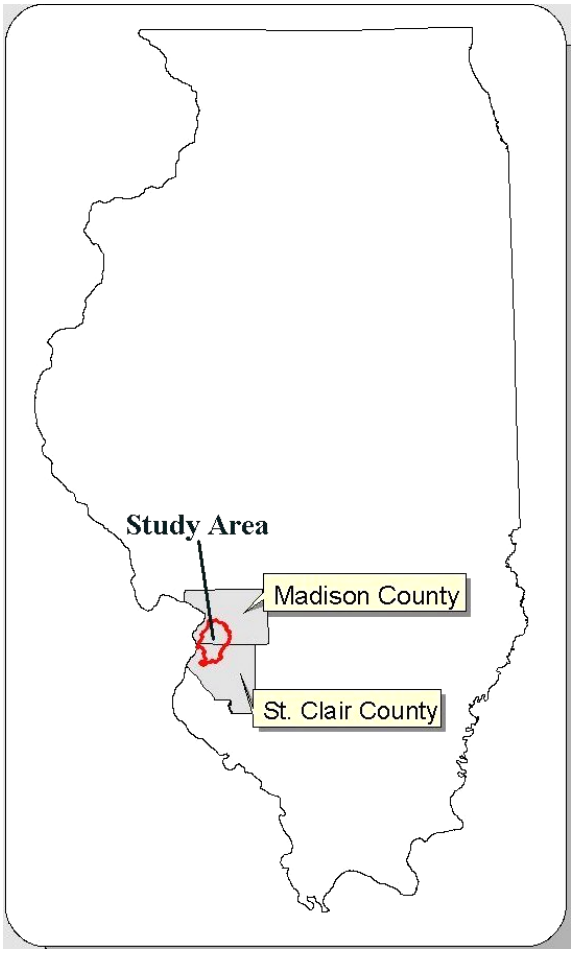
EAST ST. LOUIS AND VICINITY, ILLINOIS ECOSYSTEM RESTORATION AND FLOOD DAMAGE REDUCTION PROJECT

FINAL GENERAL REEVALUATION STUDY

SUMMARY REPORT

October 2003



EAST ST. LOUIS AND VICINITY, ILLINOIS ECOSYSTEM RESTORATION AND FLOOD DAMAGE REDUCTION PROJECT FINAL GENERAL REEVALUATION STUDY

SUMMARY REPORT

OVERVIEW

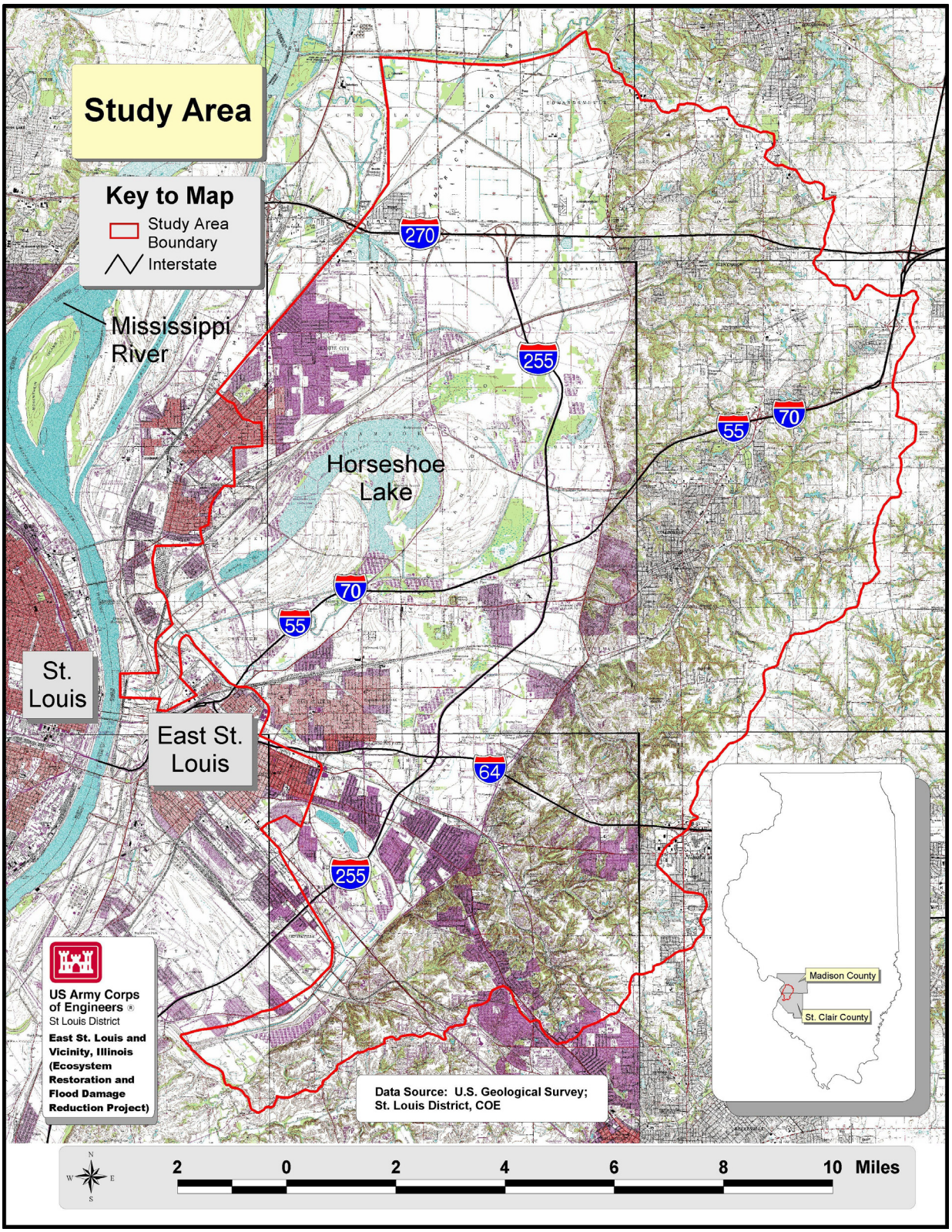
This report presents a summary of the East St. Louis and Vicinity, Illinois, Ecosystem Restoration and Flood Damage Reduction Project General Reevaluation Report with Integrated Environmental Impact Statement. As such, this Summary Report includes material also contained in the above referenced General Reevaluation Report (GRR) but in a much more abbreviated form. For complete details, the reader is urged to reference the above GRR.

The East St. Louis and Vicinity, Illinois Project is located in Madison and St. Clair Counties, Illinois, along the left bank of the Mississippi River between river miles 175 and 195 above the Ohio River. It includes a portion of the bottomlands between the bluffs on the east and the Mississippi River and Chain of Rocks Canal on the west. It extends from the Prairie Du Pont canal on the south to the Cahokia Creek diversion channel on the north.

The study area to be re-evaluated envelops about 166 square miles or 105,000 acres in the MetroEast area. About half of the study area occurs on the floodplain of the Mississippi River, and the remainder consists of small tributary watersheds that drain into the bottoms. The floodplain area includes approximately 55,000 of the 86,000 acres that are protected by an urban levee system along the Mississippi River, Chain of Rocks Canal, Prairie du Pont canal, and Cahokia Creek diversion channel. The upland area includes watersheds of seven named and several unnamed tributary streams draining a total of about 50,000 acres. Tributary streams typically end at the bluff-floodplain border, and continue as a ditch and canal system on the floodplain to carry water as directly as possible to the river. Larger streams to the north and south of these watersheds were diverted many years ago to the Mississippi River between flank levees to reduce drainage into the bottomlands.

Even though the study area is protected from Mississippi River overflow by an urban design levee, the bottomland inside or interior to this levee can experience flooding after significant rainfall. The ditches and canals of the interior flood control system were constructed in the early 1900's, and have not been modified to handle the increased runoff caused by urbanization, and more intense summer rainstorms due to a localized climatic change called the St. Louis effect. As a result, moderate storms over the tributary watersheds are capable of overtopping the ditch and canal system, and damaging adjacent farmland and urbanized areas. Additionally, low lying areas in the mid-region of the floodplain that typically do not flood from overtopping events will pond stormwater that cannot gravity flow into the interior flood control system when its ditches and canals are full of flow from tributary streams. This inability to get water into the interior flood control system also causes flood damages across the study area.

Figure 1 The study area



In 1965 a flood protection project was authorized for East St. Louis and Vicinity, Illinois, to provide protection in the bottoms from flooding caused by local storm events. In 1976 Blue Waters Ditch, a segment of the authorized project was reevaluated, and in 1989 new and improved drainage channels and a pump station were constructed to eliminate flooding from about 700 acres of the original 136,000-acre Project area. In 1984 a reevaluation of the recommendations contained in the 1965 report for the Cahokia Canal and Harding Ditch drainage areas found them not to be economically justified.

In the mid 1990's when interior flooding again became a major issue in the area, it was realized that the un-constructed portions of the authorized project would still not be economically justified. However, by 1998 the Corps was participating with Region 5 of the U. S. Environmental Protection Agency and interested local parties in the MetroEast area on issues related to urban sprawl, smart growth and watershed planning. During this timeframe a second re-evaluation of the un-constructed portions of the 1965 authorized project was initiated. It was determined at the outset that a completely fresh look of the existing problems and opportunities needed to be made, as there had been substantial changes in the existing conditions since the 1965 report was prepared.

In 2000, the project for flood protection was modified to include ecosystem restoration as a project purpose. The purpose of ecosystem restoration activities in the Civil Works program is to restore significant ecosystem function, structure, and dynamic processes that have been degraded. The intent of restoration is to partially or fully reestablish the attributes of a naturalistic, functioning, and self-regulating system. Restoration opportunities most appropriate for Corps involvement are associated with wetlands, riparian and other floodplain and aquatic systems.

When Europeans began settling the study area about two hundred years ago, the Mississippi River floodplain and adjacent tributary watersheds supported a high level of biodiversity. On the floodplain, backwater lakes, sloughs, and marshes punctuated broad expanses of forest and prairie. Streams beginning in upland forests and prairies meandered across the floodplain to discharge into the Mississippi. Forest typically comprised the riparian corridors along rivers and streams. Wetlands consisted of shallow ponds, forested wetlands, wet prairies, and marsh. Seasonal flooding from the Mississippi River and tributary streams inundated the floodplain to various degrees from year to year. The dynamic process of flooding was accompanied by other periodic natural disturbances, such as wildfire and drought. These disturbances were important because they maintained biological diversity, growth and productivity. Wetlands performed various functions, such as temporary storage of surface water, maintenance of habitat for numerous plant and animal species, and export of organic carbon.

Under current conditions, the study area lies within the largest concentration of industrial, commercial, and residential land use on the Mississippi River floodplain north of New Orleans. Development has greatly affected historic ecosystem structure, function, and dynamic processes. By area, about half of all lakes and ponds are gone, about two-thirds of forests, wetlands, and floodplain streams no longer exist, and virtually all historic prairie has disappeared. Remaining resources are fragmented and degraded. Many wetlands have become isolated from historic sources of flooding because riverine overflow has been engineered out of today’s environment. Due to their isolation, wetlands no longer temporarily store much surface water.

The lack of significant periodic flood disturbances or flood pulses jeopardizes the sustainability of floodplain resources and the maintenance of characteristic plant and animal communities. Development in tributary watersheds has also degraded tributary streams, where channel and bank instability diminish in-stream habitat quality and give rise to excessive levels of sediment transported by storm water to the floodplain.

Despite these changes, remaining aquatic resources in the study area are significant at the national and regional scale. Such resources include the 2,000-acre Horseshoe Lake, about 6,000 acres of wetlands in the lake's vicinity, and over 200 miles of tributary streams. Sources of significance are technical and institutional, and include the North American Waterfowl Management Plan, Upper Mississippi River System Environmental Management Program, Clean Water Action Plan, Action Plan of the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force, and several international bird conservation initiatives supported by the Federal government to protect a variety of bird species of concern. Technical significance is based on the ecological concepts of connectivity and status and trends.

The recommended plan would restore significant ecosystem structure, dynamic processes, and function to aquatic resources in the study area at a watershed level. About 4,700 acres of forests, prairies, marshes, scrub-shrub wetlands, and lakes and ponds would be restored at eight proposed floodplain habitat restoration sites. Restoration activities would improve about 2,300 acres of existing, degraded habitats, and recreate about 2,400 acres of wetlands and floodplain habitats at sites where they formerly occurred that are now agricultural. About 11 miles of floodplain streams would be restored within the floodplain habitat areas, and about 178 miles of streams in the tributary watersheds would be restored. Introducing storm water from tributary watersheds into the proposed habitat restoration areas, thereby mimicking the historic flood pulse, would restore the dynamic process of flooding. The plan would make significant contributions to the national and regional plans and programs outlined above. By restoring ecosystem functions at a watershed level, existing problems and opportunities including those identified by the public could best be addressed.

The MetroEast Sanitary District has been the local sponsor for this General Reevaluation Study. As a reevaluation of an authorized project, the Planning, Engineering and Design costs were shared on a 25% non-Federal and 75% Federal basis.

STUDY AUTHORITY

The East St. Louis and Vicinity, Illinois Flood Protection Project was specifically authorized (and modified) through Congressional actions in 1965 under Section 204 of the Flood Control Act of 1965, (Public Law 89-298) and subsequently under the Water Resources Development Act of 1976 (Public Law 94-587). Section 204 of the Flood Control Act of 27 October 1965 (Public Law 89-298) provides that:

"The following works of improvement for the benefit of navigation and the control of destructive floodwaters and other purposes are hereby adopted and authorized to be prosecuted under the direction of the Secretary of the Army and the supervision of the Chief of Engineers in accordance with the plans in the respective reports hereinafter designated and subject to the conditions set forth therein. The necessary plans, specifications, and preliminary work may be prosecuted on any project authorized in this title with funds from appropriations hereafter made for flood control so as to be ready for rapid inauguration of a construction program. The projects authorized in this title shall be initiated as expeditiously and prosecuted as vigorously as may be consistent with budgetary requirements. Penstocks and other similar facilities adapted to possible future use in the development of hydroelectric power shall be installed in any dam authorized in this Act for construction by the Department of the Army on the recommendation of the Chief of Engineers and the Federal Power Commission."

UPPER MISSISSIPPI RIVER BASIN

"The project for flood protection at East St. Louis and Vicinity, Illinois, (East Side Levee and Sanitary District), is hereby authorized substantially, as recommended by the Chief of Engineers, in House Document Numbered 329, Eighty-eighth Congress, at an estimated cost of $6,180,000."

The Water Resources Act of 1976 (Public Law 94-587) provides that:

"An Act"

"Authorizing the construction, repair, and preservation of certain public works on rivers and harbors for navigation, flood control, and other purposes.

"Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,"

"Sec. 137. The project for flood control in East St. Louis and Vicinity, Illinois, authorized by Section 204 of the Flood Control Act, approved October 27, 1965, is hereby modified to authorize the Secretary of the Army, acting through the Chief of Engineers, to construct the Blue Waters Ditch segment of the overall project independently of the other project segments. Prior to initiation of construction of the Blue Waters Ditch segment, appropriate non-Federal interests shall agree, in accordance with the provisions of section 221 of the Flood Control Act of 1970, to furnish non-Federal cooperation for such segment."

A reevaluation of the recommendations contained in the 1965 Report under current conditions was completed for the Blue Waters Ditch in 1976. The results showed that the Blue Waters Ditch portion of the authorized project was still economically justified with a benefit to cost ratio of 1.35 to 1. Blue Waters Ditch was completed in 1989 and includes 4.4 miles of new/improved drainage channels and a 600 c.f.s. pump station, which eliminates flooding from an estimated 700 acres of approximately 136,000 acres of the original project area.

A reevaluation of the recommendations contained in the 1965 Report under current conditions was completed for the Cahokia Canal and Harding Ditch Areas in 1984. This evaluation found the recommendations contained in the authorized project to not be economically justified under the existing interest rate at that time of 8 1/8 percent.
Major interior flooding in the study area resulted in four disaster declarations during the period 1993 to 1996. As a result, the 104th Congress, 2d Session provided funding via House Report 104-782, Appropriations for Energy and Water Development for the Fiscal Year Ending September 30, 1997, to initiate a reevaluation of the authorized project.

PURPOSE AND SCOPE OF STUDY

In broad terms, the purpose of this Study is to re-examine the Cahokia Canal and Harding Ditch areas of the authorized East St. Louis and Vicinity, Illinois Project under current conditions, existing authorities, and Executive Branch priorities with a view towards looking for new solutions to old problems. The principal goal is to identify potential improvements to the natural system for ecosystem restoration and to address related land and water resources problems and opportunities.

The Study follows the Corps' methodology for the reevaluation of a feasibility report. In general, the previous study information was examined and updated to current and future without project conditions. Additionally, an analysis of the pre-levee condition (ca. 1800) was made in order for a full array of ecosystem alternatives to be understood and explored that might best achieve study objectives.

Through a series of public and agency involvement activities, objectives for the ecosystem restoration project were identified and existing baseline data gathered for use in the formulation of alternatives and their analyses. As an outgrowth of utilizing existing Corps' policy guidance and extensive coordination among project partners, environmental restoration benefits were utilized to measure, evaluate and compare alternative plans through the application of an incremental cost analysis methodology. The Waterways Experiment Station’s (WES) Integrated Bio-Economic Planning System (IBEPS) was used in conjunction with the Institute for Water Resources' (IWR) method of cost effectiveness analysis for environmental planning. In addition to Corps' expertise, the Study Team included biologists from partnering agencies. They included representatives from: the U.S. Environmental Protection Agency, Region 5; the U.S. Fish and Wildlife Service, Region 3; the Natural Resources Conservation Service, Illinois; and the Illinois Department of Natural Resources. The Study Team was augmented throughout the reevaluation process by technical experts from respective resource agencies as needs arose.

Since a feasibility report normally does not include a significant level of detail and thus, includes an inherent level of uncertainty, the GRR documents the resultant uncertainties involved with plan selection and with the future tasks that will be needed to minimize these uncertainties. Engineering and real estate cost estimates have been based upon the analyses and assumptions made during the process of formulating and developing components of the recommended plan. Uncertainties in design details could impact future alternative analyses and subsequent design and cost estimates. As a result, the Study Team decided, in consultation with the Environmental Protection Agency and the U.S. Fish and Wildlife Service, that a Programmatic Environmental Impact Statement would be most appropriate for this report because of the size of the study area and complexity of ecosystem features. However, after review of the draft report, these agencies agreed that the level of information provided was able to satisfy the requirements for preparation of an Environmental Impact Statement. It was determined following this review that the project should follow a tiered evaluation approach to accomplish future NEPA requirements.

In order to clarify a potential area of confusion, the term "Study" in this report refers to the General Reevaluation Study as addressed in the more detailed "East St. Louis and Vicinity, Illinois Ecosystem Restoration and Flood Damage Reduction Project General Reevaluation Report with Integrated Environmental Impact Statement" mentioned above. The term "Project" refers to the congressionally authorized but un-constructed segments of the East St. Louis and Vicinity, Illinois Flood Protection Project (as amended) known as the Cahokia Canal and Harding Ditch Drainage Areas upon which the General Reevaluation Study is based.

RELATED PROJECTS AND STUDIES

Existing Authorized Project. The East St. Louis main line flood protection system, authorized by the Flood Control Act of 1936, has been essentially complete for many years. Its features are approximately 19.8 miles of levee/floodwall improvements including: 6.1 miles of reconstructed riverfront levee, 4.8 miles of upper flank levee; 4.9 miles of lower flank levee; 0.9 miles of new riverfront levee; and 3.1 miles of riverfront floodwall. Complementary appurtenant works consist of gravity drainage structures at highway crossings, alterations and reconstruction of existing pumping plants, construction of new pumping plants, servicing of access roads on the levee crown, seepage corrective measures, and alterations to railroad tracks and bridges at levee crossings. The project levee grade (52 feet on the Market Street gage) affords protection against a flood with a 500-year return period.

Prior Corps' Studies. In 1957, the Corps was authorized to study the engineering and economic feasibility of improvements to the interior flooding problem in the study area. Completion of the study and a recommended plan were documented in a Survey Report published in 1962. The Survey Report plan recommended 14 separate features: improvement of four channel systems; the construction of five bottomland detention areas; the construction of one upland reservoir on Little Canteen Creek; the use of two existing lakes for storage; the construction of one new channel; and, the construction of a new pump station for the Blue Waters Ditch area. The modification of the interior flood control system based on the 1962 Survey Report was authorized by the Flood Control Act of 1965 and had four major components: Blue Waters Ditch, Cahokia Low Water Dam, Harding Ditch drainage area, and the Cahokia Canal drainage area.

The Water Resources Development Act (WRDA) of 1976 modified the 1965 Act by authorizing construction of the Blue Waters Ditch segment of the overall project independently of the other project segments. The Blue Waters segment was constructed in the 1980s.

Major repair work was done on the Cahokia Low Water Dam after the 1993 flood. The success of the repair will likely preclude the need to replace the low water dam as was originally authorized. The Harding Ditch and Cahokia Canal segments, the subject of this reevaluation study, were studied in the 1980s and resulted in a revised unpublished draft report in 1985. The conclusion stated in the document was that there is no economic justification for these two segments. The recommendation in the report was for those segments to be reclassified as inactive. However, due to severe flooding in 1995 through 1997 on the Harding Ditch and Cahokia Canal segments, a new Congressional appropriation in 1997 initiated a re-start of a general reevaluation of the interior area.

Other Related Projects. Due to intense local interest, the State of Illinois became involved in the flooding problems of the Dobrey Slough area. Flooding in the Dobrey Slough area was a problem from both surface water and from a rising groundwater table. In 1974, the State provided a solution for the more frequent surface water flooding through the installation of a small pump station that discharged into the Nameoki Ditch system.

Next, during a Mississippi River flood event, which occurred in October 1986, a roller gate failed at the East St. Louis Pumping Station, resulting in river water backing into East St. Louis. This caused 1200 persons to be evacuated from their homes, and flood damages estimated at $35 million. This disaster helped focus attention on the need for rehabilitation of the very deteriorated flood protection system, and led to the authorization of the Corps' "East St. Louis Flood Protection Rehabilitation Project." The majority of the rehabilitation took place along the mainline Mississippi River protection, but channel rehabilitation in the bottoms was also an authorized purpose. Much of the work has been completed, however, relief well rehabilitation is currently under contract and cleanout of the upper portion of Canteen Creek is about to get underway. A supplemental report with additional rehabilitation items has been prepared.

Finally, after a large rainfall event in May 1995, significant interior flooding occurred throughout the bottoms area. This disaster reiterated the need to rehabilitate the deteriorated condition of the interior flood protection channels that were choked with vegetative growth and sediment. FEMA funded a $5 million cleanout of many of the major ditches in the bottoms. $4 million more has spent on rehabilitation of many of the major ditches under the Corps Rehabilitation Project.

Related Studies and Reports by Others. In 1950, the Illinois Department of Public Works and Buildings' Division of Waterways issued a report entitled, "Proposed Hillside Diversion Project, Madison and St. Clair Counties, Illinois." The report included a recommendation for a project that included a bluff-line diversion channel, floodway enlargements, pumping station improvements, and run-off impoundments within the bottoms area of their study area.

In 1970, the Illinois Department of Transportation's Division of Water Resource Management completed a draft report entitled, "Flood Control Project For East St. Louis and Vicinity, Illinois," which incorporated the most desirable features of the 1950 report and added to this earlier plan, a reservoir on Prairie Du Pont Creek at the bluff line and the proposed deepening and widening of the Prairie Du Pont Diversion Channel.

In November 1972, the Illinois Department of Transportation issued a report entitled "Request for Public Law 99 Assistance, Dobrey Slough Flood Water Conduit". This report proposed a floodwater conduit to reduce flooding in the Dobrey Slough area.

In August 1975, the Southwestern Illinois Metropolitan and Regional Planning Commission issued a report entitled "Plan for Major Drainage: The American Bottoms and Hillside Drainage Area Planning Basin". The report proposed alternatives for reducing stormwater flooding in both the Cahokia Canal and Harding Ditch watersheds.

In December 1978, the Illinois State Water Survey issued a report on the analysis of the inflow hydrology of Horseshoe Lake. The report describes the drainage history of the lake, its hydrologic modeling, inflow frequency analysis, and hydrologic budget.

In August 1986, Hurst-Rosche Engineers, Inc. completed a report commissioned by the Metro-East Sanitary District (MESD) to identify the scope of rehabilitation and improvements needed to restore the flood control facilities under MESD operational control. The MESD's commissioning of the report was prompted by the failure of the roller gate at the East St. Louis Pumping Station in October 1986. The Hurst-Rosche report was used as a starting point to get the Corps' involved in the rehabilitation of the project.

Between 1990 and 1995 the Natural Resource Conservation Service (NRCS) in Madison and St. Clair Counties completed 6 planning studies that were designed to address flooding and sedimentation caused by erosion in the project area. However, no projects resulted from these studies:

Little Canteen Creek/Harding Watershed, May 24, 1995
Big Canteen Creek Hydrologic Unit Resource Plan February 9, 1995
Schoolhouse Branch Watershed Resource Inventory and Alternative Evaluation, September 15, 1995
Long Lake Watershed Resource Inventory and Alternative Evaluation, July 25, 1995
Judy's/Burdick Branch Watershed Resource Inventory and Alternative Evaluation, September 1, 1995

RESOURCE SIGNIFICANCE IN STUDY AREA

Aquatic resources of national and regional significance are found in the Project area. They include aquatic features such as 2,000-acre Horseshoe Lake, over 6,000 acres of various wetlands on the Mississippi River's floodplain, and over 200 miles of streams in small tributary watersheds. The national and regional level of significance attributed to these resources comes from institutional and technical sources. Sources of significance for the Project area's aquatic resources are described below.

North American Waterfowl Management Plan. Because the study area's aquatic resources are within a waterfowl habitat area of major concern designated under the North American Waterfowl Management Plan, and within a joint venture area approved under the Plan, their institutional significance is recognized from both a national and international perspective. Additionally, the study area's aquatic resources exist within a priority or focus area designated in the Upper Mississippi River/Great Lakes Region Joint Venture Implementation Plan, which recognizes their institutional significance from a regional perspective. Based on technical recognition, Horseshoe Lake and surrounding wetlands are significant from a state perspective because they are important resources for migratory waterfowl in terms of connectivity. At the landscape level, the lake and its surrounding wetlands serve as an important link in a chain of habitats used by migratory waterfowl along the Mississippi flyway. Based on public recognition, Horseshoe Lake is locally significant because of the hunting opportunities it offers to the public, and because the Illinois Chapter of Ducks Unlimited, Inc., supports wetland enhancement opportunities at the lake.

Upper Mississippi River System Environmental Management Program. Because the study area's aquatic resources on the Mississippi River's floodplain are located within the floodplain of the Upper Mississippi River System, they can be recognized as part of a nationally significant ecosystem. Also, because these resources are within an area of the UMRS targeted for habitat restoration under the Upper Mississippi River Environmental Management Program, its natural resources can be recognized as institutionally significant from a regional perspective. In addition, floodplain prairies, hardwood forests, marshes, and deep backwaters within the study area can be recognized as technically significant from a regional perspective based on status and trends as described in the UMRS-EMP's recent Habitat Needs Assessment.

Clean Water Action Plan. The small watersheds within the Study area are designated as priority watersheds for restoration in Illinois under the Clean Water Action Plan and are recognized as institutionally significant from a national perspective.

Action Plan of the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force. Because the study area is located on the floodplain of the Mississippi River north of the Ohio River, it occurs in an area highlighted by the Action Plan of the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force as potentially important to contributing to the Action Plan's goals of reducing nitrogen loads to the Gulf of Mexico and improving waters within the river's basin. As such, the study area and its aquatic resources can be recognized as institutionally significant from a regional perspective.

Given the potential to implement one of the Action Plan's recommended actions in the study area, namely the restoration of floodplain wetlands, further significance is associated with the study area and its aquatic resources.

Conservation Initiatives for Bird Species of Concern. Aquatic resources within the Study area serve as migratory, wintering, or breeding habitat for 34 bird species of concern. The cause of concern is the species' declining population levels. The Study area's aquatic resources also support two Federally threatened species (a bird and a plant). The listing of certain migratory birds as species of concern by the U.S. Fish and Wildlife Service illustrates that the Federal government recognizes them as highly significant. Their institutional significance is further supported by various international agreements the Federal government has entered into with Canada, Mexico, and other countries to foster continental and regional bird conservation strategies. Technical significance is supported because aquatic habitats in the study area and along the Mississippi River also serve as habitat for these 34 bird species of concern as well as the two federally threatened species.

PRE-DEVELOPMENT STUDY AREA CONDITIONS

This section provides an overall characterization of the conditions that existed in the Project area about two hundred years ago (ca. 1800), prior to construction of the Mississippi River levee system and prior to drainage and development activities in the East St. Louis floodplain. The Project Team determined that it was important to understand how the ecosystem of the Project area functioned prior to recent human development in order to realize how the functioning of the natural ecosystem has been impacted by human activity. This information provides a key to guide potential ecosystem restoration.

Topography. Erosional and depositional forces have shaped the natural topography of the Project area over the last 7,000 years. The area has three main topographic areas: the relatively level alluvial flood plain of the Mississippi River; the upland bluff area of steep erodible slopes and narrow valleys; and the rolling hills of the uplands.

The Project area is primarily located within a portion of the Mississippi River floodplain known locally as the "American Bottom", and includes western portions of Madison and St. Clair Counties. The American Bottom extends beyond the Project area boundaries going farther north up to Alton and south into Monroe County near Dupo. The American Bottom covers approximately 175 square miles (112,000 acres). The area is approximately 30 miles long and 11 miles wide at its widest point. The topography in the floodplain is nearly level bottomland. The floodplain generally slopes to the south and drops in elevation approximately 0.5-foot per mile mirroring the Mississippi River surface profile. The floodplain typically exhibits river meander scars, abandoned channel oxbow lakes, low-relief ridges, and swales. The average elevation to the north near Alton is 415 feet above the National Geodetic Vertical Datum (NGVD) and to the south near Dupo is 405 feet NGVD. In the northern portion, there are terraces located along the foot of the bluff between East Alton and Roxana. The terraces are approximately 25 to 35 feet above the floodplain with elevations between 440 and 450 feet NGVD. The Project area north of Horseshoe Lake is typically higher than the adjacent floodplain with elevations between 420 and 435 feet NGVD.

