UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT

FOX ISLAND DIVISION HABITAT REHABILITATION AND ENHANCEMENT PROJECT

POOL 20, MISSISSIPPI RIVER MILES 358.5 THROUGH 353.6
CLARK COUNTY, MISSOURI

EXECUTIVE SUMMARY

The Fox Island Division (FID) Habitat Rehabilitation and Enhancement Project (HREP) is located on the west bank of the Mississippi River, one mile downstream of Alexandria, MO in Clark County. The project lies in Pool 20 between Upper Mississippi River Miles (RM) 353.6 and 358.5. The 2,033-acre FID, part of the Great River National Wildlife Refuge, is made up of unleveed bottomland forests, fields, and sloughs. There are myriad wetlands on the Division and several features with open water for at least part of every year. Water features include Coin Pond, Slim Slough, Logsdon Slough, Old Lake, and Nelson Lake. All project lands are in Federal ownership and are managed as a National Wildlife Refuge by the U.S. Fish and Wildlife Service (USFWS).

The extent and quality of bottomland forests, wetlands, and floodplain grasslands along the Upper Mississippi River (UMR) have been steadily declining due to past and ongoing pressure from human development of the floodplain and hydrologic alteration of the UMR and its basin tributaries. Historically, the project area has provided substantial benefits to waterfowl and other wetland wildlife. Presently, the project area's wetlands and water bodies have filled with sediment from floodwaters of the Mississippi and Fox Rivers, reducing their size and habitat value. Many forested areas and native grasslands in the floodplain were cleared to create farmland prior to USFWS management, resulting in reduced species diversity and smaller tract size, which contributed to habitat fragmentation and degradation of their function as wildlife habitat.

The goal of this HREP is to rehabilitate and enhance aquatic and related floodplain habitat. The following objectives and enhancement measures were considered in detail to achieve the project goal:

Objective 1. Reduce Forest Fragmentation and Enhance Forest Species Diversity

- No action (Natural Regeneration)
- Plant mast-producing hardwood trees using container-grown stock
- Plant mast-producing hardwood trees using precision direct seeding
- Plant mast-producing hardwood trees using container-grown stock and direct seeding

Objective 2. Enhance Existing Wetlands

- No action
- Enhance Logsdon Slough by installing a new well and a water control structure
- Enhance Coin Pond, Slim Slough, and Old Lake by constructing a new well and a surface water source, improving water distribution channels, and installing new water control structures
- Enhance Logsdon Slough, Coin Pond, Slim Slough, and Old Lake by providing water sources, improving channels, and installing water control structures

Objective 3. Restore Native Grassland

- No Action
- Plant native grasses and forbs

The benefits of the project enhancement features were evaluated using the Wildlife Habitat Appraisal Guide (WHAG) and cost-effectiveness/incremental cost was analyzed using U.S. Army Corps of Engineers Institute for Water Resources program (IWR) Plan. The WHAG evaluation quantifies habitat output in the form of habitat units, which are used in conjunction with project cost data and functional life expectancy to compare the benefit-cost relationship for each category of proposed enhancement features.

The recommended plan (figure ES-1) includes:

- planting mast-producing hardwoods on 215 acres using container-grown stock and 60 acres using direct seeding;
- enhancing 78 acres of wetlands in and around Logsdon Slough, Coin Pond, Slim Slough, and Old Lake; and
- planting 98 acres of native grasses and forbs.

Planting mast-producing hardwood trees would improve the quality and quantity of wildlife habitat by reintroducing mast, a high-quality food source for resident and migratory wildlife, to a forest community increasingly dominated by silver maple and cottonwood. Enhancing water level management capability would provide more moist soil habitat, greater vegetation diversity, and a reliable food supply. Planting native grasslands would increase habitat complexity and provide feeding and nesting opportunities for a wide variety of wildlife.

Implementation of the recommended plan would increase the quality and quantity of wildlife habitat and meet the life requisites for a large variety of native floodplain species. The project outputs are consistent with the refuge Comprehensive Conservation Plan (2004) goals and objectives and support the overall goals and objectives of the Upper Mississippi River System-Environmental Management Program (UMRS-EMP), the North American Waterfowl Management Plan, and the Partners in Flight Program.

The U.S. Army Corps of Engineers (Corps) would be responsible for the Federal share of any mutually agreed-upon rehabilitation of the project that exceeds the annual operation and maintenance requirements identified in the final Definite Project Report (DPR) and that is needed as a result of specific storm or flood events. Rehabilitation of the project is considered to be reconstructive work, which cannot be accurately estimated at this time.
All FID project features would be located on Federally-owned lands managed by the USFWS. As a result, first cost funding for enhancement features would be 100 percent Federal. Project operation and maintenance at an estimated average annual cost of $32,436 would be accomplished by the USFWS, the Federal project sponsor. The Missouri Department of Conservation (MDOC) and Illinois Department of Natural Resources (ILDNR) are non-Federal, non cost-sharing project sponsors.

The Corps' Rock Island District Engineer has reviewed the project outputs and determined that implementation of the recommended plan is justified and in the Federal interest. Therefore, the Rock Island District Engineer recommends construction approval at an estimated Federal expense of $2,097,250 for the FID HREP. Total Federal cost, including general design and construction management, is $3,070,250.

Figure ES-1. FID HREP Location Map

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1. INTRODUCTION

A. Location. The Fox Island Division (FID) Habitat Rehabilitation and Enhancement Project (HREP) is located on the west bank of the Mississippi River, one mile downstream of Alexandria, MO in Clark County. The project lies in Pool 20 between Upper Mississippi River Miles (RM) 353.6 and 358.5. The 2,033-acre FID is made up of bottomland forests, fields, and sloughs. There are myriad wetlands on the FID and several features with open water for at least part of every year. Water features include Coin Pond, Slim Slough, Logsdon Slough, Old Lake, and Nelson Lake. All project lands are in Federal ownership and are managed as a National Wildlife Refuge (NWR) by the U.S. Fish and Wildlife Service (USFWS). The FID is part of the USFWS' Great River NWR, which is part of the Mark Twain NWR Complex. Plate 1 provides vicinity and location maps for the FID.

B. Purpose. The purpose of this report is to present a detailed proposal for the rehabilitation and enhancement of the FID project area. This Definite Project Report (DPR) provides planning, engineering, and sufficient construction details to allow final design and construction of the recommended plan to proceed. The USFWS serves as the Federal project sponsor. The Missouri Department of Conservation (MDOC) and the Illinois Department of Natural Resources (ILDNR) serve as non-Federal project sponsors.

C. Resource Problems and Opportunities. The extent and quality of bottomland forests, wetlands, and floodplain grasslands along the Upper Mississippi River (UMR) have been steadily declining due to past and ongoing pressure from human development of the floodplain and hydrologic alteration of the UMR and its basin tributaries. Historically, the project area has provided substantial benefits to waterfowl and other wetland wildlife. Presently, the project area's wetlands and water bodies have filled with sediment from annual floodwaters of the Mississippi and Fox Rivers, reducing their size and habitat value. Many forested areas and native grasslands in the floodplain were cleared to create farmland prior to USFWS management, resulting in reduced species diversity and smaller tract size, which has contributed to habitat fragmentation and degradation of their function as wildlife habitat.

Substantial opportunities are available for preserving and enhancing habitat for migratory birds (neo-tropical, shorebird, and waterfowl), aquatic wildlife, amphibians, reptiles, and mammal species by reintroducing mast trees, encouraging re-forestation of flood prone cropland, enhancing water supply to wetlands, and re-establishing native floodplain grasslands.

D. Project Selection. The USFWS nominated the FID HREP for inclusion in the Rock Island District's Environmental Management Program (EMP). The Fish and Wildlife Interagency Committee (FWIC) then ranked the project habitat benefits based on critical habitat needs along the Mississippi and Illinois Rivers. After considering resource needs and deficiencies, pool by pool, the FWIC and the River Resources Coordinating Team (RRCT) recommended that the FID HREP be pursued. The recommendation is based upon the project's potential for providing significant aquatic, wetland, and related floodplain benefits. Development of this report was actively coordinated with the project sponsors – the USFWS, the MDOC, and the ILDNR. Coordination occurred during visits to the project site, team meetings, and phone conversations (Appendix A).

E. Scope of Study. This HREP focuses on proposed project features that would improve aquatic, wetland, and floodplain habitat and enhance overall resource values on the 2,033-acre FID. The project is consistent with USFWS, HREP, and the Rock Island District's EMP management goals and was planned for the benefit of resident and migratory birds, reptiles, and other wildlife.

Field surveys, aerial photography, and habitat quantification procedures were completed to support the planning and assessment of proposed project alternatives. Soil borings were taken to determine soil properties such as gradation, permeability, and consolidation, which are required for the design of water control features.

The USFWS and the MDOC have made wildlife studies and observations within the study area. These data, along with future studies and monitoring, would assist in evaluating project performance.

F. Format of Report. The DPR is organized to follow a general problem-solving format. The purpose, problems, and project selection process are presented in Section 1. Section 2 establishes the baseline for existing resources. Section 3 presents the objectives of the project. Section 4 proposes and Section 5 evaluates alternatives for meeting the objectives. Section 6 describes the recommended plan and lists general design and construction considerations. Section 7 proposes the schedule for final design and construction. Section 8 contains cost estimates for initial construction and operation and maintenance. Section 9 assesses the environmental effects of the recommended plan. Section 10 describes a plan for monitoring performance and evaluating progress. Section 11 describes real estate requirements. Section 12 summarizes the roles of each sponsoring agency. Section 13 records the coordination effort with local, state, and Federal agencies and comments received through public outreach. Sections 14 and 15 present the conclusions and recommendations. A *Finding of No Significant Impact* statement and *References* follow. Plates and appendices have been furnished to provide sufficient detail to allow review of the existing features and the recommended plan.

G. Authority. The Upper Mississippi River System – Environmental Management Program (UMRS-EMP) is a Federal-State partnership designed to (a) plan, construct, and evaluate measures for fish and wildlife habitat improvement through HREPs and (b) monitor the natural resources of the river system through the Long Term Resource Monitoring Program (LTRMP). The Water Resources Development Act (WRDA) of 1986 (P.L. 99-662) states:

> To ensure the coordinated development and enhancement of the Upper Mississippi River system, it is hereby declared to be the intent of Congress to recognize that system as a

> nationally significant ecosystem and a nationally significant commercial navigation system. Congress further recognizes that the system provides a diversity of opportunities and experiences. The system shall be administered and regulated in recognition of its several purposes. (Section 1103).

The UMRS-EMP was originally comprised of five elements: HREP; LTRMP; Recreation Projects; Economic Impacts of Recreation; and Navigation Monitoring. Currently, EMP is comprised of only two elements—HREP and LTRMP. The other EMP elements have either been successfully completed or are now carried out under other authorities.

The original authorizing legislation has been amended three times since its enactment. The 1990 WRDA, Section 405, extended the original EMP authorization an additional 5 years to FY 2002, which allowed for ramping up of the program. The 1992 WRDA, Section 107, amended the original authorization by allowing limited flexibility in how funds are allocated between the habitat projects program and the long-term resource monitoring program. WRDA 1992 also assigns sole responsibility for operation and maintenance of habitat projects to the agency that manages the lands on which the project is located. The 1999 WRDA, Section 509, reauthorized EMP as a continuing authority with Reports to Congress every 6 years and changed the cost sharing percentage from 25 percent to 35 percent. The FID HREP has no cost sharing requirement because all project features are located on federally-owned land managed by the USFWS as a national wildlife refuge.

2. ASSESSMENT OF EXISTING RESOURCES

The Great River NWR is centrally located within the Mark Twain NWR complex. The Mark Twain complex stretches 350 miles along the Mississippi River in the states of Iowa, Illinois and Missouri. The Great River NWR contains approximately 15,000 acres along 100 miles of the river in Illinois and Missouri. It is managed as four large tracts—FID (formerly Gregory Landing), Long Island Division (formerly Gardner), Delair Division, and Clarence Cannon NWR. Key management goals are to enhance the quality and diversity of fish and wildlife habitat, especially for migrating birds, and to restore floodplain functions in the river corridor. Great River NWR headquarters are located near Annada, Missouri, 40 miles north of St. Louis.

The FID is located on the right descending bank (west side) of the Mississippi River immediately downstream of Alexandria in the southeast corner of Clark County, Missouri. The 2,033 acre refuge lies generally between the Mississippi River on the east and the Fox River on the west. It extends from Upper Mississippi River Mile 353.6 to 358.5. The western tip of FID touches the eastern edge of the 620-acre Rose Pond Conservation Area, which is managed by the MDOC. An aerial view of FID showing existing features is included as figure 2-1. Key water bodies are labeled on the photo, including the Fox and Mississippi Rivers, Grey Chute, Logsdon Slough, Slim Slough, Coin Pond, Nelson Lake, and Old Lake.

A. Resource History and Description of Existing Features. As with most of the Mississippi River floodplain, the FID area was formed from alluvial deposits over millions of years. The lakes and ponds on the division are former channels of the Fox and Mississippi Rivers, remnants of past meanderings. Vegetative land cover has been affected by the tendency for frequent flooding.

Most of the land that now lies within the FID was cultivated during the last half of the 19th century and most of the 20th century. No agricultural levees were ever constructed in this area because the extensive wetlands, lakes, streams, and floodplain forests rendered the area only marginally productive. The levees were constructed, instead, west of the Fox River, where farming conditions were more favorable and flood protection more manageable.

There had been several homes within the current refuge boundaries. A county road provided access from Alexandria. There was a bridge over the Fox River near the mouth of Logsdon Slough. The homes were gradually abandoned and removed, due in part to increased frequency of flooding in the latter half of the 20th century. The fields have continued to be cultivated even though flooding frequently causes crop damage.

The chutes, sloughs and ponds on the FID provide resting, brooding, and foraging habitat for waterfowl and many other marsh and wading birds, and quality habitat for reptiles and amphibians. Over the years, the water bodies within the FID have filled with sediment, deposited from floodwaters and from local erosion. Now Coin Pond and the sloughs are nearly filled in. Nelson Lake and Old Lake are the only non-flowing bodies of water that contain water year round. Nelson Lake, once a significant and popular fishery resource, is now too shallow and muddy to sustain populations of most native fish.

B. Land Use and Current Area Management Objectives. Figure 2-2 indicates that the land on the division is divided among farmed or idle fields, wet floodplain forest, and willow stands (Salix Community). There are also large areas of open water and wet meadows. The Burlington Northern-Santa Fe (BNSF) Railroad transects the FID along the Mississippi River shoreline. Levees for the Des Moines–Mississippi Levee District No. 1 and Mississippi-Fox Drainage and Levee District No. 2 separate the FID from the city of Alexandria to the north, and the surrounding farmland to the west and south. A former unpaved county road runs through the Division, entering on the north and running along the east bank of the Fox River. A small portion (approximately 98 acres) of the Division lies within the Mississippi-Fox Levee District west of Logsdon Slough. This 98-acre tract is an old agricultural field that has grown up in weedy vegetation.

The primary purpose of the FID is to provide resting and feeding areas for resident and migratory birds, especially waterfowl. Habitat is also provided for bald eagles, herons, and a variety of other wildlife species. Acquisition of property for the FID began in the late 1980s. Approximately 1,100 acres were added after the 1993 flood, bringing the FID to its current size of 2,033 acres. The USFWS plans to acquire additional acreage in the future, as lands and funds are available.

Approximately 925 acres of the FID are wet floodplain forest, dominated by soft mast producing species such as silver maple and cottonwood. Pin oaks occur in higher elevations. Wetlands, sloughs, and oxbows comprise about 111 acres of the FID. The remaining 997 acres are a combination of farmland and abandoned fields. Approximately 620 acres are being farmed to maintain open areas for hardwood reforestation. The yield from cultivation is variable from year to year because of flooding. In the year 2001, only 60 acres of row crops were harvested. Many of the fields in the southern half of the FID were farmed until the mid 1990s, but cottonwood and other wetland forest species have regenerated under USFWS management.

The soils found on higher ground of the FID are silty and sandy loam, typical of alluvial deposits. They are characterized as fast draining, occasionally to frequently flooded, on shallow slopes. The swales and other low elevation areas have a higher concentration of clay and hydric soils, that is soils that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions. Hydric soils include soils developed under sufficiently wet conditions to support the growth and regeneration of hydrophytic vegetation. They are less porous and often vegetated with hydrophytic plant communities. Figure 2-3 is a map of the soils within the FID, created from data by the Natural Resources Conservation Services (NRCS). The map is indicative of the pattern of deposition that occurs along channels and oxbows. Attribute data include the type of vegetation supported, the annual period of inundation, the slope, and other information that can help determine which areas are best for plantings of various species of trees, herbs, or grasses, and which areas may sustain high quality wetlands.

USFWS has partially restored wetlands in and around Coin Pond and Logsdon Slough. The Service has excavated or cleared channels to promote connectivity between water bodies and has installed galvanized metal stoplog structures to increase management capability. These wetlands are dependent upon surface water runoff or flooding and do not typically maintain open water year round. They are usually dry during the fall waterfowl migratory season.

A significant focus of FID management has been on reforestation of farmland to increase wildlife habitat. In 1994, 160 acres were planted with acorns and pecans. An additional 80 acres were planted in 1998. The success of these tree plantings has been limited due to competition from grasses and other, faster-growing plant species, and by flooding. Those areas that have been left to revegetate naturally have grown up in thick stands of cottonwood, silver maple and willow. The USFWS continues to lease much of the area for cultivation of row crops and small grains in order to keep the land open for future plantings of hardwoods. Plate 3 shows the location of previous acorn/pecan plantings and the location of existing water control structures.

Figure 2-1. Existing Features Map

Figure 2-2. Land Cover/Land Use

Figure 2-3. Soils Map

C. Aquatic Resources. Surface water features on or adjacent to the FID include rivers, channels, ponds, and wetlands. The project area is bordered on the east by the Mississippi River and by the Fox River on the west. The Fox River is a small, highly variable flow river which drains about 500 square miles at its mouth. Grey Chute, a side channel of the Mississippi River, forms the northern half of the east boundary. Other named water features include:

- Logsdon Slough, an oxbow channel on the west side of the Fox River, dries out much of the year but supports dense annual and perennial hydrophytic vegetation. The USFWS has installed a stoplog structure at the south end (mouth) of the slough.
- Slim Slough, an oxbow channel on the east side of the Division, is dry most of the year but sustains both annual and perennial hydrophytic vegetation.
- Coin Pond, a shallow pond in the north central area of the division, surrounded by forests and wetlands. The pond is mostly filled with sediment and dries out in the summer.
- Old Lake, a perennial open-water body on the west side of the Division.
- Nelson Lake, the largest body of water on the Division. With at least 23 acres of open water year round (more in the spring), the lake is an attractive resource for frogs, turtles and wading birds. The water is shallow and muddy. The bottom is unconsolidated sediment and does not support vegetation.

These water bodies are fringed with a 20- to 100-foot-wide band of woody vegetation, while annuals dominate the channels of the sloughs and centers of the ponds when the water has receded.

These resources and other unnamed wetlands and drainage ways are shown on figure 2-1 and Plate 3. The ground surface in the FID lies about 10 feet higher than the normal pool elevation (480.0 feet MSL) of the Mississippi River. Most of the sloughs, ponds, and swales are 2 to 5 feet lower than the surrounding terrain. All of them except Nelson Lake and Old Lake dry out in most years during the summer and fall. Their value to aquatic wildlife is diminished throughout much of the summer and most years they are nearly dry during the waterfowl migration in the fall. Insufficient storage and the inability to control water levels are the primary limitations on the quality of the wetlands on the FID.

A variety of birds, reptiles, and mammals are found in and around the water of the FID. Resident and migratory birds include eagles, herons, egrets, geese, ducks, and many kinds of song birds. Reptiles include toads, frogs, northern water snakes, snapping turtles, and western painted turtles. Mammals on the division include muskrats, deer, fox, squirrels, and raccoons. Fish and mussels are found in the Mississippi and Fox Rivers adjacent to the FID.

Spring flooding plays a significant role in the planning for this unprotected floodplain between two rivers. Floodwaters nourish the wetlands, providing a source of water that can last for weeks. It affects planting times and crop success or failure. The type of natural vegetation that occurs across the Division is largely a function of the length of time that its location is under water.

Figure 2-4 indicates the location of hydric soils, which are indicative of conditions conducive to the formation of wetlands. These wetlands could be enhanced by improving water supply and restoring natural vegetation. The NRCS soil survey was supplemented with soil borings at specific sites on the

project. The borings were performed to gather information about porosity in areas that were identified for wetland enhancement. The borings show that the soils are tight in the lowest areas of the sloughs, where hydric conditions are most apparent. On the perimeter of the sloughs the soil is quite porous. The natural wetlands are clearly demarcated by a perimeter band of woody, hydrophytic vegetation.

