

# THE THREE RIVERS STUDY



*Photograph: Montgomery Point Lock and Dam at the confluence of the White and Mississippi Rivers*

## Tentatively Selected Plan Milestone Meeting

Little Rock District, Southwestern Division

30 January 2017

*"The views, opinions and findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy or decision, unless so designated by other official documentation."*



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# Study Progress to Date

Milestone	Date
Feasibility Cost Sharing Agreement Signed	30 JUN 2015
Alternatives Milestone	15 DEC 2015
Tentatively Selected Plan Milestone	30 JAN 2017
Agency Decision Milestone	18 MAY 2017
Division Engineer Transmittal	15 FEB 2018
Civil Works Review Board	27 MAR 2018
Chief's Report Signed	29 JUN 2018

On Schedule to be 3x3 compliant



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# BLUF

## Meeting Objective: Obtain Concurrence on the Tentatively Selected Plan

Alternative 1 - Containment Structure at Elevation 157 feet with a relief channel through the Historic Cutoff at elevation 145 feet

- Provides continued safe and reliable navigation
- Reduces risk of catastrophic breach
- Reduces costs for repairs and rehabilitation to maintain aging structures
- Does not change the hydrology of the surrounding bottomland hardwood ecosystem
- Provides increase in spawning and nursery habitat



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# Study Authority

Flood Control Act of 1970, Section 216 (Public Law 91-611).

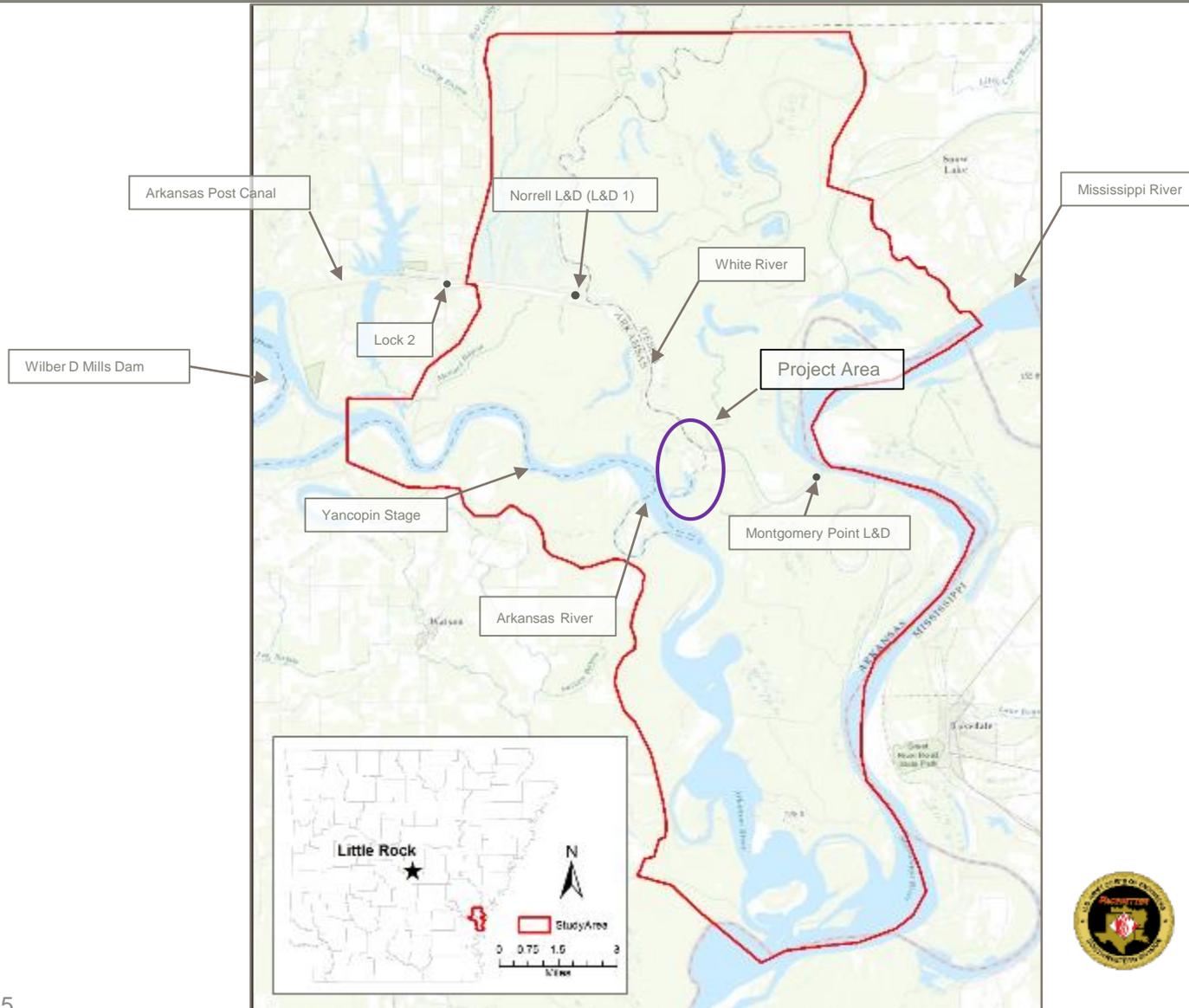
*"The Secretary of the Army, acting through the Chief of Engineers, is authorized to review the operation of projects the construction of which has been completed and which were constructed by the Corps of Engineers in the interest of navigation, flood control, water supply, and related purposes, when found advisable due to significantly changed physical or economic conditions, and to report thereon to Congress with recommendations on the advisability of modifying the structures or their operation, and for improving the quality of the environment in the overall public interest."*



