FINAL SUPPLEMENT NO. 1 TO THE 1982
YAZOO AREA PUMP PROJECT
FINAL ENVIRONMENTAL IMPACT STATEMENT

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The responsible lead agency is the U.S. Army Corps of Engineers, Vicksburg District. The responsible cooperating agencies are the U.S. Fish and Wildlife Service; Environmental Protection Agency; Natural Resources Conservation Service; U.S. Department of Agriculture Forest Service; Mississippi Department of Environmental Quality; and Mississippi Department of Wildlife, Fisheries and Parks. The local sponsor is the Board of Mississippi Levee Commissioners.

Abstract: The Yazoo Backwater Area is located in west-central Mississippi immediately north of Vicksburg, Mississippi. The Backwater Area is bounded on the west by the left bank Mississippi River levee, the west levee of the Will M. Whittington Auxiliary Channel on the east and the Yazoo River on the south. The Backwater Area has historically been subject to flooding from backwater from the Mississippi River. The area is also subject to headwater flooding from the Yazoo River, Sunflower River, and Steele Bayou. The Backwater Area is divided into five subareas--Satartia, Satartia Extension, Rocky Bayou, Carter, and Yazoo areas. Only the Yazoo area is considered in detail.

The recommended alternative is a 14,000-cubic-foot-per-second diesel pump station, with a year-round pump elevation of 87.0 feet, National Geodetic Vertical Datum (NGVD) (1-year flood plain), at the Steele Bayou structure. The nonstructural flood damage reduction features include perpetual conservation easements from willing sellers and the reestablishment of bottom-land hardwoods on 55,600 acres of open land primarily at or below the pump elevation. Also included is the modification of the operation of the Steele Bayou structure to maintain water in existing river and channels between 70.0 to 73.0 feet, NGVD, during low-water periods. The first cost of this alternative is $220,094,000 with an annual cost of $15,051,000 and annual operation and maintenance cost of $2,117,000. The benefit–cost ratio for the recommended alternative is 1.5, including employment benefits.

If you would like further information on the supplement, please contact:

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Vicksburg, Mississippi 39183-3435

NOTE: Information, displays, maps, etc., discussed in the Main Report and appendixes are incorporated by reference in the Supplemental Environmental Impact Statement.

FINAL SUPPLEMENT NO. 1 TO THE 1982 YAZOO AREA PUMP PROJECT
FINAL ENVIRONMENTAL IMPACT STATEMENT

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FINAL SUPPLEMENT NO. 1 TO THE 1982 YAZOO AREA PUMP PROJECT FINAL ENVIRONMENTAL IMPACT STATEMENT

INTRODUCTION

1. As a result of the 1941 authorization and subsequent modifications, the works of improvement in the Yazoo Backwater area consist of levees, associated drainage channels, pumps, and floodgate systems to provide flood protection to five subareas (Yazoo, Satartia, Satartia Extension, Rocky Bayou, and Carter). The location of the various areas and the authorized flood control features are shown on Plate 4-1. Authorized work in the Yazoo subarea includes levees, connecting channel, water control structures, and pumping facilities. The levee is an extension of the Mississippi River east bank levee, generally along the west bank of the Yazoo River to a connection with the Will M. Whittington (Lower) Auxiliary Channel levee in the vicinity of the mouth of the Big Sunflower River. The authorized water control structures are Steele Bayou, Little Sunflower River, and Muddy Bayou. The pumping facility near the Steele Bayou structure is the focus of this report. All of these features have been completed other than the pumping facilities. The levee, connecting channel, and floodgate systems were completed by 1978. The action addressed in this Final Supplemental Environmental Impact Statement (FSEIS) is the remaining flood damage reduction, including construction and operation of the pump station and nonstructural flood damage reduction features (Yazoo Backwater Project Area). The Yazoo Backwater Project Area is bounded on the west by the left descending bank of the mainline Mississippi River levee, on the east by the west bank levees of the Will M. Whittington Auxiliary channel and the connecting channel, and the Yazoo River on the south (926,000 acres). The Yazoo Backwater Study Area encompasses those lands within the 100-year flood frequency, approximately 630,000 acres.

2. The combination of proposed construction changes, substantial environmental concerns, and additional significant environmental information concerning the Yazoo Backwater Project Area required reevaluation of the environmental effects. This FSEIS supplements the 1982 Yazoo Area Pump Project, Final Environmental Impact Statement, Flood Control, Mississippi River and Tributaries, Yazoo Basin, Mississippi. The Record of Decision was signed in July 1983. The current FSEIS is an integral part of the reformulation report and furthers the purposes of the National Environmental Policy Act (NEPA).

3. This FSEIS is an analytical document that informs decision makers. It defines current environmental issues, evaluates an array of alternatives, and addresses features to avoid, minimize, and compensate unavoidable impacts, where appropriate. The Main Report, terrestrial, aquatic, waterfowl, wetlands, water quality, Section 404(b)(1), mitigation, endangered and threatened species, cultural resources, economics, real estate, socioeconomics, and engineering appendixes support this FSEIS and are referenced extensively. The Main Report and appendixes, and the information they contain, are an integral part of the FSEIS and are incorporated by reference. The reader is encouraged to reference these appendixes for specific methodologies and detailed information.

4. The recommended plan (Alternative 5) reduces average annual flood damages to urban and agricultural areas through a combination of structural and nonstructural flood damage reduction features, minimizes adverse impacts through project design, and provides a net gain in environmental value to the entire Yazoo Backwater Study Area. The recommended plan represents a balanced approach to addressing the flood damage reduction and environmental opportunities in the Yazoo Subarea.

5. The estimated cost of the recommended plan is $220.1 million with a benefit-cost ratio of 1.4. The alternative includes a pump station with a maximum combined pumping capacity of 14,000 cubic feet per second (cfs) with a year-round pumping elevation of 87.0 feet (1-year flood plain), National Geodetic Vertical Datum (NGVD), at the Steele Bayou structure and acquisition of perpetual conservation easements (from willing sellers) with reforestation/conservation features on up to 55,600 acres of agricultural land primarily at or below elevation 87.0 feet, NGVD, at the Steele Bayou structure. The pump station provides structural flood damage reduction above elevation 87.0 feet, NGVD, at the Steele Bayou structure, and the reforestation provides nonstructural flood damage reduction primarily below elevation 87.0 feet, NGVD, at the Steele Bayou structure. Operation of the Steele Bayou structure would also be modified to maintain water elevations between 70.0 and 73.0 feet, NGVD, during low-water periods. This would make more water available in the Yazoo Backwater Study Area during late summer low-water periods.

6. Adverse effects to environmental resources would result from the construction and operation of the pump station (structural feature) which will bring about changes to the physical environment as a result of changes in flood duration and frequency of Yazoo Backwater flooding. However, the nonstructural flood damage feature (reforestation) provides substantial environmental benefits in all categories. Compensatory mitigation for all impacts is included in the nonstructural component and will be acquired prior to pump station operation. The net effect of the project is an increase of 30.3 percent in aquatic spawning resource value, 8.0 percent increase in aquatic rearing resource value, 19.5 percent increase in wetland resource value, 11.2 percent increase in terrestrial resource value, and a 52.8 percent increase in waterfowl resource foraging value (Appendix 1). Although reforestation results in a foraging loss to waterfowl, foraging areas included in the recommended plan will provide a net gain in waterfowl foraging habitat (Appendix 12). Additional information concerning adverse environmental impacts is included in the Environmental Consequences section of the FSEIS.

AREAS OF CONTROVERSY

7. The approach to addressing the Yazoo Backwater Study Area's problems and opportunities is an area of controversy. Traditionally, flood control needs and opportunities have been addressed through structural flood damage reduction features. However, consideration of nonstructural flood damage reduction features has become increasingly common. The controversy is whether the solution should be an entirely nonstructural approach, a combination structural and nonstructural approach, or an entirely structural approach.

UNRESOLVED ISSUES

8. One of the unresolved issues that the U.S. Fish and Wildlife Service (FWS) raised on the Draft Supplemental Environmental Impact Statement (DSEIS) was over the future without-project land use predictions for the Yazoo Backwater Study Area (i.e., the area impacted by the 100-year frequency flood). The FWS estimated in 1999 that over the 50-year project life that 43,432 acres of agricultural lands would be reforested in the Yazoo Backwater Study Area. The FWS chose not to revise their future without-project projections for this final report. The U.S. Army Corps of Engineers (USACE), Vicksburg District, thought that since the ceiling for the Wetland Reserve Program (WRP) of the U.S. Department of Agriculture (USDA) for Sharkey and Issaquena Counties had been reached, there would not be any further increase in reforested lands. The Vicksburg District has recently updated the land use in the study area (2005 data). The FWS does not want to revise their estimate.

9. The FWS raised procedural, policy, and technical issues in their October 2006 Final Fish and Wildlife Coordination Act (FWCA) Report. These issues broadly included the Vicksburg District's response to the Office of Management and Budget reformulation directives, the Vicksburg District's incomplete and inaccurate characterization of baseline and future without-project conditions, the Vicksburg District's characterization of environmental problems and concerns, and the Vicksburg District's inadequate acknowledgement of the cumulative impacts of the Mississippi River and Tributaries Projects on wetland loss in the Lower Mississippi Valley. These issues, in their entirety, can be reviewed in Appendix 3. The Vicksburg District has provided FWS with its responses to these issues.

RELATIONSHIP TO ENVIRONMENTAL PROTECTION STATUTES AND OTHER ENVIRONMENTAL REQUIREMENTS

10. The relationship of each alternative to the requirements of environmental laws, executive orders, memorandums, land use plans and permits was evaluated (Table SEIS-1). Information concerning the resources addressed under each of the laws on Table SEIS-1 is presented more fully in later subsections of this Final Supplemental Environmental Impact Statement (FSEIS), as well as in the Main Report and its appendixes.

CLEAN WATER ACT

11. The Section 404(b)(1) evaluation concluded that the proposed disposal sites are in compliance with the Environmental Protection Agency (EPA) guidelines (Appendix 2). Approximately 38 acres of mature bottom-land hardwood wetlands would be impacted at the pump station site. The impacts from the clearing of the 38 acres have been analyzed using assessments for terrestrial, aquatics, waterfowl, and wetland resources. While this assessment documents adverse impacts in all four categories due to the structural feature, the nonstructural (perpetual easements) reforestation/conservation features will fully offset these environmental losses. In addition, 5.6 acres of open water will be filled at the pump site. This loss will be offset by the inlet channel which will provide 30.8 acres of additional permanent open water as is also covered in the 519 acres of mitigation proposed for the past construction activities at the pump station site. Pursuant to Section 404 of the Clean Water Act, a public meeting to address project planning and to provide the opportunity for public comment was conducted on 9 November 2000. A Section 401 water quality certificate must be obtained from the State of Mississippi before construction. The Vicksburg District intends to issue a joint Public Notice with the State of Mississippi to solicit comments on the project and the Section 401 water quality certificate.

EXECUTIVE ORDER ON FLOOD PLAIN MANAGEMENT

12. Executive Order 11988 directs Federal agencies to reduce flood loss risk; minimize impacts on human safety, health and welfare; and restore and preserve the natural and beneficial values served by flood plains. Agencies must consider alternatives to avoid adverse and incompatible development in the flood plain. If the only practical alternative requires action in the flood plain, agencies must design or modify their action to minimize adverse impacts.

TABLE SEIS-1
ENVIRONMENTAL PROTECTION STATUTES AND REQUIREMENTS
YAZOO BACKWATER AREA REFORMULATION

Item	Alternative Compliance								
	2	2A	2B	2C	3	4	5	6	7
Federal Statutes Archeological and Historic Preservation Act, as amended, 16 U.S.C. 469, et seq.	Full	Full	Full	Full	Full	Full	Full	Full	Full
Clean Air Act, as amended, 42 U.S.C. 7401, et seq.	Full	Full	Full	Full	Full	Full	Full	Full	Full
Clean Water Act, as amended (Federal Water Pollution Control Act), 33 U.S.C. 1251, et seq.	Full	Full	Full	Full	Full	Full	Full	Full	Full
Coastal Zone Management Act, as amended, 16 U.S.C. 1451, et seq.	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endangered Species Act, as amended, 16 U.S.C. 1531, et seq.	Full	Full	Full	Full	Full	Full	Full	Full	Full
Estuary Protection Act, 16 U.S.C. 1221 et seq.	NA	NA	NA	NA	NA	NA	NA	NA	NA
Federal Water Project Recreation Act, as amended, 16 U.S.C. 460-1(2), et seq.	Full	Full	Full	Full	Full	Full	Full	Full	Full
Fish and Wildlife Coordination Act, as amended, U.S.C. 661, et seq.	Full	Full	Full	Full	Full	Full	Full	Full	Full
Land and Water Conservation Act, as amended, 16 U.S.C. 4601, et seq.	NA	NA	NA	NA	NA	NA	NA	NA	NA
Marine Protection, Research and Sanctuaries Act, 22 U.S.C. 1401, et seq.	NA	NA	NA	NA	NA	NA	NA	NA	NA
National Historic Preservation Act, as amended, 16 U.S.C. 470a, et seq.	Full	Full	Full	Full	Full	Full	Full	Full	Full
National Environmental Policy Act, as amended, 42 U.S.C. 4321, et seq.	Full	Full	Full	Full	Full	Full	Full	Full	Full

TABLE SEIS-1 (Cont)

Item	Alternative Compliance								
	2	2A	2B	2C	3	4	5	6	7
ER 1165-2-132, Water Resource Policies and Authorities, HTRW Guidance for Civil Works Projects, 27 June 1992	Full	Full	Full	Full	Full	Full	Full	Full	Full
Rivers and Harbors Act, 33 U.S.C. 401, et seq.	Full	Full	Full	Full	Full	Full	Full	Full	Full
Watershed Protection and Flood Prevention Act, 16 U.S.C. 1001, et seq.	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wild and Scenic Rivers Act, as amended, 16 U.S.C. 1271, et seq.	NA	NA	NA	NA	NA	NA	NA	NA	NA
Farmland Protection Policy Act	Full	Full	Full	Full	Full	Full	Full	Full	Full
Executive Orders, Memorandums, etc. Flood Plain Management (E.O. 11988)	Full	Full	Full	Full	Full	Full	Full	Full	Full
Protection of Wetlands (E.O. 11990)	Full	Full	Full	Full	Full	Full	Full	Full	Full
Environmental Effects Abroad of Major Federal Actions (E.O. 12114)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Environmental Justice Considerations (E.O. 12898)	Full	Full	Full	Full	Full	Full	Full	Full	Full
State and Local Quality Standards Mississippi Water Quality Standards	Full	Full	Full	Full	Full	Full	Full	Full	Full

Notes: Compliance categories:

a. Full Compliance. All requirements have been met for this stage of planning.

b. Partial Compliance. Some requirements remain to be met for this stage of planning.

c. Noncompliance. None of the requirements have been met for this stage of planning.

d. Not Applicable. Statute, E. O., or other policy not applicable.

13. Plan formulation included no-action, nonstructural, structural, and combination structural and nonstructural alternatives. Any solution to reduce flood damages in the Yazoo Backwater Study Area must occur in the flood plain. The recommended plan minimizes adverse effects to environmental values from the structural flood damage reduction feature by initiating pumping at elevation 87.0 feet, NGVD, at the Steele Bayou structure (compared to the structural only alternative which initiates pumping at 80.0 feet, NGVD). The nonstructural flood damage reduction feature (reforestation of up to 55,600 acres) reduces flood loss risk (removes potential crop damage) and provides a net increase to the natural and beneficial values served by the flood plain. Operation of the Steele Bayou structure to maintain water elevations between 70.0 and 73.0 feet, NGVD, during low-flow periods will add instream channel water for waterfowl and aquatic resources.

EXECUTIVE ORDER ON WETLANDS

14. Executive Order 11990 directs Federal agencies to avoid, to the extent possible, long- and short-term adverse impacts associated with destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands if a practical alternative exists. Furthermore, agencies shall consider the action's effect on (a) public health, safety and welfare, (b) maintenance of natural systems, including conservation and long-term productivity of existing flora and fauna, species and habitat diversity and stability, hydrologic utility, fish, wildlife, timber, and food and fiber resources, and (c) other wetland uses.

15. Impacts from the structural component were reduced by increasing the pumping elevation from 80.0 feet, NGVD (1982 Final Report and Final Environmental Impact Statement (EIS)), to elevation 87.0 feet, NGVD, at the Steele Bayou structure. The nonstructural component, which consists of perpetual easements with the reforestation/conservation features on up to 55,600 acres of agricultural land, results in a net gain to wetland resources. The recommended plan results in a 19.5 percent increase in wetland resource values in the Yazoo Backwater Study Area.

HAZARDOUS, TOXIC, AND RADIOACTIVE WASTES

16. The Vicksburg District conducted an onsite hazardous, toxic, and radioactive wastes (HTRW) assessment of the pump station site on 31 July 1998 (Appendix 6). No indicators of hazardous wastes were observed. A records search of the Mississippi Department of Environmental Quality (MDEQ) indicated no known or potential sites within a 1-mile radius of the pump station site. Based on this assessment, the risk of encountering HTRW during construction was determined to be low.

17. The HTRW assessments of the easement properties will be conducted after identification and prior to any real estate transaction.

NEED FOR AND OBJECTIVES OF ACTION

18. The Yazoo Backwater Study Area (100-year flood plain) consists of portions of six counties in west-central Mississippi and a very small section of one parish in northeastern Louisiana. The counties in Mississippi include Washington, Humphreys, Sharkey, Issaquena, Warren, and Yazoo. The parish in Louisiana is Madison. The primary purpose of the authorized Yazoo Backwater Project is to provide reduced flood damages from the Mississippi and Yazoo Rivers to areas in the lower Mississippi Delta. During periods of high-water stages on these rivers, the floodgates at two structures (Steele Bayou and Little Sunflower) in the backwater levee system are closed, necessitating storage of interior drainage within two ponding areas. This interior flooding affects public roads and bridges, residential and nonresidential structures, other infrastructure, and agricultural and forested lands.

19. When the Little Sunflower River and Steele Bayou structures are closed because of high stages in the Mississippi River, flooding from ponding of interior drainage is the principal problem in the study area. However, the interior flooding is much less than it would be if the Yazoo Backwater levee was not in place. The Yazoo Backwater levee extends from the end of the east bank mainline Mississippi River levee to the downstream end of the west guide levee of the Will M. Whittington Channel along the Yazoo River. Major problems that have resulted from frequent flooding include flood damage to agricultural crops, rural residential property, commercial fisheries, timber management, and public roads. Major floods have caused undue hardships and economic losses to residents of the area due to flooding of homes, disruption of sanitation facilities, lines of communications, and transportation.

20. Three important factors which affect flood losses in the Yazoo Backwater Area are time of year, duration, and frequency of flooding. These factors influence farming practices on agricultural lands and the amount of damages incurred by residential and nonresidential structures. They are also important to the functioning of natural areas such as forested areas, lakes, streams, commercial fisheries, wildlife management areas, and wetland areas. Frequent or intermittent floods can occur any time of the year. However, flood records indicate that the majority of floods occur during the months of March through June, which is typically the time land preparation and spring crop planting occurs.

21. The alluvial lands of the Yazoo Backwater Project Area have always been subject to flooding by the Mississippi River. From 1897 through 1937, massive floods inundated the region regularly. Then for a 35-year period less severe flooding occurred, causing many to dismiss massive floods as a thing of the past. In 1973, a severe flood again devastated the area. Other destructive floods followed in rapid succession in 1974, 1975, 1979, 1983, 1984, 1991, and 1997. Hundreds were forced from their homes, crops and buildings were damaged or lost, and wildlife was destroyed.

22. The Steele Bayou structure is the principal structure for the Yazoo Backwater Project. Any time the stage on the landside of the Steele Bayou structure is higher than the riverside and above 70.0 feet, NGVD, the gates are open. The Little Sunflower structure generally remains closed. It is opened during flood events when the riverside water surface elevation is less than the landside elevation and the Steele Bayou structure is closed. With the rising of the Mississippi and Yazoo Rivers, two interior ponding areas (Steele Bayou and Little Sunflower River) are allowed to rise to an elevation of 75.0 feet, NGVD. The floodgates are closed when the river elevations are higher than the interior ponding levels. Although the interior area is protected from high stages of the Mississippi and Yazoo Rivers, it is subject to flooding resulting from inflow from the 4,093-square-mile drainage area of Steele Bayou, Deer Creek, Little Sunflower River, and Big Sunflower River into the ponding areas. During low-flow periods, the Steele Bayou structure is operated to control water levels in Study Area streams. The present criterion calls for holding water levels between elevation 68.5 and 70.0 feet, NGVD. At these elevations, water is still in the river channel.

23. Congress, the Vicksburg District, and the Board of Mississippi Levee Commissioners are responding to additional need for urban and agricultural flood protection for the area.

AUTHORITY AND DIRECTION

24. The Yazoo Basin, Yazoo Backwater, Mississippi, Project was authorized by the Flood Control Act (FCA) of 18 August 1941 (House Document (HD) 359/77/1, as amended by the Acts of 22 December 1944 and 27 October 1965 (HD 308/88/2) and the Water Resources Development Act (WRDA) of 1986 and 1996. Authorized flood control measures include levees, associated drainage channels, pump stations, and floodgates. The Yazoo Backwater Area is divided into five subbasins: (a) the Satartia Area, (b) the Satartia Extension Area, (c) the Rocky Bayou area, (d) the Carter Area, and (e) the Yazoo Area. The location of the various areas and the authorized flood control features are shown on Plate 4-1. The Yazoo Area is the focus of this study and will be referred to as the Yazoo Backwater Project Area. The Yazoo Backwater Project Area is bounded on the west by the left descending bank of the mainline Mississippi River levee, on the east by the west bank levees of the Will M. Whittington Auxiliary channel and the connecting channel, and the Yazoo River on the south (926,000 acres). The Yazoo Backwater Study Area encompasses those lands within the 100-year flood frequency, approximately 630,000 acres.

25. The FCA of 1941 authorized the extension of the east bank mainline Mississippi River levee, generally upstream along the west bank of the Yazoo River for a distance of approximately 54 miles to a connection in the vicinity of Yazoo City, Mississippi, with the Yazoo River levee feature of the Yazoo Basin Headwater Project. A structure was included at Little Sunflower River, and a combination of structures and pump stations at Big Sunflower River, Deer Creek, and Steele Bayou with a total pumping capacity of 14,000 cubic feet per second (cfs) were planned. The capacities of the three pump stations were to be 11,000, 700, and 2,300 cfs for the Big Sunflower River, Deer Creek, and Steele Bayou, respectively. By closing the structures and operating the pumps when the Yazoo River reaches elevation 80.0 feet, NGVD, the pumping capacity of 14,000 cfs would prevent the elevation of water ponding behind

the structures from rising above 90.0 feet, NGVD, more often than once in 5 years, (i.e., the 5-year frequency event with pumps would be elevation 90.0 feet, NGVD, or less). The Act also provided for the enlargement of 7 miles of levee in the Rocky Bayou Area and the adjustment in the discretion of the Chief of Engineers of grades of existing levees on the east bank of the Yazoo River, all as contemplated in Plan C of the report of the Mississippi River Commission (MRC), dated 7 March 1941. The Act provided that the Chief of Engineers should fix the grade of the extension levees so that their construction would give the maximum practicable protection to the Yazoo Backwater Area without jeopardizing the safety of the mainline Mississippi River levees.

26. The FCA of 1944 extended the project, at the discretion of the Chief of Engineers, to include 38 miles of levees on the east bank of the Yazoo River (the Satartia and Satartia Extension Areas).

27. As a result of the Comprehensive Review of the Mississippi River and Tributaries Project report dated 6 April 1962 (HD 308/88/2), the Chief of Engineers modified the authorized plan for the backwater area to include a connecting channel between the Sunflower River and Steele Bayou, with all interior drainage evacuated through the Little Sunflower and Steele Bayou structures. The Chief of Engineers report reads in part as follows: ". . . I believe that, at some future time, protection of some areas in the Yazoo Backwater by pumping may be warranted. Since the new plan developed by the Mississippi River Commission is proposed for construction under existing project authorization, selection of this plan does not affect those authorizations, which I consider sufficiently broad to permit selection of location and capacities of pump stations, or a combination of gravity and pumped drainage, as future developments dictate."

28. A report on Muddy Bayou (Eagle Lake) was prepared in December 1969 in response to requests by the Warren County Board of Supervisors, the Mississippi Game and Fish Commission, and other local interests. The report presented results of studies to determine the impacts of completed and authorized flood control works on Eagle Lake and determine feasibility and advisability of providing structural features for fishery management practices and improvement of water quality in the lake. As a result of the report, the Yazoo Backwater Project was modified to include the Muddy Bayou structure under the discretionary authority of the Chief of Engineers. The water control structure was approved in 1970. The structure allows manipulation of lake levels for improvement of water quality and fishery resources and also provides incidental flood protection for properties along Eagle Lake. This structure was completed in 1978.

29. The 23 July 1976, Yazoo Basin, Yazoo Backwater Area, Fish and Wildlife Mitigation Plan report proposed the implementation of structural features to mitigate fish and wildlife losses resulting from the constructed flood control works in the backwater area. The report was submitted for early action under the authority of the Yazoo Basin Comprehensive Study. The measures proposed in the report were limited to only those mitigation features that might be

implemented without acquiring additional lands because of then-current U.S. Army Corps of Engineers (USACE) policy to use existing public lands. The plan recommended the construction of nine greentree reservoirs and nine slough impoundments on lands of the Delta National Forest (DNF) under the discretionary authority of the Chief of Engineers. The recommended improvements were approved by the Chief of Engineers on 3 December 1976. During preparation of Design Memorandum No. 15 entitled "Fish and Wildlife Facilities, Structural Measures, Delta National Forest (DNF)," dated 19 April 1979, approved by MRC 11 June 1979, the nine greentree reservoirs were reduced to four, and the nine slough control structures were reduced to five. Four of the slough control structures and one of the greentree reservoirs were eliminated due to unsuitable site conditions. One additional greentree reservoir was deleted because of problems with an existing easement. Three of the reservoirs were eliminated because USDA Forest Service (FS) informally indicated it did not want any more greentree reservoirs built in the DNF. Additionally, the Vicksburg District obtained approval by letter report dated 14 March 1979, approved by the Mississippi River Commission 6 March 1980, to construct a boat-launching ramp on the little Sunflower River mitigating the loss of access caused by construction of the Little Sunflower River drainage structure. The FS agreed to operate and maintain the boat ramp in accordance with other features constructed in the DNF. Currently, the greentree reservoirs and the slough control structures are being operated by FS, but are being maintained by the Vicksburg District. In summary, four greentree reservoirs, five slough control structures, and one boat ramp have been completed by the Vicksburg District. Prior to the construction of the greentree reservoirs by the Vicksburg District, the Mississippi Department of Wildlife, Fisheries and Parks (MDWFP) constructed one greentree reservoir and continues to manage it. In recent years, Ducks Unlimited constructed several water control structures within the DNF.

30. A reevaluation of the economic feasibility of the pump stations' features was completed by the Vicksburg District in 1982. The results of the reevaluation are presented in the Yazoo Basin, Yazoo Backwater Area, the Yazoo Pump Project report dated July 1982 and revised November 1982. In conjunction with the 1982 reevaluation efforts, the Yazoo Area Pump Project and Yazoo Area and Satartia Area Backwater Levee Projects, Fish and Wildlife Mitigation Report dated July 1982 was also prepared. The purpose of the report was to present the results of studies conducted to determine the modifications that should be made to achieve a balance in the use of the backwater area's natural resources. The report included the mitigation analyses for the construction and operation of the Yazoo Area and Satartia Area backwater levees projects, including the connecting channel, the Big Sunflower and Steele Bayou structures, and any other associated construction work, as well as the recommended, yet unconstructed, Yazoo Area Pump Project. The recommended plan for mitigation was the acquisition of perpetual easements on 40,000 acres of wooded lands in the project area. Thirty-three thousand, five hundred acres were for the mitigation of environmental impacts due to the construction of the Yazoo Area and Satartia Area Backwater levees; 6,500 acres were for the mitigation of the potential environmental impacts due to the recommended 17,500-cfs pump station.

31. The alternatives considered during the 1982 reevaluation study were:

a. Nonstructural features.

(1) Floodproofing.

(2) Permanent evacuation of flood plain.

(3) Acquisition.

b. Levee system along both sides of the Sunflower River.

c. Dual pump stations at the mouth of the Little Sunflower River and Steele Bayou.

d. Alternative pump sizes at Steele Bayou:

(1) 10,000 cfs

(2) 15,000 cfs

(3) 17,500 cfs

(4) 20,000 cfs

(5) 25,000 cfs

(6) 30,000 cfs

e. Alternate pumping criteria:

(1) Initiate pumping at 80.0 feet, NGVD, year-round.

(2) Initiate pumping at 80.0 feet, NGVD, during cropping season; initiate pumping at 85 feet, NGVD, 1 December to 1 March and allow ponding to occur as it would under existing conditions up to elevation 85.0 feet, NGVD, 1 December to 1 March.

(3) Initiate pumping at 80.0 feet, NGVD, during cropping season; initiate pumping at 85 feet, NGVD, 1 December to 15 March; and induce ponding up to elevation 85.0 feet, NGVD, 1 December to 15 March.

(4) Initiate pumping at 80.0 feet, NGVD, during the cropping season and initiate pumping at 85.0 feet, NGVD, during 1 December to 15 March; induce ponding up to elevation 80.0, NGVD, 1 January to 15 April.

(5) Initiate pumping at 85.0 feet, NGVD, year-round.

(6) Initiate pumping at 83.0 feet, NGVD, during the cropping season and initiate pumping at 85.0 feet, NGVD, during 1 December to 1 March.

(7) Initiate pumping at 90.0 feet, NGVD, year-round.

32. The WRDA of 1986 authorized the acquisition of perpetual easements on 40,000 acres for mitigation of project-induced fish and wildlife losses within the Yazoo Backwater Area as recommended by the Vicksburg District in the July 1982 Reevaluation Report. The WRDA 1986 also changed the cost-sharing provisions of local interests for USACE projects nation-wide. Under the new provisions, the local project sponsor would provide the lands, easements, rights-of-way, relocations and disposal areas for the project or 25 percent of the construction cost whichever is greater. These new provisions were applicable to all projects or separable elements thereof on which construction was initiated after 30 April 1986. The Rocky Bayou features, the Carter Area features, and the uncompleted features for the Yazoo Area were all deemed to be separable elements of the Yazoo Basin Backwater Project, and therefore, subject to the new cost-sharing provisions.

33. In October 1989, the Vicksburg District prepared the Yazoo Backwater Area, Mississippi, Yazoo Basin, Mississippi, Mitigation Plan report. The report presented a proposal to implement mitigation through compensation for terrestrial wildlife losses that resulted from the construction and operation of the Yazoo Area and Satartia Area Backwater levees projects. Potential environmental impacts for the Yazoo Area pump station feature were not considered. Alternatives considered included:

a. Development of existing public lands.

b. Fee title acquisition and management of wooded lands.

c. Perpetual land use easement acquisition of wooded lands.

d. Fee title acquisition of cleared lands with reforestation/regeneration.

34. Fee title acquisition of 8,400 acres of frequently flooded cleared lands with reforestation were selected as the best plan for mitigating the terrestrial losses in lieu of the mitigation plan approved by WRDA 1986. The report recommended the acquisition of lands from willing sellers and identified several properties that were currently available. The recommendation was implemented, with the acquisition of the 8,800 acres of frequently flooded cleared lands referred to as the Lake George Property in 1990. However, the entire 8,800 acres included some existing levees, channels, and roads and, therefore, did not fully offset the terrestrial losses.

35. Directives from the Assistant Secretary of the Army (Civil Works) and the Director of Civil Works in January 1989 and February 1990 requested the Corps reformulate the project and identify, display, and evaluate alternative plans for the following:

a. Greater level of flood protection for urban areas.

b. Reduced levels of agricultural intensification.

c. Reduced adverse impacts on the environment.

36. The WRDA of 1996, Section 102(a)(2) amended Section 103(e)(1) of WRDA 86 by defining physical construction as the date of construction contract award (25 March 1986 for the authorized backwater pump station). Since a contract on the pump station was awarded before 30 April 1986, this modification in effect changed local cooperation requirements for the pump station to those of the original authorized project.

PUBLIC CONCERNS

37. Economic and environmental issues are primary concerns of public and private interests. The Vicksburg District received approximately 1,400 cards and letters, 4,000 e-mails, and 1 petition with over 100 signatures commenting on the DSEIS. Many of the comments received were concerning the same issues; therefore, the comments were consolidated and addressed by the Vicksburg District. The Vicksburg District has prepared responses to these comments (Appendix 5). These comments were primarily concerned with the loss of wetlands and other bottom-land hardwoods, increased pesticide contamination within the study area, adverse impacts to threatened and endangered species in the area, and adverse impacts to lakes and swamps. Concerns were also expressed that the Vicksburg District did not give equal consideration to nonstructural alternatives and failed to develop and apply techniques to assess and include benefits from carbon sequestration and water quality improvements. In addition, concern was expressed over adverse cumulative impacts to the study area.

38. This public concern, environmental awareness, and USACE policy dictate that project formulation and implementation should achieve, at a minimum, compensation of adverse affects to terrestrial, aquatic, waterfowl, and wetland resources through a balanced approach to the flood damage reduction needs and environmental opportunities in the Yazoo Backwater Study Area. The land use and economic evaluations have been updated since the DSEIS, and the terrestrial, aquatic, waterfowl, wetland, and water quality evaluations have been updated since the DSEIS was completed. A state-of-the-art wetland evaluation has been developed and used to evaluate impacts to wetlands in the study area. Formal consultation on potential effects to the endangered plant pondberry was conducted with FWS. New evaluations concerning cumulative impacts have also been included in the FSEIS. The Vicksburg District has also included three additional

nonstructural alternatives in the final array of alternatives. The Vicksburg District has determined that a balanced approach should improve the lives of people who live in the area by providing a feature of flood damage reduction and improve the environment by changing land use through reforestation/conservation features (nonstructural flood damage reduction) of the most flood-prone areas.

PURPOSE AND NEED

39. Flooding of residential and nonresidential structures and agricultural properties constitutes a major problem to residents and is a detriment to economic development of the Yazoo Backwater Study Area. A definite need exists for the reduction of this flooding. Flood protection would benefit all sections of the economy, thereby contributing to the well-being of area residents. An estimated 1,576 structures are affected by the 100-year flood. Approximately 316,000 acres of cleared lands of the total 630,000 acres are impacted by the 100-year frequency flood event. Average annual acres are determined by a statistical analysis of historic flood events. These analyses predict the cumulative probability of each of the flood events occurring in any given year and the associated number of acres flooded. There are approximately 148,000 cleared agricultural acres inundated on an average annual basis (for additional discussion on ANNUAL AVERAGE ACRES, see Appendix 7). Flood damages to agricultural properties, including agricultural crops and noncrops, total $13.3 million per year. Flood damages to nonagricultural properties, which include residential and nonresidential structures, emergency costs, streets, and public roads total $6.6 million annually. Total annual flood damage is estimated at $19.9 million. For a detailed description on computation of FLOOD DAMAGES refer to Appendix 7.

40. The primary purpose of the authorized Yazoo Backwater Project is to reduce flood damages to the study area. When high water stages occur on the Mississippi and Yazoo Rivers, the flood gates at two structures (Steele Bayou and Little Sunflower) in the Yazoo Backwater levee system are closed, necessitating storage of interior drainage within two ponding areas. Inflow from the Yazoo Backwater Drainage Basin into the ponding areas causes flooding in the study area that needs to be reduced.

PLANNING OBJECTIVES

41. Planning objectives were developed in accordance with Engineer Regulation (ER) 1105-2-100. Planning objectives stem from national, state, and local water and related land resource management needs specific to the Yazoo area of the Yazoo Backwater Area. These objectives were developed through problem analysis and a public involvement program and have provided the basis for formulation of alternatives, impact assessment, environmental design, evaluation and selection of a recommended plan. The planning objectives, as directed by Congress, are as follows:

a. Reduce flood damage to urban and rural structures as well as agricultural properties resulting from prolonged flood stages on the Mississippi River when the Steele Bayou and Little Sunflower structures are closed and floodwaters pond landside of the structures.

b. Provide reduced levels of agricultural intensification.

c. Reduce adverse environmental impacts through design.

Consistent with USACE and the Vicksburg District policy, the project also has a planning objective of:

d. Compensating for 100 percent of unavoidable environmental impacts.

Based on coordination between the Vicksburg District and FWS during project planning, this project has an additional objective:

e. While the objectives of subparagraphs a through d above were utilized to address future problems and opportunities of the study area, an additional objective is to fulfill the mitigation requirement for the already completed Yazoo Area and Satartia Area Backwater levees projects, previously constructed features of the study area. This objective is discussed in detail under the topic mitigation.

42. For purposes of comparing alternatives, the Vicksburg District utilized the first four objectives identified above as an appropriate summary description of project purpose and need. While the primary purpose of the project is flood damage reduction, these four objectives were balanced, consistent with the National Economic Development (NED), in screening and evaluating alternatives under NEPA.

ALTERNATIVES

GENERAL

43. As described in paragraphs 37 and 38 and Table SEIS-2, the affected public has been consulted to guide the formulation and evaluation of alternatives for this study. This process is reflected in the development of four arrays of alternatives prior to the DSEIS and a fifth array of alternatives for this FSEIS. These arrays are described more fully below.

44. Before describing the process and range of alternatives, this section explains the full range of features that could be utilized to meet the project purposes. The Vicksburg District considered alternatives that included nonstructural features, structural features, and combined nonstructural and structural features. Alternatives were formulated to minimize and/or avoid potential adverse project impacts on the environment and ensure identification of the NED or EQ plans. These alternatives were developed and evaluated by an interdisciplinary team of planners

TABLE SEIS-2
CONSENSUS CHRONOLOGY
YAZOO BACKWATER AREA REFORMULATION

Number	Event
1	Public Involvement Workshops (PIW) - May 97 (3)
2	EPA, FWS, CEMVK Briefing of PIW Participants - Aug 97
3	Vicksburg District (CEMVK)-EPA teleconference - May 98
4	CEMVK/CEMRC Status Briefing for EPA and FWS (Atlanta) - Sep 98
5	ASA(CW), EPA and FWS meeting (Washington) - Oct 98
6	EPA, FWS, and CEMVK staff meeting (Vicksburg) - Oct 98
7	CEMVK/CEMRC Briefing for EPA and FWS (Atlanta) - Dec 98
8	ASA(CW), CEMRC, EPA, and FWS (Atlanta) - Jan 99
9	Backwater Project presented to Congressman Bennie Thompson in Rolling Fork - Jan 99
10	FWS Briefing for EPA, CEMVK, and CEMRC on FWS Plan (Vicksburg) – Feb 99
11	FWS Planning Aid Letter defining FWS Plan - Mar 99
12	First Consensus Committee Meeting in Greenville - Mar 99
13	Followup Consensus Committee Meetings (19 Apr 99, 11 May 99, 26 May 99, 22-24 Jun 99)
14	EPA Briefing for FWS, CEMVK, CEMRC on Shabman Report (Atlanta) - Jul 99
15	Consensus Committee Meeting (Raymond, MS) - Jul 99
16	FWS Planning Aid Report - Sep 99
17	Consensus Committee Meeting (Raymond, MS) - Sep 99
18	Consensus Committee Meeting (Raymond, MS) - Mar 00
19	Mississippi Levee Board Public Meeting (Rolling Fork, MS) - Mar 00
20	Review of Draft Report by resource agencies (Vicksburg, MS) - May 00
21	Transmitted Draft Report and Draft SEIS to public and resource agencies (Vicksburg, MS) – Sep 00
22	Public Meeting (Rolling Fork, MS) – Nov 00
23	Public Meeting hosted by Congressman Bennie Thompson (Mayersville, MS) – Dec 00
24	Chief of Engineers Environmental Advisory Board (Vicksburg, MS) – Oct 01
25	EPA Wetland Meetings (Vicksburg, Atlanta, Washington) – Aug 02 – Aug 06
26	Cooperating Agency Meetings (Vicksburg, MS) – Jul 03, Jul-Oct 05, Jul 06

representing disciplines such as engineering, hydrology, economics, and environmental. Each of the alternatives was developed through a multiobjective process to satisfy the specific needs identified in this report. Water management and mitigation features were evaluated to avoid, minimize, and compensate for unavoidable adverse environmental impacts. A "no-action" alternative was evaluated to display future conditions in the absence of a Federal project.

45. All practicable nonstructural features to reduce flood damages were considered during the screening of alternatives. While some were eliminated during early formulation of alternatives, others were evaluated in detail to determine whether a combination of structural and nonstructural features would comprise the best solution for the overall study area.

46. Basically, two types of nonstructural features for flood protection exist--those which reduce existing damages and those which reimburse for existing damages and reduce future damage potential. Those nonstructural features which reduce damages are as follows:

a. Floodproofing by waterproofing of walls and openings in structures.

b. Raising structures in place.

c. Constructing walls or ring levees around structures.

d. Permanent flood plain evacuation.

(1) Relocate structures, contents, and residents to flood-free area.

(2) Relocate contents and residents and demolish structures. Provide replacement housing.

e. Flood forecasting and warning systems with temporary evacuation.

47. Nonstructural features which compensate or reimburse for existing damages and/or reduce future damages include:

a. Acquisition of flood-prone property by fee title or easement.

b. Flood plain regulation by zoning ordinances, regulations, and building codes.

c. Flood insurance.

d. Income Assurance Program – a nonstructural feature that would provide crop insurance premiums for the 50-year period of analysis. This is a one-time lump sum payment to those landowners located within the 2-year flood plain in lieu of flood protection.

48. Residential, commercial, and public structures in the flood plain are primarily slab-on-grade construction. Raising such structures through normal jacking procedures is impractical; permanent flood plain evacuation was evaluated, but was not considered a viable alternative by the project sponsor or most residents of the study area. Flood forecasting and warning systems with temporary evacuation are in essence what are being utilized now and are not satisfactory because these methods reduce loss of life, but do not reduce property damage. Floods in this area are slow to occur with people having sufficient time to evacuate the area, but it could be months before the floodwaters recede and allow them to return to their structures.

49. Two types of easements were proposed--conservation and flowage--to compensate for existing damages and reduce future damages. Conservation easements were used to control future land use. Options under a conservation easement were (a) continue existing land use (wooded or open lands) while restricting future intensification of the land use and (b) reforestation of agricultural lands. A flowage easement is required when existing hydraulic conditions (depth, frequency, and/or duration of flooding) are adversely impacted by a proposed alternative/feature. Landowner participation in conservation easements would be strictly on a willing seller basis. Flowage easements would be acquired by direct purchase with the use of condemnation in the event of nonagreement as to just compensation or incurable title problems. All easements would be perpetual in duration.

50. All six counties in Mississippi and nine communities in the backwater area are participants in the National Flood Insurance Program (NFIP). The unincorporated communities participate in NFIP through the local counties. This program allows property owners to purchase flood insurance at subsidized rates and mandates the local government to adopt and enforce flood plain regulations that require all future development within the 100-year flood plain to be elevated above the 100-year flood elevation.

