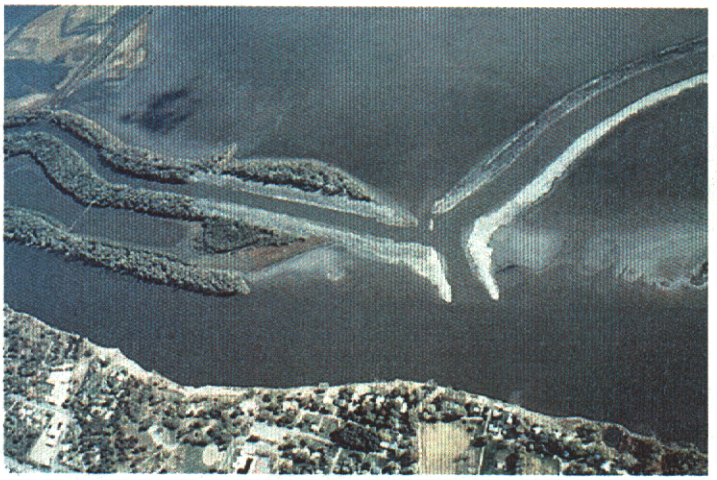
UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POST-CONSTRUCTION INITIAL PERFORMANCE
EVALUATION REPORT (IPER6F)

PEORIA LAKE HABITAT REHABILITATION AND ENHANCEMENT PROJECT



MARCH 2001
4-YRS POST CONTRUCTION

US Army Corps
of Engineers
Rock Island District

PEORIA POOL
RIVER MILES 178.5-181.0
WOODFORD COUNTY, ILLINOIS

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

REPLY TO
ATTENTION OF

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March 7, 2001

Planning, Programs, and
Project Management Division

SEE REPORT DISTRIBUTION LIST (APPENDIX H)

The Rock Island District of the U.S. Army Corps of Engineers has enclosed for your use the Post-Construction Initial Performance Evaluation Report (IPER6F) for the Peoria Lake, Illinois, Habitat Rehabilitation and Enhancement Project (HREP), dated March 2001. This report is a product of 4 years of post-construction observations and field monitoring since project completion in 1997. A 5-year report is due out in March 2002.

Performance Evaluation Reports, both initial and supplemental, are the Corps of Engineers' primary mechanism for documenting and communicating the effectiveness of Upper Mississippi River System – Environmental Management Program (UMRS-EMP) HREPs.

A December 1999 draft of this report was provided to project sponsors for their review and comment. These comments, including several changes that were made to the "Conclusions and Recommendations" section and to the Appendices, are incorporated into this version of the report.

Should you have any questions regarding this report, please contact Ken Barnes, Jon Fleischman or Dan Holmes at the U.S. Army Corps of Engineers Rock Island District, Design Branch. You may reach them at (309) 794-5159 with comments.

Sincerely,

Gary E. Loss, P.E.
Chief, Planning, Programs, and Project
Management Division

Enclosure

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

REPLY TO
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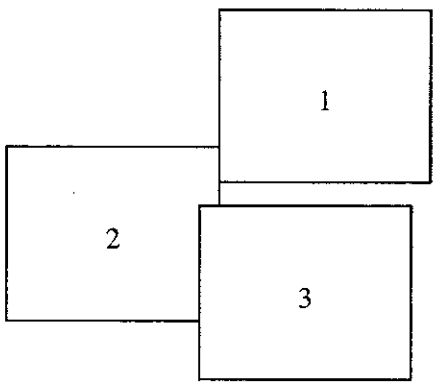
UPPER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM (UMRS-EMP) POST-CONSTRUCTION INITIAL PERFORMANCE EVALUATION REPORT (IPER6F, 4-Yrs After Construction)

PEORIA LAKE HABITAT REHABILITATION AND ENHANCEMENT PROJECT

PEORIA POOL, RIVER MILES 178.5 - 181.0
WOODFORD COUNTY, ILLINOIS

MARCH 2001



Cover photos:

1. Oblique aerial photograph taken 11 Oct 96; barrier island complex
2. Oblique aerial photograph taken 11 Oct 96; forested wetland management area
3. Oblique aerial photograph taken 11 Oct 96; barrier and overburden islands

ACRONYMS

Corps	U.S. Army Corps of Engineers
DPR	Definite Project Report
EMP	Environmental Management Program
FWMA	Forested Wetland Management Area
HREP	Habitat Rehabilitation and Enhancement Project
ILDNR	Illinois Department of Natural Resources
INHS	Illinois Natural History Survey
IPER	Initial Performance Evaluation Report
PER	Performance Evaluation Report
LTRMP	Long Term Resource Monitoring Program
msl	mean sea level
RM	River Mile
UMRS	Upper Mississippi River System
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

Additional information about the Peoria Lake HREP and the UMRS-EMP is available via the Internet at the following addresses: www.mvr.usace.army.mil/EMP/default.htm or www.mvr.usace.army.mil

ACKNOWLEDGMENT

Identified below are the primary staff members of the U.S. Army Corps of Engineers Rock Island District, the U.S. Geological Survey Department and the Illinois Department of Natural Resources who contributed to the development of this Post-Construction Initial Performance Evaluation Report for the Peoria Lake Habitat Rehabilitation and Enhancement Project:

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US Army Corps of Engineers
Rock Island District

ILLINOIS DEPARTMENT OF NATURAL RESOURCES

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WOODFORD COUNTY, ILLINOIS

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EXECUTIVE SUMMARY

Peoria Lake Rehabilitation and Enhancement Project, Post-Construction Performance Evaluation Report
March 1991 to March 2001

Two major goals of Peoria Lake Project:

A. Enhance Wetland Habitat (FWMA)

1. Increase food production/resting area for waterfowl
2. Increase submergent/emergent waterfowl vegetation

B. Enhance Aquatic Habitat (Barrier Island)

1. Provide flowing side channel aquatic habitat
2. Increase submergent waterfowl vegetation

A. Enhance Wetland Habitat (FWMA)

1. *Operation and Maintenance*: The FWMA pump station and stoplog structures are operated and maintained to control the water levels in the FWMA cells during migrating periods for waterfowl. The FWMA levees are maintained to reduce erosion and promote desirable vegetation. Post-construction high water periods have washed away initial levee seeding, giving way to bank erosion. Minor repair of the Peoria Lake side levee was accomplished by the site manager with some installation of riprap in high erosive areas, that to date is performing well. Independent operation of the FWMA cells, the weight of the stoplogs, the closing of bays with solid plates and levee erosion due to the lack of levee vegetation (seeding) are concerns that are being discussed.

2. *Vegetation Monitoring*: Mast tree plantings and tree mortality are surveyed to see what effect the pooling of the FWMA has on plantings survival/growth and waterfowl use. No measurable increase in plantings growth or tree mortality was observed. Annual spot planting and planting on levees to be discussed. Monitoring will continue.

3. *Waterfowl Use Monitoring*: Surveys by the INHS, Center for Wildlife Ecology, have shown a substantial increase in waterfowl use of the FWMA. Numbers show an increase in both total ducks and species surveyed, from 5300 ducks/9 species in 1992 to 70,700 ducks/18 species in 1997, during the fall aerial inventory period. The spring inventory increased from 1000('92) to 3000('98). Waterfowl monitoring will continue as scheduled.

B. Enhance Aquatic Habitat (Barrier Island Complex)

1. *Operation and Maintenance*: The Barrier Island has no operational requirements. The island is maintained to reduce bank erosion through vegetation planting, somewhat unsuccessful, and erosion control mats, some being washed away. An Overburden Island was also created to help reduce erosion. A survey of the islands' cross-sections is scheduled for the summer of 2001. No maintenance has been required since project completion.

2. *Wind Monitoring and Channel Velocity*: Wind monitoring was completed in 1996 and 1997 with results showing that the Barrier Island was effective in reducing wave heights 37% of the time during the testing periods. This has helped reduce the amount of suspended solids in Peoria Lake, improving clarity to promote aquatic plant growth. Post-construction water velocity measurements conducted in the East River channel have shown that water velocities ranged between 2.95 & 0.23 ft/sec in the channel, which was stagnant during low river stages prior to the dredging of the channel, thus improving the aquatic habitat by increasing the dissolved oxygen amounts in the channel. Monitoring will continue with turbidity monitoring possibly being added.

3. *Vegetation Monitoring*: Submergent vegetation monitoring is done along established transects in Peoria Lake on the leeward side of the Barrier Island. Results have revealed no evidence of aquatic plant growth from pre-sampling in 1992 to post-sampling in 1998, with unsuccessful island vegetation possibly due to high water.

4. *Waterfowl Use Monitoring*: Surveys by the INHS, Center for Wildlife Ecology, have shown a substantial increase in waterfowl use of the Peoria Lake Project as stated above. Monitoring will continue as scheduled.

5. *Flowing Side Channels*: The increase in water velocity and lack of silt accumulation is promoting a better quantity and species of fish along the East River channel. Surveys by the Havana LTRM field station show an increase in both the quantity and species of fish from 5400 fish/36 species in 1991 to 37,200 fish/59 species in 1997 at the experimental test sites. Control sites also showed increases. Monitoring will continue as scheduled, with monitoring the habitat between the islands and obtaining better fish data, such as weight, being discussed.

Conclusions

Although an increase in food and submergent/emergent vegetation for waterfowl has not been realized to date, the Peoria Lake project is providing a better resting area for waterfowl, while the dredging of the East River channel has allowed a better supply of main channel flow to enter the East River channel, providing an improved aquatic habitat.

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PEORIA LAKE HABITAT REHABILITATION AND ENHANCEMENT

PEORIA POOL, RIVER MILES 178.5 - 181.0
WOODFORD COUNTY, ILLINOIS

1. INTRODUCTION

The Peoria Lake Habitat Rehabilitation and Enhancement project, hereafter referred to as "the Peoria Lake project," is an ongoing part of the Upper Mississippi River System (UMRS) Environmental Management Program (EMP). The Peoria Lake project is located in the Peoria Pool of the Illinois Waterway between river miles (RM) 178.5 and 181.0. The location map, shown as figure 1 below, shows the main project features along with plate 1, which contains the location plan and vicinity map.

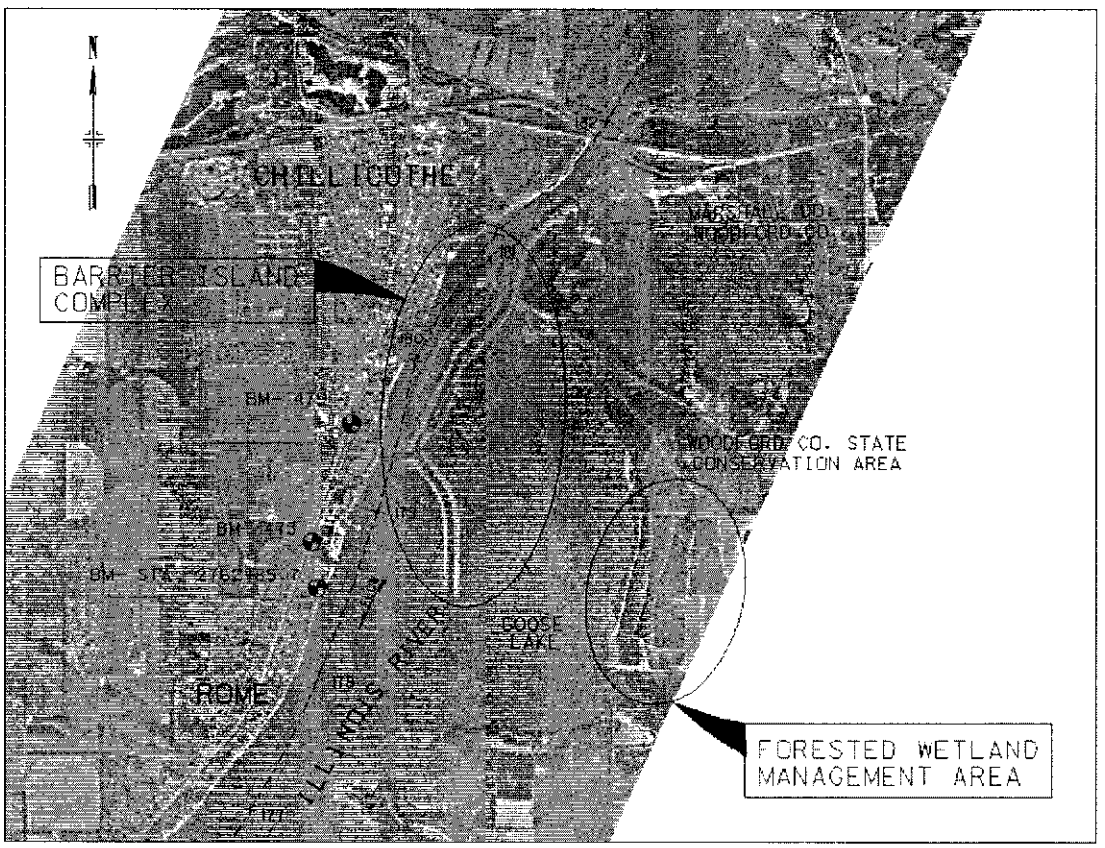


Figure 1. Location Map.

a. Purpose. The purposes of this Performance Evaluation Report (PER) are as follows:

(1) Summarize the performance of the Peoria Lake project relative to stated project goals and objectives (see project reference (1) below and Table 2-1);

(2) Present project physical, chemical, and biological monitoring data collected to date;

(3) Review the project monitoring plan;

(4) Summarize project operation and maintenance efforts to date; and

(4) Review engineering performance criteria to aid in the design of future projects.

b. Scope. This report summarizes available project monitoring data, inspection records, and observations made by the U.S. Army Corps of Engineers (Corps), the U.S Fish and Wildlife Service (USFWS), the U.S. Geological Survey (USGS), and the Illinois Department of Natural Resources (ILDNR) for the period from March 1991 through March 2000.

c. Project References. Published reports which relate to the Peoria Lake project or which were used as references in the production of this document are presented below:

(1) *Peoria Lake Enhancement, Upper Mississippi River System Environmental Management Program, Definite Project Report (R-6F) with Integrated Environmental Assessment, Peoria Pool, Illinois Waterway*, July 1990. This report presents a detailed proposal for construction of a 168-acre Forested Wetland Management Area (FWMA); a 1.1-mile-long, 16-acre Barrier Island; and restored flow through the East River side channel. This report marks the conclusion of the planning process and serves as a basis for approval of the preparation of final plans and specifications and subsequent project construction.

(2) Plans and Specifications, Contract No. DACW25-93-C-0134, *Illinois Waterway, Environmental Management Program, River Mile 178.5 to 181.0, Peoria Lake Forested Wetland Management Area*, September 23, 1993. This document was prepared to provide sufficient detail of project features to allow preparation of construction contract documents and subsequent construction of the FWMA, which included a pump station, water control structure, and mast tree planting by a contractor.

(3) Plans and Specifications, Contract No. DACW25-94-C-0083, *Illinois Waterway, Environmental Management Program, River Mile 178.5 to 181.0, Peoria Lake Barrier Island and East River Enhancement*, June 20, 1994. This document was prepared to provide sufficient detail of project features to allow construction of the Barrier Island and removal of a silt plug from the south end of the East River channel by a contractor.

(4) Plans and Specifications, Contract No. DACW25-95-C-0041, *Illinois Waterway, Environmental Management Program, River Mile 178.5 to 181.0, Peoria Lake Vegetation*, March 31, 1995. This document was prepared to provide sufficient detail of project features to plant vegetation on the barrier island, adjacent to the East River channel excavation, and in the FWMA by a contractor.

(5) Plans and Specifications, Contract No. DACW25-97-M-0515, *Rock Closure Structure, Peoria Lake, Illinois Waterway, Woodford County, Illinois*, May 15, 1997. This document was prepared to provide sufficient detail of project features to allow construction of a rock closure structure at the upstream end of the channel between the Barrier Island and the Overburden Island by a contractor.

(6) *Operation and Maintenance Manual, Peoria Lake Enhancement, Upper Mississippi River, Environmental Management Program, Peoria Pool, River Miles 178.5 - 181.0, Woodford County, Illinois,* May 1998. This manual was prepared to serve as a guide for the operation and maintenance of the Peoria Lake project. Operation and maintenance instructions for the major features of the project are presented.

(7) *Aerial Waterbird Inventories of Chautauqua National Wildlife Refuge and Peoria Lake Environmental Management Program Sites*, annual reports from 1991-1992 through 1997-1998, by Michelle M. Georgi and Stephen P. Havera. Illinois Natural History Survey, Center for Wildlife Ecology.

(8) *Midterm Report on Pre-construction Sampling at Chautauqua and Peoria Lake HREP Areas, 1992*, report of fish community monitoring during 1991, by James R. Harvey. Illinois Natural History Survey, Long Term Resource Monitoring Field Station.

(9) *Annual Progress Report: Bioresponse Monitoring at Peoria Lake and Lake Chautauqua Habitat Rehabilitation and Enhancement Projects*, report of results of fish community monitoring and vegetation (aquatic and woody) monitoring conducted during 1992, by Kevin S. Irons and K. Douglas Blodgett. Illinois Natural History Survey, LTRMP Havana Field Station.

(10) *Progress Report: Bioresponse Monitoring at Peoria Lake and Lake Chautauqua Habitat Rehabilitation and Enhancement Projects, August 1994*, report of results of fish community monitoring and vegetation (aquatic and woody) monitoring conducted during 1991-1994, by K. Douglas Blodgett, Kevin S. Irons, and Thad R. Cook. Illinois Natural History Survey, LTRMP Havana Field Station.

(11) *Annual Progress Report for the Bioresponse Monitoring of Peoria Lake Habitat Rehabilitation and Enhancement Project (HREP), February 1999*, report of results of 1997 fish community monitoring with comparisons to 1991-1992 pre-construction monitoring results, by Kevin S. Irons and Timothy M. O'Hara. Illinois Natural History Survey, Long Term Resource Monitoring Program, Center for Aquatic Ecology.

(12) *Completion Report for Bioresponse Monitoring of Peoria Lake Habitat Rehabilitation and Enhancement Project (HREP),* (in preparation), report of results of 1998 fish community monitoring with comparisons between 1991-1992 pre-construction monitoring and 1997-1998 post-construction monitoring results, by Kevin S. Irons and Timothy M. O'Hara. Illinois Natural History Survey, Long-Term Resource Monitoring Program, Center for Aquatic Ecology.

2. PROJECT GOALS, OBJECTIVES, AND MANAGEMENT PLAN

a. General. As stated in the DPR, the Peoria Lake habitat project was initiated primarily to address sedimentation that had degraded much of the fish and wildlife habitat value of Peoria Lake. The lake has lost approximately 68% of its historic volume, and average depth has been reduced from 8.1 to 2.6 feet since 1903. The shallow depths promote wind fetch re-suspension of unconsolidated sediments resulting in elevated turbidity levels. Also, these soft, unconsolidated lake bottom sediments are not receptive to the rooting and subsequent survival of aquatic plants.

b. Goals and Objectives. Goals and objectives were formulated during the project design phase and are summarized in Table 2-1.

TABLE 2-1

Project Goals, Objectives, and Enhancement Features

Goal	Objective	Enhancement Feature
Enhance Wetland Habitat	Increase reliable food production and resting area for waterfowl	Forested Wetland Management Area: water control and mast tree area
	Increase diversity and extent of submergent and emergent vegetation for waterfowl	Barrier Island Complex: aquatic vegetation bed and island vegetation along the East River and the barrier island.
Enhance Aquatic Habitat	Provide flowing side channel aquatic habitat	Flowing side channel and embankment in the East River and between the barrier island and the overburden island.

c. Management Plan. As with more recently developed EMP projects such as Andalusia Refuge, Illinois (RM 462 - 463); Potters Marsh, Illinois (RM 522.5 - 526.0); and Brown's Lake, Iowa (RM 545.8), a formal Annual Management Plan has been developed for the FWMA at the Peoria Lake project. The Corps developed the Management Plan in coordination with the ILDNR. Table 2-2 shows the management plan for the water control structures (stoplogs) in the FWMA. The Peoria Lake project is managed by the Woodford State Fish and Wildlife Area, a state park that comes under the jurisdiction of ILDNR, under authority of Cooperative Agreements with the Corps. Peoria Lake is operated as generally outlined in the O&M manual.

TABLE 2-2

Annual Management Plan for the Forested Wetland Management Area (FWMA)

Month	Management Action	Purpose
December thru March	De-water the Forested Wetland Management Area (FWMA) to elevation 440.0 by removing all of the stoplogs in all three of the stoplog structures. Start de-watering as soon as the waterfowl hunting season ends in December. Lower the water elevation slowly through to the end of March.	Removes the water from the FWMA so that plant and tree species can flourish. Slow de-watering reduces potential negative impacts of "nutrient flushing."
April to September	Maintain the FWMA at an elevation of 440.0. Begin filling of cells in the latter part of September.	Allows plant and tree species to flourish. Start of fill allows early duck use of site.
October to November	Gradually fill Cells A, B, and C to the applicable design elevation of 444', 446', or 448' MSL by Nov 1.*	Provides new exposure through October to maximize feeding and resting opportunities for migrating waterfowl.
November to December	Maintain FWMA water levels to maximum extent possible (444', 446', 448' MSL) if necessary by use of pumping capability.	Maintains maximum resting and feeding opportunities though waterfowl season.

* No or reduced fall flooding of each cell, one out of every 4 to 5 years, may be required to minimize tree stress and maintain the long-term health of the existing forests within the FWMA.

3. PROJECT DESCRIPTION

a. Project Features. The project consists of a Forested Wetland Management Area (FWMA) and a Barrier Island Complex, with associated flowing side channels and a rock closure structure. The project features are illustrated below in Figure 2 and on plate 2.

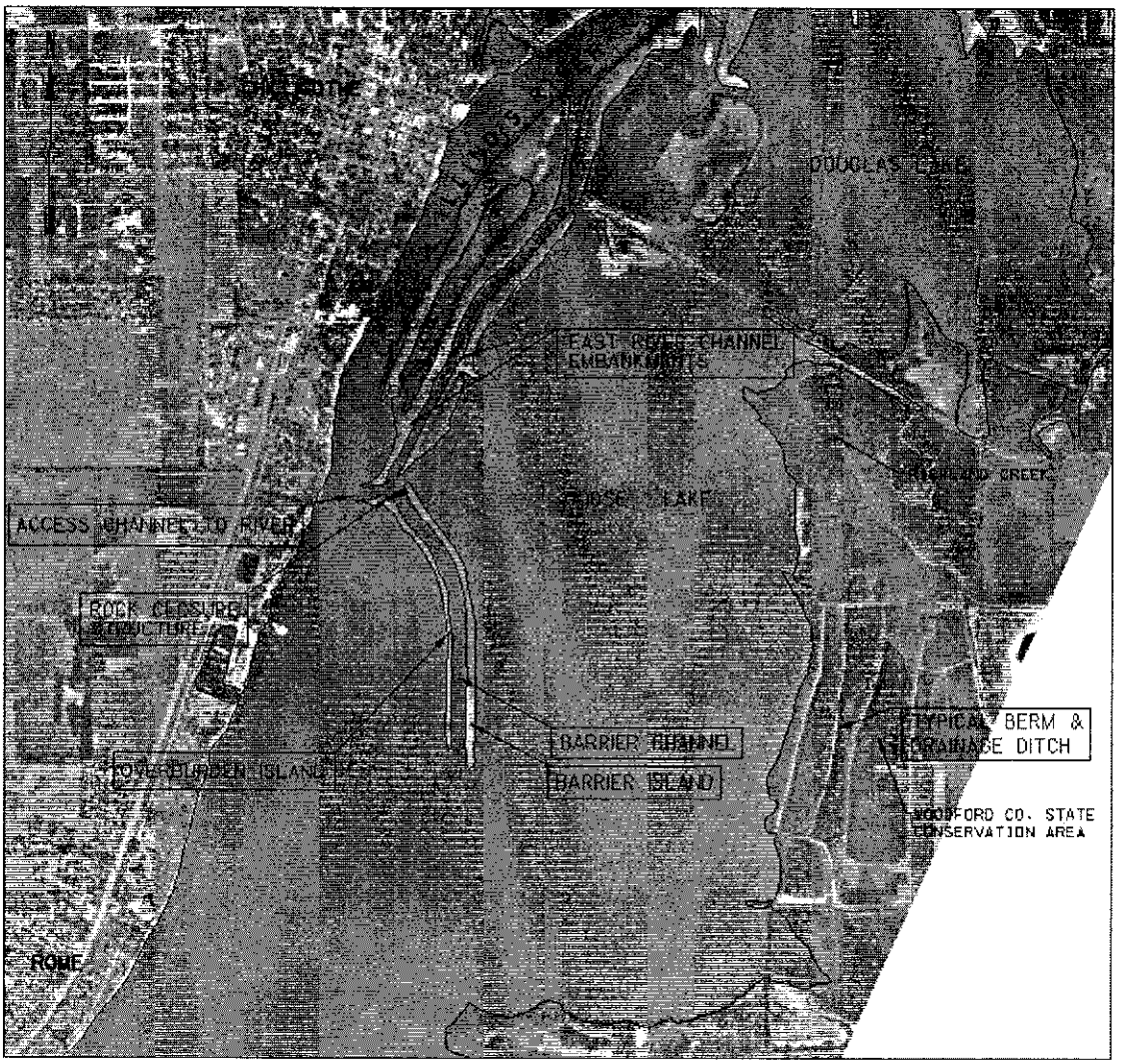


Figure 2. Project Features.

(1) Forested Wetland Management Area (FWMA). The FWMA is a 168-acre area of land adjacent to Goose Lake that is the northern end of Peoria Lake. Three earthen levees and associated water control structures and a pump station create three independently managed forested wetland areas. To flood the FWMA, water is pumped into Cell A where it is either ponded or allowed to flow through the stoplog structure into Cell B. The water is then retained in Cell B or allowed to flow through another stoplog structure into Cell C. To drain the FWMA, all stoplog structures are opened. This drains all the water through Cell C into the Illinois River. The system allows the three cells to be operated independently. Operation levels are adjusted to enhance feeding areas.

(a) Water Source. The water used to flood the FWMA comes from an existing channel adjacent to the project, which connects to the Illinois River and Upper Peoria Lake.

(b) Pump Station. The pump station is provided with a 30 hp, submersible, propeller-type pump with a capacity of 6,000 gpm against a total dynamic head of 12.5 feet. This pump was sized to fill the FWMA within 10 days. It is housed in a vandal-resistant, cast-in-place housing. The intake entrance is equipped with a trash rack. Underground electrical power is provided to the site, and all necessary electrical equipment is located on an overhead platform in the vicinity of the pump station. Water is pumped from the pump station through a 24-inch concrete pipe to a discharge assembly in Cell A. The discharge assembly is used to slow the exit velocity and to protect the pipe from vandalism.

(c) Water Control Structures. The FWMA requires the use of three concrete stoplog water control structures, each with four 5-foot-wide stoplog bays. Their purpose is to allow independent operation of the cells and to protect the FWMA from flood damage. All of the water control structures have a steel grate deck to allow for vehicle passage overhead.

(d) Levees. The levees were constructed to provide 2 feet of water depth inside the cells with 2 feet of freeboard. The top of the levee for Cell C is at elevation 446.0 MSL, the top of the levee for Cell B is at elevation 448.0 MSL and the top of the levee for Cell A is at elevation 450.0 MSL. The riverside of Cell C levee has a 6H:1V slope to prevent high water wave erosion. All other slopes are 3H:1V. The levees are 12 feet wide at the crown to facilitate access within the FWMA. Borrow for the levees came from an adjacent ditch excavation or was scraped from a borrow area located in Cell A. The ditches serve as an internal drainage system for the FWMA and facilitate the water control plan as described previously. The levees were seeded for erosion bank stabilization and erosion control.

(2) Barrier Island Complex. The Barrier Island Complex consists of a barrier island, an overburden island, and a rock closure structure.

(a) Barrier Island. The Barrier Island is an earthen embankment constructed by mechanical excavation of adjacent sediment. It is approximately 1 mile long and 182 feet wide at the base. It has a 50-foot-wide crown, side slopes of 6H:1V, and a top elevation of 446.0 MSL. The island follows historical high ground that was shown on surveys made in 1903. After the optimal foundation support was established, the island was further shifted to minimize hydraulic impacts. Also, the site provided navigation channel construction access. During construction, the top 4 feet of sediment was spoiled on the riverside of the Barrier Island to create the Overburden Island. This material was beneficial in protecting the Barrier Island from wave wash erosion.

(b) Rock Closure Structure. The rock closure structure is located at the downstream end of the East River channel and the upstream end of the Barrier Island. The structure consists of riprap placed between the barrier and overburden islands to an elevation of 438.0 MSL, which is 2 feet below the normal flat pool elevation of 440.0 MSL. The rock closure structure is marked by two steel beams that extend through its center to an elevation of 449.0 MSL. It was necessary to dredge an access channel in the East River adjacent to the closure structure in order to allow work and supply barges to access the site. This dredging work has essentially rerouted the downstream end of the East River so that it now flows to the main navigation channel instead of to Goose Lake. The installation of the rock closure structure and the dredging of the access channel allows a majority of the sediment, that flows through the East River, to exit back to the main river channel, while still allowing a small amount of flow to enhance the quality of the deep water habitat between the Barrier and Overburden Islands.

(3) Flowing Side Channels. The project was originally planned to have only one flowing side channel located on the historic East River channel. The overburden island is withstanding wind fetch and other causes of erosion quite well and thus the completed project now has an additional flowing side channel located between the barrier and overburden islands.

(a) East River Channel. The East River channel is divided into two sections. The first section is an excavation that is 95 feet wide at the bottom and that extends from the rock closure structure upstream approximately 2,250 feet. Material from this excavation was placed on the adjacent banks. Pin oak seedlings were planted on these embankments. The other section is an excavation that extends 1,300 feet from the rock closure structure to navigation channel. It serves as an outlet channel for the flow from the first section. Prior to construction of the rock closure structure, the majority of the flow in the East River channel was directed into the barrier channel and the 1,300-foot section had silted in. The material from the second excavation was placed on the adjacent banks and was not vegetated. Both sections were excavated to a depth of 433.0 MSL, 7 feet below flat pool. However, the long-term project depth is 4 feet below flat pool. The additional 3 feet of excavation accounts for expected sedimentation. Based on historic sedimentation rates, it is expected that the channel will require re-excavation in approximately 25 years.

(b) Barrier Channel. With the addition of the rock closure structure and the fact that the Overburden Island is not being washed into the barrier channel, there are now two separate channels in the Barrier Island Complex. The rock closure structure keeps the majority of the water in the East River flowing back to the main navigation channel. Only a small percentage of the flow is directed into the Upper Pool and Goose Lake area via the barrier channel.

b. Construction. The project was constructed in four distinct phases. Table 3-1 summarizes the phases and general scopes of work.

TABLE 3-1

Construction of the Project

Phase	Title	Scope of Work	Construction Period
Stage I	Forested Wetland Management Area (FWMA); DACW25-93-C-0134	Construct a three-celled FWMA with water control structures and a pump.	Awarded: 23 SEP 93 Completed: 16 MAR 96
Stage II	Barrier Island & East River Channel; DACW25-94-C-0083	Construct a new mile+/- long island, channel, and adjacent overburden island. Rehabilitate the East River channel and adjacent islands.	Awarded: 20 JUN 94 Completed: 9 DEC 94
Stage III	Vegetation; DACW25-95-C-0041	Plant vegetation on the barrier island and the FWMA, to include willow wattles, willow stakes, bulrush, reedgrass, cattails, northern pecan, pin oak, and swamp white oak.	Awarded: 31 MAR 95 Completed: 12 JUL 96
Stage IIIb	Rock Placement; DACW25-96-M-0877	Supply and place riprap on the levee between Cells A and B in the FWMA	Awarded: 18 JUN 96 Completed: 15 OCT 96
Stage IV	Rock Closure Structure; DACW-97-M-0515	Construct rock closure structure and H-beam markers on the upstream end and northeast side of the barrier island.	Awarded: 25 APR 97 Completed: 12 SEP 97

c. Operation and Maintenance. Project operation and maintenance generally consists of: (1) operation and maintenance of the water supply well and pump station in the FWMA; (2) operation and maintenance of the stoplog water control structures in the FWMA; (3) mowing of grasses and appropriate select removal of undesired vegetation of the levees in the FWMA; (4) applicable repair of the levees and levee slopes in the FWMA because of flooding, burrowing by animals, or other reasons; (5) inspection and remedial work on the barrier island to reduce erosion and enhance desired vegetation growth; and (6) maintenance of the rock closure structure. A detailed discussion of the operation and maintenance requirements can be found in the *Operation and Maintenance Manual, Peoria Lake Enhancement, Upper Mississippi River, Environmental Management Program, Peoria Pool, River Miles 178.5 - 181.0, Woodford County, Illinois,* dated May 1998. The operation of the FWMA is discussed below.

(1) Forested Wetland Management Area (FWMA).

