APPENDIX 1

MITIGATION

YAZOO BACKWATER AREA REFORMULATION

APPENDIX 1
MITIGATION

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YAZOO BACKWATER AREA REFORMULATION

APPENDIX 1
MITIGATION

1. This appendix documents the results of fish and wildlife mitigation studies for the Yazoo Backwater Area Reformulation. This appendix focuses on the impacts of the proposed project, the need for mitigation, and the development of appropriate mitigation measures to compensate aquatic, waterfowl, terrestrial, and wetland losses.

2. This appendix identifies the aquatic and terrestrial impacts in habitat units (HU), while waterfowl impacts are shown in duck-use-days (DUD) and wetland impacts are shown in acres. Losses or gains were determined for each of the plans that are presented in an array of 35 possible project alternatives. A detailed evaluation of these studies in each of these environmental areas is shown in their respective appendixes in Volume III. The U.S. Army Engineer Research and Development Center (ERDC), (formerly Waterways Experiment Station), prepared the aquatic appendix under the guidance of an interagency Aquatic Habitat Evaluation Procedures Team. The U.S. Fish and Wildlife Service prepared the waterfowl appendix. ERDC prepared the terrestrial and wetland appendixes under the guidance of an interagency Terrestrial Habitat Evaluation Team. All analyses were based on current conditions and new sampling data.

3. The goal throughout the reformulation process was to develop a project that would balance the needs of flood control and the environment.

RESOURCES

4. The project area contains 925,901 acres of land of which 144,552 acres are currently managed by state and Federal agencies or under Federal programs. This managed land accounts for the difference in adjusted acres, as shown in Table 1-1.

TABLE 1-1
TOTAL LAND USE WITHIN THE YAZOO BACKWATER
LEVEE AREA

Land Use	Acres	Adjusted Acres a/	Wetlands	Acres	Adjusted Acres a/
Cotton	178,042	175,794	Nonhydric	187,763	184,873
Soybeans	299,793	269,885	Prior Converted	365,894	345,115
Corn	476	396	Farmed Wetlands	45,390	21,702
Rice	59,648	48,820	Unclassed	1,629	1,544
Herbaceous	46,299	42,660			0
Pasture	16,408	15,670			0
Total Cleared	600,664	553,224	**Total Cleared**	600,676	553,234
Bottom-land Hardwoods	235,350	149,164	Bottom-land Hardwoods	235,350	149,164
Swamp	39,355	31,047	Swamp	39,355	31,047
Total Forested	274,705	180,211	**Total Forested**	274,705	180,211
River	4,278	3,688	River	4,278	3,687
Lake	14,121	12,510	Lake	14,121	12,510
Pond	32,121	31,535	Pond	32,121	31,535
Cloud/Sandbar	12	10	Cloud/Sandbar	0	0
Total Water	50,532	47,743	**Total Water**	50,520	47,733
WMA		91,541	WMA		91,541
NWR		27,095	NWR		27,095
WRP		22,596	WRP		22,596
CRP		3,491	CRP		3,491
Total Managed		144,723	**Total Managed**		144,723
Total	925,901	925,901	**Total**		925,901

NOTE: WMA - Wildlife Management Area
NWR - National Wildlife Refuge
WRP - Wetland Reserve Program
CRP - Conservation Reserve Program

a/ Adjusted acres - the land use acres were adjusted by removing all lands managed by state and Federal agencies or under Federal programs.

5. Significant resources are described in the draft Supplemental Environmental Impact Statement. Specific evaluations of beneficial and adverse project impacts on waterfowl, terrestrial, wetland, and aquatic resources are contained in their respective appendixes. These evaluations were used to determine compensation for the selected plan.

6. There were 35 alternative plans evaluated to determine which alternative(s) would best achieve the project purpose and have the least impact to the environmental resources of the area. The 35 plans shown in Table 1-2 that were evaluated can be grouped into three separate categories--nonstructural, structural, and combination, as defined in the Main Report.

a. Nonstructural alternatives (1and 2) include conservation easements on forested and agricultural lands. Plan 2 would include reforestation of agricultural land.

b. Structural alternatives (27 and 28) include only the construction of pumping stations at different capacities (14,000 cubic feet per second (cfs) and 17,500 cfs). The levee alternative (Plan 29) will be to construct levees along the Big Sunflower River.

c. Combination plans (3-26 and 30-35) consist of a structural component and a nonstructural component. The structural component of these alternatives is to construct a pumping station near the Steele Bayou water control structure with a capacity of 14,000 cfs or 17,500 cfs depending on the alternative. The nonstructural component includes conservation easements on forested and agricultural lands and water level management of the ponding area.

TABLE 1-2
PROJECT FEATURES - ENVIRONMENTAL INVESTIGATION ARRAY

Alternative Project Plans				
Plan	Features			
	Structural	Easement		
		Existing Woodlands	Existing Open Lands	Water Management
1	N/A	Preserve below 100.3 ft	Use Retained	N/A
2	N/A	Preserve below 100.3 ft	Reforest below 90 ft	N/A
3	14,000-cfs pump a/	Preserve below 85 ft	Use retained below 85 ft	N/A
4	14,000-cfs pump a/	Preserve below 85 ft	Use retained below 85 ft	Below 80 ft b/
5	14,000-cfs pump a/	Preserve below 85 ft	Use retained below 85 ft	Below 85 ft c/
6	14,000-cfs pump a/	Preserve below 85 ft		N/A
7	14,000-cfs pump a/	Preserve below 85 ft	Reforest below 85 ft	Below 80 ft b/
8	14,000-cfs pump a/	Preserve below 85 ft	Reforest below 85 ft	Below 85 ft c/
9	14,000-cfs pump a/	Preserve below 90 ft	Use retained below 90 ft	N/A
10	14,000-cfs pump a/	Preserve below 90 ft	Use retained below 90 ft	Below 80 ft b/
11	14,000-cfs pump a/	Preserve below 90 ft	Use retained below 90 ft	Below 85 ft c/
12	14,000-cfs pump a/	Preserve below 90 ft	Reforest below 90 ft	N/A
13	14,000-cfs pump a/	Preserve below 90 ft	Reforest below 90 ft	Below 80 ft b/
14	14,000-cfs pump a/	Preserve below 90 ft	Reforest below 90 ft	Below 85 ft c/
15	17,500-cfs pump a/	Preserve below 85 ft	Use retained below 85 ft	N/A
16	17,500-cfs pump a/	Preserve below 85 ft	Use retained below 85 ft	Below 80 ft b/
17	17,500-cfs pump a/	Preserve below 85 ft	Use retained below 85 ft	Below 85 ft c/
18	17,500-cfs pump a/	Preserve below 85 ft	Reforest below 85 ft	N/A
19	17,500-cfs pump a/	Preserve below 85 ft	Reforest below 85 ft	Below 80 ft b/
20	17,500-cfs pump a/	Preserve below 85 ft	Reforest below 85 ft	Below 85 ft c/
21	17,500-cfs pump a/	Preserve below 90 ft	Use retained below 90 ft	N/A
22	17,500-cfs pump a/	Preserve below 90 ft	Use retained below 90 ft	Below 80 ft b/
23	17,500-cfs pump a/	Preserve below 90 ft	Use retained below 90 ft	Below 85 ft c/
24	17,500-cfs pump a/	Preserve below 90 ft	Reforest below 90 ft	N/A
25	17,500-cfs pump a/	Preserve below 90 ft	Reforest below 90 ft	Below 80 ft b/
26	17,500-cfs pump a/	Preserve below 90 ft	Reforest below 90 ft	Below 85 ft c/
27	17,500-cfs pump d/	N/A	N/A	N/A
28	17,500-cfs pump d/	N/A	N/A	N/A
29	Levee	N/A	N/A	N/A
30	14,000-cfs pump	Preserve below 100.3	N/A	N/A
31	14,000-cfs pump	N/A	Reforest below 87 ft	Below 75 ft e/
32	14,000-cfs pump	N/A	Reforest below 87 ft	Below 73 ft f/

TABLE 1-2 (Cont)

Alternative Project Plans				
Plan	Features			
	Structural	Easement		
		Existing Woodlands	Existing Open Lands	Water Management
33	14,000-cfs pump	N/A	Reforest below 91 ft	Below 73 ft f/
34	14,000-cfs pump		Reforest below 91 ft.	Below 91 ft
35	14,000-cfs pump		Reforest below 88.5 ft	Below 88.5 ft

a/ Pump would be operated to provide flood damage reduction for cleared lands above the easement elevation.
b/ 1 December to 1 March.
c/ 80 feet 1 December to 1 January and 15 February to 1 March; 85 feet 1 January to 15 February.
d/ Pump would be operated to provide flood damage reduction for cleared lands above elevation 80 feet except during 1 December to 1 March when pump would be operated at 85 feet.
e/ Year-round.
f/ Minimum pool will range from elevation 70 to 73 feet during low-water periods.

7. The 35 plans evaluated above are a compilation of the third array of alternatives and final array of alternatives that were defined in the Main Report. A no-action alternative was included in the final array. Table 1-3 shows the relationship of the 35 plans to the final array.

TABLE 1-3
PLAN COMPARISON

Final Array Alternatives	Environmental Investigation Array
Plan	Plan
1	No-Action
2	2
3	27
4	6
5	32
6	35
7	34

FINAL ARRAY ALTERNATIVES

PLAN NO. 1

8. The no-action plan includes no new construction. Existing levees and flood control structures would continue to operate under current plans to maintain the current level of flood protection.

PLAN NO. 2

9. Plan no. 2 represents a nonstructural alternative where conservation easements would be obtained from willing sellers on 231,000 acres of open lands below elevation 100.3 feet, with reestablishment of forest on 107,000 acres of open land below elevation 91.0 feet. No structural component is associated with this plan. Operation of the Steele Bayou Structure would be modified to maintain water levels between 70- and 73-foot elevation during low-water periods.

PLAN NO. 3

10. This is a structural plan that consists of a 14,000-cfs pumping station that has a pump elevation of 80 feet from 1 March to 1 December and elevation 85 feet from 1 December to 1 March. Environmental impacts of the plan would require compensatory mitigation. Operation of the Steele Bayou Structure would be modified to maintain water levels between 70- and 73-foot elevation during low-water periods.

PLAN NO. 4

11. This plan represents a combination alternative that consists of a 14,000-cfs pumping station that has a year-round pumping elevation of 85 feet. The nonstructural component consists of conservation easements from willing sellers and reforestation of 40,600 acres of open lands below the pump elevation. Operation of the Steele Bayou Structure would be modified to maintain water levels between 70- and 73-foot elevation during low-water periods. This plan would require no compensatory mitigation as planned.

