

FINAL MEMO

To: Russell Schreiber, Director of Public Works

From: Angie Flores and Brian Kirsch, Raftelis

Date: May 11, 2021

Re: Lake Ringgold Economic Impact Analysis

Executive Summary

This memo contains the findings of an economic impact analysis regarding the creation of Lake Ringgold. This analysis uses a conservative approach and only considers the economic impacts that occur within the three-county region of Wichita, Clay, and Archer counties. The major findings are:

- Construction of Lake Ringgold will result in \$472 million in economic impacts to the three-county region from one-time construction activities (e.g., reservoir and housing construction).
- Lake Ringgold will cause a reduction in ranching activities and an increase in recreational activities. The net change will have a positive economic impact of nearly \$33 million per year.
- Clay County will see a net increase in property tax revenues of \$153,500 per year with the construction of new housing.
- Henrietta ISD will see a net increase in property tax revenues of \$263,600 per year with the construction of new housing.
- Without Lake Ringgold, by 2070 the Wichita Falls' safe yield need (i.e., the deficit between its water demand and its safe yield) is valued between \$55.7 and \$62.3 million each year, far exceeding the operating costs of the reservoir.
- Securing water supplies through the construction of Lake Ringgold will insure the longevity of operations at Sheppard Air Force Base, a \$4.6 billion economic engine for Texas.

Background

The City of Wichita Falls (City) is projected to have a growing water supply deficit in which future safe yields will be insufficient to meet future demand. The value of the *annual* water supply deficit is projected to grow to between \$55.7 and \$62.3 million by 2070. Recent years witnessed the drought of record in the City, which caused massive disruption within the region. In the midst of the drought, Sheppard Air Force Base (AFB) questioned its continued ability to conduct its mission. As the largest economic engine within the area, responsible for \$4.6 billion in economic activity within Texas, the loss of even some of Sheppard's operations would have a devastating effect on the local economy. To secure adequate future supplies, the City is pursuing the construction of Lake Ringgold in neighboring Clay County. The City has requested that Raftelis Financial Consultants, Inc. (Raftelis) provide estimates of the potential economic impacts of constructing the reservoir. This economic analysis considers net economic change due to the following components:

- Loss of property tax revenue from displaced ranching operations
- Additional property tax revenue from developed lakeside properties

- Loss of economic activity from displaced ranching operations
- Additional economic activity from recreational activities on Lake Ringgold
- Economic impact from the construction of Lake Ringgold
- Estimates of the difference in economic futures with and without Lake Ringgold

Two types of monetary impacts are estimated in this memo: fiscal impacts and economic impacts. Fiscal impacts are changes to tax revenues. This memo only considers fiscal impacts to Clay County and Henrietta ISD due to land use changes from the development of Lake Ringgold. Data for these estimates comes from the Clay County Appraisal District, which collects property tax for Clay County and other taxing units within Clay County. Other changes to tax revenues through changes in income, sales, hotel occupancy or other taxes are not considered as part of this study.

An economic impact is the size of an economic activity as well as the economic activity that is induced by the original economic activity. For example, a large construction project may cost \$1 million. The contractor would have a production output of \$1 million, but the construction of that project would also induce economic activity in related industries such as lumberyards, cement plants, foundries, etc. and finally, further spending enabled through the wages and profits earned in the construction of that project. The production output (i.e., cost) of that construction project may have been \$1 million, but the act of constructing the project may have had a total economic impact of \$1.5 million.

Two other economic metrics are calculated as part of this study in addition to the economic impact: jobs and local earnings. For the purpose of this memo, one job equals one year of employment. Local earnings are the portion of total economic impact that represents household income, which includes wages, salaries, and the net earnings of sole-proprietors and partnerships. We use the term “local earnings” to reinforce the idea that this income only accrues to households in the three-county study region.

This analysis models economic impacts using the RIMS II modeling framework, which is an input-output model published by United States Bureau of Economic Analysis (BEA). The RIMS II model uses data about how the economy within a defined study region operates. In the construction example above, this data quantifies the economic relationship between the construction company and the lumberyard, for example.

