



US Army Corps
of Engineers®
Savannah District

Hartwell Lake Draft Integrated Water Supply Storage Reallocation Report and Environmental Assessment and Finding of No Significant Effect South Carolina and Georgia Appendix D: Plan Formulation



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1.0 Project Background

As a result of increased population and water demand, the Corps received four requests for reallocating storage in Hartwell Lake to water supply. Per Planning Bulletin 2013-01, Dam Safety Considerations for Water Supply Storage Allocation and Reallocation Studies, “When water supply storage reallocation is requested by a non-Federal entity, the United States Army Corps of Engineers (USACE) decision-makers at all levels must fully consider the condition of the dam and associated project levees, Dam Safety Action Classification (DSAC), Interim Risk Reduction Measures (IRRM) and other remediation, and their impacts on pool levels and inspection, operation, and maintenance of the project.”

In Fiscal Year 2014, sufficient Federal funds were provided to initiate the technical work leading to the Alternatives Milestone Meeting (AMM). Detailed information on the requests and following project history (Table 2) is available in Appendix F: Correspondence with Requestors and Vertical Team.

Table 1: Project Study and Correspondence History

Date	Meeting	Result
Sep 2016	AMM	Team required to conduct additional economic analysis
Jan 2017	In-Progress Review (IPR)	Additional quantitative analysis of hydropower losses and flood damages of reallocation from flood risk management (FRM) pool was requested
Jun 2017	IPR	Vertical Team (VT) satisfied with flood risk analysis but requested flood inundation analysis
Mar 2018	Dam Safety Senior Oversight Group	Clemson Lower Diversion Dam Saddle Dike was reclassified from Dam Safety Action Class (DSAC) 4, low urgency, to a DSAC 3, moderate urgency
Apr 2018	IPR	Final Array of Alternatives (flood pool alternative eliminated)
Nov 2018	HQ USACE Deputy Dam Safety Office	USACE South Atlantic Division (SAD) submitted and received approval for Interim Risk Reduction Measures Plan (IRRMP) for Clemson Lower Diversion Dam Saddle Dike
May 2020	TSP	VT actualized selected plan; study placed on hold until April 2021 due to funding constraints
Apr 2021	Kickoff Meeting	Began finalizing the Integrated Draft Report/EA and appendices

Jun 2021	DQC	The DQC team provided multiple high levels of significance and critical comments in plan formulation, environmental, and economics
Aug 2021	IPR - RFC Discussions	The Corps initially planned to move forward without RFC
Mar 2022	IPR - RFC Alternative	Due to receipt of requestor RFC request and awareness of pending South Carolina legislation, Corps decided to hold the draft report and develop a RFC alternative
Aug 2023	Dam Safety Senior Oversight Group	All three Clemson Dams, including saddle dike, were reclassified to DSAC 2, high urgency
Oct 2023	DQC	DQC team to review report with updated model results with RFC.

As the Corps prepared the tentatively selected plan (TSP) following the June 2017 IPR, additional guidance from SAD was received on 24 July 2017, that required additional work before concurring with reallocation from the FRM pool. Dam Safety ER 1110-2-1156 (31 Mar 14), page 24-2 states: “Reallocation reports that recommend pool raises must include a review of the Potential Failure Mode Analysis (PFMA) for the dam and an analysis of the effect of a higher pool elevation on the probability of failure and consequences associated with the changed pool elevation.”

In March 2018, the Corps’ Dam Safety Senior Oversight Group, reclassified the Clemson Lower Diversion Dam Saddle Dike, located on Hartwell Lake, from a Dam Safety Action Class (DSAC) 4, low urgency, to a DSAC 3, moderate urgency. As a result of the risk reclassification, storage reallocation from the FRM pool for water supply is not permitted per regulation. Engineering Regulation (ER) 1110-2-1156, Safety of Dams – Policy and Procedures, 31 Mar 2014, Paragraph 24.4.1.2 states that “A reallocation that would require raising the conservation pool is not permitted while a project is classified DSAC 1, 2, or 3.” Additionally, reallocation studies are not allowed at projects with these classifications (ER 1110-2-1156, Paragraph 24.7.1), except when approved by the USACE Dam Safety Officer (DSO). On 26 February 2019, the WMRS PCX agreed and approved the exception package. The exception permits study of pool reallocation alternatives for water supply storage that do not sacrifice flood storage capacity.