The soil borings identify only the conditions at the location they were made and cannot give surety that there are no sand lenses where water could escape. Site visits shortly after a heavy rainfall in June 2003 found Coin Pond, Nelson Lake, and Old Lake brimming with water while Slim Slough had no standing water.

D. Floodplain Habitat Resources. The floodplain forests are predominately comprised of silver maple, willow, and cottonwood. Pin oaks are found in mixed stands on higher ground in the Division. The pin oaks and other hardwoods scattered sparsely throughout the division produce high quality mast which benefits a wide variety of wildlife.

Approximately 621 acres of the FID are under cultivation. The farm lease agreement sets aside a portion of the crop to be left in the field each fall for wildlife. Wild turkeys, squirrels, and deer feed on the un-harvested grain. In early winter, migrating ducks and geese also forage on the grain. The 160 acres of open ground that has been left unplanted has grown up in a variety of grasses, forbs, and willows.

Wood ducks utilize the open water areas in the Division for spring and summer foraging and brood habitat. The shallow marshes are attractive to wildlife such as deer, raccoons, birds, frogs and turtles, but they usually dry up during the summer months.

Flood events of significant magnitude and duration can be particularly harmful to trees, depriving roots of oxygen and causing direct mortality. The 1993 flood was particularly detrimental to trees throughout much of the Upper Mississippi River Valley.

E. Water Quality. Increasing water supply to Slim Slough, Coin Pond, and Logsdon Slough could have a beneficial effect on the quality of area surface water. Possible sources of this water would include groundwater and flood water from the Fox and Mississippi Rivers. The enhanced wetlands would improve surface water quality by removing sediments and nutrients. Information is available on the past and present water quality within the Fox and Mississippi Rivers from USGS sampling sites at Wayland and Canton, Missouri. This information is summarized in the following paragraphs, and provided in detail in Appendix G.

Figure 2-4. Hydric Soils

On its list of impaired rivers, the State of Missouri has deemed the Fox River a Category Three waterway. Category Three waters are presently recognized as impaired, but there is no practicable remedy for them. All of the Fox River was placed in this category due to naturally occurring manganese concentrations ranging from 218 – 311 micrograms per liter (µg/L), exceeding the Missouri water quality criterion of 50 µg/L. The State has given the Fox River a low priority for analysis and is scheduled to conduct a use attainability analysis to examine the manganese levels in 2007. The Fox River reach that passes through the FID is classified by the State of Missouri (10 CSR 20-7.031) as Class P1, defined as "a standing water reach of a stream that maintains permanent flow, even in drought periods." The designated uses for this Fox River reach are livestock and wildlife watering, protection of warm water aquatic life, human health protection for fish consumption, boating and canoeing, and drinking water supply. Overall, water quality appears to be good and use of the water for wetlands augmentation would be acceptable

The Mississippi River in Missouri has been placed in Category Two on the State of Missouri list of impaired waters. Category Two waters were originally reported as impaired, but the data used to determine this designation is considered older or of lesser quality. Additional data collection on Category Two waters is planned to determine whether to proceed with U. S. Environmental Protection Agency (USEPA) Total Maximum Daily Load (TMDL) program development. The entire length of the Mississippi River in Missouri is considered impaired due to habitat loss from channelization. The State has given this section of the Mississippi River a medium priority and has scheduled it for further data collection in 2005.

F. Endangered Species. The list of animals and plant below are of "conservation concern" in Missouri and was compiled by the USFWS (see letter dated August 23, 2004 in Appendix A).

Animals

Central mudminnow *(Umbra limi)* – a state-endangered fish species found in sloughs, oxbows, and backwaters of streams with low gradients, mud bottoms, and dense aquatic vegetation.

Western fox snake *(Elaphe vulpina vulpina)* – a state-endangered species found in natural wet prairies, marshes, and sometimes in lowland forests or edge habitats between wood lots and pastures.

Illinois mud turtle *(Kinosternon flavescens spooneri)* – a state-endangered species found in sandy soil in association with ponds, marshes, wetlands, lakes, and oxbows with turbid water and soft bottoms that rests on logs and in shallow water near shore and spends winters and hot summer months buried in sand.

Blanding's Turtle *(Emydoidea blandingii)* – state-endangered species found in marshes, waterholes, sloughs, streams, and ponds with mud or silt bottoms and moderate to dense aquatic vegetation that nests in grasslands.

Plant

Patterson's dawnflower *(Stylisma pickeringii var pattersonii)* – a state "critically imperiled" plant species known to prefer relatively open, sandy soils. This plant has been found in the vicinity of the project area.

The Illinois mud turtle and the Western fox snake have been reported from the Rose Pond Conservation Area but neither species has been observed since the 1993 flood. An active bald eagle nest exists near the FID. Patterson's dawnflower has been found on the levee on the western side of the Division. No other state or Federal endangered or threatened species have been observed on the FID. The endangered fat pocketbook mussel may occur undetected around the islands in the Mississippi River adjacent to the FID.

G. Historic Properties. Three historic properties reports—a literature review and two Phase I surveys—have been prepared for this project. The report cover pages and management summaries appear in Appendix M, figures M-1, M-2, and M-3

The literature review was prepared by Benn and Hengesteg (2002) and entitled *Archival, Historical, Archaeological, and Geomorphological Background Literature and Records Review and Research for Historic Properties at the Fox Island Division of the Great River National Wildlife Refuge, Mississippi River Pool 20, Clark County, Missouri.* The authors' FID study area boundary is shown in Appendix M, figure M-4 [reproduced from Benn and Hengesteg (2002:Figure 2)].

Benn and Hengesteg found a number of archaeological surveys had been conducted between 1978 and 2001 in areas just outside the FID study area and within its western margins. No archaeological sites were found to be located within the boundaries of the FID study area; nine sites were located within one mile of it (Benn and Hengesteg 2002:4).

Three Landform Sediment Assemblages were identified by Benn and Hengesteg (2002:5-7) in the FID study area. These are the Kingston Terrace (KINGSA), Middle Holocene Mississippi Channel Belt (EMHOL2), and Late Holocene Mississippi Channel Belt (LAHOL). All three have the potential to contain significant historic properties and were recommended for archaeological investigation "in the event adverse impacts are planned for all or part of the study area" (Benn and Hengesteg 2002:15).

Two Phase I archaeological surveys have been conducted to cover the footprint of the current FID project.

The first, *A Phase I Archaeological Survey and Geomorphological Evaluation for Historic Properties, Fox Island EMP Project, Clark County, Missouri*, was prepared by Hoppin and Benn (2004). The footprint of this survey covered 194.2 ha (480 ac) with boundaries as marked by the "Fox Island Division Project Area" as shown in Appendix M, figure M-5 [reproduced from Hoppin and Benn (2004:Figure 2)]. Three historic property sites were located. The Corps concurred with the authors (Hoppin and Benn 2004:19-22) that the historic period sites 23CK346 and 23CK347 were not eligible for inclusion in the National Register of Historic Places (NRHP). The Corps also concurred that prehistoric site 23CK345 was potentially eligible for inclusion in the NRHP.

The second survey, finalized in July 2004, is entitled *Intensive Archaeological Survey for Historic Properties at the New Pump Station, Fox Island EMP Project, Mississippi River Pool 20, Clark County, Missouri*, and was prepared by Benn (2004). The footprint of this survey covered approximately 0.6 ha (1 ac) with boundaries as marked by the "Project Area" as shown at Appendix M, figure M-6 [reproduced from Benn (2004:Figure 2)]. No historic properties were located by this

survey. The Corps has concurred with the negative findings of this report and its conclusion that "no additional archaeological investigations" are required (Benn 2004:11-12).

H. Sedimentation. Sedimentation impacts the FID by filling lowland areas and thus depleting their capacity for holding water (see Appendix I). This results in diminished aquatic habitat, reduction in surface area of wetlands, and reduced capability to withstand dry spells.

There are two sources for the sediment loads reaching low-lying areas:

- erosion occurring within the FID itself
- sediment laden floodwater from the Mississippi and Fox Rivers

The FID floods frequently from both the Mississippi and Fox Rivers (42 percent chance of flooding each year from the Mississippi River plus a 50 percent chance of flooding each year from the Fox River). The flood waters contain higher concentrations of suspended solids, which tend to settle out in the relatively acquiescent ponds and sloughs. In addition, flood flows aggravate erosion within the site, producing additional sediment that is carried into the low-lying wetlands and ponds. The significant water features (Coin Pond, Slim Slough, Logsdon Slough, Old Lake, and Nelson Lake) have all filled appreciably since 1937, when the first survey was conducted by the Corps (Ref #8). Nelson Lake and Coin Pond, formerly popular fishing spots, are now too shallow to sustain sport fish populations.

I. Hazardous, Toxic and Radioactive Waste. A hazardous, toxic, and radioactive waste (HTRW) compliance assessment was conducted. The project is located in an area that primarily is and historically has been agricultural land. There is little evidence that the land has been used for other purposes. There were no obvious indications of potential contamination sources or migration pathways from surrounding properties. It does not appear that there is a risk of HTRW contamination within the project area. Appendix F provides additional details on the compliance assessment and recommendations for site clean-up.

J. Future Without Project Conditions. For planning purposes, future conditions without implementation of the FID HREP were assumed to be essentially the same as baseline conditions; that is the Logsdon Tract (and adjacent fields) would continue to be managed and maintained as old field habitat similar to present conditions, and the nonforested wetlands and sloughs of the project area, though not actively managed, would maintain current plant cover types and hydrologic patterns with some continued degradation caused by siltation. The unleveed cropfields and fallow fields would not continue to be cultivated and would therefore undergo a gradual natural succession to a silver maple/cottonwood dominated bottomland forest habitat (minus the high value and historically present mast-producing component) over the next 50 years. Outside of the boundary of the FID, it is assumed that the Rose Pond Conservation area will continue to be managed as natural habitat; however, the surrounding agricultural areas within the floodplain are likely to continue under cultivation.

3. PROJECT OBJECTIVES

A. Problem Identification. The extent and quality of forests, wetlands, and grasslands along the Mississippi River have been steadily declining due to past and ongoing pressure from human activities within the basin. This is particularly true for Pool 20, which has a lower percentage of Federal- and State-managed lands dedicated to natural resources conservation than other pools in the Upper Mississippi River System (UMRS). The FID is the only Federal wildlife refuge within the 21-mile reach of Pool 20. Sedimentation and agricultural practices have contributed to the deterioration of the habitat value of FID lands. Hardwood, mast-producing forests were cleared to make room for crops. Wetlands have been drained to create cropland. Floodplain ponds and wetlands have suffered from sedimentation, which has reduced their area, volume, and habitat value. Native floodplain grasslands were long ago converted to cropland or pasture. Specific habitat losses on the FID lands include:

1. Forest Fragmentation. Hardwood forests were cleared in the 19th and 20th centuries to make room for agriculture and development. Former continuous reaches of Mississippi River floodplain forests were reduced to small tracts and are now interspersed between large agricultural fields. This fragmentation eliminated habitat for large game and reduced the attraction for nesting and migrating birds. Widespread forests with rich species diversity have been reduced to narrow stands dominated by a limited number of flood-tolerant species on the fringes of the Division's water bodies and waterways.

2. Loss of Wetlands. The FID lies within the floodplain of the Mississippi and Fox Rivers. Oxbow lakes, sloughs and wetlands were once abundant. Many of these features have been drained or leveed to create farmland. Others have been filling with sediment through natural processes of erosion and flood-borne sedimentation. Development of viable measures to prevent sedimentation is problematic because the sources of sedimentation are largely, though not entirely, external to the project area. The net result has been the loss of wetland and loss of plant and wildlife diversity tied to this habitat. This condition is recurrent all along the Mississippi River, but the FID provides special opportunities because of its location—the only riparian refuge land within Pool 20—and because most of the floodplain has not been separated from the rivers by levees.

Approximately 621 acres of the FID are presently cultivated. These cultivated areas provide marginal agricultural benefits because of frequent crop losses due to flooding. Unless managed specifically for the purpose of wildlife enhancement, they provide relatively low quality habitat. Agriculture on the Division also results in sediment, nutrient and pesticide runoff into the Mississippi and Fox Rivers. These pollutants effectively lower the dissolved oxygen content within the streams, diminishing their capability for sustaining diverse aquatic populations.

The ponds and sloughs on the Division are filling with sediment from on-site erosion and from sediment-laden flood flows. With insufficient depth to prevent solid winter freezing, they have lost their capacity to sustain fish populations. The unconsolidated, silty bottoms diminish their capacity to support aquatic plants and wildlife. Eventually the water bodies fill to the level of dry land and provide no surface water resource. This sequence is in advanced stages throughout the FID. Nelson Lake and Old Lake have filled to only a couple feet of depth. Coin Pond has only a few inches of water in the late summer and fall. The upper reaches of Logsdon Slough and all of Slim Slough are dry for most of the year.

3. Loss of Native Floodplain Grassland Community. Native grasslands, although a major component of the pre-settlement landscape, are uncommon in the present floodplain. Native grassland communities were prevalent in the pre-settlement landscape from Pool 13 in the north, through the Kaskaskia River, and the lower Illinois Waterway in the south (early 1800s General Land Office records). Native grasslands accounted for between 35 percent and 56 percent of the floodplain in this reach. Following conversion to agriculture and development, native grasslands account for 3 percent to 7 percent of the floodplain (statistics from the Habitat Needs Assessment). Native grassland fragmentation and conversion to agriculture is the most extreme land cover change in many parts of the UMR floodplain. What had been large contiguous native grasslands separated by wooded tributary riparian corridors are now isolated patches separated by large expanses of crop fields, towns, and cities. In addition, connectivity to other natural habitats has been reduced where agriculture or development abut native grasslands. Native grasslands in the floodplain persist mostly as remnants in the scattered refuges and conservation areas along the UMR corridor. Native grasslands naturally grew on slightly higher elevations in the floodplain, which were widely leveed and converted to agricultural purposes.

Restoration of this community type will most likely require restoration behind existing levee systems. Many varieties of native warm-season tall grasses and forbs are now found only in restored native floodplain grasslands. Plant communities dominated by native grasses and forbs are important for preservation of species diversity and for the habitat they provide to a variety of wildlife such as butterflies, frogs, turtles, songbirds, migratory waterfowl, pheasants, deer, and small mammals.

B. Resource Significance. The Mississippi River represents the largest riverine ecosystem in North America and the third largest in the world. The UMR ecosystem encompasses over 2.6 million acres of aquatic, wetland, forest, grassland, and agricultural habitats, supporting more than 300 species of birds; 57 species of mammals; 45 species of amphibians and reptiles; 150 species of fish; and nearly 50 species of mussels. More than 40 percent of North America's migratory waterfowl and shorebirds depend on the food resources and other life requisites (shelter, nesting habitats, etc.) that the system provides. The importance of these resources was recognized by Congress in WRDA 1986 by their declaration of the UMRS as a "nationally significant ecosystem", as noted in Section 1.G. of this DPR. Institutional recognition of the significance of this resource was further recognized by Congress' initial and continued authorization of the Environmental Management Program for the planning, construction, and evaluation of measures for rehabilitation and enhancement of fish and wildlife habitat in the UMRS.

The National Research Council recognized the ecological significance of large floodplain rivers and identified the Mississippi and Illinois Rivers as examples of two such rivers in the U.S. that could become healthy again with proper management and restoration.

Floodplain forests are declining in the Mississippi and Illinois River floodplains due to agricultural and urban development, alteration of natural riverine flood pulses, rising water tables, and island loss due to wind and wave action. The remaining forests are changing in composition from high species diversity (including mast producing trees) to a more monotypic forest dominated by silver maple and even aged stands with little to no understory or regeneration of seedlings.

Grasslands are an important ecotype that was common and abundant in the UMRS ecosystem prior to the extensive agricultural development of the floodplain from the late 19th through the mid 20th centuries. Today, wet-mesic native floodplain grasslands are the rarest and most fragmented native ecotype in the UMR ecosystem.

Within Pool 20, existing land cover is predominately agricultural (72 percent of total floodplain acreage) and likely to remain so for the foreseeable future. Opportunities for restoration of native floodplain ecotypes and habitats are limited by the small percentage of land in public ownership (2.6 percent of total floodplain acreage). For this reason, the restoration of land and water resources of the FID has an increased importance.

C. General Fish and Wildlife Management Goals. The mission of the NWR System is "to administer a national network of lands and waters for the conservation, management and where appropriate, restoration of fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." Great River NWR was established primarily to provide protection and sanctuary for migratory birds. Refuge lands also provide important habitat for numerous species of resident and migratory wildlife.

The goal of the FID HREP is to rehabilitate and enhance the quality and diversity of wildlife habitat. The goal will be achieved through expansion of wet, bottomland forests, establishment of mast producing forests, enhancement of wetlands, and restoration of native grasslands.

The HREP proposed enhancements are designed to increase the capability for the USFWS to manage the FID, providing increased flexibility to meet changing conditions.

D. Project Goals, Objectives, and Potential Enhancement Features. The specific goals, objectives, and potential features of the FID HREP are listed in table 3-1.

Table 3-1. Project Goals, Objectives, and Potential Enhancement Features

Goal	Objectives	Potential Enhancement Features
Rehabilitate & Enhance Wildlife Habitat	Reduce forest fragmentation and enhance forest species diversity	Establish hardwood, mast-producing forests
		Allow natural reforestation in low-lying areas
	Increase quality and quantity of existing wetlands	Enhance water supply, distribution and control for wetlands
	Restore native grassland	Seed part of Logsdon Tract with native grasses and forbs.

E. Planning Constraints. The following constraints were considered in plan formulation:

- **Environmental Laws and Regulations.** Construct features consistent with Federal, state, and local laws.
- **Operation and Maintenance.** Restoration features shall be designed to minimize operation and maintenance requirements.
- **Impacts to Flood Heights.** Restoration features should not detrimentally increase flood heights to adversely affect private property or infrastructure.
- **HTRW.** Project features should be designed to avoid disturbance of HTRW to minimize and prevent Federal liability under the Comprehensive Environmental Response, Compensation, and Liability Act; to reduce any threats to project workers; and to avoid costly delays associated with environmental abatement activities.

F. Criteria for Potential Enhancement Features. Table 3-2 presents general and specific criteria developed to assess potential enhancement features.

Table 3-2. Potential Enhancement Features Development Criteria

Criteria	Purpose of Criteria
A. General Criteria	
Locate and construct features consistent with EMP directives	Comply with program goals and authorities
Construct features consistent with Federal, state, and local laws	Comply with environmental laws
Develop features that can be monitored (e.g., stability, water levels, water quality)	Provide means to measure integrity, effectiveness, and efficiency of improvements.
Design features to facilitate operation and maintenance	Minimize operation and maintenance costs. Realize USFWS logistical difficulties in accessing the site
Locate and construct features consistent with best planning and engineering practices	Provide basis for project evaluation and alternative selection
Construct features which meet one or more of the project objectives	Meet project goals and objectives
B. Rehabilitate and Enhance Wildlife Habitat	
Establish hardwood, mast-producing forests	Improve forage and shelter for wildlife and increase plant diversity
Establish hardwood plantings on higher elevations	Maximize survival of species that are less flood-tolerant
Natural reforestation in low-lying areas	Reduce forest fragmentation and increase shelter and nesting habitat
Augment water supply to wetlands	Provide habitat for migrating waterfowl, other wetland dependent birds, and aquatic and amphibious species
Increase area of wetlands	Increase habitat for migrating waterfowl and aquatic and amphibious species
Provide means to control water levels	Increase management flexibility; control invasive species; enhance vegetative opportunities; improve maintenance operations
Provide access to water supply and control facilities	Increase native plant diversity and restore historic mosaic of floodplain habitats
Re-create native floodplain grassland	

4. POTENTIAL PROJECT FEATURES

This section describes potential features to meet the goal to rehabilitate and enhance the quality and diversity of wildlife habitat. The following potential enhancement features were determined based on their ultimate contribution to the goals and objectives, engineering considerations, and local restrictions or constraints. Features not considered feasible will not be subjected to further evaluation and the reason for excluding any feature will be documented. These features are shown on Plate 4, *Potential Enhancement Features Not Evaluated*. The remaining feasible project features are shown on Plate 5, *Potential Enhancement Features Evaluated*. For planning purposes, project life was established at 50 years.

