

REFORMULATION OF THE UPPER STEELE BAYOU PROJECT YAZOO BASIN, MISSISSIPPI

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Since 1989, the U.S. Army Corps of Engineers, Vicksburg District, has been reformulating the remaining unconstructed segments of the Upper Steele Bayou Project in the Yazoo Basin, Mississippi. An array of alternative plans, emphasizing increasing urban flood protection, reducing agricultural intensification, and lessening adverse environmental impacts, has been evaluated. The draft reformulation report was completed in December 1991.

The constructed portion of the Upper Steele Bayou Project consists of channel improvement and related features from Mississippi State Highway 14 to the northern end of Swan Lake (Figure 1). These unconstructed upper portions of the project are being reformulated: Main Canal and Black Bayou, which are the major outlets for both agricultural runoff and flooding in the Greenville, Mississippi, urban area. Environmental studies, however, encompass the entire project area downstream to Highway 14. Leroy Percy State Park and the Yazoo National Wildlife Refuge contain most of the important environmental resources in the area.

The flooding in the upper basin is significant. Damages total more than \$4.0 million annually. Flood damages along Black Bayou exceed \$2.5 million per year, and along Main Canal, annual damages are more than \$1.5 million. Almost 100,000 acres of productive farmland are subject to inundation. Urban flooding problems in Greenville were emphasized by two major events in February and April 1991, in the midst of the reformulation study. Damages in Greenville are estimated at almost \$1.0 million annually.

A thorough assessment of the engineering, economic, and environmental aspects of the Upper Steele Bayou project alternatives was conducted. As a part of this task, new engineering and economic information was developed, and a particular emphasis was assigned to acquiring detailed environmental data. A comprehensive review of the project design was also accomplished in order to provide much needed flood

protection to urban properties in Greenville and to the surrounding agricultural industry. Environmental features were incorporated into the design to the maximum extent possible in order to minimize fish and wildlife losses. For environmental losses which could not be offset through design, appropriate mitigation measures were developed for compensation.

Table 1 illustrates the array of plans developed for Main Canal. Several gradations of improvement were considered for the stream. "Cleanout" comprises a 2-foot deepening of the channel. Plans 3 and 7 call for as much as a 60-foot bottom width, whereas Plans 4 and 8 entail at most a 90-foot bottom width. The first four plans were developed to accommodate the existing flow distribution of 70 percent down Main Canal and 30 percent to Black Bayou. Plans 6-8 "repeat" Plans 2-4 with the only change being that 100 percent of the flow is diverted to Black Bayou by a closure in Main Canal which was a part of the original project plan prior to reformulation.

In order to address urban flooding in Greenville, the Main Canal plans extend upstream to approximately 2 miles above Highway 82 and will further improve this major outlet for Greenville. Improvements were also considered on six laterals in the Greenville area, but additional work on only Robertshaw Ditch and Ditch No. 6 is economically feasible. Proposed improvements of these two laterals, together with the best Main Canal and Black Bayou plans discussed in the following paragraphs, would afford Greenville essentially 100-year protection from Main Canal and Black Bayou flows. About 75 percent of the existing urban damages would be eliminated. These two laterals, together with Plan 3, the best, or National Economic Development plan identified for Main Canal, are shown on Figure 2. Approximately 25 miles of channel work -- from one bank only -- would convey the existing 70 percent of flow from upstream of Greenville through Main Canal. The lower 18 miles would have a 60-foot bottom width. Along the upper 7 miles, the bottom widths transition from about 55 feet to about 30 feet at the upper end of the work. Two in-

stream weirs are included. The plan provides agricultural protection south of Greenville from a 5-year frequency flow. Approximately 60 percent of the total existing flood damages would be alleviated.

Table 2 illustrates the slate of plans for Black Bayou. Clearing and snagging involves removal of all obstructions in the existing channel. The other alternatives mirror the Main Canal plans shown on Table 1. Maximum bottom widths range from 80 feet for Plans 3 and 7 to 100 feet for Plans 4 and 8.