(a) Water Control Plan. To flood the FWMA, water will be pumped into Cell A where it can either pond or be allowed to flow through the stoplog into Cell B. The water can then be retained in Cell B or allowed to flow through another stoplog into Cell C. To drain the FWMA, all of the stoplog structures are opened. This drains all the water through Cell C into the Illinois River. This system allows the three cells to be operated independently of each other. Table 3-2 gives planned water surface elevations representing maximum levels for design purposes. Actual operation levels may be adjusted to enhance feeding areas.

TABLE 3-2 Water Surface Elevations	
Cell	**Elevation (MSL)**
A	448.0
B	446.0
C	444.0

(b) Levee Stabilization. All levees were created with a desirable 3:1 slope to accommodate mowing and maintenance. Fall seeding of annual ryegrass along with erosion control mats were applied to promote levee stabilization, although the high water periods of 1997 and 1998 washed away some control mats and most of the seeding in FWMA cells B and C, allowing only minimal amounts of ryegrass to take root. The lack of vegetation for stabilization of the levees and high water periods have given way to erosion on the westerly levee of FWMA cell C along Goose Lake. The site manager has repaired portions of the eroded levee on the westerly FWMA cell C levee due to over-toping. Riprap was also applied at high erosive locations along the levee and is performing well. Alternative seeding and bank stabilization measures need to be addressed. The erosion of the levee is not detrimental to the FWMA's performance, with maintenance to repair the levees done as needed by the Site Manager.

(c) Access. The ILDNR controls access to the FWMA. Public vehicular and watercraft traffic is prohibited to minimize consequent disturbance.

(2) Barrier Island Complex.

(a) Hydraulic Impacts. The Corps of Engineers Waterways Experiment Station (WES) hydraulically modeled the Barrier Island. The modeling showed that the island would not have any significant impact on sedimentation or flow patterns in the navigation channel or on adjacent, privately owned lands. The island was created to reduce wave height and re-sespension of solids in Goose Lake.

(b) Bank Stabilization. The bank stabilization plan consisted of planting vegetation on the flattened slopes. A 12-foot-wide, permanent erosion control mat was anchored at each end of the island. Arrowheads and bulrushes were planted on the lower parts of the island. Willow cuttings were planted just above the normal low pool waterline at each end of the island. A small plot of reed and cattail plants was added for diversity. Maintenance has not been required since project completion in 1997.

4. PROJECT MONITORING SCHEDULE AND AGENCIES

a. General. The success of the project, relative to original project objectives, is measured using data collected by various agencies. The following agencies have supported the collection of the data used in this report: the U.S. Army Corps of Engineers, Rock Island District; the Illinois Natural History Survey (Forbes Biological Station); and the Illinois Department of Natural Resources (Havana LTRM Field Station).

Appendix A presents the Post-Construction Evaluation Plan. This plan was developed during the design phase and serves as a guide to measure and document project performance.

Appendix B contains the Monitoring and Performance Evaluation Matrix and Resource Monitoring and Data Collection Summary. This schedule presents the types and frequency of data that have been collected to meet the requirements of the Performance Evaluation Plan.

b. Corps of Engineers. The Corps collects water depth and vegetation data along the sediment transects whose ranges are shown on plate 3. The physical locations of the sampling stations referenced in the Performance Evaluation Report can also be located on Plate 3 and the Resource Monitoring and Data Collection Summary is located in Appendix B. The sediment transects are surveyed at various times of the year, depending on project site accessibility, water level, and agency work loads. The Corps also has collected water quality and local wind data presented in the report.

c. Illinois Natural History Survey (INHS). The INHS, Havana LTRMP Field Station, has conducted biological response monitoring of fish communities and vegetation (aquatic and woody) during both pre-construction and post-construction conditions at the project site. The INHS, Forbes Biological Station, has conducted aerial waterfowl inventories of the project site during fall and spring migration each year since (fall) 1991.

d. Illinois Department of Natural Resources (ILDNR). The ILDNR manages the project site. Monitoring activities conducted by the ILDNR include inventorying wood duck nest boxes installed in the FWMA and compiling harvest data recorded during waterfowl hunting season.

e. U.S. Fish and Wildlife Service (USFWS). The USFWS does not monitor this site. The USFWS' interest is limited to NEPA documentation and general coordination with Illinois River National Fish and Wildlife Refuge management activities.

5. EVALUATION OF WETLAND HABITAT OBJECTIVES

a. Increase Reliable Food Production and Resting Area for Waterfowl. Table 5-1 summarizes the evaluation of the effect of the project relative to its stated objective, to increase the reliable food production and resting area for waterfowl.

TABLE 5-1

Evaluation of Wetland Habitat Objectives - Increase Reliable Food Production and Resting Area

Objective	Alternative	Enhancement Feature	Unit	Year 0 Without Alternative	Year 50 Target With Alternative	Feature Measurement	Annual Field Observations by Site Manager
Increase reliable food production and resting area for waterfowl	Forested Wetland Management Area	Water control	Acres of vegetation	0	168	Perform transects C, F, G vegetation (understory) survey	Estimate numbers of waterfowl
		Mast tree area	Acre	0	10	Perform transects C, F, G vegetation (timber) survey	Estimate survival of plantings

(1) Monitoring Results.

(a) Vegetation Monitoring.

Summary. In 1992, the Havana LTRM Field Station initiated a woody vegetation survey in the FWMA, designed in conjunction with Corps and State natural resources specialists, to document pre-construction conditions and to provide baseline data for comparison with data collected after project completion. Transects were established down the approximate middle of each longitudinal cell (see Figure 3). Twenty-four circular plots (radius = 11.28 meters) were established in each cell (A, B, and C) by randomly selecting distances down the established transect line and perpendicular to said transects. Representative canopy heights and percentage of canopy cover were estimated within each plot. All trees in a plot greater than 10 cm diameter breast height (dbh = 1.3 m above ground level) were measured to the nearest 0.5 cm and identified to species. Woody understory vegetation (including vines, shrubs, and saplings greater than 2 m in height and less than 10 cm dbh) within 3.57 m of the center of the plot were identified and tallied. At least one core sample was taken from a representative mature tree in most of the plots to estimate the age of the stand.

Pre-construction sampling began in December 1992 and was completed in August 1994. A total of 18 species of woody vines, shrubs, and trees was identified in sampled plots. Combined data for all plots of the three cells showed that silver maple (*Acer saccharinum*) was the numerically dominant species, comprising 64.6% of all overstory trees surveyed. Other abundant tree species included green ash (*Fraxinus pennsylvanica*) at 16.9%, cottonwood (*Populus deltoides*) at 4.9%, red elm (*Ulmus rubra*) at 3.8%, and black willow (*Salix nigra*) at 2.8%. The mean density of overstory woody vegetation was 0.034 plants per square meter. The dominant understory woody vegetation was wild grape (*Vitis* spp.) at 33.3%. Saplings of silver maple, green ash, black willow, and red elm were frequent constituents of the understory at 19.8%, 13.6%, 12.3%, and 9.9%, respectively. Poison ivy (*Toxicodendron radicans*) comprised 9.9%. Understory woody vegetation averaged 0.030 stems per square meter. Estimated ages of cored trees averaged 42 years, ranging from a red elm of 8 years to a green ash that was estimated at 105 years. The overall estimated density of the forest canopy in sampled plots averaged 74%, while mean canopy height was 19.9 m. Cell A, the farthest from the river, had the highest density of mature trees and understory (0.043 overstory trees and 0.061 understory stems per square meter), and it had the highest diversity (18 species). By contrast, Cell C, the closest to the river, had the lowest diversity withonly four tree species, mostly only adult trees, and virtually no understory

During initial pre-sampling visits to the FWMA in August 1992, LTRM field station staff discovered a federally threatened species, *Boltonia decurrens (B. decurrens)*, decurrent false aster. After the initial finding was reported, the site was revisited and additional plant stands were discovered.

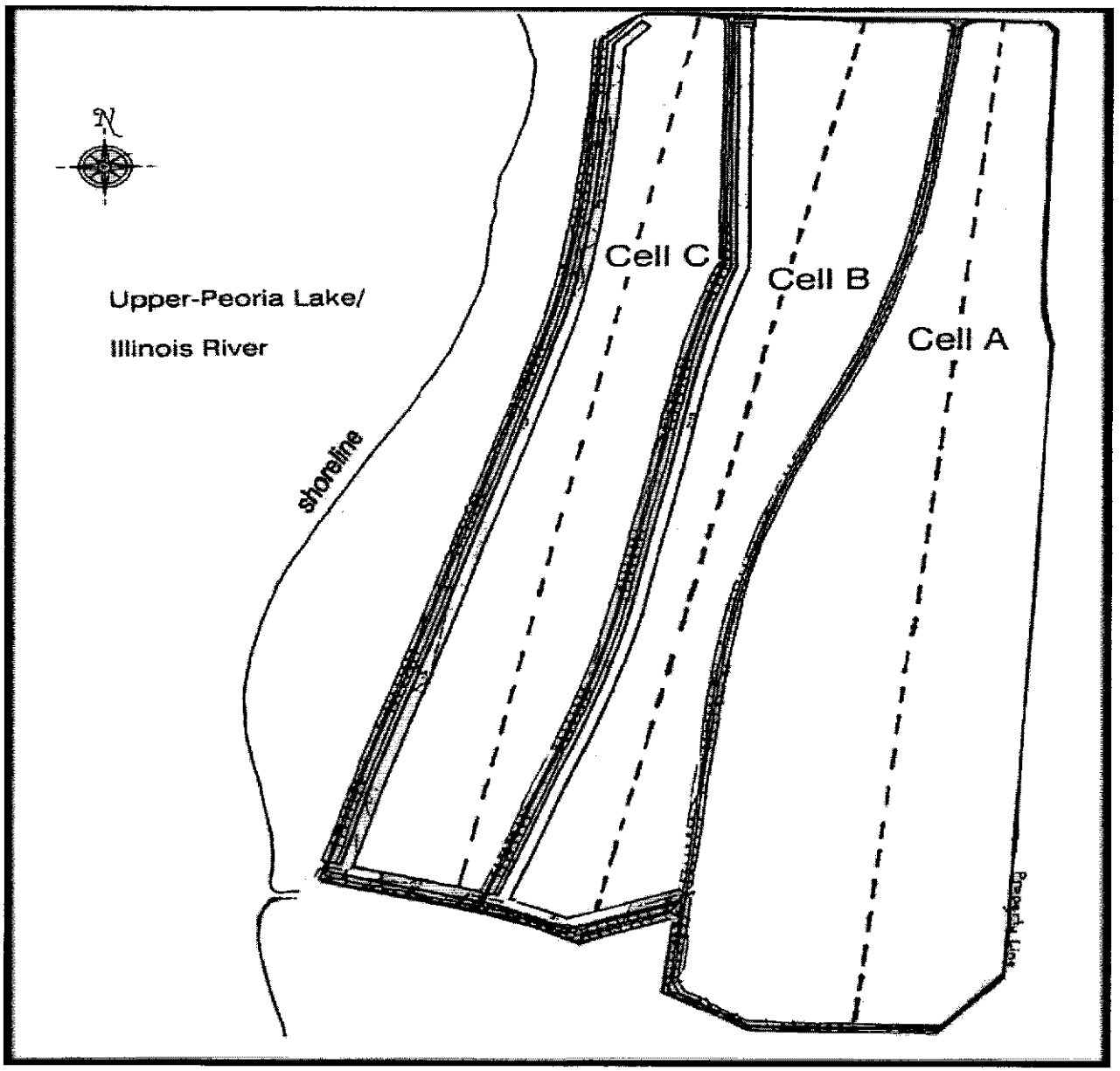


Figure 3. Schematic of Forested Wetland Management Areas Three Cells & Transect Lines.
See plate 2 for constructed alignment of FWMA cells.

A post-construction survey of the FWMA was conducted in July 1997 to document the current tree community and to compare it with the pre-project tree community surveyed in 1992-1994. Methods for the post-construction survey were similar to those used in the pre-construction survey, with the exception that representative trees were not cored and aged for the post-construction survey. Preliminary results of the 1997 field survey revealed no appreciable change in species composition, and no measurable increase in tree mortality was observed.

During pre- and post-construction fieldwork, *B. decurrens* was routinely encountered, particularly in Cells B and C, and large stands were marked. While *B. decurrens* is adapted to disturbed areas, it is unclear whether the project will have any long-term effects on this population. Corps staff inspecting the project area with ILDNR personnel on August 22, 1996, noted the presence of a specimen of *B. decurrens* at the eastern edge of the borrow area.

Conclusions. Post-construction surveys compared to pre-construction surveys of woody vegetation indicate that management of water levels within the FWMA did not measurably increase tree mortality in these first years since project construction. Monitoring of this project feature as outlined in Appendix B, will be summarized in future Supplemental Performance Evaluation Reports.

(b) Waterfowl Use Monitoring.

Summary. Weekly aerial waterfowl numbers during fall and spring migration periods have been inventoried for the Peoria Lake HREP for 6 years, beginning in fall 1991. The INHS, Center for Wildlife Ecology, conducts surveys of both the Peoria Lake and the Lake Chautauqua HREPs as separate components of their annual aerial waterfowl inventory of the Illinois River. A total of 24 species of waterfowl (dabbling ducks, diving ducks, mergansers, geese, coot, bald eagles, cormorants, and pelicans) are inventoried for the survey. The Peoria Lake project area has two inventory segments—the lake segment and the FWMA, which are combined for the a total project number. At the beginning of the monitoring effort, there was uncertainty as to whether the FWMA could be accurately surveyed from a fixed-wing plane. Waterfowl utilizing forested wetlands, particularly wood ducks, are difficult to inventory aerially because they are concealed by vegetation. Consequently, their numbers are often underestimated. This may account in part for the lack of recorded waterfowl observations for the FWMA during the first 4 years of the monitoring effort. Peak waterfowl numbers observed in the FWMA during post-construction surveys ranged from 350 in the fall of 1995 to 700 in the fall of 1998. Mallards, black ducks, and pintails were identified and included in the counts, along with unknown ducks.

The fall of 1995 (September-January) was the first complete waterfowl aerial inventory period since the levees were constructed and the area was inundated. Waterfowl that could be positively identified by species and enumerated were recorded in the survey. Waterfowl that could not be identified by species due to poor visibility were not recorded; therefore, fall 1995 and spring 1996 are considered to be minimum estimates of birds in the area. For the fall 1996-spring 1997 survey period, the INHS began recording waterfowl that could not be identified by species as "unknowns." This approach acknowledges the visibility biases inherent in aerially surveying forested wetlands by fixed-wing aircraft but still allows recorded observations to be used as an index to the relative abundance of waterfowl.

Conclusions. Results of post-construction aerial waterfowl inventories show a substantial increase in waterfowl use of the area as recorded by the aerial census, both in the total number of individuals and in the number of species identified. Waterfowl monitoring, although still in its early stages, is providing evidence that indicates the FWMA is meeting its objective of providing a reliable feeding and resting area for waterfowl. Monitoring will continue as outlined in Appendix B.

b. Increase Diversity and Extent of Submergent and Emergent Vegetation for Waterfowl. A summary of the evaluation of the effect of the project to increase the diversity and extent of submergent and emergent vegetation for waterfowl is shown below in Table 5-2.

TABLE 5-2

Evaluation of Wetland Habitat Objectives - Increase Diversity and Extent of Submergent and Emergent Vegetation for Waterfowl

Objective	Alternative	Enhancement Feature	Unit	Year 0 Without Alternative	Year 50 Target With Alternative	Feature Measurement	Annual Field Observations by Site Manager
Increase diversity and extent of submergent & emergent vegetation for waterfowl	Barrier island construction	Aquatic vegetation bed	Acres of aquatic vegetation	0	100	Perform transects A, B, C, D, E vegetation (aquatic) survey	Estimate acres of emergent, submergent, and floating vegetation
						Perform transects A, B, C, D, E hydrographic soundings	Record erosion deposition patterns
		Island vegetation	Acre	0	16	Perform transect I vegetation survey	Describe condition of shoreline erosion, sprigs, mat, cuttings, seedlings, and cover
		Improved water quality	mg/l suspended solids	100	50	Perform water quality tests at stations UPL - A, B, & C	Describe presence of suspended solids on lee side of island

(1) Monitoring Results.

(a) Wind Monitoring and Channel Velocity.

Summary. The barrier island feature of the Peoria Lake EMP project was constructed for the purpose of reducing wind fetch and wave height. It was anticipated that the reduced wave height on the leeward side of the island would promote bottom sediment consolidation and a decrease in sediment re-suspension. During the normal growing season, this would facilitate the growth of submergent and emergent aquatic vegetation, thereby increasing habitat diversity. To evaluate the effectiveness of this feature, the resource monitoring plan called for the measurement of several water quality and wind parameters and also wind velocity and direction. An attempt was made to measure water quality *in-situ* using multi-parameter instruments; however, this was infeasible due to the shallow water depth in the vicinity of the island. Therefore, to measure the effectiveness of the island's orientation in reducing wind fetch, wind speed/direction measurements and wave height observations were made.
Another feature of the project consisted of dredging the East River channel to allow for an increase in flowing side channel aquatic habitat. Accretion of sediment had caused a reduction in flow through the channel with the lower end of the channel being completely blocked by a silt plug. Fishery benefits would result from an increase in flow through the channel following dredging. Post-project velocity measurements were taken in the East River [and barrier island] channel[s] to determine the effectiveness of the dredging.

Monitoring Methods. An R. M. Young Wind Sentry set coupled with a Campbell Scientific CR10 datalogger were used to measure and record wind speed and direction during the 1996 and 1997 growing seasons. During 1996, the monitoring equipment was placed approximately 350 yards from the southern tip of the island, while in 1997 it was positioned at the island's midpoint. Data was collected from April 24-May 30 and June 28-October 1 in 1996 and from May 15-October 9 in 1997. The station was taken out of operation during most of June 1996 because of high water levels. The datalogger was programmed to record average wind speed and direction and maximum wind speed on an hourly basis.

East River water velocity measurements were taken by Havana, Illinois, LTRM field station personnel in conjunction with their fish monitoring work during 1997. Velocity was measured 20 centimeters below the surface utilizing a Marsh-McBirney, Inc., model 201D flow meter. Velocity measurements were taken in the upper (site I180.8B), middle (site I180.3B), and lower (site I179.5B) portions of the East River. The measurement location at each site was dependent on the type of fish sampling gear used—measurements were taken close to shore when Fyke nets were used and in deeper water when hoop nets were utilized. The hoop net velocity data are more representative of the flow in the deeper part of the channel; therefore, only these velocity measurements will be discussed.

Monitoring Results. Pie charts showing wind direction distribution during 1996 and 1997 are given in Figures 4 and 5, respectively. The island's orientation was intended to reduce the height of waves on its east side. The island should be most effective at accomplishing this when the wind is from the southwest, west, or northwest. During the 1996 growing season, the wind was from the southwest (15%), west (12%) or northwest (11%) 38% of the time. During the 1997 growing season, the wind was from the southwest (17%), west (12%), or northwest (7%) 36% of the time. The pie charts indicate that the wind distributions during the 1996 and 1997 growing seasons were very similar. During both years, the wind was predominantly from the northeast, followed by the southwest and east.

Average wind speed and duration are described in 3-D charts found in Figures 6 through 9. Figures 6 and 7 address the 1996 data, while Figures 8 and 9 describe the 1997 data. For each year, the first chart displays effective wind direction data, while the second chart displays ineffective wind direction data. The effective wind direction charts include data when the wind was from the southwest, west, or northwest (when the island's orientation was most effective at reducing wind fetch). The ineffective direction charts address the remaining wind data (when the island's orientation was ineffective at reducing wind fetch). The 1996 and 1997 charts indicate the most common combinations of average wind speed and duration were 0 to 5 mph for 1 to 8 hours for both the effective and ineffective wind directions. The highest sustained average wind speeds were measured when the wind was from the ineffective direction; on at least one occasion during both 1996 and 1997, the average wind speed exceeded 15 mph for 25-32 hours.

TABLE 5-3

East River Velocity Data

Date	Location	Depth (ft)	Velocity (ft/s)
18-Jun-97	I180.8B	9.8	2.95
18-Jun-97	I180.3B	6.6	0.98
18-Aug-97	I179.5B	7.9	0.82
23-Sep-97	I180.8B	7.5	0.33
23-Sep-97	I180.3B	-	0.36
30-Sep-97	I179.5B	6.6	0.23

Water velocities ranged from 2.95 ft/s in the upper part of the East River on June 18, 1997, to 0.23 ft/s in the lower portion on September 30, 1997, as shown in Table 5-3 above. The river stage on these two dates as measured at the Henry gage was 442.14 and 441.15 ft MSL, respectively. The post-project velocities are significant considering that prior to dredging there was little, if any, flow through the channel when river stage was relatively low.

Conclusions. The alignment of the Peoria Lake Barrier Island was designed to reduce wave heights to the east of the island. The results from on-site wind monitoring during the 1996 and 1997 growing seasons indicate that the island was effective in accomplishing this approximately 37% of the time. Although during both growing seasons, the wind was predominantly from the northeast, the wind fetch in this direction is only about 25% of that occurring when the wind is from the southwest; therefore, waves generated from northeasterly winds are much smaller than those generated from southwesterly winds. In addition to wind monitoring, wave height observations were also used to evaluate the island's effectiveness. On several site visits, Corps and IDNR personnel observed significant reductions in wave height on the leeward side of the island when the prevailing wind was from the southwest, west or northwest, helping reduce sediment re-suspension.

Water velocity results have shown that main channel flow is entering the East River Channel, promoting a better supply of dissolved oxygen as shown by the increase in fish quantities and species.

Recommendations. Evaluation of this project has highlighted the need for collecting more site-specific wind data as part of baseline monitoring/general design monitoring of HREPs. This need is being addressed with respect to future project sites. Water velocity monitoring will be continued as outlined in Appendix B and through field observations, making sure the East River Channel is free of sediment and debris.

Figure 4. Peoria Lake Wind Direction: 4/24/96-5/30/96 and 6/28/96-10/1/96

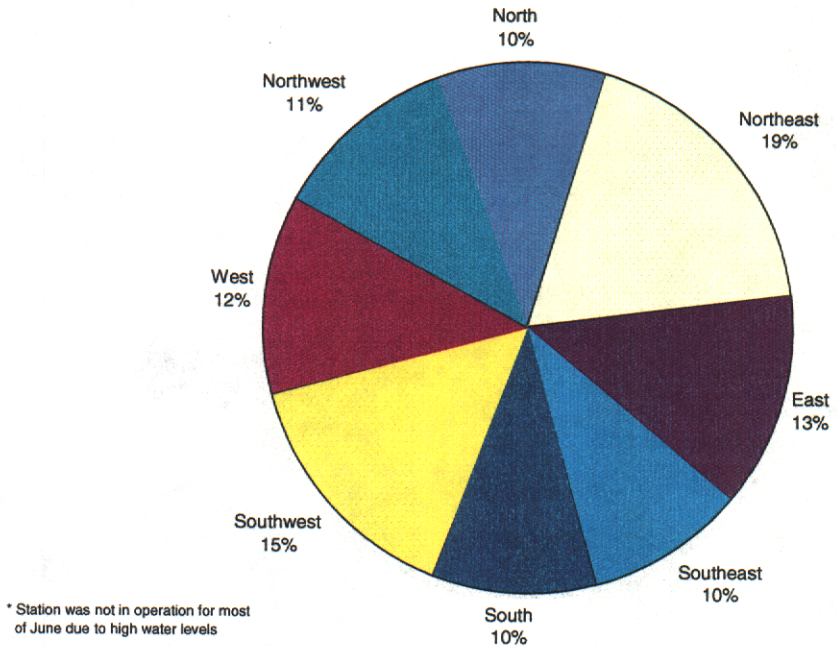


Figure 5. Peoria Lake Wind Direction: 5/15/97-10/8/97

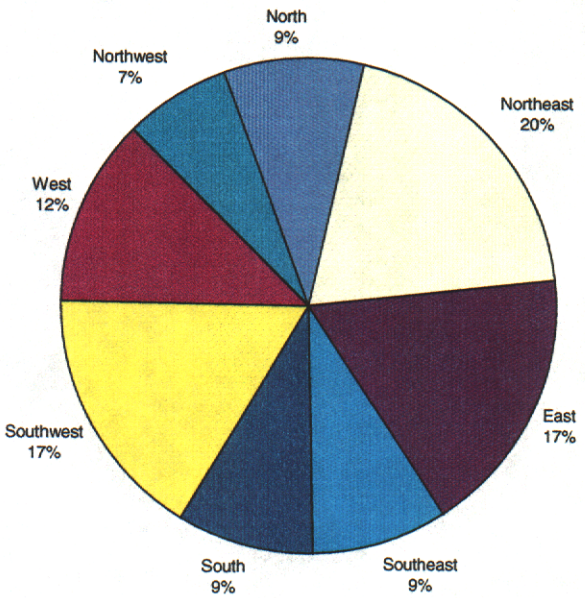


Figure 6. Peoria Lake Effective Wind Direction: same periods 1996

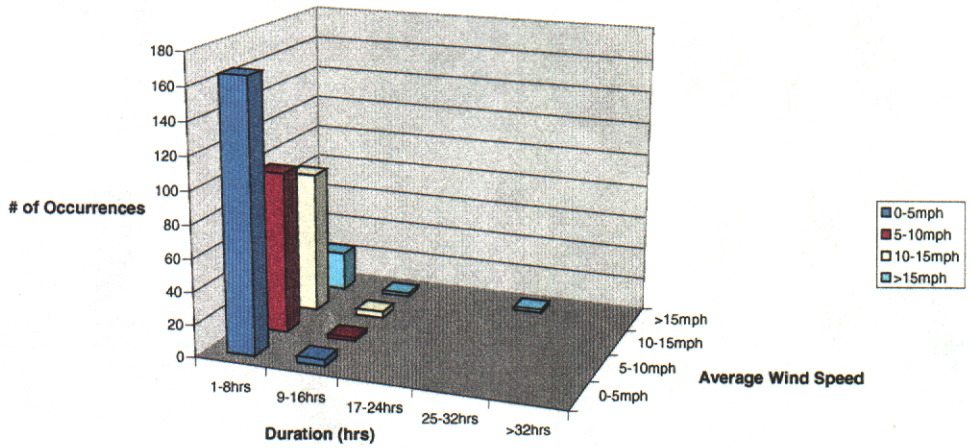


Figure 7. Peoria Lake Ineffective Wind Direction: same periods 1996

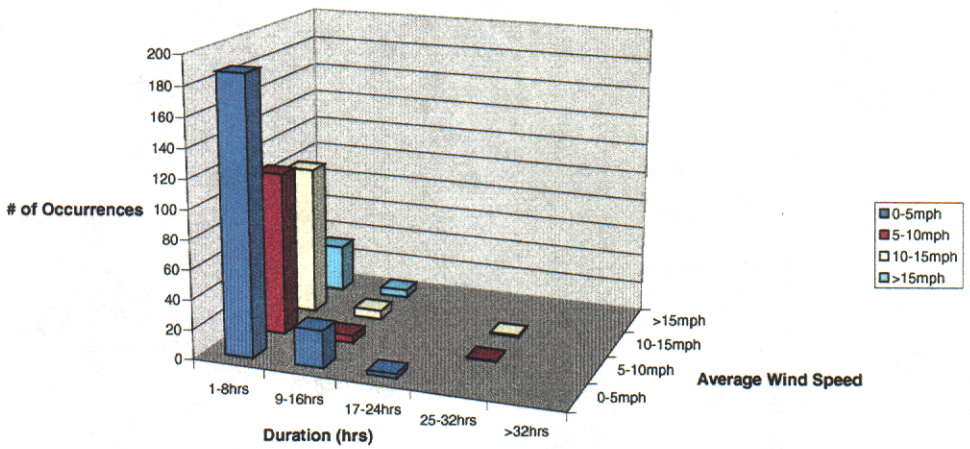


Figure 8. Peoria Lake Effective Wind Direction: same period 1997

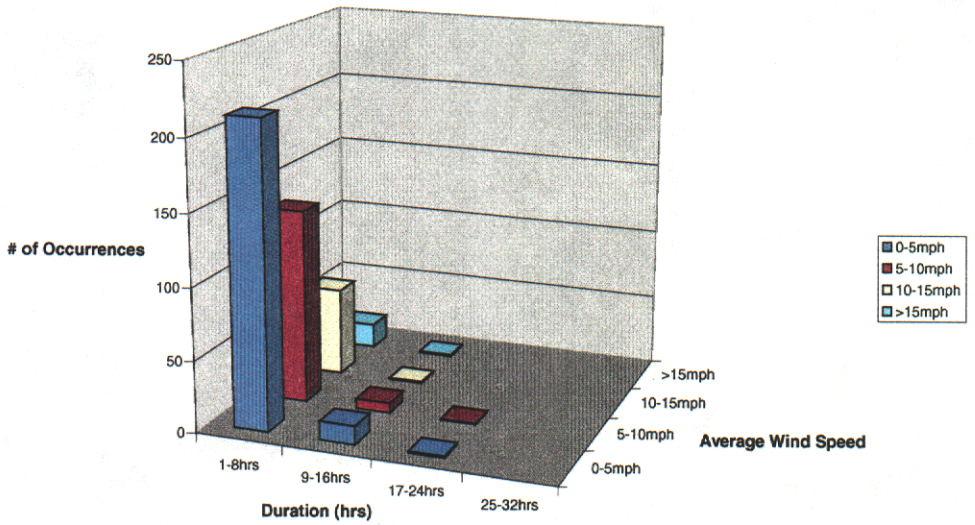
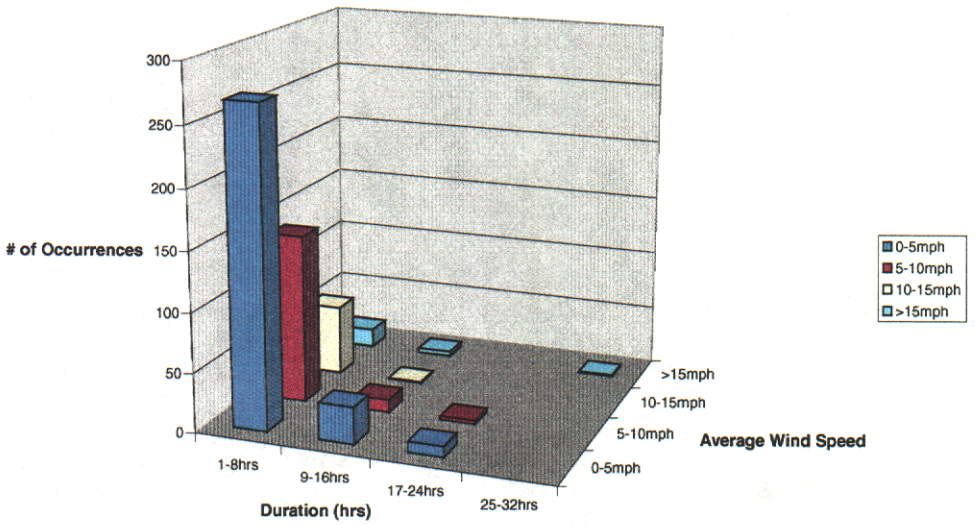


Figure 9. Peoria Lake Ineffective Wind Direction: same periods 1997



(b) Vegetation Monitoring.

Summary. Pre-construction sampling in 1992 along Transects A, B, C, D, and E did not reveal any evidence of aquatic plant growth. During August 1993, sediment core samples were collected from five sites in the project area. Core samples were shipped to the Waterways Experiment Station in Vicksburg, Mississippi, where their ability to support plant growth was determined using a plant growth bioassay. Shoot length and above-ground biomass values for water milfoil (*Myriophyllum spicatum*) plants grown in the Peoria Lake sediments were compared with those obtained from plants grown in sediment from Brown's Lake near Vicksburg, a reference sediment known to promote relatively good growth. Plant growth, both in terms of shoot length and above-ground biomass, was reasonable in all four sediment samples, indicating no apparent sediment toxicity to plants.

A site inspection of the Barrier Island in August 1996 revealed no evidence of growth from the herbaceous aquatic vegetation planted on the island perimeter. Although most of the willow stakes originally planted along the riverward perimeter of the island were still present, only a minority of these showed any evidence of growth (shoots and leaves). A mixture of adventitious forbs and woody vegetation such as seedling cottonwood has colonized the crown of the Barrier Island. The overburden island was largely devoid of visible vegetation; however, some early successional vegetation, similar in species composition to the community found on the crown of the barrier island, was noted on the higher elevations.

Aerial photography of the project was flown in August 1997. This period corresponds to predicted low water conditions and maximum aquatic plant biomass on this reach of the Illinois River. Post-construction sampling along Transects A, B, C, D, and E also was conducted during 1998. No evidence of aquatic plant growth was encountered either through examination of aerial photography or transect sampling.

Conclusions. Aside from the willow stake cuttings, vegetative planting efforts around the barrier island feature appear, to date, to have been unsuccessful. Several potential reasons for the lack of success have been suggested, including grass carp perdition, fluctuating water levels, barrier island orientation, continuing high turbidity, or some combination of these factors. However, the critical factors constraining vegetation establishment at this site are not known. It is possible that the physical changes created by barrier island construction may take several years to create the conditions necessary for successful aquatic plant growth.

Recommendations. Continue monitoring twice per year as specified in report Table B-2.

(c) Waterfowl Use Monitoring.