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# Three Rivers Study Area



# Existing Conditions

- Study Area is vital for inland navigation and interstate commerce.
  - 77% (9.2M tons) cargo annually on the MKARNS flow through study area, valued at \$3B per year.
- Frequent High Water Events = differing water surface elevations (head differential) between the White River and Arkansas River
  - Scouring of land due to damaging high velocity flows that will lead to a catastrophic breach and loss of navigation on the MKARNS.
- Since 1990, \$23M (FY17 dollars) spent on repairing existing containment structures (average annual expenditure \$850k)
  - This is just OMRR&R, does not address catastrophic breach nor damage to the local ecosystem each time a repair is needed.



# Problems



# Study Objective

Provide safe and reliable navigation through the study area over the period of analysis

- Reduce risk breach
- Reduce dangerous cross currents
- Reduce impacts to BLH



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# Key Uncertainties

- **Risk:** The USFWS is required to issue a compatible use permit for construction on USFWS lands pursuant to the National Wildlife Refuge System Improvement Act of 1997, 16 U.S.C. 668dd-6689ee
  - The PDT has engaged in extensive on-going consultation with:
    - USFWS (from DBWRNWR and AES Field Office), AGFC, ANHC, etc.
    - TSP design provides ancillary ecosystem restoration benefits (i.e. the “net benefit gain” USFWS requires)
  
- **Risk:** Forgone cost savings per ton versus LCA \$15/ton from 2005 Arkansas River Navigation Study (indexed and maintained by PCXIN)
  - Awaiting results of new rate study to update Draft Report
  - Expect NO CHANGE in the TSP decision



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# Measures Considered and Screened Out

Measure	Reason for Screening Out
Long-term research and monitoring	Does not meet the study objective: will not reduce probability of breach.
Evaluate changes in Mississippi River	Not a feasible alternative due to large land requirements and cost.
Change water management to raise the Arkansas River stage in the study area.	Does not meet the study objective: will not reduce probability of breach.
Dam on the Arkansas River downstream of study area.	Violates Regulation #2 ADEQ Extraordinary Resource Body Designation and Candidate National Wild and Scenic River status.
Bank stabilization of Arkansas River	Does not meet the study objectives: will not reduce probability of breach.
Shorten stream distance on Arkansas River from Melinda to mouth of the river	Violates Regulation #2 ADEQ Extraordinary Resource Body Designation and Candidate National Wild and Scenic River status.
Abandon navigation	Does not meet the study objective: will not reduce probability of breach.
Open meanders on Arkansas	Violates Regulation #2 ADEQ Extraordinary Resource Body Designation and Candidate National Wild and Scenic River status.
Build a New Channel	Result in extensive environmental impacts without providing the relief for identified navigation problems