This study seeks to err on the conservative side and consider only local economic impacts. As such, the study region selected for this analysis is the Wichita Falls Metropolitan Statistical Area, which contains Wichita, Archer, and Clay counties. The RIMS II model only considers economic impacts within the defined study region. The economic impacts estimated in this analysis are thus wholly contained within this three-county region. Economic activity will be generated outside of this three-county region on account of Lake Ringgold but is not quantified as part of this analysis.

Economic Impact of Construction of Lake Ringgold

This study uses cost estimates supplied in the Texas Water Development Board’s 2021 Regional Water Plan for Region B, which provides a total project cost estimate for Lake Ringgold in 2018 dollars of \$389.3 million, excluding interest costs. This 2021 project cost estimate is built upon a prior estimate contained within the 2013 Lake Ringgold Feasibility Study (Feasibility Study) by Freese and Nichols. This study’s analysis calculates the total economic impact of constructing the reservoir. It begins by organizing construction costs into various economic activities and multiplying those activities’ costs by the appropriate factors provided by the RIMS II model in order to estimate the total economic impact of those activities.

A significant portion of the total project cost is due to the cost of land, to be used both for the reservoir site and mitigation. Consistent with other similar recent economic impact analyses in the region, we assume that 20% of the cost of land will be used as household income by landowners. Household income is an economic activity, and as such is used to calculate an economic impact.

The economic impact of the construction of Lake Ringgold is summarized in Table 1. The RIMS II model also includes the ability to calculate the number of jobs associated with an economic activity. A “job” as defined here is one year of employment, or 2,000 hours of employment, that is a direct, indirect, or induced outcome of the modeled economic activity. The total jobs supported by the construction of Lake Ringgold is also contained in Table 1. Finally, Table 1 also estimates earnings that will result from the construction of Lake Ringgold. Earnings include wages, salaries, and sole-proprietorship income. Please see page Appendix-1 for a full listing of industry codes and multipliers to calculate each of these estimates.

Table 1: Summary of Economic Impact of Construction of Lake Ringgold (2018 \$'s)

Description	Total Cost	Total Economic Impact	Jobs	Local Earnings
Capital Costs				
Dam and Reservoir	\$72,731,000	\$117,890,000	829	\$46,737,000
Transmission Pipeline	59,057,000	79,804,000	262	16,418,000
Intake Pump Stations	40,481,000	54,702,000	180	11,254,000
Pipeline Crossings	16,372,000	25,897,000	69	5,843,000
Integration, Relocations, & Other	<u>7,911,000</u>	<u>12,731,000</u>	<u>80</u>	<u>4,314,000</u>
Subtotal Capital Costs	196,552,000	291,024,000	1,420	84,206,000
Other Project Costs				
Professional Costs & Contingencies	65,022,000	105,394,000	661	35,456,000
Land Acquisition & Surveying¹	41,076,000	5,929,000	49	9,595,000
Env. & Archeological Studies & Mitigation – Professional Services	13,002,450	21,203,000	193	10,315,000
Env. & Archeological Studies & Mitigation – Land¹	<u>73,680,550</u>	<u>10,635,000</u>	<u>88</u>	<u>17,212,000</u>
Subtotal Other Project Costs	192,781,000	143,161,000	991	72,578,000
Total	\$389,333,000	\$434,185,000	2,411	\$156,784,000

¹ 20% of land acquisition costs are assumed to count as household income.

Table 1 shows that for a total project cost of \$389.3 million, the construction of Lake Ringgold will have a total economic impact of \$434.2 million. The construction of Lake Ringgold is expected to result in 2,411 jobs and provide \$156.8 million in earnings to the Wichita Falls area.

