Recommended Determination of the U.S. Environmental Protection Agency Region IV Pursuant to Section 404(c) of the Clean Water Act Concerning the Yazoo Backwater Area Pumps Project in Humphreys, Issaquena, Sharkey, Warren, Washington, and Yazoo Counties, Mississippi

U.S. Environmental Protection Agency
Region IV

June 23, 2008

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I. Executive Summary

The Yazoo Backwater Area Project is a U.S. Army Corps of Engineers (the Corps) Civil Works project designed to address flooding concerns in a 630,000 acre area situated between the Mississippi and Yazoo Rivers in west-central Mississippi (Yazoo Backwater Area). The primary component of this project is a 14,000 cubic feet per second (cfs) pumping station that would pump floodwater out of the Yazoo Backwater Area during high water events on the Mississippi River.

According to the Corps, the Yazoo Backwater Area contains between 150,000 to 229,000 acres of wetlands, as well as an extensive network of streams, creeks, and other aquatic resources. Extensive information collected on the Yazoo Backwater Area demonstrates that it includes some of the richest wetland and aquatic resources in the Nation. These include a highly productive floodplain fishery, substantial tracts of highly productive bottomland hardwood forests that once dominated the Lower Mississippi River Alluvial Valley (LMRAV), and hemispherically important migratory bird foraging grounds. These wetlands provide important habitat for an extensive variety of wetland dependent animal and plant species, including the Federally protected Louisiana black bear and pondberry plant. In addition to serving as critical fish and wildlife habitat, project area wetlands also provide a suite of other important ecological functions. These wetlands protect and improve water quality by removing and retaining pollutants, reduce flood damages by storing floodwaters, maintain stream flows, and support aquatic food webs by processing and exporting significant amounts of organic carbon.

Construction and operation of the proposed pumps would dramatically alter the timing, and reduce the spatial extent, depth, frequency, and duration of time project area wetlands flood. These large-scale hydrologic alterations would eliminate or significantly degrade the critical ecological functions provided by approximately 67,000 acres of wetlands in the Yazoo Backwater Area, including those functions that support wildlife and fisheries resources.

The Yazoo Backwater Area Project has a long and difficult history. It was first authorized by the United States Congress in the Flood Control Act of 1941 (Flood Control Act of 1941; P.L. 77-228, August 18, 1941). The U.S. Environmental Protection Agency (EPA) has been an active participant in the review of this project for the past thirty years and has consistently raised concerns during this period regarding the project's anticipated extensive and unacceptable adverse environmental impacts. When the Corps published the Draft Supplemental Environmental Impact Statement (DSEIS) for the proposed project in September 2000, EPA concluded that the project was environmentally unsatisfactory and noted that it was a candidate for further action under Clean Water Act (CWA) section 404(c). The U.S. Fish and Wildlife Service (FWS) has raised similar concerns regarding the proposed project since the mid-1950s.

The Corps published a Final Supplemental Environmental Impact Statement (FSEIS) for the project in November 2007. Since no substantive modifications had been made to the proposed pumps project after the 2000 DSEIS, on March 19, 2008, EPA issued a

Proposed Determination to prohibit the project based on anticipated unacceptable adverse impacts to wildlife and fisheries pursuant to CWA section 404(c). EPA solicited public comments on the Proposed Determination and held a public hearing in Vicksburg, MS, on April 17, 2008. EPA received over 47,600 written comments on the Proposed Determination. Of these approximately 47,600 comments, 99.91 percent urged EPA to prohibit the proposed pumps project while approximately 0.084 percent supported construction of the proposed pumps project. Among those in support of EPA's position is the FWS, which concurred with EPA's conclusion that the proposed project would result in extensive and unacceptable adverse impacts to wildlife and fisheries. FWS also highlighted its concerns that the proposed project would significantly degrade the wildlife habitat provided by its four National Wildlife Refuges located within the Yazoo Backwater Area - reducing the capability of these refuges to achieve the purpose and intent for which they were Congressionally established.

EPA Region IV has carefully considered the record developed by EPA and the Corps, including information in the FSEIS, public comments, information presented at the public hearing, and submissions by other federal and state agencies. EPA Region IV has determined that the proposed discharge of fill material into 43.6 acres of wetlands and other waters of the United States in connection with the construction of the pumping station and the subsequent secondary impacts, would result in unacceptable adverse effects to at least 67,000 acres of wetlands and other waters and their associated wildlife and fisheries resources. Therefore, EPA Region IV recommends that action be taken under section 404(c) of the CWA to prohibit the specification of the subject wetlands and other waters of the United States within Humphreys, Issaquena, Sharkey, Warren, Washington, or Yazoo Counties, MS, as a discharge site for dredged or fill material for the purpose of construction of the proposed project or any similar pump project in the Yazoo Backwater Area that would result in an unacceptable adverse effect to the waters of the United States.

The FSEIS conservatively estimates that the proposed project would result in adverse impacts to approximately 67,000 acres of wetlands in the Yazoo Backwater Area. EPA Region IV's review of the record identified as much as an additional 24,000 acres of wetlands in the Yazoo Backwater Area that would potentially be adversely impacted by the proposed project. The Region does not believe that adverse impacts to 67,000 acres of wetlands as described in the FSEIS, much less the additional 24,000 acres of wetland impacts identified by the Region, are consistent with the requirements of the CWA. Further, these impacts must be viewed in the context of the significant cumulative losses across the LMRAV, which has already lost over 80 percent of its bottomland forested wetlands, and specifically in the Mississippi Delta where the proposed project would significantly degrade important remnant bottomland forested wetlands.

EPA Region IV does not believe the potential impacts of the Yazoo Backwater Area Project can be adequately mitigated to reduce the impacts to an acceptable level. Additionally, the Region does not believe that the environmental benefits suggested by the FSEIS to accrue from the project's nonstructural component (e.g., the reforestation of up to 40,571 acres) have been substantiated. The Region supports the goal of providing improved flood protection for the residents of the Mississippi Delta; however, it believes that this vital objective can be accomplished in a manner that ensures effective protection for the area's valuable natural resources. In light of existing information, the Region believes that there are likely to be less environmentally damaging practicable alternatives available to achieve the improved flood protection goals of the proposed Yazoo Backwater Area Project.

II. Introduction

This document explains the basis for EPA Region IV's recommendation to prohibit the specification of certain waters of the United States within Humphreys, Issaquena, Sharkey, Warren, Washington, or Yazoo Counties, Mississippi as a discharge site for dredged or fill material for the purpose of construction of the proposed project or any similar pump project in the Yazoo Backwater Area that would result in an unacceptable adverse effect to the waters of the United States.

EPA Region IV is recommending that action be taken under section 404(c) of the CWA because the Region believes that the proposed Yazoo Backwater Area Pumps Project would result in unacceptable adverse effects to at least 67,000 acres of wetlands and other waters of the United States and their associated wildlife and fisheries resources. The Yazoo Backwater Area includes some of the richest wetland and aquatic resources in the Nation, including a highly productive floodplain fishery, substantial tracts of highly productive bottomland hardwood forests that once dominated the LMRAV, and hemispherically important migratory bird foraging grounds. These wetlands provide important habitat for a variety of wetland dependent animal and plant species, including the Federally protected Louisiana black bear and pondberry plant. In addition to serving as critical fish and wildlife habitat, project area wetlands also provide a suite of other important ecological functions. These wetlands protect and improve water quality by removing and retaining pollutants, reduce flood damages by storing floodwaters, maintain stream flows, and support aquatic food webs by processing and exporting significant amounts of organic carbon. EPA Region IV does not believe that the anticipated adverse impacts associated with the project are consistent with the requirements of the CWA.

The following section describes the proposed Yazoo Backwater Area Pumps Project and summarizes the history of the project. It also provides a summary of EPA's authorities under Clean Water Act (CWA) section 404(c) and brief synopsis of the regulatory procedures for implementing section 404(c) of the Act. Section IV describes the environmental characteristics of the project area and the overall Yazoo Basin. Section V examines the anticipated impacts of the proposed project on the Yazoo Backwater Area. In keeping with the environmental attributes protected by CWA section 404(c), this *Recommended Determination* focuses primarily on the significance of the site for fish and wildlife and the anticipated unacceptable adverse impacts the proposed project would likely have to those resources. Section VI discusses other important considerations, including recreation and environmental justice, which have been central to discussions on this project. Section VII presents EPA Region IV's conclusions and recommendations with regard to the Region's CWA section 404(c) review of the Yazoo Backwater Area Pumps Project.

III. Background

A. Section 404(c) Procedure

The CWA, 33 U.S.C. 1251 *et seq*., prohibits the discharge of pollutants, including dredged or fill material, into waters of the United States (including wetlands) except in compliance with, among other provisions, section 404 of the CWA, 33 U.S.C. 1344. Section 404 authorizes the Secretary of the Army (Secretary), acting through the Chief of Engineers, to authorize the discharge of dredged or fill material at specified disposal sites. This authorization is conducted, in part, through the application of environmental guidelines developed by EPA, in conjunction with the Secretary, under section 404(b) of the CWA, 33 U.S.C. 1344(b). Section 404(c) of the CWA authorizes EPA to prohibit the specification (including the withdrawal of specification) of any defined area as a disposal site and it is authorized to restrict or deny the use of any defined area for specification (including the withdrawal of specification) as a disposal site, whenever it determines, after notice and opportunity for public hearing, that the discharge of such materials into such area will have an unacceptable adverse effect on municipal water supplies, shellfish beds and fishery areas (including spawning and breeding areas), wildlife, or recreational areas.

The procedures for implementation of section 404(c) are set forth in 40 CFR part 231. Under those procedures, if the Regional Administrator has reason to believe that use of a site for the discharge of dredged or fill material may have an unacceptable adverse effect on one or more of the aforementioned resources, he may initiate the section 404(c) process by notifying the Corps and the applicant (and/or project proponent) that he intends to issue a Proposed Determination. Each of those parties then has fifteen days to demonstrate to the satisfaction of the Regional Administrator that no unacceptable adverse effects will occur, or that corrective action to prevent an unacceptable adverse effect will be taken. If no such information is provided to the Regional Administrator, or if the Regional Administrator is not satisfied that no unacceptable adverse effect will occur, the Regional Administrator will publish a notice in the Federal Register of his Proposed Determination, soliciting public comment and offering an opportunity for a public hearing.

Following the public hearing and the close of the comment period, the Regional Administrator will decide whether to withdraw the Proposed Determination or prepare a Recommended Determination. A decision to withdraw may be reviewed at the discretion of the Assistant Administrator for Water at EPA Headquarters. If the Regional Administrator prepares a Recommended Determination, he then forwards it and the administrative record compiled in the Regional Office to the Assistant Administrator for Water at EPA Headquarters. The Assistant Administrator makes the Final Determination affirming, modifying, or rescinding the Recommended Determination.

This document represents the third step in the process and explains the basis for EPA Region IV's Recommended Determination.

B. Project Description

The Yazoo Backwater Area is located in west-central Mississippi, just north of Vicksburg, Mississippi (Figure 1). The portion of this area relevant to the Yazoo Backwater Area Project is located between the east bank mainline Mississippi River levee and the west bank levees of the Will M. Whittington Auxiliary Channel, and comprises about 926,000 acres. Of particular focus are the approximately 630,000 acres inundated by the 100-year flood event which lie in parts of Humphreys, Issaquena, Sharkey, Warren, Washington, and Yazoo Counties in Mississippi and part of Madison Parish in Louisiana. The Big Sunflower River, Little Sunflower River, Deer Creek, and Steele Bayou flow through this area. The high ground along Deer Creek forms a natural divide between Steele Bayou and the Sunflower River Basins.

The Yazoo Backwater Area has historically been subject to extensive backwater flooding from the Mississippi and Yazoo Rivers. When the Mississippi River reached a certain stage, water would back up into the Yazoo River Basin, causing flooding, while preventing the Yazoo River Basin from draining. With the implementation of the Mississippi River and Tributaries Project, which began in 1928, levees were constructed and the Steele Bayou flood gate was installed by 1978, to prevent Mississippi River water from flowing into the Yazoo Backwater Area. The gate feature, combined with other levees, has greatly decreased backwater flooding in the Yazoo Backwater Area from the Mississippi and Yazoo Rivers. However, when the Steele Bayou flood gate is closed, precipitation from the Delta region becomes trapped and backs up behind the gate which may cause flooding in the Yazoo Backwater Area.

The primary purpose of the Yazoo Backwater Area Project is to reduce the flood damages in the Yazoo Backwater Area caused by flooding within the existing levee system. As stated in the FSEIS, a principal objective of the project is to reduce flood damages "to urban and rural structures, as well as agricultural properties." To achieve this objective, the Corps and the Board of Mississippi Levee Commissioners (project sponsor) have proposed a flood damage reduction project with "structural" and "nonstructural" components.

The structural component entails the construction of a 14,000 cfs pumping station at Steele Bayou with a pump-on operation elevation of 87.0 feet, National Geodetic Vertical Datum (NGVD). When floodwaters at the Steele Bayou structure reach (or are anticipated to reach) an elevation of 87.0 feet, NGVD, the pumps will be turned on and will move water from behind the gate into the Mississippi River. The effects of the pumping will be to reduce the amount of land within the Yazoo Backwater Area that floods, and to remove water faster from those areas that still experience flooding. The nonstructural component proposes reforestation of up to 40,571 acres of agricultural lands through the purchase of perpetual conservation easements from willing sellers and operation of the Steele Bayou control gates to maintain water elevations between 70.0 and 73.0 feet, NGVD, in the Yazoo Backwater Area waterways during low-water periods when practical. Construction of the proposed pumps involves the discharge of dredged or fill material into approximately 43.6 acres of forested wetlands and other waters of the

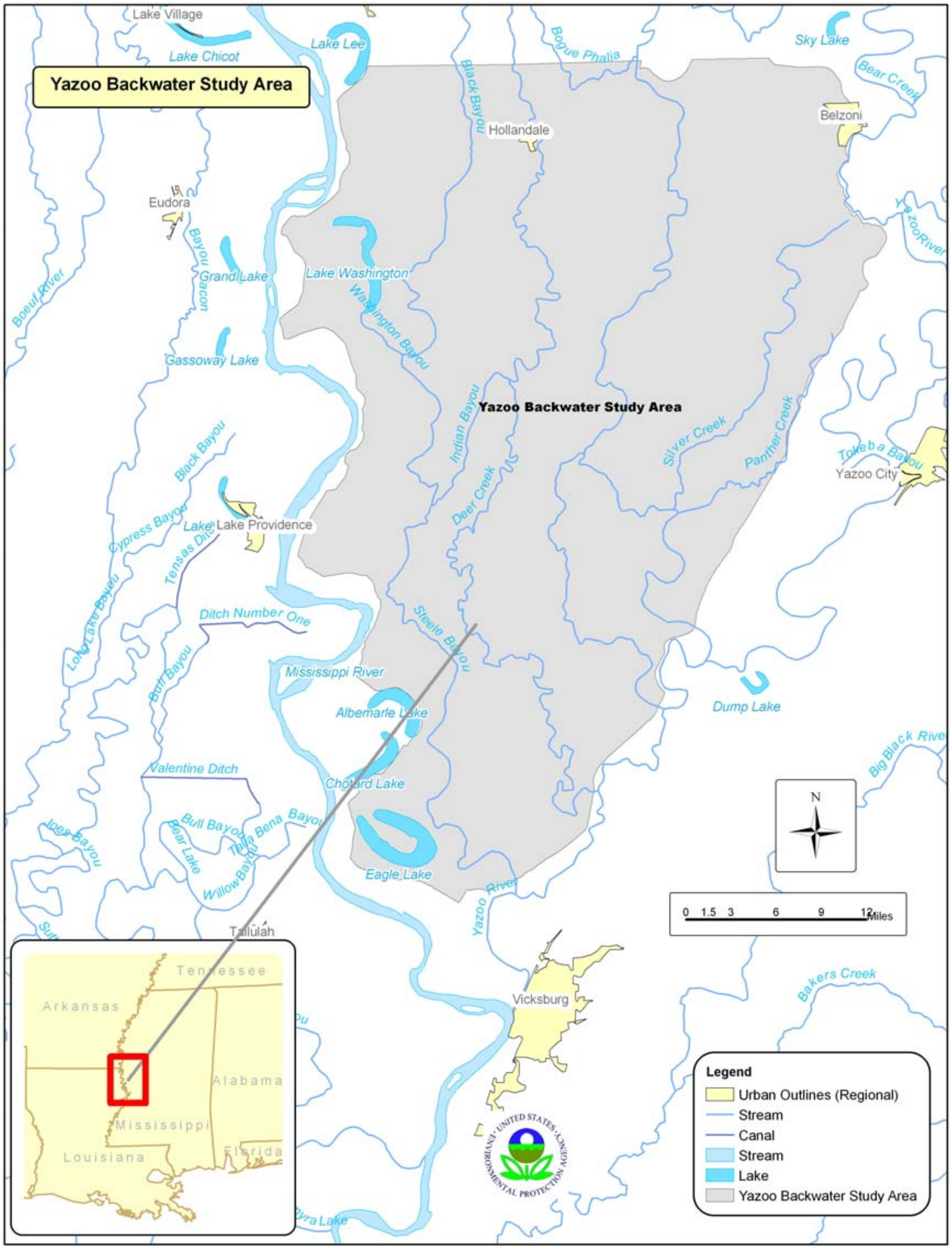

Figure 1. The Yazoo Backwater Area is located in west-central Mississippi, just north of Vicksburg, Mississippi. Of particular focus are the approximately 630,000 acres inundated by the 100-year flood event which lie in parts of Humphreys, Issaquena, Sharkey, Warren, Washington, and Yazoo Counties in Mississippi.

United States in Issaquena County, Mississippi. The estimated Federal cost of the proposed action is $220.1 million, with an annual operational cost of $2.1 million.

C. Project History

This project was authorized by Congress in the Flood Control Act of 1941 (Flood Control Act of 1941; P.L. 77-228, August 18, 1941), which envisioned a plan to reduce backwater flooding in the Yazoo River Basin through a combination of levees, drainage structures, and pumping plants fully funded by the Federal government. This Act also designated Yazoo Backwater Area lands located below 90 feet in elevation to serve as a sump area for floodwater storage.

Over the next 37 years, the Corps planned and executed key flood control projects in the Yazoo Backwater Area, including: construction of the Will Whittington Auxiliary Channel and Levees in 1962; construction of the Steele Bayou and Little Sunflower flood control gates, which were completed in 1969 and 1975, respectively; construction of the Yazoo Backwater Levee completed in 1978; and construction of the Sunflower River to the Steele Bayou Connecting Channel also completed in 1978.

In April 1982, EPA provided comments on the Draft Environmental Impact Statement (DEIS) for the 1982 version of the proposed project. EPA comments on the DEIS highlighted concerns regarding the proposed project's potentially extensive impacts on wetlands and associated fish and wildlife habitat and our belief that a less environmentally damaging design would meet the project's objectives. We stressed the importance of the flood water storage and water quality enhancement functions provided by area wetlands and expressed our concerns that the proposed project would degrade these critical functions. We also expressed concerns that the project would stimulate agricultural intensification in flood-prone areas, potentially increasing suspended solids, pesticides, and fertilizers in the water column, and exacerbate existing water quality problems. Additionally, we expressed concerns that the proposed mitigation would not adequately minimize and offset the extensive adverse environmental impacts associated with the proposed project.

In our May 1983 comments on the Final Environmental Impact Statement (FEIS), we expressed similar concerns. Our review of the FEIS concluded that the project would likely "decrease water quality in the area through increases in suspended solids, pesticides and fertilizers; reduce natural overbank flooding and decrease nutrient assimilation by wetland vegetation; transfer flood peaks downstream; serve as a precedent to similarly convert other bottomland hardwood remnants in the lower Mississippi River Valley; and greatly diminish a fish and wildlife resource, which, due to previous clearing elsewhere, has become nationally valuable."

The FWS also raised similar concerns regarding the proposed project. According to FWS, its first report on the Yazoo Backwater Area Project and related flood control projects in the Yazoo River Basin was issued in 1956. This report concluded that losses of fish and wildlife resources as a result of the construction of the Yazoo Headwater

Project and Yazoo Backwater Project would be large, and that the proposed pumps would promote large scale clearing of forests and intensification of agriculture in wetlands. In February 1978, FWS provided a Fish and Wildlife Coordination Act report to the Corps which concluded that the pumping plant was environmentally unsound, and that the Service was opposed to the project as planned. A subsequent Fish and Wildlife Coordination Act report submitted in June 1982 noted continued concerns with the proposed project and indicated that it may consider the project a candidate for referral to the Council on Environmental Quality (CEQ).

The Water Resources Development Act (WRDA) of 1986 modified the funding for the project by requiring a local-cost share. Under this new provision, 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 was greater. Work on the project effectively halted. The reauthorization of WRDA ten years later in 1996 reversed the cost-sharing provisions established in 1986 and restored the project to full Federal funding and work on the project began once again.

In 1997, EPA initiated an ecosystem restoration prioritization analyses with the U.S. Geological Survey (USGS). This work evolved into ecological and economic model development for nonstructural floodplain management alternatives in the Yazoo Backwater Area. Between 1998 and 2000, EPA participated in a series of interagency and stakeholder meetings with the Corps, USGS, FWS, the Virginia Polytechnic Institute and State University, and representatives of the Board of Mississippi Levee Commissioners to discuss concerns regarding the proposed project and potentially less environmentally damaging alternatives.

In 2000, EPA also participated in multiple meetings with a group composed of the Mississippi Department of Environmental Quality, Mississippi Department of Wildlife, Fisheries and Parks, the Corps, FWS, Board of Mississippi Levee Commissioners and Yazoo Backwater Area landowners in which we discussed our concerns with the proposed project. EPA also voiced its concerns with the proposed project in meetings with the Office of Management and Budget (OMB), CEQ and representatives from Corps Headquarters in February and March of 2000.

In September 2000, the Corps released the project’s Draft Supplemental Environmental Impact Statement (DSEIS). One of the purposes of this reformulation of the project’s 1982 FEIS was to respond to a 1991 directive from OMB to evaluate a broader suite of alternatives to the proposed project that would provide: 1) greater levels of flood protection for urban areas; 2) reduced levels of agricultural intensification; and 3) reduced adverse impacts to the environment. The OMB directive also stated that the revised evaluation should include “full consideration of predominantly nonstructural and nontraditional measures” to address flooding issues.

In a November 3, 2000, letter to the Corps on the DSEIS, EPA raised significant concerns regarding the proposed project’s extensive impacts to wetlands and associated fish and wildlife resources, its potential to exacerbate existing water quality problems in the

Yazoo Backwater Area, the inadequacy of the proposed compensatory mitigation, and the uncertainty associated with the proposed reforestation. We also identified, for further consideration, a number of potentially less environmentally damaging alternatives that emphasized nonstructural and nontraditional measures to address flooding issues. We concluded that the project was environmentally unsatisfactory and noted that it was a candidate for referral to CEQ under section 309(b) of the Clean Air Act and the CEQ regulations at 40 CFR part 1504 and for further action under CWA section 404(c).

