Section VII – Economic Analysis of Final Alternative Plans

This portion of the document presents pertinent cost data, benefit data, and presents the analysis of annual costs and benefits for each of the final alternative plans. All cost and benefit data within the final analysis are expressed in FY 2001 dollars. Costs and benefits are analyzed assuming a 50-year project life and an interest rate of 6.375 percent. These data are a refinement of the design, costs, and benefit analyses utilized in the screening process presented in Section V.

1. First Costs and Investment Costs

The estimated first costs and investment costs for each alternative as well as for the without-project condition are summarized in Table VII-1. Contingencies are computed by individual item and are included in the first costs. Investment costs reflect the inclusion of interest during construction.

The differences among the lock replacement alternatives are in the lock costs; planning, engineering, and design costs; and construction management costs. Other major cost categories are identical among the plans. The variations in lock costs primarily reflect differences in concrete requirements for the alternative lock sizes.

Investment costs represent the sum of the construction outlays plus the accrued interest on those expenditures up to the time that a plan’s benefit or service become available. The earliest probable date by which a new lock could become available for use at Chickamauga is 2010. It was determined that any of the lock size alternatives could be placed in operation by 2010, under an optimal authorization and implementation scenario. Therefore, 2010 became the base year for calculating interest during construction for each of the final alternatives. All expenditures prior to year 2010 were increased by adding compound interest at 6.375 percent from the date of the expenditure to year 2010. Similarly, expenditures after year 2010 were discounted from the date of expenditure to

the base year. The estimated investment costs for each of the final alternatives are summarized in Table VII-1.

**Table VII-1 – Summary of First Costs and Investment Costs
Final Alternative Plans
(Thousands of FY 2001 Dollars; 6.375% Discount Rate)**

Item	WOPC 60'x360'	WOPC w/ Congestion Fee	75'x400'	110'x600'
Cost Category:				
Lands & Damages	$ 927	$ 927	$ 927	$ 927
Relocations	6,740	6,740	6,740	6,740
Locks	156,192	156,192	168,241	189,040
Channel Improvements	10,125	10,125	10,125	10,125
Cultural Resources Pres.	135	135	135	135
Buildings, Grounds, & Utils.	5,232	5,232	5,232	5,232
Permanent Operating Equip.	2,483	2,483	2,483	2,483
Feasibility Studies	2,000	2,000	2,000	2,000
Planning, Engineering, Design	32,490	32,490	34,810	38,580
Construction Management	9,940	9,940	10,620	11,780
HTRW Remedial Action	125	125	125	125
Total First Cost	$226,389	$226,389	$241,438	$267,167
Interest During Construction	38,587	38,587	39,877	40,639
Total Investment Cost	$264,974	$264,976	$281,315	307,806

2. Annual Costs

Annual costs for the without-project condition and the alternative improvement plans are displayed in Table VII-2. Total annual costs for each alternative plan are the summation of the annualized capital costs and the annual operation and maintenance costs. Annual capital costs represent the annual interest and amortization charges on the total investment costs, calculated using the interest rate of 6.375 percent and a 50-year project life, as previously indicated.

Annual O&M costs were estimated based upon actual cost experience at Tennessee River projects. Average annual maintenance costs are estimated to be $2.6 million for the WOPC and 75'x400' lock while the 110'x600' lock is $15,000 per year less. This difference results from the more operating cycles associated with the smaller locks. Because of the more operating cycles, future maintenance will be conducted earlier than for the 110'x600' which has significantly less cycles. Maintenance costs include both

normal operation and maintenance costs and more extensive scheduled maintenance activities. Normal operation and maintenance costs provide for staffing the project and routine operation and maintenance activities such as utilities, equipment maintenance and supplies. Repair costs capture repairs to the five major lock components subjected to detailed reliability analysis and to the three components evaluated by means of expert elicitation.

Table VII-2 – Annual Costs of Final Alternative Plans Compared to the Without-project Condition (Thousands of FY 2001 Dollars; 6.375% Discount Rate)

Item	WOPC 60'x360'	WOPC W/ User Fee	75'x400'	110'x600'
Annual Investment Costs	$ 17,682	$ 17,682	$ 18,771	$ 20,465
Annual O&M Costs:				
Helper Boats	3,175	3,175	1,506	1,485
Maintenance	2,601	2,601	2,601	2,586
Repairs	179	179	179	179
Fee Administration	0	30	0	0
Subtotal	$ 5,955	$ 5,985	$ 4,286	$ 4,250
Total Annual Costs	$ 23,637	$ 23,667	$ 23,057	$ 24,715
Incremental Annual Costs		$ 30	$ -580	$ 1,078
Helper Boat Adjustment*		0	1,669	1,690
Incremental Annual Costs (Adj)		$ 30	$ 1,089	$ 2,768

* Helper boat cost reductions are treated as benefits, therefore the incremental helper boat cost reductions are removed from the costs and added to the benefits.

The incremental annual costs for each alternative presented in Table VII-2 represent the annual costs of the alternatives less the without-project condition annual costs. Incremental annual costs range from $30,000 for the congestion fee alternative to about $2.8 million for the 110'x600' alternative. It is recognized that the administration of a congestion fee program has an associated cost ($30,000) that distinguishes this alternative from the without-project condition.

