# In-reservoir and downstream channel effects of a low-cost sediment bypass options at Tuttle Creek Lake

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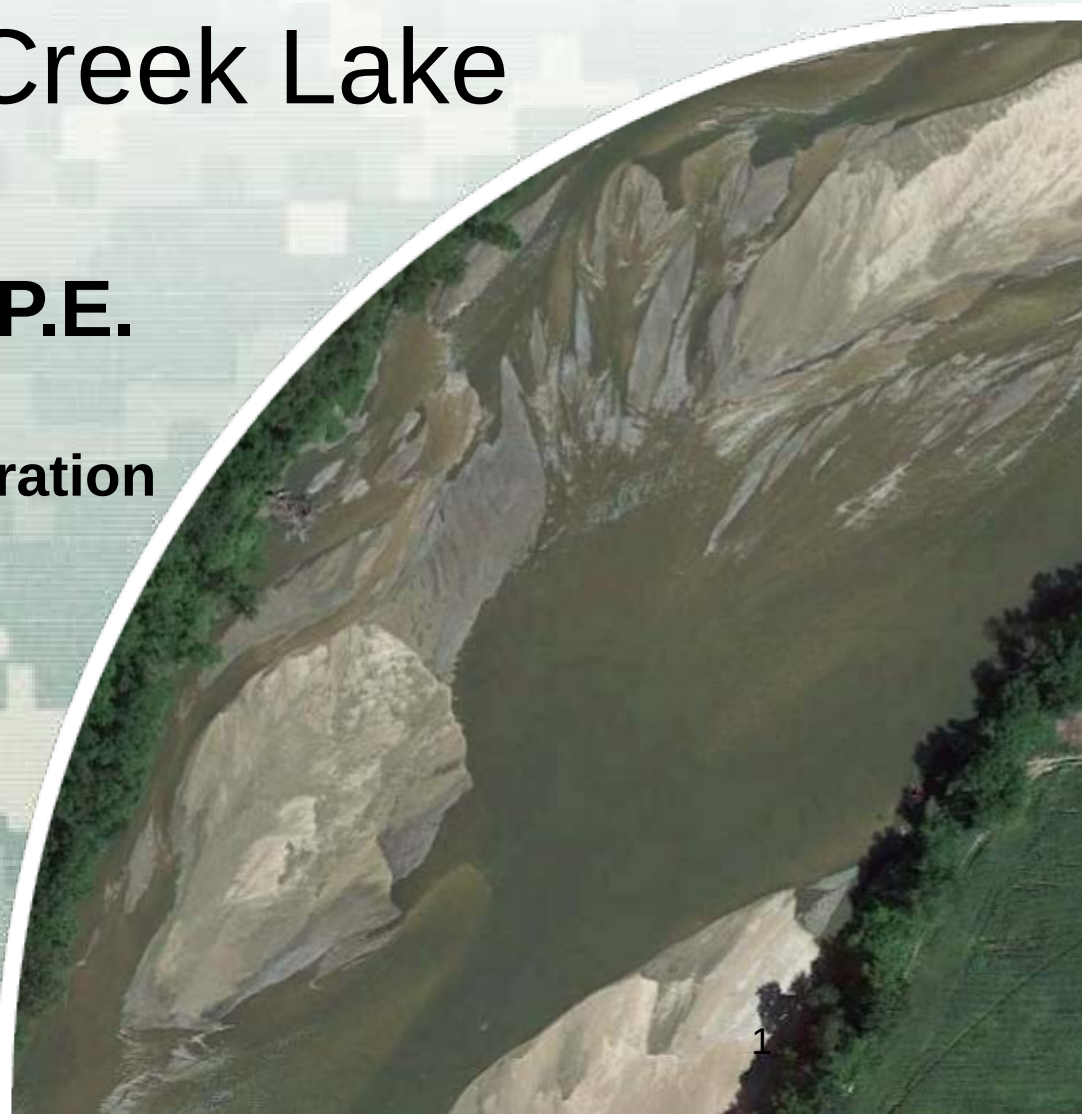
**Kansas City District**