# Alternative Formulation

## Measures Carried Forward for Analysis

1. Raise existing containment structure;
2. Open Historic Cutoff;
3. Allow multiple flow paths (Historic Cutoff, Melinda/Owens, LaGrues);

## Design Criteria

1. Isthmus velocities
2. Hydraulic head differentials
3. Duration of head differentials
4. Location of overtopping
5. Change in hydrology in the surrounding BLH forest
6. Safe and reliable navigation



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# Alternatives

No Action: Continue repairs and replacement as needed

Alternative 1: Containment Structure at elevation 157 feet with opening at the Historic Cutoff at elevation 145 ft. The width of the opening will be determined during design

Alternative 2: Multiple Openings (Historic Cutoff, Melinda Corridor, J. Smith) elevation of openings will be determined during design



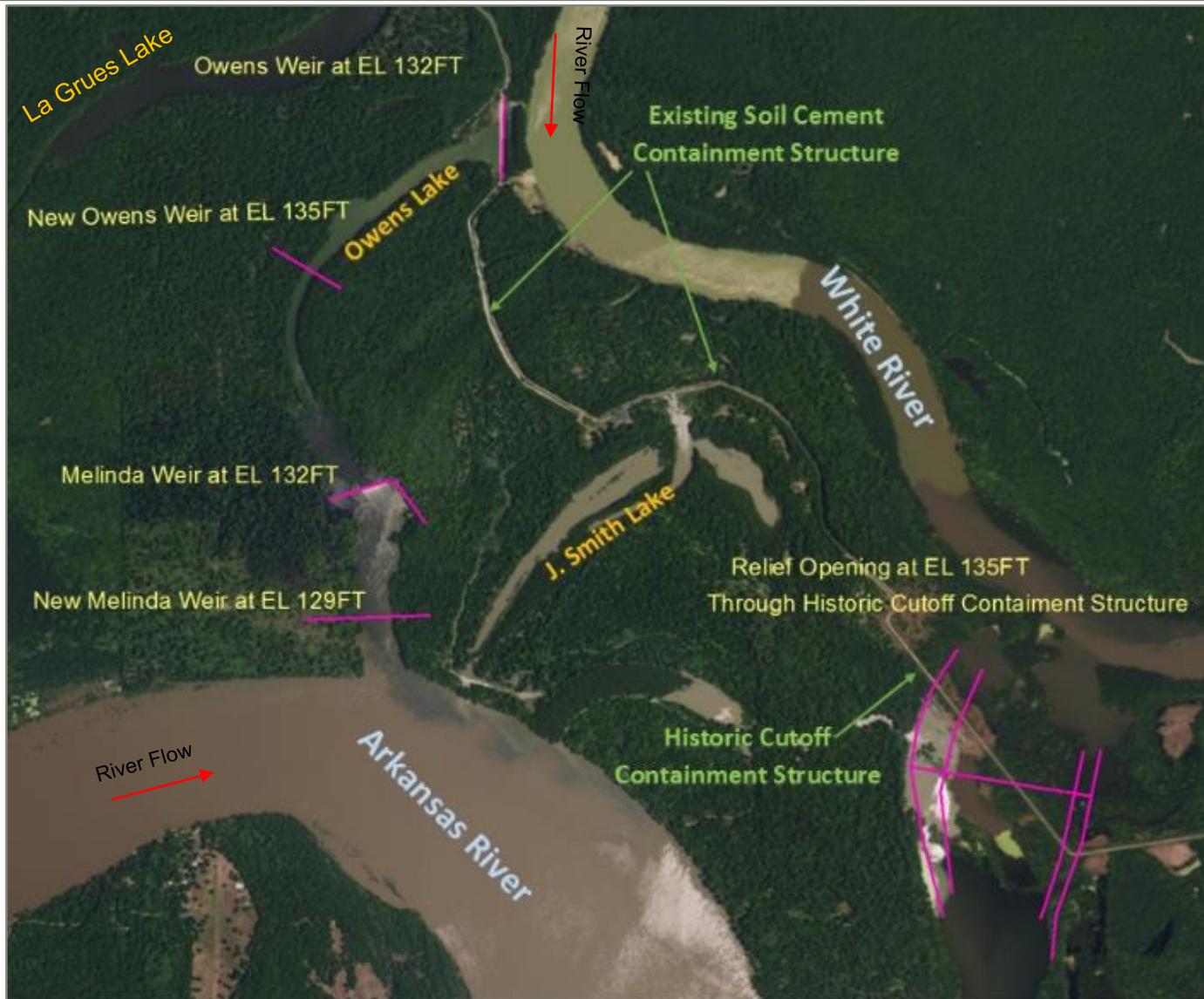
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# Alternative One



