NASHVILLE DISTRICT WOLF CREEK DAM DISSOLVED OXYGEN RECON EVALUATION

Travis Wiley
Environmental Section
Project Planning Branch
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RECONNAISSANCE-LEVEL EVALUATION OF DO IMPROVEMENT (MARCH 2017)

- **Background - Stakeholders requested Corps consider technologies to prevent loss of revenues for Hydropower due to Sluicing/Orifice Gate Release at Wolf Creek (WOL).**
- **Report contains:**
  - **Cumberland River System (Flow, Temperature, etc)**
  - **Discussion of Alternatives (Effectiveness and Cost)**
  - **Future Evaluations (NEPA, Consideration of Effects to Environment)**
  - **Cost for equipment to improve DO**

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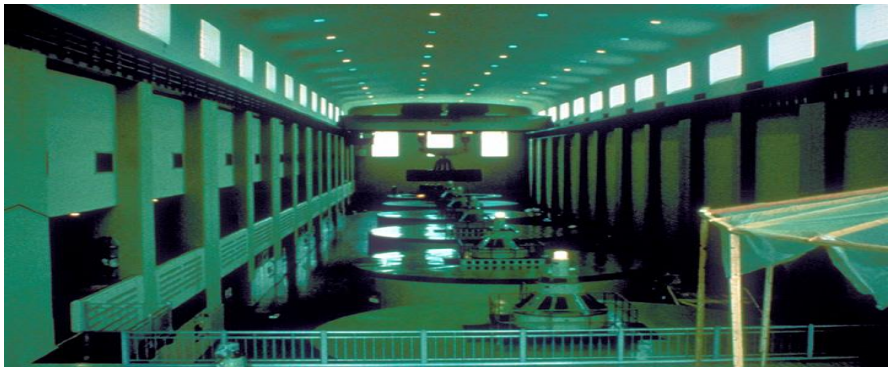
WOLF CREEK DAM – LAKE CUMB.

- Six Turbines – 45 MW
- Three Units with Hub Baffle & Air Modifications
- Largest reservoir in Cumberland- 6,089,000 ac-ft
- Provides +65% of Flow Down Cumberland Mainstem
- Penstock @ elevation 610
- Withdrawal Zone between 590’-670’



Wolf Creek Dam

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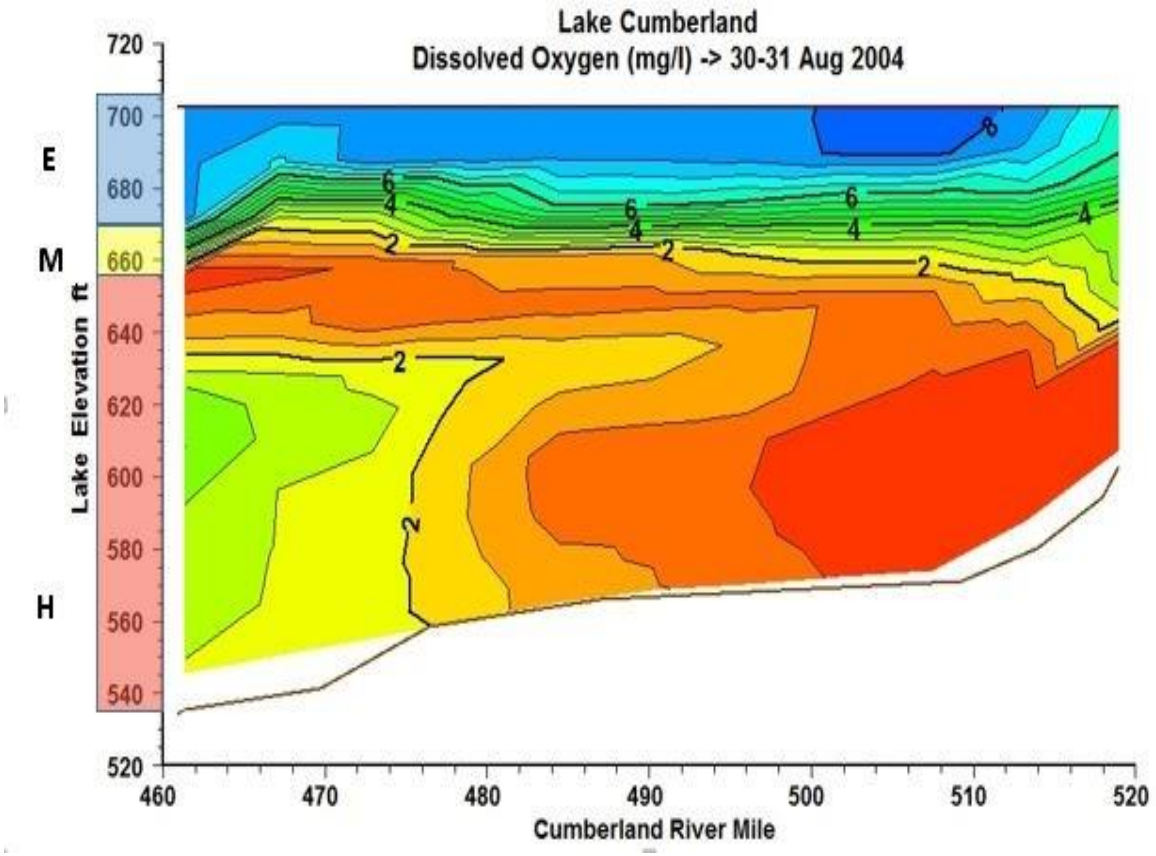
SEASONAL STRATIFICATION

