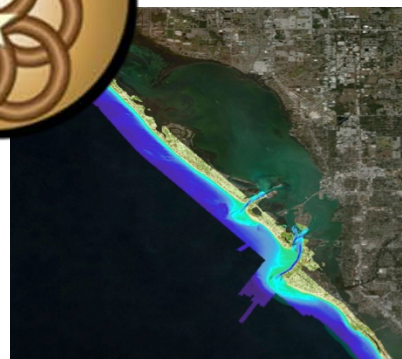
Reservoir Sediment Management & Analysis for Engineers

TURBIDITY CURRENT VENTING

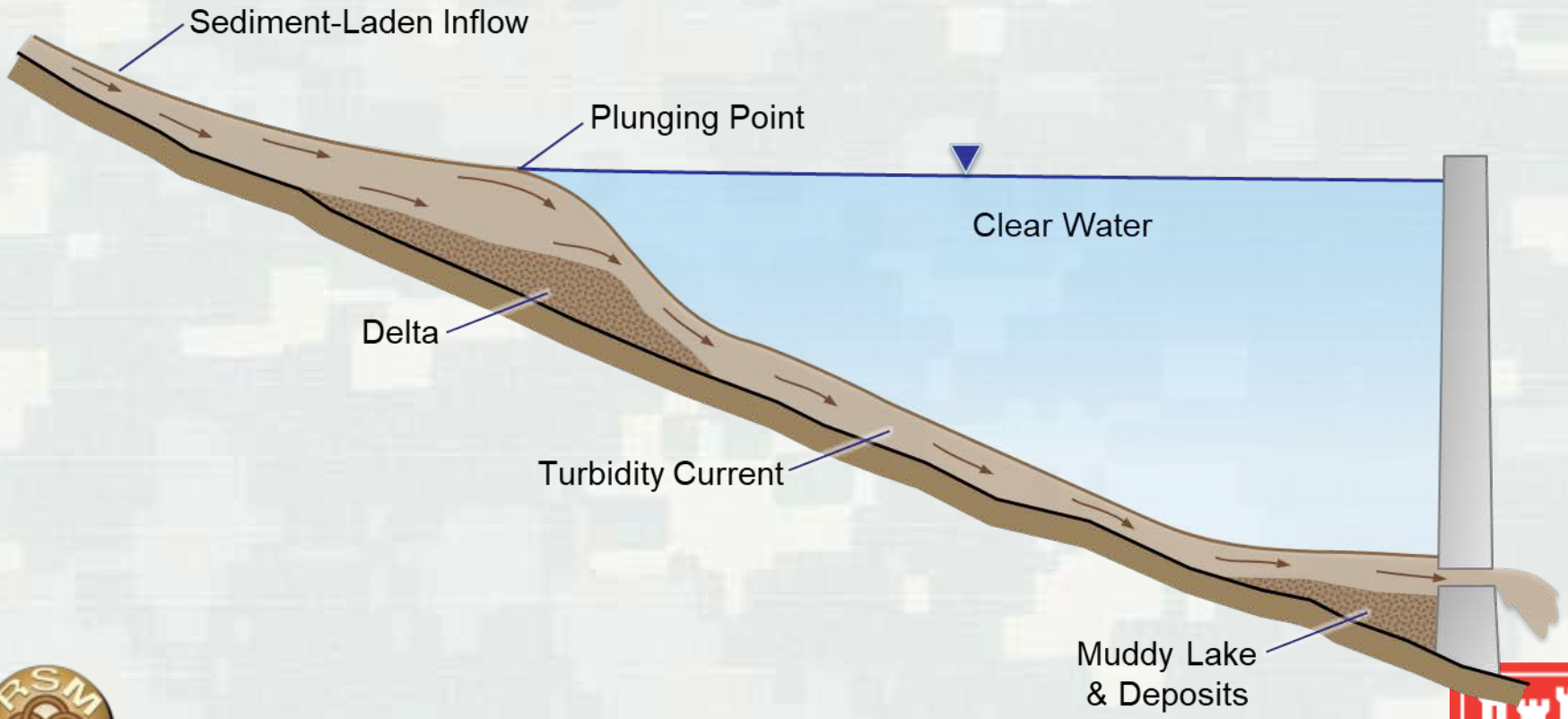


University of Kansas
LEEP2 Building – Room G415
June 11-15, 2018

ERDC