Economic Impact of Loss of Ranching Operations

The construction of Lake Ringgold is estimated to require 24,000 acres of land described as “cultivated crops and grassland” to be taken out of production. This analysis does not include a detailed analysis of the current agricultural activities on that land. Rather, to be conservative, it is assumed that this land is used wholly for cattle grazing. Estimates for the carrying capacity of the local pasture is 1 Animal Unit (AU) per 10 – 12 acres, where an AU is equivalent to a 1,000 lb. cow with or without a calf less than 6 months old. Assuming the maximum production of 1 AU per 10 acres to be conservative, that implies an annual output of \$1,680,000 of cattle production. The loss of that amount of cattle production would result in a negative economic impact of \$3.37 million annually, 27.4 jobs, and an earnings loss of \$667,000, as shown in Table 2.

Table 2: Summary of Economic Impact of Loss of Ranching Operations (2018 \$'s)

Description	Output	Total Economic Impact	Jobs		Local Earnings
			Jobs	Local Earnings	
Cattle ranching operations	(\$1,680,000)	(\$3,371,592)	(27.4)		(\$666,792)
Total	(\$1,680,000)	(\$3,371,592)	(27.4)		(\$666,792)

See Appendix-2 for a full accounting of economic multipliers for ranching operations.

Economic Activity from Recreation on Lake Ringgold

The economic impact of recreation on reservoirs is estimated using survey methodologies. The specific survey techniques vary, but the fundamental principal is to arrive at an estimate of the number of recreation visitors and an estimate of the average spending per person per visit. Multiplying the total annual visitors by average spending per person produces the estimate of total annual spending for recreation.

The U.S. Army Corps of Engineers manage reservoirs across the nation and carefully track economic activities associated with their projects. In the “USACE Recreation 2019 District Report”, the Fort Worth District reports the economic benefits of recreation on the 25 reservoirs they manage across central Texas, covering 381,698 water acres. Thus, the average USACE reservoir in the Fort Worth District is 15,268 acres, or just slightly smaller than Lake Ringgold. They report approximately \$694 million in annual visitor spending within 30 miles of USACE lakes, or an average of \$27.8 million per lake. In the case of recreation, an economic impact analysis ignores the spending of locals. It is assumed that a local resident spending \$1 at a new local recreation venue is spending \$1 less at an old local recreation venue. Non-local recreation users tend to comprise a minority of total users, but their per trip spending is much higher. They tend to stay longer and consume more goods and services during their visit. In a study of economic impacts of recreation at a set of USACE reservoirs, researchers found that 83% of total spending was done by non-local visitors. If we assume average annual recreation spending at Lake Ringgold equal to the average annual recreation spending at the Fort Worth District’s 25 reservoirs (\$27.8 million) and that 83% of spending is done by non-local visitors, then that represents \$23.1 million in non-local recreation spending. Recreation has a final demand multiplier of 1.56, meaning that recreation spending at Lake Ringgold would have an annual economic impact of \$36.0 million, would support 481.4 jobs, and would increase earnings by \$11.9 million, as listed in Table 3. For a full accounting of the economic multipliers, see Appendix-3. These values do not include consideration of additional tax revenues such as income, hotel occupancy, or sales taxes that may arise from additional recreation spending.

Table 3: Summary of Economic Impact of Recreation (2018 \$'s)

Description	Output	Impact	Total Economic	
			Jobs	Local Earnings
Recreation	\$23,074,000	\$35,995,440	481.4	\$11,896,954
Total	\$23,074,000	\$35,995,440	481.4	\$11,896,954

Economic Activity from Housing Development

Consistent with other reservoirs in Texas, Lake Ringgold will create desirable lakefront property that will spur housing development. Given the size of Lake Ringgold and the expected development model, development around Lake Ringgold is expected to roughly match the development that has occurred around Lake Arrowhead.

In the City's most recent property tax assessment, the development around Lake Arrowhead totals 416 structures valued at \$21,144,240, or an average of \$50,828 per structure. Across Clay County, the average residential single-family structure is valued at \$55,972, as shown in Table 4.

Table 4: Determination of Average Residential Structure Values around Lake Arrowhead and in Clay County

Description	Amount
Lake Arrowhead Total Assessed Value of Structures¹	\$21,144,240
Number of Lake Arrowhead Structures	416
Average Value of Lake Arrowhead Structures	\$50,828
Total Improvements of Clay Co. "A" Properties (\$)	\$252,489,760
Number of Clay Co. "A" Properties	4,511
Average Net Taxable Value of Clay County "A" Properties (\$/property)	\$55,972

¹ Values provided by City staff.