Each Black Bayou alternative includes a selective clearing and snagging 6.3-mile reach along lower Black Bayou in the vicinity of the environmentally sensitive Leroy Percy State Park. Since before this study, the Vicksburg District had been working with the State of Mississippi concerning the appropriate extent of work in this area. Beginning in the fall of 1990, coordination intensified, primarily with the Mississippi Department of Wildlife, Fisheries, and Parks. Simply stated, this work is the maximum allowable in view of the Park's fish and wildlife resources. At the same time, the feature is the minimum degree of improvement which will still fit with all the upstream plans studied to accomplish needed flood control along Black Bayou.

Figure 2 also shows the National Economic Development plan for Black Bayou based on the study findings. Above the lowermost selective clearing and snagging reach would be approximately 30 miles of cleanout which would involve work from only one bank to remove about 2 feet of material from the bed and gradually less from the work bank, tapering out at the top of the bank. Five in-stream weirs are included in the plan. Only the existing 30 percent of flow from upstream of Greenville would be carried in the channel. This plan provides a 2 to 3 year frequency level of protection to agricultural areas; as on Main Canal, roughly 60 percent of the total existing flooding damages would be eliminated.

The best plans identified for Black Bayou and Main Canal, including the proposed laterals work in Greenville, comprise the "system" plan recommended in the draft report.

Major appurtenant features of the recommended plan include the seven in-stream weirs, which have the primary purpose of vegetation control within the weir pools to reduce maintenance requirements. They also have secondary benefits such as stabilizing water levels to the benefit of fish and wildlife.

Some 78 small grade and water control structures would be constructed along the banks within the project rights-of-way. Their major purposes are sediment reduction and protection from head cutting in tributaries to the project streams. An associated benefit is water quality improvement. In addition, these structures would have water retention capability during the winter for waterfowl.

Approximately 800 acres of riparian forested buffers would be established along the lower portions of Black Bayou and Main Canal, contiguous with Leroy Percy State Park and Yazoo National Wildlife Refuge. Benefits of these buffers are similar to those described above, plus the additional acreage of bottom-land hardwoods provided, which would also serve as a wildlife corridor connecting the remaining significant tracts of woodlands in the area.

A tally of the environmental effects of the Upper Steele Bayou Project indicates that significant waterfowl benefits accrue. Minor adverse aquatic impacts would be offset through project design, but remaining terrestrial and wetland losses require additional fish and wildlife mitigation. Most of these losses are associated with the previously completed work from the Swan Lake vicinity south to Highway 14. The mitigation would be in the form of acquisition of about 4,600 acres of frequently flooded, cleared agricultural lands from willing sellers for reforestation.

Table 3 presents pertinent project data. In summary, the reformulation study concludes that additional flood control measures in the Upper Steele Bayou Basin are economically feasible and environmentally sustainable, at an estimated cost of less than \$30 million. The proposed plan would provide significant flood protection to urban and agricultural properties. Urban protection to Greenville is essentially 100-year frequency while agricultural protection ranges from 2 to 5 years. Project features are incorporated which reduce maintenance requirements and sediment inflow while concurrently providing improved habitat for fish and wildlife. Approximately 4,600 acres of cleared agricultural lands would have to be acquired for reforestation to offset remaining environmental losses.

Findings discussed in this paper and documented in the draft report are tentative at this time. Results and recommendations are subject to possible modifications during review of the draft report by Corps' higher headquarters and the public. The final report is scheduled for completion in December 1992.