In March 2022, the Corps determined, based on pending RFC legislation in South Carolina, that the appropriate path forward was to hold the report and develop an alternative prior to the draft report’s release to the public. The additional alternative development added approximately nineteen months to the schedule. The current completion date for the signed Chief’s Report is March 31, 2025.

2.0 PLAN FORMULATION AND EVALUATION OF ALTERNATIVES

Plan formulation and evaluation of alternatives for this study were conducted in accordance with *USACE's Planning Guidance Notebook (ER 1105-2-100)* and *USACE's Water Supply Handbook*, both originating from the *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Planning Act* (P.L. 89-80) and Executive Order (EO) 11747, which was approved by the U.S. Water Resources Council in 1982 and by the president in 1983. In addition, this study applies SMART planning principals codified in Section 1001 of WRDA 2014.

2.1 Planning Framework

The Corps planning process follows the six-step process defined in the 1983 U.S. Water Resources Council's Economic and Environmental Principles & Guidelines (P&G) for Water and Related Land Resources Implementation Studies. This process is a structured approach to problem solving which provides a rational framework for sound decision making. The six-step process shall be used for all planning studies conducted by the Corps of Engineers. The six steps are:

- Identifying problems and opportunities
- Inventorying and forecasting conditions
- Formulating alternative plans
- Evaluating alternative plans
- Comparing alternative plans
- Selecting a plan

The Corps' decision making is generally based on the accomplishment and documentation of all these steps. It is important to stress the iterative nature of this process. As more information is acquired and developed, it may be necessary to reiterate some of the previous steps. The six steps, though presented and discussed in a sequential manner for ease of understanding, occur iteratively, and sometimes concurrently. Iterations of steps are conducted as necessary to formulate efficient, effective, complete, and acceptable plans. Those steps culminate in the description of the TSP. The report includes an integrated Environmental Assessment (EA) with National Environmental Policy Act (NEPA) information interwoven in the integrated report to accomplish respective requirements.

With regards to IWSSRR/EA, the basic theme of the planning process is to evaluate the feasibility of reallocating water storage in Hartwell Lake to water supply storage for four requestors in order to meet increased user demand due to population growth.

The period of analysis for this study is a 50-year timeframe, assuming the report will be approved in Fiscal Year (FY) 2025 and the water supply agreement will be executed in FY25.

2.2 Focused Array of Alternatives

In addition to those aforementioned criteria, the Corps compared the plans to each other with an emphasis on the outputs and effects that have the most influence on the decision-making process. This focused array of alternatives was later updated to a final array once RFCs became an issue. For this study, the Corps further screened the alternatives based on impacts to dam safety, recreation, flood risk management, and hydropower. Alternative 2 was initially identified as the alternative to carry forward for detailed analysis. However, Alternative 2 was eliminated from final array once RFC became a requirement for completeness.

2.2.1 Alternative 1: No Action Alternative

Under the NAA, the Corps would continue current management for water supply in Hartwell in accordance with the current plan of regulation. No reallocation would occur to meet water supply needs of the four requestors. Under the NAA, most of the requestors would not have sufficient water supply to meet 2035 water demands. Current water supply amounts would not support projected future growth throughout the region. Current water conservation efforts would continue, but alone do not sufficiently decrease the gap in water supply needs.

To meet future water demands, the requestors would take predictable actions as a consequence of the NAA. The requestors would acquire it from some other non-Federal source. These non-Federal sources of water would be obtained at a higher financial and economic cost and with greater environmental impacts due to construction of new transmission lines versus obtaining water from current connections to raw water in Hartwell Lake, new pump stations and paying higher rates at non-Federal water sources versus Hartwell Lake.

- ARJWS's most likely NAA under consideration to address future water supply needs in the absence of a new reallocation of storage for water supply from Hartwell Lake includes construction of a pump station and transmission main pipelines to purchase water from the Greenville Water System (Adkins Water Treatment Plant). That water source comes from Keowee Lake just upstream of Hartwell Lake on a tributary of the Savannah River. That system has adequate capacity to supply ARJWS's future water supply needs. The Greenville Water System withdraws water from Lake Keowee at the Adkins Water Treatment Plant (WTP), which is located near Six Mile, South Carolina. For ARJWS to connect into the Greenville Water System, ARJWS would need to construct and operate a pump station sized for 40,300 gallons per minute at or near the Adkins WTP and a 26-mile transmission main pipeline with a 60-inch diameter. The estimated initial capital cost to construct the pump station and transmission main from Greenville Water System Adkins WTP to ARJWS WTP site is estimated at \$187,373,000. The Greenville Water System's rate for wholesale water is currently \$2.81 per 1000 gallons. This is 51 percent higher than the \$1.86 per 1000 gallons the ARJWS currently charges its members (ARJWS Water Reallocation Report, October 2021). In addition, obtaining water supply from

Greenville Water System strains existing water treatment plant capacity in Anderson County by restricting current facilities to 50 percent of capacity.