51. Structural features evaluated included a pump station at Steele Bayou, a levee system along the Big and Little Sunflower Rivers and local protection projects; i.e., ring levees with pump stations to protect residential areas.

52. Approximately 80 percent of the drainage in the Yazoo Area is from the Sunflower River system. The Sunflower River and the Steele Bayou Basins were not connected until the construction of the connecting channel in 1978. Construction of levees along each side of the Sunflower River would restore the original division of drainage and result in reductions of flood stages especially in the Steele Bayou Basin. The connecting channel would be closed as part of the levee alternative, contained in several arrays. Under the levee alternative, drainage from the Sunflower River Basin would continue to be evacuated through the existing Little Sunflower River structure. This structure would be used to regulate low-water conditions for minimum ponding. A fixed overflow section would be required at the existing drainage structure to accommodate large streamflows. Drainage from the leveed area would be provided by landside collection ditches through gravity structures into the Sunflower River.

53. Local protection projects were evaluated for the towns of Rolling Fork, Eagle Lake, Cary, Holly Bluff, and Valley Park. Protection works usually consisted of ring levees, interior structures, and often a pump station to remove interior drainage.

INITIAL ARRAY

54. For the initial array in 1995, the Vicksburg District considered a range of nonstructural features. Table SEIS-3 shows the summary of the economic analysis of several nonstructural features for the four hydrologic reaches used in the 2000 Draft Report. Based on field observations by Vicksburg District economic and real estate personnel, structures were located in the field, marked and numbered on a map, and an approximate size and value determined. Then using a digital elevation model, the elevation of the structures was determined. Using the above data, hydrologic data, and computer models, the first cost, annual cost, annual benefits, and benefit-cost ratios were determined for the various nonstructural features. Table SEIS-3 was based on the structures that existed in the study area in 2000; dollar values are in 1996 dollars. Since that time, structural data were updated, refined, and reevaluated both in 2000 and 2005, results of which were utilized in the final array of alternatives, but not to update Table SEIS-3. The nonstructural analysis includes no projection as to future growth because while the population of Mississippi has increased over the past several decades, the counties of the lower Yazoo Basin have experienced very little growth. The populations of Sharkey and Issaquena Counties have been flat or slightly decreasing. As far as structures are concerned, there has been some increase in recreational and weekend homes in the area, as well as some new primary homes built in the Eagle Lake area. It is unlikely that the population of these counties will increase significantly under current economic conditions. As can be seen from the Table SEIS-3, none of the nonstructural features evaluated in the 2000 Draft Report for individual structures were feasible. However, nonstructural features to reduce future damage potential were considered in the next iteration of alternatives. These included conservation and flowage easements, structure raising, ring levees, and structure acquisition/demolition. These features are discussed in more detail in the following paragraphs, and the discussions associated with the final array of alternatives.

TABLE SEIS-3
ECONOMIC SUMMARY
OF NONSTRUCTURAL FEATURES BY PROJECT REACH a/
BASE (WITHOUT-PROJECT) CONDITIONS
YAZOO BACKWATER AREA REFORMULATION
(Current Year, 1996 Values)

Item/Reach	No. of Structures	First Cost ($000)	Annual Cost ($000)	Annual Benefit ($000)	Benefit-Cost Ratio
Reach 1					
Floodproofing	545	9,317.0	728.9	127.4	0.17
Structure Raising	412	10,637.2	832.2	127.4	0.15
Small Walls	657	10,663.1	834.2	127.4	0.15
Relocation	412	20,024.6	1,566.5	100.9	0.06
Acquisition/Demolition	413	27,708.8	2,167.7	100.9	0.05
Reach 2					
Floodproofing	191	4,113.8	321.8	31.9	0.10
Structure Raising	149	4,219.2	330.1	31.9	0.10
Small Walls	205	4,122.5	322.5	31.9	0.10
Relocation	149	8,716.0	681.9	25.4	0.04
Acquisition/Demolition	149	11,291.4	883.3	25.4	0.03
Reach 3					
Floodproofing	75	985.3	77.1	13.7	0.18
Structure Raising	29	392.3	30.7	13.7	0.45
Small Walls	64	788.8	61.7	13.7	0.22
Relocation	29	701.5	54.9	12.8	0.23
Acquisition/Demolition	18	596.6	46.7	12.8	0.27
Reach 4					
Floodproofing	251	4,824.3	377.4	43.3	0.11
Structure Raising	142	3,450.2	369.9	43.3	0.16
Small Walls	260	5,027.6	393.3	43.3	0.11
Relocation	142	6,669.5	521.8	34.8	0.07
Acquisition/Demolition	139	7,885.1	616.9	34.8	0.06
Total For All Reaches					
Floodproofing	1,062	19,240.4	1,505.2	216.3	0.14
Structure Raising	732	18,698.9	1,462.9	216.3	0.15
Small Walls	1,186	20,602.0	1,611.7	216.3	0.13
Relocation	732	36,116.0	2,825.1	173.9	0.06
Acquisition/Demolition	719	47,481.9	3,714.6	173.9	0.05

a/ Nonstructural analysis conducted in 2000 based on 7-5/8 percent discount rate and no other project improvements in place, including structures in each reach.

55. The initial array of alternatives was developed in 1995 to determine whether a structural solution was economically feasible. Five alternative pump station capacities (10,500, 14,000, 17,500, 21,000, and 24,500 cfs with a year-round pump operation elevation of 80.0 feet, NGVD, at the Steele Bayou structure) were evaluated. Pump station sizes were determined previously in the 1982 Backwater study and have been modeled by the U.S. Army Corps of Engineers, Portland District. A pump station is not one big pump, but a series of pumps. In general, the cost per cubic feet per second goes down as the pump size increases until reaching a size that physically cannot be constructed. In the case of the 14,000-cfs pump station, there are twelve 1,167-cfs pumps, each powered by its own motor. Pump sizes were determined by maximizing the pumping capacity that could be effectively manufactured by pump suppliers and the number of pumps that could be installed in each monolith. A Sunflower River levee alternative and local protection projects were also evaluated. Estimated compensatory mitigation costs were based on a preliminary aquatic impact analysis by the U.S. Army Engineer Research and Development Center (ERDC), which was the resource that required the acquisition of the largest mitigation acreage when compared to other resources. An economic comparison of the alternative plans is presented in Table SEIS-4. The costs of the pump stations shown in Table SEIS-4 reflect the use of electric motors to power the pumps. All the alternative pump station capacities and the Sunflower River levee alternative were economically feasible with a 14,000-cfs pump station providing the greatest excess of benefits over cost. The local protection plan was determined not to be economically feasible. Damages in the five areas were determined to be $433,000/year. These damages would only support a first cost of an alternative of $6.3 million, and this assumes that all damages are alleviated. No structural features could be built around any of the areas for this amount. Therefore, no further economic analysis was conducted. A combination levee and pump station alternative was not considered further due to the fact that the levee would provide 100-year protection at a cost greater than any size pump station in the initial array. In addition, environmental losses would increase if both features were constructed. After determining that a 14,000-cfs pump station powered by electric motors provided the greatest excess benefits over cost, cost engineers evaluated this pump station size to determine the cost of a 14,000-cfs diesel-powered pump station. Results showed a savings when the pump station is powered by diesel engines over electric motors. These data are shown in Table SEIS-5.

56. Therefore, only diesel-powered pump stations were evaluated in subsequent arrays. The costs, benefits, interest rate, etc., utilized in Tables 5 and 6 in the Main Report reflect the price levels that were in existence in 1995. These tables were not updated to reflect 2005 price levels/benefits since they were utilized for screening purposes only. The relative difference in the plans would be the same regardless of the prices or interest rates utilized. Diesel engines are still the most economical.

TABLE SEIS-4
ECONOMIC DATA FOR INITIAL ARRAY OF ALTERNATIVES a/
YAZOO BACKWATER AREA REFORMULATION

Benefits	Pump Station					Levee	Local Protection Projects c/
	10,500 cfs b/	14,000 cfs b/	17,500 cfs b/	21,000 cfs b/	24,500 cfs b/		
	Electric						
Agricultural Crop ($000)	11,400	13,500	14,600	15,300	15,700	10,400	
Agricultural Noncrop ($000)	2,380	2,800	3,040	3,180	3,280	2,000	
Catfish ($000)	337	362	404	442	467	325	
Structures ($000)	1,560	1,790	1,920	1,970	2,000	1,750	108
Road/Bridge ($000)	697	828	902	950	985	436	
Emergency ($000)	135	152	161	164	166	90	169
Flood Insurance ($000)	21	27	30	31	32	25	4
Automotive ($000)	11	13	14	14	14	13	14
Street ($000)	68	77	85	89	92	60	138
Total (Rounded) ($000)	16,600	19,500	21,200	22,100	22,700	15,100	433 d/
Costs							
Construction Cost ($000)	90,800	109,000	133,000	153,000	169,000	190,300 e/	
Mitigation Cost ($000)	18,700	22,600	23,100	26,700	30,600	12,600	
Total Construction Cost (Rounded) ($000)	110,000	131,000	156,000	179,000	200,000	203,000 e/	
Annual							
Amortization ($000)	9,510	11,400	13,600	15,600	17,300	12,700	
Operation and Maintenance ($000)	2,000	2,530	3,140	3,500	3,800	300	
Major Replacements ($000)	101	135	169	202	236	0	
Total Annual (Rounded) ($000)	11,600	14,100	16,900	19,300	21,400	13,500	
Excess Benefits (Rounded) ($000)	5,000	5,400	4,300	2,800	1,300	1,600	
Benefit-Cost Ratio (%)	1.4	1.4	1.3	1.2	1.1	1.1	

NOTE: Cost and benefit data rounded to three significant figures.

a/ Reflects 1995 benefits, costs, and 7-5/8 percent interest rate, 1988 land use.
b/ Assumes year-round pump operation at elevation 80.0 feet, NGVD.
c/ Local protection projects were evaluated at Rolling Fork, Eagle Lake, Cary, Holly Bluff, and Valley Park.
d/ This level of damages would support a first cost of $6,272,000. No project could be constructed for this cost; therefore, this alternative was dropped from further study.
e/ Based on staged levee construction.

TABLE SEIS-5
ECONOMIC DATA FOR ELECTRIC VERSUS DIESEL-POWERED PUMP STATION a/
YAZOO BACKWATER AREA REFORMULATION

Benefits	14,000 cfs	
	Electric b/	Diesel b/
Agricultural Crop ($000)	13,500	13,500
Agricultural Noncrop ($000)	2,800	2,800
Catfish ($000)	362	362
Structures ($000)	1,790	1,790
Road/Bridge ($000)	828	828
Emergency ($000)	152	152
Flood Insurance ($000)	27	27
Automotive ($000)	13	13
Street ($000)	77	77
Total (Rounded) ($000)	19,500	19,500
Costs		
Construction Cost ($000)	109,000	102,000
Mitigation Cost ($000)	22,600	22,600
Total Construction Cost (Rounded) ($000)	131,000	124,000
Annual		
Amortization ($000)	11,400	10,800
Operation and Maintenance ($000)	2,530	1,290
Major Replacements ($000)	135	126
Total Annual (Rounded) ($000)	14,100	12,200
Excess Benefits (Rounded) ($000)	5,400	7,300
Benefit-Cost Ratio (%)	1.4	1.6

NOTE: Cost and benefit data rounded to two significant figures.

a/ Reflects 1995 benefits, costs, and interest rate; 1988 land use.

b/ Assumes year-round pump operation at elevation 80.0 feet, NGVD.

SECOND ARRAY

57. The second array of alternatives was a modification of the first array based on the public involvement workshops held in 1997. Economic analyses were performed on concepts the participants requested to be considered. Cost data were based on a preliminary analysis and were refined if the alternative was carried forward into the next array. The alternatives are presented in Table SEIS-6, along with preliminary cost and environmental data. Table SEIS-6 reflects 1996 cost levels and was not updated to 2005 price levels because it was utilized for screening purposes only. The relative difference in the alternatives would be the same regardless of the prices or interest rate utilized. The acres of mitigation required to offset the remaining environmental losses were not updated using the revised environmental models presented in this Final Report nor were the acres available for reforestation updated to reflect 2005 land use conditions. Nine nonstructural alternatives, 6 structural alternatives, and 13 alternatives combining both nonstructural and structural features were considered. The data were presented at the 7 August 1997 briefing to assist the public involvement participants in the selection of alternatives to be considered in the next iteration.

58. The nonstructural alternatives included conservation easements on open and forested lands and flowage easements for water management. Conservation easements were used to (a) preserve the existing woodlands in the study area, (b) reestablish forest on open lands below the elevations of 85.0 feet, NGVD (approximately 0.7-year frequency flood event), and elevation 90 feet, NGVD (slightly less than the 2-year frequency flood), at the Steele Bayou structure, (c) compensate owners of open lands who would experience continued flooding, and (d) reduce agricultural flood damage. Flowage easements were used for water management during the winter waterfowl season. The addition of a winter waterfowl water management feature is justified considering that waterfowl resources are considered significant by institutional, public, and technical criteria. Restoring important waterfowl habitat to one of the seven priority conservation (Yazoo Basin) areas with the United States is an initiative of the North America Waterfowl Management Plan which was signed by the United States, Canada, and Mexico in 1986 and 1994, respectively. Winter waterfowl water would be provided by closing the gates of the Steele Bayou structure from 1 December to 1 March to induce ponding of interior/landside flows to water stage elevations of 80.0 and 85.0 feet, NGVD, at the Steele Bayou structure.

59. The following assumptions were used to formulate the nonstructural alternatives.

a. Conservation easements.

(1) Easement taken on cleared and/or wooded lands below a given elevation as shown in Table SEIS-6. Current land use either retained or reforested depending on elevation.

TABLE SEIS-6
SECOND ARRAY OF ALTERNATIVES[a]/
YAZOO BACKWATER AREA REFORMULATION

Alternative	Easements			Easements	Reforestation	Mitigation	Structural	Total	Pump Station	Acres of Mitigation
	Conservation Easements on Woodlands	Reforestation/Open Lands	Flowage/Water Management [b]/	($ Million)						
NONSTRUCTURAL										
1	Preserved below 100.3 feet	Use Retained below 100.3 feet	N/A	217.0			N/A	217.0	N/A	
2	Preserved below 100.3 feet	Use Retained below 100.3 feet	Below 80.0 feet	235.3	0		N/A	235.3	N/A	
3	Preserved below 100.3 feet	Use Retained below 100.3 feet	Below 85.0 feet	253.2	0		N/A	253.2	N/A	
4	Preserved below 100.3 feet	Reforested below 85.0 feet	N/A	232.1	8.1		N/A	240.2	N/A	
5	Preserved below 100.3 feet	Reforested below 85.0 feet	Below 80.0 feet	255.0	8.1		N/A	263.1	N/A	
6	Preserved below 100.3 feet	Reforested below 85.0 feet	Below 85.0 feet	257.0	8.1		N/A	265.1	N/A	
7	Preserved below 100.3 feet	Reforested below 90.0 feet	N/A	246.5	15.7		N/A	262.2	N/A	
8	Preserved below 100.3 feet	Reforested below 90.0 feet	Below 80.0 feet	269.3	15.7		N/A	285.0	N/A	
9	Preserved below 100.3 feet	Reforested below 90.0 feet	Below 85.0 feet	280.1	15.7		N/A	295.8	N/A	
COMBINATION NONSTRUCTURAL-STRUCTURAL										
10	Preserved below 85.0 feet	Use Retained below 85.0 feet	N/A	48.9	0		102	150.9	14,000 cfs [c]/	
11	Preserved below 85.0 feet	Use Retained below 85.0 feet	Below 80.0 feet	59.2	0		102	161.2	14,000 cfs [c]/	
12	Preserved below 85.0 feet	Use Retained below 85.0 feet	Below 85.0 feet	75.1	0		102	177.1	14,000 cfs [c]/	
13	Preserved below 85.0 feet	Reforested below 85.0 feet	N/A	59.7	8.1		102	169.8	14,000 cfs [c]/	
14	Preserved below 85.0 feet	Reforested below 85.0 feet	Below 80.0 feet	68.9	8.1		102	179.0	14,000 cfs [c]/	
15	Preserved below 85.0 feet	Reforested below 85.0 feet	Below 85.0 feet	78.9	8.1		102	189.0	14,000 cfs [c]/	
16	Preserved below 90.0 feet	Use Retained below90.0 feet	N/A	82.5	0		102	184.5	14,000 cfs [c]/	
17	Preserved below 90.0 feet	Use Retained below90.0 feet	Below 80.0 feet	87.7	0		102	189.7	14,000 cfs [c]/	
18	Preserved below 90.0 feet	Use Retained below90.0 feet	Below 85.0 feet	103.6	0		102	205.6	14,000 cfs [c]/	
19	Preserved below 90.0 feet	Reforested below 90.0 feet	N/A	104.6	15.7		102	222.3	14,000 cfs [c]/	
20	Preserved below 90.0 feet	Reforested below 90.0 feet	Below 80.0 feet	111.8	15.7		102	229.5	14,000 cfs [c]/	
21	Preserved below 90.0 feet	Reforested below 90.0 feet	Below 85.0 feet	121.6	15.7		102	239.3	14,000 cfs [c]/	
22	Preserved below 100.3 feet	N/A	N/A	69.1		22.6	102	193.7	14,000 cfs [c]/	18,500
STRUCTURAL										
23	N/A	N/A	N/A			18.7	85	103.7	10,500 cfs [d]/	15,000
24	N/A	N/A	N/A			22.6	102	124.6	14,000 cfs [d]/	18,500
25	N/A	N/A	N/A			23.1	124	147.1	17,500 cfs [d]/	19,000
26	N/A	N/A	N/A			26.7	145	171.7	21,000 cfs [d]/	22,000
27	N/A	N/A	N/A			30.6	158	188.6	24,500 cfs [d]/	25,000
28	N/A	N/A	N/A			12.6	177	189.6	N/A	10,000

[a]/ Reflects 1996 cost data; 1988 land use.
[b]/ 1 December to 1 March.
[c]/ A 14,000-cfs pump station would be operated to reduce flood damages above easement elevations.
[d]/ Initiate pumping at elevation 85.0 feet, NGVD, during 1 December to 1 March; initiate pumping at elevation 80.0 feet, NGVD, during cropping season.

NOTES:
Alternatives 1 through 9 are Nonstructural.
Alternatives 10 through 22 are Combination.
Alternatives 23 through 27 are standard plans, including a pump station while Plan 28 is a structural levee plan along the Sunflower River.

(2) No public access.

(3) Normal silvicultural practices would be allowed on woodlands.

(4) Future flood damage reduction foregone.

(5) Government has no right to induce flooding.

(6) All encumbrances would be perpetual.

(7) Structures would not be relocated unless affected by water management.

(8) All woodlands would be preserved with restrictions preventing conversion to more intensive use.

(9) Reforestation of cleared lands would be a 100 percent Federal cost.

(10) Operation of Little Sunflower and Steele Bayou structures would continue under current operational guidelines.

(11) All agricultural easements would contain restrictions preventing conversion to more intensive use.

b. Flowage easement for water management modifications.

(1) Operation of Steele Bayou and Little Sunflower structures would be modified to manage water during the period 1 December to 1 March using internal and external sources.

(2) Easements would be taken on cleared and wooded lands at or below a given elevation as shown in Table SEIS-6.

(3) Residential structures would be relocated if affected by water management.

(4) All encumbrances would be perpetual.

(5) Existing land use would not be allowed to intensify.

60. The structural alternatives included the pump station (five alternative pump station capacities) and the Sunflower River levee. Estimated compensatory mitigation requirements were included. Pumping would be initiated at elevation 85.0 feet, NGVD, in the 1 December to 1 March timeframe, but the remainder of the year pumping would be initiated at elevation 80.0 feet, NGVD, at the Steele Bayou structure.

61. The alternatives combining both nonstructural and structural features included a 14,000-cfs pump station in combination with conservation and flowage easements. Conservation easement elevations were set at elevation 85.0 and 90.0 feet, NGVD, at the Steele Bayou structure. Flowage easement elevations were set at elevation 80.0 and 85.0 feet, NGVD, at the Steele Bayou structure for water management--induced ponding of water for winter waterfowl. The 14,000-cfs pump station would be operated to reduce flood damages above the conservation easement elevations.

62. The total cost for the nonstructural alternatives ranged from $217 to $295.8 million (1996 cost data). The least costly alternative was Alternative 1 which included conservation easements to preserve all existing wooded lands within the study area and conservation easements on open lands to compensate landowners for continued flooding. The most costly alternative (Alternative 9) included (a) conservation easements to preserve all existing wooded lands within the study area, (b) conservation easements to reestablish forest on open lands below elevation 90.0 feet, NGVD, at the Steele Bayou structure, (c) conservation easements on open lands above elevation 90.0 feet, NGVD, at the Steele Bayou structure to compensate landowners for continued flooding, and (d) flowage easements for water management (during the winter waterfowl season (1 December to 1 March) on lands below elevation 85.0 feet, NGVD, at the Steele Bayou structure.

63. The total costs for the alternatives with combined features ranged from $151 to $239 million (1996 cost data). The least costly alternative (Alternative 10) included (a) 14,000-cfs pump station to reduce flooding above the elevation 85.0 feet, NGVD, at the Steele Bayou structure, (b) conservation easements to preserve existing wooded lands below elevation 85.0 feet, NGVD, at the Steele Bayou structure, and (c) conservation easements to compensate landowners of open land below elevation 85.0 feet, NGVD, at the Steele Bayou structure for continued flooding. The most expensive alternative (Alternative 21) included (a) 14,000-cfs pump station to reduce flooding above elevation 90.0 feet, NGVD, at the Steele Bayou structure, (b) conservation easements to preserve existing wooded lands below elevation 90.0 feet, NGVD, at the Steele Bayou structure, (c) conservation easements to reestablish forest on open lands below elevation 90.0 feet, NGVD, at the Steele Bayou structure, and (d) flowage easements for water management during the winter waterfowl season on lands below elevation 85.0 feet, NGVD, at the Steele Bayou structure.

64. The total costs for the structural alternatives ranged from $104 to $190 million (1996 cost data). The least costly alternative was Alternative 22 (10,500-cfs pump station). The most expensive alternative was Alternative 27 (levee alternative).

65. Of the 28 alternatives, two nonstructural alternatives (Alternatives 1 and 7), all the alternatives with combined features, and three structural alternatives (Alternatives 24, 25, and 28) were selected at the 7 August 1997 briefing for more detailed analysis. The Board of Mississippi Levee Commissioners requested that a 17,500-cfs pump station also be evaluated in combination with nonstructural features.

THIRD ARRAY

66. The third array of alternatives is presented in Table SEIS-7. The third array includes all the alternatives developed through the public involvement workshops that were conducted by the Vicksburg District in August 1998. This information was presented to the consensus committee in March 1999. Table SEIS-7 includes 2 nonstructural alternatives; 12 combination alternatives utilizing a 14,000-cfs pump station and 12 combination alternatives utilizing a 17,500-cfs pump station; a 14,000-cfs pump station structural alternative; a 17,500-cfs pump station structural alternative; a levee alternative along the Big Sunflower River; and an alternative utilizing a 14,000-cfs pump station while preserving all existing woodlands below elevation 100.3 feet, NGVD. An economic comparison of the alternatives is presented in Table SEIS-7. Table SEIS-7 reflects 1998 cost levels and was not updated to 2005 price levels because it was utilized for screening purposes only. The relative difference in the alternatives would be the same regardless of price or interest rate utilized. The acres of mitigation required to offset the remaining environmental losses were not updated using the revised environmental models presented in this Final Report nor were the acres available for reforestation updated to reflect 2005 land use conditions. Neither of the nonstructural alternatives was economically feasible. Five of the alternatives with combined features were economically justified--three with a 14,000-cfs pump station and two with a 17,500-cfs pump station. The combined alternative with the greatest excess of benefits over cost was Alternative 6, which included (a) a 14,000-cfs pump station with a pump operation elevation of 85.0 feet, NGVD, and (b) conservation easements to preserve existing woodlands below elevation 85.0 feet, NGVD, at the Steele Bayou structure. Two of the structural alternatives were economically feasible. The alternative with the greatest excess of benefits over costs was a structural alternative (Alternative 27), a 14,000-cfs pump station with a pump operation elevation of 80.0 feet, NGVD, during the cropping season (1 March-1 December) and a pump operation elevation of 85.0 feet, NGVD, during the waterfowl season (1 December-1 March) with compensatory mitigation. The 17,500-cfs pump station with a pump operation elevation of 80.0 feet, NGVD, during the cropping season and elevation 85.0 feet, NGVD, during the waterfowl season with compensatory mitigation was economically feasible.

67. After a review of the third array by the consensus committee and the Vicksburg District, flowage easements for water management were eliminated. There was not sufficient interior flow during 1 December to 1 March to consistently achieve an elevation between 80.0 and 85.0 feet, NGVD. Although there was sufficient interior flow to achieve an elevation of 80.0 feet, NGVD, the feature was not considered to be cost effective. The habitat units (HU) and associated total cost are presented in Table SEIS-8.

68. Conservation easements to preserve woodlands added cost to alternatives with no economic or environmental benefit. The Vicksburg District believes that sufficient laws and policies are available to prevent any substantial conversion of bottom-land hardwoods and the Consensus Committee concurred. Therefore, the costs for the easements for the conservation of woodland were dropped from further consideration.

TABLE SEIS-7
THIRD ARRAY a/
YAZOO BACKWATER AREA REFORMULATION

Alternative	Construction Cost											Average Annual Costs	Average Annual Benefit	Excess Benefits
	Easements				Reforestation		Environmental Impacts	Mitigation Cost	Structural Modification	Pump Station	Total			
	Conservation Woodlands	Reforestation Open Lands b/	Flowage/ Water Management	Total ($ Million)	Acres	($ Million)	(HU)	($ Million)	($ Million)	($ Million)	($ Million)	($000)	($000)	($000)
NONSTRUCTURAL PLANS														
1	Preserve below 100.3	Use retained	N/A	261.4	0	0	0	0	0	0	261	19,238	0	-19,238
2	Preserve below 100.3	Reforest below 90.0	N/A	307.8	101,800	14.3	80,070	0	0	0	330	24,265	-4,452	-28,717
COMBINATION PLANS - 14,000 CFS PUMP b/														
3	Preserve below 85.0	Use retained below 85.0	N/A	42.1	0	0	-49,151	31.3	0	120	193	16,365	16,242	**-123**
4	Preserve below 85.0	Use retained below 85.0	Below 80.0 c/	63.5	0	0	-41,104	26.2	0.35	120	210	17,548	16,242	-1,306
5	Preserve below 85.0	Use retained below 85.0	Below 85.0 d/	81.7	0	0	-41,200	26.2	0.35	120	228	18,890	16,242	-2,648
6	Preserve below 85.0	Reforest below 85.0	N/A	56.0	53,000	7.4	10,608	0	0	120	187	15,574	16,900	**1,326**
7	Preserve below 85.0	Reforest below 85.0	Below 80.0 c/	70.2	53,000	7.4	21,533	0	0.35	120	202	16,654	16,900	**246**
8	Preserve below 85.0	Reforest below 85.0	Below 85.0 d/	81.7	53,000	7.4	21,390	0	0.35	120	213	17,503	16,900	-603
9	Preserve below 90.0	Use retained below 90.0	N/A	85.2	0	0	-30,927	19.1	0	120	224	18,522	13,387	-5,135
10	Preserve below 90.0	Use retained below 90.0	Below 80.0 c/	102	0	0	-9,232	5.8	0.35	120	228	18,675	13,387	-5,288
11	Preserve below 90.0	Use retained below 90.0	Below 85.0 d/	117	0	0	-9,223	5.8	0.35	120	243	19,783	13,387	-6,396
12	Preserve below 90.0	Reforest below 90.0	N/A	135	101,800	14.3	36,022	0	0	120	276	22,155	13,883	-8,272
13	Preserve below 90.0	Reforest below 90.0	Below 80.0 c/	139	101,800	14.3	66,607	0	0.35	120	280	22,466	13,883	-8,583
14	Preserve below 90.0	Reforest below 90.0	Below 85.0 d/	141	101,800	14.3	66,616	0	0.35	120	282	22,615	13,883	-8,732
COMBINATION PLANS - 17,500 CFS PUMP b/														
15	Preserve below 85.0	Use retained below 85.0	N/A	42.1	0	0	-53,614	34.2	0	143	219	18,562	18,052	**-510**
16	Preserve below 85.0	Use retained below 85.0	Below 80.0 c/	63.5	0	0	-45,832	29.2	0.35	143	236	19,756	18,052	-1,704
17	Preserve below 85.0	Use retained below 85.0	Below 85.0 d/	81.7	0	0	-45,828	29.2	0.35	143	254	21,097	18,052	-3,045
18	Preserve below 85.0	Reforest below 85.0	N/A	56.0	53,000	7.4	3,932	0	0	143	210	17,532	18,159	**627**
19	Preserve below 85.0	Reforest below 85.0	Below 80.0 c/	70.2	53,000	7.4	14,414	0	0.35	143	225	18,612	18,159	-453
20	Preserve below 90.0	Reforest below 85.0	Below 85.0 d/	81.7	53,000	7.4	14,417	0	0.35	143	236	19,461	18,159	-1,302
21	Preserve below 90.0	Use retained below 90.0	N/A	85.2	0	0	-35,692	22.8	0	143	251	20,783	14,794	-5,989
22	Preserve below 90.0	Use retained below 90.0	Below 80.0 c/	102	0	0	-11,473	7.3	0.35	143	253	20,763	14,794	-5,969
23	Preserve below 90.0	Use retained below 90.0	Below 85.0 d/	117	0	0	-11,469	7.2	0.35	143	268	21,855	14,794	-7,061
24	Preserve below 90.0	Reforest below 90.0	N/A	135	101,800	14.3	29,534	0	0	143	299	24,113	14,917	-9,196
25	Preserve below 90.0	Reforest below 90.0	Below 80.0 c/	139	101,800	14.3	63,519	0	0.35	143	303	24,424	14,917	-9,507
26	Preserve below 90.0	Reforest below 90.0	Below 85.0 d/	141	101,800	14.3	63,523	0	0.35	143	305	24,573	14,917	-9,656
STRUCTURAL PLANS b/														
27 (14K P) e/	N/A	N/A	N/A	0	0	0	-63,743	40.5	0	120	161	13,990	17,539	**3,549**
28 (17.5K P) e/	N/A	N/A	N/A	0	0	0	-75,884	48.2	0	143	191	16,636	19,664	**3,028**
29 (LEV) f/	N/A	N/A	N/A	0	0	0	-30,081	19.1	0	215	234	19,552	15,102	**-4,450**
30 (14K P)	Preserve below 100.3	N/A	N/A	73.3	0	0	-63,743	39.4	0	120	233	19,348	17,539	-1,809

a/ Reflects 1998 costs, benefits, and interest rate; 1988 land use.

b/ Pump station would be operated to provide flood damage reduction for cleared lands above the easement elevation.

c/ 1 December - 1 March.

d/ Elevation 80.0 feet, NGVD, 1 December - 1 January and 15 February - 1 March; elevation 85.0 feet, NGVD, 1 January - 15 February.

e/ Pump station would be operated to provide flood damage reduction for cleared lands above elevation 80.0 feet except during 1 December - 1 March when pump station would be operated at elevation 85.0 feet, NGVD.

f/ Does not reflect cost of pump station but of the levee.

TABLE SEIS-8

PRELIMINARY AQUATIC SPAWNING RESOURCE SUMMARY a/

YAZOO BACKWATER AREA REFORMULATION

			Alternative	Impact	Reforest	Total	Mitigation	Mitgation	Mitigation O&M	Impact/ Reforest Ratio	Break Even Easement Reforestation	Break Even Reforestation Cost
				Habitat Units			Acres	$			Acres	$
			No-Action	200,553	0	200,553	0	0	0	0.00	0	
Ease. < 100.3			Alternative 1	0	0	0	0	0	0	0.00	0	
Easements < 90			Alternative 2	0	70,531	70,531	0	0	0	0.00	0	
14,000 Pump	Easements < 85	No	Alternative 3	-49,235	0	-49,235	21,041	32,549,856	315,609	0.00	0	
		80	Alternative 4	-41,170	0	-41,170	17,594	27,218,127	263,912	0.00	0	
		85	Alternative 5	-41,267	0	-41,267	17,636	27,282,316	264,534	0.00	0	
		No	Alternative 6	-49,235	59,759	10,524	0	0	0	0.82	43,650	34,920,365
		80	Alternative 7	-41,170	62,637	21,467	0	0	0	0.66	34,823	27,858,793
		85	Alternative 8	-41,267	62,593	21,325	0	0	0	0.66	34,930	27,944,244
	Easements < 90	No	Alternative 9	-20,090	0	-20,090	8,585	13,281,556	128,780	0.00	0	
		80	Alternative 10	-9,242	0	-9,242	3,950	6,110,319	59,247	0.00	0	
		85	Alternative 11	-9,234	0	-9,234	3,946	6,104,400	59,189	0.00	0	
		No	Alternative 12	-20,090	71,810	51,720	0	0	0	0.28	28,471	11,857,689
		80	Alternative 13	-9,242	75,839	66,597	0	0	0	0.12	12,402	5,165,418
		85	Alternative 14	-9,234	75,842	66,609	0	0	0	0.12	12,390	5,160,206
17,500 Pump	Easements < 85	No	Alternative 15	-53,709	0	-53,709	22,953	35,507,643	344,289	0.00	0	
		80	Alternative 16	-45,910	0	-45,910	19,620	30,351,858	294,297	0.00	0	
		85	Alternative 17	-45,907	0	-45,907	19,618	30,349,567	294,275	0.00	0	
		No	Alternative 18	-53,709	57,544	3,835	0	0	0	0.93	49,450	39,560,066
		80	Alternative 19	-45,910	60,246	14,336	0	0	0	0.76	40,374	32,299,052
		85	Alternative 20	-45,907	60,247	14,340	0	0	0	0.76	40,370	32,296,388
	Easements < 90	No	Alternative 21	-22,333	0	-22,333	9,544	14,764,565	143,160	0.00	0	
		80	Alternative 22	-11,487	0	-11,487	4,909	7,594,383	73,637	0.00	0	
		85	Alternative 23	-11,484	0	-11,484	4,908	7,592,092	73,614	0.00	0	
		No	Alternative 24	-22,333	70,988	48,655	0	0	0	0.31	32,016	13,334,359
		80	Alternative 25	-11,487	74,992	63,505	0	0	0	0.15	15,589	6,492,502
		85	Alternative 26	-11,484	74,993	63,509	0	0	0	0.15	15,584	6,490,507
14000			Alternative 27	-63,859	0	-63,859	27,290	42,217,952	409,353	0.00	0	
17500			Alternative 28	-76,022	0	-76,022	32,488	50,258,960	487,320	0.00	0	
Levee			Alternative 29	-30,081	0	-30,081	12,855	19,886,883	192,827	0.00	0	
14000 Preserve			Alternative 30	-63,859	0	-63,859	27,290	42,217,952	409,353	0.00	0	

a/ Reflects 1988 land use and draft environmental appendixes.

69. The 17,500-cfs pump station was dropped from further consideration due to concerns expressed by the consensus committee and results of a Vicksburg District analysis which found excess benefits to be greater for the 14,000-cfs pump station when compared to the 17,500-cfs pump station. Only the 14,000-cfs pump station was carried into the fourth and final arrays.

FOURTH ARRAY OF ALTERNATIVES (2000 DRAFT REPORT)

70. The fourth array of alternatives resulted from the evaluations of previous arrays, a consensus building public involvement process and the combined utilization of satellite scenes, river gage stations, and Geographic Information System (GIS) technology. Previously, planning efforts centered around utilization of the U.S. Geological Survey (USGS) quadrangle maps which are generally shown on 5-foot contours. With the advance in GIS technology, several satellite scenes could be acquired that showed levels of flooding at the various river elevations in the study area. This provides a planner a more accurate picture of the area impacted under preproject conditions. In addition, computer modeling had progressed such that postproject maps of the impacted area could be simulated and verified for each alternative. During the consensus building process, resource agencies requested the Vicksburg District utilize this technology to utilize pump-on/off elevations that were significant to environmental resources. For example, elevation 87.0 feet, NGVD, at the Steele Bayou structure is the 1-year frequency flood event. Elevation 88.5 feet, NGVD, is the 5 percent duration elevation, and elevation 91.0 feet, NGVD, is the 2-year frequency flood elevation. In addition, the proposed change in the operation plan of the Steele Bayou structure to maintain water elevation between 68.5 and 70.0 feet, NGVD, to an elevation between 70.0 and 73.0 feet, NGVD, during low-flow conditions was a result of the consensus building process.

71. The EPA funded Dr. Leonard Shabman of Virginia Tech University to evaluate nonstructural flood damage reduction initiatives in the Yazoo Backwater Area. The results of his studies are included in Appendix 17.

72. The Shabman Report evaluated the following initiatives:

a. Adopt existing economic analysis protocols for evaluating nonstructural alternatives.

b. Demonstrate the analytical protocol with an evaluation of nonstructural actions for the Yazoo River backwater.

c. Describe an implementation plan that would provide incentives for landowners' adoption of nonstructural actions.

d. Review Vicksburg District preliminary estimates of agricultural benefits for a pump.

73. The Vicksburg District was briefed on the Shabman Report on 11 February 2000 and later received a copy for review. The Vicksburg District reviewed the report as it related to the planning objectives to determine if it adhered to current policies and guidance. The Vicksburg District also evaluated whether the report recommendations warranted further review as a reasonable alternative. Several of the Shabman Report objectives were similar to the Vicksburg District objectives. A major difference was that the Shabman Report recommendations only affected a portion of those lands and properties below the 2-year frequency flood elevation, while the Vicksburg District alternatives provided benefits to those lands and properties up to the 100-year frequency flood elevation.

74. In summary, the Shabman Report identified 3 findings and 12 implications which are discussed in more detail in Appendix 17 and summarized in the following paragraphs.

75. Based on the Vicksburg District's understanding of the Shabman Report, which recommended a nonstructural alternative that included voluntary reforestation of approximately 70 percent of the 2-year frequency flood elevation (88,000 acres—1988 land use), an income assurance program for farms outside the 2-year flood plain, and relocation or the utilization of local flood protection features for a limited number of structures. This alternative was not economically justified without counting benefits from carbon sequestration and nutrient load reduction. To be used, economic markets for these two categories must be found to exist and be predictable. Also, these benefit categories must be extended to all Federal water resource projects where reforestation is combined with a nonstructural approach. The Vicksburg District concluded that these benefit categories had been overstated based on information received by the Vicksburg District (K. Pennington, 1999, "Relationship Between Surface Water Sediment Concentration, Total Phosphorus, and Total Kjeldahl Nitrogen in Mississippi Delta Streams," Proceedings of the 29th Mississippi Water Resources Conference). In addition, the Shabman Report failed to account for all the costs involved. For example, the cost of acquiring the 88,000 acres (1988 land use) proposed by Dr. Shabman was not quantified. The Shabman Report projected that approximately 40,000 acres would be enrolled in WRP and the Conservation Reserve Program (CRP) (therefore, paid for by USDA funds, rather than project funds). Dr. Shabman did not account for the costs of administration to acquire and reforest these lands, to provide the income assurance program to those lands above the 2-year flood plain, to elevate roadways, and to relocate any structures. The Vicksburg District's detailed review of the Shabman Report is included in Appendix 17. Due to the above-listed reasons and because this alternative does not meet the overall objectives of the study, the Vicksburg District concluded that the Shabman Plan was not a reasonable alternative. The full Shabman Report was included as an appendix in the Draft Report and circulated for public comment.

76. Project features carried into the fourth array alternatives included (a) a pump station to provide flood damage reduction benefits above the pump operation elevation, (b) conservation easements from willing sellers with reestablishment of forest on open land below the pump operation elevation to prevent existing flood damages by converting the land to a use more

compatible to frequent flooding, (c) conservation easements from willing sellers to preserve forest land below the pump operation elevation of 91.0 feet, NGVD (requested by FWS), at the Steele Bayou structure, (d) compensatory mitigation for unavoidable environmental impacts, and (e) modification of the operation of the Steele Bayou structure to maintain water elevations between 70.0 and 73.0 feet, NGVD, during low-flow conditions. This allows for more permanent water in the existing channels and provides additional environmental habitat. This feature has no cost associated with it, but provides a positive environmental gain for the area. Seven alternative plans are included in the fourth array. Included in the array is the no-action alternative, a nonstructural alternative, a structural alternative, and four combinations of structural and nonstructural alternatives. Several of these alternatives were modified by further discussions with the consensus committee from what was shown in Array 3. Alternatives were developed relating pump-on elevations to flood frequency. Elevation 87.0 feet, NGVD, at the Steele Bayou structure represents the 1-year frequency flood elevation, while elevation 91.0 feet, NGVD, is the 2-year frequency flood at the Steele Bayou structure. Elevation 88.5 feet, NGVD, at the Steele Bayou structure represents the elevation of Federally defined wetlands as determined by backwater flooding analyses. Alternatives have been developed that utilize these elevations for pump station operation.

77. The alternatives carried into the fourth array are:

a. Alternative 1. No action.

b. Alternative 2 - nonstructural alternative. No pump station with conservation easements from willing sellers on 212,600 acres of open land, below the 100-year elevation of 100.3 feet, NGVD, with reestablishment of forest on 107,000 acres of open land below elevation 91.0 feet, NGVD, which is the 2-year frequency flood event, and modified operation of Steele Bayou structure to maintain water levels between elevations 70.0 to 73.0 feet, NGVD, during low-water periods.

c. Alternative 3. The 14,000-cfs pump station with pump operation elevation of 80.0 feet, NGVD (1 March-1 December), at the Steele Bayou structure and elevation 85.0 feet, NGVD (1 December-1 March); acquisition and reestablishment of forest on 27,435 acres for mitigation and modified operation of Steele Bayou structure to maintain water levels between 70.0- to 73.0-foot, NGVD, elevation during low-water periods.

d. Alternative 4. The 14,000-cfs pump station with a year-round pump operation elevation of 85.0 feet, NGVD, at Steele Bayou; conservation easements from willing sellers and reestablishment of forest on 40,600 acres of open land below the pump elevation; and modified operation of Steele Bayou structure to maintain water levels between 70.0- to 73.0-foot, NGVD, elevations during low-water periods.

e. Alternative 5. The 14,000-cfs pump station with a year-round pump operation elevation of 87.0 feet, NGVD, at Steele Bayou; conservation easements from willing sellers; and reestablishment of forest on 62,500 acres of open land below the pump elevation, modified operation of Steele Bayou structure to maintain water levels between 70.0- to 73.0-foot, NGVD, elevations during low-water periods.

f. Alternative 6. The 14,000-cfs pump station with a year-round pump operation elevation of 88.5 feet, NGVD, at Steele Bayou; conservation easements from willing sellers; and reestablishment of forest on 77,300 acres of open land below the pump elevation; modified operation of Steele Bayou structure to maintain water levels between 70- to 73-foot, NGVD, elevations during low-water periods and to reintroduce flows from the Mississippi River up to elevation 87.0 feet, NGVD, at Steele Bayou structure (1-year frequency flood event).

g. Alternative 7. The 14,000-cfs pump station with a year-round pump operation elevation of 91.0 feet, NGVD, at Steele Bayou structure; conservation easements from willing sellers; reestablishment of forest on 107,000 acres of open land below the 91.0 feet, NGVD, elevation; conservation easements on 91,600 acres of existing woodlands below elevation 91.0 feet, NGVD (requested by FWS); modified operation of Steele Bayou structure to maintain water levels between 70.0 to 73.0 feet, NGVD, elevation during low-water periods; and reintroduce flows from the Mississippi River up to elevation 87.0 feet, NGVD, at Steele Bayou structure (1-year frequency flood event).