PLAN NO. 5

12. This plan represents a combination alternative that consists of a 14,000-cfs pumping station with a year-round pump elevation of 87 feet. The nonstructural component consists of conservation easements from willing sellers and reforestation of 62,500 acres of open lands below the pump elevation. Operation of the Steele Bayou Structure would be modified to maintain water levels between 70- and 73-foot elevation during low-water periods. This plan would require no compensatory mitigation as planned.

PLAN NO. 6

13. This plan represents a combination alternative that consists of a 14,000-cfs pumping station with a year-round pump elevation of 88.5 feet. The nonstructural component consists of conservation easements from willing sellers and reforestation of 77,300 aces of open lands below the pump elevation. Operation of the Steele Bayou Structure would be modified to maintain

water levels between 70- and 73-foot elevation during low-water periods and reintroduce flows from the Mississippi River up to elevation 87 feet at the Steele Bayou Structure. This plan would require no compensatory mitigation as planned.

PLAN NO. 7

14. This plan consists of a 14,000-cfs pump with a year-round elevation of 91 feet at Steele Bayou, conservation easements from willing sellers, and reestablishment of forest on 107,000 acres of open lands below the 91-foot pump elevation. Conservation easements to preserve 91,600 acres of existing forest lands would be included in this plan. Operation of the Steele Bayou structure would be modified to maintain water levels between 70- to 73-foot elevation during low-water periods and to reintroduce flow from the Mississippi River up to elevation 87 feet at Steele Bayou. This plan would require no compensatory mitigation as planned.

ENVIRONMENTAL IMPACTS

GENERAL

15. Environmental impacts or benefits of each of the 35 with-project alternatives have been evaluated. Terrestrial, wetlands, waterfowl, and aquatic resources have been independently evaluated for project-inducted impacts. A detailed analysis of each of these environmental resources can be found in Appendixes 12, 13, 11, and 10, respectively.

16. The information included in this mitigation appendix deals only with the final array of alternatives. Results of the various resource evaluations presented in this appendix were extracted from their respective analysis in Volume III of this report.

17. The information presented in this section of the appendix deals only with indirect project impacts that are the result of the project. Direct environmental impacts (pump site area) will be addressed in paragraph "Environmental Impacts Due to Construction" of this appendix.

TERRESTRIAL RESOURCES

18. Environmental impacts for terrestrial resources were determined using Habitat Evaluation Procedures (HEP) developed by the U.S. Fish and Wildlife Service (FWS). A HEP team composed of professional biologists from the Corps of Engineers, FWS, and Mississippi Department of Wildlife, Fisheries and Parks (MDWFP) worked in cooperation to accomplish this study. Project lands were sampled to determine habitat quality based on habitat suitability index (HSI) models developed for evaluation species. Impacts were measured in average annual habitat units (AAHU's), which were used to determine compensation requirements. A contractor, Geo-Marine, Inc., under the guidance of ERDC and the HEP team, performed sampling of the habitat.

19. The HEP was used to quantify the potential impacts of the flood control project on the habitat units (HU's) for terrestrial wildlife. HEP is a habitat-based evaluation system that estimates current habitat conditions, predicts future conditions, compares project alternatives, and devises mitigation strategies without the need for direct sampling of the animal populations. HEP determines HU's which express the quality and quantity of the habitat for selected evaluation species. HU's are calculated by multiplying a Habitat Suitability Index value that ranges from 0.0 (unsuitable habitat) to 1.0 (optimum habitat) by the number of acres impacted for each species.

20. The species selected by the HEP team to evaluate habitat quality and the resulting project impacts were mink, wood duck, pileated woodpecker, barred owl, gray squirrel, and Carolina chickadee. To maintain consistency with the previous components of the Yazoo Basin flood control projects, the HEP team agreed to use the same six evaluation species used in previous studies.

21. HEP was used to evaluate hydrologic impacts of the project. Hydrologic impacts result from project-induced changes in flood frequency or duration over the project area.

22. Impacts or benefits of each project plan were determined by calculating the net change in AAHU between the 35 with-project alternatives for each evaluation species. Details of these evaluations are shown in Appendix 12. Table 1-4 shows the results of the terrestrial evaluation for the selected species as it pertains to the final array of alternatives. This table reflects only the hydrologic changes due to the project. The environmental benefits of reforestation are not included and neither are direct impacts as a result of pump station site clearing that will result in the removal of 38 acres of bottom-land hardwoods or the loss of 108 HU's.

TABLE 1-4
HYDROLOGIC IMPACTS ON TERRESTRIAL WILDLIFE HABITATS
(NONSTRUCTURAL REFORESTATION NOT INCLUDED)
FINAL ARRAY ALTERNATIVES

Alternative	Net Change in Average Annual Habitat Units (AAHU)						
	Barred Owl	Gray Squirrel	Carolina Chickadee	Pileated Woodpecker	Wood Duck	Mink	Total
1	-	-	-	-	-	-	-
2	0	0	0	0	0	0	0
3	0	0	0	0	-5,615.09	-957.10	-6,572.19
4	0	0	0	0	-3,406.84	-424.42	-3,831.26
5	0	0	0	0	-2,786.34	-108.53	-2,894.87
6	0	0	0	0	1,561.82	-378.24	1,183.58
7	0	0	0	0	4,055.85	-334.48	3,721.37

23. The results shown in Table 1-4 were taken from Appendix 12 and summarized for this appendix. Plans 6 and 7 include a minimum water level of 70-73 feet during periods of low water. Plans 2 through 5 were not evaluated with this low-water management plan and its benefits have not been quantified, but would increase the gains in the wood duck and mink categories since these are water-dependent species.

24. The addition of reforestation of open lands as part of the nonstructural flood control measures has a net positive increase in terrestrial AAHU's in addition to that shown in Table 1-4. Table 1-5 shows the net result of reforestation.

TABLE 1-5
OVERALL HYDROLOGIC AND NONSTRUCTURAL FEATURE BENEFITS
ON TERRESTRIAL WILDLIFE HABITATS
FINAL ARRAY ALTERNATIVES

Plan	Net Change in Average Annual Habitat Units (AAHU)						
	Barred Owl	Gray Squirrel	Carolina Chickadee	Pileated Woodpecker	Wood Duck	Mink	Total
1 a/	-	-	-	-	-	-	-
2	31,653.12	45,403.00	45,088.20	24,676.64	20,415.09	3,177.15	170,413.20
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	12,655.00	18,152.28	18,026.40	9,865.80	16,477.10	3,295.24	78,471.82
5	19,481.24	27,943.76	27,750.00	15,187.48	17,186.56	3,125.56	110,676.60
6	24,094.40	34,560.84	34,321.20	18,783.88	19,148.32	3,002.82	133,911.46
7	33,351.88	47,839.72	47,508.00	26,001.00	19,991.22	3,023.27	177,715.09

NOTE: Low-water management of 70 to 73 feet was not included in Plans 2–5 and benefits as such have not been qualified.

a/ Plan No. 1 is the No-Action alternative.

25. The results shown in Table 1-5 indicated a substantial increase in terrestrial AAHU's for a majority of the plans in the final array. Plan 3 is a structural plan that does not include a reforestation component and would require compensatory mitigation. No mitigation would be required for terrestrial resources under any of the other plans. The recommended alternative (Plan 5) has a net increase of 110,676.60 AAHU's.

WETLAND RESOURCES

26. A semiquantitative method developed by the Wetland Research Program at the ERDC was used to evaluate functional hydrologic impacts to forested and farmed wetlands (Appendix 13). Wetland functions evaluated were short-term water storage, long-term water storage, sediment detention, onsite erosion control, nutrient and dissolved substance removal, and organic carbon export. Wetland functional impacts were expressed as functional capacity units, which reflect both the quantity and quality of wetland functional valves. Functional capacity units were determined by multiplying the functional capacity index value of each function and the acreage affected. Forested and farmed wetland functional index values ranged from 0 to 1, with 1 representing optimal wetland value. Table 1-6 shows the results of hydrologic impacts to wetlands as it related to the final array of plans. Numbers in parentheses represent wetland acres lost, while other values represent a net gain of wetland acres above the baseline acreage shown.

27. A Geographic Information System was used to determine the percentages of forested wetlands and farmed wetlands. These data were derived from a wetland delineation prepared by an interagency team that included the Environmental Protection Agency and the Natural Resources Conservation Service. These percentages were applied to the average daily flooded acres (based on a period of record from 1943-1997) to determine wetland acreage for with- and without-project conditions. The net impact by wetland type for hydrologic and nonstructural features are presented in Table 1-6. Farmed wetlands are defined as those lands cropped before December 1985, but which still exhibit important wetland functions. Each hydrologic reach was visited to aid in identification of wetland type, and assessment of wetland functional capacity.

TABLE 1-6
WETLAND ACRES IMPACTED
BY HYDROLOGIC CHANGES
FINAL ARRAY ALTERNATIVES

Alternative	Total for all Reaches		Overall Total
	Forested	Farmed	
Baseline	35,134	13,398	48,532
1 a/	0	0	0
2	0	0	0
3	(8,341)	(3,495)	(11,836)
4	(6,238)	(2,610)	(8,848)
5	(2,915)	(1,277)	(4,191)
6	3,691	1,000	4,691
7	5,023	1,697	6,720

NOTE: ( ) indicates wetland acres lost, all other values represent a net gain of wetland acres.
a/ Plan 1 is the No-Action alternative.

28. Of the seven alternatives in the final array, three plans--3, 4, and 5--were a negative impact to wetlands resources. This negative impact is the result of hydrologic changes as a result of the pump operation. The remaining four alternatives have a positive or no net change. The recommended plan no. 5 will result in a net loss of 4,191 acres of wetlands based on hydrologic changes. The addition of reforestation of open lands as part of the nonstructural flood control measures is not included in Table 1-6.

29. Compensatory mitigation for wetlands hydrologic impacts of the final array of plans is shown in Table 1-7. Mitigation requirements are based on the concept of replacing lower value farmed wetlands with higher value forested wetlands. Acreage to compensate for a loss of wetland function was based on Function Capacity Units (FCU). FCU's are the product of the wetlands Functional Capacity Index (FCI) times the impacted acreage. Table 1-8 shows a breakdown of the FCI values used for impacts to farmed and forested wetlands for the reaches.