² Source: Clay County Appraisal District at

http://www.claycad.org/Posted/2019%20recap_cert_combined_real-personal-miup.pdf

To determine the total economic output of residential construction around Lake Ringgold, we will assume 416 structures will be constructed, the same as at Lake Arrowhead. Given the two average values calculated in Table 4, we will use the higher value (the average value of Clay County residential structures). Both averages are similar in value, but the higher Clay County average reflects the fact that this will be new construction which is generally higher valued. That said, even assuming the higher of these two values is meant as an extremely conservative estimate, as new home construction is likely to be valued much higher than either of these estimates.

The total residential construction output is thus \$23.3 million, based upon 416 structures with an average value of \$55,972. Construction of these structures will have a total economic impact of \$38.6 million, increase local earnings by \$14.4 million, and support 261 jobs, as shown in Table 5.

Table 5: Summary of Economic Impact of Residential Construction (2018 \$'s)

Description	Output	Total Economic Impact	Jobs	Local Earnings
Residential Construction	\$23,284,352	\$38,554,230	261.1	\$14,380,416
Total	\$23,284,352	\$38,554,230	261.1	\$14,380,416

For a full listing of multipliers used, see Appendix-4.

Changes to Clay County and Henrietta ISD Property Tax Revenues

Loss of Property Tax Revenues from Displaced Agricultural Operations

The 2016 Wichita Falls Long-Range Water Supply Plan (Water Supply Plan) estimates the reservoir as requiring the total land to be removed from agricultural production to be 24,000 acres. This land is generally described as “cultivated crops and grassland”, which is classified as “D1” or agricultural by the Clay County Appraisal District. Further, this memo does not evaluate specific parcels of land that may be purchased by the City. Rather, the Appraisal District published the 2019 History Value Recap containing the total acreage classified as D1 as well as its total market value. This memo calculates the average market value per acre of D1 land in Clay County and calculates the change in Clay County property taxes using the 2019 tax rate. In addition to Clay County, Henrietta ISD also assesses property taxes on the impacted land. See Table 6 for development of the estimate of property tax losses for both Clay County and Henrietta ISD due to the construction of Lake Ringgold.

Table 6: Calculation of Clay Co. and Henrietta ISD Property Tax Losses Due to Lake Ringgold Construction

Description	Amount
Total Market Value of Clay Co. D1 Land (\$)	\$54,430,840
Total Clay Co. D1 Land (acres)	<u>665,421</u>
Average Market Value of D1 Land (\$/acre)	\$81.80
Total Land Removed from Ag Production (acres)	<u>24,000</u>
Estimate of Market Value of Land (\$)	\$1,963,200
2020 Clay Co. Property Tax Rate (\$ / \$100 assessed value)	\$0.720
Clay Co. Property Tax Losses (\$ / year)	\$14,135
2020 Henrietta ISD Property Tax Rate (\$ / \$100 assessed value)	\$1.2364
Henrietta ISD Property Tax Losses (\$ / year)	\$24,273

As Table 6 indicates, Clay County would see annual property tax revenues reduced by \$14,135 and Henrietta ISD would see annual revenues reduced by \$24,273 by the formation of the reservoir.

Growth of Property Tax Revenues from Additional Housing Development around Lake Ringgold

The construction of Lake Ringgold will eliminate significant amounts of cropland and rangeland as detailed in the previous section. However, as detailed earlier, the construction of Lake Ringgold is likely to result in desirable lakefront property in the same manner as Lake Arrowhead has homes located on its shores.

As estimated in the earlier section, “Economic Activity from Housing Construction”, we make a conservative assumption that 416 structures will be constructed with an average value of \$55,972 for a total value of \$23.3 million. Table 7 shows that residential development will produce a net gain of \$153,500 and \$263,600 for Clay County and Henrietta ISD, respectively, in new property tax revenues.