78. Table SEIS-9 summarizes the economic analysis of the fourth array based on 2000 price levels, 6-5/8 percent interest rate, and 1988 land use. As shown, Alternative 3, the structural alternative, along with the combination Alternatives 4-6, are economically justified.

TABLE SEIS-9
SUMMARY, ECONOMIC ANALYSIS (FOURTH ARRAY)
FIRST COSTS, ANNUAL COSTS, ANNUAL BENEFITS,
EXCESS BENEFITS OVER COST, AND BENEFIT-COST RATIO
YAZOO BACKWATER AREA REFORMULATION

Item	Alternatives (Fourth Array)					
	2	3	4	5	6	7
Costs ($000)						
First Cost a/b/	291,001	153,710	154,732	181,595	196,274	274,654
Structural	--	115,233	140,391	134,978	127,913	120,383
Nonstructural	291,001	--	14,341	46,617	68,461	154,271
Interest During Construction	27,731	14,648	14,740	17,305	18,704	26,173
Structural	--	14,648	13,374	12,863	12,180	11,472
Nonstructural	27,731	--	1,366	4,442	6,524	14,701
Mitigation	--	38,477	--	--	--	--
Gross Investment	318,732	168,358	169,472	198,900	214,981	300,827
Structural	--	129,881	153,765	147,841	140,093	131,855
Nonstructural	318,732	--	15,707	51,059	74,985	168,972
Annual Cost a/b/c/ ($000)						
Structural						
Amortization	--	11,623	10,616	10,207	9,665	9,103
O&M Project	--	812	812	812	812	812
O&M Energy	--	379	253	183	142	76
O&M Mitigation	--	334	--	--	--	--
Pump Replacement	--	154	154	154	154	154
Nonstructural						
Amortization	22,005	--	1,085	3,525	5,177	11,666
Total Annual Costs a/b/c/	22,005	13,302	12,920	14,881	15,950	21,811
Structural	--	13,302	11,835	11,356	10,773	10,145
Nonstructural	22,005	--	1,085	3,525	5,177	11,666
Annual Benefits c/ ($000)						
Structural						
Agricultural Crop	--	12,934	10,085	9,763	8,708	6,274
Agricultural Noncrop	--	2,705	2,579	2,241	2,159	1,770
Structures	--	1,967	1,935	1,871	1,788	1,639
Road and Bridge	--	883	863	828	802	766
Urban Streets	--	90	89	83	80	66
Emergency Cost	--	170	168	158	152	126
FIA	--	31	31	30	29	25
Catfish	--	383	377	365	352	319
Total Structural	--	19,163	16,127	15,339	14,070	10,985

TABLE SEIS-9 (Cont)

Item	Alternatives (Fourth Array)					
	2	3	4	5	6	7
Nonstructural						
Agricultural Crop	380	--	1,027	1,162	854	380
Timber/Hunting Leases	2,488	--	608	936	1,158	2,488
Total Nonstructural	2,868	--	1,635	2,098	2,012	2,868
Employment						
Structural	--	438	417	376	351	395
Nonstructural	841	--	43	130	188	384
Total Employment	841	438	460	506	539	683
Annual Benefits (All Benefit Categories) ($000)						
Structural	--	19,601	16,544	15,715	14,421	11,380
Nonstructural	2,410	--	1,678	2,228	2,200	3,252
Total Annual Benefits (All Benefit Categories) ($000)	2,410	19,601	18,222	17,943	16,621	14,536
Annual Benefits (With Employment Excluded) ($000)						
Structural	--	19,163	16,127	15,339	14,070	10,985
Nonstructural	1,569	--	1,635	2,098	2,012	2,868
Total Annual Benefits (With Employment Excluded) ($000)	1,569	19,163	17,762	17,437	16,082	13,853
Excess Benefits Over Cost (All Benefit Categories) ($000)	(19,595)	6,299	5,302	3,063	670	(7,181)
Excess Benefits (With Employment Excluded) ($000)	(20,436)	5,861	4,842	2,557	131	(7,960)
Benefit-Cost Ratio (All Benefit Categories)	0.11	1.47	1.41	1.23	1.07	0.67
Benefit-Cost Ratio (With Employment Excluded)	0.07	1.44	1.37	1.19	1.03	.64

a/ February 2000 price levels.

b/ Includes costs for mitigation for Alternatives 3, 2, and 4-7 include conservation easement and reforestation costs (1988 land use).

c/ Annualized using 50-year project life 6-5/8 percent Federal discount rate.

79. Tables SEIS-10 and SEIS-11 summarized the environmental analysis of the alternatives carried into the fourth array. Table SEIS-10 presents the analyses in terms of average annual habitat units (AAHU), functional capacity units (FCU), and duck-use-days (DUD). Additional information is included in Appendixes 10-13.

80. The fourth array was the final array in the 2000 Draft Report, and served as a basis for the final array of alternatives.

FINAL ARRAY OF ALTERNATIVES (2007 FINAL REPORT)

81. Ten alternative alternatives are included in the final array. These include the no-action alternative, four nonstructural alternatives, a structural alternative, and four combination alternatives utilizing both structural and nonstructural features. Alternatives were developed which utilized the elevation of hydrologic events. Elevation 87.0 feet, NGVD, at the Steele Bayou structure represents the 1-year frequency flood event while elevation 91.0 feet, NGVD, is the 2-year frequency flood event. Elevation 88.5 feet, NGVD, represents the upper limit of backwater sustained wetlands at the Steele Bayou structure. Alternatives were developed that utilized these elevations for pump operation. Project measures carried into the final array alternatives included (a) a pump station to provide flood damage reduction benefits above the pump operation elevation, (b) perpetual easements from willing sellers with reestablishment of forest/conservation measures on open land primarily below the pump operation elevation to reduce flood damages by converting the land to a use more compatible to frequent flooding, (c) perpetual easements from willing sellers to preserve forest land primarily below the pump operation elevation of 91.0 feet, NGVD (requested by FWS), and (d) compensatory mitigation for unavoidable environmental impacts, (e) ring levees, (f) floodproofing or relocating structures below 100-year flood plain, (g) income assurances, (h) restore connectivity with Yazoo and Mississippi Rivers for the 1-year frequency flood plain, and (i) modification of the operation of the Steele Bayou structure during low-water periods.

82. A number of changes and updates have occurred since the release of the Draft Report and Draft SEIS. These changes are highlighted below:

a. Land use data were updated from 1988 to 2005. The Vicksburg District's updated land use revealed that some of the low-lying agricultural lands were reforested under USDA conservation programs during these years. This change affected the economic and environmental analyses, and there is less acreage available for reforestation under the nonstructural flood damage reduction feature.

TABLE SEIS-10
ENVIRONMENTAL GAINS AND LOSSES
FOURTH ARRAY
YAZOO BACKWATER AREA REFORMULATION
(2000 Draft Report) (1988 Land Use)

Alternative	Terrestrial (AAHU)			Wetland (FCU)			Waterfowl (DUD)			Aquatics Spawning (AAHU) a/			Aquatics Rearing (AAHU)		
	Structural Effects		Nonstructural Effects	Structural Effects		Nonstructural Effects	Structural Effects		Nonstructural Effects	Structural Effects		Nonstructural Effects	Structural Effects		Nonstructural Effects
	Construction	Hydrologic	Reforestation	Construction	Hydrologic	Reforestation	Construction	Hydrologic	Reforestation	Construction	Hydrologic	Reforestation	Construction	Hydrologic	Reforestation
2	0	0	175,542	0	0	77,919	0	0	-824,505	0	0	80,072	0	0	41,730
3	-108	-6,572	0	-463	-52,788	0	-2,166	-188,934	0	-142	-63,744	0	-44	-42,913	0
4	-108	-3,832	78,473	-463	-39,469	63,227	-2,166	-184,086	-750,357	-142	-49,151	59,759	-44	-31,571	31,853
5	-108	-2,896	110,678	-463	-18,579	70,562	-2,166	-80,438	-790,828	-142	-29,919	67,489	-44	-15,905	36,556
6	-108	1,183	133,912	-463	22,072	83,318	-2,166	326,326	-958,177	-142	-12,659	74,555	-44	-2,679	40,394
7	-108	3,721	177,715	-463	30,824	92,362	-2,166	362,462	-973,220	-142	2,802	81,200	-44	+5,327	43,146

NOTE: Construction effects are those that result from the actual construction site; hydraulic effects are those that result from operation of the structural features; and reforestation effects are those that result from reforesting agricultural lands.

+ indicates a gain in environmental resources.
- indicates a loss in environmental resources.

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

TABLE SEIS-11
NET ENVIRONMENTAL GAINS AND LOSSES
FOURTH ARRAY
(1988 LAND USE)
(2000 DRAFT REPORT)
YAZOO BACKWATER AREA REFORMULATION

Alternative	Terrestrial (AAHU)	Wetland (FCU)	Waterfowl (DUD)	Aquatics (AAHU) (Flood Plain Spawning)	Aquatics (AAHU) (Flood Plain Rearing)
2	175,542	77,919	-824,505	80,072	41,730
3	-6,680	-53,251	-191,100	-63,886	-42,957
4	74,533	23,295	-936,609	10,466	238
5	107,674	51,523	-873,432	37,425	20,607
6	134,987	104,928	-634,017	61,754	37,671
7	181,328	122,722	-612,924	83,860	48,429

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

AAHU – Average Annual Habitat Units
FCU – Functional Capacity Units
DUD – Duck-Use Days

b. A wetland reanalysis was completed, which modeled the extent of wetlands sustained by backwater flooding with a GIS. The functional values of wetlands were determined utilizing the Hydrogeomorphic Method (HGM) approach. The HGM approach was developed ERDC in conjunction with EPA. This method measures eight wetland functions over a range of durations and land cover types. The method, when used with the Vicksburg District's Flood Event Simulation Model (FESM), allowed for a comparison of pre- and postproject changes to the Yazoo Backwater area's wetlands. The FESM is a GIS model developed to simulate flooding using stage data and a digital elevation model (DEM).

c. In order to verify the Vicksburg District's wetland delineation, EPA requested a statistically valid field testing of the results. To accomplish this, EPA wetland scientists utilized their Environmental Monitoring and Assessment Program (EMAP) to randomly choose 150+ sample sites within the study area for field testing. The goals of this sampling were to verify the Vicksburg District offsite wetland delineation, produce a statistically significant estimate of the project areas wetland acreage, and compare that acreage to the amount estimated by the Vicksburg District FESM model. In June 2003, interagency teams of scientists and engineers representing EPA, FWS, NRCS, and the Vicksburg District performed wetland determinations on the 150+ sampling sites. The wetland determinations were made using the 1987 Wetland Manual. Based on the results of the random field sampling, EPA estimated that there are 216,600 acres of wetlands within the study area.

d. The economic analysis was revised using an updated MSU report on crop production costs and yield data based on planting dates. Residential and nonresidential structural data were also updated.

e. The water quality analysis was updated to address total maximum daily loads (TMDL) and quantify project impacts using HGM.

f. A consulting firm, specializing in environmental justice (EJ) issues, prepared an EJ report.

g. The nonstructural feature was modified to allow up to 10 percent of the reforestation lands to be used for other conservation measures. These features include the installation of water control structures which will provide additional foraging habitat for waterfowl.

h. The date for securing the perpetual easements on the nonstructural feature was extended from 1 to 10 years after pump station construction is complete.

i. Sufficient easements would be purchased prior to pump station operation to offset adverse impacts of the project.

j. Quantified the cumulative effects to terrestrial, wetlands, waterfowl, and aquatic from constructing both the Yazoo Backwater Project and the Big Sunflower River Maintenance Project.

83. Other initiatives added include:

a. A 7-year, $4.9 million, pondberry study with USFS and FWS.

b. A 4-year, $1.0 million, suspended sediments/nutrient stormwater runoff study with USGS.

Both of these studies are ongoing at this time.

84. Formal consultation with FWS was conducted on the endangered plant, pondberry, as well as informal consultation on the threatened species Louisiana black bear.

85. The final array of alternatives is similar to the fourth array (2000 Draft Report), but with the addition of three nonstructural alternatives—Alternatives 2A, 2B, and 2C. The EPA requested that additional nonstructural alternatives be evaluated in their review of the 2000 Draft Report, including an alternative similar to the alternative outlined in the Shabman Report. Alternative 2A flood proofed the structures within the 100-year flood plain and provide income assurance to lands above elevation 88.5 feet, NGVD. Alternative 2B consisted of 14 ring levees, which would protect 88 percent of the structures in the 100-year flood plain. The parts of the Shabman Report which could be considered benefit categories utilizing USACE Principles and Guidelines were evaluated in Alternative 2C. Each of the above alternatives also had a nonstructural feature under which agricultural lands would be acquired and reforested.

86. In addition to the Shabman Report, EPA submitted another plan to be considered for the area. This plan was submitted to the Vicksburg District after the release of the Draft Report in September 2000. It will be discussed in the following paragraphs as part of the Final Report. The plan was entitled "The Lower Yazoo River Basin Economic and Environmental Initiative." The complete 5-page EPA report, along with Vicksburg District comments, are presented in Appendix 17.

87. The EPA's Lower Yazoo River Basin Economic and Environmental Initiative was estimated to cost approximately $170 million. It involved numerous state and Federal agencies, private industry, and nongovernment organizations in ongoing programs, but also recommended several new programs that would require congressional authorization and funding. The initiative was divided into three priority areas and the costs associated with each. Priority 1 involved public health and safety at a cost of $55.0 million. Priority 2 involved flood plain protection and restoration and community economic development at a cost of $73.0 million. Priority 3 was economic development through nature-based tourism at a cost of $42.0 million. The final array of alternatives includes flood damage reduction features proposed in Priorities 1 (Flood protection of structures-houses/business/roads) and 2 (Conservations easements from

willing sellers on 50,000 to 80,000 acres on the most frequently flooded lands through specially targeted Emergency Wetland Reserve Program (Natural Resources Conservation Service (NRCS))/Section 319 (EPA) initiatives). All remaining features in Priorities 1, 2, and 3 involve economic development and do not meet the study authority and objective of flood damage reduction. Thus, this plan was dropped from further consideration. The initiative is included in Appendix 17.

88. Since the release of EPA's document in September 2000, the Vicksburg District is not aware of any effort by EPA or others to go forward with this initiative. The EPA has not held any meetings or discussions with the state and Federal agencies who have primarily responsibilities in the areas that EPA desired to address in developing their initiative. In addition, Congress has not enacted any legislation or funded any of the initiatives beyond what the agencies were already funded to carry out.

ALTERNATIVES IN FINAL ARRAY

89. The alternatives carried into the final array are described below, and all elevations are based on the elevation at the Steele Bayou structure. The operation of the Little Sunflower structure will not change with any of the alternatives:

[NOTE: Blocking Out. The reforestation/conservation features easement acquisition limits for the Yazoo Backwater Reformulation Study were established based upon flood frequency stage elevations. However, based upon sound real estate practices and guidance as found in USACE real estate regulations, blocking out will be utilized to address such items as access, the extent of severance damages, and avoidance of an uneconomic remainder. The blocking out will result in the acquisition of some lands outside a given flood event or elevation. The Vicksburg District Real Estate Division has vast experience in the acquisition of lands based upon elevation and typically uses a blocking factor of 30 percent. This figure was utilized for calculating the acreage to be acquired for the reforestation/conservation features easement in connection with the Yazoo Backwater Reformulation Study. The symbol "(b)" indicates a blocked acreage in the alternative descriptions listed below. Acreages are rounded to the nearest 100 acres and are based on 2005 land use.

Slope. Throughout the descriptions of the alternatives, the elevation at the Steele Bayou structure will be referenced regarding the acquisition of perpetual/flowage easements. These references do not imply an absolute elevation, but imply an elevation that rises as you move upstream from the structure. The rate of the rise or the slope of the surface can be found in Appendix 6 (Engineering), and it is based upon a hydrologic event, such as the 1-year frequency flood. The use of the elevation at the Steele Bayou structure establishes a standard point of reference for comparison of the alternatives.]

a. No Action.

Alternative 1. This is the no-action alternative. This action would not eliminate potential flood damages. Residential and nonresidential structures would continue to be affected by flooding, which economically impacts the area. Local, state, and Federal governments would continue to pay for flood-fighting efforts and repair of urban and rural roads, bridges, and other infrastructure. There will be no project impacts with the no-action alternative.

b. Nonstructural alternatives. The flowage easements and income assurance features of the nonstructural alternatives would require additional authorization from Congress to implement.

(1) Alternative 2. This alternative contains nonstructural and operational features which influence land-use patterns and activities. There is a no-pump station feature in Alternative 2. To be consistent with alternatives that include a pump station (i.e., some level of benefit across the study area), the nonstructural easements would provide flood damage reduction through reforestation or some degree of compensation across the entire study area. Reforestation of the 2-year flood plain (elevation 91.0 feet, NGVD, at the Steele Bayou structure) would provide flood damage reduction and remove impacts of agricultural practices on these lands. Compensation would be provided above elevation 91.0 feet, NGVD, at the Steele Bayou structure. Features include:

(a) Nonstructural.

1. Acquisition and reforestation/conservation features on up to 124,400 (b) acres of agricultural lands through perpetual easements from willing sellers only. Approximately 95,700 acres of cleared land are potentially available below elevation 91.0 feet, NGVD (2-year flood plain at the Steele Bayou structure), and the remaining acreage needed to reach up to the 124,400 acres would be acquired above elevation 91.0 feet, NGVD (2-year flood plain at the Steele Bayou structure). Up to10 percent of an acquired property could be in conservation features other than reforestation. Conservation features are practices implemented and maintained solely for wildlife management purposes. Conservation features include, but are not necessarily limited to, (a) water management impoundments for waterfowl, wading birds, or other wildlife purposes; (b) food plots; (c) permanent openings maintained in early successional stages; (d) access trails, roads, and firebreaks; or (e) facilities and buildings necessary for property management (constructed above the 100-year flood plain elevation). While the Vicksburg District will provide the pipe for the waterfowl impoundment, landowners would be responsible for the cost of implementing and maintaining the waterfowl impoundment and any other conservation practices. Landowners also would be responsible for maintaining ditches used for agricultural operations on remaining portions of their properties or for agricultural operations on other properties dependent on those ditches. The Vicksburg District will have the right to enforce the terms of the recorded conservation easements.

2. Acquisition of up to 197,600 acres of agricultural lands between elevations 91.0 and 100.3 feet, NGVD, at the Steele Bayou structure, through flowage easements. No agricultural intensification or other development would be allowed under the easement. Easements would be perpetual and from willing sellers only.

(b) Operational. Operation of the Steele Bayou structure to maintain water elevations between 70.0 and 73.0 feet, NGVD, during low-water periods. No additional real estate is required for this feature.

(2) Alternative 2A. This alternative contains nonstructural features which influence land-use patterns and activities. There is a no-pump station feature in this alternative. Features include:

(a) Nonstructural.

1. Acquisition and reforestation/conservation features on up to 81,400 (b) acres of agricultural lands through perpetual easements from willing sellers only. Approximately 62,600 acres of cleared land are potentially available below elevation 88.5 feet, NGVD, at the Steele Bayou structure, and the remaining acreage needed to reach up to the 81,400 acres would be acquired between elevations 88.5 and 91.0 feet, NGVD (2-year flood plain at the Steele Bayou structure). Up to 10 percent of an acquired property could be in conservation features other than reforestation. Conservation features are practices implemented and maintained solely for wildlife management purposes. Conservation features include, but are not necessarily limited to, (1) water management impoundments for waterfowl, wading birds, or other wildlife purposes; (2) food plots; (3) permanent openings maintained in early successional stages; (4) access trails, roads, and firebreaks; or (5) facilities and buildings necessary for property management (constructed above the 100-year flood plain elevation). While the Vicksburg District will provide the pipe for the waterfowl impoundment, landowners would be responsible for the cost of implementing and maintaining the waterfowl impoundment and any other conservation practices. Landowners also would be responsible for maintaining ditches used for agricultural operations on remaining portions of their properties or for agricultural operations on other properties dependent on those ditches. The Vicksburg District will have the right to enforce the terms of the recorded conservation easements.

2. Flood proofing 1,363 structures in the 100-year flood plain.

3. Implementing an income assurance program that would be established for 235,000 acres of cropland above elevation 88.5 feet, NGVD.

(3) Alternative 2B. This alternative is a nonstructural alternative with a structural component. There is a no-pump station with this alternative. Features include:

(a) Nonstructural.

1. Acquisition and reforestation/conservation features on up to 26,400 (b) acres of agricultural lands through perpetual easements from willing sellers only. As a result of design and alignment of the 14 ring levees (see below), approximately 20,300 acres of cleared land are potentially available below elevation 91.0 feet, NGVD (2-year flood plain at the Steele Bayou structure), and outside the ring-leveed areas. Up to 10 percent of an acquired property could be in conservation features other than reforestation. Conservation features are practices implemented and maintained solely for wildlife management purposes. Conservation features include, but are not necessarily limited to, (1) water management impoundments for waterfowl, wading birds, or other wildlife purposes; (2) food plots; (3) permanent openings maintained in early successional stages; (4) access trails, roads, and firebreaks; or (5) facilities and buildings necessary for property management (constructed above the 100-year flood plain elevation). While the Vicksburg District will provide the pipe for the waterfowl impoundment, landowners would be responsible for the cost of implementing and maintaining the waterfowl impoundment and any other conservation practices. Landowners also would be responsible for maintaining ditches used for agricultural operations on remaining portions of their properties or for agricultural operations on other properties dependent on those ditches.

2. Relocate the remaining 194 structures not protected by the ring levees.

(b) Structural. Fourteen ring levees would be required with this alternative to provide 100-year protection to 88 percent of the structures in the Yazoo Backwater Study Area. Ring levees would require an accompanying infrastructure to evacuate precipitation from inside the ringed area and provide for operation of septic systems in saturated grounds. This would require water control structures, interior channels, road crossings, wastewater facilities, pumps, etc., in addition to the levees.

(4) Alternative 2C. This alternative is a nonstructural alternative that influences land-use patterns and activities. This alternative is based on the Shabman Report. There is a no-pump station feature in this alternative. Features include:

Nonstructural.

1. Acquisition and reforestation/conservation features on up to 114,400 (b) acres of agricultural lands through perpetual easements from willing sellers only. Approximately 95,700 acres of cleared land are potentially available below elevation 91.0 feet, NGVD (2-year flood plain at the Steele Bayou structure), and the remaining acreage needed to reach up to the

114,400 acres would be acquired above elevation 91.0 feet, NGVD (2-year flood plain at the Steele Bayou structure). Up to 10 percent of an acquired property could be in conservation features other than reforestation. Conservation features are practices implemented and maintained solely for wildlife management purposes. Conservation features include, but are not necessarily limited to, (1) water management impoundments for waterfowl, wading birds, or other wildlife purposes; (2) food plots; (3) permanent openings maintained in early successional stages; (4) access trails, roads, and firebreaks; or (5) facilities and buildings necessary for property management (constructed above the 100-year flood plain elevation). While the Vicksburg District will provide the pipe for the waterfowl impoundment, landowners would be responsible for the cost of implementing and maintaining the waterfowl impoundment and any other conservation practices. Landowners also would be responsible for maintaining ditches used for agricultural operations on remaining portions of their properties or for agricultural operations on other properties dependent on those ditches.

2. Implementing an income assurance program on 201,900 acres of cropland, which is all remaining cropland in the 100-year flood plain.

3. Relocation of all 1,576 structures damaged by a 100-year flood event.

c. Structural alternative. As part of the structural feature, pump-on elevations were selected to meet project purpose.

(1) Alternative 3. Features include:

(a) A 14,000-cubic-foot-per-second (cfs) pump station with a pumping elevation of 80.0 feet, NGVD, between 1 March and 31 October. Pumping elevation of 85.0 feet, NGVD, between 1 November and 28 February. This would allow retention of more water during the winter waterfowl season.

(b) Operational. Operation of the Steele Bayou structure to maintain water elevations between 70.0 and 73.0 feet, NGVD, during low-water periods. No additional real estate is required for this feature.

d. Combined structural and nonstructural alternatives. As part of the structural feature, pump-on elevations were selected to meet project purpose.

(1) Alternative 4. Features include:

(a) Acquisition and reforestation/conservation features on up to 37,200 (b) acres of agricultural lands through perpetual easements from willing sellers only. Approximately 28,600 acres of cleared land are potentially available below elevation 85.0 feet, NGVD, at the Steele Bayou structure, and the remaining acreage needed to reach up to the 37,200 acres would

be acquired between elevations 85.0 and 91.0 feet, NGVD (2-year flood plain at the Steele Bayou structure). Up to 10 percent of an acquired property could be in conservation features other than reforestation. Conservation features are practices implemented and maintained solely for wildlife management purposes. Conservation features include, but are not necessarily limited to (1) water management impoundments for waterfowl, wading birds, or other wildlife purposes; (2) food plots; (3) permanent openings maintained in early successional stages; (4) access trails, roads, and firebreaks; or (5) facilities and buildings necessary for property management (constructed above the 100-year flood plain elevation). While the Vicksburg District will provide the pipe for the waterfowl impoundment, landowners would be responsible for the cost of implementing and maintaining the waterfowl impoundment and any other conservation practices. Landowners also would be responsible for maintaining ditches used for agricultural operations on remaining portions of their properties or for agricultural operations on other properties dependent on those ditches.

(b) Structural. A 14,000-cfs pump station with a year-round pumping elevation of 85.0 feet, NGVD.

(c) Operational. Operation of the Steele Bayou structure to maintain water elevations between 70.0 and 73.0 feet, NGVD, during low-water periods. No additional real estate is required for this feature.

(2) Alternative 5. Features include:

(a) Nonstructural. Acquisition and reforestation/conservation features on up to 55,600 (b) acres of agricultural lands through perpetual easements from willing sellers only. Approximately 42,800 acres of cleared land are potentially available below elevation 87.0 feet, NGVD (1-year flood plain at the Steele Bayou structure), and the remaining acreage needed to reach up to the 55,600 acres would be acquired between elevations 87.0 and 91.0 feet, NGVD (2-year flood plain at the Steele Bayou structure). Up to 10 percent of an acquired property could be in conservation features other than reforestation. Conservation features are practices implemented and maintained solely for wildlife management purposes. Conservation features include, but are not necessarily limited to (1) water management impoundments for waterfowl, wading birds, or other wildlife purposes; (2) food plots; (3) permanent openings maintained in early successional stages; (4) access trails, roads, and firebreaks; or (5) facilities and buildings necessary for property management (constructed above the 100-year flood plain elevation). While the Vicksburg District will provide the pipe for the waterfowl impoundment, landowners would be responsible for the cost of implementing and maintaining the waterfowl impoundment and any other conservation practices. Landowners also would be responsible for maintaining ditches used for agricultural operations on remaining portions of their properties or for agricultural operations on other properties dependent on those ditches.

(b) Structural. A 14,000-cfs pump station with a year-round pumping elevation of 87.0 feet, NGVD.

(c) Operational. Operation of the Steele Bayou structure to maintain water elevations between 70.0 and 73.0 feet, NGVD, during low-water periods. No additional real estate is required for this feature.

(3) Alternative 6. Features include:

(a) Nonstructural. Acquisition and reforestation/conservation features on up to 81,400 (b) acres of agricultural lands through perpetual easements from willing sellers only. Approximately 62,600 acres of cleared land are potentially available below elevation 88.5 feet, NGVD, at the Steele Bayou structure, and the remaining acreage needed to reach up to the 81,400 acres would be acquired between elevations 88.5 and 91.0 feet, NGVD (2-year flood plain at the Steele Bayou structure). Up to 10 percent of an acquired property could be in conservation features other than reforestation. Conservation features are practices implemented and maintained solely for wildlife management purposes. Conservation features include, but are not necessarily limited to (1) water management impoundments for waterfowl, wading birds, or other wildlife purposes; (2) food plots; (3) permanent openings maintained in early successional stages; (4) access trails, roads, and firebreaks; or (5) facilities and buildings necessary for property management (constructed above the 100-year flood plain elevation). While the Vicksburg District will provide the pipe for the waterfowl impoundment, landowners would be responsible for the cost of implementing and maintaining the waterfowl impoundment and any other conservation practices. Landowners also would be responsible for maintaining ditches used for agricultural operations on remaining portions of their properties or for agricultural operations on other properties dependent on those ditches.

(b) Structural. A 14,000-cfs pump station with a year-round pumping elevation of 88.5 feet, NGVD.

(c) Operational.

1. Operation of the Steele Bayou structure to maintain water elevations between 70.0 and 73.0 feet, NGVD, during low-water periods. No additional real estate is required for this feature.

2. Reintroduce flows from the Mississippi River up to a maximum elevation of 87.0 feet, NGVD (1-year frequency annual flood event), by leaving the Steele Bayou structure open.

(4) Alternative 7. Features include:

(a) Nonstructural.

1. Acquisition and reforestation/conservation features on up to 124,400 (b) acres of agricultural lands through perpetual easements from willing sellers only. Approximately 95,700 acres of cleared land are potentially available below elevation 91.0 feet, NGVD (2-year flood plain at the Steele Bayou structure), and the remaining acreage needed to reach up to the 124,400 acres would be acquired above elevation 91.0 feet, NGVD (2-year flood plain at the Steele Bayou structure). Up to 10 percent of an acquired property could be in conservation features other than reforestation. Conservation features are practices implemented and maintained solely for wildlife management purposes. Conservation features include, but are not necessarily limited to, (a) water management impoundments for waterfowl, wading birds, or other wildlife purposes; (b) food plots; (c) permanent openings maintained in early successional stages; (d) access trails, roads, and firebreaks; or (e) facilities and buildings necessary for property management (constructed above the 100-year flood plain elevation). While the Vicksburg District will provide the pipe for the waterfowl impoundment, landowners would be responsible for the cost of implementing and maintaining the waterfowl impoundment and any other conservation practices. Landowners also would be responsible for maintaining ditches used for agricultural operations on remaining portions of their properties or for agricultural operations on other properties dependent on those ditches.

2. Conservation easements on 81,800 acres of forested lands below elevation 91.0 feet, NGVD. Easements would be perpetual and from willing sellers only.

(b) Structural. A 14,000-cfs pump station with a year-round pumping elevation of 91.0 feet, NGVD.

(c) Operational.

1. Operation of the Steele Bayou structure to maintain water elevations between 70.0 and 73.0 feet, NGVD, during low-water periods. No additional real estate is required for this feature.

2. Reintroduce flows from the Mississippi River up to a maximum elevation of 87.0 feet, NGVD (1-year frequency annual flood event), by leaving the Steele Bayou structure open.

90. A summary comparison of the final array features is provided in Table SEIS-12.

TABLE SEIS-12
SUMMARY COMPARISON OF FINAL ARRAY FEATURES a/
YAZOO BACKWATER AREA REFORMULATION

Alternative	Measure		
	Nonstructural	Structural	Operational
1	Not applicable	Not applicable	Not applicable
2	Up to 124,400 (b) acres of agricultural lands reforested; Conservation easements on 197,600 acres of agricultural lands between elevation 91.0 and 100.3 feet, NGVD; no intensification or development would be allowed in the easement. Waterfowl structures to provide additional waterfowl foraging habitat.	Not applicable	Maintain water elevations between 70.0 and 73.0 feet, NGVD, during low-water periods.
2A	Up to 81,400 (b) acres of agricultural lands reforested; Floodproofing 1,363 structures in the 100-year flood plain; Implementing an income assurance program that would be established for 234,600 acres of cropland above elevation 88.5 feet, NGVD. Waterfowl structures to provide additional waterfowl foraging habitat.	Not applicable	Not applicable
2B	Up to 26,400 (b) acres of agricultural lands reforested outside the ring-leveed areas. Relocation of 194 structures. Ring levees would be used to protect 88 percent of the structures. Waterfowl structures to provide additional waterfowl foraging habitat.	Not applicable	Not applicable
2C	Up to 114,400 (b) acres of agricultural lands reforested; Implementing an income assurance program on 201,600 acres of agricultural lands, which is all remaining agricultural land in the 100-year flood plain; Relocation of 1,576 structures damaged by a 100-year flood event. Waterfowl structures to provide additional waterfowl foraging habitat.	Not applicable	Not applicable

TABLE SEIS-12 (Cont)

Alternative	Measure		
	Nonstructural	Structural	Operational
3	Not applicable	14,000-cfs pump station, 80.0-foot, NGVD pumping elevation from 1 March to 31 October.	85.0 feet, NGVD, pumping elevation during waterfowl season 1 November through 28 February; Maintain water elevations between 70.0 and 73.0 feet, NGVD, during low-water periods.
4	Up to 37,200 (b) acres of agricultural lands reforested. Waterfowl structures to provide additional waterfowl foraging habitat.	14,000-cfs pump station,85.0-foot, NGVD, pumping elevation	Maintain water elevations between 70.0 and 73.0 feet, NGVD, during low-water periods.
5	Up to 55,600 (b) acres of agricultural lands reforested. Waterfowl structures to provide additional waterfowl foraging habitat.	14,000-cfs pump station, 87.0-foot, NGVD, pumping elevation	Maintain water elevations between 70.0 and 73.0 feet, NGVD, during low-water periods.
6	Up to 81,400 (b) acres of agricultural lands reforested. Waterfowl structures to provide additional waterfowl foraging habitat.	14,000-cfs pump station, 88.5-foot, NGVD, pumping elevation	Maintain water elevations between 70.0 and 73.0 feet, NGVD, during low-water periods; reintroduce Mississippi River water to elevation 87.0 feet, NGVD.
7	Up to 124,400 (b) acres of agricultural lands reforested. Waterfowl structures to provide additional waterfowl foraging habitat.	14,000-cfs pump station, 91.0-foot, NGVD, pumping elevation	Maintain water elevations between 70.0 and 73.0 feet, NGVD, during low-water periods; reintroduce Mississippi River water to elevation 87.0 feet, NGVD.

a/ Complete descriptions are provided in the section entitled “ALTERNATIVES IN FINAL ARRAY.”

COMPARATIVE IMPACTS OF ALTERNATIVES (FINAL ARRAY)

91. A summary of the environmental effects and the economic information for each alternative is presented in Tables SEIS-13 and SEIS-14, respectively. Table SEIS-13 shows the net increase or decrease to a given environmental resource. Detailed analysis and discussions concerning the environmental effects produced by each alternative are provided in the "Affected Environment" and "Environmental Consequences" sections and the technical appendixes of this FSEIS. Included are the impacts from the conversion of bottom-land hardwoods with the installation of a structural feature, any hydrological changes due to the structural feature, and the impacts from the nonstructural feature.

SUMMARY OF ALTERNATIVE COMPARISONS

92. For a detailed comparison of hydrologic, economic, and environmental effects by alternative, refer to Main Report, section "EVALUATION OF ALTERNATIVES." The no-action alternative (Alternative 1) does not achieve a balanced solution to the flood control needs and environmental opportunities in the Yazoo Backwater Study Area. Flood damages to residential and nonresidential structures, agricultural lands, and infrastructure would continue, impacting the city and county governments and the social well-being of local residents, and the opportunity to achieve environmental benefits would be foregone. Alternatives 3 through 6 are economically justified (Table SEIS-14). Alternatives 2, 2A, 2B, 2C, and 7 were not economically justified (see Appendix 7).

93. Alternative 3 is economically justified, but does not balance the flood damage reduction needs and environmental opportunities in the Yazoo Backwater Study Area, as well as Alternatives 4 through 6. Alternatives 4, 5, and 6 best address the combined flood damage reduction needs and environmental opportunities in the Yazoo Backwater Study Area.

94. Utilizing the traditional NED benefit analysis process, Alternative 4 was determined to be the NED Plan. However, based on Vicksburg District's public input, consensus building activities, and input from the local sponsor, additional analysis was conducted.

95. Utilizing the traditional NED benefit process, Plan 4 was determined to be the NED Plan. However, based on the Vicksburg District's public input, consensus building activities, and input from the local sponsor, additional analysis was conducted. A modified incremental environmental analysis was conducted to determine the most cost-effective alternative from an environmental benefit perspective for the Yazoo Backwater evaluation. This is a "modified" incremental environmental analysis because this analysis was conducted to demonstrate that a deviation from the NED Plan is warranted and in the best interest of the Nation in regard to implementing water resources improvements in the Yazoo Backwater Study Area.

TABLE SEIS-13
COMPARATIVE IMPACTS OF ALTERNATIVES a/
(RECOMMENDED PLAN IS PLAN 5)
YAZOO BACKWATER AREA REFORMULATION

Alternative	Terrestrial Resources b/	Aquatic Resources c/	Wetland Resources d/	Waterfowl Habitat e/	Water Quality	Endangered Species
No Action Alternative 1	Existing conditions will continue. 241,800 acres of bottom-land hardwood habitat.	Existing conditions will continue. 34,122 acres of 2-year average flooded acres of spawning habitat and 135,292 acres of 2-year flooded acres of rearing habitat.	Existing conditions will continue. 189,600 acres of 5 percent duration wetlands.	Existing conditions will continue. 13,333 acres of waterfowl foraging habitat.	Existing conditions will continue. No direct impacts. Degraded water quality would continue.	Not applicable
Alternative 2	25.0 percent increase in terrestrial habitat. Net gain of 174,658 AAHUs. Reforestation of up to 124,400 acres of bottom-land hardwoods.	86.3 percent increase in spawning habitat value. Net gain of 16,684 AAHUs. 31.6 percent increase in rearing habitat value. Net gain of 28,222 AAHUs rearing habitat value. Reforestation of up to 124,400 acres of bottom-land hardwoods.	47.2 percent increase in wetland functional value or net gain of 418,291 FCUs. Reforestation of up to 124,400 acres of bottom-land hardwoods.	84.8 percent increase in waterfowl foraging habitat values. Hydrologic gain of 195,476 DUDs. Reforestation of up to 124,400 acres of bottom-land hardwoods or loss of 526,574 DUDs. Gain of 3,116,220 DUDs due to waterfowl structures. Overall gain of 2,785,122 DUDs.	Conditions should improve with the reforestation of up to 124,400 acres of bottom-land hardwoods.	Reforestation of up to 124,400 acres of bottom-land hardwoods will provide additional habitat for the endangered pondberry plant (*Lindera melissifolia)* and the threatened Louisiana black bear (*Ursus americanus luteolus*).
Alternative 2A	16.3 percent increase in terrestrial habitat. Net gain of 114,286 AAHUs. Reforestation of up to 81,400 acres of bottom-land hardwoods.	56.5 percent increase in spawning habitat value. Net gain of 10,917 AAHUs. 19.7 percent increase in rearing habitat value. Net gain of 10,917 AAHUs of spawning habitat value and 17,582 AAHUs of rearing habitat value. Reforestation of up to 81,400 acres of bottom-land hardwoods.	30.9 percent increase in wetland functional value or net gain of 273,704 FCUs. Reforestation of up to 81,400 acres of bottom-land hardwoods.	90.0 percent increase in waterfowl foraging habitat values. Reforestation of up to 81,400 acres of bottom-land hardwoods or loss of 471,171 DUDs. Gain of 2,039,070 DUDs due to waterfowl structures. Overall gain of 1,567,899 DUDs.	Conditions should improve with the reforestation of up to 81,400 acres of bottom-land hardwoods.	Reforestation of up to 81,400 acres of bottom-land hardwoods will provide additional habitat for pondberry and the Louisiana black bear.

TABLE SEIS-13 (Cont)

Alternative	Terrestrial Resources b/	Aquatic Resources c/	Wetland Resources d/	Waterfowl Habitat e/	Water Quality	Endangered Species
Alternative 2B	3.3 percent increase in terrestrial habitat. 2,194 acres of bottom-land hardwoods and 962 acres of reforested lands converted or a loss of 9,892 AAHUs. Hydrologic loss of 3,901 AAHUs. Reforestation of up to 26,400 acres of bottom-land hardwoods or a gain of 37,066 AAHUs. Net gain of 23,273 AAHUs. Also requires reforestation of 26,619 acres to achieve a no net loss in resource values.	27.0 percent decrease in spawning habitat value. 32.6 percent decrease in rearing habitat value. 2,194 acres of bottom-land hardwoods and 962 acres of reforested lands converted or a loss of 1,904 AAHUs of spawning habitat value and a loss of 2,116 AAHUs of rearing habitat value. Hydrologic loss of 6,864 AAHUs of spawning habitat value and a hydrologic loss of 32,742 AAHUs of rearing habitat value. Reforestation of up to 26,400 acres of bottom-land hardwoods or a gain of 3,541 AAHUs of spawning habitat value and a gain of 5,702 AAHUs of rearing habitat value. Net loss of 5,227 AAHUs of spawning habitat value and a net loss of 29,156 AAHUs of rearing habitat value. Requires an additional 26,619 acres of reforestation of frequently flooded lands to mitigate the loss of spawning habitat value.	2.4 percent increase in wetland functional value. 2,194 acres of bottom-land hardwoods and 962 acre of reforested lands converted or a loss of 16,732 FCUs. Hydrologic loss of 50,869 FCUs. Reforestation of up to 26,400 acres of bottom-land hardwoods or 88,769 FCUs. Net gain of 21,168 FCUs. Also requires reforestation of 26,619 acres to achieve a no net loss of resource value.	31.5 percent decrease in waterfowl foraging habitat values. 2,194 acres of bottom-land hardwoods and 962 acres of reforested lands converted or a loss of 290,768 DUDS. Hydrologic loss of 673,635 DUDs. Reforestation of up to 26,400 acres of bottom-land hardwoods or loss of 279,754 DUDs. Gain of 661,320 DUDs due to waterfowl structures. Net loss of 582,837 DUDs. Also requires an additional 26,619 acres of compensatory mitigation on frequently flooded lands.	Conditions should improve with the reforestation of up to 53,019 acres of bottom-land hardwoods.	Reforestation of up to 53,019 acres of bottom-land hardwoods will provide additional habitat for pondberry and the Louisiana black bear.
Alternative 2C	23.0 percent increase in terrestrial habitat. Net gain of 160,618 HUs. Reforestation of up to 114,400 acres of bottom-land hardwoods.	78.8 percent increase in spawning habitat value and a 27.6 percent increase in rearing habitat value. Net gain of 15,343 AAHUs of spawning habitat value and a net gain of 24,710 AAHUs of rearing habitat value. Reforestation of up to 114,400 acres of bottom-land hardwoods.	43.4 percent increase in wetland functional value, or net gain of 384,666 FCUs. Reforestation of up to 114,400 acres of bottom-land hardwoods.	129.4 percent increase in waterfowl foraging habitat values. Reforestation of up to 114,400 acres of bottom-land hardwoods or loss of 471,171 DUDs. Gain of 2,865,720 DUDs due to waterfowl structures. Overall gain of 2,394,549 DUDs.	Conditions should improve with the reforestation of up to 114,400 acres of bottom-land hardwoods.	Reforestation of up to 114,400 acres of bottom-land hardwoods will provide additional habitat for pondberry and the Louisiana black bear.