A. Potential Features to Reduce Forest Fragmentation and Enhance Forest Species Diversity. The once contiguous Mississippi River floodplain forests have been dissected into small plots to make room for agriculture, towns, levees and roads. The loss of contiguous forest affects the density and diversity of wildlife in this riparian zone. The following features would re-establish contiguous forest along the north-south extent of the Division.

1. Plant Mast-Producing, Hardwood Trees. Several methods were considered for planting mast trees, including:

- **Precision direct seeding in rows, using a drill:** This method would be used to create rows of trees, closely spaced within the row but with rows spaced far enough apart to allow mowing.
- **Broadcast direct seeding:** This method would result in a dense, random pattern of seedlings. Herbicides would be used for weed control because there would not be room to mow around the trees. This option was not evaluated in detail because USFWS and Corps foresters indicated precision seeding worked better with their current operations and maintenance program. Precision seeding provides better access and improved capacity to monitor and address problems.
- **Plant common nursery rootstock:** This rootstock comes in a variety of sizes, from bare-root seedlings to 5-gallon root balls. The stock is typically planted in rows with sufficient room between rows to mow. This option was not evaluated in detail because recent restoration experience by the USFWS and Corps indicated much better survival and overall improved economics of container-grown stock plantings despite the higher initial costs.
- **Plant vigorous container-grown stock:** This method is more expensive than other methods but has a much higher survival rate than common root stock or direct seeded acorns during the first crucial years after planting. Container-grown stock comes in pots three gallons or greater, has a caliber of 5/8 inch or greater at the base of the tree, with a dense, fibrous root mass, and are 4 to 6 feet tall. Tree height is very important during flooding because if the trees are not completely inundated, they have a much higher survival rate. Container-grown stock is also planted in rows with enough space between the rows for mowing. Since 1989, the Corps' Rock Island District has had good survival rates with this planting method at previous HREPs, including Bay Island, Gardner Division, Big Timber, Princeton Refuge, and Cottonwood Island.

All methods of selective planting require vigorous weed control to enhance survival rates. Several methods were considered. The objective of all the methods is to limit competition until the saplings have reached sufficient height and breadth to create a canopy that shades out competitive species. Under normal growing conditions, the weed control program can be stopped or reduced after three years.

Mechanical weed control (mowing) requires the trees to be planted in patterns that allow equipment to pass near each tree. Typically the trees are planted in rows, too close within the row for cross mowing but with rows spaced wide enough to allow tractor access. Sometimes the trees are spaced far enough apart in both directions to allow mowing each way. The disadvantage of planting for cross mowing is a lower tree population, especially if some of the trees die. Trees planted densely in rows can be thinned to the proper spacing after it becomes clear which trees would survive.

Tree mats and rolls of plastic were considered for weed control. Trees would be planted through holes in strips of material laid along the ground in rows to prevent weed growth. Spacing between rows would allow water to reach the root system. Many foresters have success with herbicides for weed control. A proper regime of pre- and post-emergent herbicides can prevent unwanted species without damaging the preferred crop.

Some areas of the Division were seeded with hardwoods a few years prior to this project. Some of those seeded areas have not resulted in viable hardwood stands and this study investigated replanting there. One such area, the East Winkleman Tract, consists of the Division land lying east of the BNSF Railroad. Acorns were broadcast over this area in 2001, but there are few oak saplings to be found now. After site investigation and discussions the project team decided not to pursue re-seeding because the area is more prone to flooding than other areas on the Division.

Another area that was recently seeded with hardwoods lies on the east bank of the Fox River, near Old Lake. The USFWS has decided to leave this area to grow up in combination of hardwood trees from the seeding and native species that take hold through natural regeneration.

2. Reforestation of Lowland Areas. This option is to allow lower-lying ground to reforest naturally, yielding flood tolerant species such as silver maple and cottonwood. This option would restore the extent of forested area on the Division to pre-development levels, providing habitat for woodland wildlife and improving conditions for forest-dwelling birds that require larger continuous tracts. The soft-mast varieties that would dominate the forest would not provide as much food value or diversity as the hard-mast forest, but they are much more capable of withstanding flood events.

B. Potential Features to Increase Quality and Quantity of Existing Wetland. The FID is rich with ponds, wetlands, and natural channels. The area is frequently inundated from high spring flows on the Mississippi and Fox Rivers, as well as local flood-producing storms. Three smaller basins converge with the Fox River at the Division:

- Pickle House Slough flows in from the north;
- Hemp Slough from the northwest; and
- Honey Creek from the west.

The flood waters remain in the Division for weeks after the streams have receded, nourishing hydrophytic plants and expanding habitat for dabbling ducks, wading birds, amphibians, and other wetland species. By developing alternative water sources and new means to control water levels, the wetland habitat can be expanded spatially and temporally.

1. Enhance Logsdon Slough. This option would increase the water levels in Logsdon Slough, on the west side of the Fox River, by developing a source of water and controlling the discharge from the slough to the Fox River. Part of this tract is currently enrolled in the Natural Resources Conservation Service (NRCS) Wetland Reserve Program (WRP).

For a source of water, there is an existing well on Logsdon tract, on the opposite side of the flood control levee from the slough. To utilize this water, a new discharge line would have to be constructed over the levee. Two concerns led to the early dismissal of this option for water supply:

- The capacity of the well was questionable and marginal; and
- The cost of piping the water from the well over the levee was higher than the cost of developing a new well.

There was some consideration for pumping water out of the Fox River, but the river is not very accessible from the west side and the water supply is not reliable, especially in the late summer and fall.

A new well could be drilled to develop a dependable source of water. Several irrigation companies were contacted and confirmed that new wells in this area are capable of developing the 600 to 2,000 gallons per minute discharge required to operate the wetlands efficiently. The feeder channel from the new well to the slough would be located on land in the wetland reserve program.

There is an existing stoplog structure, located near the mouth of the slough where it discharges to the Fox River, capable of pooling water to about elevation 485 with some enhancements. New stoplog boards and some excavation are needed to ensure that the area can be properly drained to promote moist soil vegetation growth. The new well, enhanced stoplog structure, and excavation would allow inundation of a reach of the slough that is currently dry during most of the late summer and fall.

2. Enhance Coin Pond, Slim Slough, Old Lake Complex. Many wetlands, ponds, sloughs, and drainage ditches occur on the east side of the Fox River, between the Fox River and the Mississippi. The centrally located water bodies—Coin Pond, Slim Slough, and Old Lake—are connected by a series of natural channels, wetlands, and swales. Altogether, more than 350 acres of contiguous lowland can be inundated by a single pumping source and a single water control structure.

A little more than 50 acres of this complex occurs within the discernable banks of the three water bodies. Although these water bodies recede during dry periods, the limits of normal high water are recognizable by the dark hydric soils, hydrophytic plants, and border of water-tolerant trees and brush. The remaining 300 acres of lowland within this complex are farmed or recently abandoned farmland. These low areas are frequently inundated. Uncultivated areas are dominated by hydrophytic plants such as smart weed, nettles, and willows.

There is concern that uncontrollable seepage could occur if too high of water levels are attempted. The natural channels are lined with fine-grained sediments, which have accumulated over centuries of erosion and flood deposition. Outside the channels, however, soils on the Division are sandy and pervious. Cultivation in the cropland swales may have disturbed the impervious layer that continues to seal the natural wetlands. Natural sand lenses may also provide a seepage path. Some evidence of this varying permeability was observed in July 2003, when Coin Pond, Logsdon Slough and Old Lake were observed bank-full, while Slim Slough had almost no open water. Therefore, this feature calls for inundation of only the 53 acres of still-natural wetland within the complex. The structural features that provide the capability to manage the 53 acres, however, are also capable of inundating the remaining 300 acres (by raising water levels).

Additional stoplog structures are included in the plan so that segments of the complex may be isolated and managed separately. In the event that part of the complex could hold higher water levels without leaking, the extra control would allow that to happen.

Under this feature, new water sources would be developed. The wetland complex is so extensive that there was significant uncertainty whether a single well could develop sufficient flow to fill and maintain water at desired levels in a timely fashion. A plan for developing two wells near Coin Pond was developed as a means to ensure sufficient water supply. This concept was developed enough to derive a cost estimate and discuss operation and maintenance concerns. One concern was that the two wells would draw down the groundwater, thereby reducing their total capacity. Another option utilized a groundwater well near Coin Pond and a surface water pump on Grey Chute to fill the wetlands. The combination of ground water and surface water sources provides management flexibility. Redundant sources provide greater reliability under varying conditions such as fluctuations in ground water levels, river levels, pump maintenance, and accessibility.

One option for developing a surface water source involved a portable or stationary pump station on the east bank of the Fox River. To create enough depth in the river to supply a pump, a low sill would need to be constructed across the river. This is problematic in that the pool created by the sill would be prone to sedimentation and would require frequent maintenance dredging. Furthermore, there is insufficient flow in the Fox River in the late summer and fall, when pumping would be most needed, to sustain the river ecology and nourish the wetlands. This option was eliminated without further analysis.

The option for using water from Grey Chute was immediately appealing because the water source is perennial and overwhelmingly sufficient to meet the needs of the Division wetlands. A major obstacle for developing this water source was getting the water to the other side of the railroad, into the wetlands. The plan for constructing a force main from the pump station, beneath the railroad, to the upper reaches of Slim Slough provided a solution. The pump station would be located in the south panhandle of the East Winkleman Tract, where there is access to Grey Chute and the length of the force main would be minimized.

A self-contained trailer-mounted pump was considered for the Grey Chute pump station. In addition to being less expensive than a stationary pump station, this type of pump is completely removable during the non-pumping season to prevent damage from flooding or vandalism.

A significant disadvantage is that the design head and discharge for this application are at the extreme high end of the trailer-mounted pump's capabilities. A stationary pump is also simpler for applications such as this that require connecting to a force main, because the connection only needs to be made once. By contrast, a trailer-mounted pump must be disconnected and re-connected each time it is moved.

The main water control structure for the Coin Pond- Slim Slough-Old Lake complex would be constructed of reinforced concrete. This structure would serve as the primary means for controlling water levels within the wetland. Additional stoplog structures installed in the connecting channels between segments of the wetland would be lighter-weight, corrugated metal structures. These structures would be used to isolate segments of the wetland, to provide greater management flexibility.

One option considered for inundating the wetland complex involved installation of a flap gate or Tideflex® valve on the Fox River stoplog structure to capture Fox River flood pulses. This alternative was not considered as very beneficial because the flood pulses normally occur in the spring, when the wetlands are typically already inundated. Also, wetland managers often plan to draw down water levels in the summer to encourage consolidation of the sediments and growth of plants for forage. This option was eliminated without further design.

Some work would be required to improve existing channels, to enhance connectivity throughout the complex. Connecting channels would be constructed with zero longitudinal slope so that water movement can occur in either direction. Corrugated metal culverts would be installed at road crossings.

Some roadwork would be required within the complex, to provide all-season access to the pumping stations and water control structures. An existing county road provides access to much of the refuge but extensions would be required to reach the Coin Pond well and Grey Chute pumping station. Additional work would be needed at the reinforced concrete stoplog structure.

The main connection between the wetland complex and the Fox River occurs at the natural channel where the proposed concrete stoplog structure would be constructed. Natural berms along the east bank of the Fox River would provide containment up to the design wetland water levels. But there is a location about 500 feet upstream of the main water control structure where the bank has eroded. This site would be raised and armored with riprap in order to provide closure to the containment perimeter. The eroded area is about 50 feet long and the bank must be built up from 3 to 6 feet above its existing grade.

3. Enhance East Winkleman Tract Wetland. There is a long, narrow, wooded swale running parallel to the Mississippi River, about 200 feet east of the BNSF railroad on the area known as the East Winkleman Tract. The new pumping station on Grey Chute lies at the southern end of this former river channel. The swale extends beyond the 4,000–foot north-south dimension of the Winkleman Tract, about 3,000 feet onto private property. By constructing a berm near the northern boundary of the Division, this swale could be seasonally inundated to increase moist soil habitat. The Grey Chute pump could be designed to flood this area in addition to the Coin Pond,/Slim Slough/Old Lake complex, so no additional pump would be required. A drainage swale would be required to direct the runoff from the private land directly to Grey Chute, rather than passing through the Winkleman Tract as it currently does.

The USFWS was concerned that the adjacent landowner would be adversely impacted by construction of this wetland. The additional water on the Winkleman Tract could cause wet conditions on adjacent farmland, which could result in crop damage. There is also concern for the effect that the berm would have during Mississippi River flooding. The berm would alter the deposition pattern of flood-borne sediments, which could result in crop damage, damage to the wetland, or increased maintenance costs. Due to these concerns, this potential feature was not further analyzed.

4. Dredge Nelson Lake. The largest and southernmost water body, Nelson Lake, has lost its deep-water aquatic habitat due to sedimentation. The murky water and unconsolidated bottom are not conducive to aquatic plants or wildlife. This option would restore aquatic habitat by hydraulically dredging the lake to restore deep water and remove unconsolidated sediment. Measures would be taken to reduce recurring sedimentation, such as constructing a low berm around the lake to prevent inflow from frequent, sediment-rich floods. Preliminary analysis and discussions with USFWS and MDOC removed this option from further consideration. There were several concerns:

- The cost of dredging would be higher than the costs of all other improvements combined.
- To prevent further siltation a berm would need to be constructed to reduce the frequency of flooding. These frequent flood pulses are a significant feature of the Division, one of the last remnants of the unleveed Mississippi River floodplain.
- With no connection to either river, the lake's fishery benefit is limited.

C. Potential Features to Restore Native Grasslands. The 98-acre site proposed for grassland restoration is an old agricultural field with sandy soil that is seasonally flooded and protected by a levee. The site lies adjacent to the 377-acre, MDOC-managed, Rose Pond Conservation Area. The Rose Pond Conservation Area has been widely planted in native species of grasses and forbs. Native grassland restoration on the FID would be compatible with the Rose Pond tracts and reclaim some of the tall-grass ecology that prevailed prior to conversion to row crop cultivation. This restoration would also provide potential habitat for the state-endangered Illinois Mud Turtle, which, when not utilizing nearby aquatic areas, specifically nests, hibernates, and estivates in sandy areas adjacent to open water that are free of trees. The Illinois Mud Turtle also may be found in flooded fields associated with sandy soils.

D. Potential Features to Reduce Sedimentation. A perimeter levee or series of deflection embankments were considered as a means to reduce the project's sedimentation problem. They were not pursued due to high construction costs, potential impacts to flood heights, and loss of connectivity with both the Fox and Mississippi Rivers. Deepening the lakes and ponds by dredging was also considered, but not pursued because ensuring optimum water levels via channels and a well and pump station was less expensive to construct and cheaper to maintain over the project's 50-year life.

5. EVALUATION OF FEASIBLE PROJECT FEATURES AND FORMULATION OF ALTERNATIVES

This section describes the features that met the goals and objectives of this project. Each feature was evaluated to determine its potential for environmental restoration and enhancement. Estimated costs were also derived for each of the feasible alternatives.

A. Environmental Output Evaluation. A habitat analysis was performed for the FID project, with the goal to rehabilitate and enhance wetland and associated floodplain habitat quality and diversity. This analysis employed a multi-agency team approach with representatives from the Corps, USFWS, ILDNR, and MDOC participating.

Analysis of existing study area conditions, future conditions without the project, and impacts of several proposed features and alternatives was completed using the Wildlife Habitat Appraisal Guide (WHAG) procedures developed by the MDOC and the USDA Natural Resources Conservation Service. The WHAG is a numerical habitat appraisal methodology based on USFWS Habitat Evaluation Procedures (HEP) (1980).

WHAG procedures evaluate the quality and quantity of particular habitats for animal species selected for evaluation by the WHAG team members. The qualitative component of the analysis is known as the Habitat Suitability Index (HSI) and is rated on a 0.1 to 1.0 scale. The quantitative component of the analysis is the measure of acres of habitat that are available for the selected evaluation species. From the qualitative and quantitative determinations, the standard unit of measure, the Habitat Unit (HU), is calculated using the formula HSI x Acres = HUs. Changes in the quality and/or quantity of HUs would occur as a habitat matures naturally or is influenced by development. Cumulative HUs are annualized and averaged. To facilitate comparison, target years were established at 0 (baseline or existing conditions), 1, 25, and 50 years. HSIs and average annual habitat units (AAHUs), for each evaluation species, were calculated to reflect expected habitat conditions over the life of the project.

For a more detailed description of the habitat analysis, refer to Appendix D of this report.

B. Feasible Project Features. Plate 5, *Potential Enhancement Features – Evaluated,* shows the locations of the three feasible project features described below.

Project Feature 1. Reduce Forest Fragmentation and Enhance Forest Species Diversity. About 620 acres of cropland and approximately 220 acres of open land could be converted to 840 acres of forests. Of these 840 acres, approximately 275 acres are at a suitable elevation for mast tree survival under current hydrologic conditions. The remaining open areas would be allowed to reforest naturally. Two methods of active reforestation—planting container grown stock and precision direct seeding of acorns—were evaluated for the 275 acres of higher ground that can feasibly be planted with mast-producing hardwood trees. For planning purposes, 60 acres of the highest ground available within the 275 acres were considered sufficient size to test the less expensive but more uncertain direct acorn seeding method and to assess the success of that method in the floodplain environment. Natural regeneration will be the reforestation method for the remaining 565 acres of cropland and open land at lower elevations. A total of four combinations were evaluated: A0 - No action (275 acres); A1 - Plant Container Grown Stock (215 acres); A2 - Precision Direct Seeding (60 acres); and A3 - Combination of RPM Stock and Precision Direct Seeding – (215+60=275 acres).

Alternative A0. No Action. This alternative would not require any additional management effort. Present farm leases would be discontinued and open areas would be allowed to revegetate naturally. This feature would result in an increase of forest habitat comprised of floodplain species such as silver maple and cottonwood, which compete favorably on wet soils and periodic flooding. However, the regenerated areas would lack a mast producing component and would not fully restore the lost functions of the historic floodplain forest community that existed in the area prior to the hydrologic and land use alterations of the floodplain and river basin.

Alternative A1. Plant Hardwood Container-Grown Stock. This alternative consists of planting hardwood trees on 215 acres of higher ground on the north end of the FID. These seedlings would be container-grown stock from a local nursery. The container-grown stock system produces vigorous, competitive stock, which stand a greater chance of survival than bare-root seedlings. The container-grown stock would include a mixture of Swamp White Oak, Bur Oak, Pin Oak, Northern Pecan, Shellbark Hickory, Kentucky Coffeetree, and Persimmon. Areas for planting would be selected to minimize the duration of flood inundation. This alternative yields a net benefit of 60 Average Annual Habitat Units (AAHUs).

Alternative A2. Plant Hardwood Trees by Precision Direct Seeding. This alternative consists of planting 60 acres of hardwood trees by direct seeding of nuts and acorns. The mix would include species such as oak, walnut, sycamore, and green ash. This method utilizes chemical and mechanical weed control until a thick canopy is achieved, typically within three years of planting. The precision planting method requires less seedbed preparation and less seed than broadcast seeding, and the resulting rows make for easier monitoring, management and weed control. Time to maturity is somewhat longer than container grown stock, and the risk of failure as a result of flooding in the early years is much greater with this planting method. This alternative yields a net benefit of 12 AAHUs.

Alternative A3. Plant Hardwood Trees Using Container-Grown Stock and Direct Seeding. This alternative is a combination of Alternatives A1 and A2 and yields a net benefit of 72 AAHUs.

Project Feature 2. Enhance and Expand Existing Wetlands. About 78 acres of existing wetlands, on both sides of the Fox River, could be enhanced by providing reliable water sources and the means to control water levels. The enhanced wetlands would provide increased benefits for migratory waterfowl and wading birds by enabling the draining and filling of these areas for optimum management of forage plants, nesting habitat, and fall resting grounds.

B0. No Action. This alternative would require no additional management effort. No habitat gain or loss would be realized other than what occurs naturally. Sedimentation will continue to degrade the remaining wetlands, further reducing the benefit to fall migratory waterfowl and other wetland species except during exceptionally wet years.

B1. Enhance Logsdon Slough. This action would enhance water supply and control within Logsdon Slough. A new 100-foot-deep well with an 18-inch casing would provide the capability of inundating 25 acres of moist soil vegetation. The well would be located on the east

(unprotected) side of the Mississippi-Fox Drainage and Levee District levee, near the west Division access road. A 2,000 gallon per minute (GPM) irrigation pump, energized by a portable diesel power unit, would supply water to the wetland via a new channel. The upper 40 feet of the 200-foot-long channel would be lined with riprap to promote aeration and control erosion.

