Franklin County Water District



Preliminary Engineering Report (PER)

Flood Relief Project Alternatives

3/6/2017

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Lake Cypress Springs

900



2723

ake:Cypress_Spring

3122

SAN

LCS DAM

Lake Cypress Springs Spillway



December 2015 Event (383.92')











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Data Gathering for Analysis – Online Survey

Costs	
Total Structural Damage Cost	\$571,642.00
Average Total Structural Cost	\$38,169.14
Total Boathouse Damage Cost	\$303,144.50
Average Boathouse Damage Cost	\$7,496.16
Total Retaining Wall Damage Cost	\$64,561.00
Average Retaining Wall Damage Cost	\$3,397.95
Total Other Damage Cost	\$460,977.65
Average Other Damage Cost	\$14,634.57
TOTAL DAMAGE COST	~\$1,500,000

Data Gathering for Analysis – Online Survey

Percentage of Total Damage Cost



Data Gathering for Analysis - Samples



Evaluated Alternatives

- 1. Addition of canal on emergency spillway
- 2. Addition of box culverts on north end of Lake Cypress Springs Dam (LCS)
- Add tainter gates to LCS dam (comparable to Lake Bob Sandlin (LBS))
- 4. Add pump station at north end of LCS

Dam

- **5.** Additional morning glory spillway
- 6. Operational Alternative









Building a Secondary Morning Glory



Additional Canal



Canal Section

NATURAL CANALS



CONCRETE LINED



Crossing Section

CAST-IN PLACE CULVERTS

> LOW PROFILE CULVERTS

71- 14

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BRIDGES

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LOW WATER CROSSINGS

Box Culverts



Building a Tainter Gate System



Response from the Public



5 Task Hurdles / 3 Sub-Alternatives

Task Hurdle								
Hydraulic Feasibility	Federal / State Agency Approval is Feasible	Local Agency Approval (Downstream Stakeholders) is Feasible	Cost Feasibility	Minimal Impact to Water Supply				
-								

Sub-Alternative Identification

Sub-Alternatives					
Sub-Alternative A	Sub-Alternative B	Sub-Alternative C			
100-Yr Flood Event	350-Yr Flood Event (December 2015 Event)	500-Yr Flood Event			
Max Water Surface Elevation 381.00 msl	Max Water Surface Elevation 381.00 msl	Max Water Surface Elevation 381.00 msl			

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Alternatives Matrix

		Task Hurdle					
				Local Agency			
			Federal /	Approval		M	inimal
			State Agency	(Downstream		Im	pact to
	Нус	draulic	Approval is	Stakeholders)	Cost	V	Vater
Alternative	Fea	sibility	Feasible	is Feasible	Feasibility	S	upply
1A							
1B							
1C				Legend			
2A			Carollo predicts	FCWD's ability to	hurdle the tas	sk is	
2B			feasible for speci	ific alternative.			
2C		Carollo predicts FCWD's ability to hurdle the task is					
3A		feasible, however, cost feasibility and funding					
3B			options will be determined by the FCWD available				
3C		1	funds and policy	decisions.			
6A			Carollo predicts	FCWD would not	be able to hu	rdle	
6B			× the requirements for a specific alternative.				
6C			Feasibility of accomplishment is deemed low.				
6D							
6E							

Local Agency Approval (All Alternatives)

Task Hurdle						
Hydraulic Feasibility	Federal / State Agency Approval is Feasible	Local Agency Approval (Downstream Stakeholders) is Feasible	Cost Feasibility	Minimal Impact to Water Supply		

Local Agency Approval (Downstream Stakeholders) is Feasible						
Agency Owner		Request	Approximate Cost			
Titus County Fresh Water Supply District TCFWSD	Lake Bob Sandlin	H&H Analysis for Downstream Impacts	~250K			
North East Texas Municipal Water District NETMWD	Lake of the Pines	Water Quality Assessment	~85K			

