EXECUTIVE SUMMARY

The Tennessee Valley Authority, as owner of the Chickamauga Project, requested the U.S. Army Corps of Engineers Nashville District to conduct a feasibility study of problems at Chickamauga Lock. This Support For Others (SFO) effort, funded by TVA, was later supplemented by WRDA 2000, which directs the Chief of Engineers to prepare a report using TVA funds. Section 2401 of the Supplemental Appropriations Act of 2001 made available $500,000 of Corps of Engineers Operations and Maintenance funds to complete this study.

Chickamauga Lock and Dam, at mile 471.0 on the Tennessee River, is about 13 miles upstream of the Port of Chattanooga, Tennessee. Chickamauga Lock and Dam is one of 10 multipurpose lock-and-dam projects comprising the Tennessee River navigation system. The lock is a single chamber (no auxiliary lock) measuring 60’x360’.

In 1999, about 2.3 million tons of commodities moved on the Upper Tennessee navigation system, accounting for about 6.5 percent of the entire Tennessee River system traffic. Commodities traversing Chickamauga Lock travel an average distance of 1,400 miles and have origins or destinations in 42 congressional districts in 17 states in the South, Midwest, and the Mid-Atlantic regions.

The entire Chickamauga project is plagued with “concrete growth” resulting from an alkali-aggregate reaction (AAR). This reaction creates a gel that absorbs moisture, swells, and expands the concrete. When the concrete is restrained, the growth increases internal stresses, which causes cracking and movement of the concrete monolifts. This movement causes equipment misalignment as well as structural instability. The growth is continuing; therefore, non-standard, major maintenance is significantly increasing, raising both expenses and lock outages.

During the past two decades, the Corps and TVA have worked together to evaluate the problem and develop remedial actions. Both agencies agree that the lock has a finite life limited by economics and safety.

The economic scenario is the cost for maintaining the lock will determine when the lock should be closed. With

significant annual maintenance, Chickamauga Lock can be economically kept open until at least year 2010. Beyond that time, the accelerating rate of deterioration will increase both the frequency and cost of major repairs. This study has shown that replacement-in-kind (RIK) of the existing lock by 2010 is far more economical than trying to continue maintaining and repairing a “deteriorating” lock. Thus, the economic life of the lock is considered to extend only to 2010.

The safety scenario is solely based on the structural integrity of the lock as a segment of the dam. Concrete growth and the associated cracking and movements diminish the margin of safety of the lock structures to resist the water pressure from the reservoir. Anchoring the lock walls to the foundation with steel tendons has temporarily restored the necessary margins of safety. TVA and the Corps have installed an instrumentation system at the lock to continuously monitor 1) stresses in the concrete and 2) minute movements of the lock. When analysis of the data indicates that operational and/or structural limits have been reached, TVA’s Dam Safety Officer will close the lock. This action will provide immediate protection to barge workers, boaters, and fisherman near the lock and will preclude the environmental and economic consequences of an uncontrolled release of water from the reservoir. In the event of closure, TVA will implement existing plans to construct a concrete plug in the lock chamber which will provide a permanent water barrier.

In addition to the concrete growth problems, Chickamauga Lock has only one chamber, measuring 60 feet wide and 360 feet long. The lock, completed in 1940, can accommodate four standard barges (26’x175’), which have virtually disappeared from the Tennessee River System. Growth in traffic, barge sizes (jumbo barges 35’x195’ are now preferred), and the size and configuration of tows have increased delays and processing times. The small lock at Chickamauga currently passes only one barge per lockage. With an average processing time of 8 hours per tow, Chickamauga Lock has the highest average locking time in the entire Ohio River System. This represents a significant economic loss to the shipping industry and, ultimately, to the consumer.

Chickamauga Lock's poor reliability, potential for closure, and long processing time is hampering waterway

transportation. Traffic studies identified 4.3 million tons of commodities that could move on the waterway at a savings if Chickamauga Lock was reliable. Given these factors, it makes sense to evaluate larger more, efficient locks against the most efficient without project condition (replacement-in-kind).

Tow sizes of new locks and a congestion fee combined with a replacement-in-kind were considered in the final analyses. Of these, only the two larger locks (75’x400’ and 110’x600’) were economically justified.

The 75’x400’ lock has the greatest net benefits ($1,960,000) and is therefore the NED plan and the recommended plan. The 75’x400’ lock satisfies study needs and opportunities and reduces average transit time from the 13.7 hours per tow for the projected 7.5 million tons of commodities expected in 2010 to 8.2 hours. The 75'x400' lock is more efficient than RIK and facilitates safer transit through the project. Over the long term, the 75’x400’ lock provides benefits to air quality, noise, and aquatic resources by reducing the numbers of trucks and railcars transporting goods.

A 110’x600’, however, has advantages that cannot be captured in the economic analyses but are valid nonetheless. Firstly, the difference in initial construction costs between the two lock sizes is less than $26 million or only 10.7 percent more than the cost of the 75’x400’ lock.

Secondly, a 110’x600’ lock is superior in reducing lockage-transit time and facilitating safe movement of traffic. The shorter processing times also improve efficiency for the towing industry and reduce transportation costs. The 110’x600’ lock provides an additional $961,000 per year in transportation savings. It also provides greater environmental benefits.

Thirdly, a 110’x600’ lock is compatible with all the downstream Tennessee River main lock chambers (except Pickwick 110’x1000’) and is also compatible with lock chambers on the Ohio and Upper Mississippi Rivers. If the vast majority of locks on the inland waterway system are at least 110'x600', it is reasonable to anticipate any changes in barge and tow sizes (which are not considered in the economic analysis) will be based on a 110'x600' lock.