


## LESSONS LEARNED FROM A BENEFIT-COST ANALYSIS OF DAM OWNERSHIP

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## A G E N D A

- Overview of Fort Hood Dam Safety Program
- Dam Costs/Dam Benefits
- Hydraulic Analysis
- Economic Analysis
- Lessons Learned





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## F O R T H O O D O V E R V I E W

- On Post Population = 62,000+
- Total Area = 342 square miles
- \$35+ Billion economic impact on Texas economy


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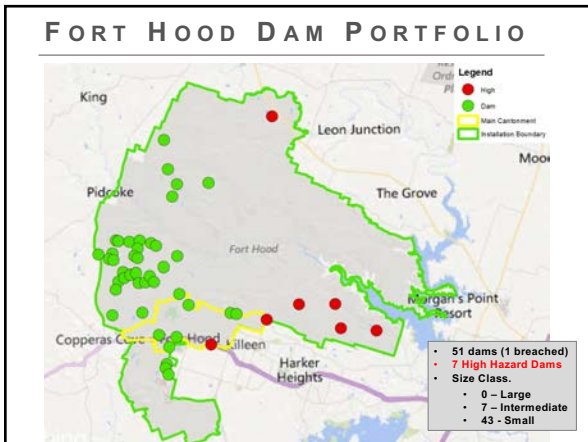
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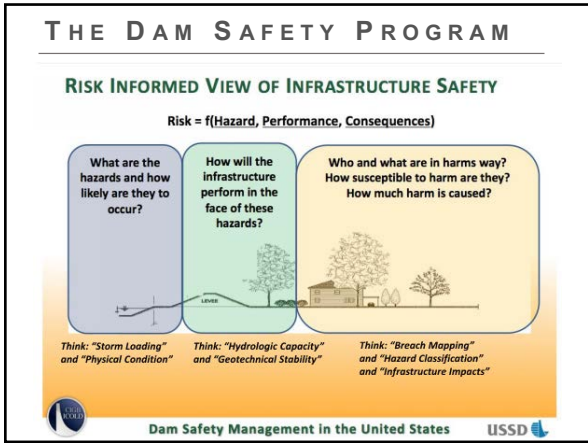
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### HAZARD CLASSIFICATIONS

Hazard Classification	Federal – Army (DA PAM 420-1-3)	State – TCEQ (TAC Chpt. 299)
Low Hazard	No loss of human life (PAR = 0) Low economic losses Low environmental losses	No loss of human life (PAR=0) Minimal economic loss Damage to minor highways
Significant Hazard	No loss of human life (PAR = 0) Some economic loss Some environmental damage Disruption of lifeline facilities	Loss of human life (PAR<6) Appreciable economic loss Damage to secondary highways Damage to public utilities
High Hazard	Loss of human life (PAR > 0)	Loss of human life (PAR>6) Serious economic loss Damage to main highways

TEXAS COMMISSION  
ON ENVIRONMENTAL QUALITY

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## DAM OWNERSHIP COSTS

- Regular Inspection
- Emergency Action Plans
- Engineering Analysis
- Standard Operating Plans
- O&M Plans
- Mowing/Vegetation Control
- Structural Upgrades
- Instrumentation



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## DAM BENEFITS

- Water Supply
- Sedimentation & Erosion
- Recreation
- Fish and Wildlife
- **Flood Control**

Less Obvious  
Harder to Quantify



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Bringing High Hazard Dams into Compliance

Evaluate Impact to Downstream Communities

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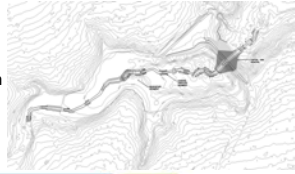
## DESIGNS TO BRING DAMS INTO COMPLIANCE

### Rehabilitate

- Raising Embankment
- Add Parapet Wall
- Lower Spillway
- Increase size of Principal Spillway
- Clear trees & blockage from spillways

### Decommission

- Design Stable Channel including cut into dam embankment



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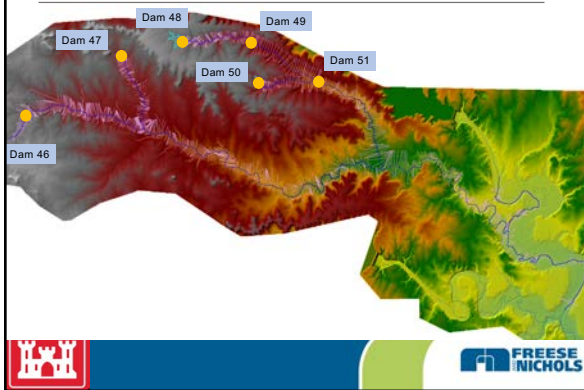
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## H & H ANALYSIS