Summary. Tables 5-4and 5-5 summarize the results of aerial waterfowl inventories conducted from 1991-92 through 1997-98. The fall of 1997 was the third aerial waterfowl censusing period (September through January) since the completion of the barrier island feature. Peak numbers for several species of waterbirds in the lake segment during fall 1997 were the highest recorded since the INHS began monitoring in 1991. On December 1, 1997, a total of 70,700 ducks and 400 Canada geese were recorded for the lake segment. During the fall inventories of 1996 and 1997, the majority of the dabbling ducks, particularly mallards and Canada geese were observed on and around the Barrier Island and Overburden Island. The three post-construction fall periods also recorded a greater number of species (14 in 1995, 20 in 1996, and 18 in 1997).

Although shorebirds and wading birds are not recorded as part of the INHS aerial inventory, numerous individuals of these species were observed on the Overburden Island by Corps and ILDNR staff conducting site inspections of the Barrier Island during August 1996 and again in May 1997.

Conclusions. Although the barrier island feature has yet to realize its objective of increasing submergent and emergent vegetation, a substantial increase in waterfowl use of the area was recorded by the aerial census, both in the total number of individuals and in the number of species identified. Results of the aerial census combined with numerous observations of waterbirds at the site during spring and summer months, by site managers, LTRM samplers and Corps staff, provide evidence that the barrier island feature is meeting the project goal of enhancement of wetland habitat.

Recommendations. Continue monitoring project features as specified in report Table B-2.

TABLE 5-4

Peak Numbers* of Waterbirds Aerially Inventoried at Upper Peoria Lake EMP Site, Fall 1991-1997

	Pre-Construction				Post-Construction		
Ducks	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**
Mallard	1000	3000	1000	400	5000	29000	63000
American black duck	75	150	50	50	400	3000	7000
Northern pintail	200	0	50	0	600	700	2500
Blue-winged teal	20	0	0	0	30	200	50
Green-winged teal	0	0	50	300	50	500	200
American wigeon	0	0	0	0	0	100	700
Gadwall	800	0	0	0	1000	2500	1500
Northern shoveler	0	0	0	0	0	75	0
Scaup	250	300	0	0	0	1200	800
Ring-necked duck	0	300	0	100	300	500	1500
Canvasback	0	0	0	0	0	100	100
Redhead	0	0	0	0	0	0	0
Ruddy duck	0	0	0	0	0	0	0
Common goldeneye	50	2000	3500	200	100	500	900
Bufflehead	0	0	0	0	0	4500	0
Common merganser	0	1000	1000	0	700	50	500
Red-breasted merganser	0	0	0	0	0	0	0
Hooded merganser	0	0	0	0	0	0	0
Total Ducks**	**2050**	**5310**	**4500**	**800**	**6000**	**41200**	**70700**
Canada goose	100	0	50	100	2000	1500	1500
Greater snow goose	0	0	0	0	50	500	300
American coot	300	1000	0	1000	1000	2300	3000
Bald eagle	0	3	0	0	11	2	3
Double-crested cormorant	0	50	25	0	100	800	300
White pelican	0	0	0	0	0	50	20
Total Species Inventoried	**9**	**9**	**8**	**7**	**14**	**20**	**18**

Source: Illinois Natural History Survey, Center for Wildlife Ecology (Forbes Biological Station, Frank C. Bellrose Waterfowl Research Center)

Note: Construction of the barrier island and side channel features in Upper Peoria Lake occurred during 1994.

* Data collected through weekly aerial inventory during September-January timeframe. Numbers shown represent the 1-day peak for each species and are not cumulative.

** Peak numbers for total ducks may not represent the sum of the peaks for each species because the peak numbers for different species may have occurred on different dates.

TABLE 5-5

Peak Numbers of Waterbirds Aerially Inventoried at Upper Peoria Lake EMP Site, Spring 1992-1998

Ducks	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
Mallard	300	0	100	700	2100	700	2550
American black duck	0	0	0	0	50	0	200
Northern pintail	0	0	0	0	0	0	150
Blue-winged teal	100	0	0	0	0	0	20
Green-winged teal	100	0	0	0	0	0	0
American wigeon	200	0	0	0	0	0	25
Gadwall	0	0	0	0	0	0	100
Northern shoveler	0	0	0	0	0	0	0
Scaup	200	100	50	0	0	0	150
Ring-necked duck	0	0	50	0	0	0	400
Canvasback	0	0	0	150	0	150	100
Redhead	0	0	0	0	0	0	50
Ruddy duck	0	0	0	0	0	0	20
Common goldeneye	400	0	25	50	750	50	0
Bufflehead	0	0	0	0	0	0	0
Common merganser	100	100	400	4000	1800	4000	0
Red-breasted merganser	0	0	0	0	0	0	0
Hooded merganser	0	0	0	0	0	0	0
Total Ducks**	**1000**	**100**	**500**	**4350**	**2825**	**4350**	**2935**
Canada goose	50	300	0	500	40	500	200
Lesser snow goose	0	0	0	0	0	0	0
American coot	200	0	600	0	100	0	500
Bald eagles	0	0	0	0	5	38	2
Double-crested cormorant	0	0	0	0	0	0	0
White pelican	0	0	0	0	0	0	0
Total Species Inventoried	**9**	**3**	**6**	**5**	**7**	**6**	**14**

Source: Illinois Natural History Survey, Center for Wildlife Ecology (Forbes Biological Station, Frank C. Bellrose Waterfowl Research Center)

Note: Construction of the barrier island and side channel features in Upper Peoria Lake occurred during 1994.

* Data collected through weekly aerial inventory during February-April timeframe. Numbers shown represent the 1-day peak for each species and are not cumulative.

** Peak numbers for total ducks may not represent the sum of the peaks for each species because the peak numbers for different species may have occurred on different dates.

6. EVALUATION OF AQUATIC HABITAT OBJECTIVES.

a. Provide Flowing Side Channel Aquatic Habitat Area.

TABLE 6-1

Evaluation of Wetland Habitat Objectives

Objective	Alternative	Enhancement Feature	Unit	Year 0 Without Alternative	Year 50 Target With Alternative	Feature Measurement	Annual Field Observations by Site Manager
Provide flowing side channel aquatic habitat	Flowing side channel	Side channel excavation	Acres of flowing channel surface	0	20	Perform transect H (East River) hydrographic sounding	Describe presence of snags, channel sedimentation, and vegetation
			Sq. ft of cross-sectional area of flowing channel	0	500	Perform transects C, D, E (East River) hydro-graphic soundings	
			Velocity of flowing channel in ft/s	0	1	Perform transects C, D, E (East River) velocity measurements	
		Mast trees	Acre	0	2	Perform transect I vegetation survey	Describe condition of shoreline, springs, cuttings, and seedlings

(1) Monitoring Results. During a walkover inspection of the east side of the excavated channel, several specimens of the mast tree plantings were encountered. Surviving mast tree seedlings are surrounded by competing vegetation such as smartweeds and seedling silver maple. Of note was the observation that all surviving mast tree plantings encountered were found at elevations at least 1 to 2 feet higher than the lowest elevation where silver maple seedlings were encountered.

Side channel aquatic habitat sedimentation transects are shown on plates 3 through 5. As shown above and in Appendix A, Table A-1, the year 50 target with alternative is to obtain 20 acres of flowing channel surface, 500 square feet of cross-sectional area of flowing channel, and a velocity of the flowing channel of 1 foot per second.

Pre-construction monitoring of fish communities began with establishing and sampling at fixed sites during 1991 and 1992. The sites in Upper Peoria Lake were designated as experimental sites that could be impacted by the HREP. The sites in Babbs Slough were chosen to act as control sites that should not be affected by the project and may help in determining year-to-year changes in fish populations due to environmental conditions independent of the HREP.

Post-construction monitoring began in 1997 by sampling at the eight sites established and monitored in 1991 and 1992, plus two additional sites (3 and 4) in areas created by project construction: the lower East River site (3) is in the re-opened side channel and the Island site (4) is located between the newly constructed barrier island and the overburden island lying parallel to and riverward of the barrier island. These ten sites were sampled in 1997 and again in 1998 to complete the post-construction monitoring of fish populations.

The LTRMP fish component also began recording incidental catches of turtles in 1993, and this was incorporated into biological response monitoring at the HREP site. Turtle species, gender, and carapace length were recorded and included in the database beginning in 1997. A total of 28 individuals, representing 5 taxa, were collected at experimental and control sites. Species caught were redear slider (*Trachemys scripta*), spiny softshell (*Trionyx spinifer*), western painted turtle (*Chrysemys picta*), common snapping turtle (*Chelydra serpentina*), and common map turtle (*Graptemys geographica*).

Table 6-2 lists the species and total numbers of fish collected during pre-construction monitoring (1991 and 1992) and the first year of post-construction monitoring (1997) from both experimental and control sites. Table 6-3 lists unique fish species collected during pre- and post-construction monitoring, differentiated between experimental and control sites. There were no State or federally listed endangered or threatened species collected during sampling efforts.

Corps staff visited the East River channel with ILDNR and LTRM staff in May 1997 to investigate the condition of mast tree plantings. Several specimens were encountered during a walkover inspection of the eastern side of the excavated channel. Surviving mast tree seedlings were surrounded by competing vegetation such as smartweeds and seedling silver maples. Of note was the observation that all of the surviving mast trees encountered were planted at elevations at least 1 to 2 feet higher than the lowest elevation where living silver maple seedlings were encountered.

(2) Conclusions. Because there are more experimental sites representing a greater diversity of habitats than the control sites, it is not surprising that total numbers of fish collected were higher at the Peoria Lake HREP than at Babbs Slough. However, comparison of pre and post-construction fish community monitoring results at experimental sites shows an increase in the number of species collected as well as in total numbers of fish collected during post-construction monitoring. The comparison of pre- and post-construction results at the control sites did not show a similar increase. In addition, a greater diversity of species was collected at experimental sites, and more unique species were encountered in post-construction sampling at experimental sites. The results of fish community monitoring suggest that restoration of the East River channel, and the physical diversity provided by construction of the barrier and overburden islands, have positively affected the fisheries in this section of Upper Peoria Lake.

(3) Recommendations. Continued monitoring of project as specified in report Table B-2.

Table 6-2. Total numbers of fish collected at experimental and control sites by all gear types at HREP bioresponse monitoring sites at Upper Peoria Lake during three years of monitoring (1991, 1992, and 1997).

Common Name	*Scientific Name*	Experimental Sites 1991 Total	1992 Total	1997 Total	Sub Total Experimental	Control Sites 1991 Total	1992 Total	1997 Total	Sub Total Control	**Grand Grand Total**
Longnose gar	*Lepisosteus osseus*		1		1		1	2	3	4
Spotted gar	*Lepisosteus oculatus*		1		1					1
Shortnose gar	*Lepisosteus platostomus*	36	147	141	324		53	92	145	469
American eel	*Anguilla rostrata*		1		1					1
Bowfin	*Amia calva*		1	4	5					5
Gizzard shad	*Dorosoma cepedianum*	1,212	1,669	7,493	10,354	307	3,962	2,437	6,706	17,060
Threadfin shad	*Dorosoma petenese*	198	38	3,534	3,770	61	198		259	4,029
Skipjack herring	*Alosa chrysochloris*	20	91	66	177	9	84	52	145	322
Goldeye	*Hiodon alosoides*		6	27	33		2	17	19	52
Mooneye	*Hiodon tergisus*			1	1					1
Central stoneroller	*Compostoma anomalum*			5	5					5
Grass carp	*Ctenopharyngodon idella*			6	6			2	2	8
Red shiner	*Cyprinella lutrensis*		11	74	85			4	4	89
Common carp	*Cyprinus carpio*	843	1,635	2,246	4,724	164	689	343	1,196	5,920
Goldfish	*Carassius auratus*	3	46	4	53		2		2	55
Carp x goldfish	*Cyprinus carpio x auratus*	5	6	8	19	10	7		17	36
Silver chub	*Macrhybopsis storeriana*	23	32	81	136	13	3	3	19	155
Golden shiner	*Notemigonus crysoleucas*			8	8					8
Emerald shiner	*Notropis atherinoides*	81	13,900	16,927	30,908	42	8,788	450	9,280	40,188
Striped shiner	*Luxilus chrysocephalus*			1	1					1
River shiner	*Notropis blennius*			6	6					6
Spottail shiner	*Notropis hudsonius*	88	338	509	935	12	12	48	72	1,007
Silverband shiner	*Notropis shumardi*	1	245	74	320			3	3	323
Sand shiner	*Notropis stramineus*			43	43			5	5	48
Suckermouth minnow	*Phenacobius mirabilis*			1	1					1
Bluntnose minnow	*Pimephales notatus*		2	85	87					87
Bullhead minnow	*Pimephales vigilax*	4	84	546	634		1	13	14	648
Blacknose dace	*Rhinichthys atratulus*			2	2					2
Creek chub	*Semotilus atromaculatus*			9	9					9
River carpsucker	*Carpiodes carpio*	189	262	564	1,015	65	148	62	275	1,290
Quillback	*Carpiodes cyprinus*	75	14	19	108	39	12		51	159
Highfin carpsucker	*Carpiodes velifer*		4	4	8		6	2	8	16
White sucker	*Catostomus commersoni*	1	2		3	1	1		2	5
Northern hogsucker	*Hypentelium nigricans*			4	4					4
Smallmouth buffalo	*Ictiobus cyprinelus*	196	244	1,249	1,689	161	207	593	961	2,650
Bigmouth buffalo	*Ictiobus cyprinelus*	3	18	19	40		34	9	43	83
Black buffalo	*Ictiobus niger*	6	12	14	32	1	7	27	35	67
Unidentified buffalo	*Ictiobus sp.*			132	132			12	12	144
Silver redhorse	*Moxostoma anisurum*			1	1					1
Golden redhorse	*Moxostoma erythrurum*	1	2	6	9					9
Shorthead redhorse	*Moxostoma macrolepidotum*	9	50	58	117	2	13	11	26	143
Black bullhead	*Ameiurus melas*	2	7	4	13	4	9	5	18	31
Yellow bullhead	*Ameiurus natalis*	2	4	5	11		2	2	4	15
Brown bullhead	*Ameiurus nebulosus*	8	94	17	119	616	18	6	640	759
Channel catfish	*Ictalurus punctatus*	67	299	309	675	41	442	146	629	1,304
Stonecat	*Noturus flavus*						1		1	1
Tadpole madtom	*Noturus gyrinus*					2	6		8	8
Flathead catfish	*Pylodictis olivaris*		4	3	7	1	1		2	9
Western mosquitofish	*Gambusia affinis*			2	2		5	1	6	8
Brook stickleback	*Culaea inconstans*			2	2					2
White perch	*Morone americana*	1	13	4	18					18
White bass	*Morone chysops*	295	797	1,116	2,208	25	91	186	302	2,510
Yellow bass	*Morone mississippiensis*	8	3	12	23	1	2	4	7	30
Green sunfish	*Lepomis cyanellus*	85	21	20	126	2			2	128
Pumpkinseed	*Lepomis gibbosus*	1			1					1
Warmouth	*Lepomis gulosus*		1	1	2					2
Orangespotted sunfish	*Lepomis humilis*	14	10	7	31					31
Bluegill	*Lepomis macrochirus*	1,159	544	463	2,166	13	28	6	47	2,213
Green sunfish x bluegill	*L. cyanellus x macrochirus*		4	2	6					6
Smallmouth bass	*Micropterus dolomieui*			9	9					9
Largemouth bass	*Micropterus salmoides*	102	76	88	266	2	1	1	4	270
White crappie	*Pomoxis annularis*	89	32	43	164	1	3	5	9	173
Black crappie	*Pomoxis nigromaculatus*	86	88	191	365		2	2	4	369
Mud darter	*Etheostoma asprigene*			1	1					1
Logperch	*Percina caprodes*	4	20	74	98	2		1	3	101
Slenderhead darter	*Percina phoxocephala*			1	1					1
Sauger	*Stizostedion canadense*	32	15	115	162	22	6	31	59	221
Walleye	*Stizostedion vitreum*		1	4	5	1			1	6
Freshwater drum	*Aplodinotus grunniens*	462	294	819	1,575	442	225	77	744	2,319
Unidentified	*Unidentified unidentified*			8	8					8
TOTAL		5,411	21,189	37,271	63,871	2,062	15,072	4,660	21,794	85,665
Total number of species collected		36	46	59	64	28	36	34	43	66
Total number of hybrids collected		1	2	2	2	1	1	0	1	2

(Source: Illinois Natural History Survey, Havana LTRM Field Station.)

Table 6-3. Unique fish species from the Peoria Lake HREP experimental and control sites Chillicothe Island area.

Experimental Sites

Pre Project (1991 and 1992)		Post Project (1997)	
Unique species	***Individuals***	***Unique species***	***Individuals***
American eel	1	Slenderhead darter	1
Spotted gar	1	Suckermouth minnow	1
Pumpkinseed	1	Striped shiner	1
White sucker	5	Mud darter	1
		Silver redhorse	1
		Mooneye	1
		Western mosquitofish	2
		Brook stickleback	2
		Blacknose dace	2
		Northern hogsucker	4
		Central stoneroller	5
		River shiner	6
		Grass carp	6
		Golden shiner	8
		Smallmouth bass	9
		Creek chub	9
		Sand shiner	42
Total species + hybrids	47 + 2		59 + 2
Total number of fish	26,600		37,271

Pre and post project total species + hybrids **64 + 2**
Pre and post project total number of fish **63,871**

Control Sites

Pre Project (1991 and 1992)		Post Project (1997)	
Unique species	***Individuals***	***Unique species***	***Individuals***
Stonecat	1	Grass carp	2
Walleye	1	Silverband shiner	3
Goldfish	2	Red shiner	4
Green sunfish	2	Sand shiner	5
White sucker	2		
Flathead catfish	2		
Tadpole madtom	8		
Quillback	51		
Threadfin shad	259		
Total species + hybrids	39 + 1		34 +0
Total number of fish	17,134		4,660

Pre and post project total species + hybrids **43 + 1**
Pre and post project total number of fish **21,794**

(Source: Illinois Natural History Survey, Havana LTRM Field Station.)

7. OPERATION AND MAINTENANCE SUMMARY

a. Operation. The ILDNR has operated the project as described in the Annual Management Plan (Table 2-2) since its completion in the fall of 1997. The FWMA is de-watered from May-July to expose mudflats and promote growth of moist soil species. The FWMA water levels are gradually increased from August to November to correspond with the growth of the moist soil plant community and to provide migratory access to food plants. The higher water levels are maintained in the FWMA from December through April to control excessive plant growth and provide deeper water. The Barrier and Overburden Islands have no operational needs.

b. Maintenance.

(1) Inspections. The Site Manager is to inspect the Peoria Lake project at least annually and will follow inspection guidance presented in the O&M manual. Other project inspections should occur as necessary after high water events or as scheduled by the Site Manager. The ILDNR and the Corps are to periodically conduct joint inspections of the Peoria Lake project. These inspections are necessary to determine maintenance needs and required monitoring. The Site Manager's project inspection and monitoring results for 1996 and 1997 can be found in Appendix C.

(2) Maintenance Based on Inspections. Some maintenance has been required due to FWMA bank stabilization. No other maintenance has been required or done since project completion in 1997.

8. CONCLUSIONS AND RECOMMENDATIONS

a. Project Goals, Objectives, and Management Plan. Based on data and observations collected since project completion in 1997, it appears the stated goals and objectives for the Peoria Lake Project are being met.

b. Post-Construction Evaluation and Monitoring Schedules. In general, project monitoring efforts have been performed according to the Post-Construction Performance Evaluation Plan located in Appendix A and the Resource Monitoring and Data Collection Summary located in Appendix B. The next comprehensive Post-Construction Performance Evaluation Report will be completed in March 2002 following collection of data for the first 5-year interval. Supplemental Performance Evaluation Reports will be prepared annually.

c. Project Operation and Maintenance. Project operation and maintenance has been conducted in accordance with the O&M manual. Annual site inspections by the Site Manager have resulted in proper corrective maintenance actions. The Site Manager repaired some bank erosion along the westerly levee of FWMA cell C that included placement of riprap in high erosive areas, which is performing well. Bank stabilization practices will need to be addressed to limit erosion, and will be included in the next Supplemental Performance Evaluation Report. Monitoring of the levee bank erosion and Barrier and Overburden Islands erosion/silt sedimentation is planned for the summer of 2001. Bank erosion along the levees of the FWMA is not detrimental to the project features operation.

d. Project Assessment and Potential Design Enhancements. Discussions with ILDNR and Corps personnel involved with the operation, maintenance, and monitoring activities at the Peoria Lake project have resulted in several general conclusions regarding project features which may influence future project designs or warrant modifications to the Peoria Lake habitat project.

(1) <u>December 1999 Summary</u>. In the initial draft of this report, dated December 1999, the following comments were made regarding the project features:

> *Forested Wetland Management Area.* The water control features of the FWMA are performing well, with the cells filling in less than the required time. The erosion control mats and seeding for erosion control along the levees of FWMA cells C and B was not successful due to water level fluctuations, giving way to bank erosion. Traditional riprap was installed in place of these mats at various locations.
>
> *Barrier Island Complex.* The seven (7) cubic yard bucket was successful as a non-traditional construction technique for the Barrier Island. In general, the Island is performing well. Contracted aquatic plantings were not successful, possibly due to consumption by grass carp and/or waterfall, or due to water fluctuations. Volunteer woody vegetation was successful due to the final elevation constructed for the island. The weed barrier mats were not successful due to water level fluctuations. Further research is required if specifying similar designs; however, it is possible that inadequate anchoring of these barriers may have contributed to the early failure. The Outlet to the East River was subject to greater than anticipated vegetation.

(2) <u>Award Package</u>. This project was submitted for consideration to the U.S. Army Corps of Engineers, Chief of Engineers, Design and Environmental Awards Program - 2000 in January of 2000. A copy of the submittal is attached to this report. Some of the project achievements summarized in this submittal are as follows:

Results of post-construction aerial waterfowl inventories indicate the *Forested Wetland Management Area* is providing a reliable feeding and resting area. Post-construction surveys of woody vegetation indicate that seasonal impoundment of water within this area has not increased tree mortality. This feature is contributing significantly to the project goal of wetland habitat enhancement.

In the *Barrier Island Complex*, a substantial increase in waterfowl usage was recorded by aerial census—both in the total number of individuals and in the number of species identified. Results of the aerial census, combined with numerous observations of waterbirds at the site during spring and summer months, provide evidence that the *Barrier Island Complex* has enhanced wetland habitat. Additionally, wind monitoring and observations indicate that the *Barrier Island* has been effective in reducing wave heights. Significant reductions in wave height on the leeward side of the island when the prevailing wind is from the southwest, west, or north is resulting in reduced sediment re-suspension and greater water clarity.

In the *Flowing Side Channel*, comparison of pre- and post-construction fish community monitoring results shows an increase in the number of species collected as well as in total numbers of fish collected during post-construction monitoring. In addition, a greater diversity of species was collected and more unique species were encountered after project completion. The results of fish community monitoring suggest that restoration of the East River channel and construction of the barrier and overburden islands have had positive effects on fisheries in this section of Peoria Lake.

(3) <u>February 2000 Sponsor Meeting</u>. A Peoria Lake team meeting was conducted on February 23, 2000. Members from the U.S. Army Corps of Engineers, Rock Island District; the U.S. Army Corps of Engineers, Waterways Experiment Station; the Illinois Department of Natural Resources (ILDNR); The Nature Conservancy; and the U.S. Fish and Wildlife Service were present at this meeting. Additionally, a site visit with the Woodford State Fish and Wildlife Area Site Manager was conducted prior to this meeting. A memorandum for record, dated March 13, 2000, outlines the meeting minutes and is attached to this report (see Appendix C). While several successes were shared during this meeting, these were basically summarized above in Sections 8.b.1. and 8.b.2. Listed here were areas where improvement measures could be introduced.

While the *Forested Wetland Management Area* is meeting the project goals as described above, there were some difficulties encountered with this feature. These include: an expected increase in the tree mortality rate; the inability to independently operate the three cells; challenges to operating the stop log structures due to their weight (the Peoria Lake structures are constructed of timber, while in recent designs, aluminum has been used); and levee erosion (concerns with matting material used, difficulties with seeding, and frequent overtopping along the Peoria Lake side of the perimeter levee, discussed earlier). Traditional riprap installed in place of the mats is performing well. Some of these concerns are similar to those documented in the *Bay Island Habitat Rehabilitation and Enhancement Project Post-Construction Initial Performance Evaluation Report, Pool 22, Mississippi River Miles 311-312, Marion Country, Missouri*. These features are being evaluated to determine if adaptive measurements should be taken.

In the *Barrier Island Complex*, it was determined by the ILDNR that willow posting was not necessary. It was also recommended to increase data collection in this area due to the uniqueness of the feature. Proposed data collection included turbidity monitoring on the windward and sheltered sides of the island.

In the *Flowing Side Channel*, it was also recommended to increase monitoring. Fisheries monitoring was proposed for this project, which would include control points, the presence or absence of species, and relative weight data. The ILDNR has background fisheries data to use as a pre-project comparison. Additionally, the deep-water habitat between the islands should be monitored. It is thought that this area may be providing valuable over-wintering escape habitat.

e. Biological Response. Substantial increases in waterfowl use of the open water and wooded areas of the Woodford State Fish and Wildlife Area over pre-project conditions have been recorded following construction of the HREP for Peoria Lake. Waterfowl harvest data for the Woodford State Fish and Wildlife Area show similar increases for this period (see Tables 5-4 & 5-5). Growth of waterfowl populations throughout the North-Central U.S. in the 1990's may account for a portion of this increase, but the magnitude of difference between pre- and post-construction aerial inventories suggests that fluctuations in overall populations are not a major influence on waterfowl response to the project. Both the barrier island complex and the FWMA are closed to public access during waterfowl hunting season, and both areas are adjacent to public blind sites within the Woodford State Fish and Wildlife Area and private lands where hunting is allowed. However, the apparent increase in attractiveness of these refuge areas to waterfowl following project construction does not appear to have adversely affected harvest success in adjacent public and private areas. Use of the area by neotropical migrant birds other than waterfowl was identified as a potential addition to the monitoring plan outlined in Table B-2.

Fisheries response to construction of the barrier island complex and re-establishing flow to the East River Channel has been positive, as demonstrated by studies comparing pre- and post-construction sampling results from the project area to sampling results from a similar nearby area unaffected by construction. Off-channel habitat that retains connectivity to the main channel plays a critical role in various life stages of many species of fish and is one of the rarest habitat types in the Illinois River system under existing conditions. Restoration of this habitat through construction of the HREP for Peoria Lake may potentially produce benefits over time that extend over a wider reach of the river beyond the immediate project area. Additional information from future monitoring as specified in Table B-2 should aid in evaluating long-term response. One addition to the monitoring plan will include sampling the area between the barrier and overburden islands to assess the use of this area by over-wintering fish. Monitoring use of the area by other aquatic organisms such as mussels also was identified as a potential addition to the monitoring plan.

The long-term survival potential of woody vegetation in the FWMA and the lack of success to date in re-establishing submergent and emergent vegetation behind the barrier island remain items of concern in evaluating biological response to the HREP for Peoria Lake. Bottomland forests within the Woodford State Fish and Wildlife Area and throughout the Upper Mississippi River System have been adversely affected by extreme high water events during the 1990's, and some flood-induced mortality would be expected even in the absence of FWMA construction. However, results of monitoring and observations by site managers indicate concern that the perimeter and interior levees of the FWMA do not afford enough protection from river stage fluctuations to enhance natural regeneration of hardwoods, and operation of this feature may potentially have a minor adverse effect on such regeneration. Continued monitoring of forest composition and mortality as specified should provide additional information on long-term mortality and regeneration. If necessary, modifications in operation and management of this feature will be considered to ensure long-term survival and enhanced diversity for this forest community.

The reason for the lack of aquatic vegetation response to barrier island construction remains unclear. While sediment composition does not appear to be a determining factor, several other potential inhibiting factors have been identified. These include island orientation, ambient turbidity in areas protected from wind and wave action, river stage fluctuations during the growing seasons in post-construction years to date, substrate disturbance by rough fish, and foraging activity by fish and/or waterfowl. Turbidity monitoring on the windward and sheltered sides of the island complex will be added to the monitoring plan to assess the importance of this potential influencing factor. Exclosure studies of vegetation also will be added to assess the influence of foraging activity on vegetative growth in this area.

APPENDIX A

POST-CONSTRUCTION EVALUATION PLAN

Table A-1 presents the post construction evaluation plan. The monitoring parameters were developed to measure the effectiveness of the stated goals. The Site Manager follows this table to make annual field observations. The annual field observations and the quantitative monitoring parameters will form the basis of the project evaluation.

TABLE A-1
POST-CONSTRUCTION QUANTITATIVE MEASUREMENTS

Goal	Objective	Alternative	Enhancement Feature	Unit	Initial Value	Estimated Current Value	Target Value at 50 years	Feature Measurement	Annual Field Observations by Site Manager
Enhance Wetland Habitat	Increase reliable food production and resting area	Forested Wetland Management Area	Water control	Acres of vegetation	0	168	168	Perform transects C, F, and G vegetation (understory and timber) survey	Estimate numbers of waterfowl
			Mast tree area	Acre	0	0	10	Land use/land cover mapping	Estimate survival of plantings
	Increase diversity and extent of submergent and emergent vegetation for waterfowl	Barrier Island	Aquatic vegetation bed	Acres of aquatic vegetation	0	0	100	Perform transects A, B, C, D, and E vegetation (aquatic) survey Perform transects A, B, C, D, and E hydrographic soundings	Estimate acres of emergent, submergent, and floating vegetation Record erosion deposition patterns
			Island vegetation	Acre	0	10-12	16	Perform transect I vegetation survey	Describe condition of shoreline erosion, sprigs, mat, cuttings, seedlings, and cover
			Improved water quality	mg/L suspended solids	100	[1]	50	Perform water quality tests at stations UPL - A, B, and C	Describe presence of suspended solids on lee side of island
Enhance Aquatic Habitat	Provide flowing side channel aquatic habitat	Flowing Side Channel	Side channel excavation	Acres of flowing channel surface	0	[1]	20	Perform transect H (East River) hydrographic sounding	Describe presence of snags, channel sedimentation, and vegetation
				Sq. ft of cross-sectional area of flowing channel	0	[1]	500	Perform transects C, D, and E (East River) hydrographic soundings	
				Velocity of flowing channel in ft/s	0	0.23-2.95	1	Perform transects C, D, E (East River) velocity measurements	
			Mast trees	Acre	0	1	2	Perform transect I vegetation survey	Describe condition of shoreline, sprigs, cuttings, and seedlings

[1] Insufficient information available at this time.

TABLE A-2

Peoria Lake Habitat Rehabilitation and Enhancement Project
Sedimentation Transect Project Objectives Evaluation

	Project Objectives to Be Evaluated		
Transect (1)	Increase Reliable Food Production and Resting Area	Increase Diversity and Extent of Submergent and Emergent Vegetation for Waterfowl	Provide Flowing Side Channel Aquatic Habitat
A		X	
B		X	
C	X	X	X
D		X	X
E		X	X
F	X		
G	X		
H		X	X
I		X	X

(1) See plate 3.