Table 7: Estimate of Clay County Property Tax Gains per Residential Development on Lake Ringgold

Description	Amount
Total Improvements of Lake Ringgold Residential Construction (\$)	\$23,284,352
2020 Clay Co. Property Tax Rate (\$ / \$100 assessed value)	\$0.720
Clay Co. Property Tax Gains (\$/yr)	\$167,647
Loss of Agricultural Property Tax Revenues (\$/yr)	(\$14,135)
Net Change to Clay County Property Tax Revenues with Lake Ringgold (\$/yr)	\$153,512
2020 Henrietta ISD Property Tax Rate (\$ / \$100 assessed value)	\$1.2364
Henrietta ISD Property Tax Gains (\$/yr)	\$287,888
Loss of Agricultural Property Tax Revenues (\$/yr)	(\$24,273)
Net Change to Henrietta ISD Property Tax Revenues with Lake Ringgold (\$/yr)	\$263,615

Economic Benefit of a Secure Water Supply

Raftelis was asked to quantify the economic benefit of a secure water supply. Put another way, the question was posed, “What is the value to North Texas’ economy and the tri-county region’s economy to be able to continue to grow unconstrained by water supply shortages?” The WaterReuse Research Foundation sponsored research that conducted willingness-to-pay surveys to estimate how consumers valued avoiding water restrictions^{1,2}. From this research, they derived values of \$4,386/acre-foot and \$4,900/acre-foot in 2011 dollars. Inflating those estimates to 2020 dollars, the low value for water is \$5,131/acre-foot and the high value for water is \$5,733/acre-foot. The *2021 Texas Water Development Board Region B Regional Water Plan* contains estimates of the Wichita Falls’ safe yield need (i.e., the shortfall in safe yield versus expected demand) extending from 2040 to 2070, along with estimates of the annual costs for Lake Ringgold. Due to sedimentation of the City’s reservoirs, without Lake Ringgold, the City’s safe yield need grows over time, and thus, so do the benefits of eliminating that supply gap. Table 8 calculates low and high estimates for the value of the City’s shortfall in safe yield from 2040 through 2070. These estimates of the value of the safe yield need can also be framed as the benefit that the City receives by eliminating the shortfall in safe yield through construction of Lake Ringgold. Table 8 shows that even in 2040, the benefits of filling the water supply gap are roughly double the debt service costs of Lake Ringgold. Beyond 2070, one would expect the benefits of Lake Ringgold to continue to grow as Lake Ringgold’s supply continues to fill an ever-growing safe yield need.

¹ Raucher, R., Clements, J., Donovan, C., Chapman, D., Bishop, R., Johns, G., Hanemann, M., Rodin, S., and Garrett, J., *The Value of Water Supply Reliability in the Residential Sector*, 2013.

² Raucher, R.; Darr, K.; Hnerson, J.; Linsky, R.; Rice, J.;Sheikh, B.; Wagner, C. *An Economic Framework for Evaluating the Benefits and Costs of Water Reuse.*, 2006.

Table 8: Cost of the Safe Yield Shortfall versus Annual Cost of Lake Ringgold

Description	2040	2050	2060	2070
Wichita Falls Total Safe Yield Need (ac-ft / yr)	5,134	6,137	7,344	10,864
Value of Water – Low Estimate (\$ / ac-ft)	\$5,131	\$5,131	\$5,131	\$5,131
Value of Water – High Estimate (\$ / ac-ft)	\$5,733	\$5,733	\$5,733	\$5,733
Value of Supply Need – Low Estimate	\$26,342,554	\$31,488,947	\$37,682,064	\$55,743,184
Value of Supply Need – High Estimate	\$29,433,222	\$35,183,421	\$42,103,152	\$62,283,312
Estimated Annual Cost of Lake Ringgold	\$13,175,000	\$13,175,000	\$0	\$0
Annual Net Benefit – Low Estimate	\$13,167,554	\$18,313,947	\$37,682,064	\$55,743,184
Annual Net Benefit – High Estimate	\$16,258,222	\$22,008,421	\$42,103,152	\$62,283,312