**River Engineering and Restoration Section**

**May 2017**



US Army Corps of Engineers

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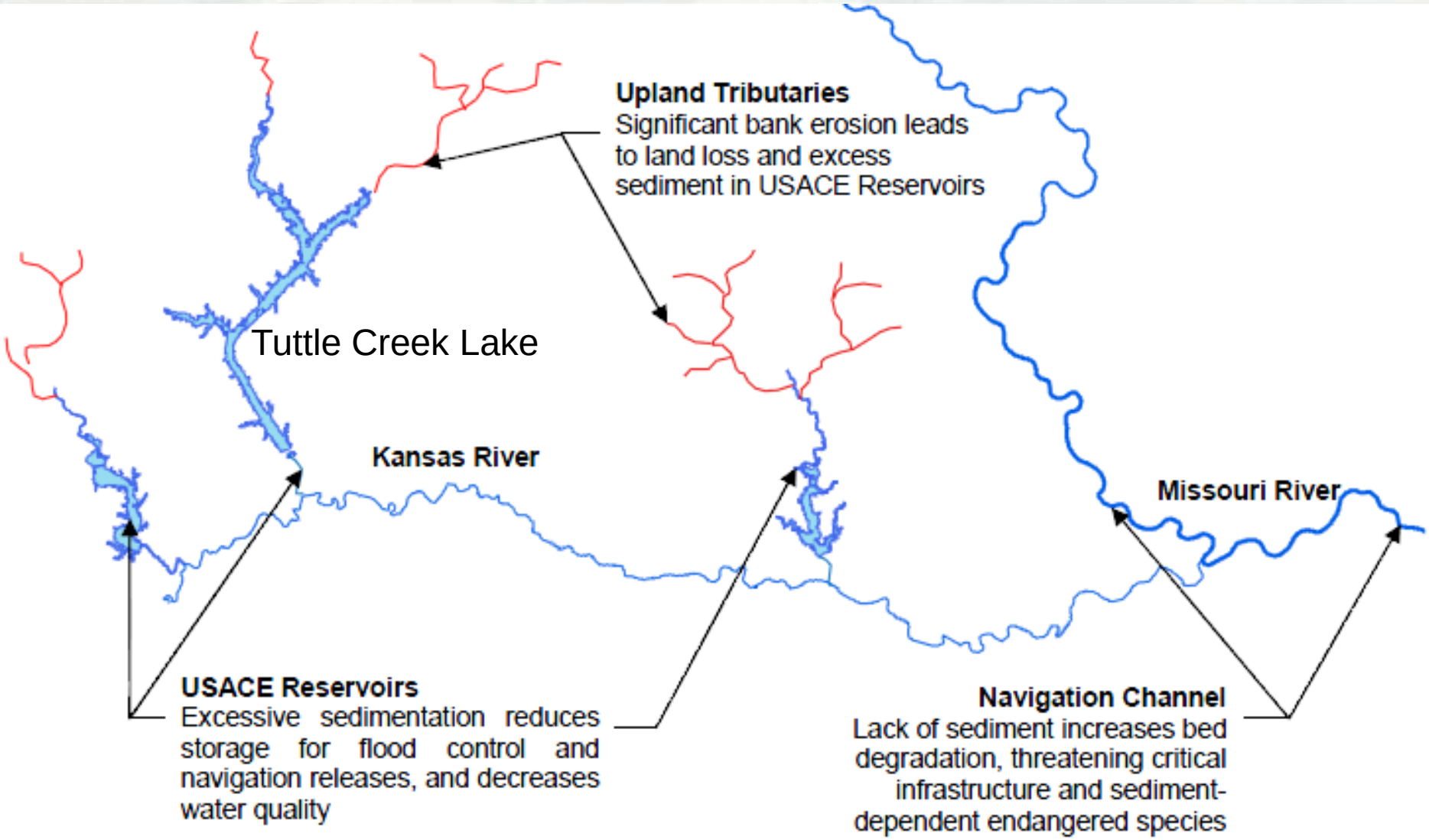
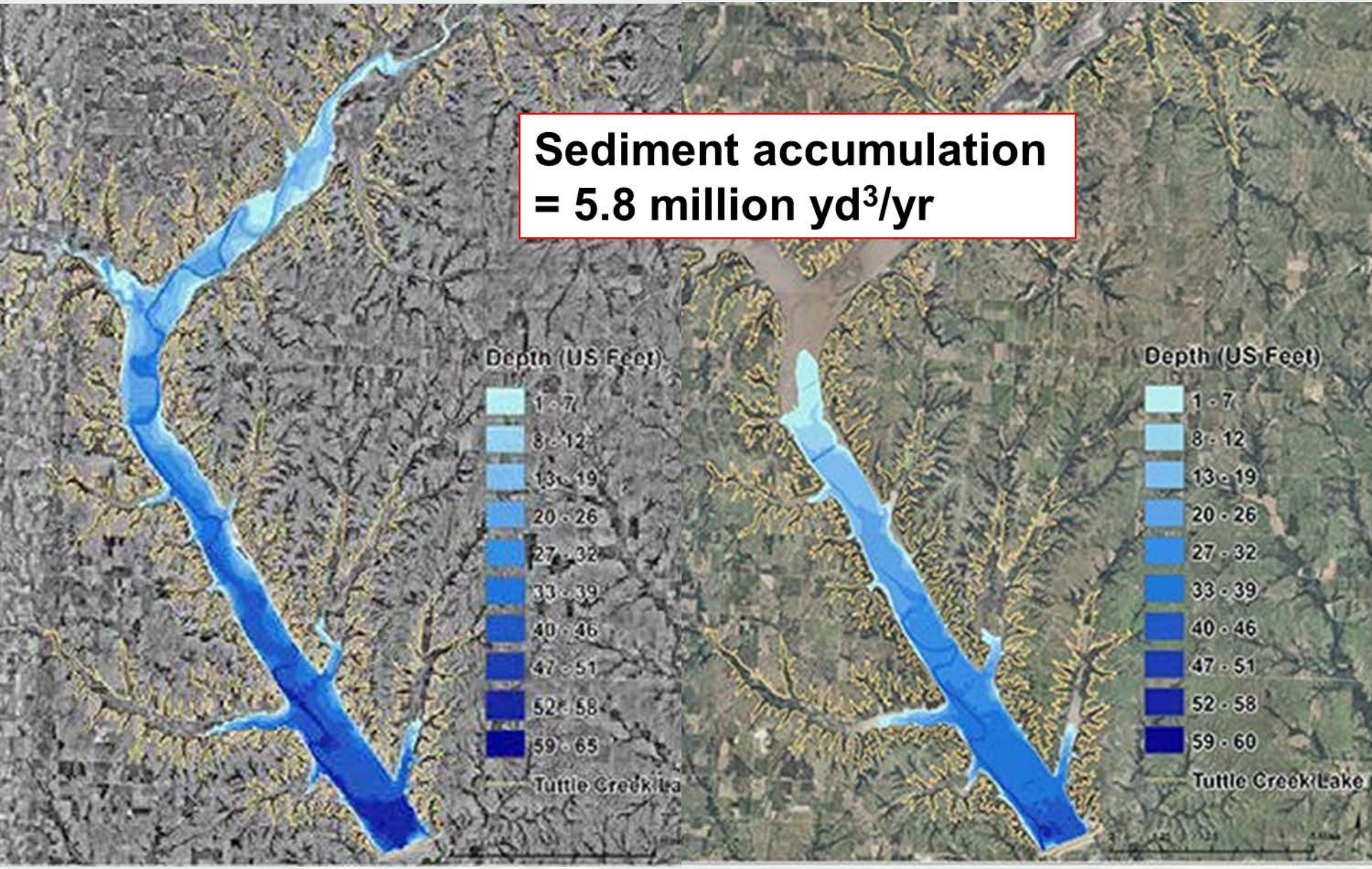
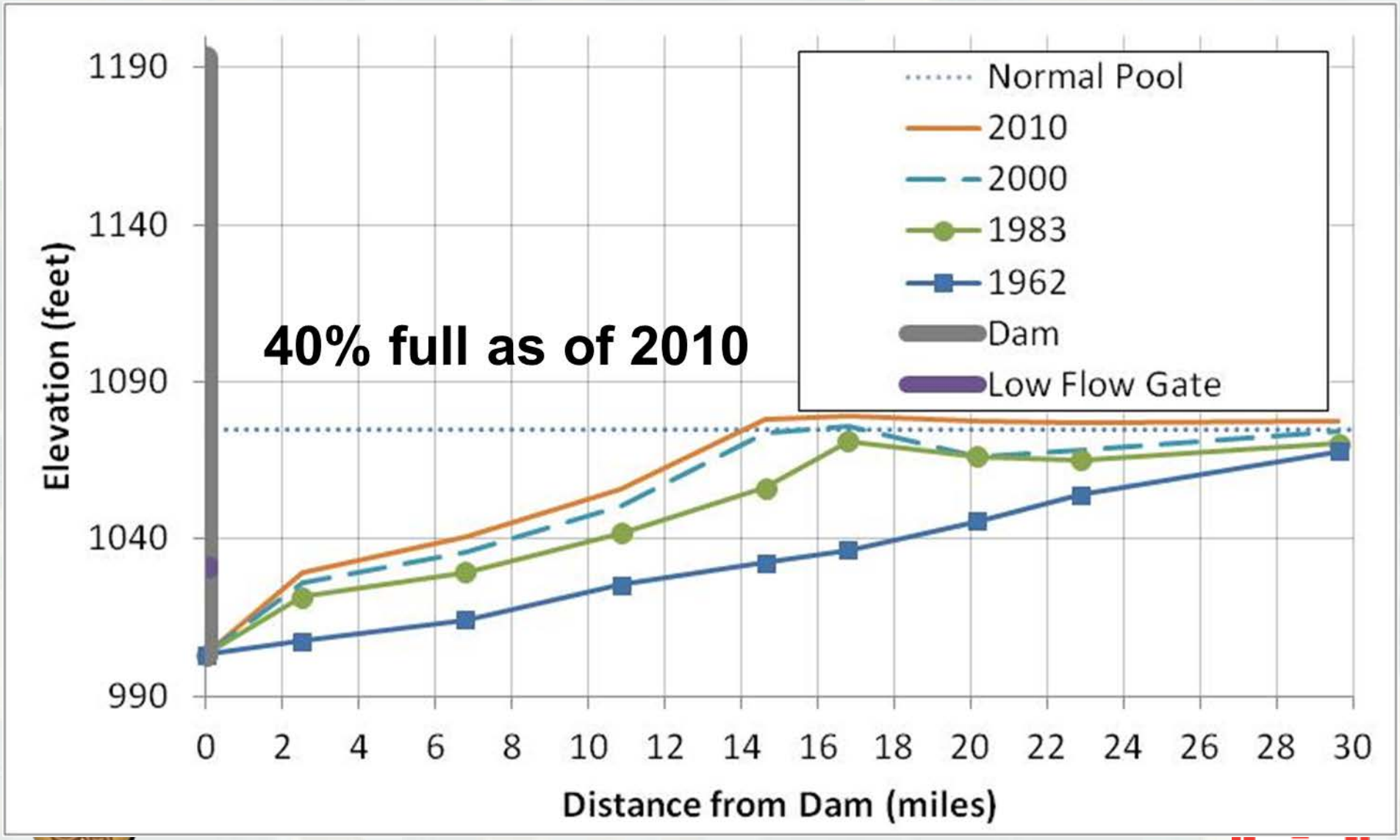