Layers develop in lake- low DO Late-July to Mid-Nov.

Temperatures follow same pattern – colder Hypolimnion



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ALTERNATIVES CONSIDERED

- No Action- Continued Use of Hub Baffles & Orifice/Sluice Gates
- Auto-Venting Turbines
- Surface Pumps in Forebay
- Hypolimnetic Oxygenation System (TVA Design)
- Inverted Cone (Speece Cone)

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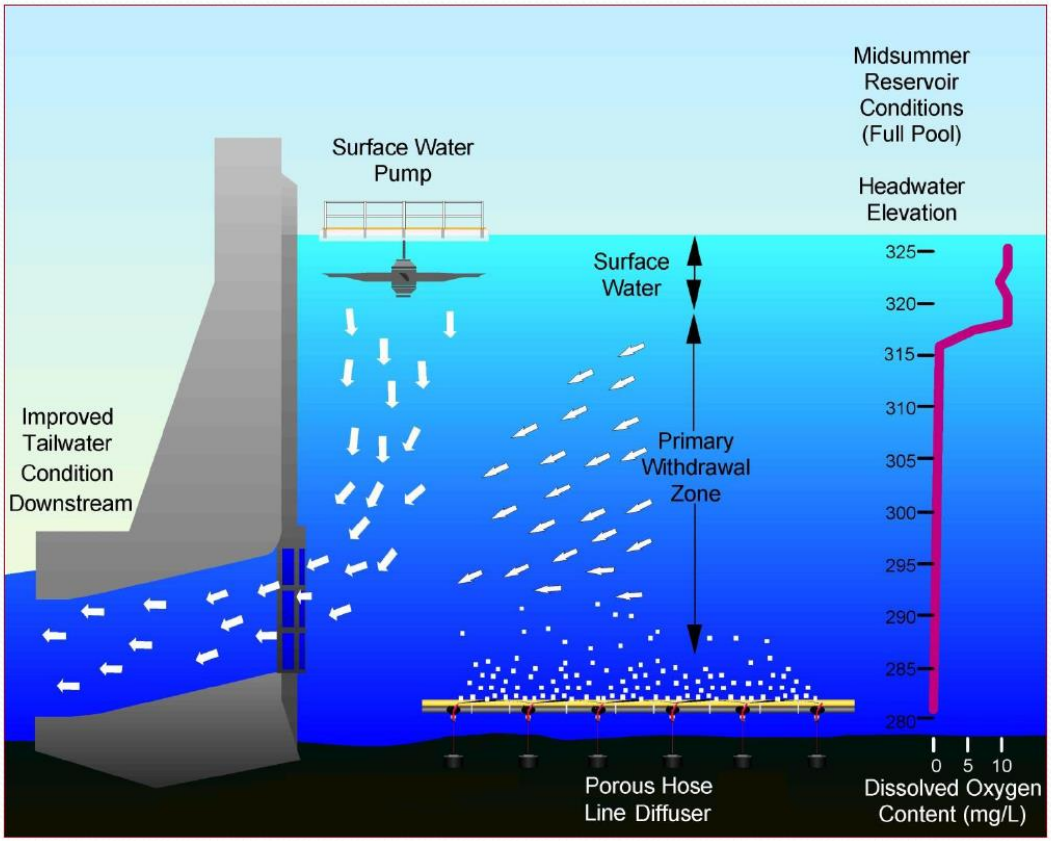
SEPA
SouthEastern Power Administration