APPENDIX B

MONITORING AND PERFORMANCE EVALUATION MATRIX
RESOURCE MONITORING AND DATA COLLECTION SUMMARY

TABLE B-1

Monitoring and Performance Evaluation Plan

Project Phase	Type of Activity	Purpose	Responsible Agency	Implementing Agency	Funding Source	Remarks
Pre-Project	Problem Analysis	System-wide problem definition. Evaluates planning assumptions.	Corps	Corps/USFWS/USGS/ States	Corps (UMRS-EMP LTRMP and HREP)	Habitat Needs Assessment
	Pre-Project Monitoring	Identifies and defines problems at HREP site. Establishes need of proposed project features.	ILDNR	ILDNR	ILDNR	
	Baseline Monitoring	Establishes baselines for performance evaluations.	Corps	Corps	Corps (HREP)	See Table 6-2
Design	Data Collection for Design	Includes quantifying project objectives, design project, and development of performance evaluation plan.	Corps	Corps	Corps (HREP)	See Table 6-2
Construction	Construction Monitoring	Assess construction impacts. Assure permit conditions are met.	Corps	Corps	Corps (HREP)	See State Section 401 stipulations
Post-Construction	Performance Evaluation Monitoring	Determine success of project.	Corps	Corps/Sponsor	Corps (HREP)	-See Table 6.3 -Includes sponsor's field observations
	Analysis of Biological Responses to Projects	Evaluate predictions and assumptions of habitat unit analysis. Studies if projects do not have the desired biological results. Studies beyond the scope of performance evaluations.	Corps	USGS-BRD (UMESC)/ State [1]	Corps (HREP)	

[1] BRD = Biological Resources Division
UMESC = Upper Midwest Environmental Sciences Center

TABLE B-2 [1]

Resource Monitoring and Data Collection Summary

TYPE OF MEASUREMENT	WATER QUALITY DATA						ENGINEERING DATA						NATURAL RESOURCE DATA						Remarks
	Pre-Project Phase		Design Phase		Post-Const. Phase		Pre-Project Phase		Design Phase		Post-Const. Phase		Pre-Project Phase		Design Phase		Post-Const. Phase		
	Apr-Sep	Oct-Mar	Apr-Sep	Oct-Mar	Apr-Sep	Oct-Mar	Apr-Sep	Oct-Mar	Apr-Sep	Oct-Mar	Apr-Sep	Oct-Mar	Apr-Sep	Oct-Mar	Apr-Sep	Oct-Mar	Apr-Sep	Oct-Mar	
POINT MEASUREMENTS																			
Stations UPL - A, B, C																			
Turbidity	2W	M	2W	M															
Secchi Disk Transparency	2W	M	2W	M															
Dissolved Oxygen	2W	M	2W	M															
Specific Conductance	2W	M	2W	M															
Water Temperature	2W	M	2W	M															
Velocity	M	M	M	M															
Water Depth	2W	M	2W	M															
Water Elevation	2W	M	2W	M															
Percent Ice Cover	-	M	-	M															
Ice Depth	-	M	-	M															
Percent Snow Cover	-	M	-	M															
Snow Depth	-	M	-	M															
Substrate Particle Presence	6M	M	6M	M															
Substrate Hardness	6M	M	6M	M															
pH	2W	M	2W	M															
Chlorophyll	2W	M	2W	M															
Suspended Solids	2W	M	2W	M															
Wind Direction [2]	2W	M	2W	M	C														
Wind Velocity [2]	2W	M	2W	M	C														
Wave Height	2W	M	2W	M															
Station UPL-1, 2, 3, 4																			
Elutriate			1																
Bulk Sediment			1																
Column Settling (except UPL 3, 4)									1										
East River Transects C, D, & E																			
Velocity					2Y [3]														
Select Point Locations																			
Soil Borings [4]							1		1										
Nutrient Analyses UPL 3, 4															1				
Seed Bank Analyses UPL 3, 4															1				
Floating Island Inspections													5Y						Features deleted from project

TABLE B-2 (Continued)

Resource Monitoring and Data Collection Summary

TYPE OF MEASUREMENT	WATER QUALITY DATA						ENGINEERING DATA						NATURAL RESOURCE DATA						Remarks
	Pre-Project Phase		Design Phase		Post-Const. Phase		Pre-Project Phase		Design Phase		Post-Const. Phase		Pre-Project Phase		Design Phase		Post-Const. Phase		
	Apr-Sep	Oct-Mar	Apr-Sep	Oct-Mar	Apr-Sep	Oct-Mar	Apr-Sep	Oct-Mar	Apr-Sep	Oct-Mar	Apr-Sep	Oct-Mar	Apr-Sep	Oct-Mar	Apr-Sep	Oct-Mar	Apr-Sep	Oct-Mar	
TRANSECT MEASUREMENTS																			
Transects C, D, E, H (East River Only)																			
Hydrographic Soundings							M		M		5Y								
Transects A, B, C, D, E																			
Hydrographic Soundings									1		5Y								
Aquatic Vegetation													1		1		2Y		
Transects C, F, G,																			
Vegetation (Understory and Timber)													1		1		5Y		
Transect I																			
Vegetation																	2Y		
AREA MEASUREMENTS																			
Mapping																			
Aerial Photography													1				5Y		LTRMP LU/LC mapping standards

Legend
W = Weekly
M = Monthly
Y = Yearly
C = Continuous
nW = n-Week Interval
nY = n-Year Interval
1, 2, 3, ... = Number of times data are collected within the designated project phase

Notes
[1] See drawing 21 for locations of sampling points, transects, and areas except as noted.
[2] A wind station will be placed on the mid-point of the island and measurements will be taken continuously from April - September.
[3] Velocity measurements will be taken twice per year in the East River channel along transects C, D, and E.
[4] See drawing 7 for soil borings.

APPENDIX C

COOPERATING AGENCY CORRESPONDENCE

CEMVR-PM-M 13 March 2000

MEMORANDUM FOR RECORD

SUBJECT: Peoria Lake, Illinois, Habitat Rehabilitation and Enhancement Project (HREP)
Post-Construction Draft Initial Performance Evaluation Report (IPER)

1. On 23 February 2000, a meeting to discuss the subject report was held at the Illinois Department of Natural Resources (ILDNR) office in Pekin, Illinois. The following individuals attended the meeting:

1. U.S. Army Corps of Engineers, Rock Island District (CEMVR):

Jerry Skalak	CEMVR-PM-M (Project Management)	309/794-5605
Kara Mitvalsky	CEMVR-ED-DN (Environmental Engineering)	309/794-5623
Charlene Carmack	CEMVR-PM-R (Environmental Analysis)	309/794-5570

2. U.S. Army Corps of Engineers, Waterways Experiment Station (CEWES):

Elly Best	CEWES-ES-P (Environmental Systems)	601/624-4246
Bill James	CEERD-ES-P (Environmental Systems)	715/778-5896

Illinois Department of Natural Resources (ILDNR):

Larry Rice	Marshall/Woodford SFWA Site Manager	309/246-8351
Byron Paulsen	Wildlife Biologist	309/347-5119
Wayne Herndon	Fisheries Biologist	309/347-5119
Michelle Simone	Natural Heritage	309/347-5119
Fred Davidson	Woodford SFWA Site Manager	309/822-8861

The Nature Conservancy (TNC):

Doug Blodgett	Great Rivers Area Director	309/543-6502

U.S. Fish and Wildlife Service (USFWS):

Ron Fisher	Illinois River Refuges, Assistant Manager	309/535-2290

Notes:

- This MFR was provided in draft to Corps of Engineers attendees for review and comment prior to final distribution.

- J. Skalak, K. Mitvalsky, C. Carmack, E. Best and B. James visited the project site with F. Davidson immediately prior to the subject meeting.

2. Following introductions of the attendees, J. Skalak presented the following meeting objectives:

   - Identify and discuss project lessons learned to date and project-related biological and Operation and Maintenance (O&M) issues.
   - Confirm availability of project data and information, including photographs, etc.
   - Coordinate report completion schedule.
   - Review current project monitoring and assessment activities and consider future evaluation needs.

3. Forested Wetland Management Area:

   General:

   - Trees inside the cells will eventually be lost. This is a long-term concern.
   - Need to consider design changes that would allow for totally independent operation of each cell.
   - Dr. Yao Yin's inundation duration and tree mortality model should be utilized.
   - Current management schema should be reviewed. Although keeping the units forested is the preferred goal, a shift toward management that favors shrub plants may need to be considered.
   - Explore options for improving tree mix and addressing lack of tree age diversity in the cells. Possible solution may be to annually spot plant swamp white oaks, river birch, etc.
   - Consider planting trees on the tops of the intermediary levees.

   Stop Log Structures:

   - On-site staff have experienced significant difficulties with removing and installing stop logs.
   - Number of bays may have been greater than necessary.
   - Need winch or similar device for removing stop logs.
   - Consider using solid plates to close off three of four bays.

Levees:

- Seeding and maintaining levee vegetation is problematic due to flooding events.
- Need to evaluate alternative seeding/stabilization options.
- Gravel surface on lower levee has migrated down slope due to post-construction flooding events.
- B. Paulsen - consider using switch grasses or Virginia rye. Reed Canary grass has been removed from ILDNR recommended grasses list.
- E. Best - wool grass or native sedges might be a good option for stabilizing levees. Prairie Cord grass would be another alternative.

4. Barrier Island Complex:

- Willow posting was not necessary.
- Turbidity monitoring on both the windward and sheltered sides of the island needs to be added to the monitoring plan.
- Issues exist with respect to collecting monitoring data during waterfowl resting periods. A compromise approach might need to be identified (e.g., collect data after 4 p.m.). Any data collection activity needs to be closely coordinated with site management.
- Rough fish activities and over grazing are likely the main reasons for the lack of aquatic vegetation on the leeward side of the island.

5. East River Flowing Side Channel:

- The ILDNR has fisheries data to use as background information. Need better data that includes control points, presence/absence, relative weight data, etc.
- Need to monitor deepwater habitat between the islands. Possibly providing valuable over wintering escapement habitat.

6. Additional General Comments:

- F. Davidson provided 10 years of waterfowl hunting success statistics for the project area. This data will be summarized in a future report.
- Geese are actively nesting on the barrier island, in the management unit cells, and even on the management unit levees.
- Neotropical bird and mussel monitoring should be added to the overall monitoring program.
- The report from the most recent EMP E&D conference (June 1999) should be widely distributed.
- Land acquisition/conversion needs to continue to be a priority in ultimately addressing the problems with Peoria Lake and the Illinois River.

/s/

JERRY A. SKALAK
Project Management Branch

Copies Furnished:

Meeting Attendees (see above)
John Marlin, ILDNR
Marvin Hubbell, ILDNR
Dan Holmes, ILDNR
Mike Cochran, ILDNR
Steve Havera, INHS
Kevin Irons, ILDNR (LTRMP Field Station - Havana)

Dist File (PM-M)
PM-M (Skalak)
PM-M (B.Thompson)
PM-M (Foley)
PM-R (Carmack)
ED-DN (Mitvalsky)
DD (Brunso)

Addressees:

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Experiment Station
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Vicksburg, Mississippi 39180-6199

ATTN: CEERD-ES-P (Bill James)
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APPENDIX D

ILLINOIS NATURAL HISTORY SURVEY, FEBRUARY 1999

Annual Progress Report for the Bioresponse Monitoring of Peoria Lake Habitat Rehabilitation and Enhancement Project (HREP)

February 1999

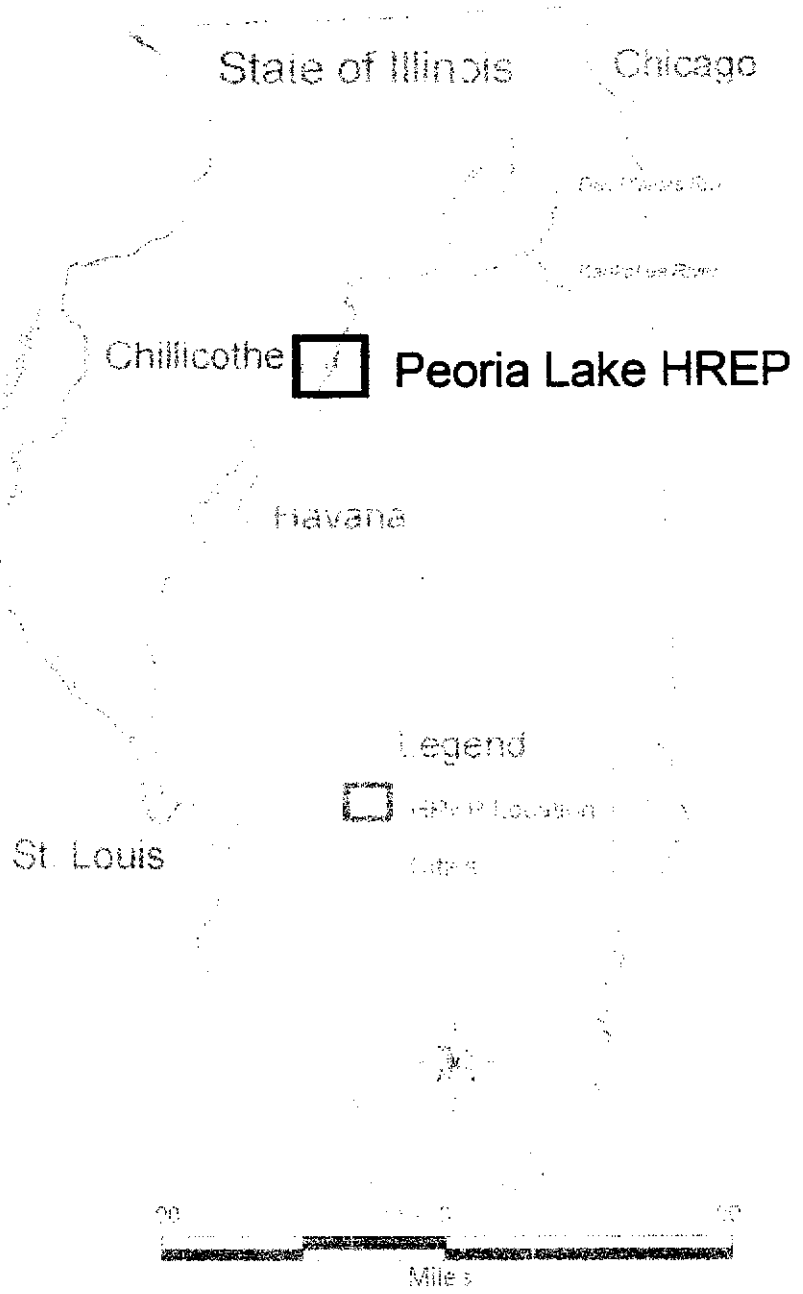
Kevin S. Irons and Timothy M. O'Hara
Illinois Natural History Survey
Long Term Resource Monitoring Program

For
U.S. Army Corps of Engineers, Rock Island District

Kevin S. Irons
Center for Aquatic Ecology
Illinois Natural History Survey

Dr. Dan Soluk, Director
Center for Aquatic Ecology
Illinois Natural History Survey

Figure 1. State of Illinois showing Illinois River and location of HREP bioresponse monitoring site.



Introduction

This report summarizes fish data collected in 1997 for bioresponse monitoring at the Peoria Lake Habitat Rehabilitation and Enhancement Project (HREP). This is a continuation of monitoring during 1991 and 1992 that provided baseline data on fish populations and communities at the Peoria Lake HREP prior to construction. Some preliminary comparisons of the 1997 data are made with the 1991-92 pre-construction HREP data to begin to assess the possible responses of fish populations to the project. Data were collected by staff at the Illinois Natural History Survey (INHS) Long Term Resource Monitoring Program (LTRMP) Field Station at Havana, Illinois. Funding for this work was provided by the Rock Island District of the U.S. Army Corps of Engineers (USACOE).

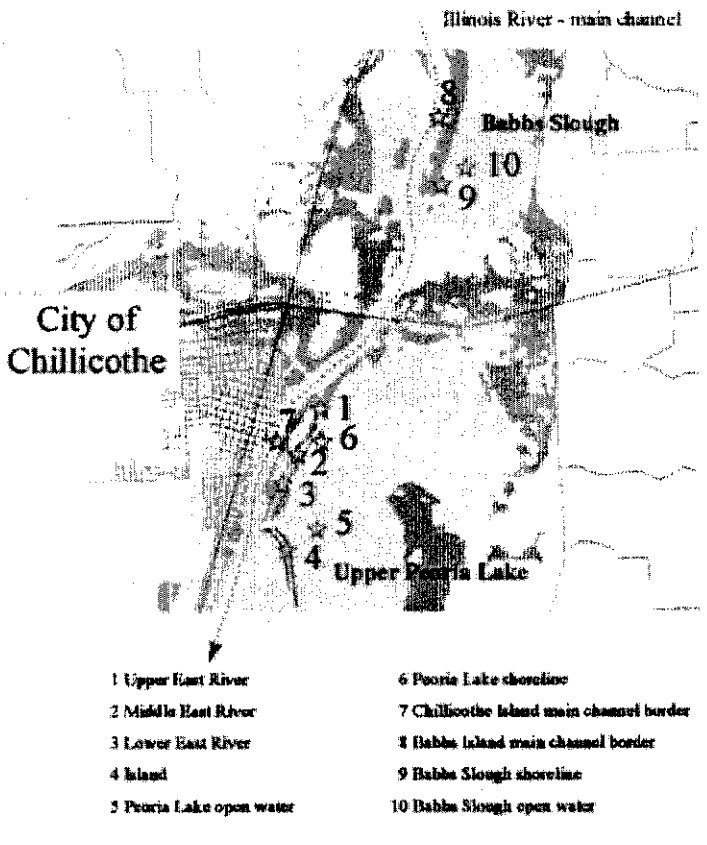
Methods

Site Descriptions

Monitoring of fish communities before (pre-construction, 1991-92) implementation of the Peoria Lake HREP (Figure 1) began with establishing and sampling at fixed sites (numbered 1-2, 5-10 in Figure 2, Dept. of the Army 1991, Harvey 1992, Irons and Blodgett 1993, Blodgett et al. 1994). The HREP consisted of 3 main parts: 1) reopening the lower end of the East River which became plugged in the mid 1960s, thus increasing the side channel habitat in the study area, 2) construction of a barrier island across Upper Peoria Lake to reduce wind generated waves, reducing resuspension of sediments and increasing depth, and 3) construction of a Forested Wetland Management Area (FWMA; Department of the Army 1991). These fixed monitoring sites were chosen to act as experimental and control sites. In 1991-92 the experimental sites were those in the vicinity of the HREP project, numbered 1, 2, and 5-7 in Figure 2, that may see the most impact of the project. The control sites were sites located in similar habitat types, sites 8, 9, and 10 in Figure 2, that should not be affected by the project and may help in determining year to year changes in the fish populations due to other environmental conditions acting independent of the HREP project.

During pre-construction the five experimental sites include the upper East River (1), middle East River (2), Peoria Lake open water (5), Peoria Lake shoreline (6), and Chillicothe Island main channel border (7). The three control sites roughly 3 miles upstream from the project area include Babbs Island main channel border (8), Babbs Slough shoreline

Figure 2. Peoria Lake HREP sampling sites.



(9), and Babbs Slough open water (10). Because of the lack of side channel habitat in this reach of the river, there was not a control site with characteristics of the East River.

During 1997 the same sites (utilized in 1991-92) were sampled along with two additional sites in areas created by construction: the lower East River site (3) is in the newly created side channel and the Island site (4) is located between the newly constructed barrier island and the dredge spoil island that is smaller and parallel to the barrier island (Figure 2). The lower East River site can be characterized as side channel habitat; it is within a dredged out portion of the East River that had previously been obstructed by debris, silted in, and eventually became terrestrial. Since construction, this site maintains flow, good water depths, and some brush piles that often characterize side channels. The new Island site also functions as side channel habitat with flow throughout the sampling area. In the fall of 1997 a rock closing structure was constructed at the upstream end of the channel between the islands. This was intended to limit some flow through the channel between the new barrier Island and dredge spoil island and direct more current and sediments back into the main channel. All together, we sampled 10 sites from four sampling periods during 1997. Locations for each site were collected and recorded during 1997 using a Gamin 75 Global Positioning System (GPS) unit using UTM's (Universal Transverse Mercator).

Sampling Descriptions and Effort

Fish sampling methods in 1997 are comparable to those used in the 1991-92 sampling and the LTRMP sampling protocols (Lubinski and Rasmussen, 1988) that were adopted for this project. The updated LTRMP protocols are documented in the LTRMP Procedures Manual, Fish Monitoring Section (Gutreuter et. al., 1995). These new protocols are followed with noted exceptions to ensure consistency between years. Sites were sampled throughout four of the six HREP sampling periods (2 - 5) during 1997. Each period sampled during 1997 was 45 days long (Table 1).

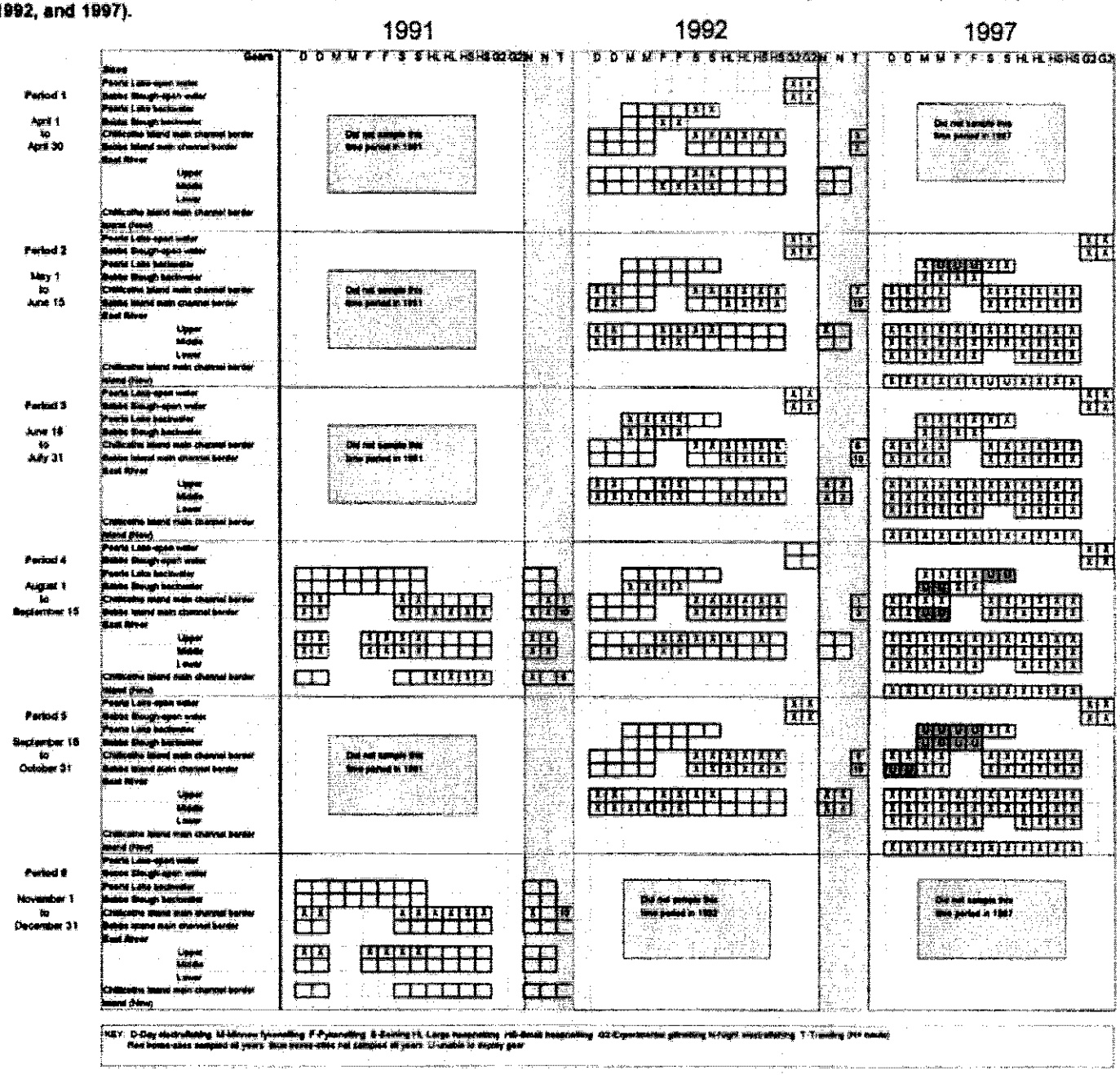
In 1997, there were only slight modifications in effort as compared to sampling during 1991-92 (Figure 3). Night electrofishing and trawling was not utilized in 1997 primarily for safety and scheduling reasons. Also, minnow fyke net sets and seines were fished at all sites except for the Babbs Slough shoreline site where sediments were too flocculent to seine efficiently. Hoop nets utilized in 1997 were fished in tandem (bridled) as in 1991-92 sampling for consistency although LTRMP protocols have changed to a side by side implementation of small and large hoop nets. The seining effort for each site was doubled, four hauls per site in 1997 (two per replicate) instead of two (one per replicate) as in 1991-92.

Table 1. Sampling periods for HREP bioresponse monitoring of Peoria Lake.

HREP time periods	Inclusive dates
1 (not sampled in 1997)	1 April to 30 April
2	1 May to 15 June
3	16 June to 31 July
4	1 August to 15 September
5	16 September to 31 October
6 (not sampled in 1997)	1 November to 31 December

During each sampling period, the two main channel sites at Chillicothe Island and Babbs Island (Figure 2) were sampled with the following gears: two daytime electrofishing runs, two tandem hoop net

Figure 3. Summary of gear deployment per sampling window at Peoria Lake HREP sites for all years and time periods, (1991, 1992, and 1997).



sets, two minnow fyke nets, and four seine hauls. The four side channel sites, three in the East River and the Island site, were sampled with the following gears: two daytime electrofishing runs, two tandem hoop net sets, two fyke nets, two minnow fyke nets, and four seine hauls. Babbs Slough and Peoria Lake shoreline sites were fished with the following gears: two daytime electofishing runs, two fyke net sets, and two minnow fyke net sets. There were four seine hauls at Peoria Lake per time period and none at Babbs Slough. Two gill nets were set at both Peoria Lake and Babbs Slough open-water sites.

Each site was designed to have two replicate samples taken for each sampling period. At each of the sites each gear was fished with duplicate effort. This duplicated effort (replicate) is combined to describe that particular site. Physically a site is 450 m long, outlined by two 200 m stretches of shoreline (for electrofishing runs) separated by 50 m of shoreline. At each site, half of the total effort per time period is within each of the 200 m stretches. For example, at each site two fyke nets are fished per time period. One net is set in the upstream 200 m section or replicate one, the second net is set in the downstream 200 m section or replicate two. These pseudo replicate samples (e.g., two hoop net sets) that were fished simultaneously and recorded independently were pooled together to describe an individual site for this report.

Overall, effort has been somewhat variable over the three years of sampling at the Peoria Lake HREP. During 1991 much of the effort was focused on the experimental sites with only Babbs Island main channel being sampled as a control. Also, in 1991 the main channel site at Chillicothe Island was upstream a tenth of a mile than where the subsequent years site was sampled. The control sites were all sampled in 1992. The most complete sampling year, also with the most effort was 1997 (Figure 3).

We classified the relative success of collections by assigning a report code of 1-7 for each collection as specified by LTRMP protocols (Lubinski and Rasmussen 1988, Gutreuter 1995). Those collections with summary codes of 1 or 2 represent net sets or electrofishing that did not meet LTRMP requirements; for example, the net was not set due to low or lack of water, the net flipped, a hole was discovered in net when lifted, or the net was stolen. Only gears that fished successfully (IE. summary codes > 2) were included in this report.

The LTRMP fish component also began identifying turtles in 1993 and we continued at this HREP site. Turtle species, gender, and carapace length were recorded and included in the database beginning in 1997. The turtle data were reported as total catch for each species.

Hydrology

During 1991-92, water surface elevations at Peoria Lake gage station were used as an index of water depths to determine if the Peoria Lake HREP sites could be sampled. The Peoria Lake gage station proved to be an unreliable indicator of water level conditions at the HREP sites. In late 1992 and 1997 sampling, water surface elevations from the Henry gage station were used to predict sampling accessibility at the HREP sites (Figures 4). For this report, the Henry gage will be used for all years. In general, if water levels fell below 441 feet above mean sea level at the Henry gage access to sampling sites was limited. In addition to water surface elevation, other measurements such as water temperature, dissolved oxygen, specific conductance, secchi disk transparency, and water velocity were taken at the fixed sites. All measurements were taken using LTRMP protocols (Gutreuter et. al.,1995).

All data collected was recorded on LTRMP fish collection and measurement sheets. These data

sheets were proofed and submitted to a contractor for data entry. The entered data were returned via the Upper Midwest Environmental Sciences Center (UMESC), USGS, Onalaska, WI. The data were then line by line verified between the original datasheets and an R:base application designed at the UMESC.

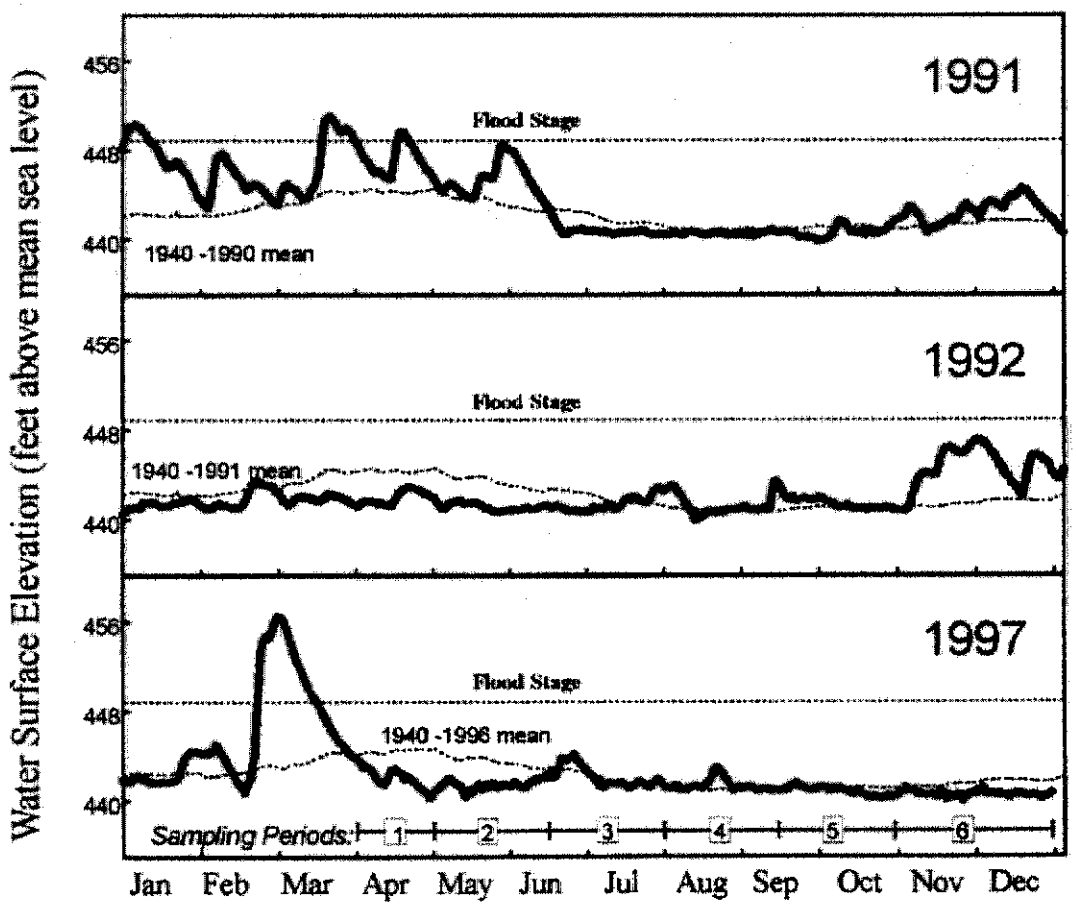
Data in this report are summarized several ways. First, we will present a summary of total fish collected at each site during 1997 HREP bioresponse monitoring, including number of species present (species richness) and most abundant species for each site (relative abundance). Second, comparisons will be made using catch data grouped by years, first as post-construction and then pre-construction, with 1991 and 1992 data combined as pre-construction data as well as having data from individual years. Third, data will be presented for comparisons of experimental sites and catches both post- and pre- construction. Fourth, comparisons of post- and pre-construction data from the control sites will be presented. Basic comparisons within these groups will consist of total fish abundance, species richness, and most abundant species information. Nomenclature for fishes follows Robins et al. (1991).

Results and Discussion

Hydrology

In 1997, water surface elevations at the HREP sites were low and stable throughout the year with only a

Figure 4. Water surface elevations at Henry, IL. as reported by the USACOE.



few exceptions. During late February and March the water levels were above flood stage, peaking approximately 6 feet over flood stage. During much of April and May water levels remained below the 52 year mean (Figure 4).
The water surface elevations in 1991 were high and unstable in sampling periods one and two before falling below the 50 year mean and remaining relatively stable through period three, four, and five. Water levels rose slightly above the mean during period six (Figure 4).

In 1992, water surface elevations remained below the long-term mean for most of the year. Low and stable levels remained prevalent through the first five time periods with levels rising above the mean in period six (Figure 4).

Although water levels in 1997 at Peoria Lake HREP were low, 299 of 320 (93%) scheduled sampling events were completed (Figure 4). The majority of the incomplete samples during 1997 were from the Peoria Lake and Babbs Slough shoreline sites. This was due to the low gradient between open water and shoreline which made boat accessibility very difficult during low water.

1997 Catch Summaries by Site

In 1997, the upper East River site (1) yielded 9,923 fish consisting of 50 species from all gears combined (Table 2). Emerald shiners (*Notropis atherinoides*, 76%, 7,584) were most abundant followed by gizzard shad (*Dorosoma cepedianum*, 5%, 541) and white bass (*Morone chrysops*, 3%, 263). This site accounted for the highest fish count and species diversity of any site and the most centrarchids at any site (4%, 368). We collected striped shiner (*Luxilis chrysocephalus*) for the first time during HREP or LTRMP La Grange Reach fish sampling at this site. Eight species were unique to this site in 1997: bowfin (*Amia calva*), striped shiner, river shiner (*Notropis blennius*), suckermouth minnow (*Phenacobius mirabilis*), flathead catfish (*Pylodictis olivaris*), warmouth (*Lepomis gulosus*), mud darter (*Etheostoma asprigene*), and slenderhead darter (*Percina phoxocephala*).

At the middle East River site (2) we collected 4,303 fish consisting of 44 species and two hybrids in 1997 (Table 2). Emerald shiners (45%, 1,940) were most abundant followed by gizzard shad (12%, 516) and common carp (*Cyprinis carpio*, 10%, 426). Blacknose dace (*Rhinichthys atratulus*) and brook stickleback (*Culaea inconstans*) were both collected here and at the Island site for the first time, one each per site. This is the only site during this HREP monitoring where mooneye (*Hiodon tergisus*) has been collected.

