

7.9 Lake Whitney Reallocation

7.9.1 Description of Option

Lake Whitney is a major impoundment located on the Brazos River approximately 30 miles north of the City of Waco in Hill and Bosque Counties. The location of Lake Whitney is shown in Figure 7.9-1. Lake Whitney was completed in 1951 by the U.S. Army Corps of Engineers for the primary purposes of flood control, water conservation, and production of hydroelectric power. The total storage in Lake Whitney is 1,999,500 acft, making it the largest reservoir in the Brazos River Basin. The vast majority of storage in Lake Whitney is for flood control, comprising 1,372,400 acft (68.6 percent of the total reservoir storage) (Table 7.9-1). The original conservation storage capacity was 627,100 acft at elevation 533 ft-msl, but it has since been reduced by sedimentation to 554,203 acft. The capacity below elevation 520 ft-msl is reserved for power head and sediment storage, and has a capacity of 320,711 acft according to the most recent survey (Figure 7.9-1). In 1972, the top of the power pool was raised from 520 ft-msl to 533ft-msl, and the top of power head reserve was raised from 510 ft-msl to 520 ft-msl, making 248,000 acft of storage available to hydropower¹. In 1982, approximately 20 percent of the hydropower storage (50,000 acft) was reallocated to water conservation storage. A water right was issued to the Brazos River Authority (BRA) that authorizes the BRA to divert and use 18,336 acft/yr from the water conservation storage (Table 7.9-1).

Hydroelectric power generation from Lake Whitney is administered through the Southwestern Power Administration (SWPA), a federal agency. The SWPA has contracted with the Brazos Electric Power Cooperative to provide annual energy in the amount of 1,200 kWh per kilowatt of peaking power, with the energy not to exceed 200 kWh per kilowatt in any one month, or 600 kWh per kilowatt during four consecutive months. Whitney provides 30,000 kWh of peaking power. For purposes of this plan, the monthly energy demands were assumed to be 6,000,000 kWh in July and August, 2,000,000 kWh in June and September, and 2,500,000 kWh in each of the eight other months, for a total of 36,000,000 kWh per year.

The potential for reallocation of the hydropower storage and inactive storage at Lake Whitney to water conservation storage has been studied in various forms in the past and is an option for developing additional water supply in the Brazos River Basin². The conversion of storage to water supply purposes at Lake Whitney can produce a significant supply of water that could be utilized by a number of entities throughout the Brazos River Basin. Potential users include entities in Bosque County and Johnson County, as well as entities downstream in Region H.

¹ Whitney Reservoir Section 216 Initial Appraisal Report. Prepared by the U.S. Army Corps of Engineers. December 2014.

² Texas Water Resources Institute, "Reservoir/River System Reliability Considering Water Rights and Water Quality," Texas A&M University, March 1994.

