5A.5 Lake Whitney Reallocation

5A.5.1 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 5A.5-1. 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 the storage in Lake Whitney is for flood control, comprising 1,372,400 acft (68.6 percent of the total reservoir storage). The conservation storage capacity is 627,100 acft at elevation 533 feet-mean sea level, with 379,100 acft of this storage defined as inactive. The hydropower storage in the reservoir was originally 248,000 acft. 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 BRA that authorizes the BRA to divert and use 18,336 acft/yr from the water conservation storage. Hydropower generation is operated on a non-priority basis and is junior to all water rights in the Brazos River Basin, including any future water rights.

Hydroelectric power generation from Lake Whitney is administered through the Southwestern Power Administration, a federal agency. The Southwestern Power Administration 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 study, 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. This totals to 36,000 kWh per year.

The potential for reallocation of the hydropower storage and inactive storage 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 Basin.[1] The potential storage available of 622,500 acft can produce a significant supply of water that could be utilized by a number of

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

entities throughout the Brazos River Basin. Potential users include entities in Bosque County and Johnson County and others downstream.

5A.5.2 Available Yield

The firm yield of the hydropower portion of Lake Whitney was estimated based on the Brazos WRAP model developed for Task 3A. The WRAP Model simulates streamflows, reservoir operations, and existing water rights for the historical period of 1900 to 1984. Reallocation of the hydropower and inactive storage in Lake Whitney to water conservation storage will produce a considerable firm yield. For purposes of this study, the entire firm yield of Lake Whitney was assumed to be diverted directly from Lake Whitney. The critical drought period for Lake Whitney was during the 1950s, extending from June 1950 to May 1957. This is the same critical drought period for Lake Granbury, which is located upstream of Lake Whitney. Considerable evaporation losses are experienced at Lake Whitney during the critical drought period due to the higher than normal evaporation rates and the large surface in Lake Whitney that is exposed to evaporation. During the 1950s, evaporation rates were found to be as high as 17,000 acft/yr. During the critical drought period, there is very little inflow that may be impounded by Lake Whitney due to the senior water rights that exist both upstream and downstream of the reservoir. Essentially, the storage in Lake Whitney is consumed over the 7-year critical drought period. The firm yield for reallocation of the hydropower and inactive storage in Lake Whitney was found to be 54,500 acft/yr. This is in addition to the 18,336 acft/yr already permitted from the reservoir for a total firm yield of 72,836 acft/yr. It is important to note that the firm yield would likely be greater if reallocation of Lake Whitney storage were evaluated in terms of system yield development. The firm yield identified in this study is a conservative estimate of the potential firm yield that could be developed from reallocation of storage.

5A.5.3 Environmental Issues

Reallocation of hydroelectric and inactive storage in Lake Whitney will reduce hydroelectric generation and downstream streamflows and will have an impact on reservoir pool levels. The evaluation summarized in Table 5A.5-1 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.

Table 5A.5-1.
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 below Lake Whitney[2]	Possible Low Impacts	Possible Moderate Impacts on Brazos River segment below Lake Whitney[3]	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. Assumes decrease in average annual instream flows below Lake Whitney as a result of reduced hydroelectric generation. Does not account for cumulative effects of decrease regional stream flows.
3. Impacts would be variable depending on resulting change in flows. Adverse impacts would be possible for bottomland hardwood forests and wetlands.

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).

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 of the modified pool elevation. 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.

5A.5.4 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. The estimated cost for implementation of this alternative includes the cost for water supply storage, as well as the cost for mitigation of hydroelectric power generation and environmental 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 this study.

Table 5A.5-2 summarizes the estimated cost for this option. The estimated cost for water supply storage was based on the updated investment cost of the reallocated hydropower storage as a proportion of the hydropower storage to total useable storage (198,000 acft / 1,554,600 acft or 12.7 percent). The total investment cost for Lake Whitney was computed to be $72,019,000, and the cost for water supply storage was estimated as $9,173,000. The impact to hydroelectric power generation will vary from year to year depending on hydrologic conditions. Based on the WRAP Model simulations and diversion 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 of 36,000 kWh. The mitigation cost for the reduction in hydroelectric power generation was based on a replacement cost of $0.08 per kWh, which results in an annual cost of $2,160,000. The total annual cost for this alternative is estimated to be $3,103,000 which, based on the firm yield of 54,500 acft/yr, results in a unit cost of raw water of $57 per acft ($0.17 per 1,000 gallons).

5A.5.5 Implementation Issues

This water supply option has been compared to the plan development criteria, as shown in Table 5A.5-3, and the option meets each criterion.

Implementation of reallocation of storage in Lake Whitney will require several implementation 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 provide below:

1. Local sponsor requests the U.S. Army Corps of Engineers perform a reallocation study. Indicate local interest, purpose, financial capability, etc.

Table 5A.5-2.
Cost Estimate Summary for
Reallocation of Storage in Lake Whitney
(Fourth Quarter 1999 Prices)

Item	*Estimated Costs*
Capital Costs	
Water Supply Storage Cost	$9,173,574
Total Capital Cost	**$9,173,000**
Water Rights Permit from TNRCC	$300,000
Environmental & Archaeological Studies and Mitigation	$2,000,000
Administrative Cost for USACE Storage Reallocation Process	$1,500,000
Total Project Cost	**$12,973,000**
Annual Costs	
Debt Service (6 percent for 30 years)	$943,000
Hydropower Generation Compensation	$2,160,000
Total Annual Cost	**$3,103,000**
Available Project Yield (acft/yr)	**54,500**
Annual Cost of Water ($ per acft) Raw Water from Lake Whitney	**$56.94**
Annual Cost of Water ($ per 1,000 gallons) Raw Water from Lake Whitney	**$0.17**

[1] Water Supply Storage Cost based on updated investment cost of reallocation of active hydropower storage to total useable storage.
[2] Hydroelectric Generation Compensation based on a replacement energy cost of $0.08 per kWh.

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. 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
      1) Reallocation of flood control storage
      2) Raise top of flood control pool
      3) Reallocate existing conservation pool/power pool

Table 5A.5-3.
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
C. Impact on Other State Water Resources	• No apparent negative impacts on state water resources; no effect on navigation
D. Threats to Agriculture and Natural Resources	• No threats to agriculture; possible changes in downstream flows
E. Equitable Comparison of Strategies Deemed Feasible	• Option is considered to meet municipal and industrial shortages
F. Requirements for Interbasin Transfers	• Not applicable
G. Third Party Social and Economic Impacts from Voluntary Redistribution	• None

4) Hydropower compensation and other hydropower issues
5) Other
6) No action
7) Screening of alternatives
8) Selection rationale and selection of a plan

e. Selected plan
1) Value of storage reallocation
2) Impacts of reallocation
3) Public involvement
4) Environmental impacts
5) 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 Permit from TNRCC