At the lower East River site (3) we collected 3,070 fish consisting of 33 species and two hybrids (Table 2). Emerald shiner (33%, 1010) were most abundant followed by common carp (21%, 644) and gizzard shad (15%, 456). There were no unique species collected here.

The Island site (4) yielded 6,269 fish consisting of 39 species and one hybrid (Table 2). Emerald shiners (44%, 2,776) were most abundant followed by gizzard shad (25%, 1,584) and common carp (10%, 617). There were no unique species except for the first-time collections of blacknose dace and brook stickleback shared with the middle East River site.

At the Peoria Lake open water site (5) we collected 588 fish consisting of 16 species (Table 2). Gizzard shad (49%, 288) were most abundant followed by smallmouth buffalo (*Ictiobus bubalus*, 13%, 74) and freshwater drum (*Aplodinotus grunniens*, 7%, 41).

At the Peoria Lake shoreline site (6) we collected 3,686 fish consisting of 23 species (Table 2). Emerald shiners (71%, 2,619) were most abundant followed by gizzard shad (14%, 519) and river

Table 2. Numbers of fish collected by all gear types from all sites (experimental and control) at HREP bioresponse monitoring sites at Upper Peoria Lake during 1997.

		Experimental Sites								Control Sites				All Sites
Common Name	*Scientific Name*	Island (New)	East River Lower	East River Middle	East River Upper	Peoria Lake open water	Chillicothe Is. main channel border	Peoria Lake shoreline	Experimental Sites	Babbs Is. main channel border	Babbs Slough shoreline	Babbs Slough open water	Control Sites	
Longnose gar	*Lepisosteus osseus*									2			2	2
Spotted gar	*Lepisosteus oculatus*													
Shortnose gar	*Lepisosteus platostomus*	7	19	10	10	31	13	51	141	16	71	5	92	233
American eel	*Anguilla rostrata*													
Bowfin	*Amia calva*				4				4					4
Gizzard shad	*Dorosoma cepedianum*	1,584	456	516	541	290	3,567	519	7,473	1,508	187	742	2,437	9,910
Threadfin shad	*Dorosoma petenese*	1	2	4	3		3,524		3,534					3,534
Skipjack herring	*Alosa chrysochloris*	4	14	13	15	8	11	1	66	30	1	21	52	118
Goldeye	*Hiodon alosoides*	1	1		2	23			27			17	17	44
Mooneye	*Hiodon tergisus*			1					1					1
Central stoneroller	*Campostoma anomalum*			2	2		1		5					5
Grass carp	*Ctenopharyngodon idella*	2	2		2				6	1	1		2	8
Red shiner	*Cyprinella lutrensis*	1		38	29		6		74	4			4	78
Common carp	*Cyprinus carpio*	617	644	426	164	34	348	13	2,246	247	17	79	343	2,589
Goldfish	*Carassius auratus*			1	2		1		4					4
Carp x goldfish	*Cyprinus carpio x auratus*	1	3	4					8					8
Silver chub	*Macrhybopsis storeriana*	7	2	17	22		33		81	3			3	84
Golden shiner	*Notemigonus crysoleucas*			1	5		1	1	8					8
Emerald shiner	*Notropis atherinoides*	2,776	1,010	1,940	7,584		998	2,619	16,927	447	3		450	17,377
Striped Shiner	*Luxilus chrysocephalus*				1				1					1
River shiner	*Notropis blennius*				6				6					6
Spottail shiner	*Notropis hudsonius*	42	69	62	196		138	2	509	48			48	557
Silverband shiner	*Notropis shumardi*	44	12	9	7			2	74	3			3	77
Sand shiner	*Notropis stramineus*	6		11	15		11	0	43	5			5	48
Suckermouth minnow	*Phenacobius mirabilis*				1				1					1
Bluntnose minnow	*Pimephales notatus*	13	4	12	39		16	1	85					85
Bullhead minnow	*Pimephales vigilax*	74	22	199	185		62	4	546	13			13	559
Blacknose dace	*Rhinichthys atratulus*	1		1					2					2
Creek chub	*Semotilus atromaculatus*	5		3			1		9					9
River carpsucker	*Carpiodes carpio*	99	22	57	77	31	65	213	564	30	16	16	62	626
Quillback	*Carpiodes cyprinus*	1		2	1	2	13		19					19
Highfin carpsucker	*Carpiodes velifer*	1		1			2		4		1	1	2	6
White sucker	*Catostomus commersoni*													
Northern hogsucker	*Hypentelium nigricans*						4		4					4
Smallmouth buffalo	*Ictiobus cyprinellus*	288	151	263	139	74	328	6	1,249	498	21	74	593	1,842
Bigmouth buffalo	*Ictiobus cyprinellus*	4		3	2	5		5	19		1	8	9	28
Black buffalo	*Ictiobus niger*	3	3	3			5		14	15	1	11	27	41
Unidentified buffalo	*Ictiobus sp.*	35	1	10	9		9	68	132	12			12	144
Silver redhorse	*Moxostoma anisurum*						1		1					1
Golden redhorse	*Moxostoma erythrurum*			2	4				6					6
Shorthead redhorse	*Moxostoma macrolepidotum*	4	11	16	19	3	2	3	58	2	5	4	11	69
Black bullhead	*Ameiurus melas*				3	1			4	1	2	2	5	9
Yellow bullhead	*Ameiurus natalis*		1	1	3				5	1	1		2	7
Brown bullhead	*Ameiurus nebulosus*	9	1	3	3	1			17			6	6	23
Channel catfish	*Ictalurus punctatus*	33	32	92	31	6	115		309	139		7	146	455
Stonecat	*Noturus flavus*													
Tadpole madtom	*Noturus gyrinus*													
Flathead catfish	*Pylodictis olivaris*				3				3					3
Western mosquitofish	*Gambusia affinis*				2				2	1			1	3
Brook stickleback	*Culaea inconstans*	1		1					2					2
White perch	*Morone americana*	1	1		2				4					4
White bass	*Morone chrysops*	245	187	226	263	26	68	101	1,116	94	74	18	186	1,302
Yellow bass	*Morone mississippiensis*	3	1	5	3				12	1	1	2	4	16
Green sunfish	*Lepomis cyanellus*		1	3	13		3		20					20
Pumpkinseed	*Lepomis gibbosus*													
Warmouth	*Lepomis gulosus*				1				1					1
Orangespotted sunfish	*Lepomis humilis*		1	1	5				7					7
Bluegill	*Lepomis macrochirus*	21	61	137	200		5	39	463	4	2		6	469
Green sunfish x bluegill	*L. cyanellus x macrochirus*		1	1					2					2
Smallmouth bass	*Micropterus dolomieui*	2		2	2		0	3	9					9
Largemouth bass	*Micropterus salmoides*	1	13	15	52		5	2	88	1			1	89
White crappie	*Pomoxis annularis*	7	6	12	17		1		43	3	2		5	48
Black crappie	*Pomoxis nigromaculatus*	29	17	45	78		3	19	191		2		2	193
Mud darter	*Etheostoma asprigene*				1				1					1
Logperch	*Percina caprodes*	1	13	26	32		1	1	74	1			1	75
Slenderhead darter	*Percina phoxocephala*				1				1					1
Sauger	*Stizostedion canadense*	17	19	13	40	12	9	5	115	8	1	22	31	146
Walleye	*Stizostedion vitreum*	1	2	1					4					4
Freshwater drum	*Aplodinotus grunniens*	277	265	84	82	41	62	8	819	44	6	27	77	896
Unidentified	*Unidentified unidentified*			8					8					8
TOTAL		6,269	3,070	4,303	9,923	588	9,432	3,686	37,271	3,182	416	1,062	4,660	41,931
Total number of species collected		39	33	44	50	16	35	23	59	29	21	18	34	60
Total number of hybrids collected		1	2	2	0	0	0	0	2	0	0	0	0	2

carpsucker (*Carpiodes carpio*, 6%, 213). There were no unique species collected here.

The Chillicothe Island main channel border site (7) yielded 9,432 fish consisting of 35 species (Table 2). Gizzard shad (38%, 3567) and threadfin shad (*Dorosoma petenense*, 37%, 3524) were most abundant followed by emerald shiner (11%, 998). Northern hogsucker (*Hypentelium nigricans*) and silver redhorse (*Moxostoma anisurum*) were collected for the first time and were unique to this site.

At the Babbs Island main channel border site (8) we collected 3,182 fish consisting of 29 species (Table 2). Gizzard shad (47%, 1508) were most abundant followed by smallmouth buffalo (16%, 498) and emerald shiner (14%, 447). Longnose gar (*Lepisosteus osseus*) was only collected at this site in 1997.

At the Babbs Slough shoreline site (9) we collected 416 fish consisting of 21 species (Table 2). Gizzard shad (45%, 187) were most abundant followed by white bass (18%, 74) and shortnose gar (*Lepisosteus platostomus*, 17%, 71). There were no unique species collected here.

At the Babbs Slough open water site (10) we collected 1,062 fish consisting of 18 species (Table 2). Gizzard shad (70%, 742) were most abundant followed by common carp (7%, 79) and smallmouth buffalo (7%, 74). There were no unique species collected here.

Post-construction and Pre-construction annual summaries

Post-construction

During 1997, a total of 41,931 fish from 60 species and 2 hybrids was collected from all sites (Table 3). Of these, 41 % (17,377) were emerald shiner, while gizzard shad (24%, 9,910) and threadfin shad (8%, 3,534) followed in total abundance.

Pre-construction

During pre-construction sampling (1991-92), a total of 43,734 fish were collected (Table 3). Of these, 52% (22,811) were emerald shiner, while gizzard shad (16%, 7,150) and common carp (8%, 3,331) followed in total abundance. A total of 50 species and 2 hybrids was collected during pre-construction sampling.

During 1991, 7,473 fish consisting of 39 species and 1 hybrid were collected (Table 3). Gizzard shad (20%, 1,519) and bluegill (*Lepomis macrochirus*, 16%, 1,172) dominated the catch with common carp (13%, 1,007) third in abundance.

In 1992, 36,261 fish consisting of 49 species and 2 hybrids were collected (Table 3). Of these, 63% (22,688 fish) were emerald shiner followed by gizzard shad (16%, 5,631) and common carp (6%, 2,324).

Post-construction vs Pre-construction

From all years, 1997 and 1991-92 combined, we collected a total of 85,665 fish consisting of 66 species and 2 hybrids during HREP monitoring at Peoria Lake (Table 3). The total numbers of species we collected during post-construction sampling (1997; 60 and 2 hybrids), and preconstruction sampling (1991-92 combined; 50 and 2 hybrids), are higher than the 39 species expected from data collected over the 5 years prior to this study by the Illinois Department of Conservation (now Illinois Department of Natural Resources [IDNR]; USACOE, 1990). Although methods weren't disclosed for the IDNR historical data, the HREP sampling is likely more intensive, over a longer time, and with a wider variety of gears and habitats.

Table 3. Total numbers of fish collected post-construction (1997) and pre-construction (1991-92) by all gear types from all sites (experimental and control) at HREP bioresponse monitoring sites at Upper Peoria Lake during three years of monitoring (1991, 1992, and 1997).

Common Name	*Scientific Name*	1991	1992	Sub Total (1991-92)	1997	Grand Total 1991-92, 1997
Longnose gar	*Lepisosteus osseus*		2	2	2	4
Spotted gar	*Lepisosteus oculatus*		1	1		1
Shortnose gar	*Lepisosteus platostomus*	36	200	236	233	469
American eel	*Anguilla rostrata*		1	1		1
Bowfin	*Amia calva*		1	1	4	5
Gizzard shad	*Dorosoma cepedianum*	1,519	5,631	7,150	9,910	17,060
Threadfin shad	*Dorosoma petenese*	259	236	495	3,534	4,029
Skipjack herring	*Alosa chrysochloris*	29	175	204	118	322
Goldeye	*Hiodon alosoides*		8	8	44	52
Mooneye	*Hiodon tergisus*				1	1
Central stoneroller	*Compostoma anomalum*				5	5
Grass carp	*Ctenopharyngodon idella*				8	8
Red shiner	*Cyprinella lutrensis*		11	11	78	89
Common carp	*Cyprinus carpio*	1,007	2,324	3,331	2,589	5,920
Goldfish	*Carassius auratus*	3	48	51	4	55
Carp x goldfish	*Cyprinus carpio x auratus*	15	13	28	8	36
Silver chub	*Macrhybobsis storeriana*	36	35	71	84	155
Golden shiner	*Notemigonus crysoleucas*				8	8
Emerald shiner	*Notropis atherinoides*	123	22,688	22,811	17,377	40,188
Striped Shiner	*Luxilus chrysocephalus*				1	1
River shiner	*Notropis blennius*				6	6
Spottail shiner	*Notropis hudsonius*	100	350	450	557	1,007
Silverband shiner	*Notropis shumardi*	1	245	246	77	323
Sand shiner	*Notropis stramineus*				48	48
Suckermouth minnow	*Phenacobius mirabilis*				1	1
Bluntnose minnow	*Pimephales notatus*		2	2	85	87
Bullhead minnow	*Pimephales vigilax*	4	85	89	559	648
Blacknose dace	*Rhinichthys atratulus*				2	2
Creek chub	*Semotilus atromaculatus*				9	9
River carpsucker	*Carpiodes carpio*	254	410	664	626	1,290
Quillback	*Carpiodes cyprinus*	114	26	140	19	159
Highfin carpsucker	*Carpiodes velifer*		10	10	6	16
White sucker	*Catostomus commersoni*	2	3	5		5
Northern hogsucker	*Hypentelium nigricans*				4	4
Smallmouth buffalo	*Ictiobus cyprinellus*	357	451	808	1,842	2,650
Bigmouth buffalo	*Ictiobus cyprinellus*	3	52	55	28	83
Black buffalo	*Ictiobus niger*	7	19	26	41	67
Unidentified buffalo	*Ictiobus sp.*				144	144
Silver redhorse	*Moxostoma anisurum*				1	1
Golden redhorse	*Moxostoma erythrurum*	1	2	3	6	9
Shorthead redhorse	*Moxostoma macrolepidotum*	11	63	74	69	143
Black bullhead	*Ameiurus melas*	6	16	22	9	31
Yellow bullhead	*Ameiurus natalis*	2	6	8	7	15
Brown bullhead	*Ameiurus nebulosus*	624	112	736	23	759
Channel catfish	*Ictalurus punctatus*	108	741	849	455	1,304
Stonecat	*Noturus flavus*		1	1		1
Tadpole madtom	*Noturus gyrinus*	2	6	8		8
Flathead catfish	*Pylodictis olivaris*	1	5	6	3	9
Western mosquitofish	*Gambusia affinis*		5	5	3	8
Brook stickleback	*Culaea inconstans*				2	2
White perch	*Morone americana*	1	13	14	4	18
White bass	*Morone chysops*	320	888	1,208	1,302	2,510
Yellow bass	*Morone mississippiensis*	9	5	14	16	30
Green sunfish	*Lepomis cyanellus*	87	21	108	20	128
Pumpkinseed	*Lepomis gibbosus*	1		1		1
Warmouth	*Lepomis gulosus*		1	1	1	2
Orangespotted sunfish	*Lepomis humilis*	14	10	24	7	31
Bluegill	*Lepomis macrochirus*	1,172	572	1,744	469	2,213
Green sunfish x bluegill	*L. cyanellus x macrochirus*		4	4	2	6
Smallmouth bass	*Micropterus dolomieui*				9	9
Largemouth bass	*Micropterus salmoides*	104	77	181	89	270
White crappie	*Pomoxis annularis*	90	35	125	48	173
Black crappie	*Pomoxis nigromaculatus*	86	90	176	193	369
Mud darter	*Etheostoma asprigene*				1	1
Logperch	*Percina caprodes*	6	20	26	75	101
Slenderhead darter	*Percina phoxocephala*				1	1
Sauger	*Stizostedion canadense*	54	21	75	146	221
Walleye	*Stizostedion vitreum*	1	1	2	4	6
Freshwater drum	*Aplodinotus grunniens*	904	519	1,423	896	2,319
Unidentified	*Unidentified unidentified*				8	8
TOTAL		7,473	36,261	43,734	41,931	85,665
Total number of species collected		39	49	50	60	66
Total number of hybrids collected		1	2	2	2	2

Unique species caught in 1997 from all sites combined included: mooneye, central stoneroller (*Campostoma anomalum*), grass carp (*Ctenopharyngodon idella*), striped shiner, golden shiner (*Notemigonus crysoleucas*), river shiner, sand shiner (*Notropis stramineus*), suckermouth minnow, blacknose dace, creek chub (*Semotilus atromaculatus*), northern hogsucker, silver redhorse, brook stickleback, smallmouth bass (*Micropterus dolomieui*), mud darter, and slenderhead darter. Pumpkinseed (*Lepomis gibbosus*) was only caught in 1991. Spotted gar (*Lepisosteus oculatus*), american eel (*Anguilla rostrata*), and stonecat (*Noturus flavus*) were only caught in 1992.

Experimental Sites

Post-construction

The experimental sites yielded 64 species and 2 hybrids (63,871 fish) for all years combined (Table 4). Eighty-nine percent (37,271) of the total fish collected in 1997 (41,931) were caught at these experimental sites. Emerald shiners composed 45% (16,927) of the catch from the experimental sites, while gizzard shad and threadfin shad constituted 20% (7,473) and 9% (3,534) of the catch respectively.

Pre-construction

Sixty-one percent (26,600) of the total fish collected in 1991-1992 (43,734) were from the experimental sites (Table 4). Emerald shiners were most abundant from the experimental sites with 53% (13,981) of the total catch, of these 99% (13,900) were from 1992. Gizzard shad (11%, 2,881) and common carp (9%, 2,478) followed as the next most common species caught from the experimental sites during 1991 and 1992 combined.

In 1991, the experimental sites accounted for 5,411 fish (Table 4). Gizzard shad (22%, 1,212), bluegill (21%, 1,159), and common carp (16%, 843) dominated the catches

In 1992, 21,189 fish were collected from the experimental sites (Table 4). This catch was dominated by emerald shiner (66%, 13,900), gizzard shad (8%, 1,669), and common carp (8%, 1,635).

Post-construction vs Pre-construction

Within the experimental sites, seventeen species were collected during 1997 that we had not collected during our pre-construction sampling in 1991-92. They were mooneye, central stoneroller, grass carp, golden shiner, striped shiner, river shiner, sand shiner, suckermouth minnow, blacknose dace, creek chub, northern hogsucker, silver redhorse, western mosquitofish (*Gambusia affinis*), brook stickleback, smallmouth bass, mud darter, and slenderhead darter. Only four species collected in 1991 or 1992 at the experimental sites were not collected in 1997, they were spotted gar, american eel, white sucker (*Catostomus commersoni*), and pumpkinseed (Table 5).

Control Sites

Post-construction

From the control sites for all years combined, a total of 43 species and 1 hybrid (21,794 fish) were collected (Table 4). The catch at the control sites in 1997 show gizzard shad (52%, 2,437) being the most numerous. Smallmouth buffalo (12%, 593) and emerald shiner (10%, 450) were the second and third most abundant at the control sites.

Pre-construction

A total of 17,134 fish was collected from the control sites during pre-construction sampling consisting mostly of emerald shiner (52%, 8,830), gizzard shad (25%, 4,269), and common carp (5%, 853; Table 4).

Table 4. Total numbers of fish collected at experimental and control sites by all gear types at HREP bioresponse monitoring sites at Upper Peoria Lake during three years of monitoring (1991,1992, and 1997).

		Experimental Sites				Control Sites				
Common Name	Scientific Name	1991 Total	1992 Total	1997 Total	Sub Total experimental	1991 Total	1992 Total	1997 Total	Sub Total control	Grand Grand Total
Longnose gar	*Lepisosteus osseus*		1		1		1	2	3	4
Spotted gar	*Lepisosteus oculatus*		1		1					1
Shortnose gar	*Lepisosteus platostomus*	36	147	141	324		53	92	145	469
American eel	*Anguilla rostrata*		1		1					1
Bowfin	*Amia calva*		1	4	5					5
Gizzard shad	*Dorosoma cepedianum*	1,212	1,669	7,473	10,354	307	3,962	2,437	6,706	17,060
Threadfin shad	*Dorosoma petenese*	198	38	3,534	3,770	61	198		259	4,029
Skipjack herring	*Alosa chrysochloris*	20	91	66	177	9	84	52	145	322
Goldeye	*Hiodon alosoides*		6	27	33		2	17	19	52
Mooneye	*Hiodon tergisus*			1	1					1
Central stoneroller	*Compostoma anomalum*			5	5					5
Grass carp	*Ctenapharyngodon idella*			6	6			2	2	8
Red shiner	*Cyprinella lutrensis*		11	74	85			4	4	89
Common carp	*Cyprinus carpio*	843	1,635	2,246	4,724	164	689	343	1,196	5,920
Goldfish	*Carassius auratus*	3	46	4	53		2		2	55
Carp x goldfish	*Cyprinus carpio x auratus*	5	6	8	19	10	7		17	36
Silver chub	*Macrhybopsis storeriana*	23	32	81	136	13	3	3	19	155
Golden shiner	*Notemigonus crysoleucas*			8	8					8
Emerald shiner	*Notropis atherinoides*	81	13,900	16,927	30,908	42	8,788	450	9,280	40,188
Striped Shiner	*Luxilus chrysocephalus*			1	1					1
River shiner	*Notropis blennius*			6	6					6
Spottail shiner	*Notropis hudsonius*	88	338	509	935	12	12	48	72	1,007
Silverband shiner	*Notropis shumardi*	1	245	74	320			3	3	323
Sand shiner	*Notropis stramineus*			43	43			5	5	48
Suckermouth minnow	*Phenacobius mirabilis*			1	1					1
Bluntnose minnow	*Pimephales notatus*		2	85	87					87
Bullhead minnow	*Pimephales vigilax*	4	84	546	634		1	13	14	648
Blacknose dace	*Rhinichthys atratulus*			2	2					2
Creek chub	*Semotilus atromaculatus*			9	9					9
River carpsucker	*Carpiodes carpio*	189	262	564	1,015	65	148	62	275	1,290
Quillback	*Carpiodes cyprinus*	75	14	19	108	39	12		51	159
Highfin carpsucker	*Carpiodes velifer*		4	4	8		6	2	8	16
White sucker	*Catostomus commersoni*	1	2		3	1	1		2	5
Northern hogsucker	*Hypentelium nigricans*			4	4					4
Smallmouth buffalo	*Ictiobus cyprinellus*	196	244	1,249	1,689	161	207	593	961	2,650
Bigmouth buffalo	*Ictiobus cyprinellus*	3	18	19	40		34	9	43	83
Black buffalo	*Ictiobus niger*	6	12	14	32	1	7	27	35	67
Unidentified buffalo	*Ictiobus sp.*			132	132			12	12	144
Silver redhorse	*Moxostoma anisurum*			1	1					1
Golden redhorse	*Moxostoma erythrurum*	1	2	6	9					9
Shorthead redhorse	*Moxostoma macrolepidotum*	9	50	58	117	2	13	11	26	143
Black bullhead	*Ameiurus melas*	2	7	4	13	4	9	5	18	31
Yellow bullhead	*Ameiurus natalis*	2	4	5	11		2	2	4	15
Brown bullhead	*Ameiurus nebulosus*	8	94	17	119	616	18	6	640	759
Channel catfish	*Ictalurus punctatus*	67	299	309	675	41	442	146	629	1,304
Stonecat	*Noturus flavus*						1		1	1
Tadpole madtom	*Noturus gyrinus*					2	6		8	8
Flathead catfish	*Pylodictis olivaris*		4	3	7	1	1		2	9
Western mosquitofish	*Gambusia affinis*			2	2		5	1	6	8
Brook stickleback	*Culaea inconstans*			2	2					2
White perch	*Morone americana*	1	13	4	18					18
White bass	*Morone chysops*	295	797	1,116	2,208	25	91	186	302	2,510
Yellow bass	*Morone mississippiensis*	8	3	12	23	1	2	4	7	30
Green sunfish	*Lepomis cyanellus*	85	21	20	126	2			2	128
Pumpkinseed	*Lepomis gibbosus*	1			1					1
Warmouth	*Lepomis gulosus*		1	1	2					2
Orangespotted sunfish	*Lepomis humilis*	14	10	7	31					31
Bluegill	*Lepomis macrochirus*	1,159	544	463	2,166	13	28	6	47	2,213
Green sunfish x bluegill	*L. cyanellus x macrochirus*		4	2	6					6
Smallmouth bass	*Micropterus dolomieui*			9	9					9
Largemouth bass	*Micropterus salmoides*	102	76	88	266	2	1	1	4	270
White crappie	*Pomoxis annularis*	89	32	43	164	1	3	5	9	173
Black crappie	*Pomoxis nigromaculatus*	86	88	191	365		2	2	4	369
Mud darter	*Etheostoma asprigene*			1	1					1
Logperch	*Percina caprodes*	4	20	74	98	2		1	3	101
Slenderhead darter	*Percina phoxocephala*			1	1					1
Sauger	*Stizostedion canadense*	32	15	115	162	22	6	31	59	221
Walleye	*Stizostedion vitreum*		1	4	5	1			1	6
Freshwater drum	*Aplodinotus grunniens*	462	294	819	1,575	442	225	77	744	2,319
Unidentified	*Unidentified unidentified*			8	8					8
TOTAL		5,411	21,189	37,271	63,871	2,062	15,072	4,660	21,794	85,665
Total number of species collected		36	46	59	64	28	36	34	43	66
Total number of hybrids collected		1	2	2	2	1	1	0	1	2

Table 5. Unique fish species from the Peoria Lake HREP experimental and control sites Chillicothe Island area.

Experimental Sites

Pre Project (1991 and 1992)		Post Project (1997)	
Unique species	*Individuals*	*Unique species*	*Individuals*
American eel	1	Slenderhead darter	1
Spotted gar	1	Suckermouth minnow	1
Pumpkinseed	1	Striped shiner	1
White sucker	5	Mud darter	1
		Silver redhorse	1
		Mooneye	1
		Western mosquitofish	2
		Brook stickleback	2
		Blacknose dace	2
		Northern hogsucker	4
		Central stoneroller	5
		River shiner	6
		Grass carp	6
		Golden shiner	8
		Smallmouth bass	9
		Creek chub	9
		Sand shiner	42
Total species + hybrids	47 + 2		59 + 2
Total number of fish	26,600		37,271
Pre and post project total species + hybrids	**64 + 2**		
Pre and post project total number of fish	**63,871**		

Control Sites

Pre Project (1991 and 1992)		Post Project (1997)	
Unique species	*Individuals*	*Unique species*	*Individuals*
Stonecat	1	Grass carp	2
Walleye	1	Silverband shiner	3
Goldfish	2	Red shiner	4
Green sunfish	2	Sand shiner	5
White sucker	2		
Flathead catfish	2		
Tadpole madtom	8		
Quillback	51		
Threadfin shad	259		
Total species + hybrids	39 + 1		34 + 0
Total number of fish	17,134		4,660
Pre and post project total species + hybrids	**43+1**		
Pre and post project total number of fish	**21,794**		

In 1991, 2,062 fish were collected from the control sites with brown bullhead (*Ictalurus nebulosus*, 30%, 616), freshwater drum (21%, 442), and gizzard shad (15%, 307) being most abundant (Table 4).

In 1992, 15,072 fish were collected from the control sites (Table 4). Of these, emerald shiner (58%, 8,788), gizzard shad (26%, 3,962), and common carp (5%, 689) were most abundant.

Post-construction vs Pre-construction

From within the control sites, four species were unique in 1997. They were grass carp, red shiner (*Cyprinella lutrensis*), silverband shiner (*Notropis shumardi*), and sand shiner. Nine species were caught only during 1991 or 1992 from the control sites, they were threadfin shad, goldfish (*Carassius auratus*), quillback (*Carpiodes cyprinus*), white sucker, stonecat, tadpole madtom (*Noturus gyrinus*), flathead catfish, green sunfish (*Lepomis cyanellus*), and walleye (*Stizostedeon vitreum*; Tables 5).

Experimental Sites vs Control Sites

Being that there are more experimental sites in more varying habitats than control sites it is not surprising that there are more taxa (64 species and 2 hybrids) present at the experimental sites than the control sites (43 species and 1 hybrid; Table 4). Abundance of the top three species within the two groups of sites (experimental and control) however followed the same pattern with emerald shiner, gizzard shad, and common carp being first, second, and third in both experimental and control sites.

Turtles

During 1997 we collected data from turtles taken as incidental catch in our fish nets. Twenty-eight turtles were collected consisting of five taxa. Species caught were redear slider (*Trachemys scripta*), spiny softshell (*Trionyx spinifer*), western painted turtle (*Chrysemys picta*), common snapping turtle (*Chelydra serpentina*), and common map turtle (*Graptemys geographica*).

Executive Summary and Notes

Planned construction at the HREP site was completed by 1997, with additional revetment being added during 1997 to modify the flow of water through the East River and Island site by the USACOE.

During 1997, sampling sites were established in the new habitats created by construction.

In general, water levels have been low and somewhat stable throughout the three years of HREP bioresponse monitoring.

A total of 299 of 320 or 93% of all scheduled sampling was completed in 1997.

A total of 41,931 fish, consisting of 60 species and 2 hybrids, was collected in 1997. Prior to construction (1991-92) 43,734 fish were collected consisting of 50 species and 2 hybrids.

A total of 85,665 fish has been collected in 1991, 1992, and 1997 consisting of 66 species and two hybrids. Forty-seven percent or 40,188 of these fish were emerald shiner.

There were no state or federally threatened or endangered species collected.

Five species of turtles were identified within the experimental and control areas in 1997.

Gill nets were added to the gears used at the Island site in 1998 to compare this one-time open water habitat to that of the Peoria Lake open water site

which was only sampled with gill nets.

Additional post-construction sampling was completed in 1998 and data analysis is underway.

A comprehensive report comparing all years will be completed using two pre-construction and two post-construction years of data.

Acknowledgments

Funding for this research was provided by the Rock Island District, U.S. Army Corps of Engineers through the Upper Midwest Environmental Sciences Center of the Biological Resources Division, U.S. Geological Survey, with assistance from the Illinois Department of Natural Resources. The views expressed in this report are those of the authors.

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Table 3. Total numbers of fish collected post-construction (1997-98) and pre-construction (1991-92) by all gear types from all sites (experimental and control) at HREP bioresponse monitoring sites at Upper Peoria Lake during four years of monitoring (1991, 1992,1997, and 1998).