Figure 7.9-1 Map of Lake Whitney

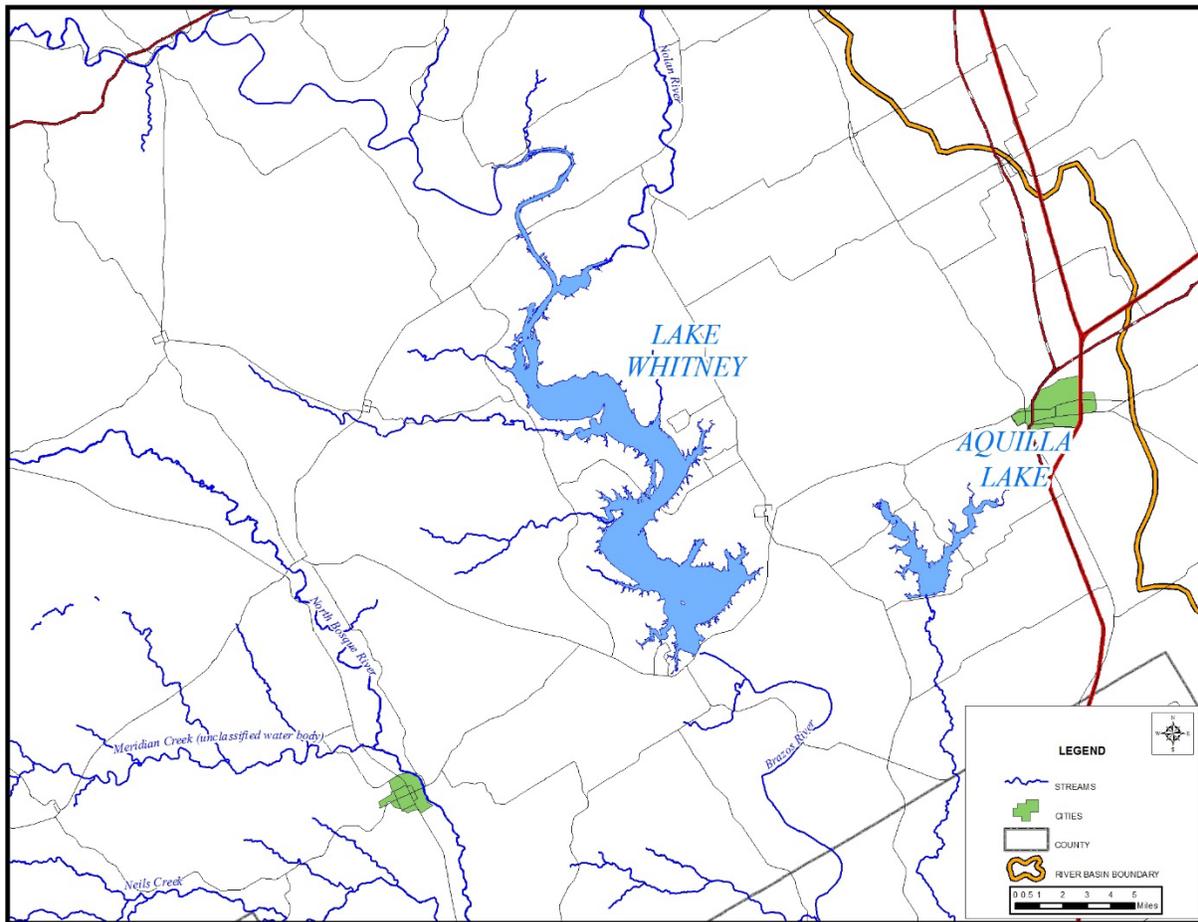


Table 7.9-1 Lake Whitney Characteristics

Owner	U.S. Army Corps of Engineers
Water Supply Contract	
Owner	Brazos River Authority
Storage amount	50,000 acft
Texas Water Right	
Number	CA 12-5157
Owner	Brazos River Authority
Diversion	18,336 acft/yr
Storage	50,000 acft between 520 ft and 533 ft-msl
Priority date	August 30, 1982



Table 7.9-1 Lake Whitney Characteristics

Owner	U.S. Army Corps of Engineers
Flood Pool1	
Top elevation	571 ft
Storage	1,372,400 acft
Conservation Pool2	
Top elevation	533 ft
Surface area	23,220 ac
Storage	554,203 acft
Inactive Storage3	
Top elevation	520 ft
Storage	320,711 acft

¹. Based on original 1959 survey. Represents volume of flood pool only (i.e., volume between 533ft and 571ft assuming no sedimentation in flood pool).

². Based on 2005 TWDB volumetric survey. Represents volume from 533ft and below.

³. Based on 2005 TWDB volumetric survey. Capacity from 520ft and below is reserved for sediment and power-head storage space.

7.9.2 Available Supply

The firm yield for the reallocation of Lake Whitney was estimated using the Brazos Water Availability Model (WAM) Run 3 with Senate Bill 3 environmental flows. The sedimentation conditions for Lake Whitney were updated to projected storage capacities in 2020 and 2070, while all other reservoirs in the basin remained at their original permitted storage amounts. The WAM simulates streamflows, reservoir operations, and existing water rights for the historical period of 1940-1997. This evaluation does not consider converting flood storage to water supply storage at Lake Whitney, but rather evaluates the reallocation of hydropower storage and a portion of the inactive storage in Lake Whitney to water supply storage. This reallocation could produce a considerable firm yield. The increase in firm yield for reallocation of the hydropower storage in Lake Whitney was found to be 20,842 acft/yr for 2070 conditions (Table 7.9-2). This is in addition to the 18,336 acft/yr already permitted from the reservoir for a total firm yield of 39,178 acft/yr. If ten feet of previously inactive storage were reallocated to water supply, the increase in yield would be 73,125 acft/yr, for a total yield of 91,461 acft/yr (Table 7.9-2). This strategy could potential be provided supply under the BRA System Operation permit (See Section 7.12), currently pending at the Texas Commission on Environmental Quality. If an entity other than the BRA were to sponsor and pursue this strategy, then an agreement with the BRA would be required to address concerns related to the potential subordination of the System Operation strategy.