TABLE 1-7
WETLAND RESOURCE
IMPACT SUMMARY OF COMBINED HYDROLOGIC
AND NONSTRUCTURAL FEATURES

Alternative	Impacted Acres	Total Impacted FCU	Reforestation Acres	Total Reforestation FCU	Total FCU Change	Total FCU/ Total FCI	Mitigation Acres Required
1	0	0	0	0	0	0	0
2	0	0	32,602	77,919	77,919	32,602	0
3	(11,836)	(52,787)	0	0	(52,787)	(22,087)	22,087
4	(8,848)	(39,468)	26,455	63,227	23,759	9,941	0
5	(4,191)	(18,575)	29,524	70,562	51,987.2	21,752	0
6	4,691	22,071.5	34,861	83,318	105,389.3	44,096	0
7	6,720	30,824.3	38,645	92,362	123,185.9	51,542	0

TABLE 1-8
FCI VALUES FOR REFORESTATION OF
FREQUENTLY FLOODED AGRICULTURAL LANDS

Function	$FCI_{Forested}$	FCI_{Farmed}	FCI_{AA}
STWS	1.0	0.90	0.08
LTWS	1.0	0.45	0.44
SD	1.0	0.26	0.59
OSEC	0.67	0.04	0.50
NDSR	0.67	0.10	0.46
OCE	1.0	0.60	0.32
Total	5.34	2.35	2.39

30. FCI_{AA} is the average annualized Functional Capacity Index for mitigation acreage. It assumes a linear recovery of full functional capacity of acquired mitigation lands over a 20-year period. These values are used in calculating both mitigation acreages and reforestation benefits of nonstructural measures.

31. The final array of alternatives has three plans that produced negative impacts to wetland resources. The reforestation component for plan nos. 4 and 5 offset this negative impact and therefore would not require mitigation. Plan no. 3 would require 22,087 acres of mitigation to compensate for wetland losses. The recommended plan no. 5 will have an additional conversion (direct) impact due to construction of the pump structure. A total of 38 acres of bottom-land hardwoods and 110 acres of farmed wetlands would be converted by the project. These conversion losses will be addressed in the section "Environmental Impact Due to Construction" of this appendix.

WATERFOWL RESOURCES

32. The waterfowl analysis was conducted by FWS based on the caloric value of foraging habitat available to migratory waterfowl during the fall and winter months (Appendix 11). Impacts were measured in duck-use-days lost due to land use changes. A Geographic Information System data base prepared by the Corps for FWS was tailored to identify the acres of available foraging habitat under existing conditions with and without the project. For a determination of existing and future carrying capacities (based on the implementation of an alternative), land use was broken down into available foraging habitats having food value to wintering waterfowl: soybeans, rice, moist soil, bottom-land hardwood forested wetlands, and other to include pasture, open water, etc.

33. Waterfowl foraging habitat, regardless of food value, is only of use to wintering waterfowl if available. Food available is dependent on flooding. Waterfowl use relatively shallow water areas, 18 inches or less for feeding. Through the use of extensive hydrological data (1943-1999), the Corps provided seasonal acres flooded 18 inches or less for the wintering season. The land use data provided for the study area were specific to those acres inundated and represent only potential available foraging habitat. The acres to reforest in Table 1-9 below represent that portion of the reforestation acres that will directly contribute to waterfowl.

TABLE 1-9
GAINS OR LOSSES IN DUCK-USE-DAYS
SUMMARY OF COMBINED NONSTRUCTURAL AND HYDROLOGIC FEATURES

Alternative	DUD w/o Reforestation	Acres to Reforest	DUD with Reforestation	Plan Total DUD	Baseline Conditions, DUD	Change in DUD
1 a/	2,074,371	0	N/A	2,074,371	2,074,371	0
2	2,074,371	4,050	959,850	1,249,866	2,074,371	-824,505
3	1,885,437	0	N/A	1,885,437	2,074,371	-188,934
4	1,890,285	3,697	876,189	1,139,928	2,074,371	-934,443
5	1,993,933	3,902	924,774	1,203,105	2,074,371	-871,266
6	2,400,697	4,708	1,115,796	1,442,520	2,074,371	-631,851
7	2,436,833	4,778	1,132,386	1,463,613	2,074,371	-610,758

NOTE: Although reforestation results in a loss of waterfowl foraging habitat for all plans, there are other important waterfowl habitat requirements that are met with reforestation (loafing, pair bonding, etc.) and that are notably absent in agricultural fields.

a/ Plan No. 1 is the No-Action alternative.

34. The index of carrying capacity for wintering waterfowl foraging habitat is expressed DUD's per acre which represents the capacity of the available forage per acre that meets the energy requirements of one duck for one day. The information requirements to estimate DUD are (1) current land use, (2) extent, duration, and depth of flooding, (3) amount of winter food present by land use, (4) energy of food items, (5) deterioration rates of food items, (6) energy requirements of waterfowl, and (7) estimated density of waterfowl. Estimates of changes in DUD for the final array of plans are shown in Table 1-9.

35. All of the plans presented in the final array would have no change or a negative impact on waterfowl based on DUD's. This loss in DUD's can generally be attributed to the conversion of high caloric agricultural lands to forest and its associated loss in foraging habitat. Table 1-10 shows a breakdown of baseline conditions based on land use. Project-induced impacts by comparing future with- and without-project conditions using food as an index or carrying capacity are expressed in terms of DUD's. However, quantifying food availability and consumption by waterfowl in shallow water represents only one facet of waterfowl biology. DUD's represent only a portion of waterfowl habitat requirements. The availability of winter water at depths greater than 18 inches can have other uses; i.e., loafing and pair bonding are equally important and should be considered when selecting a plan that could reduce the extent of wintering waterfowl habitat.

TABLE 1-10
DUCK-USE-DAYS
AVAILABLE FOR BASELINE CONDITIONS

Land Use	Total Acres	DUD/Acre	Total DUD (Acres X DUD/Acre)
Fallow Fields	549	1,037	569,313
Rice	1,007	580	584,060
Soybeans	2,494	253	630,982
Crop Subtotal	4,050		1,784,355
Bottom-Land Hardwoods	5,088	57	290,016
Total Acres	9,138		2,074,371

36. In addition to food values, the benefits to wintering waterfowl would also be realized from the establishment or enhancement of forested wetlands. Benefits would include isolation for pair bonding, better protection from disturbance and harassment than in open areas, and protection for predation and extreme weather conditions. These unqualified benefits resulting from

establishment of more dependable wintering waterfowl foraging habitat will accrue to the whole range of resident and migratory species attracted to wetlands. It is for these reasons that no compensatory mitigation should be required for a reduction in DUD's as a result of the recommended plan. According to FWS, the overall benefits that result from reforestation far exceed losses of foraging habitat.

AQUATIC RESOURCES

37. A HEP team composed of members from the MDWFP, FWS, and Corps of Engineers was formed to guide the evaluation of aquatic resource impacts of the Yazoo Backwater Study. This aquatic analysis was conducted by the ERDC (Appendix 10). As in the terrestrial evaluation, HSI models were developed for evaluation species to determine changes in habitat value, with impacts measured in AAHU'S.

38. Table 1-11 is a summary of flood plain spawning acres and AAHU for each of the plans in the final array. Total spawning acres are average daily acres flooded during March - June within the 2-year flood plain. Spawning acres do not include that portion of the flood plain where duration of flooding is less than 8 days and depth of flooding is less than 1 foot. Total AAHU, calculated using cumulative HSI values for all evaluation species, are summed for all flood plain habitats. AAHU gained are the product of reforested acres and an annualized HSI (2.34) that reflects a 20-year transition from cleared to forested lands. Net change in AAHU is relative to baseline conditions and includes AAHU gained from reforestation.

TABLE 1-11
OVERALL EFFECTS OF COMBINED NONSTRUCTURAL
AND HYDROLOGIC FEATURES ON
AQUATIC HABITATS
FLOOD PLAIN SPAWNING ACRES

Alternative	Total Spawning Acres	Total AAHU	Reforested Acres	AAHU Gained	Net Change in AAHU
Baseline	72,316	200,106.94	0	0.00	0.00
1	72,316	200,106.94	0	0.00	0.00
2	72,316	200,106.94	34,218	80,070.12	80,070.12
3	48,777	136,363.49	0	0.00	-63,743.45
4	54,279	150,956.13	25,538	59,758.92	10,608.11
5	61,318	170,188.36	28,840	67,485.60	37,567.02
6	67,604	187,448.28	31,861	74,554.74	61,896.08
7	73,338	202,908.84	34,701	81,200.34	84,002.24

39. Based on the results shown above, all plans in the final array with the exception of plans 1 and 3 have a net positive benefit on aquatic spawning AAHU's. A net loss of 63,743.45 AAHU's for plan no. 3 would need to be compensated. Based on the annualized HSI value of 2.34, as stated above, the mitigation requirements for plan no. 3 would be 27,241 reforested acres. It should be noted that revised operation of the Steele Bayou Structure to maintain a minimum water surface of 70-73 feet during periods of low water has been included in plans 2 through 5; however, its benefits are not quantified in this analysis. The increase in minimum ponding depth would have a positive effect on the aquatic habitat. A substantial gain of 37,567.02 AAHU's above baseline conditions would be realized with the recommended plan.

40. Table 1-12 is a summary of flood plain rearing acres and AAHU's for each of the plans in the final array. Rearing acres are average daily acres flooded during March-June within the 2-year flood plain. Rearing acres do not include that portion of the flood plain where duration of

flooding is less than 8 days and depth of flooding is less than 1 foot. Total AAHU's are calculated using cumulative HSI values for all evaluation species and are summarized for all flood plain habitats. AAHU's gained are the product of reforested acres and an annualized AAHU of 0.69 that reflects a 20-year transition from cleared to forested lands. Net change in AAHU's is relative to baseline conditions and includes AAHU's gained from reforestation.

TABLE 1-12
AVERAGE EFFECTS OF COMBINED NONSTRUCTURAL
AND HYDROLOGIC FEATURES ON
AQUATIC HABITATS
FLOOD PLAIN REARING ACRES

Alternative	Total Remaining Acres	Total AAHU's	Reforested Acres	AAHU's Gained	Net Change in AAHU's
Baseline	129,013	140,881.90	0	0.00	0.00
1	129,013	140,881.90	0	0.00	0.00
2	129,013	140,881.90	60,478	41,729.82	41,729.82
3	88,622	97,969.27	0	0.00	-42,912.63
4	99,337	109,310.24	46,164	31,853.16	281.50
5	113,940	124,977.88	52,979	36,555.51	20,651.49
6	125,970	138,202.43	58,542	40,393.98	37,714.51
7	133,665	146,209.20	62,530	43,145.70	48,473.00

41. Based on the results shown in Table 1-12, all plans in the final array with the exception of Plans 1 and 3 have a net positive benefit on aquatic rearing AAHU's. A substantial gain of 20,651.49 AAHU's for rearing habitat above baseline conditions would be gained with the recommended Plan 5. In addition, the revised operation of the Steele Bayou structure to hold a minimum water surface between 70 to 73 feet during the low-water period will be included in this plan. Its benefits were not qualified in this analysis.

