UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT (R-19PR)

POOL 12 OVERWINTERING HABITAT REHABILITATION AND ENHANCEMENT PROJECT

POOL 12, MISSISSIPPI RIVER MILES 563 -573
JO DAVIESS COUNTY, ILLINOIS

PUBLIC REVIEW DRAFT

SEPTEMBER 2005

US Army Corps of Engineers ®
Rock Island District

DEPARTMENT OF THE ARMY
ROCK ISLAND DISTRICT, CORPS OF ENGINEERS
CLOCK TOWER BUILDING - P.O. BOX 2004
ROCK ISLAND, ILLINOIS 61204-2004

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ACKNOWLEDGEMENT

Many members of the Rock Island District assisted in the preparation of the Pool 12 Overwintering Habitat Rehabilitation and Enhancement Project. The primary project development team members who contributed to the technical aspects of this plan are:

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US Army Corps of Engineers ®
Rock Island District

WE'RE PROUD TO SIGN OUR WORK

EXECUTIVE SUMMARY

The Pool 12 Overwintering Habitat Rehabilitation and Enhancement Project (HREP) is located in Jo Daviess County, Illinois, upstream of Bellevue, Iowa, in Pool 12 between Upper Mississippi River Miles (RM) 563 and 573. All project lands are in Federal ownership and are managed by the U.S. Fish and Wildlife Service (USFWS) as part of the Upper Mississippi River National Wildlife and Fish Refuge.

The project area is comprised primarily of a series of islands, backwater channels, and backwater lakes modified or created following construction of Lock and Dam 12 in 1939. This construction contributed to an abundance of deep, lentic, backwater habitat within Pool 12 which is particularly ideal overwintering habitat for certain fish species such as bluegill, largemouth bass, and white and black crappie. Following lock and dam construction, river sediments have been slowly accumulating in backwater areas and have reduced the depth and area of quality backwater habitats and blocked entryways to backwater areas. Construction of Lock and Dam 12 also resulted in changes to the floodplain forest communities of Pool 12. Areas of this pool are currently dominated by similar-aged species of cottonwood and silver maple. This lack of species diversity results in reduced habitat value.

The goals of the proposed project are to restore and protect aquatic habitat and restore floodplain forest habitat. The objectives identified to meet these goals were: (1) create off-channel deep-water areas to provide overwintering and year-round habitat for fish; (2) maintain and increase depth diversity in backwaters; (3) increase forest stands with hard mast-producing trees as a dominant or component species; and (4) create areas within the pool with sufficient elevation to support regeneration of hard mast-producing trees. The following enhancement features were considered to achieve the project goals and objectives: excavate channels in backwater areas; construct deflection berms, higher-level terraces, and/or islands from dredged material; and establish native mast-producing trees on deflection berms. The following six backwater sites and their features were chosen for evaluation:

Sunfish Lake	No Name Lake
Fishtrap Lake	Kehough Slough
Stone Lake	Tippy Lake

Cost and habitat benefits were estimated for each site. Habitat benefits were estimated using Habitat Evaluation Procedures. Cost-effectiveness and incremental analyses were conducted to identify cost-effective plans and reveal changes in cost for increasing levels of environmental outputs.

The recommended plan (shown on figure ES-1) would restore backwater habitat at six lakes by excavating approximately 80 acres of deep backwater channels to a depth of 8 feet below flat pool, providing overwintering and year-round habitat for fish in the surrounding 6,942 acres. The plan provides 109 Average Annual Habitat Units of fish habitat. Excavated material would be used to construct deflection berms or higher-level terraces, or would be placed in confined placement sites at two nearby locations. The recommended plan would also establish mast-producing trees on approximately 24 acres of raised berms. Riprap would be placed where needed to protect deflection berms.

Constructing deflection berms, higher-level terraces, and islands from dredged material would restore and protect aquatic habitat by reducing sedimentation and improving topographic diversity within the floodplain. Planting the higher-level terraces with mast-producing trees would improve the associated vegetative assemblages within the terrestrial floodplain. Dredging channels in the backwater areas would create overwintering and year-round habitat for fish and increase aquatic diversity, while also providing material to construct the berms, terraces, and islands.

Implementation of the recommended plan would increase the quality and quantity of preferred habitat at this location. The project outputs meet site management goals and objectives and support the overall goals and objectives of the Upper Mississippi River System-Environmental Management Program (UMRS-EMP), and the Upper Mississippi River National Wildlife and Fish Refuge.

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. Major rehabilitation of the project is not included in the project cost estimate.

Section 906(e) of the 1986 Water Resources Development Act (WRDA) specifies that first cost funding for enhancement features "located on lands managed as a national wildlife refuge" will be 100 percent Federal. All Pool 12 project features would be located on federally owned lands managed through a cooperative agreement with the USFWS, the Federal participant in the project. Per Section 107(b) of the 1992 WRDA, the USFWS will accomplish project maintenance at an estimated average annual cost of $19,600. The Illinois Department of Natural Resources (ILDNR) and the Iowa Department of Natural Resources (IADNR) are project proponents.

The District Engineer has reviewed the project outputs and determined that the implementation of the selected plan is justified and in the Federal interest. Therefore, the Rock Island District Engineer recommends construction approval for the Pool 12 Overwintering HREP at an estimated Federal expense of $10.5 million (current working estimate). The total Federal cost estimate, including general design and construction management, is $13.0 million (current working estimate).

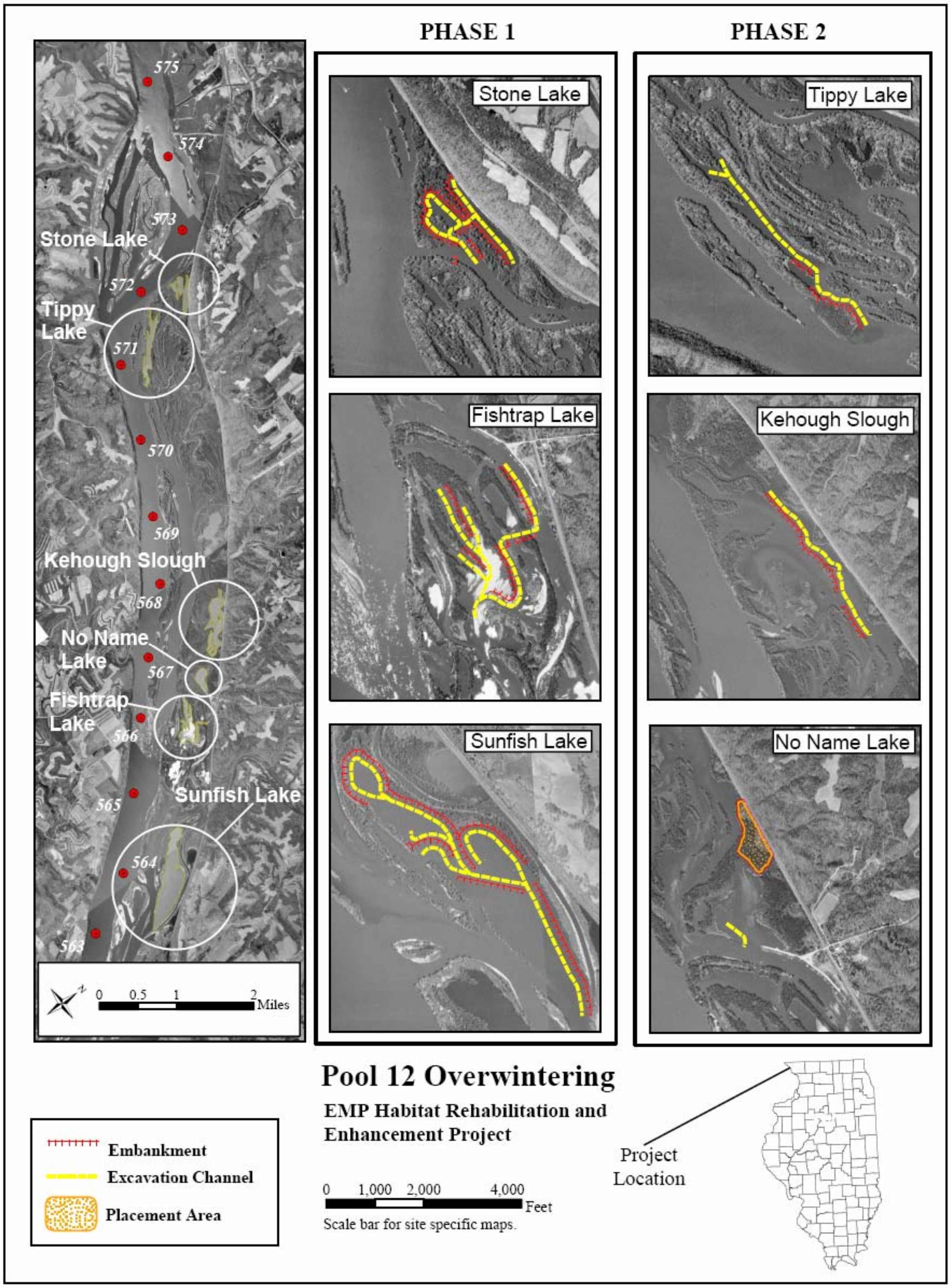

FIGURE ES-1. Project Location Map

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I. INTRODUCTION

A. Purpose. The purpose of this report is to present a detailed proposal for the rehabilitation and enhancement of Upper Mississippi River (UMR) backwater habitat areas of Pool 12. This report provides planning, engineering, and sufficient construction details of the recommended plan to allow final design and construction to proceed subsequent to approval of this document.

B. Resource Problems and Opportunities. The Pool 12 project area is part of the U.S. Fish and Wildlife Service's (USFWS) Upper Mississippi River National Wildlife and Fish Refuge, Savanna District. The project area is comprised primarily of a series of islands, backwater channels and backwater lakes modified or created following construction of Lock and Dam 12 in 1939 (plate 1). This construction contributed to an abundance of deep, lentic, backwater habitat and created a less diverse floodplain forest within Pool 12. These backwater areas provide habitat for multiple life-stages of various fishes, but are particularly ideal overwintering habitat for certain fish species, including sunfish species such as bluegill, largemouth bass, and white and black crappie.

Following lock and dam construction, river sediments have continued to accumulate in backwater areas of Pool 12. This sedimentation has reduced the depth and area of historic backwater sites used by fisheries resources for various life-stage needs, including overwinter survival. It also has blocked entrances to backwater fishery overwintering areas, which reduces the overall value of otherwise useable fish habitat. Ultimately, sedimentation has resulted in a reduction in both the quantity and quality of backwater fishery habitat, particularly overwintering habitat, utilized by several native fish species.

Construction of Lock and Dam 12 also resulted in changes to the floodplain forest communities of Pool 12. Areas of this pool are currently dominated by similar-aged species of cottonwood and silver maple. This lack of both species and age diversity is undesirable for the floodplain forest habitat.

This report evaluates opportunities to restore deep off-channel habitat and floodplain forest for fish and wildlife in existing backwaters of Pool 12.

C. Project Selection. Initially this project was called Molo Slough, referring to a 100-acre side channel in the Nine Mile island complex on the Iowa side of the Mississippi River navigation channel, approximately 9 miles south of Dubuque, river miles (RM) 574.4 - 571.5. The project involved constructing a closing dike across the upper end of the slough to reduce sedimentation and create an overwintering area for fish. During project planning, the Iowa Department of Natural Resources (IADNR) executed a commercial contract to mechanically dredge sand from Molo Slough. The dredge created a shallow sand bar at the slough's upper end to simulate the proposed closing structure and dredged additional scattered holes to create diversified water depths. This created conditions similar to what the original project hoped to produce. The project proponents were pleased with the new site conditions at Molo Slough and proposed modifying the project by addressing overwintering habitat needs in other backwater lakes along the Illinois side of the Mississippi River. This evolved into the Pool 12 Overwintering Habitat Rehabilitation and Enhancement Project (HREP) proposed in this report.

The IADNR and Illinois Department of Natural Resources (ILDNR), with support from the USFWS, nominated the Pool 12 Overwintering HREP. 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 Pool 12 Overwintering HREP was recommended and supported by the FWIC and the River Resources Coordinating Team (RRCT) as providing significant aquatic and terrestrial benefits with opportunities for habitat enhancement. Enhancement of habitat for fish and wildlife would be achieved by implementing the proposed project features.

D. Scope of Study. The Pool 12 Overwintering project area is located in the middle to lower half of Pool 12, upstream of Bellevue, Iowa in Jo Daviess County, Illinois, between RM 563 –573. All project lands are in Federal ownership. Plate 1 provides vicinity and general location maps for the Pool 12 Overwintering HREP. Plates 2 thru 8 show site-specific plans.

The scope of this study focuses on proposed project features that would improve both aquatic backwater overwintering habitat and floodplain forest habitat. The project is consistent with agency management goals and was planned for the benefit of resident fish and floodplain forest communities.

Field surveys and habitat quantification procedures were completed to support the planning and assessment of proposed project alternatives. Soil borings were taken to determine sediment types and properties. Baseline water quality monitoring was performed to define present water quality conditions/problems.

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

E. Format of Report. The report is organized to follow a general problem-solving format. Existing conditions and anticipated future conditions are reviewed and project goals and objectives are identified. Restoration alternatives are formulated to address the goals and objectives. Costs and benefits of the restoration alternatives are identified and the alternative plans are compared on this basis resulting in recommendation of a single restoration plan for implementation. A detailed analysis of the recommended plan is presented and includes: design and construction considerations; operation, maintenance, and rehabilitation considerations; a detailed cost estimate; a plan for monitoring the performance of the restoration; real estate requirements; environmental effects; and a detailed schedule for implementation. Conclusions and recommendations are presented. Drawings (plates) have been furnished to provide sufficient detail to allow review of the existing features and recommended plan.

F. Authority. This project is proposed as part of the Upper Mississippi River System – Environmental Management Program (UMRS-EMP), a Federal-State partnership to (a) plan, construct, and evaluate measures for fish and wildlife habitat improvement through HREP, and (b) monitor the natural resources of the river system through the Long Term Resource Monitoring (LTRM) Program. The authority for this report is provided by the 1985 Supplemental Appropriations Act (Public Law 99-88) and Section 1103 of the Water Resources Development Act (WRDA) of 1986 (Public Law 99-662), Section 405 of WRDA 1990 (Public Law 101-640), Section 107 of WRDA 1992 (Public Law 102-580), and Section 509 of WRDA 1999 (Public Law 106-53). The proposed project would be funded and constructed under these authorizations. The Pool 12 Project is located on land owned by the United States as purchased through the Army Corps of Engineers, managed by the USFWS under a Cooperative Agreement between the Department of the Interior, the USFWS, and the Corps, dated February 14, 1963 as amended on July 31, 2001.and thus has no cost-sharing requirement.

II. ASSESSMENT OF EXISTING RESOURCES AND CONDITIONS

Pool 12 flows from the tailwaters of Lock and Dam 11 at Dubuque, Iowa, south 26.3 river miles to Bellevue, Iowa. Pool 12 was impounded in 1939 following construction of Lock and Dam 12 at UMR RM 556.7. The entire Pool 12 area contains several types of aquatic and terrestrial habitats. All of these areas have been affected to varying degrees by sedimentation and altered hydrology throughout the operating life of the navigation pool. Four rivers and four minor creeks flow into Pool 12. Of these, the Galena and Sinsinawa Rivers are the tributary streams that likely contribute most to sedimentation of side channel and backwater areas of Pool 12. Backwaters are off-channel aquatic areas such as contiguous impoundments, floodplain lakes, and shallow aquatic areas, as well as secondary, tertiary, and tributary channels.

This study focused on the portion of Pool 12 that extends from RM 563 – 573. The average width of the river and its floodplain within this reach is approximately 1.0 mile.

A. Resource History. Prior to constructing the lock and dam, this reach of river featured multiple channels, sloughs, shallow lakes, bottomland forests, and islands. Numerous wing dams, closing dams, and bank revetment in the channel borders and side channels were already present in the pool as a result of construction of the 4- and 6-Foot Channel Navigation Projects decades earlier. Construction of Lock and Dam 12 inundated additional low-lying terrestrial areas and increased the depth of existing aquatic areas in the middle and lower portions of the pool. While these changes reduced habitat for terrestrial wildlife, they expanded the habitat available for fish and other aquatic organisms. Today, more than 50 percent of the Pool 12 floodplain is covered by permanent water.

In the decades following impoundment, sedimentation, erosion, and altered hydrology have affected many types of aquatic habitat in Pool 12. Off-channel, backwater areas have become shallower and it is likely that these areas will continue to slowly transform from deep (>4 feet) aquatic habitat to shallow aquatic or even terrestrial habitat. Some pockets of deeper water remain in off-channel areas and are typically associated with flowing channels. Although shallow and/or flowing-water areas are used by many aquatic species, they do not perform some of the important habitat functions provided by deeper areas located in backwater habitats.

B. Habitat Types and Distribution. The navigation channel runs along the bluff on the Iowa side of the river for its entire length within the project area of Pool 12 (figure 2-1). As a result, essentially all off-channel land and water areas are located on the Illinois side of the main channel. A variety of geomorphic areas and cover types are represented in Pool 12. Geomorphic areas and land cover acreages were compiled for the UMRS based on aerial photography and GIS analysis compiled in 1989 and compiled in the Habitat Needs Assessment prepared for the EMP (West Consultants Inc. 2000; USACE 2000)

Backwater areas investigated as part of this study include Sunfish Lake, Fishtrap Lake, No Name Lake, Kehough Slough, Hires Lake, Tippy Lake, and Stone Lake, as well as other off-channel areas (figure 2-1). The Galena and Sinsinawa Rivers enter the project area on the Illinois side. These rivers likely serve as corridors for certain migratory fish species. In addition to aquatic habitat, Pool 12 includes large tracts of terrestrial floodplain and numerous islands. Additional information on existing terrestrial habitat (vegetation) types is included in Section 2.e. below. A more detailed account of geomorphic areas is provided in Appendix D of this report.

Backwater areas provide year-round benefits to fisheries resources, but are particularly important for the overwintering of many fish species. Local resource managers and biologists believe that availability and quality of these areas may become one of the primary limiting factors for certain fish populations. The Upper Mississippi River and Illinois Waterway Navigation Feasibility Study – Cumulative Effects Study (West Consultants Inc. 2000) did not predict that the contiguous backwaters in the project area would be converted to terrestrial habitat. However, the Habitat Needs Assessment (USACE 2000) projected the continued loss of the habitat value of the Pool 12 backwaters due to sedimentation. Backwaters in the study area would not completely fill in, but sedimentation would reduce their value as overwintering habitat for centarchids.

Impoundment of Pool 12 directly converted some previously terrestrial habitat to aquatic habitat. Additionally, alteration of hydrology within the middle to lower reaches of the pool has degraded existing terrestrial habitat by reducing the ability of these areas to support desirable native plant communities, particularly floodplain forest.