Engineer Research and Development Center

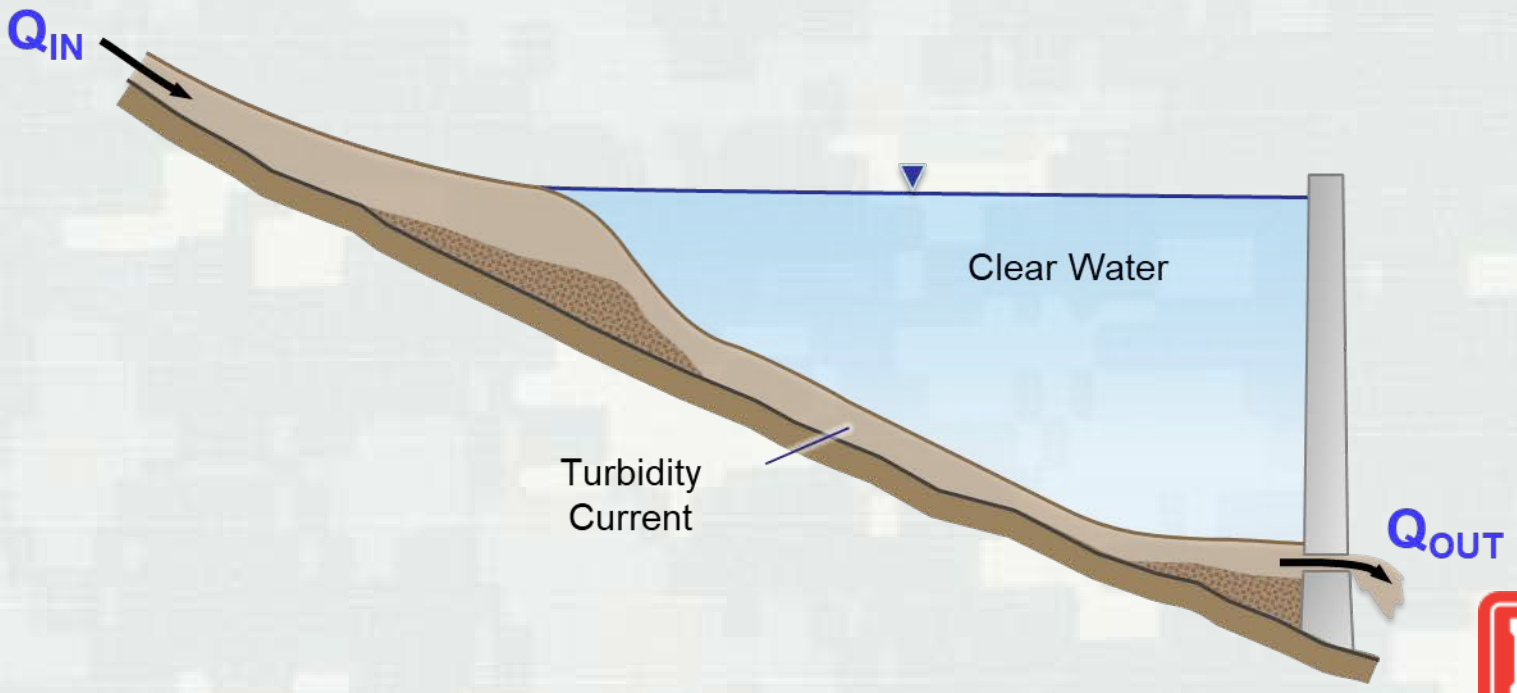
TURBIDITY CURRENTS VENTING

When the conditions are present for the turbid flow to reach the dam, it could be released through low level outlets reducing sediment deposition significantly.