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## H & H ANALYSIS

Modeled Scenario	Dams					
	46	47	48	49	50	51
Without Project: Decommission	Decom	Decom	Decom	Decom	Decom	Decom
Existing	Existing	Existing	Existing	Existing	Existing	Existing
Scenario01	Rehab	Rehab	Decom	Rehab	Existing	Rehab
Scenario02	Rehab	Rehab	Decom	Decom	Existing	Rehab
Scenario03	Rehab	Rehab	Rehab	Rehab	Decom	Rehab
Scenario04	Rehab	Rehab	Decom	Decom	Decom	Rehab
Scenario05	Rehab	Rehab	Rehab	Rehab	Existing	Decom
Scenario06	Rehab	Rehab	Rehab	Decom	Existing	Rehab
Scenario07	Rehab	Decom	Rehab	Rehab	Existing	Rehab
Scenario08	Decom	Rehab	Rehab	Rehab	Existing	Rehab
Scenario09	Rehab	Rehab	Rehab	Rehab	Existing	Rehab
Scenario10	Rehab	Existing	Rehab	Rehab	Existing	Rehab
Scenario11	Rehab	Rehab	Rehab	Rehab	Existing	Existing



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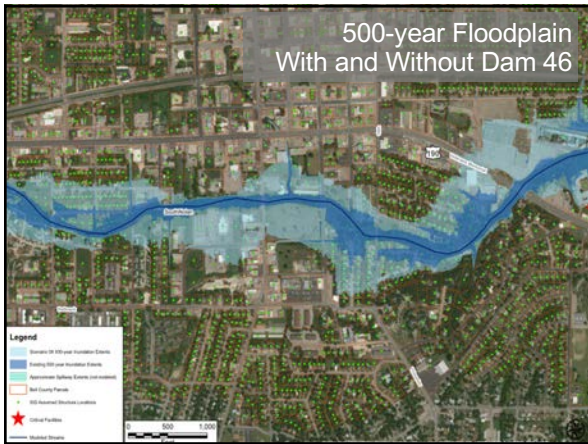
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## ECONOMIC ANALYSIS

Components of HEC-FDA ➔ EAD(\$)

- Modeled Water Surface Profiles
  - Obtained from HEC-RAS
- Exceedance Probability Functions
  - Assign weighted probability to WSE by reach and therefore associated damage
- ***STRUCTURE INVENTORY DATABASE***
  - All structures subject to damage and pertinent details: value, FFE, etc.
- Content-to-Structure Value Ratio (CSVR)
  - Value of content based on structure value; assigned according to type of structure
- Stage – Damage Curve (Structure and Content)
  - Damage to the structure or content calculated as a percentage of total value and based on the depth of water within the structure

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## ECONOMIC ANALYSIS

Structure Inventory

Individual Structure: 502

Structure Value (\$1,000s): 6212.000

Content Value (\$1,000s): 6212.000

Other Value (\$1,000s):

Damage Category: 55

Occupancy Type: 51

1 of 1108

Structure Stages

Ground Stage

Freese Nichols

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## ECONOMIC ANALYSIS

Depth-Percent Damage Plot

Structure Occupancy Type: 55

Define Depth-Percent Damage Function

Content to Structure Value Ratio (percent):

Other to Structure Value Ratio (percent):

Define Uncertainty Parameters

Depth (ft.)

Damage (Percent)

Median Damage +2.50 +1.50 +1.00 +3.00

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## ECONOMIC ANALYSIS RESULTS

Plan Name	Equivalent Annual Damages (With Uncertainty) in Thousands of \$		
	Total Without Project	Total With Project	Damages Reduced
Without Project: Decommission	\$2,647	\$2,647	\$0
Existing	\$2,647	\$1,523	\$1,124
Scenario01	\$2,647	\$1,610	\$1,038
Scenario02	\$2,647	\$1,627	\$1,021
Scenario03	\$2,647	\$1,606	\$1,041
Scenario04	\$2,647	\$1,624	\$1,023
Scenario05	\$2,647	\$1,787	\$860
Scenario06	\$2,647	\$1,626	\$1,022
Scenario07	\$2,647	\$1,773	\$875
Scenario08	\$2,647	\$2,075	\$573
Scenario09	\$2,647	\$1,608	\$1,040
Scenario10	\$2,647	\$1,591	\$1,056
Scenario11	\$2,647	\$1,582	\$1,066