- Pioneer RWD's most likely alternative would be to increase water supply purchases from ARJWD and Seneca Light & Water to address future water supply needs in the absence of a reallocation of storage from Hartwell Lake. Pioneer RWD currently gets raw water from Hartwell Lake. They use reallocation capacity from ARJWD's existing water supply storage agreement with the Corps. ARJWD charges them the rate of \$0.011 per 1,000 gallons, the existing rate water supply storage agreement rate with the Corps, and an annual fee of \$60,000. Pioneer RWD currently has a connection for finished water with Seneca Light & Water that is active. Seneca may need to upgrade their booster pump station to meet future Pioneer RWD demands of 5 MGD. Those upgrade costs were not estimated for this analysis. Pioneer RWD would pay Seneca Light and Water a tiered rate including a monthly base fee plus \$4,600 up to 2.6 million gallons per month, \$1.75 per 1,000 gallons for 2.6 to 10 million gallons per month, and \$1.50 per 1,000 gallons for more than 10 million gallons per month. The estimated annual cost to purchase finished water from Seneca Light and Water is expected to exceed \$8 million. As ARJWD and Seneca Light & Water's future demands increase, Pioneer RWD may experience an increased probability of insufficient water supply storage capacity from them and the future rates for their customers may increase as well. Hence, Seneca Light and Water would not be a reliable, long-term source of water supply with increased rates and the uncertainty that comes with a temporary agreement. For any alternative, an increase from 2.5 MGD to 5.0 MGD would require upgrades to their water treatment plant at an initial capital cost of \$7,500,000.
- The City of Lavonia's most likely alternative would be to purchase wholesale water from the City of Toccoa to address future water supply needs in the absence of new storage reallocation from Hartwell Lake. This would involve building 6.5 miles of waterline to the nearest adequate water main in the City of Toccoa's water system. Construction capital cost is estimated at \$10,000,000.
 - The City of Lavonia can also construct a raw water line from the Broad River. This system has adequate capacity to supply the City of Lavonia's future water needs. It would necessitate the construction of a new intake structure, pump station, and 20 miles of 16-foot waterline from the river 4.8 miles southwest of Royston, Georgia to the Crawford Creek Reservoir at an estimated capital cost of \$27,000,000. Relative to getting treated wholesale water from the City of Toccoa, Broad River would not be the City of Lavonia's most likely, least cost alternative source of water. Since construction of a raw water line to Broad River would not be the most efficient or cost-effective alternative for the City of Lavonia, it is not included as part of NAA analysis.

- Currahee Club's most likely alternative would be to purchase treated potable wholesale water from the City of Toccoa water system and transmit it to the Club for irrigation purposes. At a rate of \$3.85 per 1,000 gallons, potable water is a costly alternative for irrigation.

2.2.2 Alternative 2: Hartwell Lake Reallocation of Conservation Storage to Supply

Alternative 2 would reallocate conservation storage for water supply from Hartwell Lake. The Corps anticipates that reallocating storage from conservation storage to water supply would produce relatively minor positive or negative impacts from the Federal NAA to hydropower production with low cost and time to obtain it. There is an estimate decrease of 0.02 feet or 0.24 inches in the average annual pool elevation at Hartwell and no change in elevation at Russell or Thurmond. Slight changes in Savannah River flows were detected at Augusta, GA with an average annual decrease of 12 cubic feet per second (cfs) from an average annual flow of 8,956 cfs to 8,944 cfs. As this alternative. This alternative was not carried forward for full consideration and analysis in the final array of alternatives for water supply storage reallocation. This alternative was not carried forward as it did not include RFC, and therefore was not considered a complete alternative.