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ALTERNATIVES CONSIDERED

No Action – Existing Condition

- Hub baffles and sluice/orifice gates
- Hub baffles add up to 1.5mg/L
- Loss of $800-870K power annually
- D.O. and temperature unchanged

Auto-Venting Turbines

- Used at Norris (TVA) and J. Strom Thurmond (JST)
- JST D.O. was 1.5-3.0 mg/l above baseline
- Not expected to substantially alter temperatures from baseline

Surface Pumps

- Cherokee and Douglas Dams (TVA)
- For WOL: 14 mixer units
- DO increase of 0.25 mg/l above baseline observed at Cherokee per mixer unit
- Increased water temperatures would be expected

Hypolimnetic Oxygen System

- Liquid Oxygen Supplied by Truck (Cherokee 80 tons/day)
- Due to higher cost TVA uses to top off after hub baffles / surface mixers
- D.O. improvement would vary based on amount of oxygen infused
- Not expected to substantially alter temperatures from baseline

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SUMMARY OF ALTERNATIVES

Technology (Design Life years)	D.O. Impacts (observed)	Temp. Impacts (estimated)	Estimated Capital Cost ($Million)	Estimated Average Annual O&M Cost	Estimated Total Annual Cost	NEPA Required EA/EIS
No Action	0	same	$ 0	minimal	$0.87M*	none
Auto-Venting Turbine (35)	1.5 -3.0 mg/l	minimal	$20M	minimal	$0.909M	EA
Surface Pumps (20)	0.25 mg/l per mixer	raise	$5M	$0.09M	$0.425M	EA/EIS
Oxygen Diffusers (20)	Dependent on amount of oxygen infused	minimal	$2.5M (120 tons/day)	$0.37M	$2.043M	EA

**Average Annual Cost to Hydro Due to Sluicing for D.O.: $.8M-.87M*

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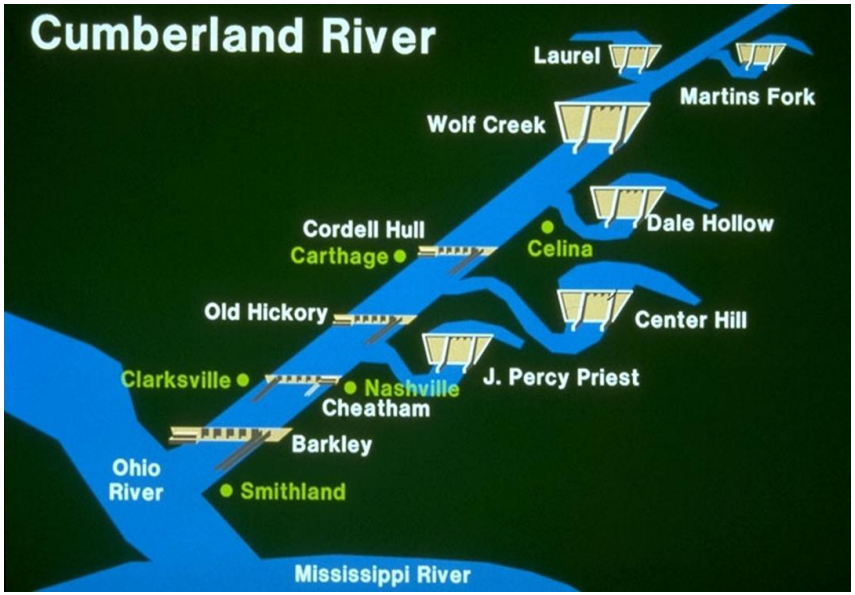
SYSTEM CONSIDERATIONS

Temperature:

- Balancing Trout & Native Mussels
  - Trout in WOL tailwater (some warming of reach)
  - Native (Listed) mussels reach d/s COR- ESA Compliance
- Cooling water for Gallatin

Discharge:

- Mainstem Flow: WOL (65%), DAL (15%), CEN (16%)
- Hydropower
- Navigation



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Questions

Tim Higgs, Chief, Environmental Section
615-736-7863
timothy.a.higgs@usace.army.mil

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