Alternatives Matrix

	Task Hurdle					
			Local Agency			
		Federal /	Approval		Minimal	
		State Agency	(Downstream		Impact to	
	Hydraulic	Approval is	Stakeholders)	Cost	Water	
Alternative	Feasibility	Feasible	is Feasible	Feasibility	Supply	
1A			\checkmark			
1B			\checkmark			
1C			\checkmark			
2A			\checkmark			
2B			\checkmark			
2C			\checkmark			
3A			\checkmark			
3B			\checkmark			
3C			\checkmark			
6A			\checkmark			
6B			\checkmark			
6C			\checkmark			
6D			\checkmark			
6E			\checkmark			

Alternatives Matrix

	Task Hurdle					
			Local Agency			
		Federal /	Approval		Minimal	
		State Agency	(Downstream		Impact to	
	Hydraulic	Approval is	Stakeholders)	Cost	Water	
Alternative	Feasibility	Feasible	is Feasible	Feasibility	Supply	
1A			\checkmark		\checkmark	
1B			\checkmark		\checkmark	
1C			\checkmark		\checkmark	
2A			\checkmark		\checkmark	
2B			\checkmark		\checkmark	
2C			\checkmark		\checkmark	
3A			\checkmark		\checkmark	
3B			\checkmark		\checkmark	
3C			\checkmark		\checkmark	
6A			\checkmark			
6B			\checkmark			
6C			\checkmark			
6D			\checkmark			
6E			✓			

Additional Canal



Hydraulic Feasibility

Task Hurdle					
Hydraulic Feasibility	Federal / State Agency Approval is Feasible	Local Agency Approval (Downstream Stakeholders) is Feasible	Cost Feasibility	Minimal Impact to Water Supply	

			1 - STR	UCTURAL ALTERN	ATIVES
			Alternative 1A	Alternative 1B	Alternative 1C
		Revised	100-YR	350-YR	500-YR
Rain Event	Probability	Conditions	71 culverts*	203 culverts*	243 culverts*
2-year	0.50000	379.1	378.9	378.8	378.7
5-year	0.20000	379.5	379.2	379.0	379.0
10-year	0.10000	379.9	379.6	379.3	379.2
25-year	0.04000	380.5	379.9	379.6	379.5
50-year	0.02000	381.3	380.5	379.9	379.8
100-year	0.01000	382.3	381.0	380.3	380.1
350-Year	0.00285	384.7	382.1	381.0	380.9
500-Year	0.00200	384.9	382.4	381.3	381.0

* 1 Culvert = 10' Wide X 4' Tall Box Pipe

Federal Agency Approval

Task Hurdle						
Hydraulic Feasibility	Federal / State Agency Approval is Feasible	Local Agency Approval (Downstream Stakeholders) is Feasible		Cost Feasibility	Minim Impact Water Su	al to ipply
LBS			Cross Section Alternative	Capacity of Cross Section Maximum Discharge of A / 1C Alternative 1C Alternative 1B Alternative 1A CS3	ons Compared wi Alternatives 1A /	th 1B CS4
Maximu	ım Area (SF) Availab for Discharge	le	0	100,000 200,000 3 CFS Capacity (Cross (Alter	300,000 400,000 Section) or Discharg matives)	500,000 ge

USACE Permit Process State and Federal Regulation





- EPA U.S. Environmental Protection Agency
- USFWS U.S. Fish and Wildlife Service
- **TPWD** Texas Parks and Wildlife Department
- NMFS National Marine Fisheries Services
- **TxDOT** Texas Department of Transportation
- **HUD** U.S. Department of Housing and Urban Development
- BOR Bureau of Reclamation
- SHPO State Historic Preservation Office
- **TCEQ** Texas Commission on Environmental Quality
- TCH Texas Historical Commission

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Cost Feasibility

Task Hurdle					
Hydraulic Feasibility	Federal / State Agency Approval is Feasible	Local Agency Approval (Downstream Stakeholders) is Feasible	Cost Feasibility	Minimal Impact to Water Supply	

		ALTERNATIVE 1						
ITEM CATEGORIES		1A		1B			1C	
Startup and SW3P Items		\$642,526		\$1,788,644			\$2,136,139	
Canal Items	\$7,174,574			\$20,501,685		\$24,540,203		
Road Crossing Items	\$11,295,307			\$31,346,107			\$37,422,107	
Closeout and Other Items		\$2,570,000		\$7,190,000			\$8,590,000	
Design Fees		\$3,734,861		Ç	9,225,048		\$	11,021,624
Contingency	20%	\$5,083,454		20%	\$14,010,297		20%	\$16,742,015
OPCC TOTAL COST	\$30),501,000		\$84	,062,000		\$10	0,452,000