TURBIDITY CURRENTS VENTING

- While releasing the turbid inflow, the storage pool levels are maintained by trying to ***match the outflow volume at the low-level outlets with the turbid inflowing volume***.



TURBIDITY CURRENTS VENTING

Generating a turbidity current event depends on:

- ✓ Hydrological events
- ✓ Sedimentological predispositions
- ✓ Topography of the reservoir

Unknown. Provided by G. Morris

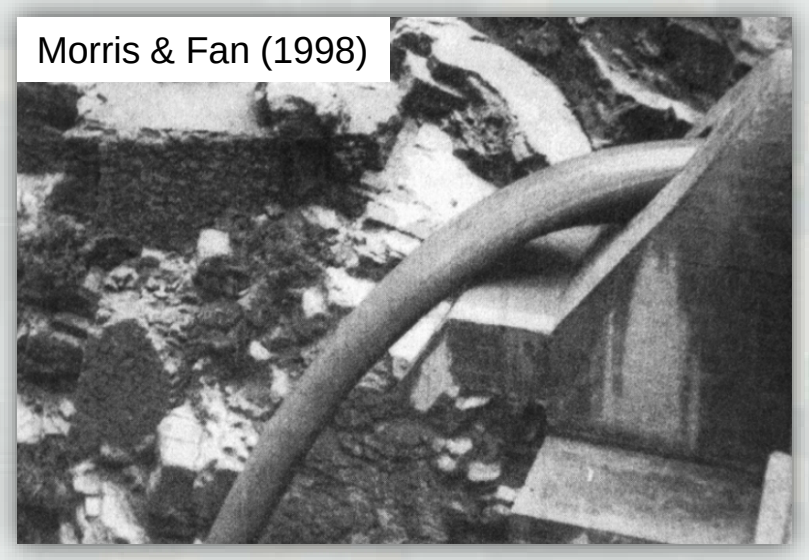
PREDICTING TURBIDITY CURRENT VENTING

Effectiveness of turbidity currents venting depends on:

- Topographic features of a reservoir
- Length of the reservoir
- Magnitude of the incoming flood peak
- Inflow sediment characteristics
- Water level in the reservoir during the period of venting
- Density difference between clear water and turbid inflow
- Outlet elevation in relation to the reservoir bottom
- Discharge capacity of the outlets
- Mode of operation of reservoir

ADVANTAGE OF TURBIDITY CURRENT VENTING

- Desired reduction of sedimentation
- No effect on the pool storage or elevation
- Preserves the natural sediment-transport characteristics of the river
- More ecological justifiable way to release sediments out of a reservoir
- Beneficial for the downstream environment



LIMITATIONS OF TURBIDITY CURRENT VENTING

- Requires monitoring of turbidity currents (can be expensive)
- Guidelines on the operational conditions that can lead to high release efficiencies are needed for each reservoir
- Optimal conditions to perform efficient venting have not been studied sufficiently
- Researchers have highlighted the importance of this technique in the past but very few have performed quantitative research on the subject.

HISTORICAL DATA

- Main countries: Asia, America, Africa
- Earliest record: July 1919 (Elephant Butte Reservoir, NM)
- General documented efficiency: 50% - 80%

