GRANT

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT (R-11F)
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT

BANNER MARSH STATE FISH AND WILDLIFE AREA

SEPTEMBER 1995

US Army Corps
of Engineers
Rock Island District

LA GRANGE POOL
ILLINOIS WATERWAY
RIVER MILES 138.5 - 143.9
FULTON & PEORIA COUNTIES, ILLINOIS

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

REPLY TO
ATTENTION OF:

October 6, 1995

Planning Division

SEE REPORT DISTRIBUTION LIST I (APPENDIX L)

The Rock Island District of the U.S. Army Corps of Engineers (Corps) has enclosed the final Definite Project Report (R-11F) with integrated Environmental Assessment and Technical Appendices for the Banner Marsh State Wildlife Area, Illinois, Habitat Rehabilitation and Enhancement Project. This project is a part of the Upper Mississippi River System - Environmental Management Program.

The Banner Marsh project was proposed by the Illinois Department of Natural Resources and is being developed in cooperation with the Corps' Rock Island District, the U.S. Fish and Wildlife Service, and other appropriate Federal and State agencies.

The project goals are to enhance wetland, terrestrial, and aquatic habitat. The following design objectives have been identified to meet these goals: (1) increase littoral zone for fish and waterfowl, (2) improve water level control reliability, (3) increase food and cover for terrestrial birds and mammals, and (4) increase diversity in aquatic habitat.

The project goals and objectives will be met by providing a reliable water control source for the contiguous channels; contour grading to diversify aquatic habitat and increase the littoral zone; clearing and stabilizing the existing levee; and grading gradual slopes for seeding with natural grasses. Implementation of these proposed project features will result in valuable habitat unit gains for a variety of wetland, terrestrial, and aquatic species.

Questions or comments regarding this report should be submitted no later than 30 days from the date of this letter to Mr. Darron Niles of our Planning Division's Waterway Systems Branch. You may reach Mr. Niles by telephoning 309/794-5400, or by writing to our address above, ATTN: Planning Division (Darron Niles).

Sincerely,

Charles S. Cox
Colonel, U.S. Army
District Engineer

Enclosure

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

REPLY TO
ATTENTION OF:

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RIVER MILES 138.5 THROUGH 143.9
FULTON AND PEORIA COUNTIES, ILLINOIS

SEPTEMBER 1995

ACKNOWLEDGMENT

Primary study team personnel who are familiar with the technical aspects of the study are listed below:

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US Army Corps of Engineers
Rock Island District

WE'RE PROUD TO SIGN OUR WORK

EXECUTIVE SUMMARY

The 5,524-acre Banner Marsh State Fish and Wildlife Area (SFWA) lies adjacent to the Illinois Waterway between River Miles (RM) 138.5 and 143.9, approximately 18 miles downstream of Peoria Lock and Dam, between Banner and Kingston Mines, Illinois. The wetland complex is delimited by an existing perimeter levee on the south, east, and west and by U.S. Highway 24 on the north. All lands are owned by the State of Illinois.

The Banner Marsh SFWA has been managed for migratory birds and other wetland-dwelling species since the Illinois Department of Natural Resources (DNR) (formerly Illinois Department of Conservation) began purchasing tracts of land in the project area in the 1980's. However, a deteriorating perimeter levee could potentially negatively impact efforts to optimize the operation of the area and meet management goals and objectives. Opportunities exist to increase the reliability, total quantity, and overall quality of preferred habitats at this location.

The goals of the proposed project are to enhance wetland, terrestrial, and aquatic habitats. The following objectives have been identified to meet these goals: (1) increase littoral zone for ducks and fish; (2) improve flood control reliability; (3) increase food and cover for terrestrial birds and mammals; and (4) increase diversity in aquatic habitat.

Four enhancement features and their associated construction options were considered to achieve the project goals and objectives (the no action option was assessed for each feature):

A. Levee Restoration

1 Excavate borrow material from interior highwalls to reduce the slopes and create shallow (littoral) wetland areas.

2 Excavate borrow material from adjacent interior areas with suitable material, which would create shallow marsh areas.

3 Excavate borrow from riverward sites to restore side channel habitat.

4 Hydraulically dredge borrow material from the main channel as part of channel maintenance activities.

B. Water Level Control

1 Construct a new two-way pumping facility at the existing one-way pump station site.

2 Construct a second pump station outside the levee to pump into the marsh.

3 Construct a new two-way pumping facility near Copperas Creek.

4 Install a well to pump ground water into the marsh.

C. Littoral Zone Grading

1 Grade 7 miles of highwall shoreline by pushing material into deep water areas or spreading over surrounding lands.

2 Grade selected locations near existing water bodies (excluding highwall shoreline) by pushing material into deep water areas or spreading over surrounding lands.