Between 2002 and 2005, EPA worked with the Corps to improve the evaluation of the extent of wetlands in the Yazoo Backwater Area, the extent of wetlands potentially impacted by the project, and the nature and degree of these impacts. This work involved extensive site visits and data collection in the Yazoo Backwater Area, meetings, and conference calls. In December 2005, EPA provided detailed technical comments on the revised draft Wetland and Mitigation appendices for the DSEIS outlining a number of concerns regarding the evaluation approaches used in these appendices. We noted that flaws in these evaluation approaches result in an underestimation of the potential adverse impacts to wetlands and fish and wildlife resources associated with the construction and operation of the proposed pumps and an overestimation of the potential environmental benefits associated with the proposed reforestation.

In November 2007, the Corps released the Yazoo Backwater Area Reformulation Main Report and Final Supplemental Environmental Impact Statement (FSEIS)[1]. Although the Corps responded to many of our November 2000 comments on the DSEIS, no substantive modifications had been made to the structural component of the proposed project since November 2000. In our January 22, 2008, letter to the Corps on the FSEIS, we concluded that the nature and extent of anticipated adverse environmental impacts continue to be significant and that we continue to have significant concerns with the proposed project including: 1) magnitude of anticipated impacts to wetlands and associated fish and wildlife resources; 2) compliance with the CWA's substantive environmental criteria (i.e., the Section 404(b)(1) Guidelines); 3) uncertainties with the proposed reforestation plan; 4) changes in land use; 5) environmental justice (EJ) considerations; 6) uncertainty with the economic analysis; and 7) the evaluation of potential project alternatives. We again identified the project as a candidate for referral to CEQ and for further action pursuant to our authorities under the CWA.

In its January 18, 2008, comment letter to the Corps regarding the FSEIS, the FWS shared similar concerns, particularly those associated with the proposed project's potentially unacceptable adverse impacts on fish and wildlife resources. The FWS also reiterated its determination that the project is a candidate for referral to CEQ.

[1] U.S. Army Corps of Engineers' Yazoo Backwater Area Project Reformulation Main Report and FSEIS: http://www.mvk.usace.army.mil/offices/pp/projects/YBR_Report/index.html

On February 1, 2008, EPA Region IV's Regional Administrator[2] informed the Corps and the Board of Mississippi Levee Commissioners of his intention to begin a section 404(c) action, based on his belief that the project may have an unacceptable adverse effect on fish and wildlife resources. During the 15-day response period following the 404(c) initiation letter (which was extended to March 3, 2008) EPA met with representatives from the Corps and Board of Mississippi Levee Commissioners. In addition, EPA had a number of conference calls with the Corps during this consultation period to discuss specific technical concerns we had with the Corps' analysis (many of which are discussed in this Recommended Determination). However, following this consultation step, the Regional Administrator was not satisfied that no unacceptable adverse effect would occur, or that adequate corrective action would be taken to prevent an unacceptable adverse effect, and took the next step in the section 404 (c) process.

On March 19, 2008, the Regional Administrator published a Proposed Determination to prohibit the use of wetlands and other waters in Issaquena County, MS, as disposal sites for the purpose of constructing the Yazoo Backwater Area Project's pumping station or any other pumping proposal in the Yazoo Backwater Area that would involve significant adverse impacts on waters of the United States. In accordance with 40 CFR part 231.3(a)(2), EPA published notice of the proposed determination in the Federal Register on March 19, 2008 (73 FR 14806). The notice established a public comment period from March 19 to May 5, 2008 and indicated a public hearing would be held. Notice of the Proposed Determination and of the public hearing was also published in the Delta Democrat-Times on March 19, 2008, the Clarion Ledger and Deer Creek Pilot on March 20, 2008, and the Vicksburg Post on March 22, 2008.

EPA conducted the public hearing at the Vicksburg Convention Center on April 17, 2008. Approximately 500 people were in attendance for the five-hour hearing. A total of 67 people provided oral statements, including one representative from the Corps' Vicksburg District and four individuals representing the project sponsor. Of the 62 people not directly affiliated with the project, 32 people spoke in opposition to the proposed pumps project, 29 spoke in favor of the pumps project and one person did not specify a position. Several of these speakers urged EPA to move promptly to prohibit the project. Representatives of U.S. Senator Thad Cochran and Mississippi Governor Haley Barbour urged EPA to stop the 404(c) process pending further discussions on appropriate means of flood control for this area of the Mississippi Delta.

The public comment period ended on May 5, 2008. EPA received approximately 47,600 comment letters including approximately 1,500 individual comment letters and 46,100

[2] At the request of the Regional Administrator, EPA Region IV, EPA Administrator Stephen L. Johnson has designated Mr. Lawrence E. Starfield, Deputy Regional Administrator for EPA Region VI, to implement the regional responsibilities of the Regional Administrator under EPA's section 404(c) regulations (40 CFR Part 231) associated with the review of the Yazoo Backwater Area Project. Since Mr. Starfield has been designated to exercise all such authority for the Regional Administrator for the Yazoo Backwater Area Project, any reference to the authority of the Regional Administrator in this Recommended Determination is the responsibility of Mr. Starfield for the purposes of this action.

mass mailers.[3] Of these 47,600 comments, 99.91 percent urged EPA to prohibit the proposed pumps project and approximately 0.084 percent supported construction of the proposed pumps project. Within the State of Mississippi, approximately 461 residents submitted written comments or spoke at the public hearing. Of these, 417 expressed support for EPA's proposal and 43 favored construction of the pumps.

Commenters in support of EPA's position echoed EPA's concerns regarding the extensive level of anticipated adverse environmental impacts associated with the proposed project. These impacts are described in more detail in this Recommended Determination. Additionally, numerous commenters in support of EPA's position also expressed concerns that the project would allow more intensive agricultural practices on marginal farmland that would in turn increase farm subsidy payments and that taxpayers would bear the burden of any economic gains from the project. Numerous commenters also questioned whether such a substantial amount of federal taxpayer money is needed to address the "limited" flooding that occurs within the "sparsely" populated project area, and whether the money allocated to construct and operate the pumps would be better spent addressing the more pressing needs of the region, such as economic development opportunities.

Those in support of the proposed project, including a number of local county officials, believe the project would alleviate flooding damages and is part of a long standing commitment to residents of the project area. These individuals stressed that the pumps are the final piece of a larger flood control plan for the Yazoo Backwater Area, and that the previously completed flood control structures (such as the connecting channel) were designed with pumps in mind. Those in support of the proposed project also stated that periodic flooding contributes to the poor economy of the area because of public service interruption, road damage, people moving away from the area, and agriculture/crop damage. They noted that flooding does not yield to emergency services or school buses, and destroys many kinds of infrastructure. They believe that without the flood protection provided by the pumps, future economic development of the South Delta Region is seriously diminished. Some of these commenters cited the flooding that occurred this past Spring in Mississippi and their belief that the pumps could have been used to diminish the damaging effects of these floods. Further, several commenters also suggested that the project would improve water quality and enhance wildlife habitat.

EPA's regulations require that the Regional Administrator either withdraw the Proposed Determination or prepare a Recommended Determination within 30 days after the conclusion of the public hearing, in this case by May 17, 2008 (40 CFR 231.5(a)). However, in order to allow full consideration of the extensive record, including the 47,600 public comments we received, EPA extended the time period provided in 40 CFR 231.5(a) for the preparation of this Recommended Determination until no later than July 11, 2008 (73 FR 27821). This time extension was made under authority of 40 CFR

[3] Public comments received in response to EPA Region IV's Proposed Determination may be viewed and downloaded at www.Regulations.gov, Docket Number EPA-R04-OW-2008-0179. See: http://www.regulations.gov/fdmspublic/component/main?main=DocketDetail&d=EPA-R04-OW-2008-0179

231.8, which allows for such extensions upon a showing of good cause. EPA Region IV has had the opportunity to review the information provided during the public comment period, and we have been able to complete our review in advance of this date. We are now in a position to move forward with the section 404(c) process.

This Recommended Determination represents the culmination of the EPA Region IV's section 404(c) review of the proposed Yazoo Backwater Area Project. This document, along with the Administrative Record, is being transmitted to EPA's Assistant Administrator for Water for review and final action.

IV. Site Characterization

A. Site Ecology

The Lower Mississippi River Alluvial Valley (LMRAV) was a 25 million acre area of forested wetlands that extended along both sides of the Mississippi River from Illinois south to Louisiana and the Gulf of Mexico. Saucier (1994) and Klimas et al. (2005) point out the effect the Mississippi River has had upon topographic diversity in the LMRAV and in the Yazoo River Basin. The effects of glaciation and the subsequent fluvial response of the Mississippi River, has created landforms which are the basis for the various wetland types in the Yazoo Backwater Area. Smith and Klimas (2002) indicate that the Yazoo Basin has 4 hydrogeomorphic (HGM) classes and 7 different wetland subclasses based on the geomorphology of the Yazoo Basin. These classes and subclasses are listed in Table 1 and illustrated in Figure 2.

Table 1. Hydrogeomorphic classes and subclasses of Yazoo Basin (Smith and Klimas 2002)

HGM Class	HGM Subclass	Class Characteristics
Riverine	Backwater	Wetland within 5-yr floodplain; floodwaters typically back-up into wetland due to high water downstream
	Overbank	Wetland within 5-yr floodplain; Floodwaters typically flow parallel to channel
Fringe	Isolated	Wetland in topographic depression with water >2 m deep; Not within 5-yr floodplain
	Connected	Wetland in topographic depression with water >2m deep within 5-yr floodplain
Depression	Isolated	Wetland in topographic depression with water <2 m deep; Not within 5-yr floodplain
	Connecetd	Wetland in topographic depression with water <2m deep within 5-yr floodplain
Flat		Wetland Not in topographic depression and not within 5-yr floodplain

Historically, the extent, hydrodynamics and duration of seasonal flooding from the Mississippi River fluctuated annually, shaped the topography, recharged the LMRAV systems and created a diversity of dynamic habitats that once supported a vast array of fish and wildlife resources. Although floodplains are characterized as being relatively flat in comparison to the surrounding landscape, it has been well documented that variations in the microtopography (i.e., spatial heterogeneity) along with variations in flooding frequency and duration (i.e., hydrologic heterogeneity) leads to an abundance of biodiversity (Schnitzler et al, 2005; Burnett et al, 1998; and Nichols et al., 1998).

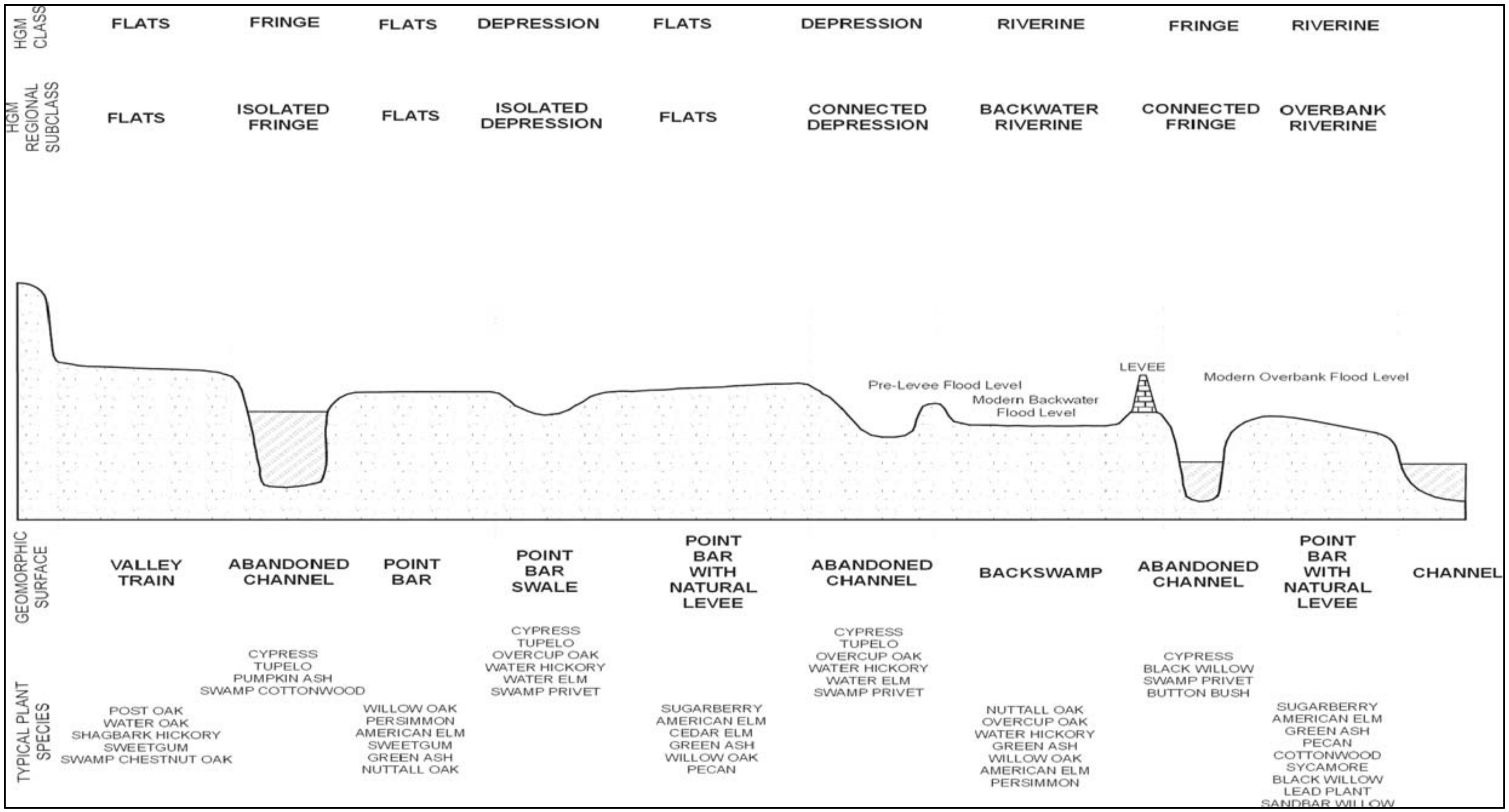

Figure 2 shows a floodplain cross section and the geomorphic position and dominant plant communities associated with the hydrogeomorphic classes in the Yazoo Basin (from Smith and Klimas, 2002).

Different wetland species require wet and dry conditions at different times in their life cycle. The various elevations of land in a floodplain combined with various hydrologic events to create numerous habitat conditions which are available to animals and plants at different times. It was the spatial and temporal heterogeneity of these bottomland hardwood ecosystems which provided the components for the great biodiversity for which this region was once known (Schnitzler et al., 2005), vestiges of which remain today. The topographic and hydrologic complexity of floodplains is important to the distribution of plant communities, and it is these plant communities that create the primary production necessary to support the immensely diverse food web that make bottomland hardwood ecosystems unique.

Except during major floods, the dominant sources of water in the Yazoo Basin are precipitation and runoff from the hills along the eastern flank of the basin. The only surface outlet is through the Yazoo River, which enters the Mississippi River at the southern end of the basin near Vicksburg. Most stream flow in the Yazoo River originates in the uplands along the eastern flank of the basin and is carried to the Yazoo River via the Coldwater, Yokona, Tallahatchie, and Yalobusha Rivers, and several smaller streams. Interior drainage is provided by numerous small streams that discharge to Deer Creek, the Big Sunflower River, or Bogue Phalia - all of which flow to the lower Yazoo River. The direction of drainage within the basin is generally southward, but can be complicated by the topography left by the abandoned meander belts of the Mississippi River (Smith and Klimas, 2002; Saucier, 1994).

The hydrology of the Yazoo Basin has been modified extensively. Federal projects have largely protected the basin from the effects of major floods, allowing extensive land clearing and agricultural development. Water entering or underlying the modern basin is rerouted, stored, and exported from the system in complex patterns that can result in more or less water available to remaining wetlands. For example, heavy winter and spring rains make drainage necessary for agricultural operations while low rainfall periods in summer and fall warrant irrigation of crops. This drainage may involve land leveling as well as ditching, and can have various effects on wetlands. Area wetlands may serve as sumps to which adjacent fields drain or may themselves be drained to streams or larger ditches. During periods of backwater flooding, these same artificial drainage networks may function in reverse, delivering water to low areas far from the source stream channels (Smith and Klimas, 2002).

Hydrology is the single most important factor in the establishment and maintenance of wetlands (Mitsch and Gosselink, 2000; Frederickson, 2005). The hydroperiod is the seasonal pattern of water flow and fluctuations that characterizes each wetland type and provides stability to ecological patterns and processes. The hydroperiod, including flood duration, intensity or magnitude, frequency and timing ultimately limits species composition and influences ecosystem structure and function (Sharitz and Mitsch, 1993).

Three natural patterns of succession are recognized for floodplain sites of major river bottoms: 1) those occurring on permanently flooded sites; 2) those on low elevation wet sites; and 3) those on higher elevation, better drained sites. Floristic composition and successional patterns are strongly influenced by the hydrologic events on the sites and particularly by rates and types of deposition. Small differences in elevation can result in great differences in site quality primarily because of differences in hydrology (Hodges, 1997). Historically, forests of the LMRAV, including the project area, were dominated by Sweetgum (*Liquidambar styraciflua*),sugarberry (*Celtis laviegata*), oaks (*Quercus spp.)*, ash (*Fraxinus spp*.), cypress (*Taxodium spp*.) and elm (*Ulmus spp*.) (Ouchley et al., 2000). These extensive forests and associated floodplains had an abundance of plant and animal biodiversity (Wharton, 1982; Frederickson, 2005).

Despite long-term man-made alternations and disturbances, comparison of the species richness (i.e., the number of species in a given area) in the Yazoo Backwater Area with that of larger southeastern United States and Lower Mississippi Valley bottomland hardwood ecosystems, demonstrate that the project area still includes some of the richest wetland and aquatic resources in the Nation. For instance:

- The Coastal Plain of the southeastern United States, which encompasses portions of 11 states, including Mississippi, is documented to contain an estimated 575 vertebrate species that occur in lowland communities (Echternacht and Harris, 1993). Of these species, 130 are amphibians, 112 are reptiles, 231 are birds, and 102 are mammals. Sixty-three percent of the number of vertebrate species in the entire Coastal Plain are found in the Yazoo Backwater Area.
- The Mississippi Lowland Forest ecoregion, which coincides with the LMRAV, is documented to contain an estimated 372 vertebrate species, including 35 amphibians, 52 reptiles, 223 birds, and 62 mammals.[4] Ninety-eight percent of the number of vertebrate species in the entire Mississippi Lowland ecoregion are found in the Yazoo Backwater Area.

The Mississippi Museum of Natural Science has documented 19 species of amphibians, 34 species of reptiles, and 45 species of mammals that occur within the Yazoo Backwater Area.[5] In addition, the FWS has documented 258 bird species in this area.[6] The FWS and State's records for the Yazoo Backwater Area include many species not documented in the Mississippi Lowland ecoregion list, including 2 amphibian, 3 reptile, 74 bird, and 3 mammalian species. Further, collection records indicate that 116 species of fish use the project area (Appendix 1).

The World Wildlife Fund includes the Lower Mississippi River, and its associated tributaries and floodplains in their Global 200 designation. This designation has been given to the 200 ecoregions in the world which are most critical for the preservation of biodiversity. Selection of the ecoregions was based on species richness, number of species unique to the region, unique higher taxa, unusual ecological or evolutionary phenomena, and global rarity of major habitat types. The Lower Mississippi River

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[4] World Wildlife Fund Mississippi Lowland Forest species list: http://worldwildlife.org/wildfinder/searchByPlace.cfm?ecoregion=NA0409

[5] Personal Communication between William Ainslie, EPA Region 4, and Scott Peyton, Mississippi Museum of Natural Science, February 5, 2008.

[6] FWS list of bird species utilizing wildlife refuges in the Yazoo backwater Area: http://www.npwrc.usgs.gov/resource/birds/chekbird/r4/yazoo.htm

ecoregion, which encompasses the Yazoo Backwater Area, is included due to its diversity of fish species and their link to floodplain habitats. The Lower Mississippi River has the second richest assemblage of fish species in North America and is also noted for its diversity of aquatic invertebrates, amphibians, and reptiles. Only 4 percent of North America's fish species are endemic to the Lower Mississippi River, and these are found in tributary drainages rather than in the Mississippi mainstem. The Yazoo Backwater Area provides habitat for two species of fish found only in the Lower Mississippi River, a shiner (*Notropis rafinesquei*) and catfish (*Noturus hildebrandi*).

In its comments on the FSEIS, the FWS reports that the Yazoo Backwater Area is part of a major continental migration corridor for birds funneling through the midcontinent from as far north as the Arctic Circle and as far south as South America. The Yazoo Backwater Project Area comprises approximately 630,000 acres located in the LMRAV, through which 60 percent of all bird species in the U.S., including more than 40 percent of the Nation's waterfowl population and 500,000 to 1,000,000 shorebirds, migrate on a biannual basis. FWS also notes that natural springtime flooding in the area's riverine backwater wetlands coincides with two major events in the LMRAV: 1) native bird and waterfowl migration that requires suitable and productive stopover and foraging habitats to meet migratory energy needs; and 2) breeding bird and waterfowl nesting that requires adequate nesting and foraging habitats to meet reproductive and rearing needs.

On a regional scale, the importance of the project area is recognized by the State of Mississippi's 2005 Comprehensive Wildlife Conservation Strategy (MCWCS). Bottomland hardwood wetlands such as those in the Yazoo Backwater Area provide habitat for 33 *species of greatest conservation need*[7] including 20 birds, 12 mammals, and 1 reptile. Also, all of the standing and running water systems of the Mississippi Alluvial Plain, including those in the Yazoo Backwater Area, have been classified by the State as critically imperiled because of their high conservation priority rank and the widespread degradation of stream habitats in this region. These waterbodies provide important habitat for 23 *species of greatest conservation need*, including 4 fish, 18 mussels, and 1 reptile. Finally, the stream habitat that remains in the Upper Coastal Plain Yazoo Drainage area, which receives significant hydrologic inputs from the Yazoo Backwater Area, is considered to be vulnerable because of extensive alteration caused by channelization, agricultural use of surrounding lands and impoundments. This portion of the Yazoo River Basin provides critical habitat for 17 *species of greatest conservation need* including 1 amphibian, 12 fish, and 1 reptile (Mississippi Museum of Natural Science, 2005).