Alternatives Matrix

		Task Hurdle						
			Local Agency					
		Federal /	Approval		Minimal			
		State Agency	(Downstream		Impact to			
	Hydraulic	Approval is	Stakeholders)	Cost	Water			
Alternative	Feasibility	Feasible	is Feasible	Feasibility	Supply			
1A	×	×	\checkmark	×	\checkmark			
1B	×	×	\checkmark	×	\checkmark			
1C	×	×	\checkmark	×	\checkmark			
2A			\checkmark		\checkmark			
2B			\checkmark		\checkmark			
2C			\checkmark		\checkmark			
3A			\checkmark		\checkmark			
3B			\checkmark		\checkmark			
3C			\checkmark		\checkmark			
6A			\checkmark					
6B			✓					
6C			\checkmark					
6D			\checkmark					
6E			\checkmark					

Box Culverts



Hydraulic Feasibility

		Task Hurdle		
Hydraulic Feasibility	Federal / State Agency Approval is Feasible	Local Agency Approval (Downstream Stakeholders) is Feasible	Cost Feasibility	Minimal Impact to Water Supply

			2 - STR	UCTURAL ALTERN	ATIVES
			Alternative 2A	Alternative 2B	Alternative 2C
		Revised	100-YR	350-YR	500-YR
Rain Event	Probability	Conditions	72 culverts*	204 culverts*	244 culverts*
2-year	0.50000	379.1	378.9	378.8	378.7
5-year	0.20000	379.5	379.2	379.0	379.0
10-year	0.10000	379.9	379.6	379.3	379.2
25-year	0.04000	380.5	379.9	379.6	379.5
50-year	0.02000	381.3	380.5	379.9	379.8
100-year	0.01000	382.3	381.0	380.3	380.1
350-Year	0.00285	384.7	382.1	381.0	380.9
500-Year	0.00200	384.9	382.4	381.3	381.0

* 1 Culvert = 10' Wide X 10' Tall Box Pipe

Federal/State Agency Approval

	Task Hurdle							
Hydraulic Feasibility	Federal / State Agency Approval is Feasible	Local Agency Approval (Downstream Stakeholders) is Feasible	Cost Feasibility	Minimal Impact to Water Supply				

- Threatened and Endangered Species
- Jurisdictional Waters and Adjacent Wetlands
 - Roadway Concerns (FM3007)



Cost Feasibility

	Task Hurdle							
Hydraulic Feasibility	Federal / State Agency Approval is Feasible	Local Agency Approval (Downstream Stakeholders) is Feasible	Cost Feasibility	Minimal Impact to Water Supply				

		ALTERNATIVE 2						
ITEM CATEGORIES		2A		2B			2C	
Startup and SW3P Items		\$485,259		\$1,173,943		\$1,381,980		\$1,381,980
Emergency Spillway Items		\$349,885		\$349,885		\$349,885		\$349,885
Dam Crossing Items	\$12,142,763			\$33,366,896			\$39,798,452	
Closeout and Other Items		\$3,305,000		\$4,625,000		\$5,025,000		
Design Fees		\$2,924,936			\$5,928,285			\$6,984,224
Contingency	20%	\$3,841,569		20%	\$9,088,802		20%	\$10,707,908
OPCC TOTAL COST	\$23,049,000			\$54	,533,000		\$64	1,247,000

Alternatives Matrix

			Task Hurdle	_	
			Local Agency		
		Federal /	Approval		Minimal
		State Agency	(Downstream		Impact to
	Hydraulic	Approval is	Stakeholders)	Cost	Water
Alternative	Feasibility	Feasible	is Feasible	Feasibility	Supply
1A	×	×	\checkmark	×	\checkmark
1B	×	×	\checkmark	×	\checkmark
1C	×	×	\checkmark	×	\checkmark
2A	×	\checkmark	\checkmark	×	\checkmark
2B	×	\checkmark	\checkmark	×	\checkmark
2C	×	\checkmark	\checkmark	×	\checkmark
3A			\checkmark		\checkmark
3B			\checkmark		\checkmark
3C			\checkmark		\checkmark
6A			\checkmark		
6B			\checkmark		
6C			\checkmark		
6D			\checkmark		
6E			✓		