Table 7.9-2 Storage Capacities and Firm Yields for Existing, Hydropower Reallocation, and Hydropower plus Inactive Storage Reallocation

Bottom of Conservation Elevation (feet)	Top of Conservation Elevation (feet)	2020 conditions			2070 conditions		
		Storage (acft)	Firm Yield (acft/yr)	Yield Increase (acft/yr)	Storage (acft)	Firm Yield (acft/yr)	Yield Increase (acft/yr)
520.00	533.00	50,000	18,336	0	50,000	18,336	0
520.00	533.00	231,084	39,866	21,530	226,999	39,178	20,842
510.00	533.00	351,448	93,376	75,040	341,301	91,461	73,125

7.9.3 Environmental Issues

Reallocation of hydroelectric and inactive storage in Lake Whitney will reduce hydroelectric generation and downstream streamflows and may have an impact on reservoir pool levels. The evaluation summarized in Table 7.9-3 was based on a wide range of natural resource databases on threatened and endangered species, and on riparian (stream bank) and littoral (lake side) habitats.

The reallocation of hydroelectric storage in Lake Whitney could possibly have moderate impacts on environmental water needs/instream flows in the Brazos River below the reservoir. Potential effects on aquatic and riparian habitats could result from reduction in stream flow, particularly in the summer months when flows are naturally lower and oxygen depletion in the water is greater. Reduced releases may increase the downstream concentration of pollutants from wastewater treatment plants and other sources, potentially impairing water quality in the stream. Seasonally reduced flows downstream from Lake Whitney could also adversely affect riparian vegetation and habitat, including bottomland hardwoods and wetlands. Changes in reservoir pool elevations could have possible low impacts on bank vegetation, wildlife habitat, and cultural resources sites. These issues will be evaluated closely by federal permitting agencies including the U.S. Army Corps of Engineers (for wetlands permitting), and the Federal Energy Regulatory Commission (for hydroelectric permitting).



Table 7.9-3 Environmental Issues: Lake Whitney Reallocation

Water Management Options	Implementation Measures	Environmental Water Needs / Instream Flows	Bays and Estuaries	Fish and Wildlife Habitat	Cultural Resources	Threatened and Endangered Species
Reallocation of Hydroelectric Storage to Conservation Storage in Lake Whitney	Reduced Hydroelectric Discharges to Brazos River below Lake Whitney ¹	Possible Moderate Impacts on Brazos River below Lake Whitney ¹	Possible Low Impacts	Possible Moderate Impacts on Brazos River Segment below Lake Whitney ²	Possible Low Impacts	Negligible Impacts
1. Assumes decrease in average annual instream flows below Lake Whitney as a result of reduced hydroelectric generation. Does not account for cumulative effects of decreased regional stream flows.						
2. Impacts would be variable depending on resulting change in flows. Adverse impacts would be possible for bottomland hardwood forests and wetlands						

This preliminary identification of environmental issues is based on an evaluation of the general characteristics of the water management options. Site specific investigations of the potentially affected environments would be necessary to provide detailed evaluations of possible habitat and cultural resources impacts from the reallocation. A quantitative estimate of magnitude and seasonal distribution of the reduced downstream flows implied in the reallocation would be needed to assess the effects on environmental water needs/instream flow and on fish and wildlife in the Brazos River below Lake Whitney.

7.9.4 Engineering and Costing

Development of the firm yield from reallocation of storage in Lake Whitney will not require major facilities for implementation. However, implementation of this alternative requires a detailed evaluation of various issues that will require mitigation of adverse impacts. In addition to these costs, a detailed U.S. Army Corps of Engineers reallocation study is required. The final cost for implementation of this alternative will be dependent on the results of that study.

Table 7.9-4 summarizes the estimated cost for this option. The estimated cost for water supply storage in Lake Whitney is the maximum of two numbers: 1) the updated investment cost of the reallocated hydropower storage as a proportion of the reallocated storage to total useable storage (198,000 acft / 1,554,600 acft or 12.7 percent), or 2) the amount of money needed to compensate for lost hydropower benefits. The updated total investment cost for Lake Whitney was estimated to be \$202,622,000, so the increase in cost for water supply storage was estimated to be \$25,733,000. This corresponds to the first number referred to above. The impact to hydroelectric power generation will vary from year to year depending on hydrologic conditions. Based on the WAM simulations and diversions of the firm yield from the reservoir, the impact to hydroelectric power generation may be as much as 75 percent of the annual power generation amount. The mitigation cost for the reduction in hydroelectric power generation was based on a replacement cost of \$0.09 per kWh, which results in an annual cost of \$2,430,000. This

amount is converted from an annual value to a present value of \$76,359,000 by assuming a 50 year planning horizon and an inflation rate of 2%. This corresponds to the second number referred to above. Because \$76 million is much larger than \$26 million, the cost for hydropower compensation was taken as the cost for reallocated storage. The total annual cost for this reallocation strategy is estimated to be \$7,527,000, which based on the increase in firm yield of 20,842 acft/yr, results in a unit cost of raw water of \$361 per acft (\$1.11 per 1,000 gallons). Compensation to BRA may be required if this strategy were developed by another entity other than BRA to compensate for any subordination of the System Operations strategy.