# Alternative Two



# Addressing the Criteria

Design Criteria	No Action	Alternative 1	Alternative 2
Overall Decrease in Isthmus Velocities			
Minimizes Hydraulic Head Differentials			
Minimizes Duration of Hydraulic Head Differentials			
Controls Location of Overtopping Events			
Maintains Current Hydrology in the BLH			
Safe & Reliable Navigation			

 Most Successful  
 Least Successful



# Future Without Project Condition No Action

- Costs independent of breach
  - Corps continues OMRR&R to reduce the risk of a breach
  - Corps reconstruct/rehabilitates existing containment structures as structural integrity decreases
  - New structures as head cuts progress
  
- Costs dependent on breach
  - Probability of breach
    - Expert elicitation and Bayesian statistical model
  - Costs of closing a breach
  - Increased dredging costs
  - Lost navigation benefits due to loss of MKARNS navigation
    - Traffic projections, shipper response to closure, and transportation costs savings



# No Action Analysis

## Costs Independent of Breach

- Corps continues OMRR&R as structures require
  - Since 1990 - \$23M, \$850,000 per annum average (FY17 prices levels)
- Future rehab and expand existing containment structures
  - Jim Smith and Melinda structures - Expect 2 each rehabs over period of analysis anticipated total cost of \$15M (FY17 price levels)
- Three new structures as head cuts progress
  - New Melinda, La Grues Lake South, and Future Jim Smith at a total cost of \$18M
- Costs model inputs include risk and uncertainty analysis
  - Probability distribution fitted to historical data and tested and ranked using goodness of fit tests (e.g., Chi-square, Bayesian, Kolmogorov-Smirnov)



# No Action Analysis Breach Consequences

- Expect 220 Days to repair - \$15M
  - Initially, channel will close for approx. 30 days due to high water
  - Estimate 110 days channel would be non-navigable. Closure days may not be consecutive
- Dredging costs
  - Sediment transfer from river to river – most likely from the Arkansas River to the White River
  - 1.5 million to 2.7 million cubic yards at a cost of about \$27 million
- Loss of commercial navigation
  - Generally, any unplanned closure greater than 30 days considered serious
  - For an extended closure, nearly 70 percent of shippers would shift to rail and truck
  - Reported increase in freight costs \$20 to \$100 per ton (average \$35)



# Breach Risk

- Estimated using historical frequency data and expert elicitation
- Experts provided probability of breach for magnitude and duration of different head differentials between two rivers
- Weighted by historical frequencies of head differentials and their duration
- Assumed structures were fully rehabilitated and repaired
- Probability increases as structures deteriorate over planning period and resets to initial condition after assumed rehabs
- Annual probability of breach ranges from about 1% to 30% (annual average of 7.4% over 50-year period)