Over the past 100 years, the greatest changes to the LMRAV landscape have been land clearing for both agriculture and flood control projects. As a result of these and other

[7] Species of Greatest Conservation Need (SGCN) are those animals, both aquatic and terrestrial, that are at risk or are declining in a State. They include threatened and endangered species, as well as other species of concern. The SGCN for Mississippi was developed through a rigorous analysis of the Mississippi Natural Heritage Program's list of "Animals of Special Concern" (ASC). An Expert Team of scientists evaluated the approximately 1,500 species from the ASC and narrowed this list down to only the species most at risk – resulting in approximately 300 Species of Greatest Conservation Need statewide (Mississippi Museum of Natural Science, 2005).

land use changes, the historic geomorphologic and hydrologic diversity of the LMRAV has been reduced. The landscape level modification of geomorphic topography and reduced flooding, in turn have altered wildlife habitat, which has had an adverse effect on biological diversity and integrity. For example, breeding bird surveys show continuing declines in species richness and population numbers. In addition to the loss of approximately 80 percent of the bottomland forested wetlands within the LMRAV (DOI, 1988), there have been significant alterations in the region's hydrology due to river channel modification, construction of flood control levees and reservoirs, and deforestation. The cumulative effect of these hydrological alterations has reduced both the extent and duration of the annual seasonal flooding, adversely affecting the forested wetlands and their associated wetland-dependent species (Harris and Gosselink, 1990).

The significant cumulative aquatic resource losses across the LMRAV are mirrored in the Mississippi Delta and in the Yazoo Backwater Area. The Mississippi Comprehensive Wildlife Conservation Strategy reports that only 15 percent of the Mississippi Delta remains forested. The largest remaining segment is the complex of bottomland hardwood forests approximately 100,000 acres in size within and surrounding the Delta National Forest. Much of this important complex of remaining forests and forested wetlands is located in the Yazoo Backwater Area (Mississippi Museum of Natural Science, 2005).

B. Wetland Functions

The FSEIS estimates that the Yazoo Backwater Area contains between 150,000 to 229,000 acres of wetlands. In addition to serving as critical fish and wildlife habitat, project area wetlands also provide a suite of other important ecological functions. These wetlands protect and improve water quality by removing and retaining pollutants, reduce flood damages by storing floodwaters, maintain stream flows, and support aquatic food webs by processing and exporting significant amounts of organic carbon. Wetlands in the Yazoo Backwater Area that will be impacted by the proposed project have been described by the Corps as belonging to the HGM *riverine backwater* subclass. This classification indicates that these wetlands flood as a result of impeded drainage of small streams, channels, and drainage ditches due to high water in larger downstream reaches. As a result of this impeded drainage, low lying areas associated with these small streams fill with relatively still "backwater." The characteristics of the riverine backwater wetlands in this area are: a direct connection to a channel during flood stages equivalent to at least the 5-year frequency return period; the primary source of hydrology to the wetland is backwater; and floodwaters largely drain from the site back to the channel as flood stages fall (as opposed to being retained on the site in depressions) (Smith and Klimas, 2002).

Hydrology is considered by most to be the critical determinant of the establishment and maintenance of specific types of wetlands and wetland processes (Mitsch and Gosselink, 2000). The combination of the hydrologic, soil, and vegetative characteristics of this wetland subclass contribute to the wetland processes, or functions, which support the area's diverse and abundant flora and fauna. In 2002, the Corps and EPA, in partnership with FWS, the Natural Resources Conservation Service (NRCS), the National Marine

Fisheries Service (NMFS) and the Federal Highway Administration (FHWA), published a comprehensive guidebook (Yazoo Basin HGM Guidebook) for applying the HGM approach to assessing wetland functions of selected regional wetland subclasses in the Yazoo Basin (Smith and Klimas, 2002). The HGM wetland assessment outlined in the Yazoo Basin HGM Guidebook uses indicators of flooding, plant community and soil structure to assess wetland functions given the assumption that these structural indicators are representative of wetland function and, if altered, would adequately capture a change in wetland function. As thoroughly discussed in the Yazoo Basin HGM Guidebook and outlined below, maintenance of the hydrologic regime (i.e., timing, frequency, and duration of water reaching area wetlands) is the most important factor in ensuring that riverine backwater wetlands in the Yazoo Backwater Area perform important functions, such as floodwater detention, nutrient cycling, organic carbon export, pollutant filtering/removal, and maintenance of biologically diverse plant and animal habitat.

Functional Capacity Indices (FCI) are the result of combining the HGM assessment's hydrologic, plant, soil and landscape indicators to estimate a change in function as the result of change in indicators. The FCIs are scaled between zero and one, with one being the optimal score for a function. Table 2 shows the baseline FCIs for the 8 riverine backwater functions for 5 typical land uses in the Yazoo Backwater Area. Mature forested areas generally have the highest scores across all functions due to their mature plant community and well developed soils. The other cover types show that as plant community and soil indicators are degraded by various land uses (e.g., silviculture, agriculture) FCIs decrease indicating a reduction in function. Each of the functions included in Table 2 below is described in more detail below (with the exception of "detain precipitation" which is not expected to change significantly as a result of the proposed project).[8] However, there is considerable overlap between the hydrologic, plant, and soil indicators and the role they play in wetland function. EPA views the "with-project" FCIs as indicators of the effect this project will have on the wetland ecosystems in the project area. In other words, these wetland functions will not be viewed as separate, interchangeable entities, but as integrated signals of ecosystem health.

Table 2. Baseline functional capacity indices for riverine backwater wetlands by land use type for the Yazoo Backwater Area (FSEIS HGM Assessment, 2007)

Function	Mature Forest	Middle Aged Forest	Pasture/ Planted/ Early Aged Forest	Recently Logged	Agricultural	Other
Detain Floodwater	0.98	0.78	0.75	0.73	0.25	na
Detain Precipitation	0.83	1.00	0.48	0.76	0.56	na
Cycle Nutrients	0.95	0.88	0.56	0.67	0.29	na
Export Organic Carbon	0.64	0.58	0.32	0.42	0.17	na
Physical Removal of E and C	0.53	0.69	0.21	0.49	0.43	na
Biologial Removal of E and C	0.64	0.58	0.32	0.42	0.17	na
Maintain Plant Communites	0.93	0.94	0.55	0.71	0.00	na
Provide Wildlife Habitat	0.92	0.88	0.48	0.74	0.00	na

[8] Physical and biological removal of elements ("E") and Compounds ("C") are considered together in this discussion under the heading "Pollutant Filtering and Removal."

1. Floodwater Detention

When riverine backwater wetlands are allowed to temporarily detain and moderate floodwater they provide a number of important benefits. Floodwater interaction with wetlands tends to dampen and broaden the flood wave, which reduces peak discharge downstream. Wetlands can reduce the velocity of water currents and, as a result, reduce erosion. Some portion of the floodwater volume detained within riverine backwater wetlands is likely to be evaporated or transpired, thereby reducing the overall volume of water moving downstream. The portion of the detained flow that infiltrates into the alluvial aquifer, or which returns to the channel very slowly via low-gradient surface routes, may be sufficiently delayed that it contributes significantly to the maintenance of baseflow in some streams long after flooding has ceased. Retention of particulates is also an important component of the flood detention function because sediment deposition directly alters the physical characteristics of the wetland (including hydrologic attributes) and positively influences downstream water quality.

2. Nutrient Cycling

In riverine backwater wetlands, nutrients are stored within, and cycled among, four major compartments: (a) the soil; (b) primary producers such as vascular and nonvascular plants; (c) consumers such as animals, fungi, and bacteria; and (d) dead organic matter, such as leaf litter or woody debris, referred to as detritus. The transformation of nutrients within each compartment and the flow of nutrients between compartments are mediated by a complex variety of biogeochemical processes associated with primary production and decomposition. These biogeochemical processes and their ability to support the rich array of flora and fauna found in the Yazoo Backwater Area are directly linked to maintenance of the timing, frequency, and duration of flooding in the area's riverine backwater wetlands systems.

3. Organic carbon export

The high productivity and close proximity of riverine backwater wetlands to streams make them important sources of dissolved and particulate organic carbon for aquatic food webs and biogeochemical processes in downstream aquatic habitats. Dissolved and particulate organic carbon is a significant source of energy for the microbes that form the base of the detrital food web in aquatic ecosystems. The ability of riverine backwater wetlands to perform this critical function is directly linked to factors associated with their natural hydrologic cycle of backwater flooding, including: (a) the large amount of organic matter in the litter and soil layers that comes into contact with surface water during flooding; (b) relatively long periods of inundation and, consequently, contact between surface water and organic matter, thus allowing for significant leaching; (c) the ability of the labile carbon fraction to be rapidly leached from organic matter when exposed to water; and (d) the ability of floodwater to transport dissolved and particulate organic carbon from the floodplain to the stream channel.

As the floodwaters rise during a hydrologic event, biological productivity is expected to be stimulated by release of nutrients from the newly flooded soil. In addition, floodwaters warm as they spread out on the floodplain improving fish yields (Sparks, 1995). Organic matter wetted by the flood and then dried decomposes faster and subsequent floods then carry fine and dissolved organic matter to the adjacent streams in support of aquatic foodwebs. Not explicitly captured in the description of this function is the role that soil microbes and invertebrates play in processing the organic material into forms which can be utilized by other organisms in the food chain, completing the nutrient cycle.

The role of invertebrates in decomposition and nutrient cycling in bottomland hardwood forests, such as those in the Yazoo Backwater Area, is very important, as is their subsequent role in the food chain. Loosely bound nutrients (e.g., potassium and magnesium) as well as simple sugars are leached from the organic material soon after inundation occurs. Sometimes this leaching can occur within 24-48 hours of flooding. The rapid release of nutrients by leaching along with any additional nutrient inputs from the floodwaters promotes colonization of leaf litter surfaces by algae and microbes (i.e., fungi and bacteria). Microbes are important because they immobilize and concentrate nutrients from leaf litter and floodwater inputs and provide invertebrates an available and primary source of nutrition. Microbes also make the particles of leaf litter more palatable and digestible to invertebrates due to the reduction of complex carbohydrates to simpler, and more digestible, sugars.

Shredders, like amphipods, isopods, crayfish and crane fly larvae, are the first invertebrates to begin the decomposition process by consuming coarse organic particles and processing the material into finer particles. The resultant fine particulate organic matter, with its increased surface area is subsequently colonized by microbes which are then utilized by grazers (particularly snails in the Planoridae and Physidae families). Midge larvae, freshwater worms and fingernail clams are common bottomland hardwood collectors that feed on fine particulate organic matter. The processed fine particulate organic matter and associated nutrients then become available for plant uptake as the nutrient cycle is completed. Natural flooding regimes are essential to maintaining the balance between litter decomposition and its accumulation, as well as sustaining the biotic component of detrital processing and wetland productivity (Batema et al., 2005).

4. Pollutant Filtering and Removal

The area's riverine backwater wetlands permanently remove or temporarily immobilize elements and compounds that are imported to the wetland from various sources, but primarily via the flood cycle. Elements include macronutrients essential to plant growth (e.g., nitrogen, phosphorus, and potassium) as well as heavy metals (zinc, chromium, etc.) that can be toxic at high concentrations. Compounds include pesticides and other imported materials. The primary benefit of this function is that the removal and sequestration of elements and compounds by wetlands reduces the load of nutrients, heavy metals, pesticides, and other pollutants in rivers and streams. This often translates into improved water quality and aquatic habitat in adjacent or down gradient rivers and streams.

Once nutrients and compounds arrive in riverine backwater wetlands, they may be removed and sequestered through a variety of biogeochemical processes including complexation, chemical precipitation, adsorption, denitrification, decomposition to inactive forms, hydrolysis, uptake by plants, and other processes. The effective performance of many of the most critical biogeochemical processes depends on maintenance of the hydrologic cycle of flooding in riverine backwater wetlands and the anoxic/reducing environment created by periodic cycles of inundation and saturation. For example, denitrification will not occur unless the soil is anoxic and the reduction-oxidation (redox) potential falls below a certain level. Flooding and soil inundation for approximately 14 days causes soils to become anoxic. When this occurs and other soil conditions are favorable (i.e., availability of soil carbon) the nitrogen in nitrate (NO_2) is removed by denitrification and released as nitrogen gas to the atmosphere. In addition, sulfate is reduced to sulfide, which then reacts with metal cations to form insoluble metal sulfides such as copper sulfide (CuS), iron sulfide (FeS), lead sulfide (PbS), and others which then fall out of the water column and are retained by the wetland sediments (Smith and Klimas 2002).

5. Plant Habitat

The ability of riverine backwater wetlands to maintain a characteristic plant community is important because of the intrinsic value of the plant community and the many attributes and processes of wetlands that are influenced by the plant community. For example, primary productivity, nutrient cycling, and the ability to provide a variety of habitats necessary to maintain local and regional diversity of animals are directly influenced by the plant community. Due to the inundation by nutrient rich floodwaters, diverse assemblages of plants grow in riverine backwater wetlands and contribute to the primary production of these ecosystems. The growth of different plant communities as a result of variable hydrologic regimes and topography contributes to the uptake and release of nutrients and provides many layers of potential habitat (i.e., litter layer to canopy) for the hundreds of wildlife species which utilize these wetlands. In addition, the plant community of river connected wetlands such as riverine backwater wetlands in the Yazoo River Basin influences the quality of the physical habitat, nutrient status, and biological diversity of downstream systems. As noted in the Yazoo Basin HGM Guidebook, maintaining the natural hydrologic regime of these wetlands is consistently cited as the principal factor controlling plant community attributes (Smith and Klimas 2002).

Riverine backwater wetlands in the Yazoo Backwater Area typically contain vegetative communities dominated by green ash (*Fraxinus pennsylvanica*) and Nuttall oak (*Quercus nuttallii*), as well as overcup oak (*Q. lyrata*) and water hickory (*Carya aquatica*) in more low lying areas. In addition to these dominant canopy species, willow oak (*Q. phellos*), Sugarberry (*Celtis laviegata*), American elm (*Ulmus americana*), cedar elm (*U. crassifolia*), Red maple (*Acer rubrum*), Cypress (*Taxodium distichum*), water elm (*Planera aquatica*), and Black willow (*Salix nigra*) were also found dominating many of the field sampled plots in the area. Appendix 3 contains a detailed plant species list for the Yazoo Backwater Area.

6. Fish and Wildlife Habitat

A broad array of fish and wildlife species utilize the riverine backwater wetlands in the Yazoo Backwater Area during some part of their life cycles. Terrestrial, semi-aquatic, and aquatic animals use these wetlands extensively. These wetlands provide important habitat for a diversity of organisms, are sites of high levels of secondary production, and are essential in the maintenance of complex trophic interactions. Habitat functions span a range of temporal and spatial scales. For example, invertebrate communities utilize the organic matter generated in these wetlands as a food source and the vertical structure of the plant community as refugia from flooding. Amphibian and reptile species use the wetlands for breeding and foraging habitats and fish utilize floodplains for spawning, rearing, and foraging. Birds and mammals utilize the wetlands for food, cover, and nesting. Most wildlife and fish species found in riverine backwater wetlands of the Yazoo River Basin depend on certain aspects of wetland structure and dynamics such as specific vegetation composition and proximity to other habitats, but of particular importance to the life cycles of these species is the periodic flooding or ponding of water associated with the hydrologic regime of riverine backwater wetlands (Smith and Klimas 2002).

In addition to the information provided in the FSEIS, EPA evaluated additional information regarding faunal assemblages and species in the project area, including information provided by the FWS at the request of EPA (Appendix 4). As noted above, the Yazoo Backwater Area is an area that is micro-topographically and geomorphologically diverse. It can be broadly classified as a river-floodplain ecosystem characterized by seasonal floods which exchange nutrients and organisms among a mosaic of habitat types. The movement of floodwaters onto the floodplain and the associated exchange of materials lead to the biological productivity of these bottomland hardwood ecosystems (Junk et al., 1989; Bunn and Arthington, 2002; and Sparks, 1995). A growing body of evidence indicates that the ecological diversity and integrity of large floodplain rivers are maintained by flood pulses, channel-forming floods, and by river-floodplain connectivity. The native biota has developed strategies to take advantage of these flood pulses.

a. Invertebrates

Invertebrates are at the base of the food web and a primary aspect in the breakdown of organic carbon as discussed earlier in Section IV.B.3. Many invertebrate species respond to various inundation regimes found throughout the floodplain. Common taxa collected from forested wetlands, include: isopods (*Asellus* sp.), fingernail clams (*Pisidium* sp), amphipods (*Cragonyx* sp), crayfish (*Procambarus* sp.), and oligochaetes (Wehrle, 1992). Isopods and amphipods (primary shredders); midge larvae, aquatic worms and fingernail clams (collectors); and orb snails (grazers) were encountered more frequently in naturally flooded forests within the Delta National Forest than in artificially flooded greentree reservoirs or clearcut areas indicating natural conditions promote productive invertebrate populations (Wehrle, 1992). These organisms are very abundant in flooded bottomland hardwood forests facilitating organic carbon and nutrient cycling as well as providing an abundant food source for amphibians, reptiles, birds, and mammals. Wehrle et al. (1995) found that invertebrate biomass and density in the Delta National Forest was greater in seasonally flooded forest than in greentree reservoirs which have more static flood levels, indicating that invertebrate populations have increased numbers of taxa and individuals when a variable flood regime is present.

b. Amphibians and Reptiles

There are 21 species of amphibians which have been documented as occurring in the project area. Frogs [e.g., Southern cricket frog (*Acris gryllus*) and green frog (*Rana clamitans*)] newts [(e.g., eastern newt (*Notophthalmus viridescens*)] and salamanders [e.g., marbled (*Ambystoma opacum*) and mole (*Ambystoma talpoideum*)], toads (*Bufo spp*), and treefrogs [e.g., Bird-voiced (*Hyla avivoca*), Cope's gray (*Hyla chrysoscelis*), and green (*Hyla cinerea*) treefrogs] comprise the predominant species (Appendix 1). The list of species from the project area includes 60 percent of the number of species listed as occurring in the larger Mississippi Lowland ecoregion. There are 37 species of reptiles listed as occurring in the project area, most of which are snakes [e.g., copperhead (*Agkistrodon contortrix*), water moccasin (*Agkistrodon piscivorous*), rat snake (*Elaphe obsolete*)] skinks [e.g., Five-lined (*Eumeces fasciatus*), and Broadhead (*Eumeces laticeps*)], and turtles [e.g., false map (*Graptemys pseudogeographica*) and common musk (*Stenotherus odoratus*)] (Appendix 1). This represents 71 percent of the number of species found in the entire Mississippi Lowland ecoregion.

The backwater flooding that currently occurs in the project area benefits a myriad of aquatic and terrestrial species. All of the 21 amphibian species, and all but 5 of the 37 reptile species benefit from the flood pulse. Shallow areas at the periphery of the flooded zone hold water for the shortest period, from days to a couple of months, and provide breeding habitat for species such as the mole salamanders, which are winter breeders in Mississippi, and for winter-breeding frogs such as leopard frogs, pickerel frogs, spring peepers, and chorus frogs. Areas which are deeper and flooded for longer periods (i.e., places closer to the main channel of the river) are utilized by the summer-breeding frog species as water levels drop in late spring and summer.

Larval amphibians make significant contributions to the biomass of other vertebrates, including many of the wading birds. Aquatic turtles, such as the common red-ear slider, also support the diet of many species of fish, birds, and mammals, which eat their eggs and hatchling turtles. Turtles produce several clutches of eggs per season, over a reproductive lifetime of several decades, and thus can be a significant food source for numerous aquatic and terrestrial species (Appendix 4).

c. Fish

Riverine floodplain ecosystems support productive inland fisheries and a high degree of species richness for fish (Hoover and Kilgore, 1998). River floodplains and backwater ecosystems are crucial to numerous fish species. In a diverse floodplain, fish will seek out different flow regimes and temperatures among the floodplain habitats in order to fulfill certain life-history requirements (Turner et al., 1994). Riverine backwater wetlands provide abundant food, which promotes rapid growth along with providing complex habitat used as refugia by fish. Flooding of these areas, particularly in late winter and spring, provide backwater dependent fish with the necessary conditions, including water with little or no current, soft-sediment substrates, and aquatic or inundated terrestrial vegetation, for spawning, nursing, and juvenile and adult feeding. Forested wetlands along the Big Sunflower River provide excellent habitat for fish spawning and rearing (Hoover and Kilgore, 1998). Life history and production dynamics of fish in river floodplain ecosystems are linked primarily to hydrologic regimes and heterotrophic processes (e.g., microbes convert organic materials to forms utilized by invertebrates which in turn are food for fishes). The warmer waters found in flooded backwater locations stimulate biological activity of aquatic invertebrates and fishes in these systems (Jackson, 2005). As water gradually covers the forest floor, invertebrate eggs, such as water fleas, begin to hatch and feed upon bacteria and fungi colonizing detritus. Flooding also increases aquatic habitat for fish. For instance flooding will introduce snags which provide important in-stream habitat for fish and attachment substrates for invertebrates.

FWS reports that despite being leveed and gated, the Yazoo Backwater Area is a highly productive fishery for catfishes [flathead (*Pylodictis olivaris*), blue (*Ictalurus furcatus*) and channel (*Ictalurus punctatus*)] and catostomids [primarily buffalofishes (e.g., Smallmouth (*Ictiobus bulbalus*) and Bigmouth buffalo (*Ictiobus cyprinellas*)]. These two groups in particular, are sought by subsistence and artisanal (i.e., small scale commercial) fishermen in the Yazoo Backwater Area. Blue sucker (*Cycleptus elongates*), which was once considered an important commercial fish but is now listed as a fish of special concern by the American Fisheries Society, is also found in the project area (Hand and Jackson, 2003). Blue sucker stocks are fairly strong and dynamic in the Yazoo River Basin and depend on the functional integrity (i.e., seasonal flooding, incorporation of organic material into streams, and maintenance of deep water by natural geomorphic processes) of river ecosystems like the upper Yazoo River (Hand and Jackson, 2003; Appendix 4). Many of these species utilize floodplains for either feeding or spawning. The catfishes use floodplains for foraging and cover while the buffaloes use the floodplains for spawning and foraging. Larger individuals and more abundant stocks of bigmouth buffalo, smallmouth buffalo and channel catfish, are produced as a result of the interaction between floodplain and stream during flooding (Jackson and Ye, 2000).

As noted in Table 3, fish collection records indicate at least 116 species of fish occur in the Yazoo Backwater Area (see Appendix 1). Of these, FWS estimates that over 58 species depend on backwater flooding and access to the floodplain to fulfill numerous life history requirements. Wharton (1982) reported that at least 20 families and 53 species of fish use various portions of the floodplain for foraging and spawning. In Arkansas' Cache River, another Lower Mississippi Valley backwater ecosystem, Kilgore and Baker (1996) reported similar results with most fish species utilizing floodplain habitats at some time during the year, many for spawning and rearing. Fish find different microhabitats to fulfill life history requirements in hydrologically and microtopographically diverse floodplains. Based on the increased availability of vegetation and associated food and habitat as the moving littoral zone traverses the floodplain, the pattern of annual flooding in the Cache River appears to be of paramount importance in structuring the wetland fish assemblage (Kilgore and Baker, 1996). Another Lower Mississippi Valley backwater ecosystem, the Atchafalaya River, also supports a diverse fish assemblage similar to the Yazoo Backwater area (Bryan et al., 1974). Fish undertake longitudinal (i.e., along the river/stream channel) and lateral (i.e., across the floodplain) migrations to spawning and feeding areas because optimal conditions for both activities vary with the flood cycle and do not often occur simultaneously in the same areas (Sparks, 1995).