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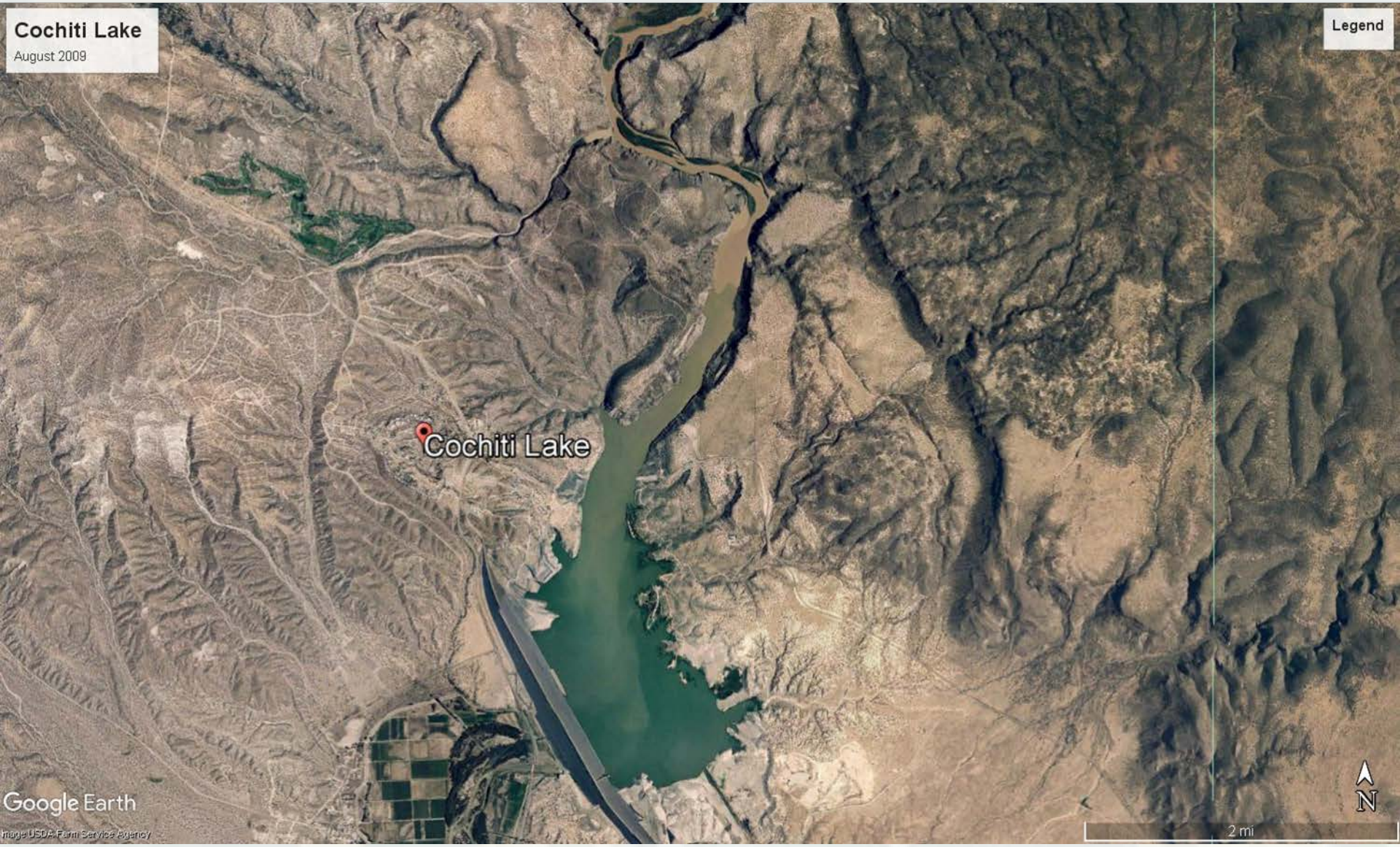