SUMMARY OF HYDROLOGIC/
REFORESTATION PROJECT IMPACTS

42. Table 1-13 is a summary of the final array of plans and environmental impact evaluations for indirect project impacts. Additional direct (pump site) impacts will be addressed later in this appendix. Numbers in parentheses indicate an environmental loss for which compensatory mitigation may be required. All other numbers indicate a gain in environmental habitat.

TABLE 1-13
PROJECT IMPACTS OF NONSTRUCTURAL AND
HYDROLOGIC FEATURES

Alternative	Terrestrial AAHU	Wetland FCU	Waterfowl DUD	Aquatic AAHU	Mitigation Requirements
1	N/A	N/A	N/A	N/A	N/A
2	170,413.20	77,919	(824,505)	80,070.12	0
3	0.00	(52,787)	(188,934)	(63,743.45)	27,241 acres
4	78,471.82	23,759	(934,443)	10,608.11	0
5	110,676.60	51,987.2	(871,266)	37,567.02	0
6	133,911.46	105,389.3	(631,851)	61,896.08	0
7	177,715.09	123,185.9	(610,758)	84,002.24	0

43. Compensatory mitigation would only be required for only plan no. 3 as shown in Table 1-13. The 27,241 acres shown as mitigation required is based on aquatic spawning AAHU's. Wetland and waterfowl mitigation requirements are less than that of aquatics.

44. Table 1-14 shows a summary of the appropriate resource factor for the determination of mitigation acreage.

TABLE 1-14
RESOURCE FACTORS FOR MITIGATION

Resource	Value per Acre
Terrestrial (AAHU's)	1.7561 a/
Wetlands (FCU's)	2.39
Waterfowl (DUD's)	237 (@70% Red Oaks)
Aquatic (AAHU's)	2.34

a/ Based on a weighted average. Under existing conditions 30 percent of available land is wood duck habitat; therefore, an assumed 30 percent of mitigation lands would be wood duck habitat Management Plan (MP) 4 (0.7) + Management Plan 5 (0.3).

ENVIRONMENTAL IMPACTS DUE TO CONSTRUCTION

45. The gains and losses presented above account for indirect changes to the environment. These are changes that are predicted to occur outside of the pump structure site. These indirect changes are based on altered hydrology and nonstructural features (reforestation) within the basin.

46. Direct impacts have and will occur at the pump site and were not included in the above evaluations. Direct impacts will be the result of land use conversion due to the construction of the pump plant.

47. The open lands at the pump site are generally the same today as they were in 1986, after the initial project clearing. Construction of the pump, however, would require the conversion of an additional 38 acres of bottom-land hardwoods and 110.5 acres of farmed wetlands. This conversion, due to construction of the pump, will result in a loss of 463 functional capacity units (FCU) based on the currently used wetland model. This loss will require the acquisition of 194 acres of mitigation lands.

PAST ENVIRONMENTAL IMPACTS

Lake George Area

48. In 1990, the Corps acquired 8,807 acres of open lands in Yazoo County, Mississippi. It was acquired in two parts. One tract consisted of an 8,382-acre block, which was reforested, and now reconnects Panther Swamp NWR with Delta National Forest. The other tract of 425 acres borders Panther Swamp NWR on the west. These properties were acquired to mitigate for the terrestrial losses that have occurred from the project-induced land clearing, the reduction in flooding, and the rights-of-way clearing for the completed reaches of the Yazoo Area Backwater levees.

49. Due to the timing of the acquisition of the Lake George WMA in relationship to when the terrestrial losses occurred with the construction of the Yazoo Backwater levees and the fact that all of the Lake George WMA could not be reforested, the Corps in consultation with FWS agreed to restudy the compensatory mitigation requirements for the Yazoo Backwater Levee. Based on the difference in time of loss and the time of acquisition and for those areas within Lake George that were not reforested, the Corps agreed to reanalysis and mitigate for these losses.

50. The Lake George reanalysis for additional mitigation requirements is based on the construction of the Yazoo and Satartia area levee projects that resulted in the loss of 526,950 terrestrial AAHU's. These losses are documented in "Yazoo Area Pump Project and Yazoo Area and Satartia Area Backwater Levee Projects, Fish and Wildlife Mitigation Report," July 1982. The levee system was completed in 1978; however, mitigation was not implemented until 1990. The objectives of this reanalysis were to:

a. Recalculate necessary total HU's lost based on the 13-year delay in implementing the mitigation.

b. Account for the phased planting over an 8-year period (1990-1997).

c. Calculate additional HU's lost assuming additional plantings occur in 2002 (a 5-year delay from 1997).

d. Determine additional mitigation acreage required.

51. Objectives a and b above were calculated with the following assumptions:

a. 526,950 terrestrial AAHU's were lost.

b. The period of analysis was 63 years rather than 50 years to account for the 13-year delay in implementation.

c. FWS estimated a 55.57 AAHU per acre gain from reforestation and the Corps estimated 62.78 AAHU's per acre gain. An average of 59.27 AAHU's per acre was used to estimate the gain from reforestation.

d. No AAHU value was assigned at the beginning of planting year 1 and full value was assigned in planting year 8.

e. 8,082 acres were planted from 1990 to 1997.

52. The AAHU's lost from 1978 to 2040 was 33,197,850 HU's (526,950 AAHU's per year X 63 years). Approximately 22,274,436 HU's will be gained from the 8,082 acres planted from 1990 to 1997 (1,676,570 HU's from the phased planting and 20,358,355 HU's from 1998 to 2040). Therefore, 10,923,413 HU's remain to be compensated.

53. Additional compensation will be achieved through easement conservation associated with the recommended plan in 2002. This would result in an additional 5-year delay in completing the compensation. An additional 866,940 HU's (173,388 AAHU's ÷ 5 years) would be lost during this time period. The 173,388 AAHU's is the difference between the annualized loss of 526,950 AAHU's and the annualized gain of 353,562 from reforesting 8,082 acres (22,274,436 ÷ 63 years). Therefore, the total HU's which require compensation is 11,790,353. Mitigation acreage was determined by dividing the AAHU's loss of 214,370 AAHU's (11,790,353 ÷ 55 years) by the reforestation benefit of 59.27 AAHU per acre. This results in the need for an additional 3,617 acres of reforestation.

54. The 3,617 acres of additional mitigation requirement was based on a terrestrial loss of 526,950 AAHU's. The 526,950 AAHU's presented here are based on an older method of resource assessment, like the method used for the original pump site clearing. The most notable difference was that resource factors ranged from 0 to 100 rather than the current method of 0 to 1.0 that is used in this appendix. Also, different parameters were measured; however, at the time, this method was approved by the Corps and FWS.

Yazoo Backwater Pump Site

55. In 1986 the site location of the proposed pump structure was cleared of 296 acres of bottom-land hardwood. The inlet and outlet channels and cofferdam were completed. The cleared 296 acres of land at the construction site has not been mitigated. This mitigation would be

implemented in 2002 as part of the conservation easement associated with the recommended plan. The existing habitat value used to determine impacts in the Fish and Wildlife Mitigation Report was 74.2 HU's per acre. Therefore, 21,963 HU's would be lost each year. This environmental loss of 21,963 AAHU's was evaluated under a similar but superseded method than that was presented in this appendix. The most notable difference was that resource factors varied for 0 to 100 rather than 0 to 1.0 and different parameters were measured. However, at the time, this method was approved by the Corps and FWS. The total HU's lost over the 65-year period of analysis (15 years from 1987 to 2002 plus the 50-year project life) is 1,427,608 HU's. The AAHU's lost is 28,552 (1,427,608 HU's ÷ 50 years). This results in the need for an additional 481 acres (28,552 AAHU ÷ 59.27 AAHU per year). This additional mitigation acreage will be included with the recommended plan.

SUMMARY OF ENVIRONMENTAL IMPACTS

56. This mitigation appendix has presented resource evaluations of terrestrial, wetlands, waterfowl and aquatics. Gains and/or losses to the environment have included indirect, direct (conversion of lands by construction) and past losses that have been prorated over time. Table 1-15 is a summary of these resource changes for the final array of alternatives.

57. Table 1-16 is a further summary of Table 1-15.

58. In conclusion, five of the six plans that are shown above have a net overall environmental benefit above the baseline values. The nonstructural features included in Plans 4-7 more than offset any environmental damages. As shown in Table 1-16, substantial gains in the environment can be made with all but one of these plans.

TABLE 1-15
ENVIRONMENTAL GAINS AND LOSSES
FINAL ARRAY OF ALTERNATIVES

Alternative	Terrestrial (AAHU)			Wetland (FCU)			Waterfowl (DUD)			Aquatics (HU) a/		
	CON	HYD	REF	CON	HYD	REF	CON	HYD	REF	CON	HYD	REF
2	0	0	175,542	0	0	77,919	0	0	-824,505	0	0	80,072
3	-108	-6,572	0	-463	-52,788	0	-2,166	-188,934	0	-142	-63,744	0
4	-108	-3,832	78,473	-463	-39,469	63,227	-2,166	-184,086	-750,357	-142	-49,151	59,759
5	-108	-2,896	110,678	-463	-18,579	70,562	-2,166	-80,438	-790,828	-142	-29,919	67,489
6	-108	1,183	133,912	-463	22,072	83,318	-2,166	326,326	-958,177	-142	-12,659	74,555
7	-108	3,721	177,715	-463	30,824	92,362	-2,166	362,462	-973,220	-142	2,802	81,200

NOTE: CON - Conversion losses
HYD - Hydrologic Changes
REF - Reforestation

a/ Flood plain spawning had the greatest impacts than rearing habitat value and was used to determine compensatory mitigation and the minimum threshold of reforestation required under Plans with negative hydrologic effects.

TABLE 1-16
ENVIRONMENTAL GAINS AND LOSSES

Alternative	Terrestrial (AAHU)	Wetland (FCU)	Waterfowl (DUD)	Aquatics (HU) a/
2	175,542	77,919	-824,505	80,072
3	-6,680	-53,251	-191,100	-63,886
4	74,533	23,295	-936,609	10,466
5	107,674	51,520	-873,432	37,425
6	134,987	104,927	-634,017	61,754
7	181,328	122,723	-612,924	83,860

NOTE: Although reforestation results in a loss of waterfowl foraging habitat for all plans, there are other important waterfowl habitat requirements that are met with reforestation (loafing, pair bonding, etc.) and that are notably absent in agricultural fields.

a/ Flood plain spawning.