TABLE SEIS-13 (Cont)

Alternative	Terrestrial Resources b/	Aquatic Resources c/	Wetland Resources d/	Waterfowl Habitat e/	Water Quality	Endangered Species
Alternative 3	Slight decrease in AAHUs due to conversion effect. 38 acres of bottom-land hardwoods converted or a loss of 113 AAHUs. Requires reforestation of 53,363 acres of bottom-land hardwoods to achieve a no-net loss in resource values. Pump station site construction results in a loss of 5.6 acres of open water, but construction of the inlet channel results in a gain of 30.8 acres of open water.	40.3 percent decrease in spawning habitat value and a 16.4 percent decrease in rearing habitat value. 38 acres of bottom-land hardwoods converted or a loss of 27 AAHUs of spawning habitat value and a loss of 30 AAHUs of rearing habitat value. Hydrologic loss of 7,791 AAHUs of spawning habitat value and 14,663 AAHUs of rearing habitat value. Overall loss of 7,818 AAHUs of spawning habitat and an overall loss of 14,693 AAHUs of rearing habitat. Requires reforestation of 53,363 acres of bottom-land hardwoods to achieve a no net loss in resource value. Pump station site construction results in a loss of 5.6 acres of open water, but construction of the inlet channel results in a gain of 30.8 acres of open water.	5.0 percent overall decrease in wetland functional values or 44,230 FCUs. 38 acres of bottom-land hardwoods converted or a loss of 240 FCUs. Hydrologic loss of 43,990 FCUs. Requires reforestation of 53,363 acres of bottom-land hardwoods to achieve a no net loss in resource values. Pump station site construction results in a loss of 5.6 acres of open water, but construction of the inlet channel results in a gain of 30.8 acres of open water.	1.1 percent decrease in waterfowl foraging habitat. 38 acres of bottom-land hardwoods converted or a loss of 2,166 DUDs. Hydrologic loss of 17,485 DUDs. Net loss of 19,651 DUDs. Requires reforestation of 53,363 acres of bottom-land hardwoods to achieve a no net loss of resource values. Pump station site construction results in a loss of 5.6 acres of open water, but construction of the inlet channel results in a gain of 30.8 acres of open water.	Construction of structural features will cause a short-term increase in turbidity. Reforestation of 53,363 acres of bottom-land hardwoods will improve water quality over time. Pump station site construction results in a loss of 5.6 acres of open water, but construction of the inlet channel results in a gain of 30.8 acres of open water.	An on-ground survey and biological assessment for *Lindera melissifolia* and *Ursus americanus luteolus* were complete. No colonies of pondberry were found at the pump station site in rights-of-way, and no signs of Louisiana black bear were found. The FWS concurred that the project is not likely to adversely affect the Louisiana black bear. The FWS did not concur with the "not likely to adversely affect" pondberry determination. The FWS Biological Opinion concluded the project was not likely to jeopardize the continued existence of pondberry. Reforestation of up to 53,363 acres of bottom-land hardwoods will provide additional habitat.

TABLE SEIS-13 (Cont)

Alternative 4	7.5 percent overall increase in terrestrial habitat value. 38 acres of bottom-land hardwoods converted or a loss of 113 AAHUs. Hydrologic gain of 239 AAHUs. Reforestation of up to 37,200 acres of bottom-land hardwoods or gain of 52,229 AAHUs. Overall gain of 52,355 AAHUs. Pump station site construction results in a loss of 5.6 acres of open water, but construction of the inlet channel results in a gain of 30.8 acres of open water.	4.7 percent overall increase in spawning habitat value and a 1 percent overall decrease in rearing habitat value. 38 acres of bottom-land hardwoods converted or a loss of 27 AAHUs of spawning habitat value and a loss of 30 AAHUs of rearing habitat value. Hydrologic loss of 4,049 AAHUs of spawning habitat value and 8,825 AAHUs of rearing habitat value. Reforestation of up to 37,200 acres of bottom-land hardwoods or a gain of 4,989 AAHUs of spawning habitat value and a gain of 8,035 AAHUs of rearing habitat value. Overall gain of 913 AAHUs of spawning habitat value and a net loss of 820 AAHUs of rearing habitat value. Pump station site construction results in a loss of 5.6 acres of open water, but construction of the inlet channel results in a gain of 30.8 acres of open water.	10.9 percent overall increase in wetland functional value. 38 acres of bottom-land hardwoods converted or loss of 240 FCUs. Hydrologic loss of 28,132 FCUs. Reforestation of up to 37,200 acres of bottom-land hardwoods or gain of 125,084 FCUs. Overall gain of 96,712 FCUs. Pump station site construction results in a loss of 5.6 acres of open water, but construction of the inlet channel results in a gain of 30.8 acres of open water.	26.5 percent overall increase in waterfowl foraging habitat value. 38 acres of bottom-land hardwoods converted or a loss of 2,166 DUDs. Hydrologic gain of 42,032 DUDs. Reforestation of up to 37,200 acres of bottom-land hardwoods or loss of 482,318 DUDs. Gain of 931,860 DUDs due to waterfowl structures. Overall gain of 489,408 DUDs. Pump station site construction results in a loss of 5.6 acres of open water, but construction of the inlet channel results in a gain of 30.8 acres of open water.	Construction of structural features will cause a short-term increase in turbidity. Reforestation of up to 37,200 acres of agricultural land will improve water quality over time. Pump station site construction results in a loss of 5.6 acres of open water, but construction of the inlet channel results in a gain of 30.8 acres of open water. Pump station site construction results in a loss of 5.6 acres of open water, but construction of the inlet channel results in a gain of 30.8 acres of open water.	Same as Alternative 3 except reforestation of up to 37,200 acres will provide additional habitat.

TABLE SEIS-13 (Cont)

Alternative	Terrestrial Resources b/	Aquatic Resources c/	Wetland Resources d/	Waterfowl Habitat e/	Water Quality	Endangered Species
Alternative 5	11.2 percent overall increase in terrestrial habitat value. 38 acres of bottom-land hardwoods converted or a loss of 113 AAHUs. Hydrologic gain of up to 239 AAHUs. Reforestation of up to 55,600 acres of bottom-land hardwoods or a gain of 78,062 AAHUs. Overall gain of 78,188 AAHUs. Pump station site construction results in a loss of 5.6 acres of open water, but construction of the inlet channel results in a gain of 30.8 acres of open water.	30.3 percent overall increase in flood plain spawning habitat value and an 8.0 percent overall increase in rearing habitat value. 38 acres of bottom-land hardwoods converted or a loss of 27 AAHUs of spawning habitat value and a loss of 30 AAHUs of rearing habitat value. Hydrologic loss of 1,580 AAHUs of spawning habitat and 4,779 AAHUs of rearing habitat value. Reforestation of up to 55,600 acres of bottom-land hardwoods or a gain of 7,457 AAHUs of spawning habitat value and a gain of 12,010 AAHUs of rearing habitat value. Overall gain of 5,850 AAHUs of spawning habitat value and a net gain of 7,201 AAHUs of rearing habitat value. Pump station site construction results in a loss of 5.6 acres of open water, but construction of the inlet channel results in a gain of 30.8 acres of open water.	19.5 percent overall increase in wetland functional value. 38 acres of bottom-land hardwoods converted or a loss of 240 FCUs. Hydrologic loss of 14,188 FCUs. Reforestation of up to 55,600 acres of bottom-land hardwoods or a gain of 186,953 FCUs. Overall gain of 172,525 FCUs. Pump station site construction results in a loss of 5.6 acres of open water, but construction of the inlet channel results in a gain of 30.8 acres of open water.	52.8 percent overall increase in waterfowl foraging habitat value. 38 acres of bottom-land hardwoods converted or a loss of 2,166 DUDs. Hydrologic gain of 77,973 DUDs. Reforestation of up to 55,600 acres of bottom-land hardwoods or a loss of 491,181 DUDs. Gain of 1,392,780 DUDs due to waterfowl structures. Overall gain of 977,406 DUDs. Pump station site construction results in a loss of 5.6 acres of open water, but construction of the inlet channel results in a gain of 30.8 acres of open water.	Construction of structural features will cause a short-term increase in turbidity. Reforestation of up to 55,600 acres of agricultural land will improve water quality over time. Pump station site construction results in a loss of 5.6 acres of open water, but construction of the inlet channel results in a gain of 30.8 acres of open water.	Same as Alternative 3 except reforestation of up to 55,600 acres will provide additional habitat.

TABLE SEIS-13 (Cont)

Alternative 6	16.4 percent overall increase in terrestrial habitat value. 38 acres of bottom-land hardwoods converted or a loss of 113 AAHUs. Hydrologic gain of 361 AAHUs. Reforestation of up to 81,400 acres of bottom-land hardwoods or gain of 114,286 AAHUs. Overall gain of 114,534 AAHUs. Pump station site construction results in a loss of 5.6 acres of open water, but construction of the inlet channel results in a gain of 30.8 acres of open water.	56.3 percent overall increase in flood plain spawning habitat and an 18.6 percent overall increase in rearing habitat value. 38 acres of bottom-land hardwoods converted or a loss of 27 AAHUs of spawning habitat value and a loss of 30 AAHUs of rearing habitat value. Hydrologic loss of 1 AAHU of spawning habitat value and a hydrologic loss of 910 AAHUs of rearing habitat value. Reforestation of up to 81,400 acres of bottom-land hardwoods or a gain of 10,917 AAHUs of spawning habitat value and a gain of 17,582 AAHUs of rearing habitat value. Overall gain of 10,889 AAHUs of spawning habitat value and overall gain of 16,642 AAHUs of rearing habitat value. Pump station site construction results in a loss of 5.6 acres of open water, but construction of the inlet channel results in a gain of 30.8 acres of open water.	29.8 percent overall increase in wetland functional value, 38 acres of bottom-land hardwoods converted or a loss of 240 FCUs. Hydrologic loss of 9,300 FCUs. Reforestation of up to 81,400 acres of bottom-land hardwoods or a gain of 273,704 FCUs. Overall gain of 264,164 FCUs. Pump station site construction results in a loss of 5.6 acres of open water, but construction of the inlet channel results in a gain of 30.8 acres of open water.	94.8 percent overall increase in waterfowl foraging habitat value. 38 acres of bottom-land hardwoods converted or a loss of 2,166 DUDs. Hydrologic gain of 261,126 DUDs. Reforestation of up to 81,400 acres of bottom-land hardwoods or a loss of 543,808 DUDs. Gain of 2,039,070 DUDs due to waterfowl structures. Overall gain of 1,754,222 DUDs. Pump station site construction results in a loss of 5.6 acres of open water, but construction of the inlet channel results in a gain of 30.8 acres of open water.	Construction of structural features will cause a short-term increase in turbidity. Reforestation of up to 81,400 acres of agricultural land will improve water quality over time. Pump station site construction results in a loss of 5.6 acres of open water, but construction of the inlet channel results in a gain of 30.8 acres of open water.	Same as Alternative 3, except reforestation of up to 81,400 acres will provide additional habitat.

TABLE SEIS-13 (Cont)

Alternative	Terrestrial Resources b/	Aquatic Resources c/	Wetland Resources d/	Waterfowl Habitat e/	Water Quality	Endangered Species
Alternative 7	25.0 percent overall increase in terrestrial habitat value. 38 acres of bottom-land hardwoods converted or a loss of 113 AAHUs. Hydrologic gain of 361 AAHUs. Reforestation of up to 124,400 acres of bottom-land hardwoods or a gain of 174,658 AAHUs. Overall gain of 174,906 AAHUs. Pump station site construction results in a loss of 5.6 acres of open water, but construction of the inlet channel results in a gain of 30.8 acres of open water.	93.1 percent overall increase in flood plain spawning habitat and a 31.6 percent overall increase in rearing habitat value. 38 acres of bottom-land hardwoods converted or a loss of 27 AAHUs of spawning habitat value and a loss of 30 AAHUs of rearing habitat value. Hydrologic gain of 1,353 AAHUs of spawning habitat value and a hydrologic gain of 1,403 AAHUs of rearing habitat value. Reforestation of up to 124,400 acres of bottom-land hardwoods or a gain of 16,684 AAHUs of spawning habitat value and a gain of 26,870 AAHUs of rearing habitat value. Overall gain of 18,010 AAHUs of spawning habitat value and an overall gain of 28,243 AAHUs of rearing habitat value. Pump station site construction results in a loss of 5.6 acres of open water, but construction of the inlet channel results in a gain of 30.8 acres of open water.	46.8 percent overall increase in wetland functional value. 38 acres of bottom-land hardwoods converted or a loss of 240 FCUs. Hydrologic loss of 3,949 FCUs. Reforestation of up to 124,400 acres of bottom-land hardwoods or a gain of 418,291 FCUs. Overall gain of 414,102 FCUs. Pump station site construction results in a loss of 5.6 acres of open water, but construction of the inlet channel results in a gain of 30.8 acres of open water.	153.9 percent overall increase in waterfowl foraging habitat value. 38 acres of bottom-land hardwoods converted or a loss of 2,166 DUDs. Hydrologic gain of 281,591 DUDs. Reforestation of up to 124,400 acres of bottom-land hardwoods or a loss of 549,128 DUDs. Gain of 3,116,220 DUDs due to waterfowl structures. Overall gain of 2,846,517 DUDs. Pump station site construction results in a loss of 5.6 acres of open water, but construction of the inlet channel results in a gain of 30.8 acres of open water.	Construction of structural features will cause a short-term increase in turbidity. Reforestation of up to 124,400 acres of agricultural land will improve water quality over time. Pump station site construction results in a loss of 5.6 acres of open water, but construction of the inlet channel results in a gain of 30.8 acres of open water.	Same as Alternative 3 except reforestation of up to 124,400 acres will provide additional habitat.

NOTE: For detailed information on aquatic, waterfowl, terrestrial, and wetland resources; water quality; and endangered species, see Appendixes 1, 10-14, and 16.

a/ Terrestrial, aquatic, wetland, waterfowl ,water quality, and endangered species impacts apply only to the reformulated portion of the Yazoo Backwater Study Area.

b/ AAHU=average annual habitat units.

c/ AAHU=average annual habitat units.

d/ FCU=functional capacity units.

e/ DUD=duck-use days. Although reforestation results in a loss of waterfowl foraging habitat by all alternatives, there are other important waterfowl habitat requirements that are met with reforestation (loafing, pair bonding, shelter, etc.) and that are notably absent in agricultural fields. According to FWS, the overall benefit that results from reforestation far exceeds losses of foraging habitat. The foraging losses would also be more than offset by structural areas provided on lands (Appendix 1).

TABLE SEIS-14
SUMMARY, ECONOMIC ANALYSIS
FIRST COSTS, ANNUAL COSTS, ANNUAL BENEFITS,
EXCESS BENEFITS OVER COST, AND BENEFIT-COST RATIO
(5-1/8 PERCENT FEDERAL DISCOUNT RATE)
YAZOO BACKWATER AREA REFORMULATION

Item	Alternative 2	Alternative 2A	Alternative 2B	Alternative 2C	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7
First Cost ($000) b/	430,544	377,812	416,746	480,105	233,865	192,802	220,094	261,651	383,267
Annual Costs ($000) a/ b/	24,397	21,329	27,702	27,136	18,028	13,688	15,051	17,322	24,035
Total Benefits Including Employment ($000)	14,973	17,101	24,269	19,995	23,815	22,478	22,416	22,514	-22,513
Total Benefits Excluding Employment ($000)	14,792	16,983	22,613	19,829	22,620	21,417	21,328	21,389	21,325
Excess Benefits Including Employment ($000)	-9,424	-4,228	-3,433	-7,141	5,787	8,790	7,365	5,192	-1,522
Excess Benefits Excluding Employment ($000)	-9,605	-4,346	-5,089	-7,307	4,592	7,729	6,277	4,067	-2,710
B/C Ratio (Including Employment)	0.61	0.80	0.88	0.74	1.3	1.6	1.5	1.3	0.94
B/C Ratio Excluding Employment Benefits	0.61	0.80	0.82	0.73	1.3	1.6	1.4	1.2	0.89

a/ Benefits (in 2005 prices) and costs (in 2006 prices) are annualized at the current Federal interest rate of 5-1/8 percent and a 50-year project economic life.

b/ October 2006 price levels. Mitigation costs are included.

96. Table SEIS-15 provides the incremental first costs, annual costs, NED benefits, and EQ benefits for Alternatives 4-6 for the nonstructural component only when compared to Alternative 4, the NED Plan.

97. The NED Plan is the optimum plan economically (i.e., the plan that maximizes net benefits by producing the greatest excess benefits over costs or net benefits). The EQ Plan is the environmental quality plan (i.e., the plan that protects the quality of the environmental resources such as fish and wildlife habitat, water quality, streamflow, cultural resources, and/or wetlands). In accordance with Engineer Regulation (ER) 1165-2-28 (30 April 1980), the EQ Plan "must enhance, preserve, or restore the environment of the study area." Other guidance can be found in ER 1105-2-100 and Policy Guidance letter No. 24 (USACE, 1991). While various alternatives may meet EQ criteria, the objective is to identify an alternative that satisfied EQ criteria and NED criteria in a maximum manner. A detailed breakdown of the incremental environmental analysis is shown in Appendix 7.

98. Table SEIS-16 displays the average annual cost for the nonstructural features for Alternatives 4, 5, and 6. Alternatives 5 and 6 are the two alternatives in the final array closest to the NED Plan (Alternative 4) and exhibit the "least" total average annual costs. For these plans, the average annual costs of nonstructural features ranged from a low of $966,000 with Alternative 4 to a high of $6.3 million with Alternative 6.

99. The four resource functions that were analyzed in a quantitative manner--wetlands, terrestrial, waterfowl, and aquatic spawning--and their corresponding number of units are shown for each alternative in Table SEIS-16. Since units cannot be integrated between habitat types, outputs for each habitat type must be evaluated individually, as well as compared with incremental benefits from the entire array of outputs. For example, with Alternative 4, the average cost per aquatic spawning AAHU was determined to be $1,058.05. This is calculated by dividing the average annual cost by AAHU for each environmental resource. For example, the incremental cost for aquatic spawning AAHUs for Alternative 4 is obtained by $966,000 ÷ 913 AAHUs. This same process was utilized to determine the average cost per unit by habitat type for all three alternatives. As a result, Alternative 5 was identified to produce more units at a lower cost per unit for aquatics AAHUs which is the resource requiring the most reforestation.

TABLE SEIS-15
INCREMENTAL ANALYSIS
NONSTRUCTURAL FEATURE ONLY
YAZOO BACKWATER AREA REFORMULATION

Item	Alternative 4 a/	Alternative 5 b/	Alternative 6 c/
First Costs ($000)	--	41,064	51,988
Annual Costs ($000)	--	2,379	2,998
NED Benefits (excluding employment) ($000)	--	-89	98
Excess Benefits	--	-1,452	-2,210
EQ Benefits d/e/			
Wetlands (FCUs)			
Total Wetlands	125,084	186,953	273,704
Incremental Change	--	61,869	86,751
Percent Change		49	46
Terrestrial (AAHUs)			
Total Terrestrial	52,229	78,062	114,286
Incremental Change	--	25,833	36,224
Percent Change		49	46
Waterfowl (DUDs)			
Total Waterfowl	449,542	901,599	1,495,262
Incremental Change	--	452,057	593,663
Percent Change		100	66
Aquatics (AAHUs)			
Total Spawning	4,989	7,457	10,917
Incremental Change	--	2,468	3,460
Percent Change		49	46

a/ Alternative 4 is the NED Plan.
b/ Alternative 5 is compared to Alternative 4.
c/ Alternative 6 is compared to Alternative 5.
d/ Units represent the net gain provided by the nonstructural features (reforestation and water impoundments), but do not include units associated with acres necessary to obtain a no net loss and units associated with mitigation owed for previous construction works for the Yazoo Backwater system.
e/ EQ benefits taken from Table 16.

TABLE SEIS-16
AVERAGE ANNUAL NONSTRUCTURAL FEATURE COSTS BY HABITAT TYPE
AND ALTERNATIVE
YAZOO BACKWATER AREA REFORMULATION

Habitat Type	Environmental Benefits by Alternative								
	Alternative 4			Alternative 5			Alternative 6		
	Annual Costs a/b/ ($000)	Units c/	Cost Per Unit ($)	Annual Costs a/b/ ($000)	Units c/	Cost Per Unit ($)	Annual Costs a/b/ ($000)	Units c/	Cost Per Unit ($)
Wetlands (FCU)	966	96,712	9.99	3,345	172,525	19.39	6,343	264,164	24.01
Terrestrial (AAHU)	966	52,355	18.45	3,345	78,188	42.78	6,343	114,534	55.38
Waterfowl (DUD)	966	489,408	1.97	3,345	977,406	3.42	6,343	1,754,222	3.62
Spawning Aquatics (AAHU)	966	913	1,058.05	3,345	5,850	571.79	6,343	10,889	582.51

a/ Values presented in 2006 dollars, including all costs associated with the construction and operation of these alternatives, and annualized at the current Federal interest rate of 5-1/8 percent over a 50-year economic project life.

b/ Annual costs for the nonstructural component are shown in Table 14 and include the cost of land and reforestation, which applies to all environmental resource categories.

c/ Units were reduced from those shown in Table 16 to account for those needed to compensate for construction of the structural feature. This table only reflects those units attributable to the nonstructural feature.

100. Table SEIS-17 provides the results of the incremental cost analysis, which illustrates the cost per unit increase between alternatives, and further substantiates the change from Alternative 4 to Alternative 5. The average annual nonstructural cost for Alternative 5 increased by $2,379,000 over Alternative 4's average annual costs (i.e., $3,345,000 for Alternative 5 less $966,000 for Alternative 4 from Table SEIS-16). Likewise, the average annual cost for the nonstructural features of Alternative 6 increased by $2,998,000 (i.e., $6,343,000 for Alternative 6 less $3,345,000 for Alternative 5 from Table SEIS-16). In order to determine the incremental units generated by Alternatives 5 and 6, the units shown in Table SEIS-16 need to be subtracted between Alternatives 4 and 5 and 5 and 6 to determine the number of incremental units for Table SEIS-17 in each of the environmental benefit categories; i.e., in Table SEIS-16, Alternative 4 generates 96,712 FCUs (wetland) and Alternative 5, 172,525 FCUs; subtracting these numbers gives 75,813 FCUs as shown in Table SEIS-17. The same procedure would be performed for each category under Alternative 5 and then the same procedure would be repeated for Alternatives 5 and 6.

101. In regard to additional costs per unit, Alternative 5 produces 4,937 more in aquatics spawning AAHUs than Alternative 4 at an incremental cost of $481.87 per unit while Alternative 6 generates an additional 5,039 AAHUs, but at a much greater cost of $594.96 per unit. Implementation of Alternative 5 reduces the incremental cost of aquatics. Therefore, the alternative with the least cost per habitat unit for spawning is the best overall alternative.

TABLE SEIS-17
AVERAGE ANNUAL NONSTRUCTURAL INCREMENTAL COSTS
ABOVE THE NED PLAN
BY HABITAT TYPE AND BY SELECTED ALTERNATIVE
YAZOO BACKWATER AREA REFORMULATION

Habitat Type	Environmental Benefits by Alternative								
	Alternative 4 a/			Alternative 5 b/			Alternative 6 c/		
	Annual Costs d/ e/ ($000)	Units	Cost Per Unit ($)	Annual Costs d/ e/ ($000)	Units	Cost Per Unit ($)	Annual Costs d/ e/ ($000)	Units	Cost Per Unit ($)
Wetlands (FCU)	0	0	0	2,379	75,813	31.38	2,998	91,639	32.72
Terrestrial (AAHU)	0	0	0	2,379	25,833	92.09	2,998	36,346	82.49
Waterfowl (DUD)	0	0	0	2,379	487,998	4.88	2,998	776,816	3.86
Spawning Aquatics (AAHU)	0	0	0	2,379	4,937	481.87	2,998	5,039	594.96

a/ Alternative 4 is the NED Plan.
b/ Alternative 5 is compared to Alternative 4.
c/ Alternative 6 is compared to Alternative 5.
d/ Values presented in 2006 dollars, including all costs associated with the construction and operation of these alternatives, and annualized at the current Federal interest rate of 5-1/8 percent over a 50-year economic project life.
e/ Annual costs for the nonstructural component are shown in Table 14 and include the cost of land and reforestation, which applies to all environmental resource categories.

102. The ERDC fishery scientists (Appendix 11) concluded that spawning habitat is the controlling aquatic resource. Without successful spawning, year-class fish numbers would be reduced even if rearing habitat was optimum. In contrast to spawning, rearing fishes do not have specific hydrologic requirements other than a preference to slack-water or swift-water conditions, depending o the species. Larval fish can exploit a variety of depths, and most species along the shoreline tend to move with fluctuating water levels without stranding or injury. Deeper, persistent water, inclusive of spawning sites, is exploited by larval fishes for food (plankton, benthos) as is shallow, transient water for rapid growth (i.e., warmer water temperatures elevate larval fish metabolism). For these reasons, we assumed that spawning is the limiting life stage regulating population growth when changes in flood elevation and duration are altered due to flood control features. Therefore, the aquatic rearing habitat type was not carried forward in subsequent analyses due to the fact that without a successful spawn, rearing habitat would not be required.

103. As explained in Appendix 1, when the AAHUs are converted to acres, aquatic spawning habitat requires the greatest number of mitigation acres. That is, the reforestation/conservation acres will generate a certain number of units for each resource function, and the function that requires the maximum number of acres is aquatic spawning. For that reason, aquatic spawning is the controlling resource for calculating mitigation. The mitigation acres needed to offset impacts to aquatic spawning will generate units for other resource categories that exceed the impacts to those resources.

SUMMARY OF HYDROLOGIC, ECONOMIC, AND ENVIRONMENTAL EVALUATIONS

104. Table SEIS-18 presents a comparison of the results of NED and EQ evaluations for Alternatives 4, 5, and 6. As shown, there is a reduction of excess benefits between Alternatives 4 and 5 of $1.4 million and an additional reduction of $2.2 million between Alternatives 5 and 6. Results of the benefit-cost analysis yield benefit cost ratios within close proximity 1.6 to 1 for Alternative 4, 1.4 to 1 for Alternative 5, and 1.3 to 1 for Alternative 6. Total average annual benefits were all in the $21.3 to $21.4 million range. Structural flood damages are reduced by 50.6, 41.0, and 34.9 percent for Alternatives 4, 5, and 6, respectively. Nonstructural flood damages are reduced by 24.5, 34.3, and 41.5 percent for Alternatives 4, 5, and 6, respectively. This was due to the fact that more land was being reforested under each alternative which removed these lands from future flood damages. When combining both the structural and nonstructural flood damage reductions, the total flood damage reductions were 75.1, 75.2, and 76.4 percent for Alternatives 4, 5, and 6, respectively. Alternative 4 reduces the acres impacted by the 10-year flood event by 34.0 percent and the 100-year flood event by 26.9 percent. Alternative 5 reduces the acres impacted by the 10-year flood event by 33.0 percent and the 100-year flood event 25.1 percent. Alternative 6 reduces the acres impacted by the 10-year flood event by 28.1 percent and the 100-year flood event by 24.1 percent.

TABLE SEIS-18
SUMMARY OF NED/EQ ANALYSIS
YAZOO BACKWATER AREA REFORMULATION

Item	Alternative 4	Alternative 5	Alternative 6
Results of the NED Analysis (Monetary Impacts) a/			
Average Annual Costs ($000)	13,688	15,051	17,322
Difference Between Alternatives ($000)	--	*+1,363*	+2,271
Average Annual Benefits ($000) b/	21,417	21,328	21,389
Difference Between Alternatives ($000)	--	*-89 c/*	+61
Benefits Cost Ratio	1.6	1.4	1.2
Difference Between Alternatives	--	*-.2*	-.2
Excess Benefits over Costs ($000)	7,729	6,277	4,067
Difference Between Alternatives ($000)	--	*-1,452*	-2,210
Total Flood Damage Reduction (FDR) (%)	75.1	75.2	76.4
Structural FDR (%)	50.6	41.0	34.9
Nonstructural Agricultural FDR (%)	24.5	34.3	41.5
Hydrologic Effects			
10-year Flood Reduction (%)	34.0	33.0	28.1
100-year Flood Reduction (%)	26.9	25.1	24.1
Results of the Incremental Analysis of Environmental Benefits (Nonmonetary Impacts in HUs)			
Wetlands (FCUs)	96,712	172,525	264,164
Difference Between Alternatives	--	*+75,813* (78%)	+91,639 (53%)
Terrestrial (AAHUs)	52,355	78,188	114,534
Difference Between Alternatives	--	*+ 25,833 (49%)*	+36,346 (46%)
Waterfowl (DUDs)	489,408	977,406	1,754,222
Difference Between Alternatives	--	*+487,998 (100%)*	+776,816 (79%)
Spawning Aquatic (AAHUs)	913	5,850	10,889
Difference Between Alternatives	--	*+4,937 (541%)*	+5,039 (86%)

a/ Values presented in 2006 dollars, including all costs associated with the construction and operation of these alternatives, and annualized at the current Federal interest rate of 5-1/8 percent over a 50-year economic project life.

b/ Excludes employment benefits, but includes all other categories.

c/ Less than 0.5 percent difference.

105. Environmentally, Alternative 5 produces 541 percent more spawning aquatic AAHUs at approximately half the cost per unit when compared to Alternative 4 ($1,058.05 per unit versus $571.79 per unit) (see Table SEIS-16). Incrementally, the cost per spawning aquatic AAHU cost dropped from $1,058.05 per unit with Alternative 4 to $481.87 per unit with Alternative 5 (Table SEIS-17). Likewise, deviating to Alternative 6 caused the spawning aquatic AAHU cost per unit to increase from $481.87 with Alternative 5 to $594.96. This was a 23 percent increase in incremental cost over Alternative 5. As previously discussed, the spawning aquatic AAHUs are the controlling resource and thus, deviation for the NED Plan could be based solely on the economic incremental cost for this category. In the overall habitat comparison using all four resource categories, Alternative 5 produces 78, 49, 100, and 541 percent more units, respectively, for the Wetlands (FCU), Terrestrial (AAHU), Waterfowl (DUD), and Aquatic Spawning (AAHU) categories than Alternative 4 (Table SEIS-18). Alternative 6 produced 53, 46, 79, and 86 percent more units, respectively, for the Wetlands (FCU), Terrestrial (AAHU), Waterfowl (DUD), and Aquatic Spawning (AAHU) categories than Alternative 5 (Table SEIS-18). However, the average cost per unit increased for all four resource categories when deviating from Alternative 5 to 6 (Table SEIS-16). For the reasons stated previously, Alternative 5 was determined to be the NED/NEQ Plan because it produces more units at a lower average and incremental cost per unit (for the aquatic spawning category) than Alternative 4.

106. While Alternative 6 would reforest up to 81,400 acres primarily at or below elevation 88.5 feet, NGVD, at the Steele Bayou structure, it would cost $52.0 million more than Alternative 5 (Table SEIS-15). Annual costs for Alternative 6 increased $2.3 million over Alternative 5 while annual benefits would increase by $134,000. Therefore, based on the first costs and the environmental incremental analysis, Alternative 6 was eliminated from further consideration.

107. Alternative 5 would reforest up to 55,600 acres primarily at or below elevation 87.0 feet, NGVD, at the Steele Bayou structure. According to Table SEIS-15, Alternative 5 would cost $27.3 million more than Alternative 4. Annual costs for Alternative 5 increased by $1.4 million over Alternative 4 while annual benefits would decrease by $207,000. Alternative 4 would reforest up to 37,200 acres primarily at or below elevation 85.0 feet, NGVD, at the Steele Bayou structure. It would produce greater excess economic benefits than Alternative 5, but would not provide as many environmental benefits. Alternative 5 provides more environmental benefits for less cost through the flood damage reduction feature of reforestation/conservation features on up to 55,600 acres when compared to Alternative 4. Alternative 5 more completely addresses the environmental opportunities than Alternative 4 for the following reasons.

a. The structural component of Alternative 5 has no affect on the size of the 1-year flood plain elevation 87.0 feet, NGVD, at the Steele Bayou structure. The structural component of Alternative 4 affects the 1-year flood plain by 2 feet, reducing the 1-year flood plain from elevation 87.0 to 85.0 feet, NGVD, at the Steele Bayou structure. This equates to 12,532 acres.

b. The structural component of Alternative 4 affects 101,115 acres of Federally-defined wetlands (43,000 acres < 5 percent duration and 58,200 acres changed duration), as determined by backwater flooding, while the structural component of Alternative 5 affects 66,900 acres (26,300 acres < 5 percent duration and 40,600 acres changed duration).

c. As previously discussed, all conservation easements will be acquired using a blocking factor. In order to achieve the goal of acquiring the easements with the 1-year frequency flood plain, the blocking factor will require the acquisition of some land outside the 1-year flood frequency. Due to the Yazoo Backwater Study Area's hydrology, the Vicksburg District believes most of these blocks would be on those lands within the existing 2-year frequency flood plain. Table SEIS-19 provides the percentage of agricultural lands that would be reforested within the existing 2-year flood frequency and within the with-project 2-year flood frequency for Alternatives 4 and 5. Alternative 4 includes reforestation of up to 37,200 acres of cleared acres with this alternative. Likewise, Alternative 5 includes up to 55,600 acres of reforestation. Under existing conditions, there are approximately 95,700 acres of cleared lands within the 2-year flood plain. Under with-project conditions, the acres flooded at the 2-year frequency flood event are reduced to 38,300 acres for Alternative 4 and 56,428 acres for Alternative 5. Reforestation of 37,200 acres with Alternative 4 equates to 38.9 percent (37,200 ÷ 95,700) of the existing 2-year flood plain and 97.5 percent (37,200 ÷ 38,300) of the with-project 2-year flood plain. Using this same methodology, Alternative 5 would reforest 58.1 percent (55,600 ÷ 95,700) of the existing 2-year flood plain and 98.5 percent (55,600 ÷ 56,428) of the with-project 2-year flood plain.

TABLE SEIS-19
LANDS TO BE REFORESTED WITHIN THE 2-YEAR FLOOD FREQUENCY
(2005 LAND USE)
YAZOO BACKWATER AREA REFORMULATION

Alternative	Without-Project 2-Year Frequency (Percentage)	With-Project 2-Year Frequency (Percentage)
Alternative 4 a/	38.9	97.1
Alternative 5 b/	58.1	98.6

a/ Includes reforestation of up to 37,200 acres of the existing cleared acres.
b/ Includes reforestation of up to 55,600 acres of the existing cleared acres.

d. Increasing the pumping elevation from 85.0 on Alternative 4 to elevation 87.0 feet, NGVD, on Alternative 5 increases the probability of successful fish egg incubation by providing an additional 2 feet of spawning habitat in the Yazoo Backwater Study Area. This equates to 5,200 acres of spawning habitat. The fish-spawning model uses an 8-day duration as an average incubation period. The range is from 1 to 14 days. Increasing the size of the flood plain would benefit those fishes that are at the lower duration of the incubation range. More detailed explanation of the fish-spawning model is included in Appendix 11.

e. The shorter duration and higher frequency of inundation of Alternative 4 at elevation 85.0 feet, NGVD, at the Steele Bayou structure versus the 1-year flood plain (elevation 87.0 feet, NGVD, of Alternative 5) results in more variability in forest flooding. Not reforesting lands between elevations 85.0 and 87.0 feet, NGVD, results in fewer future habitat values.

f. A greater area of inundation results in better connectivity between aquatic flood plain habitat types, particularly between agricultural lands and bottom-land hardwoods. This is especially important because the predation rate on larval fish is higher in agricultural lands. Better connectivity allows larval fish to disperse into the structural cover of bottom-land hardwoods.

g. Particulate organic matter, mainly leaf detritus from the flood plain forests, is the basis of the food chain in heterotrophic systems such as the Yazoo River and Lower Mississippi River. Reforestation of the hydrologically unchanged 1-year flood plain would result in a significant increase in export of particulate organic matter to the aquatic system, which would increase benthic invertebrate and zooplankton production.

h. The fish-carrying capacity of a river system is dependent in part on the habitat quantity and quality during annual low flow conditions. The increased low flow aquatic habitat provided with the operational feature could significantly increase standing stock and production for many fish species. Reforestation of the 1-year flood plain (versus elevation 85.0 feet, NGVD, at the Steele Bayou structure) would better ensure the supply of organic matter and fish food organisms to young-of-the-year fish necessary to support increased standing stock.

i. Water quality improvement would be greater with reforestation of the 1-year flood plain. A larger area would be removed from agricultural production, and therefore, greater decreases in suspended sediments and nutrients would occur.

j. Increasing the reforestation from elevation 85.0 feet, NGVD, flood plain to elevation 87.0 feet, NGVD, flood plain at the Steele Bayou structure (1-year flood plain) will result in additional larger contiguous tracts of wooded habitat, which would greatly increase habitat value for the Louisiana black bear and other bottom-land hardwood bird and mammal species, including Neotropical birds.

k. Although Alternatives 4 and 5 both allow for the installation of conservation features on up to 10 percent of the acres under the nonstructural component, Alternative 5 would have a greater positive impact on all resources because more acreage is involved in the nonstructural component.

l. The additional reforestation acreage associated with Alternative 5 when compared to Alternative 4 causes a greater loss of waterfowl foraging habitat. However, according to FWS, the overall benefit that results from reforestation far exceeds losses of foraging habitat.

m. Mitigation to offset adverse impacts is included within the reforestation/conservation perpetual easement acreage for Alternative 5 (and other alternatives). The Vicksburg District has committed to acquire the mitigation acreage prior to operation of the pump station. Also, the length of time to secure the perpetual easements under the nonstructural feature has been extended from 1 year after completion of the pump station to 10 years. This will allow sufficient time for the community to cycle through postproject flood experiences as well as two possible Farm Bill Amendments. Landowners also have been afforded an option to leave up to 10 percent of the perpetual easements in other conservation features including 5 percent for waterfowl with the Vicksburg District furnishing the water control structure for installation and operation by the landowners. This feature allows for a diversity of environmental resources.

RECOMMENDED PLAN

108. Alternative 5 is the Vicksburg District's recommended plan. Nonstructural flood damage reduction (reforestation) would be provided primarily at or below elevation 87.0 feet, NGVD, at the Steele Bayou structure, and structural flood damage reduction (pump) would be provided above elevation 87.0 feet, NGVD. Operation of the Steele Bayou structure would be modified to maintain water elevations between 70.0 and 73.0 feet, NGVD, during low-water periods. Current operation is to maintain water elevations between 68.5 and 70.0 feet, NGVD. This change would allow greater water depths during low-flow periods and would improve water quality conditions for the aquatic resource. There are conversion (clearing), hydrologic (pump station operation), and reforestation effects associated with this alternative. Thirty-eight acres of bottom-land hardwoods will be converted to other features at the pump station site, and 5.6 acres of open water will be filled which will more than be offset by the section of 30.8 acres of permanent channel at the site. Features of the plan include:

a. Nonstructural. Acquisition and reforestation/conservation measures on up to 55,600 acres of agricultural lands primarily below elevation 87.0 feet, NGVD, at the Steele Bayou structure, through perpetual easements. Easements would be from willing sellers only.

b. Structural. A 14,000-cfs pump station with a year-round pumping elevation of 87.0 feet, NGVD, at the Steele Bayou structure.

c. Operational. Operation of the Steele Bayou structure to maintain water elevations between 70.0 and 73.0 feet, NGVD, during low-water periods. No additional real estate is required for this feature.

109. The pump station would be operated according to a pump station operation manual. This operation alternative would address several factors. One factor would be that the diesel-driven pumps could not be instantaneously turned on all at the same time nor would all the pumps be utilized every time stages were predicted to exceed elevation 87.0 feet, NGVD. Other factors that would have to be accounted for would be the forecast of inflows due to Mississippi River conditions, interior conditions (stages and ground conditions) and forecasted flood and weather conditions. A more detailed description of the pump operation is given in the Engineering Appendix (Appendix 6).

110. Agricultural benefits of the recommended plan were updated to include 2005 crop budgets and 2005 current normalized (Guideline II) prices. Table SEIS-20 presents first costs, annual costs, benefits, excess benefits, and benefit-cost ratios for the alternatives at the 5-1/8 percent discount rate. Total benefits of the recommended plan are estimated to be $21.3 million at the current discount rate of 5-1/8 percent, excluding employment benefits. Annual costs are estimated to be $15.1 million. Total annual nonstructural benefits for the recommended plan are estimated to be $9.3 million based on this analysis.

QUANTIFIED ENVIRONMENTAL EVALUATIONS

111. Construction, hydrologic, reforestation, and cumulative impacts to terrestrial, wetland, waterfowl, and aquatic resources were quantified for this study. Summary results are given in the "AFFECTED ENVIRONMENT" and "ENVIRONMENTAL CONSEQUENCES" sections of this FSEIS. The evaluations make use of species models, wetland functional models, hydrologic models, and GIS-developed land use information. The terrestrial and aquatic evaluations use models that have been developed by use of the Habitat Evaluation Procedures (HEP) of FWS. The waterfowl evaluation used was developed by FWS and the wetland evaluation used the HGM developed by ERDC with assistance from EPA. These methods required specific GIS and hydrologic information that was developed by hydrologists at the Vicksburg District. Additional detailed information concerning the models, GIS, and hydrologic data used in these evaluations is given in the terrestrial, wetland, waterfowl, and aquatic appendixes (Appendixes 13, 10, 12, and 11, respectively) that were prepared by scientists from ERDC for the Vicksburg District.

ENVIRONMENTAL DESIGN AND MEASURES TO MINIMIZE IMPACTS

112. Environmental design and measures to avoid and minimize adverse effects include a higher pumping elevation than was recommended in the 1982 report, a nonstructural flood damage reduction feature, and maintaining higher water levels at the Steele Bayou structure during the low-water period.

TABLE SEIS-20
SUMMARY ECONOMIC ANALYSIS
RECOMMENDED PLAN
YAZOO BACKWATER AREA REFORMULATION
($000) a/

Item	5-1/8 Percent Discount Rate
Benefits ($000)	
Structural	
Agricultural Crop	6,534
Agricultural Noncrop	2,328
Structures	2,154
Public Roads	443
Emergency Costs	104
Flood Insurance Costs	147
Automobiles	298
Total Structural	12,008
Nonstructural	
Agricultural Crop	4,615
Agricultural Noncrop	3,632
Timber/Hunting Leases	1,073
Total Nonstructural	9,320
Employment	1,088
Structural	1,007
Nonstructural	81
Total Benefits (Excluding Employment)	21,328
Total Benefits (Including Employment)	22,416
Costs	
First Cost (Total Project)	220,094
Structural	162,659
Nonstructural	57,435
Interest During Construction	11,545
Structural	10,687
Nonstructural	858
Gross Investment Costs	231,639
Structural	173,346
Nonstructural	58,293
Annual Costs	
Total Annual Structural Costs	11,706
Amortization	8,814
O&M Project	1,056
O&M Energy	557
Pump Replacement	393
Mitigation	865
O&M Mitigation Lands	21

TABLE SEIS-20 (Cont)

Item	5-1/8 Percent Discount Rate
Total Annual Nonstructural Cost	3,345
Amortization	3,255
O&M Nonstructural	90
Total Annual Costs	15,051
Total Benefits (Excluding Employment)	21,328
Structural	12,008
Nonstructural	9,320
Total Benefits (Including Employment)	22,416
Excess Benefits (Excluding Employment)	6,277
Excess Benefits (Including Employment)	7,365
Benefit-Cost Ratio (Excluding Employment)	1.4
Benefit-Cost Ratio (Including Employment)	1.5

a/ Benefits (in 2005 prices) and costs (October 2006 price levels) annualized at the current Federal interest rate of 5-1/8 percent and a 50-year economic life.