The topography near the Illinois bluff on the eastern edge of the floodplain is generally higher than the adjacent floodplain with elevations between 435 and 465 feet NGVD. The bluff rises steeply between 150 to 200 feet above the floodplain. The bluff has a rather rugged topography with the drainage channels forming valleys with steep slopes. Beyond the bluff line the topography consists of rolling hills and valleys with elevations ranging between 500 and 600 feet NGVD.

System Hydrology/Watershed Characteristics. Two major rivers, the Mississippi and Missouri, carried drainage from major portions of the North American continent past St. Louis. The drainage area of the Mississippi River at St. Louis is nearly 700,000 square miles, and that of the Missouri River is about 530,000 square miles. Flooding from the Mississippi and Missouri Rivers frequently inundated large areas of the American Bottom.

Over 500 square miles of tributary or bluff watersheds drained into the study area in pre-settlement times (Figure 2, Table 1). Cahokia Creek was the major tributary watershed. Tributary streams emptied onto the bottoms. Drainage generally flowed toward the Mississippi River and was intercepted by swales, creeks, and major channels. The naturally flat topography in the bottoms was a major factor for the existence of wide meandering creeks and overland flows across the Project area. Abandoned river channels and swales held water that formed large lakes and wetlands. The natural channels had very little slope and were not efficient in moving surface water from either the bluff or the bottoms to reach the outlets to the Mississippi River.

Three distinct natural watersheds were present on the floodplain of the Mississippi River in the American Bottom. The Cahokia Creek watershed was larger than either the Wood River or Prairie du Pont watersheds. Figure 3 displays these three watersheds, along with streams and floodplain lakes.

Sediments were transported during predevelopment times into and out of the Mississippi River floodplain. Flows from the tributary streams carried eroded sediments from the uplands and bluffs onto the American Bottom. Where each tributary discharged onto the floodplain, a colluvial fan consisting of heavier sediments formed. Finer grained sediments were carried further out into the floodplain, and eventually dropped out in the meandering channels or on adjacent lands during overland (out-of banks) flows. Flood events from the Mississippi and Missouri Rivers also deposited alluvial materials on the floodplain. Large high-velocity flood events from these major rivers also periodically scoured out portions of the floodplain. A dynamic balance existed between aggradation (filling) due to sediment deposition and degradation (deepening) due to scouring. Although some low areas represented by lakes, sloughs, or wetlands filled up over time with sediments, new ones were created concurrently at other locations.

Figure 2 Historic Tributary Watersheds of the American Bottom

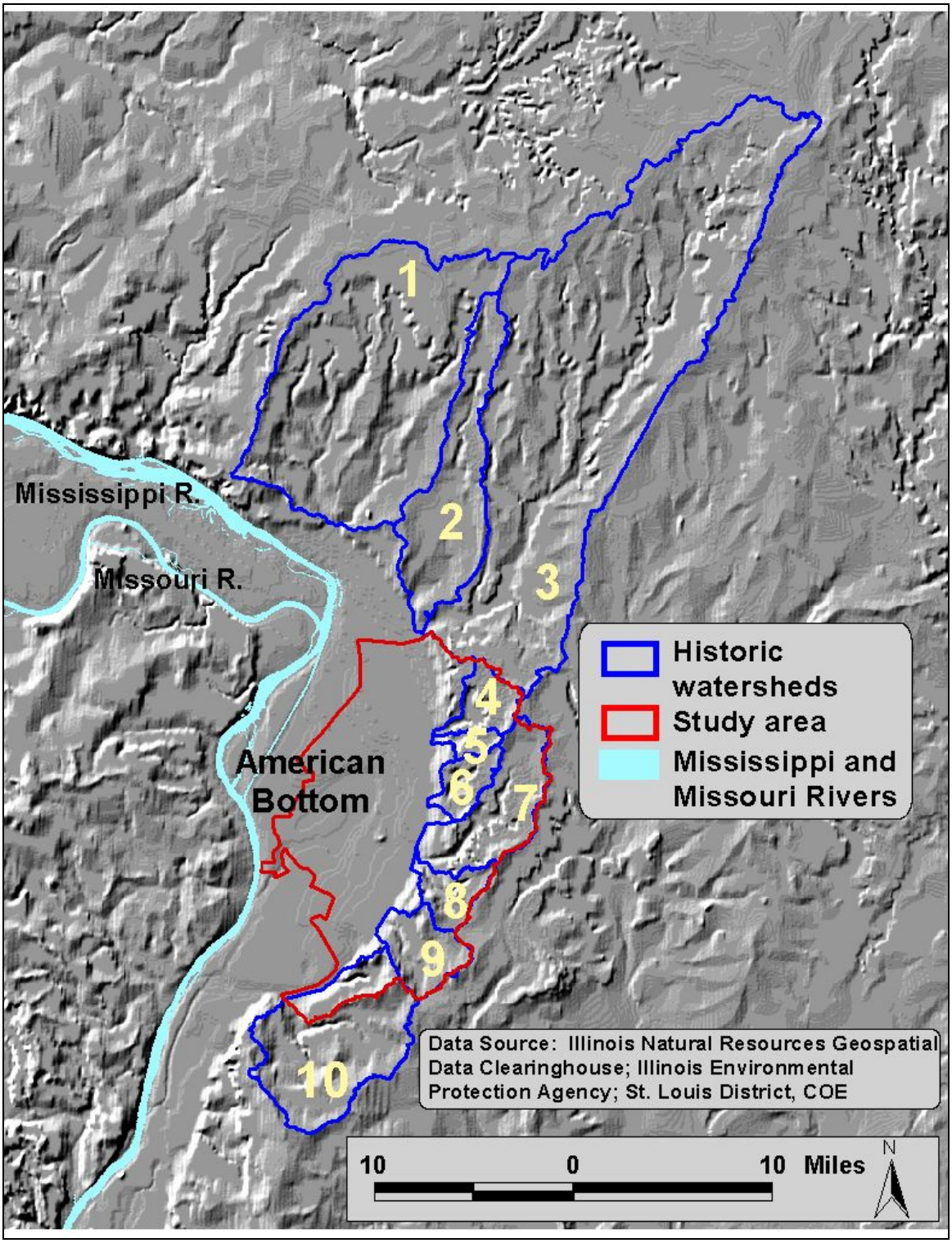
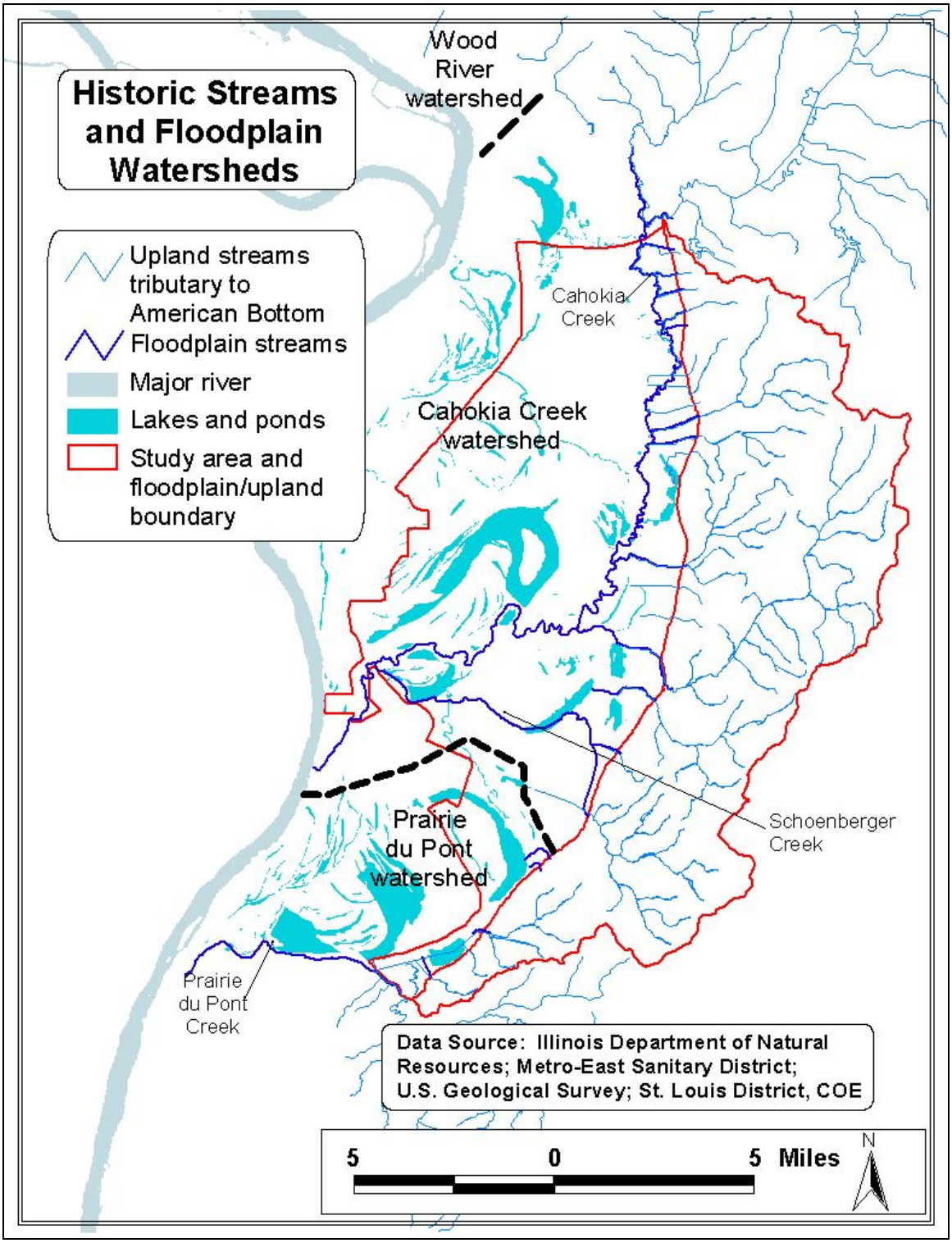


Table 1 Tributary Watersheds that Historically Drained into the American Bottom

Watershed number (Figure 2)	Name of Watershed	Area (sq. miles)	Percent of all watersheds
1	Wood River	121.4	23.8
2	Indian Creek	40.2	7.9
3	Cahokia Creek	217.0	42.6
	Bluff 1	4.5	0.9
4	Judy's Branch	8.5	1.7
5	Burdick Branch	2.9	0.6
	Bluff 2	1.0	0.2
6	Schoolhouse Branch	7.1	1.4
	Bluff 3	1.6	0.3
	Bluff 3/4	<0.1	<0.1
7	Canteen Creek	22.7	4.5
8	Little Canteen Creek	7.9	1.6
	Bluff 4	1.5	0.3
9	Schoenberger Creek	12.1	2.4
	Bluff 5	1.5	0.3
(10)	Powdermill Creek	1.3	0.3
(10)	Bluff 6	1.8	0.4
10	Prairie du Pont Creek (including Hickman Creek)	56.2	9.0
Total		509.4	100.0

Figure 3 Historic Streams and Floodplain Watersheds



Geomorphology. Locally, the Mississippi River is quite old, and probably was established during the Mesozoic Era, and at the very latest during the Tertiary Period of the Cenozoic Era. The Mississippi River maintained its course at the eastern edge of the Ozark Plateaus (uplift) and eroded a broad bedrock valley bottom ranging in elevations between 290 and 310 feet NGVD with an average elevation of 300 feet NGVD, some 300 feet below the surrounding uplands. The eastern bluff has exposed bedrock outcroppings consisting of hard limestone deposits and softer deposits of shale, coal, and some sandstone. The limestones were formed during the Mississippian Period and are located north of Alton, Illinois, and south of Dupo, Illinois. Between Alton and Dupo, soft Pennsylvanian Period shales, coals, and some sandstones extend westward into St. Louis, Missouri, much like a tongue. It is this tongue of weaker shales and coals that enabled the young Mississippi River to cut a wider floodplain (11 miles wide at its widest point), which it was unable to do either upstream and downstream through harder limestone deposits.

Physiography. The Project area is located in part in two geological provinces, Ozark Plateau on the west, and Central Lowlands on the east. The uplands are in the Springfield Till Plain of the Central Lowlands. The Springfield Till Plain was formed by Illinoisan glacial drift that formed a nearly level surface, except where stream dissection has taken place. Narrow flat-topped divides, V-shaped valleys, and slopes of up to 35 percent characterize the bluff. The area has a mean slope of eight degrees and an average local relief of 132 feet.

Stratigraphy. The geologic history of the Project area is divided into three main periods: (1) bedrock formations formed during the Paleozoic Era; (2) deposition of the unconsolidated glacial materials occurring during the Pleistocene Series; and (3) erosion and deposition of the unconsolidated materials occurring, and modern soils formed during the Recent Epoch. During the Paleozoic Era, the Project area, as well as most of the Midwest, was intermittently submerged beneath the sea. Responding to continental tectonic activity with continental plate movements in the nearby Ozark Plateaus and the more distant Appalachian Mountains to the east, the seas alternately advanced, depositing sedimentary rocks, and retreated from the area. This migration of seas brought periods of marine deposition, followed by times of erosion. These events are recorded in some 1,500 to 3,000 feet of sedimentary rocks, mostly limestone, shale and sandstone, which underlie the glacial and Recent Epoch aged sediments.

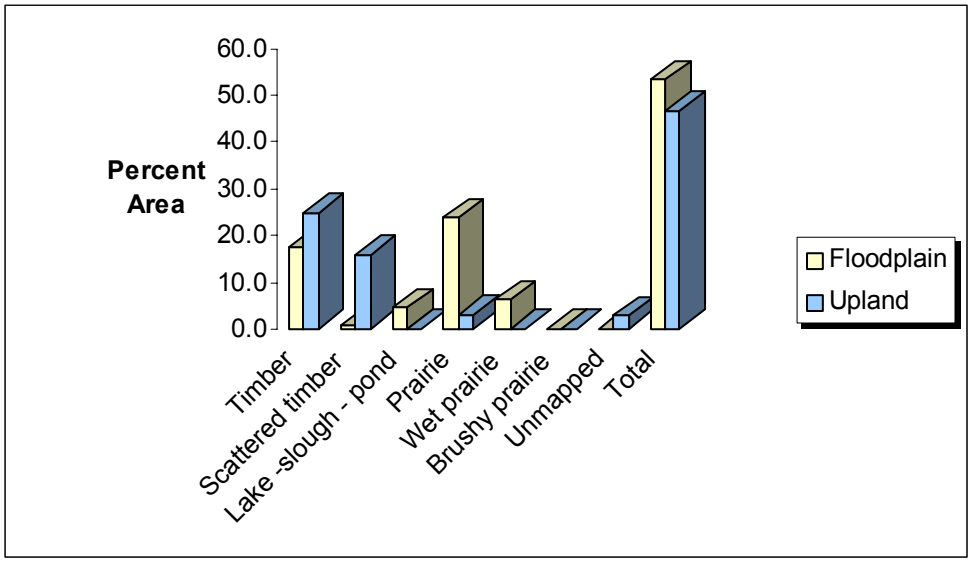
The upland areas of the Project area are covered with glacial till and outwash of sands, gravels, and silts that vary in thickness from zero to over one hundred feet. The Banner Formation of the Kansan Stage probably overlies much of the bedrock of the Project area. The extent and thickness of this formation is unknown.

The Recent Epoch generally is accepted to begin at the end of the last ice age, Wisconsinan Stage. It defines all deposits younger than the top of the Wisconsinan Stage and extends 7,000 years B.P. to the present. The upper portions of the surficial soils within the Project area were formed during the Holocene Stage. However, the lower portion of some of the surficial soil deposits were aggrading during the Wisconsinan Stage since as soon as the glaciers melted away, an assortment of soils were being deposited. In many areas the soils were intermixed, overlapped, and intertongued. The boundaries between Wisconsinan Stage and Recent Epoch deposits are blurred.

Ecological Conditions. Before Europeans settled the study area about 200 years ago, the Study area's ecosystem was vibrant and diverse. Water played a significant role in sustaining the ecosystem and its resources. Mississippi River floods, overflows from tributary streams, rainfall and local runoff all provided periodic disturbances in the form of flooding at various times of the year. These actions, coupled with the occurrence of fire, provided the natural system with the maintenance necessary to ensure its biological integrity. The historic dynamics that contributed to the functioning of the predevelopment ecosystem provide an insight into ways in which improvements can be made to reintroduce missing components, improve habitat quality and ecological function, and recreate a sustainable ecosystem.

Prairie and forest were the dominant forms of land cover during predevelopment times. Land cover of the historic ecosystem has been reconstructed using notes taken by General Land Office surveyors that worked in the area in the early 1800s to establish the public land survey system on the ground. Figure 4 is a map showing six types of land cover in the Project area. They include timber, scattered timber, lake-slough-pond, prairie, wet prairie, and brushy prairie. Nearly 60 percent of the Project area was forested while about 33 percent consisted of different kinds of prairie (Table 2). Aquatic areas, including lakes, sloughs and ponds, covered about five percent of the Project area. About two-thirds of all forest in the Project area occurred in the uplands. Over 90 percent of all kinds of prairie were in the floodplain. All of the lakes, sloughs, and ponds were in the bottoms. A large floodplain lake (called Horseshoe Lake today) comprised most of this water. Additionally, nearly all of the scattered timber was in the uplands, and all the wet and brushy prairies were in the bottoms.

Table 2 Predevelopment Land Cover in the Project area



A better understanding of historic plant and animal communities has been obtained by determining the kinds of natural communities that most likely existed, using the classification system recently developed by the Illinois Natural Area Inventory. Historic community classes included forest, prairie, wetland, lake and pond, stream, cultural, and possibly savanna (Table 2). About 25 kinds of natural communities probably were present in the study area, excluding cultural ones. At least a dozen different natural communities occurred in both the Mississippi River floodplain and tributary watersheds (uplands). The wetland, lake and pond, and stream community classes represent aquatic resources that were present, along with those natural communities in the forest and prairie community classes that occurred on hydric or wetland soils. In addition to marshes, shrub swamps, and ponds, there were variants of forests and prairies that were wetlands, and they are marked in Table 3 with an asterisk. The various kinds of natural communities were associated with differences in geomorphology, topography, and soils. Many of them were influenced by periodic disturbances in the form of flooding and wildfire.

Figure 4 Predevelopment Land Cover of the Study Area

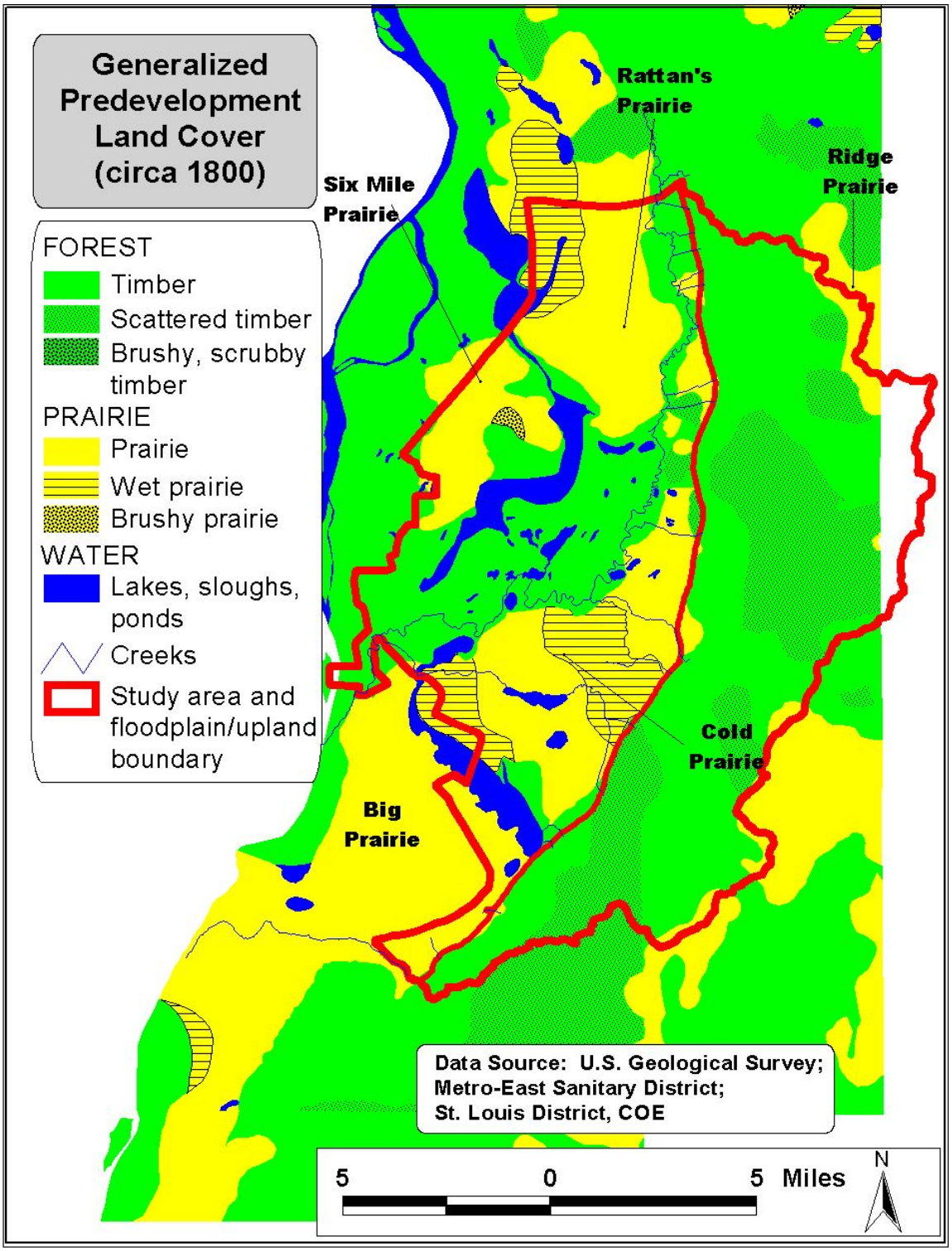


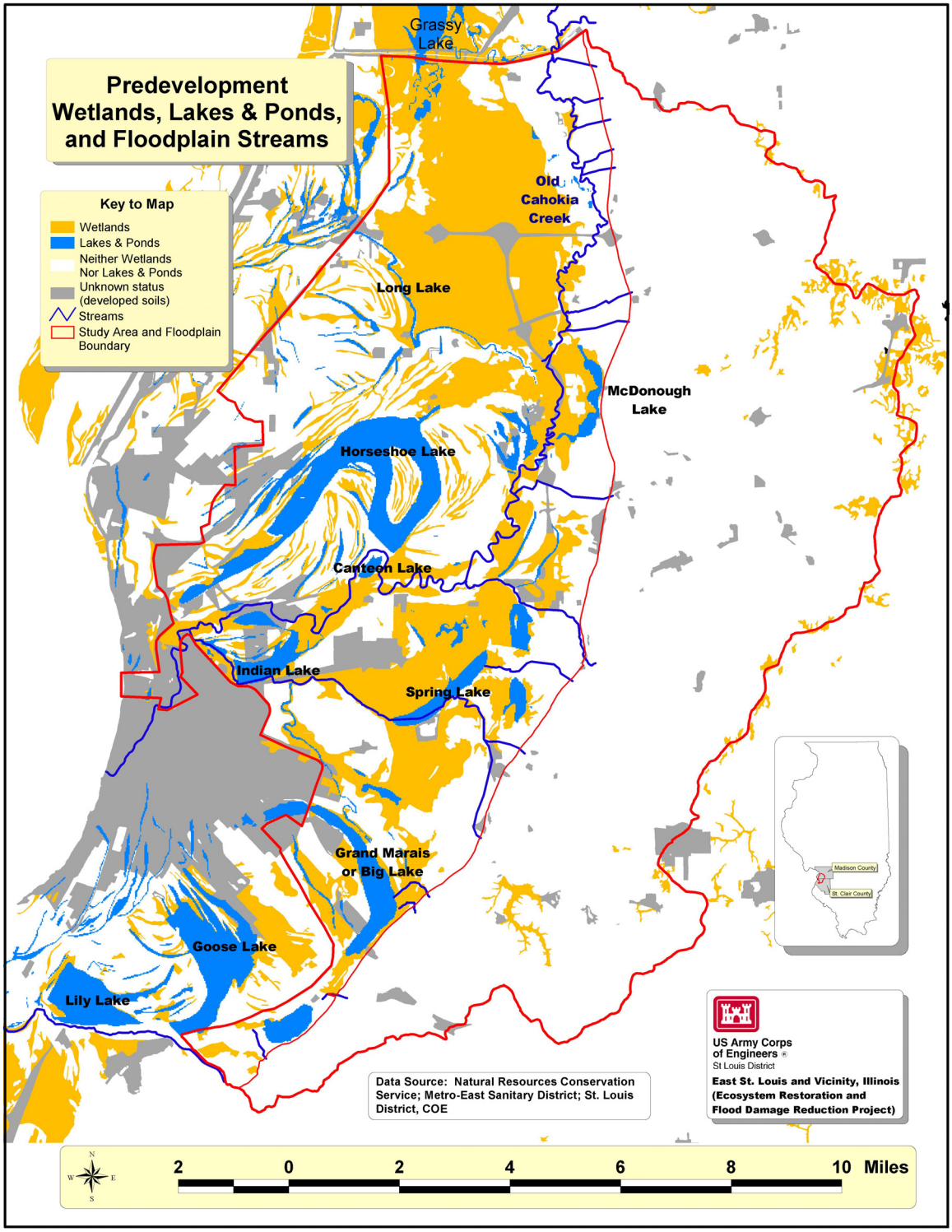
Table 3. Community Classes and Natural Communities of the Predevelopment Study Area (ca. 1800), using the Illinois Natural Areas Inventory Classification System. (1)

Community Class	**Natural Community (2)**	**Mississippi River floodplain**	**Adjacent tributary watersheds**
Forest	Dry upland forest		?
	Dry-mesic upland forest		√
	Mesic upland forest		√
	*Wet-mesic upland forest		√
	Mesic floodplain forest	√	√
	*Wet-mesic floodplain forest	√	√
	*Wet floodplain forest	√	?
	Mesic sand forest	√	
Prairie	Dry prairie		?
	Dry-mesic prairie		√
	Mesic prairie	√	√
	*Wet-mesic prairie	√	√
	*Wet prairie	√	?
	Mesic sand prairie	√	
	Loess hill prairie		√
Savanna	Dry-mesic savanna		?
	Mesic savanna		?
Wetland	*Marsh	√	
	*Shrub swamp	√	
Lake and Pond	*Pond	√	
	Lake	√	
Stream	High-gradient creek		√
	Medium-gradient creek		√
	Low-gradient creek	√	√
	Low-gradient river	√	
	Major river	√	
Cultural	Pastureland	?	?
	Successional land	?	?
	Developed land	?	?
	Cropland	?	?

(1) Questionable communities indicated by "?"
(2) Natural communities that are wetlands preceded by "*"

Wetlands were a significant component of the historic ecosystem. The spatial extent of presettlement wetlands is displayed in Figure 5. Wetland soils comprised nearly 23 percent of the Project area, as determined from digital modern soil surveys. About 95 percent of these wetland soils occurred in the floodplain. Two-thirds of the Project area was comprised of non-wetland soils, and nearly 66 percent of those occurred in the uplands. About 40 percent of the bottoms consisted of wetland soils, and another seven percent of water. In the uplands, nearly 95 percent consisted of nonwetland soils, roughly two percent of wetland soils, and about one percent of water.

Figure 5 Predevelopment Wetlands, Lakes & Ponds, and Floodplain Streams



Flora And Fauna. A high level of species diversity was characteristic of the Project area and its vicinity. The juxtaposition of two major landforms, floodplain and uplands, and the localized physical variations in each, created the setting for an abundance of life forms to exist.

"Mammals" included more than 45 species which lived in the area, including opossum, rabbit, and various shrews and moles, bats, rodents, carnivores, and ungulates (those with hoofs). They utilized all habitats, from forests, prairies, and herbaceous wetlands, to creeks and lakes. Other than a few bat species that migrated, they lived there year-round.

"Birds" included about 285 species that inhabited the Project area and environs. They belonged to many taxonomic groups, included the loons, grebes, pelicans and cormorants, egrets and herons, geese and ducks, hawks and falcons, gallinules, rails, shorebirds, gulls and terns, doves, parakeets, cuckoos, owls, nighthawks, swifts and hummingbirds, woodpeckers, and the diverse songbirds. Like mammals, they made use of all terrestrial, wetland, and aquatic habitats. Many bird species reproduced and stayed throughout the year. Others also raised young but then left before winter to migrate to warmer climates, returning the following year. Still other species passed through the area seasonally, on their way to distant breeding or wintering areas. The Mississippi River corridor was an important flyway for many migratory bird species.

"Fishes" included over 90 species that lived in the various creeks, rivers, ponds, and lakes in the Project area, including the Mississippi River. They were very diverse taxonomically, representing 24 families. Some species lived in the Mississippi River only, while others also used the adjacent standing waters on the floodplain. A few species were restricted to the small tributary streams. Many had broad ecological tolerances and inhabited tributary creeks, floodplain habitats, and the Mississippi River. During seasonal flooding, fishes were carried to aquatic areas on the floodplain, where some species spawned. Backwaters on the floodplain also served as winter refuges from cold, swift, main channel currents.

"Reptiles and Amphibians" included at least 65 species that occurred in the Project area. Reptiles consisted of various salamanders, toads, and frogs, and amphibians included a variety of turtles, lizards, and snakes. For these species as a whole, every habitat in the floodplain and uplands was exploited. Amphibians as a group needed some kind of aquatic habitat, such as a wetland, pond, lake, creek, or river, for breeding, yet the adults of many species also used nonaquatic areas, such as drier forests and prairies, for their other activities. Most turtles also required some type of aquatic habitat for survival. A number of lizards and snakes did not, and instead existed in terrestrial habitats such as forests and prairies. Some reptiles and amphibians made seasonal short-distance migrations between breeding habitats on the floodplain and drier habitats in the uplands.