Common Name	Scientific Name	1991	1992	Sub Total (1991-92)	1997	1998	Sub total (1997-98)	Grand Total All years combined
Longnose gar	Lepisosteus osseus		2	2	2	2	4	6
Spotted gar	Lepisosteus oculatus		1	1		1	1	2
Shortnose gar	Lepisosteus platostomus	36	200	236	233	118	351	587
American eel	Anguilla rostrata		1	1			0	1
Bowfin	Amia calva		1	1	4		4	5
Gizzard shad	Dorosoma cepedianum	1,519	5,631	7,150	9,910	52096	62006	69156
Threadfin shad	Dorosoma petenese	259	236	495	3,534	75	3609	4104
Skipjack herring	Alosa chrysochloris	29	175	204	118	97	215	419
Goldeye	Hiodon alosoides		8	8	44	32	76	84
Mooneye	Hiodon tergisus				1		1	1
Central stoneroller	Campostoma anomalum				5	9	14	14
Grass carp	Ctenopharyngodon idella				8	9	17	17
Red shiner	Cyprinella lutrensis		11	11	78	33	111	122
Common carp	Cyprinus carpio	1,007	2,324	3,331	2,589	1351	3940	7271
Goldfish	Carassius auratus	3	48	51	4	3	7	58
Carp x goldfish	Cyprinus carpio x auratus	15	13	28	8	21	29	57
Bighead carp	Hypopthalmichthys nobilis					1	1	1
Silver chub	Macrhybobsis storeriana	36	35	71	84	104	188	259
Golden shiner	Notemigonus crysoleucas				8	18	26	26
Emerald shiner	Notropis atherinoides	123	22,688	22,811	17,377	9024	26401	49212
Striped Shiner	Luxilus chrysocephalus				1		1	1
River shiner	Notropis blennius				6		6	6
Spottail shiner	Notropis hudsonius	100	350	450	557	267	824	1274
Silverband shiner	Notropis shumardi	1	245	246	77	211	288	534
Sand shiner	Notropis stramineus				48		48	48
Suckermouth minnow	Phenacobius mirabilis				1		1	1
Bluntnose minnow	Pimephales notatus		2	2	85	122	207	209
Bullhead minnow	Pimephales vigilax	4	85	89	559	340	899	988
Blacknose dace	Rhinichthys atratulus				2	3	5	5
Creek chub	Semotilus atromaculatus				9		9	9
River carpsucker	Carpiodes carpio	254	410	664	626	281	907	1571
Quillback	Carpiodes cyprinus	114	26	140	19	9	28	168
Highfin carpsucker	Carpiodes velifer		10	10	6	6	12	22
White sucker	Catostomus commersoni	2	3	5		1	1	6
Northern hogsucker	Hypentelium nigricans				4		4	4
Smallmouth buffalo	Ictiobus cyprinellus	357	451	808	1,842	1803	3645	4453
Bigmouth buffalo	Ictiobus cyprinellus	3	52	55	28	5	33	88
Black buffalo	Ictiobus niger	7	19	26	41	9	50	76
Silver redhorse	Moxostoma anisurum				1	1	2	2
Golden redhorse	Moxostoma erythrurum	1	2	3	6	8	14	17
Shorthead redhorse	Moxostoma macrolepidotu	11	63	74	69	39	108	182
Black bullhead	Ameiurus melas	6	16	22	9	12	21	43
Yellow bullhead	Ameiurus natalis	2	6	8	7	17	24	32
Brown bullhead	Ameiurus nebulosus	624	112	736	23	41	64	800
Channel catfish	Ictalurus punctatus	108	741	849	455	738	1193	2042
Stonecat	Noturus flavus		1	1		1	1	2
Tadpole madtom	Noturus gyrinus	2	6	8			0	8
Flathead catfish	Pylodictis olivaris	1	5	6	3	11	14	20
Northern pike	Esox lucius					5	5	5
Western mosquitofis	Gambusia affinis		5	5	3	29	32	37
Brook stickleback	Culaea inconstans				2	2	4	4
White perch	Morone americana	1	13	14	4	8	12	26
White bass	Morone chysops	320	888	1,208	1,302	2337	3639	4847
Yellow bass	Morone mississippiensis	9	5	14	16	9	25	39
Green sunfish	Lepomis cyanellus	87	21	108	20	30	50	158
Pumpkinseed	Lepomis gibbosus	1		1		1	1	2
Warmouth	Lepomis gulosus		1	1	1		1	2
Orangespotted sunfis	Lepomis humilis	14	10	24	7	15	22	46
Bluegil	Lepomis macrochirus	1,172	572	1,744	469	673	1142	2886
Green sunfish x blueg	L. cyanellus x macrochirus		4	4	2	15	17	21
Smallmouth bass	Micropterus dolomieui				9	15	24	24
Largemouth bass	Micropterus salmoides	104	77	181	89	199	288	469
White crappie	Pomoxis annularis	90	35	125	48	78	126	251
Black crappie	Pomoxis nigromaculatus	86	90	176	193	128	321	497
Mud darter	Etheostoma asprigene				1	6	7	7
Johnny darter	Etheostoma nigrum					3	3	3
Logperch	Percina caprodes	6	20	26	75	583	658	684
Blackside darter	Percina maculata					1	1	1
Slenderhead darter	Percina phoxocephala				1	9	10	10
Sauger	Stizostedion canadense	54	21	75	146	129	275	350
Walleye	Stizostedion vitreum	1	1	2	4	1	5	7
Freshwater drum	Aplodinotus grunniens	904	519	1,423	896	944	1840	3263
							0	0
Unidentified	Unidentified				8		8	8
Unidentified clupeid	Clupeidae spp.					2767	2767	2767
Unidentified CT	Catostomidae spp.					2	2	2
Unidentified buffalo	Ictiobus spp.				144	112	256	256
Unidentified carpsuck	Carpiodes spp.					2	2	2
								0
								0
TOTAL		7,473	36,261	43,734	41,931	75,022	116,953	160687
								0
Total number of species collected		**39**	**49**	**50**	**60**	**59**	**68**	**68**
Total number of hybrids collected		1	2	2	2	2	2	2
Taxa		40	51	0 52	0 62	62	0 70	0 70

APPENDIX E

1997 PEORIA LAKE FORESTED WETLAND MANAGEMENT AREA DRAFT REPORT, JUNE 1999

1997 Peoria Lake Forested Wetland Management Area Draft Report

A summary of pre-and post-construction monitoring of the Forested Wetland Management Area within the Peoria Lake Habitat Rehabilitation and Enhancement Project, Woodford County, Illinois

June 1999

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Disclaimer

The findings, conclusions, and views expressed herein are those of the researchers and are not necessarily the position of the Illinois Natural History Survey, the Illinois Department of Natural Resources , the U.S. Geological Survey or the U.S. Army Corps of Engineers.

Executive Summary

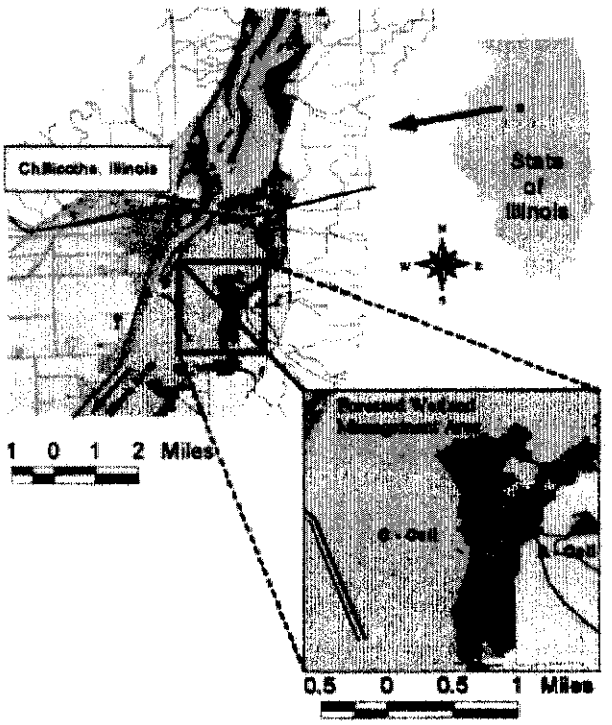
Pre-construction sampling of the Forested Wetland Management Area (FWMA) began in the summer of 1992 and continued through the summer of 1994. Following completion of construction at the FWMA, post-construction sampling was initiated and completed during the summer of 1997. A total of 144 plots were sampled within the three cells of the FWMA. A total of 1,949 trees representing 22 species were tallied in the understory and overstory combined. Species composition of the forest community within the FWMA is comprised primarily of silver maple, cottonwood and ash. Silver maple was the dominant tree species of this flood plain forest community accounting for 64.6% of over story trees in the pre-construction survey and 68.4% of over story trees in the post-construction survey with no significant difference between pre- and post-construction. Green ash (20.7% and 16.9%), and Cottonwood (4.6% and 4.9%) were the other relatively dominant overstory tree species in the pre- and post-construction surveys, respectively. Importance values for silver maple in the pre-construction survey were 98, 146, and 152 in cells A, B, and C, respectively. Importance values for overstory silver maple in the post-construction survey were 120, 144, and 144 in cells A, B, and C, respectively. Importance values for green ash, and cottonwood in the pre-construction survey were 29, 27, and 35, and 31, 9, and 4, respectively. Importance values for green ash and cottonwood in the post-construction survey were 46, 25, and 47, and 17, 29 and 0, respectively. Average canopy height for all cells in the pre- and post-construction survey were 19.9 m and 20.6 m respectively. Average estimated percent canopy cover was 74% in the pre-construction survey, and 63% in the post-construction survey. Ages of trees cored within all three cells ranged from 8-105 yrs. Mean ages of trees cored were 35, 47, and 71 for cells A, B, and C, respectively. Species composition of the forest community has not changed since pre-construction within the FWMA. A decrease in cottonwood numbers and loss of some understory within cell A, and slight changes in overall percent canopy cover and height are the only changes that have occurred here since 1992.

Introduction

Upper and Lower Peoria Lakes are large mainstem lakes located within the Peoria reach of the Illinois River. These large, unique land forms are naturally occurring, shallow bodies of water which, prior to European-American settlement, were smaller by comparison to thier present day state (figure 1). Peoria Lakes are much larger today, due in part to the diversion of water from Lake Michigan in 1900 and the completion of the locks and dams for navigation in the late 1930's. These large expanses of water were much deeper for several decades following their enlargement. Richardson (1921) described Peoria Lakes as having extensive beds of pondweeds (*Potomogeton spp.*), wild celery (*Valisnaria ammericana*), and coontail *(Certophylum demersom*) present between 1910 and 1914. Pre-settlement tree composition in the Middle Illinois River Valley derived from the Government Land Office (GLO) surveys conducted between 1815 - 1860 (Table 1) characterize floodplain forests as being very diverse and composed of more mast producing species such as pin oak [*Quercus palustris*] and pecan [*Carya Illinoensis*] (Il. State archives, GLO survey data). At present, Peoria Lakes have been reduced to large silt laden shallow bodies of water which are void of submersed aquatic vegetation and bordered by a forest predominated by silver maple, cottonwood and ash. The present day forest community within the Middle Illinois River Valley no longer contains the diversity of tree species that it once had, and lacks the mast producing trees that waterfowl relied on as a source of food during migration.

The purpose of the Forested Wetland Management Area (FWMA figure 1) of the Peoria Lake Habitat Rehabilitation and Enhancement Project (HREP) is to enhance existing habitats and provide predictable resting areas and food sources for migratory waterfowl (USACOE 1990). The FWMA consists of a series of low levees and water control structures constructed to create three impoundments (cells) within the existing floodplain forest (figure 2).

Figure 2. Peoria Lake HREP FWMA.



Construction of the levees created 18-20 acres of grassland and woodland edge habitat within the FWMA which will allow for more closely regulated seasonal inundation of the approximately 148 acres of remaining bottom land forest and will help meet goals set forth in the Peoria Lake

Figure 1. Comparison of 1820 General Land Office (GLO) Surveys and 1989 LandSat Thematic Mapping of Peoria Lakes, RM 158-175.5.

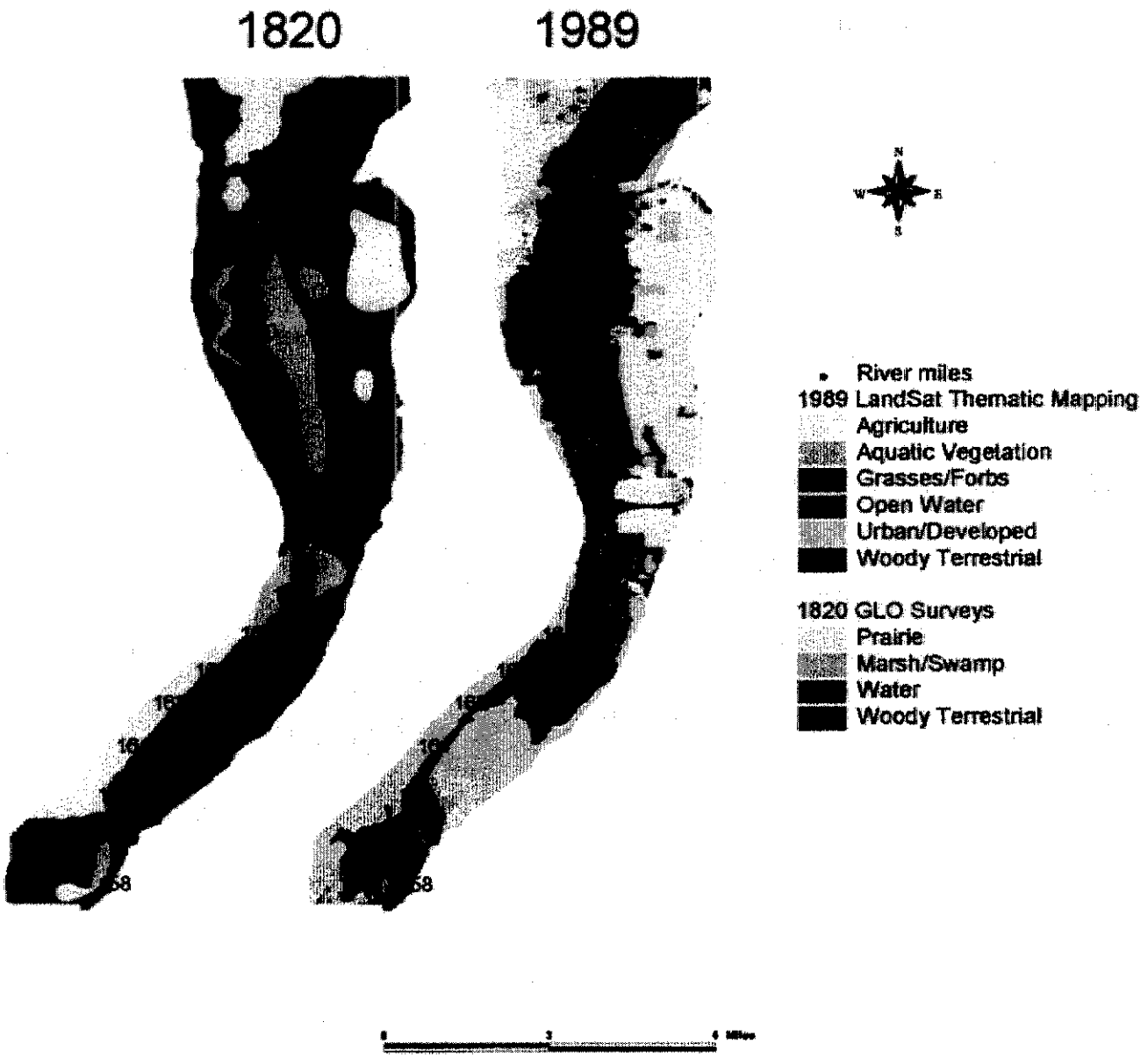


Table 1. Frequency, basal area (BA [m^2]), relative dominance (rDOa), relative density (rDa) and importance values (Imp. Val.) for overstory floodplain taxa at Peoria Lake taken from 1820's GLO survey.

Species	Common Name	Freq.	BA (m^2)	rDOa	rDa	Imp. Val.
Acer saccharinum	Silver maple	44	7	24.1	28.4	52.4
Acer saccharum	Sugar maple	4	0.8	2.6	2.6	5.2
Aesculus spp.	Buckeye	7	0.4	1.5	4.5	6
Celtis occidentalis	Hackberry	1	0.1	0.4	0.6	1
Carya illinoensis	Pecan	3	0.4	1.4	1.9	3.3
Carya spp. (Hickory)	Hickory	4	0.1	0.4	2.6	3
Fraxinus spp.	Ash	5	0.5	1.6	3.2	4.8
Gymnocladus dioicus	Kentuckey coffee tree	1	0.1	0.2	0.6	0.9
Juglans nigra	Black walnut	4	1.4	4.7	2.6	7.3
Morus spp	Mulberry	3	0.3	0.9	1.9	2.8
Platanus occidentalis	Sycamore	1	0.7	2.2	0.6	2.9
Populus deltoides	Cottonwood	6	1.3	4.3	3.9	8.2
Quercus alba *	White oak	9	5.8	19.8	5.8	5.6
Quercus lyrata	Overcup oak	2	0.5	1.8	1.3	3.1
Quercus palustris	Pin oak	7	2.4	8.2	4.5	12.7
Quercus stellata	Post oak	5	0.5	1.6	3.2	4.8
Salix spp.	Willow	26	1.6	5.6	16.8	22.4
Ulmus spp.	Elm	23	5.4	18.6	14.8	33.4

*On floodplain, burr oak, overcup oak and swamp white oak were probably recorded under the general category of white oak.

Definite Project Report (1990). Subsequent plantings of mast trees (e.g., pin oak) at the borrow site within cell A and other locations within the HREP area should, in the future provide a highly valued food source for migrating waterfowl.

In 1992, staff at the Illinois Natural History Survey, Long Term Resource Monitoring Program (LTRMP) Field Station at Havana began a survey of the proposed FWMA construction site to gather quantifiable baseline data on the forest community prior to construction at the Peoria Lake HREP (Blodgett et al. 1994). The purpose for the pre-construction and post-construction monitoring at the FWMA was to document the present day forest community and evaluate pre- and post-construction standing timber.

Methods

Methods for the pre-construction survey (1992-1994) of the FWMA were adapted from those proposed by Yin (1992) for investigation of terestrial forest communities. Permanent transects were

established longitudinally through the approximate center of each cell (A,B, and C) for both the pre- and post-construction surveys. Twenty-four randomly selected circular plots (radius = 11.28 m) were established within the levees of each cell (A, B, and C) at distances down the transect line and distances perpendicular to the transects. A clinometer was used to calculate the representative canopy height within each of these plots. Percent canopy cover was determined by estimating the amount of forest floor that was covered (shaded) by overstory trees and woody understory vegetation within each plot (Yin 1994). All overstory trees greater than 10 cm diameter at breast height (dbh = 1.3 m above ground level) within each plot were identified to species and measured to the nearest 0.5 cm. with a diameter tape. Woody understory vegetation (including vines, shrubs, and saplings greater than 2 m in height and with a dbh of <10 cm) were identified to species and tallied within 3.57 m of the center of the plot. Nomenclature for all trees and woody vegetation follows Mohlenbrock (1986). Age of the stand was determined by aging tree cores taken from a representative tree from within each circular plot during the pre-construction survey. Because of the short temporal span between the two sampling periods, no trees were cored for aging during the 1997 survey. Basal area, relative density, relative dominance, and importance values (rel. den. + rel. dom. = Importance value) were calculated for both the 1992-1994 and 1997 surveys using tree measurements and stem counts from field collections.

Sampling for the pre-construction survey occurred from the summer of 1992 through the summer of 1994. High river stage conditions, especialy in 1993, hampered efforts and only allowed sampling during low water. Methods for the post-construction monitoring of the FWMA were the same as those used during pre-construction. Post-construction monitoring began and finished uninterrupted in May, 1997.

Results/discussion

A total of 17 species of woody vines, shrubs, and trees were identified in sampled plots during the 1997 survey. Species richness was similar to that observed in 1992-1994 when 18 species were documented. The total number of species identified within plots at the FWMA for both surveys combined was 22. When data for all plots sampled in 1997 were combined (Table 2), 68.4% of the overstory trees sampled were silver maple (Acer sacharinum) which dominated the overstory trees in all three cells. Other relatively dominant tree species in the overstory were green ash (Fraxinus pennsylvanica) (20.7% of the overstory tree community), cottonwood (Populus deltoides) (4.6%), american elm (Ulmus americana) (2.3%), and black willow (Salix nigra) (1.0%). Observations for all plots from 1992-1994 were similar to those of 1997 for overstory trees with no significant difference noticed in the forest community (Tables 2 and 3). A list of scientific and common names for all woody vegetation occurring in sample plots in both surveys at the FWMA is given in Appendix A.

Understory woody vegetation was dominated by silver maple in the 1997 survey with a relative percentage of 31% (Table 3). This represents an increase of 11.2% from the 1992-1994 survey even though total

Table 2. Number (N) and relative percentages for overstory woody vegetation in cells A, B, and C at the FWMA, 1992-1994 and 1997.

	1992-1994								1997							
Cell	A		B		C		All		A		B		C		All	
Species	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Acer negundo	9	2.2%	0	0.0%	0	0.0%	9	1.0%	7	1.8%	0	0.0%	0	0.0%	7	0.8%
Acer saccharinum	214	51.7%	174	72.5%	195	78.6%	583	64.6%	215	54.8%	217	80.4%	199	76.2%	631	68.4%
Celtis occidentalis	8	1.9%	1	0.4%	0	0.0%	9	1.0%	5	1.3%	0	0.0%	0	0.0%	5	0.5%
Cornis obliqua	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Cornus spp.	4	1.0%	0	0.0%	0	0.0%	4	0.4%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Crataegus crus-galli	2	0.5%	0	0.0%	0	0.0%	2	0.2%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Crataegus mollis	2	0.5%	2	0.8%	0	0.0%	4	0.4%	1	0.3%	0	0.0%	0	0.0%	1	0.1%
Diospyros virginiana	4	1.0%	0	0.0%	0	0.0%	4	0.4%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Forestiera acuminata	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Fraxinus pennsylvanica	75	18.1%	42	17.5%	36	14.5%	153	16.9%	104	26.5%	34	12.6%	53	20.3%	191	20.7%
Gleditsia tricanthos	0	0.0%	0	0.0%	0	0.0%	0	0.0%	2	0.5%	0	0.0%	0	0.0%	2	0.2%
Gymnocladus dioicus	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	0.3%	0	0.0%	0	0.0%	1	0.1%
Juglans nigra	23	5.6%	0	0.0%	0	0.0%	23	2.5%	1	0.3%	0	0.0%	0	0.0%	1	0.1%
Morus spp.	1	0.2%	0	0.0%	0	0.0%	1	0.1%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Platanus occidentalis	4	1.0%	3	1.3%	0	0.0%	7	0.8%	5	1.3%	1	0.4%	0	0.0%	6	0.7%
Populus deltoides	39	9.4%	3	1.3%	2	0.8%	44	4.9%	28	7.1%	14	5.2%	0	0.0%	42	4.6%
Salix amygdaloides	0	0.0%	0	0.0%	0	0.0%	0	0.0%	2	0.5%	1	0.4%	0	0.0%	3	0.3%
Salix nigra	10	2.4%	0	0.0%	15	6.0%	25	2.8%	0	0.0%	0	0.0%	9	3.4%	9	1.0%
Ulmus americana	0	0.0%	0	0.0%	0	0.0%	0	0.0%	18	4.6%	3	1.1%	0	0.0%	21	2.3%
Ulmus rubra	19	4.6%	15	6.3%	0	0.0%	34	3.8%	3	0.8%	0	0.0%	0	0.0%	3	0.3%
Total #	414		240		248		903		392		270		261		923	
Species richness	15		7		4		15		14		6		3		15	
Plots sampled	24		19		24		67		23		23		24		70	
Density (#/m²)	0.043		0.032		0.026		0.034		0.043		0.029		0.027		0.033	

Table 3. Number (N) and relative percentages for understory woody vegetation in Cells A, B, and C at the FWMA, 1992-1994 and 1997.

	1992-1994								1997							
Cell	A		B		C		All		A		B		C		All	
Species	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Acer negundo	1	1.7%	0	0.0%	0	0.0%	1	1.2%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Acer saccharinum	10	16.9%	3	15.8%	3	100.0%	16	19.8%	6	37.5%	3	25.0%	4	28.6%	13	31.0%
Celtis occidentalis	1	1.7%	0	0.0%	0	0.0%	1	1.2%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Cephalanthus occident.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	10	71.4%	10	23.8%
Cornus obliqua	1	1.7%	0	0.0%	0	0.0%	1	1.2%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Crataegus crus-galli	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	6.3%	0	0.0%	0	0.0%	1	2.4%
Forestiera acuminata	1	1.7%	0	0.0%	0	0.0%	1	1.2%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Fraxinus pennsylvanica	9	15.3%	2	10.5%	0	0.0%	11	13.6%	4	25.0%	3	25.0%	0	0.0%	7	16.7%
Platanus occidentalis	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	6.3%	0	0.0%	0	0.0%	1	2.4%
Salix nigra	10	16.9%	0	0.0%	0	0.0%	10	12.3%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Toxicodendron radicans	4	6.8%	1	5.3%	0	0.0%	5	6.2%	1	6.3%	0	0.0%	0	0.0%	1	2.4%
Ulmus americana	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	6.3%	0	0.0%	0	0.0%	1	2.4%
Ulmus rubra	6	10.2%	2	10.5%	0	0.0%	8	9.9%	1	6.3%	0	0.0%	0	0.0%	1	2.4%
Vitis spp.	16	27.1%	11	57.9%	0	0.0%	27	33.3%	1	6.3%	6	50.0%	0	0.0%	7	16.7%
Total #	59		19		3		81		16		12		14		42	
Species richness	10		5		1		10		10		3		2		15	
Plots sampled	24		19		24		67		23		23		24		70	
Density (#/m²)	0.061		0.025		0.003		0.030		0.017		0.013		0.015		0.015	

numbers of understory silver maple declined from the pre-construction survey, the total number of all other understory species were found to have declined even further giving silver maple the higher relative percentage in the second survey. Wild Grape (Vitis spp) was the dominant understory woody vegetation in the 1992-1994 survey with a relative percentage of 33.3%. Wild grape made up only 16.7% of the relative percentage of understory woody vegetation in the 1997 survey. Green ash also frequented the species record of the understory in the 1997 survey at 16.7%. All other understory species individually encountered in 1997 occurred at a frequency of 2.4%.

Cell A

Cell A receives the least amount of influence (e.g., mortality caused by inundation and ice damage) from the river of all three cells. In 1997 cell A had the highest diversity as well as the highest density of mature trees and understory (0.043 overstory trees and 0.017 understory stems per m^2, Tables 2 and 3). Silver maple accounted for 54.8% of the overstory trees in cell A. Importance value for overstory silver maple in 1997 (Table 4) was 120. Other abundant overstory trees were green ash, cottonwood, american elm and box elder (*Acer negundo*) accounting for 26.5%, 7.1%, 4.6% and 1.8% of trees sampled, respectively. Importance value for silver maple in the 1992-94 survey was 98, and relative density was 51.7% (Tables 2 and 6). Other abundant trees observed during pre-construction were green ash, cottonwood, black walnut *(Juglans nigra)*, and red elm, accounting for 18.1%, 9.4%, 5.6%, and 4.6%, respectively. The total number of stems tabulated in the understory within cell A during the 1997 survey (Table 5) was 37, down from the 1992-1994 total of 59 (Table 7). Average estimated canopy height for cell A was 16.0 meters (Table 8), down 4.9 meters from 1992-1994 survey. The average estimated percent canopy cover for cell A was 62% (Table 9), down 24% from the estimate for 1992-1994. Estimated ages for cored trees from 1992-1994 in cell A ranged from 8 to 86 years with a mean of 35 years (Table 10).

Cell B

Frequent inundation and ice damage probably contributed to cell B's lack of diversity in the overstory trees (less than half) compared to cell A. In 1997 the understory in cell B contained only 3 species compared to 8 species found in cell A (Table 3). This number was down from the 1992-1994 survey which revealed a total of 5 species for cell B. Again, silver maple dominated the overstory in cell B in the 1997 survey (79.9%) followed by green ash (12.8%) and cottonwood (5.1%) (Table 2). Importance values for these species were 144, 25 and 29, respectively (Table 4). Density of overstory trees was 0.029/m^2 for 1997, down from 0.032 in 1992-1994 (Table 2). Wild grape, silver maple, and green ash accounted for all the understory stems counted in 1997 totaling 50%, 25.0% and 25.0%, respectively. The average estimated canopy height was 23.1 m for 1997, up from 19.3 m in the 1992-1994 survey (Table 8). Average percent canopy was estimated at 63% for 1997, down 11% from the 1992-1994 survey (Table 9). Aged trees from the 1992-1994 survey ranged from 13 to 90 years with a mean of 47

Table 6. Basal area (m^2), relative dominance, relative density and importance values for overstory woody vegetation in sampled cells A, B, and C at the Forested Wetland Management Area of the Peoria Lake HREP, 1992-1994.

Cell	A				B				C			
Species	BA (m^2)	rDOa	rD1a	ImpVal	BA (m^2)	rDOb	rD1b	ImpVal	BA (m^2)	rDOc	rD1c	ImpVal
Acer negundo	0.9	3.8%	2.2%	6	0.0	0.0%	0.0%	0	0.0	0.0%	0.0%	0
Acer saccharinum	11.1	46.6%	51.7%	98	16.9	73.7%	72.5%	146	18.8	73.6%	78.6%	152
Celtis occidentalis	0.5	2.0%	1.9%	4	0.0	0.2%	0.4%	1	0.0	0.0%	0.0%	0
Cornus obliqua	0.0	0.0%	0.0%	0	0.0	0.0%	0.0%	0	0.0	0.0%	0.0%	0
Cornus spp.	0.1	0.3%	1.0%	1	0.0	0.0%	0.0%	0	0.0	0.0%	0.0%	0
Crataegus crus-galli	0.1	0.3%	0.5%	1	0.0	0.0%	0.0%	0	0.0	0.0%	0.0%	0
Crataegus mollis	0.1	0.2%	0.5%	1	0.0	0.1%	0.8%	1	0.0	0.0%	0.0%	0
Diospyrus virginiana	0.9	3.9%	1.0%	5	0.0	0.0%	0.0%	0	0.0	0.0%	0.0%	0
Forestiera acuminata	0.0	0.0%	0.0%	0	0.0	0.0%	0.0%	0	0.0	0.0%	0.0%	0
Fraxinus pennsylvanica	2.7	11.3%	18.1%	29	2.1	9.0%	17.5%	27	5.1	20.0%	14.5%	35
Juglans nigra	0.8	3.4%	5.6%	9	0.0	0.0%	0.0%	0	0.0	0.0%	0.0%	0
Morus spp.	0.1	0.3%	0.2%	1	0.0	0.0%	0.0%	0	0.0	0.0%	0.0%	0
Platanus occidentalis	0.1	0.2%	1.0%	1	1.7	7.3%	1.3%	9	0.0	0.0%	0.0%	0
Populus deltoides	5.1	21.4%	9.4%	31	1.8	7.9%	1.3%	9	0.9	3.5%	0.8%	4
Salix nigra	0.9	3.8%	2.4%	6	0.0	0.0%	0.0%	0	0.7	2.9%	6.0%	9
Ulmus rubra	0.5	2.3%	4.6%	7	0.4	1.9%	6.3%	8	0.0	0.0%	0.0%	0
		100%	100%	200		100%	100%	200		100%	100%	200
Total BA (m^2)	23.8				22.9				25.6			

Table 7. Stem count and relative density of understory woody vegetation in sampled cells A, B, and C at the Forested Wetland Management Area of the Peoria Lake HREP, 1992-1994.

Cell	A		B		C	
Species	count	rD	count	rD	count	rD
Acer negundo	1	1.7%	0	0.0%	0	0.0%
Acer saccharinum	10	16.9%	3	15.8%	3	100.0%
Celtis occidentalis	1	1.7%	0	0.0%	0	0.0%
Cornus obliqua	1	1.7%	0	0.0%	0	0.0%
Cornus spp.	0	0.0%	0	0.0%	0	0.0%
Crutagis crus-galli	0	0.0%	0	0.0%	0	0.0%
Cretagis mollis	0	0.0%	0	0.0%	0	0.0%
Disporus virginiana	0	0.0%	0	0.0%	0	0.0%
Foresteria acuminata	1	1.7%	0	0.0%	0	0.0%
Fraxinus pennsylvanica	9	15.3%	2	10.5%	0	0.0%
Juglans nigra	0	0.0%	0	0.0%	0	0.0%
Morus spp.	0	0.0%	0	0.0%	0	0.0%
Platanus occidentalis	0	0.0%	0	0.0%	0	0.0%
Populus deltoides	0	0.0%	0	0.0%	0	0.0%
Salix nigra	10	16.9%	0	0.0%	0	0.0%
Toxicadendrun radicans	4	6.8%	1	5.3%	0	0.0%
Ulmas rubra	6	10.2%	2	10.5%	0	0.0%
Vitus spp.	16	27.1%	11	57.9%	0	0.0%
		100.0%		100.0%		100.0%
Total # stems tallied	59		19		3	

Table 4. Basal area (m^2), relative dominance, relative density and importance values for overstory woody vegetation in sampled cells A, B, and C at the Forested Wetland Management Area of the Peoria Lake HREP, 1997.

Cell	A				B				C			
Species	BA (m^2)	rDOa	rDa	ImpVal	BA (m^2)	rDOb	rDb	ImpVal	BA (m^2)	rDOc	rDC	ImpVal
Acer negundo	2.0	0.9%	1.5%	2	0.0	0.0%	0.0%	0	0.0	0.0%	0.0%	0
Acer saccharinum	13.9	64.3%	55.4%	120	21.3	63.8%	79.9%	144	23.6	67.9%	76.2%	144
Celtis occidentalis	0.1	0.6%	1.0%	2	0.0	0.0%	0.0%	0	0.0	0.0%	0.0%	0
Cretaegus mollis	0.0	0.1%	0.3%	0	0.0	0.0%	0.0%	0	0.0	0.0%	0.0%	0
Cretaegus crus-galli	0.0	0.0%	0.0%	0	0.0	0.0%	0.0%	0	0.0	0.0%	0.0%	0
Fraxinus pennsylvanica	4.1	19.1%	26.7%	46	4.0	12.0%	12.8%	25	9.3	26.8%	20.3%	47
Gleditsia aquatica	0.1	0.2%	0.5%	1	0.0	0.0%	0.0%	0	0.0	0.0%	0.0%	0
Gymnocladus dioicus	0.1	0.5%	0.3%	1	0.0	0.0%	0.0%	0	0.0	0.0%	0.0%	0
Juglans nigra	0.0	0.1%	0.3%	0	0.0	0.0%	0.0%	0	0.0	0.0%	0.0%	0
Platanus occidentalis	0.3	1.4%	1.0%	2	0.1	0.3%	0.4%	1	0.0	0.0%	0.0%	0
Populus deltoides	2.0	9.4%	7.2%	17	7.9	23.6%	5.1%	29	0.0	0.0%	0.0%	0
Salix amiglidoides	0.3	1.5%	0.5%	2	0.0	0.0%	0.4%	0	0.0	0.0%	0.0%	0
Salix nigra	0.0	0.0%	0.0%	0	0.0	0.0%	0.0%	0	1.8	5.3%	3.4%	9
Ulmus Americana	0.3	1.6%	4.6%	6	0.1	0.2%	1.1%	1	0.0	0.0%	0.0%	0
Ulmus Rubra	0.1	0.3%	0.8%	1	0.0	0.0%	0.0%	0	0.0	0.0%	0.0%	0
		100%	100%	200		100%	100%	200		100%	100%	200
Total BA (cm^2)	23.4				33.4				34.8			

Table 5. Stem count and relative density of understory woody vegetation in sampled cells A, B, and C at the Forested Wetland Management Area of the Peoria Lake HREP, 1997.