Upland Tributaries
Significant bank erosion leads to land loss and excess sediment in USACE Reservoirs
Tuttle Creek Lake
Kansas River
Missouri River
USACE Reservoirs
Excessive sedimentation reduces storage for flood control and navigation releases, and decreases water quality
Navigation Channel
Lack of sediment increases bed degradation, threatening critical infrastructure and sediment-dependent endangered species

# Tuttle Creek Lake: 1957 to 2010



# Tuttle Creek Lake



# Lake Dredging Costs of Nearby Lakes

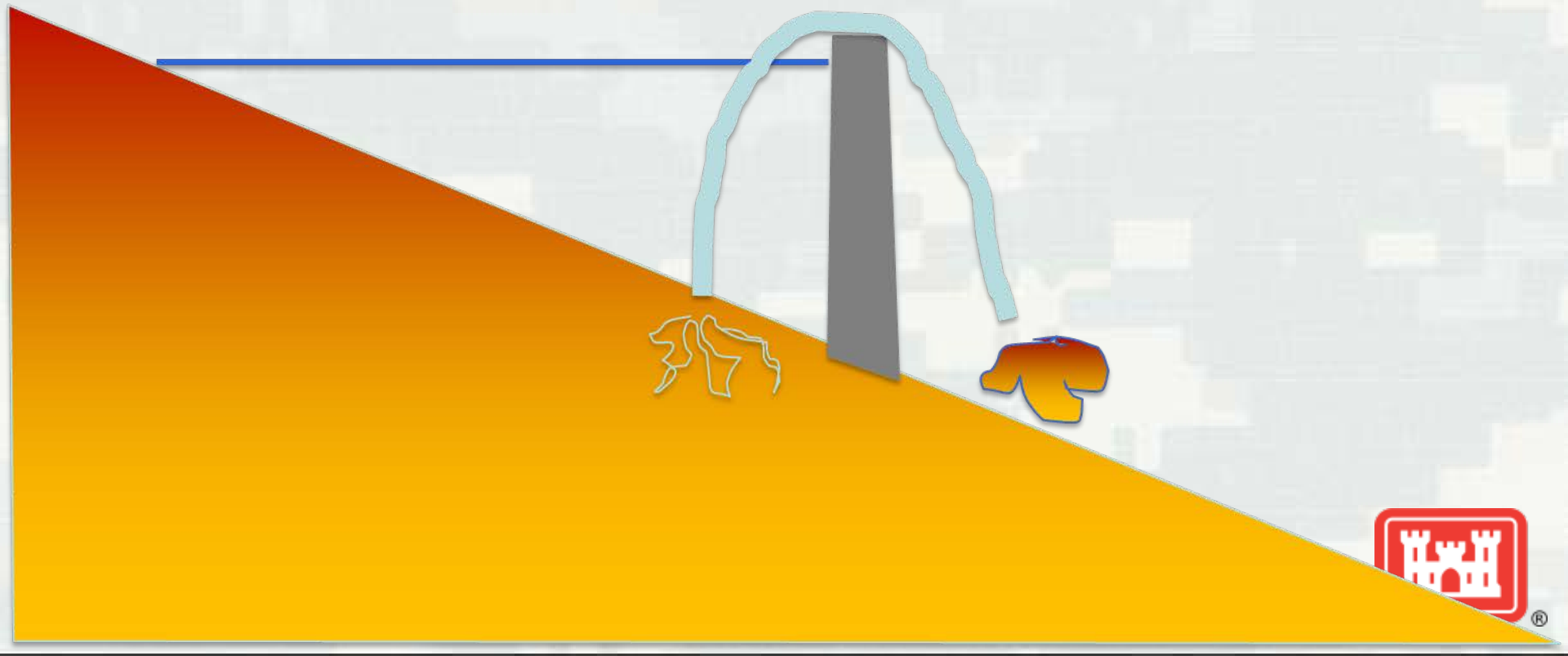
- John Redmond: $6.5/cu yd
- Mission Lake: $6.5/ cu yd
- Tuttle would cost more, due to higher land prices