"Plants" included a variety of vascular species that were found in the Project area. They included all the trees, shrubs, vines, forbs, grasses, and sedges. They formed the preponderance of vegetation that constituted the various natural communities described previously. Plants grew in all habitats, except for those places where either flowing or standing water prevented the establishment of either emergent or rooted floating water-tolerant species.

Ecosystem Disturbance Dynamics. A variety of natural disturbances, such as flooding, wildfire, drought and windstorms, occurred periodically during predevelopment times. Disturbances disrupt ecosystem, community, or population structure and change resources, substrate availability or the physical environment. Disturbances are important to some ecosystems, including those prone to flooding and fire because they are necessary in order to maintain biological growth and productivity. The flooding and wildfire disturbances that were common influences on the ecosystem around 1800 have been largely eliminated from today's environment.

Flooding Disturbances. Flooding varied on a continuum from small to very large, in terms of depth and duration. Because the watershed of the Mississippi River at St. Louis was so immense relative to the combined area of all the tributary watersheds that drained into the American Bottom, it was the primary source of flood pulses that inundated large portions of the floodplain. Flooding from the Mississippi River varied by season and from year to year. Floods could happen during any month, but they usually occurred in the spring (April-June) and fall (September-October). Springtime events were often higher and greater in duration. Low flow periods typically coincided with summer and winter. In many years, the Mississippi River rose and gently overflowed its banks, spreading out over the adjacent floodplain to a minor degree. On an infrequent basis it inundated much of the American Bottom.

Flood pulses are important to wetlands and other floodplain habitats for a variety of reasons. In riverine wetlands, they drive processes such as sediment deposition and nutrient transport. Flood pulses also serve as a temporary connection or link between the floodplain and river channel.

Wildfire Disturbances. Like flooding, wildfire also was a cyclical phenomenon during predevelopment times. Fires started naturally, as from lightning strikes, but they also were set by people, whether Native Americans or early settlers. When intentional, fire could be used to facilitate the hunting of wild animals, or to clear open areas under invasion from woody encroachment. Fires occurred any time of the year, depending on how dry conditions were, but were most prevalent in the fall and early winter.

Fire is important ecologically for maintaining the overall biological integrity of natural habitats adapted to it. In prairies and other herbaceous plant communities, fall or winter burning removed the build-up of dead aboveground plant parts such as leaves and stems, while underground root systems were protected and dormant until the next spring. Without periodic elimination of dead growth, the amount of each year's new growth would be reduced. Other effects of fire on prairie grasses include increased flowering, improved seed germination, and earlier emergence of new growth in the spring. Fire also suppressed the encroachment of trees into prairies. In forests, fire maintained plant species composition and diversity, and variably aged populations of trees. In all areas, nutrients bound in plant materials were released by fire to the soil as ash.

Ecosystem Function. The physical, chemical, and biological processes that occurred in the predevelopment ecosystem were necessary for self-maintenance, such as primary production, nutrient cycling, and decomposition. These processes reflected dynamics within the uplands, floodplain, and Mississippi River, and between these spatial entities. Seven functions described below serve as a foundation for understanding how wetlands were a vital component of the historic ecosystem. This knowledge can be applied in developing solutions to today's environmental and flooding problems and opportunities in the Project area.

Temporary Storage of Surface Water. In light of the flooding problems facing the Project area today, perhaps the most important wetland function intrinsic to the historic ecosystem was the ability to temporarily store floodwater. Due to properties such as width, slope, and roughness, riverine wetlands in the American Bottom routinely detained riverine overflow from the Mississippi River and adjacent tributary watersheds, and released it slowly back to the creeks and river. Aquatic areas (sloughs, lakes, ponds) associated with these riverine wetlands also received overbank floodwaters, and they performed this function. Likewise, nonwetland areas in the American Bottom that became inundated during the larger flood events also temporarily stored floodwater. Wetlands detaining overbank flows dissipate energy, and reduce the velocity of moving water. From a flood damage perspective, the capacity for erosion is reduced. Similarly, storage of riverine overflow in wetlands prolongs the passage of a flood event, and thereby reduces the peak discharge downstream.

Maintenance of Plant Community Characteristics. Another important wetland function was the maintenance of its own characteristic plant community, like that of forest, prairie, or marsh, which are distinct in terms of species composition and physical characteristics. Large areas of these various wetland plant communities existed in the American Bottom. They created much primary production in the form of plant biomass. The type of plant community affected other functions, such as wildlife habitat.

Provision of Wildlife Habitat. The various wetland plant communities served as habitat for many kinds of animals, ranging from macroinvertebrates to vertebrates. The composition and spatial complexity of the vegetation above ground affected the kinds of animals living there and their abundance. Forested wetlands exhibited vertical stratification (understory, subcanopy, overstory), and this structural complexity offered various opportunities for animals to find sites for shelter, nesting, breeding and foraging. Prairies and marshes had simpler structure, which offered opportunities for other species. At the landscape scale, the heterogeneity of wetland types in the American Bottom helped maintain higher levels of species diversity. The extensive spatial distribution of wetlands, and the linkages or connections that existed between different wetland types, facilitated the movement and dispersal of animals. Movements between wetlands, between wetlands and uplands, and between uplands (via relatively small, irregularly shaped wetlands) occurred, in addition to those between wetlands and aquatic areas. Nonwetland areas in the American Bottom also provided wildlife habitat.

Nutrient Cycling. Cycling of nutrients, a fundamental ecosystem function, consists of the abiotic and biotic processes that convert elements from one form to another; primarily recycling processes. In one process, nutrients are taken up from the soil in inorganic form by plants and transformed into organic forms during photosynthesis and growth. In another process, after the plant dies, these organic nutrients are converted back into inorganic form through microbial decomposition, for renewed uptake by plants. In ecological terms, the function is represented by net primary productivity and detritus turnover. Wetlands in the American Bottom performed this function. Nutrient cycling was also a fundamental process in nonwetland areas.

Removal of Elements and Compounds. Surface water can import natural nutrients (like nitrogen, phosphorus, or potassium), present-day contaminants (such as herbicides and pesticides), and other elements and compounds into wetlands. Once there, wetlands can permanently remove these materials from the water column, or immobilize them. The avenues by which they are removed or immobilized include sorption, sedimentation, denitrification, burial, decomposition to inactive forms, uptake and incorporation into long-standing woody and long-lived perennial herbaceous biomass, and similar process. Practical applications of this function are the current use of artificial or natural wetlands to "clean" partially treated wastewater or sewage effluent. As purifiers, wetlands improve the quality of water as it moves downstream. Wetlands in the American Bottom had performed this function, as did aquatic areas.

Particulate Retention. Floodplain wetlands naturally retain organic and inorganic particulates carried in by overbank floodwater. When moving floodwater enters a wetland, its velocity is reduced by the wetland's roughness and increased cross-sectional area. As velocity is reduced, the capacity of the water to carry suspended particulates is reduced, and particulates drop out of the water column and settle. Sedimentation is a common example of this physical process. Deposition of silt is often observed in wetlands after floodwaters recede. Sedimentation raises ground or substrate surface elevations, creates topographic variability, and augments nutrient levels; the accumulation of organic particulates supports decomposition, nutrient cycling, and detrital food webs. Wetlands and aquatic areas in the American Bottom naturally retained organic and inorganic particulates.

Organic Carbon Exportation. Organic carbon in the form of dead and live plant material is exported from wetlands by moving water. Carbon material is either dissolved or particulate. Dissolved forms include organic materials leached out of litter and surface soil during periods of surface inundation. Particulates include living biomass, leaf litter, and fine and coarse woody debris. Organic carbon is typically flushed out of riverine wetlands by overbank floodwater. Downstream aquatic areas usually receive this material. The microbial food web, which forms the base of the detrital food web in aquatic ecosystems, is fueled in large part by the energy in this organic carbon. Given their proximity to the Mississippi River and floodplain lakes and ponds, wetlands in the American Bottom would have been significant sources of organic carbon. Adjacent nonwetland areas on the floodplain would also have been sources of organic carbon, but their rates of carbon export are lower than those of wetlands.

EXISTING STUDY AREA CONDITIONS

Urbanization has had a profound impact on the Project area since pre-development days. The ecosystem has been significantly disturbed and the Project area's flooding patterns, which historically helped create, develop, and sustain habitat quality, have been significantly altered in order to minimize agricultural and structural damages.

Land Cover. The study area lies within the largest concentration of industrial, commercial, and residential land use on the Mississippi River floodplain north of New Orleans. As of the early 1990s, about 68 percent of the Project area consisted of urban/built-up, cropland, and grassland areas (Figure 6). The largely "natural" cover types - forested, wetland, and open water areas - made up the remaining 32 percent. Row crops comprised most cropland, and accounted for about 25 percent of the Project area. Figure 7 displays recent land cover.

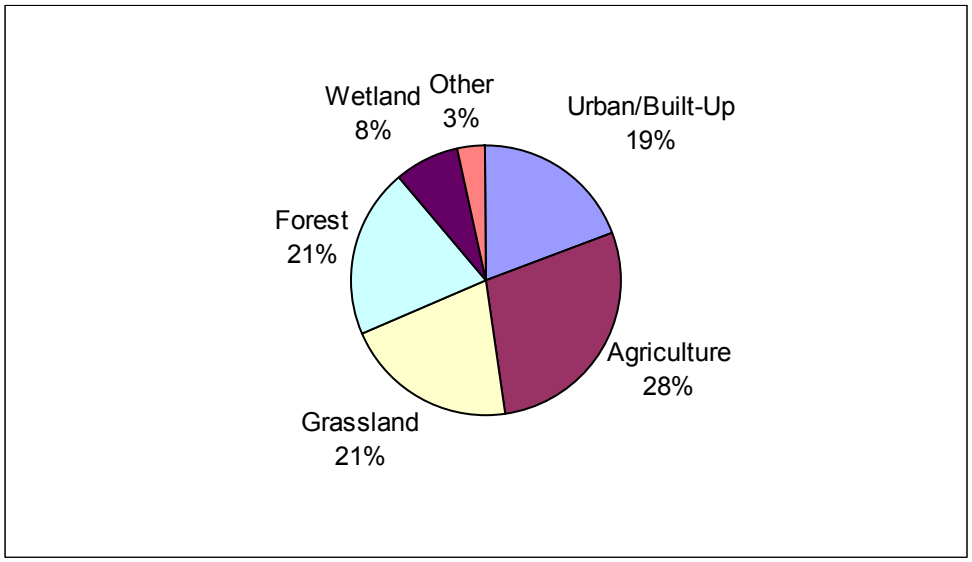
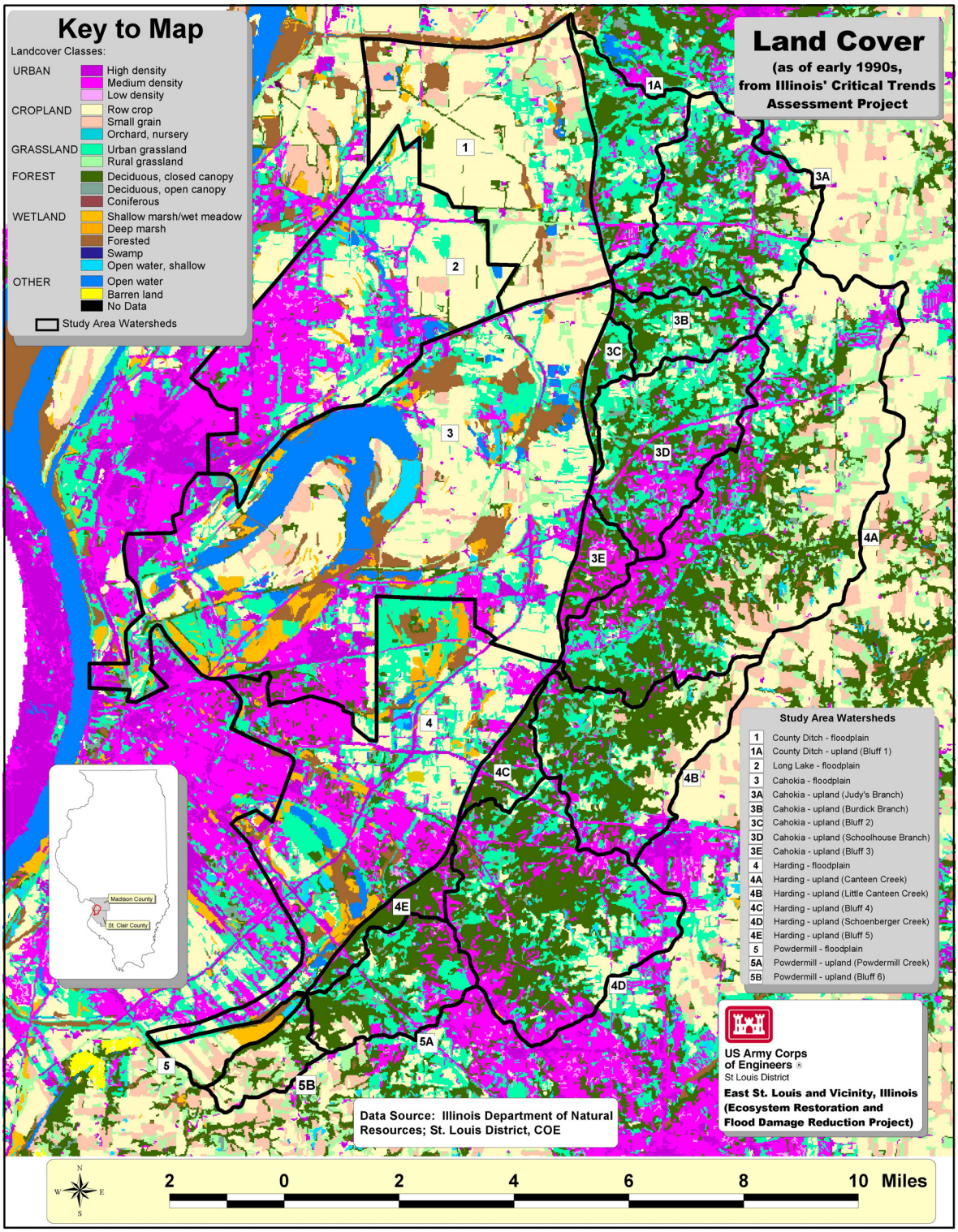


Figure 7 Land Cover Data for Project Area (early 1990s).



Topography. Existing topography has not substantially different from the pre-development period. Changes to topography on the floodplain since pre-settlement times are man made. The area is crisscrossed with railroad beds that form small levee systems across the surface of the area. Mine subsidence in the last 100 years has created some shallow surface depressions less than 5 feet deep east of the bluff line in the uplands.

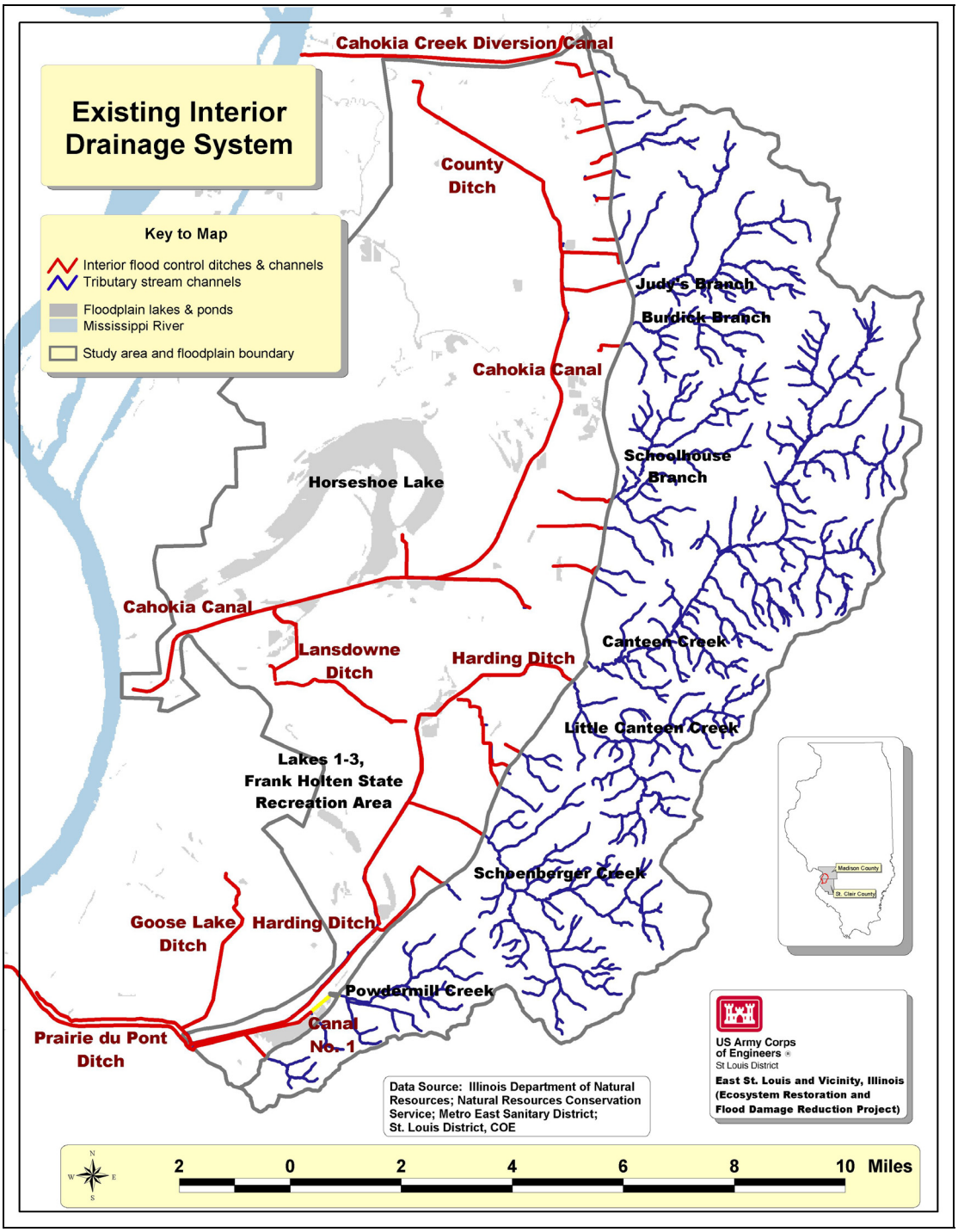
Drainage. By the 1800's, changes to topography from development of the railroad lines traversing the area had altered the natural drainage patterns of the area. Likewise, man-made levee systems designed to protect cropland from flooding changed the natural drainage. Later in the 1900's, as a result of increased development in the area, drainage districts were formed for the sole purpose of managing the drainage of the floodplain. By 1904, engineering plans were underway for the construction of a system of canals and drainage ditches designed to carry water as quickly and directly as possible to the River. The construction of this system eliminated the creek system that originally flowed across the Project area. By this time, a levee system had been constructed along the Mississippi River to protect the area from River flooding and in 1910, the tributary drainage area of Cahokia Creek was eliminated from the floodplain and diverted into a large diversion canal on the northern end of the Project area for the purpose of having the creek flow directly into the River. All flow was diverted into the Cahokia Creek Diversion Canal and levees were constructed along the northern boundary of the newly formed East Side Levee and Sanitary District. The Diversion Canal that is approximately 4.5 miles long flows directly west into the Mississippi River at Mile 195. The levee system continued to be improved and today an urban design (500-year) flood control system protects the Project area within the floodplain with large earthen levees and floodwalls. On the northern Project boundary, a levee is located on the left descending bank of the Cahokia Creek Diversion Canal and ties into the bluff west of Edwardsville. On the southern Project boundary, a levee is located on the right descending bank of the Prairie Du Pont Creek and ties into the bluff. While this mainline protection system has continually been improved over time, the original interior drainage canals and ditches remain as originally constructed in the early 1900's. The interior drainage system is shown in Figure 8.

The natural topography is still a major factor contributing to storm drainage and flooding problems within the Project area. The manmade drainage channels have very little slope and are not efficient in moving surface water from either the bluff or the bottoms to reach the outlets to the Mississippi River. Surface water moves slowly in the ditch system to the Mississippi River or remains in numerous natural depressions. Additionally, the carving up of the natural drainage areas by railroad and road embankments makes drainage of the floodplain areas even more difficult.

Surface drainage problems are made worse because groundwater has historically been very shallow in many areas within the floodplain. The combination of shallow groundwater and poor draining alluvial soils of alternating layers of clays, silts, and sands further promoted the need for the development of the extensive drainage system of levees and varying sizes of drainage ditches, channels, and canals. During the height of the industrial period to until the mid 20th century, the groundwater surface was generally lowered between 2 and 12 feet with localized reductions as a result of extensive ground water pumping in ten areas for industrial and municipal purposes.

When this pumping stopped, groundwater returned to its historical level and areas that were constructed with dry basements in the 1950's, suffer groundwater flooding today as a result of the cessation of groundwater pumping for industrial purposes.

Figure 8 Existing Interior Drainage System



Surficial Soils. The surficial alluvial soils that cover the American Bottom are related to their mode of river deposition. Glacial deposits from the Pleistocene Epoch underlie the alluvial soils. Five alluvial soil types are identified by their depositional fluvial geomorphic process: abandoned channel, backswamp, point bar, and chutes and bar deposits. The bluffs and uplands within the Project area are predominately glacial drift deposits and aeolian (wind deposited) loess deposits.

Geomorphology. The last major Mississippi River flood experienced by the American Bottom occurred in 1903. Construction of a levee system along the river following that flood event prevented Mississippi River overflow from inundating the American Bottom, and halted the historic depositional and scouring processes that periodically reworked the floodplain's surface. The deep loess mantle in the uplands is highly erodible, and development in the tributary watersheds has produced increased runoff, with higher peak flows due to the increased amount of impervious surfaces. As a result, the tributary stream channels have become unstable. These instabilities have adversely impacted floodplain drainage, as well as infrastructure and stream quality. Excessive levels of sediment are reaching the bottom. Sedimentation is occurring in the floodplain ditch and canal system, and in aquatic resources where storm water flows. For example, a delta of sediment has formed in Horseshoe Lake where storm water enters it from Cahokia Canal. With the scouring forces of the Mississippi River no longer present, sediments deposited by tributary streams cannot be carried out of the American Bottom. The result is a net gain of sediments accumulating in the bottoms.

Climate and Weather. Because of its central U.S. location, St. Louis feels the effects of warm moist air moving north from the Gulf of Mexico and the cold air masses moving south from Canada. The conflict along the frontal zones of these invading air masses provides a variety of weather conditions. Winters are brisk with temperatures dropping to zero or below generally only two or three days per year. Snowfall averages about 20 inches per season. Daily temperatures of 32 degrees or less occur less than 25 days per year, while temperatures of 90 degrees F or higher occur about 35-40 days a year. Temperatures exceeding 100 degrees F occur every other year generally, although some years may see 15 or more days with temperatures exceeding 100 degrees F. The prevailing wind direction is from the south for May through November and from the northwest for December through April.

Precipitation averages about 36 inches per year. The winter months are the driest while the months of May through July are the wettest. Rainfall can be severe at times with as much as eight inches of rain recorded in a 24-hour period in 1957. Thunderstorms occur between 40 and 50 days per year, with a few being severe, causing hail and damaging winds. Tornadoes have produced damage and loss of life in the St. Louis area.

An important condition affecting precipitation in the Project area of Madison and St. Clair counties in Illinois is the St. Louis urban effect. Studies by the Illinois State Water Survey have shown substantial increases in rainfall downwind of the City of St. Louis. The increases tend to be the largest in relatively heavy rainstorms and most pronounced in spring and summer when most of the large rainstorms occur. Frequency rainfall values for Madison and St. Clair Counties used in this Project have been adjusted to account for the St. Louis urban effect.

Air Quality. Air quality information was prepared under a cooperation agreement, by the USEPA Region 5. The Project area is located to the east of St. Louis, within the Metropolitan St. Louis Interstate Air Quality Control Region (AQCR). This AQCR covers part of Missouri and Illinois. Areas within the AQCR are further defined according to the attainment status of criteria pollutants. The Metropolitan St. Louis AQCR includes the Illinois counties of Madison, Monroe, and St. Clair, which are referred to as the Metro-East Nonattainment Area (IEPA, 1995). The Metro-East Nonattainment Area is a moderate nonattainment area for ozone. The Project area is in attainment for most of the criteria pollutants, sulfur dioxide, particulate matter, carbon monoxide, nitrogen dioxide, and lead. The area is "nonattainment" for the pollutant ozone and is classified as moderate. A portion of the area is also a "maintenance" area for particulate matter. The townships of Granite City and Nameoki are "maintenance" for PM10.

Noise. Noise is not considered to be an issue in the preparation of this General Re-evaluation Report.

Surface Water. Floodplain management has been a challenge for the inhabitants of the bottoms since the early 1900s when the push began in earnest to farm the rich land and develop for industry and commerce the area that sits on the river at the crossroads of the nation. With the diversion of Cahokia Creek and the construction of the Mississippi River levee system, the challenge of taking the remaining surface water from the bluffs to the river, while protecting the intermediate area from flooding, has yet to be met. As early as 1905, the problem of managing interior flooding was sited as being key to the future development of the area. By 1908, construction had begun on a canal system that was designed to manage this surface water as it traveled from the bluff to the river. The system instituted during this period is the same system that is in service today with only minor changes. Past urbanization of the area and climactic changes have increased significantly the peak volume this original system is now expected to contain.

The result is severe flooding across the bottoms when rainfall events of moderate intensity occur. At the bluff line a system of man made ditches and channels take the flows from tributary streams across the floodplain to the levee where the water enters the Mississippi River. When rainfall events exceed the capacity of this interior drainage system, whose size has not been altered since constructed, the water typically breaks out immediately downstream of the bluff line. They instead damage the urban and agricultural areas that hug the bluff line of the project area.

Floodplain Management. Floodplain management is divided among the four drainage districts on the floodplain that have responsibility for the operation and maintenance of the canal and ditch system as well as the pumping facilities associated with them. Additionally, the county for unincorporated areas and each municipality have responsibility for floodplain management within their area of responsibility. This management responsibility takes the form of ordinance enforcement and the issuance of permits for any disruptive activity (such as construction) that occurs within the drainage system, all within the context of the regulation of the federal flood insurance program.

The Federal and State Emergency Management Agencies also form a review and approval tier in the floodplain management process, as does the Corps of Engineers with its oversight responsibility for the Section 404 permit program. As in any urban setting where watersheds cross county and municipal boundaries, the effective management of the floodplain is a constant challenge. The formation of the Metro East Regional Stormwater Committee has been an attempt on the part of the floodplain communities to address these challenges. The Metro East Regional Storm Water Committee charter envisions a region in which properly managed storm water leads to a higher quality of life for the residents and better protection for the overall environment. With the implementation of Phase II Stormwater Regulations by the USEPA, both Madison and St. Clair Counties have pursued the establishment of ordnances and best management practices to address the problems associated with the increased stormwater runoff created by the addition of impermeable surfaces that come with urbanization.

Water Quality. The streams, lakes and river in the Project area have been assessed by the Illinois Environmental Projection Agency for a wide variety of water quality parameters over time. Because none of the streams, lakes or river segments is pristine, the causes of water quality impairment and the possible sources of impairment have been evaluated. Overall general causes of impairment in the Project area include the following: Priority Organic Contaminants; Metals Contaminants; Nutrient Enrichment (i.e., phosphorus, nitrogen, nitrates); Siltation; Organic Enrichment/Low Dissolved Oxygen; Habitat Alteration; Suspended Solids; Excessive Algae; and, Noxious Aquatic Plants. Detailed information concerning water quality conditions is in Appendix B of the main report.

The sources of impairment to water quality within the Project area vary widely from urban to industrial to agricultural. The following impairment sources are commonly found to be associated with most of the watersheds in the Project area: Agricultural Operations; Construction/Land Development/Commercialization/Urbanization; Urban/Stormwater Runoff; Hydrologic/Habitat Modification via Channelization; Land disposal/Septic Tanks and, Streambank Erosion.

Ecological and Natural Resources. Despite extensive local losses of various historic natural resources, and degradation of remaining resources, the Project area lies in a belt of existing "resource rich areas" strung along the Mississippi River in southwestern Illinois. "Resource rich areas" are relatively large areas in Illinois where current biologically significant resources are concentrated. Thirty such areas have been identified statewide. They were delineated and evaluated by the Illinois Natural History Survey as part of the Critical Trends Assessment Project and Ecosystems Program of the Illinois Department of Natural Resources. They often occur along the state's major streams and rivers. Two resource rich areas are found in the vicinity of the Project area. "Big Rivers" lies just north, and "Karst/Cave Area" overlaps partially with the Project area.

Forest. Estimates of forest losses in the Project area range from about 60 to 70 percent. This level of loss has occurred in both floodplain and upland areas. Similar losses of forest have occurred in Illinois at the state and county level. Loss of historic forest for the state is estimated to be about 63 percent, and about 58 percent and 67 percent for Madison and St. Clair Counties. All wet-mesic upland forest that occurred on the flat drainage divide in the headwater reaches of the Project area's tributary watersheds during pre-development times appears to be gone.

Prairie. The most striking loss in the Project area is the virtual disappearance of prairie. Roughly 35,000 acres of historic prairie have been reduced to about 33 acres, which are confined to the floodplain. This equates to an overall loss of about 99.9 percent. At least half of Madison and St. Clair Counties was once prairie and countywide losses are also at the same level. Of the eight types of prairie natural communities that were present historically, six have disappeared – two from the floodplain and four from the uplands.