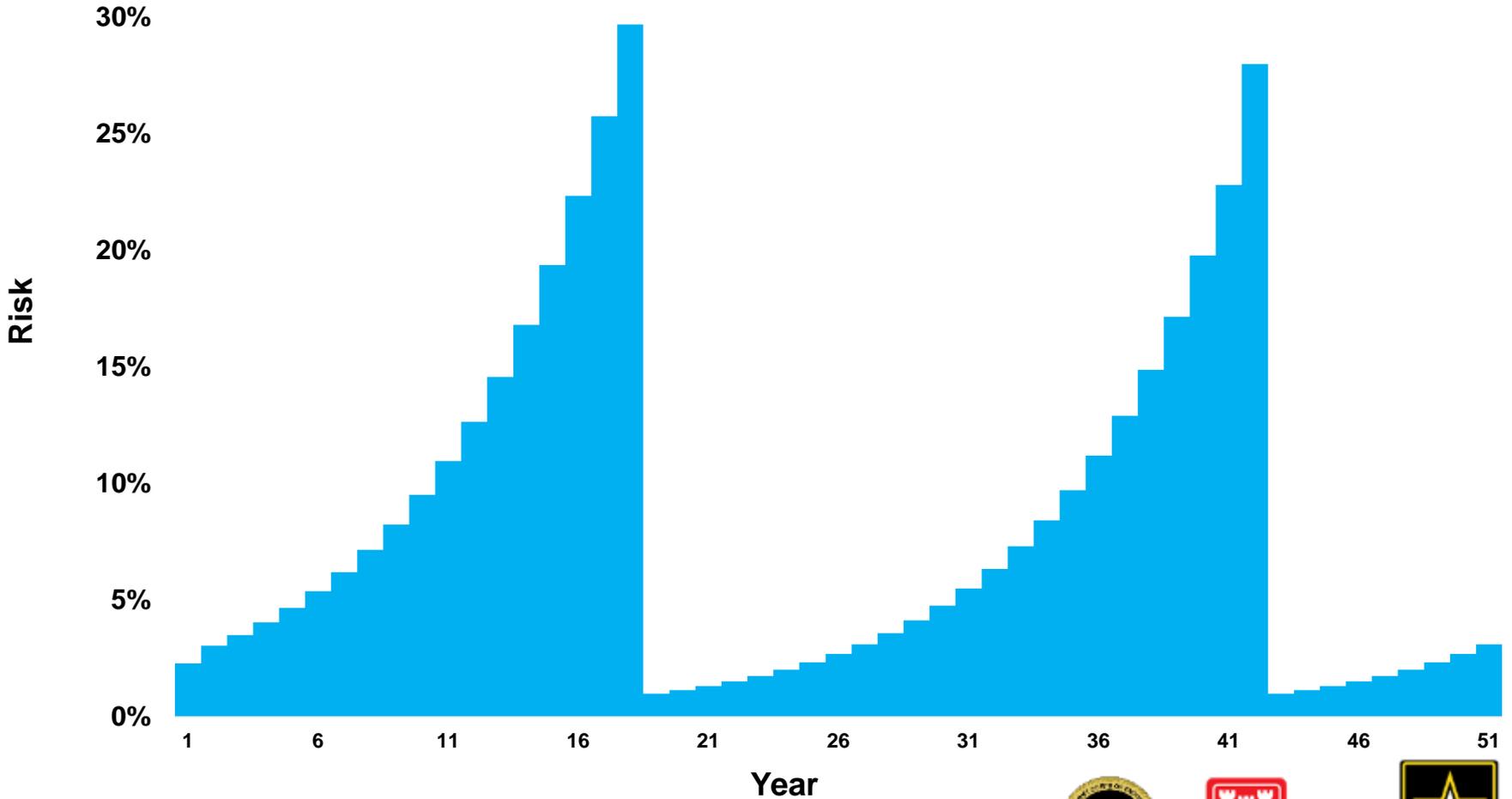
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# Annual Probability of Containment Structure Breach