Secure Water Supply for Sheppard AFB

The largest economic driver within the Wichita Falls region is Sheppard AFB. During the drought of record some consideration was made whether Sheppard AFB could continue to fulfill its mission in the face of dwindling water supplies. In its most recent report, the Texas Military Preparedness Commission Biennial Report (2019 – 2020) estimates that Sheppard AFB has an economic impact of \$4.6 billion on the Texas state economy and total employment of 22,323 jobs. It can be assumed that the vast majority of benefits accrue to the Wichita Falls area. Moreover, the Air Force is increasingly focused on the strategic importance of water. In its “Installation Energy Strategic Plan 2021”, the Department of the Air Force (DAF) writes, “Though the DAF has historically focused on electrical energy assurance, it is increasingly recognizing the need to consider how water provides critical mission support. This new focus has been driven by a deeper understanding of... recent real-world instances of water impacting mission success, and growing water availability challenges that affect water quantity, quality, and access.” If conditions approximating the drought of record were to occur repeatedly such that Sheppard AFB would close or downsize, the negative impact on the local economy could be devastating. At last count, approximately 5,300 personnel live on-base and another 4,369 active duty servicemembers and their dependents live off base. The loss of just those residents would be devastating to the local economy, let alone the local spending of personnel housed on-base or those with civilian jobs on-base. In fact, assuming an average U.S. Air Force salary of \$35,937, losing the spending power of the Air Force salaries alone would result in a loss of over \$250 million in annual spending in the region. One potential way to view the costs of Lake Ringgold is as an insurance policy that prevents the catastrophic loss of the largest economic engine within the region.

Conclusions

This analysis indicates that construction of Lake Ringgold will have large, positive economic benefits for the Wichita Falls region. Table 9 presents a summary of the economic impacts predicted to occur with Lake Ringgold. One-time economic activities, in this case the construction of Lake Ringgold and new housing construction, will increase economic activity in the region by \$472.7 million, will create 2,674 jobs, and will increase local earnings by \$171.2 million. Changes to on-going economic activities include a reduction in ranching activities, but they will be replaced with recreation spending, resulting in a net *annual* increase of \$32.6 million in economic activity, a net *annual* gain of 454 jobs, and an *annual* gain of \$11.2 million in local earnings.

Table 9: Summary of Economic Impacts Associated with Lake Ringgold

Description	Frequency	Total Economic Impact	Jobs	Local Earnings
Construction of Lake Ringgold	One-time	\$434,184,995	2,412.6	\$156,783,826
Construction of New Housing	One-time	<u>\$38,554,230</u>	<u>261.1</u>	<u>\$14,380,416</u>
<i>Total One-time Impacts</i>		\$472,739,225	2,673.7	\$171,164,242
Ranching	Annual	(\$3,371,592)	(27.4)	(\$666,792)
Recreation	Annual	<u>\$35,995,440</u>	<u>481.4</u>	<u>\$11,896,954</u>
<i>Total Annual Impacts</i>		\$32,623,848	454	\$11,230,162
		Net Change		
Clay County Property Tax Change	Annual	\$153,500	N/A	N/A
Henrietta ISD Property Tax Change	Annual	\$263,600	N/A	N/A
Value of 2070 Safe Yield Need	Annual	\$60,000,000	N/A	N/A
Ongoing Economic Benefit to Texas by Insuring Sheppard AFB Operations through Secure Water Supplies	Annual	\$4,600,000,000	22,323	N/A