Table 3. List of potential fish species occurring in the Yazoo Backwater Area based on collections by the Corps and the Mississippi Museum Of Natural History from Sharkey, Issaquena, Yazoo and Humphreys counties. Backwater dependency based on literature or collection records in backwater areas. (COE - collected by Corps in YBWA; BW-USFWS backwater dependent based on literature)

List of Spp in YBWA	**Common name**	**COE**	**BW-USFWS**
Alosa chrysochloris	Skipjack herring		
Ameiurus melas	Black bullhead	X	X
Ameiurus natalis	Yellow bullhead	X	X
Ameiurus nebulosus	Brown bullhead		X
Amia calva	Bowfin	X	X
Ammocrypta beani	Naked sand darter		
Ammocrypta clara	Western sand darter		
Ammocrypta vivax	Scaly sand darter	X	
Anguilla rostrata	American eel	X	
Aphredoderus sayanus	Pirate perch	X	X
Aplodinotus grunniens	Freshwater drum	X	X
Campostoma anomalum	Central stoneroller		
Carassius auratus	Goldfish		
Carpiodes carpio	River carpsucker	X	
Carpiodes cyprinus	Quillback		
Centrarchus macropterus	Flier	X	X
Cycleptus elongatus	Blue sucker	X	
Cyprinella camura	Bluntface shiner	X	
Cyprinella venusta venusta	Blacktail shiner	X	X
Cyprinus carpio	Common carp	X	
Dorosoma cepedianum	Gizzard shad	X	X
Dorosoma petenense	Threadfin shad	X	X
Elassoma zonatum	Banded pygmy sunfish	X	X

Erimyzon oblongus	Creek chubsucker		
Esox americanus	Redfin pickeral	X	X
Etheostoma asprigene	Mud darter	X	X
Etheostoma caeruleum		X	
Etheostoma chlorosoma	Bluntnose darter	X	X
Etheostoma fusiforme	Swamp darter	X	X
Etheostoma gracile	Slough darter	X	X
Etheostoma histrio	Harlequin darter		
Eteostoma lynceum			
Etheostoma nigrum	Johnny darter		
Etheostoma parvipinne	Goldstripe darter		
Etheostoma stigmaeum	Speckled darter		
Etheostoma swaini	Gulf darter		
Etheostoma whipplei artesiae	Redfin darter	X	
Fundulus blairae			
Fundulus chrysotus	Golden topminnow	X	X
Fundulus dispar	Starhead topminnow	X	
Fundulus notatus	Blackstripe topminnow	X	X
Fundulus olivaceus	Blackspotted topminnow	X	X
Gambusia affinis	Mosquitofish	X	X
Hiodon alosoides	Goldeye	X	
Hiodon tergisus	Mooneye	X	
Hybognathus hayi	Cypress minnow		X
Hybognathus nuchalis	Mississippi sivery minnow	X	X
Hybopsis amnis			
Hypophthalmichthys molitrix			
Hypophthalmichthys nobilis	Bighead carp		
Ichthyomyzon castaneus	Chestnut lamprey	X	
Ictalurus furcatus	Blue catfish	X	X
Ictalurus punctatus	Channel catfish	X	X
Ictiobus bubalus	Smallmouth buffalo	X	X
Ictiobus cyprinellus	Bigmouth buffalo	X	X
Ictiobus niger.	Black buffalo		X
Labidesthes sicculus	Brook silverside	X	X
Lepisosteus oculatus	Spotted gar	X	X
Lepisosteus ossens	Longnose gar	X	X
Lepisosteus platostomus	Shortnose gar	X	X
Lepomis cyanellus	Green sunfish	X	X
Lepomis gulosus	Warmouth	X	X
Lepomis humilis	Orangespotted sunfish	X	X
Lepomis macrochirus	Bluegill	X	X
Lepomis marginatus	Dollar sunfish	X	X
Lepomis megalotis	Longear sunfish	X	X
Lepomis microlophus	Redear sunfish	X	X
Lepomis miniatus	Spotted sunfish	X	X
Lepomis symmetricus	Bantum sunfish	X	X
Luxilus chrysocephalus isolepis	Striped shiner	X	

Lythrurus fumeus	Ribbon shiner		
Lythrurus umbratilis cyanocephalus	redfin shiner	X	X
Macrhybopsis aestivalis	Speckled chub	X	
Macrhybopsis storeriana	Silver chub	X	X
Menidia audens			
Menidia beryllina	Inland silverside	X	
Micropterus punctulatus	Spotted bass	X	
Micropterus salmoides	Largemouth bass	X	X
Morone chrysops	White bass	X	X
Morone mississippiensis	Yellow bass		X
Morone saxatilis	Striped bass	X	
Moxostoma poecilurum	Blacktail redhorse	X	
Notemigonus crysoleucas	Golden shiner	X	X
Notropis atherinoides	Emerald shiner	X	X
Notropis blennius	River shiner		
Notropis buchanani	Ghost shiner	X	X
Notropis longirostris	Longnose shiner		
Notropis lutrensis	Red shiner	X	X
Notropis maculatus	Taillight shiner		
Notropis rafinesquei	Yazoo shiner	X	
Notropis sabinae	Sabine shiner	X	
Notropis shumardi	silverband shiner	X	X
Notropis texanus	Weed shiner		
Notropis volucellus	Mimic shiner	X	X
Notropis wickliffi			
Noturus gladiator			
Noturus gyrinus	Tadpole madtom	X	X
Noturus hildebrandi hildebrandi	Least madtom		
Noturus nocturnus	Freckled madtom	X	
Opsopoeodus emiliae	Pugnose minnow	X	X
Percina caprodes	Logperch		
Percina maculata	Blackside darter		
Percina sciera	Dusky darter	X	
Percina shumardi	River darter		
Polyodon spathula	Paddlefish	X	X
Phoxinus erythrogaster	Southern redbelly dace		
Pimephales notatus	Bluntnose minnow	X	
Pimephales promelas	Fathead minnow	X	X
Pimephales vigilax	Bullhead minnow	X	X
Pimephales vigilax perspicuus	Bullhead minnow		
Pomoxis annularis	White crappie	X	X
Pomoxis nigromaculatus	Black crappie	X	X
Pylodictis olivaris	Flathead catfish	X	
Scaphirhynchus platorynchus	Shovelnose sturgeon		
Semotilus atromaculatus	Creek chub		
Stizostedion canadense	Sauger	X	
116		79	58

The longer the fish can remain on the floodplain the greater the recruitment potential for the rivers' fish stocks (Jackson, 2005). It is commonly accepted that temperature, day-length, and the rise in water level are important for spawning. Upon hatching, most freshwater fish possess a yolk sac, which supplies nutrients for the first 7-10 days. Once the sac is used up, the fry have reached a critical stage where they must encounter food quickly, or starve. Flooded hardwoods and the abundance of food they produce enable fish larvae to encounter the critical food supply necessary for survival and growth. As the amount of flooded hardwoods increase, the supply of spawning and nursery habitat and the associated invertebrate populations, also increase. The result is an acceleration in the productivity of the habitat and, therefore, greater survival and growth in the fish populations (McCabe, et al., 1982). Studies suggest that reproductive success of early spring spawners will be poorer when there is reduced spring flooding. "In both tropical and temperate rivers, fish yields per unit surface area are considerably greater in rivers with flood pulses and floodplains than in nearby impoundments where flood pulses are reduced or absent" (Jackson, 2005).

In shallow flooded areas, such as the Yazoo Backwater Area, larval fish feed on rotifers, copepods, and cladocerans. Juvenile bluegill as well as other species feed primarily on aquatic insects, particularly midge larvae and small crustaceans (Ross, 2001). Crawfish (primarily *Procambrus clarkii*) constitute a principle food source for many juvenile and adult fishes which utilize the Yazoo Backwater Area, including largemouth bass, warmouth, yellow bullhead, and blue catfish (Bryan et al., 1975). During seasonal inundation of bottomland hardwood wetland systems such as the Yazoo Backwater Area, crayfish occupy open water on the floodplains and adult channel catfish aggregate in locations where the river channel and floodplain are coupled and forage heavily on crayfish (Flotemersch and Jackson, 2005).

d. Birds

There are 223 species of birds listed as occurring in the Mississippi Lowland ecoregion by the World Wildlife Fund. FWS has documented 184 of these species as well as an additional 74 (for a total of 258) utilizing the complex of National Wildlife Refuges located in the Yazoo Backwater Area (see Appendix 1). The FWS wildlife refuge list is a more comprehensive list, with greater species richness due to the length of the record (observations began in 1956) and the inclusion of "rare" migrants. Each season of the year, "rare" migrants will utilize the diverse assemblage of habitats present at area refuges but are not regular inhabitants. Hence, the species richness for birds at the refuges tends to be higher than ecoregional or physiographic area richness estimates. There are 41 bird species on the National Wildlife Refuge List for the Yazoo Complex which are listed as "rare." These rare species are often not included in other bird species lists. The Mississippi Lowland ecoregion list is comprised of regular residents/migrants in the Region. A comparison of the Wildlife Refuge list without "rare" species and the Mississippi Lowland ecoregion list is 217 to 223 respectively.

FWS has reported that project area wetlands support an abundant and diverse bird community reflective of similar bottomland hardwood wetlands in the LMRAV (Appendix 4). Smith et al. (1993) listed 200 species of birds that occur in the LMRAV, largely in bottomland hardwood wetlands, which is 85 percent of the 236 species of birds listed in eastern North America. Table 4 identifies wetland dependent bird species found in the Yazoo Backwater Area.

Table 4. Birds of the Yazoo River Basin documented as requiring seasonal flooding during winter (W), spring migration (M), or breeding season (B), as determined by the FWS (Appendix 4)

Common Name	**Scientific Name**	**Season Of Use**	**References**
Spotted Sandpiper	*Actitis macularia*	M	Yazoo NWR list
Wood Duck	*Aix sponsa*	W, B	Heitmeyer et al. 1981, Reinecke et al. 1987, Drobney 1977
Roseate Spoonbill	*Ajaia ajaja*	M	Yazoo NWR list
Northern Pintail	*Anas acuta*	W, M	Fredrickson & Heitmeyer 1988, Heitmeyer 2001
American Wigeon	*Anas americana*	W, M	Fredrickson & Heitmeyer 1988, Heitmeyer 2001
Northern Shoveler	*Anas clypeata*	W, M	Fredrickson & Heitmeyer 1988, Heitmeyer 2001
Green-winged Teal	*Anas crecca*	W, M	Fredrickson & Heitmeyer 1988, Heitmeyer 2001
Blue-winged Teal	*Anas discors*	W, M	Fredrickson & Heitmeyer 1988, Heitmeyer 2001
Mallard	*Anas platyrhynchos*	W, M	Fredrickson & Heitmeyer 1988, Hietmeyer 1988, Heitmeyer 2001, Heitmeyer & Fredrickson 1981, Reinecke et al. 1987
American Black Duck	*Anas rubripes*	W, M	Fredrickson & Heitmeyer 1988, Heitmeyer 2001
Gadwall	*Anas strepera*	W, M	Fredrickson & Heitmeyer 1988, Heitmeyer 2001
Anhinga	*Anhinga anhinga*	B	Yazoo NWR list
Greater White-fronted Goose	*Anser albifrons*	W, M	Yazoo NWR list
Great Egret	*Ardea alba*	B	Unpub. report 2002, Yazoo NWR list
Great Blue Heron	*Ardea herodias*	B	Unpub. report 2002, Yazoo NWR list
Ring-necked Duck	*Aythya collaris*	W, M	Fredrickson & Heitmeyer 1988, Heitmeyer 2001
American Bittern	*Botaurus lentiginosus*	M, B	Unpub. report 2002, Yazoo NWR list
Canada Goose	*Branta canadensis*	W, M	Fredrickson & Heitmeyer 1988
Green Heron	*Butorides virescens*	B	Yazoo NWR list
Sanderling	*Calidris alba*	M	Yazoo NWR list

Dunlin	*Calidris alpina*	M	Yazoo NWR list
Baird's Sandpiper	*Calidris bairdii*	M	Yazoo NWR list
Western Sandpiper	*Calidris mauri*	M	Twedt et al. 1997
Pectoral Sandpiper	*Calidris melanotus*	M	Twedt et al. 1997
Least Sandpiper	*Calidris minutilla*	M	Twedt et al. 1997
Semipalmated Sandpiper	*Calidris pusilla*	M	Twedt et al. 1997
Killdeer	*Charadrius vociferus*	M, B	Twedt et al. 1997
Little Blue Heron	*Egretta caerulea*	B	Rodgers & Smith 1995, Unpub. report 2002
Reddish Egret	*Egretta rufescens*	B	Yazoo NWR list
Snowy Egret	*Egretta thula*	B	Yazoo NWR list
Tricolored Heron	*Egretta tricolor*	B	Unpub. report 2002, Yazoo NWR list
Acadian Flycatcher	*Empidonax virescens*	B	Heitmeyer et al. 2005, Yazoo NWR list
White Ibis	*Eudocimus albus*	B	Unpub. report 2002
Common Snipe	*Gallinago gallinago*	W, M	Twedt et al. 1997
Common Moorhen	*Gallinula chloropus*	B	Yazoo NWR list
Black-necked Stilt	*Himantopus mexicanus*	M, B	Yazoo NWR list
Least Bittern	*Ixobrychus exilis*	M, B	Unpub. report 2002, Yazoo NWR list
Short-billed Dowitcher	*Limnodromus griseus*	M	Twedt et al. 1997
Long-billed Dowitcher	*Limnodromus scolopaceus*	M	Twedt et al. 1997
Hooded Merganser	*Lophodytes cucullatus*	W, B	Fredrickson & Heitmeyer 1988, Yazoo NWR list
Wood Stork	*Mycteria americana*	M	Unpub. report 2002
Yellow-crowned Night-Heron	*Nyctanassa violacea*	B	Fredrickson 2005, Unpub. report 2002

Large numbers of 12 species of waterfowl commonly use bottomland hardwood habitats in the southeastern U.S., small numbers of 11 species regularly use bottomland hardwood areas, and 8 species less commonly use bottomland hardwood (Fredrickson and Heitmeyer, 1988; Heitmeyer, 2001). All of these species of waterfowl utilize habitats in the Yazoo Backwater Area. Waterfowl occupy many niches in bottomland hardwood wetlands of the LMRAV. The flooded forests of the LMRAV provide waterfowl with many of their needs. Acorns, as well as seeds from wetland plants growing in forest openings are important foods. Leaf litter furnishes a rich substrate for invertebrates, which can be a significant component of waterfowl diets (Heitmeyer, 1988). Nutrient reserves, such as invertebrates, fuel migration and help meet energetic requirements during periods of low, widely dispersed food availability (Heitmeyer et al., 2005). Population size and recruitment of most species of waterfowl are correlated with wetness of primary breeding habitats, and, at least for some species, also migration and wintering habitats. The amount and type of habitat flooded, annual food production, and availability of refuges within bottomland hardwood and associated wetland habitats in the LMRAV influences local and regional distribution of species (e.g., Nichols et al., 1983), and subsequent production and survival of mallards and wood ducks (Heitmeyer and Fredrickson, 1981; Reinecke et al., 1987). The wood duck is an important resident species in the Yazoo River Basin. Wood ducks require wetland areas that provide a high-quality plant and invertebrate food base. During the breeding season, female wood ducks may use stored lipid reserves to assist with egg production; however, they must consume essentially all of the protein needed for egg formation on a daily basis during the laying period (Drobney, 1977). The required source of most of these proteins is a variety of invertebrates produced in these wetland habitats.

In bottomland hardwood wetland ecosystems, one of the most important elements of their productivity is the invertebrate population (Griffith and Welker, 1987). In turn, hydrology is the most important factor that determines vegetative structure and function (Fredrickson, 1979; Klimas et al., 1981; Schoenholtz, 1996), and thus invertebrate communities (Moore, 1970; Reid, 1985; Fredrickson and Reid, 1990; Magee et al., 1999; Sharitz and Batzer, 1999). Wetland invertebrates, such as adult aquatic insects, insect larvae and nymphs, crustaceans and mollusks, provide an important food source for wetland bird species during critical physiological periods such as breeding and migration (Reid, 1985). Short-term flooding regimes may determine the occurrence and abundance of invertebrates (Fredrickson and Reid, 1988). The duration and timing of flooding in river basins, such as the Yazoo River Basin, directly influences availability of aquatic habitat and indirectly affects invertebrate populations. Densities of invertebrates change rapidly and dramatically as organisms break or enter dormant stages and otherwise respond to changing environmental conditions (Smock, 1999). Fragmentation and modification of the timing and duration of natural flooding in bottomland hardwood ultimately reduces long-term productivity of these wetlands, limiting habitat availability, and resulting in a decline of wetland bird use (Fredrickson and Reid, 1990). For example, when forests become fragmented and drier, small rodent populations increase, causing greatly reduced survival of tree seedlings and changes to detrital bases which have ripple effects throughout most food chains in the system (Heitmeyer et al., 2005). "In Mississippi, invertebrate biomass was reduced by approximately one-half (80.05 vs. 40.64 kg/ha) in consecutive years in a naturally flooded bottomland hardwood forest with less frequent flooding during the second winter" (Wehrle et al., 1995). Wehrle (1992) also documented a positive correlation between water depth and invertebrate abundance in naturally flooded hardwood bottomlands at Noxubee National Wildlife Refuge in Mississippi, where lower sites which flooded deeper and longer had greater invertebrate biomass.

Fourteen of 18 species of wading birds found in North America use bottomland hardwood habitats, and 12 of these species breed regularly in this system (Heitmeyer et al., 2005). Diets of most wading birds vary with seasonal availability, and many species forage extensively on small fish, amphibians, reptiles, and crayfish. Waders generally depend on seasonally-fluctuating water levels in bottomland hardwood and associated wetlands to make prey more available. One species that nests in the Yazoo Backwater Area, the Little Blue Heron, has recently shown declines in its population. Although the overall causes for this population change cannot be directly determined, it is believed that altered hydrocycles and habitat conversion have caused and continue to cause the greatest threats to this species. Food limitation, caused by wetland destruction and degradation, appears to be a significant factor controlling its breeding success and, therefore, its population numbers (Rodgers and Smith, 1995). Among the wading birds listed as priority species for management in the LMRAV are the following: Little Blue Heron, Tricolored Heron, American Bittern, Least Bittern, Black-crowned Night Heron, Yellow-crowned Night Heron, Great Egret, White Ibis, and Wood Stork (Appendix 4).

For many shorebird species, migration "stop-over" habitats play a vital role in their ability to accumulate fat reserves. Shorebirds unsuccessful in obtaining necessary fat are thought to have very low survival rates (Brown, Hickey, and Harrington, 2000). If these fat deposits are crucial for breeding and if they are dependent on feeding conditions on migratory stopovers south of breeding area, then changes in quantity and quality of migratory habitat could influence breeding populations and fitness parameters (Appendix 4).

Several species of secretive marsh birds, such as rails and gallinules, commonly use bottomland hardwood habitats, primarily during migration. Some populations of this bird group, such as the King Rail, have declined alarmingly in the past 30 years, due mostly to loss of wetlands (Meanley, 1992). Reid (1989) discusses this issue: "The Mississippi River corridor has historically formed important breeding and migratory habitat for King Rails…[m]ajor degradations to this ecosystem have occurred in the last century and include constriction of banks that modify flow and flood capacity, dike construction that impacts channel direction, and addition of toxicants through point and non-point pollution. Perhaps the greatest direct threat to King Rail habitats has been the large reduction in herbaceous floodplain wetlands through agricultural, urban, and industrial developments…" The most important food items for King Rails are crayfish and aquatic insects. Crayfish formed 61 percent by volume of foods in spring in rice fields and associated wetlands in eastern Arkansas (Meanley, 1956). Seasonal flooding of wetlands in the Yazoo project area is required for the production of these important foods as well as nesting cover.

Other aquatic-associated migrants utilizing the deeper open water portions of the Yazoo Backwater Area include the pied-billed grebe, double-crested cormorant, and anhinga. Anhingas breed in the area, typically in low elevation sites where large baldcypress trees and permanent water occur.

About 130 species of songbirds regularly use bottomland hardwood habitats, most of which have been documented in the Yazoo Backwater Area (see Appendix 1). Most songbirds in this system are insectivorous during spring migration and the breeding season. These birds capitalize on pulses of certain foods, often linked with flood pulses, which produce insect hatches in spring and lepidopteran larvae in early summer (Heitmeyer et al., 2005).

e. Mammals

There are 62 species of mammals listed as occurring in the Mississippi Lowland ecoregion by the World Wildlife Fund. Of these, 45 occur in the Yazoo Backwater Area and an additional 3 species have been collected which were not listed by WWF (see Appendix 1). Thus 77 percent of the number of species which occur at the ecoregion scale also occur in the project area. The project area has representative species from the 7 mammalian orders: Insectivora [(e.g., southeastern shrews (*Sorex longirostris*), least shrews (*Cryptotis parva*), and eastern moles (*Scalopus aquaticus*)]; Chirpotera (e.g., bats); Lagomorpha [e.g., eastern cottontail (*Sylvilagus floridanus*) and swamp rabbits (*Sylvilagus aquaticus*)]; Rodentia [e.g., squirrels, mice, beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus)*]; Carnivora [e.g., Louisiana black bear (*Ursus americanus*), river otter (*Lutra canadensis*), long tailed weasel (*Mustela frenata*), raccoons (*Procyon lotor*)]; Marsupialia [opossum (*Didelphis virginiana*)]; and Artiodactyla [white-tail deer (*Odocoileus virginianus*)]. The species richness of mammals in bottomland hardwood wetlands is equal to or exceeds the richness in adjacent upland habitats. Many mammal species are omnivores and have diverse diets in order to take advantage of complex food chains and food availability after major events like floods. Food chains in bottomland hardwood wetlands are long and complex and ultimately detrital based (i.e., all begin at the bottom of the food chain with invertebrate shredders, grazers, and collectors which process plant material). As with the other wildlife groups discussed above, invertebrates form a major food resource for predators and are available in detrital-based and production-based food webs. Small mammals, such as shrews, will consume large volumes of insects (Wigley and Lancia, 1998).

f. Nationally Significant Public Lands

Significant, seasonally-inundated public lands are located in the Yazoo Backwater Area including: (a) the Delta National Forest (61,800 acres); (b) the Yazoo National Wildlife Refuge (NWR) Complex [including the Yazoo (13,000 acres), Holt Collier (1,400 acres), Theodore Roosevelt (4,000 acres), and part of Panther Swamp (14,000 acres) refuges]; (c) Twin Oaks Mitigation Area (5,675 acres); (d) Mahanna Mitigation Area (12,675 acres); and (e) Lake George Wildlife Management Area (8,383 acres). Figure 3 illustrates the locations of the FWS NWRs and the Delta National Forest in and near the Yazoo Backwater Area.