HIGHER PUMPING ELEVATION

113. The recommended alternative in the 1982 report recommended that pump station operation be initiated at elevation 80.0 feet, NGVD, during the crop season (1 March through 30 November) and elevation 85.0 feet, NGVD, during the waterfowl season (1 November through 28 February). By proposing a pump-on initiation at elevation 87.0 feet, NGVD, the project minimizes the adverse effects of pump station operation on the lands and resources in that 7-foot elevation difference.

NONSTRUCTURAL FLOOD DAMAGE REDUCTION

114. The recommended plan's nonstructural flood damage reduction feature, reforestation/conservation measures on up to 55,600 acres of agricultural land primarily at or below elevation 87.0 feet, NGVD, at the Steele Bayou structure, will provide environmental benefits to resources in the study area. At a minimum, 90 percent of this acreage would be reforested while the remaining 10 percent could be used for other conservation purposes, such as waterfowl foraging areas or wildlife food plots. Landowners would retain ownership, but the reforested lands will be removed from agricultural production and planted to bottom-land hardwood species. Landowners on one-half of the remaining 10 percent (5 percent) of the lands to be used for other conservation purposes would be provided materials for water control structures to allow them to flood their land during the winter months for waterfowl habitat. The remaining 5 percent of these lands could be used for other conservation purposes. The Vicksburg District would pay for the appropriate easement, reforestation, and water control structures. The landowners would be responsible for the installation of the water control structure and the management of it and the other conservation features. Reforestation, combined with other conservation measures, will provide a net gain in terrestrial, wetlands, waterfowl, and aquatic spawning and rearing resource values to the Yazoo Backwater Study Area.

MODIFICATION OF THE OPERATION OF THE STEELE BAYOU STRUCTURE

115. Operation of the Steele Bayou structure will be modified to maintain water elevations between 70.0 and 73.0 feet, NGVD, during low-water periods. Current operation is to maintain water elevations between 68.5 and 70.0 feet, NGVD. This change would allow greater water depths during low-flow periods and would not affect water quality conditions for aquatic resources. This change would provide a net gain of flood plain acres of 1,384 of waterfowl foraging habitat and 2,353 of aquatic rearing habitat in the flood plain without implementation of the structural measures.

MITIGATION ALTERNATIVE

116. Generally, compensatory mitigation for unavoidable impacts due to the construction of a project is determined after avoidance and minimization of impacts are considered. Under USACE regulations and policy (ER 200-2-2), the impacts to terrestrial, aquatic, wetland, and waterfowl habitat in the Yazoo Backwater Study Area require in-kind mitigation.

117. The Vicksburg District considered alternative forms of compensatory mitigation (Appendix 1). The mitigation for environmental impacts should be in-kind to the extent practicable. The primary method to achieve mitigation is the reforestation of agricultural land. Loss of bottom-land hardwood wetlands is a major regional concern. Reforestation of the 1- and 2-year flood plain addresses this concern. For this reason, the Vicksburg District focused its mitigation on reforestation of bottom-land hardwood on agricultural lands, which provides benefits to terrestrial, aquatic, wetlands, and waterfowl.

118. There is no mitigation required for Alternatives 2, 2A, and 2C (nonstructural). To offset unavoidable impacts, Alternative 2B (nonstructural) requires 26,400 acres of reforestation/ conservation easements and an additional 26,619 acres of fee title acquisition. Alternative 3 (structural) requires 53,363 acres of fee title acquisition and reforestation. Alternatives 4 through 7 are combinations of structural and nonstructural measures. The mitigation needed for Alternatives 4 through 7 is included as the minimum threshold within the nonstructural feature (Table SEIS-21). The minimum threshold is the acreage that would need to be reforested to compensate for the adverse effects from construction and operation of the pump station.

TABLE SEIS-21
MITIGATION/MINIMUM THRESHOLD AND REFORESTATION
NONSTRUCTURAL REFORESTATION
YAZOO BACKWATER AREA REFORMULATION

Alternative	Nonstructural Reforestation (acres)	Mitigation/Minimum Threshold (acres)
1	0	0
2	124,400	0
2A	81,400	0
2B	26,400	53,019 a/
2C	114,400	0
3	0	53,363 b/
4	37,200	27,230 c/
5	55,600	10,662 c/
6	81,400	66 c/
7	124,400	0

a/ To meet the mitigation requirements for Alternative 2B, 26,619 acres of reforestation are needed in addition to the acres of reforestation needed for the nonstructural reforestation feature.

b/ Alternative 3 does not have a nonstructural reforestation measure. A total of 53,363 acres of reforestation are needed for this alternative to compensate for the adverse effects from the construction and operation of the pump station.

c/ Reforestation of the minimum threshold acres are needed to compensate for the adverse effects from construction and operation of the pump station. These minimum threshold acres would be acquired prior to pump operation.

119. Because lands acquired for nonstructural flood damage reduction feature are from willing sellers, it is possible that not all acres would be acquired and reforested. Therefore, on combination alternatives, a minimum threshold of reforestation was determined to offset the adverse effects due to the construction and operation of the pump station only (Table SEIS-21). If this minimum threshold is not achieved through easement acquisition from willing sellers, then the remaining acreage required would be acquired in fee title. This acreage would be acquired before the pump station would be operated. Acquisition of the remaining easements would continue for 10 years or until the necessary acres are obtained.

120. The net effect of the alternative is a gain in wetland, terrestrial, waterfowl, and flood plain aquatic spawning and rearing resource values. Although the operation of the pump station would cause adverse impacts to wetland and aquatic resources, the nonstructural component (reforestation of up to 55,600 acres) provides significant increases in environmental values. A minimum of 10,662 acres would be required to compensate for the aquatic spawning resource value losses on the recommended plan. Impacts to wetlands would require 3,858 acres of reforestation. By compensating for the aquatic spawning resource value, the terrestrial, waterfowl, and wetland resources will achieve a net increase over the baseline values.

PROJECT MAINTENANCE

121. Maintenance of the inlet and outlet channels for the pump station would be conducted over the 50-year project life. An estimated 80,000 cubic yards of material would be excavated once or twice over the life of the project from the channels. Herbicide spraying and/or mechanical methods would be used to control vegetative growth along the banks of the inlet and outlet channels, utilizing herbicides labeled for aquatic use. Structural maintenance of the pump station's major components is expected at year 35 into the project life. The major replacement would involve the renovation or replacement of the diesel engines, axial flow pump, speed reducer, backstop device, and high- and low-speed couplings.

122. Minimal Federal onsite operation and maintenance (O&M) will be required on the 55,600 acres of perpetual conservation easement lands. An annual cost of $2 per acre per year for monitoring the land use on the 55,600 acres using remote-sensing methods is included in the project O&M costs. The landowner will be responsible for maintaining the property consistent with conservation purposes. As stated earlier, these lands are presently open and once an easement is secured, the team will determine the best practice for that tract and then the reforestation/conservation measures will be initiated. The Vicksburg District will monitor these tracts after the initial reforestation/conservation measures are installed, but once reforestation is determined to be successful, only occasional visual on-the-ground monitoring will be conducted.

The District will primarily use remote-sensing techniques to monitor the land use of these tracts. Should monitoring indicate a violation in the terms of the easement, the Vicksburg District will take the necessary action to regain voluntary compliance with the terms of the agreement or use legal actions, if necessary.

123. Major maintenance would be the responsibility of the Vicksburg District, and minor maintenance would be the responsibility of the local sponsor (Board of Mississippi Levee Commissioners). Minor maintenance would involve the spraying and removal of vegetative growth from the inlet and outlet channel, utilizing herbicides labeled for aquatic use.

AFFECTED ENVIRONMENT

GENERAL DESCRIPTION

124. Extending from Memphis, Tennessee, to Vicksburg, Mississippi, the Yazoo Basin covers 13,400 square miles and two physiographic subdivisions. One of these is a leveed alluvial plain no longer subject to overbank flooding and referred to as the "Delta." The other consists of rolling hills which drain into the Delta. The Yazoo Backwater Project Area is approximately 926,000 acres in the lower portion of the Delta known as the Yazoo Area (Plate 4-1). It includes all or portions of Humphreys, Issaquena, Sharkey, Warren, Washington, and Yazoo Counties, Mississippi, and a portion of Madison Parish, Louisiana.

CLIMATE

125. The climate is mild with an average annual temperature of 65 degrees F. The average monthly temperature ranges from 44 degrees F in January to 82 degrees F in July. Annual rainfall averages 51 inches. Normal monthly rainfall varies from 5.81 inches in March to 2.58 inches in October.

HUMAN RESOURCES

126. The economic base study area (Plate 4-4) comprises Sharkey and Issaquena Counties, Mississippi, which are completely or partially within the hydrological boundaries of the Yazoo Backwater Study Area and are considered to be economically representative of the project area. These counties cover approximately 841 square miles (538,000 acres) in total land area. Significant population clusters in or adjacent to the economic base area are Anguilla, Belzoni, Cary, Delta City, Eagle Lake, Fitler, Glen Allan, Holly Bluff, Louise, Mayersville, Midnight, Rolling Fork, Silver City, and Valley Park, Mississippi.

127. Overall, the population of the economic base area (Sharkey and Issaquena Counties) has decreased from 17,869 in 1950 to approximately 8,854 in 2000 or a 50 percent decline. The most significant occurrence was the loss of 3,555 persons during the 1950 to 1960 period. Sharkey County experienced the majority of the loss, a decline of 6,323 persons from 1950 to 2000. The number of persons per square mile (population density) in the economic base area has ranged from 21.0 persons per square mile of land area in 1950 to 10.5 persons in 2000. This is in contrast to the state whose population density increased from 46.0 in 1950 to 60.6 in 2000. When the estimated population for the portions of the other Mississippi counties that are located within the Yazoo Backwater Project Area are included (i.e., Humphreys, Warren, Washington, and Yazoo Counties), total population estimates approximately 20,000 people.

128. For economic purposes, "structures" were defined as a building and all built-in appliances, excluding furniture and personal contents. All structures within the study area 100-year delineation were inventoried. The inventory process included determining the elevation of the structure, location, and the estimated value. In the existing 100-year flood plain, there are 1,576 residential and nonresidential structures that receive damages from a 100-year flood event. Residential structures are those that are occupied full time as residences. Nonresidential buildings are all other buildings which were not classified as residential. Of the 1,576 structures damaged by a 100-year flood event, approximately 1,300 were residential and the remainder were nonresidential. For more details on structures impacted, see Appendix 7.

129. Almost the entire project area has excellent transportation access facilities. Access is provided by Federal, state, and local highways, railroads, aircraft, and waterways via the Mississippi and Yazoo Rivers. U.S. Highway 61 bisects the area and provides two-lane, north-south access through Valley Park, Rolling Fork, and Hollandale, Mississippi. Mississippi Highway 12 provides two-lane, east-west, access through Belzoni and Hollandale. U.S. Interstate 20 is located to the south of the project area, and U.S. Interstate 55 is located to the east of the area--providing access to points throughout the United States. Two major rail systems located outside the project area provide adequate rail transportation. The Columbus and Greenville Railroad operates a rail system located to the north of the area from Greenwood Mississippi to Greenville, Mississippi. The Canadian National Railroad, located to the east of the project area, operates 935 miles of rail service from Chicago, Illinois. It provides north-south access from Memphis, Tennessee, through Greenwood to Jackson, Mississippi. The area is accessible by water via the Mississippi and Yazoo Rivers. The navigation channel from Greenwood to Vicksburg provides a 9-foot draft approximately 46 percent of the time. Terminal port facilities serving the Yazoo Backwater Project Area are located in Belzoni and Yazoo City, Mississippi.

130. Most of the industry in the economic base area (Sharkey and Issaquena Counties) is agribusiness-oriented. Previously, agriculturally related employment dominated the area; however, activities of nonagricultural industries currently constitute a major portion of the total economy. In 2000, three major industry groups accounted for almost one-half (42.2 percent) of the total employment in the area. These groups include retail trade (9.1 percent), government (21.2 percent), and manufacturing (11.9 percent). Agricultural employment comprised 38.9 percent of the total employment in 2000.

131. The number of farms in the economic base area has decreased significantly from 2,036 in 1954 to 192 in 2002, while the average size of farms has increased from 140 to 2,913 acres during the same period. The value of farm products sold was an estimated $55.7 million in 1954 (expressed in 1996 dollars), but has greatly fluctuated since that time. The trend has been as follows: an increase to $88.1 million in 1964, decrease to $62.2 million in 1969. Steady increases to $132.1 million in 1992, before a declining trend reaching $64.2 million in 2002. Sales from crops were estimated to be $78.7 million in 1997, representing 86 percent of the total value from agricultural products sold. Data on crop sales were unavailable for 2002. Prior to 1997, crop sales averaged 92 to 97 percent of total agricultural sales.

ENVIRONMENTAL JUSTICE CONSIDERATIONS

132. Executive Order 12898 directs Federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations. The Yazoo Backwater Study Area for these considerations consists of portions of six counties in west-central Mississippi and a very small section of one parish in northeastern Louisiana. The counties in Mississippi include Washington, Humphreys, Sharkey, Issaquena, Warren, and Yazoo. The parish in Louisiana is Madison. The majority of the impact area is concentrated in two counties--Issaquena and Sharkey. These two counties are almost completely located within the hydrological boundaries of the Yazoo Backwater Study Area.

133. The purpose of EJ is to ensure fair and full participation by all involved parties, particularly minority and low-income populations; avoidance or mitigation of impacts on these affected populations; and the proportionate spreading of benefits associated with the project.

134. Population data for the Yazoo Backwater Project Area for the years 1980-2000 are presented in Table SEIS-22. The statistics illustrate an overall population decline in the area over the period. The greatest population decline since 1980 has been in Issaquena and Sharkey Counties. The trend corresponds to substantial out-migration of the minority population, particularly African-American, which could have resulted from a number of social and economic factors. Based on interviews and other statistical data collected for the EJ Study, these factors were identified as poverty, fear of flood disasters, mechanization of large farms and less demand for manual labor, the resulting loss of employment, and the possibility of better employment and housing opportunities outside of the lower Delta region. Many former Delta residents migrated to more industrialized areas in northern and midwestern urban areas. The overall population of the two primary impact counties decreased by nearly 60 percent from 21,866 in 1940 to approximately 8,854 in 2000 (Table SEIS-23).

TABLE SEIS-22
YAZOO BACKWATER AREA POPULATION DATA (1980-2000) a/
YAZOO BACKWATER AREA REFORMULATION

Area	Population and Percentage Change				
	1980 (No.)	Percent Change 1980-1990	1990 (No.)	Percent Change 1990-2000	2000 (No.)
Humphreys County	13,931	-12.9	12,134	-7.6	11,206
Issaquena County	2,513	-24.0	1,909	19.1	2,274
Sharkey County	7,964	-11.3	7,066	-6.9	6,580
Warren County	51,627	-7.3	47,880	3.7	49,644
Washington County	72,344	-6.1	67,935	-7.3	62,977
Yazoo County	27,349	-6.7	25,506	10.4	28,149
Total	175,728	-7.6	162,430	-1.0	160,830
Economic Base Area b/	10,477	-14.3	8,975	-1.3	8,854
Mississippi	2,520,638	2.1	2,573,216	10.5	2,844,658
United States	226,545,805	9.8	248,709,873	13.2	281,421,906

SOURCE: U.S. Census Bureau (April 2006), University of Virginia Library Geospatial and Statistical Data Center.

a/ Table SEIS-22 includes all six Mississippi counties with some portion of county in the Yazoo Backwater Study Area. Subtotal of six counties provided as an indication of total potential population impacts. Madison Parish, Louisiana, is excluded since it comprises 0.37 percent of the study area.

b/ The Economic Base Area includes Issaquena and Sharkey Counties.

TABLE SEIS-23
YAZOO BACKWATER AREA POPULATION SHIFTS (1950-2000)
YAZOO BACKWATER AREA REFORMULATION

County	Year and Percent Change						
	1940	1950	1960	1970	1980	1990	2000
Issaquena	6,433	4,966	3,576	2,737	2,513	1,909	2,274
	-	-29.5%	-38.9%	-30.7%	-8.9%	-31.6%	16.1%
Sharkey	15,433	12,903	10,738	8,937	7,964	7,066	6,580
	-	-19.6%	-20.2%	-20.2%	-12.2%	-12.7%	-7.4%

135. Population trends for Issaquena and Sharkey Counties and the State of Mississippi are shown in Table SEIS-24 by race for the years 1980-2000. The data illustrate that the minority population, which is primarily African-American, has fluctuated during the period. Still, the percentage of minority populations in Issaquena and Sharkey Counties remains well above statewide averages. With a 2000 Census level of nearly 63.7 and 70.6 percent, respectively, the relative percent of minority population in those counties actually increased between 1980 and 2000. By comparison, Mississippi's minority population was estimated to be 38.6 percent in 2000.

TABLE SEIS-24
TOTAL POPULATION BY RACE (1980-2000)
YAZOO BACKWATER AREA REFORMULATION

Area	Year	Total Population (No.)	Minority Population a/		Majority Population b/	
			(No.)	(%)	(No.)	(%)
Issaquena County	1980	2,513	1,410	56.1	1,103	43.9
	1990	1,909	1,076	56.4	833	43.6
	2000	2,274	1,448	63.7	826	36.3
Economic Base Area Total	1980	7,964	5,232	65.7	2,732	34.3
	1990	7,066	4,727	66.9	2,339	33.1
	2000	6,580	4,648	70.6	1,932	29.4
YBW TOTAL c/	1980	10,477	6,642	63.4	3,835	36.6
	1990	8,975	5,798	64.6	3,177	35.4
	2000	8,854	6,092	68.8	2,762	31.2
Mississippi	1980	2,520,638	904,909	35.9	1,615,729	64.1
	1990	2,573,216	993,166	36.5	1,633,461	63.5
	2000	2,844,658	1,098,559	38.6	1,746,099	61.4

SOURCE: U.S. Census Bureau (April 2006).

a/ Minority refers to all racial populations other than Caucasian; such as African-American, Hispanic, Asian, Indian, etc.

b/ Majority refers to the Caucasian population.

c/ The Yazoo Backwater Economic Base Area consists of Issaquena and Sharkey Counties for this report. Since these two counties comprise 87 percent of the Yazoo Backwater Study Area, they are the most representative of the economy.

136. Incomes within the study area are low compared to those throughout the rest of the state. Table SEIS-25 illustrates the per capita income (PCI) of residents of Issaquena and Sharkey Counties compared to the State of Mississippi from 1979 to 1999 based on Census estimates updated to 1996 dollars for comparison purposes. Note that in 1999, the PCI for these two counties was approximately one-third less than the state's average. Based on the updated PCI, incomes decreased in both Issaquena and Sharkey Counties, as well as the Yazoo Backwater Area from 1979 to 1989, before growing substantially by 1999. Both counties are areas of relative low-income concentrations as indicated in comparison to the state. They also rank among the lowest in the state.

TABLE SEIS-25
PER CAPITA INCOME (1979-1999)
YAZOO BACKWATER AREA REFORMULATION

Area	1979 PCI		1979-1989 Change	1989 PCI		1989-1999 change	1999 PCI		Overall Change 1979-1999
	($)	(% of State)	(%)	($)	(%)	(% of State)	($)	(% of State)	(%)
PCI (Census Data in Current Dollars)									
Issaquena	4,538	87.6	-	6,412	66.5	-	10,581	66.8	-
Sharkey	4,032	77.8	-	6,032	62.5	-	11,396	71.9	-
Economic Base Area Total a/	4,153	80.1	-	6,117	63.4	-	11,187	70.6	-
Mississippi	5,183	-		9,648	-	-	15,853	-	-
PCI (1996 Dollars) b/									
Issaquena	8,686	87.6	-11.3	7,701	66.5	31.4	10,115	66.8	16.5
Sharkey	7,717	77.8	-6.0	7,244	62.5	50.4	10,895	71.9	41.2
Economic Base Area Total a/	7,949	80.1	-7.6	7,347	63.4	45.6	10,695	70.6	34.6
Mississippi	9,918	-	16.8	11,587	-	30.8	15,155	-	52.8

SOURCE: U.S. Census Bureau (April 2006): Income data provided by Census for the given years; University of Virginia Library Geospatial and Statistical Data Center.

a/ Economic Base Area total derived by dividing the total personal income for Sharkey and Issaquena Counties by their total population for each given year.

b/ Current dollars converted to 1996 dollars.

137. Estimates of local income data based on the latest available Census indicated that nearly one-third each of the populations in Issaquena and Sharkey Counties were living below the poverty level during 2003 (Table SEIS-26).

TABLE SEIS-26
POPULATION BELOW POVERTY LEVEL (1999-2003)
YAZOO BACKWATER AREA REFORMULATION

Area	1999			2003		
	Total Population	Total Population with Income Below Poverty Level		Total Population	Total Population with Income Below Poverty Level	
	(No.)	(No.)	(%)	(No.)	(No.)	(%)
Issaquena County	2,274	666	29.3	2,062	659	32.0
Sharkey County	6,580	2,492	37.9	6,234	1,935	31.0
Economic Base Area Total	8,854	3,158	35.7	8,296	2,594	31.3
Mississippi	2,844,658	548,079	19.3	2,882,594	514,663	17.9

SOURCE: U.S. Census Bureau (2004).

138. In 1999, household and family incomes in the Yazoo Backwater Economic Base Area were significantly lower than those in the state as a whole. Table SEIS-27 illustrates the change of the median household and family incomes, respectively, in Issaquena and Sharkey Counties for the years from 1979 to 1999. Both are presented in current dollars (as provided by the Census) and updated to 1996 dollars for comparison purposes. These statistics reveal the median households and family incomes of the Yazoo Backwater Economic Base Area closely parallel ratios of Yazoo Backwater PCI to the state. Although both median household and family income showed overall growth during the 1979-1999 period, they are significantly lower than the state averages. In 1999, both median household and median family income in Sharkey and Issaquena Counties ranged from 28 to 36 percent, respectively, less than the state for the updated values.

139. Other economic and income indicators used in the analysis of EJ considerations are presented in the EJ Analysis (Attachment 8A to Appendix 8). These indicators include civilian labor force and unemployment, housing, agriculture and aquaculture, occupational resources employment rank by industry, and retail business.

TABLE SEIS-27
HOUSEHOLD AND FAMILY INCOME (1979-1999)
YAZOO BACKWATER AREA REFORMULATION

Area	1979		1979-1989 change	1989		1989-1999 change	1999		Overall change 1979-1999
	($)	(% of State)	(%)	($)	(% of State)	(%)	($)	(% of State)	(%)
Median Household Income									
(Current Dollars) a/									
Issaquena	9,167	75.8	-	13,005	64.6	-	19,936	63.6	-
Sharkey	8,250	68.2	-	13,304	66.1	-	22,285	71.1	-
Mississippi	12,096	-	-	20,136	-	-	31,330	-	-
(Updated to 1996 Dollars) b/									
Issaquena	17,546	75.8	-11.0	15,619	64.6	22.0	19,059	63.6	8.6
Sharkey	15,791	68.2	1.2	15,978	66.1	33.3	21,304	71.1	34.9
Mississippi	23,152	-	4.5	24,183	-	23.9	29,951	-	29.4
Median Family Income									
(Current Dollars) a/									
Issaquena	11,625	79.7	-	14,167	58.0	-	23,913	63.9	-
Sharkey	9,406	64.5	-	15,682	64.2	-	26,786	71.6	-
Mississippi	14,591	-	-	24,448	-	-	37,406	-	-
(Updated to 1996 Dollars) b/									
Issaquena	22,250	79.7	-23.5	17,015	58.0	34.4	22,861	63.9	2.8
Sharkey	18,003	64.5	4.6	18,834	64.2	36.0	25,607	71.6	42.2
Mississippi	27,927	-	5.1	29,362	-	21.8	35,760	-	28.1

SOURCE: U.S. Census Bureau (April 2006): Profile of Selected Economic Characteristics. Income data provided by the Census for the given years.

a/ Census data provided in current dollars for the year reported such as 1979, 1989, and 1999 dollars.

b/ Current dollars converted to constant 1996 dollars for comparison purposes.

LAND USE

140. Land use apportionment and distribution are important in defining the structural and functional characteristics of the environment. The Yazoo Backwater Project Area (Table SEIS-28) and study area (Table SEIS-29) are a mosaic of agricultural land, bottom-land hardwoods, rivers and lakes, and urban areas. Existing and future without-project land use in these areas are expected to be the same. All economic and environmental analyses were conducted within the study area (100-year flood frequency).

TABLE SEIS-28
EXISTING LAND USE AND FUTURE WITHOUT-PROJECT LAND USE
IN THE YAZOO BACKWATER PROJECT AREA a/
YAZOO BACKWATER AREA REFORMULATION

Land Use	Existing and Future Without-Project Conditions
Cropland	502,200
Noncropland b/	90,200
Bare Soil	1,200
Forest	274,900
Total Water	26,400
Ponds	31,100
Total	926,000

a/ Yazoo Backwater Project Area includes all lands in the Yazoo Area. Based on 2005 land use data.

b/ Contains 60,500 acres of herbaceous ground cover and 29,700 acres of recently reforested lands.

TABLE SEIS-29
EXISTING LAND USE AND FUTURE WITHOUT-PROJECT LAND USE
IN THE YAZOO BACKWATER STUDY AREA a/
YAZOO BACKWATER AREA REFORMULATION

Land Use	Existing and Future Without-Project Conditions
Cropland	273,100
Noncropland b/	67,300
Bare Soil	300
Forest	241,800
Total Water	24,100
Ponds	23,400
Total	630,000

NOTE: Includes all public and private lands.

a/ Yazoo Backwater Study Area includes all lands in the 100-year frequency flood using 2005 land use data.

b/ Contains 39,400 acres of herbaceous ground cover and 27,900 acres of recently reforested lands.

141. Cropland and noncropland account for 54 percent of the land use in the study area (Table SEIS-29). Approximately 38 percent of land use is in bottom-land hardwoods. Larger tracts support a greater diversity of flora and fauna, and smaller, fragmented bottom-land hardwood tracts support a less diverse flora and fauna.

142. Projecting future land use involves some uncertainty and requires making assumptions about surrounding conditions. Cropping patterns are likely to change in the future based on periodic fluctuations of economic conditions. It was assumed, however, that the distribution of agricultural land to forested lands would remain constant over the next 50 years without the project (Tables SEIS-28 and SEIS-29). No projection for an increase in reforestation was made because the ceiling for enrollment in WRP of USDA has been reached in Sharkey and Issaquena Counties. While FWS and others see the reforestation trend continuing in the absence of a project, the fact remains that the limits of acres enrolled under WRP have essentially been reached and, although some acreage could still be enrolled in CRP, it is highly unlikely that these lands meet the program's criteria and other areas currently enrolled in CRP not being re-enrolled in the program. If not re-enrolled in CRP, it could be cleared and put back into crop production. Local citizens have expressed reservations on raising these ceilings due to the negative impact on county tax revenues. Based on local and to-date actions and recent congressional actions, future expansions of these programs are not likely. Current environmental laws that regulate clearing of existing forested wetlands were not in effect in the 1950s and 1960s when the majority of land clearing occurred. Therefore, the Vicksburg District anticipates the probability of major land clearing in the Yazoo Backwater Study Area to be very low (See Appendix 1, Risk and Uncertainty section).

143. Approximately 73 percent of Yazoo Backwater Study Area lands are privately held (Table SEIS-30). Twenty-seven percent of lands are in state wildlife management areas, national forests, national wildlife refuges, and Wetland and Conservation Reserve Programs. Ninety-four percent of cleared and 51 percent of forested lands are privately held.

TABLE SEIS-30
DISTRIBUTION OF PUBLIC AND PRIVATE LAND USE
IN THE STUDY AREA a/
YAZOO BACKWATER AREA REFORMULATION

Land Use	Private	Public Interest b/	Total
Cropland	259,000	14,100	273,100
Noncropland			
Herbaceous	34,000	5,400	39,400
Reforest	0	27,900	27,900
Bare Soil	300	0	300
Forest	123,900	117,900	241,800
Total Water c/	21,100	3,000	24,100
Pond	23,000	400	23,400
Total	461,300	168,700	630,000

a/ Study area includes all lands in the 100-year flood frequency.
b/ Includes wildlife management areas, national forests, national wildlife refuges, and wetland and conservation reserve programs.
c/ Includes rivers and lakes.

SIGNIFICANT RESOURCES

144. For purposes of this SEIS, "significant resources" include those resources identified by institutional, public, or technical criteria. Institutional criteria are laws and formal Government policies. Public recognition can include controversy, support or opposition relative to utilization of resources. Technical recognition is based on scientific knowledge or judgment of resource characteristics. The significance may be recognized by more than one criterion. For example, the significance of bottom-land hardwoods is recognized by Public Law 99-662 (requires in-kind mitigation to the extent possible), local communities for the consumptive and nonconsumptive recreational value, and the scientific community for the wetland functional value. The Vicksburg District performed a scoping process to help identify the significant resources during this study.

145. Significant natural resource areas include Leroy Percy State Park, Shipland Wildlife Management Area, Panther Swamp National Wildlife Refuge, Yazoo National Wildlife Refuge, DNF, Lake George Wildlife Management Area, Twin Oaks Wildlife Management Area, and Mahannah Wildlife Management Area. These areas provide recreational, water quality, esthetic, wildlife, and intrinsic benefits to the human environment. Other significant resources addressed in this SEIS include prime farmlands, waterfowl, bottom-land hardwoods, wetlands, threatened and endangered species, and cultural resources.

PRIME FARMLANDS

146. Approximately 50 percent of the land use in the Yazoo Backwater Study Area is dedicated to agriculture. Pursuant to coordination requirements of the Farmland Protection Policy Act (FPPA), NRCS was sent Form AD 1006. This form evaluates the potential impacts of the alternatives on prime and unique farmlands. Prime farmland, as defined by FPPA, is land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural crops with minimal inputs of fuel, fertilizers, pesticides, and labor without intolerable soil erosion. Unique farmlands are defined by FPPA as land other than prime farmland that is used for production of specific high-value food and fiber crops. The NRCS returned the Form AD 1006 after completing their portion of the form for each county in the study area. They identified and quantified the prime farmland in each county. The Vicksburg District compiled their portion of the form and concluded that the total site assessment was less than 160 points for each county (See Appendix 5). Based on USDA guidance, if the value of assessment points is less than 160 points, no mitigation is required. Additionally, other alternatives impact more farmland than the recommended plan.

WATERFOWL RESOURCES

147. The North American Waterfowl Management Plan states, "in all waterfowl management decisions and actions, first priority should be given to perpetuate waterfowl populations and their supporting habitats." Wintering waterfowl populations in the Mississippi River Alluvial Valley and the study area have generally been below long-term averages, the result of breeding and wintering habitat conversion (Appendix 12). Habitat availability, utilization, and suitability are critical components to wintering waterfowl. Recent research showed that winter wetland availability is linked to current and cross-seasoned life-cycle events of mallards and wood ducks and possibly other waterfowl using alluvial environments (Appendix 12). The waterfowl analysis conducted for this study used as its key components habitat availability and utilization. Accordingly, baseline available waterfowl foraging habitat and carrying capacity were estimated by integrating period-of-record hydrology (1943-1997) with existing land use (Appendix 12). The Yazoo Backwater Study Area is within the Mississippi Flyway, a major migratory corridor for waterfowl. The waterfowl resources are of importance on a local, regional, national, and international level.

148. The index of carrying capacity for waterfowl foraging habitat was expressed in duck-use-days (DUD) per acre. One DUD represents the amount of energy required for one duck for one day. The methodology required (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. The methodology was developed by FWS. The waterfowl analysis was limited to land use categories with potential foraging value: soybeans, rice, fallow fields and bottom-land hardwoods. See Appendix 12 for detailed discussions.

149. To account for the modified hydrology from the pump station operation and water management, acres within the 2-year flood plain were converted to average flooded acres. Average flooded acres were determined by summing the number of acres flooded less than 18 inches each day between 1 November and 28 February over the period of record (1943 to 1997) and dividing the total by the number of days. Land use percentages in the 10 percent duration flood plain (Table SEIS-31) were applied to the average flooded areas to determine the acreage for each habitat type (Table SEIS-32). The DUD/acre habitat value ranged from 57 for bottom-land hardwoods to 1,037 for fallow land.

TABLE SEIS-31
RELATIVE WATERFOWL FORAGING HABITAT DISTRIBUTION (PERCENT)
FOR BASELINE AND FUTURE WITHOUT-PROJECT PROJECTIONS
YAZOO BACKWATER AREA REFORMULATION

Land Use	Little Sunflower Upper Ponding Reach a/	Steele Bayou Lower Ponding Reach a/
Fallow field	3.49	4.21
Rice	0.61	0.17
Soybeans	6.98	5.82
Bottom-land hardwoods	60.69	55.95
Reforested b/	14.02	7.77

a/ Baseline and future without-project projection.
b/ Agricultural lands recently planted with bottom-land hardwoods.

TABLE SEIS-32
AVAILABLE WATERFOWL FORAGING HABITAT FOR
BASELINE AND FUTURE WITHOUT-PROJECT CONDITIONS
YAZOO BACKWATER AREA REFORMULATION

Land use	DUDs/Acre	Little Sunflower Upper Ponding Area Acres a/	Steele Bayou Lower Ponding Area Acres a/
Fallow field	1,037	399.61	199.89
Rice	580	69.85	8.07
Soybeans	253	799.21	276.33
Bottom-land hardwoods	57	6,949.01	2,656.51
Reforested b/	184	1,605.29	368.92
Total	N/A	9,822.97	3,509.72

a/ Baseline and future without-project projection. Average flooded acres from 1 November to 28 February.
b/ Agricultural lands recently planted with bottom-land hardwoods.

150. Baseline seasonal carrying capacity for the study area is approximately 1,849,741 DUDs on 13,333 acres of seasonally flooded foraging habitat available from 1 November to 28 February (Table SEIS-33 and Appendix 12). The future without-project projection is also 1,849,741 DUDs.

TABLE SEIS-33
BASELINE DUCK-USE DAYS (DUD) AND FUTURE
WITHOUT-PROJECT DUD PROJECTIONS
YAZOO BACKWATER AREA REFORMULATION

Reach	Average Flooded Acres a/	Baseline DUD b/	Future Without-Project DUD
Little Sunflower Upper Ponding Area	9,823	1,348,568	1,348,568
Steele Bayou Lower Ponding Area	3,510	501,173	501,173
Total	13,333	1,849,741	1,849,741

a/ Total across all habitat types in Table SEIS-24.
b/ Determined by multiplying the DUD/acre habitat values in Table SEIS-32 by the available habitat and summing across all habitat types.

TERRESTRIAL RESOURCES

151. Terrestrial habitats range from open agricultural monocultures to diverse bottom-land hardwoods. Agricultural fields and edges between bottom-land hardwoods and agricultural fields provide habitat for some species. However, 241,800 acres of bottom-land hardwoods (including swamp cover type) provide the highest quality and most stable habitat. FWS classifies bottom-land hardwoods as Resource Category 2: "Habitat to be impacted is of high value for evaluation species and is relatively scarce or becoming scarce on a national basis or in the ecoregion section." Terrestrial wildlife species associated with bottom-land hardwoods (e.g., deer, raccoon, woodpeckers, owls, various resident and migratory songbirds, rabbits, mice, wild turkey, squirrel, wood duck, and mink) are significant resources. The FWS has designated some migratory bird conservation areas in the Yazoo Basin.

152. The HEP developed by FWS quantified habitat quality for terrestrial species (Table SEIS-34 and Appendix 13). The evaluation species, selected by the interagency HEP team of wildlife biologists, represented a range of ecological value and wildlife habitat requirements for forested areas. Species' models used in the evaluation were developed by FWS. The wood duck and mink evaluation species are water-dependent terrestrial species. The other four species evaluated were gray squirrel, Carolina chickadee, pileated woodpecker, and the barred owl. On a scale of 0.0 (unsuitable habitat) to 1.0 (optimal), most habitat suitability index (HSI) values occurred between 0.50 and 0.90, indicating above average habitat quality for most evaluation species. The pileated woodpecker had the highest HSIs and the mink the lowest. Habitat quality is limited by small tree diameters for barred owls, relative abundance of hard-mast producers for gray squirrel, small tree height for Carolina chickadees, lack of large-diameter trees for pileated woodpeckers, lack of brood habitat for wood ducks, and percent of the year with water present for the mink. The HUs are determined by multiplying the acres of habitat by the HSI value.

TABLE SEIS-34
TERRESTRIAL HABITAT SUITABILITY INDEX (HSI) VALUES
YAZOO BACKWATER AREA REFORMULATION

Reach	Barred Owl	Gray Squirrel	Carolina Chickadee	Pileated Woodpecker	Wood Duck a/	Mink b/
Little Sunflower Upper Ponding Area	0.82	0.62	0.71	0.86	0.45	0.12
Steele Bayou Lower Ponding Area	0.70	0.58	0.65	0.79	0.58	0.11

a/ Wood duck HSI applies only to areas flooded from March through May each year (brood habitat).
b/ Mink HSI applies only to flooded >25% of the year at the 2-year frequency.

153. There are approximately 699,592 AAHUs under existing conditions (Table SEIS-35). The Vicksburg District future without-project projection is also 699,592 AAHUs. The HUs are an expression of habitat quality and quantity, and they are derived by multiplying an HSI by the number of acres of the particular habitat. The AAHUs are derived by annualizing HUs to take into account changes over time.

TABLE SEIS-35
BASELINE TERRESTRIAL AVERAGE ANNUAL HABITAT UNITS (AAHU)
AND FUTURE WITHOUT-PROJECT AAHU PROJECTIONS
YAZOO BACKWATER AREA REFORMULATION

Evaluation Species	Forested Acres	Baseline AAHUs b/	Future Without-Project AAHU
Nonwater Dependent a/	241,800	693,029	693,029
Wood Duck	9,850	5,073	5,073
Mink	12,960	1,490	1,490
Total	N/A	699,592	699,592

a/ Barred owl, gray squirrel, Carolina chickadee, and pileated woodpecker. The average HSI for each species across all reaches was used to determine baseline.
b/ Based on 2005 land use.

WETLAND RESOURCES

GENERAL

154. The Yazoo Backwater Study Area contains wetland resources supported by various sources of hydrology. These hydrology sources include rainwater (51 inches annually), headwater flooding (numerous streams including Steele Bayou and Big Sunflower River), and backwater flooding. The Vicksburg District concentrated its analysis of wetland resources on those wetlands whose source of hydrology is backwater flooding. Wetlands supported by other sources of hydrology will not be impacted by the project.

155. The wetland studies to delineate the areal extent and determine the functional values of wetlands in the study area are a result of considerable collaborative work done by two agencies--Vicksburg District and EPA (Appendix 10). The areal extent of wetlands was determined with two offsite methods utilizing a combination of remote-sensing and GIS techniques and tested by a field sampling method. The wetland functional values were determined by ERDC using some modifications of the methods outlined in the Regional Hydrogeomorphic Guidebook for the Yazoo Basin. The FESM was used to determine the areal extent of wetlands as determined by backwater flooding. The FESM model is the only method of the three that segregates wetlands supported by backwater flooding from wetlands supported by other hydrology sources. Based on this model, there are an estimated 189,600 acres of wetlands supported by backwater flooding (Table SEIS-36). These wetlands under existing conditions provide approximately 885,296 FCUs.

TABLE SEIS-36
VICKSBURG DISTRICT WETLAND DISTRIBUTION
IN YAZOO BACKWATER STUDY AREA
(2005 LAND USE)
YAZOO BACKWATER AREA REFORMULATION

Land Use	Acres
Cleared (Crop/Noncrop)	27,100
Forested	123,200
Reforested	22,600
Water	15,700
Pond	1,000
Total	189,600

WETLAND DEFINITION

156. Wetlands are defined as those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support and, under normal circumstances, do support a prevalence of vegetation typically adapted for a life in saturated soils conditions. The ERDC Technical Report Y-87-1 (USACE Wetlands Delineation Manual (WDM)) further describes wetland hydrology with the following statements:

a. An area may have wetland hydrology if it is inundated or saturated to the surface for at least 5 percent of the growing season in most years.

b. The growing season is defined as the portion of the year when soil temperature (measured 20 inches below the surface) is above biological zero (5 degrees C or 41 degrees F).

c. The minimum 5 percent duration refers to a single continuous episode of inundation.

d. The computed growing season from NRCS data was the period 1 March-27 November (270 days). Five percent of this growing season is 13.5 days rounded to 14 days. Wetland hydrology is more fully discussed in the WDM, which was used during this wetland evaluation. This discussion on wetland hydrology includes the following statements.

(1) Areas that are irregularly inundated or saturated less than 5 percent of the growing season continuously are not wetlands.

(2) Areas that are inundated or saturated irregularly more than 12.5 percent of the growing season continuously are definitely wetlands.

(3) Areas that are inundated or saturated between 5 and 12.5 percent of the growing season continuously may or may not be wetlands.

157. In this analysis of wetlands in the Yazoo Backwater Study Area, the assumption was made that lands inundated continuously for at least 5 percent (14 days) or more would be classed as wetlands.

OFFSITE WETLAND DELINEATION METHODS

158. The Vicksburg District has been developing a GIS-based wetland delineation method since 1990. This method is called the 5 Percent Duration Flood Method or sometimes it is

shortened to the Flood Method. Due to the large areal extent of the Yazoo Backwater Study Area (630,000 acres), the Vicksburg District utilized an offsite method in lieu of many site-specific determinations. This process included a comparison of other methods to project areal extent of wetlands. However, the Vicksburg District opted to use the 5 percent Duration Flood Method because it (a) likely overestimates the areal extent of wetlands potentially affected by backwater flooding, (b) provide a spatially explicit delineation of wetlands, (c) enables pre- and postproject comparisons of wetland areal extent due to changes in backwater flooding.

159. The basic process of this method involves these four steps:

a. Wetland elevation development. Analyze stage data to determine the 5 percent duration elevation at each gage. Daily gage records from six gages within the study area were used. Stage records from 1943 to 1997 were used.

b. Satellite imagery. Find and classify a satellite image (or images) where the observed stage data are similar to the 5 percent duration elevation for each gage.

c. Verify flood extent. Verify that the flooded areas on the classified satellite images accurately reflect the stages on the date of the flood scene.

d. Verification of wetland delineation. Field verification of the wetland delineation using onsite methods by wetland experts.