Cell	A		B		C	
Species	Count	rD	Count	rD	Count	rD
Acer negundo	0	0.0%	0	0.0%	0	0.0%
Acer sacccharinum	9	24.3%	3	20.0%	3	23.1%
Celtis occidentalis	1	2.7%	0	0.0%	0	0.0%
Cephalanthus occidentalis	0	0.0%	0	0.0%	10	76.9%
Cretaegus mollis	0	0.0%	0	0.0%	0	0.0%
Cretaegus crus-galli	4	10.8%	0	0.0%	0	0.0%
Fraxinus pennsylvanica	7	18.9%	2	13.3%	0	0.0%
Gleditsia aquatica	0	0.0%	0	0.0%	0	0.0%
Gymnocladus dioicus	0	0.0%	0	0.0%	0	0.0%
Juglans nigra	0	0.0%	0	0.0%	0	0.0%
Platanus occidentalis	2	5.4%	0	0.0%	0	0.0%
Populus deltoides	0	0.0%	0	0.0%	0	0.0%
Salix amiglidoides	0	0.0%	0	0.0%	0	0.0%
Salix nigra	0	0.0%	0	0.0%	0	0.0%
Toxicodendron radicans	7	18.9%	0	0.0%	0	0.0%
Ulmus Americana	1	2.7%	0	0.0%	0	0.0%
Ulmus Rubra	2	5.4%	0	0.0%	0	0.0%
Vitus spp.	4	10.8%	10	66.7%	0	0.0%
		100%		100%		100%
Total # of stems tallied	37		15		13	

Table 8. Average canopy height (m) and difference between years for all plots sampled in cells A, B and C of the Forested Wetland Management Area of the Peoria Lake HREP, 1992-1994 and 1997.

	1992-94	1997	1997
Cell	avg ht. (m)	avg ht. (m)	difference (m)
A	20.9	16.0	-4.9
B	19.3	23.1	3.8
C	19.6	22.6	3.0
All cells	19.9	20.6	2.3

Table 9.

Average estimated percent (%) canopy cover and difference between years for all plots sampled in cells A, B and C of the Forested Wetland Management Area of the Peoria Lake HREP, 1992-1994 and 1997.

	1992-94	1997	1997
Cell	est. (%)	est. (%)	difference (%)
A	86%	62%	-24
B	74%	63%	-11
C	62%	63%	1
All cells	74%	63%	-11

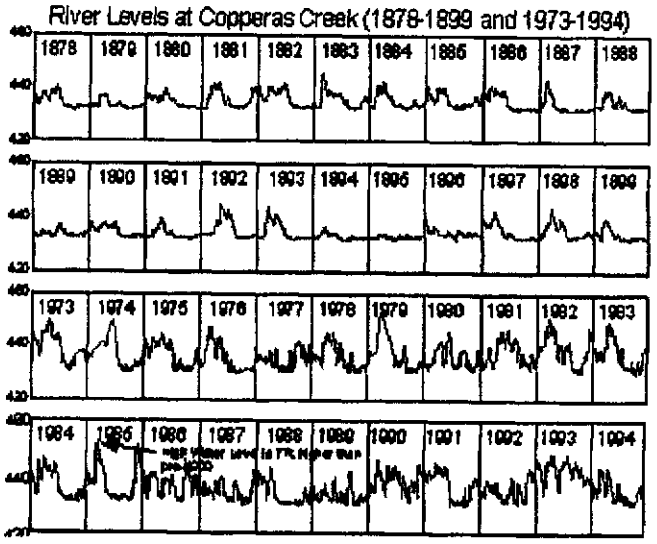
Cell C

Cell C is probably subjected to a more frequent occurrence of inundation and ice damage than the other two cells which may help to explain the lack of diversity of tree species and understory here. Overstory was again dominated by silver maple in 1997 (76.2%) and was similar to that observed in the 1992-1994 survey (78.6%) (Table 2). Importance value for overstory silver maple in 1997 within cell C was 144 (Table 4). Green ash and black willow were the only other overstory tree species sampled in cell C during both the 1997 and 1992-1994 surveys. Green ash accounted for 20.3% of the overstory in 1997 followed by black willow with 3.4%; in 1992-1994 these species were 14.5% and 6.0%, respectively. Importance values for these species in 1997 were 47 and 9 respectively (Table 4). Understory trees within cell C were almost non-existent. Button bush (*Cephalanthus occidentalis*) dominated the understory woody vegetation in cell C at 71.4% (Table 3). A total of 14 stems were tallied in 1997, of which, 10 were button bush. Silver maple (4 stems) was the only tree species found here in 1997, accounting for 28.6% of the stems tallied with almost no change from the 1992-1994 survey where three stems were observed. Silver maple accounted for 100% of the understory in cell C in the 1992-94 survey. Average estimated canopy height for cell C in 1997 was 22.6m, down 3.0m from the 1992-94 survey (Table 8). The average estimated percent canopy cover was 63% with almost no change from the 1992-94 survey (Table 9). Estimated ages of cored trees ranged from 36 to 105 yrs with a mean of 71 (Table 10).

Discussion

The combination of alterations to the Illinois River, including draining and leveeing of floodplain for agriculture coupled with raised water levels (from Lake Michigan diversion and installation of locks and dams) has changed the rivers hydrological regime. Water elevations along the Illinois river were raised permanently in the early 1900s inundating some areas of forest and prairie. Prior to alterations to the Illinois River and its floodplain, the annual flood cycle consisted of a large, predictable, spring flood followed by a gradual fall in surface elevation to a period of low stable water levels during the summer (1878-1899, Figure 3). Present day flood cycles are less predictable and much more erratic (1973-1994, Figure 3). Flood conditions may occur in June or July with water elevations changing several feet in a day.

Figure 3. River levels at Copperas Creek, Illinois River (1878-1899 and 1973-1994)



Yin and Nelson (1995) found that changes in forest composition and structure since pre-settlement were related to changes in hydrology. The structure of forest community within the FWMA is heavily influenced by the Illinois River. The disappearance of mast trees within the river floodplain is directly related to changes made to the rivers hydrology in that the more flood tolerant species (e.g. silver maple and cottonwood) have become more prevalent than the less flood tolerant mast trees (e.g. pin oaks and pecans). In areas outside mainline navigation levees near Cape Girardo, Missouri in 1993 where flooding had been eliminated, pin oak had become the dominant species (Yin and Nelson 1995). However, the tree assemblage of the pre-settlement forest community was not solely driven by hydrology. There were many forces which drove and formed the floodplain ecosystem. The waters that inundate floodplain forests not only deposited nutrient-rich sediments to the floodplain which revitalized the soils, they also scoured existing landscapes and played a large role in the way floodplain forest communities developed (Yin and Nelson 1995).

Another disturbance thought to have driven the development of floodplain forests was fire. Deputy GLO surveyors described the uplands on the west side of the Illinois River near Lake Peoria using the following terms, many of which are indicators of savanna communities; "*timbered*", *"thinly timbered"*, *"barrens"*, *"timber with prairie grass"*, *"woods open-grassy"* and some places were described as having large oaks and prairie grasses, for example one surveyors line description characterizes the savanna conditions that were once widespread in the region west of Lake Peoria in 1816. *"Land*

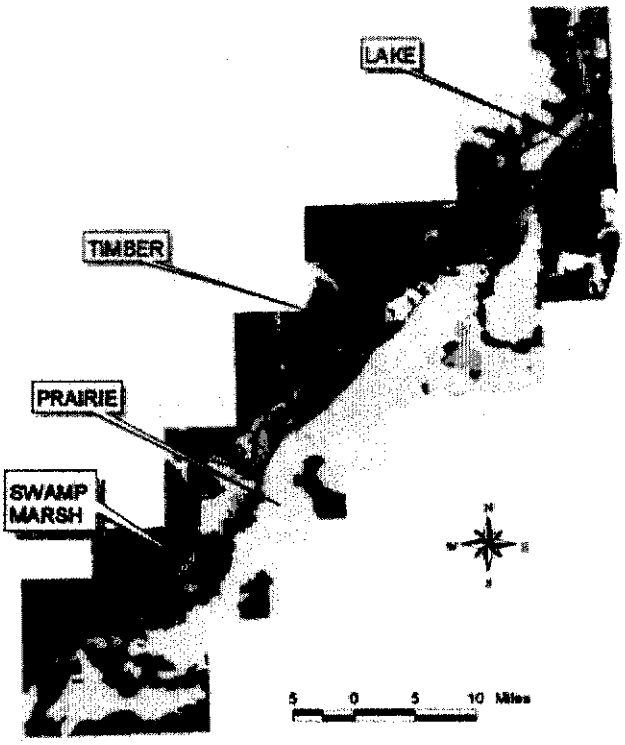
Table 10. Estimated age of trees cored in sampled cells A, B, and C in the Forested Wetland Management Area of the Peoria lake HREP, 1992-1994.

Core #	Cell/Plot	Species	Age (years)
1	A-1	Acer saccharinum	14
2	A-1	Populus deltoides	13
3	A-2	Fraxinus pennsylvanica	48
4	A-2	Fraxinus pennsylvanica	25
5	A-3	Sycamore	15
6	A-4	Fraxinus pennsylvanica	20
7	A-4	Fraxinus pennsylvanica	37
8	A-5	Fraxinus pennsylvanica	31
9	A-5	Black Walnut	15
10	A-6	Acer saccharinum	29
11	A-6	Acer saccharinum	21
12	A-7	Fraxinus pennsylvanica	36
13	A-7	Fraxinus pennsylvanica	N/A
14	A-8	Acer saccharinum	42
15	A-8	Populus deltoides	N/A
16	A-9	Fraxinus pennsylvanica	20
17	A-11	Populus deltoides	23
18	A-12	Acer saccharinum	67
19	A-13	Acer saccharinum	47
20	A-14	Diospyros virginiana	86
21	A-15	Populus deltoides	58
22	A-16	Acer saccharinum	61
23	A-17	Populus deltoides	57
24	A-17	Populus deltoides	70
25	A-18	Acer saccharinum	11
26	A-18	Ulmus rubra	8
27	A-19	Acer saccharinum	33
28	A-20	Acer saccharinum	38
29	A-21	Acer saccharinum	35
30	A-22	Acer saccharinum	27
31	A-23	Acer saccharinum	22
32	B-1	Acer saccharinum	55
33	B-2	Acer saccharinum	69
34	B-3	Acer saccharinum	78
35	B-4	Celtis occidentalis	80
36	B-5	Fraxinus pennsylvanica	47
37	B-6	Acer saccharinum	26
38	B-7	Acer saccharinum	44
39	B-8	Fraxinus pennsylvanica	90
40	B-9	Acer saccharinum	28
41	B-10	Fraxinus pennsylvanica	26
42	B-12	Fraxinus pennsylvanica	21
43	B-13	Populus deltoides	60
44	B-14	Acer saccharinum	21
45	B-15	Fraxinus pennsylvanica	76
46	B-16	Acer saccharinum	13
47	B-17	Acer saccharinum	N/A
48	B-18	Fraxinus pennsylvanica	30
49	B-19	Acer saccharinum	32
50	B-20	Fraxinus pennsylvanica	45
51	C-3	Fraxinus pennsylvanica	78
52	C-4	Fraxinus pennsylvanica	66
53	C-5	Fraxinus pennsylvanica	36
54	C-6	Fraxinus pennsylvanica	105

thin mile gently rolling. Timber oak and hickory. The land here is covered with a strange kind of grass such as grows in prairie"(T9NR8E).
Another deputy surveyor described the Illinois River floodplain after descending the timbered terrain of the bluffs as *"Prairie or open plain of high grass running north and south with the river"*(T10NR8E). In the spring of 1901, R. N. McFarland, the last survivor of the first pioneers to settle in what is now Brown County, Illinois described to B. F. Bond, for publication, interesting events and incidents in the lives of the first settlers. This account was written by B. F. Bond and was published for the first time in the Versailles Sentinel in 1922, 100 years following the events described. Mr. McFarland described the area along the river, *" Land along these bluffs on the edge of this river bottom prairie was covered with a heavy growth of grass and weeds that in places grew so tall and rank that a man on horse back could hardly see over it and in places covered with flowers of every hue of the rainbow. Great fires swept these bottoms every fall the Indians told us. No doubt the Indians set those fires to run out the wild game. This would destroy all the vegetation and leave the ground blackened and charred and no doubt, was the cause of these low lands having no more timber on them as these fires would extend into the forests hereabouts, burning the under bush.."* (1972 Stevens Publishing). The expanse of prairies into the pre-settlement floodplain (figure 4) could have introduced fire to wetlands and floodplain forests that are considered moist areas incapable of burning, becoming a driving force in the development of these plant communities (Nelson 1997).

It is possible that the presence of newly constructed levees, and the ability to control water within these areas would help permit the re-establishment of pre-settlement species such as pin oak and pecan increasing the diversity within the FWMA and surrounding floodplain. The introduction of fire to the plant community through prescribed burns could also, in part, help to accomplish some of the goals set forth with the construction of the FWMA.

Figure 4. 1820 GLO map of lower middle Illinois River showing extent of prairies into floodplain (adapted from Nelson 1999).



Summary

Although slight modifications were made in the sampling regime for the 1997 survey of FWMA to accommodate for completed

construction, comparisons of both urveys showed little or no significant difference in the tree community within the FWMA. Removal of trees for construction, and slight reduction in average canopy height and understory were the only changes in the forest community here since 1992. Overall, the forest community within the FWMA has not changed, but individual cells showed slight changes in relative densities of overstory and understory trees, canopy cover and height. There are several factors that could have influenced these slight changes. Record high river levels occurred during the pre-construction sampling and were maintained throughout the entire growing season of 1993. The period between pre-construction and post-construction sampling (1994-1997) saw record water levels that inundated floodplain forests, some for long durations during portions of the growing season. Flood induced mortality may account for some of the changes in under story for cells A and B (table 3). These areas contain species that are less flood tolerant (i.e., wild grape and hackberry) and tend to inhabit the areas within those cells that, for the most part, are dryer. The elevation gradient at the FWMA (450.0 ft. msl Cell A and 443.0 ft. msl Cell C) was reflected in importance values for over story silver maples. Cell A, having the highest species richness, had a lower importance value for silver maples (119.7) where as cell C, located within the lowest elevation and having the lowest number of species, had the highest importance values for silver maple (144). Species richness was very comparable for the two sampling periods, but total number of understory stems counted within sampled plots was down in 1997 compared to that of 1992-1994 (table 2). This could be attributed to flood induced mortality.

Although the post-construction survey of the FWMA was intended to evaluate project success, overall changes that occurred within the tree community between sampling periods was slight and insignificant. A survey to evaluate success at the FWMA project after 5 years of management may show more changes within the tree community. Unless a major disturbance in magnitude of the 1993 flood were to occur, a survey done before five years would likely reveal little or no change.

Biological note

During the pre-construction survey of the FWMA, Boltonia decurrens (False Decurrent Aster), a State and Federally threatened species, was discovered growing within the construction area. Boltonia was again encountered within the area surveyed in 1997. Although the FWMA was dry during our survey, a cool spring coupled with relatively high river levels in April had hampered the herbaceous vegetation growth in the two lower elevation cells B and C. Although we encountered relatively few plants, Boltonia was found in cell A but was not seen at the time of the survey in cells B and C which were inundated for a longer period of time in the spring of 1997. Initially, construction of levees at this site did not seem to affect the growth of Boltonia, however, water level management practices at this site have only been implemented for two years. It is unclear what, if any, impacts these practices will have on this population of Boltonia over the long term.

Acknowledgments

Funding for this research was provided by the Rock Island District, U.S. Army Corps of Engineers through the Upper Midwest Environmental Sciences Center of the Biological Resources Division, U.S. Geological Survey, with assistance from the Illinois Department of Natural Resources. The views of this report are those of the authors.

We are indebted to the following Illinois Natural History Survey employees for their assistance in the field and lab, including Jeff Arnold, Kevin Irons, and T. Matt O'Hara; Cammy Smith was the office manager and K. Douglas Blodgett was the field station team leader during this project. K. Douglas Blodgett and Todd Koel reviewed an earlier draft of this report and provided valuable suggestions. Kevin Irons assisted with the Arcview/GIS figures. John C. Nelson provided assistance with the GLO survey data. The cooperation and assistance from the Marshall County Conservation Area, Illinois Department of Natural Resources was appreciated. Charlene Carmack, U.S. Army Corps of Engineers, was the project biologist for this work.

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Blodgett, K. Douglas, Irons, K.S., and T.R. Cook. 1994 Progress report: Bioresponse Monitoring at Peoria Lake and Lake Chautauqua Habitat Rehabilitation and Enhancement Projects, August 1994. Prepared for the U.S. Army Corps of Engineers, Rock Island District. 45 p.

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Yin, Y. 1992. Unpublished document. 1992 vegetation projects for the Cape Girardeau Field Station (draft)--Project one: Investigation of terrestrial forest communities/stands.

Yin, Y., and J.C. Nelson. 1995. Modifications of the Upper Mississippi River and their effects on floodplain forests. Nation Biological Service, Environmental Technical Center, Onalaska, Wisconsin, February 1995. LTRMP 95-T003. 17 pp.

Yin, Y., J.C. Nelson, and K.S. Lubinski. 1997. Bottom land Hardwood forests along the Upper Mississippi River. Natural Areas Journal 17(2): 164-173. Reprinted by U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, November 1997. LTRMP 97-R025. 10pp.

Appendix A. Scientific and common names of woody vegetation species recorded within sample plots at the Forested Wetland Management Area of the Peoria Lake HREP, 1992-1997.

Scientific name	Common name
Acer negundo	Box elder
Acer saccharinum	Silver maple
Celtis occidentalis	Hackberry
Cornis obliqua	Silky dogwood
Cornis spp.	Dogwood species
Crataegus crus-galli	Cock-spur thorn
Crataegus mollis	Red haw
Diospyros virginiana	Persimmon
Forestiera acuminata	Swamp privet
Fraxinus pennsylvanica	Green ash
Gleditsia aquatica	Water locust
Gymnocladus dioicus	Kentucky coffee tree
Juglans nigra	Black walnut
Morus spp.	Mulberry
Platanus occidentalis	Sycamore
Populas deltoides	Cottonwood
Salix amygdaloides	Peach leaved willow
Salix nigra	Black willow
Toxicodendron radicans	Poison ivy
Ulmus rubra	Red elm
Ulmus americana	American elm
Vitis spp.	Wild grape

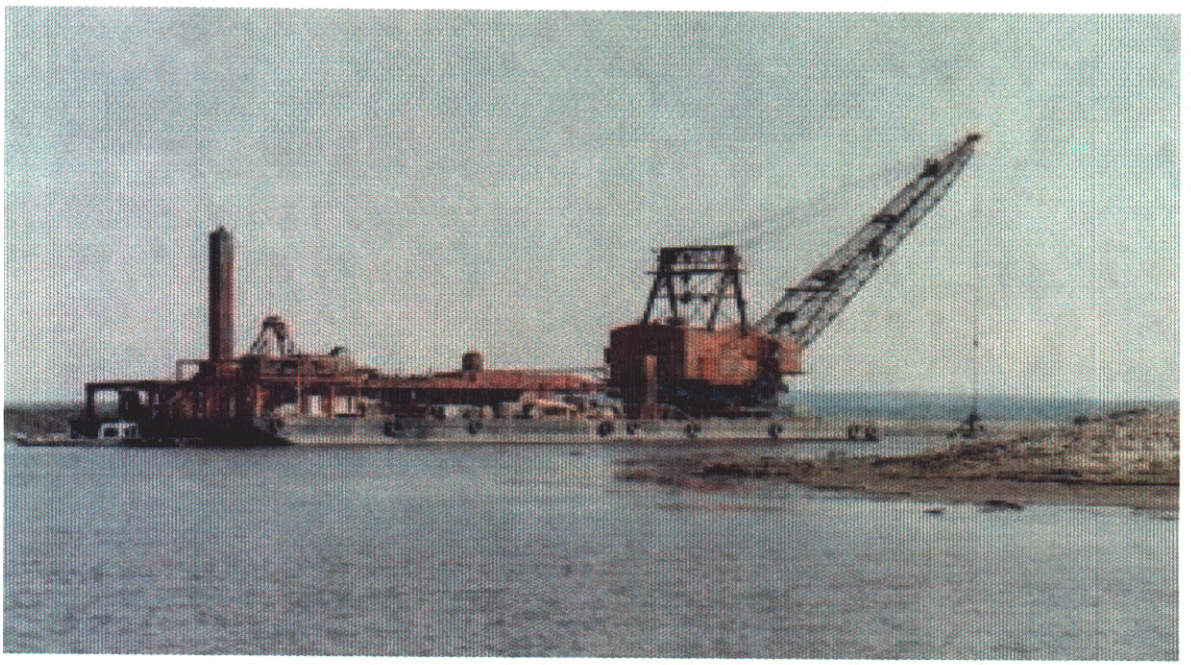
APPENDIX F

SITE VISITS

Peoria Lake Habitat Rehabilitation and Enhancement Project Site Visit

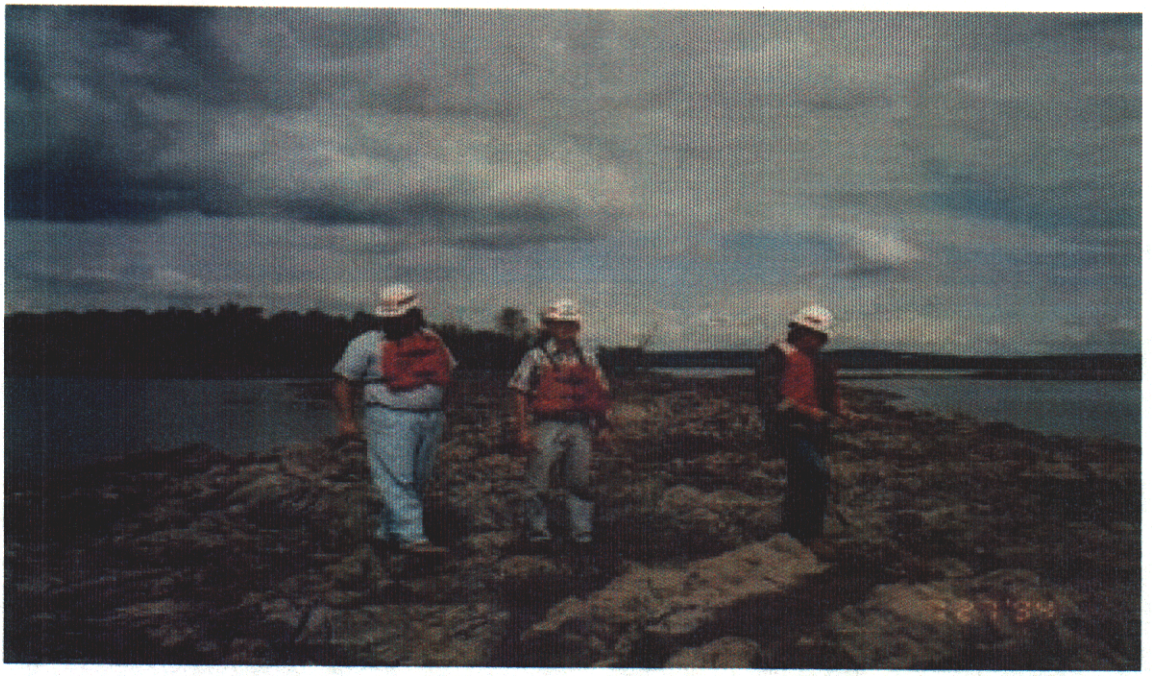
July 1994

Island Creation



Willow Planting (Island)

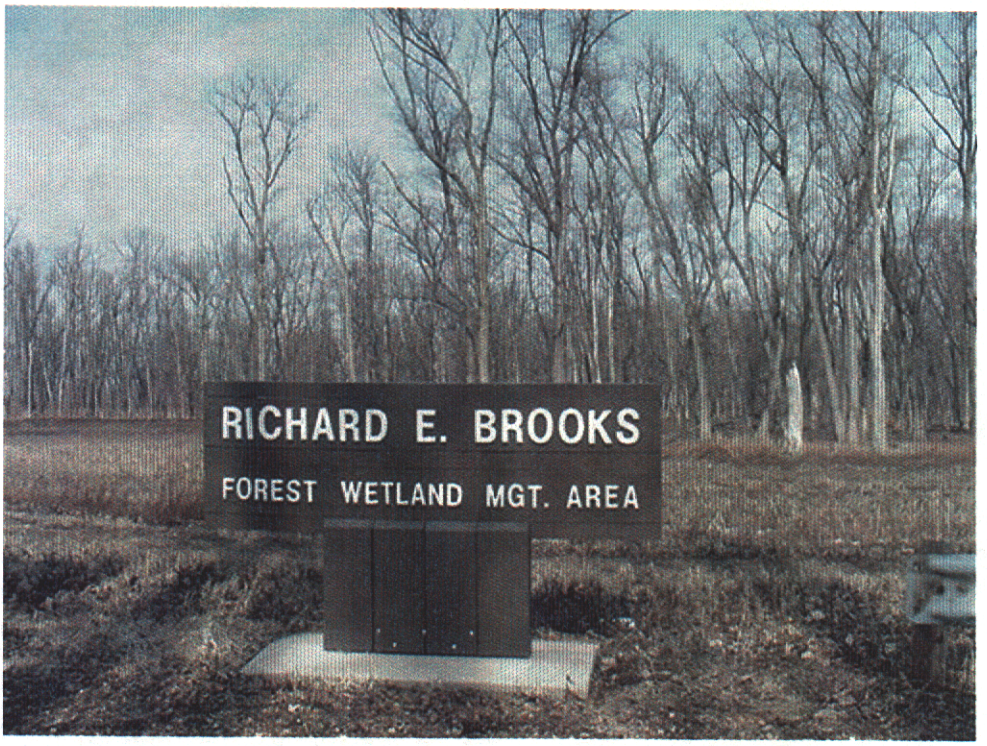
Forested Wetland Management Area

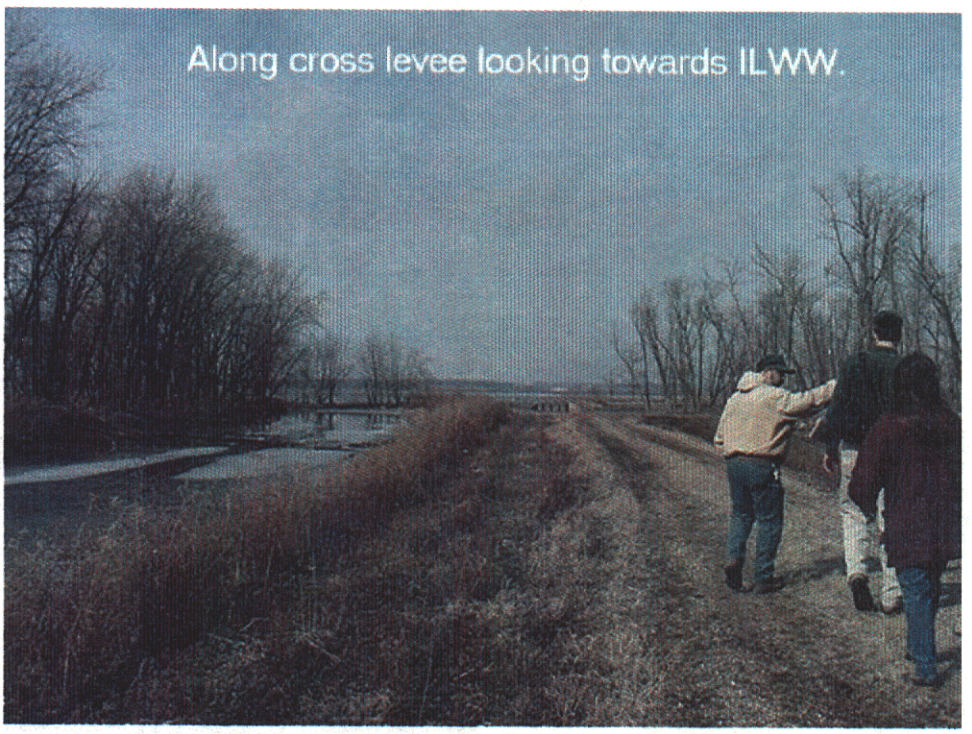


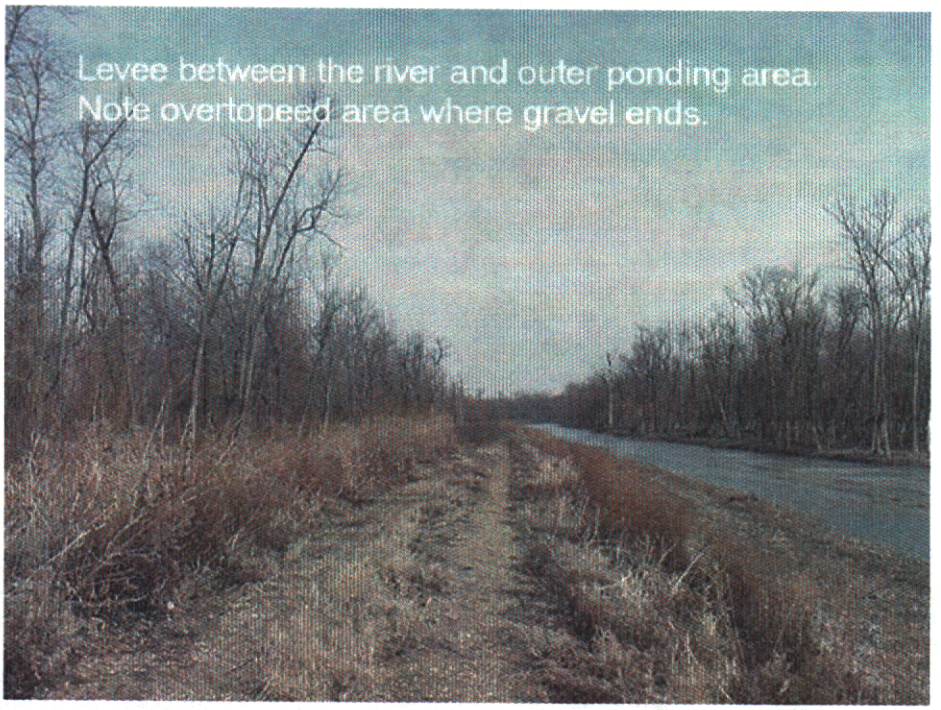
Peoria Lake Habitat Rehabilitation and Enhancement Project Site Visit

February 23, 2000

Forested Wetland Management Unit

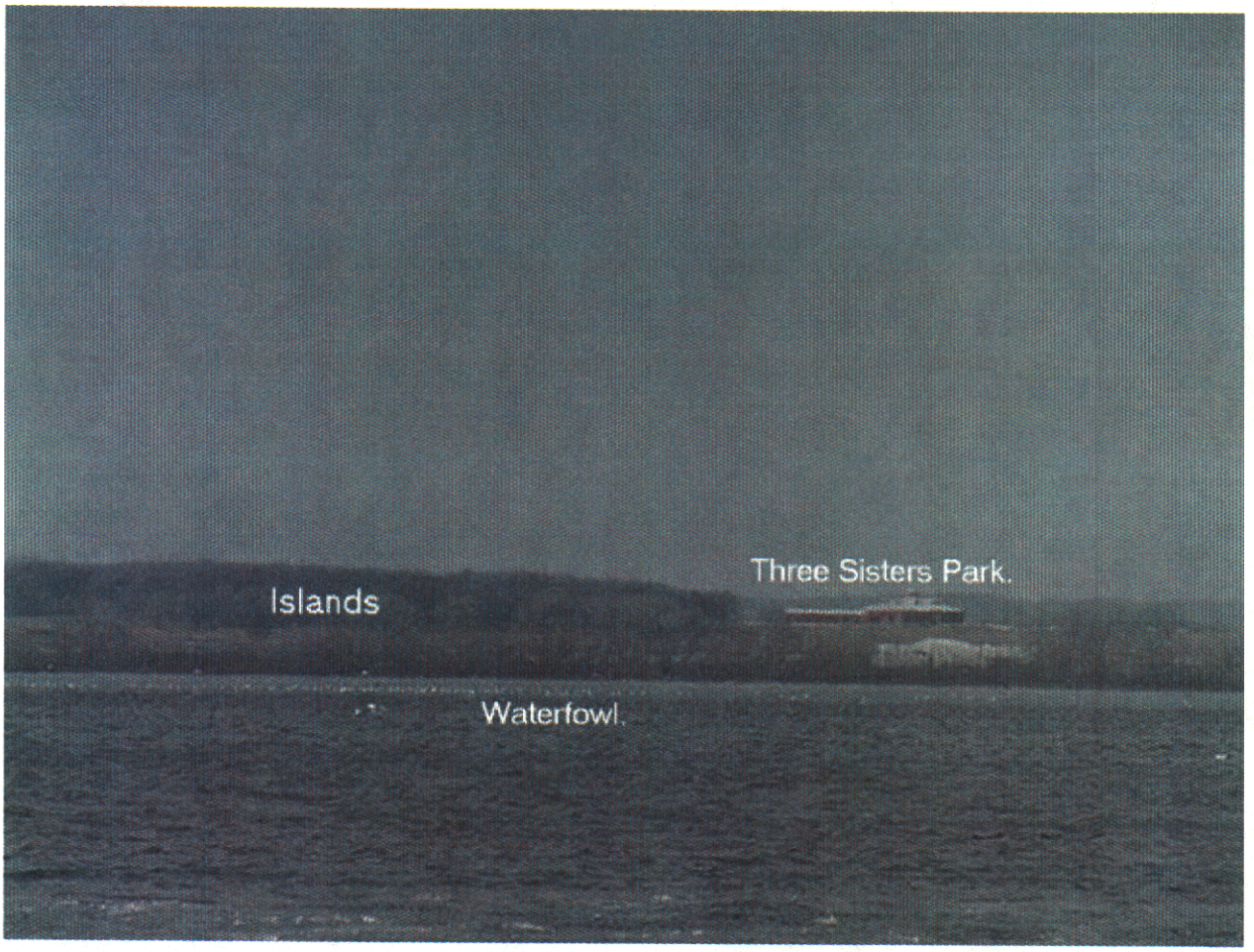





Levee between the river and outer ponding area.
Note overtopeed area where gravel ends.