- At $6.5/ cu yd

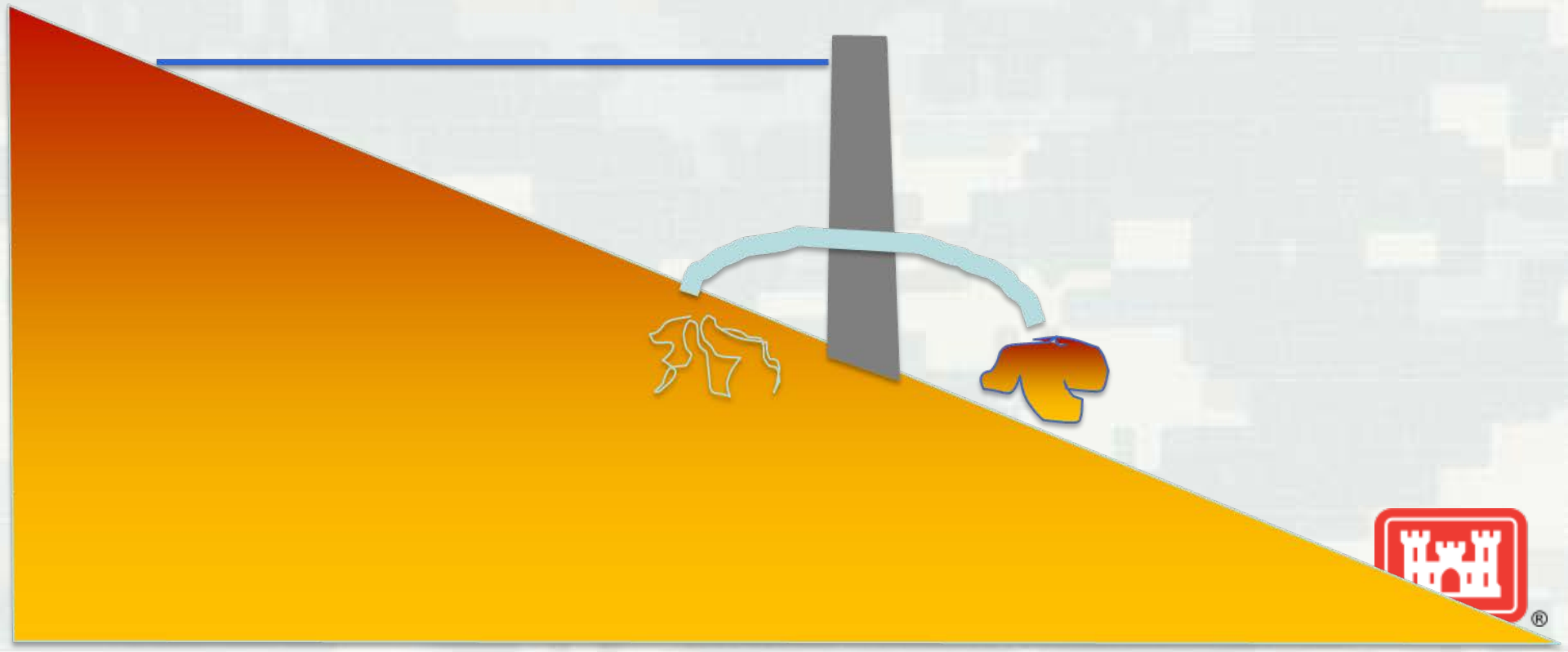
►$38++ million / year

►Increasing cost every year, forever

# Hydrosuction: A Less Expensive Option



# Hydrosuction: A Less Expensive Option



ERDC/CHL LR-15-6
November 2015

# Tuttle Creek Dam Siphon Dredging Investigation

*by Dr. Brian C. McFall and Tim L. Welp*

| Option | Cavitation | Design Flow Velocity [ft/s] | Design Flow Rate ($ft^3/s$) | Estimated Production Rate [$10^6$ $yd^3/yr$] (6% solids) | Maximum Pipe Elevation Above Reservoir without Cavitation [ft] |
|---|---|---|---|---|---|
| 1 | Yes | N/A | N/A | N/A | 28 – 29 |
| 2 | Yes | N/A | N/A | N/A | 28 – 29 |
| 3 (1 Pipe) | No | 8.9 – 19.1 | 28 – 60 | 2.0– 4.2 | N/A |
| 3 (2 Pipes) | No | 8.9 – 19.1 | 56 – 120 | 4.0 – 8.4 | N/A |

**Table 2:** Summary of results for the three (3) design options.

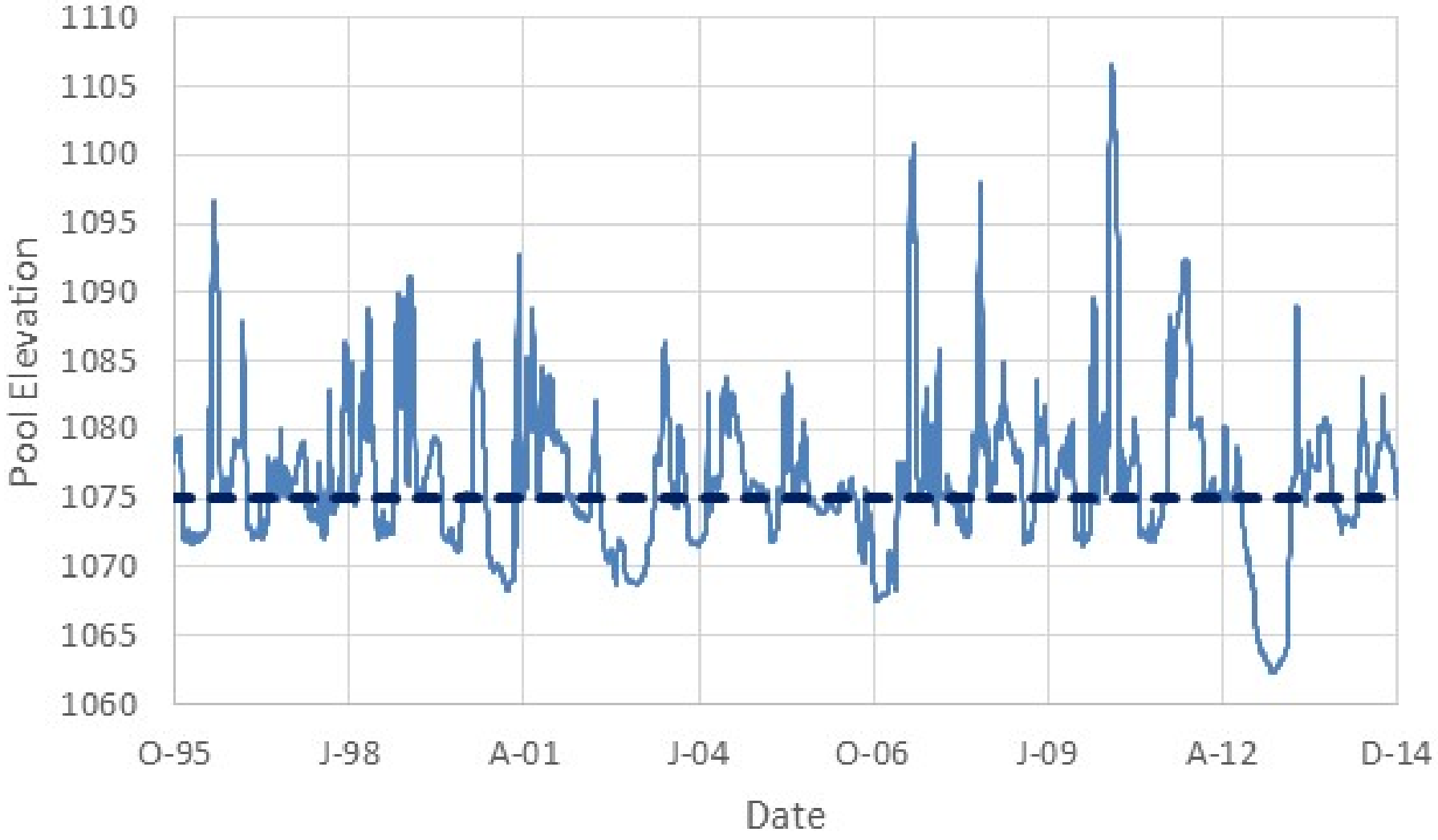
1 pipe: 26 to 54% of annual sediment load