160. The FESM model was used to delineate wetlands affected by backwater flooding in the study area. The FESM is a GIS model which was developed by the Vicksburg District to simulate flooding using a stage data and a DEM. The use of this model allows the pre- and postproject wetland acreages to be delineated and is described in Appendix 6, the Engineering Appendix. There are five steps in applying the FESM model to predict changes in wetland area--acquire or create input data layers, calibrate the model output to a satellite image, verify the model output verses a second satellite scene, run the base and with-project conditions, and determine the land use of the flooded areas. These steps are discussed more fully in Appendix 10, the Wetland Appendix. To facilitate a detailed determination of the Yazoo Backwater Project's hydrologic impacts to wetlands, the wetlands were subdivided into 4 percent duration bands. These bands were a 5.0 to 7.5 percent, >7.5 to 10 percent, >10 to 12.5 percent, and >12.5 percent.

ASSESSING IMPACTS TO WETLAND FUNCTIONS

161. The ERDC, Environmental Lab, Wetlands and Coastal Ecology Branch, assessed the impacts of the proposed project on wetland functions and estimated the potential for proposed nonstructural and other mitigation areas to offset the impacts of the project using the Yazoo Basin Regional Guidebook for HGM. For purposes of this study, the Vicksburg District focused on wetland functions. A functional analysis was used because a functional analysis reflects both quality and quantity of wetlands. The Vicksburg District then was able to compare baseline, project impacts, and mitigation. This assessment included models and procedures and is included as Appendix B of Appendix 10. The eight functions evaluated were: Detain Floodwater, Detain Precipitation, Cycle Nutrients, Export Organic Carbon, Physical Removal of Elements and Compounds, Biological Removal of Elements and Compounds, Maintain Plant Communities, and Provide Wildlife Habitat.

162. The wetland functional assessment, conducted on the area defined by backwater flooding, classified land into six cover types--mature forest (dominant trees >50 years of age), middle aged forest (dominant trees 20 to 50 years of age), early aged forest/planted bottom-land hardwood mitigation areas (dominant trees <20 years of age), agricultural, recently logged, and other. The "other" land cover type used in the assessment included permanent water bodies, catfish ponds, and other areas where a change in function would not occur as a result of project impacts.

163. The GIS coverage provided by the Vicksburg District showed the percent duration of backwater flooding during the growing season on the land cover types as produced from the FESM model. As stated previously, this coverage showed conditions in four duration bands including 5.0 to 7.5 percent, 7.5 to 10.0 percent, 10.0 to 12.5 percent, and >12.5 percent.

164. The entire assessment area occurred within the geomorphic subclass Riverine Backwater; therefore, the models from the Yazoo Basin Regional Guidebook for this subclass were used to conduct the analysis. The results from the field sampling, duration bands, and model equations were used to compute functional capacity indices (FCI) (Tables SEIS-37 through SEIS-40) which were multiplied by acres (see Table SEIS-41) to produce FCUs that were used in the assessment. The total FCUs under existing or baseline conditions were determined to be 885,296.

TABLE SEIS-37
WETLAND FCI VALUES BY DURATION
BAND (5-7.5 PERCENT) FOR BASELINE CONDITIONS
YAZOO BACKWATER AREA REFORMULATION

	Land Cover				
Function	Mature Forest	Mid-Aged Forest	Early-Aged Forest a/	Recently Logged	Agricultural
Detain Floodwater	0.98	0.78	0.75	0.73	0.25
Detain Precipitation	0.83	1.00	0.48	0.76	0.56
Cycle Nutrients	0.95	0.88	0.56	0.67	0.29
Export Carbon	0.64	0.58	0.32	0.42	0.17
Physical Removal of Elements and Compounds (E&C)	0.53	0.69	0.21	0.49	0.43
Biological Removal of E&C	0.64	0.58	0.32	0.42	0.17
Main Plant Communities	0.93	0.94	0.55	0.71	0.00
Provide Wildlife Habitat	0.92	0.88	0.48	0.74	0.00

a/ This land cover type also includes pasture and planted lands.

TABLE SEIS-38
WETLAND FCI VALUES BY DURATION
BAND (7.5-10 PERCENT) FOR BASELINE CONDITIONS
YAZOO BACKWATER AREA REFORMULATION

	Land Cover				
Function	Mature Forest	Mid-Aged Forest	Early-Aged Forest a/	Recently Logged	Agricultural
Detain Floodwater	0.98	0.78	0.75	0.73	0.25
Detain Precipitation	0.83	1.00	0.48	0.76	0.56
Cycle Nutrients	0.95	0.88	0.56	0.67	0.29
Export Carbon	0.68	0.61	0.34	0.45	0.18
Physical Removal of E&C	0.57	0.73	0.22	0.52	0.46
Biological Removal of E&C	0.68	0.61	0.34	0.45	0.18
Main Plant Communities	0.93	0.94	0.55	0.71	0.00
Provide Wildlife Habitat	0.92	0.89	0.48	0.75	0.00

a/ This land cover type also includes pasture and planted lands.

TABLE SEIS-39
WETLAND FCI VALUES BY DURATION
BAND (10-12.5 PERCENT) FOR BASELINE CONDITIONS
YAZOO BACKWATER AREA REFORMULATION

	Land Cover				
Function	Mature Forest	Mid-Aged Forest	Early-Aged Forest a/	Recently Logged	Agricultural
Detain Floodwater	0.98	0.78	0.75	0.73	0..25
Detain Precipitation	0.83	1.00	0.48	0.76	0..56
Cycle Nutrients	0.95	0.88	0.56	0.67	0..29
Export Carbon	0.72	0.65	0.36	0.47	0.19
Physical Removal of E&C	0.60	0.77	0.23	0.55	0.48
Biological Removal of E&C	0.72	0.65	0.36	0.47	0.19
Main Plant Communities	0.93	0.94	0.55	0.71	0.00
Provide Wildlife Habitat	0.93	0.89	0.49	0.75	0.00

a/ This land cover type also includes pasture and planted lands.

TABLE SEIS-40
WETLAND FCI VALUES BY DURATION BAND (>12.5 PERCENT) FOR BASELINE CONDITIONS
YAZOO BACKWATER AREA REFORMULATION

	Land Cover				
Function	Mature Forest	Mid-Aged Forest	Early-Aged Forest a/	Recently Logged	Agricultural
Detain Floodwater	0.98	0.78	0.75	0.73	0.25
Detain Precipitation	0.83	1.00	0.48	0.76	0.56
Cycle Nutrients	0.95	0.88	0.56	0.67	0.29
Export Carbon	0.74	0.67	0.37	0.49	0.20
Physical Removal of E&C	0.62	0.79	0.24	0.57	0.49
Biological Removal of E&C	0.74	0.67	0.37	0.49	0.20
Main Plant Communities	0. 93	0.94	0.55	0.71	0.00
Provide Wildlife Habitat	0..93	0.90	0.49	0.75	0.00

a/ This land cover type also includes pasture and planted lands.

TABLE SEIS-41
BASELINE ACRES BY LAND COVER TYPE AND PERCENT DURATION RANGE a/
YAZOO BACKWATER AREA REFORMULATION

Land Cover Type	Acres by Percent Duration Range			
	5-7.5	7.5-10	10-12.5	>12.5
Mature Forest	13,984	27,539	16,012	38,694
Mid-Aged Forest	302	543	157	788
Early-Aged Forest	7,685	9,145	7,801	17,038
Recently Logged	36	26	31	80
Agricultural	12,395	7,024	5,475	15,796

a/ A category designated “other” is not included in this table. It included permanent water bodies, catfish ponds, and other areas (8,823 acres) where a change in function would not occur as a result of project impacts.

165. Fish communities are a mixture of the Yazoo River system and Lower Mississippi River ichthyofaunas. Studies of the Mississippi River, Steele Bayou, Upper Yazoo River, and Big Sunflower River indicate that a diverse ichthyofauna can potentially utilize the flood plain for spawning and rearing. Many of these fishes use the inundated flood plains as spawning, nursery, and foraging areas, and others reside year-round in permanent pools and oxbow lakes on the flood plain (Appendix 11).

166. Effects to aquatic resources were determined with Habitat Evaluation Procedures (HEP). An HEP team of aquatic biologists from MDWFP, FWS, and the Vicksburg District worked cooperatively to establish the HEP methodology. The analysis for the Yazoo Backwater study was conducted by ERDC (Appendix 11). The analysis addressed effects to spawning and rearing habitat. Habitat was sampled to determine habitat quality based on habitat suitability models for the nine evaluation species. The HEP estimated current habitat value, future habitat value, compared alternatives, and evaluated mitigation strategies. The HEP calculated HUs, which reflected both the quality and quantity of the habitat. The HUs were calculated by multiplying the HSI value by the number of acres affected. The HSI values ranged from 0.0 (unsuitable) to 1.0 (optimal habitat).

167. Twenty-three species of juvenile/adult fishes were collected in the study area in the spring and summer of 1994. Additional samplings in 2004, 2005, and 2006 were conducted in the lower portion of the basin. These additional samplings revealed an improvement in the fishery in relation to 1994 conditions. There were no long-term (1993-2006) trends in mean species richness or total number of fish collected during the evaluation period. The numerically dominant groups of gar, gizzard shad, common carp, buffalo, catfish, crappie, and freshwater drum are characteristic of Mississippi delta fish assemblages. Species richness was highest below Steele Bayou structure and lowest in the DNF lakes. In 1994, a total of 10,184 larval fishes representing 17 taxa were collected. Species richness was highest in the fringing flood plain connected to the outlet/inlet channel of the structure. Abundant larval fishes in the flood plain were buffalo, white crappie, shad, freshwater drum, and sunfishes. Mean dissolved oxygen (DO) ranged from 4-5 milligrams per liter (mg/L) at all locations during sampling, but stratification occurred in the DNF lakes and behind the Steele Bayou structure.

168. The HEP developed by FWS were used to determine baseline conditions in flood plain spawning and rearing habitat for nine evaluation species: threadfin shad, blacktail shiner, ghost shiner, speckled chub, small mouth buffalo, flathead catfish, channel catfish, white crappie, and freshwater drum (Table SEIS-42 and Appendix 11). The evaluation species selected by the HEP team represented a range of ecological value and fisheries flood plain habitat requirements. Spawning and rearing habitat was classified into five types: agricultural lands; bottom-land hardwood; scatters, brakes and tributary mouths; fallow land; and oxbow lakes. HSI values for each species and habitat combination were developed in accordance with HEP procedures. On a scale of 0.0 (unsuitable habitat) to 1.0 (optimal), HSI values ranged from 0.1 to 1.0 for spawning habitat and 0.1 to 1.0 for rearing habitat.

TABLE SEIS-42
FLOOD PLAIN HSI SCORES FOR SPAWNING (S) AND REARING (R) OF FISH
YAZOO BACKWATER AREA REFORMULATION

Evaluation Species	Flood Plain Habitats									
	CAG		Fallow		BLH		Oxbow		SBT	
	S	R	S	R	S	R	S	R	S	R
Threadfin shad	0.2	0.2	0.4	0.1	0.8	0.5	0.8	1.0	0.7	0.8
Blacktail Shiner	0.1	0.2	0.2	0.5	0.8	0.8	0.9	1.0	1.0	1.0
Ghost shiner	0.2	0.3	0.2	0.6	0.8	0.8	1.0	1.0	1.0	1.0
Speckled chub	0.1	0.2	0.4	0.7	0.8	1.0	0.6	0.8	0.7	0.7
Smallmouth buffalo	0.3	0.3	0.8	0.5	0.9	0.8	1.0	1.0	1.0	0.8
Channel catfish	0.1	0.2	0.2	0.4	0.7	0.7	1.0	1.0	1.0	1.0
Flathead catfish	0.1	0.1	0.2	0.2	0.7	0.7	0.8	0.8	1.0	1.0
White crappie	0.4	0.2	0.6	0.4	0.7	0.7	1.0	1.0	1.0	0.8
Freshwater drum	0.1	0.1	0.2	0.6	0.5	0.5	0.8	1.0	0.8	1.0
Average	0.2	0.3	0.3	0.4	0.7	0.8	0.8	0.9	0.9	0.9

CAG = Cultivated agricultural land
Fallow = Fallow fields
BLH = Bottom-land hardwoods
Oxbow = Oxbow lakes
SBT = Scatters, brakes, and tributary mouths

169. To account for the modified hydrology from the pump station operation and water management, aquatic flood plain acres within the 2-year frequency for March, April, May, June (primary spawning and rearing timeframe) were converted to average flooded acres. Average flooded acres were determined by summing the number of acres flooded each day over the period of record (1943 to 1997) in the 2-year frequency flood plain and dividing the total by the number of days. The percentages of habitat types between the 1- and 2-year flood plains (Table SEIS-43) were applied to the average flooded acres to determine the average flooded acres for each habitat type. The net change between the with- and without-project projections of average flooded acres represents the acres of habitat gained or lost from modifying the hydrology on each habitat type.

TABLE SEIS-43
PERCENT LAND USE FOR EXISTING CONDITIONS
AND IMPACT ASSESSMENT
YAZOO BACKWATER AREA REFORMULATION

Condition a/	CAG	Fallow	BLH	Reforested	Oxbows	SBT
Base(0-2 year)	26.5	3.1	55.9	8.7	2.6	3.2
Alternatives 3-7 (1-2 year)	37.0	4.7	50.2	7.8	0.1	0.2
CAG = Cultivated agricultural land Fallow = Fallow fields BLH = Bottom-land hardwoods				Reforested = Recently reforested lands Oxbows = Oxbow lakes SBT = Scatters, brakes, and tributary mouths		

a/ Land use between the 0- and 2-year flood plain was used for base conditions. Land use between the 1- to 2-year flood plain was used for the alternatives that included a pump station.

170. There are approximately 19,337 spawning and 89,414 rearing AAHUs under baseline conditions. The Vicksburg District future without-project projections are also 19,337 spawning and 89,414 rearing AAHUs (Table SEIS-44).

TABLE SEIS-44
BASELINE AQUATIC AVERAGE ANNUAL HABITAT UNITS (AAHUs)
AND FUTURE WITHOUT-PROJECT AAHU PROJECTIONS
YAZOO BACKWATER AREA REFORMULATION

Habitat	Average Flooded Acres a/	Baseline AAHU b/	Future Without-Project AAHU
Spawning	34,122	19,337	19,337
Rearing	135,292	89,414	89,414

a/ Multiply average flooded acres by habitat percentages in Table SEIS-43 to determine habitat acres for baseline and future without-project.

b/ The sum of the habitat acres multiplied by their respective HSI values from Table SEIS-42.

171. The ERDC fishery scientists (Appendix 11) concluded that spawning habitat is the controlling aquatic resource. Without successful spawning, year-class fish numbers would be reduced even if rearing habitat was optimum. In contrast to spawning, rearing fishes do not have specific hydrologic requirements other than a preference to slack-water or swift-water conditions, depending on the species. Larval fish can exploit a variety of depths, and most species along the shoreline tend to move with fluctuating water levels without stranding or injury. Deeper, persistent water, inclusive of spawning sites, is exploited by larval fishes for food (plankton, benthos) as is shallow, transient water for rapid growth (i.e., warmer water temperatures elevate larval fish metabolism). For these reasons, spawning is the controlling stage regulating population growth when changes in flood elevation and duration are altered due to flood control features. Therefore, the aquatic rearing habitat type was not carried forward in subsequent analyses due to the fact that, without a successful spawn, rearing habitat would not be required.

THREATENED AND ENDANGERED SPECIES

172. The FWS identified the endangered plant pondberry (*Lindera melissifolia*) and the threatened Louisiana black bear (*Ursus americanus luteolus*) as species that may occur in the study area. Pursuant to Section 7 of the Endangered Species Act, a Biological Assessment (BA) was sent to FWS 5 December 2005 (Appendix 14). The Vicksburg District determined that the project was not likely to adversely affect either species.

173. Pondberry was listed Federally as an endangered species on 31 July 1986 (Federal Register 51(47):27495-27500). It is a low-growing, deciduous shrub ranging in height from 1.5 to 6 feet. The plants commonly grow in clumps of numerous scattered stems somewhat resembling a "plum thicket." The most critical threat to pondberry, as with many endangered species, is the alteration/modification and/or loss of habitat. Three factors which constitute this threat are certain timber-harvesting practices, certain drainage activities, and land-clearing operations for agricultural, commercial, and private development. Appendix 14 provides detailed discussions about the pondberry's ecology and status. The pondberry profile (Appendix 14, Attachment 1) provides a comprehensive set of available literature, professional opinion, and survey data on pondberry ecology and life history.

174. During the period September-October 1994, field surveys for pondberry were conducted. The survey included the entire direct rights-of-way (ROW) for the project and a 5 percent survey (2,000 acres) of forested tracts, with a high potential for pondberry occurrence, south and west of DNF. In addition to pondberry profile report information (Appendix 14, Attachment 2), flood-frequency data, and professional judgment were utilized to select forested tracts to survey. A summary of the transects surveyed for pondberry is presented in Appendix 14, Table 14-1. No pondberry colonies or evidence of pondberry presence was noted within either the rights-of-way or the 2,000 acres surveyed in 1994. Three colonies were discovered during surveys for

three previous Yazoo Basin studies--Upper Yazoo Projects, Mississippi Delta Project, and the Big Sunflower River Maintenance Project. A colony containing six stems was located in Tallahatchie County, Mississippi, during the Upper Yazoo Projects; a colony containing hundreds of stems was located in Bolivar County, Mississippi, during the Mississippi Delta study; and one small colony was discovered in the ROW for the Big Sunflower River Maintenance Project. In addition, 62 pondberry sites in DNF and private lands near Shelby and Merigold, Mississippi, were sampled in May and June 2000 (Appendix 14, Attachment 4). The objective of this data collection was to evaluate the relationship between pondberry colony characteristics and flood frequency. During June-July 2005, data were collected from the same 62 colonies sampled in 2000 (Appendix 14, Attachment 6). A review of Appendix 14, Pondberry BA by A. Dale Magoun, Ph.D., is also presented in Appendix 14. This review presents statistical analysis for the characteristics of number of clumps, stems, dead stems, females, mature fruit stems, height, and average diameter of stems of known colonies within DNF.

175. The Louisiana black bear was listed as a Federally threatened species on 7 January 1992. The Louisiana black bear is one of 16 recognized subspecies of the American black bear (*Ursus americanus)*. Other free-living bears of the species *Ursus americanus* within the same range of the Louisiana black bear have also been designated as threatened due to similarity of appearance. Black bears are primarily animals of heavily wooded areas. Destruction or modification of bottom-land hardwood habitat represents the most significant threat to the Louisiana black bear. In addition, habitat fragmentation has limited the potential for the present population to expand its current range. Appendix 14 provides detailed discussions about the Louisiana black bear's ecology and status.

CULTURAL RESOURCES

176. A literature and records search was conducted to ascertain whether any previously recorded or known prehistoric and historic cultural resources were located in or adjacent to the project study area and determine what types of cultural resources might be expected in the study area. All alternatives were considered in the cultural resources literature and records. The review was conducted in June 2005 and involved the examination of holdings housed at the Mississippi Department of Archives and History—the archeological site records, the standing structure forms, the National Register of Historic Places (NRHP), and other pertinent documents and maps; e.g., soil survey data, cultural resource reports, local histories, USGS topographic maps, and aerial photography. In addition, the Louisiana Division of Archaeology was consulted regarding the portion of Madison Parish located east of the Mississippi River.

177. Approximately 595 archeological sites have been recorded within the Yazoo Backwater Study Area. These sites are listed by county/parish (Table SEIS-45). A total of 93 NRHP eligible properties have been listed within the study area (Appendix 15, Table 15-2). There has been 251 cultural resource surveys conducted within the study area. The pump station site has previously been subjected to a cultural resources survey and no significant cultural resources were identified.

TABLE SEIS-45
ARCHEOLOGICAL SITES RECORDED WITHIN THE STUDY AREA
JUNE 2005
YAZOO BACKWATER AREA REFORMULATION

County/Parish	Total Number of Recorded Archeological Sites	Total Number of NRHP Sites	Total Number of Recorded Archeological Studies
Mississippi			
Humphreys	81	18	52
Issaquena	67	22	25
Sharkey	149	25	30
Warren	1	0	22
Washington	199	21	54
Yazoo	87	7	38
Louisiana			
Madison Parish	11	0	30
TOTAL	595	93	251

178. Native American tribes having cultural affiliation to areas within the project's affected environment were identified, were notified of the project, and were provided with copies of the draft SEIS for review and comment. Currently, no properties having religious or cultural significance to the tribes that may be eligible for the National Register of Historic Places have been identified in the project's affected area.

WATER QUALITY

179. A complete analysis of existing surface water, sediment, and fish tissue quality in the Yazoo Backwater Study Area is found in Appendix 16. The following is a synopsis of the findings.

a. Most water bodies in the Yazoo Backwater Study Area have been designated for the propagation of fish and wildlife by the State of Mississippi. Many of these waters have been determined to be only partially supporting their designated use and were determined to be impaired when compared to existing water quality criteria. Impairments are generally due to sediment/siltation, historic-use pesticides, nutrients, organic enrichment/low DO, or pathogens. The MDEQ has completed TMDL analysis for many of these impaired water bodies. The TMDLs for the remaining impaired streams are scheduled to be completed in 2007. Eagle Lake (Eagle Bend Lake), which is shared by Warren County, Mississippi, and Madison Parish, Louisiana, does not have any impaired listings for either Mississippi or Louisiana.

b. The water quality analysis for the Yazoo Backwater Project used data collected by the Vicksburg District and USGS between 1990 and 2005 from stations in the Steele Bayou, Deer Creek, and Big Sunflower basins and the Backwater Lakes in DNF. The analysis also used data collected by ERDC, NRCS, and MDEQ. For this analysis, summary statistics for water, sediment, and fish tissue data were evaluated against current EPA and State quality criteria.

c. Concentrations of many surface water parameters such as water temperature DO, nutrients, and suspended solids vary by season. The DO concentrations and water temperatures were often outside their recommended ranges during the late summer months. Suspended sediment concentrations were observed to be highest during rainfall events in late winter and spring. Only 11 historic organochlorine pesticides from surface water samples had concentrations greater than their method detection limits and these were generally reported in sub-parts per billion amounts. Pesticides used in cotton, corn, soybean, and rice production are currently the most frequently detected pesticides in water. Pesticides concentrations show distinct seasonal patterns that corresponded to the type of crops grown in the watershed and the use of pesticides on those crops. Overall, the highest pesticide concentrations occur in the summer months, peaking in June and July. Four priority pollutant metals (cadmium, copper, lead, and mercury) had surface water concentrations that occasionally exceeded their MDEQ freshwater criteria. However, low level analysis of surface water samples collected in March 2005 by USGS showed that dissolved mercury concentrations in the Little Sunflower River and a DNF Backwater lake were less than the freshwater chronic criterion of 0.012 µg/L. The concentration of dissolved mercury in the Little Sunflower River was 0.00267 µg/L, while the concentration of dissolved mercury in Cypress Bayou was 0.00171 µg/L.

d. Sediment samples were analyzed for legacy organochlorine pesticides and metals. These data are compared to the EPA threshold effects concentration (TEC) and the EPA probable effects concentration (PEC), criteria developed from freshwater sediment bioassays. These criteria provide an upper and lower limit for evaluating the probability of a chemical in sediment being associated with adverse biological effects. The TEC represents concentrations of a chemical below which adverse biological effects are unlikely to occur. The PEC represents concentrations of chemicals in sediment above which harmful effects are likely to be observed. The range between the TEC and PEC represents a range in which the link between concentration and adverse biological effects is less certain.

e. Sediment metals concentrations compared to their respective EPA TEC and PEC criteria show that overall, 98 percent of the sediment metals samples were below the PEC. Seventy-six percent of these samples had concentrations less than the TEC and should not cause harmful biological effects. These data suggest that metals sediment concentrations in the Yazoo Backwater Study Area are not in the range that would cause harmful biological effects.

f. The most frequently detected pesticides in surface sediments were DDD, DDE, DDT, and the total of the three, ∑DDT. These pesticides were found in more than 80 percent of the samples. Twelve percent of samples with detectable ∑DDT were less than the TEC concentration of 5.28 µg/kg and 99 percent were less than the PEC concentration of 572 µg/kg. Overall, 78 percent of the Yazoo Backwater Study Area sediment samples had pesticide concentrations less than the PEC. Twenty-three percent of these had pesticide concentrations less than the TEC and should not cause harmful biological effects. These data show that a majority of the Yazoo Backwater Study Area sediments evaluated did not have organochlorine pesticides at concentrations that could be associated with frequent biological effects in aquatic organisms.

g. The Vicksburg District fish tissue database contains 235 samples analyzed for organochlorine pesticides between 1993 and 2005. In general, average tissue concentrations were higher in buffalo, shortnose gar, and paddlefish. The pesticides DDD, DDE, and DDT were detected in more than 95 percent of the fish tissue samples. The average and maximum concentrations measured in fish collected in the Yazoo Backwater Project Area since 2000 were 0.52 mg/kg and 5.8 mg/kg ∑DDT and 0.30 mg/kg and 0.84 mg/kg toxaphene, respectively. Since 2000, only 18 percent of the fish tissue samples tested exceeded the DDT consumption criterion of 1.0 mg/kg while only 4 percent of the fish tested exceeded the toxaphene criterion of 0.4 mg/kg. Recent pesticide data from fish tissue collected in the Steele Bayou Basin suggest that the average fish tissue ∑DDT concentrations may be decreasing as a result of channel cleanout in upper Steele Bayou in the 1990s. Fish collected postproject in 2000, 2001, and 2005 show a 90 percent decrease in ∑DDT concentrations compared to fish collected before 1990. These data show that removal of pesticides from the aquatic environment would have the effect of reducing pesticide fish tissue concentrations.

ENVIRONMENTAL CONSEQUENCES

180. This section of the FSEIS describes the impacts of the alternatives in the final array on the same significant resources that were previously discussed in the "Affected Environment" section. The results of quantified and qualitative evaluations are presented that evaluate both beneficial and adverse effects to these resources. The same quantified environmental methodologies that are described in the "Affected Environment" section have been used to determine the environmental impacts of the alternatives.

181. The initial planning and evaluations of the nonstructural flood damage reduction measures in the final array (reforestation of 100 percent of perpetual easement lands) were changed during the final iteration of the planning process. The terrestrial, wetland, waterfowl, and aquatic evaluations contained in Appendixes 13, 10, 12, and 11, respectively, included the effects of reforesting 100 percent of the perpetual easement lands. In final planning, the Vicksburg District decided to allow up to 10 percent of the land to be placed in conservation features for the benefit of fish and wildlife. As a result, although these conservation features are optional, the FSEIS calculates that only 90 percent of these lands will be reforested. After the release of the Draft Report, the reforestation feature was modified by the Vicksburg District to include other conservative features on up to 10 percent of the perpetual easement lands. Out of this 10 percent, MDWFP requested the Vicksburg District consider 5 percent of the easements for

waterfowl habitat by installing water control structures. The landowners would be furnished water control structures by the Vicksburg District that could be used to flood natural areas or landowner planted agricultural crops during the winter that would provide foraging habitat for waterfowl. It was estimated that one-half of the easement acreage (5 percent) that may not be reforested by the Vicksburg District could be used for foraging habitat for waterfowl. The remaining 5 percent of the easement lands that the Vicksburg District may not reforest could be used by the landowner for other wildlife-related purposes. The FSEIS and Mitigation Appendix both display the effects of just reforesting 90 percent of the perpetual easement lands, even though more than 90 percent may be reforested, and providing the water control structures for 5 percent of these easement lands for waterfowl foraging benefits.

WATERFOWL RESOURCES

182. A waterfowl evaluation developed by FWS was used by ERDC to perform this analysis. Waterfowl resources will experience four different impacts. These impacts include the conversion of 38 acres of forested wetland and hydrologic changes to waterfowl habitat for Alternatives 3 through 7. Alternative 2B will convert 2,194 acres of forested wetland and 962 acres of reforested wetland. As described more fully in Appendix 12, waterfowl resources were evaluated quantitatively and qualitatively. There will be an overall net increase in the value of foraging habitat based on the quantitative assessment. Although the reforestation feature will reduce the value of foraging habitat, this net increase results from the installation of structures on up to 5 percent of lands managed as waterfowl foraging habitat. Based on the qualitative assessment, reforestation meets other life cycle waterfowl requirements.

183. Alternatives 3 through 7 include 38 acres of bottom-land hardwood clearing from pump station construction, disposal area construction, and the realignment of the Highway 465 bridge/culvert over the outlet channel. This result is a permanent loss of 2,166 DUDs (38 acres x 57 DUDs/acre). Alternative 2B would include a permanent loss of 290,768 DUDs due to construction of the ring levees and interior pumps necessary to evacuate interior rainfall. Alternatives 3 through 7 would result in a loss of 5.6 acres of open water at the pump station site, which will be more than offset by the creation of 30.8 acres of permanent channel. These effects on open water are not included in the waterfowl evaluation because the areas do not provide waterfowl foraging habitat.

184. All alternatives, which have a reforestation component, would result in a loss of available waterfowl foraging value. These losses are due to hydrological conversion and reforestation effects ranged from -1.1 to -67.3 percent (Table SEIS-46). Alternatives with nonstructural flood damage reduction (reforestation) had the greatest losses, and Alternative 3 (the structural alternative) had the fewest losses. The alternatives with reforestation had greater quantitative losses because the value of the agricultural land to waterfowl foraging is greater than the waterfowl foraging value of bottom-land hardwoods. However, the reforestation provides other waterfowl habitat requirements (Appendix 12) and helps achieve the North American Waterfowl Management Plan goals of bottom-land hardwood reestablishment.

TABLE SEIS-46
EFFECTS OF ALTERNATIVES ON WATERFOWL FORAGING VALUE
YAZOO BACKWATER AREA REFORMULATION

Alternative	Structural Effects a/ (DUD)	Nonstructural Effects b/ (DUD)	Effect c/	
			DUD	Change (%)
1	0	0	0	0.0
2	195,476	-526,574	-331,098	-17.9
2A	0	-471,171	-471,171	-25.5
2B d/	-964,403	-279,754	-1,244,157	-67.3
2C	0	-471,171	-471,171	-25.5
3	-19,651	0	-19,651	-1.1
4	39,866	-482,318	-442,452	-23.9
5	75,807	-491,181	-415,374	-22.5
6	258,960	-543,808	-284,848	-15.4
7	279,425	-549,128	-269,703	-14.6

a/ Hydrological and construction effects (DUD).
b/ Reforestation effects. Ninety percent of the reforestation acreage was used to estimate DUDs because up to 10 percent of the property could be used for other conservation measures.
c/ Effects of hydrologic conversion and reforestation impacts. Ninety percent of the reforestation acreage was used to estimate DUDs because up to 10 percent of the property could be used for other conservation purposes (Appendix 1).
d/ Values for Alternative 2B were recalculated after the Waterfowl Appendix was finalized.

185. Up to 5 percent of land acquired for the nonstructural flood damage reduction measure could be used for waterfowl foraging areas by landowners. Waterfowl foraging areas are areas that seasonally impound water on moist soil plants or agricultural grains (for conservation purposes only) through the use of water control structures. An average DUD value of 501 DUDs per acre was used to estimate the benefit from these waterfowl foraging areas (Appendix 1). The use of these waterfowl foraging areas produced substantial overall net gains in waterfowl foraging value for all alternatives except Alternatives 2B and 3 (Table SEIS-47).

TABLE SEIS-47
FORAGING BENEFITS FROM WATERFOWL FORAGING AREAS
YAZOO BACKWATER AREA REFORMULATION

Alternative	Waterfowl Foraging Areas (Acres) d/	Waterfowl Foraging Effects (DUDs) a/	Hydrologic and Reforestation Effects (DUDs) b/	Net Effect (DUDs)	Relative Effects (%) c/
1	0	0	0	0	0
2	6,220	3,116,220	-331,098	2,785,122	150.6
2A	4,070	2,039,070	-471,171	1,567,899	84.8
2B	1,320	661,320	-1,244,157	-582,837	-31.5
2C	5,720	2,865,720	-471,171	2,394,549	129.4
3	0	0	-19,651	-19,651	-1.1
4	1,860	931,860	-442,452	489,408	26.5
5	2,780	1,392,780	-415,374	977,406	52.8
6	4,070	2,039,070	-284,848	1,754,222	94.8
7	6,220	3,116,220	-269,703	2,846,517	153.9

a/ Waterfowl foraging acres x 501 DUDs/acre.
b/ From Table SEIS-46.
c/ Relative effects determined by dividing net effect DUDs by baseline DUDs (1,849,741).
d/ Waterfowl foraging areas are based on 5 percent of the conservation easements.

TERRESTRIAL RESOURCES

186. The HEP evaluation developed by FWS was used by ERDC to perform this evaluation. Adverse effects to wildlife species dependent on bottom-land hardwood habitat result primarily from land use conversion (removal of habitat) or from altered hydrologic characteristics (reduced flood frequency and duration). Terrestrial resource value can also be increased through reforestation of agricultural lands (Appendix 13). Evaluation species were selected for the terrestrial analyses that utilize the habitat that could be impacted by the project, including wood duck, mink, squirrel, and three bird species.

187. In addition to the hydrologic and reforestation effects of Alternatives 3 through 7 on terrestrial resource value, each alternative would include 38 acres of bottom-land hardwood clearing from pump station construction, disposal area construction, and the realignment of the Highway 465 bridge/culvert over the outlet channel. The loss of 38 acres would result in a permanent loss of 113 AAHUs. Alternatives 3 through 7 would also result in the loss of 5.6 acres of open water at the pump station site, which will be offset by the creation of 30.8 acres of permanent channel at this site. The effects on open water were not used in the terrestrial analysis because these areas do not provide habitat for the water-dependent species. In addition, there would be a loss of 2,194 acres of forested wetland and 962 acres of reforested wetland for Alternative 2B, which results in the loss of 9,892 AAHUs.

188. All alternatives, except Alternatives 1 and 3, would result in gains in terrestrial resource value. The net change due to the hydrologic, construction, and reforestation measures ranged from 0.0 to 25.0 percent (Table SEIS-48).

TABLE SEIS-48
EFFECT OF ALTERNATIVES ON TERRESTRIAL VALUE
YAZOO BACKWATER AREA REFORMULATION

Alternative	Structural Effects (AAHUs) a/	Nonstructural Effects (AAHUs) b/	Net Effects (AAHUs)	Relative Effect (%) d/
1	0	0	0	0.0
2	0	174,658	174,658	25.0
2A	0	114,286	114,286	16.3
2B c/	-13,793	37,066	23,273	3.3
2C	0	160,618	160,618	23.0
3	-113	0	-113	0.0
4	126	52,229	52,355	7.5
5	126	78,062	78,188	11.2
6	248	114,286	114,534	16.4
7	248	174,658	174,906	25.0

a/ Hydrologic and construction effects.
b/ Reforestation effects. Ninety percent of the reforestation acreage was used to estimate AAHUs because up to 10 percent of the property could be used for other conservation purposes (Appendix 1).
c/ Values for Alternative 2B were recalculated after the Terrestrial Appendix was finalized.
d/ The net effects change is calculated by dividing the net effects AAHUs by the baseline AAHUs (699,592).

189. There would be no change in the terrestrial resource with the no-action alternative. The recommended plan would result in a 11.2 percent increase in terrestrial resource value.

WETLAND RESOURCES

190. The wetland functional evaluation was performed by ERDC and coordinated extensively with EPA. In general, adverse wetland effects result from land use conversion or by changing hydrology. Wetland functional value can be increased on sites with appropriate hydrology through reforestation (Appendix 10).

191. In addition to the hydrologic and reforestation effects of Alternatives 2B and 3 through 7 on wetland resource value, Alternative 2B includes the loss of 2,194 acres of forested wetland and 962 acres of reforested wetland for levee and pump station construction. The loss of wetland resource value due to conversion impacts on Alternative 2B would be 16,732 FCUs. The loss of wetland value due to conversion impacts on Alternatives 3 through 7 would be 240 FCUs (63 FCUs/acre x 38 acres). Alternatives 3 through 7 would result in a loss of 5.6 acres of open water at the pump station site, which will be offset by the creation of 30.8 acres of permanent channel. In addition, these impacts have been accounted for and will be mitigated in the 519 acres for previous construction at the pump station site.

192. All alternatives, except Alternatives 1 and 3, would result in gains in wetland functional value. The net changes due to the combination of structural and nonstructural features ranged from 2.4 to 47.2 percent (Table SEIS-49). Alternative 3 would result in a 5.0 percent decrease in wetland functional value.

TABLE SEIS-49
EFFECTS OF ALTERNATIVES ON WETLAND FUNCTIONAL VALUE
YAZOO BACKWATER AREA REFORMULATION

Alternative	Structural Effects (FCUs) a/	Nonstructural Effects (FCUs) b/	Net Effects (FCUs)	Relative Effects (%) d/
1	0	0	0	0.0
2	0	418,291	418,291	47.2
2A	0	273,704	273,704	30.9
2B c/	-67,601	88,769	21,168	2.4
2C	0	384,666	384,666	43.4
3	-44,230	0	-44,230	-5.0
4	-28,372	125,084	96,712	10.9
5	-14,428	186,953	172,525	19.5
6	-9,540	273,704	264,164	29.8
7	-4,189	418,291	414,102	46.8

a/ Hydrologic and construction effects.
b/ Reforestation effects. Ninety percent of the reforestation acreage was used to estimate FCUs because up to 10 percent of the property could be used for other conservation purposes (Appendix 1).
c/ Values for Alternative 2B were recalculated after the Wetland Appendix was finalized.
d/ Relative effects are calculated by dividing the net effects by the baseline (885,296 FCUs).

COMPARISON OF EPA AND VICKSBURG DISTRICT RECOMMENDED PLAN WETLAND ANALYSES

193. The Vicksburg District wetland analysis (calculations and assumptions) consistently overestimated the existing areal extent and project impacts to wetlands (e.g., all lands with a minimum 5 percent backwater flood duration were classified as wetlands). Appendix 10 documents the conservative assumptions and calculations used in the analysis. The extent of wetlands by the Vicksburg District was 27,000 acres less than that of EPA's EMAP method. The Vicksburg District estimated there were 189,600 acres, and EPA estimated there were 216,600 acres. The EPA estimated total wetlands in the study area, regardless of the source of hydrology, while the Vicksburg District estimated only those wetlands in the study area that were inundated for 5 percent or more of the growing season by backwater flooding. While the Vicksburg District methodology captures some wetlands that are inundated from sources other than backwater flooding, it is designed to focus on the source of the hydrology. Thus the Vicksburg District methodology is not designed to estimate all of the wetlands, such as the areas of wetlands that could be sustained by the 51 inches of annual rainfall.

194. The Vicksburg District used the HGM approach to determine the functional value of impacted wetlands. This analysis is fully discussed in Appendix 10, and the offsetting mitigation for wetland impacts is discussed in the Appendix 1. As explained in Appendix 1, the mitigation to fully offset the wetland impacts for the recommended plan will require the reforestation of approximately 3,800 acres. In order to show how this would compare to the EPA wetland acreage, the Vicksburg District used a 90 percent confidence range on its duration elevations and computed both the impacted acreage and functional values of the wetlands in the 90 percent confidence range. The results of the analysis are shown Table SEIS-50, and represent only the hydrologic impacts from the operation of the pump station.

TABLE SEIS-50
WETLAND CONFIDENCE RANGE
RECOMMENDED PLAN a/
YAZOO BACKWATER AREA REFORMULATION

Item	Lower 90 Percent Confidence	Recommended Alternative	Upper 90 Percent Confidence
Wetland Acres	150,000	189,600	229,000
Change in Acres (<5%) b/	12,900	26,300	44,600
Change in Acres (>5%) c/	39,900	40,700	50,600
No Change in Acres	97,100	122,600	133,800
Base FCUs (total)	759,500	885,300	1,144,600
Change in FCUs (<5%)	-6,600	-10,800	-24,500
Change in FCUs (>5%)	-4,700	-3,600	-5,400
Total Loss in FCUs	-11,300	-14,400	-29,900
Mitigation Acres	3,000	3,800	8,000

a/ Represents only the structural feature of Alternative 5.
b/ Acres which were within the 5 percent duration, but are no longer within the 5 percent.
c/ Acres which remained above 5 percent duration, but changed duration.

195. The Vicksburg District's 90 percent confidence range (150,000 to 229,000 acres) encompasses EPA's EMAP estimate of 216,600 acres of wetlands. The tabulation provides that even if the Vicksburg District assumed that the upper limit of estimated wetland acres (229,000) was used to estimate impacts, the mitigation needed to offset such impacts would be 7,893 acres of reforested lands. As explained in Appendix 1, the aquatic spawning habitat, not the wetlands, was the controlling resource for determining mitigation, as offsetting the impacts to this resource required the largest single number of acres of reforestation (10,662). As a result, even if the Vicksburg District used the larger estimate of wetland impacts, the total 10,662 acres of mitigation provided by the project would offset those wetland impacts.

AQUATIC RESOURCES

196. In general, adverse aquatic flood plain effects can result from land use conversion (complete loss of habitat) or by changing hydrology (partial changes in habitat value). Aquatic flood plain spawning and rearing value can also be increased on sites within the 2-year frequency flood plain through reforestation (Appendix 11).

197. In addition to the hydrologic and reforestation effects of Alternative 2B on spawning habitat value, there would be a loss of 2,194 acres of forested wetland and 962 acres of reforested wetland for Alternative 2B levee construction and pumps. There would be a loss of 38 acres of bottom-land hardwood clearing from pump station construction, disposal area construction, and the realignment of the bridge/culvert over the outlet channel for Alternatives 3 through 7. These impacts would result in a loss of 1,904 spawning AAHUs for Alternative 2B and a loss of 27 spawning AAHUs for Alternatives 3 through 7.

198. The construction impacts at the pump site for Alternatives 3 through 7 would result in the loss of approximately 5.6 acres of open water. This loss of open water would include 0.9 acre of Cypress Lake and 4.7 acres of open water located within the existing cofferdam and adjacent to Highway 465. These 4.7 acres of open water areas are seasonal and are sustained by precipitation. These waters are not connected to the flood plain and therefore, have no aquatic spawning or rearing value. This loss of open water would be offset by completion of the inlet channel which will provide 30.8 acres of permanent open water behind the Steele Bayou pump station.

199. There was no hydrologic effect on Alternatives 2, 2A, and 2C. The hydrologic effect resulted in a loss of AAHUs on Alternatives 2B, 3, 4, and 5 and a gain for Alternatives 6 and 7 (Table SEIS-51). The structural effects on the aquatic flood plain spawning area resulted in a loss of AAHUs for Alternatives 2B, 3, 4, 5, and 6. Alternative 7 showed a gain in AAHUs.

200. Reforestation of agricultural lands provided substantial spawning habitat for all alternatives except Alternative 3, which did not have a reforestation measure (Table SEIS-51). The reforestation resulted in net AAHU increases for each alternative except Alternatives 2B and 3.