59. The reforestation of 62,500 acres (recommended plan) is based on the amount of open acres that currently exist within the 1-year frequency flood plain. This proposed acreage is to be obtained by the Corps by easement from willing sellers. Should the total acreage of 62,500 not be acquired, a minimum mitigation acreage was determined. Habitat units offset by conservation easements are the same as if purchased in fee title. Table 1-17 summaries the minimum required acreages that would be required for compensatory mitigation of the recommended plan.

TABLE 1-17
MINIMUM COMPENSATORY MITIGATION ACREAGE
RECOMMENDED PLAN

Mitigation Item	Acreage
Mitigation Required – Recommended Plan	
Pump Structure – Indirect (Changes in hydrology)	12,786
Pump Structure – Direct (38 acres of woodlands at site)	194
Subtotal	12,980
Mitigation Required – Past Construction	
Pump Structure (original 296 acres of clearing in 1986 prorated for time lag)	481
Lake George Mitigation Area – (Prorated for time lag and unplanted areas)	3,617
Subtotal	4,098
Total Acreage to be Acquired (Minimum Mitigation Requirement)	17,078

MITIGATION PLANNING

60. The lands in the lower Mississippi Delta are noted for high value fish and wildlife resources. The area serves as an integral part of the economic and social life of local residents and sportsmen from around the Nation. Incorporating environmental design features/concepts into the project design eliminated losses to the terrestrial, wetland, waterfowl, and aquatics resources in the basin. The combination of structural/nonstructural flood control eliminates the need for traditional measures of mitigation that have been used in previous projects.

61. The reforestation of 62,500 acres of open lands by easement from willing sellers is the nonstructural feature of the recommended plan. Should this total acreage not be obtained and the minimum mitigation requirements are not met, then traditional mitigation efforts will be used,

such as fee title acquisition. The difference between the voluntary conservation easements and the required compensatory mitigation will be used as a basis for additional mitigation. The basis for mitigation (if needed) will be based on the results of the compensation analysis.

COMPENSATION ANALYSIS

TERRESTRIAL RESOURCES

62. The recommend plan will result in an increase of 107,674 terrestrial AAHU's with the construction and operation of the pump structure and reestablishment of bottom-land hardwoods with this plan. The habitat benefits of establishing new forest vary with the characteristics of the site and may depend upon the features that must be provided at the same time. For example, the four generalist species--barred owl, gray squirrel, Carolina chickadee, and pileated woodpecker--will benefit from almost any newly established forest, if tracts are of sufficient size (>10 acres not counting narrow or fringe woods) and enough time is allowed for growth. Wood ducks, however, require surface water within the forest at least during the brood-rearing period, and have the additional requirement of secure nesting cavities. Mink will use forested wetlands that are flooded more than 25 percent of the year, and also will benefit from establishment of forest cover adjacent to streams or lakes, as long as shoreline vegetation is allowed to develop.

63. The HEP software was used to calculate the net gain in terrestrial AAHU's provided by reforestation of 100 acres of cleared land under various management plans. Models of the predicted HSI values for each evaluation species over the initial stages of forest growth were developed by consensus of the HEP team. It was assumed that management plans would be

implemented concurrently with construction. The assumed median date of forest establishment was 2004 and the analysis extended to the end of the project life. AAHU benefits were annualized over the 50-year economic life of the project.

64. In practice, the selection of tree species composition for reestablished of bottom-land hardwoods will depend on the existing hydrology and soil characteristics of the site. Although Table 1-18 was developed specifically for bottom-land hardwoods, it is anticipated that actual forest replacement will involve a mixture of bottom-land hardwood species.

TABLE 1-18
TERRESTRIAL BENEFITS OF FOREST REESTABLISHMENT
UNDER VARIOUS MANAGEMENT PLANS

Plan	Increase in Average Annual Habitat Units (AAHU) per 100 Acres						
	Barred Owl	Gray Squirrel	Carolina Chickadee	Pileated Woodpecker	Wood Duck	Mink	Total
	Natural Succession						
MP 1	31.17	24.23	44.40	24.30	0.00	0.00	124.10
MP 2	31.17	24.23	44.40	24.30	60.38	43.05	227.53
MP 3	31.17	24.23	44.40	24.30	60.38	54.09	238.57
	Reforestation with Hard-Mast Trees						
MP 4	31.17	44.71	44.40	24.30	0.00	0.00	144.58
MP 5	31.17	44.71	44.40	24.30	60.38	43.05	248.01
MP 6	31.17	44.71	44.40	24.30	60.38	54.09	259.05

65. MP's 1, 2, and 3 assume that the area is allowed to revegetate naturally with a mix of typical bottom-land species, whereas MP 4, 5, and 6 involve active reforestation by planting primarily mast-bearing species (i.e., oaks and hickories). Within each category, plans differ according to the assumed flooding regime within the developing forest or its proximity to a semipermanent stream or lake.

66. MP 1 and MP 4 assume that the site is flooded cumulatively less than 25 percent of the year (<90 days) and is not located within 328 feet of a stream or lake containing surface water more than 90 days each year. Therefore, reestablishing forest cover on the site will benefit barred

owls, gray squirrels, Carolina chickadees, and pileated woodpeckers, but will provide no habitat for either mink or breeding wood ducks. It probably would not be appropriate to rely solely on these management plans for any project that involves significant impacts to the water-dependent species. However, these MP's may be appropriate in some portions of a larger management area or if more than one site is used in mitigation of project impacts.

67. The remaining plans are applicable to management areas adjacent to streams or lakes that contain water for long periods each year. As long as dense shoreline cover is encouraged, these areas will provide added benefits to mink and wood ducks. The plans are not well suited to flood plain situations because the frequent, very long-duration flooding would likely reduce habitat value for the generalist forest species (barred owl, gray squirrel, Carolina chickadee, pileated woodpecker) and may prevent the establishment of a diverse and structurally complex forest.

68. MP 2 (natural succession) and MP 5 (reforestation) assume that the management area is within 328 feet of a stream or lake that contains surface water for exactly 6 months cumulatively each year including continuous inundation during the March-May wood duck brood-rearing period. If the adjacent water body contained water less than 6 months, the site would have somewhat less value to mink, whereas it would have greater value if water was present more than 6 months. The benefit to wood ducks depends upon the presence of abundant over-water brood cover, and adequate numbers of well maintained, predator-proof nesting boxes.

69. MP 3 and MP 6 assume that the reforested area is within 328 feet of a stream or lake, that water is present more than 9 months each year including the March-to-May period, and that wood duck boxes are provided. Well-developed shoreline cover (for mink) and brood cover over the water (for wood ducks) are required.

WETLAND RESOURCES

70. Forested wetlands within the alluvial flood plains of the Lower Mississippi River delta were assessed for the following wetland functions: short- and long-term water storage, sediment detention, nutrient and dissolved substance removal, onsite erosion control, and export of organic carbon to downstream aquatic ecosystems. The degree to which existing forested wetlands and farmed wetlands perform these functions is related to the degree that hydrology has been altered in the past. Generally, farmed wetlands in delta areas have greater hydrologic alteration than forested wetlands. The proposed plans will alter the hydrology and land use and modify the capacity of forested wetlands and farmed wetlands to perform these wetland functions.

71. Certain assumptions were made during the evaluation of project impacts, which affect how the FCI values were determined. Those assumptions are:

a. Deposition of fill is expected to remove wetland hydrology, soils, and vegetation.

b. All farmed wetlands have been altered in the past to improve conveyance of water off of farmed land.

72. The types of wetlands and their functions are fairly uniform throughout the project area. Because of the uniformity of wetland function, all forested wetlands within the study area were assigned the same index values for ponding, roughness, storage, disturbance, surface area, and primary productivity. Likewise for all farmed wetlands in the study area, appropriate values were assigned for each parameter and were consistent for all reaches. Table 1-8 shown previously in this appendix summarizes the FCI values for impacts to farmed and forested wetlands for all reaches.

WATERFOWL RESOURCES

73. A total of 873,432 DUD of waterfowl habitat will be lost to the basin by the recommended plan. This net change in DUD is based on reforestation of open lands with bottom-land hardwoods using 70 percent red oaks. Although reforestation results in a loss of DUD's, there are other important waterfowl benefits that are met with reforestation that are absent from agricultural fields. Therefore, the overall benefits that result from reforestation far exceed losses of foraging habitat.

74. Compensation for impacts can be achieved through land use conversion resulting in a net increase in waterfowl forage value. Forage values for various land uses are shown in Table 1-19. Reforesting these tracts with 70 percent red oaks will change the value to 237 DUD's per acre. Waterfowl compensation will be integrated with wetland, aquatic, and terrestrial compensation.

TABLE 1-19
COMPENSATION VALUES FOR WATERFOWL MITIGATION

Land Use	DUD per Acre
Moist Soil	1,037
Rice	580
Soybean	253
Bottom-land Hardwoods @ 30% Red Oak	57
Bottom-land Hardwoods @ 50% Red Oak	123
Bottom-land Hardwoods @ 70% Red Oak	237 a/
Bottom-land Hardwoods @ 90% Red Oaks	270

a/ 70 percent red oaks is used in this appendix as an average seedling survival rate. Forty-one DUD was added due to the present of moist soil (fallow field) habitat during the first years after planting. The 237 DUD/ acre is used as the carrying capacity of reforested cleared land in the calculation of future with and without project conditions, and to determine mitigation acres.

75. Reforestation is the FWS preferred mitigation technique for waterfowl for several reasons:

a. Reforestation constitutes an ecosystem approach to replacing the waterfowl values that would be lost through project construction. Instead of concentrating on implementing a mitigation feature aimed at primarily replacing the lost food values, reforestation would address all wintering waterfowl habitat requirements. A bottom-land hardwood forest ecosystem provides food and other waterfowl habitat needs such as courtship sites, protection from predators and adverse weather, resting and roosting areas, and isolation from human disturbance.

b. Reforestation would provide a stable, low maintenance, high reliability mitigation feature. These mitigation features would last for the 50-year project life with little or no management/maintenance required. Other mitigation techniques that would replace lost waterfowl food values, such as moist soil management areas, would require periodic maintenance and/or active operation in order to provide the predicted food supply. With constantly changing funding priorities a "no maintenance-no operation-self sustaining" mitigation feature is more reliable and cost effective.

c. The chance of successful waterfowl habitat value replacement is highest with reforestation. Reforestation would create a system that would mimic the previously existing bottom-land hardwood ecosystem, which historically has a proven record of providing high quality waterfowl habitat.

d. Application of the principles of landscape ecology dictate that reforestation be used as the primary mitigation technique. The project area contains large blocks of agricultural land and lacks large blocks of forested habitat. To establish ecosystem diversity, large blocks of forested habitat should be established.

e. Reforestation would also offset terrestrial, aquatic, and wetland losses.

f. Reforestation of marginal agricultural (farmed wetlands) or other cleared lands is easily accomplished.