FIGURE 1

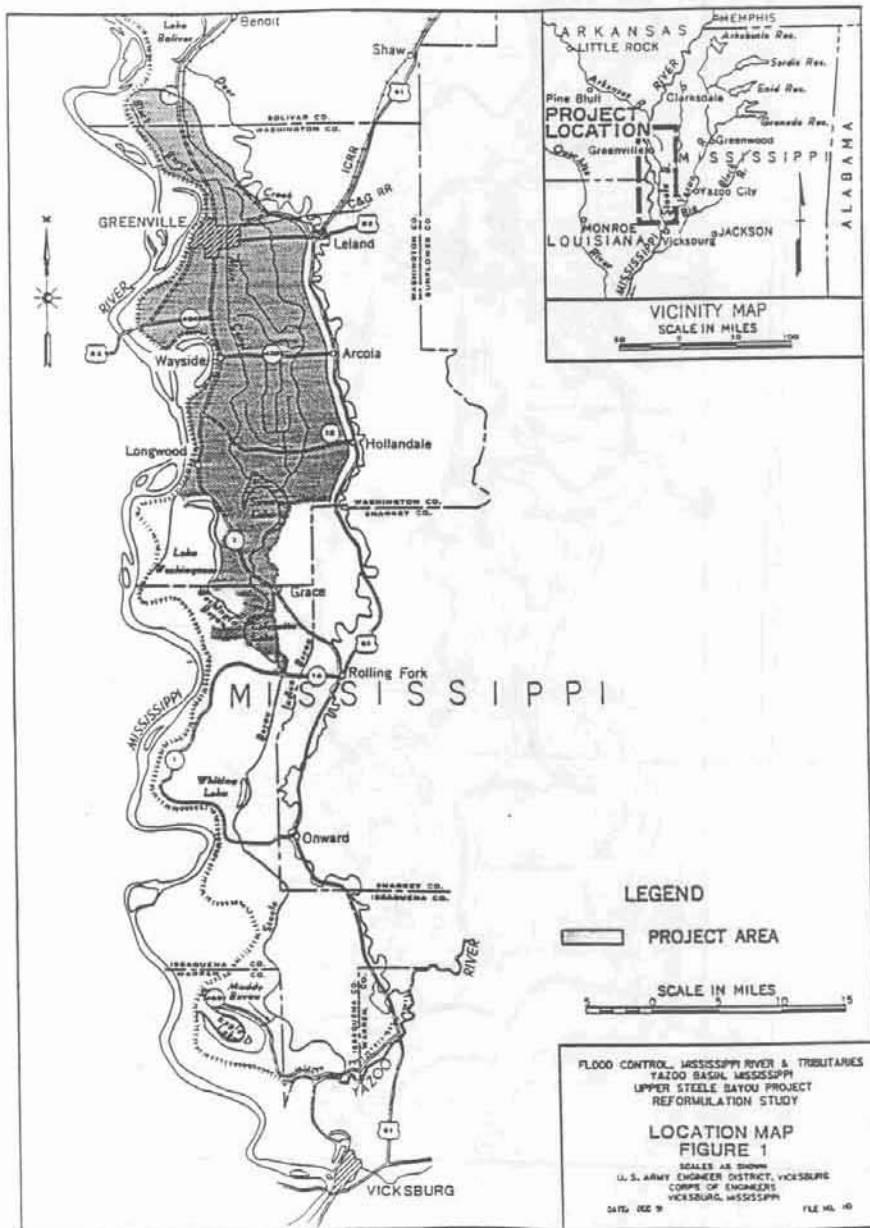


FIGURE 2

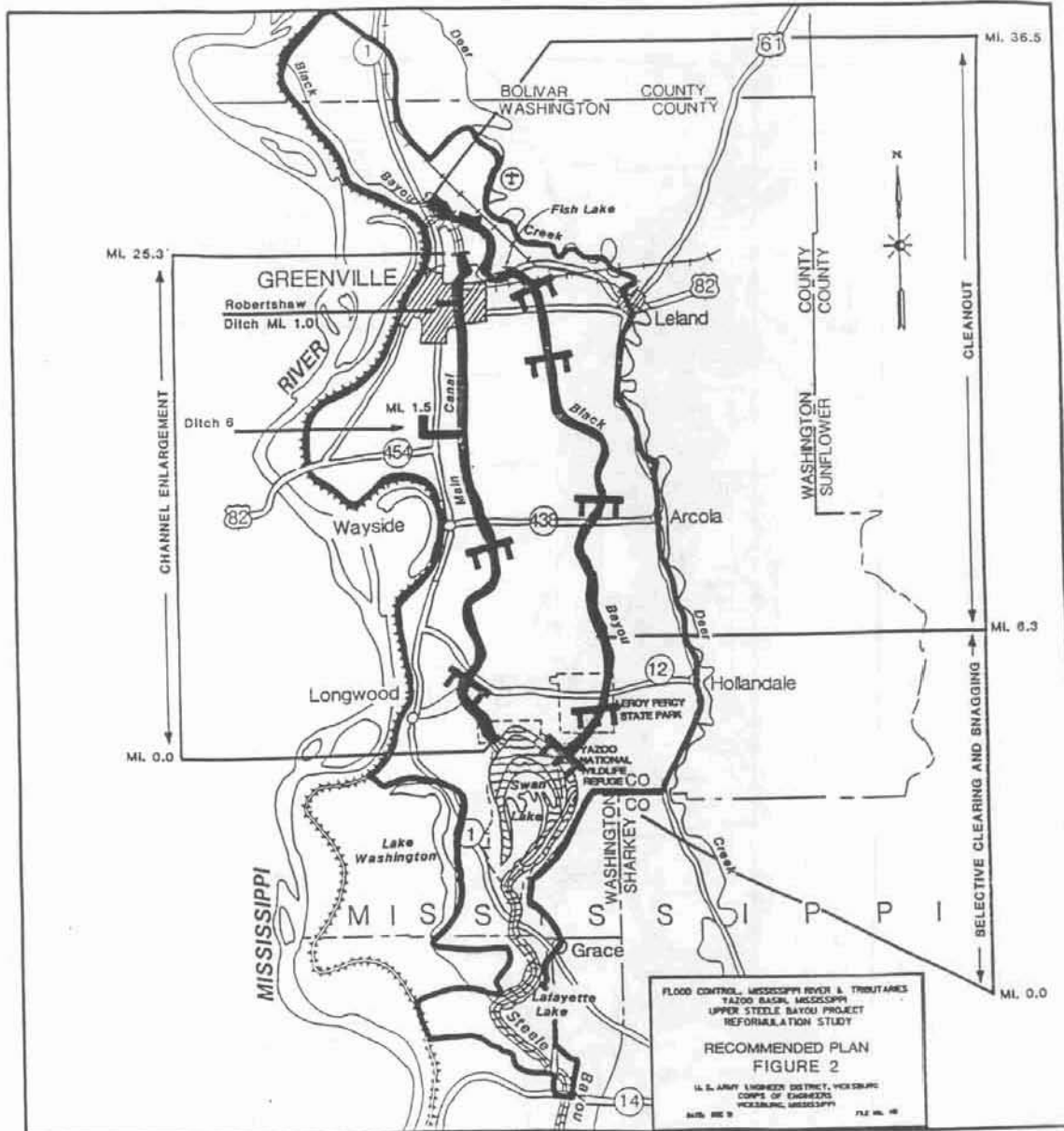


TABLE 1
MAIN CANAL PLANS SUMMARY
FIRST COSTS, ANNUAL COSTS, ANNUAL BENEFITS, EXCESS BENEFITS OVER COSTS, AND BENEFIT-COST RATIOS
(8-3/4 Percent Discount Rate Analysis)