C. Water Resources. The Rivers and Harbors Act of July 3, 1930 authorized the existing navigation project on the Mississippi River between the Missouri River and Minneapolis, Minnesota. The project provides for a 9-foot channel of adequate width between the mouth of the Missouri River and Minneapolis by constructing a system of locks and dams, supplemented by dredging. The proposed Pool 12 Overwintering HREP project features are adjacent and contiguous to the Mississippi River 9-foot channel. The proposed project and features thereof as described in this report would not affect navigation. Table 2-1 details flood flows and elevations at Lock and Dam 12

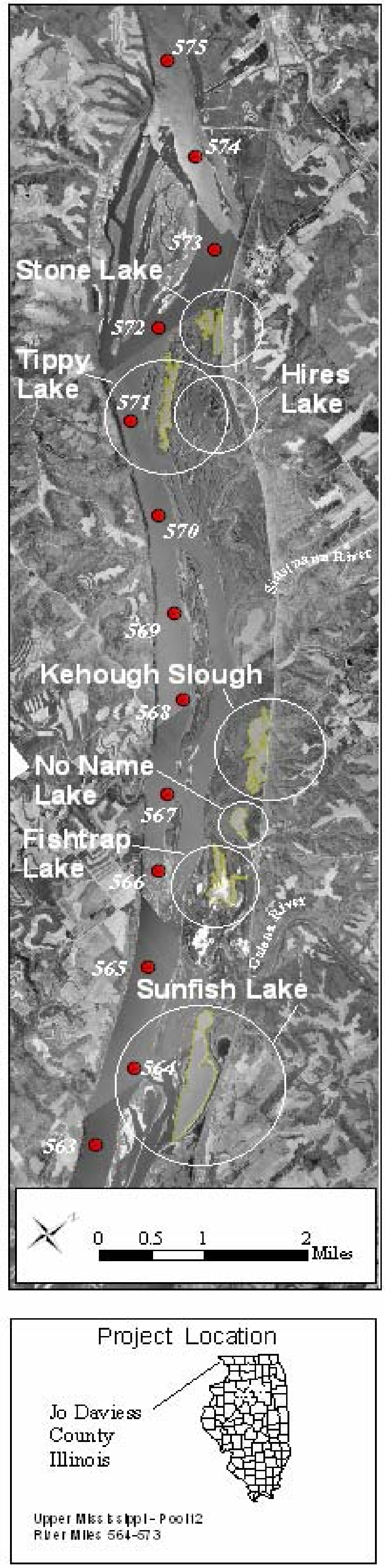

Figure 2-1. General Project Area

Table 2-1. Flood Flows and Elevations at Lock and Dam 12 (Approximate RM 556.8) based on 2004 Flow Frequency Study

Event	Elevation (ft) [1]	Flow (cfs)
flat pool	592.0	0
2-year	594.3	127,000
5-year	597.2	169,000
10-year	598.9	196,000
25-year	600.9	228,000
50-year	602.1	252,000
100-year	603.2	275,000
200-year	604.1	298,000

[1] Elevations are based on 1912 MSL Datum

D. Water Quality. Water quality in backwater areas is strongly influenced by depth. Reduced depths result in wider fluctuations in water temperature and low dissolved oxygen which limits the usefulness of these areas as deep-water, off-channel habitat for fish. Previous HREP projects have suggested that ideal overwintering habitat for sunfishes would include areas that provide and maintain dissolved oxygen levels of 5 mg/L, water temperatures near 4ºC, little to no current velocity, and at least 4 feet of depth (Palesh and Anderson 1990).

Baseline water quality data has been collected during the winter period for several backwater locations in Pool 12 (Appendix F – Water Quality). The Corps has utilized *in situ* data loggers to continuously monitor temperature, dissolved oxygen (DO), pH and turbidity in Kehough (Jan-Feb 2001); Tippy and Hires (Jan-Feb 2002); and Sunfish, Fishtrap, Kehough, Tippy and Stone (Dec 2002 - Mar 2003). The Corps also collected additional water temperature data from Sunfish, Fishtrap, No Name, and Stone (Jan-Feb 2002).

The IADNR has also collected water quality information (water temperature, DO and ice thickness, as well as other parameters) from Sunfish Lake since 1993 as part of the LTRM program. This data is limited to individual point measurements and is not as complete as that collected for Kehough, Hires and Tippy. Additional point measurements have been collected in Pool 12 by IADNR in association with winter habitat-use fisheries surveys.

Monitoring of habitat conditions has shown that on occasion DO concentrations fall well below 5 mg/l during the winter months. In some cases, DO levels of about 1 mg/L have been observed during winter months in Pool 12. Monitoring by the Corps during 2001 and 2002 within areas of Sunfish, Fishtrap and Kehough have not documented DO levels below 5 mg/L, suggesting that critically low DO may not occur every year.

Low DO concentrations can have adverse impacts on species that rely on backwater habitats for overwintering. Shallow backwater areas are particularly susceptible to winterkills during periods with extended cold temperatures and heavy snow cover. With continued sedimentation in backwater areas, the frequency of winterkills would likely increase.

Although variable, monitoring by the Corps identified that water temperatures often were 1° C or less within backwater areas. During the winter of 2002, weather conditions were so extreme that some backwater areas (Sunfish and No Name) were frozen from the water surface to the bottom.

E. Vegetation. Previous observations of aquatic vegetation by the IADNR on Sunfish Lake as a part of the LTRM have noted both submergent and emergent vegetation. Vegetation abundance has been identified as "sparse" to "dense." Plants potentially found in shallow areas include sago pondweed (*Potamogeton pectinatus*), coontail (*Certophyllum demersum*), elodea (*Elodea canadensis*), curly pondweed (*Potamogeton crispus*), floating-leaf pondweed (*Potamogeton natans*), lotus (*Nelumbo lutea*), water milfoil (*Myriophyllum verticillatum*), duckweed (*Lemna* sp.), and arrowhead (*Sagittaria latifolia*). In addition to aquatic vegetation, trees and woody debris supply additional cover in backwater areas.

Large areas of Pool 12 are wet floodplain forest lacking species and age diversity. The UMR floodplain forest is dominated by flood tolerant species such as silver maple (*Acer saccharinum*), and cottonwood (*Populus deltoides*). Other woody plants may include green ash (*Fraxinus pennsylvanica*), box elder (*Acer negundo*), elm (*Ulmus americana*), and willow (*Salix* sp.). Understory tree species include willow, silver maple, green ash, box elder, mulberry (*Morus* sp.) and hackberry (*Celtis occidentalis*).

Species diversity is limited by the availability of tree species capable of surviving UMR floods. Less flood tolerant species such as bur oak (*Quercus macrocarpa*), pin oak (*Quercus palustris*), swamp white oak (*Quercus bicolor*), shellbark hickory (*Carya laciniosa*), and pecan (*Carya illinoensis*) provide natural diversity on the floodplain. These species produce acorn and nuts (hard mast) that are important food sources for some wildlife. As is typical of Mississippi River floodplain forests, mast trees are found in Pool 12 on higher elevations or ridges within the floodplain. Floodplain forest conditions changed considerably with impoundment of the navigation pools. Artificially higher and stable water levels have increased inundation or saturation of the root zone reducing areas suitable for mast trees. Corps forest inventory data shows that of the 4,370 acres of forest in Pool 12, mast trees are dominant in stands totaling 122 acres and notable in stands totaling 1,374 acres. Many of the mast trees found in the floodplain today were alive and growing prior to impoundment of the navigation pool. There is virtually no natural regeneration of hard mast trees in the floodplain.

Land use conditions prior to impoundment, clearing during construction of the Nine-Foot Navigation Channel, and characteristics of the dominant species resulted in forest stands with even aged mature trees and little or no understory or seedling regeneration (Urich et al. 2002). These floodplain areas were naturally revegetated, in a narrow time frame, by shade intolerant species. Shade intolerant species often grow in even-aged, single-canopied stands. Such an even-aged community could collapse as the result of disease, providing substantial adverse effects to the UMRS ecosystem.

F. Fish and Wildlife. Fisheries sampling in Pool 12 backwater areas (Summer 2000) collected 56 different species. This is comparable to results from long-term sampling of backwaters in Pool 13 (1994 – 2002) that collected an average of 52 species per year. Species collected in Pool 12 include numerous minnow species (Cyprinidae), gizzard shad (*Dorosoma cepedianum*), brook silverside (*Labidesthes sicculus*), black crappie (*Pomoxis nigromaculatus*), white crappie (*Pomoxis annularis*), bluegill (*Lepomis macrochirus*), and largemouth bass (*Micropterus salmoides*) (Mike Steuck, IA DNR, pers. comm.).

Off-channel deep-water overwintering habitat in Pool 12 is limited and continues to degrade due to sedimentation. Backwater areas provide spawning and nursery habitat and are particularly important for the overwintering of many fish species. Pitlo (1992) suggested that the decline of deep backwater habitats might limit populations in the sunfish (Centrarchid) family. Species in this family include bluegill, largemouth bass, smallmouth bass, and white and black crappie. Decline of backwater habitat suitability can result in winter fish kills and negatively affect fish populations.

Pool 12 is an integral part of the Mississippi Flyway, a major migratory corridor for waterfowl, neotropical birds and many other avian species in the central United States. The area provides migration requirements in the fall and spring for species that spend the summer and winter in other parts of the continent. It has been estimated that 20 percent of all ducks in North America utilize the Upper Mississippi River.

More than 20 species of native freshwater mussel have been found in past surveys at various locations in Pool 12; however, no surveys have been conducted in the backwater areas. Substrates within the backwaters of the project area are largely soft clay sediments. Backwater habitats with soft substrates and low current velocities do not generally provide suitable habitat to support a diverse mussel community.

G. Endangered and Threatened Species. Four federally listed threatened or endangered species are listed for Dubuque and Jackson Counties, Iowa and Jo Daviess County, Illinois. The bald eagle (*Haliaeetus leucocephalus*) is recorded for both counties. Migrating bald eagles perch in trees throughout Pool 12. Three bald eagle nest sites are known to occur in the HREP study area. The Higgins' eye pearly mussel (*Lampsilis higginsii*) has been collected during surveys of main channel border habitats several miles downstream of the project area (Stanley 1987). However, this species is typically not found in backwater habitats dominated by fine sediments and reduced flows, and would unlikely be found within the project area. The Iowa Pleistocene snail (*Discus macclintockii*) and northern wild monkshood (*Aconitum noveborasence*) also are listed for the counties that border Pool 12. However, suitable habitat for these species (algific talus slopes and areas with cool soil conditions, respectively) is not found within the project area. The Indiana bat (*Myotis sodalis*) is listed as potentially occurring in Jo Daviess County, Illinois and suitable habitat exists in the floodplain forests of the study area.

Numerous State of Illinois threatened and endangered species may occur in the vicinity of the proposed project. The State-endangered ornate box turtle and State-threatened Blanding's turtle may utilize the area. The western hognose snake is a State-threatened species which may be found in the project area. State threatened and endangered mussels potentially occurring within this river reach include the Higgins' eye, spectacle case and butterfly mussels. The lake sturgeon, western sand darter, pallid shiner, bobcat, river otter, yellow-headed blackbird, and red-shouldered hawk are also listed for the county. State of Iowa threatened and endangered species that may occur in the vicinity of the project include the river otter and Higgins' eye pearly mussel.

H. Land Use and Management. The Corps of Engineers has primary administrative responsibility for approximately 4,900 acres of Federal land in Pool 12. Management of the majority of this area (approximately 4,425 acres) was subsequently outgranted to the Department of Interior, USFWS for fish and wildlife purposes under a Cooperative Agreement between the Department of the Interior, the USFWS, and the Corps, dated February 14, 1963 as amended on July 31, 2001. The

USFWS fee title and Cooperative Agreement lands within Pool 12 are managed collectively as part of the Savanna District of the Upper Mississippi River National Wildlife and Fish Refuge.

A number of recreational facilities exist in Pool 12. Approximately one mile above the Lock and Dam 12 berm on the Illinois shoreline is the Blanding Landing Public Use Area which includes a boat ramp. Two boat ramps are located on the Iowa shore below the project area, including one located at RM 559, and another at the Spruce Creek Public Use Area one-half mile upstream. The Galena Boat Club is located adjacent to No Name Lake off Harris Slough near RM 567. Massey Marina is located along the Iowa shore above the project area between RM 573 and 574. Additional facilities can be found further upstream near Dubuque, Iowa.

Although the project area does not contain large industry, such facilities can be found upstream near Dubuque between RM 578 and 581.

I. Hazardous, Toxic, and Radioactive Waste (HTRW). A Phase I Environmental Site Assessment (ESA) or Hazardous Toxic Radioactive Waste Documentation Report (HTRWDR) for the Pool 12 Overwintering HREP was completed in accordance with ER 1165-2-132, HTRW Guidance for Civil Works Projects, and ER 405-1-12, Real Estate Handbook. The Phase I ESA was performed in conformance with the scope and limitations of ASTM Standards E 1527-00 and E 1528-00. The information was obtained through site reconnaissance, informal interviews, a review of maps and aerial photographs, Corps records, and a search of federal and state environmental databases. These screening methods have been selected based on the particular nature of the ecosystem habitat project.

The assessment has revealed no evidence of HTRW, or other regulated contaminants ("recognized environmental conditions") in connection with the project sites at the Pool 12 Overwintering HREP. Please refer to Appendix E for an Executive Summary of the HTRWDR. The complete HTRWDR is on file at the Corps' Rock Island District office.

No ESA can wholly eliminate uncertainty regarding the existence of recognized environmental conditions concerning a property. This assessment is intended to reduce, but not eliminate, uncertainty regarding the existence of recognized environmental conditions in connection with a property with reasonable limits of time and cost. Continuing the Environmental Due Diligence Audit process beyond this Phase I ESA would not reduce uncertainty, nor reveal any unidentified environmental liabilities. If any previously un-addressed recognized environmental condition should arise, this Phase I ESA will be revisited.

J. Historic Properties. The Pool 12 project has no historic properties listed on or eligible for inclusion in the National Register of Historic Places. Appendix A includes Corps letters dated March 19, 2004 and April 20, 2004 to the Illinois State Historic Preservation Offices (SHPOs). The Illinois SHPO's reply of April 9, 2004 (IHPA Log #: 064032204) indicates concurrence with the findings of the archeological survey and the Corps determination of "no historic properties affected" by the Pool 12 undertaking. If the scope of the project should change, the Corps will coordinate any changes with the Illinois SHPO. In addition, if the execution of the project should uncover any item of archaeological, historical, or architectural interest, the Corps will ensure that reasonable efforts are taken to avoid or minimize harm to the property until its significance can be determined (36 CFR 800.11); the Corps will also comply with appropriate Federal and State laws should human remains be discovered.

K. Future Conditions Without Project. Without implementation of the Pool 12 Overwintering HREP, the overwintering habitat suitability of backwater areas and overall floodplain forest health are anticipated to decline. Continued sedimentation of backwaters is anticipated, which could limit deep-water, off-channel habitat in favor of backwaters with shallow open water and emergent vegetation.

Reduced depths would limit the suitability of backwaters as overwintering and year round habitat for fish in Pool 12. During cold winters with greater than average snowfall, DO conditions in the backwaters may drop below suitable levels. As sedimentation continues, low DO conditions are anticipated to occur more frequently. As DO drops, some fish may leave backwaters for the less suitable conditions of the main channel and side channels, which stresses the fish and likely reduces their overall fitness. Fish kills may occur as fish become trapped in the backwaters due to a combination of ice thickness and reduced depth of entrance/exit channels.

The Upper Mississippi River Conservation Committee (UMRCC) Wildlife Technical Section (Urich et al. 2002) outlined future conditions without active forest management. Forested areas may be converted to herbaceous vegetation as trees die-off if regeneration conditions are not ideal. Higher water levels in the lower and mid-pool areas may result in a gradual replacement of forest species with more flood tolerant herbaceous vegetation such as reed canary grass. Shade intolerant species such as cottonwood and willow may decline and shade tolerant species such as box elder and mulberry may increase. A continued reduction of mast-producing trees is also anticipated. Mast-producing trees and other tree species with a high habitat value may be replaced with less desirable floodplain trees and herbaceous vegetation.

A reduction in the floodplain forest would likely impact wildlife that depends on this habitat. Bald eagles, great blue herons, and cerulean warblers which favor taller trees such as cottonwood and swamp white oak would be negatively impacted if tall tree habitat continues to diminish (Urich et al. 2002). Resident and migratory songbirds that utilize the closed canopy forest would also be impacted.

III. PROJECT GOALS AND OBJECTIVES

A. Habitat Problems and Opportunities. The backwaters and floodplain forests of Pool 12 have been negatively affected by impoundment and continued sedimentation. Sedimentation has reduced backwater depths thus reducing the suitability of these areas as year-round and overwintering habitat for fish. The floodplain forests consist of even-aged stands dominated by silver maple and cottonwood with little species diversity. Mast-producing trees, which provide an important food source for wildlife, are limited and there is no natural regeneration. The lack of age and species diversity would continue to negatively impact birds and other wildlife.

Significant opportunities are available to restore deep off-channel habitat by excavating backwater areas. Excavated material can be used to raise existing islands to create areas suitable for the establishment of mast-producing trees. This would restore diversity to the floodplain forests. Restoration of backwaters and floodplain forests would restore important fish and wildlife habitat.

B. Resource Significance. Backwater habitats on the UMR are a significant resource. In 1986, Congress designated the Upper Mississippi River System as both a nationally significant ecosystem and a nationally significant navigation system. The National Research Council's Committee on Restoration of Aquatic Ecosystems recently targeted the Upper Mississippi River and the Illinois River for restoration as two of only three large river-floodplain ecosystems so designated. The UMRCC, made up of UMR resource professionals, is a strong advocate for habitat restoration on the river. The Upper Mississippi River Basin Association is also an advocate for restoration of habitat on the Upper Mississippi River. The UMRCC recognized the importance of the floodplain forest to the fish and wildlife of the Upper Mississippi River in the report "Upper Mississippi and Illinois River Floodplain Forests" (Urich et al., 2002). The report describes the habitat significance of the forest, describes the changes in the floodplain forests, and recommends management actions to restore the species, age, and structural diversity of the forest. Knutson et al. (1996) described the importance of floodplain forest in the conservation and management of neotropical migratory birds. The Upper Mississippi River floodplain forest is dominated by flood tolerant species such as silver maple, cottonwood, and green ash.

Pool 12 is part of the Upper Mississippi River National Wildlife and Fish Refuge. Refuge objectives include maintaining and enhancing the habitat of fish and other aquatic life on the Upper Mississippi River (USFWS 1987).

The public recognizes the Upper Mississippi River, including Pool 12, as a nationally, regionally, and locally significant resource. American Rivers, a non-governmental organization dedicated to protecting and restoring healthy, natural rivers, listed the Mississippi River in America's Top Ten Endangered Rivers for 2004. Regional groups also recognize the importance of backwater habitats and floodplain forests. The public recognizes the backwaters and side channels of Pool 12 as a locally and regionally important recreational fishery.

The Fish and Wildlife Interagency Committee (FWIC), a committee of state and federal natural resource specialists that work on Pools 11-22, is developing Environmental Pool Plans to address navigation and restoration needs. The FWIC has identified numerous backwater complexes in Pool 12 as priority areas in need of habitat restoration. These areas were identified as priority areas for restoration as part of the Upper Mississippi River-Illinois Waterway System Navigation Study (DeHaan et al. 2003).

Fisheries biologists recognize the importance of off-channel deepwater habitat to overwintering and year-round habitat to fish. Fisheries biologist have identified overwintering habitat as a limiting factor for centrarchid populations (Bodensteiner and Lewis, 1992 and 1994, Gent et al. 1995, Sheehan et al. 2000a and 2000b) and are continuing research on winter habitat selection of centrarchid fishes (Pitlo pers com.).

C. Land Use Management Goals. The USFWS manages lands in Pool 12 in accordance with the Upper Mississippi River National Wildlife and Fish Refuge Master Plan (USFWS 1987). A few of the many goals and objectives in the master plan relate closely to the problems described above. One goal is to "Conserve and enhance the habitats of fish and other aquatic plant and animal life" by "maintaining and enhancing, in cooperation with the states, the habitat of fish and other aquatic life on the Upper Mississippi River." The Corps maintains forest management responsibilities for land in the project area. Corps forest management goals are described in Mississippi River Project Operational Management Plan (U.S. Army Corps of Engineers 1990). The basic goal is to manage project lands to provide natural resource benefits to the public by perpetuating a diversity of ecological communities that are suitable for a variety of public purposes. Additional goals include "Sustain the integrity of the Mississippi River forested riverine ecosystem" and "Manage forested habitat to protect and enhance biodiversity."

D. 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 facilitate operations and maintenance and 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 (CERCLA), to reduce any threats to project workers, and to avoid costly delays associated with environmental abatement activities.

E. Project Goals, Objectives, and Potential Project Features. Based on the identified problems affecting the significant natural resources and considering the fish and wildlife management goals of the cooperating agencies, the following goals, objectives, and potential project features have been developed for the project (table 3-1).