An existing stoplog structure at the downstream end of the slough would be used to adjust water levels and control the discharge to the Fox River. New stoplog boards and some excavation are needed to ensure that the area can be properly drained to promote moist soil vegetation growth. A system for locking the stoplogs in place and securely storing the ones that are not in use is needed to reduce losses due to vandalism. The area could be drained by gravity following spring floods and allowed to vegetate naturally in forage for waterfowl, then flooded in the fall to provide food and shelter for migrating flocks. The new well, enhanced stoplog structure, and excavation would allow inundation of a reach of the slough that is currently dry during most of the late summer and fall. This feature yields a net benefit of 17 AAHUs.

B2. Enhance Coin Pond - Slim Slough - Old Lake. This action would enhance water supply and control to the channels and wetland areas within the Coin Pond - Slim Slough - Old Lake complex. Proposed new features include a well near Coin Pond, a surface water pump at Grey Chute, stoplog structures, and channel improvements. The new well near Coin Pond would include a 18-inch casing 100 feet deep and a 2,000 GPM pump powered by a portable diesel unit. This setup, comparable in size to irrigation systems in the vicinity, would be capable of filling the 53-acre wetland complex in approximately 30 days.

A new line-shaft surface water pump, powered by a portable diesel unit, would be installed on the bank of Grey Chute, on the East Winkleman Tract. A 24-inch force main would convey the water beneath the BNSF Railroad before discharging into a new channel that connects to Slim Slough and Coin Pond. This 10,000 GPM pump would have a capacity to fill Coin Pond, Slim Slough, and the Old Lake wetland complex in approximately 6 days.

A cast-in-place concrete stoplog structure would be constructed on the west side of the complex, where two natural drainage channels come together before discharging into the Fox River. This structure would also serve as a bridge, providing access along the east side of the Fox River between the north and south halves of the Division.

Four galvanized metal stoplog structures would be installed across the distribution channel, separating it into three reaches. These structures would allow independent manipulation of the water levels in Coin Pond, Slim Slough, and Old Lake wetland areas. The level-bottomed channel would provide equal flow capacity in either direction.

This alternative also includes raising and protecting a 50-foot section of the east bank of the Fox River. This eroded stream bank could short-circuit the main water control structure if not protected. This feature, enhancing wetlands in Coin Pond, Slim Slough, and Old Lake yields a net benefit of 34 AAHUs.

B3. Enhance Logsdon Slough and Coin Pond/Slim Slough/Old Lake. This alternative is a combination of Alternatives B1 and B2 and yields a net benefit of 51 AAHUs.

Project Feature 3. Restore Native Grassland. About 98 acres of an old field could be enhanced by planting native grasses and forbs, which would help restore the most fragmented floodplain land cover type in the Upper Mississippi River. This native grassland would provide additional foraging areas that would benefit migratory waterfowl and resident species. The grassland would also provide critical habitat for the endangered Illinois Mud Turtle to use for hibernation and estivation.

C0. No Action. This alternative would not require any additional management effort. No habitat gain or loss would be realized other than what occurs naturally. The abandoned cropland would experience natural revegetation by forbs and woody plants with no control over selection. Habitat enhancement would be less than optimal.

C1. Plant Grasses and Forbs. Under this option, approximately 98 acres of the Logsdon Tract would be restored to native grassland. This restoration, adjacent to existing grassland within the Rose Pond Conservation Area, would result in a contiguous grassland area of up to 400 acres when the Rose Pond restoration has been completed. Native grass and forbs species would be selected based on their historical range, affinity for open, sandy meadows, and ability to withstand some flooding.

Candidate species include grasses such as:

Big and Little Bluestem	Indian Grass
Switchgrass	Prairie Cord-grass

and forbs such as:

Black-Eyed Susan	Butterfly Milkweed
Compass Plant	Evening Primrose
Lanceleaf Coreopsis	Large-Flowered Beardtongue
Leadplant	Pale Purple Coneflower
Rattlebox	Showy Goldenrod
Stiff Goldenrod	Upland White Aster
White Prairie Clover	White Wild Indigo
Yellow Coneflower	

Some areas near Logsdon Slough would be cleared of recent growth cottonwoods and willows. This feature yields a net benefit of 55 AAHUs.

C. Cost Estimates for Habitat Improvement Measures. Table 5-1 summarizes the outputs and costs associated with each management measure. A breakdown of costs is outlined in Section 8, *Cost Estimates.*

Table 5-1. Environmental Output and Costs of Each Feature

Feature	Symbol	Output [1]	Cost [2]	Annualized Cost [3]
Reduce Forest Fragmentation and Enhance Forest Species Diversity (Reforestation)				
Plant Hardwood Container-Grown Stock	A1	60	762	42.4
Plant Hardwood Trees by Precision Direct Seeding	A2	12	74.4	4.1
Enhance and Expand Existing Wetlands (Wetland Enhancement)				
No Action	B0	0	0	0
Enhance Logsdon Slough	B1	17	158.8	8.8
Enhance Coin Pond/Slim Slough/Old Lake	B2	34	1,053	58.6
Restore Native Grassland				
No Action	C0	0	0	0
Plant Grasses and Forbs	C1	55	192.8	10.7

[1] Outputs are calculated as Average Annual Habitat Units (AAHUs).
[2] All costs in $1,000s.
[3] Annualized cost is initial construction cost based on a 50-year project life, 5.1% interest rate.

D. Incremental Cost Analysis of Alternatives. Cost effectiveness analysis has been used to assist the decision-making process to determine which project features should be built. The decision is based upon the habitat benefits (outputs) that meet the goals and objectives of the project in the most cost effective way. The cost effectiveness analysis is conducted to ensure that the least cost solution is identified for each possible level of environmental output. After the cost effectiveness of each alternative has been established, subsequent incremental cost is conducted to reveal changes in costs for increasing levels of environmental output. In the absence of a common measurement unit for comparing the non-monetary benefits with the monetary costs of environmental plans, cost effectiveness and incremental cost analysis are valuable tools to assist in decision making. Appendix E presents the results of the cost effectiveness analysis and incremental cost analysis.

i. Method. The project was evaluated using guidance and software prepared by the Corps of Engineers' Institute for Water Resources. Institute for Water Resources - Plan Decision Support Software (Version 3.33) was used in this analysis.

The cost effectiveness and incremental cost analysis procedures are presented in nine steps, which can be grouped into four tasks:

Task 1. Formulation of Combinations:
Step 1 – Display outputs and costs.
Step 2 – Identify combinable management measures.
Step 3 – Calculate outputs and costs of combinations.

Task 2. Cost Effectiveness Analysis:
Step 4 – Eliminate economically inefficient solutions.
Step 5 – Eliminate economically ineffective solutions.

Task 3. Development of Incremental Cost Curve:
Step 6 – Calculate average costs.
Step 7 – Recalculate average costs for additional outputs.

Task 4. Incremental Cost Analysis:
Step 8 – Calculate incremental costs.
Step 9 – Compare successive outputs and incremental costs.

The results of these analyses are displayed as graphs and tables (tables 5-2 through 5-8 and figure 5-1). They permit the decision makers to progressively compare alternative levels of environmental outputs and ask if the additional environmental output in the next level is worth its additional monetary costs.

It is important to note that these analyses would not usually lead, and are not intended to lead, to a single best solution as in economic cost-benefit analysis. They would improve the quality of decision making by ensuring that a rational, supportable, focused and traceable approach is used for considering and selecting alternative methods to produce environmental outputs.

Task 1. Formulation of Combinations

Step 1: Display Outputs and Costs. Table 5-2 displays the outputs and costs of potential management measures. Outputs were determined using WHAG and are presented as net Average Annual Habitat Units. Costs were annualized based upon a 50-year project life and 5.1 percent interest rate.

Step 2: Identify Combinable Management Measures. The two methods of forest regeneration, A1 and A2, are combinable for the 275 acres of higher ground that can be planted with mast-producing hardwood trees. The combination of these methods is limited by the divisibility of the 275 acres into areas of sufficient size to make each of the methods practicable. For planning purposes, 60 acres is considered sufficient size to use one of the forest regeneration methods and to assess the success of that method. Natural Regeneration was the preferred method for the wet floodplain forest on the Logsdon Tract; outside the WRP easement, on the west side of the Fox River, which is the "no action" alternative. A total of four combinations were found:

- A0 - No Action
- A1 - Plant Container-Grown Stock
- A2 - Precision Direct Seeding
- A3 - Combination of Container-Grown Stock and Precision Direct Seeding

The two wetland enhancement features, Logsdon Slough and Coin Pond /Slim Slough/ Old Lake are combinable, as both have benefits of wetland AAHUs. Coin Pond, Slim Slough and Old Lake would benefit from the same structural features and therefore are not separable. A total of four combinations were formed

- B0 - No Action
- B1 - Enhance Logsdon Slough
- B2 - Enhance Coin Pond, Slim Slough, and Old Lake
- B3 - Enhance Both Sets of Wetlands

Native grassland restoration has no combinable methods. The two alternatives for grassland restoration are C0, No Action and C1, Plant Grasses and Forbs. The incremental cost analysis was not performed on the grassland restoration because there was only one alternative, other than No Action.

Incremental Cost Analysis is typically used to compare the habitat enhancement features with the same output, Average Annual Habitat Units (AAHUs). For this project the wetland enhancement features have an output of wetland AAHUs, primarily mallard and Canada goose habitat. The reforestation features have an output of forest AAHUs, consisting of white-tailed deer, wild turkey, pileated woodpecker, fox squirrel, wood thrush, and Kentucky warbler habitat.

The alternatives for wetland enhancement, reforestation and floodplain enhancement could be evaluated together if the different types of outputs were weighted. On this project, each of the alternatives was evaluated separately because they each provide unique conditions that are not duplicated by other alternatives. A combined evaluation would not provide information that would assist decision-making.

Table 5-2. Annualized Cost of Environmental Enhancement Features Based Upon 50 Year Life and 5.1% Interest

Feature Alternative	Area (Acres)	Symbol	Output (AAHUs)	Cost ($1,000)	Annualized Cost ($1,000)	Average Cost ($1,000 per AAHU)
Reforestation						
No Action		A0	0	0	0	0
Plant hardwood container-grown stock	215	A1	60	762	42.4	0.7067
Plant hardwood trees by precision direct seeding	60	A2	12	74.4	4.1	0.3417
Wetland Enhancement						
No Action		B0	0	0	0	0
Enhance Logsdon Slough	25	B1	17	158.8	8.8	0.5176
Enhance Coin Pond/Slim Slough/Old Lake	53	B2	34	1,053	58.6	1.7235
Restore Native Grassland						
No Action		C0	0	0	0	0
Plant Grasses and Forbs	98	C1	55	192.8	10.7	0.1945

Step 3: Calculate Output and Costs of Combinations. Table 5-3 displays the outputs and costs of the forest regeneration alternatives. The combinations are listed in ascending order of their total AAHU outputs. For features with only one possible alternative other than No Action, incremental cost analysis is not necessary, such as with the native grassland. Table 5-4 displays the respective outputs and costs of wetland enhancement features, which are combinations of Logsdon Slough and Coin Pond/Slim Slough/Old Lake.

Table 5-3. Reforestation Alternatives: Outputs and Costs of Combinations Ranked in Order of Output

Alternative Combination	Symbol	Output (AAHUs)	Annualized Cost $1,000)	Average Cost ($1,000/AAHU)
No Action	A0	0	0	0
Plant hardwood trees by precision direct seeding	A2	12	4.1	0.3417
Plant hardwood container-grown stock	A1	60	42.4	0.7067
Plant hardwood trees using container-grown stock and direct seeding	A3	72	46.5	0.6500

Table 5-4. Wetland Enhancement Alternatives: Outputs and Costs of Logsdon Slough Combinations with Coin Pond/Slim Slough/Old Lake Ranked in Order of Output

Alternative Combination	Symbol	Output (AAHUs)	Annualized Cost ($1,000)	Average Cost ($1,000/AAHU)
No Action	B0	0	0	0
Enhance Logsdon Slough	B1	17	8.8	0.5176
Enhance Coin Pond/Slim Slough/Old Lake	B2	34	58.6	1.7235
Enhance Logsdon Slough and Coin Pond/ Slim Slough/Old Lake	B3	51	67.4	1.3218

Task 2. Cost Effectiveness Analysis

Steps 4 and 5: Eliminate Economically Inefficient Solutions and Economically Ineffective Solutions. Step 4 eliminates economically inefficient solutions and identifies the least cost solution for each level of output. For example, if two plans produce two AAHUs and one costs $3,000 while the other $4,000, the more expensive plan is eliminated.

Step 5 eliminates the economically ineffective solutions by identifying and deleting those solutions that would produce less output at equal or greater cost than subsequently ranked solutions. For example, if one plan produces 2 AAHUs for $8,000 and the next plan produces 4 AAHUs for $6,000, the first plan would be eliminated because it is not economically effective.

Table 5-5 displays the least cost alternatives for forest regeneration. The alternative of using only the container-grown trees was eliminated in this process for its high cost per AAHU. The analysis did not evaluate the survivability of the two planting methods. Trees started from seeds are more susceptible to flooding than root stock during the first few years. Therefore, the planning team prefers a combination of

planting methods to enhance the chances for hardwood reforestation while taking advantage of the lower cost and efficiency of direct seeding.

Table 5-6 displays the least cost wetland enhancement combinations. The cost of enhancing Logsdon Slough is much less than the cost of enhancing the wetland complex on the east side of the Fox River (Coin Pond/Slim Slough/Old Lake) because Logsdon Slough would not require as many structural improvements. But the wetland area is limited and much smaller than on the east side. Therefore combination B2—enhancing Coin Pond/Slim Slough and Old Lake—is not cost effective (the low-cost enhancement should be constructed before the high cost); however, the combination of both wetlands, B3, is cost effective because it develops a much larger area of preferred habitat.

Table 5-5. Reforestation Alternatives Cost Effective and Least Cost Combinations

Alternative	Symbol	Output (AAHUs)	Annualized Cost (1,000)	Average Cost ($1,000/AAHU)
No Action	A0	0	0	0
Plant hardwood trees by precision direct seeding	A2	12	4.1	0.3417
Plant hardwood trees using container-grown stock and precision direct seeding	A3	72	46.5	0.6500

Table 5-6. Wetland Enhancement Alternatives Cost Effective and Least Cost Combinations

Alternative Combination	Symbol	Output (AAHUs)	Annualized Cost $1,000)	Average Cost ($1,000/AAHU)
No Action	B0	0	0	0
Enhance Logsdon Slough	B1	17	8.8	0.5176
Enhance Logsdon Slough and Coin Pond/Slim Slough/Old Lake	B3	51	67.4	1.3218

Task 3. Development of Incremental Cost Curve

Step 6: Calculate Average Costs. Average costs for each least-cost, cost-effective plan are determined by dividing the cost of the plan by the output (AAHUs). Average costs are expressed in cost per AAHU ($/AAHU). The plan with the lowest average cost is identified. Plans with less output at a higher average cost are eliminated.

Step 7: Recalculate Average Costs for Additional Outputs. This step asks the question "of the remaining levels of output, which has the lowest additional cost for additional output?"

Using levels of output from Step 6, the average annual costs for additional output are calculated. The previous step's lowest average cost level of output was used as the "zero level." Levels of output less than the lowest average cost level are dropped from further analysis, while level of output greater than the lowest average cost level advance to the next recalculation. Recalculations are then made using the new lowest average cost level as the "zero level." Recalculations are made until the highest level of output is reached. The analysis of incremental costs for additional outputs was not applied to reforestation because the extent of coverage for each of the four combinations was based on survivability, not economics. The

more expensive Container-Grown Stock has higher cost per AAHU, but due to its vigorous growth pattern, has a greater chance of surviving. Common rootstock and direct seeded trees are more susceptible to flooding and competition from weeds and brush during the first few years. Direct-seeded trees would be planted over sixty acres of higher ground that is less susceptible to flooding. Utilizing two planting methods for this project would provide comparative maintenance and survivability data that should be helpful to foresters in the future for selecting planting methods. Accurate incremental analysis would require knowledge of the risk, timing, and duration of flooding with respect to the time that the trees are most vulnerable.

In this case of wetland enhancement, there is no breaking point where incremental additions cause a change in average cost per AAHU. Once you have created the structure to contain the water and have developed a source to supply the water, the entire wetland area would be enhanced, due to the connectivity that exists there. Separating areas, to reduce inundation would require additional earthwork and cost more money. The ability to increase the area of inundation is limited by the extent of pervious soil outside the naturally-occurring wetlands. Therefore the best buy combination is the same combination as shown in table 5-6.

Task 4. Incremental Cost Analysis

Step 8: Calculate Incremental Costs. The plans in table 5-7 are the "best buys," producing the most AAHUs per dollar. The incremental costs shown in table 5-7 are calculated by dividing the differences between each plan's output and annualized cost.

Table 5-7. Wetland Enhancement Features Incremental Costs (Best Buy Plans)

Alternative Combination	Symbol	Output (AAHUs)	Annualized Cost ($1,000)	Average Cost ($1,000/AAHU)	Incremental Cost per Output
No Action	B0	0	0	0	0
Enhance Logsdon Slough	B1	17	8.8	0.5176	0.5176
Enhance Logsdon Slough and Coin Pond/ Slim Slough/Old Lake	B3	51	67.4	1.3218	1.7235

As noted in Step 7, incremental cost analysis was not calculated for reforestation (A0 through A3) because the areas allocated to each application (i.e. natural regeneration, planting container-grown stock, and direct seeding) were determined by non-economic factors. Natural regeneration is the least expensive but does not increase diversity. Direct seeding is less expensive than planting rootstock but is more vulnerable to flooding. The preferred mixture could not be assessed by incremental analyses without putting a dollar value on diversity and flood tolerance.

Incremental cost analysis was not applied to Restore Native Grassland (C0 and C1) because no alternative means of acquiring the same habitat benefits were available. Either the site would be planted in native grasses and forbs or it would not. The species mixture and relative costs and benefits of each were not developed for this preliminary design. During final design, a specific seeding mixture would be developed.

Figure 5-1 is a graph of the costs of wetland combinations as listed in table 5-4; as the graph shows, there are two "best buy" combinations, B1 and B3.

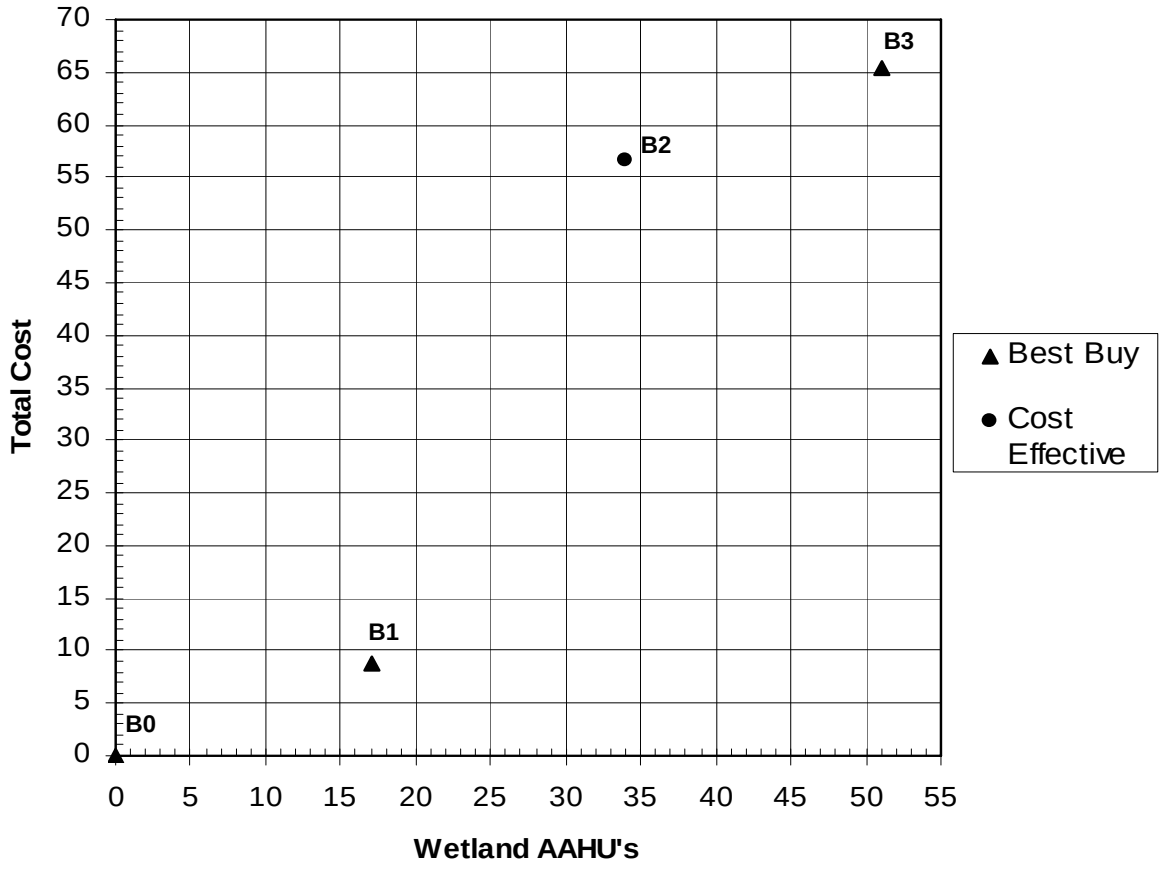

Figure 5-1. Cost Effective and Best Buy Plans Wetland Enhancement Alternatives

Step 9: Compare Successive Outputs and Incremental Costs. Table 5-7 and figure 5-1 were used as decision making tools by progressively proceeding through available levels of output and asking if the next level was worth its additional monetary cost. This step examined the additional habitat value, as measured by increased AAHU output, for an increase in monetary costs.