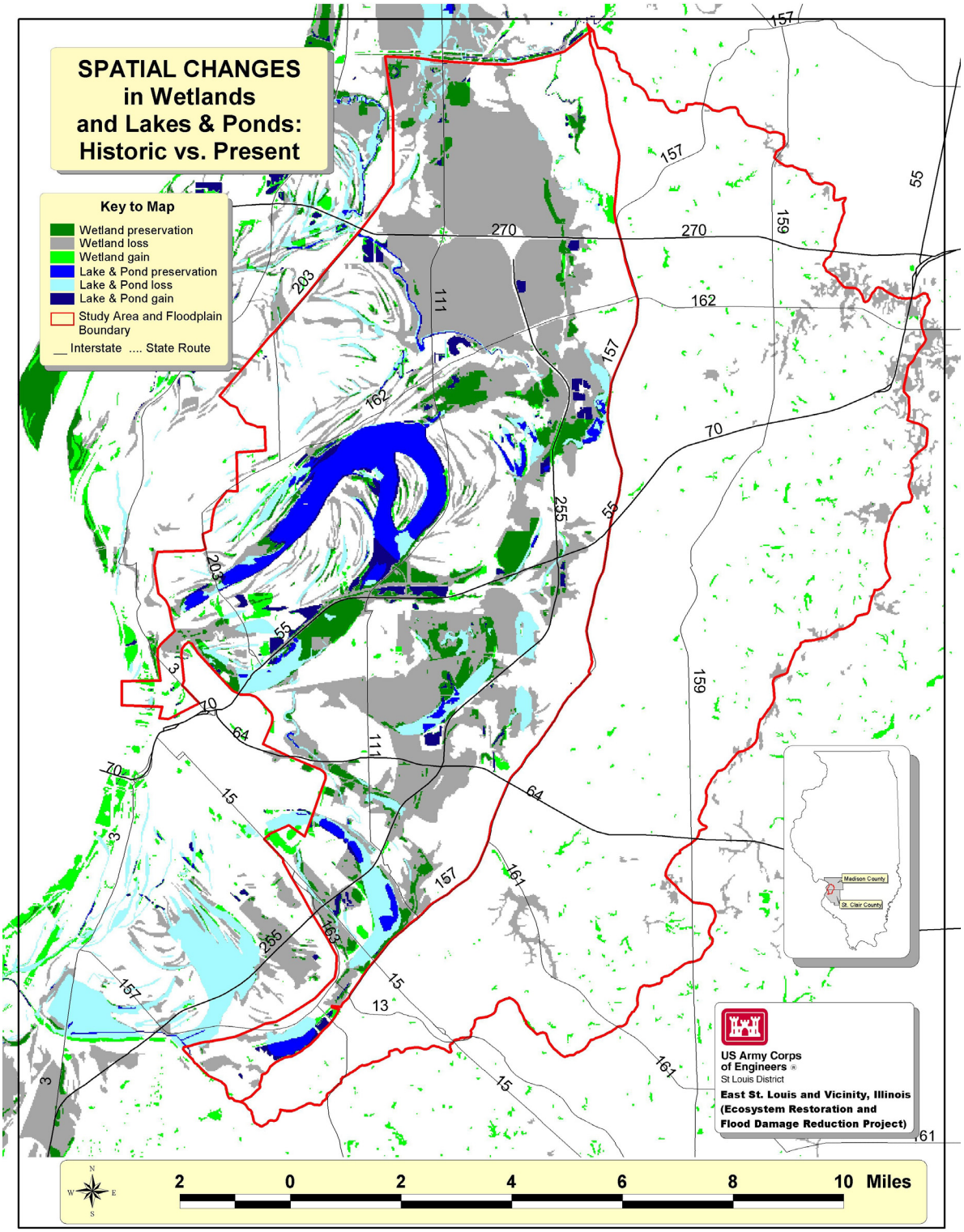
Savanna. Savanna is not currently known from the Project area. It is mentioned because it may have been present in predevelopment times in the uplands. If any remnants survived, they would have since changed into forest. Because periodic wildfires enabled this type of vegetation to persist in historical times, the suppression of wildfire that came with settlement caused vegetational changes in savanna. Tree density became greater and open savanna converted to closed forest. Other factors have led to the loss of savanna in addition to fire absence and destruction. These include fragmentation, degradation of the ground cover from intense grazing, and invasion by exotic plant species.

Wetland. Estimates of wetland losses in the Project area range from about 65 to 85 percent. For Madison and St. Clair Counties, estimates of wetland losses are 61 and 63 percent, respectively. Wetland diversity has declined because of the loss of three of ten historic wetland natural communities: wet-mesic upland forest and wet-mesic prairie in the uplands, and wet prairie in the floodplain. Wetland losses are displayed in Figure 9. Flooding from tributary streams caused by "out of bank" flows do not provide a beneficial disturbance to remaining wetland or other habitat resources, as they are too far removed from the bluff line to receive these flows.

Lake and Pond. Estimates of lake and pond loss range from about 35 to 50 percent in the Project area. Because lakes and ponds still occur in the Project area today, diversity of natural communities within this class has not been reduced. Losses of lakes and ponds due to development are shown in Figure 9.

Stream. The overall loss of all floodplain streams by length in the Project area is estimated to be about 66 percent. About 62 percent of the historic channel of Cahokia Creek in the Project area has been filled in for development or modified into ditches. The isolated remnants no longer convey flowing waters.

Figure 9 Losses of lakes and ponds due to development



Existing Species.

Plants. Roughly 1,000 plant species consisting of various trees, shrubs, vines, grasses, sedges, forbs, and ferns occur, or are likely to occur, in the Project area. About 18 percent of the Project area's flora, consisting of 173 species, is not native to Illinois. Exotic species occur in all kinds of natural communities, but, excluding cultural areas, are most prevalent in remnant prairies and savannas.

Invertebrates. Roughly 350 relatively common macroinvertebrate species consisting primarily of beetles, worms, water bugs, midges, caddisflies, mayflies, damselflies, dragonflies, damselflies, leeches, mosquitoes, clams, crayfish, mussels, and snails occur, or are likely to occur, in the Project area.

Fishes. The existing fish fauna is much reduced from what it was historically, and today has little relationship to the original fauna. Native species are wide-ranging, and are characteristic of habitats that have been heavily modified and subjected to considerable environmental fluctuations, such as in water temperature, flow, turbidity, and dissolved oxygen. Thirty-six species of fish have been collected since 1984 during fish surveys of channels and lakes within the Project area. Thirty-three species inhabit floodplain channels, and twenty-one species occur in lakes. None of the 36 species are federally or state protected. Three species, the gold fish, common carp, and grass carp, are exotic or non-native.

Reptiles and Amphibians. A total of 65 species of reptiles and amphibians occur or may occur in the Project area. Various kinds of salamanders and toads and frogs comprise the 22 amphibian species, of which 12 have documented occurrences. Forty-three species of reptiles include a number of turtles, lizards, and snakes; twenty-four of these species have been documented from the area. All species are native. None have been introduced. Reptiles and amphibians are found in all communities of the Project area. In cultural areas, such as cropland, pasture, successional field, developed land, and tree plantations, they are less diverse than in forest, prairie, wetland, creek and river, and lake and pond habitats. The alligator snapping turtle has become locally extinct. One species of frog and three species of snakes are either state or federally protected species.

Birds. Numerous species of birds occur regularly or occasionally in the Project area. There are 126 species that occur regularly. Birds are the most diverse group of vertebrates living in the Project area and consist of species from over 40 families. Herons, waterfowl, sandpipers, woodpeckers, flycatchers, swallows, warblers, sparrows, and blackbirds are bird families that are represented by numerous species. When bird species that occasionally use the Project area are added to those that are regular inhabitants, the total number of species increases to 288. Of the 288 species, one dove, one starling, one finch, and two sparrows are exotic or non-native.

Mammals. There are 41 mammal species that occur or are likely to occur in the Project area. The most diverse groups include the shrews and moles, bats, rodents, and carnivores. The remaining groups of mammals are represented by single species of opossum, rabbit, and deer. Twenty-five of the species have documented occurrences in the Project area.

Two species of bats are federally protected. Two species are not native, the Norway rat and house mouse. Mammals are found in all habitats of the Project area. Many species inhabit forest, including both upland forests as well as floodplain forests. Most species use a variety of habitats. About half use forests and prairies as well as nonwoody wetlands, such as marshes. Only two species are restricted to prairies and grasslands. Mammals found in cultural areas, such as cropland, pasture, successional field, developed land, and tree plantations, are rather diverse. Since settlement, a number of species have been extirpated from Illinois or on a regional basis within the state. Most of them are carnivores, and/or they require large home ranges.

Endangered and Threatened Species. Ten federally listed and 47 state-listed endangered and threatened species do occur or may occur within the Project area.

Federally-Listed Species. The U. S. Fish and Wildlife Service identified eight federally-listed species, and one candidate species for listing, that may be present in the Project area in a letter dated March 10, 1999 (see Appendix G of the main report). The piping plover (*Charadrius melodus*) has been added to this list by the Corps because it has been recently sighted within the Project area. In its letter, the USFWS indicated that no designated critical habitat exists within the Project area for any of these species. Similarly, there is no designated critical habitat for the piping plover. The potential or documented occurrences of federally-listed species in the Project area are discussed in a biological assessment included in Appendix B of the main report. In Illinois, these ten federally-listed species are also state-listed species. The bald eagle and decurrent false aster are known to occur in the project area.

State-Listed Species. The potential or documented occurrences of state-endangered species in the Project area are discussed in a biological assessment included in Appendix B of the main report.

Natural Areas, Natural Preserves and Endangered Species Sites. The Project area includes ten examples of natural areas, nature preserves, or endangered species sites.

Natural Areas – Bohm Woods (5 acres, dry mesic and mesic upland forest); Poag Railroad Prairie (33 acres, mesic sand and wet mesic prairie); Levee Lake (230 acres, pond shrub swamp, and marsh)

Nature Preserves – William & Emma Bohm Memorial (7 acres, dry mesic and mesic upland forest)

Endangered Species Sites – Chouteau Catchfly Site (2 acres, royal catchfly); Poag Railroad Prairie (33 acres, spring ladies' tresses); Precision Habitat (475 acres, Illinois chorus frog); Eagle Park Marsh (105 acres, common moorhen, pied-billed grebe, yellow-headed blackbird); Fairmont City Site (38 acres, decurrent false aster); East St. Louis (Alorton) Heron Colony (2 acres, snowy egret, little blue heron, black crowned night-heron).

Cultural Resources. The American Bottom portion of the Project area is arguably the richest, most complex, archaeological region in all of North America. Native American occupation of the Project area began at least 12,000 years ago and continued up until the early nineteenth century when the last groups of Native Americans were displaced from the area by ever-increasing numbers of Euro-American settlers. The crown jewel of this archaeological legacy is the Cahokia Mounds World Heritage Site, located near the center of the Project area. Eight centuries ago this site covered 5 square miles of the Mississippi River floodplain and was, in turn, surrounded by hundreds of supporting communities. These settlements ranged in size from large towns and villages to individual farmsteads. Even today, more than six centuries after the last of these prehistoric residents of the Central Mississippi River valley mysteriously abandoned the area, fragments of their discarded tools are commonly observed throughout the Project area by the trained eye of archaeologists.

The cultural value of these prehistoric remains to the Nation was recognized but not well protected until well into the twentieth century. By then, the remains of many of these sites had been significantly damaged, or destroyed. The preponderance of professional archaeological investigations conducted within the project area during the late twentieth century was administered by the Illinois Department of Transportation. For the most part these investigations were associated with interstate highway construction - the largest of those being Interstate 255. The right-of-way for this highway traverses the entire length of the American Bottom portion of the East St. Louis Ecosystem Restoration Project area. Scores of archaeological remains, some deeply buried and dating back more than 4000 years, were identified and excavated in advance of construction related to that project.

Only a small portion of the American Bottom has been systematically surveyed for the presence of archaeological remains. Therefore, it is impossible to reliably estimate the number of archaeological sites that have been lost as a result of commercial and residential development. However, it is safe to assume that the number is large. The scientific value (and corresponding loss to the Nation) of the information once contained in these destroyed archaeological sites is incalculable. Present-day land use within the areas being considered for potential ecosystem restoration includes agricultural fields, former residential and commercial tracts, lakes / sloughs, and public land. The preservation and enhancement of significant archaeological remains within these contexts is a priority of this Project.

Outdoor Recreational Resources. The voters of Madison and St. Clair Counties approved a metropolitan park and recreation district in November of 2000. The objectives of this park district, which will be supported by tax revenues, are to preserve natural lands adjacent to waterways, filter pollutants and protect wildlife habitat, provide safe places for families and children to play by repairing worn equipment and improving maintenance in existing parks, create trails and paths for walking, biking and other compatible uses, create new parks in newer communities, and, provide expanded disabled and public access to recreational areas. Within the Project area, the State of Illinois owns and maintains Horseshoe Lake State Recreation Area, Cahokia Mounds State Historic and World Heritage Site, and Frank Holten State Park. The two parks are managed for both recreational activities and as wildlife management areas. Horseshoe Lake provides seasonal duck hunting opportunities within sight of the Arch.

While there are fishing opportunities, they are limited for consumption purposes because of existing contamination. Likewise, the interior drainage canal and borrow sites along the I-55/I-70 highway route provide informal fishing opportunities. Frank Holten provides a more urban recreational experience with the inclusion of an 18-hole golf course while Horseshoe Lake provides both primitive and supported overnight campsite facilities. Within the local communities there are small city parks as well as school and neighborhood recreational areas that support those living in the immediate vicinity with basic recreational facilities.

Aesthetics. The Project area's aesthetic (visual) characteristics run the gamut from less attractive, heavily urbanized/heavy industrial sites to natural areas with pristine-like qualities. The landscape exhibits a wide variety of visual stimuli, including upland and bottomland forests, lakes, rivers, canals, marshes, ponds, small and large cities, farmland, and parks. The topographic features include remarkably flat expanses of bottomlands as well as bluff areas in the uplands. Man-made features abound in the form of flood control structures, interstates, highways, roads, utility structures, communication facilities, buildings, signs, billboards, and many other things normally associated with a heavily urbanized area. Unique to this area is the ancient man-made Cahokia Mounds World Heritage Site, and Monks Mound, its primary feature, can be seen from a distance. Also prominent is the highly visible St. Louis Gateway Arch located just across the Mississippi River.

Hazardous, Toxic and Radioactive Waste. Over 80 hazardous waste sites have been identified in the vicinity of the Project area through the Superfund program. Many of the sites are related to former industrial or landfill operations. These sites fall into four Superfund categories. First, there are 29 CERCLIS sites at which clean up is being considered, and they are listed in the U.S. EPA's Comprehensive Environmental Response, Compensation, and Liability Information System. Secondly, two sites are on EPA's National Priorities List, and involve long-term remedial response actions. Thirdly, two sites have been proposed for inclusion on the NPL. Lastly, 49 sites have been archived. Archived sites include those for which an assessment has been completed and EPA has determined no steps will be taken to designate the site as a priority by listing it on the NPL, and no further remedial action is planned under the Superfund Program. Thirteen hazardous waste sites occur within the Project area. Of these, six occur in Madison County and seven in St. Clair County. Nine are CERCLIS sites, and four are archived sites. None of the sites in the Project area are NPL sites or proposed for listing on the NPL. Most sites are outside the Project area to the southwest, in the vicinity of East St. Louis and Sauget.

FUTURE WITHOUT PROJECT STUDY AREA CONDITIONS

The future without project condition describes selected characteristics within the Project area over the next 50 years if no action is taken. The Federal regulations implementing the National Environmental Policy Act of 1969 require that the no action plan be considered as an alternative in assessing the potential effects of all Federal actions.

Climate and Weather. No significant climatological changes are expected to occur over the 50-year planning period used for this Project.

Ecological Resources.

Forest. The amount of forest in the Project area has declined significantly since presettlement times. This trend is expected to continue. Given the projections for greater population growth in the Bluff Corridor, the rate of forest loss in tributary watersheds is expected to substantially exceed that on the floodplain in the American Bottom Corridor.

Forest in Tributary Watersheds. Future rates of upland forest loss are expected to vary by major watershed. The two central watersheds, Cahokia and Harding, are expected to show considerably greater rates of loss than the two peripheral watersheds to the north and south. The two central watersheds, Cahokia and Harding, are expected to show considerably greater rates of loss than the two peripheral watersheds to the north and south. Remaining forest is expected to be concentrated on the steepest slopes of upland ravines and along narrow creek bottoms.

Ecological Problems of Forest in Tributary Watersheds. Upland forests in the Project area are expected to exhibit further loss of ecological integrity due to additional fragmentation, habitat degradation, introduction of exotic species, and a continued absence of fire.

Wildlife Habitat of Forest in Tributary Watersheds. Wildlife species diversity in shrinking areas of upland forest is expected to decrease and remaining species are expected to consist mainly of those adapted to human disturbances and suburban/urban conditions. Compared to mammals, reptiles and amphibians, the decline in bird species diversity is expected to be high, especially among breeding species.

Forest in the Bottoms. The rate of loss for forested wetlands in the bottoms over the 50-year project life was assumed to be 25 percent on privately owned lands and no loss on publicly owned lands. Forecasted rates of loss for forested wetlands and forested non-wetlands in the bottoms do not reflect any future implementation of tree preservation or "green space" requirements on development by local government.

Ecological Problems of Forest in the Bottoms. Additional fragmentation and habitat degradation caused by sedimentation and the introduction of exotic species are expected to lead to further loss of ecological integrity in bottomland forests. In addition, forested wetlands will continue to exhibit hydrological regimes that depart from natural conditions either because changes in hydrology have resulted in stabilized water levels, or timing of floods have shifted, either of which may depart too drastically from any natural cycle to permit an adapted forest community to remain or develop on a site.

Wildlife Habitat of Forest in the Bottoms. Wildlife species diversity of bottomland forests is expected to decline with decreasing area of forest. However, because most forested non-wetland is already extremely fragmented, this effect should be most noticeable in forested wetlands.

Prairie. Given that most prairies in the Project area are on public lands (and consist of restorations), the amount of prairie in the future is expected to remain relatively constant. There are no known plans for future restorations of prairie on public lands.

Ecological Problems of Prairie. The only known remnant of natural prairie in the Project area is expected to experience further fragmentation. Continuing invasion by exotic species and habitat degradation related to railroad maintenance is expected. Unless additional plant species are added, most existing areas of prairie restorations will continue to show little floristic similarity to historic prairies because of their low plant species diversity.

Wildlife Habitat of Prairie. Existing restorations will continue to be too small to attract many species of area sensitive grassland-adapted animals, including breeding birds. Although these areas of prairie may not decline in extent, anticipated development in their vicinity is expected to cause a small decline in diversity of species using them as habitat.

Wetlands. Wetlands occurring on private lands are expected to decline in area by 25 percent over the 50-year project life whereas no loss is anticipated for those found in public areas. This assumption applies equally to all kinds of wetlands - forested wetlands, marshes, and scrub-shrub.

Ecological Problems of Wetland. Continuing problems in marshes and scrub-shrub swamps include altered hydrologic regimes, addition of sediments and agricultural chemicals or urban runoff, encroachment by exotic plant species, and disturbance-tolerant native plant species dominating the local plant community. Continuing ecological problems associated with forested wetlands are discussed above and those associated with ponds are given below.

Wildlife Habitat of Wetland. Wildlife species diversity of marshes and scrub-shrub swamps is expected to decline to a small degree because of decreasing area of these habitats as well as increasing development surrounding wetlands. A decline of wetlands in the Project area, either forested or herbaceous, is expected to adversely affect numerous listed birds and some other species. Fewer nesting or feeding opportunities would be available to as many as twenty-one listed bird species known or likely to occur in the Project area. Among other listed species, the Illinois chorus frog, Indiana bat, and decurrent false aster would also be potentially adversely affected.

Functional Capacity of Wetlands. Sources of hydrology driving existing wetland functions are not expected to change in the future. Overbank flooding from the Mississippi River will continue to be excluded from the Project area and overflow from tributary streams will remain confined to floodplain channels of the interior flood control system under normal circumstances. On occasions when storms in tributary watersheds overtop the floodplain flood control system, overflow into adjacent wetlands is expected to continue occurring in a random manner with respect to location and season. Consequently, flooding in wetlands historically adapted to riverine overflows is expected to continue to come primarily from direct rainfall and local runoff.

Lake and Pond. Future development in the Project area was not assumed to affect lakes and ponds directly. However, lakes and ponds receiving regular inputs of stormwater from the interior flood control system were assumed to decrease in surface area by 1.5 percent every 10 years, or a total of 7.5 percent during the 50-year project life. Reduction in area was expected because of the accumulation of sediment carried by stormwater originating from tributary streams. Lakes and ponds remaining constant in area were assumed to be those that are relatively isolated from stormwater carried by the interior flood control system.

Examples of waterbodies experiencing future losses in surface area include Horseshoe Lake and Grand Marais Lake (lake 3) at Frank Holten State Recreation Area.

Ecological Problems of Lake and Pond. Ongoing siltation and habitat degradation will continue to cause problems at lakes and ponds. Not only does siltation cause loss of surface area, but it also causes a gradual decrease in average water depth. Since many natural lakes are only several feet deep, decreasing water depths may at some point threaten fish populations during periods of drought when water levels are low. Local watersheds carrying runoff into lakes and ponds are expected to become less agricultural and more urbanized. Major pollutants in storm water are expected to shift from agricultural chemicals to transportation related pollutants such as oil, antifreeze, and gasoline. An overall lack of natural aquatic and emergent plant growth in these water bodies, the presence of fish species such as carp that uproot such plants, summer algal blooms that can cause fish mortality, and a general lack of habitat structure are problems that will continue to affect lakes and ponds.

Wildlife Habitat of Lake and Pond. Expected reductions in surface area of some lakes and ponds and continuing ecological problems probably will lead to small reductions in diversity of animal species using these communities as habitat. Increasing urbanization surrounding lakes and ponds is anticipated to also contribute to this effect.

Streams. The area or extent of floodplain streams has been assumed to remain constant in the future. Periodic maintenance of the floodplain's interior flood control system, including cleanout of ditches and canals that carry storm water, is expected to maintain existing channel dimensions. Future development in the tributary watersheds is expected to directly affect headwater reaches of many tributaries, but not downstream reaches. In order to maximize the amount of developable land in the uplands, headwater streams are expected to be lost by either channelization or replacement by underground pipe over which fill material would be placed. Additional channelization of floodplain streams is unlikely in the future.

Ecological Problems of Streams. Floodplain channels will continue to be affected by the lack of riparian vegetation, transport of sediment into channels, inflows of agricultural and urban runoff, and encroachment by exotic plant species, such as Japanese hops. In the uplands, additional urbanization is expected to continue encroaching upon streams and their adjacent floodplains. Existing instability of stream banks and channel bottoms is expected to continue and become more widespread as additional stream reaches are indirectly impacted by adjacent development. Sediments and polluted runoff entering tributary streams are expected to continue.

Wildlife Habitat of Streams. Expected adverse changes in physical and chemical characteristics of streams are expected to be greater in tributary watersheds than on the floodplain. Consequently, the capacity of tributary streams to serve as habitat for fish and other wildlife is expected to decline to a greater degree than that of floodplain channels.

Cultural. Due to anticipated development, new cultural habitats consisting of residential, commercial, and industrial areas will arise from future losses of forests, prairies, and various wetlands. Similarly, these kinds of cultural habitats will come from future losses of agricultural land. To conduct the habitat assessment for this Project, the interagency biology team assumed that 75 percent of existing floodplain agricultural areas would be developed in 50 years. Therefore, the ongoing shift in cultural habitats, from agricultural to suburban and urban, is expected to continue.

Wildlife Habitat of Cultural Areas. Over the next 50 years, wildlife species using cultural habitats in the Project area are expected to gradually shift in composition from a mixture of agricultural and suburban-urban species to mainly suburban-urban species. The overall number of species is expected to decline.

Water Quality. The surface water quality within the project area has a wide variety of impairments with causes originating from agricultural uses, urban-runoff, stream bank erosion, point source discharges (industrial and public/private treatment works) and land development. New stormwater ordnances and attention by the counties to EPA Phase II regulations can address future problems. However, the degradation that has begun from past practices in the tributary streams will not be fixed without direct intervention. If action is not taken in tributary streams they will continue to experience increasing destabilization of stream banks and put heavier sediment loads into the system and further degrade their quality. The general trend in population and commercialization/industrialization is increasing within the project area. Based upon the increasing trend the surface water quality would most likely have additional impairment loads placed upon it over time. The surface water quality would degrade with an increased impairment load. Downstream receiving water would then have an increased impairment load which decreases water quality within those regions. The degrading water quality condition, with time, within the project area would result in a decreased amount of possible designated uses.

Physical Facilities and Operations. The current capacity of the interior ditching system in the Bottoms area has been re-established through the recent channel cleanouts that were performed using either Corps of Engineers' Rehabilitation funding or FEMA funding. These cleanouts occurred after the 1995 through 1997 flooding. Under the future without project condition, continued sedimentation in the Bottom's channels and degradation of the bluff stream channels is expected. Any loss of channel capacity as a result of inadequate maintenance will reduce future flood protection. Degradation of bluff stream channels will continue to adversely impact existing infrastructure. It is assumed that the channel cross-sections attained after the recent Corps of Engineers' and FEMA cleanouts will be maintained by MESD or other responsible parties thereby continuing an expensive operation and maintenance program in the future.

Outdoor Recreational Resources. Greenways offer opportunities to creatively preserve open space in rapidly developing areas, protect important natural resources such as wetlands and wildlife corridors, and provide opportunities for outdoor activities such as bicycling and walking. Greenways and trails have been one of the top public concerns identified through the Statewide Comprehensive Outdoor Recreation Plan (SCORP) Public Participation program for years. Southwestern Illinois offers tremendous greenway opportunities.

Currently, the Metro East region has three of the 16 National Millennium Trails designated in 1999 and there are three major greenway systems proposed for the region. The Millennium Trails program is an initiative of the White House Millennium Council in partnership with the U.S. Department of Transportation and the Rails-to-Trails Conservancy.

Millennium Trails will recognize, promote and support trails as a means to preserve open spaces, interpret history and culture, and enhance recreation and tourism. The majority of the systems are located in Madison County where they are expected to be expanded to form a comprehensive regional network.

As urban growth continues, the demand for open space preservation and the development of outdoor recreational opportunities is expected to increase.

PROBLEMS AND OPPORTUNITIES

The identification of problems and opportunities and the development of clear operational objectives was the initial challenge in the formulation process for the Project team. The identification of problems and opportunities began with the assessment of the information compiled for the preparation of the pre-development, existing, and future without project conditions in addition to the input received during the public involvement process.

During the identification and validation process of problems facing the Study area, it became clear that there was a logical connection between these problems and the degradation of the natural ecosystem from a variety of causes. In every instance, there appeared to be a compelling reason to address Project area problems as environmental opportunities. As the Project team delved into the history of the area and the operation of the natural system during pre-settlement times, the picture that evolved provided a focus for the plan formulation process.

Ecological Resources. A recent report on trends in Illinois' environmental and ecological conditions concluded that the condition of natural ecosystems in Illinois is rapidly declining as a result of fragmentation and continual stress. Over the last two centuries, the historic natural ecosystem of the Project area has been reduced to a fraction of what it once was. Ecological problems that are identified and addressed include loss of biodiversity, fragmentation of natural systems, loss of historic ecosystem disturbances, loss of habitat quality, and degradation of water quality.

Loss of Biodiversity. Much of the historical biodiversity of the Project area, consisting of numerous natural communities and their constituent plant and animal species, has been lost due to intensive economic development. The loss of much of the natural heritage within the Project area is illustrative of a larger pattern in Illinois that indicates a trend toward simpler natural systems. The once complex historical natural environment has been replaced with one that is fairly simple biologically. Spatial losses in the Project area due to habitat destruction are significant. Only about 30 percent of the Project area, collectively, now consists of remnant forests, prairies, wetlands, lakes and ponds, and streams. Built-up areas, agriculture, and non-native grassland represent the remaining 70 percent, which supports low levels of biodiversity as compared to natural habitats.

Losses also consist of declines in the diversity of natural communities. Some types of forest, prairie, and stream natural communities have disappeared entirely. The case of prairie losses is the most extreme. About 99.9% of the historic prairie is gone. Once extending over roughly 35,000 acres and consisting of seven distinct communities, only about 35 acres comprising two communities remain. Widespread natural disturbances, such as flooding and wildfire, added a temporal dimension to the spatial complexity of the historic ecosystem that is gone today. Biodiversity losses also include the loss of some native plant and animal species that once inhabited the Project area as a result of the presence of introduced or exotic species that can out-compete native plants and animals. This shift in species composition illustrates another broader pattern in Illinois that is a trend toward non-native species. Continuing urbanization is expected to be the chief cause of future losses of biodiversity, especially to forests in the uplands.

Opportunities exist within the Project area to restore some of the lost and diminished components of the historic ecosystem. These include floodplain prairies, forests, marshes, and streams. Economic and agricultural activities prevent the re-creation of an entire stream traversing the floodplain, but there are locations where partial restorations could occur. Likewise, undeveloped areas exist where natural areas such as forests and prairies could be restored. Restoration of such features would replicate, albeit on a much reduced scale, the historic natural ecosystem.

Fragmentation of Natural Systems. As a result of development, natural areas within the Project area have become highly fragmented and remnants are generally too small to support all plant and animal species characteristic of functional ecosystems. The fragmented character of natural areas within the Project area is illustrative of a broader pattern in Illinois, which exhibits a trend toward fragmented natural systems. Fragmentation is the transformation of continuous areas of natural ecosystems into smaller and smaller pieces as a result of development. Along with habitat destruction, fragmentation is considered by many ecologists to be among the chief causes of loss of biodiversity worldwide. Requirements for the establishment and maintenance of self-sustaining and functional natural ecosystems in Illinois have yet to be defined.

Opportunities exist within the Project area to restore some forested areas and to create prairie restorations that are large enough to support animals sensitive to habitat fragmentation, including birds.

Loss of Historic Ecosystem Disturbances. Remaining natural areas cannot be expected to retain much similarity to their former structure and function if periodic ecosystem disturbances are not introduced to mimic historic flooding and wildfire. Natural flooding and wildfire sustained the historic natural ecosystem. With the elimination of these natural forces, today's remaining natural areas cannot maintain much similarity with their former historic condition without intervention. Fragmentation of natural areas and the loss of linkages between wetlands, streams, and rivers in the Project area have reduced the ability of many wetlands to perform historic functions, such as to temporarily store overland flows of water, or to remove natural nutrients and other elements and compounds from floodwaters.

The elimination of disturbance factors such as flooding and fire from much of today's environment has also diminished the ability of wetlands to serve as support systems for some plant and animal species. For example, the decurrent false aster, a federally threatened species, is an herbaceous plant that historically occurred in open habitats on the floodplain of the Illinois and Mississippi Rivers, such as wet prairies, shallow marshes, and the shores of rivers, creeks, and lakes. It is found within the Project area today in old or mowed fields, marshes, and at the edges of active fields, farm facilities, golf courses, and a railroad. The plant requires high levels of light to survive. Riverine flooding apparently benefits this species by disbursing seeds to new areas for colonization and suppressing the encroachment of woody vegetation that would create shady conditions. Likewise, wildfire would also have maintained open habitats in areas such as wet prairies and marshes.