According to the FWS, the four NWRs located in the Yazoo Backwater Area are managed, in part, to provide habitat for breeding and migratory birds with an emphasis on waterfowl. They are also managed to provide opportunities for compatible public use or recreational activities. The NWR System Improvement Act of 1997 states that the Secretary of the Interior shall "ensure that the biological integrity, diversity and environmental health of the NWR System are maintained for the benefit of present and future generations of Americans." The NWR System Improvement Act also established six priority public uses on refuge lands where they are compatible with the defined purpose(s) of each refuge. These priority public uses are hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation.

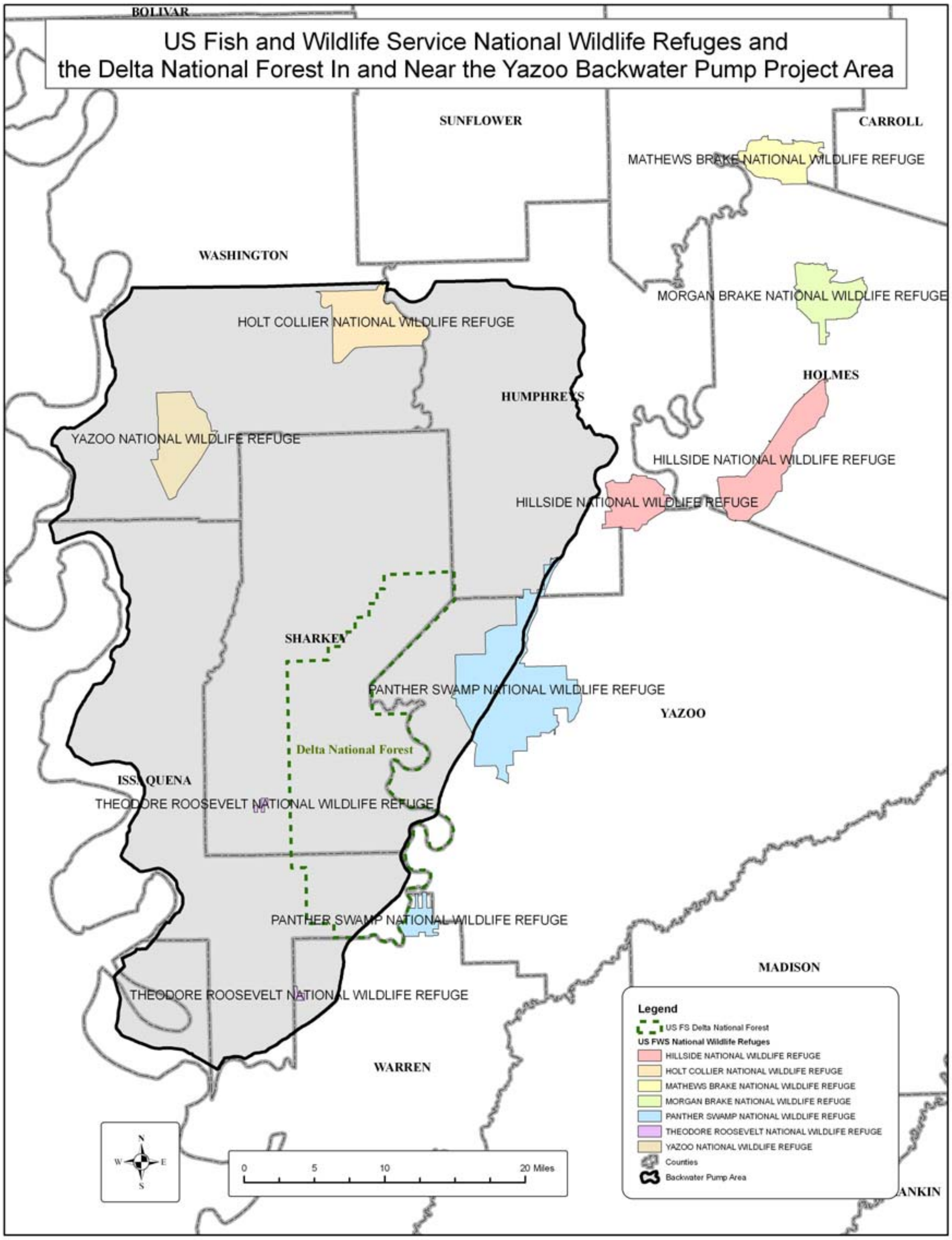

Figure 3 illustrates the locations of the U.S. Fish and Wildlife Service National Wildlife Refuges and the Delta National Forest in and near the Yazoo Backwater Area.

According to the FWS, Mississippi has a 30,538,118 acre land base of which only 1,042,408 acres or 3 percent is publicly owned and not all of those acres are open to public recreation. Thus, these refuges provide important public recreational opportunities in an area where such opportunities are limited. In 2001, there were 357,000 licensed hunters and 586,000 anglers in the state of Mississippi. FWS reports that in 2002, an estimated $13.7 million in revenue was generated by hunting and angling activities and wildlife watchers spent $974 million, which supported 12,258 jobs in Mississippi.

There are an estimated 103,000 visits to Panther Swamp, Holt Collier, and Yazoo NWRs each year (only 320 acres is owned within the Theodore Roosevelt NWR acquisition boundary and these acres were only recently obtained; as such visitor use data is not yet available for this refuge). Historically, the refuges' visitor services programs focused on traditional recreational uses, primarily hunting and fishing. However, NWRs now fulfill a much broader need and offer more services than before. Of the 103,000 people per year that visit the refuges in the Yazoo Backwater Area, the majority (80-87 percent) are there to observe, hear, photograph, or learn about wildlife in a natural setting. According to the FWS, these refuges provide vast acreages of bottomland hardwood forested wetlands that are home for a diverse assemblage of fish and wildlife found nowhere else in Mississippi.

C. Summary

Based on the administrative record, EPA Region IV finds that the Yazoo Backwater Area contains outstanding fish and wildlife resources and habitat. The Region bases its conclusion on several factors including extensive species lists and collection records from the World Wildlife Fund; Mississippi Department of Wildlife, Fisheries, and Parks; the Mississippi Natural Heritage Program and Natural Science Museum; and the FWS National Wildlife Refuges. All of these sources as well as a great deal of published literature indicate that the Yazoo Backwater Area includes significant wetland and aquatic resources of national importance. The biodiversity of the Yazoo Backwater Area is a product of the topographic and hydrologic complexity which is a result of the fluvial geomorphology of the Mississippi River. This complexity has lead to the development of numerous wetland and aquatic habitats which are connected via the backwater flood pulse and foster tremendous wetland plant and wildlife productivity. The wetlands in the Yazoo Backwater Area represent a small remnant of the once vast bottomland hardwood wetlands of the LMRAV. The Yazoo Backwater Area is of major importance as a migratory corridor for many species of birds and mammals including the Federally protected Louisiana Black Bear. The productivity of the fishery and those species dependent on backwater areas indicates that river floodplain connectivity is still operating. The area provides not only habitat for a wide range of fish and wildlife but also provides wetland functions which promote improved flood storage and water quality. These wetland functions contribute to the ecosystem health of the Yazoo Backwater Area. Despite historic and cumulative influences by human activities, the wetland, wildlife and fisheries resources of this area are significant.

V. Adverse Environmental Impacts

A. Section 404(c) Standard

The CWA requires that exercise of the final section 404(c) authority be based on a determination of “unacceptable adverse effect” to municipal water supplies, shellfish beds, fisheries, wildlife, or recreational areas. In making this determination EPA takes into account all information available to it, including any written determination of compliance with the Section 404(b)(1) Guidelines. EPA’s regulations at 40 CFR 231.2(e) define "unacceptable adverse effect" as:

> *Impact on an aquatic or wetland ecosystem which is likely to result in significant degradation of municipal water supplies or significant loss of or damage to fisheries, shellfishing, or wildlife habitat or recreation areas. In evaluating the unacceptability of such impacts, consideration should be given to the relevant portions of the Section 404(b)(1) Guidelines (40 CFR Part 230).*

Those portions of the Guidelines relating to less environmentally damaging practicable alternatives, significant degradation of waters of the United States, water quality impacts, and impact minimization are particularly important to evaluating the unacceptability of environmental impacts. The Guidelines prohibit any discharge of dredged or fill material where: (1) there is a less environmentally damaging practicable alternative to meet the project purpose; (2) the proposed project would violate other environmental standards, including applicable water quality standards; (3) the proposed project would cause or contribute to significant degradation of the Nation’s waters; or (4) the proposed project fails to adequately minimize and compensate for wetland and other aquatic resource losses (see 40 CFR 230.10(a)-(d)).

B. Extent and Location of Wetland Impacts

EPA Region IV has determined that the proposed project will have an unacceptable adverse effect on extensive areas of ecologically significant and important forested wetlands and their associated fisheries and wildlife resources. According to the FSEIS, the construction and operation of the proposed pumps would degrade the critical functions and values of approximately 67,000 acres of wetland resources in the Yazoo River Basin (Table 5). As a point of reference, the impacts estimated by the Corps for this single project are more extensive than the total impacts (on an annual average basis) associated with the 86,000 projects authorized by the Corps permit program nationwide each year.[9] We do not believe that impacts of this magnitude are consistent with the requirements of the CWA, including those established pursuant to section 404(c).

[9] Based on data from Fiscal Years 1999 to 2003. Source: Corps Regulatory Program, Headquarters, 2008. See: http://www.usace.army.mil/cw/cecwo/reg/2003webcharts.pdf

Table 5. Change in flood duration, by cover type, in the FSEIS wetland assessment area (FSEIS HGM Assessment Report, 2007)

Land Cover Type	Acres Changed
Mature forest	29,822
Middle aged forest	341
Early aged forest	18,174
Recently logged	78
Agricultural	17,577
Other	949
Total	**66,941**

EPA's concerns regarding this project are amplified because we believe the spatial extent of wetlands potentially impacted by the proposed project is much greater than that estimated in the FSEIS. As discussed below, EPA's analysis identified 81,000 acres of wetlands which are located outside of the wetland impact assessment area established in the FSEIS. EPA believes that approximately 24,000 acres of these 81,000 acres of wetlands are connected to backwater flooding and will be adversely impacted by the project. However, the FSEIS did not evaluate impacts to these wetlands.

1. Additional Wetland Impacts

In our November 2000, comment letter on the DSEIS, EPA recommended that the Corps expand its scope of wetland impact assessment to include jurisdictional wetlands in the 2-year floodplain (i.e., areas extending out to the 91.0 foot, NGVD elevation). While the FSEIS implies that there are more wetlands in the 100-year floodplain than previously estimated in the DSEIS, the FSEIS assumes that only those wetlands flooded for 5 percent of the growing season and which occur at or below the 88.6 foot, NGVD elevation [i.e., the wetland impact assessment area established in the FSEIS using the Flood Event Assessment Tool (FEAT)/Flood Event Simulation Model (FESM)] will be affected by this project. The FSEIS also concludes that any wetlands occurring outside the FEAT/FESM modeled boundary are not connected to the backwater ecosystem and thus would not be impacted by the pumping project. We disagree and, as discussed further below, note that data included in the FSEIS supports EPA's position that a significant amount of wetlands outside the FEAT/FESM modeled boundary is indeed connected to the backwater ecosystem, and thus will likely be adversely impacted by the proposed project.

During the course of this project several attempts have been made to estimate the spatial extent of wetlands based upon remote sources of data (i.e., Geographic Information Systems (GIS), satellite images, hydrologic models). These remote based estimates of wetland extent ranged from approximately 60,000 to over 200,000 acres. Since these landscape level estimates were based on remote data with un-estimated error, EPA determined a field based, statistical survey would provide a more precise and scientifically defensible basis for establishing the extent and spatial distribution of wetlands in the study area. Therefore, in 2003, EPA in cooperation with the Corps, the FWS and NRCS implemented a field sampling survey using EPA's Environmental

Monitoring and Assessment Program (EMAP). EMAP survey designs and methods have been developed and tested within EPA's Office of Research and Development over the past decade with published results. The results of this study were included in the FSEIS (FSEIS Appendix 10, Supplement A) and are incorporated into this document as Appendix 2.

The spatial extent and distribution of wetlands in the Yazoo Backwater Area was determined with known confidence using EPA's EMAP survey design and analysis. Based on this design, the total wetland extent for the 100-year floodplain is approximately 212,000 acres. As illustrated by Table 6, within the Study Region (i.e., the 100-year floodplain) 3 categories of potential wetlands were identified: 1) wetlands depicted by the Corps' FEAT/FESM flood model (Feat Potential), 2) forested areas outside the FEAT/FESM modeled boundary (NLCD/WRP Potential) and 3) remaining areas in the 100-year floodplain not captured by the first two categories and which were thought to not likely contain wetlands (Low Potential).

Table 6. EMAP wetland results for Lower Yazoo Basin

Wetland Category	**Wetland Status**	**N Resp**	**Estimate (%)**	**StdEr r. (%)**	**LCB90 (%)**	**UCB 90 (%)**	**Estimate (ac)**	**StdErr (ac)**	**LCB90 (ac)**	**UCB90 (ac)**
Study region	Not wet	82	67.8	2.1	64.3	71.3	446244	14023	423178	469311
Study region	Wet	70	32.2	2.1	28.7	35.7	**212284**	14023	189218	235351
Study region	Total	152	100.0				658529			
FEAT Potential	Not wet	8	16.3	4.0	9.8	22.9	25544	6207	15335	35753
FEAT Potential	Wet	41	83.7	4.0	77.1	90.2	**130914**	6207	120705	141123
FEAT Potential	Total	49	100.0				156458			
NLCD/WRP Potential	Not wet	25	51.5	6.2	41.3	61.7	70161	8431	56294	84028
NLCD/WRP Potential	Wet	27	48.5	6.2	38.3	58.7	**66091**	8431	52224	79959
NLCD/WRP Potential	Total	52	100.0				136252			
Low potential	Not wet	49	95.8	2.6	91.6	100.0	350539	9330	335192	365818
Low potential	Wet	2	4.2	2.6	0.0	8.4	**15279**	9330	0	30626
Low potential	Total	51	100.0				365818			

LCB90 = Lower Confidence Band, 90th percentile
UCB90 = Upper Confidence Band, 90th percentile

Most of the wetlands were found in the FEAT/FESM predicted area. However, EMAP also found approximately 81,370 acres of wetlands occurring outside the wetland boundary predicted by the Corps' FEAT/FESM model (i.e., in the NLCD Potential category and the Low Potential category). It is the potential impacts to these wetlands that EPA believes were not analyzed in the FSEIS.

In order to determine how many of these 81,000 acres of additional wetlands may be impacted by the project, EMAP statisticians calculated the extent of wetlands in an area bounded by the 2 year floodplain. The areal extent of the 2 year floodplain was provided to EPA, by the Corps as an output of their flood model in 2005. As Table 7 indicates, the total area of wetlands in the 2 year floodplain is 179,120 acres. There are approximately 127,327 acres of wetlands within the FEAT/FESM boundary and 51,792 acres outside the

Corps' assessment area (i.e., in the NLCD Potential category and the Low Potential category).

Table 7. EMAP estimates of wetland extent in the 2 year floodplain with- and with-out project

Wetland Category	Wetland Status	NResp	Estimate %	StdError %	LCB 90 %	UCB90 %	Estimate (ac)	Std Error (ac)	LCB 90 (ac)	UCB 90 (ac)
Without Project										
2yr floodplain	Not Wet	36	46.8	3.4	41.3	52.4	157707	11368	139008	176406
2yr floodplain	Wet	55	53.2	3.4	47.6	58.7	**179120**	11368	160421	197819
2yr floodplain	Total	91	100.0				336827			
Feat Potential	Not Wet	8	16.7	4.0	10.1	23.2	25465	6093	15443	35488
Feat Potential	Wet	40	83.3	4.0	76.8	89.9	**127327**	6093	117305	137350
Feat Potential	Total	48	100.0				152793			
NLCD/WRP	Not Wet	11	45.8	7.8	33.0	58.7	31552	5385	22694	40410
NLCD/WRP	Wet	13	54.2	7.8	41.3	67.0	**37289**	5385	28431	46147
NLCD/WRP	Total	24	100.0				68842			
NonWet(3)	Not Wet	17	87.4	6.9	76.1	98.8	100689	7944	87622	113755
NonWet(3)	Wet	2	12.6	6.9	1.2	23.9	**14503**	7944	1437	27570
NonWet(3)	Total	19	100.0				115192			
With Project										
2yr floodplain	Not Wet	24	40.5	3.5	34.8	46.3	105697	9072	90775	120619
2yr floodplain	Wet	49	59.5	3.5	53.7	65.2	**155073**	9072	140151	169996
2yr floodplain	Total	73	100.0				260770			
Feat Potential	Not Wet	6	13.3	3.9	7.0	19.7	19555	5657	10250	28861
Feat Potential	Wet	39	86.7	3.9	80.3	93.0	**127109**	5657	117803	136414
Feat Potential	Total	45	100.0				146664			
NLCD/WRP	Not Wet	7	43.8	9.8	27.6	59.9	15789	3538	9968	21609
NLCD/WRP	Wet	9	56.3	9.8	40.1	72.4	**20300**	3538	14480	26120
NLCD/WRP	Total	16	100.0				36089			
NonWet(3)	Not Wet	11	90.2	7.9	77.2	100.0	70353	6146	60243	78018
NonWet(3)	Wet	1	9.8	7.9	0.0	22.8	**7665**	6146	0	17774
NonWet(3)	Total	12	100.0				78018			

EMAP statisticians then evaluated how many of the wetlands in the 2-year floodplain would be impacted by the proposed project (Appendix 5). The lower section of Table 7 shows the extent of wetlands predicted to exist with the project. This is a conservative estimate of wetland impacts in the 2-year flood plain because it looks only at hydrologic impacts as a result of the change in flood frequency As illustrated in Table 8, approximately 24,000 acres of wetlands outside the Corps' assessment area would experience this level of hydrologic impact. Despite EPA's recommendations to do so, none of these impacts were evaluated in the FSEIS.

Table 8. Change in EMAP wetland acres on 2 year floodplain as a result of Yazoo Backwater project.

Wetland Strata	Without Project Wetland Acres	With Project Wetland Acres	Change in acres
Feat Potential	**127327**	**127109**	**219**
NLCD/WRP	**37289**	**20300**	**16989**
NonWet(3)	**14503**	**7665**	**6838**
2yr floodplain	**179120**	**155073**	**24047**

2. Wetland Connection

The stated effect of the Yazoo Backwater Area Project is the reduction of the areal extent and duration of floods greater than the 1-year flood (FSEIS, paragraph 31). Paragraphs 194-195 in the Main Report state that the timing, frequency and duration of flooding will be affected by the project. Therefore, areas typically covered/inundated by 2-, 5-, 10-, 25-, 50-, and 100-year flood events will be reduced with the proposed project (i.e., less area will be flooded). These areas contain a substantial acreage of wetlands.

Data included in the FSEIS indicates that hydrologic connections exist to wetlands beyond those depicted by FEAT/FESM. The Wetlands Appendix of the FSEIS (Table 10-7) indicates that the March 10, 1989; March 21, 1987; and the January 9 and 13, 1983 satellite scenes show between 18,000 and 71,000 acres flooded in the area between 91.0 feet and 100 feet, NGVD (i.e., 2-100 year band). Hence, it is likely that the wetlands between the 2-year and 100-year flood elevations currently experience flooding. This conclusion is further supported by the statement in the FSEIS that the FESM model overestimates flooding close to the channels utilized by the model, but does "less well" when flooded areas are away from the channels (FSEIS, paragraph 43). EPA interprets this to mean that areas away from the FESM channels could flood, but the model is unable to depict those flooded areas. The Wetlands Appendix in the FSEIS (Appendix 10, Tables 10-10 (Areal extent of wetlands by composite wetland cell value) and 10-11 (Wetland losses by duration interval and duration zone) and Plate 10-25) further indicate there are wetland areas beyond the FEAT boundary that flood and would be affected by the proposed pump by virtue of having decreased flood durations after the project. These items in Appendix 10 indicate impacts to be approximately 60,000 acres. The Wetland Appendix also indicates that approximately 41,000 acres outside the Corps' assessment area (i.e., "Tier 2" wetlands in Table 10-16) flood during the 2-year return period flood.

The Corps' hydrologic data also indicates that flooded wetlands exist in the 2-year floodplain *and* will be impacted through a change in flood duration as well as a change in flood frequency. In 2004, the Corps provided EPA with a copy of the Period of Record gage data for the years 1943 to 1997. The data provided contained daily gage records, presumably as outputs from the Period of Record Routing model, for the with- and without project scenarios at Steele Bayou and Little Sunflower gages. A frequency analysis of this data indicates the 2-year flood elevation (stage) is 91.0 feet, NGVD, in the Lower Ponding area and 91.6 feet, NGVD, in the Upper Ponding area (FSEIS, Appendix 6 – Engineering Summary and Appendix 10). A stage duration analysis of these data indicates that, over the entire period of record, flooding sufficient for wetland hydrology occurs in areas between 89.0 feet and 92.0 feet, NGVD, at Steele Bayou under base conditions (Appendix 6). As a result of the proposed project, durations would be decreased, on an average annual basis, by 4.5 percent or 15 days. Flood frequency would be changed, at this 2-year return interval elevation, approximately 45 percent. This corresponds to the Corps' calculated stage reductions of approximately 4.5 feet (92.9 feet, NGVD, reduced to 88.5 feet, NGVD) at Steele Bayou.

The Corps' stage-frequency data indicates flooding will become much less frequent in the 2-and 5-year floodplains, increasing from a 2-year return interval to a 10-year return interval and a 5-year return interval to a 50-year return interval (FSEIS, Appendix 6, Table 6-14 and 6-15). This would result in significant impacts to, among other functions, the hydrologic functions of wetlands in the 2-year floodplain. However, as discussed previously, the Corps failed to evaluate these impacts by restricting their assessment area to only the FEAT/FESM modeled areas.