76. Reforested mitigation areas should be subject to frequent and sustained winter flooding. Forest stand composition should intentionally favor, but not be exclusively composed of, heavy seed species dominated by red oaks for maximum benefits to wintering waterfowl. Reforestation benefits could be expected immediately due to the presence and availability of native moist soil plants in the newly planted "forest" and would gradually change to those benefits associated with forest dominated by red oaks and the associated invertebrate community.

AQUATIC RESOURCES

77. HU's, calculated by multiplying a HSI value ranging from 0.0 (unusable habitat) to 1.0 (optimum habitat) by a measure of area, were used to express the quality and quantity of fish habitat for the different project plans. The assumption of this approach is that the abundance and distribution of evaluation species respond in a predictable fashion to changes in habitat quality defined by the variables in the HSI model. However, changes in HU's may not be directly associated with population density but areas with higher HU's are assumed to have potential to support more fish than areas with lower HU's. Pre- and postproject HU's were calculated for the following flood plain habitats.

a. Seasonally inundated agricultural land.

b. Seasonally inundated fallow land.

c. Seasonally inundated bottom-land hardwoods.

d. Oxbow lakes seasonally connected to the main stem river.

e. Small, permanent backwaters, such as scatters, brakes, and tributary mouths that are seasonally connected to the main stem river.

78. HSI values used to express quality of habitat for the evaluation species were developed by consensus of an interagency team of state and Federal fishery biologist and supplemented by field and literature data. The HEP team eliminated portions of flood plain where duration of flooding was less than 8 days and depth of flooding was less than 1 foot. Tables 1-20 and 1-22 provide flood plain habitat HSI values for spawning and rearing for the evaluation species.

TABLE 1-20
FLOOD PLAIN HABITAT HSI VALUES FOR SPAWNING
BY SPECIES

Species	Flood Plain Habitats				
	CAG	FALLOW	BLH	OXBOW	SBT
Flathead Catfish	0.04	0.11	0.71	0.61	0.92
Small mouth Buffalo	0.42	0.80	0.85	0.90	0.89
Blacktail Shiner	0.05	0.15	0.59	0.70	0.75
White Crappie	0.25	0.64	0.74	0.96	0.93
Largemouth Bass	0.19	0.51	0.86	0.98	0.97
Total	0.95	2.21	3.75	4.15	4.46

CAG – Cultivated Agricultural Land
FALLOW – Fallow Land
BLH – Bottom-land Hardwood
OXBOW – Oxbow Lake
SBT – Scatters, Brakes, and Tributary Mouths

TABLE 1-21
FLOOD PLAIN HABITAT HSI VALUES FOR REARING
BY SPECIES

Species	Flood Plain Habitats				
	CAG	FALLOW	BLH	OXBOW	SBT
Flathead Catfish	0.0	0.0	0.25	0.5	0.75
Small mouth Buffalo	0.17	0.01	0.06	1.0	0.11
Blacktail Shiner	0.0	0.0	0.03	0.0	1.00
White Crappie	0.02	0.04	0.08	1.0	0.12
Largemouth Bass	0.0	0.0	0.25	1.0	1.0
Freshwater Drum	0.05	0.15	0.50	0.0	0.19
Total	0.24	0.20	1.17	3.50	3.17

CAG – Cultivated Agricultural Land
FALLOW – Fallow Land
BLH – Bottom-land Hardwood
OXBOW – Oxbow Lake
SBT – Scatters, Brakes, and Tributary Mouths

79. An annualized HSI value for spawning and rearing of 2.34 and 0.69, respectively, that reflects a 20-year transition from cleared to forested lands was used to determine project-induced impacts. Since conversion of agricultural lands to bottom-land hardwoods is comparable to the mitigation methods used under the terrestrial, waterfowl, and wetland categories, this is the only mitigation method considered for flood plain aquatic impacts.

IDENTIFICATION AND SCREENING OF ALTERNATIVES

80. Incorporation of environmental features to reduce project impacts to the environment has been an integral component of the planning and design of the reformulation study. These measures are a refinement of the project flood control plan in an effort to reduce, minimize, avoid, or eliminate some adverse environmental impacts while not compromising the purpose of the project. The following measures were considered during the evaluation of the project impacts.

OPERATION OF PUMP STRUCTURE

81. Plans 3 through 7 in the final array are all based on the same capacity pump structure. The difference between the plans is primarily centered on the pump on/off elevation. In general, the lower in elevation that the pump is used the potential for impacts to the environment increases. The consensus of the reformulation effort was to protect higher elevations lands while changing the land use on lower elevation lands.

OPERATION OF STEELE BAYOU/
LITTLE SUNFLOWER STRUCTURES

82. The current minimum ponding area elevation during periods of low water ranges from 68.5 to 70 feet. A revision in this operation plan to raise this minimum ponding area to 70.0 to 73.0 feet was considered in the final array of alternatives. This increase in ponded water will have a net positive effect on the environment habitat of the area.

MITIGATION BY ACQUISITION AND
MANAGEMENT OF SEPARABLE LANDS

Fee Title Acquisition and Management
of Bottom-land Hardwoods

83. This alternative, considered in previous studies, is based on providing additional habitat quality through management of existing bottom-land hardwoods. Project-induced losses are assumed to be offset through management of existing bottom-land hardwoods by increasing the HU value of the land. Only the incremental increase in habitat value can be used to offset AAHU losses; therefore, vast amounts of land are required. In addition, the net gain from management is difficult to measure; therefore, monitoring of this alternative to ensure increases in habitat values are occurring and offsetting impacts is impractical. Reforestation of cleared lands is a more practical approach and results in much less property under Federal control.

Based on this information, acquisition and management of privately owned bottom-land hardwoods to offset project losses have been eliminated from further consideration.

Perpetual Land Use Easement Acquisition
of Bottom-land Hardwoods

84. This alternative is designed to prevent any change in existing land use for bottom-land hardwoods by securing a perpetual land use easement. This alternative preserves bottom-land hardwoods but does not offset project impacts. No project-induced clearing is anticipated as a result of this study; therefore, this alternative was not considered. In addition, sufficient laws exist that make it not economically feasible to convert bottom-land hardwoods.

Easement Acquisition of Cleared Agricultural
Lands with Reforestation/Regeneration

85. Farmers/landowners are allowed to retain ownership, but the lands are removed from production and allowed to revegetate naturally or reforested with naturally occurring hardwood species. The Corps would pay for the appropriate easement, reforestation, and other management requirements. This is the key element in the nonstructural feature of the recommended plan.

Fee Title Acquisition of Cleared Agricultural
Land with Reforestation/Regeneration

86. This alternative would reestablish a functional bottom-land hardwood forest on open agricultural lands. The Corps acquisition of these lands would increase the property under Federal control. Management of these lands would become necessary to establish and maintain the desired HU of the property.

RECOMMENDED MITIGATION PLAN

87. The lands in the lower Mississippi Delta are noted for high-value fish and wildlife resources. The area serves as an integral part of the economic and social life of local residents and sportsmen from around the nation. It is for these reasons that plan 5 was selected as the recommended plan.

88. Losses to terrestrial, wetland, and aquatic species were eliminated due to project planning. The pumping plant structure that is proposed in plans 3-7 is identical with the exception of the on/off elevation on the ponding area. The proposed reestablishment of 62,500 acres of bottom-land hardwoods is a nonstructural method of reducing flood damage, while providing a substantial increase in the quality/quantity of the environmental habitat of the basin. Although waterfowl losses do occur, the benefits derived from reforestation of agricultural lands far exceed the losses of foraging habitat.

IMPLEMENTATION OF NONSTRUCTURAL FLOOD CONTROL

89. Easement acquisition of 62,500 acres of open land will be from willing sellers. These lands represent the open lands within the 1-year frequency flood plain or below the pump elevation of 87.0 feet. Under this proposed method, easement lands are removed from production and are reforested with naturally occurring hardwood species. The Corps would pay for the appropriate conservation easement and reforestation.

90. Prior to the purchase of the conservation easements and eventual reforestation, several criteria must be met. A cultural resource survey will be conducted on those lands, which show the most potential for having sites, and a hazardous, toxic, and radioactive waste survey will also be conducted. Once these criteria are satisfied, Real Estate Division will prepare a Real Estate Design Memorandum which will have estimated values of the easements prior to offers being made to willing sellers.

91. The process of securing conservation easements could begin in 2001 or after the Record of Decision is signed. Purchasing of the easements will be undertaken as quickly as the real estate process can be completed and as funds become available. The first conservation easement will be used to offset those remaining environmental losses from the construction of the Yazoo Backwater levee and the previous work on the inlet and outlet channel that was completed in 1987. As more conservation easements are purchased, these would be counted toward any mitigation requirements on the Yazoo Backwater pump station. The Corps is committed to the acquisition and reforestation of the entire 62,500 acres of conservation easements.

REVIEW OF PAST BOTTOM-LAND HARDWOOD RESTORATION EFFORTS

92. The Lower Mississippi River Alluvial Valley, comprising the flood plain of the Mississippi River from southern Illinois to Louisiana, historically contained an estimated 25 million acres of bottom-land hardwood forest (Natural Resources Conservation Service, Wetland Science Institute, 1998). These bottom-land hardwoods provide value such as wildlife habitat and timber production. Because of their positions along rivers and streams or in other wet areas, they also provide value to society such as water quality enhancement and flood control. The objectives of most reforestation programs were to establish forest cover for wildlife habitat or restore other functions and values of cleared bottom-land hardwood systems (King and Keeland, 1999). There has been a major effort by Government agencies in restoring these ecosystems by utilizing Federal funds and restoration programs, such as the Conservation Reserve Program, Wetland Reserve Program (WRP), Wildlife Habitat Improvement Program, and the Environmental Quality Incentives Program.