Building a Tainter Gate System



Hydraulic Feasibility

Task Hurdle								
Hydraulic Feasibility	Federal / State Agency Approval is Feasible	Local Agency Approval (Downstream Stakeholders) is Feasible	Cost Feasibility	Minimal Impact to Water Supply				

			3 - STRUCTURAL ALTERNATIVES				
			Alternative 3A	Alternative 3B	Alternative 3C		
		Revised	100-YR	350-YR	500-YR		
Rain Event	Probability	Conditions	1 gates	2 gates	3 gates		
2-year	0.50000	379.1	378.0	378.0	378.0		
5-year	0.20000	379.5	378.0	378.0	378.0		
10-year	0.10000	379.9	378.3	378.0	378.0		
25-year	0.04000	380.5	378.6	378.0	378.0		
50-year	0.02000	381.3	379.1	378.0	378.0		
100-year	0.01000	382.3	379.7	378.4	378.0		
350-Year	0.00285	384.7	381.1	379.4	378.4		
500-Year	0.00200	384.9	381.5	379.6	378.6		

Hydraulic Feasibility

		Task Hurdle		
Minimal Impact to Water Supply	Cost Feasibility	Local Agency Approval (Downstream Stakeholders) is Feasible	Federal / State Agency Approval is Feasible	Hydraulic Feasibility
		tion Carollo	Previous Loca Presented by (
		hift in	Recommended	
		hift in	Recommended S Location	

Cost Feasibility

	Federal / State	Task Hurdle Local Agency		Minimal
Hydraulic Feasibility	Agency Approval is Feasible	Approval (Downstream Stakeholders) is Feasible	Cost Feasibility	Impact to Water Supply

	ALTERNATIVE 3							
ITEM CATEGORIES	3A			3B			3C	
Mobilization	\$120,400			\$154,800] [\$197,800	
Structure Costs	\$14,439,975			\$18,973,300] [\$23,906,625	
Closeout and Other Items		\$2,236,474		\$2,938,076] [\$3,702,440	
Design Fees		\$3,027,027		Ċ	\$3,817,426] [Ċ	\$3,702,440
Contingency	20%	20% \$3,964,775		20%	\$5,176,721		20%	\$6,497,079
OPCC TOTAL COST	\$23,789,000			\$31,060,000			\$38	8,982,000

Alternatives Matrix

	Task Hurdle						
				Local Agency			
			Federal /	Approval		Minimal	
			State Agency	(Downstream		Impact to	
	Hyd	raulic	Approval is	Stakeholders)	Cost	Water	
Alternative	Feas	ibility	Feasible	is Feasible	Feasibility	Supply	
1A		×	×	\checkmark	×	√	
1B				Legend		√	
10		(Carollo predicts	FCWD's ability to	hurdle the ta	sk is 🖌	
2A		✓ * [†]	feasible, however, cost feasibility and funding options will be determined by the FCWD available				
2B		•					
2C			√				
3A		\checkmark	\checkmark	\checkmark	√ *	\checkmark	
3B		\checkmark	\checkmark	\checkmark	√ *	\checkmark	
3C		\checkmark	\checkmark	\checkmark	√ *	\checkmark	
6A				\checkmark			
6B				\checkmark			
6C				\checkmark			
6D				\checkmark			
6E				\checkmark			

Operational Alternative

Task Hurdle							
Hydraulic Feasibility	Federal / State Agency Approval is Feasible	Local Agency Approval (Downstream Stakeholders) is Feasible	Cost Feasibility	Minimal Impact to Water Supply			
V	V		V				

Impact to Drinking Water Supply

Task Hurdle							
Hydraulic Feasibility	Federal / State Agency Approval is Feasible	Local Agency Approval (Downstream Stakeholders) is Feasible	Cost Feasibility	Minimal Impact to Water Supply			