Item	: Cleanout : Enlargement : Enlargement : Cleanout : Enlargement : Enlargement					
	: Plan 2	: Plan 3 ^{a/}	: Plan 4	: Plan 6	: Plan 7	: Plan 8
	- - Existing Flow Distribution - -			- - 100 Percent Flow Diversion - -		
First Costs (\$000) ^{b/c/}	8,025	15,692	20,478	8,336	15,751	20,537
Annual Costs (\$000) ^{b/d/e/}	801	1,582	2,105	879	1,588	2,111
Annual Benefits (\$000) ^{d/}						
All benefit categories ^{d/}	937	1,830	2,196	1,401	2,059	2,327
Benefits with redevelopment benefits excluded ^{f/}	859	1,656	1,958	1,314	1,884	2,088
Excess Benefits Over Costs (\$000)						
Benefits with redevelopment benefits excluded ^{f/}	58	74	-147	435	296	-23
Benefit-Cost Ratio						
All benefit categories ^{f/}	1.2	1.2	1.04	1.6	1.3	1.10
Benefits with redevelopment benefits excluded ^{f/}	1.07	1.05	0.93	1.5	1.2	0.99

^{a/} At the current Federal discount rate, the only implementable plan which provides the greatest amount of benefits over costs; i.e., the NED plan, is Plan 3.

^{b/} August 1991 price levels.

^{c/} Excludes mitigation costs; however, costs would be similar for all plans.

^{d/} Annualized using 50-year project economic life.

^{e/} Excludes fish and wildlife losses.

^{f/} Excludes fish and wildlife benefits.

TABLE 2
BLACK BAYOU PLANS SUMMARY
FIRST COSTS, ANNUAL COSTS, ANNUAL BENEFITS, EXCESS BENEFITS OVER COSTS, AND BENEFIT-COST RATIOS
(8-3/4 Percent Discount Rate Analysis)

Item	: Clearing : : : : : : : :							
	: and : : : : : : : :							
	: Snagging : Cleanout : Enlargement : Enlargement : Cleanout : Enlargement : Enlargement :							
	Plan 1	Plan 2 ^{a/}	Plan 3	Plan 4	Plan 6	Plan 7	Plan 8	
	- - - - Existing Flow Distribution - - - - - 100 Percent Flow Diversion - -							
First Costs (\$000) ^{b/c/}	8,037	15,542	24,262	30,980	16,675	24,262	30,980	
Annual Costs (\$000) ^{b/d/e/}	887	1,649	2,541	3,342	1,767	2,541	3,342	
Annual Benefits (\$000) ^{d/}								
All benefit categories ^{d/}	1,606	2,805	3,256	3,360	1,283	2,077	2,608	
Benefits with redevelopment benefits excluded ^{f/}	1,509	2,630	2,971	2,977	1,094	1,792	2,225	
Excess Benefits Over Costs (\$000)								
Benefits with redevelopment benefits excluded ^{f/}	622	981	430	-365	-673	-749	-1,117	
Benefit-Cost Ratio								
All benefit categories ^{f/}	1.8	1.7	1.3	1.01	0.73	0.82	0.78	
Benefits with redevelopment benefits excluded ^{f/}	1.7	1.6	1.2	0.89	0.62	0.71	0.67	

^{a/} At the current Federal discount rate, Plan 2 provides the greatest amount of excess benefits over costs; i.e., NED plan.

^{b/} August 1991 price levels.

^{c/} Excludes mitigation costs; however, costs would be similar for all plans.

^{d/} Annualized using 50-year project economic life.

^{e/} Excludes fish and wildlife losses.

^{f/} Excludes fish and wildlife losses.

TABLE 3
UPPER STEELE BAYOU PROJECT
REFORMULATION STUDY
PERTINENT DATA SUMMARY
RECOMMENDED PLAN

Item	Amount
Cost	\$29.9 million
Level of Protection	
Urban	100 Years
Agricultural	2 to 5 Years
Weirs	7 Each
Control Structures	78 Each
Forested Riparian Buffers	800 Acres
Mitigation Lands	4,600 Acres