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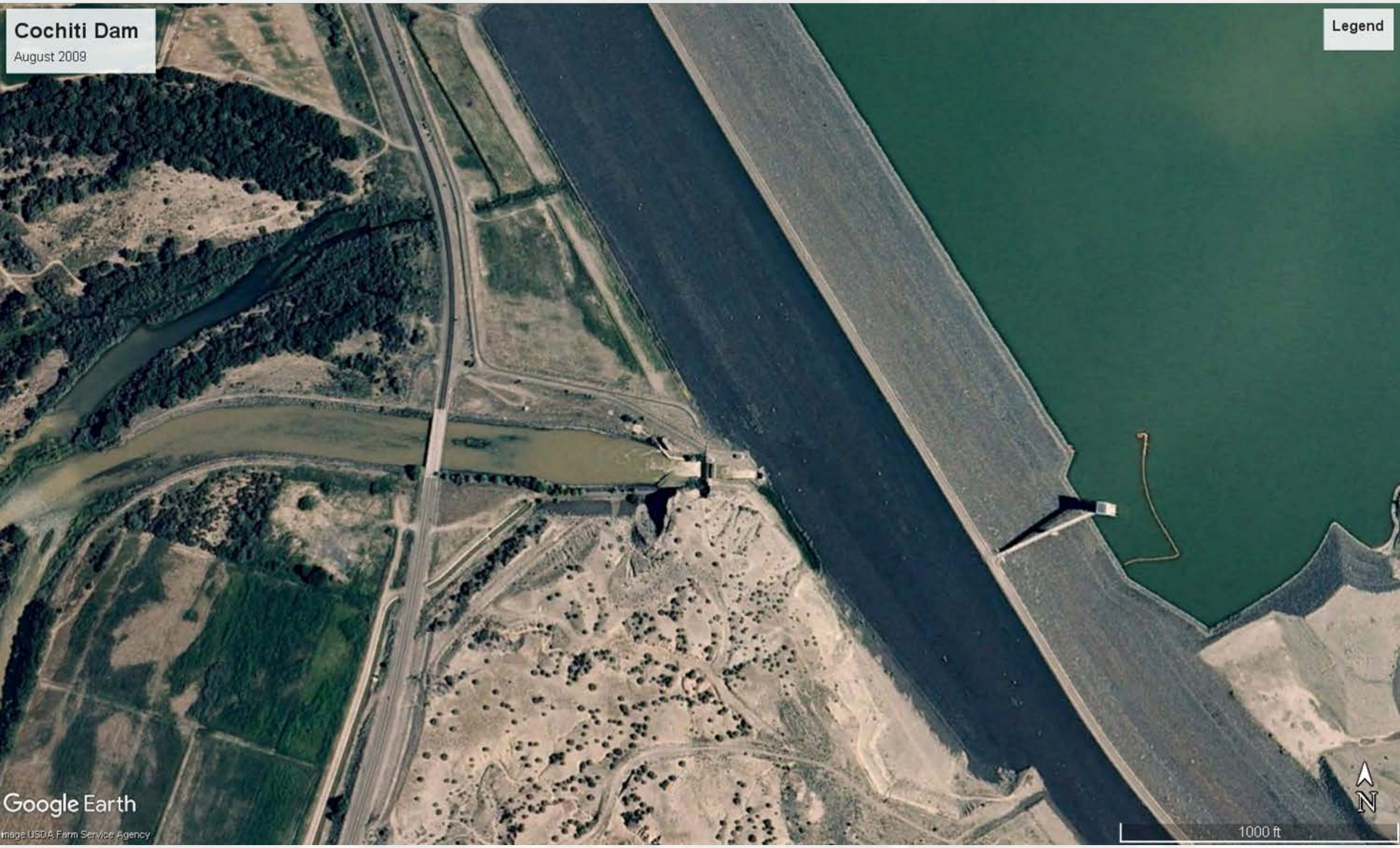
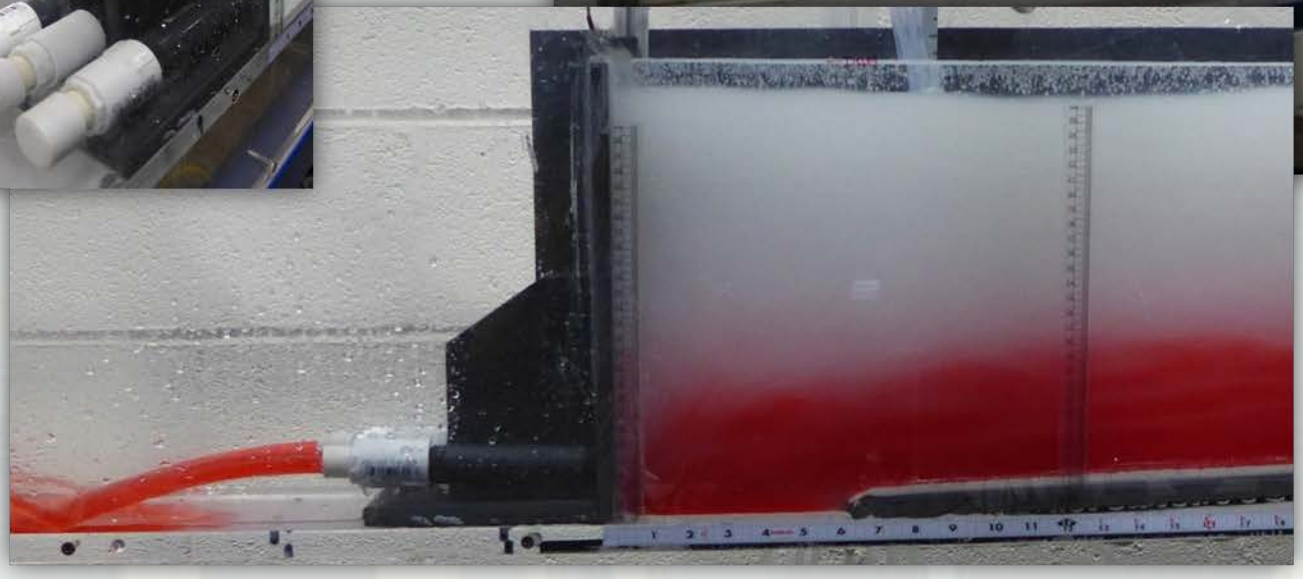