3 Utilize both highwall shoreline and low areas for littoral zone grading (C1 + C2).

D. Warm Season Grass Planting

1 Plant a mixture of warm season grasses and forbs.

2 Plant a mixture of warm season grasses.

3 Plant a monoculture of switchgrass.

Evaluation of the project enhancement features and construction options was accomplished through application of two habitat quantification methodologies and annualization of outputs and costs. Existing habitat conditions and the effects of planned habitat management features were evaluated using the Wildlife Habitat Appraisal Guide (WHAG) and the Aquatic Habitat Appraisal Guide (AHAG). Both evaluation methodologies quantify habitat output in the form of habitat units (HUs). The WHAG and AHAG numeric values were subsequently used in conjunction with project cost data and functional life expectancy to compare the construction options of the proposed enhancement features. This incremental analysis determines which combination of enhancement features would provide the greatest total outputs per unit cost over time.

The recommended plan (shown on Figure ES-1) includes: restoring the existing 44,500-foot perimeter levee to a 50-year level of protection using borrow material excavated from adjacent interior lands, which would create shallow marsh areas (A2 above); constructing a second small pump station structure outside the levee to pump into the project area (B2); grading to increase the littoral zone (106 acres) at selected locations near existing water bodies (excluding highwall shoreline) by pushing material into deep water areas or spreading over surrounding lands (C2); and planting a mixture of warm season grasses on 208 acres (D2).

Restoration of the perimeter levee would provide a reliable levee system that protects Banner Marsh SFWA against flooding and its deleterious effects on management operations. Constructing a second pump station would provide the necessary water

level control by raising water elevations sufficiently to inundate previously dry land and the newly created littoral areas to optimum depths. Littoral zone grading would optimize habitat for fish spawning, waterfowl/waterbird feeding, and rearing areas for both fish and waterfowl by creating areas adjacent to existing water bodies that are approximately 18 inches deep (432.5 NGVD). Warm season grass plantings would enhance the 208-acre area for upland bird and animal use by providing more escape and nesting cover and a variety of food (seeds).

Implementation of the recommended plan would provide increased management flexibility and the capability to optimize the quality and quantity of preferred habitat at this location. The project outputs meet site management goals and objectives and support the overall goals and objectives of the Upper Mississippi River System - Environmental Management Program (UMRS-EMP), the North American Waterfowl Management Plan, and the Partners in Flight program.

Per Section 107(b) of the 1992 Water Resources Development Act (WRDA), project operation and maintenance, at an estimated average annual cost of $49,510, would be accomplished by the Illinois DNR, the non-Federal project sponsor.

The U.S. Army Corps of Engineers would be responsible for the Federal share of any mutually agreed upon rehabilitation of the project that exceeds the annual operation and maintenance requirements identified in the final Definite Project Report and that is needed as a result of specific storm or flood events. Rehabilitation of the project is considered to be reconstructive work which cannot be accurately estimated at this time.

In accordance with the WRDA of 1986, a 25-percent non-Federal cost-sharing will be required of the general design and construction costs assessable to those project features or portions thereof located on lands not "managed as a national wildlife refuge." All features identified for the Banner Marsh SFWA project will require cost sharing. A Project Cooperation Agreement (PCA) will be executed consistent with this requirement.

The District Engineer has reviewed the project outputs and determined that the implementation of the selected plan is justified and in the Federal interest. Therefore, construction approval for the Banner Marsh State Fish and Wildlife Area is recommended by the Rock Island District Engineer at an estimated Federal expense of $2,420,320. The total Federal cost, including general design, is $3,283,757. The total non-Federal cost share is estimated at $1,094,586.