93. Some problems that often occur in restoration efforts are a lack of clear definition of restoration, clear plans and objectives, and no established baseline for restoration, as well as problems with obtaining the seed and seedlings from suppliers and restored or managed hydrology (King and Keeland, 1999). Ecological restoration is generally accepted as the

reestablishment of natural ecological processes that produce certain dynamic ecosystem properties of structure, function, and processes. However, restoration is a term that is often used and applied loosely (Stanturf and Schweitzer, 1998). It is difficult to obtain a clear definition of restoration and quantifying the different spatial end ecological entities involved in restoration success. The lack of clear objectives will increase the chances of failure. There must be objectives in order to be successful in the effort of restoration. Monitoring is critical to ensure that the plans and objectives are being achieved and find out what went wrong when it fails. Without an established baseline for restoration projects, it will be difficult to monitor for restoration success.

94. Many factors may influence failures or success of a given restoration project, including acorn collection and handling, planting techniques, competition, weather, herbivore damage, species selection, or a combination of all these. In a survey conducted by the U.S. Geological Survey during late 1997 on "Evaluation of Reforestation in the Lower Mississippi River Alluvial Valley," several Federal and state agencies restorationists were surveyed. The survey obtained questions dealing with the amounts of restoration tract, problems, failures, and success of reforestation. In the survey, restorationists indicated certain problems that could lead to failures of any given restoration project; e.g., excessive flooding, drought and herbicidal damage (King and Keeland, 1999). In 1996, the Forest Service conducted a survey on 46 WRP tracts for the purpose of assessing reforestation success on these tracts (Stanturf and Schweitzer, 1998). According to their findings, the first years of the WRP program were not successful.

95. The success of the Federal and state agency reforestation programs and its foundation on principles of landscape ecology were encouraging; however, as noted by the U.S. Geological Survey, the overall success is still limited by on-the-ground problems (King and Keeland, 1999). King and Keeland stated in their report that state and Federal agencies are having an impact on reforestation of the Lower Mississippi River Alluvial Valley. The amount of land scheduled for reforestation by all agencies over the next 5 years (219,852 acres) is estimated to exceed totals from the previous 10 years (191,914 acres).

96. To have a successful reforestation or restoration program, the first step is to eliminate the factors responsible for ecosystem degradation (King and Keeland, 1999).

REESTABLISHMENT OF BOTTOM-LAND HARDWOODS

97. Acquisition of reforestation easements on cleared agricultural lands within the 1-frequency flood plain will be initiated concurrent with project design and construction. Once a tract of land has been identified, evaluated, and an easement secured by the Corps, a reforestation plan will be developed that will evaluate the species of trees most suitable for this tract. The evaluation will include a review of the frequency and duration of flooding, soil types, tree species common to the area, planting dates, and other factors which may affect the mortality of the trees. The spacing and number of trees per acre will be based on the species recommended and current planting practices. After planting, the tract will be monitored to ensure a sufficient survival rate of trees. If sufficient trees do not survive, the tract will be replanted until sufficient survival rates exist to ensure a satisfactory forest stand.

98. Planting species to provide ecological productivity is the primary objective of the reforestation effort. Additional diversification will come from volunteer species expected for a given site. Plantings and natural regeneration of species such as willow, water, Nuttall, and overcup oaks; bitter pecan; green ash; persimmon and other native species and understory plants will provide diversity to recreate a forest environment ideal for supporting a wide range of wildlife populations.

99. Reforestation can be accomplished through natural succession or artificial regeneration. These reforestation methods are discussed below.

a. Natural succession. This method of reforestation should only be considered where available acorn or other seed sources exist at or near the site to be reforested. The increase in

AAHU's associated with natural succession presented in Table 1-18 assumes that reliable mast-producing seed sources exist near or within the mitigation site. Available mitigation lands are typically cultivated on a large scale for crops with little or no adjacent trees for mast sources. Natural regeneration on these types of areas would most likely result in undesirable light seeded, wind-distributed species with few hard mast-producing trees such as oaks and pecans. Although this alternative is economical, quality reforestation and desired mitigation results are site dependent.

b. Artificial regeneration. Experience in the reestablishment of bottom-land hardwoods on mitigation tracts indicates that containerized seedlings tend to survive in much greater proportions than bare root seedlings or trees established through direct seeding. These and other considerations will be taken into account prior to choosing a method of reforestation on a tract-by-tract basis. Seedling survivability depends to a great extent on the amount of flooding or drought that occurs during the first few growing seasons. All reasonable techniques will be employed to ensure the survival of seedlings through this critical period.

100. Acquisition of easements and reforestation will be accomplished concurrently with project design and construction. The conservation easements acquired initially will be used to mitigate for past construction at the pump site and Lake George area. A total of 4,098 acres will be required. After this milestone is met, all future lands will be assigned to the recommended plan.

INCREMENTAL ANALYSIS

101. The minimum compensatory mitigation acreages for the recommended plans as shown in Table 1-17 is 12,980 acres. Natural regeneration will require the purchase of additional conservation easements due to a reduced habitat value. Table 1-18 provides a breakdown of estimated benefits under various management plans. A breakdown of the cost comparison is shown below.

Artificial Regeneration

12,980 acres x 1.7561 AAHU's per acre = 22,794.18 AAHU's

12,980 acres x $1,931.50 (development costs per acre, Table 1-23) = $25,070,870.00

$25,070,870.00 ÷ 22,794.18 AAHU's = $1,099.88 per AAHU

Natural Regeneration

22,794.18 AAHU's ÷ 1.5513 AAHU's per acre = 14,693.60 acres

14,693.60 acres x $1,756.50 (development costs per acre, Table 1-24, less reforestation) = $25,809,308.40

$25,809,308.40 ÷ 22,794.18 AAHU's = $1,132.28 per AAHU

This cost comparison shows that artificial regeneration provides the required HU's at less cost. Natural regeneration would require the purchase of conservation easements on an additional 1,713.60 acres of open lands in order to meet minimum mitigation requirements. Values of AAHU's per acre used in the above calculation are based on a weighted average of 70 percent of Management Plan 4 plus 30 percent of Management Plan 5 to reflect existing available wood duck habitat.

IMPLEMENTATION OF MITIGATION MEASURES

102. Although compensatory mitigation is not a part of the recommended plan, it has been calculated. The Corps of Engineers is committed to the fee title acquisition and reforestation of lands should insufficient conservation easement lands become available to mitigate for the unavoidable losses from construction of the pump plant. Table 1-22 shows the compensatory mitigation acres required to offset construction of a pump station without the use of voluntary conservation easements or additional mitigation requirements from past construction.

TABLE 1-22
COMPENSATORY MITIGATION AND MINIMUM THRESHOLD FOR
NONSTRUCTURAL REFORESTATION

Alternative	Compensatory Mitigation (acres) b/	Minimum Threshold (acres) a/	
		Corps b/	FWS c/7
1	None	None	None
2	None	None	None
3	27,435	27,435	29,787
4	None	21,199	23,022
5	None	12,980	14,015
6	None	5,604	6,103
7	None	194	194

a/ Number of acres to reforest to achieve a no net loss of environmental resource value.
b/ Based on Corps future without-project projection.
c/ Based on FWS future without-project projection.

103. Under the recommended plan, the Vicksburg District has committed to the purchase of conservation easements on 62,500 acres of agricultural lands below elevation 87.0 feet, NGVD. As previously stated, the purchase of easements will begin as soon as the Record of Decision is signed, funding becomes available, and the Real Estate documentation can be completed. This process will run concurrently with the design of and construction of the pump station. One year after physical completion of the pump station, the Vicksburg District will evaluate its success in securing conservation easements from willing sellers. No additional conservation easements will be purchased after this timeframe. Should the District be unsuccessful in securing enough conservation easements to cover the compensatory mitigation requirements of the Yazoo pump station, the previous work on the inlet and outlet channel, those remaining losses from the timing of the mitigation for the Yazoo Backwater levee, and unforested areas within Lake George WMA, then the difference between the amount of conservation easements and the required compensatory mitigation will be purchased in fee title from willing sellers. This purchase in fee

would first be evaluated in the Yazoo-Mississippi Delta, but if sufficient agricultural lands were not available, then the District would look elsewhere in the Mississippi Alluvial Valley. These lands would be reforested and eventually turned over to a state or Federal agency to manage.

104. Tracts of land acquired by the Corps for fee title would be of sufficient size to justify management or would be contiguous to existing public lands. The Corps will authorize funds to provide for the operation and maintenance of mitigation lands to assure they will be developed and managed to their fullest potential. In order to establish baseline costs associated with management of Federal lands, Tables 1-23 and 1-24 are provided for a conceptual 1,000-acre mitigation tract. Table 1-23 shows a detailed breakdown of the first costs that can be expected to occur with fee title acquisition of mitigation lands. Table 1-24 shows a detailed breakdown of the estimated annual costs necessary for the proper operation and maintenance of Federally owned mitigation lands. The information provided on these two tables (although conceptual) is based on prior acquisition and development of mitigation lands by the Corps. Actual costs associated with acquisition, development, and operation and maintenance will vary due to the location and hydrology of the actual site.

TABLE 1-23
CONCEPTUAL MITIGATION TRACT OF 1000 ACRES
ESTIMATED FIRST COSTS

Item	Total Value ($)
Real Estate Costs	
Cropland (1,000 acres @ $800)	800,000
Improvements	20,000
Severance Damage	0
Total Lands	820,000
Contingencies (25%)	205,000
Total Lands	1,025,000
Acquisition Costs	
Two ownerships at $20,000	40,000
Public Law 91-646	
Public Law 91-646	
Relocations	7,000
Hired Labor	1,000
Title II Payments (Two ownerships at $25,000)	50,000
Title III Payments (Two ownerships at $500)	1,000
Total Estimated Real Estate Costs	1,124,000
Development Costs	
Reforestation (1,000 acres at $140 per acre)	140,00
Wood Duck Boxes (1,000 acres * 0.5 * 0.1 * $60 each)	3,000
Road Construction (4 miles at $40,000 per mile)	160,000
Boundary Survey (6 miles at $1500 per mile)	9,000
Contingencies (25%)	78,000
Total Development Costs	390,000
Engineering and Design (25%)	378,500
Construction Management (10%)	39,000
Total Estimated First Costs	1,931,500

TABLE 1-24
CONCEPTUAL MITIGATION TRACT OF 1000 ACRES
ESTIMATED ANNUAL COSTS

Item	Total Value ($)
Annual Costs	
Interest Rate (0.06625)	128,000
Sinking Fund (0.00279)	5,400
Wood Duck Boxes (50 at $10 each per year)	500
Canals and Channel Maintenance (1,000 acres at $2 / acre / year)	2,000
Road Maintenance (4 miles at $1,000 / mile / year)	4,000
Boundary Maintenance (6 miles at $200 / mile / year)	1,200
Vegetation and Water Management (1,000 acres at $2/acre/year)	2,000
Timber Management (1,000 acres at $3/acre/year)	3,000
Project Administration (lump sum at $10,000 per year)	10,000
Total Annual Costs	156,100

POTENTIAL MITIGATION/CONSERVATION LANDS

105. The 62,500 acres of conservation easements is based on the total number of open lands within the 1-year flood plain. Should acquisition of these lands from willing sellers not meet expectations, then Corps project managers in coordination with project sponsor and appropriate Federal agencies will determine whether to expand offers to those lands at or below the 2-year flood plain. Any compensatory mitigation lands that have to be acquired will be within the 2-year flood plain.