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## MAJOR PROJECT FINDINGS




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## ADDITIONAL ANALYSIS

Crossing Information		Annual Exceedance Probability Event that Overtops Crossing										
River	Name	Existing	Scenario01	Scenario02	Scenario03	Scenario04	Scenario05	Scenario06	Scenario07	Scenario08	Scenario09	Decommissioned
Loughbranch	Wendell Rd	2-yr	2-yr	2-yr	2-yr	2-yr	2-yr	2-yr	2-yr	2-yr	2-yr	2-yr
Loughbranch	Tripp Trail	250-yr	25-yr	25-yr	50-yr	25-yr	25-yr	25-yr	2-yr	25-yr	25-yr	2-yr
Loughbranch	N 30th St	10-yr	5-yr	5-yr	5-yr	5-yr	5-yr	5-yr	2-yr	5-yr	5-yr	2-yr
Loughbranch	Lake Rd	> 500-yr	500-yr	500-yr	> 500-yr	250-yr	500-yr	250-yr	25-yr	250-yr	250-yr	25-yr
Loughbranch	Lake Inks Ave	2-yr	2-yr	2-yr	> 500-yr	2-yr	2-yr	2-yr	2-yr	2-yr	2-yr	2-yr
Loughbranch	E Rancier Ave	100-yr	100-yr	100-yr	250-yr	100-yr	100-yr	100-yr	10-yr	100-yr	100-yr	10-yr
Nolan	H 117	500-yr	500-yr	500-yr	500-yr	500-yr	500-yr	500-yr	500-yr	500-yr	500-yr	250-yr
Nolan	Penelope St	500-yr	500-yr	500-yr	500-yr	500-yr	500-yr	500-yr	500-yr	500-yr	> 500-yr	250-yr
Nolan	H 35 Frontage Rd	2-yr	2-yr	2-yr	2-yr	2-yr	2-yr	2-yr	2-yr	2-yr	2-yr	2-yr
Nolan	H 35	> 500-yr	> 500-yr	500-yr	> 500-yr	> 500-yr	500-yr	500-yr	500-yr	> 500-yr	> 500-yr	250-yr
Nolan	H 35 Frontage Rd	2-yr	2-yr	2-yr	2-yr	2-yr	2-yr	2-yr	2-yr	2-yr	2-yr	2-yr

\*Selection from reported table



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## ADDITIONAL ANALYSIS



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## ADDITIONAL CONSIDERATIONS

The true cost of decommissioning extends beyond the economics

- Avoiding damage – facilitating buyout program; raising road crossings
- Conducting a Physical Map Revision, Coordinating with FEMA and local Floodplain Manager
- Impacts to people

Bottom line: **Decommissioning is not low cost**



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## HOW DOES THIS IMPACT THE DAM SAFETY PROGRAM?

	Higher Benefit <b>Category A</b>	Lower Benefit <b>Category C</b>
Higher Risk (Persons-at-Risk, Infrastructure, Loss of Function) ↑	<ul style="list-style-type: none"> <li>• Rehabilitate/upgrade to current dam safety standards</li> <li>• Continue O&amp;M activities</li> <li>• Continue investment</li> <li>• Examples:             <ul style="list-style-type: none"> <li>○ Dam 46</li> <li>○ Dam 47</li> <li>○ Dam 49</li> <li>○ Dam 51</li> </ul> </li> </ul> <p style="text-align: center;"><b>Focus Investment</b></p>	<ul style="list-style-type: none"> <li>• Intentional breach and/or decommission</li> <li>• Actively remove risk</li> <li>• Consider discontinuance of O&amp;M activities</li> <li>• Consider stop investment</li> <li>• Examples:             <ul style="list-style-type: none"> <li>○ Dam 43</li> </ul> </li> </ul>
Lower Risk (Persons-at-Risk, Infrastructure, Loss of Function)	<ul style="list-style-type: none"> <li>• Perform repairs to restore original intended design condition</li> <li>• Continue O&amp;M activities</li> <li>• Continue investment</li> <li>• Will need to consider end-of-life costs, such as dredging or decommissioning for sediment control structures</li> <li>• Examples:             <ul style="list-style-type: none"> <li>○ Dam 07 through Dam 31</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Discontinue O&amp;M activities</li> <li>• Stop investment</li> <li>• Abandon or allow natural breach to occur</li> <li>• Alternative would be to consider intentional breach and/or decommission</li> <li>• Examples:             <ul style="list-style-type: none"> <li>○ Dam 40</li> <li>○ Dam 04</li> </ul> </li> </ul> <p style="text-align: center;"><b>Stop Investment/Decommission</b></p>

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## LESSONS LEARNED

1. **Defining** not just the **original intended purpose** of the dam, but the **current roles** that it plays is important to understanding the dam benefits
2. **Important to consider dams as assets, not just liabilities.** Benefits can be quantified and communicated to justify further investment or decommissioning
3. Maintaining a comprehensive GIS database allows for **effective asset management**

★ **GOAL: Informed Decision-making** ★



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## QUESTIONS ?

### Kenneth (Lynn) Schaub

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## THE NEED FOR SAFETY

### Texas floods: 9 soldiers killed in Fort Hood accident

By Ralph Ellis, Steven Visser and Faith Karimi, CNN  
Updated 1:44 PM ET, Sun June 5, 2016



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