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

Goal	Objectives	Potential Project Features
Restore and Protect Off-Channel Aquatic Habitat	Create off-channel deep-water areas to provide overwintering and year-round habitat for fish Maintain and increase depth diversity in backwaters	Excavate channels in backwater areas Construct deflection berms, higher-level terraces, and/or islands from dredged material.
Restore Floodplain Forest Habitat	Increase forest stands with hard mast-producing trees as a dominant or component species Create areas within the pool with sufficient elevation to support regeneration of hard mast-producing trees	Establish native mast-producing trees on created high elevation areas. Create areas with elevations above the 2-year flood recurrence

The primary goals identified were to (1) restore and protect off-channel aquatic habitat and (2) restore floodplain forest habitat. The objectives included (1) creating off-channel deep-water areas to provide overwintering and year-round habitat for fish; (2) maintaining and increasing depth diversity in backwaters; (3) increasing forest stands with hard mast-producing trees such as oak and hickory as a dominant or component species; and (4) creating areas within the pool with sufficient elevation to support regeneration of hard mast-producing trees.

The potential project features listed in table 3-1 are described below. Channels would be excavated in the backwater areas to create deep-water and year-round habitat for fish. Berms would be constructed with the dredged material to deflect sediment from depositing in the excavated channels. Berms built to sufficient elevation would be inundated less frequently. Mast-producing trees which are less tolerant of flooding would be established on the berms. Some berms would be high enough to support natural regeneration of mast-producing trees thus establishing a sustainable mast component to the floodplain forest.

F. Criteria for Potential Enhancement Features. Following are specific criteria for some of the potential enhancement features.

Excavate channels in backwaters. Channels should be excavated to a depth of 8 feet below flat pool elevations to accommodate settling following construction and sedimentation over the 50-year project life. General characteristics of suitable overwintering sites include off-channel areas that do not freeze to the bottom, have suitable D.O. levels, slightly warmer waters, and protection from the current (Bodensteiner and Lewis, 1992 and 1994; Sheehan et al., 2000a and 2000b). As stated previously, ideal overwintering areas maintain dissolved oxygen levels of 5 parts per million, have water temperatures near 4° C, and have little to no current velocity (Palesh and Anderson, 1990). Backwater depths of 4 feet or greater should help attain suitable water quality conditions.

Construct deflection berms/create areas with higher elevation. To support regeneration of hard mast-producing trees, terrestrial berms should be constructed to higher elevations with reduced flooding frequency. Berms should be constructed to equal or exceed the target elevations shown in table 3-2 which are approximately the 2-year flood recurrence. Target elevations increase upstream with the water profile of the navigation pool. Elevations one to two feet lower than those shown in table 3-2 would likely support mast-producing trees, but would be less likely to support natural regeneration of mast-producing trees.

Table 3-2. Target Minimum Elevation for Terrestrial Berms by River Mile (uses 2-year Recurrence Interval from Flow Frequency Study) [1]

River Mile	Target Elevation (1912 MSL Datum)
RM 564	596.3 ft
RM 566	596.8 ft
RM 568	597.4 ft
RM 570	598.0 ft
RM 572	598.5 ft

Establish hard mast-producing tree. Native hard mast-producing trees that would have historically been found in the bottomland forest should be planted including the following species: swamp white oak, pin oak, bur oak, pecan, and shellbark hickory.

[1] US Army Corps of Engineers (USACE). 2004. Upper Mississippi River System Flow Frequency Study: Final Report. Prepared by the Rock Island, St. Louis, St. Paul, Omaha, and Kansas City Districts, US Army Corps of Engineers. January 2004.

IV. POTENTIAL PROJECT FEATURES AND PROJECT SITES

This section describes and assesses a preliminary number of potential enhancement features and sites that meet the goals and objectives described in Section 3. Potential project features were determined based on their contribution to the project goals and objectives, engineering considerations, and local restrictions or constraints. Features that were not recommended were not subject to further evaluation. A variety of backwater sites were then considered for implementing each of the feasible project features. Feasible features at selected backwater sites were developed into project alternatives in Section 5. The backwater areas and their features that were not considered feasible are shown on Plates 11 and 12. Feasible features are shown on Plates 2 through 10. For planning purposes, the project life was established as 50 years.

A. Potential Project Features

1. Dredging. Shallow water depths are found throughout the project area. Dredging a system of channels can restore backwater habitat to desired depths, thus restoring habitat conditions. This feature also would provide material for construction of other potential features such as deflection berms and elevated areas for mast-producing trees. Dredging is necessary for the construction equipment to access the selected backwater areas.

a. Hydraulic Versus Mechanical Dredging. Dredging could be accomplished using mechanical and/or hydraulic techniques. Mechanical dredging would allow adjacent placement to build deflection berms, which would protect the dredged channels, or to create areas of raised topography to enhance the environment. In a few of the areas, adjacent placement is not desirable. Tippy Lake, shown on Plate 7 and discussed below, is an example. This would require finding a suitable containment area for hydraulically dredged material, or double handling mechanically-dredged material to move it to an acceptable location.

b. Channel Dimensions. Channel depth and bottom width is based on reasonable assumptions concerning constructability, environmental need, and longevity. A desirable depth is 4 feet or greater below flat pool elevation of 592 feet MSL. This provides enough water under the winter ice cover for overwintering fish. The channel shall be excavated to 8 feet below flat pool to maintain suitable depths through the 50-year project life and allow 4 feet of sedimentation before project performance becomes degraded. Channels could be excavated deeper than 8 feet below flat pool; however, there is a limit to cost effectiveness. Over-dredging eventually becomes less effective with added depth because the deeper excavations tend to silt in faster than the more shallow excavations. It is difficult to quantitatively predict how sediment deposition rates vary with channel depths, and therefore it was assumed that 2 feet of over excavation is a cost-effective alternative and is consistent with other projects. A channel bottom width of 60 feet was selected to provide adequate fish habitat. Channel side slopes are a geotechnical design consideration in terms of channel stability. For this project, it was estimated at 3 horizontal to 1 vertical.

c. Channel Location. Channel location and orientation are based on the existing underwater topography, backwater flow patterns, and the reach capabilities of the dredge if the material is being mechanically placed. Most of the mechanically placed dredged material is placed to direct flows and reduce channel sedimentation. In some areas, the material placement would concentrate the flow so that the current velocities increase and maintain the channel depth. In other areas, the material placement is designed to protect the channels from flood flows that carry large sediment loads or to protect the channels from wave wash induced sediments that can scour from the shallow river bottom and move across the lakebed into the channels. Channels were located within reach of the banks or deflection berms to minimize handling costs.

2. Containment Areas. To the extent possible, dredged material would be utilized to the benefit of the project. This would include the deflection berms and raised topography discussed above. In some instances, however, construction of these types of structures is not desirable. Due to construction issues, cost issues, and sensitive habitat areas that should be avoided, some areas do not lend themselves to these beneficial uses. In preparation of this study, various containment alternatives were studied and include upland placement alternatives, hydraulic containment within the floodplain, low-level containment on existing islands, and high solids dredging as discussed below. The mechanical dredging with both adjacent placement and double handling is addressed in the berms discussion.

a. Upland Placement. Placing dredged material in an upland location out of the floodplain could be accomplished using hydraulic dredging equipment. This would require installing a discharge line through culverts under the railroad, up the steep bluffs and onto privately owned farm fields. It would be costly to pump the material up to the bluff and difficult to find a suitable return water route. The farm fields near the top of the bluff are relatively small and may not provide sufficient space for the material. This alternative would require a cost-share sponsor for land acquisition and site preparation. The ILDNR was not willing to cost-share this alternative. Due to the increased costs, lack of a cost-share sponsor, time requirements, and beneficial use of the material in the floodplain for berm construction, upland placement was not further pursued.

b. Hydraulic Containment within the floodplain. Constructing relatively large containment areas within the backwaters of Pool 12 would avoid the costs of pumping material to the top of the bluff on private property. The containment areas could be converted to “perched” wetlands. A containment ring could be constructed using mechanical dredging and utilizing existing natural features as much as possible. These alternatives were considered and are shown near the lower part of Sunfish Lake, at two different areas within the Kehough Slough area, and in the upper portion of Hires Lake (plates 11 and 12). Once containment areas are constructed, hydraulic dredging is a cost-effective alternative to constructing the fish channels. The disadvantage to these alternatives is that the containment areas replace open water areas or emergent wetland areas. The multi-agency study team determined that replacing the open water or existing wetland with the large containment areas was not desirable and should not be pursued. These areas were dropped from further consideration.

c. Low-level Containment Areas. Dredged material could be placed in a low-level containment area. The containment area would consist of a ring of straw bales staked into the ground to contain a relatively small amount of hydraulically dredged material – varying in depth from 6 inches to 2 feet. The straw bales could be reinforced with silt fence or geotextile fabric, but this is not anticipated. The straw bales would effectively filter the runoff from the containment area. The remaining dredged material would raise the existing ground level by a small amount. The higher elevation could potentially allow more diverse plant species, including mast-producing trees, to populate the area. Some of the existing trees could die as a result of the material placement; however, many trees may also survive the shallow material placement. The dead trees would help diversify the existing monotypic stand of trees and provide a different type of terrestrial habitat. The straw bales would not adversely affect the environment and may be left in place.

Low-level containment areas were recommended at Fishtrap Lake and north of No Name Lake. The Fishtrap Lake containment area was initially reduced in size due to the presence of existing oak seedlings starting to emerge. During a subsequent site visit, it was eliminated for the same reason. The site shown north of No Name Lake should have sufficient capacity to allow No Name Lake to be dredged with a hydraulic dredge.

Higher levels of containment were also considered in these areas but not recommended. While stacking material higher would reduce the footprint of the containment area, all existing vegetation would likely be killed. The higher containment would be constructed with an earth berm or potentially staking straw bales in a pyramid or by using the very large, heavy bales. Constructing earth berms was ruled out to avoid the required clearing and grubbing associated with this alternative. The heavy straw bales or pyramid shaped smaller bales were ruled out due to the expense of placing them and unknown strength characteristics of designing and working with straw bales.

d. Rock Enclosure Containment Area. The entrance channel to Harris Slough is shallow and may require dredging to access Fishtrap Lake, No Name Lake, and Kehough Slough. Currently, a small area along the left descending bank of the entrance channel is rimmed with rocks in order to protect the entrance and prevent siltation. However, the rock area is fairly low, allowing frequent sediment-laden water to flow over the top of them and causing silt to drop out into the entrance channel. The dredged material from the entrance channel could be used to create an elevated area within the rock enclosure. The material would be reinforced with stone to prevent erosion.

3. Berms. Berms would provide a means to beneficially utilize dredged materials removed from backwater sites and would be of two general types; either aquatic deflection berms or terrestrial berms for mast-tree establishment. Deflection berms created in aquatic areas would not be high enough to support mast-producing trees. However, such berms would help to divert flow and sediments away from backwater habitats, potentially extending the project life of dredged areas. Terrestrial berms would be created on land to a minimum top elevation shown in table 3-2 in order to plant desirable mast tree species. This would assist in increasing bottomland forest diversity and value to wildlife habitat.

4. Mast Tree Establishment. Placement of dredged material to an elevation such that after consolidation of the material the elevation is high enough to mimic pre-impoundment ridges provides an opportunity to add tree diversity to Pool 12. Mast tree establishment would include local seed gathering, growing seed to desired planting stock size, planting trees, and maintaining trees. Candidate species for planting include swamp white oak, bur oak, pin oak, shellbark hickory, and pecan. Three common methods of planting are direct seeding, seedling planting, and large stock seedling planting. Due to the inherit risk of failure of any planting from unpredictable flooding - large stock seedling planting offers the best chance for success.

B. Potential Project Sites to Implement Feasible Project Features. Feasible project features from above were combined into a single restoration measure for each backwater site under consideration. Numerous meetings with the project team were conducted to find the most desired location and magnitude of project features for each individual site. Considerations during this process included existing habitat conditions at and near each backwater site; location, magnitude and expense of various dredging options; optimal area for each backwater site; volume, beneficial use and remaining dredged material placement; location of deflection berms and raised topography; and location of other sites for dredged material placement. The project team ultimately reached a consensus for each site and its features. The potential sites considered were; Sunfish Lake, Fishtrap Lake, No Name Lake, Kehough Slough, Hires Lake, Tippy Lake and Stone Lake. The individual sites and project features are discussed below, with the various combinations of proposed sites discussed thereafter.

1. Sunfish Lake (RM 564). Backwater restoration at Sunfish Lake would involve dredging and constructing a series of deflection and terrestrial berms. Various configurations of dredging were considered based on recommendations (plates 2, 3 and 11). Construction of a containment area with an emergent wetland was considered, but was not further pursued because of existing fish use in the proposed containment area. Therefore, all dredged material would be utilized to construct berms at Sunfish Lake. The top of the land-based berms would be planted with mast-producing trees.

2. Fishtrap Lake (RM 566). Backwater restoration at Fishtrap Lake would involve dredging and constructing a series of deflection and terrestrial berms. Various configurations of dredging were considered (plates 4 and 11). In addition to the berms, it was considered to place some material within a containment facility on the wooded area along the northwest edge of the lake, outlined on Plate 11. However, this site was dropped from further consideration because it was discovered that the site has existing areas of raised topography with desirable trees such as pin oak, swamp white oak, hickory, and locust. Therefore, the dredged material would be side cast onto both sides of the peninsula in order to raise the topography and widen this area. The terrestrial berms would be planted with mast-producing trees.

3. No Name Lake (RM 566.5). Backwater restoration at No Name Lake would involve dredging. Various configurations of dredging were considered (plates 5 and 11). Extending the channel to the north end of No Name Lake was first considered. The material would have been hydraulically dredged and placed in a portion of the lake or mechanically dredged and used for island construction to diversify the habitat and topography. These alternatives were not recommended because the emergent wetland provides suitable duck habitat. Excavation of a shorter channel to the northwest was also considered. Excavated dredged material would be placed within a low-level hydraulic placement facility on the northwest of the lake, adjacent to Kehough Slough or double-handled and placed mechanically at an alternate location, such as along the islands at Kehough Slough.

4. Kehough Slough (RM 567.5). Backwater restoration at Kehough Slough would involve mechanical dredging and construction of a series of deflection and terrestrial berms. Various configurations of dredging were considered (plates 6 and 12). The terrestrial berms would be planted with mast-producing trees. In addition to the berms, excess material could be placed within the low-level hydraulic placement facility on the southeast edge of the lake, the same area where material from No Name Lake would be placed.

Instead of building the deflection berms or placing the material in the low-level containment area, creating a relatively large containment area in the open water of Kehough Slough was considered as shown on Plate 12. The containment area could be built with a mechanical excavator. The interior of the containment would be filled with dredged material, creating a "perched" wetland. This containment alternative and hydraulic dredging was not selected because it covers up open backwater area.

5. Hires Lake (RM 571). Backwater restoration at Hires Lake would involve hydraulically dredging channels throughout the lake. Dredged material would be confined by existing banklines and islands. To maintain State of Illinois water quality standards for turbidity during placement of material, existing channels would be closed with berms or silt fence. Material could then be pumped into the lake to build low-level islands. . The resulting emergent wetland would be suitable habitat for migrating waterfowl and other wildlife. Placement of dredged material in this location was not further pursued due to concerns regarding loss of existing open water. No other suitable placement sites were identified.

Access channels to Hires Lake are very narrow, making it difficult to access with dredging equipment. While the site could be accessed by cutting through existing islands, this was not recommended. Backwater restoration of Hires Lake was not considered further due to access concerns and lack of an acceptable placement site.

6. Tippy Lake (RM 571). Backwater restoration at Tippy Lake would involve hydraulic and mechanical dredging and construction of a series of berms. Various configurations of dredging were considered (plates 7 and 12). Adjacent placement is not desirable because the existing backwater is fairly narrow and the existing stand of trees is environmentally significant and should not be disturbed. Therefore, some dredged material would be double handled and placed within a low-level containment site on the south edge of the lake. Another contractor option would be to construct a containment area for hydraulic dredging. One side of the placement site could utilize the flow deflection berm as a barrier. The material could be re-shaped to allow for increased elevations within areas of placement for planting of desirable mast-producing trees. A small wingdam exists across the entrance channel to Tippy Lake, which would be removed to allow the dredge access to the backwater area.

7. Stone Lake (RM 572). Backwater restoration at Stone Lake would involve dredging and constructing a series of berms. Various configurations of dredging were considered (plates 8 and 12). Dredged material would be utilized to construct berms on existing land. The top of these land-based berms would be planted with mast-producing trees. A rock deflection berm and a rock closure structure were considered to divert sediment away from the upstream end of Stone Lake. However, the cost and required coordination to obtain right-of-way from the railroad was compared to the potential benefit of constructing the structure. The study team decided not to pursue this further. Another flow diversion structure near the entrance was considered. After hydraulic modeling, this structure was modified as shown on Plate 8 to help keep the entrance open longer.

V. FORMULATION AND EVALUATION OF FEASIBLE PROJECT ALTERNATIVES

This section describes the sites and the features chosen for that site which met the goals and objectives of this project. Each feature was evaluated to determine its potential for environmental restoration and enhancement. Costs also were derived for all feasible project sites.

A. Feasible Project Sites and Their Features. Plates 2 through 8 show the locations of all feasible project sites and their features as described below. Table 5-1 summarizes the outputs and costs associated with each backwater site. The final dredging configuration for each site that was chosen by the project team was evaluated.

1. Sunfish Lake. Backwater restoration at Sunfish Lake involves dredging and constructing a series of deflection berms to deflect external sediments from entering the site (plates 2 and 3). Sunfish Lake would include dredge cuts of 13,850 linear feet. Dredge cuts would have a bottom width of 60 feet, with dredging performed to a depth of 584 ft MSL, 8 feet below flat pool elevation. All dredged material would be utilized to construct deflection berms on land as well as within water. Deflection berms within the water would be constructed to an elevation near flat pool elevation (592 ft MSL). Deflection berms on land would be made to a minimum elevation of 596.3 ft MSL. The top of these land-based berms would be planted with mast-producing trees.

2. Fishtrap Lake. Backwater restoration at Fishtrap Lake involves dredging and constructing a series of deflection berms to prevent external sediments from entering the site (plate 4). Fishtrap Lake would include dredge cuts of 9,720 feet. Dredge cuts would have a bottom width of 60 feet, with dredging performed to a depth of 584 ft MSL. The majority of dredged material would be utilized to construct deflection berms on land as well as within water. Deflection berms within the water would be constructed to an elevation near flat pool elevation (592 ft MSL). Deflection berms on land would be made to an elevation of 596.8 ft MSL.

3. No Name Lake. Backwater restoration at No Name Lake involves dredging (plate 5). Deflection berms would not be constructed at No Name Lake. No Name Lake would include dredge cuts of about 650 feet. Dredge cuts would have a bottom width of 60 feet, with dredging performed to a depth of 584 ft MSL, eight feet below flat pool elevation. Dredged material could be placed within a 13.7-acre low-level hydraulic placement facility on the northwest of the lake. Dredged material from No Name Lake could also be placed on the berms at Kehough Slough.

4. Kehough Slough. Backwater restoration at Kehough Slough involves dredging and constructing a series of deflection berms to deflect external sediments from entering the site (plate 6). Kehough Slough would include dredge cuts of about 3,760 feet. Dredge cuts would have a bottom width of 60 feet, with dredging performed to a depth of 584 ft MSL. The majority of dredged material would be utilized to construct deflection berms on both land and potentially within water. Deflection berms within the water would be constructed to an elevation near flat pool elevation (592 ft MSL). Deflection berms on land would be made to an elevation of 597 ft MSL. In addition to deflection berms, some material could be placed within the 13.7-acre low-level hydraulic placement facility on the southeast edge of the slough, the same area where material from No Name would be placed. The deflection berms would be planted with mast-producing trees.

5. Tippy Lake. Backwater restoration at Tippy Lake involves dredging and constructing a series of deflection berms to deflect external sediments from entering the site (plate 7). Tippy Lake would include dredge cuts of about 5,730 feet. Dredge cuts would have a bottom width of 60 feet, with dredging performed to a depth of 584 ft MSL. The majority of dredged material would be utilized to construct deflection berms on both land and potentially within water. Deflection berms within the water would be constructed to an elevation near flat pool elevation (592 ft MSL). Deflection berms on land would be made to an elevation of 598.3 ft MSL. In addition to deflection berms, some material would be placed within a 10-acre placement facility on the southwest edge of the lake. This material would be re-shaped to allow for increased elevations within areas of placement to allow for planting of desirable trees.