DENSITY CURRENT VENTING

Physical Model

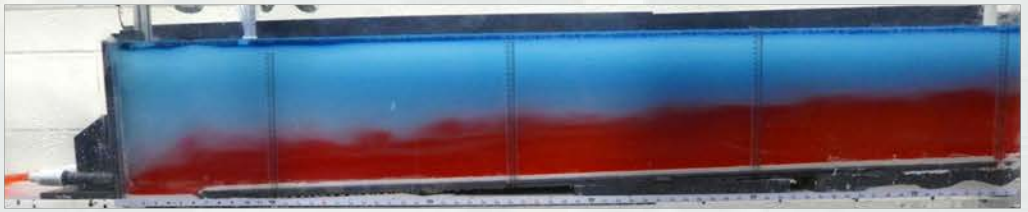


DENSITY CURRENT VENTING

Physical Model

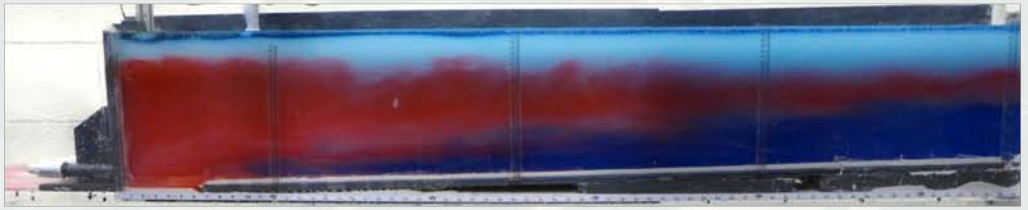
t = 0 m 0 s

t = 0 m 30 s

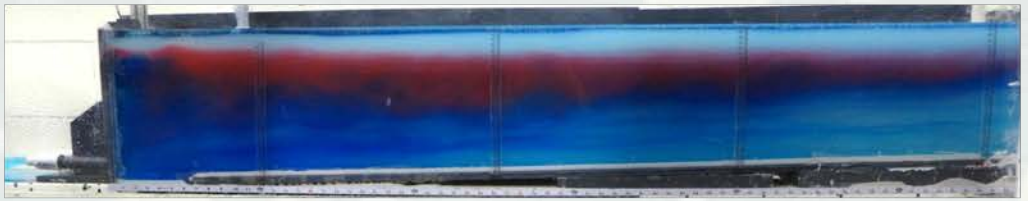


t = 1 m 0 s

t = 1 m 30 s



t = 2 m 30 s



"*If water is life, rivers are its arteries. Dams regulate or divert the flow through these arteries, affecting the life-blood of humanity.*" - World Commission on Dams, 2000 (p. 3)