3. Annual Benefits

a. Total Annual Benefits. In the current analytical context, focusing on cost minimization, benefits are

measured as specific cost reductions relative to the without-project condition. Benefits are measured as reductions in overall transportation costs (plus congestion fee revenues). Since recreational costs are based on number of days of lock closure, there are no incremental recreational benefits because all the new locks have the same amount of closure. The incremental benefits for each year in the period of analysis are converted to average annual benefits using standard discounting techniques, based again on a 50-year project life (2010-2060) and the 6.375 percent interest rate. Incremental annual benefits for the alternative improvement plans are presented in Table VII-3.

b. Benefits by Type. The navigation benefits (Table VII-3) attributable to the alternative plans are cost reduction, shift-of-mode and increased growth of existing movements, as well as the congestion fee revenues collected under the Congestion Fee alternative. Cost reduction benefits are benefits to existing traffic that is able to realize efficiencies because of the installation of a larger lock. Cost reduction benefits can be either delay reduction or fleet benefits, which reflect the capability to move in larger tows, more efficient barges, and so forth. Shift-of-mode benefits result when shippers shift from an overland mode or from another waterway routing to take advantage of efficiencies offered by the waterway improvement. New movement benefits (or benefits to induced traffic), in this instance, result when existing shippers choose to move larger volumes of traffic on the waterway because of improvements at Chickamauga. Congestion fee revenues represent the cost that was previously imposed on shippers that have left the navigation system because of imposition of the congestion fee.

Table VII-3 – Incremental Annual Benefits for Final Alternative Plans (Thousands of FY 2001 Dollars; 6.375% Discount Rate)			
Benefit Category	**User Fee**	**75'x400'**	**110'x600'**
Navigation Benefits:			
Transportation Cost Reductions	$ -6,031	$ 1,380	$ 2,341
Congestion Fee Revenues	5,954	0	0
Subtotal, Navigation Benefits	-77	$ 1,380	$ 2,341
Other Benefits:			
Helper Boat Cost Reductions	0	1,669	1,690
Fee Administration Reductions	-30	0	0
Subtotal, Other Benefits	$ -30	$ 1,669	$ 1,690
Total Incremental Annual Benefits	$ -107	$ 3,049	$ 4,031

Other benefits evaluated are also presented in Table VII-3. The categories are helper boat cost reductions and external cost reductions, measured as incremental reductions in highway congestion, emissions, accidents, and highway damages that would result from reductions in diverted traffic with navigation improvements at Chickamauga. Helper boat cost reductions occur because fewer helper boats are required with larger lock sizes. It was estimated that no appreciable increase in recreation traffic would occur because of the alternative improvement plans; therefore, there is essentially no incremental increase in recreation benefits with the alternative plans. External cost reductions stem primarily from reduced congestion, with much of the remainder attributable to reduced emissions. Reductions in highway damages contribute only a minor portion of the external cost reductions.

4. Summary of Annual Costs and Benefits

A summary of the annual costs and benefits for each of the alternative plans and the corresponding net annual benefits and benefit-cost ratios are displayed in Tables VII-4 and VII-5. Project data are displayed for the cost minimization framework in Table VII-4, and for a more traditional (benefit/cost) framework in Table VII-5. The congestion fee alternative, in this instance, produces negative net benefits. The plan that maximizes net benefits (or minimizes total costs, in the cost

minimization context) is the plan calling for construction of a lock measuring 75'x400'. This plan becomes, by definition, the National Economic Development (NED) plan. The 110'x600' lock also provides positive net benefits. The difference in net benefits between the two lock sizes is $697,000.

Table VII-4 – Summary of Annual Costs, Benefits, and Net Benefits for Alternative Plans (Cost Minimization Framework)
(Thousands of FY 2001 Dollars; 6.375% Discount Rate)

Item	WOPC 60'x360'	WOPC W/ User Fee	75'x400'	110'x600'
Investment Cost[1]	$ 17,682	$ 17,682	$ 18,771	$ 20,465
Non-Construction Costs:				
Helper Boats	3,175	3,175	1,506	1,485
Maintenance	2,601	2,601	2,601	2,586
Repair	179	179	179	179
Recreation	27	27	27	27
Transportation	312,447	318,478	311,067	310,106
Less Congestion Fee Revenues	0	-5,954	0	0
Fee Administration	0	30	0	0
Subtotal, Non-Construction Costs	$318,429	$318,506	$315,380	$314,383
Total Annual Costs	$336,111	$336,188	$334,151	$334,848
Net Benefits[2]		$ -77	1,960	$ 1,263

[1] Includes Interest During Construction
[2] Total Annual Costs for WOPC less Total Annual Costs for Alternative

Table VII-5 – Summary of Annual Costs, Benefits, and Net Benefits for Alternative Plans (Traditional Framework)
(Thousands of FY 2001 Dollars; 6.375% Discount Rate)

Item	WOPC 60'x360'	WOPC W/ User Fee	75'x400'	110'x600'
Incremental Annual Costs				
Incremental Capital Costs[1]	-	$ 0	$ 1,089	$ 2,783
Maintenance	-	0	0	-15
Repair	-	0	0	0
Fee Administration	-	30	0	0
Total, Incremental Annual Costs	-	$ 30	$ 1,089	$ 2,768
Incremental Annual Benefits				
Helper Boat Cost Reduction		0	1,669	$ 1,690
Fee Administration Reductions	-	-30	0	0
Transportation Cost Reductions	-	-6,031	1,380	2,341
Plus: Congestion Fee Revenues	-	5,954	0	0
Total, Incremental Annual Benefits	-	$ -107	$ 3,049	$ 4,031
Benefit/Cost Ratio	-	*	2.8	1.5

[1] Includes Interest During Construction