6. Stone Lake. Backwater restoration at Stone Lake involves dredging and constructing a series of deflection berms to deflect external sediments from entering the site (plate 8). Stone Lake would include dredge cuts of about 6,430 feet. Dredge cuts would have a bottom width of 60 feet, with dredging performed to a depth of 584 ft MSL. All dredged material would be utilized to construct deflection berms. Deflection berms on land would be made to an elevation of 598.5 ft MSL. The top of these land-based berms would be planted with mast-producing trees. In addition, a rock deflection berm is proposed to divert sediment away from the entrance to the Stone Lake backwater area. The rock berm should aid to extend the project life at Stone Lake.

B. Formulation of Project Alternatives. Restoration activities at the identified project sites would benefit not only the individual footprint areas, but also would have a systemic benefit within Pool 12. Because of the range of potential benefits and project costs that may be associated with various combinations of backwater sites, a range of combinations to compare project costs with potential resulting ecological benefits were evaluated. Fishtrap and No Name Lakes were combined into one project to reduce the number of potential combinations. This is also appropriate due to their close proximity, and the fact these two sites may share similar dredged material placement areas. By combining Fishtrap and No Name lakes, the number of backwater sites was reduced from six to five. A total of 31 project alternatives were developed from all possible combinations of the five sites (table 5-1). It was assumed that all five sites were combinable with each other, with no dependencies of one site upon another.

Evaluation of alternatives was accomplished through comparison of environmental benefits and associated costs. The evaluation is a three-step procedure: (1) calculate the environmental outputs of each alternative; (2) estimate costs for each alternative; and (3) compare the alternatives to evaluate the best overall project alternative based on habitat benefits and associated cost. While cost and environmental outputs must be considered, other factors such as the ability to construct, schedule, likelihood to achieve projected results, incalculable environmental benefits, professional opinion, local support, and ancillary benefits are very important in deciding the preferred alternative.

C. Environmental Output Evaluation. This project would produce environmental benefits in two main areas: site-specific overwintering benefits for each individual backwater and systemic overwintering benefits for Pool 12. Site-specific overwintering benefits and systemic overwintering benefits were quantified and these output units were used to compare project alternatives. A detailed discussion of these environmental analyses, including discussion on methodology and results, can be found in Appendix D.

1. Site-Specific Overwintering Benefits. The project would improve aquatic habitats at each individual backwater site. Increasing backwater depths and improving water quality would promote and improve the aquatic environment and associated fisheries communities. The project also would improve the floodplain forest community within areas of raised topography. Raised areas would be planted with hard mast-producing trees.

A complete description of the methodology used to quantify site-specific benefits has been included in appendix D and will only be discussed here briefly. Habitat Evaluation Procedures (HEP) were utilized to evaluate potential site-specific benefits of project alternatives. Participants for this analysis included biologists from the Corps, the USFWS, the IADNR, and the ILDNR. HEP can be used to evaluate the quality and quantity of particular habitats for certain species. The qualitative component is known as the Habitat Suitability Index (HSI) for key indicator species and is rated on a scale of 0.0 to 1.0. The quantitative component is the measure of acres of habitat that is available for the selected 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.

The proposed project alternatives would affect the value of backwater habitats within the project area. Changes in HUs would occur as habitat matures and is influenced over time by river conditions. These changes influence the values derived over the life of the project. To help identify general habitat changes over time HUs are averaged over the life of the project (50 years). This determines what is known as the Average Annual Habitat Units (AAHUs). AAHUs are used to estimate site-specific changes of all alternatives, including the No Action alternative.

HSI models were reviewed to identify appropriate models that could quantify habitat changes as a result of project alternatives. Following this review, it was decided that a general HSI model of Centrarchid Overwintering would be utilized. This model was based on the bluegill overwintering model by Palesh and Anderson (1990), and was modified by the project team to be representative of general centrarchid habitat (Appendix D). In addition to these overwintering benefits, other year-round site-specific benefits would be realized at these sites. These year-round benefits were coarsely evaluated by analyzing a representative site (Sunfish Lake) with the use of the Bluegill HSI model (Stuber et al., 1982).

The proposed project also would have benefits to the floodplain forest community through tree planting of berm areas. These benefits will be discussed qualitatively in terms of acres of improved habitat. These benefits will not be carried forward with a HEP-type analysis because these benefits are relatively small compared to the benefits of backwater habitats.

2. Systemic Overwintering Benefits. The project alternatives would benefit fish populations not only within individual sites, but systemically within Pool 12 as well. Centrarchid species, as well as other fish taxons, rely on off-channel backwater habitat for use during winter conditions. Radio telemetry studies performed by IADNR in Pool 12 and other adjacent pools have documented that centrarchids migrate varying distances to overwinter at known sites, and that sites have been utilized year after year by individual fish. Migration distances vary, but previous studies by IADNR (Pitlo 1992) found that largemouth bass might typically migrate 5 miles to reach overwintering sites. Additional radio telemetry work supported by the Corps during the winter of 2002 identified that bluegills, black crappies and white crappies typically migrated distances of 3 miles to reach overwintering habitat in Pool 12 (Pitlo, per comm.). Inferences from these data sets indicate that suitable backwater overwintering areas need to be spaced within a pool relatively close to one another to be effective.

To identify potential systemic benefits, the area of aquatic habitat within a 3-mile radius of proposed backwaters was determined. This was used to calculate the amount of aquatic habitat that could benefit from restoration at a specific backwater. Overlapping areas from multiple backwaters were not "double counted." A complete description of the methodology used to quantify systemic benefits has been included in Appendix D.

This approach quantifies the amount of aquatic habitat that could benefit from a potential project at a given backwater. However, the systemic analysis does not answer the ultimate question of "how much" backwater overwintering habitat is "needed" within a given area. Unfortunately, the understanding of cause-effect relationships between habitat and UMR fish populations is not yet strong enough to identify how much overwintering habitat is necessary to support an identified centrarchid population level. However, this approach provides some insight into how much physical area may benefit from a proposed alternative; and how backwater sites may need to be spaced to maximize potential benefits.

3. Year-round Aquatic and Floodplain Forest Benefits. In addition to the benefits discussed above, the proposed project also would provide additional year-round benefits to aquatic backwater habitat, as well as providing benefits to the floodplain forest community. These benefits, while valuable, are not included in the detailed cost/benefit evaluation, discussed below, for multiple reasons. First, suitable habitat typically utilized during spring, summer and fall is probably more abundant than wintering habitat in the project area, and may be less critical to fish populations. In addition, for floodplain forest enhancement, the realized benefits would be small in terms of acreage, relative to backwater lake habitat. Discussing these two benefits qualitatively allows for a more simplified analysis while still discussing important habitat values resulting from the project. The results of these brief analyses are discussed below, with a detailed discussion of resulting improvements in year-round aquatic and floodplain forest habitat included in Appendix D.

Year-round benefits to fish were assessed by modeling baseline and future conditions with- and without project in Sunfish Lake. The results of this analysis were then extrapolated to estimate potential changes to other potential sites. This assessment indicated that the proposed feature (backwater dredging) could potentially increase year-round habitat suitability by 10 to 20 percent, over the No Action alternative, at each affected site over the next 50 years.

For floodplain forest habitat, it was assumed that acres of elevated berm would be planted to desirable hard mast-producing trees. For this discussion, beneficial changes were identified simply in terms of acres of habitat converted to desirable forest habitat. Acreage is calculated based on the top area of the berm likely to support mast-producing trees. In short, the project would improve anywhere from less than one to about five acres of adjacent floodplain forest habitat per individual backwater lake (Appendix D).

4. Additional Habitat Changes. In addition to the benefits discussed above, the proposed project also would result in other changed habitat conditions within the project area. The berms would include a footprint area of about 47 acres of terrestrial habitat, and 29 acres of aquatic habitat. Berms placed in aquatic habitat would generally remain below the water surface, and thus the area would remain aquatic. The aquatic berms would likely become vegetated with emergent and submergent vegetation due to the increased shallowness of the area. Conversely, berms placed on terrestrial habitat would include almost 16 acres planted with mast-producing trees. The remaining 31 acres would include a graded elevation from near flatpool elevation up to the top of the berm. Such graded areas would provide the topographical diversity sought by resource managers. Following initial disturbance during placement, these areas would become revegetated within a few years. Discussion of these changes is also included in Appendix D.

D. Cost Estimates for Habitat Improvement Measures. Table 5-1 shows an estimated cost of project alternatives. A more detailed breakdown of costs is outlined in Section 8, *Cost Estimates.* The cost estimates were prepared to May 2004 price levels and include construction; planning, engineering and design; and construction management. Project features are on Federal land. Consequently, there are no lands and damages and relocations costs. Total project costs were annualized based on the Fiscal Year 2004 discount rate of 5.625 percent and a 50-year project life.

Table 5-1. Environmental Outputs and Cost of Project Alternatives

Alternatives		No. Sites	Systemic Benefits (acres) [1]	Combined Net Increase AAHUs [2]	Total Cost	Average Annual Cost [3]
1	Sunfish	1	3,904	41	$3,873,000	$232,955
2	No Name-Fishtrap[4]	2	2,757	26	$2,020,000	$121,500
3	Kehough	1	2,918	13	$ 911,000	$ 54,795
4	Tippy	1	2,891	13	$1,017,000	$ 61,171
5	Stone	1	2,714	16	$1,553,000	$ 93,410
6	Tippy, Kehough	2	4,501	26	$1,928,000	$115,966
7	Stone, Kehough	2	4,648	29	$2,464,000	$148,206
8	Stone, Tippy	2	3,038	30	$2,570,000	$154,581
9	Tippy, No Name-Fishtrap	3	5,052	40	$3,037,000	$182,671
10	Stone, No Name-Fishtrap	3	5,199	42	$3,573,000	$214,910
11	Tippy, Sunfish	2	6,795	54	$4,854,000	$291,960
12	Stone, Sunfish	2	6,618	57	$5,390,000	$324,200
13	Sunfish, No Name-Fishtrap[4]	3	4,500	67	$5,857,000	$352,289
14	Sunfish, Kehough	2	5,212	53	$4,748,000	$285,585
15	No Name-Fishtrap, Kehough	3	3,469	39	$2,931,000	$176,295
16	Stone, Tippy, Kehough	3	4,648	42	$3,481,000	$209,377
17	Tippy, Kehough, No Name-Fishtrap	4	5,052	52	$3,948,000	$237,466
18	Stone, Kehough, No Name-Fishtrap	4	5,199	55	$4,484,000	$269,705
19	Stone, Tippy, No Name-Fishtrap	4	5,199	56	$4,590,000	$276,081
20	Tippy, Kehough, Sunfish	3	6,795	67	$5,651,000	$346,756
21	Stone, Kehough, Sunfish	3	6,942	70	$6,301,000	$378,995
22	Kehough, No Name-Fishtrap, Sunfish	4	5,212	80	$6,768,000	$407,084
23	Stone, Tippy, Sunfish	3	6,942	70	$6,407,000	$385,371
24	Tippy, No Name-Fishtrap, Sunfish	4	6,795	81	$6,874,000	$413,460
25	Stone, No Name-Fishtrap, Sunfish	4	6,942	83	$7,410,000	$445,700
26	Stone, Tippy, Kehough, and No Name-Fishtrap	5	5,199	69	$5,501,000	$330,876
27	Stone, Tippy, Kehough, Sunfish	4	6,942	83	$7,318,000	$440,166
28	Tippy, Kehough, No Name-Fishtrap, Sunfish	5	6,795	93	$7,785,000	$468,255
29	Stone, Kehough, No Name-Fishtrap, Sunfish	5	6,942	96	$8,321,000	$500,495
30	Stone, Tippy, No Name-Fishtrap, Sunfish	5	6,942	97	$8,427,000	$506,871
31	Stone, Tippy, Kehough, No Name-Fishtrap, Sunfish	6	6,942	109	$9,338,000	$561,666

[1] Systemic benefits are the combined total aquatic habitat within 3 miles of the identified backwaters.
[2] Average Annual Habitat Units
[3] Annualized based on FY2004 discount rate of 5.625% and a 50-year project life
[4] Acreage of systemic benefit was estimated.

E. Comparison of Alternative Plans. For environmental planning, traditional benefit-cost analysis is not possible because costs and benefits are expressed in different units. However, cost-effectiveness and incremental cost analyses can provide decision-makers with relative benefit-cost relationships of the various enhancement or restoration solutions. While these analyses are not intended to lead to a single best solution, they do 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 (Appendix D).

1. Methodology. The Corps of Engineers guidance requires cost-effectiveness and incremental cost analyses for recommended ecosystem restoration plans. Two analytical processes are conducted to meet these requirements. First, a Cost-Effectiveness Analysis (CEA) is conducted to ensure that the least-cost solution is identified for each possible level of environmental output (Orth , 1994). Cost effectiveness means that no plan can provide the same benefits for less cost or more benefits for the same cost (Appendix D).

Second, an Incremental Cost Analysis (ICA) of the least-cost solutions is conducted to reveal changes in costs for increasing levels of environmental outputs. Plans that provide the greatest increase in benefits for the least increase in costs are identified as “Best Buy” plans. 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 analyses are valuable tools to assist in decision-making (Appendix D).

Because this analysis produced two different environmental outputs, the analyses described above were performed using both site-specific and systemic benefits as outputs. Appendix D presents the detailed cost-effectiveness and incremental cost analyses for the project.

2. Results. The results of the cost-effectiveness and incremental cost analyses are presented below. Figure 5-1 shows the cost-effectiveness results for all alternatives as it relates to site-specific benefits. Figure 5-2 shows the cost-effectiveness results as it relates to systemic benefits for Pool 12. Each point within these two figures represents an alternative. The “Best Buy” plans are identified by a triangle symbol and labeled with the alternative name. In total, 31 project alternatives and the No Action alternative were evaluated within the CEA and ICA (table 5-1).

For the site-specific analysis, besides the No Action alternative, six best buys were identified out of the 21 cost-effective alternatives. All 31 alternatives were relatively close, with a strong linear relationship among alternatives for cost and resulting benefits (figure 5-1 and Appendix D). This general trend is not surprising, as this analysis would support the conclusion that the more area improved, the greater the anticipated site-specific benefits. Of all the alternatives evaluated, alternatives 3, 15, 17, 26, 28 and 31 have been identified as a “best buy, ” meaning they provide the greatest increase in environmental benefits for least incremental cost (table 5-2 and figure 5-3).

For the CEA with systemic benefits, greater distinction occurs between project alternatives compared to the site-specific analysis. Eight alternatives were identified as being cost effective (figure 5-2). Of these, four alternatives were identified as best buys –alternatives 3, 6, 11, and 21 (table 5-3 and figure 5-4. Alternatives combining 4 and 5 sites did not provide any additional systemic benefit, as outlined within the parameters of this analysis. However, this analysis only evaluated for project spacing and did not truly quantify the amount of overwintering habitat needed in Pool 12. The analyses were biased toward smaller project sites as these sites generally cost less while still meeting systemic spacing criteria. However, it does provide insight into what may be ideal spacing of potential project sites, and how benefits may extend throughout Pool 12 (Appendix D).

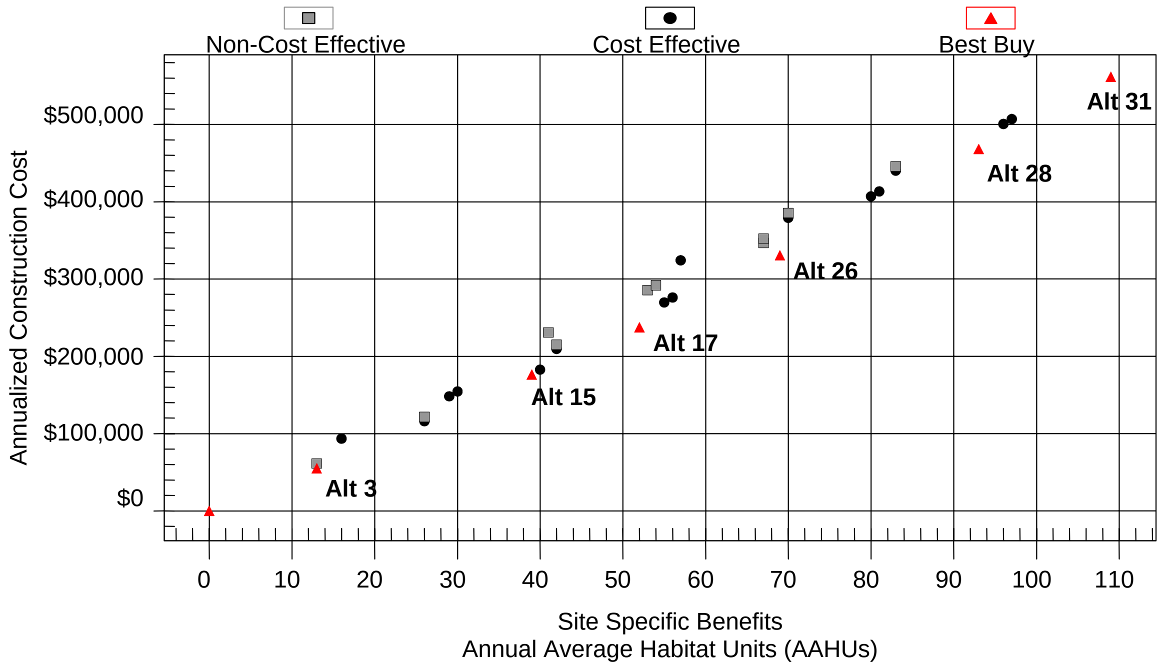

Figure 5-1. Cost-effectiveness Analysis – Site-Specific Benefits

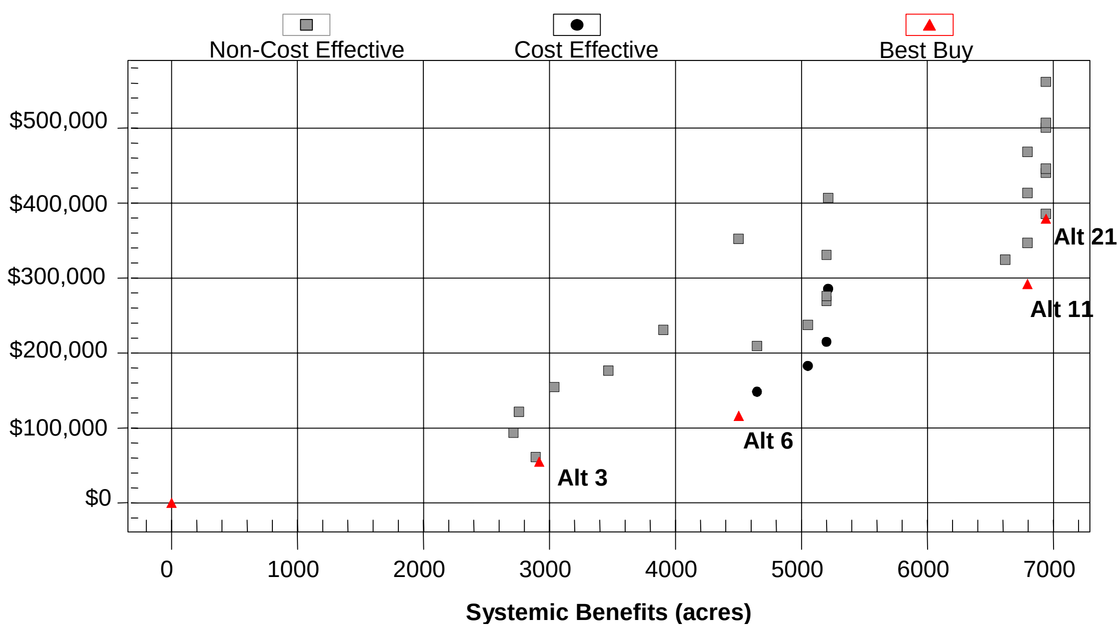

Figure 5-2. Cost-effectiveness Analysis – Systemic Benefits

Tables 5-2 and 5-3, and figures 5-3 and 5-4 show the alternatives that were identified as "Best Buy" plans under Site-Specific and Systemic considerations, respectively. These alternatives may be considered to be the most cost-effective and incrementally justified plans to accomplish restoration at the project site, given the parameters of the analysis (Appendix D).

