure Flushing
Pressure Flushing
Cherry Creek Flush

- Pressure flush to maintain operational capability at low level outlet
- Every year alternating high (1300 cfs) and low (250 cfs) flow
Cherry Creek Flush: Elevation Change for small flush undetectable
Not Effective at Every Lake

- Kanopolis Lake, KS

- What about water injection dredging or agitation dredging?

- Huge market for small-scale dredging to make pressure flushes more effective
Reservoir Drawdown Flushing

Draw down the reservoir
Reservoir Drawdown Flushing

Draw down the reservoir
Reservoir Drawdown Flushing

Draw down the reservoir
Reservoir Drawdown Flushing

Very high sediment load
Reservoir Drawdown Flushing

Headcuts and "bank" erosion move upstream

Very high sediment load

US Army Corps of Engineers
Reservoir Drawdown Flushing

Headcuts and “bank” erosion move upstream

Very high sediment load
Reservoir Drawdown Flushing

Headcuts and “bank” erosion move upstream

Very high sediment load
Reservoir Flushing: Fall Creek
Reservoir Flushing: Spencer Dam

Boyd and Gibson, 2016
Reservoir Flushing: Spencer Dam
Reservoir Flushing Challenges

- Must have a low-elevation gate
- Uses ALL the water
- Will not usually flush out the “floodplain” i.e. maintained reservoir storage typically much less than the original
- Sediment-laded effluent – high concentration short duration
Gebidim Dam Flushing
Drawdown flushing is for small (typically hydropower) reservoirs

- Spencer Dam was able to maintain 10% of its original storage by flushing twice a year for two weeks

- If agitation, water injection, or some other type of dredging were employed along with the flush, a larger pool could have been maintained.
Dredging Example - Millsite Reservoir
Dredging Example – Millsite Reservoir
Dredging Example – Millsite Reservoir
Dredging Example – Millsite Reservoir
Dredging Example – Millsite Reservoir

Saves 40% - 60% of total project cost

Potential for positive ecosystem benefits
But you’ll still have to go to battle to get your permit!
Water Injection Dredging (WID)
Water Injection Dredging

- Able to introduce sediment into
  - Low-elevation gate releases
  - Pressure flushes
  - Drawdown flushes

- Market is huge

- State of Kansas seeking to do a WID pilot project at Tuttle Creek Lake
  - Email Josh.Olson@kwo.ks.gov if you are interested
Conclusion

- Reservoir dredging: So much more than “trap and store”

- Pass the sediment downstream
  - Pressure flushing
  - Drawdown flushing
  - Hydraulic dredging with discharge downstream
  - Water injection dredging

- The need is HUGE