MITIGATION MONITORING

106. Although compensatory mitigation is not a part of the recommended plan, it has been calculated. The Corps is committed to the fee title acquisition and reforestation of these lands should insufficient conversion of open land to bottom-land hardwoods be accomplished with conservation easements to ensure mitigation for the unavoidable losses from the recommended plan. Mitigation monitoring will not be a part of the recommended plan. Since 1991, terrestrial

monitoring has been ongoing on the Lake George WMA which is within the study area. The Lake George Project is a nationally recognized restoration project. This monitoring project was implemented to evaluate terrestrial habitat replacement by the reforestation of agricultural lands. Projections of the terrestrial HU's gained over time were used to estimate the acres of terrestrial mitigation owed by a project. Should the monitoring efforts show different results than those projected by the biologists, then the amount of terrestrial mitigation owed on a project will be adjusted accordingly.

107. A wetland monitoring program has also been initiated by the Corps and FWS to evaluate not only the Lake George area, but other reforested areas to determine if the wetland projections anticipated by the biologists to be gained under the seven wetland functions will accrue. These seven wetland functions are short-term water storage, long-term water storage, water velocity reduction, sediment detention, onsite erosion control, nutrient and dissolved substance removal, and organic carbon export. Here too should results be different than projected, then adjustments to wetland mitigation will be undertaken.

STATUS OF VICKSBURG DISTRICT MITIGATION

108. The Vicksburg District is committed to fulfilling all of its authorized mitigation requirements. Lands acquired for mitigation by the Vicksburg District are from willing sellers and must meet certain environmental potentials such as its use as a moist soil area or its frequency of flooding prior to purchase. The lands purchased to meet this mitigation requirement are acquired concurrent with project construction. To date, the Vicksburg District has purchased 82,050.95 acres of mitigation lands, which is 12,450.95 acres above our required minimum mitigation of 69,600 acres. The current status of the District’s mitigation is shown in Table 1-25. It should be noted, however, that this is continuing effort, so this table may be updated at any time.

TABLE 1-25
VICKSBURG DISTRICT MITIGATION EFFORTS
12 JUNE 2000

Project	Authorized Acres	Acres Acquired	Acres Remaining	Percent Acquired (%)
Upper Steele Bayou	5,250	2,725	2,525	52
Upper Yazoo Project	17,000	8,183	8,817	48
Yalobusha and Tallahatchie River Channel Maintenance	1,380	1,380	0	100
Big Sunflower River Channel Maintenance	1,912	0	1,912	0
Yazoo Backwater Levee	8,400	8,807	+407	105
MS River Levee	5,200	0	5,200	0
Aloha-Rigolette Area	964	964	0	100
Abiaca/Coldwater	505	811	+306	161
Red River Waterway a/	14,000	6,400	7,600	46
Red River below Denison Dam	189	0	189	0
Tensas-Cocodrie Pump Plant	6,400	6,400	0	100
Sicily Island Area Levee	3,000	3,000	0	100
Below Red River	3,100	3,100	0	100
Bushley Bayou	1,400	1,400	0	100
Tensas River	0	0	0	100
Red River Waterway below Mile 104	900	900	0	100
Total	69,600	44,070	26,243	63 b/

a/ The mitigation requirement is 14,000 acres, although 26,000 acres are authorized. Remaining figures are based on the 14,000-acre requirement.

b/ Percentage does not include excess mitigation lands in the Tensas National Wildlife Refuge. Actual percentage of mitigation lands acquired to date is 118 percent.

PROJECT MITIGATION

109. Mitigation for the Upper Steele Bayou Project requires the purchase from willing sellers of 5,250 acres of frequently flooded agricultural lands for reforestation. The District has identified and obtained approval to acquire 8,195 acres of potential mitigation lands. To date, 2,725 acres of mitigation lands have been purchased. About 3,226 of the 8,195 acres are no longer available for purchase because of offer withdrawals, changes in ownership, desirability of lands and negotiation failures. The Upper Steele Bayou Project is under construction.

110. Mitigation for the Upper Steele Bayou Project in the Swan Lake area of the Yazoo NWR consists of a series of five weirs (complete), four lakes (complete), and levees (under construction) for facilitating the waterfowl management practices of FWS. The completion of these facilities will increase the aquatic AAHU's by 12,400 or 105 percent over preproject conditions. The completion of these facilities will also result in an increase in waterfowl resources of 806,938 DUD's over preproject conditions.

111. Mitigation for the Upper Yazoo Projects, Ascalmore Creek-Tippo Bayou, Big Sand Creek Levee Extensions, and the Pelucia Creek Project requires the purchase from willing sellers of 16,250 acres of frequently flooded agricultural lands for reforestation and 750 acres of moist soil management areas. The District has identified and obtained approval to acquire 15,313 acres of potential mitigation lands. To date, 8,183 acres of mitigation lands have been purchased, of which 788 acres are moist soil. About 2,596 of the 15,313 acres are no longer available for purchase because of offer withdrawals, changes in ownership, desirability of lands and negotiation failures. The Upper Yazoo Projects is under construction.

112. Mitigation for the Yalobusha and Tallahatchie River Channel Maintenance required the reforestation of 980 acres, creation of a 400-acre moist soil management area and anchoring instream structures. The District has reforested 980 acres and created a 400-acre moist soil area on Federal lands in the Askew Area. Instream structures did not work as designed and had to be removed. The instream fishery mitigation is being evaluated by ERDC. If this review shows that the fishery resource has not recovered to that of preproject conditions, then the Corps will work with the resource agencies to identify other methods to offset these losses. Construction of the Yalobusha and Tallahatchie River Channel Maintenance Projects is complete.

113. Mitigation for the Big Sunflower River Channel Maintenance requires the purchase from willing sellers of 1,912 acres of frequently flooded agricultural lands for reforestation. The District is working to identify potential mitigation lands for the project. The first item of construction for the maintenance project has been completed, and several mitigation tracts are under consideration to offset these losses.

114. Reformulation of the Yazoo Backwater Project is underway. The District has purchased 8,807 acres for mitigation for the levee features of the project. The District has reanalyzed this mitigation feature as part of the Yazoo Backwater Reformulation Report.

115. Mitigation for the Mississippi River Levees Project requires the reforestation of 5,200 acres of frequently flooded agricultural lands. Currently, the District is in the process of attaining approval to acquire 700 acres in Louisiana.

116. Mitigation for Aloha-Rigolette Area Project requires the reforestation of 542 acres and construction of 422 acres of waterfowl habitat on the Grand Cote NWR near Marksville, Louisiana. Contracts to accomplish this effort are complete.

117. Environmental design measures incorporated into the Abiaca Creek Watershed levee project, Demonstration Erosion Control (DEC) Project, Yazoo Basin, Mississippi, resulted in approximately 811 acres mitigation/reforestation acreage for the project. The District purchased a perpetual easement on the acreage that allows for reforestation and certain timber management rights. Mitigation requirements for Sediment and Flood Control Measures, Coldwater River Watershed, and DEC project were met by dedicating 313 Abiaca Creek Watershed reforestation acres as compensation.

118. Red River Waterway, Mississippi River to Shreveport, Louisiana. Mitigation for the Red River Waterway Project, Above River Mile 104, requires the acquisition of approximately 14,000 acres of forested wetlands from willing sellers and the management thereof. Through the original authorizing legislation (Water Resources Development Act of 1986) and subsequent modifying legislation, the District has authority to acquire up to 26,000 acres. To date, the District has identified and obtained approval to acquire up to approximately 15,400 acres in two parts, 4,900 acres in the vicinity of the Loggy Bayou WMA, and 10,500 acres in the vicinity of the Bayou Bodcau WMA. Lands acquired to date in the Loggy Bayou area total 3,263 acres

and offers are outstanding on an additional 107 acres. No further acquisitions are anticipated in the Bossier Parish portion of the area, based on the District's current knowledge of willing sellers. A total of approximately 4,000 acres could possibly be acquired in the Bayou Bodcau area based on willing sellers identified to date. Lands acquired to date in this area total 3,158 acres, and quote letters have been sent to owners of an additional 403 acres. Negotiations with the owners involving the 403 acres will continue during the remainder of FY 00 and will continue beyond FY 00 as needed. Offers or quote letters will also be submitted to the owners of the balance of "willing seller" acreage based on the suitability of the lands. Upon completion of acquisition from willing sellers in the Bayou Bodcau area, a remaining balance is expected to fulfill the requirement of 14,000 acres. Therefore, planning efforts in FY 00 will focus on the identification of suitable lands in additional authorized areas such as Caddo, Red River, and Avoyelles Parishes. The Tensas NWR was established in 1980 (Public Law 96-285) to mitigate the environmental losses caused by six water resource development projects, which includes the lower 104 miles of the Red River Waterway Project.

119. Red River Below Denison Dam, Red River Levees Rehabilitation/Restoration, Arkansas. The final EIS has been filed with EPA and the Record of Decision has been signed. Reforestation of periodically flooded cleared lands within the Red River Basin in Arkansas is recommended to compensate terrestrial wildlife impacts. The mitigation will be accomplished concurrent with construction. Lands will first be solicited from state and Federal agencies within the project area. If sufficient suitable lands from these sources are not found, acquisition of private lands from willing sellers will be pursued. The maximum acreage that will be required is 189 acres. This is an unbudgeted project. However, it is anticipated that identification of suitable lands and other planning efforts will be initiated once funding becomes available.

120. The Corps has purchased approximately 40,000 acres of the 52,780.95 acres in the Tensas NWR as mitigation. Mitigation requirements were for a total of 14,800 acres leaving a credit of 37,980.95 acres.

REFORESTATION

121. A total of approximately 5,400,000 trees have been planted by the Vicksburg District in the last 10 years. Since January 1991, the District has reforested approximately 18,000 acres of lands acquired by easement and by fee title. The Vicksburg District's commitment to mitigation has resulted in an excess of 500,000 seedlings planted per year on average over the last 10 years.

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