Federal planning for water resources development is conducted in accordance with the requirements of the *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* (P&G). The P&G provides a decision rule for selecting a recommended plan where both outputs and costs are measured in dollars. This rule states, "The alternative plan with the greatest net economic benefit consistent with protecting the Nation's environment (National Economic Development Plan, NED Plan) is to be selected… (Paragraph 1.10.2)". There is no similar rule for plan selection where the outputs are not measured in dollars, as is the case in planning for restoration and mitigation. In the absence of such a decision-making rule, cost-effectiveness and incremental-cost analyses helped to better understand the consequences of the preferred plan in relation to other choices. Other factors considered in the selection were site topography, management objectives of the resource agencies, critical needs of the region, and ecosystem needs of the UMRS.

ii. Recommended Plan. For reforestation, the combination of planting container-grown rootstock and direct seeding (Alternative A3) was selected for its versatility. This alternative has higher costs than total precision direct seeding, but provides a better chance for survival over the full range of conditions that may be encountered during the critical first three years after planting. Furthermore, the combination of planting container-grown rootstock and precision direct seeding would provide useful data for comparing the two methods. This evaluation would help determine the optimum methods for future HREP projects.

For wetland enhancement (Alternative B3) improving water supply and control on both sides of the Fox River, including Logsdon Slough, Coin Pond, Slim Slough, and Old Lake, is preferred because of its capability to expand the area of wetland habitat and to extend the inundation period to the fall migration. This plan is a best buy although the additional AAHUs provided by the Coin Pond/Slim Slough/Old Lake area have higher average cost per AAHU than Logsdon Slough. The Logsdon Slough wetland alone is too small to achieve the wetland benefits desired for this refuge.

To restore native grassland (Alternative C1) planting Logsdon Tract with grasses and forbs is preferred over the No Action Alternative (C0). Restoring native grasslands improves plant diversity, provides habitat for a wide variety of wildlife, and increases the extent of this vastly diminished habitat.

E. Summary. The results of the incremental analyses in this section were considered with other factors, including physical features on the site, management objectives of the resource agencies, critical needs of the region, and ecosystem needs of the UMRS.

In cooperation with the USFWS, the MDOC, and the ILDNR, the Corps has planned and designed a cost-effective project that meets the HREP's goals and objectives, increases habitat diversity and quality, and best meets the overall management objectives for the site. The preferred alternative has an overall output of 178 AAHUs. These figures are summarized in table 5-8.

Table 5-8. Recommended Plan: Environmental Output and Cost of Each Feature

Feature Alternative	Symbol	Output (AAHUs)	Cost ($1000s)	Annualized Cost ($1000s)
Plant hardwood trees using container-grown stock and precision direct seeding	A3	72	836.4	46.5
Enhance Logsdon Slough, Coin Pond, Slim Slough and Old Lake	B3	51	1,211.9	67.4
Restore native grassland	C1	55	192.8	10.7
TOTAL		**178**	**2,241.1**	**124.7**

6. RECOMMENDED PLAN: DESCRIPTION WITH DESIGN, CONSTRUCTION, OPERATION AND MAINTENANCE CONSIDERATIONS

The recommended plan for habitat rehabilitation and enhancement on the FID includes reforestation through planting hardwood container-grown stock and precision direct seeding (Alternative A3). The forests would replace the open farm fields that are currently or were recently in production. The recommended plan also includes enhancing wetlands in Logsdon Slough, Coin Pond, Slim Slough, and Old Lake (Alternative B3). And the recommended plan includes restoring native grassland on Logsdon Tract by replanting an abandoned farm field in native grasses and forbs (Alternative C1). The details of this plan are described below and mapped on Plate 2.

A. Reduce Forest Fragmentation and Enhance Forest Species Diversity: Direct Seeding and Container-Grown Planting (A3). This feature consists of reforestation by the cultivation of high-forage-value, mast-producing trees. There are currently about 840 acres of open land on the refuge, clear of forests because of current or recent cultivation. Mast-producing trees would be planted over approximately 275 acres of higher ground on the north end of the Division, where exposure to flooding is infrequent and of short duration. The planted trees would serve as a seed source for natural re-vegetation, improve floodplain habitat for resident and migratory birds, and expand habitats for mast consuming species such as turkeys and squirrels. Proposed species include Swamp White Oak, Pin Oak, Bur Oak, Northern Pecan, Sycamore, Green Ash, Kentucky Coffeetree, Walnut, Shellbark Hickory, and Persimmon. All tree plantings would be on areas above elevation 488.0, where there is less than a 31 percent chance of flooding lasting more than four weeks in any year (Appendix J, table J-2).

Approximately 60 of the 275 mast-producing acres would be direct seeded with equal numbers of the target mast tree species. Nuts and acorns would be drilled 4 to 6 inches on center, in rows 9 to 10 feet apart, yielding 10 thousand seedlings per acre. To provide ground cover and limit competition from other species, the site would be tilled and seeded with grasses prior to tree-planting and a nursery crop of oats or wheat would be sewn. Competition would be further controlled by herbicides and mowing for approximately three years, until the trees develop a canopy. Some thinning would be required, once the trees have become established, to achieve the desired density.

The remaining 215 acres would be planted with container-grown nursery stock. Container grown stock are specially raised by the nurseries using methods to induce vigorous growth and increase root mass. The trees exhibit vigorous growth upon transplantation, capable of withstanding some flooding and competition from other vegetation. The saplings are grown in 3- to 5-gallon containers, stand about 5 feet and have at least 5/8-inch caliper. They should be grown from acorns or seeds obtained from bottomland sources within 100 miles of the project site. The trees would be planted on a 30-foot by 30-foot spacing, staggered in adjacent rows and intermixed to avoid blocks of the same species. This spacing yields 50 trees per acre. Trees would be planted in the spring between March 1 and May 15, or in the fall between October 1 and December 10.

Table 6-1 shows planting rates for container-grown rootstock by species per acre.

Table 6-1. Container-Grown Stock Mast Tree Planting Rates

Common Name	Scientific Name	Planting Rates Per Acre	Number of Mast Trees
Swamp White Oak	*Quercus bicolor*	8	1,720
Bur Oak	*Quercus macrocarpa*	8	1,720
Pin Oak	*Quercus palustris*	8	1,720
Northern Pecan	*Carya illinoensis*	8	1,720
Shellbark Hickory	*Carya laciniosa*	6	1,290
Kentucky Coffeetree	*Gymnocladus dioicus*	6	1,290
Persimmon	*Diospyros virginiana*	6	1,290
Total		**50**	**10,750**

The container-grown tree area would be prepared similarly to the direct seeded area. Prior to planting, the site would be tilled and seeded with red top grass or Kentucky bluegrass and a nursery crop of oats or wheat. The trees would be planted in the middle of a 4-foot by 4-foot weed barrier mat to reduce competition. A pre-emergent herbicide would be applied in a 12-foot diameter circle around each tree immediately after planting. Follow-up spraying would be performed during the following growing season. The contractor would be required to replace trees that do not survive at least one year, unless the loss is due to flooding.

B. Enhance and Expand Existing Wetlands (B3)

Enhance Logsdon Slough. The water supply to Logsdon Slough would be enhanced by construction of a new 18-inch diameter well. The 100-foot-deep well would be located adjacent to but not in the slough and would be accessible by truck or car via an existing farm road. The well would have a permanently mounted pump equipped with a right angle gear drive and a coupling for connection to a portable diesel engine. The pump is estimated to require approximately 30 horsepower but the final configuration, based upon ultimate yield and groundwater levels, would be determined during final design and implementation. The 30-horsepower portable diesel unit and a fuel wagon capable of at least 7 days continuous operation between fills would be provided. The diesel power unit and fuel wagon would be stored off site, protected from flooding, during the non-pumping season. The pump would be capable of producing a peak discharge of 2,000 gpm. The pumped water would be conveyed to the slough through a 200-foot long channel. The upper 40 feet of the channel would be lined with riprap to increase aeration and prevent scour.

The well would be used to fill Logsdon Slough to a planned water surface elevation of 484.5, whereby approximately 25 acres would be inundated. A stoplog structure at the downstream end of the slough would be used to adjust water levels and control the discharge to the Fox River. The stoplogs could be completely removed to drain the slough. A system should be installed for locking the stoplogs in place when they are in use, and securely storing them when they are not.

Enhance Coin Pond – Slim Slough – Old Lake Complex. Enhancing this wetland, on the east side of the Fox River, would provide the capability of controlling water levels within the banks of the three water bodies - Coin Pond, Slim Slough, and Old Lake. Fifty-three acres are inundated within these water bodies when they are filled to the top-of-bank elevation of 484. An additional 130 acres of

interconnected lowlands, natural channels and field swales also become inundated when these water bodies are filled to this level. There is evidence, such as crop discoloration and crop loss from long-standing water, hydrophytic plants such as smartweed in uncultivated areas, and direct observation of standing water up to 10 days after storm events, that indicate water could be held within this complex as high as elevation 485. At this elevation an additional 170 acres, 353 acres altogether, would be inundated.

The recommended plan for this area provides the capability to contain water to elevation 485 and higher. The entire 353 acres lying below elevation 485 is not expected to be inundated because of the sandy composition of high ground. The natural depressions on the Division are lined with cohesive, low permeability silts and clays but the subsurface soils are predominantly porous sands. Pockets of porous soil, areas of low embankments, and natural drainage swales could result in water losses from areas that are not currently wetland that are beyond the capability of the pumps to replace. The combination of pumping rates and water control features would provide the flexibility to raise water levels in those areas that can retain it, while avoiding areas of high seepage losses. Plate 12 illustrates the location of water control features for this complex.

The management plan calls for draining much of the wetland area after flood waters recede to encourage growth of forage plants. The water levels would be raised in the late summer and fall to enhance resting habitat for migrating waterfowl. The stoplog water control structures and conveyance channels would provide the capability to drain the complex by gravity.

Re-supplying the wetlands would require pumping during dry periods. For practical operation the pumping rates should be sufficient to fill these areas within about 15 days of constant, 24-hours per day, pumping. To achieve this time frame for filling the complex to elevation 484, the pumps must deliver an average discharge of 4,000 gpm. If the higher elevation of 485 is achievable, the pumping rate, not including seepage losses, should be 8,000 gpm for 15 days. Two pumps are recommended for achieving these goals, one using groundwater as the source, the other using the Mississippi River.

The combination of groundwater and surface water supply increases the management flexibility and reliability. It also enhances the capacity of the wetland to improve water quality. The capability of wetlands for removing nutrients, pesticides, and other pollutants from both groundwater and surface water sources would be an integral part of the project at no additional cost. The water sources include:

- A new well and pump, with similar characteristics to the aforementioned Logsdon Tract well, (18-inch casing, 100 feet deep, 30 HP diesel motor, capable of producing 2,000 gpm), installed to pump water through a new channel, into Coin Pond. The channel would be approximately 200 feet long and the upper 40 feet would be lined with riprap to dissipate the energy from the pump discharge, prevent erosion, and increase aeration.

- A surface water pump station, constructed on Grey Chute to supply water to the Coin Pond/Slim Slough/Old Lake complex through a force main installed beneath the railroad (plate 6). This pump station would consist of a belt-driven, angled line shaft pump with a jackshaft connection for a portable diesel engine. The pump would discharge through a 24" force main jacked beneath the railroad into a channel that would outlet into the north end of Slim Slough. The end of the discharge would be equipped with a flap gate to prevent back flow through the pump. The pump would have a capacity of approximately 10,000 gpm. A

100-horsepower portable diesel unit and a fuel wagon capable of at least 7 days continuous operation between fills would be provided. The diesel power units and fuel wagons would be stored off site during the non-pumping season to protect them from flooding. The pump station would be located at the top of the west bank of Grey Chute at the southern end of the East Winkelman Tract. A sheet pile wall would be constructed to increase bank stability. The ends of the wall would be armored with riprap to prevent bank cutting.

Stoplog water control structures would be used to manage water levels within the wetlands. The main structure would be located where the two natural drainage channels from the northeast (Coin Pond and Slim Slough) and southeast (Old Lake) merge before reaching the Fox River. This structure, depicted in Plates 7, 8, and 9, would be cast-in-place concrete, with a bridge deck to provide vehicular access between the north and south halves of the Division along the east bank of the Fox River. This structure would be stronger and more durable than the other stoplog structures on this project because it is designed to be adjusted more often and to carry vehicular traffic. This stoplog structure would be accessible by vehicle and would provide the capability to adjust water levels throughout the wetland complex, drain the system, or capture flood pulses from the Fox River. The deck of the structure would be constructed of heavy duty steel grating, capable of supporting HS-20 wheel loads.

The3 ½ "H x 6"W x 60"L stoplogs would be fabricated from aluminum tube stock and designed to fit in slots created from steel channels cast into the reinforced concrete structures. The stoplogs would be designed with rubber seals and be easily removable even when submerged. The reinforced concrete channel through the structure would facilitate the removal of sediment that may be deposited during periods of high water.

Additional galvanized metal stoplog structures would be located on the connecting channels to allow independent control of water within separate segments of the wetland. These structures (depicted on Plate 10), are fabricated from sections of corrugated metal pipe and fitted with steel channels to receive 2-inch dimensional lumber. The stoplogs are each approximately 60 inches long:

- An existing water control structure, located at the south end of Coin Pond, would be replaced with a new galvanized metal stoplog structure. This structure, located on a spur off the main distribution channel, would provide the capability of isolating Coin Pond and the new well from the rest of the complex. The existing spur channel would be cleaned and leveled to provide two-way flow capability.

- Two galvanized metal stoplog structures would be constructed on Slim Slough, one at each end. The structures would provide the capability for isolating Slim Slough and allow it to be filled or drained from either end.

- A fourth galvanized metal stoplog structure would be constructed on the channel at the north end of Old Lake This structure, in combination with the structure at the south end of Slim Slough, would provide the capability for isolating Old Lake and allow it to be filled or drained from either end.

The connecting channels within the wetland complex would be designed to flow both ways:

- To drain the complex into the Fox River, or
- To fill the wetlands by pumping or from the Fox River when it is in high stage. High stage in the Fox River could be the result of storms within the Fox River basin or backwater from the Mississippi River.

Channel improvements include clearing, excavating and regrading existing channels; few new channels would be required. A length of new channel would be required at the point of discharge from each of the new pump locations. These channels would be lined with riprap in their upper reaches to dissipate energy and increase aeration:

- The well pump north of Coin Pond would require a short channel to an existing swale that flows to Coin Pond. This channel would allow placement of the well outside the pond and swale for improved accessibility.
- Discharge from the Grey Chute pump force main would flow through a newly constructed channel from the railroad right-of-way to the upper end of Slim Slough.

The channel between Coin Pond and Slim Slough would be cleared and graded to improve conveyance. An existing stoplog structure would be removed from this reach, to be replaced by the stoplog structure at the upper end of Slim Slough described above. The channel between the south end of Slim Slough and Old Lake would be cleared and re-graded to improve conveyance. The channel connecting the north end of Old Lake to the main water control structure would also be cleared and graded. Vegetation that is cleared and grubbed during channel improvements would be piled on site. Excavated material would be used as required to construct berms and backfill structures. Excess material would be spread over adjacent fields and tilled to match existing terrain.

When completed, all channels would be approximately 5-feet deep with 8-foot wide bottoms and 3H:1V side slopes. They would be graded level at constant bed elevation of 480, and provide a complete loop connecting Coin Pond, Slim Slough, Old Lake, and the Fox River. The two pumping locations would be indirectly connected to this distribution channel. The looped channel would provide the means to distribute water throughout the wetlands and to selectively isolate and drain individual segments.

Culverts would be required at two locations to provide vehicular access across drainage channels. Both culverts would be 36” diameter corrugated metal pipe (CMP), 50 ft long. They would be laid level, at invert elevation 480.0, to match the channel thalweg:

- One culvert would be integral with the galvanized metal stoplog structure on the south end of Coin Pond. The road at this culvert provides access between the areas on the east and west sides of Coin Pond and Slim Slough.
- A second culvert would be integral with the galvanized metal stoplog structure at the south end of Slim Slough. The road at this culvert provides access from the south to the center of the wetland complex.

The channels would be protected from erosion with riprap in the high velocity areas such as the pump discharge sites. Twelve-inch D_{50} riprap would be applied in a 24-inch thick layer over a 6-inch layer of bedding stone. The bedding stone is a uniform-graded 1½ - inch crushed rock that acts as a filter to prevent fine soil from eroding between the riprap.

A 50-foot eroded section of the east bank of the Fox River, located about 500 feet north of the primary water control structure, would also be raised and protected with riprap. If not protected, this eroded stream bank could short-circuit the main water control structure.

There is an existing county road that provides access to the part of the Division lying east of the Fox River. This road comes out of Alexandria on the north, then follows the east bank of the Fox River to a point about midway between Alexandria and the mouth of the Fox River, where there once was a bridge crossing the river. The bridge has long since been removed and county maintenance of the roadway within the Division has ceased. In many locations the road is no longer discernible or passable. Clark County has tentatively agreed to vacate this right-of-way. The roads would not be improved to increase public visitation. A new 250-foot-long road would be constructed to access the pump on Grey Chute. The new well pump near Coin Pond would require 1,000 feet of new road. Figure 6-1 shows project access roads and rights-of-way.

The 12-foot wide roads would be constructed by cutting a drainage ditch on each side of the roadway, and using the excavated material to raise and level the road sub-grade. Then a 6-inch thick base course of crushed-stone would be applied, leveled and compacted. Finally, a 3-inch thick surface layer of smaller gradation crushed stone would be applied and compacted over the base course.

Most of the roads on the Division are un-surfaced dirt farm roads. These roads would not be improved at this time; so traffic should be limited during wet conditions to avoid creating large impasses. Two existing railroad crossings would be maintained, but not improved. These crossings provide access from a dirt farm road on the east side of the BNSF Railroad tracks to dirt roads in the Division between the Fox River and the railroad.

Description of the Excavated Material. The channel improvements proposed for Logsdon Slough, Coin Pond, Slim Slough, and the Old Lake Complex will result in approximately 16,000 cubic yards of excess excavated material. This excess material will be spread over open ground in areas where mast trees are to be planted. The material will be spread level, in lifts up to 6-inches thick, and then incorporated with the layer below by disking. No material will be placed in open water.

C. Restore Native Grassland (C1). Approximately 98 acres of the Logsdon Tract, lying west of the Fox River levee system, would be planted in native grasses and forbs. This tract is the only flood-protected area within the FID. The levee is owned and maintained by the Mississippi-Fox Drainage and Levee District No. 2. The grassland would be created by seeding land that was formerly planted in row crops and small grains.

The proposed grassland is adjacent to a native grassland restoration that was recently planted within the Rose Pond Conservation Area, managed by the MDOC. The Logsdon Tract restoration, in combination with additional plantings planned by the MDOC would result in a contiguous grassland area of up to 400 acres. Although miniscule in proportion to the native floodplain grasslands that existed before the mid 19th century, this would become one of the largest native grasslands in this part of the state. It would provide habitat for resident and migratory wildlife.

Restoring the floodplain grassland would require tilling and seeding the area with native grasses and forbs. Some clearing would be required near the slough, where recent growth cottonwoods and willows have become established on former agricultural land. Weed control would be required until

the preferred vegetation becomes well established. This can be accomplished through a combination of herbicides, mowing and seasonal burning.

Native grass and forbs species would be selected based on their historical range, their affinity for open, sandy meadows, and their ability to withstand some flooding. The restored native grassland would be seasonally inundated by seepage through the sand levee during high water events on the Mississippi and/or Fox Rivers.