2.2.3 Alternative 3: Hartwell Lake Reallocation of Inactive Storage to Supply

Alternative 3 would reallocate inactive storage for water supply from Hartwell Lake. The Corps anticipates that reallocating storage from inactive storage to water supply would produce relatively minor positive or negative impacts and hydropower production with low cost and time to obtain it. Hydrology impacts resulting from reallocation from the Inactive Storage had minor positive changes in elevations at Hartwell and JST Lakes increasing Hartwell Lake's annual average elevation 0.23 feet and JST Lake's 0.16 feet. The positive change in elevation is a result of the reallocation of storage from the Inactive Storage to the Conservation Storage, slightly increasing the size of the Conservation Storage. The annual average flows at Augusta, GA would decrease by 10 cfs when compared to the NAA resulting in a minor negative impact to hydrology in the Savannah River flows at Augusta, GA. This alternative was not carried forward as minor adverse impacts to flood risk management may occur and it underperformed when compared to Alternative 2.

2.2.4 Alternative 4: Hartwell Lake Reallocation of Flood Storage to Supply

Alternative 4 would reallocate flood storage for water supply from Hartwell Lake. Although there would be no impacts to recreation and only minor impacts to hydropower, there would be high impacts expected to dam safety and flood risk management requiring high costs in money and time.

All three Clemson Dams, including saddle dike, were recently reclassified to DSAC 2. Hence, reallocating storage from flood storage for water supply would not be effective in meeting future water demands over the next 20 years. In addition, it would not be cost-effective or efficient. The Corps estimates that it could cost over \$14 million to re-establish DSAC 4. Hence, the flood storage cannot be considered as an alternative source of water supply storage.

There have been two significant flood events on the Savannah River within the last eight years. One used the entire system's flood storage and the other event used Hartwell Lake's entire flood storage. In 2013, a less than 50-year storm required use of Hartwell's entire flood storage and prevented an estimated \$13.95 million in damages. From a system perspective, the regulated outflow from Hartwell Lake was less than a 10-year event (10 percent chance of occurring in any given year) due to the combined flood storage of the Corps' reservoirs. In 2015, a non-tropical winter-time event resulted in the total use of all three of the Savannah River's multi-purpose project's flood pools and a forced release of roughly twice the channel capacity from JST Dam through the City of Augusta/Richmond County, Georgia, and North Augusta, Aiken County, South Carolina. The Corps' reservoirs prevented approximately \$13.67 million in damages. The City of North Augusta begins to flood at relatively moderate stream flows due to encroachment on the floodplain. The Augusta Levee, which protects the Georgia side of the river, has not been maintained to Corps' standards. It is currently inactive in the Corps' Rehabilitation and Inspection Program (RIP), and it is rated unacceptable by the Corps. The LSAC rating (September 2013) is 3 prior to overtopping and 4 for overtopping.

With the likelihood that a reallocation from flood storage would increase flood risks, policy not permitting a DSAC 2 dam to use flood storage, and the cost and time required to re-establish DSAC 4 to consider using flood storage, the Corps removed this measure from further consideration in the final array of alternatives. Additionally, the Assistant Secretary of the Army for Civil Works stated that the Corps will not entertain reallocation from flood storage per current guidance.

2.2.5 Alternative 5: Hartwell Lake Reallocation of Conservation Storage to Water Supply and Return Flow Credit

Alternative 5 was added to the alternatives in 2023 after modeling completed. This alternative would reallocate conservation storage for water supply from Hartwell Lake and includes RFC. This alternative is the same as Alternative 2 (see section 3.7.3.2) but adds RFC for the water account holders. As with Alternative 2, the TSP produces minor positive FRM impacts, but unlike Alternative 2 also creates minor positive impacts from the NAA to the hydropower production. The provision of RFC removes some of the total Hartwell inflow from being distributed proportionally across all account holders, and instead credits it directly to the account of the returner. This shift allows those returning account holders to hold smaller storage accounts while still meeting their demands during the critical period. At the same time, other account holders receive less total inflow, and is reflected in their current account sizes no longer being able to provide the same level of withdrawals over the critical period. Thus, the other account holders (those who do not return flows directly to Hartwell Lake) would require slightly larger accounts (Table 26). The Corps anticipates that reallocation from conservation storage to water supply would produce relatively minor positive or impacts to hydropower production with low cost and time to obtain it. The purpose of this model run was to properly size the water storage accounts needed to meet the 2035 demands during the critical period under the conditions of full return storage credit.