Structure rehab 1

Structure rehab 2



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# Breach Consequences

## Key Assumptions

- During breach repair period 75 percent of commodities shift to Least Cost Alternative (LCA) route, 25 percent shipped on waterway during periods when navigation possible
- Forgone cost savings per ton versus LCA \$15 from 2005 Arkansas River Navigation Study (indexed and maintained by PCX)



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# Summary of Annualized Benefits

Non-breach costs	\$Millions
New structures	\$0.6
Rehabs and repairs	\$1.3
Breach costs	
Repairs and dredging	\$3.0
Lost transportation cost savings	\$6.5
Total	\$11.5



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# Cost & Benefit Comparison

Alternative 1	
Construction	\$86,000,000
Mitigation	\$200,000
Real Estate	\$300,000
Interest During Construction	\$7,417,000
Total Investment	\$93,917,000
Annual Costs:	
Interest	\$2,700,000
Amortization	\$864,000
Operation & Maintenance	\$348,000
Total Annual Costs	\$3,912,000
Annual Benefits:	
Cost Savings	\$11,000,000
BCR	2.8
Net Benefits	\$7,088,000

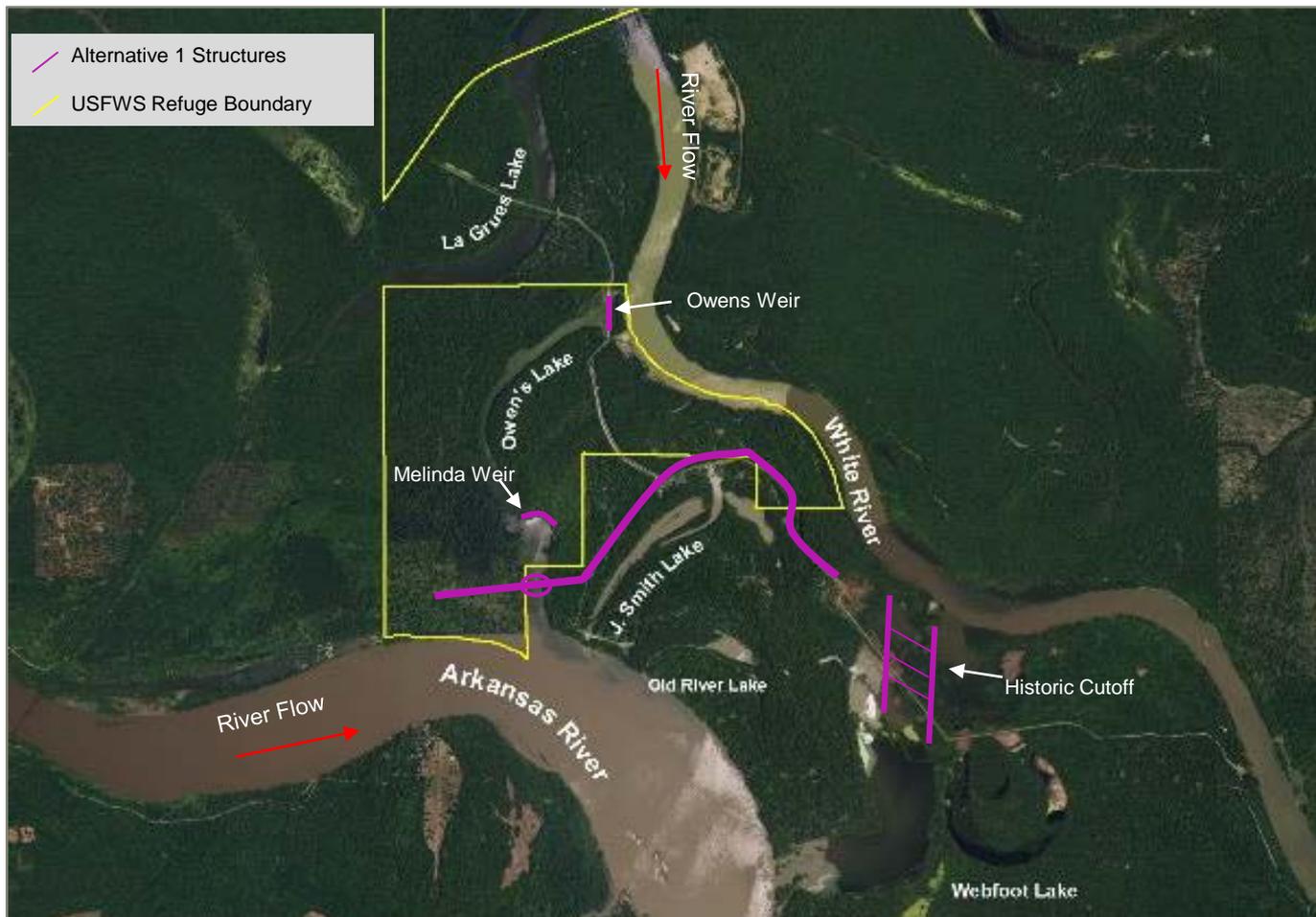
Alternative 2	
Construction	\$143,000,000
Mitigation	\$200,000
Real Estate	\$300,000
Interest During Construction	\$12,333,000
Total Investment	\$155,833,000
Annual Costs:	
Interest	\$4,480,000
Amortization	\$1,433,000
Operation & Maintenance	\$579,000
Total Annual Costs	\$6,493,000
Annual Benefits:	
Cost Savings	\$11,000,000
BCR	1.7
Net Benefits	\$4,506,000