Candidate species include grasses such as:

Big and Little Bluestem	Indian Grass
Switchgrass	Prairie Cord-grass

and forbs such as:

Black-Eyed Susan	Butterfly Milkweed	Compass Plant
Evening Primrose	Lanceleaf Coreopsis	Large-Flowered Beardtongue
Leadplant	Pale Purple Coneflower	Rattlebox
Showy Goldenrod	Stiff Goldenrod	Upland White Aster
White Prairie Clover	White Wild Indigo	Yellow Coneflower

The seed may be a commercial mesic to wet mix from a nursery in Iowa, Illinois or Missouri with a slightly different composition than shown here.

D. Project Feature Summary. Table 6-2 summarizes project data.

Table 6-2. FID Project Feature Summary Table

Item	Measurement	Unit of Measure
REDUCE FOREST FRAGMENTATION AND ENHANCE FOREST SPECIES DIVERSITY		
Hardwood Mast Forest		
Root Production Method Stock	215	Acres
50 trees per Acre	10,750	Trees
Cover Crop, Seeding & Weeding	215	Acres
Mulch	215	Acres
Plant Trees By Seeding	60	Acres
10,000 seeds per acre	600,000	Seeds
ENHANCE AND EXPAND EXISTING WETLANDS		
Enhance Logsdon Slough	25	Acres
Water Supply		
Drilled Well	100	Feet Deep
Well Casing and Screen	18	Inches Diameter
Submersible Well Pump	2,000	Gallon per Minute Capacity
Trailer-mounted Diesel Power Unit	30	Horsepower
Fuel Wagon	1,000	Gallon Capacity
Channel Improvements	200	Linear Feet
Channel Excavation	148	Cubic Yards
Cross Section Area	80	Square Feet
Clearing and Grubbing	7,000	Square Feet
Seeding	7,000	Square Feet
Riprap Channel Lining	1,500	Square Feet
2 Feet Thick	60	Cubic Yards
6" of Riprap bedding	15	Cubic Yards
Rehabilitate Existing Stoplog Structure		
Excavation	200	Cubic Yards
Clearing and Grubbing	6,100	Square Feet
Seeding	6,100	Square Feet
Backfill and compact	90	Cubic Yards
Place and grade spoils	110	Cubic Yards
Enhance Coin Pond, Slim Slough & Old Lake	130	Acres
Coin Pond Water Supply		
Drilled Well	100	Feet Deep
Well Casing and Screen	18	Inches Diameter
Submersible Well Pump	2,000	Gallons per Minute Capacity

Table 6-2. FID Project Feature Summary Table – Continued

Item	Measurement	Unit of Measure
Channel Improvements	2,000	Linear Feet
Channel Excavation	8,300	Cubic Yards
Cross Section Area	203	Square Feet
Clearing and Grubbing	60,984	Square Feet
Seeding	60,984	Square Feet
Riprap Channel Lining	1,500	Square Feet
2 Feet Thick	60	Cubic Yards
6" of Riprap bedding	15	Cubic Yards
Road to Site	1,000	Linear Feet
Crushed Stone Aggregate	333	Cubic Yards
Pump Water From Grey Chute		
Pump with Power Unit	10,000	Gallons per Minute Capacity
Cantilevered Sheet Pile Wall	230	Linear Feet
Riprap Bank Protection	340	Cubic Yards
24" Diameter Force Main	320	Linear Feet
Bore Under Railroad	75	Linear Feet
Fuel Wagon	1	1,000 gallon capacity
Flap Gate	1	Each
Channel Improvements	450	Linear Feet
Channel Excavation	2,704	Cubic Yards
Cross Section Area	115	Square Feet
Clearing and Grubbing	74,052	Square Feet
Seeding	74,052	Square Feet
Riprap Channel Lining	1,500	Square Feet
2 Feet Thick	60	Cubic Yards
6" of Riprap bedding	15	Cubic Yards
Road to Site	250	Linear Feet
Crushed Stone Aggregate	84	Cubic Yards
Water Control Structures and Channels		
Fox River Structure		
Excavation and Backfill for Structures	300	Cubic Yards
CIP Reinforced Concrete	45	Cubic Yards
Grating for road deck	70	SF
Aluminum Stoplogs	55	SF
Guard Rail	100	Linear Feet
Embankment	1,000	Cubic Yards
Riprap Bank Protection	239	Cubic Yards

Table 6-2. FID Project Feature Summary Table – Continued

Item	Measurement	Unit of Measure
Old Lake Structure		
Galvanized Stoplog Structure	1	Each
Corrugated Metal Pipe	50	Linear Feet
Excavation and Backfill for Structures	90	Cubic Yards
Channel Improvements	700	Linear Feet
Channel Excavation	3,230	Cubic Yards
Cross Section Area	80	Square Feet
Clear and Grub	130,680	Square Feet
Seeding	130,680	Square Feet
Coin Pond Structure		
Remove Existing Structure	1	Each
Galvanized Stoplog Structure	1	Each
Corrugated Metal Pipe	50	Linear Feet
Excavation and Backfill for Structures	90	Cubic Yards
Channel Improvements	2,200	Linear Feet
Channel Excavation	4,563	Cubic Yards
Cross Section Area	80	Square Feet
Clear and Grub	87,120	Square Feet
Seeding	6,111	Square Feet
Upper Slim Slough Structure		
Remove Existing Structure	1	Each
Galvanized Stoplog Structure	1	Each
Corrugated Metal Pipe	25	Linear Feet
Excavation and Backfill for Structures	90	Cubic Yards
Channel Improvements	400	Linear Feet
Channel Excavation	370	Cubic Yards
Cross Section Area	115	Square Feet
Clear and Grub	1,612	Square Feet
Seeding	1,200	Square Feet
Lower Slim Slough Structure		
Galvanized Stoplog Structure	1	Each
Corrugated Metal Pipe	50	Linear Feet
Excavation and Backfill for Structures	90	Cubic Yards
Channel Improvements	1,500	Linear Feet
Channel Excavation	3,011	Cubic Yards
Cross Section Area	115	Square Feet
Clear and Grub	101,930	Square Feet
Seeding	5,200	Square Feet
RESTORE NATIVE GRASSLAND		
Plant Native Grasses and Forbs	98	Acres

Figure 6-1. Access Roads and ROW

E. Construction Considerations

i. Storm Water Pollution/Erosion Control. The potential for storm water pollution during construction can be contained within the confines of the FID. Preparation of the fields for planting trees and native grassland would expose some soil to erosion, but these areas would not be as vulnerable as under the current farming practices. Minimizing tilling and planting nursery cover crops would help reduce erosion. Pipes, stoplog structures and channel excavation would require sediment control measures such as silt fence and erosion control mats to keep soil in place until the vegetation can be re-established. The long-term storm water runoff characteristics of the site would be improved by the cessation of tilling.

ii. Permits. A public notice, as required by Section 404 of the Clean Water Act, was distributed on December 21, 2005 (CEMVR-OD-P-2005-1309). A Section 401 Water Quality Certificate from the Missouri Department of Natural Resources (MDNR) and a Section 404(b)(1) Evaluation are included in Appendix A *Correspondence* and Appendix B *Clean Water Act Section 404(b)(1)*, respectively,. Since all land disturbances are addressed in the 404(b)(1) Evaluation, a National Pollutant Discharge Elimination System (NPDES or Section 402) permit for storm water discharges would not be required.

iii. Historic Properties. Avoidance of all impacts to archaeological site 23CK345—which is considered potentially eligible for inclusion on the National Register of Historic Places—would be accomplished by restricting the proposed mast tree plantings both within the site area and within a 100-foot wide buffer zone all around the site boundary. This site's location is not specified in this public document, but would be detailed in the construction contract specifications with clear directions for the restriction of mast tree plantings in this area.

iv. Construction Sequence. The probable construction sequence is summarized in table 6-3; however, no sequence would be required contractually. Planting and construction can be completed in one year. Weed control for planting may continue for three years.

F. Operational Considerations. Operation of water supply and water control equipment is primarily intended to mimic the historic hydrologic regime in the UMR. This regime is normally characterized by a high spring flood pulse, followed by a period of low flow and low water levels during the summer months, and then a second, smaller flood pulse in the fall. To that effect, the wetlands may be partially drained after spring floods to allow plant growth to provide food for waterfowl. These areas would then be re-flooded in the fall to provide protected resting and feeding areas. Fluctuating water levels provide a wider variety and more dependable supply of food. Planned features would allow wetlands to be drained to elevation 480 or filled to elevation 485. Normal high water operations would be held at 484 (484.5 in Logsdon Slough), however, to prevent excessive seepage. Widely varying flow conditions and events as well as fall rain conditions would result in variations in operations.

Many of the wetlands in the FID are capable of sustaining perennial aquatic habitat. This habitat has resulted in an abundance of fishes, frogs and turtles, as well as species of birds and mammals that feed on them. The increased water control made possible through this project would ensure that those populations can survive dry spells.

G. Maintenance Considerations. The proposed features have been designed to require low annual maintenance. Routine maintenance would include periodic inspection and lubrication of the pumps and water control structures. The pumps should be designed to withstand flooding and the engines should be removed before a flood occurs. When a flood has inundated the pumps, they must be examined and serviced according to the manufacturer's routine. Vandalism is always a concern under these isolated conditions. The pumps should be "exercised" periodically to ensure operational readiness. The Fox River shoreline should be routinely inspected for evidence of erosion.

Weed control would be required around the mast trees for at least the first three years following planting. Weed control may involve mowing and/or herbicide application.

The excavated channels would require periodic debris clean out and minor excavation to maintain the design elevation. The project access roads would need additional gravel and occasional grading dependent on use and/or flood events.

The estimated annual maintenance costs are presented in table 8-2. These quantities and costs may change during final design.

Table 6-3. Probable Construction Sequence

Sequence	Construction Work Item	Instructions	Purpose
1	Abandon county road or obtain easement	Address real estate concerns early	Obtain permanent access and management control.
2	Excavate channels	Excavate during low river/groundwater levels	Excavation would be in relatively dry soil if water table is low.
3	Spread and compact excavated material	Allow material to dry before spreading	Drying would facilitate spreading and compacting.
4	Remove old / construct new water control structures	Construct during low river/groundwater levels	Construction during dry period would minimize dewatering. Work has to be performed "in the dry".
5	Raise and protect eroded area	Fill with dry excavated material and armor with riprap	If not protected, this eroded stream bank could short-circuit the main water control structure.
6	Place and compact berms	Control moisture content	Compaction requirements are easier to achieve with low moisture content
7	Line channels	Line channels with riprap while dry period persists	Better control is achieved when riprap is not placed under water.
8	Install culverts	Install during channel work	Improves efficiency and reduces risk of flood failure during construction.
9	Construct roadways	Construct prior to well and pump work	Prevent environmental damage during pump station construction.
10	Drill wells; install and test pumps	Perform work after channels, culverts, and water control structures have been completed	Pump tests can test water supply and circulation to wetland areas.
11	Construct surface water pump station	Perform work after channels, culverts, and water control structures have been completed	A pump station will ensure that desired water levels can be reached and maintained during waterfowl migration.
12	Install force main	Acquire easement for railroad crossing; acquire construction permit from RR	Construction cannot proceed on the jacked railroad crossing until a permit has been obtained.
13	Direct seed mast trees	Mow seeding area in mid August, allow 4-8" of re-growth, apply herbicides, till soil, and plant seeds; require follow-up maintenance	This assumes fall planting and properly prepares seedbed. Maintenance eliminates competition form other vegetation.
14	Plant mast tree nursery stock	Use 5-gallon container-grown nursery stock and require follow-up maintenance; plant between Mar 1 and May 15 or after Oct 1 and before Dec 10	Vigorous root stock improves survivability and controls competition. Spring and fall plantings are both acceptable. Fall planting is preferred.
15	Restore native floodplain grassland	Till planting area, broadcast seed (spring or fall), harrow, and roll. Mow through following year to prevent weeds from going to seed.	Provides good seed bed and minimizes competition.

7. SCHEDULE FOR DESIGN AND CONSTRUCTION

Table 7-1 presents the schedule of project completion steps.

Table 7-1. Project Implementation Schedule

Requirement	Scheduled Date
Distribute Draft DPR	October 2003
Complete Internal Technical Review of Draft DPR	January 2004
Submit DPR for Public and Agency Review	January 2005
Submit Final DPR to Mississippi Valley Division	September 2006
Initiate Plans and Specifications	March 2008
Submit Plans and Specifications for Internal Technical Review	July 2008
Complete Plans And Specifications	September 2008
Advertise Contract	December 2008
Award Contract	March 2009
Complete Construction	December 2011
Prepare Operation And Maintenance Manual	February 2012

8. COST ESTIMATES

Project elements and contingency costs are presented in Appendix K. This appendix includes an analysis of the fully funded estimate (FFE) and the current work estimate (CWE). Table 8-1 compares these costs.

Table 8-1. FID Habitat Rehabilitation and Enhancement Fully Funded Estimate vs. Current Work Estimate January 2005 Price Level

Account Code	Item	FFE	CWE
01	Lands and Damages	$0	$0
02	Relocations	$0	$0
06	Fish and Wildlife Facilities	$2,238,260	$2,097,250
30	Planning, Engineering and Design	$744,544	$698,000
31	Construction Management	$293,341	$275,000
	Total	**$3,276,145**	**$3,070,250**

The FFE was calculated based on the proposed construction schedule, expected escalation costs, and a contingency factor, and represents the money expected to be spent at the end of project construction. The CWE, with a 20 to 30 percent contingency factor, was used for annualized costs in the incremental analysis and is shown in a detailed estimate of project construction costs as presented in table 8-2. A detailed estimate of operation, maintenance, and rehabilitation costs is presented in table 8-3. Table 8-4 presents the estimated annual monitoring costs. These tables use the January 2005 price levels.

Table 8-2. FID Habitat Rehabilitation and Enhancement Construction Cost Summary, January 2005 Price Level

Acct Code	Item	Quantity	Unit	Unit Price	Amount [1]	Contingency
01	**LANDS AND DAMAGES**					
02	**RELOCATION**					
06	**FISH AND WILDLIFE FACILITIES**					
06.01	**PLANT HARDWOOD MAST TREES**					
	Plant Container-Grown Stock					
	Cover Crop, Seeding & Weeding	215	AC	$ 1,021	$ 219,515	$ 43,884
	Plant Container-Grown Trees	215	AC	$ 1,748	$ 375,820	$ 75,169
	TOTAL Plant Container-Grown Stock				**$ 595,335**	**$ 119,053**
	Plant Trees By Seeding					
	Plant Trees By Seeding	60	AC	$ 895	$ 53,700	$ 16,104
	TOTAL Plant Hardwood Mast Trees				**$649,035**	**$135,157**
06.02	**ENHANCE WETLANDS**					
	Enhance Logsdon Slough					
	Drill Well	100	LF	$ 718	$ 71,800	$ 14,366
	Pump	1	EA	$ 17,161	$ 17,161	$ 4,290
	Channel Excavation	200	LF	$ 14	$ 2,800	$ 555
	Channel Lining	52	TN	$ 92	$ 4,784	$ 1,199
	Portable Diesel Power Unit	1	EA	$ 17,760	$ 17,760	$ 3,552
	Fuel Wagon	1	EA	$ 5,911	$ 5,911	$ 1,182
	Repair Stoplog Structure	1	EA	$ 2,210	$ 2,210	$ 442
	TOTAL Enhance Logsdon Slough				**$122,426**	**$ 25,586**
	Enhance Coin Pond, Slim Slough & Old Lake					
	Coin Pond Well					
	Drill Well	100	LF	$ 718	$ 71,800	$ 14,366
	Well Pump	1	EA	$ 17,161	$ 17,161	$ 3,432
	Channel Excavation	2000	LF	$ 30	$ 60,000	$ 12,094
	Channel Lining	130	TN	$ 37	$ 4,810	$ 1,199
	Road Improvements	1000	LF	$ 12	$ 12,000	$ 3,593
	TOTAL Coin Pond Well				**$ 165,771**	**$ 34,684**

Acct Code	Item	Quantity	Unit	Unit Price	Amount [1]	Contingency
	Pump Water From Grey Chute					
	Angled Drive Pump w/ Power Unit	1	EA	$ 107,870	$ 107,870	$ 21,574
	Cantilevered Sheet Pile Wall	2250	SF	$ 36	$ 81,000	$ 24,411
	Dumped Rip Rap	600	TN	$ 41	$ 24,600	$ 6,150
	24" Dia Force Main	320	LF	$ 47	$ 15,040	$ 3,738
	Flap Gate	1	EA	$ 4,040	$ 4,040	$ 808
	Channel Excavation	1600	LF	$ 16	$ 25,600	$ 4,969
	Jack Force Main Under RR	50	LF	$ 1,108	$ 55,400	$ 13,844
	Road Improvements	250	LF	$ 12	$ 3,000	$ 906
	Fuel Wagon	1	EA	$ 6,652	$ 6,652	$ 1,330
	Channel Lining	130	TN	$ 37	$ 4,810	$ 1,199
	TOTAL Pump Water From Grey Chute				**$ 328,012**	**$ 78,929**
	Fox River Water Control					
	Excavation and Backfill for Structures	300	CY	$ 62	$ 18,600	$ 4,644
	Channel Clearing and Excavation	1000	CY	$ 3	$ 3,000	$ 710
	Structural Concrete	45	CY	$ 730	$ 32,850	$ 8,210
	Structural Steel and Misc. Metals	1	LS	$ 10,606	$ 10,606	$ 2,651
	Riprap Erosion Protection	78	CY	$ 320	$ 24,960	$ 6,248
	TOTAL Fox River Water Control				**$90,016**	**$22,463**
	Old Lake Water Control					
	Excavation and Backfill for Structures	90	CY	$ 15	$ 1,350	$ 342
	Channel Clearing and Excavation	3230	CY	$ 19	$ 61,370	$ 15,534
	Structural Steel and Misc. Metals	1	LS	$ 8,919	$ 8,919	$ 2,230
	TOTAL Old Lake Water Control				**$71,639**	**$18,106**
	Coin Pond Water Control					
	Excavation and Backfill for Structures	90	CY	$ 15	$ 1,350	$ 342
	Channel Clearing and Excavation	4563	CY	$ 12	$ 54,756	$ 14,052
	Structural Steel and Misc. Metals	1	LS	$ 8,919	$ 8,919	$ 2,230
	Stoplog Structure Removal	1	LS	$ 392	$ 392	$ 98
	TOTAL Coin Pond Water Control				**$65,417**	**$16,722**
	Upper Slim Slough Water Control					

Acct Code	Item	Quantity	Unit	Unit Price	Amount [1]	Contingency
	Excavation and Backfill for Structures	90	CY	$ 15	$ 1,350	$ 342
	Channel Clearing and Excavation	370	CY	$ 19	$ 7,030	$ 1,747
	Structural Steel and Misc. Metals	1	LS	$ 6,593	$ 6,593	$ 1,648
	Stoplog Structure Removal	1	LS	$ 392	$ 392	$ 98
	TOTAL Upper Slim Slough Water Control				**$15,365**	**$3,835**
	Lower Slim Slough Water Control					
	Excavation and Backfill for Structures	90	CY	$ 15	$ 1,350	$ 342
	Channel Clearing and Excavation	3011	CY	$ 16	$ 48,176	$ 12,265
	Structural Steel and Misc. Metals	1	LS	$ 8,919	$ 8,919	$ 2,230
	TOTAL Lower Slim Slough Water Control				**$58,445**	**$14,837**
	TOTAL Enhance Coin Pond, Slim Slough and Old Lake				**$794,665**	**$189,576**
	TOTAL Enhance Wetlands				**$ 917,091**	**$ 215,162**
06.03	**GRASSLAND RESTORATION**					
	Logsdon Tract Restoration	98	AC	$ 1,476	$ 144,648	$ 36,157
	TOTAL Grassland Restoration				**$144,648**	**$ 36,157**
	SUBTOTAL Fish and Wildlife Facilities Cost				**$1,710,774**	
	Subtotal Contingencies					**$ 386,476**
	COST TOTAL Fish and Wildlife Facilities				**$ 2,097,250**	
30	**PLANNING, ENGINEERING AND DESIGN**	1	LS	$ 698,000	**$ 698,000**	
	Definite Project Report				$ 538,000	
	Plans and Specifications				$ 120,000	
	Engineering During Construction				$ 40,000	
31	**CONSTRUCTION MANAGEMENT**	1	LS	$ 275,000	**$ 275,000**	
	Contract Administration				$ 60,000	
	Shop Drawing Review				$ 15,000	
	Inspection and Quality Assurance				$ 200,000	
	TOTAL PROJECT COST				**$ 3,070,250**	

[1] Numbers may differ slightly from MCACES report due to rounding.