Opportunities exist within the Project area to re-establish lost linkages between wetlands and tributary streams and re-introduce periodic flooding to existing floodplain natural areas. Such flooding could mimic the predevelopment flood pulse. Although the Mississippi River is no longer a feasible source, storm water from tributary watersheds could serve as the basis for the desired flood pulse. Prescribed fire is currently used to maintain some small prairie restoration areas within the Project area. Its use could be expanded into other natural areas to provide the same ecological benefits.

Loss of Habitat Quality. Many areas of fish and wildlife habitat in the urbanizing Project area are poor to fair in quality as a result of human activities and influences. Habitat quality in the Project area ranges from poor to good, and most habitats rank as poor to fair. This assessment is based on data gathered for this Project in the spring of 1999 by an interagency group of biologists studying 228 individual sites in floodplain (terrestrial, wetland, aquatic) and tributary stream (terrestrial) habitats. These quality ratings represent the ability of sampled habitats to fulfill the food, cover, or reproductive needs of eight fish and wildlife species occurring in the Project area. These species, which include the black crappie, eastern meadowlark, fox squirrel, great blue heron, marsh wren, mink, slider turtle, and wood duck, were selected to serve as representatives of a broad number of other species that are present or desirable and that also use forest, marsh, prairie, lake, stream, and cultural habitats. These animals, and the current quality of habitats they use, serve in this Project as the benchmark against which the expected effects of alternative solutions for ecosystem restoration can be compared. Further details about the habitat assessment method are found in Appendix A of the main report.

Opportunities exist within the Project area to make numerous improvements to habitat quality. Native plant communities can be restored in existing forests by introducing historically occurring tree species that are now lacking or underrepresented. Oaks can be planted in developed areas to benefit birds. Lakes and ponds can be improved for fishes by creating deep-water areas to serve as overwintering habitat. Emergent vegetation can be increased along the margins of these water bodies to benefit resident fishes, birds that feed in such areas, and enhance the production of macroinvertebrates that serve as food sources for such animals. Buffer zones of natural vegetation can be added around the perimeter of natural areas to minimize human disturbances. Wetlands can be improved by restoring native grassland around them or by adding wooded buffers. Invasions of exotic plant species in the Project area can be controlled or eliminated.

Existing narrow riparian zones along streams can be widened to benefit greater numbers of species. Connections or linkages consisting of natural vegetation can be established between various habitats to provide corridors for animal movements. Levels of sediment and chemicals carried by runoff into natural areas can be reduced.

Degradation of Surface Water Quality. The surface water quality within the Project area has a wide variety of impairments with causes originating from agricultural uses, tributary stream bank erosion, urban-runoff, point source discharges (industrial and public/private treatment works) and land development. In particular, sediment makes a significant contribution to the degradation of water quality that adversely impacts aquatic habitats, such as streams and lakes. Likewise, water quality is adversely impacted by non-point source water pollution that enters the tributary streams, the interior drainage system, and then on to the Mississippi River. Water passing over the land, either from rain, car washing, watering of crops, or lawns, picks up an array of contaminants including oil from roadways, agricultural chemicals from farmland, and nutrients and toxic materials from urban and suburban areas. This runoff is defined by the Water Resource Advisory Council as non-point source water pollution and finds its way into waterways either directly or through storm drain collection systems.

The general trend in population/urbanization/ industrialization and tributary stream degradation for the Project area and vicinity is increasing. Based upon this increasing trend, it is concluded that increased degradation of water quality will continue to be a problem. The adverse effects of this degraded water quality are not limited to large lakes or rivers but can be found in local streams and ponds and natural areas.

Opportunities exist within the Project area to improve surface water quality for the benefit of restoring and protecting important aquatic habitat. Measures implemented in the tributary streams could reduce impairments with upland origins and reduce sediment loads by stabilizing degraded streams before they reach the bottoms via tributary streams. Natural areas such as existing or constructed wetlands could be protected from the debilitating affects of degraded water quality while serving as an additional filtration systems to improve water quality before it is released into the Mississippi River.

Erosion and Sedimentation. Erosional processes occurring in the Project area related to rain events, increased peak flows due to storm water runoff, and head cutting and rotational bank slumping in tributary streams. These processes are causing excessive sedimentation in the bottoms and degradation of tributary stream resources. Community leaders and the local people who participated in the public involvement program ranked sedimentation and erosion problems on a par with flooding problems. Urban sprawl and the loss of greenspace and open space were believed to contribute to both the flooding and sedimentation problems. Federal and State resource agencies that participated in the study expressed concern about the adverse environmental effects of the sediment and erosion problems.

In general, the runoff from the hillside creeks enters the canals in the Bottoms area at a high velocity capable of transporting heavy loads of sediment out of the bluffs. However, when these high velocity flows reach the Bottoms, the velocity of the water drops substantially because the gradient flattens and the water in the canal is no longer able to transport the sediment load. This sediment is then transported through follow-on storm events through the drainage canal system eventually finding its way to the Mississippi River or remaining captured in the canal system reducing its capacity. Approximately 202,700 tons of sediment per year are being generated from gross erosion from the uplands. Very little sediment is found to originate from the bottomland sources because of the flat topography and sluggish runoff velocities.

Sedimentation creates several serious problems in the bottomlands of the Project area. As sediment collects in the already undersized drainage channels, the flow area is reduced even further so that a given amount of runoff is more likely to overflow the channel or break through the spoilbank levees. Sediment has also degraded the environmental quality of numerous wetland and aquatic areas in the bottomlands, including Horseshoe Lake and the lake resources at Frank Holten State Park. Sedimentation of Horseshoe Lake has dramatically impacted its fisheries quality. It is now approximately two feet deep on average and provides less than desired habitat for aquatic resources. Sediment also has degraded the quality of tributary streams in the Project area. Aquatic habitat no longer supports the variety of species that were present during pre-settlement times. Urban development has increased the volume, duration, and frequency of stormwater entering the stream system and has affected the stability and habitat functions of streams. This degradation once begun will continue to adversely impact stream functions. Sediment left behind in drainage canals also contributes to loss of flood conveyance capacity. Following the severe flooding experienced by the area between 1996 and 2001, approximately $10,000,000 in federal, state and local funds have been expended in removing sedimentation from the interior drainage system. This is a continuing effort and expense.

Opportunities exist within the Project area to reduce sedimentation. Measures sited within the tributary watersheds would be located closest to the “problem” and address both the problem of sediment transfer to the floodplain and degradation of stream quality and function. Measures could also be implemented in the Bottoms to detain sediment.

Tributary Steam Channel Instability. Tributary stream channels in the Project area have responded to growing development in their watersheds with bank instability and head cutting. Increasing areas of developed, impermeable land surfaces in tributary watersheds has allowed greater amounts of storm water to pass through stream systems per unit time. These increased flows have lead to channel instability by creating unstable bank lines. In addition, base flows in some watersheds have increased due to the addition of effluent from septic systems in some subdivisions. Increased base flow can also lead to channel bottom instability and headcutting. Head cutting in tributary streams and tributaries has contributed to some dramatic losses and destabilization of banks throughout the system. This situation not only contributes large volumes of sediment to the system that ultimately reaches the floodplain, but it also degrades stream quality, threatens bluff infrastructure, existing developments, and habitat quality.

In spite of actions being taken today to manage stormwater runoff and future problems associated with urbanization, the destabilization process that has begun in the streams will continue to worsen if not addressed. For this reason, solving these tributary stream problems on a systematic watershed basis became an important facet of the overall Project focus.

An opportunity exists within the Project area to address the instability of tributary streams. For the purposes of this Project, this opportunity could beneficially address the sediment problem in a way that could provide increased and sustainable environmental viability for the tributary streams while protecting the restored floodplain habitat resources from unwanted sediment deposition. The NRCS was brought in to analyze the problems associated with sediment and to explore opportunities to address this problem. Appendix E of the main report includes the detailed findings and recommendations from these analyses. For purposes of this Project, the ability to find solutions for loss of sediment from the tributary streams was viewed as an environmental opportunity to improve water quality and aquatic habitat. Evaluation of potential measures to reduce sediment and stabilize and restore tributary streams became a focus of the plan formulation process.

Flooding and Flood Damages. Flooding that currently occurs when storm water overtops the existing water conveyance system in the bottoms will continue to cause significant flood damages. As discussed earlier, the Project area bottomlands are protected from direct flooding from the Mississippi River by a series of levees and floodwalls. However, the Project area has a history of serious interior flooding which is caused by storms producing interior flows that exceed the capacity of the canals in the bottomlands area.

At the bluff line the system of man-made ditches and channels take the flows from tributary streams across the floodplain to the levee where the water enters the Mississippi River. When rainfall events exceed the capacity of this interior drainage system, whose size has not been altered since constructed, the water typically breaks out immediately downstream of the bluff line. These "out of bank" flows do not provide a beneficial disturbance to wetland or other habitat resources as they are too far removed from the bluff line to receive these flows. They instead damage the urban and agricultural areas that hug the bluff line of the project area. Additionally, when the interior drainage system is full, floodplain areas cannot remove ponded water quickly enough, allowing these waters to damage urban areas away from the bluff line.

Interior flooding associated with large rainfall events producing widespread damages across the floodplain occurred in the Project area as a result of the storms of August 1915, July 1942, August 1946, July 1952, June 1957, May 1961, and May 1995. Perhaps the most damaging event occurred in August 1946 when approximately 19½ inches of rain fell over Madison and St. Clair Counties during an eight-day period. This storm produced an average depth of 15.1 inches over the entire Project area. Flood damage from this event was estimated to be $56,800,000 (2001 dollars) and the event was estimated to be rarer than the 100-year storm in terms of inches of rainfall. Flooding caused by a 14-inch rainfall over a two-day period in June 1957 caused approximately $25,000,000 (2001 dollars) in damages. This event and the 1995 event produced approximately a 100-year rainfall with average depths of over 8 inches across the Project area.

Unlike the other problems identified in this Study, the problem of interior flooding in the Study area has been the subject of numerous reports prepared by a number of different local, state and federal agencies. However, to date, no definitive solution has proved to be economically viable to address the situation and as a result, the cycle of flooding and disaster relief continues. Nevertheless, an opportunity exists to address flood damage reduction as part of the efforts to restore the historic flood pulse to the Project area. This opportunity to provide incidental flood damage reduction benefits occurs because of the multi-objective nature of the flood pulse restoration measures.

Cultural Resources. Literally hundreds of prehistoric and historic archeological resources are located throughout the Project area and are under constant threat from the pressures of development. The most well known site is the world-renowned Cahokia Mounds which is a World Heritage Site recognized by the United Nations. Despite the fact that more than 2,000 acres of the Cahokia Mounds site are publicly designated, more than one third of the site is still in private hands and is highly vulnerable to commercial or residential development.

The Project Team has concluded that if present growth rates throughout the Project area continue unabated during the twenty-first century, virtually all of the archaeological sites not currently in public ownership will be destroyed by commercial and residential development. If that is allowed to occur, the loss of the information contained in these sites will have a profound effect upon the ability of future generations to accurately interpret the prehistory of the Project area; one of the most significant prehistoric regions in all of North America.

An opportunity exists where feasible to incorporate the locations of archeological sites present in the Project area into the boundaries of the habitat areas developed for this Project. In this manner, the irreplaceable information contained within these sites will be protected and available for the benefit and enjoyment of future generations of all Americans.

Outdoor Recreation. The area is fortunate to have both the Horseshoe Lake and Frank Holten State Park systems and a start in implementing a "rails to trails" program. However, as the Project area continues to develop, there will be a growing need for additional outdoor recreation areas. As the surrounding land becomes increasingly urbanized, additional pressure is placed on the wildlife areas managed in the Horseshoe Lake State Park. Each of the counties have plans to enhance their outdoor recreational resources to attempt to keep pace with the growing population and ever expanding interest in outdoors activities.

Opportunities exist within the Project area to improve outdoor recreational opportunities through the restoration, protection and enhancement of existing ecosystem resources. Eco-education and related tourism is a new pastime of a society chiefly separated from natural areas and environmental resources. The opportunity also exists to adapt the existing flood protection system to meet outdoor recreational needs while the restoration and expansion of natural areas could create connectivity to augment and expand existing outdoor recreational opportunities.

Summary. The main problems within the Study area are the loss of ecological resources primarily caused by urbanization, sedimentation (which contributes to loss of water quality and aquatic environmental quality), and persistent recurring flooding. After looking at the cause and effect of these problems in depth, it becomes clear that they are inter-related and require an inter-related watershed based focus in the search for potential opportunities and resultant solutions. Natural ecosystem areas must be preserved now in order to protect them from loss on the floodplain. Likewise tributary streams must be restored now in order to protect them from being lost. Stormwater is the only viable floodplain hydrology source that remains to restore and revitalize the natural ecosystem. The beneficial uses of this water provide the possibility of identifying numerous environmental opportunities that could not otherwise be realized. An investigation of the pre-settlement hydrology of the area provides a picture of a vibrant natural ecosystem sustained by over-bank flooding coming from the Mississippi River as well as from the tributary watersheds. This investigation, coupled with an inventory of existing natural areas, provides a roadmap for restoration possibilities.

For the purposes of this Study, the interior flooding problems were viewed as an ecosystem service opportunity and the evaluation of the use of stormwater events to restore a flood pulse necessary to mimic pre-settlement ecosystem conditions as a foundation of the formulation process. The restoration of watershed functions appeared to be the best way to address the problems of the study area while capitalizing on the opportunities available. It is believed that through the identification of the ecosystem services gained from environmental restoration actions, the cost of ecological restoration activities can be competitive with other demands for limited public financial resources. By clearly demonstrating the many contributions to social well being that ecosystem restoration achieves, a restoration project can become the focal point of an area's master plan. From the onset of this Study, the potential mitigation of floods by the natural ecosystem has been highlighted as the most important service to provide social well-being for the Project area.

PLAN DEVELOPMENT

Planning Assumptions. The following assumptions were made in order to help guide the plan development effort:

The existing levee system and interior flood control system will remain functional and operational.

The existing pump station capacities are adequate and will not be impacted by Study recommendations.

Pre-development conditions can be used to guide the development of ecosystem restoration plans in order to address multiple problems.

Ecosystem restoration can provide incidental flood damage reduction and be competitive for scarce sponsor financial resources.

Watershed based solutions will be essential based on the Study area characteristics and the limited remaining resources.

Planning Constraints. Every planning process has constraints placed upon it. Below are those that were identified during this Study effort:

Limitations within the Corp of Engineers' program prevent the investigation of problems associated with combined sewers under the flood control and environmental restoration authority and thus presents a constraint to this study's ability to address problems of combined sewer overflow, as expressed by the citizens in areas like East St. Louis.

Limitations within the Corps of Engineers' program prevent the investigation of interior drainage problems impacting less than one square mile and thus presents a constraint to this study's ability to address floodplain flooding caused by the ponding of stormwater falling within many of the smaller drainage areas of the floodplain itself.

Limitations established by the existing flood protection system and drainage canal system.

Limitations of available land suitable for ecosystem restoration.

Planning Objectives. Specific objectives for this Study have been developed in response to the problems and opportunities identified during the scoping, public involvement, and early Project research efforts. The analysis of pre-settlement land cover and conditions in the Project area became the guide to establishing restoration planning targets for the Project. The comparison of historic land cover mapping with today's existing conditions also provided insight into restoration possibilities.

In general, planning objectives are specific operational statements that provide the direction for the development of specific alternative plans. The planning objectives for this Project are identified below, in no particular order of importance. Planning targets were developed for each objective based on an analysis of pre-settlement conditions and existing conditions in order to provide information to the team during the iterative evaluation and assessment process. These planning targets served as guideposts for developing alternative plans, and for comparing the desired restoration level to the level of restoration expected to be achieved through the implementation of any alternative plan formulated to address the corresponding planning objective.

Planning Objective 1 - Restore Natural Areas. Increase the overall spatial extent of under-represented natural communities by restoring and expanding existing natural areas wherever possible. Planning target: natural areas to be established by the Project should contain ten percent of the historic amount of Mississippi River floodplain forest in the Project area (1,880 acres), five percent of the historic amount of floodplain prairie in the Project area (1,612 acres), and 100 acres of created (new) floodplain marsh. Floodplain forest is to consist of one-third existing forest (627 acres) and two-thirds new forest (1,253 acres).

Planning Objective 2 - Restore Flood Pulse. Reintroduce a flood pulse into floodplain natural areas that mimics the historic hydrological condition. Planning target: the maximum flood pulse will not exceed the depth of the Mississippi River flood of 1844 at St. Louis, or 14 days in duration.

Planning Objective 3 – Restore Habitat Quality. Restore habitat quality in existing and re-created natural areas. Planning target: develop and maintain, at a minimum, moderate habitat quality for all evaluation species in existing and re-created natural areas.

Planning Objective 4 - Improve Water Quality. Improve the quality of surface waters. Planning target: reduce levels of sedimentation in as many surface tributaries as possible.

Planning Objective 5 - Reduce Erosion. Reduce erosion in the tributary watersheds. Planning target: Reduce the total amount of sediment reaching the bottoms by 70 percent.

Planning Objective 6 – Restore Tributary Streams. Improve the stability of tributary streams in order to restore stream quality and aquatic functions.

Planning Objective 7 - Restore Floodplain Streams. Restore floodplain streams and associated riparian corridors. Planning target: recreate flowing floodplain streams with associated riparian corridors for a distance equivalent to 10 percent of the floodplain length of historic Cahokia Creek (four miles) and establish three miles of riparian corridor linkages between existing or proposed natural areas.

Planning Objective 8 - Incidental Social Objectives. The interrelationship between problems and opportunities that was identified through the public involvement process dictated the need to identify and measure incidental Project contributions to the social well being of the area. As previously discussed, it was deemed important to quantify the ecosystem services that would be provided as a natural by-product of the restoration Project in order to ensure the public had a full appreciation of the many positive benefits to be realized from an ecosystem restoration project. Objectives designed to focus on these issues were developed to ensure that ecosystem services incidentally provided by the Project could be tracked and quantified.

Planning Objective 8a - Reduce Flood Damages in Urban and Agricultural Areas. Planning target. To the maximum extent possible within the planning target to restore a floodplain flood pulse.

Planning Objective 8b - Enhance Outdoor Recreation. Increase and enhance outdoor recreational opportunities within natural areas. Planning target: Provide passive outdoor recreational opportunities at as many sites as possible.

Planning Objective 8c - Protect Cultural Resources. Protect cultural and archeological resources and enhance their values. Planning target: Envelop known archaeological sites into Project lands rather than attempt to avoid them.

Measures to Address the Planning Objectives. The Project Team identified and developed a number of measures that could be implemented to address each planning objective:

Objective 1. Expand natural areas. Measures: 1-Obtain land (existing or new habitats); and, 2-Create habitats (forest, prairie, marsh).

Objective 2. Restore flood pulse. Measures: 1-Modify existing channels; 2-Construct new channels; 3-Divert surface flow into habitat areas; 4-Construct earthen berms to contain flood pulse in habitat areas; and, 5-Detain surface flow in habitat areas.

Objective 3. Maintain habitat quality. Measures: 1-Increase tree species diversity and abundance in existing upland and floodplain forests (implement tree stand improvements, or selective clearing and planting of underrepresented species, such as oaks); 2-Install nesting boxes in existing marshes and floodplain forest (i.e., wood duck); 3-Add flood pulse to existing floodplain wetlands, lakes, ponds, borrow pits; 4-Remove standing water from areas of "drowned" forest; 5-Create overwintering areas for fish in existing floodplain lakes and ponds; 6-Add woody debris in floodplain lakes and ponds; 7-Add shoreline plantings in existing floodplain channels, lakes, ponds, borrow pits; 8-Augment base flow in existing floodplain channels with new pump station; 9-Add riffle and pool complexes in tributary streams; and, 10-Protect natural areas by restricting them to compatible uses.

Objective 4. Improve water quality. Measures: 1-Construct buffer strips and tile outlet terraces to control erosion in upland agricultural areas; 2-Construct in-stream sediment detention basins in tributary streams or dry sediment detention basins on the floodplain in habitat areas to capture sediment; 3-Create riffle and pool complexes in tributary streams to restore in-stream habitat; 4-Construct in-channel grade control structures in tributary streams to prevent headcutting; and, 5-Plant grassy or prairie buffers in floodplain swales to capture sediment.

Objective 5. Reduce erosion. Measures: 1-Construct tributary stream sediment detention basins; and, 2-Construct terraces in the uplands; 3-Construct underground outlet & subsurface drains in the uplands; 4-Construct water and sediment control basins in the uplands; 5-Install critical area plantings in the uplands; 6-Construct diversions in the uplands; 7-Install filter strips in the uplands; 8-Install grass waterways in the uplands; 9-Stabilize banks of tributary streams; 10-Install grade control structures in tributary streams; 11-Create riffle and pool complexes in tributary streams; 12-Allow for natural deposition of sediment on alluvial fans; and, 13-Construct lowland dry sediment detention basins.

Objective 6. Restore tributary streams. Measures: 1-Stabilize banks of tributary streams; 2-Create riffle and pool complexes; 3-Construct in-channel grade control structures; and, 4-Implement bio-erosion control techniques.

Objective 7. Restore floodplain streams. Measures: 1-Obtain land; 2-Reconnect historic stream channel fragments; 3-Plant natural vegetation; 4-Create connectivity corridors between natural areas that are centered along existing streams, by planting natural vegetation; 5-Create connectivity corridors between natural areas that are centered along existing ditches, by modifying existing ditch system (set back one or both levees) and planting natural vegetation within levees; and, 6-Create connectivity corridors between natural areas that are centered along existing ditches, by planting natural vegetation outside levees.

Objective 8. Incidental Social Objectives

8a. Reduce flood damages. Measures: 8a-1-Modify existing channels; 8a-2-Construct new channels; 8a-3-Divert surface flow into temporary storage areas; 8a-4-Construct earthen berms; and, 8a-5-Detain surface flow in temporary storage areas.

8b. Enhance recreation. Measures: 8b-1-Construct trails; 8b-2-Provide interpretive areas; 8b-3-Provide signage; and, 8b-4-Provide access areas.

8c. Protect cultural resources. Measures: 8c-1-Obtain selected sites; 8c-2-Plant historic natural vegetation; 8c-3-Add historic flood pulse; and, 8c-4-Provide interpretive areas.

Identification of Potential Restoration Sites. The initial array of possible restoration sites for each watershed was next developed based upon insight provided by analysis of the pre-settlement land cover and hydrology, project restoration planning targets, public outreach, previous reports, identification of existing habitat sites and the knowledge of agency personnel. In this manner the Project Team developed a list of potential sites for the Project area which were organized and identified in relation to the five area watersheds: Long Lake; County Ditch; Cahokia Canal; Harding Ditch; and, Powdermill. The item in parentheses below is the potential restoration sites' unique identifier.

Long Lake. Borrow Pits near Long Lake, south (LO-23); Borrow pit between Rte 162 and Long Lake (LO-27); Wetland along railroad track Granite City (LO-28); Dobrey Slough (LO-29); Dobrey Slough Agricultural land east of tracks; Wetland near Horseshoe Lake, Route 162, west (LO-47); Wetland West side of Lake Road Route 162, east (LO-48); Long Lake; Mitchell Ditch; Dobrey Slough Canal (concept); and, Legacy Golf Course.

County Ditch. Wetland near Rte. 111 (CO-18); Wetland along Old Cahokia Creek, north (CO-20); Wetland along Old Cahokia Creek, south (CO-21); Wetland along County Ditch, north (CO-24); Wetland along County Ditch, south (CO-25); County Ditch; and, Bluff 1 Tributary Watershed.

Cahokia. McDonough Lake (CA-30); Wetland Edelhardt Meander Scar, Rte. 111 west (CA-31); Wetland Edelhardt Meander Scar, Rte. 111 east (CA-32); Agricultural land Edelhardt Meander Scar, middle (CA-33); Wetland Edelhardt Meander Scar, east (CA-34); Arlington Subdivision Wetland Edelhardt Meander Scar, south (CA-35); Arlington Subdivision area Wetland Horseshoe Lake, delta at Cahokia Diversion Canal (CA-36); Wetland Horseshoe Lake, west fringe (CA-37); Wetland Horseshoe Lake, Rte. 203 east (CA-37.1);

Wetland Horseshoe Lake, east fringe (CA-38); Wetland Horseshoe Lake, northeast fringe (CA-38.1); Wetland Horseshoe Lake, Walker Island (CA-39); Wetland, Milam mitigation site, Horseshoe Lake (CA-40); Horseshoe Lake Wetland Brushy Lake (CA-41); Agricultural land, Brushy Lake North; Wetland Eagle Park west (CA-42); Wetland Eagle Park east (CA-43); Wetland Cakokia Canal borrow pits along I-55/70 (CA-44); Wetland at Indian Lake, Fairmont City (CA-45); Wetland East of Route 203, North of I-55/70 (CA-46); Wetland Lansdowne Ditch (CA-49); Lansdowne Ditch Wetland Canteen Creek (CA-54); State Park Place; Judy's Branch Watershed; Burdick Branch Watershed; Agricultural land Judy's/ Burdick; Schoolhouse Branch Watershed; Canteen Creek Watershed; National City Stockyard; Cahokia Canal; and, Bluff 3 Watershed.

Harding. Wetland Cahokia Mounds (HA-50); Cahokia Mounds State Historic Site; Wetland Spring Lake meander scar, north (HA-51); Wetland Spring Lake meander scar, North of Forrest Blvd (HA-52); Wetland Spring Lake meander scar, south of Forest Blvd. (HA-53); St. Clair Farms; Farmed wetland along Harding Ditch, Bunkum Rd. (HA-54); Wedgewood; Centerville; Wetland Crooked Lake (HA-55); Wetland East St. Louis (HA-59); Wetland Holten State Park, north (HA-60); Wetland Holten State Park, northwest (HA-60.1); Wetland, Holten State Park, south (HA-61); Lakes 1 and 2, Holten State Park Lake; ALCOA Site; Wetland Canal No. 1, north (HA-62); Wetland Mary Spencer (HA-63); Wetland near Mary Spencer (HA-64); Farmed wetland North of Sterling Place; City of Caseyville (HA-68.5); Farmed wetland by Crooked Lake (HA-68.1); Farmed wetland by Crooked Lake (HA-68.2); Farmed wetland along Harding Ditch, south (HA-68.3); Area along Harding Ditch, north near Centerville (HA-68.6); Area along Harding Ditch, south near Centerville (HA-68.7); Farmed wetland East of I-255 South of I-64 (HA-68.8); Little Canteen Creek Watershed; Schoenberger Creek Watershed; Bluff 2, Watershed; Bluff 4, Bluff 5 Watershed; and, Harding Ditch.

Powdermill. Wetland Mullen Slough (PO-66); Wetland Fishing Pond (PO-67); Wetland Canal No. 1 (PO/HA-67); Agricultural Land Mullens Slough; Powder Mill Creek Watershed; and, Bluff 6 Watershed.

Identification of Potential Measures. In the spring of 1999, numerous sites throughout the Project area were visited to establish baseline habitat conditions. In all, some 112 sites were evaluated using the HydroGeoMorphic Approach to assessing wetland functions (HGM), and 160 sites were evaluated using the Habitat Evaluation Procedures (HEP) as apart of the initial baseline assessment process. Floodplain sites and bluff sites were subjected to a baseline evaluation using HEP, and wetland sites were additionally assessed using HGM. Tributary streams were assessed at 17 sites using the Qualitative Habitat Evaluation Index (QHEI) method. The first-hand experience gained from the HEP/HGM analysis at each site assisted in the identification of potential measures at these sites.

A detailed discussion showing the full array of objectives and measures that could potentially be applicable to each of the sites identified in the five watersheds is beyond the scope of this Summary Report but is contained in the more detailed General Reevaluation Report.

Screening of Potential Restoration Sites. Following the assessment and evaluation of measures, the Team began the evaluation of restoration sites and restoration site combinations based on location, topography, area hydrology, soils, and existing conditions to contribute to Project planning objectives. This next iteration of assessment and evaluation addressed each restoration site's ability to stand alone or work effectively in combination with others to address the planning objectives. Based upon the large number of potential sites, the Team agreed that in order to formulate viable alternative plans, the focus had to be on the identification of a few areas that could contribute in a meaningful way to the planning objectives. It was infeasible to develop a large number of small fragmented sites across the Project area that contributed to only to a few objectives and still hope to achieve restoration planning targets. Therefore, the Team determined that sites or combination of sites needed to meet multiple objectives to have a chance of making a meaningful change in the existing conditions of the Project area. Sites were evaluated based on their ability to contribute individually or in combination to multiple project objectives and also have the potential to meet planning targets. In this way, potential action areas were to be identified. The following identifies by watershed, the restoration areas that survived the screening process. This screening process is detailed in Section 6 of the main report.

Restoration Site Survivors:

Long Lake. Dobrey Slough (LO-29); Dobrey Slough Agricultural land east of tracks; Long Lake; and, Mitchell Ditch.

County Ditch. Wetland along Old Cahokia Creek, north (CO-20); Wetland along Old Cahokia Creek, south (CO-21); Wetland along County Ditch, north (CO-24); Wetland along County Ditch, south (CO-25); County Ditch; and, Bluff 1 Tributary Watershed.

Cahokia. McDonough Lake (CA-30); Wetland Edelhardt Meander Scar, Rte. 111 east (CA-32); Agricultural land Edelhardt Meander Scar, middle (CA-33); Wetland Brushy Lake (CA-41); Agricultural land, Brushy Lake North; Wetland Cakokia Canal borrow pits along I-55/70 (CA-44); Wetland at Indian Lake, Fairmont City (CA-45); Lansdowne Ditch Wetland Canteen Creek (CA-54); State Park Place; Judy's Branch Watershed; Burdick Branch Watershed; Agricultural land Judy's/ Burdick; Schoolhouse Branch Watershed; Canteen Creek Watershed; National City Stockyard; Cahokia Canal; and, Bluff 3 Watershed.