2 pipes: 52 to 109 % of annual sediment load

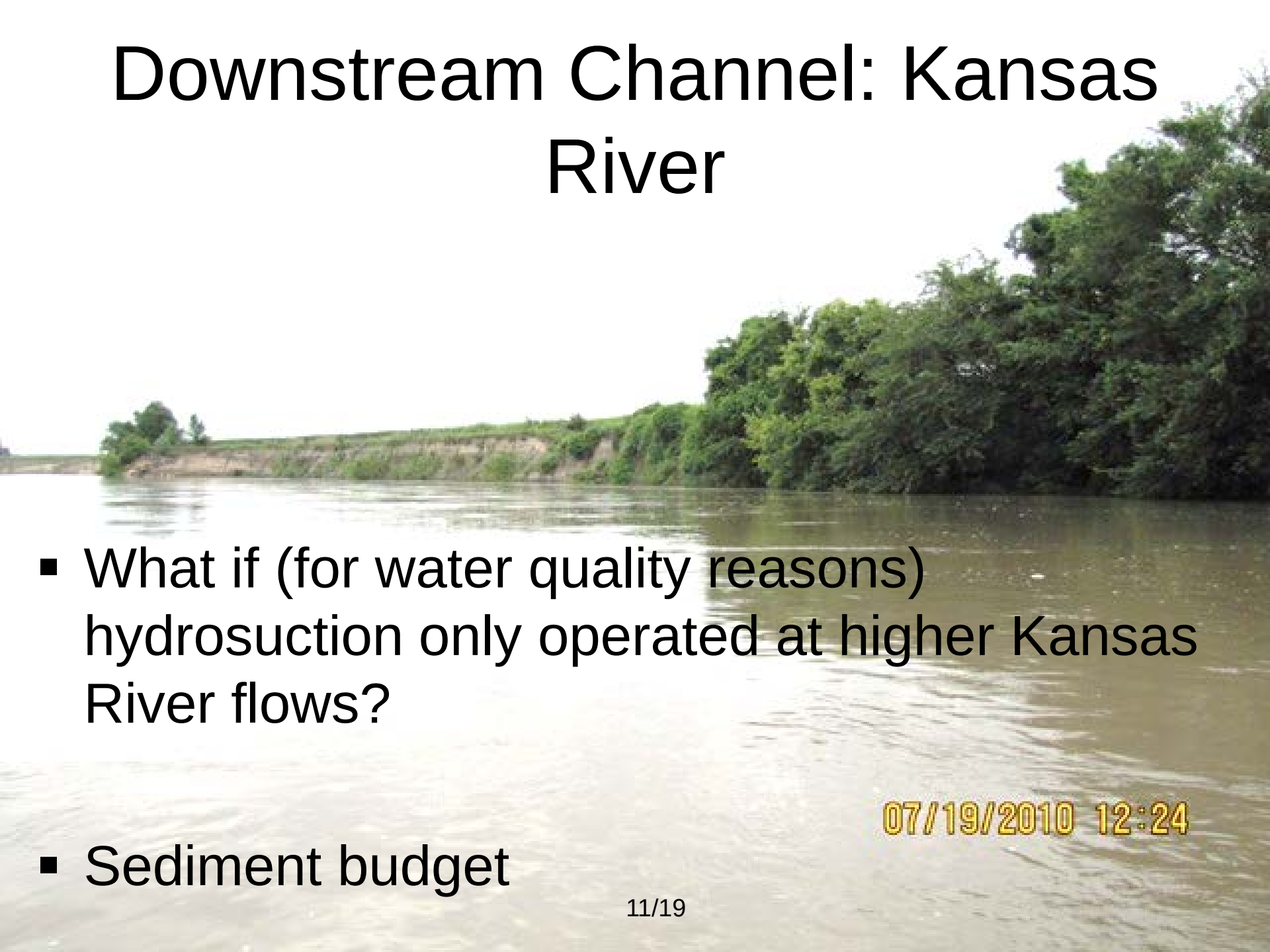
# Assumptions

- Constant reservoir pool level
- Operating 24/7
- Sufficient sediment close to the dam