Table 8-3. Estimated Annual Operation and Maintenance Costs January 2005 Price Level

Item	Quantity	Unit	Unit Price ($)	Total Cost ($)
Operation				
Pump Operation	1,400	Hr	2.50	3.500
Maintenance				
Tree Planting (first 3 years)	275	Acre	20	5,500
Pumping Equipment	60	Hr	25	1,500
Roadway Surface	1,250	LF	5	6,250
Water Control Structure	24	Hr	25	600
Galvanized Metal Stoplog Structures	60	Hr	25	1,500
Native Grass and Forb Planting	98	Acre	10	980
Channel clean out/minor excavation	80	Hr	90	7,200
Rehabilitation[1]				
Subtotal				**27,030**
Contingencies (20%)				5,406
TOTAL				**32.436**

[1] Rehabilitation cannot be accurately measured. Rehabilitation is the reconstructive work that significantly exceeds the annual operation and maintenance requirements identified above and that is needed as a result of major storms or flood events.

Table 8-4. Estimated Post-Construction Annual Monitoring Costs (January 2005 Price Level)

Item	Annual Cost
Engineering Data	$4,000
Natural Resources Data	$2,000
Subtotal	**$6,000**
Contingencies (20%)	$1,200
Data Subtotal	**$7,200**
Planning, Engineering, Design[1]	$1,500
Total	**$8,700**

[1] Includes annual cost of evaluation report

9. ENVIRONMENTAL EFFECTS

A. Summary of Effects. The proposed project would result in positive long-term effects to habitats located in the FID. The project would result in some trade-offs in wildlife habitat because of conversion of cover types, but the resulting changes would provide habitat to a greater diversity of species. No Federally protected species would be negatively affected. The project would result in short-term decreases in water quality due to localized increases in turbidity resulting from construction activities. No significant social or economic impacts would result. No impacts to historic properties are anticipated.

B. Economic and Social Impacts

i. Community and Regional Growth. No impacts to the growth of the community or region would be realized as a result of the proposed project.

ii. Community Cohesion. The proposed environmental enhancement project would not adversely impact community cohesion. No public opposition has been expressed, nor is any expected.

iii. Displacement of People. No residential relocations would be required as a result of the project.

iv. Property Values and Tax Revenues. The project would have no direct impact on property values or related tax revenues. All project lands are in Federal ownership.

v. Public Facilities and Services. Puddle ducks and other waterfowl would benefit from the proposed wetland enhancement. Mast-consuming species would benefit from the improved forest diversity. The long-term effects of habitat enhancement would increase wildlife populations and diversity, and thus enhance the opportunities for hunting and sightseeing.

vi. Life, Health, and Safety. The proposed project poses no threats to the life, health, or safety of the public. An HTRW assessment was conducted and no obvious indications of potential contamination sources were reported.

vii. Business and Industrial Growth. No long-term impacts to business or industrial activity would result from the proposed project. No business relocations would be required.

viii. Employment and Labor Force. There could be a slight increase in short-term employment opportunities resulting from project construction. No long-term impacts would occur.

ix. Farm Displacement. Currently, the USFWS leases all agricultural land (621 acres) within the FID to a local farmer for planting crops. The fields produce a relatively low yield because of flooding, and one-third of the crops are left behind for wildlife. Current farming would be phased out over the implementation of the project tree planting. No privately owned farms would be displaced as a result of the project.

x. Aesthetic Resources. The proposed environmental enhancement project would not diminish the aesthetic resources of the area.

xi. Noise Levels. Project construction would generate a temporary increase in noise levels. No long-term impacts would result.

C. Natural Resources Impacts. Impacts of the project on natural resources were evaluated using the Wildlife Habitat Appraisal Guide (WHAG) by Urich *et. al*. (1984). This habitat evaluation method was used during the planning process to evaluate various proposed project alternatives in terms of benefits to wildlife. The process attempts to optimize benefits relative to project costs to aid in the selection of project features. Benefits are expressed as "Habitat Units" (HUs). Results of this evaluation are summarized in table 5-1. A detailed analysis is included in Appendix D. Experience and established management practices were also used to assess impacts.

i. Floodplain Habitat. Currently, the FID includes about 925 acres of floodplain forest dominated by silver maple and cottonwood; 111 acres of wetlands, sloughs and backwater; and 621 acres of cultivated land. An additional 376 acres are old field, with recently seeded trees and areas in the early stages of natural forest regeneration. There is a very limited number of mast-producing trees, primarily pin oak. These areas exhibit relatively low vegetative diversity and are characterized by low quality habitat and a limited number of wildlife species. The proposed project would replace 275 acres of open area with mast-producing trees, and 98 acres of old field with native grasses and forbs. The remaining open areas would be allowed to regenerate naturally to wet floodplain forest. This plan would restore the historic native plant community and a part of the historic mosaic of habitats that characterized the UMRS ecosystem prior to the large-scale hydrologic and land use alterations of the past century. The proposed forest and grassland restoration would increase habitat diversity and improve habitat quality for migratory birds and resident wildlife.

ii. Wetland Habitat. Currently, wetland habitat on the FID relies on flooding and rains to maintain water levels. Opportunities to control and manipulate water levels are limited and most of the shallow wetland areas dry up following spring flooding. The proposed wetland enhancement features would provide a perennial water source and water level control for some of these areas. This would give management personnel the flexibility to fill or drain wetlands for the benefit of waterfowl and other wildlife. Quality wetland habitat could be provided on a consistent basis.

There would be minor short-term negative effects on the aquatic habitat in the project area due to construction activities. These effects may include increased sedimentation and turbidity in the surface water. The long-term impacts of the project would be positive.

iii. Wildlife. Improved habitat would benefit wildlife populations and increase diversity. Habitat improvements that are part of this project, including enhanced wetlands, native grassland restoration and expanded forests, should directly affect the populations of native wildlife. Wildlife species expected to benefit include migratory and resident species such as fox squirrel, pileated woodpecker, wood thrush, Kentucky warbler, dickcissel, puddle ducks and other wetland birds.

iv. Fish. The proposed wetland enhancement features would have minimal impact on fish. No deepwater habitats would be created for sustaining year round fish populations. Opportunities for creating a sport fishery are hampered by frequent flooding which would regularly introduce rough fish from the Fox and Mississippi Rivers.

v. Threatened and Endangered Species. The following is a list of State- or Federally-endangered species potentially occurring in Clark County, Missouri:

COMMON NAME	SCIENTIFIC NAME	STATUS
Patterson's Dawnflower	*Stylisma pickeringii var. pattersonii*	E (S)
Fat Pocketbook Mussel	*Potamilus capax*	E (S & F)
Topeka Shiner	*Notropis topeka*	E (S & F)
Central Mudminnow	*Umbra limi*	E (S)
Western Fox Snake	*Elaphe vulpina vulpina*	E (S)
Illinois Mud Turtle	*Kinosternon flavescens spooneri*	E (S)
Blandings Turtle	*Emydoidea blandingii*	E (S)
Bald Eagle	*Haliaeetus leucocephalus*	E (S), T (F)
Indiana Bat	*Myotis sodalis*	E (S & F)

E – Endangered; S – State Listed; T – Threatened; F – Federal Listed

The state-listed Patterson's Dawnflower has been found on the sandy slopes of the levee on the west side of the Division; no construction is planned for the levees and no impact on this species is expected.

The state-listed Illinois Mud Turtle and the Western Fox Snake have been reported from the Rose Pond area but neither species has been sighted since the 1993 flood, and are not expected to be adversely impacted.

The state-listed Central Mudminnow has been documented from Nelson Lake but no work is planned at this location.

The state-listed Blandings Turtle is not known to occur on the Division and is not expected to be impacted.

The federally-listed endangered Topeka Shiner is known to occur in Clark County. However, Topeka shiner habitat is not found in the project area, therefore the project would not impact the Topeka shiner.

The federally-listed endangered fat pocketbook mussel is a large river species and historically has been known to occur in the main stem of the Mississippi River near the FID. No work is planned in the main stem of the river, and no impact to the species would occur.

The federally-listed threatened bald eagle occurs on the FID as a winter resident, and a bald eagle nest exists in an area adjacent to the Division. The construction of the project would not occur during the nesting season and would be outside of the proximity of the nest, therefore the nest would not be disturbed by this project. A few trees must be removed to construct the surface water pump station, but this activity would be managed to avoid disturbance to bald eagles and damage to their habitat. No trees would be removed when eagles are present. Therefore, the project is not likely to adversely affect the bald eagle.

The federally-listed endangered Indiana bat also may occur in the project area. Very few trees would be removed for this project. An Indiana bat habitat suitability survey would be implemented. If roosting habitat characteristics are not evident, then the trees would be removed. If roosting habitat is evident, more detailed survey methods, such as mist-netting, would be done to further evaluate project area use by Indiana bats. Therefore, the project is not likely to adversely affect the Indiana bats.

vi. Hazardous, Toxic, and Radioactive Waste. A hazardous, toxic, and radioactive waste (HTRW) compliance assessment was conducted and is included as Appendix F to this report. This assessment evaluated the presence of HTRW or other environmental conditions on the FID that might impact the HREP. The assessment concluded that no evidence of recognized environmental conditions was noted on the FID and no further environmental investigations are needed.

vii. Prime and Unique Farmland. No prime and unique farmland would be impacted by the proposed project.

D. Historic Properties. Historic properties coordination under Section 106 of the National Historic Preservation Act is being conducted using the "process and documentation required for the preparation of an EA/FONSI or an EIS/ROD to comply with Section 106 of the National Historic Preservation Act, in lieu of the procedures set forth in 36 CFR 800.3 through 800.6" [35 Code of Federal Regulations (CFR) Part 800.8(c)]. Advance notice as required under 36 CFR 800.8(c) was provided to the Advisory Council on Historic Preservation (ACHP) and the Missouri State Historic Preservation Officer (SHPO) in a Corps letter dated January 28, 2004 (Appendix A).

i. Federal Undertaking. The Corps has determined that, for purposes of Section 106 of the National Historic Preservation Act [see 36 CFR 800. 3(a) and 800.16(y)], the Federal "undertaking" which has the potential to cause effects on historic properties is limited to the activities described in the Recommended Plan at Section 6.b, above—excluding only the acreage described as being allowed to "reforest naturally" [(Section 6.b.(2)].

ii. Consulting Parties. The Corps finds the following entitled to be consulting parties, as set out in 36 CFR 800.2, and invites them to participate in the Section 106 process:

- Advisory Council on Historic Preservation (ACHP)
- Choctaw Nation of Oklahoma
- Clark County (Missouri) Historical Society
- Eastern Shawnee Tribe of Oklahoma
- Iowa Tribe of Kansas and Nebraska
- Iowa Tribe of Oklahoma
- Jena Band of Choctaw Indians
- Miami Tribe of Oklahoma
- Missouri State Historic Preservation Officer at the MDNR
- Muscogee (Creek) Nation of Oklahoma
- Sac and Fox of the Mississippi in Iowa
- Sac and Fox Nation of Oklahoma
- Sac and Fox of the Missouri in Kansas and Nebraska
- U.S. Fish and Wildlife Service

iii. Area of Potential Effect (APE). The APE is illustrated on the map at figure 2-1 showing project features. This is the same area as covered by the Phase I archaeological surveys (Appendix M, figures M-5 and M-6). The Phase I surveys covered the footprint of all project features in the Recommended Plan described at Section 6.b-c, above, with the exception of the acreage of lands described as being allowed to "reforest naturally." The APE is all on Federal land; none is on tribal lands [36 CFR 800.16(d) and 36 CFR 800.4(a)(1)].

iv. State Historic Preservation Officer (SHPO) and Tribal Historic Preservation Officers (THPOs) Invitations. The Corps invites the SHPO/THPOs to:

- Identify any other consulting parties as per 36 CFR 800.3(f);
- Comment as per 36 CFR 800.2(d)(3) on the Corps' plan to involve the public by utilizing the Corps' normal procedures for public involvement under the National Environmental Policy Act;
- Concur in the Corps' decision that it is appropriate to address multiple steps in 36 CFR 800.3-800.6 as provided at 36 CFR 800.3(g); and,
- Comment on, or contribute to, identification efforts including definition of the APE, all as per 36 CFR 800.4(a-b).

v. Identification of Historic Properties. Review of existing information [36 CFR 800.4(a)(2)] is summarized at Section 2.g., above. Only three sites have been located within the APE (23CK345, 23CK346, and 23CK347). The Corps finds that historic properties identification has been completed for the entire APE [reference 36 CFR 800.4(b)].

vi. Request for Information from Consulting Parties. The Corps is seeking information from all consulting parties regarding their concerns with issues relating to this undertaking's potential effects on historic properties and, particularly, the tribes' concerns with identifying properties which may be sacred sites under Executive Order No. 13007 or of religious and cultural significance to them and may be eligible for the National Register [36 CFR 800.4(a)(3-4)]. Concerns about confidentiality [36 CFR 800.11(c)] regarding locations of properties can be addressed under Section 304 of the National Historic Preservation Act which provides withholding from public disclosure the location of properties under several circumstances including in cases where it would cause a significant invasion of privacy, impede the use of a traditional religious site by practitioners, endanger the site, etc.

vii. Agency Evaluation of Historic Significance, Determination of National Register Eligibility, and Invitation to the SHPO/THPOs and Consulting Parties to Comment. The Corps finds site 23CK345 to be within the APE and to be potentially eligibility for inclusion in the National Register of Historic Places (NRHP) under the criterion found at 36 CFR 60.4(d)—sites that have yielded, or may be likely to yield, information important in prehistory or history.

Partial coordination of the Hoppin and Benn (2004) Phase I report was conducted with the Missouri SHPO through a Corps letter dated November 20, 2003, and with a SHPO response dated December 9, 2003 (Log number 003-CK-04). These letters are found at Appendix A. The SHPO concurred with the Corps that "sites 1149-2 [23CK346] and 1149-3 [23CK347] are not eligible for the National Register, and that archaeological site 1149-1 [23CK345] may be eligible the National Register of Historic Places."

The Corps invites the opinion of the SHPO/THPOs and consulting parties on this determination [36 CFR 800.4(c)].

viii. Agency Determination of No Adverse Effect and Invitation to All Consulting Parties to Submit their Views. The Corps finds this undertaking would have a No Adverse Effect [36 CFR 800.5(b)] on site 23CK345. This determination is based upon the avoidance of all impacts to 23CK345 by restricting the proposed mast tree plantings both within the site area and within a 100-foot wide buffer zone all around the site boundary.

The SHPO in its December 9, 2003, letter concurred that the project would have "no adverse effect on site 1149-1 [23CK345], on the condition that mast tree plantings are restricted within the sites area, and within a 100-foot-wide buffer zone around the site."

The Corps notified all consulting parties including the SHPO/THPOs and the ACHP of this Finding of No Adverse Effect and provided them with the documentation as specified at 36 CFR 800.11(e)—see Appendix M. The Corps invited the Council and all other consulting parties to review the finding as per 36 CFR 800.5(c).

ix. Consulting Party Comments Received and Corps Responses. The Corps received three comments from the review of this document by the consulting parties and/or the public (Appendix A). In a letter dated January 14, 2005, the Eastern Shawnee Tribe of Oklahoma stated they had "no objection to the proposed construction. However if any human skeletal remains and/or any objects falling under NAGPRA (Native American Graves Protection and Repatriation Act) are uncovered during construction, the construction should stop immediately, and the appropriate persons, including state and tribal NAGPRA representative contacted." All Corps construction contracts require cessation of work, protection of materials discovered, and immediate notification of the proper parties upon the discovery of any unanticipated human remains and/or cultural resources.

In an MDNR letter dated January 24, 2005, the Missouri SHPO stated their concurrence with Corps' determination that "23CK345 is eligible for inclusion in the National Register of Historic Places (and). . . . that the proposed project would have no adverse effect on site 23CK345, on the condition that mast tree plantings are restricted within the site area and within a 100 foot wide buffer zone around the sites." The FONSI at the end of this EA incorporates the restrictions on mast tree planting. These restrictions would be incorporated into the relevant contract specifications.

In a letter dated February 1, 2005, referencing this project, the Jena Band of Choctaw Indians stated that, "After thorough review of the documents submitted, it has been determined that there would be no significant impact in regards to the Jena Band of Choctaw Indians. We have no objections to its implementation."

E.. Mineral Resources. No impacts are expected to occur to mineral resources as a result of this project.

F. Cumulative Impacts. No adverse cumulative impacts are identified. Habitat modifications should have long-term benefits to the fish and wildlife utilizing this area. This project, in concert with

other EMP HREPs on the Mississippi River, should counter other impacts to the river ecosystem such as sedimentation, pollution, and general decline in river habitats.

G. Adverse Impacts Which Cannot Be Avoided. During construction, temporary noise impacts and a temporary increase in turbidity cannot be avoided.

H. Short-Term Versus Long Term-Productivity. Short-term construction impacts would be offset by the long-term increase in quantity and diversity of floodplain, wetland and aquatic vegetation.

I. Irreversible or Irretrievable Resource Commitments. The purchase of materials and the commitment of labor, fuel, and machinery to construct the project are considered irretrievable. Other than the aforementioned, none of the proposed actions are considered irreversible.

J. Relationship of the Proposed Project to Land-Use Plans. The proposed action is in agreement with the *Land Use Allocation Plan* (Corps of Engineers, 1989) and *Comprehensive Mark Twain NWR Conservation Phase* (2004). The proposed project is not in conflict with any land-use plans currently being used for the site.