Harding. Cahokia Mounds State Historic Site; Wetland Spring Lake meander scar, north (HA-51); Wetland Spring Lake meander scar, North of Forrest Blvd (HA-52); Wetland Spring Lake meander scar, south of Forest Blvd. (HA-53); St. Clair Farms; Farmed wetland along Harding Ditch, Bunkum Rd. (HA-54); Wedgewood; Wetland Crooked Lake (HA-55); Wetland Canal No. 1, north (HA-62); Farmed wetland North of Sterling Place; City of Caseyville (HA-68.5); Farmed wetland by Crooked Lake (HA-68.1); Farmed wetland by Crooked Lake (HA-68.2); Little Canteen Creek Watershed; Schoenberger Creek Watershed; Bluff 2, Watershed; Bluff 4, Bluff 5 Watershed; and, Harding Ditch.

Powdermill. Wetland Mullen Slough (PO-66); Wetland Fishing Pond (PO-67); Wetland Canal No. 1 (PO/HA-67); Agricultural Land Mullens Slough; Powder Mill Creek Watershed; and, Bluff 6 Watershed.

Identification of Potential Action Areas. Restoration sites screened and identified to be carried forward as having potential for meeting project objectives were put through further engineering and biological analysis in order to identify the relative effectiveness of restoration sites and site combinations. These analyses are detailed in the Hydraulic, Geotechnical, and Sediment Appendixes of the General Reevaluation Report. The purpose was to eventually assemble "action areas" using one or more of the restoration areas so as to take advantage of their inherent synergistic characteristics. The action areas then would become the focus and would be the areas within which specific plans would be developed.

At this point, restoration sites were assembled into potential action areas and screened for having the ability to achieve multiple project goals and objectives and to make a significant contribution to attaining planning targets. Habitat restoration and the ability to reasonably attain hydraulic reconnection for flood pulse restoration to enhance ecosystem functions were key to the assessment process. The potential action areas determined to have inadequate potential were not carried forward. Those that did were carried forward and are identified below along with their components. The action areas carried forward from this assessment next were to be put through the alternative plan development process. They are displayed in Figure 10.

Action Areas Surviving the Screening Process:

Dobrey Slough Action Area. Consists of the Dobrey Slough (LO-29) and Dobrey Slough Agricultural land east of tracks restoration areas.

Old Cahokia Creek Action Area. Consists of the Wetland along Old Cahokia Creek north (CO-20), Wetland along Old Cahokia Creek south (CO-21), Bluff 1, and Cahokia Canal restoration areas.

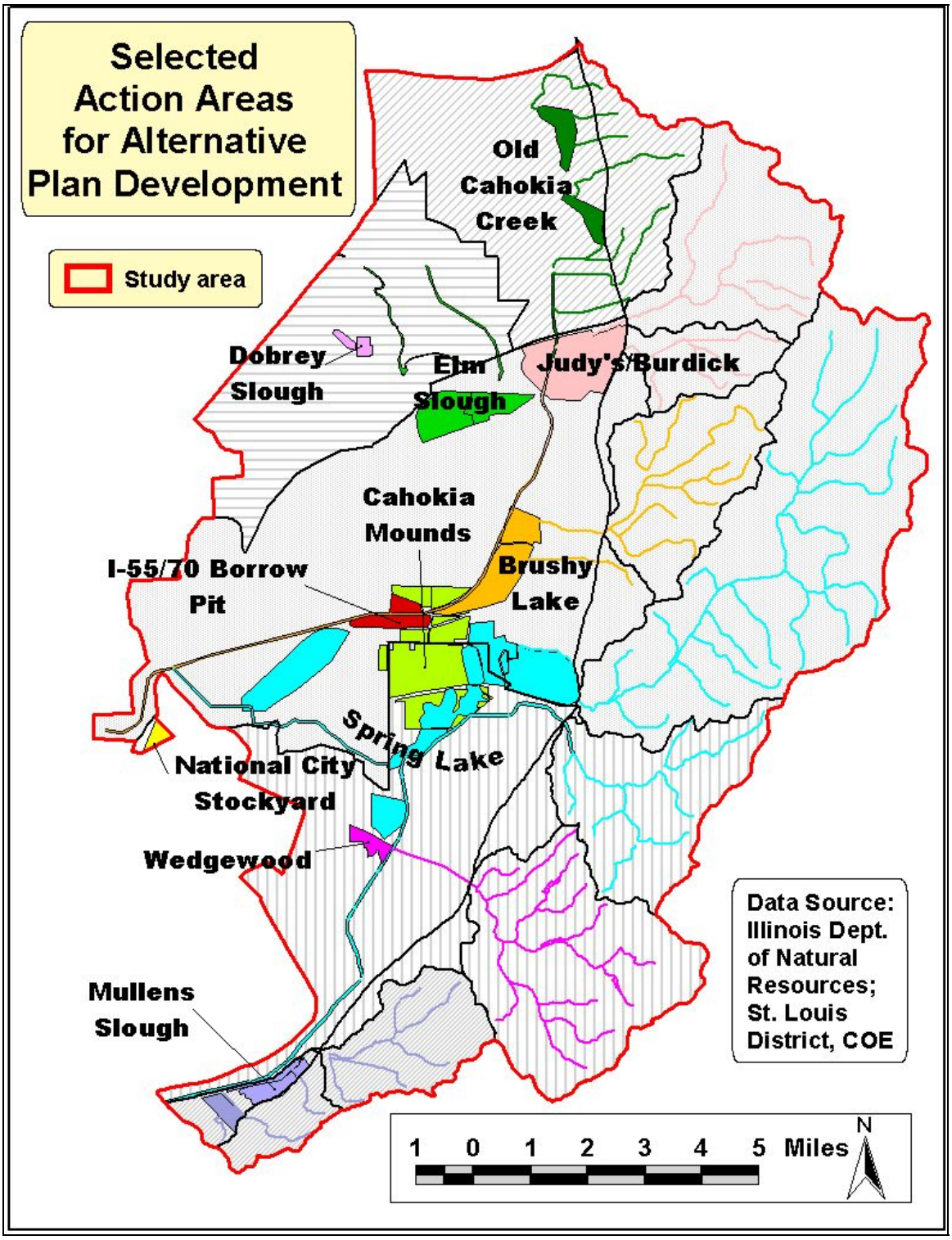
Elm Slough Action Area. Consists of the Long Lake, Mitchell Ditch, Wetland Edelhardt Meander Scar, Rte. 111 east (CA-32), and Agricultural land Edelhardt Meander Scar, middle (CA-33) restoration areas.

Judy's/Burdick Branch Action Area. Consists of the Judy's Branch, Burdick Branch and Agricultural land Judy's/Burdick restoration areas.

Brushy Lake Action Area. Consists of the Wetland Brushy Lake (CA-41), Agricultural land Brushy Lake North, Bluff 3 Watershed, and Schoolhouse Branch restoration areas.

Cahokia Mounds Action Area. Consists of the Cahokia Mounds and CA-50 restoration sites.

Figure 10 Action Areas Selected for Alternative Plan Development



Spring Lake Action Area. Consists of the Canteen Creek, Harding Ditch, Little Canteen Creek, Wetland Spring Lake meander scar, south of Forest Blvd. (HA-53), Wetland Spring Lake meander scar, North of Forrest Blvd (HA-52), St. Clair Farms, Landsdowne Ditch, Wetland at Indian Lake, Fairmont City (CA-45) and, Wetland at Indian Lake
restoration areas.

Wedgewood. Consists of the Harding Ditch, Schoenberger Creek and Wedgewood restoration areas.

Mullens Slough. Consists of the Wetland Mullens Slough (PO-66); Wetland Fishing Pond (PO-67); Wetland Canal No. 1 (PO/HA-67); Agricultural Land Mullens Slough; Powder Mill Creek Watershed; and, Bluff 6 Watershed restoration areas.

Alternative Plan Development. Preliminary alternative plans were next formulated for each action area. A variety of combinations of measures were developed at each site that could be evaluated for their effectiveness and cost efficiency in addressing planning objectives.

By this stage of the plan development process, the Team had determined the combination of species that would be used to predict habitat outputs for the various alternative plans. Appendix A of the main report provides detailed information regarding the rationale and selection process for these predictor species which are used to measure habitat outputs for the different combinations of measures in an alternative plan. The potential array of measures was developed based upon the analyses of pre-settlement land cover and hydrology, and project restoration planning targets. As described previously, the selected action areas were initially screened for their existing habitat, soils, hydraulic connectivity and spatial area. In this manner, the Team was able to develop a full array of ecosystem and social measures for efficiency and effectiveness competition at each action area. In the development of alternative plans for each action area, several conclusions from engineering and biological analysis were used to assist in guiding the process. It had been determined during the action area screening process that each of the designated project action areas could receive hydraulic input with the potential to provide disturbance depths having limited durations that would be considered beneficial for biological purposes (defined as meeting Objective 2, Flood Pulse Restoration) and could accept storm water for flood damage reduction purposes (Objective 8a, Reduce Flood Damages). Varying hydraulic events were analyzed at each site to determine the optimum for a site based upon planning targets and cost factors. A more detailed discussion of this analysis is contained in Appendix C of the main report.

Tributary stream sediment detention measures and creation of riffle and pool complexes recommended by NRCS were considered together within each watershed as an “all or nothing” unit for alternative development. This was necessitated by the inability to attribute improvements to the system in any smaller increments of action. This is in concert with the NRCS’ study, which is further detailed in Appendix E of the main report. Based on the NRCS’ analysis, land treatment measures were eliminated in alternative plans. These measures proved to be unreliable because of their voluntary nature, and uneconomical because of the rapid urbanization projections for the bluff, which meant these measures would be temporary in nature. This analysis is further discussed in Appendix E.

Tributary stream and lowland sediment detention measures were retained and analyzed during this iteration as a method for the removal of sediment and improvement of water quality for each action area that had a tributary stream connection. Appendices C and E of the main report provide more detail on tributary stream and lowland sediment detention measure analysis that determined the acceptability of measures designed to meet the Planning Target established for Objective 5 (Reduce Erosion) and Objective 4 (Improve Water Quality).

The measures at this stage of formulation had attained more specificity based upon additional hydraulic, geotechnical and sediment analyses performed. From these preliminary plans, cost curves were developed for measures that were required at multiple sites. These cost curves were utilized to identify those measures providing a similar benefit that proved less effective. This allowed for the initial reduction of alternative plans prior to running action area alternative plans through the HEP/ ICA analysis. The chart below shows the number of alternatives carried through to more detailed iterations of assessment and evaluation.

Watershed	Action Area	Alternative Counts		
		Conceived	Dropped	Evaluated
County Ditch	Old Cahokia Creek	24	12	12
Cahokia	Judy's-Burdick Branches	40	20	20
Cahokia	Brushy Lake	30	24	6
Cahokia	Elm Slough	6	1	5
Cahokia/Harding	Spring Lake	126	117	9
Harding	Wedgewood	6	2	4
Harding	Cahokia Mounds	12	6	6
Powdermill	Mullens Slough	6	0	6
Long Lake	Dobrey Slough	6	3	3
	Totals:	256	185	71

Alternative Plan Assessment. Planning level cost estimates were developed for each alternative plan within an action area. These estimates included lands, construction (including environmental treatments) and operation and maintenance costs and were annualized at the current interest rate over the 50-year project life. These estimates were to be used in the incremental cost analysis. Using this methodology, the predicted average annual habitat unit benefits (effectiveness) could be compared to the predicted annualized costs (efficiency) in order to generate a comparison of alternative plans for assessment and evaluation purposes. Appendix A of the main report describes these procedures in detail and provides data on results obtained. This process resulted in the final set of alternatives for each action are that was carried through the final incremental cost analysis process.

Final Array of Alternative Plans by Action Area. The screening process used on the alternative plans resulted in a final set of alternatives for each action area that were analyzed using the incremental cost effectiveness analysis process. The following is a recap of final alternatives that were competed through the incremental cost effectiveness analysis. Appendix A of the main report provides complete detail on this process.

Dobrey Slough. The purpose of this action area is to restore an area on the floodplain that supports natural plant and animal communities, with a flood regime as similar to presettlement (ca. 1800) conditions as practicable and to incidentally reduce flood damages in the residential neighborhoods adjacent to Dobrey Slough, in the Long Lake watershed. A total of 3 different alternatives are being evaluated.

Common measures:

1. The establishment of a habitat area with the existing "slough" (marsh-based vegetation) serving as its core.
2. The restoration of existing marsh, and the creation of new marsh, inside the habitat area supported by utilization of the stormwater events delivered by local runoff. Excavation would be necessary to support the creation of the new marsh as well. In addition, modification of the existing drainage structures, located under the railroad embankment, will be necessary.

Variable measures:

1. The creation of a forested corridor, inside the habitat area, surrounding the existing marsh. Trees would be planted (where they currently do not occur) on the west side of the railroad embankment in undeveloped areas. The forested corridor would provide habitat, and serve as a filter strip to enhance water quality in the marsh. The width of the forested corridor was considered when developing alternatives. Three corridor size options [i.e., 165 feet (50 meters), 245 feet (75 meters) and 330 feet (100 meters)] were designed for this site. These corridor widths would be created on both sides of the channel/ditch.

Old Cahokia Creek. The purpose of this action area is to restore a portion of Cahokia Creek on the floodplain to a free-flowing stream, with an adjacent forested corridor supporting natural plant and animal communities, and a flood regime as similar to presettlement (ca. 1800) conditions as practicable, to restore stream resources in the "Bluff1" watershed and to incidentally reduce flood damages in the bottoms in the County Ditch watershed, with a focus on Sand Road and vicinity. A total of 18 different alternatives are being evaluated.

Commonly shared measures:

1. The reopening of a portion of the Cahokia Creek channel on the floodplain. Segments of historic channel that were filled over the years would be reopened under these alternatives, and existing channel areas would be excavated to remove accumulated sediment to recreate a floodplain stream that once flowed from north to south.
2. The creation of a continuous forested corridor along the reopened channel. In all alternatives, trees would be planted on both sides of the creek where they currently do not occur.

3. The construction of an earthen hydraulic feature along the west side of the reopened channel. This feature, located along the west edge of the forest on the west side of the creek, would allow for a riverine overflow regime to be reestablished, while restricting overflow from the creek to the forested corridor and adjacent lands to the east.

Variable measures:

1. Tributary Stream Restoration vs. Bottomlands sediment detention – sediment would be detained by constructing 10 new tributary stream sediment detention basins in the "Bluff 1" watershed and creating a series of riffle and pool complexes to address channel destabilization and aquatic resource degradation in approximately 6 miles of tributary streams, or sediment would be detained in the Bottoms in existing ditches, and in the new habitat restoration area itself.

2. Length of channel restoration – two lengths of channel restoration were considered. From the south end of the project area, the shorter channel option would extend north along the creek for a distance of approximately 2.9 miles. The longer channel option would extend the length of the diversion channel for a distance of approximately 4.2 miles.

3. Augmentation vs. no augmentation of stream flows – for the longer channel alternatives, a new pump station could be installed at the diversion channel, and would be used to augment low stream flows to enhance environmental returns.

4. Width of forested corridor – on each side of the creek, widths of approximately 165 feet (50 meters), 245 feet (75 meters) and 330 feet (100 meters) were considered.

Elm Slough. The purpose of this action area is to restore an area on the floodplain that supports natural plant and animal communities, with a flood regime as similar to presettlement (ca. 1800) conditions as practicable and to incidentally reduce flood damages within the Long Lake watershed. Much of the project area is an old meander scar of the Mississippi River, and forest was the predominant type of vegetation two centuries ago. A total of 5 different alternatives are being evaluated.

Commonly shared measures:

1. The creation of a 670-acre forested habitat area to utilize stormwater events delivered by Long Lake and Mitchell Ditch. Trees would be planted in areas where they do not currently occur. The construction of earthen hydraulic features around the perimeter of the habitat area would also be included in this option, as well as the simulation of hydrologic conditions (in a large area of the newly planted wetland forest), similar to those of the existing wetland forest. Excavation of an area approximately 175 acre in size, will be necessary to temporarily store water.

2. The replacement of the two "funnel-shaped" waterways referred to as Mitchell Ditch and Long lake Ditch on the south side of Route 162. Stormwater from these two floodplain tributaries will be carried south into Elm Slough in a sheet-flow manner. Earthen hydraulic features constructed along the edges of these waterways will restrict stormwater to the habitat area. Culverts under Route 162, and the adjacent railroad embankments, will be modified as well.

3. Grassy vegetation will be planted inside the "funnel-shaped" drainage ways to act as filters that intercept sediment carried by stormwater.

Variable measures:

1. Replacement of under-represented tree species - two levels of management will be considered (i.e., simple vs. intensive activities). Simple improvements will focus on of selective thinning and planting of mast tree species in the existing forest. Intensive improvements will involve the removal of existing dead (drowned) timber, and the planting of appropriate tree species. The "No Action" management strategy defers improvements.

2. Presence or absence of a prairie-based vegetative buffer - the proposed buffer would be created at the location where sheet flows are anticipated to enter Elm Slough, in front of the main forested habitat area. The buffer will be designed to intercept sediment carried by flows from Long Lake and Mitchell Ditch.

Judy's-Burdick. The purpose of this action area is to create an area on the floodplain that supports natural plant and animal communities, with a flood regime as similar to presettlement (ca. 1800) conditions as practicable, to restore stream resources in the Judy's, Burdick, and "Bluff 1" watersheds and to incidentally reduce flood damages in the bottoms within the Cahokia watershed. The floodplain component lies at the southern end of historic Rattan's Prairie, a 15,000-acre wet prairie once located in the northeast part of the American Bottoms. A total of 16 different alternatives are being evaluated.

Commonly shared measures:

1. The construction of a floodplain habitat area with an earthen hydraulic feature to utilize stormwater events delivered by Judy's and Burdick Branches combined.

2. The modification of the existing levee, along the south side of Burdick Branch, to ensure delivery of stormwater events from the Judy's and Burdick tributaries into the new habitat area.

3. The creation of a 330-foot (100-meter) wide prairie buffer surrounding the perimeter of the habitat area's earthen hydraulic feature.

Variable measures:

1. Tributary Stream Restoration vs. Bottomlands sediment detention – sediment would be detained by constructing 28 new tributary stream sediment detention basins- 23 in the Judy's Branch, 4 in the Burdick Branch and 3 in the "Bluff 1" watersheds and creating a series of riffle and pool complexes to address channel destabilization and aquatic resource degradation in approximately 32 miles of tributary streams, or sediment would be detained in the Bottoms in existing ditches, and in the new habitat restoration area itself.

2. Size of habitat area – given existing urban constraint, three options are being considered to provide a variety of habitat options and hydrologic regimes (the "small" option would restore 131 acres, the "medium" option would restore 230 acres and a "large" option would restore 350 acres). Under the small and medium size, options, a moderate-extensive excavation activity will support the development of a new marsh. For the larger option, prairie would be created with little or no excavation needed.

3. Restoration of the historic Cahokia Creek channel within the habitat area – a channel would be excavated to replace the historic channel that has degraded over time - in over time in an effort to recreate the floodplain stream similar to that which once flowed from north to south across the site.

4. Create a 330-foot (100-meter) wide forested corridor along the north side of Burdick Branch extending from Cahokia Canal to Route 157.

5. Restoration of Tributary Streams a series of riffle and pool complexes would be constructed in the streams to stabilize streams and improve habitat quality.

Brushy Lake. The purpose of this action area is to restore an area on the floodplain that supports natural plant and animal communities, with a flood regime as similar to presettlement (ca. 1800) conditions as practicable, to minimize restore stream resources in the Schoolhouse Branch and "Bluff 3" watersheds, and to incidentally reduce flood damages within the Cahokia watershed. Much of the floodplain component is an old meander scar of the Mississippi River. Two centuries ago, Cahokia Creek flowed through this area, and forest was the predominant type of vegetation. A total of 6 different alternatives are being evaluated.

Common measures:

1. The creation of a 710-acre forested habitat area on the floodplain to utilize stormwater events delivered by both Schoolhouse Branch and Snyder Creek that will include planting of trees where they do not currently exist.

2. The restoration of the historic Cahokia Creek channel within the habitat area. Segments of channel that have been filled, will be reopened, and existing remnants will be excavated to remove accumulated sediments. These actions will recreate a floodplain stream similar to that which once flowed from north to south across the site.

3. Modification of the existing channels and levees of Schoolhouse Branch and Snyder Ditch to ensure delivery of stormwater events from these two bluff tributaries into the new habitat area. The current channel conditions (i.e., grassy side-slopes and earthen bottom) will be utilized.

Variable measures:

1. Tributary Stream Restoration vs. Bottomlands sediment detention – sediment would be detained by constructing 15 new tributary stream sediment detention basins- 14 in the Schoolhouse Branch watershed and 1 in the "Bluff 3" watershed and creating a series of riffle and pool complexes to address channel destabilization and aquatic resource degradation in approximately 25 miles of tributary streams, or sediment would be detained in the Bottoms in existing ditches, and in the new habitat restoration area itself.

2. Presence or absence of a prairie filter – under the Bottomland sediment detention option, a 330-foot (100 meter) wide vegetative buffer would be established in the habitat area outside the detention basin. The buffer would consist of prairie plantings to intercept sediment carried by stormwater overtopping the basin.

Spring Lake. The purpose of this action area is to restore an area on the floodplain that supports natural plant and animal communities, with a flood regime as similar to presettlement (ca. 1800) conditions as practicable, to restore stream resources in the Canteen and Little Canteen Creek watersheds, and to incidentally reduce flood damages within the Cahokia and Harding watersheds. The three floodplain areas lie in separate historic meander scars of the Mississippi River.

Two centuries ago, the principal type of vegetation occurring in these areas appears to have been marsh (Cell 1), prairie (St. Clair Farms), and forest (Indian Lake). A total of 9 different alternatives are being evaluated.

Common measures:

1. The establishment of three floodplain areas, namely Cell 1 (370 acres), St. Clair Farms (180 acres) and Indian Lake (620 acres), as habitat areas that will utilize stormwater events from Canteen and Little Canteen Creeks with the construction of earthen hydraulic features around these areas, when necessary. At Indian Lake, remnants of Cahokia Creek would be reopened to create a flowing floodplain stream, and trees would be planted along both sides of the channel (where they currently do not exist), to create a continuous forested corridor 330 feet (100 meters) wide. Impaired drainage at the northern end would be improved and standing water removed, to allow the forest to become reestablished.

2. The creation of a 330-foot (100-meter) wide forested corridor on both sides of Harding Ditch between Cell 1 and St. Clair Farms.

3. The re-establishment of a forest in the dead timber area[1] north of Forest Boulevard, within the Cahokia Mounds State Historic Site. The permanent standing water within a 35-acre tract of dead (drowned) timber would be drained and appropriate tree species planted under this option.

4. The construction of a new Canteen Creek relief channel to ensure that stormwater from the Canteen Creek watershed enters into the Harding Ditch system, and ultimately into the habitat areas. The channel would have concrete sides, a concrete bottom and earthen levies along both banks.

5. The modification of Harding Ditch, from Route 157 to Cell 1, and from Cell 1 to St. Clair Farms, in order to ensure the transference of stormwater events from Canteen and Little Canteen Creeks to the habitat areas. The channels would have grassy sides, an earthen bottom and an earthen levee along both banks.

6. The construction of a new "Fairmont City Ditch," from Cell 1 to Indian Lake, which will provide the hydraulic connection from Canteen Creek back to Cahokia Canal. The channel would have grassy sides, an earthen bottom and an earthen levee along both banks in low elevations.

Variable measures:

1. Tributary Stream Restoration vs. Bottomlands sediment detention – sediment would be detained by constructing 58 new tributary stream sediment detention basins- 37 in the Canteen Creek watershed and 21 in the Little Canteen Creek watershed and creating a series of riffle and pool complexes to address channel destabilization and aquatic resource degradation in approximately 99 miles of tributary streams, or sediment would be detained in the Bottoms in existing ditches, and in the new habitat restoration area itself.

2. Presence or absence of a new "floodplain" along "Reach 3B" of Harding Ditch. By setting back the existing levees along a 2,000-foot long reach of Harding Ditch, a "floodplain" area will be re-established.

3. Vegetative cover across the habitat areas – a variety of habitat restoration options and hydrologic regimes alternations are under consideration at the site. In Cell 1, a restoration marsh option that requires extensive excavation was compared to an option that produced a combination of marsh and forested habitat with minimal excavation required. In the St. Clair Farms area, an option that restores prairie and forested habitats to the site with no excavation activities was compared to the restoration of marsh habitat requiring minimal excavation. In "Reach 3B" of the Harding Ditch, a prairie restoration option implemented in the floodplain was evaluated. Throughout the evaluation of options, the habitat conditions in the Indian Lake area were held constant.

4. Restoration of Tributary Streams - a series of riffle and pool complexes would be constructed in the streams to stabilize streams and improve habitat quality.

Wedgewood. The purpose of this action area is to restore an area on the floodplain that supports natural plant and animal communities, with a flood regime as similar to presettlement (ca. 1800) conditions as practicable, to restore stream resources in the Schoenberger Creek watershed and to incidentally reduce flood damages within the Harding watershed. The area of the floodplain component is located in the southern portion of historic Cold Prairie that interfaced with forest. A total of 4 different alternatives are being evaluated.

Common measures:

1. The construction of a floodplain habitat area with an earthen hydraulic feature to utilize stormwater events delivered by Schoenberger Creek.
2. The modification of the existing levee, along the west side of Harding Ditch, to ensure delivery of stormwater events from Schoenberger Creek into the new habitat area.
3. The enclosure of Summit Avenue in the new habitat area, extending from Kings Highway on the west, to Harding Ditch on the east, to form a contiguous habitat area.

Variable measures:

1. Tributary Stream Restoration vs. Bottomlands sediment detention – sediment would be detained by constructing 24 new tributary stream sediment detention basins in the Schoenberger Creek watershed and creating a series of riffle and pool complexes to address channel destabilization and aquatic resource degradation in approximately 36 miles of tributary streams, or sediment would be detained in the Bottoms in existing ditches, and in the new habitat restoration area itself.
2. Vegetative cover across the habitat area – a variety of habitat restoration options and hydrologic regimes alternations are under consideration at the site, wet supported by excavation activities.

Mullens Slough. The purpose of the restoration at the Mullen's Slough action area is to restore an area on the floodplain that supports natural plant and animal communities, with a flood regime as similar to presettlement (ca. 1800) conditions as practicable, to restore stream resources in the Powdermill and "Bluff 6" watersheds and to incidentally reduce flood damages within the Powdermill/Canal No. 1 watershed. In the floodplain, much of the project area lies in an old meander scar of the Mississippi River. The historic Pittsburg or Big Lake occupied this area, and Mullens Slough now lies within its footprint. Prairie once extended south and west of this historic backwater lake. A total of 6 different alternatives are being evaluated.

Common measures:

1. The establishment of a 310-acre floodplain habitat area to utilize stormwater events delivered by the Powdermill watershed.

2. The creation of overwintering fisheries habitat in Mullens Slough. To accomplish this, a series of deep pools (water depth greater than 8 feet) would be created (by excavation), to provide suitable conditions for winter survival.

3. The creation of islands in Mullens Slough. Material excavated to create overwintering habitat would, in turn, be placed in the slough to create a series of islands. These would be planted to prairie habitat.

4. The improvement of habitat structure in Mullens Slough. Woody debris would be added to the slough, and various aquatic plant species would be planted around its perimeter.

5. The restoration of historic floodplain prairie habitat. Within the new habitat area, prairie would be planted on a 31-acre floodplain area south of Mullens Slough.

6. The creation of a 17-acre marsh area (Cell 1). Stormwater from Powdermill Creek would be passed through this area on its way to Mullens Slough.

7. The improvement of tree species diversity in the existing forests along Canal No. 1 and Mullens Slough by selective thinning and planting of mast tree species.

Variable measures:

1. Tributary stream vs. Bottomlands sediment detention – sediment would be detained either by constructing 20 new tributary stream sediment detention basins),
Tributary Stream Restoration vs. Bottomlands sediment detention – sediment would be detained by constructing 20 new tributary stream sediment detention basins - 14 in the Powdermill watershed and 6 in the "Bluff 6" watershed and creating a series of riffle and pool complexes to address channel destabilization and aquatic resource degradation in approximately 15 miles of tributary streams, or sediment would be detained in the Bottoms in a 17-acre detention basin (Cell 1) and in a second 23-acre detention basin (Cell 2), downstream of the habitat area itself.

2. Maintenance of prairie vegetation – three maintenance options were considered: Burning, Burning/Mowing, and Mowing.

Cahokia Mounds. The purpose of this action area is to restore an area on the floodplain that supports prairie plant and animal communities as similar to presettlement (ca. 1800) conditions as practicable. The project area lies within historic Cold Prairie, a 15,000-acre prairie once found in the southeast part of the American Bottoms. A total of 6 different action alternatives are being considered.

Variable measures:

1. Replacement of hay production areas with prairie plantings that would be completed within a 5 or 10- year time period. In terms of area, these rates corresponded to either ~105 or ~52.5 acres planted per year.

2. Three maintenance plans were designed to maintain the integrity of prairie plant communities by periodically removing dead plant materials.

a. Burning - the entire prairie would be burned every three years on a rotational cycle (a portion would be treated every year).

b. Burning and mowing - the entire prairie would be mowed once every two to three years, and burned once every ten years. Both treatments would be implemented on a rotational cycle.

c. Mowing only - the entire prairie would be mowed once every three years on a rotational cycle.

Review and Evaluation of Incremental Cost Analysis (ICA). The ICA results for each action area's array of alternative plans provided comparable information that could be used in the evaluation and assessment process of selecting a preferred plan. Detailed information pertaining to this analysis and its results are contained in Appendix A and Section 6 of the main report. From this documentation, the Team used a two-phase recommended plan selection process. The Team evaluated incremental differences between plans in order to determine which alternative at each site achieved the best results in relation to planning objectives and restoration planning targets. Each action area was addressed and ICA results systematically reviewed and compared in order to select the alternatives that would form the preferred plan. Following the Team's assessment, the Local Sponsor representatives went through the full assessment and evaluation process to identify their preferred plan. The following presents information on the team assessments for each action area. The process utilized to assess ICA results was to look at each action sites results, make an evaluation of these results and recommend an alternative that would be carried into the Recommended Project Plan. In each case the analysis of the No Action Alternative found it to be unacceptable and therefore it was eliminated from consideration.