# FY17 Project- Long-term Effectiveness



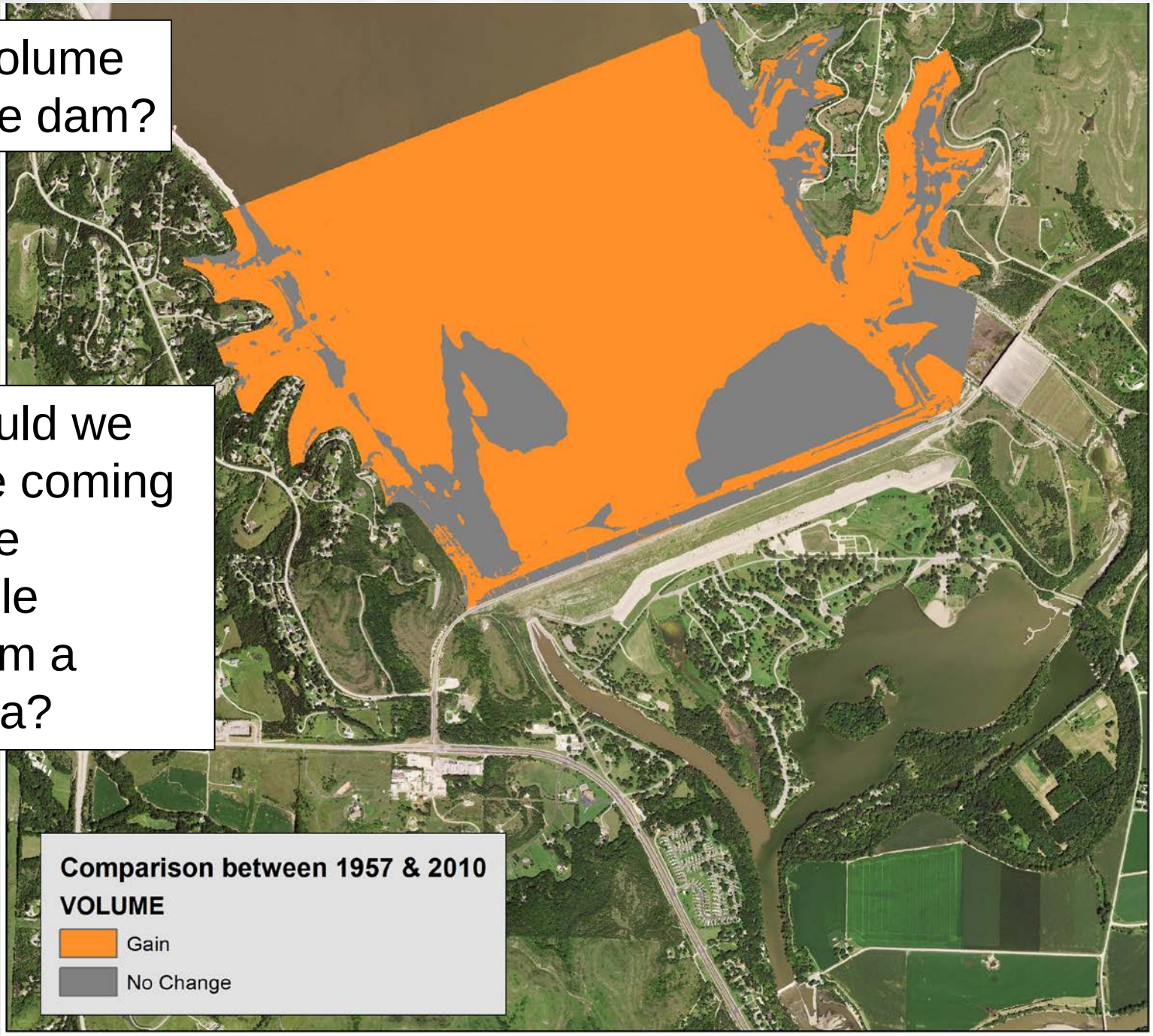
# Downstream Channel: Kansas River




- What if (for water quality reasons) hydrosuction only operated at higher Kansas River flows?
- Sediment budget