Table 5-2. Incremental Costs of Best Buy Plans for Site-Specific Benefits

Alternative		Total Cost	Average Annual Cost	Incremental Increase	Combined Net Increase AAHUs	Incremental Increase	Incremental Cost/Benefit
3	Kehough	$911,000	$54,795	$54,795	13	13	$4,215
15	No Name-Fishtrap, Kehough	$2,931,000	$176,295	$121,500	39	26	$4,673
17	Tippy, Kehough, No Name-Fishtrap	$3,948,000	$237,466	$61,171	52	13	$4,705
26	Stone, Tippy, Kehough, and No Name-Fishtrap	$5,501,000	$330,876	$93,410	69	17	$5,495
28	Tippy, Kehough, No Name-Fishtrap, Sunfish	$7,785,000	$468,255	$137,379	93	24	$5,724
31	Stone, Tippy, Kehough, No Name-Fishtrap, Sunfish	$9,338,000	$561,666	$93,411	109	16	$5,838

Table 5-3. Incremental Costs of Best Buy Plans for Systemic Benefits

Alternative		Total Cost	Average Annual Cost	Incremental Costs	Systemic Benefits (acres)	Incremental Benefits	Incremental Cost/Benefit
3	Kehough	$911,000	$54,795	$54,795	2,918	2,918	$19.00
6	Tippy, Kehough	$1,928,000	$115,966	$61,171	4,501	1,583	$39.00
11	Tippy, Sunfish	$4,854,000	$291,960	$175,994	6,795	2,294	$77.00
21	Stone, Kehough, Sunfish	$6,301,000	$378,995	$87,035	6,942	147	$592.00

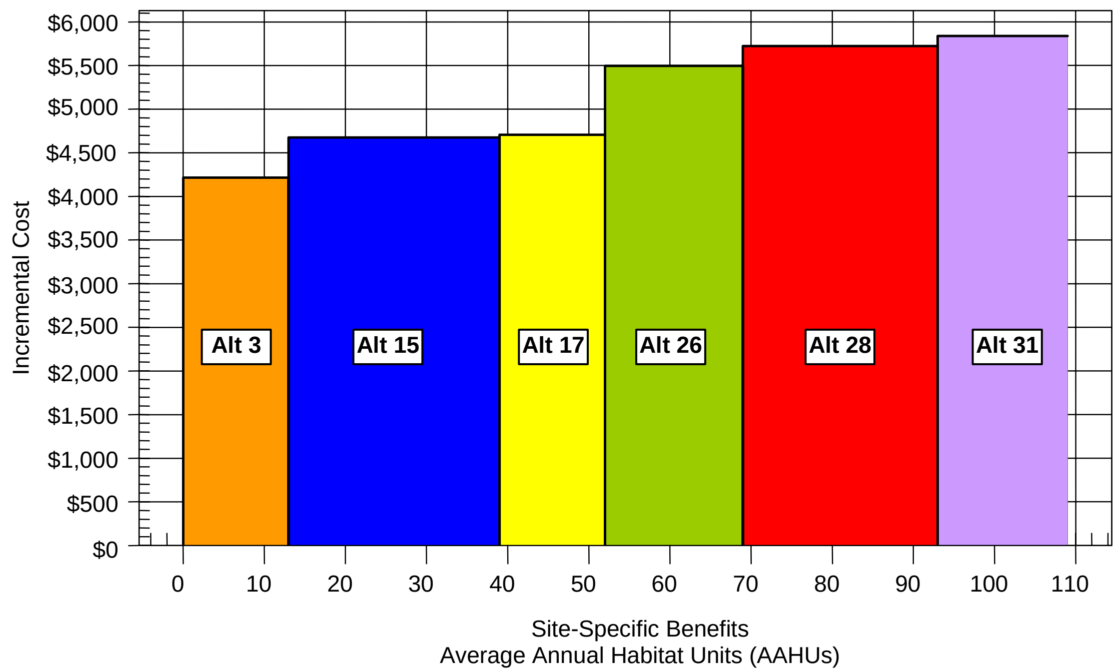

Figure 5-3. Incremental Cost Analysis "Best Buy" Plans - Site Specific

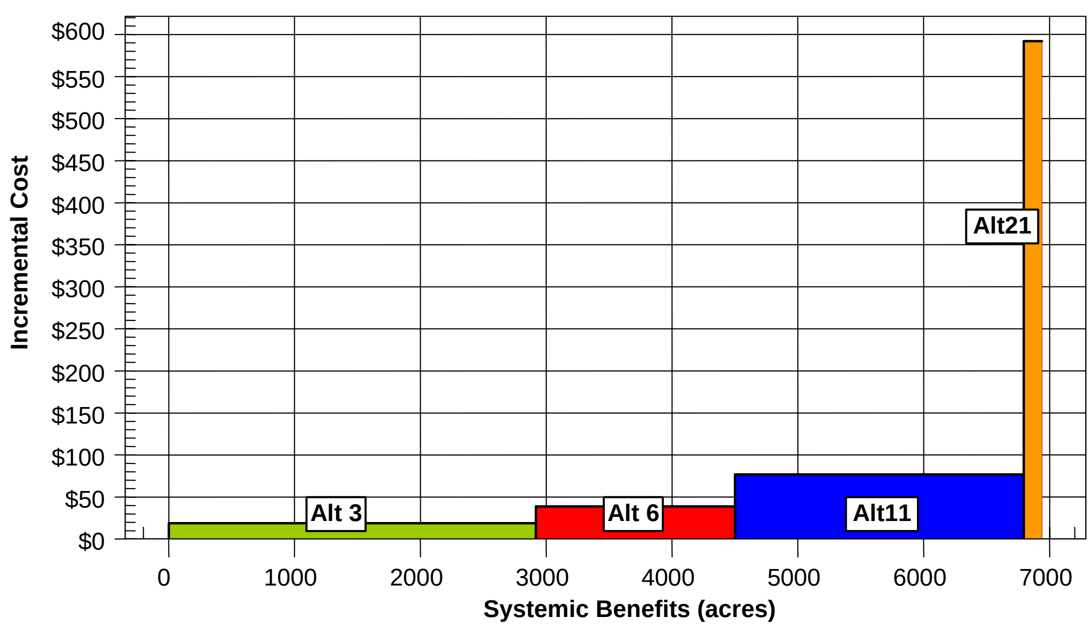

Figure 5-4. Incremental Cost Analysis "Best Buy" Plans – Systemic

3. Selecting the Recommended Plan. The systemic analysis shows that if a limited number of sites are restored, spatial distribution benefits can be maximized by restoring one backwater in the upper part of the study area and one in the lower portion of the study area. The site-specific analysis shows a linear relationship between cost and benefits. There are no significant breakpoints in the site-specific analysis that assist in identifying the recommended plan. It is not significantly more cost effective to restore a specific backwater or specific combination of backwaters. The incremental cost per benefit of the best-buy plans from the site-specific analysis did not vary significantly, ranging from $4,215 to $5,838.

The final question is "how much deep backwater habitat is needed in Pool 12?" The site-specific best buy plans would restore 1, 3, 5, or 6 backwater sites. Fisheries biologists and researchers do not yet know how much deep backwater habitat is optimal for UMR fish. The study team felt that restoration of all six sites was needed to address habitat needs in Pool 12 and that restoration of all six sites (Alternative 31) was worth the cost of restoration. Agency fisheries biologists feel strongly that restoration of all six sites (77.4 acres of deep channel, 1 percent of study area) would approach but may not exceed the backwater habitat needs in the pool. Therefore, Alternative 31, restoration of Stone Lake, Tippy Lake, Kehough Slough, No Name Lake, Fishtrap Lake, and Sunfish Lake was identified as the recommended plan.

The recommended plan would restore backwater habitat at six lakes by excavating approximately 80 acres of deep backwater channels providing overwintering and year-round habitat for fish in the surrounding 6,942 acres. The recommended plan would also establish mast-producing trees on approximately 24 acres of raised berms. The plan provides 109 AAHUs of fish habitat at a total construction cost of $9,338,000. The annualized cost is $561,666.

The four evaluation criteria of the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (U.S. Water Resources Council 1983) are acceptability, completeness, effectiveness, and efficiency; the recommended plan meets these criteria. The recommended plan is acceptable. The plan is feasible from technical, environmental, economical, financial, political, legal, institutional, and social perspectives. It is fully supported by the U.S. Fish and Wildlife Service, Illinois Department of Natural Resources and Iowa Department of Natural Resources. The plan is complete. Realization of the plan benefits does not depend on implementation of actions outside the plan. The plan effectively addresses the project objectives. The dredged channels would effectively provide off-channel deep-water habitat for year-round and overwintering fish. Berms would deflect flow to minimize sedimentation in channels and would provide sufficient elevation for establishment and regeneration of hard mast-producing trees. The plan is efficient. The recommended plan was among the best-buy plans for the site-specific analysis.

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

A. General Description. The Pool 12 Overwintering HREP recommended plan includes dredging backwater fish channels at six sites in the backwater area of the Mississippi River in Pool 12. Due to annual funding limits, it is anticipated that the project would be constructed in two phases. Phase 1 includes Sunfish Lake (RM 564), Fishtrap Lake (RM 566), and Stone Lake (RM 572). Phase 2 includes No Name Lake (RM 566.5), Kehough Slough (RM 567.5), and Tippy Lake (RM 571). The channels have various lengths and configurations as shown on Plates 2 to 8 and described below. Plates 9 and 10 show the channel cross sections. Channels would be dredged to elevation 584.0 ft (1912 MSL), 8 feet below flat pool. Flat-pool elevation is the lowest elevation that the pool would experience under very low flow conditions. Channel bottom width is 60 feet with 3 horizontal: 1 vertical side slopes.

Most of the dredging would be accomplished with mechanical dredging with the dredged material placed adjacent to the excavated channel as shown on Plate 9. Mechanical dredging would most likely be accomplished with a clamshell bucket attached to a barge-mounted crane. A minimum bucket size of 4 CY should be specified with a crane capable of moving a full bucket of dredged material to construct the berm shown on Plate 9. Tree clearing along the shore of existing islands would be required in order for the contractor to swing the bucket to place the material. Placement site preparation includes removal of trees and shrubs. The Corps forester would evaluate the sites to determine if there is merchantable timber. If a timber sale is warranted, the Corps forester would coordinate the timber sale, as appropriate. Incidental tree clearing would be required if timber sale does not occur. Confined placement areas may also be used where adjacent placement is not desirable, primarily for No Name Lake and Tippy Lake. These alternatives are described in more detail below.

The dredged material berms are placed in close proximity to the channels so that material can be easily placed with one piece of equipment without handling the material more than one time. The berms are also positioned to deflect sediment-laden waters away from the excavated channels, minimizing the amount of sediment entering the channels and helping maintain channel depth through the project life. Some of the berms are positioned to direct flood flows so that the channels are maintained through a scour action. Scour is not desirable in all channels as overwintering fish need low flow conditions. Berms constructed on the existing islands shall be high enough to support mast-producing trees. A mix of mast-producing trees would be established on the berms as described below. Berms that are placed in aquatic areas would diversify the bottom elevations in the backwater area and when exposed in low water periods would support wetland vegetation.

In some locations, adjacent placement of the dredged material is not desirable. These areas occur at No Name and Tippy Lakes and are described in more detail below.

B. Recommended Plan for Each Backwater Site. Berms would be constructed on land and in the water. Table 6-1 shows project feature details such as channel length, berm length, dredging volume, deep-water area, and berm area by site. The aquatic berms would be placed in the water on the lakebed, while the land berms would be placed on existing islands. The resulting elevation of the land berms would be higher than the aquatic berms. The estimated footprint or area of berm base of the land and aquatic berms is shown in table 6-1. The footprint width would vary depending on the height of the finished berms, type of dredge, skill of operator, number of passes by the dredge, and amount and cohesiveness of the dredged material.

The aquatic berm length is a measure of the mechanically dredged material placed adjacent to the proposed fish channel in an existing aquatic area. The aquatic berms would most likely not be high enough to support mast-producing trees. However, most of these berms would likely break the water surface and may support wetland vegetation during periods of low water when the tops of the berms are exposed to sunlight. The side slopes of the aquatic berm would be flat and the berm would be more spread out as dredged material placed in water tends to retain high moisture content and have a lower strength. The flat slopes would not be susceptible to erosion.

Land berm length, the length of mechanically dredged material placed adjacent to the proposed fish channel on existing land, is shown in table 6-1 These berms would be constructed high enough to support mast-producing trees. Trees would be placed on the top of the land berms. The top width is estimated to average 50 feet. The top width would vary depending on height of the finished berms, type of dredge and skill of operator, number of passes, amount of dredged material, position of berm relative to edge of existing land mass, height of the existing land mass, and amount of required dredging to create the fish channel. However, a minimum top width of 50 feet is desirable to ensure adequate space for tree planting. Berm widths would be wider where channels are excavated on each side of the berm as shown on Plate 10.

The minimum target elevation that would support mast producing trees is approximately the 2-year flood recurrence interval and is shown for each site in table 6-1. Plantings would consist of 30 percent swamp white oak, 30 percent pin oak, 30 percent bur oak, and 10 percent pecan or shellbark hickory. Three-gallon containerized trees are recommended; these trees have a full root mass and are relatively inexpensive. They are large enough to have a fairly high survival rate. Trees shall be planted with 20-ft spacing within each row and species shall be dispersed randomly within the planting site. One or two rows shall be planted depending on the top-width of the berm.

Channels shall be dredged to elevation 584 feet MSL (1912) with a 60-ft bottom width and 3 horizontal: 1 vertical side slopes. To estimate habitat benefits for the project, the area with a bottom elevation below 588 feet MSL (4 feet water depth) was calculated. These areas with at least 4 feet of water would be considered suitable overwintering fish habitat and are reported in table 6-1.

Table 6-2 summarizes additional key project data.

Table 6-1. Project Feature Details

	Channel Dredging			**Aquatic Berm**		**Land Berm**		
	Length (ft)	**Volume (CY)**	**Deep-water Area [1] (acres)**	**Length (ft)**	**Footprint Area (acres)**	**Length (ft)**	**Footprint Area (acres)**	**Min.Target Elevation (ft 1912 MSL)**
PHASE 1								
Sunfish Lake	13,850	265,000	26.7	6,560	18.1	6,700	15.4	596.3
Fishtrap Lake	9,720	155,000	18.7	600	1.6	5,140	11.8	596.8
Stone Lake	6,430	130,000	12.4	200	.6	5,900	13.5	598.5
Total for Phase 1	**30,000**	**550,000**	**57.8**	**7,360**	**20.3**	**17,740**	**40.7**	
PHASE 2								
No Name Lake	650	16,000	1.3	N/A	N/A	N/A	N/A	N/A
Kehough Slough	3,760	72,000	7.3	2,720	7.5	940	2.2	~597
Tippy Lake	5,730	75,000	11.0	440	1.2	1,920	4.4	598.3
Total for Phase 2	**10,140**	**163,000**	**19.6**	**3,160**	**8.7**	**2,860**	**6.6**	
PROJECT TOTAL	**40,140**	**713,000**	**77.4**	**10,520**	**29.0**	**20,600**	**47.3**	

[1] Bottom elevation ≤ 588 ft

1. CONSTRUCTION PHASE 1

a. Sunfish Lake. The recommended layout for the overwintering fish channels for Sunfish Lake is shown on Plates 2 and 3. Approximately 13,850 linear feet of channel would be mechanically dredged with material placed adjacent to the dredge cut. There is an estimated 265,000 CY of dredging. A typical cross section for this work is shown on Plate 9. The channel at points “A” (plate 3) and “D” (plate 2) meets existing deep water. The hook from points “B” to “F” and the channel above point “D” are protected from currents and should provide excellent overwintering habitat (plate 2).

The adjacent placement of dredged material in these areas helps protect the channels by blocking out floodwaters that can carry higher amounts of sediment. Water flows into Sunfish Lake near point “G.” The purpose of the flow deflection berm is to direct the flow around the bend and prevent it from dropping sediment to the north. Channel excavations are located on both sides of the deflection berm to provide sufficient building material. The bend shall be armored with riprap to minimize erosion. The berm from points “B” to “C” helps direct flow toward the east. The concentrated flow would assist in moving loose sediment downstream rather than allowing it to collect in the new channel.

Dredged material would be used to construct approximately 6,560 linear feet of aquatic berm and 6,700 linear feet of land berm. Mast-producing trees would be planted on the land berm at Sunfish Lake. For estimating purposes, the 6,700-foot berm would provide adequate space to plant 670 trees. Minimum berm height for Sunfish Lake is 595 ft MSL 1912.

To access Sunfish Lake, the dredge would likely enter from the lower end via Stone Slough shown on Plate 13. During preparation of plans and specifications, a new hydrographic survey is recommended to verify contract quantities. Access dredging is not anticipated.

b. Fishtrap Lake. The layout for the proposed overwintering fish channels for Fishtrap Lake is shown on Plate 4. Approximately 9,720 linear feet of channel would be mechanically dredged with material placed adjacent to the dredge cut. There are an estimated 155,000 CY of dredging. Around the outside bend of points “B” to “F”, there are emergent lotus beds that provide diverse habitat for wildlife. The team considered, but did not recommend, extending channel dredging northwest of point “F” (plate 11).

The entry channel at Fishtrap was extended after a site visit determined that segment I-J was fairly shallow. Harris Slough, the entry channel to the backwater area, is shallow and also may have to be dredged for construction access. If dredging is required, the amount to be dredged is expected to be minimal (approximately 500 CY). The material from the access dredging could be placed at the entrance to Harris Slough as shown on Plate 4 or loaded onto a barge and moved to an approved location. If placed at the entrance to Harris Slough, it would have to be armored with stone to protect it from eroding. Placement at this location may reduce the rate of local sedimentation.

Dredged material would be used to construct approximately 600 linear feet of aquatic berm and 5,140 linear feet of land berm. Mast-producing trees would be planted on 5,140 linear feet of land berm at Fishtrap Lake. For estimating purposes, the 5,140-foot berm would provide adequate space to plant 500 trees. Minimum berm height for Fishtrap Lake is 596 ft MSL 1912.

c. Stone Lake. The layout for the proposed overwintering fish channels for Stone Lake is shown on Plate 8. Approximately 6,430 linear feet of channel would be mechanically dredged with material placed adjacent to the dredge cut. There are an estimated 130,000 CY of dredging. The purpose of the placement berm from points "B" to "C" is to deflect flood flows away from the proposed fish channels. The berms provide higher ground elevations than existing. This allows for the establishment of better quality hardwood trees. The remaining placement locations serve to diversify the topography and create a more diverse habitat. A small rock deflection structure or wing dam is proposed as shown on Plate 8. The purpose of this structure is to keep sediment from accumulating in the entry channel to the lake. If the channel silts in, the fish could be blocked from entering or leaving the site during a hard freeze. Entry channels to the backwater areas tend to silt in faster than other areas because water in the deeper channel moves fast enough during a flood to hold or maintain the sediment load. These sediment-laden waters slow down at the entry to the backwater areas where the velocities are very low and the sediment drops out of the water.

Dredged material would be used to construct approximately 200 linear feet of aquatic berm and 5,900 linear feet of land berm. Mast-producing trees would be planted on 5,900 linear feet of berm at Stone Lake. For estimating purposes, the 5,900-foot berm would provide adequate space to plant 590 trees. Minimum berm height for Stone Lake is 598 ft MSL 1912.

Access to Stone Lake is from the main channel. Very little, if any, access dredging is anticipated.

2. CONSTRUCTION PHASE 2

a. No Name Lake. The layout for the proposed overwintering fish channel for No Name Lake is shown on Plate 5. Approximately 650 linear feet of channel would be dredged in No Name Lake. Dredged material would not be placed adjacent to the dredged channel to avoid impacting existing emergent wetland which provides duck habitat. There are an estimated 16,000 CY of dredging which would be accomplished with either mechanical dredging or hydraulic dredging. If the material is mechanically excavated, it would be loaded onto barges, and removed to an approved placement site located at Kehough Slough.