K. Compliance with Environmental Quality Statutes. Table 9-1 summarizes compliance with applicable statutes.

Table 9-1. Relationship of Plans to Environmental Protection Statutes and Other Environmental Requirements

Federal Policies	Compliance
Archaeological and Historic Preservation Act, 16 U.S.C. 469, et seq.	Full Compliance
Clean Air Act, as amended, 42 U.S.C. 1857h-7, et seq.	Full Compliance
Clean Water Act, 33 U.S.C. 1857h-7, et seq.	Full Compliance
Endangered Species Act, 16 U.S.C. 1531, et seq	Full Compliance
Federal Water Project Recreation Act, 16 U.S.C. 460-1(12), et seq.	Not Applicable
Fish and Wildlife Coordination Act, 16 U.S.C. 601, et Seq.	Full Compliance
Land and Water Conservation Fund Act, 16 U.S.C. 460/-461/-11, et seq.	Not Applicable
National Environmental Policy Act, 42 U.S.C. 4321, et seq.	Full Compliance
National Historic Preservation Act, 16 U.S.C. 470a, et seq.	Full Compliance
Rivers and Harbors Act, 33 U.S.C. 403, et seq.	Full Compliance
Watershed Protection and Flood Prevention Act, 16 U.S.C. 1001, et seq.	Not Applicable
Wild and Scenic Rivers Act, 16 U.S.C. 1271, et seq.	Not Applicable
Flood Plain Management (Executive Order 11988)	Full Compliance
Protection of Wetlands (Executive Order 11990)	Full Compliance
Farmland Protection Policy Act, 7 U.S.C. 4201, et seq.	Full Compliance
Analysis of Impacts on Prime and Unique Farmland (CEQ Memorandum, 11 Aug 80)	Not Applicable

Full Compliance: Having met all requirements of the statute for the current stage of planning.
Not Applicable: No requirements for the statute required.

i. Archaeological and Historic Preservation Act, as amended. The one historic property that is potentially eligible for inclusion in the National Register of Historic Places is being avoided by all project impacts. Details are set out in the Section 9(d) Historic Properties portion of this document.

ii. Clean Air Act, as amended. No aspect of the proposed project has been identified that would result in violations of air quality standards.

iii. Clean Water Act, as amended. A Section 404 (b)(1) evaluation for the recommended plan is found in Appendix B of this report.

iv. Endangered Species Act, as amended. Construction activities would be timed to avoid impacts to bald eagles and Indiana bats. The central mudminnow has been documented from Nelson Lake, but no work is planned at this location. The western fox snake and Illinois mud turtle has been reported from the Rose Pond area, but neither species has been sighted since the 1993 flood; therefore, impacts are not expected. The Fat Pocketbook Mussel, Topeka Shiner, and Blandings Turtle are not known to occur on the FID and no impact is expected. Patterson's Dawnflower is known from the sandy slopes of the levee on the west side of the Division but no work is planned in this area and no impact is expected. Overall, no adverse impacts to endangered species are anticipated. The restoration of part of the historic mosaic of floodplain habitats in the project area could potentially benefit listed species, though the extent of potential benefit is not quantifiable.

v. Federal Water Project Recreation Act, as amended. Since this action is not a navigation, flood control, reclamation, hydroelectric, or multiple purpose water resource project, this Act is not considered applicable.

vi. Fish and Wildlife Coordination Act, as amended. Project plans have been coordinated with the USFWS, ILDNR, and the MDOC. Coordination with these agencies, as well as others, is detailed in Section 13, *Coordination, Public Views, and Comments,* and Appendix A, *Correspondence.*

vii. Land and Water Conservation Fund Act, as amended. This Act regulates admission and special recreation user fees at certain recreational areas and establishes a fund to subsidize state and Federal acquisition of lands and waters for recreational and conservation purposes. No admission or user fees are charged for recreational use of the Division and no Federal money is being used to acquire lands or waters on this project. Therefore, this Act is not considered applicable.

viii. National Environmental Policy Act, as amended. The completion of the EA and signing of the FONSI would fulfill NEPA compliance.

ix. National Historic Preservation Act, as amended. Historic properties coordination under Section 106 of the National Historic Preservation Act is integrated into this document using the "process and documentation required for the preparation of an EA/FONSI or an EIS/ROD to comply with Section 106 of the National Historic Preservation Act, in lieu of the procedures set forth in 36 CFR 800.3 through 800.6" [35 Code of Federal Regulations (CFR) Part 800.8(c)]. Advance notice as required under 36 CFR 800.8(c) was provided to the Advisory Council on Historic Preservation (ACHP) and the Missouri SHPO in a Corps letter dated January 28, 2004 (Appendix A). Details are in

the Section 9(d) Historic Properties portion of this document. The completion of the EA process and signing of the FONSI would evidence completion of the Section 106 compliance process.

x. Rivers and Harbors Act, 33 U.S.C. as amended. This Act regulates activities in, under, or over navigable water, such as the Mississippi River. No activity is proposed that impacts the main stem of the Mississippi. However, the proposed surface water pump station would be constructed adjacent to Grey Chute, which connects to the river at both its upstream and downstream end. The Section 404 permit process would address issues that could be regulated by this Act. Completing the Section 404 permit process would result in full compliance with Section 10 of the Rivers and Harbors Act.

xi. Watershed Protection and Flood Prevention Act, as amended. Under this Act, the Soil Conservation Service at the Department of Agriculture provides planning assistance and construction funding for projects constructed by local sponsors, often in the form of flood control districts. This project is not being constructed by local sponsors, therefore, this Act is not considered applicable.

xii. Wild and Scenic Rivers Act, as amended. The Fox and Mississippi Rivers are not listed as component rivers in the National Wild and Scenic River System.

xiii. Flood Plain Management, Executive Order 11988. The project would not directly or indirectly induce growth (construction of structures and/or facilities) in the floodplain. Therefore, the project would be in full compliance with this executive order.

xiv. Protection of Wetlands, Executive Order 11990. While existing wetland habitat would be temporarily impacted by construction of the water control structures, the long-term impact to these wetlands would be protection and enhancement.

xv. Farmland Protection Policy Act, as amended. The proposed action would not result in the conversion of any prime, unique state or locally important farm land to non-agricultural uses.

xvi. Analysis of Impacts on Prime and Unique Farmland (CEQ Memorandum, 11 Aug 80). Prime farmland is defined as land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor, and without intolerable soil erosion. Unique farmland is defined as land other than prime farmland that is used for the production of specific high-value food and fiber crops, such as, citrus, tree nuts, olives, cranberries, fruits, and vegetables (7 U.S.C. 4201(c)(1)(A) & (B)). No farmland conforming to either of these definitions exists on the FID. Therefore, this Act is not considered applicable.

10. PROJECT PERFORMANCE ASSESSMENT MONITORING

This section summarizes the monitoring and data collection aspects of the project. The primary project objectives have been summarized elsewhere in this document, and the performance assessment is designed to gauge progress toward meeting these objectives.

Table 10-1 presents overall types, purposes, and responsibilities of monitoring and data collection. Table 10-2 presents actual monitoring and data parameters grouped by project phase, as well as data collection intervals. Table 10-3 presents the post construction evaluation plan, which displays the specific parameters and the levels of enhancement for the project (see Plate 16).

11. REAL ESTATE REQUIREMENTS

The FID HREP will be constructed on land owned by the Federal Government and managed as a National Wildlife Refuge by the USFWS. A draft Memorandum of Agreement between the USFWS and the Corps is included as Appendix C. A full description of the project area and real estate information is in the Real Estate Plan which is included as Appendix L. The project is located in the Great River National Wildlife Refuge in Clark County, Missouri.

Table 10-1. FID Monitoring and Performance Evaluation Matrix

Project Phase	Type of Activity	Purpose	Responsible Agency	Implementing Agency	Funding Source	Implementation Instructions
Pre-Project	Baseline Monitoring	Establish baselines for performance evaluation	Corps	USFWS	HREP Sponsor	See Table 10.2.
	Pre-Project Monitoring	Identify and define problems at HREP site. Establish need of proposed project features	Corps	USFWS	USFWS	--
Design	Data Collection for Design	Include quantification of project objectives, design of project, and development of performance evaluation plan	Corps	Corps	HREP	See Table 10.2.
Construction	Construction Monitoring	Assess construction impacts; assure permit conditions are met	Corps	Corps	HREP	See State Section 401 Stipulations
Post-Construction	Performance Evaluation Monitoring	Determine success of project as related to objectives	Corps (quantitative) Sponsor (field observations)	USFWS and Corps	HREP and USFWS	See Table 10.3.

Table 10-2. FID Resource Monitoring and Data Collection Summary

	Engineering Data			Natural Resource Data				Area Measurements	
Point Measurements	**Pre-Project Phase**	**Design Phase**	**Post-Const. Phase**	**Pre-Project Phase**	**Design Phase**	**Post-Const. Phase**	**Sampling Agency**	**Wetland Water Surface Survey**	**Grassland Plant Survey**
Mast Tree Survey				1	1	5Y	USFWS and Corps		
Floristic Survey					1	1-5Y	Corps and MDOC		X
Mapping (Aerial Photography)	2 [1]	2 [2]					Corps and USGS		
Plane Table Survey (1934)	1						Corps		
Aerial Photogrametry (1995)		1 [3]					Corps		

[1] Aerial Photos 1927 and 1995
[2] Aerial Photo 1998 (Corps) and Digital Ortho Quad by USGS 1993
[3] Aerial Survey for Flow Frequency Study, approved for public release 2003

Table 10-3. FID Post-Construction Evaluation Plan

Enhancement Potential									
Goal	**Objective**	**Enhancement Feature**	**Unit**	**Year 0 w/out Alternative**	**Year 1 w/ Alternative**	**Year 25 w/ Alternative**	**Year 50 Target w/ Alternative**	**Feature Measurement**	**Annual Field Observations by Site Manager**
Rehabilitate and Enhance Wildlife Habitat	Restore native grassland	Seed part of Logsdon Tract with native grasses and forbs	Acres	0	98	98	98	Floristic Inventory	Estimate effective acreage and wildlife use
	Expand and enhance existing wetlands	Enhance water supply, distribution and control for wetlands	Acres	15	78	75	70	Aerial photo of inundated area on October 31	Estimate effective acreage and wildlife use
	Reduce forest fragmentation and enhance species diversity	Plant container-grown trees	% survival	100	95	45	40	Tree count	Estimate effective acreage and wildlife use
		Direct seed hardwood trees	% survival	95	65	15	4	Tree count	Estimate effective acreage and wildlife use
		Allow natural reforestation in low-lying areas	Acres		50	200	345	Aerial photo of re-forestation	Estimate effective acreage and wildlife use
		Bank protection	Linear feet of bank protection	0	50	50	50	Surveys, inspections and mapping	Evaluate bank stability and erosion

12. IMPLEMENTATION RESPONSIBILITIES

A. U.S. Army Corps of Engineers, Rock Island District. The Corps, is responsible for project management and coordination with the USFWS, MDOC, ILDNR, and other affected agencies. The Corps would submit the subject Definite Project Report (DPR); administer program funds; finalize plans and specifications; complete all NEPA requirements; advertise and award a construction contract; and perform construction contract supervision and administration. Section 906(e) of WRDA 1986 states that first cost funding for enhancement features would be 100 percent Federal cost because the project features would be located on Federally owned land that is managed by the USFWS as a national wildlife refuge. Any mutually agreed upon major rehabilitation of the project that exceeds the identified annual operation and maintenance cost requirements would be the Corps' responsibility. Major rehabilitation would be considered as a result of specific storm or flood events and is not included in the project costs estimate (table 8-2 and 8-3). The Corps has agreed to support this HREP's monitoring and data collection needs as outlined in tables 10-1 and 10-2.

B. U.S. Fish and Wildlife Service. The USFWS is the Federal project sponsor and has provided a Coordination Act Report (CAR) for this project (see Appendix A). Operation and maintenance of the project, as described in Sections 6.e, 6.f, and table 8-3 is the responsibility of the USFWS in accordance with Section 107(b) of the WRDA of 1992, Public Law 102-580. These functions would be further specified in the Project Operation and Maintenance Manual to be provided by the Corps prior to final acceptance of the project by the sponsors. The USFWS has agreed to support this HREP's monitoring and data collection needs as outlined in tables 10-1 and 10-2.

C. Missouri Department of Conservation. The MDOC, a non-Federal project sponsor, has provided technical and other advisory assistance during all phases of the project and would continue to provide assistance during project implementation. The MDOC has agreed to support this HREP's monitoring and data collection needs as outlined in tables 10-1 and 10-2.

D. Illinois Department of Natural Resources. The ILDNR, a non-Federal project sponsor, has provided technical and other advisory assistance during all phases of the project and would continue to provide assistance during project implementation.

13. COORDINATION, PUBLIC VIEWS, AND COMMENTS

Coordination has been made throughout the planning and design process with the following State and Federal agencies:

Illinois Department of Natural Resources (ILDNR)
Missouri Department of Conservation (MDOC)
Missouri Department of Natural Resources (MDNR)
Iowa Department of Natural Resources
U.S. Natural Resources Conservation Service
U.S. Fish and Wildlife Service
U.S. Environmental Protection Agency

A. Coordination Meetings. Coordination with project sponsors occurred during the following meetings:

Date	Subject	Attendance
Aug 6, 2002	Kickoff Feasibility Study - Site visit	Corps, USFWS, ILDNR, Stanley Consultants
Nov 8, 2002	Draft Review Chapters 1 -5	Corps, USFWS, ILDNR, Stanley Consultants
Jun 19, 2003	Phase 2 kick-off to complete DPR	Corps, USFWS, MDC, Stanley Consultants
Jul 17, 2003	Reforestation Plan	Corps, Stanley Consultants
Aug 29, 2003	Progress Meeting	Corps, USFWS, ILDNR, Stanley Consultants
Nov 25, 2003	Draft Review	Corps, Stanley Consultants
Mar 2, 2004	Draft Review Meeting	Corps, Stanley Consultants
Jan 26, 2005	Project Open House, Keokuk, IA	Corps, Stanley Consultants, USFWS, MDOC, Public

B. Coordination by Correspondence. The following letters are contained in Appendix A, *Correspondence.*

1. Letter dated August 4, 2003, from Corps of Engineers to Distribution List.
2. Stanley Consultants, Inc. Meeting Notes #1, dated June 19, 2003, subject: Minutes of Coordination Meeting.
3. Stanley Consultants, Inc. Meeting Notes #2, dated August 9, 2003, subject: Minutes of Coordination Meeting.
4. MVR-ED E-mail, dated July 17, 2003, from Heather Whitman, U.S. Army Corps of Engineers, to Dan Miller, Stanley Consultants, Inc., subject: Fox Island Stage 2 distribution letter address list.
5. Stanley Consultants, Inc. E-mail, dated July 28, 003, from Michael Knott, Stanley Consultants, Inc., to Joseph Lundh, U.S. Army Corps of Engineers, subject: Fox Island Tree Planting.
6. MVR-ED E-mail, dated August 14, 2003, from Heather Whitman, U.S. Army Corps of Engineers, to Michael Knott, Stanley Consultants, Inc., subject: HTRW for Fox Island DPR.
7. Stanley Consultants, Inc. Telephone Call Report, dated September 9, 2003, from Dan Miller, Stanley Consultants, Inc., to Dick Klassen, Grosch Well Drilling Company, subject: Electrical vs. Diesel Motors for Irrigation Pumps.
8. Stanley Consultants, Inc. Telephone Call Report, dated July 25, 2003, from Dan Miller, Stanley Consultants, Inc., to Dick Klassen, Grosch Irrigation Co., subject: Well production and cost in Clark County Missouri.
9. Stanley Consultants, Inc. Telephone Call Report, dated July 18, 2003, from Brad Roeth, Stanley Consultants, Inc., to Dave Meyer, Layne-Western, subject: Fox Island Water Supply Wells.
10. Stanley Consultants, Inc. Telephone Call Report, dated August 21, 2003, from Steve Sutter, Landmark Irrigation, Inc., to Heather Cross, Stanley Consultants, Inc., subject: Fox Island Well Drilling.

11. MVR-PM Letter dated September 22, 2003, from Janet E. Sternburg, Missouri Department of Conservation, to Dan Miller, Stanley Consultants, Inc., subject: Endangered and Threatened Species near Fox Island.

12. Letter dated November 20, 2003, from Kenneth A. Barr, U.S. Army Corps of Engineers, to Mark Miles, Department of Natural Resources, subject: National Historic Preservation Association.

13. MVR-PM Letter dated December 9, 2003, from Mark Miles, Department of Natural Resources, to Kenneth A. Barr, U.S. Army Corps of Engineers, subject: Historic Preservation.

14. Letter dated January 28, 2004, from Kenneth A. Barr, U.S. Army Corps of Engineers, Mr. Don Klima, Advisory Council on Historic Preservation.

15. Coordination Act Report (CAR), dated August 23, 2004, from Richard C. Nelson, Fish & Wildlife Service, to Colonel Duane P. Gapinski, U.S. Army Corps of Engineers.

16. Letter dated January 14, 2005, from Jo Ann Beckham, Eastern Shawnee Tribe of Oklahoma, to Darren Niles, U.S. Army Corps of Engineers.

17. Letter dated January 24, 2005, from Mark A. Miles, Department of Natural Resources to Darron Niles, U.S. Army Corps of Engineers.

18. Letter dated February 1, 2005, from Lillie Strange, Jena Band of Choctaw Indians, to Darron Niles, U.S. Army Corps of Engineers.

19. Coordination Act Report (CAR), dated March 14, 2005, from Richard C. Nelson, Fish & Wildlife Service, to Colonel Duane P. Gapinski, U.S. Army Corps of Engineers.

20. Conversation Record, dated January 26, 2005, from Darron Niles, U.S. Army Corps of Engineers.

21. Letter from Mayor Bob Davis, Mayor of City of Alexandria, Missouri, to Darron Niles, U.S. Army Corps of Engineers.

14. CONCLUSIONS

The natural habitat value on the FID has been diminished by sedimentation of wetlands and water bodies, loss of bottomland forest, and destruction of native grasslands. Re-establishing floodplain food sources and reliable wetland habitat would benefit migratory birds and local wildlife.

The recommended project features for the FID HREP are designed to meet the project's goal to rehabilitate and enhance wildlife habitat. These goals would be met by reducing forest fragmentation and enhancing forest diversity; enhancing and expanding existing wetlands; and by restoring native grassland.

The future with-project scenario shows increased habitat value over the 50-year project life for the target species. This increase represents measurable outputs of improved habitat quality and preferred habitat quantity.

The project is consistent with and fully supports the overall goals and objectives of the Upper Mississippi River System-Environmental Management Program, the North American Waterfowl Management Plan, and the Partners in Flight Program.

15. REFERENCES

Bear Creek Archeology. Personal Communication with Ron Pulcher, U.S. Army Corps of Engineers (CEMVR-PM-A). September 8, 2003

Benn, D. W., and A. Hengesteg. *Archival, Historical, Archeological, and Geomorphological Background Literature, Records Review and Research for Historic Properties at the Fox Island Division of the Great River National Wildlife Refuge, Mississippi River Pool 20, Clark County, Missouri.* Contract No. DACW24-98-0-0001. December 2002

Brummett, K., Missouri Department of Conservation. Personal Communication with K. Cook, U.S. Army Corps of Engineers (CEMVR-PM-A). Date of communication not known

Lane, E. W. "The importance of fluvial morphology in hydraulic engineering." *American Society of Civil Engineering, Proceedings*, 81, paper 745: 1-17. 1955

Leopold, L. B. *Fluvial Processes in Geomorphology*. W H Freeman & Co. 1964

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Turner, Lewis M. "Grassland in the Floodplain of Illinois Rivers." *American Midland Naturalist,* Vol. 15, No. 6, pp. 770-780. November. 1934

Urich, D. L., *et. al.* "Habitat Appraisal of Private Lands in Missouri." *Wildlife Society Bulletin*, 12. 1984

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FOX ISLAND DIVISION HABITAT REHABILITATION AND ENHANCEMENT PROJECT

POOL 20, MISSISSIPPI RIVER MILES 358.5 THROUGH 353.6 CLARK COUNTY, MISSOURI

RECOMMENDATIONS

I have weighed the outputs to be obtained from the full implementation of this habitat rehabilitation and enhancement project against its estimated cost and have considered the various alternatives proposed, impacts identified, and overall scope. In my judgment, this project, as proposed, justifies expenditure of Federal funds. I recommend that the Mississippi Valley Division Engineer approve the proposed project to include: planting 275 acres of mast-producing trees on current farm fields; planting 98 acres of native grasses and forbs on a former farm field; and installing water supply and control facilities for enhancement of 78 acres of wetland habitat. The wetland enhancement facilities would include three water supply pumps, two culverts, five water control structures, and connecting channels. New gravel roads would be constructed for access to the water supply pumps. Five-hundred and sixty acres of farmland would be allowed to naturally revegetate into wet floodplain forest.

The current estimated Federal construction cost of this project is $2,097,250. Total Federal estimated project cost, including general design and construction management is $3,070,250. The full implementation of this project would generate 178 average annual habitat units.

At this time, I further recommend that funds in the amount of $120,000 be allocated for the preparation of project plans and specifications.

_____ _____

Date

Robert A. Sinkler
Colonel, U.S. Army
District Engineer

FOX ISLAND DIVISION HABITAT REHABILITATION AND ENHANCEMENT PROJECT

POOL 20, MISSISSIPPI RIVER MILES 358.5 THROUGH 353.6
CLARK COUNTY, MISSOURI

FINDING OF NO SIGNIFICANT IMPACT

I have reviewed the information provided by this Environmental Assessment, along with data obtained from Federal and State agencies having jurisdiction by law or special expertise, and from the interested public. I find that the proposed habitat rehabilitation and enhancement project at Fox Island Division would not significantly affect the quality of the human environment. Therefore, it is my determination that an Environmental Impact Statement is not required. This determination may be reevaluated if warranted by further developments.

An array of management features and alternatives was considered for habitat enhancement, including:

A. No Federal Action
B. Reforestation
C. Wetland Enhancement
D. Native Grassland Restoration

The preferred alternative includes 275 acres of reforestation by planting mast-produced trees, 78 acres of wetland enhancement, and 98 acres of native grassland restoration. The reforestation would convert current open land into hard mast forest by transplanting rootstock from local nurseries and by planting hard mast seeds directly on site. The wetland enhancement includes development of new water sources to provide year-round water supply capability and construction of water control structures to improve management of water levels within the wetland. The improvements would provide the capability of lowering water levels in the spring and early summer to promote plant growth that would provide additional forage for migrating waterfowl when the wetlands are re-filled in the fall. The grassland restoration would expand this region's native floodplain vegetative cover. The benefits would be leveraged by the continuity between this restoration and the Missouri Department of Conservation's Rose Pond Conservation Area.

Factors considered in making a determination that an Environmental Impact Statement was not required are as follows:

A. The project is anticipated to improve the value of FID for migratory and resident birds and other wildlife species.
B. Aside from temporary disturbance, no long-term adverse impacts to natural or cultural resources are anticipated. No endangered or threatened species, either State or Federal, would be adversely affected by the project action.
C. The project is in compliance with Sections 401 and 404 of the Clean Water Act.
D. The project is in compliance with Section 106 of the National Historic Preservation Act based upon the avoidance of all impacts to archaeological site 23CK345 by restricting the proposed mast tree plantings both within the site area and within a 100-foot wide buffer zone all around the site boundary.
E. No significant social or economic impacts are expected to occur as a result of this action.

_____ _____

(Date)

Robert A. Sinkler
Colonel, U.S. Army
District Engineer