Stop Log Structures

3. Islands



Mast Tree Planting

APPENDIX G

CHIEF OF ENGINEERS DESIGN AND ENVIRONMENTAL AWARDS PROGRAM - 2000

This project was submitted for consideration to the U.S. Army Corps of Engineers, Chief of Engineers, Design and Environmental Awards Program - 2000 in January of 2000. While not selected for the award, the submittal package highlighted several of the project's successes. Some of the project achievements summarized in this submittal are as follows:

Results of post-construction aerial waterfowl inventories indicate the *Forested Wetland Management Area* is providing a reliable feeding and resting area. Post-construction surveys of woody vegetation indicate that seasonal impoundment of water within this area has not increased tree mortality. This feature is contributing significantly to the project goal of wetland habitat enhancement.

In the *Barrier Island Complex*, a substantial increase in waterfowl usage was recorded by aerial census—both in the total number of individuals and in the number of species identified. Results of the aerial census, combined with numerous observations of waterbirds at the site during spring and summer months, provide evidence that the *Barrier Island* feature has enhanced wetland habitat. Additionally, wind monitoring and observations indicate that the *Barrier Island* has been effective in reducing wave heights. Significant reductions in wave height on the leeward side of the island when the prevailing wind is from the southwest, west, or north is resulting in reduced sediment re-suspension and greater water clarity.

In the *Flowing Side Channel*, comparison of pre- and post-construction fish community monitoring results show an increase in the number of species collected as well as in total numbers of fish collected during post-construction monitoring. In addition, a greater diversity of species was collected and more unique species were encountered after project completion. The results of fish community monitoring suggest that restoration of the East River channel, and construction of the barrier and overburden islands has had a positive effect on fisheries in this section of Peoria Lake.

A copy of the submittal is attached to this document.

CHIEF OF ENGINEERS
DESIGN AND ENVIRONMENTAL AWARDS PROGRAM - 2000
SUBMITTAL PACKET FOR PEORIA LAKE ENHANCEMENT

Peoria Lake Enhancement, Upper Mississippi River System, Environmental Management Program. Construction General Funding

Location. Peoria Lake is a riverine lake encompassing nearly 14,000 acres in the Peoria Pool on the Illinois Waterway between river miles 178.5 and 181.0 in Woodford County, Illinois, approximately 10 miles north of Peoria.

Program and Solution.

Since 1903, Peoria Lake has lost approximately 68% of its volume to sedimentation. The large open expanse of Peoria Lake and shallow water depths make the lake susceptible to continual wave generated re-suspension of sediments, resulting in increased turbidity and decreased photosynthetic activity. The soft, unconsolidated lake bottom is not conducive to the rooting and survival of aquatic plants. The lack of aquatic and wetland vegetation has resulted in a significant loss of fish and waterfowl populations.

The goals and objectives of the Peoria Lake Enhancement project are to enhance aquatic and wetland habitat by increasing reliable food production and resting area for waterfowl, to increase the diversity and areal extent of emergent and submergent vegetation, and to provide flowing side channel habitat. As designed and constructed, the project consists of three features:

(1) ***Barrier Island*** (16 acres, 1.1 miles long, with rock closure structure);
(2) ***Flowing Side Channel*** (a 1.8-mile restoration of the East River side-channel); and
(3) ***Forested Wetland Management Unit*** (170 acres bounded by low-level levees, with stop log structures and a pump station to allow for seasonal interior water level manipulation).

Cost Information. Total programmed project cost was $4,375,000. Actual cost $4,328,000.

Innovation. The design and construction of the *Barrier Island* within Peoria Lake presented the greatest project challenge. Soil conditions beneath the proposed barrier island and its potential borrow area are very poor--the bottom sediments are soft compressible clays with very low shear strength and a very high water content. For the island to be economically feasible, a construction method that utilized existing lake bottom materials to the greatest extent possible had to be developed. WES Engineers worked with the design team to determine engineering properties and foundation conditions of the soils within the barrier island footprint. A special customized vane-shear device was calibrated and utilized to directly measure the shear strength of the foundation and embankment materials. The design team ultimately selected a unique Soil Displacement Method, which allows utilization of lake bottom sediments for both foundation and embankment. Island construction, utilizing the Soil Displacement Method, required the use of a specialized large bucket clamshell crane traditionally used only in large swamp projects in the Southern United States. Construction also required a strict sequence and schedule to ensure adequate embankment consolidation between lifts and to minimize susceptibility to flooding and overtopping prior to completion.

User Satisfaction. The project provides much needed wetland and aquatic habitat. The Illinois Department of Natural Resources staff have indicated their satisfaction with the biological response to the Peoria Lake Enhancement project. To date, the project has met their operations and maintenance expectations.

Compatibility. Design features were selected to provide and enhance habitat values for species that are native to the Illinois River corridor. The project is a restoration of natural conditions that have been degrading over time due to sedimentation. The new features are very compatible with the surrounding riverine lake and wetland environment.

Siting. Much consideration was given to the siting of the Peoria Lake Enhancement project. The Peoria Pool is 73 miles long and includes several riverine lake features. Of these lakes, Peoria Lake has been the most severely degraded. Within Peoria Lake, there are several sites that possess the fundamental areal extent and ownership/management requirements necessary for the development of a multiple element habitat project. The ultimate project site was selected for its potential to enhance habitat for both waterfowl and fisheries, while meeting specific engineering parameters and satisfying potential operation and maintenance concerns. Specific siting and orientation of the *Barrier Island* within Peoria Lake was determined based on prevailing wind direction and historic landmass locations. The effective utilization of existing landforms was the main consideration in the siting of the *Forested Wetland Management Unit.*

Technology. The structural components of the *Forested Wetland Management Unit* include a pump station and three cast-in-place concrete stop-log structures. The pump station is equipped with a 6000 GPM submersible pump, which can withstand frequent flooding and is equipped with an electrical phase-converter, which alleviated the need to bring costly 3-phase power to the remote site. The stop-log structures have a simple, yet durable design to facilitate easy operation and maintenance of the management unit.

Environmental Impact. In the *Barrier Island* area, a substantial increase in waterfowl usage was recorded by aerial census--both in the total number of individuals and in the number of species identified. Results of the aerial census, combined with numerous observations of waterbirds at the site during spring and summer months, provide evidence that the *Barrier Island* feature has enhanced wetland habitat. Additionally, wind monitoring and observations indicate that the *Barrier Island* has been effective in reducing wave heights. Significant reductions in wave height on the leeward side of the island when the prevailing wind is from the southwest, west, or north is resulting in reduced sediment re-suspension and greater water clarity.

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Summary. The Peoria Lake Enhancement is a model environmental project whose success is due to the collaborative efforts of a diverse, multi-agency team of engineers, planners, and natural resource professionals working together to provide significant aquatic and wetland habitat benefits.

APPENDIX H

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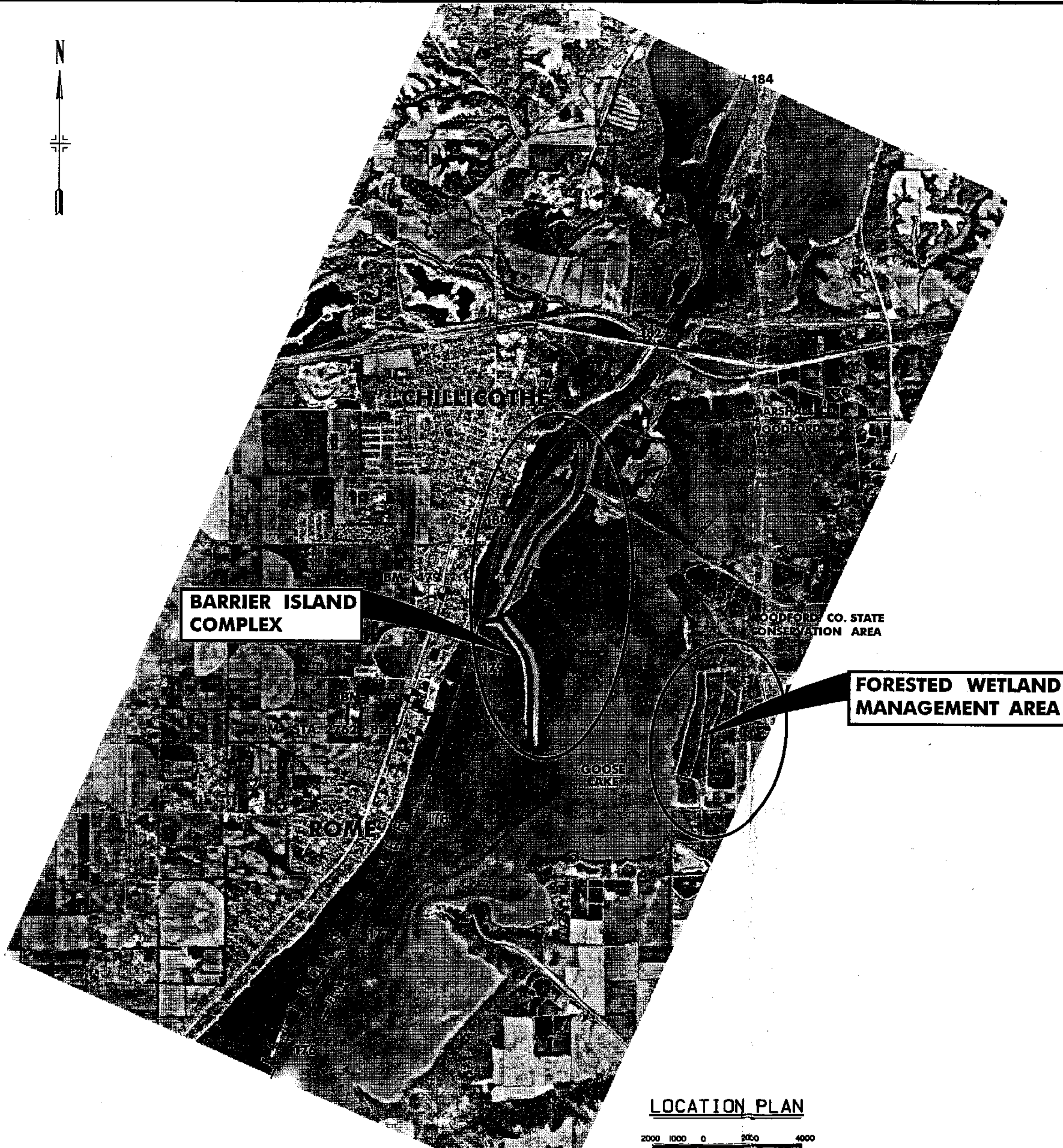
APPENDIX I

PLATES



LOCATION PLAN

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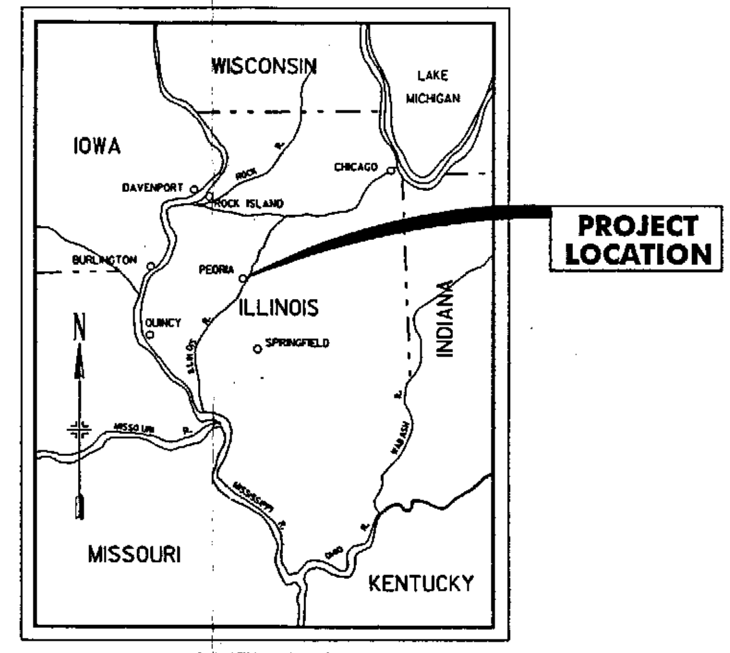

VICINITY MAP

25 0 25 50 75
SCALE IN MILES

INDEX	
SHEET REF. NO.	TITLE OF DRAWING
PLATE 1	LOCATION PLAN, VICINITY MAP, AND INDEX
PLATE 2	GENERAL PLAN AND PROJECT FEATURES
PLATE 3	SEDIMENTATION TRANSECT AND MONITORING PLAN
PLATE 4	SEDIMENTATION MONITORING RANGES RM 178.5 - 179.0
PLATE 5	SEDIMENTATION MONITORING RANGES RM 179.5 - 180.4

NOTES:
1. FOR PROJECT FEATURES SEE PLATE 2.

US Army Corps of Engineers
Rock Island District

Symbol	Description	Date	Approved
	Revisions		

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	Drawn By: TPD	Scale: AS SHOWN
	Checked By: DJJ	Drawing Code: XXXXX
	Reviewed By: BLK	Solicitation Number: DACW25-XX-B-XXXX

ILLINOIS WATERWAY
ENVIRONMENTAL MANAGEMENT PROGRAM
RIVER MILE 178.5 TO 181.0
PEORIA LAKE

LOCATION PLAN, VICINITY MAP, AND INDEX

PLATE 1

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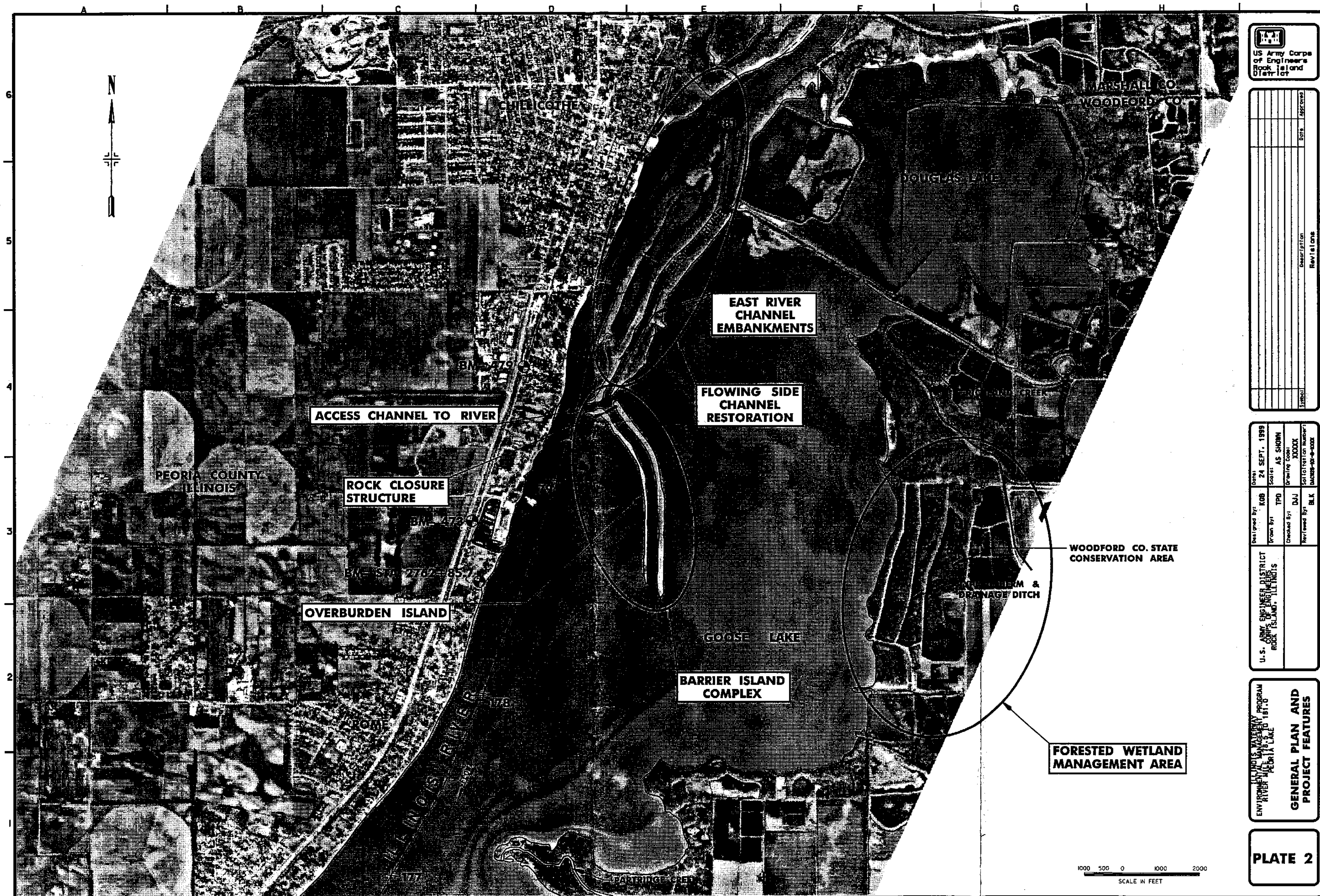
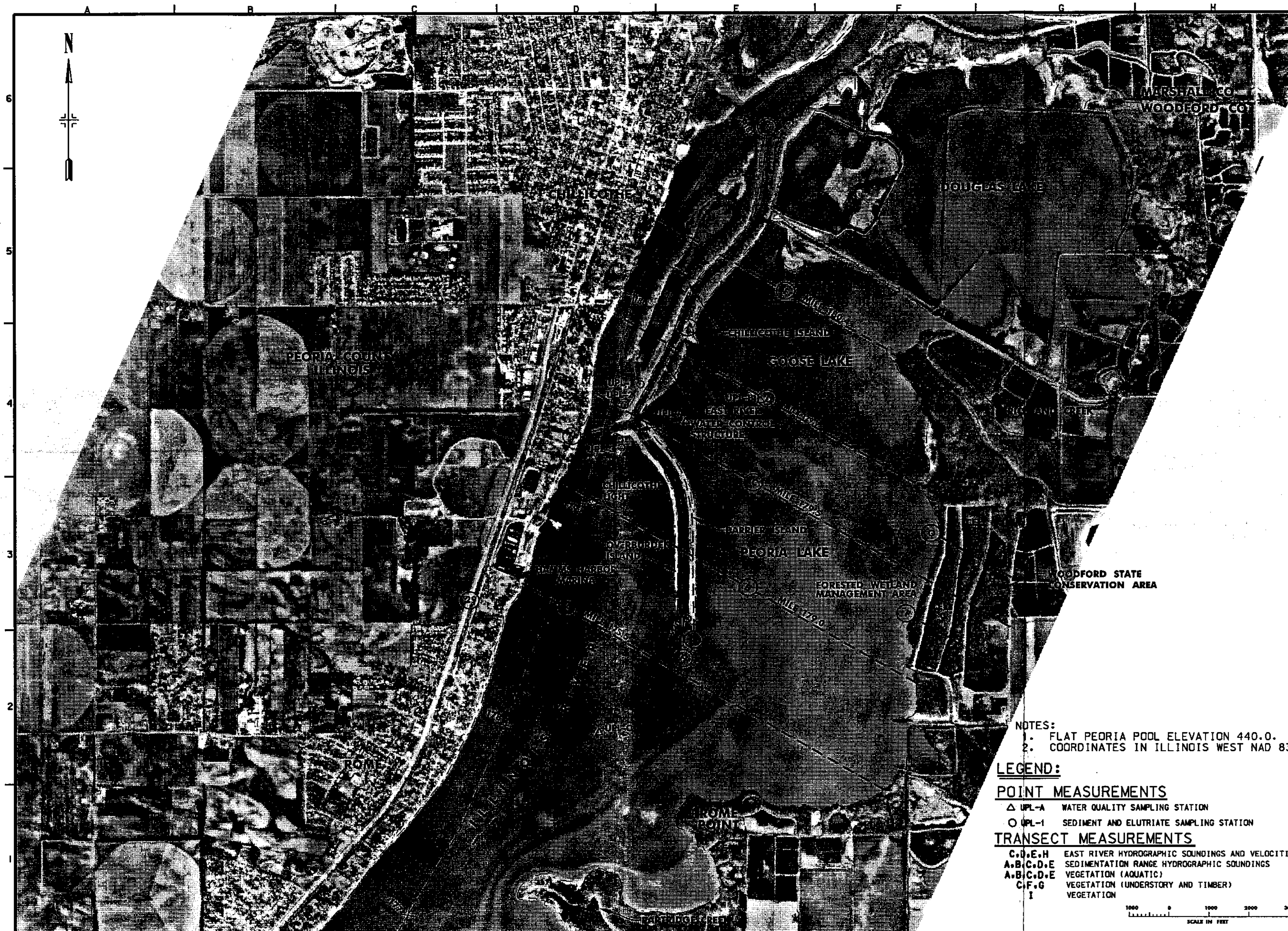


N
CHILLICOTHE
MARSHALL CO.
WOODFORD CO.
DOUGLAS LAKE
EAST RIVER CHANNEL EMBANKMENTS
FLOWING SIDE CHANNEL RESTORATION
ACCESS CHANNEL TO RIVER
PEORIA COUNTY ILLINOIS
ROCK CLOSURE STRUCTURE
OVERBURDEN ISLAND
GOOSE LAKE
BARRIER ISLAND COMPLEX
WOODFORD CO. STATE CONSERVATION AREA
DRAINAGE DITCH
FORESTED WETLAND MANAGEMENT AREA
ILLINOIS RIVER
ROME
PARTRIDGE CREEK
1000 500 0 1000 2000
SCALE IN FEET
US Army Corps of Engineers Rock Island District
Revisions
Symbol
Description
Date
Approved
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS ROCK ISLAND, ILLINOIS
Designed By: KGB
Drawn By: TPD
Checked By: DJJ
Reviewed By: BLK
Date: 24 SEPT. 1999
Scale: AS SHOWN
Drawing Code: XXXXX
ILLINOIS WATERWAY ENVIRONMENTAL MANAGEMENT PROGRAM RIVER MILE 178.5 TO 181.0 PEORIA LAKE
GENERAL PLAN AND PROJECT FEATURES
PLATE 2



NOTES:
1. FLAT PEORIA POOL ELEVATION 440.0.
2. COORDINATES IN ILLINOIS WEST NAD 83.

LEGEND:

POINT MEASUREMENTS

△ UPL-A WATER QUALITY SAMPLING STATION

○ UPL-1 SEDIMENT AND ELUTRIATE SAMPLING STATION

TRANSECT MEASUREMENTS

C.D.E.H	EAST RIVER HYDROGRAPHIC SOUNDINGS AND VELOCITIES
A.B.C.D.E	SEDIMENTATION RANGE HYDROGRAPHIC SOUNDINGS
A.B.C.D.E	VEGETATION (AQUATIC)
C.F.G	VEGETATION (UNDERSTORY AND TIMBER)
I	VEGETATION

1000 0 1000 2000 3000
SCALE IN FEET

US Army Corps of Engineers Rock Island District

Symbol	Description	Date	Approved

Revisions

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

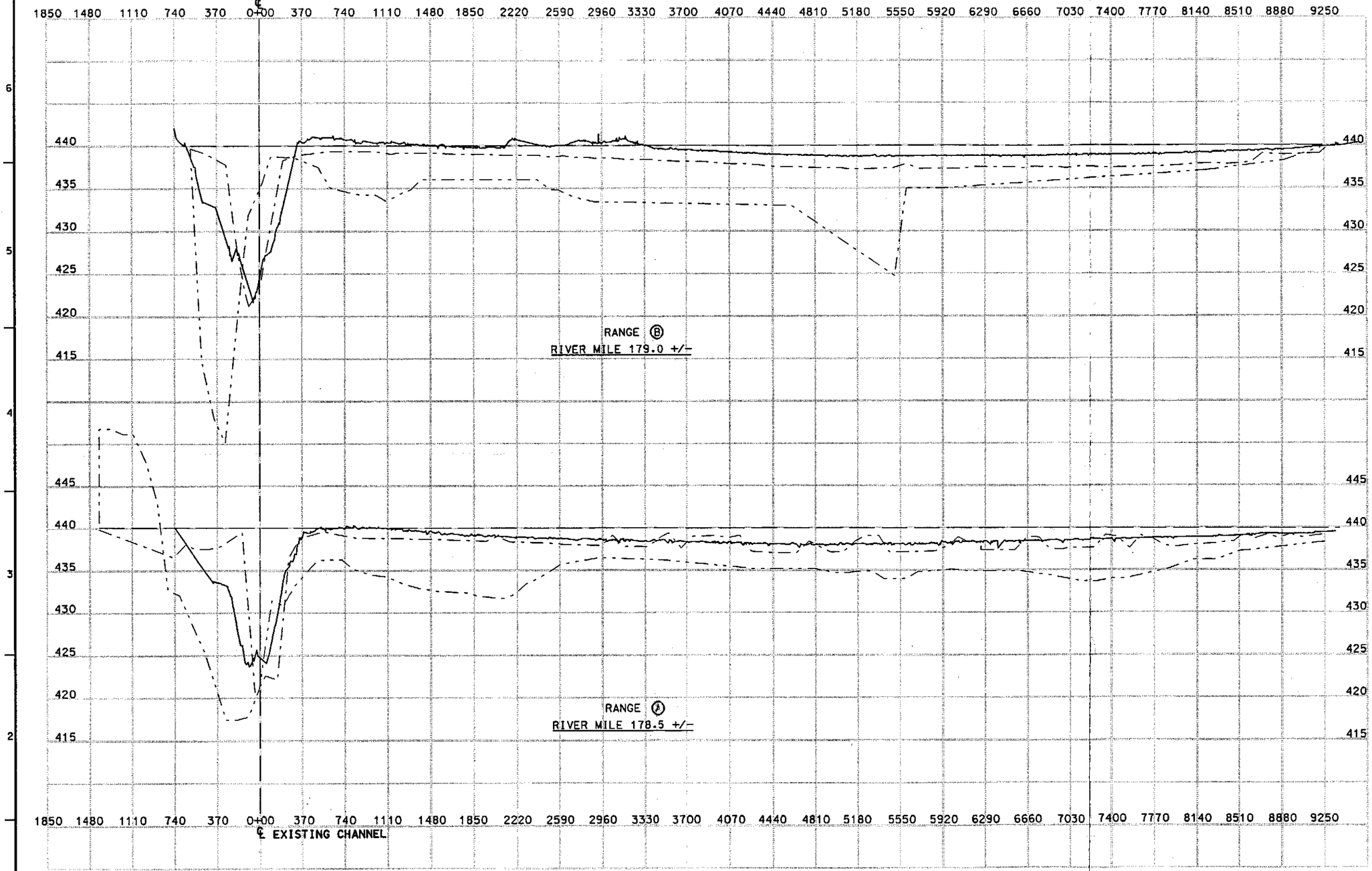
Designed By: KGB	Date: 24 SEPT. 1999
Drawn By: TPD	Scale: AS SHOWN
Checked By: DJJ	Drawing Code: XXXXX
Reviewed By: BLK	Solicitation Number: DACW25-XX-B-XXXX

ILLINOIS WATERWAY
ENVIRONMENTAL MANAGEMENT PROGRAM
RIVER MILE 178.5 TO 181.0
PEORIA LAKE

SEDIMENTATION TRANSECT AND MONITORING PLAN

PLATE 3

23-NOV-1999 10:54



US Army Corps of Engineers
Rock Island District

Symbol	Description Revisions	Date	Approved

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

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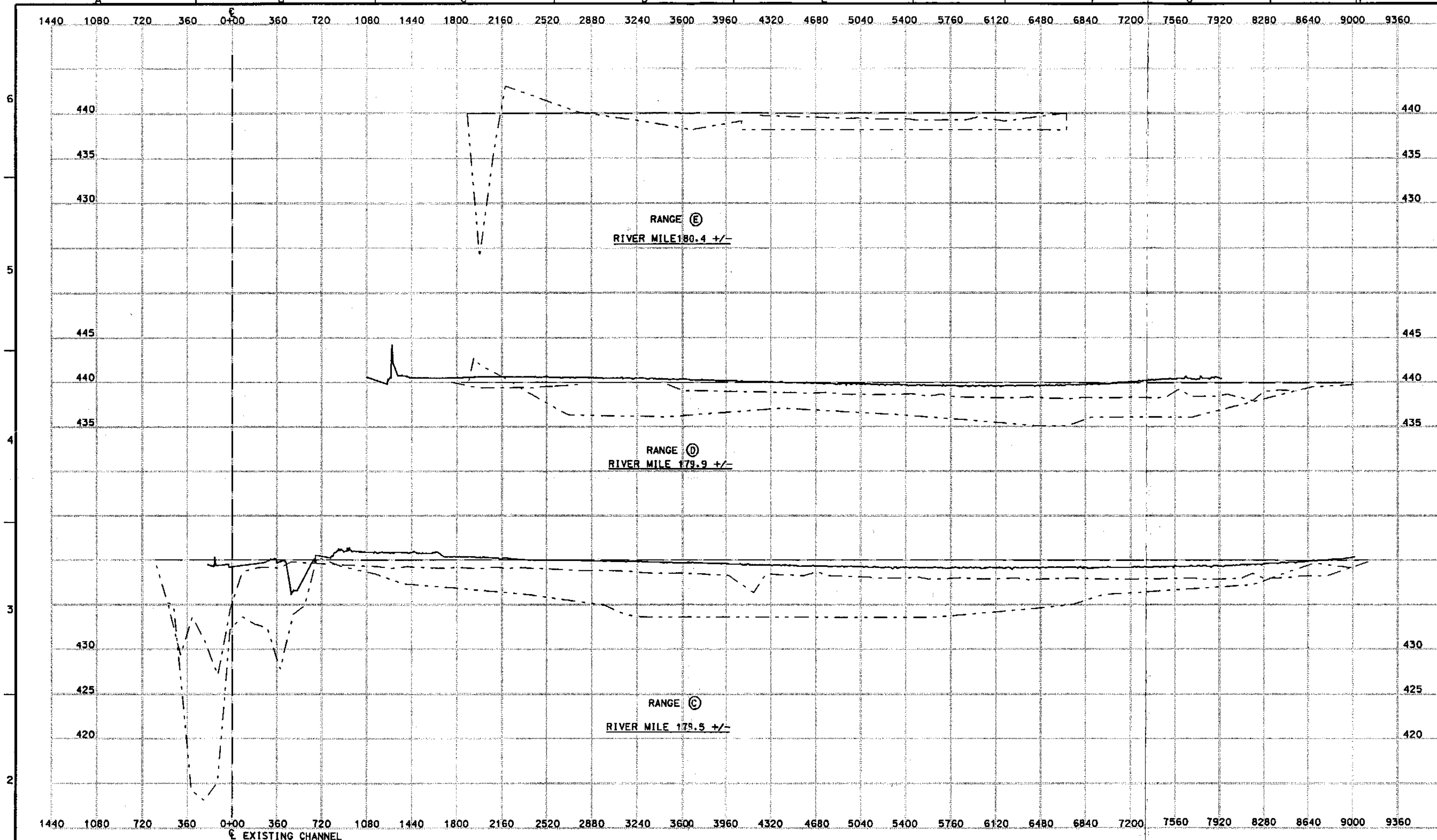
ILLINOIS WATERWAY
ENVIRONMENTAL MANAGEMENT PROGRAM
RIVER MILE 178.5 TO 181.0
PEORIA LAKE

SEDIMENTATION MONITORING RANGES RM 178.5 -179.0

LEGEND:
1903 — · — · — · —
1987 — — — — — —
1996 ————————
FLAT POOL —— ——

PLATE 4



US Army Corps of Engineers
Rock Island District

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U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

ILLINOIS WATERWAY
ENVIRONMENTAL MANAGEMENT PROGRAM
RIVER MILE 178.5 TO 181.0
PEORIA LAKE

SEDIMENTATION MONITORING RANGES: RM 179.5 - 180.4

PLATE 5