If hydraulically dredged, the material would be placed within the 13.7-acre area shown near the top of Plate 5 and confined with straw bales. Confining dredged material with straw bales would be an effective way to confine the hydraulic sediment and to filter any runoff. The limitation is the relatively low height of dredged material that can be placed in this fashion. This placement method would be tried as an innovative method of confining dredged material and was proposed by a design team member familiar with the method. The straw bales must be placed with a consistent top elevation. Lower areas would have to be built up with soil or filled in with stacked straw bales. Recommended straw bales would be the 3-twine bales that are slightly larger and heavier than the 2-twine bales. Dredged material could be placed in this area up to 2 feet deep in the center of the area where the dredge pipe outlet is located and would likely only be 6 inches deep near the straw bales. The average final depth would be approximately one foot. The 13.7 acres shown on the drawings is more than adequate for all of the dredged material in No Name Lake. The contractor would have the option of sizing it smaller, but no larger than the area shown. The resulting ground elevation might be sufficient to support more diverse plant species. Placement of dredged material on existing trees may affect survival, but wide-scale mortality is not anticipated.

Dredging equipment would access No Name Lake through Harris Slough.

b. Kehough Slough. The layout for the proposed overwintering fish channels for Kehough Slough is shown on Plate 6. Approximately 3,760 linear feet of channel would be mechanically dredged with material placed adjacent to the dredge cut. There are an estimated 72,000 CY of dredging. The dredging is to begin at point "A" which has existing adequate depths. The proposed berm would protect the channels from silt laden flood flows and provide higher elevations for vegetation. The small entrance side channel near point "B" would be left open to allow river flows into the backwater. These flows can provide dissolved oxygen to the backwaters and prevent sedimentation. In addition to deflection berms, some material could be placed within the 13.7-acre low-level hydraulic placement facility on the southeast edge of the lake, the same area where material from No Name Lake would be placed.

Dredged material would be used to construct approximately 2,720 linear feet of aquatic berm and 940 linear feet of land berm. Mast-producing trees would be planted on 940 linear feet of land berm at Kehough Slough. For estimating purposes, the 940-foot berm would provide adequate space to plant 100 trees. Minimum berm height for Kehough Slough is 597 ft MSL 1912.

Access to Kehough Slough would be from the south, using the same entrance from the main channel as Fishtrap and No Name Lakes.

c. Tippy Lake. The layout for the proposed overwintering fish channels for Tippy Lake is shown on Plate 7. Approximately 5,730 linear feet of channel would be excavated. The estimated 75,000 CY of dredging could be accomplished either mechanically or hydraulically. The lower portions of the channel would be excavated and the dredged material placed adjacent to the channel. The design team did not want to place material adjacent to the upper portion of the channel due to the quality of the existing terrestrial habitat. Therefore, a 10-acre placement area near the entrance to Tippy Lake was identified.

The upper portion could be dredged using a mechanical dredge, conventional hydraulic dredge, high solids dredge, or dry dredge. Mechanically dredged material would be loaded onto barges, and moved to the placement site. Material would be offloaded and moved around the site using dozers and/or excavators. The upper portion of the channel requires less excavation since the channel is relatively deep already. This should minimize the cost of double handling the material.

Conventional hydraulic dredging would require a containment facility constructed at the placement site. The containment berms would be constructed using dredged material and existing island material. The island material would likely be pushed up into a confinement berm using dozers or excavators. The construction contractor would design the height and size of containment berms. Restrictions for design of the containment berms would be that they must fit within the given footprint, exterior side slopes would be constructed at a 3 H to 1V side slope or flatter, berms would be seeded and mulched to protect against erosion, and any water effluent would meet all state and Federal permit requirements.

The construction contractor would be allowed to hydraulically dredge the material into a containment berm, mechanically dredge the material and double-handle it to place it in the proposed placement site, or use other methods such as high solids dredging. The contractor would be allowed to determine the most cost-effective way to move the material.

In addition to the placement site, dredged material would be used to construct approximately 440 linear feet of aquatic berm at the downstream end of the placement site and 1,920 linear feet of land berm. Mast-producing trees would be planted on 1,900 linear feet of berm at Tippy Lake. For estimating purposes, the 1,900-foot berm would provide adequate space to plant 190 trees. Minimum berm height for Tippy Lake is 598 ft MSL 1912.

Construction equipment would access Tippy Lake from the south end. The contractor would have to remove portions of an existing wing dam in the adjacent slough to provide access for construction equipment. The removal of a portion of the wingdam was coordinated with Corps staff responsible for channel maintenance. Depths along the expected access route should be included in the hydrographic survey required for preparation of plans and specifications.

C. Design Considerations

1. Hydraulic Considerations. Appendix H presents the hydraulic development and evaluation of proposed improvements that, if constructed, would provide greater water depths, reduce the rate of sediment deposition, and improve water quality in the project areas. Included in Appendix H is a description of the general climatic conditions, hydrology, flood profiles, stage hydrographs, and duration profiles and curves.

An analysis of expected sedimentation rates within the Pool 12 backwater area for both the with- and without- project conditions was completed. Every effort was made to design the proposed fish channels and the earth berms to minimize sedimentation. Various hydraulic models and methods were developed to estimate future performance. This included a study of historical deposition rates. The lake areas were divided into separate areas for evaluation. Historical sedimentation rates varied from negative 1.3 to 3.7 cm/year and are specified in Appendix H.

Results of the sedimentation analysis are shown in the Hydraulic Appendix by backwater area and channel section. The estimated theoretical computed sedimentation rates vary from no expected sedimentation to up to 5 ft of sedimentation over a 50-year project life. These estimates were used in evaluating project habitat improvement as a result of the proposed project. Tractive force plots were developed to identify areas that would experience greater flows and velocities and may experience scour.

Hydraulic models used to evaluate this project included the Surface Water Modeling System (SMS). SMS was used to compute bed shear stresses in order to predict whether cohesive sediments would remain in suspension or settle

The HEC-RAS model was used to develop: (1) steady flow water surface profile computations; (2) unsteady flow simulation; and (3) movable boundary sediment transport computations. The system contains several hydraulic design features to include bridge scour computations, uniform flow computations, stable channel design, and sediment transport capacity.

A HEC-RAS model was developed for the middle to lower portion of Pool 12 to determine floodplain impacts as a result of this project. The results indicate that, according to State of Illinois Floodplain Regulations, the project does not adversely impact the floodplain. These results are currently being coordinated through the Illinois Department of Natural Resources, Office of Water Resources.

2. Geotechnical Considerations. The geotechnical appendix is included as Appendix G. Several soil borings were obtained in each backwater site. The soil information developed from these soil borings should be sufficient to proceed to plans and specifications development. In general, most of the expected dredging would be in clayey material. Most borings showed a soft clay layer underlain by stiffer clay. There were also layers of sandy clay. Sand seams were generally found at deeper depths. Sunfish Lake borings indicate softer clay at greater depths. This is significant because the softer clays would not have as much strength as the harder clays. This could result in additional dredging time, flatter slopes, and potentially higher sedimentation rates. At the entrance to Tippy Lake is a rocky area. This shows up on the Navigation Charts as a wing dam that extends into the backwater. Initial coordination with the Rock Island District Channel Maintenance Section revealed that a fish channel could be excavated through the wing dam in this area.

After material is mechanically excavated and sidecast, it would take time to gain strength and set up. For this project, the geotechnical analysis indicated that the material could likely be placed in 2 passes. The height of the sidecast material is dependent on whether the material is placed adjacent to or on existing islands.

If the material is placed in an area where the land elevation is below flat pool, elevation 592.0 ft, it may initially stack up to a height of 6 or 7 feet above the existing lakebed with a couple passes of a large clamshell dredge. According to settlement computations, it can be expected to settle or consolidate up to 2.5 feet. This would allow a new final island height of 595.0 ft or less. In some areas, the amount of excavated material would determine placement height. In other areas, it would be controlled by the strength of the material and the number of passes. A height of 595.0 ft is similar to the height of existing islands in the area.

If the material is placed on an existing island, it can be expected to stack up another 3 to 5 feet. A minimal amount of tree clearing is expected in order to swing the bucket to the placement area. This would provide a uniform base to support the dredged material. The resultant shape and height should provide a 6 horizontal to 1 vertical side slope (or flatter) toward the water and a higher elevation capable of supporting a higher quality stand of mast trees. For additional details and information concerning soil type, existing moisture content, estimated strength, and consolidation analysis, see Appendix G.

D. Construction Considerations

1. Mechanically Dredged Channels. Plate 9 shows a typical cross section for a mechanically placed channel with adjacent placement. A mechanically dredged channel is accomplished with a barge mounted clamshell-crane combination or a barge mounted excavator with a large bucket. For these projects, it is anticipated that a clamshell with a capacity of 4 CY or larger would be a contract requirement. The clamshell typically has a longer reach and is more suitable for the dimensions shown on the cross-section. A large bucket assists in maintaining strength of the excavated material. The project would likely be placed in two passes. Material in the first pass gains strength after it is placed. It gains strength when water is allowed to drain off the material and the material begins to consolidate or compress due to its own weight. If the contractor attempts to build too quickly, the material would slide or form failure planes and not stay within the dimensions shown. Equipment with a smaller bucket and shorter boom would usually take longer to build and would have more difficulty building the far side of the berm.

2. Overhead Power Lines. Overhead power lines are located near the Galena Boat Harbor. The approximate locations are shown on the drawings. During preparation of plans and specifications, a more thorough search and description of utilities in and around the area should be identified. The contractor should be made aware of utility locations so that any required costs associated with working around these utilities can be included in the contractor's bid. The identified power lines appear to be low voltage.

3. Indiana Bats. Prior to initiation of any tree clearing activities, the Corps will conduct a survey to determine the presence or absence of Indiana bats within or adjacent to the construction area. If any bats are found, clearing activities may only be accomplished between October 1 of the year of the bat survey and March 31 of the year following the survey, to avoid potential impacts to the Federally protected species. If no bats are found as a result of this survey, clearing activity may proceed without seasonal restrictions.

4. Timber Sale. Corps foresters should evaluate the dredged material placement sites to determine if there is merchantable timber and if a timber sale is warranted. If warranted, the Corps foresters will coordinate the timber sale, as appropriate. Incidental tree clearing would be required if timber sale does not occur.

E. Project Data Summary

Table 6-2 Pool 12 Overwintering Project Data Summary

Feature	Measurement	Unit of Measure
Overwintering Fish Channel Dredging		
Dimensions common to all channels		
Bottom Width	60	feet
Depth Below Flat Pool (Flat pool is 592.0 ft 1912,	8	feet
Side Slopes	3:1	horizontal:vertical
Total Channel Length	40,140	feet
Total Dredged Amount	713,000	cubic yards
Sunfish Lake, River Mile		
Channel Length	13,850	feet
Dredged Amount	265,000	cubic yards
Type of Dredging	Mechanical	
Recommended Placement Alternative	Adjacent	
Riprap reinforcing	11,500	tons
Minimum target elevation for tree planting sites	596.3	feet
Mast Tree Establishment	670	trees
Fishtrap Lake, River Mile		
Channel Length	9,720	feet
Dredged Amount	155,000	cubic yards
Type of Dredging	Mechanical	
Recommended Placement Alternative	Adjacent	
Mast Tree Establishment	500	trees
Minimum target elevation for tree planting sites	596.8	feet
Stone Lake, River Mile		
Channel Length	6,430	feet
Dredged Amount	130,000	cubic yards
Type of Dredging	Mechanical	
Recommended Placement Alternative	Adjacent	
Riprap Flow Diversion	1,200	ton
Mast Tree Establishment	590	trees
Minimum target elevation for tree planting sites	598.5	feet
No Name Lake, River Mile		
Channel Length	650	feet
Dredged Amount	16,000	cubic yards
Type of Dredging	Mechanical or Hydraulic	
Recommended Placement Alternative	Barging or low level placement	
Confined Placement Area	13.7	acres
Kehough Slough, River Mile		
Channel Length	3,760	feet
Dredged Amount	72,000	cubic yards
Type of Dredging	Mechanical	
Recommended Placement Alternative	Adjacent	
Mast Tree Establishment	100	trees
Minimum target elevation for tree planting sites	~597	feet
Tippy Lake, River Mile		
Channel Length	5,730	feet
Dredged Amount	75,000	cubic yards
Type of Dredging	Mechanical	
Recommended Placement Alternative	Adjacent with some barging	
Placement Area	10	acres
Mast tree establishment	190	trees
Minimum target elevation for tree planting sites	598.3	feet
Reforestation		
Mast Tree Establishment	23.5	acres
Total Trees	**2050**	**trees**

F. Operation. This project has no anticipated operational requirements. There are requirements to monitor project performance and inspect project features. See the project-monitoring plan in Section X, *Project Performance Assessment*.

G. Maintenance. This project is located within the USFWS Refuge at Savanna, Illinois and would be maintained by the USFWS. The project has been designed to minimize maintenance. Over time, the dredged fish channels are expected to degrade through the process of sedimentation. Care has been taken to place the channels where they would remain open for as long as possible. Maintenance activities and schedule are reported in table 6-3. Maintenance activities would be further defined in the Operations and Maintenance Manual which would be prepared when the project construction is complete.

Maintenance includes routine inspections of the fish channels and the mast-producing trees. These would be made by boat, preferably with a depth sounder to check channel depths. Areas that appear to be filling in with sediment should be identified for closer monitoring and identified for maintenance dredging. If debris such as fallen trees blocks portions of the channels or the entry channels, the debris could cause the water velocity to slow down and drop sediment. The debris should be removed if potential sedimentation could occur as a result.

Maintenance dredging would include limited dredging if an entry channel to a backwater lake silts in and blocks winter fish passage. This is not expected every year as shown in the table below. Material would be placed on the adjacent shoreline.

Replacing riprap and repairing erosion could be a concern, but is not expected unless a critical area begins to erode. If a critical area begins to erode, it is often less expensive to repair it earlier rather than later.

Table 6-3. Maintenance Activities and Schedule

Description of Maintenance Item	Frequency
Inspect backwater channels and vegetation	2 times per year
Remove Debris	1 time per year
Dredge entry channels	Every 5 to 10 years or as funding allows
Monitor and repair eroded areas/riprap	As needed

H. Permits

Section 401/404. Construction in the floodplain requires compliance with Section 404 of the Clean Water Act. Section 404 requires mitigating for loss of wetland areas. For this project, wetland mitigation is not expected since the purpose of the project is to enhance the environment. Areas along placement berms create wetland areas and other naturally existing wetland areas are being protected. Section 404 requires compliance with Section 401 of the Clean Water Act. The ILDNR and Illinois EPA review this portion of the permit. In order to meet permit requirements, hydraulic dredging must be confined and water quality downstream is monitored. Sometimes mechanical dredging requirements include installing silt curtains and downstream monitoring.

National Environmental Policy Act (NEPA). This report includes an environmental assessment. This is required in order for the government to proceed with this project. It includes potential positive and adverse effects to the environment both during and following construction. It includes compliance with the National Historic Preservation Act. If important cultural sites were identified, the sites would be protected during construction operations.

Floodplain Permit. The ILDNR issues a floodplain permit based on hydraulic modeling described in Appendix H. Flood heights cannot be adversely affected by new projects.

US Fish and Wildlife Service Special Use Permit. A USFWS Special Use Permit from the Upper Mississippi River National Wildlife and Fish Refuge is required for construction activities within the refuge.

Other. The contractor may be required to comply with other local permit requirements and ordinances.

VII. 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 DPR for public and agency review	Sep 05
Submit final and public reviewed DPR to Mississippi Valley Division	Nov 05
DPR approval	Jan 06
Sign Memorandum of Agreement	Feb 06
Submit Phase 1 plans and specifications for Independent Technical Review	Apr 06
Obtain approval of Phase 1 plans and specifications	Aug 06
Advertise Phase 1 construction contract	Nov 06
Award Phase 1 construction contract	Mar 07
Complete construction contract of Phase 1	Nov 08
Award vegetation contract for Phase 1 Area	Mar 10
Submit Phase 2 plans and specifications for Independent Technical Review	Jan 11
Obtain approval of Phase 2 plans and specifications	Aug 11
Advertise Phase 2 contract	Nov 11
Award Phase 2 contract	Feb 12
Complete construction contract of Phase 2	Nov 13
Award vegetation contract for Phase 2 Area	Mar 15

VIII. COST ESTIMATES

Project element and contingency costs are presented in Appendix I. A 25 percent contingency was used for construction costs. Appendix I includes the fully funded estimate (FFE) and the current work estimate (CWE). Table 8-1 compares these costs. Unit costs were updated following selection of the recommended plan; therefore the costs below do not match exactly with those used in the incremental analysis. Table 8-2 summarizes the cost estimate by project area and phase of construction. Table 8-3 shows estimated annual maintenance costs and table 8-4 shows estimated post-construction annual monitoring costs.

Table 8-1. Pool 12 Overwintering Habitat Rehabilitation and Enhancement Project Cost Summary, May 2004 Price Levels

Account [1]	Features	Current Working Estimate (CWE)[2]	Fully Funded Estimate (FFE)[2]
	PHASE 1		
06	Fish and Wildlife Facilities	$187,400	$199,300
12	Dredging	$7,795,763	$8,290,793
	PHASE 1 Subtotal	$7,983,163	$8,490,093
	PHASE 2		
06	Fish and Wildlife Facilities	$14,319	$16,810
12	Dredging	$2,503,725	$2,939,373
	PHASE 2 Subtotal	$2,518,044	$2,956,183
30	Planning, Engineering and Design[3]	$1,536,100	$1,585,151
31	Construction Management	$939,000	$1,023,600
	TOTAL PROJECT COST	**$12,976,307**	**$14,055,027**

[1] Project features are on federal land. Consequently, the lands and damages and relocations costs are zero and not listed.

[2] Current Working Estimate price level is based on May 2004 prices. Construction scheduled for Phase 1 is scheduled to begin in FY07 and Phase 2 is scheduled to begin in FY12. Fully Funded Estimate (FFE) for Phase 1 is based on midpoint of construction of 2nd qtr 2008, and Phase 2 is based on a midpoint of construction of 2nd qtr 2013.

[3] The planning, engineering and design costs include the cost of the definite project report in the amount of $700,000.