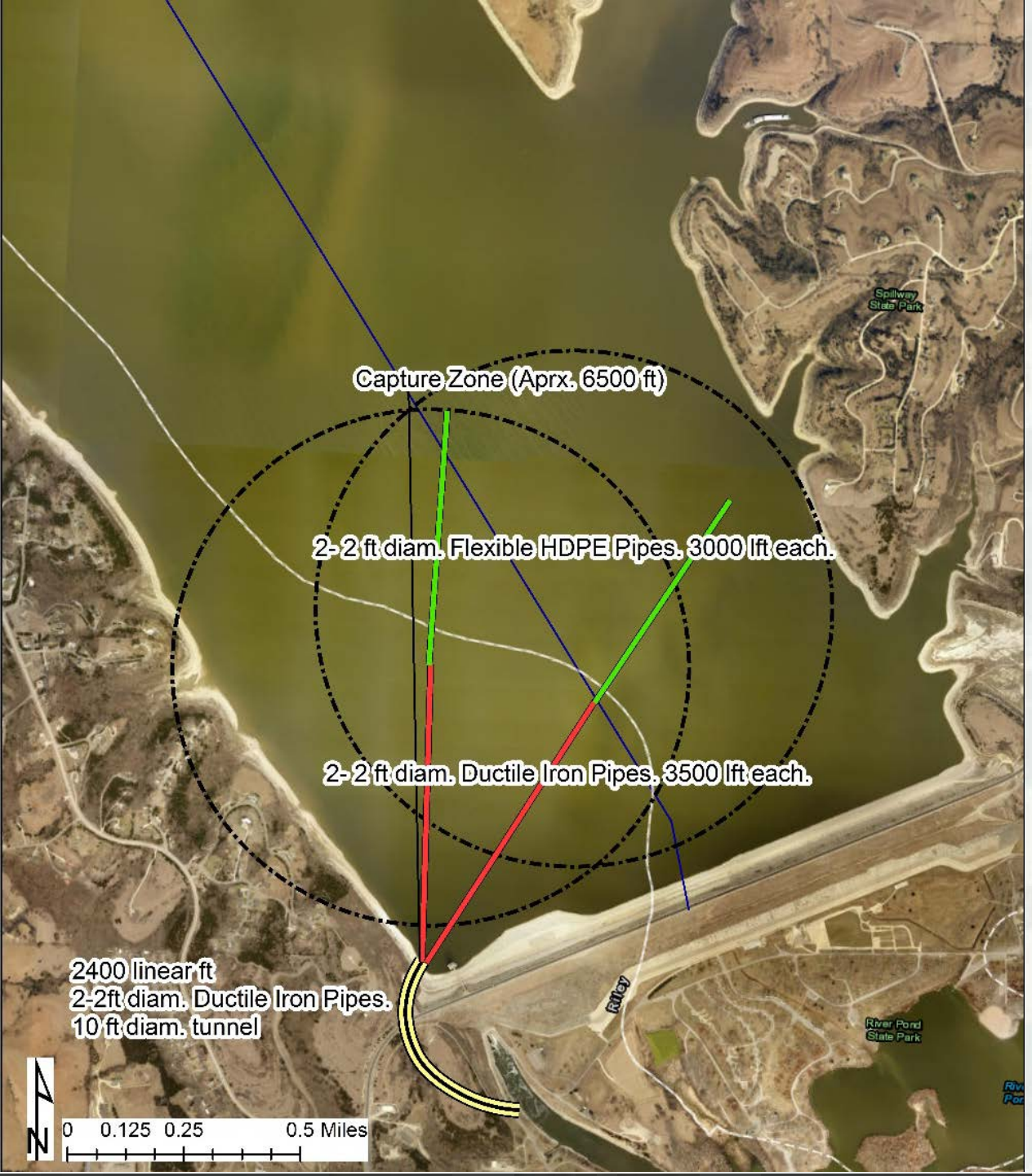
How much volume is close to the dam?

How long could we pass the rate coming into the entire reservoir while removing from a localized area?



# Leveraging

- Kansas Water Authority
- Kansas River Water Assurance District No. 1
- Cost Estimating/Dam Safety
- PAS Study (Kansas Water Office Sponsor)
- Sustainable Rivers
- P3




Order of Magnitude Cost = $100 million

Payback < 3 years

# FY17 RSM IPR
## District, Title, POC(s)

**BLUF:** This project assesses the long-term effectiveness of sediment removal from Tuttle Creek Lake and quantifies sediment concentration increases and potential impacts to the downstream Kansas River.

## Challenge/Objectives

- Re-do analysis with
  - Historic pool elevations
  - Exhaustible supply of sediment close to the dam
  - Environmental constraints on operation (i.e. no discharge during low flows)

## Approach
### (including Tools/Models/Data Used)

Hydrosuction spreadsheet

Sediment budget in the downstream Kansas River based on USGS measurements

GIS analysis of sediment deposition near the dam

# FY17 RSM IPR

District, Title

## District/Other USACE PDT Members

John Shelley (river engineering)

Patrick Miramontez (cost estimating)

Tracy Brown (GIS)

Kellen Huffman (hydraulic engineering)

Erin Reinkemeyer (hydraulic engineering)

## Stakeholders and Partners

Kansas Water Office

Kansas River Water Assurance District No. 1

Kansas Water Authority

Kansas Department of Health and Environment

## Leveraging/Collaborative Opportunities

Dam Safety Program: Paid to develop a cost estimate

PAS study: Signing for a 50/50 cost shared study (this week?)

Take sediment budget the next step to a 1D sediment model

P3 proposal: In limbo now

**FY16 RSM IPR**

District, Title

## What is working? Ups? Success?

Internal coordination- Planning, Ops, Dam Safety, Engineering, Cost Estimating

External coordination- KWO, KDHE, KWA, Kansas River Water Supply District

Incremental progress- Sec 204, RSM, DOTS, RSM,→ PAS

## What is not working? Downs? Issues?

Need real money (design, environmental permitting) that can lead to construction

P3 in limbo

Pilot project under WRDA?

**How is this project benefiting the USACE and Nation (efiiciency, monetary, technical, relationship building, outreach, etc)**

Reservoir sedimentation is a national problem.

Lots of talk.  Lots of band aids.

If we do nothing, we will be left with few benefits, huge liabilities, and few options.

# Questions?