Existing information regarding the extensive hydrologic network in the Yazoo Backwater Area offers further support that wetlands outside of the Corp's assessment area would be affected by the proposed project. The National Hydrography Dataset (NHD) is a comprehensive set of digital spatial data that encodes information about naturally occurring and constructed bodies of water and paths through which water flows. The NHD is mapped at a 1:100,000 scale. When the NHD for the Yazoo River Basin is overlain with the wetland points surveyed in EMAP, the density of stream channels at this scale strongly indicates that backwater has a great many conduits and that many wetlands on the 2-year floodplain represented by EMAP data points are connected or adjacent to channels (see Figure 4). The Yazoo Basin HGM Guidebook points out that these channels can drain adjacent areas or serve as conduits for backwater during backwater flood events (Smith and Klimas, 2002). An analysis of the distance between EMAP wetland points and the nearest NHD stream indicates that, on average, wetland points are 0.2 miles away from streams. If the area around a wetland point is expanded to encompass the forest tract within which it is situated, than all 70 EMAP wetland points are intersected by streams (Appendix 7).

For these reasons, EPA maintains that approximately 24,000 additional acres of wetlands outside the FSEIS's wetland assessment area are connected to backwater flooding and will be adversely impacted by the project. However, the FSEIS did not evaluate impacts to these wetlands.

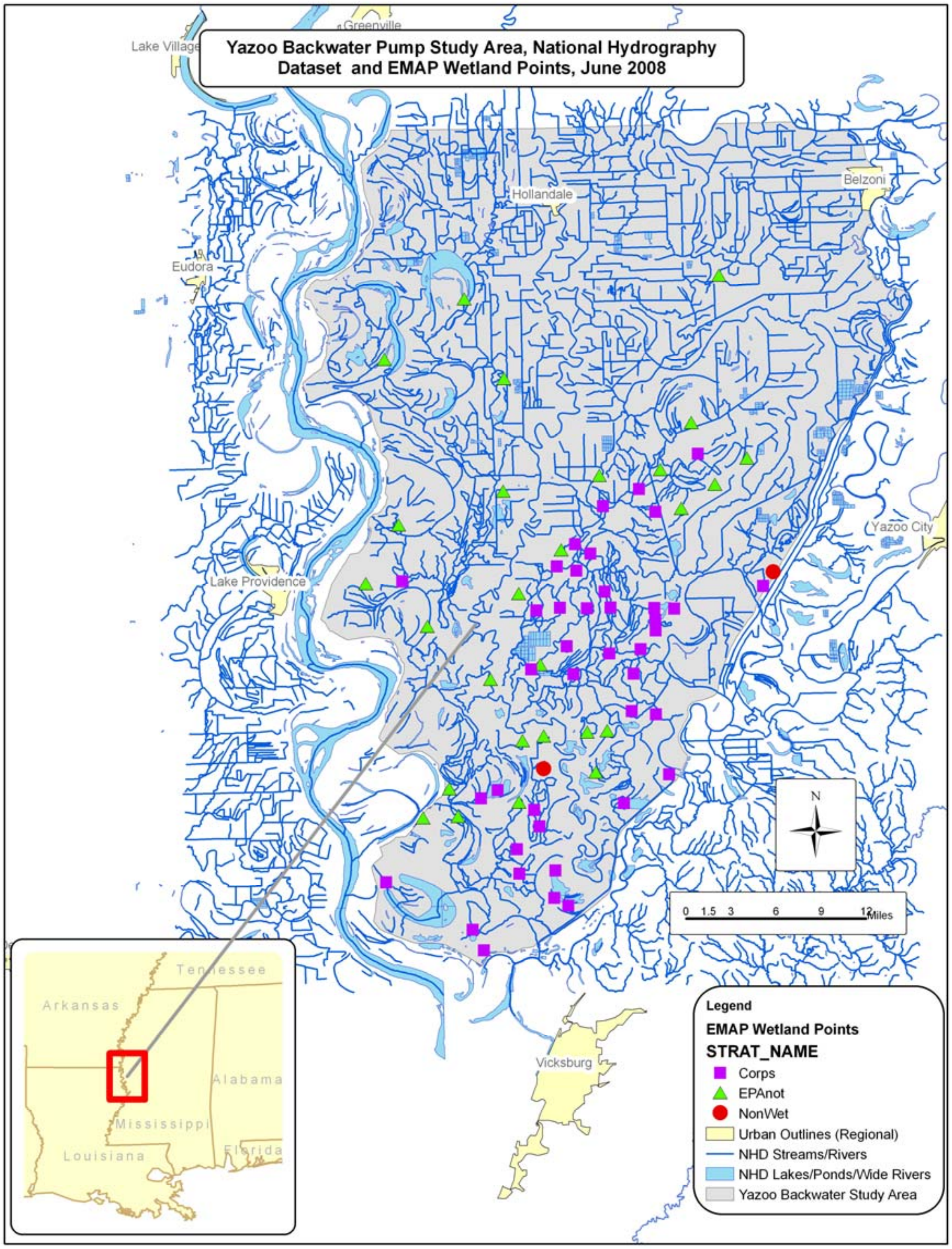

Figure 4 illustrates the Yazoo River Basin NHD overlain with EMAP wetland points

C. Adverse Impacts to Wetland Functions

EPA also maintains that the wetland, fish, and wildlife functional assessments in the FSEIS underestimate the degree and nature of adverse impacts to the 67,000 acres of wetlands that were evaluated in the FSEIS. EPA encouraged the use of the HGM assessment method and the Habitat Evaluation Procedure (HEP) as tools to help evaluate wetland functions for the FSEIS evaluations, and still supports the use of those tools. However, EPA believes that certain factors used by the Corps in the application of these assessment tools are flawed, leading to a significant underestimation of the proposed pumping station's adverse impacts on the aquatic ecosystem, as well as a significant overestimation of the project's environmental benefits. These concerns are summarized in Appendix 8. In addition to underestimating the degree and nature of the adverse effects to the 67,000 acres of wetlands noted in the FSEIS, the Corps provided no evaluation of the adverse effects to the approximately 24,000 acres of wetlands on the 2-year floodplain that EPA's EMAP evaluation determined would be affected by the proposed project. The following discussion of the adverse impacts of the proposed project is designed to provide a more complete evaluation of the proposed project's adverse impacts on wetlands and their associated fish and wildlife resources. In framing this discussion and providing our rationale for the Recommended Determination, EPA has carefully considered comments from the public as well as the Corps and project sponsor.

As discussed in Section IV, the annual hydrologic cycle of water moving into and out of the project area defines the ecological attributes of the project area's wetland and aquatic resources, which in turn fuels the fundamental processes essential to fish and wildlife productivity. This annual water cycle, or the flood pulse (Junk et al., 1989; Odum et al., 1995; Sparks, 1995), not only makes the project area's diverse habitats accessible to fish and wildlife but also provides the primary linkages that transfer energy and organisms between the project area wetlands and streams, and the rest of the lower Mississippi River ecosystem.

The basic objective of the project is to limit the spatial extent, frequency, and length of time the Yazoo Backwater Area floods. As illustrated by Figures 5 and 6, the hydrologic effect of this project, in addition to the effects of previous flood control projects in the area, will be to further dampen the variability in flood regime (the flood pulse) which currently contributes to the biodiversity of the project area's wetlands. The ecological effect of altering the hydrologic cycle of this area will be to eliminate or significantly degrade many of the critical functions provided by the wetlands in the Yazoo Backwater Area, including floodwater detention, nutrient cycling, organic carbon export, pollutant filtering/removal, and maintenance of biologically diverse plant and animal habitat. This in turn will adversely impact the diverse array of fish and wildlife species that live and depend on project area wetlands.

Table 9 shows the estimated with project FCIs for riverine backwater wetlands within the Yazoo Backwater Area. In calculating these FCIs, the Corps assumed that only one of the 19 indicators used in the HGM models (flood duration) would change as a result of

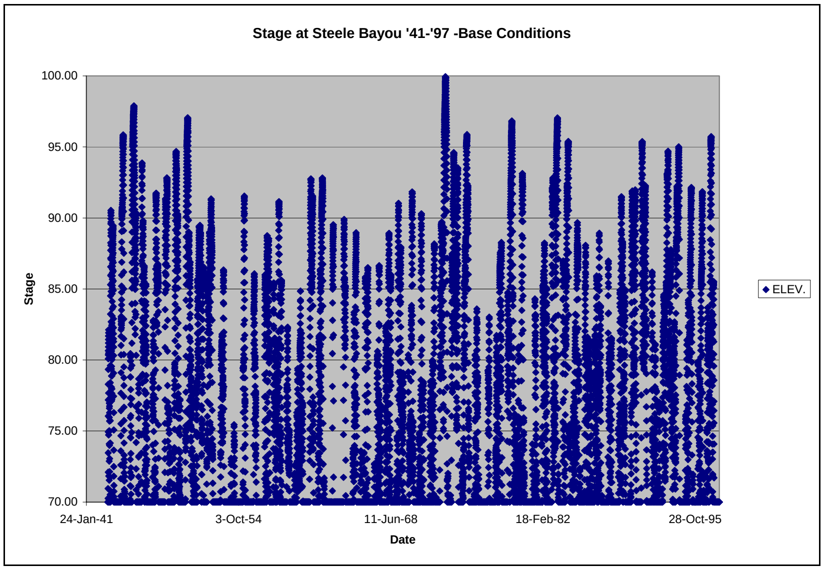

Figure 5. Annual peak water stages at Steele Bayou (1941-1997), without project.

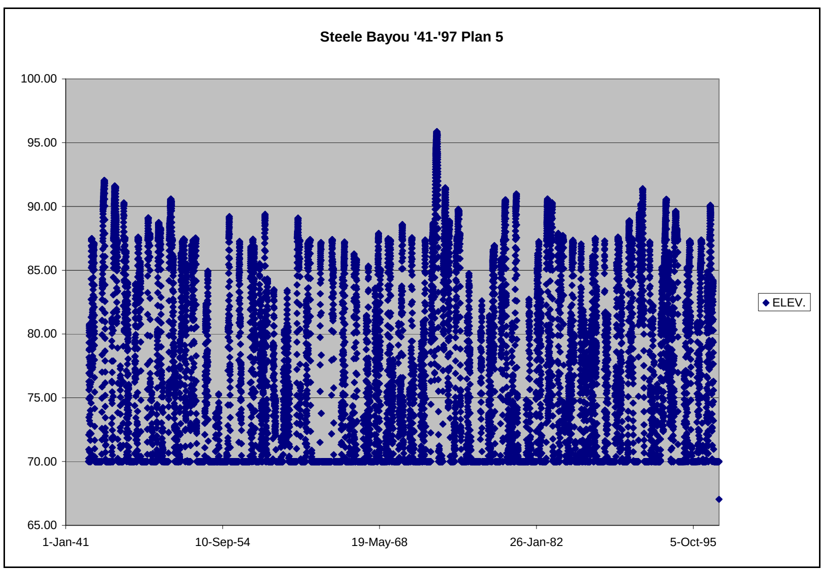

Figure 6. Annual peak water stages at Steele Bayou (1941-1997) with project.

Figures 5 and 6 show the base flooding conditions at Steele Bayou without and with the Backwater Pumps project. They were generated using the Corps Period of Record stage data to display annual peak discharges. The number and magnitude of flood events above the 90' NGVD elevation without the project (Figure 4) is drastically reduced with the project (Figure 5). The with project condition shows how the flood peaks have been "shaved-off" leading to a more regular flood regime and less hydrologic diversity (i.e., the floods don't occur as often or for as long, and are not as severe).

the project. All other indicators, including flood frequency, were assumed to remain constant. Despite the change in only one indicator, 4 functions (Export Organic Carbon, Physical and Biological Removal of Elements and Compounds, and Wildlife Habitat) showed impacts across all land use types (when compared to based conditions, shown in Table 2). As discussed below, when viewed in the context of effects on wetland biota and ecosystem integrity, these impacts become severe. Further, as discussed below and in Appendix 8, we believe that if particular flaws in the application of HGM had been addressed, the results of the FSEIS HGM analysis would have shown even greater impacts from the project.

Table 9. With project functional capacity indices for riverine backwater wetlands by land use type for the Yazoo Backwater Area (FSEIS HGM Assessment, 2007)

Function	Mature Forest	Middle Aged Forest	Pasture/ Planted/ Early Aged Forest	Recently Logged	Agricultural	Other
Detain Floodwater	0.98	0.78	0.75	0.73	0.25	na
Detain Precipitation	0.83	1.00	0.48	0.76	0.56	na
Cycle Nutrients	0.95	0.88	0.56	0.67	0.29	na
Export Organic Carbon	0.47	0.58	0.32	0.42	0.17	na
Physical Removal of E and C	0.39	0.69	0.21	0.49	0.43	na
Biologial Removal of E and C	0.47	0.58	0.32	0.42	0.17	na
Maintain Plant Communites	0.93	0.94	0.55	0.71	0.00	na
Provide Wildlife Habitat	0.89	0.88	0.48	0.74	0.00	na

1. Floodwater Detention

The FSEIS HGM assessment incorporates a flood duration variable in 4 of the 8 functions considered (i.e., Organic Carbon Export, Physical and Biological Removal of Elements and Compounds, and Wildlife Habitat). However, duration of flooding is not incorporated in the floodwater detention function, the specific function this project is designed to alter. With this omission, the HGM models do not show the project as having any effect on floodwater detention. In its discussion of the floodwater detention function in the Yazoo Basin HGM Guidebook, the authors stress the importance of flood duration to the performance of this function.

Similarly, despite information in the FSEIS Engineering Appendix (Table 10-6) which notes that areas above the 1-year floodplain will be flooded less frequently because of the project, the frequency of flooding variable in the HGM assessment models reflects no change, for any function. This again seems incongruous, since the entire objective of the project is to reduce the extent, frequency and duration of flooding. Thus, although certain analyses in the FSEIS clearly acknowledge that the ability of project area wetlands to perform the floodwater detention function will be reduced, the decision to exclude (in the case of duration) or hold constant (in the case of frequency) key variables prevents the FSEIS HGM assessment from adequately evaluating the change in this function.

The FSEIS HGM assessment also does not take into account those wetlands which occur outside the FEAT/FESM boundary and EPA believes would be affected by a change in duration and frequency (Figure 7). If these wetland areas had flooding reduced to a 5-year or greater return interval, which is indicated by the Corps' hydrologic data, then these wetlands could shift from the riverine backwater wetland subclass to the *flats* wetland subclass (see Table 1). This change in HGM subclass would result in the complete loss, by definition, of the functions performed by riverine backwater wetlands (i.e., detention of floodwater, organic carbon export and pollutant removal and sequestration functions). These functions are lost because the floodwaters no longer reach these areas with the regularity comparable to reference riverine backwater wetlands. Flat wetlands do not perform the functions associated with the regular inundation by floodwaters in riverine wetlands. The reduction in flood frequency and duration in the wetlands outside the FSEIS assessment area and the subsequent change in HGM subclass, results in a complete loss and/or change in key functions in approximately 24,000 acres of wetlands, none of which were evaluated by the FSEIS.

The reduction or elimination of the floodwater detention function of wetlands in the Yazoo Backwater Area as a result of the proposed project could increase peak discharges and water currents in the Mississippi River, and exacerbate flooding problems downstream. The decision to move forward with the proposed project comes at a time when communities in the vicinity of the project area and immediately downstream are struggling to recover from the effects of recent catastrophic flooding. By maintaining water levels of regular flood events at approximately 87.0 feet, NGVD, at the Steele Bayou gauge, water would not be allowed to collect for significant periods of time in the backwater wetlands. Instead, water that would otherwise remain in the wetlands would be drawn off by the pump and discharged to the Mississippi River, potentially impacting downstream communities. Reducing or eliminating the floodwater detention function of project area wetlands will also decrease the amount of water delivered to plants and allowed to infiltrate into the alluvial aquifer in the Yazoo Backwater Area. The effect of the project is to increase the overall volume of water moving downstream. Not allowing adequate time for floodwater infiltration in the Yazoo Backwater Area will also reduce the amount of water that returns to area streams as baseflow. This is particularly critical in the Yazoo Backwater Area as dewatering of the alluvial plain has already resulted in extremely low seasonal flows in area streams. For example, the Sunflower River flow rate often drops below the minimum low flow rate established by the USGS (i.e., the 7Q10 low flow rate) (Mississippi Museum of Natural Science, 2005).

2. Nutrient Cycling and Organic Carbon Export

These two functions are very tightly linked. Both involve the decomposition of organic material which is mediated by microbial and invertebrate communities supplied with moisture and nutrients from floodwaters. Nutrients are stored within, and cycled among: the soil; primary producers such as vascular and nonvascular plants; consumers such as bacteria, fungi, and animals; and dead organic matter (detritus) such as leaf litter or woody debris. The transformation of nutrients within and between these compartments is mediated by a complex variety of biogeochemical processes which, like organic carbon export, involve the breakdown of plant material to more readily used constituents. Certain nutrient transformations, namely denitrification, are mediated by microbes that occur in

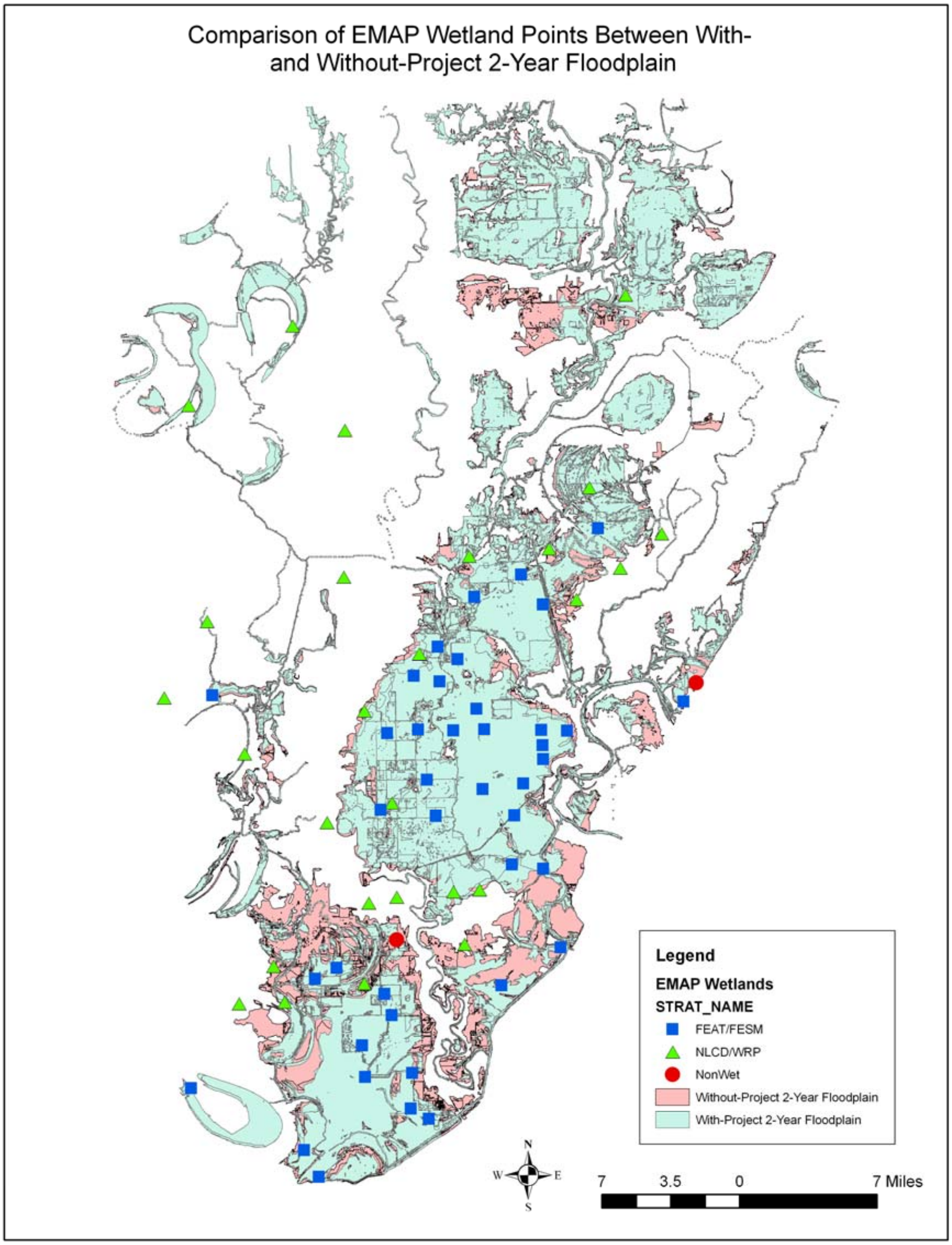

Figure 7 illustrates EMAP wetland points on 2 year floodplain with and without project an anaerobic environment. The moisture required for this and other biogeochemical processes represented by this function, can be delivered by the flood pulse. Nutrients can also be imported to the wetland via floodwaters. These nutrients can be used by the microbial and invertebrate communities to continue the nutrient cycling. Despite the recognition of the role of invertebrate biota in the processing of organic material and the subsequent cycling of this material to support internal wetland processes, and the role hydroperiod plays in supporting the invertebrate biota, no hydrologic indicator was explicitly incorporated by the Corps in its analysis of this function. This omission results in an underestimation of the effect of this project on nutrient cycling.

Reducing the spatial extent, frequency, and duration of time project area wetlands flood will significantly reduce the amount of dissolved and particulate organic carbon available for wetland and aquatic food webs as well as biogeochemical processes in downstream aquatic habitats. The microbial and invertebrate communities, which are critical to the breakdown and recycling of organic matter in these wetlands and serve as the base of the food web for wildlife, are adapted to the periodic pulsing of floodwaters which currently occurs. Without these periodic flood pulses, microbial and invertebrate communities will diminish, and this will affect the capacity of the wetland to maintain the base of the food chain. The cycling and export of dissolved and particulate carbon requires prolonged contact between soil organic matter, flood waters, and the invertebrate community and subsequent floodwater transport downstream – circumstances that would be dramatically altered by the proposed project.

In the 24,000 acres occurring in the 2 year floodplain and that were not evaluated in the FSEIS, the organic carbon export function would be lost completely since flooding would be reduced to a point (i.e., 10 year return) where floodwaters no longer access the wetland on a regular basis. Without regular input and export of nutrients and dissolved organic carbon by floods, these normally riverine wetlands would convert to flat wetlands and would no longer perform this particular function.

3. Pollutant Filtering and Removal

Reducing the spatial extent, frequency, and duration of time project area wetlands flood will reduce the capacity of area wetlands to remove water pollutants thus exacerbating existing water quality problems in the Yazoo Backwater Area. Many water pollutants are imported to wetlands via flood water. Hydrologic alterations associated with the proposed project (i.e., prevention of floodwater from accessing wetlands) will reduce the level of sediment deposition as well as the levels of permanent removal and temporary immobilization of nutrients, metals, and other elements and compounds in project area wetlands. Loss or reduction of this important water quality enhancement function is of particular concern in light of existing water quality concerns in the Yazoo Backwater Area. The State reports that overall water quality is lower in this area than anywhere else in the State, as evidenced by a region-wide advisory regarding fish consumption, and numerous consumption bans in some area waters because of high pesticide levels (Mississippi Museum of Natural Science, 2005).