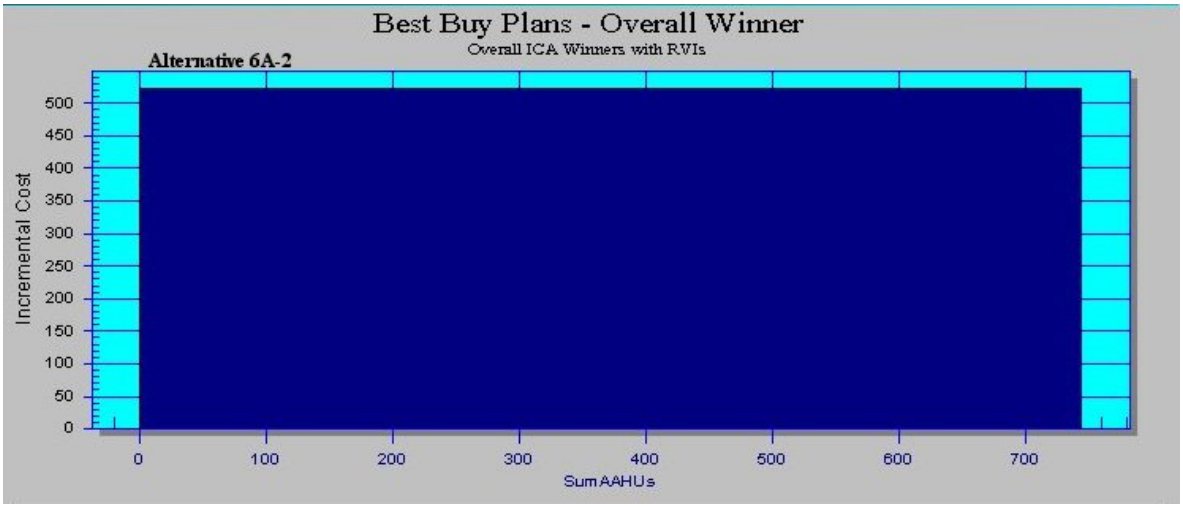
Dobrey Slough. The cost analysis process (as presented in Appendix A and Section 6.11 of the main report) identified alternative 5A-Y as the most cost effective and incrementally effective alternative (ICA winner). This plan includes a restored marsh buffered in part by a 75-meter wide forested corridor. Alternative 5A-X, with a 100-meter wide corridor, was labeled as the "HEP winner" because it produced the greatest number of environmental benefits in terms of average annualized habitat units (AAHUs). Incremental differences in cost and output between these two plans are displayed in the bar chart below. Alternative 5A-Y (ICA winner) provides 86 AAHUs at an average cost of $1,491 per AAHU, whereas alternative 5A-X (HEP winner) produces an additional increment of 1 AAHU at an average cost of $4,611 per AAHU. Of the three evaluated alternatives, both plans are considered to be least cost plans that produce alternative levels of environmental output.

During the selection process it was determined that alternative 5A-Y met the planning objectives and was the most effective alternative based on cost and output. Alternative 5A-Y was carried forward as the preferred alternative.

The following chart shows the best buy alternatives and their increment of cost versus output difference.

Elm Slough. The cost analysis process (as presented in Appendix A and Section 6.11 of the main report) identified alternative 6A-2 as the most cost effective and incrementally effective alternative (ICA winner), as well as the alternative producing the greatest number of habitat units (HEP winner). This alternative involves restoration of wetland forest in a floodplain habitat area by improving tree species diversity in existing wetland forest, restoring former wetland forest adjacent to existing wetland forest, and establishing prairie buffers between floodplain tributaries that are proposed to supply a restored flood pulse (Long Lake and Mitchell Ditch) to wetlands in the habitat restoration area. Alternative 6A-2 was carried forward as the preferred alternative.

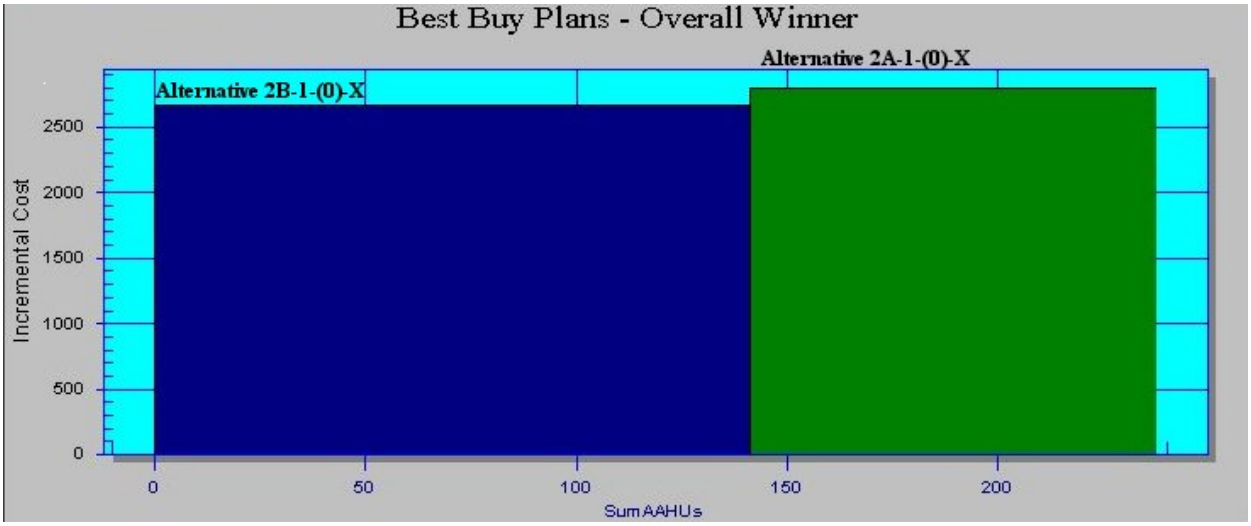
The following chart shows the best buy alternative and its increment of cost versus output difference.



Old Cahokia Creek. The cost analysis process (as presented in Appendix A and Section 6.11 of the main report) identified alternative 2B-1-(0)-X as the most cost effective and incrementally effective alternative (ICA winner). Alternative 2A-1-(0)-X was identified as the plan producing the greatest number of environmental outputs (HEP winner), and was second most cost effective. Under both alternatives, a floodplain habitat area of 314 acres would envelop 3.4 miles of restored floodplain stream and a 328-foot (100-meter) wide forested corridor along both sides of the restored creek channel. Under alternative 2A-1-(0)-X (HEP winner), restoration of floodplain aquatic habitat would be coupled with restoration of about seven miles of tributary streams in the Bluff 1 watershed, which drains into the proposed habitat area. Tributary stream restoration would consist of measures to restore physical characteristics of stream habitat, and would include ten sediment detention basins and creation of pool and riffle complexes.

During the selection process it was determined that Alternative 2A-1-(0)-X best supports the planning objectives and produces significantly greater benefits for the project area. Alternative 2A-1-(0)-X was carried forward as the preferred alternative.

The following chart shows the best buy alternatives and their increment of cost versus output difference.



Judy's/Burdick Branch. The cost analysis process (as presented in Appendix A and Section 6.11 of the main report) identified alternative 3C-4-0 as the most cost effective and incrementally effective alternative (ICA winner). Alternative 3A-4-0 was determined to be the "HEP winner" because it produced the greatest number of environmental benefits in terms of average annualized habitat units (AAHUs). This alternative was also the second-most cost effective plan. Under both alternatives, restoration of wet prairie in a 507-acre habitat area would occur on the floodplain. Under alternative 3A-4-0 (HEP winner), the floodplain habitat area would include 0.8 miles of stream restoration, and would be coupled with restoration of about 32 miles of tributary streams in the Judy's and Burdick Branch watersheds, which drain into the proposed habitat area. Tributary stream restoration would consist of measures to restore physical characteristics of stream habitat, and would include 28 sediment detention basins and creation of pool and riffle complexes.

Alternative 3C-4-0 (ICA winner) would include a floodplain sediment detention basin within the habitat area, and no floodplain or tributary stream restoration.

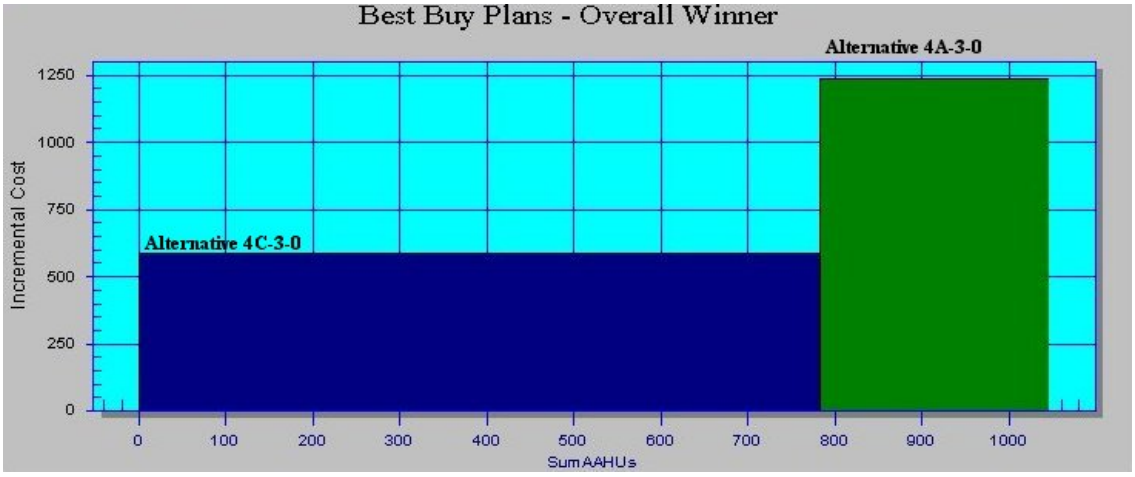
During the selection process it was determined that Alternative 3A-4(0) best supports the planning objectives and produces significantly greater benefits for the project area. Alternative 3A-4(0) was carried forward as the preferred alternative.

The following chart shows the best buy alternatives and their increment of cost versus output difference.

Brushy Lake. The cost analysis process (as presented in Appendix A) identified alternative 4C-3-0 as the most cost effective and incrementally effective alternative (ICA winner). Alternative 4A-3-0 was determined to be the "HEP winner" because it produced the greatest number of environmental benefits in terms of average annualized habitat units (AAHUs). This alternative was also the second-most cost effective plan. Under both alternatives, restoration of forested wetland in a 717-acre habitat area would occur on the floodplain. Under alternative 4A-3-0 (HEP winner), the floodplain habitat area would include 3.5 miles of stream restoration, and would be coupled with restoration of about 25 miles of tributary streams in the Schoolhouse watershed, which drains into the proposed habitat area. Tributary stream restoration would consist of measures to restore physical characteristics of stream habitat, and would include 15 sediment detention basins and creation of pool and riffle complexes. Alternative 4C-3-0 (ICA winner) would include a floodplain sediment detention basin within the habitat area, and no floodplain or tributary stream restoration.

During the selection process it was determined that Alternative 4A-3-0 best supports the planning objectives and produces significantly greater benefits for the project area. Alternative 4A-3-0 was carried forward as the preferred alternative.

The following chart shows the best buy alternatives and their increment of cost versus output difference.



Cahokia Mounds. Of the six plans evaluated for Cahokia Mounds, the incremental cost analysis identified alternative 8-1-(H) as the most cost effective alternative (ICA winner). Alternative 8-1-VH was determined to be the "HEP winner" because it produced the greatest number of environmental benefits in terms of average annualized habitat units (AAHUs).

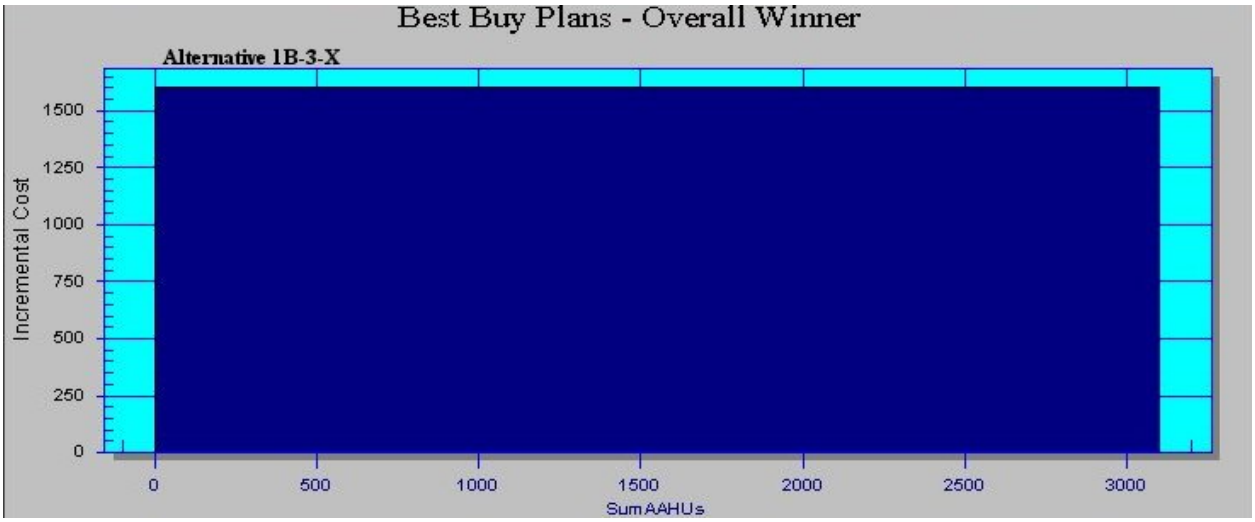
Both plans are considered to be least cost plans that produce alternative levels of environmental output.

During the selection process it was determined that alternative 8-1-(H) met the planning objectives and was the most effective alternative based on cost and output. Alternative 8-1-(H) was carried forward as the preferred alternative.

The following chart shows the best buy alternatives and their increment of cost versus output difference.

Spring Lake. The cost analysis process (as presented in Appendix A) identified alternative 1B-3-X as the most cost effective and incrementally effective alternative (ICA winner). Of the 6 evaluated alternatives, only 1B-3-X was determined to be a least cost plan, as shown in the bar chart below. It produces 3,105 AAHUs at an average cost of $1,602 per AAHU. A 1,364 acre floodplain habitat area consisting mainly of marsh and forested wetlands is to be established at three separate locations adjacent to Harding and Lansdowne Ditches. Under this alternative, the floodplain habitat area would include 3.1 miles of stream restoration, and would be coupled with restoration of about 99 miles of tributary streams in the Little Canteen and Canteen Creek watersheds, which drain into the proposed habitat area. Tributary stream restoration would consist of measures to restore physical characteristics of stream habitat, and would include 58 sediment detention basins and creation of pool and riffle complexes.

Alternative 1B-3-X was carried forward as the preferred alternative. The following chart shows the best buy alternative and its increment of cost versus output difference.



Wedgewood. As a result of comments received during public review of the draft report, which occurred between 28 February and 7 May 2003, this Action Area was eliminated and is not carried forward into the Recommended Plan. Additional information regarding this process is contained in Appendix G of the main report.

Mullens Slough. The cost analysis process (as presented in Appendix A) identified alternative 7B-2 as the most cost effective and incrementally effective alternative (ICA winner). Alternative 7A-2 was determined to be the "HEP winner" because it produced the greatest number of environmental benefits in terms of average annualized habitat units (AAHUs). This alternative was the second-most cost effective plan. Under both alternatives, a 312-acre floodplain area consisting of lake, prairie, and herbaceous wetland habitats is to be established adjacent to the confluence of Powdermill Creek and Canal No. 1. Under alternative 7A-2 (HEP winner), the floodplain habitat area would be coupled with restoration of about 16 miles of tributary streams in the Powdermill Creek watershed, which drains into the proposed habitat area.

Tributary stream restoration would consist of measures to restore physical characteristics of stream habitat, and would include 20 sediment detention basins and creation of pool and riffle complexes. Alternative 7B-2 (ICA winner) would include two floodplain sediment detention basins within the habitat area, and no tributary stream restoration.

During the selection process it was determined that Alternative 7A-2 best supports the planning objectives and produces significantly greater benefits for the project area. Alternative 7A-2 was carried forward as the preferred alternative.

The following chart shows the best buy alternatives and their increment of cost versus output difference.

Review and Evaluation of Plans. This section assesses the performance of the Biological (HEP), Incremental (ICA), and the Preferred plans with respect to the planning objectives described in Section 5. The summary of performance of each plan with respect to the planning objectives and targets is displayed below in Table 5. Table 6 provides an overview of the cost effectiveness of each plan. The No-Action Plan is displayed in Tables 5 and 6, and as it makes no contribution to any of the planning objectives it will not be further addressed in this context. Section 4 of the main report - Without Project Conditions addresses the effects of a No-Action Plan recommendation. The performance of the plans (Biological, Incremental, Preferred, and No Action) has also been assessed using results of incremental cost analyses that are presented in the Habitat Assessment of Appendix A and Section 6.12 of the main report and are displayed in Tables 7 through 9. The evaluation of plan performance against the objectives and a cost effectiveness analysis of the plans facilitate the selection of one of these plans as the Recommended Plan.

Table 5 Summary of the performance of each plan with respect to each of the planning objectives.

Objective	Target	Biological Plan	Incremental Plan	Preferred Plan	No-Action Plan
1 – Restore natural areas	Total area of habitat restored (acres)	4,885	4,440	4,830	0
2 – Restore flood pulse	% of action areas with depth of design flood < depth of 1844 flood	83	83	83	N/A
3 – Restore habitat quality	% of action areas with at least moderate habitat quality (average for 9 species)	75	60	76	N/A
4 – Improve water quality	Relative area affected	tributaries & floodplain	floodplain	tributaries & floodplain	N/A
5 – Reduce tributary erosion	% estimated sediment reduction	70	0	70	N/A
6 – Restore tributary streams	Total length of restored streams (miles)	178	99	178	N/A
7 – Restore floodplain streams	Total length of restored stream (miles)	10.8	9.7	10.8	N/A
8a – Reduce flood damages	Damages reduced by design event incidental to restoration of flood pulse (dollars)	$1,300,000	$1,300,000	$1,300,000	N/A
8b– Enhance outdoor recreation	Relative area affected	floodplain	floodplain	floodplain	N/A
8c – Protect cultural resources	Total area of known archaeological sites within action areas (acres)	999	990	989	N/A

Table 6 Summary of Cost Effectiveness Analysis of the Plans.

		Biological Plan	Incremental Plan	Preferred Plan	No Action Plan
Environmental output	Average annual habitat units generated by plan	8,399	7,093	8,332	0
Average cost of one unit of output	Average annual dollars per average annual habitat unit	$1,306	$995	$1,091	0
Total cost	Total dollars to implement plan	$136,570,000	$105,740,000	$136,120,000	0

The primary difference between the alternatives producing the higher habitat units (Biological Plan) and the alternatives that proved to be the least costly (ICA winners) is the measures used to restore tributary stream resources and reduce sediment. The Preferred Plan combines the alternatives producing the best results for this project as determined by the Biological Team and Sponsor Representative Team. In each instance where a higher cost alternative was selected the increment of cost for the higher producing habitat alternative was determined to provide additional value to the overall plan that justified the increased increment of cost.

The HEP Plan has the highest first cost of the plans compared but produces the highest habitat unit outputs. While the ICA plan produces the least habitat unit outputs its first cost is significantly less than either the HEP or Preferred Plans. Rationale for alternatives selected for the Preferred Plan is addressed in detail in the General Reevaluation Report.

The Preferred Plan has a first cost slightly lower than the HEP Plan with lower habitat unit outputs and significantly higher first cost and habitat unit output as compared to the ICA Plan. The following tables display the cost effectiveness analysis for each of the plans for comparative purposes.

Table 7 Cost Analysis for Incremental Plan

Alternative	Output (AAHU)*	Annualized Cost**	Cost Per AAHU	ICA Winner	HEP Winner	Total Cost (millions)**
Dobrey: 5A-Y	86	$128,100	$1,491	X		1.92
Elm: 6A-2	745	$389,500	$523	X	X	5.84
Cahokia: 2B-1-(0)-X	141	$377,000	$2,671	X		5.65
Brushy: 4C-3-0	782	$459,800	$588	X		6.95
Judy's: 3C-4-(0)	655	$379,500	$579	X		5.68
Cahokia: 8-1-(H)	849	$113,300	$133	X		1.68
Spring: 1B-3-X	3105	$4,975,075	$1,602	X	X	74.51
Mullens: 7B-2	730	$234,700	$322	X		3.51
TOTAL	7093	$7,056,975	$995	8	2	$105.68

*After relative value indexing **Based on planning estimates

Table 8 Cost Analysis for Biological Plan

Alternative	Output (AAHU)*	Annualized Cost**	Cost Per AAHU	ICA Winner	HEP Winner	Total Cost (millions)**
Dobrey: 5A-X	87	$134,200	$1,539		X	2.0
Elm: 6A-2	745	$389,500	$523	X	X	5.84
Cahokia: 2A-1-(0)-X	238	$647,000	$2,723		X	9.69
Brushy: 4A-3-(0)	1047	$787,300	$752		X	11.79
Judy's: 3A-4-(0)	1350	$1,255,700	$930		X	18.8
Cahokia: 8-1-(VH)	915	$141,700	$155		X	2.05
Spring: 1B-3-X	3105	$4,975,075	$1,602	X	X	74.51
Mullens: 7A-2	912	$794,400	$871		X	11.89
TOTAL	8399	$9,124,875	$1,086	2	8	$136.57

* After relative value indexing **Based on planning estimates

Table 9 Cost Analysis for Preferred Plan

Alternative	Output (AAHU)*	Annualized Cost**	Cost Per AAHU	ICA Winner	HEP Winner	Total Cost (millions)**
Dobrey: 5A-Y	86	$128,100	$1,491	X		1.92
Elm: 6A-2	745	$389,500	$523	X	X	5.84
Cahokia: 2A-1-(0)-X	238	$647,000	$2,723		X	9.69
Brushy: 4A-3(0)	1047	$787,300	$752		X	11.79
Judy's: 3A-4-(0)	1350	$1,255,700	$930		X	18.8
Cahokia: 8-1-(H)	849	$113,200	$133	X		1.68
Spring: 1B-3-X	3105	$4,975,075	$1,602	X	X	74.51
Mullens: 7A-2	912	$794,400	$871		X	11.89
TOTAL	8332	$9,090,275	$1,091	4	4	$136.12

*After relative value indexing **Based on planning estimates

Plan Development Conclusions. Of the three plans, the Preferred Plan is more effective in achieving the planning objectives. It is efficient because it consists of only "best buy" alternatives. The Preferred Plan is acceptable to state and federal resource agencies. It provides and accounts for all necessary investments needed to ensure the realization of the planned restoration outputs. Four state and federal agencies that partnered with the Corps during the study have indicated that the Preferred Plan best meets their desires and concerns. The plan is reasonable because non-Federal sponsors are willing to share study and project costs, and state and federal resource agencies support it. The Preferred Plan would provide significant restoration benefits to aquatic resources of national and regional institutional significance. The Preferred Plan provides a watershed level approach to addressing the problems and captializing on the opportunities of the project area. This plan re-establishes important linkages between tributary watersheds and floodplain ecosystems that best ensures future bio-diversity and sustainability. Based on these conclusions, the Preferred Plan is justified for selection as the Recommended Plan.

RECOMMENDED PLAN

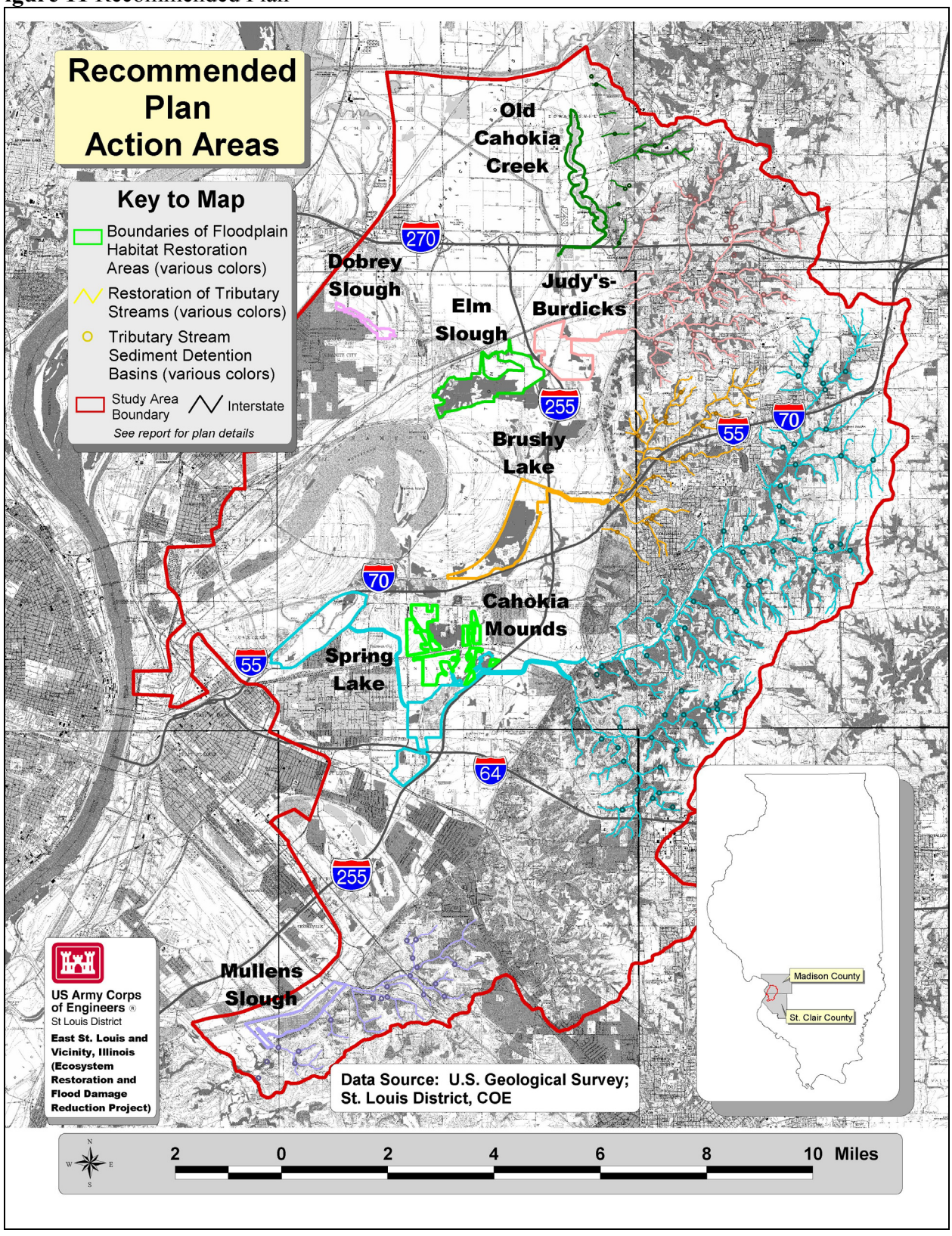
Overview. The Recommended Plan consists of the alternative selected from each of the eight Project action areas as identified in Section 6. To recap, these Project action areas are: Old Cahokia Creek; Judy's and Burdick Branch; Brushy Lake; Spring Lake; Mullens Slough; Dobrey Slough; Elm Slough; and Cahokia Mounds Prairie. The alternative selected to be a part of the Recommended Plan from each of these areas was the one that best addressed study objectives and planning targets within each respective Project action area.

In general, the Recommended Plan consists of the following measures: the restoration of bottomland forest habitat (1,705 acres), prairie habitat (1,111 acres), marsh and shrub swamp habitat (843 acres), lake habitat (460 acres), upland forest (379 acres), floodplain stream restoration (10.4 miles or 161 acres), placement of wood duck boxes (651 boxes) and prairie bird perches (870 perches), creation of over wintering holes and shoreline plantings (20 acres), and construction of tributary stream detention basins (131), riffle and pool complexes in 178 miles of streams,

earthen embankments (15.5 miles), and hydraulic control devices (culverts, flap gates, and new channels). Currently a total of 4,916 acres are included in the Project footprint, of which 4,468 acres are in the Mississippi River's floodplain and 448 acres are along streams in the tributary watersheds. The 178 miles of tributary stream restoration are not reflected in this Project area footprint.

Figure 11 displays the recommended plan. The eight proposed floodplain habitat restoration areas are outlined by various colors, the 178 miles of proposed tributary stream restoration are represented by various colors of line networks, and the 131 proposed sediment detention basins are shown as small circles along the tributary streams.

Figure 11 Recommended Plan



Features By Action Area.

Old Cahokia Creek. The Old Cahokia Creek action area consists of features to restore aquatic and terrestrial habitat in the floodplain and tributary stream watersheds. In the floodplain, about 3.4 miles of historic Cahokia Creek are to be restored to a flowing condition, and a 328-foot (100-meter) wide forested corridor is to be established along both sides of the restored creek channel. Together the restored creek and adjacent forest form a habitat area. About 6.6 miles of tributary streams in the Bluff 1 watershed are to be restored by constructing a series of riffle and pool complexes and building ten tributary stream sediment detention basins at scattered locations. The total footprint of all features is 314 acres, excluding restoration of tributary streams.

Judy's-Burdick Branch. The Judy's-Burdick action area consists of features to restore and enhance aquatic, wetland, and terrestrial habitats in the floodplain and tributary steams. A 507-acre floodplain habitat area of prairie is to be established at the confluence of Cahokia Canal, Judy's Branch, and Burdick Branch. About 32 miles of tributary streams in the Judy's, Burdick, and Bluff 1 watersheds are to be restored by constructing a series of riffle and pool complexes and building 28 tributary stream sediment detention basins at scattered locations. The total footprint of all features is 600 acres, excluding restoration of tributary streams.

Dobrey Slough. The Dobrey Slough action area consists of features to preserve, restore, and enhance aquatic, wetland, and terrestrial habitats in the floodplain. A 75-acre habitat area consisting principally of marsh and forest is to be established north of Pontoon Road and east of Maryville Road.