APPENDIX

Lake Ringgold Construction Economic Impact

Cost Type	Cost (2018 \$'s)	RIMS II Industry Codes	Output Multiplier (\$'s) (3)	Economic Impact (2018 \$'s)	Employment Multiplier (jobs / million \$'s)	Jobs	Earnings Multiplier (\$'s)	Local Earnings (\$'s)
Capital Costs								
Dam and Reservoir	\$72,731,000	Nonresidential structures	1.6209	\$117,889,678	11.4033	829.4	0.6426	\$46,736,941
Transmission Pipeline	59,057,000	Water, sewage, and other systems	1.3513	79,803,724	4.4425	262.4	0.278	16,417,846
Intake Pump Stations	40,481,000	Water, sewage, and other systems	1.3513	54,701,975	4.4425	179.8	0.278	11,253,718
Pipeline Crossings	16,372,000	Natural gas distribution	1.5818	25,897,230	4.2396	69.4	0.3349	5,482,983
Integration, Relocations, & Other	7,911,000	Construction	1.6093	12,731,172	10.1704	80.5	0.5453	4,313,868
Subtotal Capital Costs	196,552,000			291,023,779		1,421.4		84,205,356
Other Project Costs								
Professional Costs and Contingencies	65,022,000	Nonresidential structures	1.6209	105,394,160	10.1704	661.3	0.5453	35,456,497
Land Acquisition and Surveying (1)	41,076,000	Household	0.7217	5,928,910	5.9541	48.9	0.2336	9,595,354
Environmental & Archeology Studies and Mitigation - Professional Services (2)	13,002,450	Environmental & other technical consulting services	1.6307	21,203,095	14.856	193.2	0.7933	10,314,844
Environmental & Archeology Studies and Mitigation - Land (1)	73,680,550	Household	0.7217	10,635,051	5.9541	87.7	0.2336	17,211,776
Subtotal Other Project Costs	192,781,000			143,161,215		991		72,578,470
Total	\$389,333,000			\$434,184,995		2,412.6		\$156,783,826

(1) 20% of land acquisition costs is assumed to be used as household income, consistent with other regional economic impact studies.

(2) Previous cost estimates assumed approximately 15% of mitigation costs went to professional services, 85% to land.

(3) Output multipliers would be larger if considering a larger study area, such as the State of Texas. Additionally, final economic impacts within the study region are dependent upon the extent to which local firms are hired.

Lake Ringgold Economic Impact - Loss of Ranching Activity

Cost Type	Production	RIMS II Industry Codes	Output Multiplier (\$'s)	Economic Impact (2018 '\$s)	Employment		Earnings Multiplier (\$'s)	Local Earnings (\$'s)
	(2018 '\$s)				Multiplier (jobs / million '\$s)	Jobs		
Existing cattle ranching operations (1)	\$1,680,000	Beef cattle ranching and farming	2.0069	\$3,371,592	16.3087	27.4	0.3969	\$666,792
Total	\$1,680,000			\$3,371,592		27.4		\$666,792

(1) Assumes 24,000 acres removed from production, 10 acres per animal unit, each head of cattle brought to market at 2 yrs, 1,000 lbs, \$140/cwt

Lake Ringgold Economic Impact - Gain of Recreation Activity

Cost Type	Production (2018 \$'s)	RIMS II Industry Codes	Output Multiplier (\$'s)	Economic Impact (2018 \$'s)	Employment Multiplier (jobs / million \$'s)	Jobs	Earnings Multiplier (\$'s)	Local Earnings (\$'s)
Recreation spending (1)	\$23,074,000	Other amusement and recreation	1.56	\$35,995,440	20.8641	481.4	0.5156	\$11,896,954
Total	\$23,074,000			\$35,995,440		481.4		\$11,896,954

(1) Assumes spending equal to average spending at a reservoir in US Army Corps of Engineers' Ft. Worth District, multiplied by 83% to estimate total non-local spending.

Lake Ringgold Economic Impact - Gain of Residential Construction Activity

Cost Type	Production (2018 \$'s)	RIMS II Industry Codes	Output Multiplier (\$'s)	Economic Impact (2018 \$'s)	Employment Multiplier (jobs / million \$'s)	Jobs	Earnings Multiplier (\$'s)	Local Earnings (\$'s)
Residential construction (1)	\$23,284,352	Residential structures	1.6558	\$38,554,230	11.2133	261.1	0.6176	\$14,380,416
Total	\$23,284,352			\$38,554,230		261.1		\$14,380,416

(1) Assumes 416 structures built at an average value of \$55,972.