In the 24,000 acres of wetlands occurring in the 2-year floodplain that were not evaluated in the FSEIS, the pollutant removal functions would be lost completely since flooding would be reduced to a point (i.e., 10 year return) where floodwaters no longer access the wetlands on a regular basis. Without regular input of the elements and compounds by floods, these normally riverine wetlands would convert to flat wetlands and would no longer perform this particular function. Given that the Yazoo Backwater Area already contains CWA section 303(d)-listed impaired waterbodies, the extensive loss of pollutant filtering and removal functions by wetlands impacted by the proposed project could exacerbate the elevated concentrations of the pollutants of concern, potentially causing or contributing to violations of applicable state water quality standards (40 CFR 230.10(b)).

4. Plant Habitat

The HGM assessment assumes that vegetative species composition remains approximately static over time, or that any species shift that does occur as a result of the project would be within the range of the reference standards. However, EPA maintains that if the hydrologic regime of the area is changed significantly, as is proposed by the project, the changes in the plant and animal communities would be much greater than was accounted for in the FSEIS. EPA has considered comments, from the Corps and the project sponsor, which question the availability of area specific data which documents the change in plant community structure due to hydrologic changes. Although precise predictions of forest changes occurring in the Yazoo Backwater Area with the project are not possible, the scientific literature strongly suggests that bottomland hardwood forests shift over time to more drought tolerant/less flood tolerant species composition when backwater flooding is significantly reduced or eliminated. This shift is important because a change in plant community not only signals a change in hydrology, but also in the habitat resources available to wildlife. For example, a shift from hard mast trees (e.g., oaks) to soft mast trees (sweetgum and red maple) represent a loss of the food value of acorns. The plants also provide the structure for animal habitat. A diverse habitat is one with many layers of plants (i.e., herbs, shrubs, young trees, old trees, dead trees, etc.). If the hydrology is altered the forest structure could be altered, which in turn would alter wildlife habitat.

Reduction or elimination of hydrologic regimes has resulted in documented vegetative species composition changes over time in bottomland hardwood forests. For example, loblolly pine *(Pinus taeda)* and red maple *(Acer rubrum)* replaced swamp tupelo *(Nyssa sylvatica)* in the lower reaches of South Carolina's Santee River as a result of a water diversion project that caused the site to become significantly drier. The diversion of water from the Santee River took place during the 1930's and the change in species composition took nearly 60 years to become evident on the site (Kellison et al., 1998). Red maple (a constituent of project area wetlands) was found to rapidly takeover sites with reduced hydroperiod in riverine bottomland hardwoods of the Mississippi Embayment in west Tennessee (Wilder and Roberts, 2005). This invasion of former bottomland hardwoods by red maple took approximately 30 years to occur. Red maple's takeover is attributed to the loss of the flood pulse hydrology characteristic of these systems. Similar plant community conversion times could be expected in the Yazoo Backwater Area if the proposed project is implemented.

A study conducted in the Ouachita River basin in South Arkansas recorded that intolerance to soil saturation/flooding is an important factor in the development of various floodplain community types. It serves to exclude those species that might otherwise grow there if the soils were not saturated/flooded during part of the growing season. This became evident in those areas where flooding and/or soil saturation are no longer a factor, since these sites were commonly invaded by flood intolerant woody species such as shortleaf pine (*Pinus echinata*) and blackjack oak (*Quercus marilandica*) (Huffman, 1980). Although vegetative species may differ, a similar invasion of flood intolerant species could occur with the implementation of this project. These studies indicate that vegetative change is measured on the scale of decades and that over the life of this project, and beyond, the change in hydrologic regime in the project area will have an effect on the plant community.

EPA expects that large areas in the Yazoo Backwater Area currently dominated by Nuttall oak and green ash or overcup oak and water hickory will eventually become drier and be replaced by less flood tolerant species such as sweetgum, which produces mast that has a lower biological value to wildlife. This shift will result in a commensurate reduction in the habitat for other wetland dependent plant species found in the Yazoo Backwater Area such as pondberry, which is listed as Federally *endangered* under the Endangered Species Act.

The effect of this project will be more pronounced on the vegetative community in the 24,000 acres of wetlands that would be impacted in the 2 year floodplain but was not analyzed in the FSEIS. As indicated by the HGM classification of subclasses contained in the Yazoo Basin HGM Guidebook, the change in subclass from a riverine backwater wetland to a flat wetland occurs if the wetland only floods at greater than a 5 year frequency flood. As a result of this hydrologic shift, a commensurate vegetative shift is indicated by the appearance of drier species such as Shellbark hickory (*Carya laciniosa),* Black hickory (*Carya texana*), Sycamore *(Platanus occidentalis),* Pumpkin ash (*Fraxinus tomentosa*), Water locust *(Gleditsia aquatica),* Eastern cottonwood (*Populus deltoids*), and Slippery elm (*Ulmus rubra).* All of these species occur in drier sites, typical of flats. This shift in plant community is the signal that the hydrology of the wetland has been altered from a backwater flood driven system to a rain water driven system. Flats do not receive floodwater the same as backwater wetlands, therefore they do not function the same as backwater wetlands and subsequently will not support the same habitat for wetland dependent fauna as riverine backwater wetlands.

5. Fish and Wildlife Habitat

The hydrologic regime of backwater riverine wetlands creates seasonal pulses of nutrient flow and food resources. The timing of these seasonal pulses of energy is important to many wetland faunal species inhabiting the Yazoo Backwater Area. The consequences of even modest changes in the timing of events can adversely affect these species. The proposed project would significantly degrade critical habitat for over 40 wetland dependent bird species (e.g., little blue herons, yellow-crowned night herons, wood storks, Acadian flycather wood ducks, mallards, blue and green-winged teal) (Table 4) and over 50 species of fish (e.g., catfish, sunfish and crappies) which have been documented as utilizing wetlands and other waterbodies in the Yazoo Backwater Area and Yazoo River (Table 3). The proposed project would also degrade critical habitat for 33 *species of greatest conservation need* that depend on bottomland hardwood wetlands in the Yazoo Backwater Area, including the Louisiana black bear which is listed as Federally *threatened* under the Endangered Species Act and the American black bear; 23 *species of greatest conservation need* that depend on standing and running waterbodies in the Yazoo Backwater Area; and 17 *species of greatest conservation need* that depend on the Yazoo River and its major tributaries and their associated floodplains (Mississippi Museum of Natural Science, 2005; Appendix 4).

a. Invertebrates

Isopods (*Caecidotea spp*.), amphipods (*Crangonyx spp*.), midges (*Chironomidae*), freshwater worms (*Oligocheata*), crayfish (*Decapoda*), and fingernail clams (*Sphaeriidae*) make up a critical component of the macroinvertebrate communities that thrive in the area's riverine backwater wetlands due to the presence of saturated soils, organic material and periphyton (a layer of microbial organisms which colonize detrital material). These invertebrates not only contribute to the breakdown of organic material (shredders and grazers) but they are also critical sources of prey for fish, waterfowl, rodents, bats, and birds. The draining and drying of area wetlands associated with the proposed project would significantly reduce the species diversity, as well as the richness and productivity of the area's macroinvertebrate community, thus adversely impacting an extensive list of vertebrate species which depend upon the wetlands' rich macroinvertebrate community for nourishment. Project impacts on these wetland invertebrates would have a cascading adverse effect on wetland functions (e.g., organic carbon and nutrient cycling), and animals dependent on this food source. For example, delayed or reduced flood hydrology caused by the proposed project in late fall or early winter could delay and decrease detrital invertebrate populations in late winter and spring, which would affect, among other factors and other species, the foraging resources for mallards, egg-laying of night herons and hooded mergansers, embryo development in raccoons and storage of nutrient reserves needed by hibernating black bears (Heitmeyer et al., 2005).

b. Amphibians and Reptiles

Reducing the spatial extent, frequency, and duration of time project area wetlands flood will also adversely impact the 21 amphibian and 32 of the reptile species in the Yazoo River Basin that depend upon wetlands for breeding and foraging habitat. The life cycles of amphibians and reptiles in alluvial floodplain ecosystems are linked to hydrology as well as soil conditions and climate (Jones and Taylor, 2005). Abiotic factors that influence habitat conditions within floodplains include hydrologic regime, flood pulse intensity and duration, topography, wetland permanence (hydroperiod), water quality, and connectivity to rivers or streams. For many amphibians, the hydrology associated with floodplain wetlands is necessary for breeding and egg laying (Appendix 4).

All the amphibian species listed as occurring in the Yazoo Backwater Area (Appendix 1) require wetlands and/or ephemeral pools for breeding (Jones and Taylor, 2005). The proposed project would desiccate these floodplain habitats making it difficult for portions of the amphibian population to survive (Semlitsch, 2005). For example, newts (*Notophthalmus viridescens*) require wetlands for breeding and egg deposition, while requiring vernal and ephemeral pools for adult life stages. The proposed project would also adversely affect reptile and amphibian species by reducing flood pulses and wetland water recharge, modifying river-wetland connectivity, and increasing habitat fragmentation. The reduction in flooding would also adversely affect the ability of amphibians to disperse to other suitable habitats (Jones and Taylor, 2005). Further, amphibians provide a valuable prey base for aquatic insects, fish, crayfish, birds, and mammals. Thus, a decline in amphibian and reptile populations will impact food resources for other animal groups.

c. Fish

The proposed project will reduce extensive areas of flooded wetlands and other floodplain areas. Reduction in access to the floodplain, as a result of the project, would result in decreased fishery production through loss of physical spawning habitat, loss of spawning opportunity (i.e., adequate period of time when habitat is available) or reduced fecundity and/or physiological condition resulting from poorer nutrition (Brunson, 1998). Some fish utilize the floodplains both to feed and to spawn (e.g., sunfish, buffalo fish). Other species move into the floodplain primarily to take advantage of the abundant food resources to improve vigor in preparation for spawning (e.g., catfish). Catfish will return to the channel to spawn, but do so in improved condition due to the foraging opportunities provided by access to the floodplain. Crayfish, an abundant floodplain invertebrate, is vital to the reproduction of catfish by supplying essential fatty and amino acids for egg formation (Flotemersch and Jackson, 2005). However, catfish that cannot access the floodplain due to decreased flooding cannot take advantage of this significant food resource. Further, decoupling floodplains from the river by flood control activities such as channelization, dredging, and levee construction can modify channel catfish interactions with terrestrially burrowing crayfish and reduce potential benefits from this foraging (Flotemersch and Jackson, 2003). The proposed pumping plant would produce similar “decoupling” effects.

In contrast to the Corps and project sponsor’s claim that the Yazoo Backwater Levee and Steele Bayou structure have “prevented” the use of the backwater area for fish spawning and foraging, the FWS noted in its review of the FSEIS, the backwater floodplain in the project area supports a diverse fishery, and relative fish abundance is highly dependent upon seasonal overbank or backwater flooding. It also noted that reproduction by 55 of the 140 (39 percent) resident fish species in the Mississippi River is dependent on backwater flooded areas. In its January 18, 2008, detailed comments on the FSEIS, FWS concluded that the proposed action would reduce the areal extent of flooding in the

Yazoo Backwater Area that is critical to fishery reproduction by approximately 46 percent, or 112,600 acres, during the critical spawning and rearing months. Spring flooding is the major factor responsible for fishery productivity within the Yazoo River Basin. It provides access to protective spawning and nursery habitat for the species which utilize backwater areas outside the stream channels where larger predatory fish species live. These shallowly flooded areas remain inundated for a duration that allows water temperatures to rise quickly, providing suitable spawning habitat, and allowing for optimum larval fish growth. Once the larval fish hatch and their yolk sack is absorbed (7 to 10 days), these seasonally flooded bottomland hardwood areas provide protective shallow water areas with an abundance of cover for protection from predators, as well as the organic matter, nutrients, and invertebrates needed for larval and juvenile fish growth (Appendix 4).

According to the Aquatics Appendix and reported again in the Main Report of the FSEIS, fish spawning habitat is the controlling resource for this project (i.e., the resource which suffers the greatest loss and requires the greatest amount of compensatory mitigation). The results of the HEP analysis indicate that the change in hydrologic regime will adversely affect fish populations. According to the HEP model used, fish spawning habitat requires 8 days of continuous inundation at least 1 foot in depth, from March to May. The Corps has also stated that most fish species reach sexual maturity in one or two years, so a flood that occurs once every two years is necessary to maintain reproductive populations. However, eight days is insufficient for any substrate spawning fish to spawn (Appendix 4). Eggs take 3 to 5 days to hatch. Larval fish fry are barely able to swim the first 7 to 10 days while the yolk sac is being absorbed. If floodwaters recede in 8 days or less, fry would be forced to retreat to deeper channels and lake habitats where mortality rates are high. Extended periods of shallow inundation in hardwood and other vegetated areas provide critical nursery habitat for growth and escape from predators. Any reduction in extent or duration of inundation of flooded bottomland hardwood wetlands would reduce the fish productive capacity of the wetland (Wilkinson et al., 1987). The reduction in the extent and duration of the spring flood pulse would severely reduce the current fish productivity of the lower Yazoo Basin. Conversely, "managing the existing leveed floodplain to prolong inundation, increase water temperatures during spring flooding, and maintain connectivity of floodplain habitats with the main river channel should benefit fish production in the LMR" (Schramm et al., 1999).

The Corps has concluded that at least 3,300 acres of suitable fish habitat would be lost as a result of the project. However, this amount of lost habitat is inconsistent with information in the FSEIS (Table 10-10, Wetland Appendix) which indicates that there are approximately 39,000 acres that currently flood for 14 days or less but greater than 7 days. Based on the criterion of 8 days of inundation from March to May for suitable spawning, it appears reasonable that some portion of these 39,000 acres would be suitable for fish spawning in addition to the 3,300 acres noted in the HEP analysis. According to the FSEIS, those acres currently flooded for 7-14 days will flood for less than 7 days after the project (i.e., shift to the <2.5 percent flood duration band). In other words, EPA's interpretation of the FSEIS (Table 10-10) is that there is currently some portion of the

39,000 acres of suitable fish spawning habitat that meets the criterion of 8 days of inundation which will become unsuitable after project implementation. Therefore, these impacts appear underestimated in the FSEIS's Aquatics Appendix.

d. Birds

Backwater riverine wetlands such as the ones that would be impacted by the proposed project are used by more bird species than most other ecosystems in North America (Heitmeyer et al., 2005). Project area wetlands provide migratory bird habitat of hemispheric significance, particularly for waterfowl, shorebirds, over-water nesting waterbirds and wading birds (Table 4), as well as numerous migratory songbirds. The loss of the productive shallowly flooded wetlands, especially in the spring months when the proposed pumps will typically be in operation, will impact migratory birds such as shorebirds and waterfowl as they stopover and forage in preparation for their seasonal migration. Fewer shallowly flooded wetlands will reduce foraging habitat, which will equate to reduced nutritional uptake and could result in higher mortality or reduced reproductive fitness as the birds travel the great distances between their southern wintering areas and their breeding areas in the northern U.S., Canada, and the Arctic. Breeding for many species could be adversely affected during the spring-time nesting season because foraging areas would be reduced. As a result of the reduction in flooding, adult birds will have to travel longer distances to find food, which equates to longer times away from the nest or foraging for food and may ultimately lead to higher nest mortality and lower recruitment (Appendix 4).

According to Twedt et al. (1997), shallowly flooded wetlands must be present in the Yazoo River Basin for shorebirds during northbound (spring) migration. These ephemeral shallow mud flats and sandbars provide critical food sources (primarily invertebrates) for adults during their long migration to breeding areas to the north. Shorebird species that have been documented using wetlands in the project area included the following:

> Common Snipe; Kildeer; Lesser Yellowlegs; Greater Yellowlegs; Semipalmated Sandpiper; Western Sandpiper; Least Sandpiper; Pectoral Sandpiper; White-rumped Sandpiper; Long-billed Dowitcher; Short-billed Dowitcher; Black-bellied Plover; and American Golden-plover.

For many shorebird species, migration "stop-over" habitats play a vital role in their ability to accumulate fat reserves, which in turn affects their survival. For example, studies of female pectoral sandpipers (*Calidris melanotus*) show that the body fat of migrating females increases as they fly north, which indicates the importance of feeding areas along migratory stopovers. Further, the length of stay in stopover sites is positively related to invertebrate abundances, indicating longer stays at stopover points that offer higher ingestion rates. Mean egg volume is positively related to female body fat, and clutches with higher egg volume hatched larger chicks suggesting a relationship between female condition and reproductive success. All of these findings indicate the importance of wetlands, such as those in the Yazoo Backwater Area, as spring migration stopover habitat for pectoral sandpipers (Appendix 4).

Recent studies of habitat use and energetics in spring migration stopover sites suggest the need to conserve complexes of small wetlands; such landscape connectivity is needed for maintenance of a variety of foraging sites within close proximity (Appendix 4). Management of wetland and agricultural units that maintain shallowly flooded fields (1–15 cm deep) during migratory periods provide good foraging sites (Helmers, 1993).

If the frequency of spring flooding in the Yazoo Backwater Area is significantly reduced, then the loss of this seasonal wetland habitat would result in lower survival rates, and therefore, reduced northward shorebird migrations. Other shorebird species impacted by this reduced flooding frequency, which have been documented in the project area, include the following:

> Spotted Sandpiper; Baird's Sandpiper; Sanderling; Dunlin; Black-necked Stilt and Solitary Sandpiper.

The proposed project could also affect resident breeding waterfowl, such as wood ducks (*Aix sponsa*) and hooded mergansers (*Lophodytes cucculatus*) (Kaminski, 1998). Both duck species breed in Mississippi and nest in natural tree cavities or artificial nest boxes. Reduced flood pulses in the spring could adversely impact nesting and brood rearing in these birds. These species depend heavily on food resources derived from shallowly flooded forested wetlands (Heitmeyer et al., 2005) and will move their broods to newly flooded bottomland hardwood areas flooded by spring and summer flood pulses, to take advantage of the available plant and animal foods (Kaminski, 1998). Reduction in flooding, due to the project, would adversely impact food resources for these breeding waterfowl (Appendix 4).

The proposed project would reduce the extent of flooding within wetlands in the 2- to 5-year floodplain potentially from January through June. The reductions to late winter and spring flooding would result in significant adverse impacts to those birds which not only utilize the Yazoo Basin, but are dependent upon backwater flooding during these periods (Table 4). As discussed above, species that require flooded habitat for foraging and/or nesting would obviously be the most severely affected. The reduction in the extent and duration of the spring flood pulse would accelerate the decline of many bird species that depend upon the wetland habitats of the lower Yazoo River (Appendix 4).

e. Mammals

EPA is aware of the public's concern regarding the effects of flooding on wildlife populations, particularly mammals, and the belief that flood control would benefit these wildlife species. Despite selective pressures from regular and sometimes extensive flooding, bottomland hardwoods provide a greater amount of habitat diversity than other habitats. Many mammals typical of bottomland hardwood habitats are mobile and can usually move away from rising waters. However, small ground dwelling species (e.g., mice, voles, shrews) cannot as easily escape from flooding and thus do not have high populations in these bottomlands. Flood waters can have disruptive effects on mammal populations by temporarily altering feeding and shelter habitats. For example, deer and bear will move out of bottomland hardwood areas during high water during which time food resources may be limited. However, as floodwaters recede, mammalian species typical of these areas will return to take advantage of the diverse feeding, breeding and and shelter opportunities provided by bottomland hardwood wetlands.

As has been pointed out before, functional floodplain hydrology controls vegetation composition and primary and secondary production in bottomland hardwood wetlands. Floodplain hydrology also controls the seasonal pulses of nutrients and food resources. The productivity of most species of mammals in bottomland hardwoods is limited by the availability of the food resources. Small mammals (e.g., shrews and bats) take advantage of insects which hatch as a result of flood pulses. Other small mammals (e.g., mice) take advantage of seed and nuts in addition to invertebrates. Changes in the duration and/or frequency of flooding (i.e., delays in or absence of spring flooding) could delay or decrease invertebrate populations which are critical prey for many of these species. Alterations in small mammal populations would affect food resources for carnivores like the bobcat (*Lynx rufus*). Altered hydrology could also affect the abundance of seasonal fruits of trees and shrubs which are an important food source for the black bear (Heitmeyer et al., 2005).

The cumulative impacts of this project would result in shortened food chains and simplified trophic structures. Long-term land use and hydrologic perturbations, similar to those occurring in the project area, lead to loss of organisms of lower trophic levels that are more site specific (i.e., unable to move away from disturbances) than those of higher trophic levels. Animals of higher trophic levels (i.e., frogs and toads, fish, and shorebirds) seem to acquire their energy and nutrients from a diversity of food sources (i.e., energy flow pathways). A diverse food energy source is the seasonally migratory ecotone which results from fluctuating water levels in the bottomlands (i.e., the aquatic terrestrial transition zone of Junk et al. (1989), or the moving littoral zone of Kilgore and Baker (1996)). Under normal conditions, an aerobic, primary-production based food chain occurs side by side with a detritivore-based food chain. At approximately the tertiary level of the food chain vertebrates such as frogs, fish, and wading birds, as well as some furbearing mammals, begin to rely on both primary production and detritus pathways and thus integrate variance within and between pathways. Many North American fur-bearing species are found in the project area including red fox (*Vulpes vulpes*), black bear (*Ursus americanus*), mink (*Mustela vison*), and river otter (*Lutra canadensis*). Most of these species have amphibious life habits, exist at the interface of the aquatic and terrestrial subsystems, utilize both aquatic and terrestrial energy sources and are adversely affected by stresses on either energy pathway.

6. Summary

In summary, the proposed project would degrade critical ecological functions provided by wetlands in the Yazoo Backwater Area including floodwater detention, nutrient cycling, organic carbon export, pollutant filtering/removal, and maintenance of biologically diverse plant and animal habitat. The proposed project would alter the timing, and reduce the spatial extent, depth, frequency, and duration of time project area wetlands flood. These alterations would adversely impact the spawning, rearing and foraging habitat of approximately 58 species of backwater dependent fish identified by the FWS. The proposed hydrologic alterations would also adversely impact approximately 42 species of birds that FWS reports are dependent on bottomland hardwood wetlands and their associated flood regime for fulfillment of specific life requisites. These species utilize the flooded wetlands of the project area for feeding and nesting, as well as providing essential nutrition during migratory flights. Further, the proposed hydrologic alterations will adversely impact approximately 21 species of amphibians and 32 species of reptiles by disrupting their reproductive cycles and feeding opportunities and thereby reducing overall productivity. Whereas many mammals are not as dependent on the flood pulse as other species, reduction of flooding is likely to impact food resources for these animals (e.g., insects, crayfish, amphibians, acorns and fruits). In light of the cumulative impacts on bottomland hardwood wetlands in the project area, further degradation of resources for these animals is detrimental. EPA Region IV believes that impacts to these functions and species at the scale associated with this project will result in significant degradation (40 CFR 230.10(c)) of the Nation's waters, particularly in light of the extensive historic wetland losses in the lower Mississippi Valley and specifically the Yazoo Backwater Area. Further, as discussed below, we do not believe the proposed compensatory mitigation would reduce these adverse impacts to an acceptable level.