Table 8-2. Pool 12 Overwintering HREP Detailed Cost Summary, by Construction Phase
(May 2004 Price Levels)

Acct Code	Item	Quantity	Unit	Unit Price	Amount	Contingency (25%)	Total Cost w/ Cont, CWE
	CONSTRUCTION COSTS						
	PHASE 1						
	Sunfish Lake						
06	Tree/Seed Planting	670	EA	$39.50	$26,465	$6,616	$33,081
12	Mob & Demob	1	LS	$118,000	$118,000	$29,500	$147,500
12	Mech Dredging	265000	CY	$10.75	$2,848,750	$712,188	$3,560,938
06	Fell Trees to Clear Site	62	EA	$240.00	$14,880	$3,720	$18,600
	Sunfish Lake Subtotal				**$3,008,095**	**$752,024**	**$3,760,119**
	Fishtrap Lake						
06	Tree/Seed Planting	500	EA	$39.50	$19,750	$4,938	$24,688
12	Mob & Demob	1	LS	$68,600	$68,600	$17,150	$85,750
12	Mech Dredging	155000	CY	$11.00	$1,705,000	$426,250	$2,131,250
06	Fell Trees to Clear Site	48	EA	$240.00	$11,520	$2,880	$14,400
	Fishtrap Lake Subtotal				**$1,804,870**	**$451,218**	**$2,256,088**
	Stone Lake						
06	Riprap Berm Protection	1200	TN	$67.00	$80,400	$20,100	$100,500
06	Tree/Seed Planting	590	EA	$39.50	$23,305	$5,826	$29,131
12	Mob & Demob	1	LS	$59,400	$59,400	$14,850	$74,250
12	Mech Dredging	130000	CY	$10.75	$1,397,500	$349,375	$1,746,875
06	Fell Trees to Clear Site	54	EA	$240.00	$12,960	$3,240	$16,200
	Stone Lake Subtotal				**$1,573,565**	**$393,391**	**$1,966,956**
			PHASE 1 CONSTRUCTION TOTAL			**$7,983,163**	

Acct Code	Item	Quantity	Unit	Unit Price	Amount	Contingency (25%)	Total Cost w/ Cont, CWE
	PHASE 2						
	No Name Lake						
12	Mob & Demob	1	LS	$32,500	$32,500	$8,125	$40,625
12	Placement Site	1	LS	$13,300	$13,300	$3,325	$16,625
12	Hydr Dredging	16000	CY	$8.25	$132,000	$33,000	$165,000
	No Name Lake Subtotal				**$177,800**	**$44,450**	**$222,250**
	Kehough Slough						
06	Tree/Seed Planting	100	EA	$39.50	$3,950	$988	$4,938
12	Mob & Demob	1	LS	$106,000	$106,000	$26,500	$132,500
12	Mech Dredging	72000	CY	$11.25	$810,000	$202,500	$1,012,500
06	Fell Trees to Clear Site	9	EA	$240.00	$2,160	$540	$2,700
	Kehough Slough Subtotal				**$922,110**	**$230,528**	**$1,152,638**
	Tippy Lake						
06	Tree/Seed Planting	190	EA	$39.50	$7,505	$1,876	$9,381
12	Mob & Demob	1	LS	$138,000	$138,000	$34,500	$172,500
12	Mech Dredging	40000	CY	$11.75	$470,000	$117,500	$587,500
06	Fell Trees to Clear Site	18	EA	$240.00	$4,320	$1,080	$5,400
12	Placement Site	1	LS	$14,700	$14,700	$3,675	$18,375
12	Hydr Dredging	35000	CY	$8.00	$280,000	$70,000	$350,000
	Tippy Lake Subtotal				**$914,525**	**$228,631**	**$1,143,156**
		PHASE 2 CONSTRUCTION TOTAL				**$2,518,044**	
TOTAL CONSTRUCTION COSTS							**$10,501,207**

Acct Code	Item	Quantity	Unit	Unit Price	Amount	Contingency	Total Cost w/ Cont, CWE
	PLANNING, ENGINEERING, & DESIGN (PED)						
	PHASE 1						
30	P&S				$476,000	$0	$476,000
30	EDC				$159,000	$0	$159,000
30	DPR				$700,000	$0	$700,000
	Subtotal						**$1,335,000**
	PHASE 2						
30	P&S				$151,000	$0	$151,000
30	EDC				$50,100	$0	$50,100
	Subtotal						**$201,100**
TOTAL PED COST							**$1,536,100**
	CONSTRUCTION MANAGEMENT						
	PHASE 1 SUBTOTAL				$713,000	$0	$713,000
	PHASE 2 SUBTOTAL				$226,000	$0	$226,000
TOTAL CONSTRUCTION MANAGEMENT COST							**$939,000**
TOTAL PROJECT COST							**$12,976,307**

Table 8-3. Estimated Annual Maintenance Costs [1]

	QUANTITY	UNIT	UNIT PRICE	TOTAL COST
OPERATION [2]				**$0**
MAINTENANCE				
Rock Structures				
Riprap	36	TN	$100	$3,600
Equipment/Labor	6	Hrs	$100	$600
Subtotal Rock Structures				**$4,200**
Dredging Maintenance [3]				
Dredging Maintenance w/ mob & demob	380	CY	$30	$11,400
Subtotal Dredging Maintenance				**$11,400**
Remove Debris from Channels				
Debris Removal	20	Hrs	$100	$2,000
Subtotal Remove Debris from Channels				**$2,000**
Inspections				
Inspections	20	Hrs	$100	$2,000
Subtotal Inspections				**$2,000**
SUBTOTAL MAINTENANCE				**$19,600**
REHABILITATION [4]				**$0**
	TOTAL O&M and Rehabilitation Costs			**$19,600**

[1] Price level is based on may 2004 prices.
[2] The dredging features and in-stream projects being proposed are self operating and will only require periodic inspection and maintenance.
[3] The dredging maintenance cost is provided only in the event that it is needed and assumes dredging approximately 6000 CY at least 3 times during the life of the project.
[4] Rehabilitation cannot be accurately estimated. Rehabilitation is reconstructive work that significantly exceeds the annual operation and maintenance requirements identified above and which is needed as a result of major storms or flood events

Table 8-4. Estimated Post-Construction Annual Monitoring Costs

Item	**Annual Cost ($)**
Engineering Data [1]	3,000
Natural Resource Data [1]	2,000
Subtotal	**5,000**
Contingencies (20%)	1,000
Subtotal	**6,000**
Planning, Engineering, Design [2]	1,500
Total	**7,500**

[1] reference tables 10-2 and 10-3
[2] includes cost of annual evaluation report

IX. ENVIRONMENTAL EFFECTS

A. Summary of Effects. The recommended plan would improve natural resource conditions within the project area, including improvements in backwater lake and terrestrial floodplain habitat conditions. No species listed or proposed for listing under the Federal Endangered Species Act would be affected. The proposed project would result in short-term decreases in water quality due to localized increases in turbidity resulting from dredging and construction activities. Long-term effects would include conversion of some existing shallow-water habitat to deep-water habitat, depth reductions in other shallow-water areas, and elevation of some low-lying terrestrial areas. The project would provide overwintering habitat for fish, and increase floodplain forest diversity. No significant social or economic impacts would result. No federally protected species would be impacted. No impacts to historic properties are anticipated.

B. Natural Resources. Changes in habitat resulting from the project alternatives, including the recommended plan, are described in Appendix D. In general, the proposed project alternatives would result in improved natural resource conditions at the project site. Project alternatives would provide both site-specific benefits, as well as systemic benefits throughout Pool 12.

Construction activities could result in short-term impacts such as increased turbidity within backwater lake areas, as well as adjacent side channels and possibly downstream river areas. Downstream effects would likely be limited to increased sediment and turbidity levels during construction. To the extent possible, efforts would be made to limit downstream turbidity effects. However, riverine species are often subject to highly turbid conditions on an intermittent or seasonal cycle. Significant, long-term adverse effects to downstream aquatic resources are not anticipated to result from minor short-term increases in turbidity from construction activities. Moreover, resulting conditions following construction should include a long-term improvement in backwater habitat conditions.

Long-term changes in the project site would include a deepening of the backwater lake habitat at the selected sites discussed above. The recommended plan also would include reduced backwater depths in a limited number of areas to accommodate deflection berm creation with dredged material. This may promote emergent vegetation within these shallow areas, and may eventually result in more terrestrial habitat over time. However, this provides a way to place dredged material that may extend the project life of the excavated channels.

Project alternatives would result in some tree clearing and a small loss of bottomland forest wetland habitat through creation of dredged material placement areas. Clearing of trees would be avoided to the extent possible, especially in the case of existing mature mast-producing trees. Dredged material placement would create areas of increased elevation. This would convert marsh to bottomland forest with soft mast-producing trees and would convert bottomland forest with soft mast-producing trees to forest with conditions suitable to support a mix of hard and soft mast-producing trees.

The recommended plan would result in an increase in mast-producing trees, which would be considered a benefit within the existing floodplain forest community. Approximately 24 acres of mast-producing trees would be planted on elevated dredged material placement areas with a total footprint of 47 acres (table 6-1). In addition to providing benefits to the floodplain forest community, these dredged material placement areas should help to direct flow and sediments away from dredged areas during flood conditions, hopefully prolonging the life expectancy of backwater lake habitats.

In addition to placing dredged material to create elevated habitat areas for mast-producing trees, additional placement would occur within the terrestrial floodplain under the recommended plan. About 14 acres would be affected using low-level hydraulic placement. This would include hydraulically placing material one to two feet deep within select areas which is not anticipated to dramatically affect existing trees. Understory vegetation would be buried through this placement, but should re-vegetate the following growing season.

In general, any adverse effects discussed above should be offset through the positive environmental benefits of the project. These trade-offs were discussed at length and ultimately agreed upon through coordination meetings with the IADNR, ILDNR and USFWS during project planning.

C. Threatened and Endangered Species. Construction activities are not expected to occur within proximity of nesting bald eagles. As a part of pre-construction monitoring, refuge staff would monitor the various project areas for bald eagle nesting activity during the latter part of January and February. If any nesting is observed, the refuge would contact the Corps to take appropriate actions determined necessary to avoid adverse effects to nesting activity. The Corps would maintain close contact with the refuge staff regarding initiation of construction in the project areas. For these reasons, no adverse effects to the species are expected to result from the proposed project.

Prior to initiation of any tree clearing activities, the Corps will conduct a survey to determine the presence or absence of Indiana bats within or adjacent to the construction area. If any bats are found, clearing activities may only be accomplished between October 1 of the year of the bat survey and March 31 of the year following the survey, to avoid potential impacts to the Federally protected species. If no bats are found as a result of this survey, clearing activity may proceed without seasonal restrictions. For these reasons, no adverse effects to the Indiana bat are anticipated.

The Higgins' eye pearly mussel is not anticipated to be present within the backwater lake habitats evaluated as part of this project. This species is more likely to occur within main channel border and secondary channels which generally have greater flow and coarser bottom substrates. The areas under consideration for dredging typically have minimal flows and fine substrates. The Corps finds the recommended plan is not likely to adversely affect this federally listed species.

One of the general goals of the HREP (and the Refuge Master Plan) is to conserve, restore, and enhance federally listed endangered and threatened species and the habitats upon which they depend. Construction of a feature that has the potential to adversely affect any endangered species is in direct conflict with this stated goal. If potential significant effects were identified prior to construction, the Corps and the interagency team would meet to determine the best course of action to avoid impacts.

D. Cumulative Impacts. The primary resources to be affected by the recommended plan include backwater lake and adjacent floodplain forest habitats of Pool 12 of the UMR. Thus, the following discussion is focused on cumulative impacts associated with these resources. Additional discussion on cumulative changes to the Upper Mississippi River System can be found in *Ecological Status and Trends of the Upper Mississippi River System* (Lubinski and Theiling 1999); and *Upper Mississippi River and Illinois Waterway Cumulative Effects Study, Volume I and II* (WEST 2000).

Cumulative ecological effects are caused by the interaction of multiple stressors affecting all or portions of an ecosystem. Several definitions exist for cumulative impacts. One basic definition would be "…*the changes to the environment caused by an activity in combination with other past, present, and reasonably foreseeable future actions*."

1. Past Actions. For Pool 12, changes to the environmental condition of the project area began with European settlement. With changes in land-use practices during settlement, river conditions within the river basin began to change to a more disturbed system. This included changes in water quality and in-stream physical habitat conditions. The most significant change to the system occurred with the damming of the river in the 1930's, with Lock and Dam 12 completed in 1939.

Damming of the river created abundant deepwater, lentic, backwater lake habitat, possibly beyond the quantity previously found in the area. This may have resulted in a short-term boom in aquatic species that flourish in lake-like habitat, including a possible increase in fish species such as largemouth bass, bluegill, and black crappie. However, Pool 12 has since begun to suffer from sedimentation. Sediments eroding from lands within the upper watershed were carried downstream and deposited within these backwater lakes. The reduced velocities associated with the backwater lakes led to most sediments falling from the water column and accumulating within the artificial impoundment. Current maintenance of 9-foot channel project, including the Lock and Dam and channel training structures, limits the ability for the river to naturally create new backwater lake areas.

2. Present. At present, the backwater habitat of Pool 12 is degraded, with limited value as aquatic habitat. Some habitat improvement activities have occurred within adjacent areas of the UMRS, including backwater lake projects in Pool 13. However, these projects likely do not provide measurable benefits to Pool 12.

3. Future Actions. The Pool 12 HREP is the main effort to improve backwater habitat at the project area for the immediate future. With the proposed project, backwater habitat would be improved over existing conditions, with improved overwintering habitat for a variety of species. Habitat modifications should have long-term benefits to the fish and wildlife utilizing this area. This project, in concert with other EMP projects in the UMR System, should counter other impacts to the river ecosystem such as sedimentation, pollution, and general decline in river habitats.

Without this project, Pool 12 may continue to see reduced overwintering habitat for the foreseeable future. Without any improvements, Pool 12 would continue to be degraded, with any remaining overwintering habitat continuing to disappear.

At present, it is uncertain what other planning actions would address backwater habitat improvement in Pool 12. Efforts have been made in recent years for systemic habitat planning for the UMRS (e.g., “Pool Plans”). Although this effort would identify Pool 12 as an area in need of habitat restoration, it is unclear where authorization or appropriation would occur to address the issue. It is also possible that some larger restoration effort could result from the Upper Mississippi River/Illinois Waterway System Navigation Study. However, this is highly uncertain and may not immediately target improving habitat in Pool 12.

E. Socioeconomic Resources

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

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

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

4. Property Values and Tax Revenues. The proposed project would have no direct impact on property values or related tax revenues. All project lands are in Federal ownership and are managed by the U.S. Fish and Wildlife Service.

5. Public Facilities and Services. The proposed project would maintain and enhance recreational opportunities for the general public within Pool 12. Hunting and fishing in the immediate project area may be temporarily impacted during construction. However, following construction, dredging of the project area would provide improved recreational opportunities. A number of recreational facilities exist in Pool 12 including public use areas, marinas, and boat ramps. No adverse impacts to these facilities are anticipated.

The proposed project and features are adjacent to the Mississippi River 9-foot channel, but no adverse impacts to commercial navigation traffic on the river are expected. The potential exists for access problems and traffic conflicts near the Galena Boat Club during project construction; however, these impacts would be short-term.

The height of the power lines crossing the entrance to three of the project sites (No Name, Kehough and Fishtrap) is a concern. Care would need to be taken during dredging of these areas to avoid interference with the lines.

6. Life, Health, and Safety. The proposed project poses no threats to the life, health, or safety of recreationist or others in the area. A Phase I ESA assessment for the project was completed and revealed no evidence of hazardous substances, HTRW, or other regulated contaminants.

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

8. Employment and Labor Force. There could be a slight increase in short-term employment opportunities in the project vicinity due to project construction. No long-term impacts would result.

9. Farm Displacement. No farms would be displaced and no prime and unique farmland would be impacted by the proposed project.

10. Noise Levels. The proposed project sites are basically rural in nature. Project construction would generate a temporary increase in noise levels; no long-term impacts would result.

11. Aesthetics. The proposed environmental enhancement project would not diminish the aesthetic resources of the area. The recommended plan would result in an increase in mast-producing trees, which would be considered a benefit within the existing floodplain forest community. Any clearing of trees would be avoided to the extent possible, especially in the case of existing mature mast-producing trees.

F. Hazardous, Toxic, and Radioactive Waste (HTRW). A Phase I Environmental Site Assessment (ESA) or Hazardous Toxic Radioactive Waste Documentation Report (HTRWDR) for the Pool 12 Overwintering HREP was completed in accordance with ER 1165-2-132, HTRW Guidance for Civil Works Projects, and ER 405-1-12, Real Estate Handbook. The assessment revealed no evidence of hazardous substances, HTRW, or other regulated contaminants in connection with the project sites at the Pool 12 Overwintering Habitat Rehabilitation and Enhancement Project. Please refer to Appendix E for the complete HTRWDR.

G. Historic Properties. The Pool 12 project has no historic properties listed on or eligible for inclusion in the National Register of Historic Places. Appendix A includes Corps letters dated March 19, 2004 and April 20, 2004, to the Illinois State Historic Preservation Offices (SHPOs). The Illinois SHPO's reply of April 9, 2004 (IHPA Log #: 064032204) indicates concurrence with the findings of the archeological survey and the Corps determination of "no historic properties affected" by the Pool 12 undertaking. If the scope of the project should change, the Corps will coordinate any changes with the Illinois SHPO. In addition, if the execution of the project should uncover any item of archaeological, historical, or architectural interest, the Corps will ensure that reasonable efforts are taken to avoid or minimize harm to the property until its significance can be determined (36 CFR 800.11); the Corps will also comply with appropriate Federal and State laws should human remains be discovered.

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

I. Adverse Impacts Which Cannot Be Avoided. During construction, temporary noise impacts and a temporary increase in turbidity cannot be avoided. Placement of material within the river floodplain cannot be avoided, as this is the only viable placement alternative, and would in fact provide project benefits in most instances.

J. Short-Term Versus Long-Term Productivity. Short-term construction impacts would be offset by the long-term improvement of habitat quality.

K. Irreversible or Irretrievable Resource Commitments. Materials and human resources used in proposed construction are the sole irreversible commitments.

L. Relationship of the Proposed Project to Land-Use Plans. The lands are identified as Wildlife Management/Reserve Forest Lands in the Land Use Allocation Plan (U.S Army Corps of Engineers 1989). The proposed project does not conflict with this zoning. The proposed project does not conflict with any laws or regulations pertaining to establishment and management of the Upper Mississippi River National Wildlife and Fish Refuge.

M. Compliance with Environmental Quality Statutes. Table 9-1 lists Federal environmental protection statutes potentially applicable to the Pool 12 HREP, and the status of the recommended plan with respect to compliance with these statutes. Additional information relevant to compliance with specific laws and regulations is summarized below.

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

2. Clean Water Act (Sections 401 and 404). A Section 404(b)(1) evaluation for the selected plan is found in Appendix B of this report. Certification of the proposed project under Section 401 has been requested from the State of Illinois and will be obtained before construction begins.

3. Endangered Species Act of 1973, as amended. Construction activities should not disturb nesting bald eagles. No adverse effects to bald eagles would be anticipated. No impacts to the Higgins' eye mussel are anticipated to result from the project. No adverse effects to the Indiana bat are expected to result from project construction.

4. Farmland Protection. No farmland would be impacted by the proposed project.

5. Federal Water Project Recreation Act. Recreational opportunities were considered during the development of this project. Hunting and fishing in the immediate project area may be temporarily impacted during construction. However, following construction, dredging in the project area would provide improved opportunities for fishing and hunting in these areas.

6. Fish and Wildlife Coordination Act. Project plans have been coordinated with the U.S. Fish and Wildlife Service, the IADNR, and the ILDNR. Coordination with these agencies, as well as others, is detailed in Section 13, Coordination, Public Views, and Comments; and Appendix A - Correspondence. The Fish and Wildlife Coordination Act Report can be found in Appendix A.

7. National Environmental Policy Act of 1969, as amended. The completion of the EA and signing of the FONSI will fulfill NEPA compliance.

8. National Historic Preservation Act of 1966, as amended. The Pool 12 Overwintering Project has no historic properties listed on or eligible for inclusion in the National Register of Historic Places. The project has been coordinated with the Illinois State Historic Preservation Office (SHPO).

9. Wild and Scenic Rivers Act of 1968, as amended. The Mississippi River is not listed as a component river in the National Wild and Scenic River System.

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

11. Executive Order 11990 (Protection of Wetlands). Existing forested and non-forested wetland habitat would be affected by placement of dredged material on islands and in shallow water areas. However, terrestrial placement areas would be allowed to naturally revegetate or be replanted with desirable vegetation (mast-producing trees) that is of high value to the floodplain community. The shallow aquatic berms are necessary for placement of dredged material and for extending the life expectancy of dredge cuts. Existing forested wetland habitat also would be affected by placement of one to two feet of hydraulically dredged material in a low-level containment area. This placement is expected to allow continued survival of most existing on-site trees, and future regeneration of understory vegetation. Similar to the berms, the low-level hydraulic placement is necessary for placement of dredged material. In this instance, the interagency project team considered that the long-term effect of these placements would increase the ability of project area wetlands to provide fish and wildlife habitat.