Assumes 3 years for construction and 2.875% interest rate for both Alternatives

# Tentatively Selected Plan

## ALTERNATIVE 1

Containment Structure at Elevation 157 feet with a relief channel through



# Tentatively Selected Plan

## Environmental Benefits

- Reconnection of Owens Lake
  - Removal of Melinda Weir allows reconnection of both halves of the oxbow lake
  - Increased spawning and nursery habitat for fish
  
- Opening the Historic Cutoff will Prevent Webfoot Lake Headcut Progression
  - Prevent loss of bottomland hardwood due to head cutting
  - Prevent aquatic habitat degradation



# Mitigation

- Identified 25 acres of long term impacts from construction.
- Used HGM modeling to determine mitigation requirements  
- 4 FCUs
- No Action results in loss of 156 ac of BLH due to scouring and new construction ( - 121 FCUs)
- Environmental Team has determined there are sufficient areas in or near the study area to meet the mitigation requirements.



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# Environmental Compliance

- Resource agency support
  - Significant state and federal agency coordination has resulted in agency support for TSP.
- USFWS Coordination
  - Planning Aid Letter received Nov. 10, 2015.
  - FWS aware that CAR is due after TSP.
  - Biological evaluation complete
- NEPA -- Integrated Report
  - None of the criteria for an EIS are met (ER 200-2-2).
  - Propose shifting from EIS to EA.
    - VT, FWS and Arkansas Game and Fish Commission concur.
- Cultural Resources
  - SHPO and Tribal coordination on-going



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# Schedule to Completion

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# Questions?



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Alternative	Risk of Failure
Alt 2A (Gated Structure) - Restores natural hydrology in historic cut-off	0.31%
Alt 2B (Passive Weir) - Restores natural hydrology in historic cut-off	0.32%
Alt 6A - Raise Owens lake structure and soil cement dike to 155	0.32%
Alt 6B - Raise Owens lake structure and soil cement dike to 160	0.53%
Alt 6 (153) - Raise Owens lake structure and soil cement dike to 153	1.14%
Alt 6 (157) - Raise Owens lake structure and soil cement dike to 157	0.08%
<b>Average</b>	<b>0.45%</b>



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