Elm Slough. The Elm Slough action area consists of features to preserve, restore, and enhance aquatic, wetland and terrestrial habitats in the floodplain. A 670-acre habitat area consisting principally of forested and scrub-shrub wetland is to be established. Il Route 111 bounds the habitat area on the west, Il Route 162 on the north, and I-255 on the east.

Brushy Lake. The Brushy Lake action area consists of features to restore and enhance aquatic, wetland, and terrestrial habitats in the floodplain and tributary streams. A 717-acre forested floodplain habitat area is to be established at the confluence of Cahokia Canal and Schoolhouse Branch. About 25 miles of tributary streams in the Schoolhouse and Bluff 3 watersheds are to be restored by constructing a series of riffle and pool complexes and building 15 tributary stream sediment detention basins at scattered locations. The total footprint of all features is 746 acres, excluding restoration of tributary streams.

Cahokia Mounds Prairie. The Cahokia Mounds action area consists of the restoration of 525 acres of floodplain prairie within the Cahokia Mounds State Historic Site. The action area is bounded by Collinsville Road on the north, Black Lane on the east, Forest Boulevard on the south, and railroad tracks on the west. Prairie plantings are to be established in eight separate tracts currently used as hay lease areas. Native plant species consisting of a variety of grasses and herbs and some sedges and shrubs are to be used. Flooding at this site was limited to rainfall and local run off in predevelopment times except when the Mississippi River was flooding the area, as was the case in 1844.

Under the recommended plan, no additional water would be brought to this site. While soils of the area are relict hydric soils, indicating that they historically supported a wetland plant community, additional investigation will be undertaken during design, such as the installation of piezometers at the site, to ensure there is currently sufficient hydrology at the site to support this prairie complex.

Spring Lake. The Spring Lake action area consists of features to restore and enhance aquatic, wetland, and terrestrial habitats in the floodplain and tributary streams. A 1,364-acre floodplain habitat area consisting mainly of marsh and forested wetlands is to be established at three separate locations adjacent to Harding and Lansdowne Ditches. About 99 miles of tributary streams in the Canteen Creek and Little Canteen Creek watersheds are to be restored by constructing a series of riffle and pool complexes and building 58 tributary stream sediment detention basins at scattered locations. Spring Lake is the largest of all action areas, and the total footprint for all features is 1,615 acres, excluding restoration of tributary streams.

Mullens Slough. The Mullens Slough action area consists of features to restore and enhance aquatic, wetland, and terrestrial habitats in the floodplain and tributary streams. A 312-acre floodplain habitat area consisting predominantly of a lake (known as Mullens Slough) is to be established adjacent to the confluence of Powdermill Creek and Canal No. 1. About 16 miles of tributary streams in the Powdermill Creek and Bluff 6 watersheds are to be restored by constructing a series of riffle and pool complexes and building 20 tributary stream sediment detention basins at scattered locations. The total footprint of all features is 371 acres, excluding restoration of tributary streams.

Operation and Maintenance. Each of the action areas will operate independently. None of the features of the Recommended Plan have any manual or automated operational components (such as slide gate and stop log closures or pumping stations). Also, no changes in the operation of the remaining flood control features such as canals and pumping plants will be necessary. Features of the Recommended Plan will require periodic inspection and maintenance to include: the removal of collected vegetative and woody debris at all control structures and upland dry detention basins; installation of sediment panels in upland dry detention basing; periodic erosion repair; periodic inspection to maintain smooth operation of all flap gates; and, and the mowing or burning, as necessary, of berms and prairie areas.

Real Estate. The Project will require the acquisition of approximately 5,398 acres of land. It will affect approximately 1,049 land parcels and 677 landowners. Eight areas in the floodplain and 131 upland sites are a part of this Project. Fee title is required on most of the land in the floodplain to allow the Sponsors to control the environmental restoration, habitat development and operation maintenance of the land. Permanent easement will be required to construct, to access, and to operate and maintain the 131 sediment detention basins. Flowage easement will be required for a ponding area at both Old Cahokia Creek and Judy's-Burdick Branch. Flowage easement will also be required for the 131 detention basins to allow water to temporarily pond during storm events. In summary, 4,468 acres in fee, 66 acres in permanent easement, and 864 acres in flowage easement will be acquired. Temporary Easements for access and construction are required and will be determined when the Engineering Design Reports are prepared for each Project action area. The temporary construction easements for this type of project are not considered out of the ordinary.

Adaptive Assessment and Monitoring. The Recommended Plan includes post-construction monitoring to determine if predicted environmental outputs will be achieved following construction, and to provide feedback for future ecosystem restoration projects. During the study's formulation process, it was uncertain whether specific proposed measures would achieve their restoration objectives. Consequently, the monitoring program reflects the incorporation of adaptive management. Adaptive management is a technique for addressing uncertainty in restoration projects. Under this approach, restoration measures are implemented and monitored, feedback is provided based on new insights gained from the response of the system and its resources, and adjustments are made to the Project as necessary and feasible. An example of this process is the Judy's Branch demonstration project that has been established on Judy's Branch, one of the tributary watersheds. To test whether tributary stream sediment detention basins and in-stream restoration measures will perform as expected, a demonstration project was initiated in early 2000 with the implementation of sediment monitoring by the USGS on Judy's Branch. This pilot project is described in greater detail in Appendix E of the main report. With the information gained from this monitoring process, preliminary plans for stream sediment detention and in-stream restoration measures will be developed and implemented in this tributary first. The performance of these measures will be analyzed over an approximate 3-year period to determine their effectiveness in restoring stream quality, stabilizing stream banks and slowing the transfer of sediment to the floodplain. Results from this pilot project will be used to make the adaptive changes required to achieve anticipated Project outputs.

Fish and Wildlife Mitigation. Since the purpose of ecosystem restoration is to provide environmental benefits, this Project was formulated and designed to avoid and/or minimize adverse effects to environmental resources.

Cultural Resources Mitigation. Prior to the discussion of any potential Project feature locations, the State of Illinois Historic Preservation Officer (SHPO) provided the design team with the locations of all previously recorded archaeological sites within the study area. The Team used this information throughout the plan formulation phase so as to avoid impacts to any known archaeological sites.

Outdoor Recreation. During the latter study stages, local interests made formal requests to the Team to investigate water and related land resources outdoor recreation opportunities, especially as they tie-in with the existing infrastructure and the potential to be derived from the Recommended Plan. The Recommended Plan currently contains a bike trail. However, there are many other outdoor recreation opportunities that could be pursued under separate action after authorization of this project. The opportunities are due, in part, to the scenic views of natural areas with interpretive potential and in their proximity for easy connection to the regional trail network that is being developed by local organizations and agencies. Trails also could be planned not only in the levied areas, but also along the streams and greenways. Ecosystem restoration measures of the Recommended Plan such as wetlands, would also lend themselves to outdoor recreational pursuits. The development of boardwalks at the wetlands would provide a close up view of wildlife. These boardwalks also would be useful for rest stops along the trail. Any recreation or interpretive opportunities will have to be consistent with the intent of the project and not interfere with the achievement of restoration objectives.

Economics. The total first cost is estimated to be $189,266,000. The average annual project implementation cost is $11,799,000. This average is computed using the current interest rate of 5.875% over the anticipated 50-year project life. Project benefits have been quantified by means of identifying habitat units incrementally compared to their cost of production. The Recommended Plan produces approximately 8,332 annualized habitat units at an average annual cost of $1,416.

In summary, this Project was formulated as a single purpose Ecosystem Restoration project in accordance with Corps' engineering regulations which states that: "Monetary gains (e.g., incidental recreation or flood damage reduction) and losses (e.g., flood damage reduction or hydropower) associated with the project shall also be identified." In an attempt to quantify these benefits, a risk-based analysis was performed. This analysis determined that $1,366,000 in average annual flood damage reduction is incidental to plans considered. Recreation benefits are also incidental to the Project. The Cahokia Creek Bike Trail has an estimated first cost of $258,000 with an annualized cost of $16,084 producing a benefit to cost ratio of 1 to 1.7, using the Facility Capacity Method.

Cost Sharing. The Corps of Engineers, on behalf of the Federal government, and the non-Federal Sponsors for the construction project, the Counties of Madison and St. Clair, Illinois, will share in the responsibilities for implementing the Recommended Plan. The Counties will participate in a third party agreement with the State of Illinois who will provide monetary support to the Counties for the implementation of the Project.

The Corps will be responsible for designing the Project and administering all government construction contracts to implement it. The Counties and the State will share in the design and construction costs. The Counties will furnish the necessary lands, easements, rights of way, relocation, and disposal areas as well as operate and maintain the completed Project. Rules that determine how project responsibilities are shared are established in Federal law and related Administration implementing policies.

RECOMMENDED PLAN'S EFFECT ON NATURAL RESOURCES OF SIGNIFICANCE

The Study area is located within an extremely valuable and strategic ecosystem resource area. The implementation of ecosystem restoration plans within this area will contribute greatly to national, regional and local systems. Significant Study area characteristics and contributions include the following.

Aquatic resources of national and regional significance are found in the Project area. They include aquatic features such as 2,000-acre Horseshoe Lake, over 6,000 acres of various wetlands on the Mississippi River's floodplain, as well as over 200 miles of streams in small tributary watersheds.

North American Waterfowl Management Plan. The recommended plan will contribute to the North American Waterfowl Management Plan's goals for conservation and management of waterfowl species and habitat by protecting and restoring mid-migrational and breeding habitat along the Mississippi River flyway.

The proposed habitat restoration on the Mississippi River's floodplain will occur within one of the Plan's waterfowl habitat areas of major concern on the North American continent, and within a migratory focus area designated at the regional scale under the Upper Mississippi River/Great Lakes Region Joint Venture's Implementation Plan. This habitat restoration will contribute to the Joint Venture Implementation Plan's goal of increasing wetland habitats by about 36,000 acres in migratory focus areas along the Mississippi River in Illinois. The plan will contribute significantly by providing about 1,350 acres of new wetlands through reestablishment of historic vegetation and functions to former wetlands. It will also restore about 1,325 acres of existing wetlands by improving natural conditions and returning historic functions to degraded wetlands. About 30 species of migratory swans, geese, and ducks should benefit from the restoration of these 2,700 acres of affected wetlands.

The recommended plan will also provide additional benefits to migratory and resident waterfowl species at lake and pond habitats. Within the proposed habitat restoration areas, improving natural conditions and replacing historic functions will restore about 460 acres of lake and pond habitat, which is expected to provide more feeding opportunities for waterfowl by increasing production of aquatic organisms. In addition, indirect benefits to lake and pond habitat are expected outside the proposed restoration areas at the 2,000-acre Horseshoe Lake at Horseshoe Lake State Park. The proposed restoration of 178 miles of tributary streams is expected to reduce excessive sediment loads carried from the bluffs into Horseshoe Lake by the study area's interior drainage system during storm events, and similarly improve feeding opportunities for migratory and resident waterfowl.

Upper Mississippi River System Environmental Management Program. The recommended plan will contribute to the goal of the Habitat Needs Assessment of the Upper Mississippi River System Environmental Management Program of increasing by about 100,000 acres the amount of prairie, marsh, and forest on the Mississippi River's floodplain within the river reach extending from St. Louis to Cairo. The plan will significantly increase the area of prairie, marsh, and forest in this river reach by about 2,365 acres. The plan is also expected to meet the need for three specific habitat improvements identified in the Habitat Needs Assessment. First, the plan is expected to restore existing degraded habitats by improving natural habitat conditions, thereby improving habitat quality. Second, the plan will restore a flood pulse to floodplain habitats, thereby returning the current hydrological regime to a closer approximation of pre-development conditions. Lastly, the plan will restore historically typical floodplain habitats that are now uncommon, such as floodplain prairies and streams, thereby increasing floodplain habitat diversity.

Clean Water Action Plan. The recommended plan will contribute toward the goals of the Clean Water Action Plan by restoring 178 miles of streams in five small watersheds identified as priority watersheds for restoration in Illinois. The plan's proposed restoration of tributary streams in these five watersheds is expected to correct silt and sedimentation problems that have degraded in-stream habitat.

Improving the quality of in-stream habitat should restore conditions that can support a diverse food web of animals by improving substrate quality, restoring channels and pool and riffle complexes, and encouraging recolonization by benthic invertebrates.

Restoration of riparian forest along tributary streams at the 131 proposed sediment detention basins is expected to improve degraded habitat conditions by reintroducing uncommon native tree species such as oaks. Under the plan, storm water carried by the tributary streams proposed for restoration is to serve as the source of the flood pulse to be reintroduced into the proposed habitat restoration areas on the Mississippi River's floodplain. An expected secondary effect of tributary stream restoration is improvement of conditions in the floodplain habitats, by reducing excessive sediment loads currently reaching the floodplain.

Action Plan of the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force. The plan's proposed restoration of wetlands on the Mississippi River's floodplain in Illinois supports the Action Plan of the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force. The proposed restoration of about 2,700 acres of floodplain wetlands is expected to promote nitrogen retention within the study area's watersheds, reduce nitrogen loads of inflow from the interior drainage system to the Mississippi River, and contribute to the eventual improvement of the hypoxic condition in the northern Gulf of Mexico.

Conservation Initiatives for Bird Species of Concern. The recommended plan is expected to benefit 34 priority species of birds and two federally threatened species (one plant and one bird) through the restoration of about 4,300 acres of aquatic habitats on the Mississippi River's floodplain, 178 miles of tributary streams, and about 380 acres of riparian forest along the tributary streams. Migratory and breeding habitat for 10 priority species of ducks is expected to be provided by the proposed restoration of 2,700 acres of wetlands and 460 acres of lake habitat within eight proposed floodplain habitat restoration areas. The proposed plan will support the North American Waterbird Conservation Plan by providing migratory and breeding habitat for four heron and rail species of concern through the proposed wetland restoration, along with the proposed restoration of about 11 miles of floodplain streams. Feeding opportunities for two of these heron species are also expected to improve from the proposed restoration of 178 miles of tributary streams. The recommended plan will contribute to the U.S. Shorebird Conservation Plan by providing migratory habitat to eight sandpiper species of concern through the proposed floodplain wetland restoration. Horseshoe Lake at Horseshoe Lake State Park, recognized under the Shorebird Plan as an important stopover in Illinois for migratory shorebird species, is expected to indirectly benefit from the proposed plan through reduced levels of sedimentation, which is expected to provide improved feeding opportunities to shorebirds. The Neotropical Migratory Bird Conservation Program (Partners in Flight) and 11 landbird species of concern are expected to benefit from the recommended plan through the proposed restoration of forested wetlands, marshes, wet prairies, and floodplain and tributary streams, and restoration of riparian forest along tributary streams. Restoration of forested wetland habitat at the proposed Brushy Lake action area is expected to meet the size requirements for breeding habitat of some area-sensitive landbird species of concern, such as the Acadian flycatcher and Louisiana waterthrush. Similarly, area-sensitive grassland breeding species of concern like the grasshopper sparrow and sedge wren are expected to benefit from restoration of floodplain prairie at the Judy's-Burdick and Cahokia Mounds Prairie action areas.

The federally threatened bald eagle is expected to benefit from improved feeding opportunities through proposed restoration of 460 acres of lake habitats. The proposed plan will contribute to the recovery plan of the federally threatened decurrent false aster through restoration of about 1,500 acres of marsh and wet prairie habitats where it can be introduced.

IMPLEMENTATION PLAN

Implementation Process. As mentioned earlier, this Project originally was authorized to address flood damage reduction but as a result of the Water Resources Development Act of 2000, ecosystem restoration was added as a Project purpose thus permitting the formulation of alternatives for this Project using the Administration Policy Guidelines for an incrementally justified National Environmental Restoration Project. In accordance with the National Environmental Policy Act (NEPA) requirements, this report has been, and will continue to be coordinated with the public and appropriate resource agencies to seek their input. The Project Team has received public and review agency comments to the Draft Report, and this final report reflects the consideration and as appropriate incorporation of those comments. This final report is submitted to the Corps of Engineers' Mississippi Valley Division Headquarters for review and processing. After follow-on review at the Corps of Engineers' main headquarters in Washington D.C., the Chief of Engineers will release this report through the Assistant Secretary of the Army for Civil Works, who in-turn will refer it to Congress for authorization. Congressional authorization will permit a construction new start for the Project.

The Corps of Engineers will prepare the first set of plans and specifications as a part of the existing scope of the PED agreement. Based on consultation with the Sponsors, the first alternative to be undertaken outside the demonstration project will be the restoration of an area that does not have an upland component. In this manner, the analysis of stream restoration techniques can be completed on an alternative having those components prior to the completion of the design. Prior to the acquisition of Project lands and the subsequent initiation of the first item of construction, a Project Cooperation Agreement (PCA) will be executed for the entire Project effectively bringing the PED phase to a conclusion. Work under the PCA will begin with the Sponsors' acquisition of lands, easements, rights-of-way, relocations and necessary disposal areas (LERRD's) in advance of the advertisement and award of the first construction contract.

Implementation Reports. An Engineering Design Report (EDR) will be prepared to validate each recommended action plan. These reports will develop the detail for each alternative that was not accomplished during the restudy effort. Each EDR will detail the full spectrum of technical analyses required to support engineering considerations as well as assessing the validity of assumptions made during the ecosystem restoration evaluation. These EDR’s will include comparisons to the original Habitat Evaluation Procedure outputs. If differences in the alternative design are required as a result of significant changes in the existing conditions that impact acreage, basic restoration concepts, or hydrology, the incremental cost analysis of outputs will be re-validated. Each EDR also will include a real estate report that verifies costs and estates required for the Project and an overall detailed cost estimate referred to as an “MCACES” estimate. Based upon these findings, an environmental assessment or supplemental environmental impact statement will be completed in accordance with NEPA requirements.

Following public review and comment, the EDR, will be approved within the Corps' chain of command. The design of alternative features will not begin until it is determined that the proposed action plan still supports original Project objectives and thus, continued action. Designs will be packaged in units appropriate to support efficient contract work on a specific alternative and sequenced as required to maintain Project progress in a logical manner.

As a result of these actions, the integrity of the Project objectives will be maintained. It will be unlikely that any of the restoration focus will be lost or diluted over time. The institution of this rigorous process as a part of Project implementation is deemed appropriate based on the uniqueness of this Project and its underlying concepts.

Project Management. The Project will be managed in accordance with all applicable laws, regulations, and policies. Information that outlines the philosophy of project management within the Corps of Engineers is contained in Engineering Regulation 5-7-1. There will be a lead Corps of Engineers person designated to manage the Project during its life cycle. This person will be responsible for managing the programmatic and the technical aspects of the Project as well as coordinating all issues related to the Project between the Sponsors, the stakeholders, and the public.

Implementation Schedule. A Project schedule has been developed based upon the assumption that a positive Chief of Engineers' report will be forwarded to the Assistant Secretary of the Army for Civil Works during calendar year 2003 and that Congressional authorization will occur in time to program construction new start funds for FY 2005. The Project schedule sequences the reporting, design, and construction activities as they move from the simple to the complex. In this manner, there will be ample time to complete sediment analyses and to review demonstration project results so that analytical data and practical lessons learned can be incorporated into action plan execution. Additionally, the schedule has been prepared in a manner to have new EDR's prepared simultaneously, with the designing and/or constructing of action areas covered in approved EDR's. This helps to ensure that project momentum is maintained and that the necessary experts remain engaged throughout the process. The development of this schedule assumes funding is available in the years required and that the real estate and relocations actions are completed on schedule. As mentioned, initiation and completion of EDRs are independent of one another for the various action plans. However, design and construction activities are dependent upon their respective EDR's approval. A copy of the proposed schedule is included in Appendix K of the main report. The Project schedule will be evaluated and updated continuously, based upon future funding levels and the results of the EDR studies.

The recommended schedule reflects the information currently available and the current departmental policies governing execution of projects. It does not reflect program and budgeting priorities inherent in either the formulation of a national civil works construction program or the perspective of higher review levels within the Executive Branch. Consequently, the schedule recommended in Appendix I of the main report may be modified before it is transmitted to higher authority for authorization and/or implementation funding. Under current plans, this schedule begins with PED activities in FY 2003 and concludes in FY 2005 with the advertisement and award of the first item of construction.

Funding. In order to support the planning and budget development process for the Project, Table 11 depicting the necessary funding stream required to support the Project schedule is presented below. This table identifies the resource requirements by year and details non-Federal requirements for Project implementation. This Table identifies both cash requirements and the requirements estimated by year for LERRD's.

Table 11 Project Funding Stream

FY	Phase	Total Project Implementation Cost	LERRDs	PED or Construction	%	Additional Non-Fed Cash	Federal Cash Schedule
Prior FY's	PED	2407.000	0.000	2407.000		601.750	1805.250
FY03	PED	800.000	0.000	800.000		200.000	600.000
FY04	PED	793.000	0.000	793.000		198.250	594.750
FY05	Constr	4865.430	3343.890	1521.540	0.011	371.993	1149.547
FY06	Constr	1348.910	130.470	1218.440	0.009	308.347	910.093
FY07	Constr	5276.770	2074.020	3202.750	0.020	799.843	2402.907
FY08	Constr	11589.600	4182.300	7407.300	0.048	1607.902	5799.398
FY09	Constr	12626.800	6880.120	5746.680	0.038	1259.200	4487.480
FY10	Constr	12242.210	6881.970	5360.240	0.035	1178.055	4182.185
FY11	Constr	18987.800	6230.540	12757.260	0.082	2731.302	10025.958
FY12	Constr	16344.350	1620.660	14723.690	0.094	3144.219	11579.471
FY13	Constr	18853.900	633.870	18220.030	0.116	3878.391	14341.639
FY14	Constr	22284.470	968.570	21315.900	0.136	3528.471	17787.429
FY15	Constr	16491.590	791.190	15700.400	0.100	3349.312	12351.088
FY16	Constr	14666.300	469.800	14196.500	0.091	3033.518	11162.982
FY17	Constr	13120.500	0.000	13120.500	0.084	2807.577	10312.923
FY18	Constr	11529.210	0.000	11529.210	0.074	2473.433	9055.777
FY19	Constr	8845.000	0.000	8845.000	0.057	1909.795	6935.205
FY20	Constr	193.260	0.000	193.260	0.003	93.077	100.183
Total		**193266.100**	**34207.400**	**159058.700**	**1.000**	**33474.435**	**125584.265**

*Displayed in $1,000s

Financial Analysis. Madison and St. Clair Counties are expected to serve as Sponsors and thus, share in the non-Federal costs of this Project. They are being joined in a separate third party agreement with the Illinois Department of Natural Resources, who is committing to provide a minimum cash contribution of $10,000,000.

The Sponsors' share of the Project cost is estimated to be $67,681,835 of which $1,000,000 has already been contributed during PED. The Illinois Department of Natural Resources has committed to providing funds totaling approximately $10,000,000. The estimated $34,207,400 in LERRD's costs will be borne by Madison and St. Clair Counties. The remainder of the Sponsors' share estimated to be $23,474,435 will be a divided among the State and the two counties. These figures include the restoration project costs that are shared at a 35% -65% rate and recreation features that are shared at a 50%-50% rate. Madison and St. Clair Counties and the State of Illinois have the capability of performing some of the required work themselves.

During the development and negotiation of the Project Cooperation Agreement (PCA) these possibilities will be further examined.

The Sponsors have the capability to finance this Project. Additionally, they have the financial resources to accomplish future OMRR&R requirements currently estimated to be $93,000 a year. They each have taxing authority and an annual budget that supports their estimated individual share of estimated Project costs.

CONCLUSIONS

This Report presents a summary of the work that the St. Louis District, Corps of Engineers and its partners have accomplished to advance the East St. Louis and Vicinity, Illinois Ecosystem Restoration and Flood Damage Reduction Project. This work progressed from the identification of the Study Area's problems and opportunities to the development, assessment, and evaluation of alternative plans to address the problems and opportunities. Based upon rigorous evaluation and assessment, a Recommended Plan was selected.

The conclusions reached from this effort are that the implementation of the Recommended Plan will greatly improve and restore the ecosystem within the Study Area as well as provide the basis for the permanent preservation and protection of these invaluable ecosystem resources.

POST AUTHORIZATION CHANGE REPORT

A Post Authorization Change Report (PAC) has been prepared to accompany the General Re-evaluation Report based on the change in project outputs, the increase in cost estimate and period of apportionment. This report provides information identified in ER1105-2-100 comparing the authorized Project and recommended plan in detail. The conclusion of this report is that additional congressional authority is required to implement the plan recommended in the Final General Re-evaluation Report.

COMMANDER'S RECOMMENDATION

The Project area is located within an extremely valuable and strategic ecosystem resource area. The implementation of ecosystem restoration plans within this area will contribute greatly to national, regional and local systems. The Study area's ecosystem significance relates directly to contributions towards the: North American Waterfowl Management Plan; Upper Mississippi River System Environmental Management Program; Clean Water Action Plan; Action Plan of the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force; and, federal government's list of "Species of Concern".

I have carefully considered the significant factors related to the problems and associated opportunities identified within the Project Area, as well as the numerous alternative plans that were developed to address these problems and opportunities.

These factors include: the severity of the environmental, social and economic consequences of ecosystem degradation and its related land and water resources problems within this significant, internationally known and valued environmental/cultural resource area; the probability of more severe conditions in the future; the ability of each alternative plan to address the ecosystem restoration and related problems and opportunities; the costs of the plans and the relationship of the costs to their associated outputs; and the acceptability of the plans to the non-Federal interests and partner Resource agencies. In consideration of these important factors, I have determined that the following recommendation is in the public's interest.

I recommend that East St. Louis and Vicinity, Illinois project authorized by the Section 204 of the Flood Control Act of 1965 and amended by Section 310 of the Water Resources Development Act of 2000 be modified to implement the National Environmental Restoration Plan identified in this Report as the Recommended Plan, as a Federal project with further modifications as necessary, in the discretion of the Commander, USACE, that may be advisable in accordance with the cost sharing and financing arrangements satisfactory to the President and the Congress. Based on October 2003 price levels, the total cost of the recommended plan is currently estimated to be $193,266,100 including PED activities. The Federal and non-Federal shares are estimated at $125,584,265 and $67,681,835, respectively. These costs reflect a 65-35% cost share of the environmental features and a 50-50 cost share for the recreation features. The non-Federal operation, maintenance, repair, rehabilitation and replacement costs are estimated at $93,000 annually. This recommendation is made with the provision that prior to Project implementation, the non-Federal interests must:

a. Provide a minimum of 35 percent of project costs allocated to ecosystem restoration and 50 percent of the project costs allocated to recreation, as further specified below:

(1) Enter into an agreement to provide, prior to execution of the project cooperation agreement, 25 percent of design costs;

(2) Provide during construction, any additional funds needed to cover the non-Federal share of design costs;

(3) Provide all lands, easements, and rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or assure the performance of all relocations determined by the Government to be necessary for the construction, operation, and maintenance of the Project;

(4) Provide or pay to the Government the cost of providing all retaining dikes, waste weirs, bulkheads, and embankments, including all monitoring features and stilling basins, that may be required at any dredged or excavated material disposal areas required for construction, operation, and maintenance of the Project;

(5) Provide during construction, any additional costs as necessary to make the total non-Federal contributions equal to 35 percent of total project costs allocated to ecosystem restoration and 50 percent of the total project costs allocated to recreation.

b. Provide 35 percent of the cost for that portion of total cultural resource preservation mitigation and data recovery costs attributable to ecosystem restoration that are in excess of one percent of the total amount authorized to be appropriated for the Project;

c. Provide 50 percent of the cost for that portion of total cultural resource preservation mitigation and data recovery costs attributable to recreation that are in excess of one percent of the total amount authorized to be appropriated for the Project;

d. For so long as the project remains authorized, operate, maintain, repair, replace, and rehabilitate the completed project, or functional portion of the project, at no cost to the Government, in accordance with applicable Federal and State laws and any specific directions prescribed by the Government;

e. Grant the Government a right to enter, at reasonable times and in a reasonable manner, upon land which the non-Federal sponsor owns or controls for access to the project for the purpose of inspection, and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the project;

f. Comply with Section 221 of Public Law 91-661, Flood Control Act of 1970, as amended, and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended, which provides that the Secretary of the Army shall not commence construction of any water resources project or separable element thereof until the non-federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element;

g. Hold and save the Government free from all damages arising for the construction, operation, maintenance repair, replacement, and rehabilitation of the project and any project-related betterments, except for damages due to the fault or negligence of the Government or the Government's contractors;

h. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project to the extend and in such detail as will properly reflect total project costs;

i. Perform, or cause to be performed, any investigations for hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601-9675, that may exist in, on, or under lands, easements of rights-of-way necessary for the construction, operation, and maintenance of the project; except that the non-Federal sponsor shall not perform such investigations on lands, easements, or rights-of-way that the Government determines to be subject to the navigation servitude without prior specific written direction by the Government;

j. Assume complete financial responsibility for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Government determines necessary for the construction, operation, or maintenance of the project;

k. Agree that, as between the Federal Government and the non-Federal sponsor, the non-Federal sponsor shall be the operator of the project for the purpose of CERCLA liability, and to the maximum extent practicable, operate, maintain, repair, replace, and rehabilitate the project in a manner that will not cause liability to arise under CERCLA;

l. Prevent future encroachments on project lands, easements, and rights-of-way, which might interfere with the proper functioning of the Project;

m. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), as amended by Public Law 102-240, Section 1055 (re: rural electrification), as amended by Public Law 105-117, Section 104 (re: Alien not lawfully present in United States), and the Uniform Regulation contained in 49 CFR part 24, in acquiring lands, easements, and rights-of-way, and performing relocations for construction, operation, and maintenance of the project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act;

n. Comply with all applicable Federal and state laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army" and all applicable federal labor standards requirements, including, but not limited to, the Davis-Bacon Act (40 U.S.C. 276a et. seq.), the Contract Work Hours and Safety Standards Act (40 U.S.C. 327 et. seq.) and the Copeland Anti-Kickback Act (40 U.S.C. 276c).

o. Do not use Federal funds to meet the non-Federal sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is authorized.

The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for authorization and implementation funding. Consequently, this recommendation may be modified before it is transmitted to Congress as proposals for authorization and implementation funding. However, prior to transmittal to Congress, the State of Illinois, Madison and St. Clair Counties, Illinois, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

C. KEVIN WILLIAMS
COL, EN
Commanding