Table 7.9-4 Cost Estimate Summary for Reallocation of Hydropower Storage in Lake Whitney (2013 Prices)

Item	Estimated Costs
Capital Costs	
Improvements to Dam	\$3,800,000
Relocations	\$0
Total Capital Cost	\$3,800,000
Engineering, Legal Costs and Contingencies	\$1,330,000
Environmental & Archaeological Studies and Mitigation	\$3,117,000
Real Estate	\$0
Storage Reallocation	\$76,359,000
Slope Stability, Seepage and Geotechnical Studies	\$234,000
Water Rights Permit from TCEQ	\$1,500,000
Administrative Cost for USACE Storage Reallocation Process	\$3,608,000
Interest During Construction (12 months)	\$476,000
Total Project Cost	\$89,948,000
Annual Costs	
Debt Service (5.5 percent for 20 years)	\$7,527,000
Hydropower Generation Compensation (\$0.09/kWh)	\$0
Operation and Maintenance	\$79,000
Total Annual Cost	\$7,527,000
Available Project Yield (acft/yr)	20,842
Annual Cost of Water (\$ per acft)	\$361
Annual Cost of Water (\$ per 1,000 gallons)	\$1.11



7.9.5 Implementation Issues

This water supply option has been compared to the plan development criteria, as shown in Table 7.9-5, and the option meets each criterion.

Table 7.9-5 Comparison of Lake Whitney Reallocation Option to Plan Development Criteria

Impact Category	Comment(s)
A. Water Supply	
1. Quantity	1. Significant quantity available for regional use or in Region H
2. Reliability	2. High reliability
3. Cost	3. Low
B. Environmental factors	
1. Environmental Water Needs	1. Moderate impacts possible downstream
2. Habitat	2. Moderate impacts possible
3. Cultural Resources	3. Low impact
4. Bays and Estuaries	4. Low impact
5. Threatened and Endangered Species	5. Low impact
6. Wetlands	6. Low impact
C. Impact on Other State Water Resources	<input type="checkbox"/> No apparent negative impacts on state water resources; no effect on navigation
D. Threats to Agriculture and Natural Resources	<input type="checkbox"/> No threats to agriculture; possible changes in downstream flows
E. Equitable Comparison of Strategies Deemed Feasible	<input type="checkbox"/> Option is considered to meet municipal and industrial shortages
F. Requirements for Interbasin Transfers	<input type="checkbox"/> Not applicable
G. Third Party Social and Economic Impacts from Voluntary Redistribution	<input type="checkbox"/> None

7.9.6 Potential Regulatory Requirements

Implementation of reallocation of storage in Lake Whitney will require several steps including a detailed reallocation study performed by the U.S. Army Corps of Engineers and authorization from the U.S. Congress. An outline of the reallocation process is provided below:

1. Local sponsor requests the U.S. Army Corps of Engineers perform a reallocation study. Indicate local interest, purpose, financial capability, etc.
2. Reallocation studies are performed in two phases and follow the General Investigation Process consisting of a Reconnaissance Report and a Feasibility

Study. Specific funding would be required for a reallocation study. A reallocation study includes the following:

- a. Define existing project
 - b. Define current and projected water supply needs
 - c. Alternative solutions considered
 - d. Analysis of alternatives
 - i. Reallocation of flood control storage
 - ii. Raise top of flood control pool
 - iii. Reallocate existing conservation pool/power pool
 - iv. Hydropower compensation and other hydropower issues
 - v. Other
 - vi. No action
 - vii. Screening of alternatives
 - viii. Selection rationale and selection of a plan
 - e. Selected plan
 - i. Value of storage reallocation
 - ii. Impacts of reallocation
 - iii. Public involvement
 - iv. Environmental impacts
 - v. Hydropower compensation and other hydropower issues
 - f. Recommended plan
3. NEPA Compliance
 4. U.S. Army Corps of Engineers Headquarter Approval of Reallocation Study
 5. Authorization from U.S. Congress
 6. U.S. Army Corps of Engineers and Local Sponsor execute water supply contract based on Water Supply Storage Reallocation
 7. Water Rights Permits from TCEQ
 8. Coordination with BRA on any potential subordination agreements for the System Operations strategy.