TABLE SEIS-51
EFFECT OF ALTERNATIVES ON AQUATIC FLOOD
PLAIN SPAWNING VALUE
YAZOO BACKWATER AREA REFORMULATION

Alternative	Structural Effects (AAHUs) a/	Nonstructural Effects (AAHUs) b/	Net Effects (AAHUs)	Relative Effects (%) d/
1	0	0	0	0.0
2	0	16,684	16,684	86.3
2A	0	10,917	10,917	56.5
2B c/	-8,768	3,541	-5,227	-27.0
2C	0	15,343	15,343	78.8
3	-7,818	0	-7,818	-40.3
4	-4,076	4,989	913	4.7
5	-1,607	7,457	5,850	30.3
6	-28	10,917	10,889	56.3
7	1,326	16,684	18,010	93.1

a/ Hydrologic and construction effects.
b/ Reforestation effects. Ninety percent of the reforestation acreage was used to estimate AAHUs because up to 10 percent of the property could be used for other conservation purposes (Appendix 1).
c/ Values were recalculated after the Aquatic Appendix was finalized.
d/ Relative effects are calculated by dividing net effects by baseline.

201. The loss of 2,194 acres of forested lands and 962 acres of reforested lands for Alternative 2B levee construction and pumps would result in a loss of 2,116 AAHUs of rearing habitat. The loss of 38 acres of bottom-land hardwoods from pump station construction results in a loss of 30 AAHUs of rearing habitat.

202. The hydrologic effect on rearing acres was negative on Alternatives 2B, 3, 4, 5, and 6 and positive for Alternatives 2 and 7. There was no effect on Alternatives 2A, 2C, and no action (Table SEIS-52).

203. All alternatives except Alternatives 1 and 3 had substantial acreages of agricultural land reforested that provided rearing habitat (Table SEIS-52). As stated previously, Alternative 3 does not have any reforestation measure.

204. There would be a 30.3 percent increase in aquatic spawning resource value and an 8.0 percent increase in rearing resource value with the recommended plan.

TABLE SEIS-52
EFFECT OF ALTERNATIVES ON AQUATIC FLOOD PLAIN REARING VALUE
YAZOO BACKWATER AREA REFORMULATION

Alternative	Structural Effects (AAHUs) a/	Nonstructural Effects (AAHUs) b/	Net Effects (AAHUs)	Relative Effects (%) d/
1	0	0	0	0.0
2	1,352	26,870	28,222	31.6
2A	0	17,582	17,582	19.7
2B c/	-34,858	5,702	-29,156	-32.6
2C	0	24,710	24,710	27.6
3	-14,693	0	-14,693	-16.4
4	-8,855	8,035	-820	-0.9
5	-4,809	12,010	7,201	8.0
6	-940	17,582	16,642	18.6
7	1,373	26,870	28,243	31.6

a/ Hydrologic and construction effects.
b/ Reforestation effects. Ninety percent of the reforestation acreage was used to estimate AAHUs because up to 10 percent of the property could be used for other conservation purposes (Appendix 1).
c/ Values were recalculated after the Aquatic Appendix was finalized.
d/ Relative effects are calculated by dividing net effects by baseline (89,414).

205. The Vicksburg District also included an analysis of entrainment and impingement of aquatic species by the pumps. When in operation, some aquatic organisms could be moved by the current into an intake structure where they could potentially be harmed or killed from pump impellers and excessive hydraulic forces (Appendix 11). The Vicksburg District acknowledges that entrainment of invertebrates or small fish may occur during operation of the pump station, but does not anticipate significant impacts to fish populations in the Yazoo Backwater Study Area. Based on the quantity/density of fish resources in the study area, only a small percentage of fish will be in the zone that may be subject to entrainment. For those fish, given the design and operation of the pump station, entrainment is not likely to cause significant fish mortalities. (See Appendixes 6 and 11.) At the pumping elevation, there are approximately 60 miles of channels that contain floodwater, providing ample fish habitat. Impingement, the process of aquatic organisms becoming trapped against the screening devices associated with pump intakes, is also a possibility, but with a 6-inch wire mesh, most fish will either go through the rack into the pump station or avoid the intake. Therefore, no significant adverse impacts are anticipated for impingement.

206. The pump station will draw water near the bottom of the ponding area, which is approximately 27 feet in total depth. Smaller, more entrainable fishes are usually found in the mid- to upper-water column where food and oxygen are more plentiful. At the trash rack, the intake velocities will be approximately 3 feet per second. Velocities in the inlet channel will decease rapidly to less than 2 feet per second. Approximately 500 feet from the trash rack, velocities will decrease by 24 percent; 800 feet from the trash rack, they will have decreased by 32 percent. Most adult fishes, including minnows, have burst speeds of 3 feet per second or greater that can be maintained for at least 30 seconds. In addition, most fish will avoid moving backwards in current (at the point of entrainment) and will exhibit burst swimming speeds to move out of the intake area, if necessary.

207. For juvenile and larval fish that occur near the bottom of the forebay, entrainment is possible because of their weaker swimming ability. Based on previous sampling behind the Steele Bayou structure, gizzard shad will be the primary species most susceptible to entrainment because they are locally abundant and their eggs and larvae are pelagic. The impellers used for the 12 pumps are approximately 20 feet in diameter. Entrained organisms can be subjected to rapid changes in shear stress, pressure, acceleration, and turbulence. Reported mortality of larvae through impellers or propellers range from less than 5 percent for turbine intakes to >75 percent for towboat propellers. Eggs appear to be resistant to entrainment mortality, and larvae are only susceptible at small, development sizes (<15 millimeters). Considering that the Yazoo Backwater pump station impellers will be approximately 20 feet in diameter and the rotations per minute (rpm) will be relatively slow (120 to 130 rpm), physical forces (shear stress, acceleration-deceleration, turbulence) will be lower than those created by smaller and faster propellers/impellers associated with intakes and towboats. In addition, slower moving propellers have a reduced probability of striking or injuring a fish passing through. The outlet velocities will be approximately 12 feet per second, but flows will quickly subside to approximately 3 feet per second in the stilling basin, located right below the pump station. Those fish that move through the pump station unharmed will travel into the stilling basin and then through a connecting channel approximately 0.5 mile long into the Yazoo River. Given these reasons, it is assumed that entrainment mortality will be low and if fish are impacted, gizzard shad will be the most susceptible species. Since gizzard shad are ubiquitous throughout the lower Mississippi Valley, no impacts to their population integrity are anticipated.

208. The future with-project condition would be affected by reforestation measures of each alternative. There would be no change in bottom-land hardwood habitat and agricultural acreage with the no-action alternative. The nonstructural flood damage reduction features (reforestation) of all other alternatives, except Alternative 3, would result in an increase in bottom-land hardwoods in frequently flooded areas of the Yazoo Backwater Study Area. Alternative 3 does not have a nonstructural feature; however, it does include the reforestation of some frequently flooded agricultural lands as a compensatory mitigation measure. The increase in forested lands in frequently flooded areas would result in a reduction in frequently flooded agricultural lands in

the Yazoo Backwater Area. These effects have been used in the quantified and qualitative evaluations of affected resources in the Yazoo Backwater Study Area. The relative increase in bottom-land hardwood habitat in the study area ranged from 0.0 to 51.4 percent. The resulting decrease in agricultural lands ranged from 0.0 to 39.4 percent (Table SEIS-53). The recommended plan (Alternative 5) would result in a 23.0 percent increase in bottom-land hardwood habitat and a 17.6 percent decrease in agricultural lands.

TABLE SEIS-53
EFFECT OF ALTERNATIVES ON LAND USE a/
YAZOO BACKWATER AREA REFORMULATION

Alternative	Change (%) Future With Project	
	Bottom-land Hardwood	Agricultural
1	0	0
2	51.4	-39.4
2A	33.7	-25.8
2B	21.9	-8.4
2C	47.3	-36.2
3	22.1	-16.9
4	15.4	-11.8
5	23.0	-17.6
6	33.7	-25.8
7	51.4	-39.4

NOTE: This table includes mitigation while other resource tables do not include mitigation in the changes.

a/ Based on the 100-year frequency study area.

THREATENED AND ENDANGERED SPECIES

209. The FWS identified the endangered plant pondberry (*Lindera melissifolia*) and the threatened Louisiana black bear (*Ursus americanus luteolus*) as species that may occur in the study area. Pursuant to Section 7 of the Endangered Species Act, a final BA for these species was sent to FWS on 5 December 2005 (Appendix 14). The BA determined that the project was not likely to adversely affect either species. The FWS did not concur with determination that the project was not likely to adversely affect the pondberry. The FWS also indicated that additional informal consultation on the Louisiana black bear was required prior to determining whether the project was likely to adversely affect the Louisiana black bear. Although the BA concluded that the project was not likely to adversely affect pondberry, the Vicksburg District did request initiation of Section 7 formal consultation to ensure the project did not jeopardize the continued existence of pondberry. The FWS initiated Section 7 formal consultation for pondberry on 18 January 2006.

210. After additional informal consultation, FWS concurred with the Vicksburg District's determination that the project was not likely to adversely affect the Louisiana black bear (letter of 10 August 2006). The FWS provided its pondberry Biological Opinion 2 July 2007 (Attachment 13, Appendix 14). The formal consultation enabled the Vicksburg District and FWS to examine possible impacts on pondberry in greater detail. Looking at the same data, each agency drew different conclusions about the role of backwater flooding on pondberry. Despite these differences, FWS concluded the project would not jeopardize the continued existence of the endangered plant pondberry.

211. To help conserve and recover the pondberry, the Vicksburg District has significant ongoing or planned activities designed to address data and recovery tasks contained in the FWS 1993 Pondberry Recovery Plan. In 2003, the Vicksburg District, FWS, and the USDA Forest Service entered into a 7-year, $5 million interagency agreement to conduct extensive research on pondberry's biological and ecological requirements. In addition, in 2007, the Vicksburg District and FWS signed a Memorandum of Agreement to establish two new pondberry populations in the study area and conduct additional field experiments evaluating the effects on flooding, stand thinning, competition, and pathogens on pondberry.

CULTURAL RESOURCES

212. A cultural resources survey has been completed at the pump station site (Appendix 15). A cultural resource evaluation will be conducted over the property contained within the 55,600 acres to identify all cultural resources, prior to reforestation. Survey methods will include remote-sensing technologies; e.g., satellite and low aerial imagery, as well as conventional ground-truthing methods (soil coring, hand excavation). All identified resources will then be evaluated for their NRHP significance. If NRHP eligible properties are determined to be within the Yazoo Backwater Study Area, the effects of the project to the resources will be assessed and coordinated with the State Historic Preservation Officer. Efforts will be taken to either preserve the significant resources in place or mitigate appropriately for any adverse effects created by the undertaking.

213. All cultural resources efforts shall be conducted in accordance with the National Historic Preservation Act, as amended, Advisory Council on Historic Preservation's Regulations 36 CFR Part 800 and other related regulations, principles, or guidelines.

WATER QUALITY - IMPACTS

214. The Vicksburg District has evaluated the impacts on impaired waters within the Yazoo Backwater Study Area, including those waters for which MDEQ has established TMDLs. Impairments are generally due to sediment/siltation, nutrients, organic enrichment/low DO, pathogens, or legacy pesticides. A complete analysis of water quality and project impacts to the Yazoo Backwater Study Area is found in Appendix 16.

215. The water quality analysis evaluated potential impacts from each of the component features of the recommended plan. The analysis examined potential project impacts to water quality brought about by construction at the Yazoo Backwater pump station site and completion of the inlet and outlet channels, by changes to hydrology within the study area caused by pump operation, from reforestation of up to 55,600 acres of agricultural land, and from changes in operation of the Steele Bayou structure during low-flow periods.

216. Potential impacts from construction of the pump station, completion of the inlet and outlet channels, and periodic channel maintenance include temporary increases in turbidity and suspended solids in adjacent water bodies.

217. Reforestation of up to 55,600 acres will result in substantial benefits to the quality of water in the Yazoo Backwater Study Area. Reforestation will reduce erosion and sediment yield in stormwater runoff by adding permanent ground cover and eliminating tillage. Removing land from agricultural production will also reduce the amount of nutrients and pesticides entering adjacent water bodies. In addition, reforestation will improve the wetland functional value of frequently flooded land. Reforestation will increase nutrient uptake and provide structure and a supply of organic carbon (leaf litter) to benefit downstream fisheries. Scientists at ERDC used an HGM analysis of wetland functions to predict cumulative changes in wetland functional value from operation of the proposed Yazoo Backwater pump station and reforestation. Percentage changes for stormwater runoff and HGM wetland functional value were calculated for each alternative by comparing estimated changes from the targeted acres to existing/base conditions for each of the major listed water quality impairments (i.e., sediment, pesticides, organic enrichment, and nutrients). Based upon the combined analyses of the recommended plan, sediment should be reduced by 14 percent, pesticides should be reduced by 6 percent, nutrients should be reduced by 14 percent, and organic enrichment should be increased by 8 percent (Table SEIS-54).

TABLE SEIS-54
CHANGES IN WATER QUALITY
FOR THE LISTED WATER BODY IMPAIRMENTS
IN THE YAZOO BACKWATER PROJECT AREA a/
YAZOO BACKWATER AREA REFORMULATION

Stormwater Runoff	Sediment Yield		Nitrogen and Phosphorus Yield	Export of Organic Carbon
Wetland Function	Physical Removal of E/C		Removal of E/C	
Listed Impairment	Sediment	Pesticides	Nutrients	Organic Enrichment
Alternative 2	+ 36	+ 22	+ 38	+ 28
Alternative 2A	+ 27	+ 15	+ 28	+ 18
Alternative 2B	- 9	- 12	- 8	- 10
Alternative 2C	+ 35	+ 21	+ 36	+ 26
Alternative 3	- 1	- 9	- 2	- 9
Alternative 4	+ 3	- 2	+ 3	- 0.4
Alternative 5	+ 14	+ 6	+ 14	+ 8
Alternative 6	+ 24	+ 12	+ 25	+ 16
Alternative 7	+ 35	+ 21	+ 37	+ 27

a/ Based upon 90 percent reforestation of targeted agricultural lands.

218. The recommended changes to operation of the Steele Bayou structure would increase the low-flow water surface elevation from between 68.5 and 70.0 feet, NGVD, to between 70.0 and 73.0 feet, NGVD, at the structure. Results of a water quality model (EPA WASP) analysis based on typical late summer conditions, suggest that there is no clear relationship between the proposed increase in pool elevation and variation in DO concentrations largely due to the input from phytoplankton productivity. Increasing the low-flow water surface elevation will not have a detrimental impact on DO concentrations in the lower study area. The Yazoo Backwater Project will not increase organic loading during the summer. Although the HGM wetland function, export of organic carbon, will increase by 8 percent, this would occur during the spring when water levels and flows are higher and not during the late summer, low-flow period when the aquatic system is likely to become impaired for organic enrichment/low DO.

219. The segment of the Yazoo River that is the receiving water for the Steele Bayou structure and will be the receiving water for the Yazoo Backwater pump station discharge is listed as impaired by pathogens or fecal coliform. Traditionally, high fecal coliform concentrations are often observed during periods of wet weather and high surface runoff, the same conditions usually associated with backwater flooding. The recommended plan should have no impact on the Yazoo River segment. The same water will be entering the river from the Yazoo Backwater Area; only the timing of the floodwater discharge will be changed.

220. The MDEQ is targeted to complete TMDLs in the study area by December 2007. The TMDLs are an estimate of the maximum amount of a given pollutant that a body of water can assimilate without violating water quality standards. The TMDL process links material/pollutant loading from the watershed to the water quality response of the receiving water body. The TMDLs attempt to limit loads as a means of reducing or reversing adverse water quality responses. While a margin of safety is usually built into the TMLS, once established, TMDL loading and assimilative capacity are balanced such that dramatic changes in either loading or assimilative capacity could lead to violations of the TMDL. In addition, dramatic changes in a water body's assimilative capacity could affect an existing discharge source's permitted loading capacity. Other than minor, temporary increases in turbidity and suspended sediment at the pump station site, the Yazoo Backwater Project will not increase the loading of any of the listed impairments. The Vicksburg District used estimates from stormwater runoff and the water quality wetland functions of the HGM analysis to demonstrate that the project will not alter the assimilative capacity of the Yazoo Backwater system. Thus, the Yazoo Backwater Project's recommended plan should not impact TMDLs in the Yazoo Backwater Study Area.

Cumulative Water Quality Impacts

221. In addition to the evaluation of water quality impacts for the Yazoo Backwater Study recommended plan, the Vicksburg District also used the HGM analysis for a quantitative evaluation of cumulative water quality impacts for past, current, and proposed projects in the study area. Projects included in the cumulative analysis are the continued maturation of trees planted under the USDA WRP and CRP and the Vicksburg District's Yazoo Backwater Project and the proposed Big Sunflower River Maintenance Project. The water quality cumulative analysis can be found in Appendix 16, in the cumulative impact section.

222. In the last 20 years the USDA WRP and CRP have reforested approximately 61,000 acres in the Yazoo Backwater Project Area. Using the water quality functions for mature forests from the HGM analysis, these 61,000 acres would improve nutrient removal by 9 percent (over prior agriculture use) and improve sediment removal by up to 5 percent (over prior agricultural use). Completion of the Yazoo Backwater Project in conjunction with water quality benefits from existing USDA forested land could improve nutrient removal by up to 20 percent and improve sediment removal by up to 15 percent over existing conditions. The proposed Big Sunflower River Maintenance Project will reestablish the river's 1965 flow lines and restore the flood protection around Darlove, Mississippi. Completion of the Yazoo Backwater Project and the Big Sunflower River Maintenance Project (HGM-B2 scenario) would reduce the HGM benefits slightly for each of the listed water quality impairments when compared to the HGM analysis of the Yazoo Backwater Project alone (HGM-B1 scenario). For the B2 recommended plan, nutrient removal would be improved by 6 percent over existing conditions and sediment removal would be improved by 3 percent over existing conditions.

ENVIRONMENTAL JUSTICE IMPACTS

223. Some of the more pertinent impacts relative to EJ concerns include housing and residential areas, schools, churches, health and public safety, employment and income, public roadways, agriculture/aquaculture, and economic development. These impacts are summarized below. Additional data concerning impacts are given in the EJ attachment to Appendix 8.

224. The majority of Yazoo Backwater Study Area's residential structures are occupied by minority and low–income persons. Approximately 59 percent of the 1,294 residential structures currently within the existing 100-year flood plain will no longer sustain damages with completion of the pump station. Approximately 529 residential structures remain within the 100-year flood plain after construction of the pump station. Although these residential structures may not be completely protected by the proposed project, their flood damage impacts would be significantly reduced in terms of frequency, duration, and flood stage by completion of the pump station.

225. Disruption of schools is also a serious concern during major flood events. Schools are located above the 100-year flood plain; however, flooding of roads impedes the safe and efficient passage of buses, which are more likely forced to take long detours around floodwaters or cancel their routes altogether. In addition to school impacts, many citizens will lose access to their homes from flooded roadways.

226. Within and around rural communities, there are many small churches and cemeteries which have historically been at the center of religious and social life. Major flood events make it difficult for pastors to hold regular services or community events such as meetings, weddings, or funerals. A reduction in flood durations will help alleviate these problems.

227. Flood events can also lead to a number of serious health issues--taking both physical and emotional tolls on residents. Not only does emotional trauma and mental stress arise out of the experience of being flooded and surrounded by water in one's home, mold and mildew can also aggravate or lead to respiratory ailments and/or allergies.

228. The sanitation systems used in the Yazoo Backwater Study Area are comprised of septic systems, oxidation ponds, and even privies to deal with human waste. However, when the water table gets too high even without flooding, these may not work. In flood events, the mixture of human and animal wastes, dead animals, agricultural chemicals, etc., creates a health hazard. Since wells cannot be used, potable water also has to be trucked in. Furthermore, flooding can restrict access to doctors and pharmacies for needed regular medications, as well as limit access

for emergency medical vehicles. Because of the area demographics, these adverse conditions, which can be compounded by the project not being completed, have a disproportionate impact on the residents of the area, but especially the low-income and minority persons.

229. Employment and income opportunities in the area are relatively limited. Through interviews conducted during the EJ study (Attachment 8A), some residents expressed feelings that the threat of flooding may have inhibited potential employers from developing facilities in the study area. Completion of the project, as proposed, might therefore enhance the area's potential to attract job-creating activities.

230. During major flood events, roadway travel can be hazardous. If roads are open, often they have water on both sides even approaching the roadbed. Even when roads are considered passable, they might be covered with several inches of water which makes them more dangerous at night. Also, many residents (including school buses) often have to drive atop levees with one-lane graveled roads and deep water on both sides. Again, because of the area demographics, these adverse conditions disproportionately affect low-income and minority persons. Some of these conditions will be alleviated by the project. Thus, the completion of the project would not result in disproportionately adverse impacts on the minority and low-income populations.

231. Agriculture and aquaculture are important to this region. Completion of the pump station and related facilities would help stabilize planting and growing plans and help provide stability to the agricultural economy.

232. The labor intensive jobs involved in both agriculture and aquaculture are often filled by the low-income and minority residents of the area. Disruptions due to flooding not only affect the overall economic base, but employment for many of the area residents who are disproportionately minority and low income. Completion of the project, as proposed, could help stabilize the area for future economic development and employment opportunities.

233. The following paragraphs compare the different alternatives in the final array in terms of environmental justice impacts. These alternatives included no-action, nonstructural, structural, and combination alternatives.

234. The no-action alternative considered in this study would have a disproportionate effect on the population of the entire impacted area, but especially on the high number of minorities and low-income persons located in this region. This segment of the population is the most adversely impacted group located in the flood-prone Yazoo Backwater Study Area because they do not have the resources to recoup their losses. This alternative does not improve the lives of any of the people in the study area physically or economically.

235. Implementation of any of the nonstructural alternatives (Alternatives 2, 2A, 2B, and 2C) would not have any disproportionate impacts on minorities or low-income residents in comparison to the rest of the population of the region. All of the residents impacted by the project alternatives (e.g., relocation) will encounter disruptions in their lives equally. However, should any residual flooding occur with any of these alternatives, the minorities or low-income sector will experience the most difficulty since this segment of the population does not have the resources to recoup from their losses.

236. The structural alternative (Alternative 3) was determined to have no disproportionate impacts on minorities or low-income persons in the study area. However, the impoverished residents of the area, as well as all impacted residents, would continue to experience hardships from residual flooding since flood damages would only be reduced, not eliminated. Also, it is more difficult for the minority and low-income sector of the community to recover from their losses.

237. The combination alternatives (Alternatives 4 through 7) have structural and nonstructural flood damage reduction measures that generally varied with the initiation of pump operation and the acreage of reforestation under the nonstructural feature. These alternatives were determined to have no disproportionate impacts on minorities or low-income persons in comparison with the rest of the population in the region. These alternatives would offer varying degrees of relief from the backwater flooding and should help low-income and minority residents of the area. However, since it is harder for minority and low-income persons to recover from their losses, this sector of the population will experience the most difficulty should residual flooding occur with any of these alternatives in place.

238. As part of two nonstructural alternatives in the final array, relocation was evaluated. This would be extremely difficult for the residents for a variety of reasons, but the primary one being the shear number of individuals (approximately 1,300) looking for housing at the same time. Currently, there are no areas directly adjacent to the study area that have sufficient alternative housing to accommodate these large numbers of individuals. Displaced residents would be forced to relocate in towns and cities many miles away from their original residence. The closest large-scale housing options would be afforded in cities such as Greenville, Greenwood, Vicksburg, Yazoo City, and Jackson, Mississippi. Housing costs in these areas are generally much higher than those in the Yazoo Backwater Study Area and thus, in addition to the emotional costs of moving, the displaced residences would incur a higher cost of living when relocated to these alternative residential areas. In addition to these impacts, displaced individuals would be forced to find new employment or travel long distances to their workplace within the Yazoo Backwater Study Area. This would create additional emotional stress and financial costs associated with relocating.

SUMMARY OF EFFECTS

239. This section summarizes the effects that were quantified as described in the above paragraphs. Where effects were described qualitatively, but not quantitatively, they are not repeated in this Summary. Except for Alternatives 1 and 3, the nonstructural flood damage reduction measure (reforestation) had the greatest influence on the net effect of each alternative (Tables SEIS-55 and SEIS-56). Under the future with-project conditions, reforestation contributed an increase in terrestrial, wetland, and aquatic spawning and rearing resource value across all nonstructural and combination alternatives and resource categories. However, waterfowl foraging value decreased for all nonstructural and combination alternatives. This resulted from replacing relatively higher foraging value cropland with lower foraging value bottom-land hardwoods. The reduction in foraging values was offset by additional conservation measures that are discussed in Appendix 1. These measures include providing landowners structures (pipes with risers) to flood up to 5 percent of the perpetual easement lands during the winter months for waterfowl foraging. Table SEIS-57 shows the acres affected by each alternative for all resource categories.

240. The impacts of the structural feature can be summarized as the hydrologic effects or hydrologic changes shown in each of the various alternatives. These effects vary by resource category. Hydrologic effects were positive on Alternatives 4, 5, 6, and 7 for terrestrial and waterfowl resources. Hydrologic effects were negative on Alternative 3 for all resource categories except terrestrial resources. There were no hydrologic effects on Alternative 1. Effects due to hydrologic changes were negative for Alternatives 2B, 3, 4, 5, and 6 on wetland and aquatic spawning and rearing resources. The hydrologic changes for Alternative 7 were negative for wetland resources and positive for waterfowl and aquatic spawning and rearing resources.

241. The construction effects can be summarized as conversion effects from the bottom-land hardwood clearing at the pump station site for Alternatives 3 through 7. These effects account for a relatively small loss across all resource categories. Alternative 2B had major construction losses for all categories due to the construction of levees and appurtenant structures.

242. The net effect of the nonstructural (Alternatives 2, 2A, and 2C) and combination alternatives (Alternatives 4 through 7) was a net increase in value across all resource categories, except for the waterfowl (Alternative 2B) and aquatic resources (Alternative 2B). The net terrestrial resource values ranged from 0.0 to 25.0 percent (Table SEIS-48). The net wetland resource values ranged from -5.0 to 47.2 percent (Table SEIS-49). The net resource values for waterfowl ranged from -1.1 to 153.9 percent (Table SEIS-47). The net aquatic spawning

TABLE SEIS-55
ENVIRONMENTAL GAINS AND LOSSES
FINAL ARRAY OF ALTERNATIVES
YAZOO BACKWATER AREA REFORMULATION
(2005 Land Use)

Alternative	Terrestrial (AAHU)			Wetland (FCU)			Waterfowl (DUD)				Aquatic Spawning (AAHU)			Aquatic Rearing (AAHU)		
	Structural Effect		Nonstructural Effect	Structural Effect		Nonstructural Effect	Structural Effect		Nonstructural Effect		Structural Effect		Nonstructural Effect	Structural Effect		Nonstructural Effect
	Construction	Hydrologic	Reforestation a/	Construction	Hydrologic	Reforestation a/	Construction	Hydrologic	Reforestation a/	Foraging b/	Construction	Hydrologic	Reforestation a/	Construction	Hydrologic	Reforestation a/
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	174,658	0	0	418,291	0	195,476	-526,574	3,116,220	0	0	16,684	0	1,352	26,870
2A	0	0	114,286	0	0	273,704	0	0	-471,171	2,039,070	0	0	10,917	0	0	17,582
2B	-9,892	-3,901	37,066	-16,732	-50,869	88,769	-290,768	-673,635	-279,754	661,320	-1,904	-6,864	3,541	-2,116	-32,742	5,702
2C	0	0	160,618	0	0	384,666	0	0	-471,171	2,865,720	0	0	15,343	0	0	24,710
3	-113	0	0	-240	-43,990	0	-2,166	-17,485	0	0	-27	-7,791	0	-30	-14,663	0
4	-113	239	52,229	-240	-28,132	125,084	-2,166	42,032	-482,318	931,860	-27	-4,049	4,989	-30	-8,825	8,035
5	-113	239	78,062	-240	-14,188	186,953	-2,166	77,973	-491,181	1,392,780	-27	-1,580	7,457	-30	-4,779	12,010
6	-113	361	114,286	-240	-9,300	273,704	-2,166	261,126	-543,808	2,039,070	-27	-1	10,917	-30	-910	17,582
7	-113	361	174,658	-240	-3,949	418,291	-2,166	281,591	-549,128	3,116,220	-27	1,353	16,684	-30	1,403	26,870

NOTE: Construction effects result from the actual construction site; hydrologic effects result from operation of the structural features; reforestation effects result from reforesting agricultural lands; and foraging effects result from installation of water control structures.

+ indicates a gain in environmental resources.
- indicates a loss in environmental resources.

a/ 90 percent of the reforestation acreage was used to estimate habitat value because up to 10 percent of the nonstructural feature could be used for other conservation purposes.
b/ Assumes 5 percent of the easement lands would be used for waterfowl foraging habitat.

TABLE SEIS-56
NET ENVIRONMENTAL GAINS AND LOSSES
YAZOO BACKWATER AREA REFORMULATION

Alternative	Terrestrial		Waterfowl		Wetlands		Aquatic			
							Spawning		Rearing	
	(AAHU)	% Base	(DUD)	% Base	(FCU)	% Base	(AAHU)	% Base	(AAHU)	% Base
1 a/	699,592		1,849,741		885,296		19,337		89,414	
2	174,658	25.0	2,785,122	150.6	418,291	47.2	16,684	86.3	28,222	31.6
2A	114,286	16.3	1,567,899	90.0	273,704	30.9	10,917	56.5	17,582	19.7
2B	23,273	3.3	-582,837	-31.5	21,168	2.4	-5,227	-27.0	-29,156	-32.6
2C	160,618	23.0	2,394,549	129.4	384,666	43.4	15,343	78.8	24,710	27.6
3	-113	0.0	-19,651	-1.1	-44,230	-5.0	-7,818	40.3	-14,693	-16.4
4	52,355	7.5	489,407	26.5	96,712	10.9	913	4.7	-820	-1.0
5	78,188	11.2	977,406	52.8	172,525	19.5	5,850	30.3	7,201	8.0
6	114,534	16.4	1,754,222	94.8	264,164	29.8	10,887	56.3	16,642	18.6
7	174,906	25.0	2,846,517	153.9	414,102	46.8	18,010	93.1	28,243	31.6

a/ Alternative 1 represents the baseline conditions in each category by which the relative change is measured on the remaining plans.

TABLE SEIS-57
ACRES AFFECTED BY ALTERNATIVES
FINAL ARRAY OF ALTERNATIVES
YAZOO BACKWATER AREA REFORMULATION
(2005 Land Use)

Plan	Terrestrial			Wetland			Waterfowl				Aquatic Spawning			Aquatic Rearing		
	Structural Effect		Nonstructural Effect	Structural Effect		Nonstructural Effect	Structural Effect		Nonstructural Effect		Structural Effect		Nonstructural Effect	Structural Effect		Nonstructural Effect
	Construction	Hydrologic	Reforestation	Construction	Hydrologic	Reforestation	Construction	Hydrologic	Reforestation c/	Foraging d/	Construction	Hydrologic e/	Reforestation e/	Construction	Hydrologic e/	Reforestation e/
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	124,400	0	0	124,400	0	1,384	1,940	6,220	0	0	40,299	0	2,353	64,902
2A	0	0	81,400	0	0	81,400	0	0	1,753	4,070	0	0	26,370	0	0	42,468
2B	-3,156	-11,985 a/	26,400	-3,156	92,104	26,400	-3,156	-4,766	1,106	1,320	-3,156	-14,347	8,552	-3,156	-57,002	13,773
2C	0	0	114,400	0	0	114,400	0	0	1,753	5,720	0	0	37,060	0	0	59,685
3	-38	0	0	-38	118,486	0	-38	-128	0	0	-38	-16,285	0	-38	-25,529	0
4	-38	430 b/	37,200	-38	101,115	37,200	-38	301	1,793	1,860	-38	-8,463	12,051	-38	-15,364	19,408
5	-38	430 b/	55,600	-38	66,945	55,600	-38	561	1,827	2,780	-38	-3,303	18,012	-38	-8,321	29,008
6	-38	1,460 a/	81,400	-38	48,066	81,400	-38	1,861	2,001	4,070	-38	-2	26,370	-38	-1,586	42,468
7	-38	1,460 a/	124,400	-38	28,408	124,400	-38	2,001	2,022	6,220	-38	2,828	40,299	-38	2,442	64,902

NOTE: Construction effects result from the actual construction site; hydrologic effects result from operation of the structural features; reforestation effects result from reforesting agricultural lands; and foraging effects result from installation of water control structures.

+ indicates a gain in acres.
- indicates a loss in acres.

a/ Combined wood duck and mink acres.
b/ Wood duck acres only.
c/ Represents only that portion of total number of acres reforested that contribute to waterfowl resources.
d/ Waterfowl foraging acres.
e/ Average flooded acres.

resource values ranged from -40.3 to 93.1 percent (Table SEIS-51). The net aquatic rearing resource values ranged from -32.6 to 31.6 percent (Table SEIS-52). The recommended plan provides an 11.2 percent increase in terrestrial resource value, a 19.5 percent increase in wetland resource value, a 52.8 percent increase in waterfowl resource value, and a 30.3 percent increase in aquatic spawning resource value and an 8 percent increase in aquatic rearing resource value (Table SEIS-13).

CUMULATIVE EFFECTS

243. The Council on Environmental Quality's regulations implementing the procedural provisions of NEPA define cumulative effects as the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions (40 CFR §1508.7). The area affected by the project is defined as the project impact zone. For the purposes of this analysis, the project impact zone is defined as the Yazoo Backwater Project Area. This analysis addresses cumulative effects on terrestrial, waterfowl, wetlands, aquatics, water quality, threatened and endangered species and compensatory mitigation.

244. Legislative authorities and Executive Orders have addressed the issue of wetland protection in recent years. Section 404 of the Clean Water Act requires permits for the discharges of dredged or fill material into waters of the United States. The Food Security Act of 1985 (referred to as "Swampbuster") removed some incentives for wetland development by eliminating agricultural subsidies to parties that produce commodities on wetlands converted after enactment. The NRCS has indicated that clearing in the entire Mississippi Delta area over the last 20 years has totaled only 1,105 acres, and the provisions of Swampbuster are triggered by the removal of woody vegetation and not changes in drainage (reference Mitigation Appendix, Attachment 2). Executive Order 11990 directs Federal agencies to avoid, to the extent possible, long- and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands if a practical alternative exists. Executive Order 11988 directs Federal agencies to reduce flood loss risk; minimize impacts on human safety, health, and welfare; and restore and preserve the natural and beneficial values served by flood plains. If the only practical alternative requires action in the flood plain, agencies must design or modify their action to minimize adverse impacts. These legislative authorities and executive orders have and will continue to protect and restore wetlands in the study area.

Past Actions

245. Prior to the European settlement of the Yazoo Backwater Project Area, the entire area was a mosaic of bottom-land hardwoods, swamps, rivers and lakes. Assuming that all present-day agricultural land was once forested, another 593,350 acres of bottom-land hardwoods and swamps would have existed. This represents a 64 percent loss of bottom-land hardwood forest in the Yazoo Backwater Project Area. A number of past, present, and future actions have or will have the potential to impact the Yazoo Backwater Project Area (Table SEIS-58). These actions contain features that have or could have direct or indirect impacts.

TABLE SEIS-58
PAST, PRESENT, AND FUTURE ACTIONS
YAZOO BACKWATER AREA REFORMULATION

Past Actions	Present Actions	Future Actions
Mississippi River Levee	Mississippi River Levee	Mississippi River Levee
Yazoo Area and Satartia Area Backwater Levee Projects, connecting channel, and structures completed in 1978		Yazoo Area Backwater levee and structures
Mitigation	Mitigation	Mitigation
Acquisition of public lands (e.g., wildlife refuges, national forests)	Acquisition of public lands	Acquisition of public lands
Upper Steele Bayou project	Upper Steele Bayou project	
Big Sunflower project completed in 1968		Big Sunflower River Maintenance Project
Steele Bayou project completed in 1984		
Will M. Whittington Auxiliary channel and levees completed in 1962		
WRP and CRP programs	WRP and CRP programs a/	WRP and CRP programs a/
Small Corps and NRCS Projects		Continuing Authorities Projects (Corps) and Other Small NRCS Projects

a/ Assumes program will continue under new farm bills and will not exceed county acreage ceilings as established by law.

246. The construction of several water resources projects has altered the hydrology in the Yazoo Backwater Project Area. These projects include the Mississippi River levee, Yazoo Area and Satartia Area Backwater Levee Projects, connecting channel and structures, Steele Bayou, Upper Steele Bayou, Big Sunflower, and Will M. Whittington (Lower) Auxiliary channel and levees projects. These changes in hydrology have contributed to bottom-land hardwood clearing for agricultural production. In addition, construction of these projects contributed to the direct loss of bottom-land hardwoods from clearing the right-of-way. Compensatory mitigation for the unavoidable impacts from the construction of the Yazoo Area and Satartia Area Backwater Levee Projects has been determined. The purchase of the Lake George property (8,800 acres) was mitigation for terrestrial impacts. However, in subsequent discussions with FWS, it was agreed that additional mitigation is owed on this project and will be accomplished under this report (see Main Report and Appendix 1 for more information).

247. Conservation of the bottom-land hardwoods has also occurred in the past through acquisition of national wildlife refuges and national forest and state wildlife management areas. In addition, compensatory mitigation lands (reforested agricultural lands) have been established in the Yazoo Backwater Project Area. The Lake George and Big Twist properties include approximately 15,400 acres of reforestation of agricultural lands. The Mahannah and Twin Oaks properties were acquired for mitigation of wildlife losses resulting from construction, operation, and maintenance of the Tennessee-Tombigbee Waterway and include approximately 18,500 acres of both agricultural lands and bottom-land hardwoods.

248. Two voluntary programs of NRCS have affected considerable acreage in Sharkey and Issaquena Counties. These programs are WRP and CRP. Through WRP, NRCS provides technical and financial support to help landowners with their wetland restoration efforts. As of May 2007, WRP had affected 23,997 total acres in Sharkey and Issaquena Counties. The CRP reduces soil erosion, protects the Nation's ability to produce food and fiber, reduces sedimentation in streams and lakes, improves water quality, establishes wildlife habitat, and enhances forest and wetland resources. A total of 18,049 acres in Issaquena and Sharkey Counties were enrolled in CRP. Together, the WRP and CRP lands totaled 42,045 acres in these two counties as of May 2007.

Present Actions

249. Five actions in the past will continue to affect the Yazoo Backwater Project Area. Work on the Mississippi River levee project will continue, the purchase and reforestation of mitigation areas will continue, acquisition of additional public lands will continue, the Upper Steele Bayou project is nearly complete, and the WRP and CRP programs will continue to affect lands in the Yazoo Backwater Project Area. The impacts from the Mississippi River levee project and the Upper Steele Bayou project are included in Supplement No. 1 to the Final Environmental Impact Statement Mississippi River and Tributaries Project, and Supplement No. 1 to the revised Final

Environmental Impact Statement, Upper Steele Bayou Project, respectively. Landside levee enlargement, berm construction, and relief well installation on the Mississippi River levees will occur along the western boundary of the Yazoo Backwater Project Area. Along with appropriate mitigation, this work is not scheduled for completion until 2031. The Upper Steele Bayou project will continue to reduce flood damages in the upper portion of the Steele Bayou Basin and will also improve fish and wildlife habitat in Swan Lake, a large wetland in the Theodore Roosevelt National Wildlife Refuge. Work within the Theodore Roosevelt National Wildlife Refuge is nearing completion, and all mitigation lands have been purchased for the Upper Steele Bayou project. Although most of the Mississippi River Levee project mitigation lands for the impacts in Mississippi have been purchased, additional lands may be purchased for this project in the future. The terrestrial, wetland, waterfowl, and aquatic appendixes contained in this FSEIS evaluate two scenarios. These scenarios are referred to as 'B1" and "B2." Scenario B1 is the condition of the Yazoo Backwater Project without implementation of the Big Sunflower River Maintenance Project (a future project), and B2 is the condition of the Yazoo Backwater project being in place and with the Big Sunflower River Maintenance Project implemented. A comparison of the significant individual effects of the Upper Steele Bayou, Big Sunflower River Maintenance Project, and the Yazoo Backwater project is presented in Table SEIS-59. The Big Sunflower River Maintenance Project is currently being reanalyzed, but the recommended alternative, as presented in the final report of July 1996, is used in this FSEIS. Mitigation for the Big Sunflower River Maintenance Project Item 3 resulted in the purchase of 237 acres out of the total 1,912 acres owed. However, additional mitigation land could be required once this project is reviewed. The cumulative effects of implementing the Big Sunflower River Maintenance Project and the Yazoo Backwater project are given in Table SEIS-60. In addition, the NRCS Ditch E project has recently been completed, immediately adjacent to DNF, in the Yazoo Backwater Study Area. This NRCS project reduces flood and drainage damages to cropland and to the soil resource base caused by erosion. The NRCS concluded that overall, their project does not reduce environmental quality in the Yazoo Backwater Study Area.

Future Actions

250. The Yazoo Backwater levee is a separate completed feature of the Yazoo Backwater project. It is anticipated that this levee will need to be raised at some point during the 50-year project life of the recommended plan. The Yazoo Backwater area serves as a flood storage area under the Project Design Flood (PDF) on the Mississippi River and is designed to overtop; therefore, the Yazoo Backwater levee height is set 5 feet below the height of the Mississippi River levee. Portions of the Mississippi River levee are projected to be raised over the next 23 years to ensure the project design flood on the Mississippi River can be safely passed. This requires the Yazoo Backwater levee to be raised to assure overtopping at the correct time and proper operation of the Mississippi River and Tributaries project. Additional clearing of bottom-land hardwoods would occur to accommodate the larger footprint of the backwater levee.

TABLE SEIS-59
COMPARISON OF WATER RESOURCES
PROJECTS IN THE PROJECT AREA
YAZOO BACKWATER AREA REFORMULATION

Resource	Upper Steele Bayou	Big Sunflower a/	Yazoo Backwater (Recommended Plan)
Terrestrial	9 percent decrease in habitat.	<1 percent decrease in habitat.	11.2 percent increase in habitat.
Waterfowl	105 percent increase in foraging habitat value.	10.6 percent decrease in foraging habitat value.	52.8 percent increase in foraging habitat value.
Wetlands	9 percent decrease in wetlands.	<1 percent decrease in forested and farmed wetlands.	19.5 percent increase in wetland function values.
Aquatics	105 percent increase in instream habitat value.	10 percent decrease in flood plain habitat.	30.3 percent increase in spawning habitat value. 8.0 percent increase in rearing habitat value.
Water quality	Short-term construction impacts. Long-term improvement.	Short-term construction impacts. No long-term effects.	Short-term construction impacts and reforestation should reduce nutrient, sediment, and pesticide loading. Loss of 38 acres of bottom-land hardwoods and a loss of 5.6 acres of open water, but gain of 30.8 acres of permanent channel.
Threatened and endangered species	Not likely to adversely affect pondberry	Not likely to adversely affect pondberry, pallid sturgeon, or Louisiana black bear.	An on-ground survey and BA for endangered pondberry (*Lindera melissifolia)* and the threatened Louisiana black bear (*Ursus americanus luteolus)* were completed. No colonies of pondberry were found at the pump station site, and no signs of Louisiana black bear were found. The FWS concurred that the project is not likely to adversely affect the Louisiana black bear. The FWS did not concur with the "not likely to adversely affect" pondberry determination. The FWS BO concluded the project was not likely to jeopardize the continued existence of pondberry.
Compensatory mitigation	5,250 acres of reforestation. Fully offset terrestrial and wetland losses. Net gain of 2,684 acres of forested wetlands.	1,912 acres of reforestation. Fully offset wetlands and fisheries impacts. Net gain of 1,090 acres of terrestrial habitat. Net gain of 957 acres of bottom-land hardwood waterfowl foraging habitat.	The nonstructural flood damage reduction feature includes reforestation of up to 55,600 acres of bottom-land hardwoods primarily at or below elevation 87 feet, NGVD. Guarantees 15,029 acres of reforestation for mitigation.

a/ Big Sunflower River Maintenance Project is currently being reanalyzed. These impacts are from the July 1996 report.