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
Analysis of Impacts on Prime and Unique Farmland (CEQ Memorandum, 11 Aug 80)	Not applicable
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
Coastal Zone Management Act, 16 U.S.C. 1451, *et seq.*	Not applicable
Endangered Species Act, 16 U.S.C. 1531, *et seq.*	Full compliance
Farmland Protection Policy Act, 7 U.S.C., 4201, *et seq.*	Not applicable
Federal Water Project Recreation Act, 16 U.S.C. 460-1(12), *et seq.*	Full compliance
Fish and Wildlife Coordination Act, 16 U.S.C. 601, *et seq.*	Full compliance
Flood Plain Management (Executive Order 11988)	Full compliance
Land and Water Conservation Fund Act, 16 U.S.C. 460/-460/-11, *et seq.*	Not applicable
Marine Protection Research and Sanctuary Act, 33 U.S.C. 1401, *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
Protection of Wetlands (Executive Order 11990)	Full compliance
River and Harbor Act, 33 U.S.C. 403, *et seq.*	Full compliance
Watershed Protection and Flood Prevention Act, 16 U.S.C. 1001, *et seq*.	Full compliance
Wild and Scenic Rivers Act, 16 U.S.C. 1271, *et seq*.	Full compliance

Full compliance. Having met all requirements of the statute for the current stage of planning (either preauthorization or postauthorization)
Not applicable. No requirements for the statute required; compliance for the current stage of planning

X. PROJECT PERFORMANCE ASSESSMENT

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

The tables in this section present an overall description of the project phases; the activities that are to take place during certain phases, agency responsibilities, and monitoring data collection summaries. 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 specific parameters and the levels of enhancement that the project hopes to achieve. Plates 13-15 show monitoring locations.

Table 10-1. Monitoring and Performance Evaluation Matrix

Project Phase	Type of Activity	Purpose	Responsible Agency	Implementing Agency	Funding Source	Implementation Instructions
Pre-Project	Sedimentation Problem Analysis	Define system-wide problem Evaluate planning assumptions	USFWS	USGS (UMESC)	LTRM	--
	Pre-Project Monitoring	Identify and define problems at HREP site Establish need of proposed project features	Sponsor	Sponsor	Sponsor	--
	Baseline Monitoring	Establish baseline for performance evaluation	Corps	Field station or Sponsor through Cooperative Agreements, or Corps	HREP/ Sponsor	See table 10-2
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)	Sponsor through O&M, or Corps	HREP/ Sponsor	See table 10-3

USGS (UMESC) = U.S. Geological Survey (Upper Midwest Environmental Sciences Center)
USFWS = U.S. Fish and Wildlife Service

Table 10-2. Resource Monitoring and Data Collection Summary[1]

	Water Quality Data						**Engineering Data**			**Natural Resource Data**				
	Pre-Project Phase		**Design Phase**		**Post-Const. Phase**		**Pre-Project Phase**	**Design Phase**	**Post-Const. Phase**	**Pre-Project Phase**	**Design Phase**	**Post-Const. Phase**		
TYPE MEASUREMENT	**Apr-Sep**	**Oct-Mar**	**Jun-Sep**	**Dec-Mar**	**Jun-Sep**	**Dec-Mar**							**Sampling Agency**	**Remarks**
Point Measurements														
Water Quality Stations [2]														
Turbidity		M		M		M								
Secchi Disk		M		M		M								
Transparency		M		M		M								
Suspended Solids		M		M		M								
Dissolved Oxygen		M		M		M								
Specific Conductance		M		M		M								
Water Temperature		M		M		M								
pH		M		M		M							Corps and USGS (UMESC)	
Total Alkalinity		M		M		M								
Chlorophyll		M		M		M								
Velocity		M		M		M								
Water Depth		M		M		M								
% Cloud Cover	-	M	-	M	-	M								
Ice Depth	-	M	-	M	-	M								
Snow Depth	-	M	-	M	-	M								
Wind Direction		M		M		M								
Wind Velocity		M		M		M								
Wave Height		M		M		M								
Elutriate Analysis [3]				<u>1</u>									Corps	
Boring Stations [4]														
Geotechnical Borings								1					Corps	
Fish Monitoring														
Radiotracking Survey											1		IADNR 2002-2003	
Transect Measurements														
Sedimentation Transects Hydrographic Soundings							1	1	5Y				Corps	

	Water Quality Data						Engineering Data			Natural Resource Data				
	Pre-Project Phase		Design Phase		Post-Const. Phase		Pre-Project Phase	Design Phase	Post-Const. Phase	Pre-Project Phase	Design Phase	Post-Const. Phase		
TYPE MEASUREMENT	**Apr-Sep**	**Oct-Mar**	**Jun-Sep**	**Dec-Mar**	**Jun-Sep**	**Dec-Mar**							**Sampling Agency**	**Remarks**
Area Measurements														
Aerial Photography / (1:15,000)										1		5Y	Corps	
Vegetation Mapping										1		5Y	Corps	
Tree Survival / Regen Survey										1		Y5, 10 and 20	Corps	Year 5-tree survival survey; Years 10 and 20 - 1/100th acre plot sampling to record stem/acre of mast regeneration

C = Continuous C = n-Day Continuous
W = Weekly nW = n-Week interval
M = Monthly nY = n-Yearly interval
Y= Yearly 1,2,3, … = number of times data are collected within designated project phase

Corps = Corps of Engineers, Rock Island District
USFWS = U.S. Fish and Wildlife Service
USGS (UMESC) = U.S. Geological Survey (Upper Midwest Environmental Sciences Center)
IADNR =Iowa Department of Natural Resources

[1] See plates 13 through 15 for monitoring sites; plates 2 through 8 for boring locations.

[2] Water Quality Stations (Sampling by Corps unless otherwise noted)

W-M563.9T	Sunfish Lake (LTRM)	W-M564.5T	Sunfish Lake (LTRM)
W-M564.7R	Sunfish Lake	W-M566.2R	No Name Lake (LTRM)
W-M566.3P	Fishtrap Lake	W-M566.6T	No Name Lake (only water temperature data)
W-M567.5Y	Kehough Slough	W-M571.4N	Tippy Lake
		W-M571.9W	Stone Lake (only water temperature data)

[3] Elutriate Analysis

E-M564.3S	Sunfish Lake	E-M566.3P	Fishtrap Lake
E-M566.7T	No Name Lake	E-M567.7Y	Kehough Slough
E-M570.8K	Tippy Lake	E-M571.9X	Stone Lake

[4] Boring Stations
See Appendix G, Geotechnical Considerations

Table 10-3. Pool 12 Overwintering Post-Construction Evaluation Plan

Enhancement Potential									
Goal	**Objective**	**Enhancement Feature**	**Unit**	**Year 0 Without Alternative**	**Year 1 With Alternative**	**Year 20 With Alternative**	**Year 50 Target With Alternative**	**Feature Measurement**	**Annual Field Observations by Site Manager**
Restore and Protect Off-Channel Aquatic Habitat	Create off-channel deep-water areas to provide overwintering and year-round habitat for fish	Excavate channels in backwater areas	Winter water temperature (°C)	0.5	≥1.0	≥1.0	≥1.0	Perform water quality tests at established monitoring stations during winters with forecasts for heavy snow and/or lower average temps	Describe presence or absence of fish stress or kills. Describe water clarity.
			Winter DO (mg/l)	3-5 mg/l minimum	≥5 mg/l minimum	≥5 mg/l minimum	≥5 mg/l minimum		
	Maintain and increase depth diversity in backwaters		Water depth (ac > 1.2 m)	Phase 1-0 Phase 2-0	Phase 1-57.8 Phase 2–20.3	Phase 1-57.8 Phase 2–20.3	Phase 1-57.8 Phase 2–20.3	Conduct bathymetric survey	Observe condition of berms; note any evidence of revegetation, erosion, excessive slumping or filling of adjacent dredge cuts
Restore Floodplain Forest Habitat	Increase forest stands with hard mast-producing trees as a dominant or component species	Construct deflection berms, higher level terraces and/or islands from dredged material Establish native mast-producing trees on created high elevation areas	Elevated acres that meet or exceed site-specific target elevations (feet above MSL)	0	Phase 1–20.4 Phase 2–4.3	Phase 1–20.4 Phase 2–4.3	Phase 1–20.4 Phase 2–4.3	Spot-check berm elevations	Observe condition of terrestrial berms; note any evidence of uneven or excessive settling or lack of drainage
			Elevated acres containing live mast trees	0	Phase 1–20.4 Phase 2–4.3	Phase 1–20.4 Phase 2–4.3	Phase 1– 20.4 Phase 2– 4.3	Survey planted areas for survival of planted stock	Describe presence or absence of live planted stock, note any evidence of forage or other causes of mortality if observed
	Create areas within the pool with sufficient elevation to support regeneration of hard mast-producing trees	Create areas with elevations above the 2-year flood recurrence	Evidence of regeneration of mast trees	0	Phase 1–13.5 Phase 2–2.2	Phase 1–13.5 Phase 2–2.2	Phase 1–13.5 Phase 2–2.2	Conduct 1/100th acre plot sampling to record stem/acre of mast regeneration	Note any evidence of forage or other causes of mortality if observed

XI. REAL ESTATE REQUIREMENTS

The Pool 12 Overwintering HREP is a part of the Upper Mississippi River System – Environmental Management Program authorized by Section 1103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended. The project is located on the Mississippi River in Pool 12 between RM 563.0 and 573.0.

All project lands are presently owned by the United States and are under the control of USACE. The USFWS manages these lands under a cooperative agreement between the USFWS and the USACE, dated February 14, 1963, and an amended cooperative agreement dated July 31, 2001.

The project is comprised of six different areas to be constructed in two phases:

Phase 1. Sunfish Lake, Fishtrap Lake and Stone Lake

Sunfish Lake. The dredged material (berm) to be located in the Sunfish Lake area would cover approximately 15.4 acres of land.

Fishtrap Lake. The dredged material (berm) to be located in the Fishtrap Lake area would cover approximately 11.8 acres of land.

Stone Lake. The dredged material (berm) to be located in the Stone Lake area would cover approximately 13.5 acres of land.

Phase 2. Tippy Lake, Kehough Slough, and No Name Lake.

No Name Lake. There is no dredged material (berm) to be located in the No Name Lake area. The placement site upstream of No Name Lake would cover approximately 13.7 acres.

Kehough Slough. The dredged material (berm) to be located in the Kehough Slough area would cover approximately 2.2 acres of land.

Tippy Lake The dredged material (berm) to be located in the Tippy Lake area would cover approximately 4.4 acres of land. The confined placement area would cover approximately 10 acres.

The USFWS is a Federal participant in the project. The project would be 100 percent Federal cost. A map showing the project area is included on Plates 2 through 8 of this report.

There are no proposed Public Law 91-646 relocations as there are no acquisitions required.

No borrow material would be needed for this project. All berm construction materials would be dredged from within navigational servitude and project waters.

Access to the project would be by water (Mississippi River).

There are no known hazardous, toxic, or radioactive sites within the project area.

A draft Memorandum of Agreement (MOA) between the USFWS and the USACE is included as Appendix C. The Real Estate Plan is included as Appendix J. Estimated operation and maintenance costs can be found in table 8-3.

XII. VALUE ENGINEERING

A Value Engineering (VE) study was completed in March 2005 for this project in accordance with ER 11-1-321, Army Programs, Value Engineering, dated 28 February 2005 (formerly EC 11-1-114, Army Programs, Value Management/Value Engineering, dated 28 February 2003). The findings of that study have been reviewed for technical acceptance and coordinated with the sponsor as appropriate. The Draft DPR, dated October 2004 included riprap at Sunfish Lake. It was determined that the velocities through this reach do not require that riprap be placed. Therefore, the 11,500 tons of riprap that had been included in the Draft DPR has been eliminated from the project and is not included in this report, however, it is recommended that the constructed berm and dredged channel area be monitored after construction, as there could be areas that are sensitive to erosion. If damaging erosion begins to occur, riprap would be designed and constructed. The riprap would be reduced in scope to target the specific erosion rather than include a large wide band as initially proposed in the Draft DPR.

There were several other recommendations that have a potential of cost savings, but have not been incorporated in the project for this report. There appears to be a potential for savings by modifying the embankment alignments to reduce side cast-distance. More detailed surveys are needed in order to determine this proposal’s applicability. These recommendations would require further coordination and review upon the receipt of more detailed information and would require coordination with the sponsor as appropriate.

Additional opportunities to provide added value to the project will be pursued during the development of the plans and specifications and construction phases of the project.

XIII. IMPLEMENTATION RESPONSIBILITIES AND VIEWS

A. U.S. Corps of Engineers. The U.S. Army Corps of Engineers, Rock Island District, is responsible for project management and coordination with the USFWS, the States of Illinois and Iowa, and other affected agencies. The Rock Island District will submit the subject DPR; 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(3) of WRDA 1986 states that the first cost funding for enhancement features will be 100 percent Federal cost because project features will 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 will the responsibility of the Corps.

B. U.S. Fish and Wildlife Service. The USFWS is a Federal participant in the project and will produce a Coordination Act Report (CAR) for this project. Operation and maintenance of the project, as described in table 8-3, is the responsibility of the USFWS in accordance with Section 107(b) of the Water Resources Development Act of 1992, Public Law 102-580. The Corps would further specify these functions in the Project Operation and Maintenance Manual, which would be provided prior to closeout of the project.

C. Illinois and Iowa Departments of Natural Resources. The ILDNR and IADNR are project proponents and have provided technical and other advisory assistance during all phases of the project and would continue to provide assistance during project implementation.

XIV. 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
Iowa Department of Natural Resources
Illinois Historic Preservation Agency
U.S. Fish and Wildlife Service
U.S. Environmental Protection Agency

A. Coordination Meetings. Numerous coordination meetings were held with project cooperators to discuss potential enhancement features. The following meetings demonstrated ongoing coordination:

(1) February 6, 1996. Meeting with Corps, USFWS, ILDNR, and IADNR. Team proposed to combine the Molo Slough HREP and Pool 12 Overwintering HREP.

(2) December 13, 2000. General scoping meeting with Corps, USFWS, ILDNR, and IADNR.

(3) August 20, 2001. Site visit with Corps, USFWS, ILDNR, and IADNR.

(4) August 13, 2002. Meeting with Corps, USFWS, ILDNR, and IADNR to formulate preliminary dredging alternatives.

(5) February 20, 2003. Meeting with Corps, USFWS, ILDNR, and IADNR to project future without project conditions and future with project conditions for use quantifying habitat benefits.

(6) February 4, 2004. Meeting with Corps, USFWS, ILDNR, and IADNR to select the recommended plan.

(7) March 25, 2004. Site visit with Corps, USFWS, ILDNR, and IADNR.

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

(1) Letter dated April 19, 2001 from U.S. Fish and Wildlife Service Upper Mississippi River National Wildlife and Fish Refuge to the U.S Army Corps of Engineers expressing concerns regarding placement sites.

(2) Letter dated July 2, 2001 from U.S Army Corps of Engineers to U.S. Fish and Wildlife Service Upper Mississippi River National Wildlife and Fish Refuge addressing concerns related to placement sites and providing a project status update.

(3) Letter dated July 2, 2003 to multiple addressees at the Illinois DNR, Iowa DNR, US EPA, U.S. Fish and Wildlife Service, U.S. Coast Guard, Burlington Northern Santa Fe Railroad, and Galena Boat Club requesting comments on the final group of alternatives to be evaluated, any significant resources or other issues. The letter also requested USFWS comments on federally protected species.

(4) Letter dated July 31, 2003 from U.S. Fish and Wildlife Service Upper Mississippi River National Wildlife and Fish Refuge to the U.S. Army Corps of Engineers providing information on Federally protected species that may occur in the project area and requesting that the Corps evaluate potential upland placement sties.

(5) Letter dated August 4, 2003 from Illinois Department of Natural Resources to U.S. Army Corps of Engineers stating that it does not appear that the proposed project would adversely impact any Illinois threatened or endangered species and stating concurrence with the final group of alternatives. The letter also notes that the project would require permits from IDNR Office of Water Resources.

(6) Letter dated March 8, 2004, from U.S. Army Corps of Engineers to U.S. Fish and Wildlife Service and Iowa Department of Natural Resources requesting comments on potential impacts to federally protected species.

(7) Letter dated March 19, 2004, from U.S. Army Corps of Engineers to Illinois Historic Preservation Agency requesting review of Corps' opinion that the project will have "no effect" on historic properties.

(8) Stamp of Concurrence dated April 9, 2004, from Illinois Historic Preservation Agency stating concurrence with Corps March 19, 2004 letter.

(9) Letter dated April 20, 2004, from U.S. Army Corps of Engineers to consulting parties describing proposed project and results of historic property surveys. The letter also asks consulting parties for information related to the project's potential effects on historic properties. Illinois Historic Preservation Agency stating concurrence with Corps March 19, 2004 letter.

(10) Letter dated November 16, 2004 from U.S. Fish and Wildlife Service Rock Island Field Office, providing the Final Fish and Wildlife Coordination Act Report.

XV. CONCLUSIONS

Full realization of the potential habitat value in the Pool 12 has been hindered by the sedimentation of off-channel areas and changed flow regimes due to impoundment which has led to the loss of diverse bottomland forests and deep-water, off-channel habitats. Establishing off-channel areas containing reliable aquatic/wetland habitat and establishing terrestrial areas that would support survival and regeneration of hard mast-producing trees would allow the project area to realize the highest benefit to fish and migratory birds

The recommended project restoration features for Sunfish Lake, Fishtrap Lake, No Name Lake, Kehough Slough, Tippy Lake and Stone Lake (sediment deflection berms, mechanically and hydraulically dredged channels, mast tree establishment) are designed to meet the project's goals of restoring and protecting off-channel aquatic and backwater habitat and restoring floodplain forest habitat. These goals would be met by creating off-channel deep-water areas, increasing depth diversity in backwaters, increasing forest stands with hard mast-producing trees, and creating areas that support regeneration of hard mast-producing trees.

Assessment of the future with-project scenario shows definite increases in total habitat units over the 50-year project life for the target species, as well as a majority of other aquatic and wetland dwelling species. These increases represent quantification of the projected outputs: improved habitat quality and increased preferred habitat quantity.

This project is consistent with and fully supports the overall goals and objectives of the UMRS-EMP, the North American Waterfowl Management Plan, and the Partners in Flight Program.

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT (R-19PR)

POOL 12 OVERWINTERING
HABITAT REHABILITATION AND ENHANCEMENT PROJECT

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 Division Engineer approve the proposed project to include dredging backwaters, building deflection berms, building containment areas for dredged material and establishing mast-producing trees at the following six backwater sites: Sunfish Lake, Fishtrap Lake, No Name Lake, Kehough Slough, Tippy Lake, and Stone Lake.

The current estimated Federal construction cost of this project is $10,501,207. Total Federal estimated project cost, including general design and construction management, is $12,976,307.

At this time, I further recommend that funds in the amount of $476,000 be allocated for the preparation of the project plans and specifications for Phase 1.

________________________ ________________________________

(Date)

Melody D. Smith
Major, U.S. Army
Acting District Engineer

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
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POOL 12 OVERWINTERING
HABITAT REHABILITATION AND ENHANCEMENT PROJECT

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 enhancement project in Pool 12, Jo Daviess County, Illinois, 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 re-evaluated if warranted by further developments.

An array of management measures were considered from which alternatives were derived. The measures include:

A. dredging activities at one or more of six potential locations within Pool 12;
B. constructing deflection berms adjacent to select dredge cuts;
C. establishing native mast tree species on deflection berms; and
D. low-level hydraulic placement of dredged material.

The recommended plan addresses the primary goals of the Pool 12 Overwintering HREP to restore and protect off-channel aquatic habitat and restore floodplain forest habitat. The recommended plan would restore backwater habitat at six lakes by excavating approximately 80 acres of deep backwater channels providing overwintering and year-round habitat for fish in the surrounding 6,942 acres. The recommended plan would also establish mast-producing trees on approximately 24 acres of raised berms. The plan provides 109 AAHUs of fish habitat. The recommended plan also includes building deflection berms and containment areas where needed.

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 habitat value of Pool 12 for fish, and to improve the diversity of the floodplain forest community.

B. Aside from temporary disturbances during construction, no long-term significant impacts to natural or cultural resources are anticipated. No federally protected species would be affected by the proposed action.

C. Land use after the project should remain unaltered, and no significant social or economic impacts to the project area are expected.

D. The project will comply with Sections 401 and 404 of the Clean Water Act.

_________________________ __________________________________

(Date)

Melody D. Smith
Major, U.S. Army
Acting District Engineer