Alternative	Conservation Pool	Conservation Pool Difference in WSE		Difference (ac-ft)
Existing	378.0 ft msl		13,943	
Alternative 6A	377.5 ft msl	-0.5 ft	13,597	346
Alternative 6B	377.0 ft msl	-1.0 ft	13,251	692
Alternative 6C	376.0 ft msl	-2.0 ft	12,560	1,383
Alternative 6D	375.0 ft msl	-3.0 ft	11,873	2,070
Alternative 6E	374.0 ft msl	-4.0 ft	11,188	2,755

Impact to Drinking Water Supply

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FINALIZED Alternatives Matrix

	Task Hurdle					
			Local Agency			
		Federal /	Approval		Minimal	
		State Agency	(Downstream		Impact to	
	Hydraulic	Approval is	Stakeholders)	Cost	Water	
Alternative	Feasibility	Feasible	is Feasible	Feasibility	Supply	
1A	×	×	\checkmark	×	\checkmark	
1B	×	×	\checkmark	×	\checkmark	
1C	×	×	\checkmark	×	\checkmark	
2A	×	\checkmark	\checkmark	×	\checkmark	
2B	×	\checkmark	\checkmark	×	\checkmark	
2C	×	\checkmark	\checkmark	×	\checkmark	
3A	\checkmark	\checkmark	\checkmark	√ *	\checkmark	
3B	\checkmark	\checkmark	\checkmark	√ *	\checkmark	
3C	\checkmark	\checkmark	\checkmark	√ *	\checkmark	
6A		\checkmark	\checkmark	\checkmark	×	
6B		\checkmark	✓	\checkmark	×	
6C		\checkmark	\checkmark	\checkmark	×	
6D		\checkmark	\checkmark	\checkmark	×	
6E		\checkmark	\checkmark	\checkmark	×	

Total Lake Cypress Springs Damage Curve

Key Board-Decision Elements

Project	Storm	Property
Cost	Frequency (Risk)	Damages



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Total Lake Cypress Springs Impact Curve



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Alternative 3 – Benefit Cost (BC) Ratio

			ALTERNATIVE 3		
			3A	3B	3C
Rain Event	Probability	Revised Model Conditions	1 gates	2 gates	3 gates
		Impacts (\$)	Impacts (\$)	Impacts (\$)	Impacts (\$)
CAPITAL COSTS \rightarrow			\$23.8 M	\$31.1 M	\$39.0 M
100-year	0.01000	\$347,890	\$38,402	\$19,706	\$16,104
350-Year	0.00285	\$2,910,117	\$120,175	\$32,749	\$19,706
500-Year	0.00200	\$3,495,949	\$174,235	\$36,353	\$21,790
	10	0-YR BC RATIO	1.30%	1.06%	0.85%
	35	0-YR BC-RATIO	11.73%*	9.26%	7.41%
	50	0-YR BC-RATIO	13.96%*	11.14%	8.91%

* It takes over 7+ 500-yr events (or 8.5+ December 2015 Events) to

break even on the capital investment of the 1-gate project

Completed Technical Memorandums (TMs)

- TM#1 —Retaining Walls, Dredge, and Fill
- TM#2 –Boat Houses
- TM#3 –Lake Closure
- TM#4 —FEMA Coordination
- TM#5 Residential Structures



Boat Lift Changes to Rules and Regulations



TM#4 – FEMA Coordination

- County is participating in the National Flood Insurance Program (NFIP).
- The County has never been mapped, but did enter the NFIP on 07/28/2000. FEMA mapping is scheduled to be completed at some unknown date in the future.
- With mapping will come additional regulations and mandates for construction in the floodplain/floodway. It also mandates flood insurance requirements.





Example Flood Insurance Requirement



Next Steps



Emergency Spillway Elevation Comparison

LCS Emergency Spillway Cross Section



CarolloE

Emergency Spillway Restoration Possibility



Restoration by Excavation

Fill Spoils Deposit Area

1.000 F'T

Additional H&H Analysis Required to Determine Feasibility

Emergency Spillway Evaluation

Alternative	Task Hurdle					
	Hydraulic Feasibility	Federal / State Agency Approval is Feasible	Cost Feasibility			
Do-Nothing	× - √ - √*	× - √ - √*	× - √ - √*			
Return Emergency Spillway to Design	× - √ - √*	× - √ - √*	× - √ - √*			
Evaluation of Alternative Restoration	× - √ - √*	× - √ - √*	× - √ - √*			

Questions





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