TABLE SEIS-60
SUMMARY OF NET EFFECTS
YAZOO BACKWATER AREA PROJECT ONLY (YBO)
AND WITH THE BIG SUNFLOWER RIVER MAINTENANCE PROJECT (WBSRMP) a/
YAZOO BACKWATER AREA REFORMULATION

Alternative	Terrestrial (AAHU)		Wetland (FCU)		Waterfowl (DUD)		Aquatic (AAHU)			
							Spawning		Rearing	
	YBO	WBSRMP b/	YBO	WBSRMP b/	YBO	WBSRMP b/	YBO	WBSRMP b/	YBO	WBSRMP b/
1	0	0	0	0	0	0	0	0	0	0
2	174,658	174,658	418,291	418,291	2,785,122	2,755,360	16,684	16,684	28,222	26,946
2A	114,286	114,286	273,704	273,704	1,567,899	1,567,899	10,917	10,917	17,582	17,582
2B	23,273	23,291	21,168	22,340	-582,837	-605,894	-5,227	-5,525	-29,156	-30,102
2C	160,618	160,618	384,666	384,666	2,392,091	2,392,091	15,343	15,343	24,710	24,710
3	-113	-113	-44,230	-45,469	-19,651	-43,405	-7,818	-8,141	-14,693	-15,880
4	52,355	52,355	96,712	89,507	489,407	460,786	913	568	-820	-2,060
5	78,188	78,188	172,525	169,086	977,406	949,525	5,850	5,444	7,201	5,836
6	114,534	114,534	264,164	263,466	1,754,222	1,725,753	10,889	10,472	16,642	15,265
7	174,906	174,906	414,102	414,177	2,846,517	2,812,951	18,010	16,628	28,243	26,811

a/ Only 90 percent of the reforestation acreage was used to estimate AAHUs, FCUs, and DUDs because up to 10 percent of the property could be used for other conservation purposes. YBO is the condition of the Yazoo Backwater Project without implementation of the Big Sunflower River Maintenance Project. WBSRMP is the condition of the Yazoo Backwater Project being in place and with the Big Sunflower River Maintenance Project implemented.

b/ To determine the cumulative impacts (WBSRMP) for waterfowl and aquatic resource categories, take B2 with project units and subtract from B1 baseline units. This gives the cumulative hydrologic impacts. The cumulative reforestation and construction impacts remain the same as the backwater project only (B1). The cumulative impacts (WBSRMP) for wetland and terrestrial categories are the same as the B2 values. The B1, B2, and B1 baseline units can be found in the terrestrial, wetland, waterfowl, and aquatic appendixes.

Although the project would be designed to avoid clearing of bottom-land hardwoods for borrow areas to the extent practicable, it is likely that additional bottom-land hardwoods would be impacted from borrow area construction. Adverse effects would occur from construction impacts only. The extent of clearing will not be known until the planning phase of that project. Appropriate NEPA documentation will be prepared to identify the project's effects and any compensatory mitigation requirements. The Steele Bayou and Little Sunflower structures were completed in 1969 and 1978, respectively. While maintenance of these structures is ongoing, replacement could be necessary at the end of their useful life or should they not be compatible with the Yazoo Backwater levee raise.

251. The Big Sunflower River Maintenance Project (a major maintenance operation) and some minor continuing authority projects will also be implemented in the near future. River stages within the Big Sunflower River Basin are currently 1 to 3 feet above the 1962 design flowline as a result of sedimentation and vegetation. The purpose of the Big Sunflower River Maintenance Project is to reestablish the 1962 postproject flowline. The Kings Point, Upper and Lower Deer Creek, and the Lake George Restoration projects (Continuing Authorities Projects) are being studied at this time. There may be other environmental restoration projects that have not yet been developed.

252. While some minor additional mitigation and public lands may be acquired, the future without-project projections do not include any additional significant acquisition of these lands or enrollments of WRP or CRP lands. The acquisition of any additional significant National Forest, National Wildlife Refuge, and mitigation lands is not likely to occur due to a lowering of the tax base in the area and the resultant impacts on local governments.

253. Pursuant to Senate Bill 2158 of the regular session of the Mississippi Legislature for the year 2000, the Board of Supervisors of Washington, Sharkey, Issaquena, Humphreys, Yazoo, and Warren Counties have the option to assess an annual fee not to exceed $4 per acre for each acre of land which any landowner within said county shall elect to place under a reforestation easement as a feature of the Yazoo Backwater project.

254. The incremental impact of the recommended plan (proposed action), when added to former, present, and foreseeable future actions, results in a net gain in environmental resources in the study area. Although the nonstructural flood damage reduction feature (reforestation) would significantly reduce the waterfowl foraging habitat value, the installation of waterfowl impoundments on 5 percent of lands acquired for the nonstructural feature will produce a net gain in foraging habitat. The recommended plan provides a net increase in terrestrial, wetland, waterfowl, and aquatic spawning and rearing resource values such that no significant

cumulative adverse environmental impacts result on an ecosystem, landscape, or regional scale when the proposed action is considered in conjunction with other activities (Table SEIS-61). The recommended plan would contribute to the long-term goal of habitat restoration and address the flood damage reduction needs of the study area.

MITIGATION

255. Mitigation is the process of avoiding, minimizing, and compensating adverse impacts. Environmental design and other measures have been incorporated to avoid and/or reduce adverse impacts. Aquatic spawning is the controlling resource for calculating mitigation. The mitigation acres needed to offset impacts to aquatic spawning will generate units for other resource categories that exceed the impacts to those resources. In addition, the Vicksburg District agreed with the local FWS Ecological Services Office to reanalyze the mitigation required for the previously constructed Yazoo Area and Satartia Area Backwater Levee Projects. (See Appendix 1 for a detailed mitigation analysis.)

256. There is no mitigation required for Alternatives 2, 2A, and 2C (nonstructural). To offset unavoidable impacts, Alternative 2B (nonstructural) requires 26,400 acres of reforestation/conservation easements and an additional 26,619 acres of fee title acquisition. Alternative 3 (structural) requires 53,363 acres of fee title acquisition and reforestation. Alternatives 4 through 7 are combinations of structural and nonstructural measures. The mitigation needed for Alternatives 4 through 7 is included as the minimum threshold within the nonstructural feature (Table SEIS-21). The minimum threshold is the acreage that would need to be reforested to compensate for the adverse effects from construction and operation of the pump station. The pump station will not be operated until the minimum number of acres to achieve a no net loss of environmental resource values achieved. The Vicksburg District is committed to the fee title acquisition and reforestation of lands to achieve a no net loss of environmental value should the minimum number of perpetual easement acres of reforestation not be achieved. Extensive data concerning mitigation can be found in Appendix 1.

257. The recommended plan provided a net gain in terrestrial, wetland, waterfowl, and aquatic spawning and rearing resource values (Table SEIS-62). Although there was a net increase in resource value, this assumed the reforestation component provided enough acres to offset the negative effects of the pump construction and operation. The wetland and spawning and rearing habitat had a loss in resource value and must be offset to achieve a no net loss in resource value. Spawning habitat required a minimum threshold of 10,662 acres of reforestation to achieve a no net loss. When this acreage is achieved, wetland functional value would achieve a net gain of 6,804 acres of bottom-land hardwood wetlands.

TABLE SEIS-61
POTENTIAL CUMULATIVE EFFECTS
RECOMMENDED PLAN
YAZOO BACKWATER AREA REFORMULATION

Potential Impact Area	Pump Construction	Operation	Reforestation	Past Actions	Other Present Actions	Future Actions	Cumulative Impact
Terrestrial	*	*	+++	***	*	*	+
Waterfowl	*	*	+++	***/+++	+	*	+
Wetlands	*	**	+++	***	+	*	+
Aquatic	*	**	+++	***	+	*	+
Water Quality	*	[]	++	**	+	[]	+
Threatened and Endangered Species	[]	*	++	***	+	[]	+
Compensatory Mitigation				+	+	+	+

KEY: * low adverse effect; ** moderate adverse effect; *** high adverse effect; + low beneficial effect; [] no effect; ++ moderate beneficial effect; +++ high beneficial effect.

TABLE SEIS-62
MITIGATION/MINIMUM THRESHOLD REFORESTATION REQUIREMENTS
RECOMMENDED ALTERNATIVE
YAZOO BACKWATER AREA REFORMULATION

Effect	Terrestrial		Waterfowl		Wetlands		Aquatic Spawning		Aquatic Rearing	
	AAHUs	Threshold Acres	DUDs	Threshold Acres a/	FCUs	Threshold Acres	AAHUs	Threshold Acres	AAHUs	Threshold Acres
Baseline	699,529	-	1,849,741	-	885,296	-	19,337	-	89,414	-
Structural										
Construction	-113	72	-2,166	4	-240	64	-27	59	-30	65
Hydrologic	239	0	77,973		-14,188	3,794	-1,580	10,603	-4,779	19,979
Total Structural	126	72	75,807	4	-14,428	3,858	-1,607	10,662	-4,809	20,044
Nonstructural										
Reforestation	78,062	0	-491,181	980	186,953	0	7,457	0	12,010	
Foraging	N/A	NA	1,392,780	0	N/A	N/A	N/A	N/A	N/A	N/A
Total Nonstructural	78,062	0	901,599	980	186,953	0	7,457	0	12,010	0
TOTAL	78,188	72	977,406	984	172,525	3,858	5,850	10,662	7,201	20,044

a/ Acres of waterfowl impoundments.

258. Two additional items involving past work were addressed (Appendix 1). The reanalysis of the Yazoo Area and Satartia Area Backwater Levee Projects determined that an additional 3,848 acres of reforestation are required to fully offset terrestrial losses. In addition, there were 215.2 acres cleared as part of the inlet and outlet channel construction in 1987. The compensatory mitigation for this increment of work is 519 acres of reforestation. To compensate these losses, the first 4,367 acres acquired and reforested through easements would be credited toward these losses.

259. In the event that the Vicksburg District is unable to secure enough perpetual conservation easements to achieve a no net loss of environmental resource value, prior to initial pump operation (15,029 acres), then the difference between the minimum threshold and the amount of perpetual easements already acquired from willing sellers will be purchased in fee title from willing sellers. The Vicksburg District will first seek suitable lands in the Yazoo Backwater Area, then the Yazoo-Mississippi Delta; however, if sufficient lands are unavailable, then the Vicksburg District will look to other areas in the Mississippi Alluvial Valley. Acquisition and reforestation/conservation features on frequently flooded agriculture lands for mitigation should not adversely affect any threatened or endangered species. Tracts acquired through fee title will have to be of sufficient size to allow for management or adjacent to state wildlife management areas or national wildlife refuges. Reforestation/conservation features will occur after acquisition. Management of any compensatory mitigation acquired in fee title will be turned over to other state or Federal agencies that do this type of management. Management funding will be a part of any compensatory mitigation acquisition. The offer to acquire the remaining perpetual easements for the nonstructural feature within the Yazoo Backwater Study Area will remain open for 10 years after the completion of pump station.

260. The guaranteed minimum reforestation will provide 100 percent compensation for all environmental impacts including: (a) the current Yazoo Backwater project; (b) past construction at the Yazoo Backwater pump station site in 1986; and (c) the remaining mitigation owed for construction of the Yazoo Area and Satartia Area Backwater Levee Projects. The minimum guaranteed acreage will also produce a no net loss of aquatic spawning habitat value and provide a 2.1 percent increase in terrestrial value, a 1.4 percent increase in waterfowl value, and a 2.4 percent increase in wetland value over baseline conditions.

SECTION 122 ITEMS

261. The 1970 River and Harbors Act, Section 122, requires impacts on the following items be addressed.

Noise

262. There would be periodic increases in noise levels at the pump station site during and after construction. Construction noises would be present for approximately 4 years at the pump station site. In addition, there would be minimal noise associated with the periodic operation of the pump station.

263. Sound levels inside the pump station have been evaluated. It is estimated that the sound pressure level inside the structure will be about 111 decibels (dB) with all 12 pumps operating. Triple pane spaced glass will be required between the pumps and the operator's station in order to achieve a typical office sound pressure level environment. Because the structure will be constructed of concrete precast panels with a hollow masonry block resonator wall interior, it is anticipated that the exterior sound pressure level at the structure will be about 60 dB (the same level as average speech). Such a low sound level outside the building is considered quiet when compared to the nearby highway (about 85 dB).

Displacement of People

264. The project would reduce flooding and the associated financial and psychological hardships. None of the alternatives, other than alternatives that include relocation (Alternatives 2B and 2C), should result in the displacement of any households. Relocations have been addressed in the descriptions of those alternative plans.

Esthetic Values

265. Construction of the pump station and the reforestation feature will have short- and long-term effects on the esthetics of the study area. Construction of the pump station will have short-term adverse impacts on the natural esthetics at and adjacent to the site. These impacts will result from debris piling or burning, floating debris, and muddied waters at the site. After construction, the pump station would replace areas that provide natural esthetics with manmade facilities. Reforestation of up to 55,600 acres of cleared land should improve the esthetic value of portions of the study area.

Community Cohesion

266. The cultural heritage of the study area is linked to a predominantly agricultural-based lifestyle. The stability of this lifestyle is based on the continuation of an agricultural economy. Flood reduction in communities would ensure the continued existence of the agricultural economy and reduce the fragmentation and duress on individuals, families, and communities. This is especially true of low-income and minority residents (see Environmental Justice attachment to Appendix 8).

Displacement of Businesses and Farms

267. Reforestation of up to 55,600 acres of cleared lands would remove these acres from cultivation on local farms. No nonfarm businesses would be displaced by the recommended plan.

Public Services and Facilities

268. Local governmental units provide basic public services including education, police protection, various county social welfare services, and road and bridge maintenance. As stated previously, the local sponsor (the Board of Mississippi Levee Commissioners) was instrumental in getting the Mississippi Legislature to pass a law to protect the counties from losing revenue on reforestation. This law allowed easement lands to be assessed a fee equal to the loss of revenue resulting from the change of land use for this project. This fee is a county option by each county Board of Supervisors in the study area and cannot exceed $4 per acre.

Community and Regional Growth

269. The project could result in some minor growth of areas adjacent to existing urban areas. However, the project is not expected to significantly affect community and regional growth. No businesses will be directly affected by the project, and no farms will be displaced unless the landowner desires to do so, provided that the land is at or below elevation 87.0 feet, NGVD.

Employment

270. Construction, operation, and maintenance of the pump station would have a short-term positive impact on employment. Employment impact would occur during the 4-year construction period, but no long-term effect from project-related employment is expected.

Air Quality

271. Construction and operation of the pump station will result in some periodic impacts on air quality at the pump station site. Loss of vegetative cover and disruption of soils and vehicular traffic will result in increased dust in the site. An assessment for the potential for this dust to contain contaminants has been made, and it has been determined that there should not be any adverse health effects due to this effect at the pump station site. Any unavoidable burning of construction debris will adversely affect local air quality levels. The pump station would be powered by diesel engines and will comply with EPA standards. There would be periodic exhaust emissions at the pump station site.

RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF SOCIETY'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

272. Historically, flood damage reduction benefits and adverse environmental impacts represented trade-offs between the local short-term use and the long-term stability and productivity of society's environment. The recommended plan, however, represents a balanced approach to solving the flood damage reduction and environmental opportunities in the study area.

273. The recommended plan reduces damages to residential and nonresidential property, agricultural crops and nonagricultural crop items, public roads and bridges, and other amenities and provides a net gain in environmental resource values. It does so by a combination of structural and nonstructural flood damage reduction features.

274. Although adverse effects to environmental resources would result from the operation of the pump station and the clearing of 38 acres of bottom-land hardwoods and filling of 5.6 acres of seasonal open water, the nonstructural flood damage feature (reforestation) provides substantial environmental benefits. The net effect of the structural and nonstructural flood

damage reduction features is a net increase of 30.3 percent in aquatic spawning resource value, 8 percent increase in aquatic rearing resource value, 19.5 percent increase in wetland resource value, 11.2 percent increase in terrestrial resource value, and a 52.8 percent increase in waterfowl resource value.

275. Structural flood damage reduction is being provided above elevation 87 feet, NGVD, and nonstructural flood damage reduction is being provided primarily at or below 87 feet, NGVD. This combination represents a balanced approached toward addressing the short-term use and the long-term stability and productivity of wildlife resources and society's environment.

ANY IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES INVOLVED IN THE PROPOSED ACTION SHOULD IT BE IMPLEMENTED

276. Adverse environmental effect would be irreversibly and irretrievably lost, although mitigation features would be an irreversible gain. Approximately 18,000 acres of the 26,300 acres of wetlands are classified as forested or reforested and would potentially lose their Federally defined classification. Approximately 11,000 of these acres are in some form of public protection and will have a low probability of being cleared. Implementation of the recommended plan would irreversibly and irretrievably commit the lands and resources associated with up to 55,600 acres of reforestation/conservation features and the 38 acres of forested wetlands and 5.6 acres of open water at the pump station to other uses. The reforested lands would have to remain in a forested condition. Normal silvicultural practices would be allowed. The recommended plan also commits labor and material, planning and technical expertise, and monetary resources.

LIST OF PREPARERS

277. A list of preparers is shown in Table SEIS-63.

PUBLIC INVOLVEMENT, REVIEW, AND COORDINATION

PUBLIC INVOLVEMENT

278. A Notice of Intent to prepare a DSEIS was filed on 6 October 1993. A public scoping meeting was held in Rolling Fork, Mississippi, in November 1993. The meeting was advertised in the local newspaper, and 50 people attended the meeting, excluding Vicksburg District and cooperating agency personnel. Extensive briefings, meetings, and workshops were conducted to

TABLE SEIS-63
LIST OF PREPARERS

Name	Discipline/Expertise	Experience	Role in Preparing SEIS or Supporting Appendixes
Basil K. Arthur	B.S., Civil Engineer; M.S., Hydraulics	25 years, Hydraulics; 10 years, Civil, U.S. Army Corps of Engineers	Hydraulics Design team member and reviewer
Jeff Artman	B.S., Mechanical Engineering; M.S., Engineering Management	15 years, Mechanical Engineer; 7 years, Value Engineer, 1 year, River Operations, U.S. Army Corps of Engineers	Mechanical design-pumps and prime movers
Terry Baldridge	B.S., Agricultural Economics; M.S., Agricultural Economics	6 years, Research Associate; 13 years, Regional Economist, U.S. Army Corps of Engineers	Analysis of agricultural and structural damages
Larry Banks	B.S., Agricultural Engineering	37 years, Hydraulic Engineer; former Chief, Hydraulics Branch, U.S. Army Corps of Engineers. Currently Chief, Watershed Division, Mississippi Valley Division	Participation and review of H&H analysis and technical appendix
Billye Barfield	Civil Engineer Technician	27 years, Planning, Programs and Project Management Division, U.S. Army Corps of Engineers	Report assembly
Charles Baxter	B.S., Wildlife Science	30 years, Conservation Planning and Implementation, U.S. Fish and Wildlife Service	Team Leader (Mississippi Valley Division)
Jeannine Beatty	Program Support Assistant	3.5 years, Social Security Administration; 27 years, U.S. Army Corps of Engineers	Report preparation
Jerry Bolton	Biology/Ecology	13 years, NEPA and related studies, Gulf South Research Corporation	Data collection, pondberry report review
Tonya Bolton	Biology/Wildlife Management	1 year, NEPA and related studies, Gulf South Research Corporation	Data collection, pondberry report
Jacob Brister	B.S., Agricultural Business; M.S., Agricultural Economics	4 years, economist, U.S. Army Corps of Engineers	Analysis of structural and agricultural damages, GIS, Socioeconomic Appendix
Tad Britt	B.S., History; M.A., Anthropology	5 years, Consulting Archeologist; 6 years, Archeologist, U.S. Army Corps of Engineers	Cultural resources
Robert Burke	B.S., Agricultural Economics; M.S., Agricultural Economics	1 year, Real Estate Appraiser; 4 years, Economist; 25 years, Regional Economist, U.S. Army Corps of Engineers	Review of Economics Appendix and supporting attachments, prepared impacts assessment attachment
John Burnworth	B.S., Civil Engineering; M.S., Civil Engineering	32 years, Structural Engineer, U.S. Army Corps of Engineers	Structural ITR team member
Marvin Cannon	B.S., Biology	31 years, Biologist, U.S. Corps of Engineers	Technical Review (FSEIS and NEPA)
Brian Chewning	B.S., Agricultural Economics; MBA	4 years, Economist; 2 years, Regional Economist; 7 years Project Management, U.S. Army Corps of Engineers	Prepared Agricultural Risk and Uncertainty Attachment
Jay Cline	Biology/Ecology	3 years, NEPA studies, Gulf South Research Corporation	Data collection, pondberry report
Billy Cook	Associate Degree, Applied Science	27 years, Engineering Services/ Surveying	Survey Manager
Myra Dean	Program Analyst	31 years, U.S. Army Corps of Engineers	Report preparation

TABLE SEIS-63 (Cont)

Name	Discipline/Expertise	Experience	Role in Preparing SEIS or Supporting Appendixes
Phil D. Dye	B.S., Civil Engineering	3 years, Mississippi Department of Transportation; 16 years, Hydraulics and Hydrology; and 3 years, Information Management, U.S. Army Corps of Engineers	GIS
Paul Eagles	B.S., Civil Engineering	20 years, Planning and Project Management, U.S. Army Corps of Engineers	Technical Review Team Leader
Darrel E. Evans	B.S., Wildlife Zoology; M.S., Forest Wildlife Management	8 years, Research Specialist, Austin State University; 16 years, Research Wildlife Biologist, ERDC	Waterfowl Appendix
Robert Fitzgerald	B.S., Civil Engineering	29 years, Hydraulics, Hydrologic Engineering, River Stabilization and Design, U.S. Army Corps of Engineers; Engineering and Construction Division Chief	Hydraulics and Hydrologic Engineering Analysis through June 1996
Marty Garton	B.S., Ag Engineering; M.S., Civil Engineering	28 years, Study Manager; 2 years, Senior Project Manager, U.S. Army Corps of Engineers	Team Leader and draft Main Report Preparation
Bobby Gilliam	B.S., Agricultural Economics	1 year, Statistician, CSRS; 8 years, Economist; 14 years, Regional Economist, U.S. Army Corps of Engineers	Conducted analysis of rural and urban structures damages.
Shauna Ginger	B.S., Zoology; M.S., Wildlife Ecology	2 years, Research Assistant, Louisiana State University (Black Bear Field Crew Leader); 3 years, U.S. Fish and Wildlife Service with rare species	Remote-sensing assessment of impacts to Louisiana black bear, review of Biological Assessment, Louisiana black bear
Ron C. Goldman	B.S., Civil Engineering	28 years, Water Control, Hydrology Information Management, U.S. Army Corps of Engineer; and Chief, Hydraulics Branch	Hydraulic design team member and reviews
Phil Hegwood	B.S., Engineering	32 years, U.S. Army Corps of Engineers	Cost Engineering
James Henderson	B.S., Botany/Ecology	12 years environmental field studies, Gulf South Research Corporation.	Field surveys for pondberry
Tom Hill	B.S., Agricultural Economics; M.S., Agricultural Economics	2 years, Economist, Natural Resource Conservation Service; 25 years, Regional Economist, U.S. Army Corps of Engineers	Economics Appendix
Robert Hite	BSME, Mechanical Engineering	19 years, Mechanical Engineer, U.S. Army Corps of Engineers	Evaluated existing gate machinery and performed gate machinery design. Many aspects of mechanical engineering.
Michael Hudson	M.S., Botany/Ecology	4 years, NEPA and environmental studies, Gulf South Research Corporation.	Field surveys and statistics for pondberry
Chris Ingram	M.S., Biology/Ecology	30 years, NEPA and related studies, Gulf South Research Corporation	Project Manager, pondberry report
Curtis James	B.S., Wildlife Management	35 years, wildlife biologist	Fish and Wildlife Coordination Act Report
David Jenkins	B.S., Civil Engineering	13 years, Cost Engineering, Project Management, U.S. Army Corps of Engineers	Cost estimates

TABLE SEIS-63 (Cont)

Name	Discipline/Expertise	Experience	Role in Preparing SEIS or Supporting Appendixes
Dan Johnson	B.S., Civil Engineering	33 years, Planning, Programs, and Project Management Division, U.S. Army Corps of Engineers	Supervision of overall document development
David Johnson	B.S., Biology	27 years, Environmental Engineer; currently Chief, Water Quality Section, U.S. Army Corps of Engineers	Water Quality team leader, Water Quality and Wetland Appendixes, and geographic information system mapping-stage area curve development, remote sensing
Lloyd E. Inmon	B.A., Agricultural Economics; M.S., Fishery Biology	18 years, Sections 10 and 404 reviews; 16 years, U.S. Fish and Wildlife Service	Review of Water Quality Appendix
Jack Killgore	Ph.D., Biology	27 years, Research Fishery Biologist, U.S. Army Engineer Research and Development Center	Aquatic Appendix
Wendell King	B.S., Biology; M.S., Biology	3 years, Biologist, Mississippi Department of Environmental Quality; 25 years, U.S. Army Corps of Engineers	Section 404(b)(1) Evaluation and Endangered and Threatened Species
Greg Lacy	M.S., Wildlife Biology	5 years, environmental studies, Gulf South Research Corporation	Field survey and report
Fred Lee, Jr.	BSME, Mechanical Engineering	5 years, Reactor Plant Overhaul Engineer, Ingalls Shipbuilding, Pascagoula, MS; 33 years, mechanical engineer, U.S. Army Corps of Engineers	Senior Mechanical Design Engineer
Edna Lee-Jackson	AAAS, Hinds Community College	30 years, Program Analyst, U.S. Army Corps of Engineers	Funds management
Cindy Lyons	B.A., Economics	13 years, Economist; 16 years Regional Economist, U.S. Army Corps of Engineers	Economic Appendix and Environmental Justice
Matthew Mallard	B.S., Wildlife Management	5 years, Biology, U.S. Army Corps of Engineers	Data collection and analysis
Rose McCullough	Senior Computer Operator	10 years, U.S. Army Engineer Research and Development Center; 30 years, U.S. Army Corps of Engineers	Report preparation
Charles McKinnie	B.S., Civil Engineering	3 years, Civil Engineer; 24 years, Hydraulic Engineer, U.S. Army Corps of Engineers	Engineering Division and Hydraulics Branch Team Leader. Assembled and prepared Engineering and H&H Appendix
Curtis McMurl	M.S., Zoology	4 years, Fish and Wildlife Biology and GIS Applications, U.S. Fish and Wildlife Service	GIS Data Analysis
Ron Nassar	Ph.D., Wildlife and Fisheries Sciences	16 years, Wetland Management and Rehabilitation, U.S. Fish and Wildlife Service	Technical Advisor
Sharon Newman	GIS/Graphics	11 years, GIS analysis, Gulf South Research Corporation	Graphics and GIS, pondberry report

TABLE SEIS-63 (Cont)

Name	Discipline/Expertise	Experience	Role in Preparing SEIS or Supporting Appendixes
Kent Parrish	B.S., Ag Engineering; M.S., Business Administration	7 years, Asst Project Engineer, Soil Conservation Service; 12 years, Study Manager; 11 years, Senior Project Manager, U.S. Army Corps of Engineers	Senior Project Manager/Team Leader and Main Report Preparation
Allen Perry	B.S., Civil Engineering	29 years, Civil/Structural, U.S. Army Corps of Engineers, Mississippi Valley Division	Reviewer Structural Design
Fred Pinkard, Jr.	B.S., Civil Engineering M.S., Civil Engineering	14 years, Civil Engineer; 11 years, Hydraulic Engineer, U.S. Army Corps of Engineers	Water Quality
Maria Reed	M.S., Ecology	4 years, environmental studies, Gulf South Research Corporation	Field surveys for pondberry
Mike Renacker	B.S., History; M.A., Historical Archeology	4 years, contract archeologist; 3 years, archeologist, U.S. Army Corps of Engineers; 1 year, Project Management	Project Manager, report production, Project Summary, project video
Karen Myers	B.S., Biology	26 years, Biology, U.S. Army Corps of Engineers	Water Quality Analysis
Will McDearman	B.S. Zoology; M.S., Botany	12 years, U.S. Fish and Wildlife Service; 17 years, Mississippi Department of Wildlife, Fisheries and Parks; 1 year, Nature Conservancy conservation, management of biodiversity, and rare species	Assessments to Louisiana black bear and pondberry. Preparation of Biological Opinion for pondberry.
Bill Roberts	B.S., Vocational Agricultural	25 years, Real Estate Appraiser	Real Estate
Rick Robertson	B.S., Civil Engineering	1 year, Civil Engineer; 32 years, Hydraulic Engineer, U.S. Army Corps of Engineers	Independent Technical Review Team
Lee Robinson	B.S., Agricultural Economics	4 years, loan officer, FmHA; 2 years Economist; 17 years Regional Economist; 1 year, Economic Analysis Team Leader, U.S. Army Corps of Engineers	Technical Review
Tommy Runnels	Hydrologic Technician	18 years, Survey; 16 years, Hydrologics	Computer graphics/survey party coordinator
John Segrest	B.S., Agricultural Economics; M.S., Agricultural Economics	22 years, U.S. Army Corps of Engineers; 19 years, Appraisal; 3 years, acquisition; 7 years Realty Specialist, Mississippi Valley Division	Real Estate Cost Estimates
Daniel R. Smith	M.S., Ecology	2 years, Southern Illinois University; 2 years, Illinois Department of Mines; and 21 years, Plant Ecology, Wetland Assessment, and Watershed Assessment, U.S. Army Corps of Engineers	Wetland Assessment Appendix
Steve Smith	Range Conservation	8 years, NEPA and T&E surveys, Gulf South Research Corporation	Data collection, pondberry report management
Terry Smith	B.S., Engineering; M.S., Engineering	26 years, Project Management, Hydrology and Hydraulics, U.S. Army Corps of Engineers; 1 year, Mississippi Valley Division	Project Management/ Mitigation; Main Report and SEIS, Biological Assessment on pondberry

TABLE SEIS-63 (Cont)

Name	Discipline/Expertise	Experience	Role in Preparing SEIS or Supporting Appendixes
Sam Stacy	B.S., Civil Engineering; M.S., Civil Engineering	24 years, Geotechnical Engineer, U.S. Army Corps of Engineers	Geotech Team Leader
Barry Sullivan	B.S., Civil Engineering	5 years, Hydraulic Engineer; 13 years, Environmental Engineer, U.S. Army Corps of Engineers	Water Quality, geographic Information System mapping
Thomas Tucker	B.S., Civil Engineering; M.S., Engineering	4 years, co-op, engineer in training; 27 years, Structural/Civil Engineer, U.S. Army Corps of Engineers	Structural/Civil Design Team Member
Michael Turner	B.S., Civil Engineering	2 years, Production Engineer, McDermott Inc., Morgan City, LA; 18 years, Structural Engineer, U.S. Army Corps of Engineers	Surveys and mapping
William Uihlein	Ph.D., Forest Resources	3 years, Landscape Migratory Bird Conservation Planning, U.S. Fish and Wildlife Service	GIS Data Analysis and Technical Advisor
Robert Ulmer, Jr.	B.S., Geology	4 years, Hydrologic Engineering Technician; 16 years, Geologist, U.S. Army Corps of Engineers	Regional and site geology
Jim Wakeley	Ph.D., Wildlife Biology/Wetlands	10 years, Associate Professor of Wildlife/Ecology, Penn State University; 21 years, Research Wildlife Biologist, U.S. Army Engineer Research and Development Center	Terrestrial Appendix
David Wallace	B.S., Civil Engineering; M.S., Environmental Engineering	17 years, Environmental Engineer, U.S. Army Corps of Engineers	HTRW Team Leader. HTRW and water quality
Ramona Warren	B.S., Biology M.S., Environmental Science	4 years, Natural Resources Conservation Service; 26 years, Biology, U.S. Army Corps of Engineers	Biological assessment
Russ Watson	B.A., Biology	32 years, Fish and Wildlife Biology and Ecological Sciences, U.S. Fish and Wildlife Service	Author and Technical Advisor on FWCA
Eric Webb	Ph.D., Wetlands Ecology	15 years, NEPA, and environmental studies	Senior technical review, pondberry studies
Michael Weiland	B.S., Civil Engineering	30 years, Structural Engineer, U.S. Army Corps of Engineers	Structures Team Leader
Ken White	B.S., Business M.S., Business Administration	32 years, Real Estate Appraiser	Real Estate
Tim Wilkins	B.S., Wildlife Management M.S., Business Administration	36 years, Wildlife Management, Wetland Restoration, U.S. Fish and Wildlife Service	Assistant Team Leader and Technical Advisor; Report and SEIS
Joey Windam	B.S., Civil Engineer	5 years, Hydraulics Branch, U.S. Army Corps of Engineers	Hydraulics Design team member and reviewer
Sheyna Wisdom	B.S., Biology	4 years natural resources and NEPA studies, Gulf South Research Corporation	Data collection and analysis, pondberry report preparation
Robert Wood	B.S., Real Estate	21 years, Real Estate Appraiser, U.S. Army Corps of Engineers; 10 years, private sector	Real Estate Cost Estimates

TABLE SEIS-63 (Cont)

Name	Discipline/Expertise	Experience	Role in Preparing SEIS or Supporting Appendixes
Gary Young	B.S., Forestry/Wildlife Management; M.S., Forestry	4 years, Forest Service; 13 years, Biologist; currently Environmental Team Leader, U.S. Army Corps of Engineers	SEIS, NEPA Biological Assessment Endangered Species Coordination.
Jeannette Younger	Associate of Science, Drafting and Design	29 years, Civil Engineering Technician, U.S. Army Corps of Engineers	Drawings

help identify and modify alternatives and build a consensus among interested parties (see "PRELIMINARY SCREENING" section and Table SEIS-2). These meetings included a public meeting held in Rolling Fork on 9 November 2000 after release of the Draft Main Report, SEIS, and supporting documentation for review by agencies, organizations, groups, and individuals. After the 45-day comment period, the Vicksburg District had received approximately 1,400 cards and letters, 4,000 e-mails, and 1 petition with over 100 names on the report. The District then began incorporating the comments into the final Main Report and FSEIS. The Vicksburg District continued coordination efforts with cooperating agencies during 2000 to 2003. The Vicksburg District, FWS, and EPA held an interagency meeting 14-15 January 2003, focusing on wetlands. All agencies participated in the wetland field sampling exercise that resulted from this interagency meeting during 2003. During July 2005, the Vicksburg District released revised draft environmental appendixes to cooperating agencies that included interagency revisions. The agencies participated in an environmental workshop, reviewing results of EMAP investigations by EPA. The Vicksburg District transmitted the Endangered and Threatened BA to FWS on 5 December 2005 and requested formal consultation concerning potential impacts to the endangered plant pondberry. Formal consultation began on 18 January 2006 and resulted in a final BO by FWS on 2 July 2007. Additional documentation of the extensive coordination efforts for this study is contained in Appendix 5. This final Main Report, FSEIS, and supporting documentation will be sent to agencies, organizations, groups, and individuals for review and comment.

COOPERATING AGENCIES

279. The NRCS, EPA, FWS, USDA FS, MDEQ, and MDWFP were cooperating agencies during this study. These agencies were involved at various stages of the NEPA process during this study. All of them participated in the scoping process, helping to determine significant resources in the study area, impacts to significant resources, and suggested alternatives. They participated on a consensus committee to help guide the study. They also provided professional expertise when it was necessary during the study. The FWS and MDWFP were members of the Aquatic and Terrestrial HEP teams. As team members, they helped select the evaluation species, approved of the sampling schemes for these resources, helped develop the HSI values for the aquatic evaluation by using the Delphi technique, and helped guide the HEP evaluations. The FWS and EPA participated in the wetland field verification process. The new wetland evaluation used in the Final SEIS and appendixes was coordinated extensively with EPA as it was developed. The FWS prepared the Waterfowl Appendix for the draft SEIS, with ERDC preparing the final Waterfowl Appendix using the FWS outline from the draft Waterfowl Appendix. All of the agencies reviewed the draft SEIS and appendixes when it was coordinated with the public, and they all reviewed and some commented on draft environmental appendixes prepared for the FSEIS. They may review and some provide comments on the FSEIS and appendixes when they are released to the public.

COORDINATION AND REVIEW –
FISH AND WILDLIFE SERVICE

280. While there were many interagency comments, this section provides responses to recommendations contained in the FWS final Fish and Wildlife Coordination Act Report of 23 October 2006.

General. "As stated earlier, the Service's goal for the YBWA Reformulation Study is the implementation of a project that will support ecologically and economically sustainable development. The Service's desire and expectation is that a project will be implemented, one that reflects a fundamental change in the historic direction of flood control within the YBWA. To achieve this goal, such a project must continue the ongoing realignment of land use and land capability to restore a sustainable balance between agricultural development and wetland conservation within the YBWA. It must realize a new direction in water and land resource development, and must restore and maintain natural flood plain values and functions in the YBWA."

Response. The recommended plan, combining nonstructural (reforestation) and modified structural (higher pump-on elevation) features, provides a balanced water resource plan that will benefit both the environment and sustain the economy of the Yazoo Backwater Study Area. It was formulated in accordance with the Economic and Environmental Principles and Guidelines for Water and Related Land Resource Implementation Studies. The recommended plan increases the natural flood plain values and functions in the Yazoo Backwater Study Area. The recommended plan accomplishes both goals and does so utilizing both structural and nonstructural (reforestation) features to address the flood damage reduction and environmental needs of the Yazoo Backwater Study Area.

Specific Recommendations

281. Prior to its specific recommendations, FWS stated: "As such, the U.S. Fish and Wildlife Service would support a combined structural/nonstructural response to the flood damages associated with the Yazoo Backwater Area that contains the following elements and features."

a. Recommendation 1. "Adverse impacts to jurisdictional and shorter hydro-period areas and associated fish and wildlife values are fully assessed and fully mitigated prior to project operations."

Response. As set forth fully above and in Appendix 10, the Vicksburg District evaluated wetlands extent and wetlands impacts and compared results of various methodologies. The wetland functional assessment calculates the impacts to Federally defined wetlands and shorter hydroperiod areas. The recommended plan fully offsets any impacts to both categories. In addition, the aquatic, terrestrial, and waterfowl appendixes also address the impacts to the fish and wildlife resource values. The Vicksburg District has committed to acquiring reforestation acreage sufficient to offset any adverse environmental impacts of the project prior to pump (structural) operations.

b. Recommendation 2. "The restoration of natural flood plain values through nonstructural flood control is incorporated as an authorized National Ecosystem Restoration (NER) project purpose."

Response. The nonstructural (reforestation) features of the recommended plan will restore natural flood plain values. The current Yazoo Backwater project analysis evaluated a range of flood control alternatives that included a combination of structural and nonstructural components. All of the alternatives in the final array, except Alternative 3, included some form of nonstructural features. Based on a thorough economic and environmental analysis, Alternative 5 was selected as the recommended plan based on the current guidelines for USACE water resources projects. Even though this is not an environmental restoration project, the recommended plan includes reforestation/conservation features on up to 55,600 acres of farmland that are primarily located at or below the 1-year frequency flood plain. Reforesting these lands permanently removes them from agricultural production, restoring natural flood plain values.

c. Recommendation 3. "A separable, spatially explicit nonstructural flood damage reduction zone (NSFDRZ) that encompasses the 2-year frequency event is implemented as an NER project purpose."

Response: A nonstructural plan was included at the request of FWS to evaluate the purchase of easements on those agricultural lands below the 2-year frequency flood (Alternative 2). This alternative was not economically justified, but was carried forward for environmental evaluation in this FSEIS. There is no support by the sponsor for creation of an NSFDRZ.

d. Recommendation 4. "Perpetual conservation easements are offered on the 95,600 acres of cleared wetlands and on the 81,800 acres of forested wetlands in the 2-year flood plain."

Response. A plan with these features (Alternative 7) was evaluated. This alternative was not economically justified, but was carried forward for environmental evaluation in this Final SEIS. In addition, the 95,600 acres of cleared lands within the 2-year flood plain are not all wetlands. There are only 35,500 acres of cleared wetlands in the Yazoo Backwater Study Area, and all of them are targeted for reforestation under the recommended plan. The Vicksburg District concluded that there is no reason to obtain perpetual conservation easements on forested wetlands because the probability of additional clearing is low.

e. Recommendation 5. "Historic backwater flows from the Mississippi River are reintroduced up to the 87-foot, NGVD, elevation."

Response. At the request of FWS, two alternatives (Alternatives 6 and 7) were analyzed for introducing backwater flows from the Mississippi River up to elevation 87.0 feet, NGVD. This elevation refers to the 1-year flood plain under current conditions and is based on all flood events, both headwater and backwater at the Steele Bayou structure. While Alternative 6 was economically justified, Alternative 7 was not, but both alternatives were carried forward for evaluation in this FSEIS. Alternative 5 is the recommended plan because it has more excess benefits than Alternative 6. The cost for environmental benefits is maximized with Alternative 5. Moreover, the current operation of the Steele Bayou Structure (closing gates at 75 feet, NGVD, when the Mississippi and Yazoo Rivers are higher than the interior ponding areas) was addressed in prior studies and reports.

f. Recommendation 6. "Construction of localized levees and pumps as necessary to provide Project Design Flood protection for the Cary/Rolling Fork/Anguilla area. In making this recommendation, the Service acknowledges that such features are likely to lack economic justification solely on the basis of flood damages prevented. However, we believe such features should prove fully justifiable as economic restoration features and as features designed to ensure that these communities are able to sustain themselves in the face of the otherwise catastrophic impacts of the Project Design Flood."

Response. While this recommendation might provide protection of these three areas from this most extreme event, such levee actions lack economic justification, as FWS acknowledges. This proposal is not comprehensive enough to protect the hundreds of other basin developments subject to flooding in the Project Design Flood, and is not compatible with actions taken in other large metropolitan areas throughout the Nation in which no specific protection from events similar to the Mississippi River Project Design Flood were provided. The purpose of this Final EIS and Report was to provide protection from the 100-year Yazoo Backwater flood and not the Mississippi River Project Design Flood.

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ENVIRONMENTAL IMPACT STATEMENT
YAZOO BACKWATER PROJECT

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