D. Project Alternatives

The devastating effects of flooding currently being experienced in other parts of the country highlight the importance of improved flood protection in the Yazoo Backwater Area. Improving flood protection and conserving vital wetland, fish and wildlife resources should not be mutually exclusive goals for a project in the Yazoo Backwater Area. EPA Region IV strongly believes that proceeding to completion of the section 404(c) action is consistent with both of these important goals because it provides for greater public involvement, greater transparency, and more complete information on which to make decisions. The Region recommends that EPA coordinate with the State and others to move quickly to complete the section 404(c) decision and proceed to convene discussions for identifying a project alternative that satisfies both of these basic goals.

EPA Region IV believes, based on the record to date, that the Corps has not sufficiently considered potential alternatives that would avoid and minimize the proposed project's significant adverse impacts to aquatic resources pursuant to 40 CFR 230.10(a). Specifically, we believe that an alternative may be available that would provide a less environmentally damaging and more sustainable approach to floodplain management in the Yazoo Backwater Area. Such an alternative might incorporate, among other actions: reforestation of farmlands in the floodplain, relocation or flood proofing of flood-prone structures, conservation easements, localized flood protection structures including elevated transportation corridors, and expansion of insurance programs to compensate for economic losses from flooding.

While the Region believes that the nature and extent of the environmental impacts associated with the structural proposal are significant, further evaluation of nonstructural actions could produce a cost-effective solution with significantly fewer adverse environmental impacts than the proposed project, consistent with the Section 404(b)(1) Guidelines. We acknowledge that such a solution would likely require participation by multiple federal and state agencies, private industry, and non-governmental organizations, and may necessitate additional Congressional authorization. However, a primarily nonstructural approach could ultimately provide a better balance of Federal objectives for addressing the needs of the Yazoo Backwater Area community for flood reduction and wetlands protection.

E. Compensatory Mitigation

The Section 404(b)(1) Guidelines require that adverse impacts to wetlands and other waters of the United States first be avoided to the maximum extent practicable and then minimized to the extent appropriate and practicable. For unavoidable impacts which remain, compensatory mitigation is required to offset wetland and other aquatic resource losses. If, as noted above, the Corps had selected a less damaging alternative, the opportunity to identify an effective compensatory mitigation plan would have been improved. EPA Region IV has determined that the anticipated level of adverse impacts associated with the Yazoo Backwater Area Project cannot be adequately mitigated to reduce the impacts to an acceptable level.

To offset the project's extensive adverse environmental impacts, the Corps proposes 10,662 acres of compensatory mitigation. Compensation would consist of reforestation and conservation of areas located in previously cleared wetlands to restore those areas to bottomland hardwood forests. However, compensation sites have not been specifically identified for the proposed mitigation. Rather, the FSEIS states that conservation easements will be purchased only from "willing sellers" to conduct the proposed compensatory mitigation.

EPA has significant concerns regarding the adequacy of the proposed compensatory mitigation. Based on our review of the HGM analysis, we maintain that compensation requirements for impacts of this type and on this scale would be much greater than that estimated in the FSEIS (see Appendix 9). In addition, there do not appear to be enough acres of cleared wetlands with the proper hydrology and soils in the target area to satisfy more accurate projections of the mitigation needs of the proposed project. Even if sufficient compensation acreage were available, we do not believe that impacts of this scale and concentration could be effectively compensated for to avoid causing or contributing to significant degradation (40 CFR 230.10(c)), given that reliance on willing sellers would likely result in a noncontiguous patchwork of fragmented compensation sites that cannot deliver the ecological benefits predicted by the FSEIS. For example, "reforestation" that ends up being located in a patchwork of areas which are no longer connected to the floodplain will never offset the extensive impacts to fisheries identified in the FSEIS (Appendix 9).

We also maintain that the project fails to include all appropriate and practicable steps to minimize and compensate for the project's adverse impacts on the aquatic ecosystem as required by 40 CFR 230.10(d). The Section 404(b)(1) Guidelines prohibit discharges that would cause or contribute to significant degradation. As previously discussed, we have shown that this project would cause or contribute to significant degradation. If the project is going to rely on compensatory mitigation to reduce impacts to an acceptable level, there must be a very robust and detailed mitigation plan which would inform whether in fact the impacts could reliably be reduced to avoid significantly degrading the Nation's waters. These plans should include a number of critical details regarding the mitigation project(s) including: clearly articulated project goals and objectives; project site selection criteria; site protection instruments (e.g., conservation easements); detailed quantitative and qualitative baseline information describing both the impact and compensation sites; a detailed discussion of the mitigation project's credit determination methodology and results; a maintenance plan; ecological performance standards used to evaluate the degree to which the compensation projects are replacing lost functions and area; detailed monitoring requirements; a long-term management plan describing necessary long-term stewardship of the compensation sites and who is responsible for performing this stewardship; an adaptive management plan; and financial assurances to ensure project construction, implementation, and long-term management.

Another critical element of these plans is the site specific mitigation work plans. These plans include detailed written specifications and work descriptions for the compensatory mitigation project, including, but not limited to: geographic boundaries of the project; construction methods, timing, and sequence; source(s) of water, including connections to existing waters and uplands; methods for establishing the desired plant community; plans to control invasive plant species; the proposed grading plan, including elevations and slopes of the substrate; soil management; and erosion control measures.

Despite the extensive anticipated environmental impacts associated with the proposed project, no specific compensation project sites have been identified or secured. Thus, the mitigation plan included in the FSEIS lacks most of the aforementioned details. In particular, it lacks accurate information regarding baseline conditions at compensation sites, as well as substantiated information regarding potential environmental benefits likely to accrue at these sites if reforestation activities are successfully implemented. Without these details it is not possible to determine that the potential adverse environmental impacts of a project would be successfully minimized and compensated for to avoid significantly degrading the Nation's waters.

What information is included in the FSEIS describing compensatory mitigation raises more concerns. The Corps only promises that 10,662 acres of compensatory mitigation will take place prior to initiating operation of the pumps and notes that this minimum may not be located in the target area or even the greater Yazoo – Mississippi Delta, raising significant concerns that important wetland functions will not be replaced in the watershed. The FSEIS indicates that no requirements will be included to implement hydrological modifications or to otherwise ensure that the compensation projects will result in fully functioning wetland systems. This is of particular concern since the Corps envisions mitigation projects being located in areas whose hydrology will be impacted by the proposed pumping station. The conservation easements used to provide long-term site protection described in the FSEIS (if such sites can be found) will not require landowners to ensure that sites are or will retain wetland characteristics and will allow potentially ecologically disruptive silvicultural practices in these areas. Additionally, the monitoring provisions described in the FSEIS entail only initial visual inspections in the early years of project implementation followed by remote sensing techniques in later years. These are inadequate and are one of many weaknesses in the mitigation plan, which make it impossible to conclude that impacts will be reduced permanently below the threshold of significant degradation.

F. Uncertainty of the Proposed Reforestation

Consistent with our comments regarding the proposed compensatory mitigation, EPA believes the Corps does not provide effective assurances regarding the project's primary nonstructural component – the proposed reforestation of up to 40,571 acres of cleared wetlands (i.e., up to 55,600 acres less the 10,662 acres the Corps proposes to use as compensation for this project and the 4,367 acres it proposes to use as compensation for impacts associated with already implemented aspects of related projects) through the purchase of conservation easements from willing sellers. Reforestation sites have not been specifically identified in the FSEIS and, as with the compensatory mitigation, there do not appear to be enough acres of cleared wetlands with the appropriate hydrology and soils in the target area to meet this goal. Even if there were enough potential wetland reforestation acres, reliance on willing sellers does not provide effective assurance that the acreage proposed (up to 40,571 acres) will ultimately be made available for the reforestation effort.

The reforestation component also suffers from the same technical problems associated with the compensatory mitigation plan in that it would likely result in a fragmented patchwork of reforestation sites with limited benefits. In addition to logistical and technical issues, the management of the reforestation lands (e.g., ensuring the implementation and success of planting efforts, providing long-term stewardship), the restoration of wetland hydrology, the replacement of temporal losses incurred before replanted trees become fully functional bottomland hardwood forested wetlands (hardwoods typically require a minimum of 60-70 years before they are mature), and the continuation of silvicultural practices in the reforestation areas are also major uncertainties. In light of these uncertainties, the environmental benefits suggested by the FSEIS to accrue from the proposed reforestation have not been substantiated.

G. Summary

The proposed project would degrade critical ecological functions provided by wetlands in the Yazoo Backwater Area including floodwater detention, nutrient cycling, organic carbon export, pollutant filtering/removal, and maintenance of biologically diverse plant and animal habitat. EPA Region IV maintains that impacts to these functions at the scale associated with this project will result in significant degradation (40 CFR 230.10(c)) of the Nation's waters, particularly in light of the extensive historic wetland losses in the lower Mississippi Valley and specifically the Yazoo Backwater Area. The Region does not believe the potential impacts of the Yazoo Backwater Area Project can be adequately mitigated to reduce the impacts to an acceptable level. Additionally, the Region does not agree that the environmental benefits suggested by the FSEIS to accrue from the project's nonstructural component (e.g., the reforestation of up to 40,571 acres) have been substantiated.

VI. Other Considerations

A. Recreation

As previously noted, a 404(c) determination can be based on an unacceptable adverse effect on recreational areas. As noted in Section IV.B.6.f, significant, seasonally-inundated public lands are located in the Yazoo Backwater Area including the Delta National Forest, four NWRs (Yazoo, Holt Collier, Theodore Roosevelt, and Panther Swamp), as well as three state wildlife management areas and wetlands compensatory mitigation sites. The FSEIS acknowledges these lands as significant resources (FSEIS, page 90) however, it does not evaluate how these resources and particularly their recreational values will be affected by the proposed project. In its January 18, 2008, detailed comments on the FSEIS as well as its April 29, 2008, detailed comments on EPA's Proposed Determination, the FWS indicated that the proposed project will have an unacceptable adverse effect on recreational areas in the Yazoo Backwater Area, particularly the area's four NWRs.

According to the FWS, all four NWRs in the project area would be adversely impacted by the proposed project. These refuges are managed, in part, to provide habitat for breeding and migratory birds with an emphasis on waterfowl. As FWS noted in its comments on the FSEIS and the Proposed Determination, the proposed project would reduce flooding on all four NWRs by 59 percent (6,695 acres) within the 2- to 5-year floodplain – significantly reducing the extent of habitat for migratory birds and the capability of these NWRs to achieve the purpose for which they were congressionally established.

The NWRs are also managed to provide opportunities for compatible public use, or recreational activities. FWS believes that the anticipated adverse impacts to wildlife and fisheries associated with the proposed project (discussed above) will adversely affect related recreational values associated with these refuges - resulting in degradation or loss of their public benefit.

FWS estimates that approximately 10 percent of the visits to these refuges are from big game, upland game, and waterfowl hunters and 3 percent are from anglers. In 2007, there were an estimated 7,100 big game, 2,300 upland game, and 1,000 waterfowl hunter visitations. These visitations are based on use cards that are submitted by the user. However, this is a conservative estimate since it has been documented that only approximately 60 percent of the use cards are returned.

Managing wildlife populations and their habitats is a primary responsibility of FWS's "wildlife first" mission. If appropriately managed, hunting provides a biologically sound form of outdoor recreation that is used extensively throughout the Refuge System to manage wildlife populations. Hunting programs on the refuges within the Yazoo Backwater Area are coordinated annually with the Mississippi Department of Wildlife, Fisheries, and Parks, and hunting activities are managed in a manner that does not cause disturbance to migratory waterfowl in sanctuary areas within the refuges. According to the FWS:

- Deer hunting is the most popular hunting and fishing-related public use on the refuges. Hunting programs also offer opportunities to take dove, waterfowl, rabbits, squirrels, raccoons, other fur bearers, turkey, and feral swine. Large portions of the refuges are accessible by all-terrain vehicles on designated trails, which are only available for hunting and fishing purposes.
- Waterfowl hunting is the second most popular hunting and fishing-related public use on the refuges. Records obtained through hunter use card returns on Panther Swamp NWR indicate that approximately 1,000 people hunt waterfowl each year depending on waterfowl abundance which is dependent on available rainfall, backwater flooding and riverine sources for food and rest areas. The proposed pump project will result in reductions in spring flooding, which will reduce the quality and quantity of waterfowl habitat during the remainder of the year. This would cause waterfowl to disperse to other locations on and off the affected area of the refuge. Hunters will then seek alternate areas causing a negative impact to waterfowl hunting on the NWR and the local economy.
- Fishing is the third most popular hunting and fishing-related public use on the refuges. There are numerous lakes and streams suitable for fishing on the refuges, and boat ramps are available on Panther Swamp NWR. In 2007, 3,000 visits were associated with fishing within the affected area of Panther Swamp NWR. Most of this is subsistence angling by economically disadvantaged people in the local area. Further degradation of the fishery anticipated as a result of the proposed project would reduce quality fishing opportunities on Panther Swamp NWR dramatically impacting local anglers.

The FWS fully anticipates that the proposed project's adverse impacts to fish and wildlife habitat values on the four NWR's in the Yazoo Backwater Area would adversely impact visitation and recreational opportunities, as well as environmental education and interpretation opportunities at these refuges – particularly as examples of remaining intact Lower Mississippi Alluvial Valley bottomland hardwood ecosystems. Although EPA Region IV does not cite impacts to recreation as a basis for this Recommended Determination, it is likely that these impacts would be significant.

B. Environmental Justice (EJ)

Like the Corps, EPA has met with local community residents and listened to their hopes and expectations regarding the Yazoo Backwater Area Project. The community residents with whom we met expressed a strong belief that the project will protect their homes and property against flooding and bring economic development, jobs, and a return of residents to the area. EPA is sensitive to the importance of providing improved flood protection for the people living and working in the project area, which includes low-income and minority populations. Although EPA's section 404(c) determination would effectively prohibit the construction of the pumps as proposed, as mentioned previously, we continue to believe there are alternatives that could provide improved flood protection and other benefits to the communities within the Yazoo Backwater Area. EPA fully supports working with the residents of the Delta and our federal and state partners to propose and evaluate alternatives that are responsive to local conditions, needs, and preferences.

EPA appreciates the Corps' incorporation of an EJ analysis in the FSEIS, pursuant to Executive Order (EO) 12898. The Corps' socio-economic/EJ analysis discusses the general demographics of the project area, potential flood protection and economic development that could accrue from the project within communities with potential EJ concerns. However, the analysis has not specifically demonstrated which surrounding communities will be protected and which will remain subject to flooding after the project is completed, and whether they will be protected against 1-year, 2-year, or 100-year floods. At a minimum, the Corps' analysis should have included the relative proximity of susceptible EJ populations to the 1-2 year floodplain. EPA met with the Corps on February 29, 2008, and obtained the Corps' flood maps for structures within the 10-, 50-, and 100-year floodplains.

According to the Corps' maps, most structures within the sparsely populated project area will not be protected from future flooding while a portion of the structures will benefit from the project. However, the maps do not include elevation information, the structure type (i.e., residence, business, farm building, garage or other), whether they are habitable, and if so occupied or vacant, and/or what proportion of these structures are owned/occupied by residents with potential EJ concerns.

In a letter dated June 4, 2008, EPA again requested the information above and any additional records supporting the FSEIS and the Corps' section 404 regulatory review process. On June 16, 2008, the Corps provided EPA with GIS data indicating the location of structures within the 10-, 50-, and 100-year floodplains of the project area. This information also included a reference to Appendix 7 of the FSEIS which discussed the method the Corps used to determine location of the structures and the general location of these structures in the project area. It did not include information on whether the structures were currently habitable or any of the other information stated above.

In our Proposed Determination, we also raised concerns that the FSEIS does not address whether the project would adversely impact populations that depend on subsistence fishing or hunting. EO 12898 states that "[i]n order to assist in identifying the need for ensuring protection of populations with differential patterns of subsistence consumption of fish and wildlife, Federal agencies, whenever practicable and appropriate, shall collect, maintain, and analyze information on the consumption patterns of populations who principally rely on fish and/or wildlife for subsistence." In its comments on EPA's Proposed Determination, the Corps stated that it does not believe that the proposed project would adversely impact subsistence fishing and/or hunting as it relates to communities with potential EJ concerns. However, recent studies suggest that subsistence fishing and/or hunting practices of EJ communities in the project area could be affected by the proposed project's adverse impacts on area fisheries and wildlife resources (Brown, Xu, and Toth, 1998). Brown and Toth (2001) state that "[t]he rich natural resource base of the [MS] Delta is accessed extensively and in some cases intensively by local residents." Based on this study, it also appears that where and what people fish may differ by demographics. Consequently, EPA continues to believe that the Corps has not adequately considered whether the proposed project would adversely impact populations including minority and/or low-income that depend on the area's natural resources (i.e., subsistence fish and/or wildlife). Additionally, EPA continues to believe that the Corps has not fully analyzed the impact of this project on potential economic development in the EJ community.

An EPA action pursuant to section 404(c) must also satisfy EO 12898. This Order states that "To the greatest extent practicable…each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations…" A section 404(c) action has the potential to affect human health or the environment of low-income or minority populations and is part of EPA's "programs, policies and activities." Thus EPA is directed to include an EJ analysis when undertaking an action pursuant to section 404(c).

In order to satisfy Executive Order 12898, EPA examines whether there is a "…disproportionately high and adverse human health or environmental effects…" from its regulatory action. The scope of the inquiry in an EJ analysis is directly tied to the statutory provision that grants EPA authority to take a particular regulatory action. In the case of a section 404(c) action, EPA is authorized to prohibit, restrict, or deny the discharge of dredged or fill material at defined sites in waters of the United States whenever it determines that use of such sites for disposal would have an unacceptable adverse impact on "municipal water supplies, shellfish beds, fishery areas (including spawning and breeding areas), wildlife, or recreational areas."

Thus, when performing an EJ analysis in the context of a 404(c) action, EPA examines the potential effects prohibiting the discharge will have on the municipal water supplies, shellfish beds, fishery areas, wildlife and recreational areas (i.e., 404(c) resources) of the project site. Next, EPA examines whether those effects, if any, of EPA's 404(c) action on the 404(c) resources will have a "disproportionately high and adverse human health or environmental [effect]" on "minority populations and low-income populations" of the project area.

Applying the analysis above to the proposed project, EPA examined the potential effects of prohibiting the proposed project on the specific resources enumerated in 404(c) that are located in the Yazoo Backwater Area. EPA concludes, to the greatest extent practicable, after performing the EJ analysis contemplated in Executive Order 12898, that its 404(c) determination will not have a disproportionately high and adverse human health or environmental effect on the low-income and minority populations of the project area.

VII. Conclusions and Recommendations

The Yazoo Backwater Area Project is a Corps Civil Works project designed to address flooding concerns in a 630,000 acre area situated between the Mississippi and Yazoo Rivers in west-central Mississippi – the Yazoo Backwater Area. The primary component of this project is a 14,000 cfs pumping station that would pump floodwater out of the Yazoo Backwater Area during high water events on the Mississippi River.

According to the Corps, the Yazoo Backwater Area contains between 150,000 to 229,000 acres of wetlands, as well as an extensive network of streams, creeks, and other aquatic resources. Extensive information collected on the Yazoo Backwater Area demonstrates that it includes some of the richest wetland and aquatic resources in the Nation. These include a highly productive floodplain fishery, substantial tracts of highly productive bottomland hardwood forests that once dominated the LMRAV, and hemispherically important migratory bird foraging grounds. These wetlands provide important habitat for an extensive variety of wetland dependent animal and plant species, including the Federally protected Louisiana black bear and pondberry plant. In addition to serving as critical fish and wildlife habitat, project area wetlands also provide a suite of other important ecological functions. These wetlands protect and improve water quality by removing and retaining pollutants, reduce flood damages by storing floodwaters, maintain stream flows, and support aquatic food webs by processing and exporting significant amounts of organic carbon.

Construction and operation of the proposed pumps would dramatically alter the timing, and reduce the spatial extent, depth, frequency, and duration of time project area wetlands flood. These large-scale hydrologic alterations would eliminate or significantly degrade the critical ecological functions provided by at least 67,000 acres of wetlands in the Yazoo Backwater Area including those functions that support wildlife and fisheries resources. EPA Region IV does not believe that adverse impacts of this magnitude are consistent with the requirements of the CWA. Further, these impacts must be viewed in the context of the significant cumulative losses across the LMRAV, which has already lost over 80 percent of its bottomland forested wetlands, and specifically in the Mississippi Delta where the proposed project would significantly degrade important remnant bottomland forested wetlands.

As detailed in the project's FSEIS, the Yazoo Backwater Area contains significant, seasonally-inundated public lands including the Delta National Forest, four NWRs (Yazoo, Holt Collier, Theodore Roosevelt, and Panther Swamp), as well as three state wildlife management areas and wetlands compensatory mitigation sites. FWS has determined that the proposed project would significantly degrade the wildlife habitat provided by its four NWRs located within the Yazoo Backwater Area - reducing the capability of these refuges to achieve the purpose and intent for which they were Congressionally established.

EPA Region IV does not believe the Corps has demonstrated that potential impacts of the Yazoo Backwater Area Project can be adequately mitigated to reduce the impacts to an acceptable level. Additionally, the Region does not believe that the environmental benefits suggested by the FSEIS to accrue from the project's nonstructural component (e.g., the reforestation of up to 40,571 acres) have been substantiated. The Region supports the goal of providing improved flood protection for the residents of the Mississippi Delta; however, it believes that this vital objective can be accomplished in a manner that ensures effective protection for the area's valuable natural resources. In light of existing information, the Region believes that there are likely to be less environmentally damaging practicable alternatives available to achieve the improved flood protection goals of the proposed Yazoo Backwater Area Project.

EPA Region IV has carefully considered the record developed by EPA and the Corps, including information in the FSEIS, public comments, information presented at the public hearing, and submissions by other federal and state agencies. EPA Region IV has determined that the proposed discharge of fill material into 43.6 acres of wetlands and other waters of the United States in connection with the construction of the pumping station and the subsequent secondary impacts, would result in unacceptable adverse effects to at least 67,000 acres of wetlands and other waters and their associated wildlife and fisheries resources. Therefore, EPA Region IV recommends that action be taken under section 404(c) of the CWA to prohibit the specification of the subject wetlands and other waters of the United States within Humphreys, Issaquena, Sharkey, Warren, Washington, or Yazoo Counties, MS, as a discharge site for dredged or fill material for the purpose of construction of the proposed project or any similar pump project in the Yazoo Backwater Area that would result in an unacceptable adverse effect to the waters of the United States.

Dated: June 23, 2008

Lawrence E. Starfield
Regional Decision Officer

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