UMRS EMP

BANNER MARSH MANAGEMENT AREA

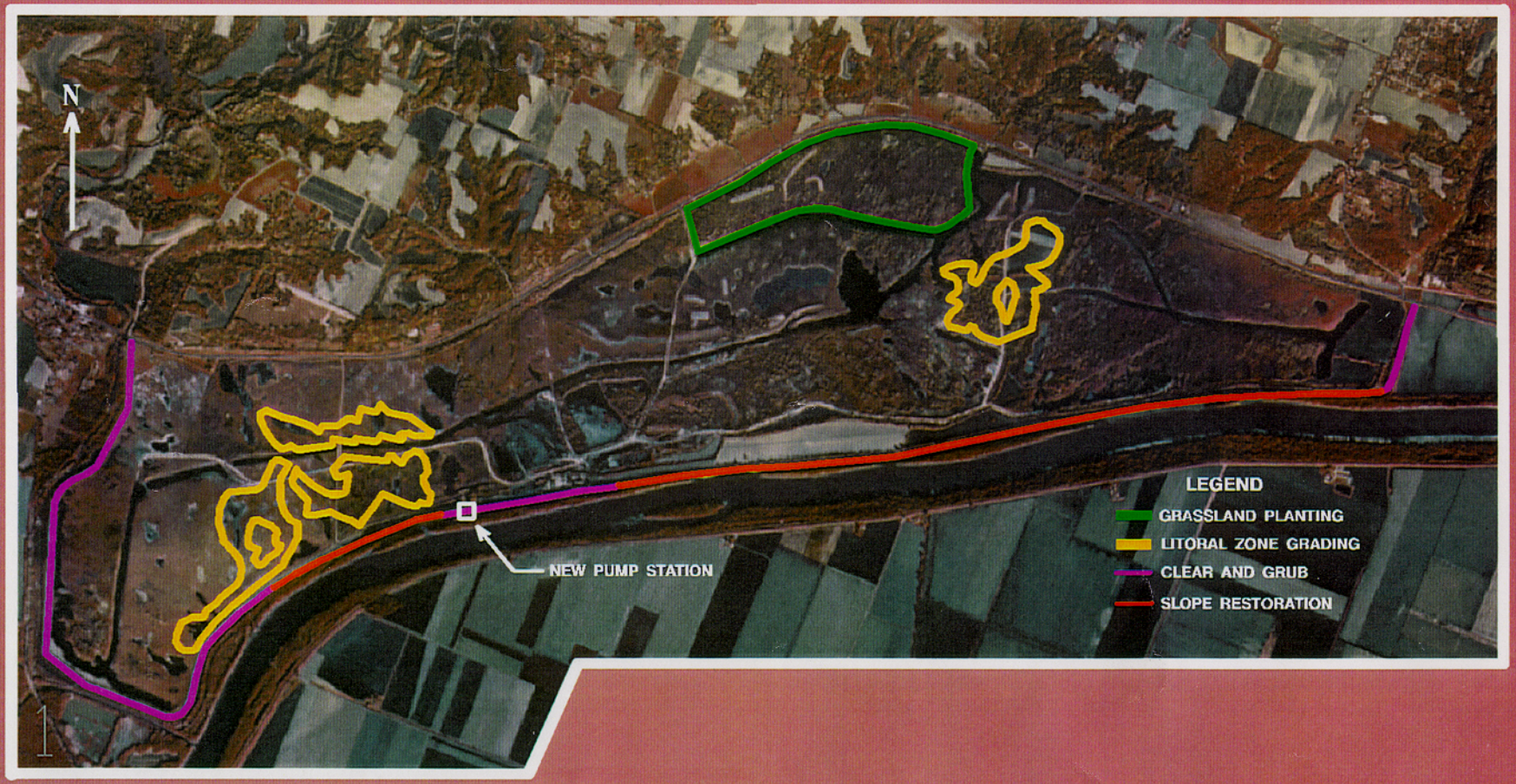

FIGURE ES-1

UPPER MISSISSIPPI RIVER SYSTEM
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1. INTRODUCTION

a. Purpose. The purpose of this report is to present a detailed proposal for the rehabilitation and enhancement of the Banner Marsh State Fish and Wildlife Area (SFWA). This report provides planning, engineering, and sufficient construction details of the selected plan to allow final design and construction to proceed subsequent to approval of this document.

b. Resource Problems and Opportunities. Banner Marsh SFWA was formerly a highly productive bottomland lake and marsh that provided valuable habitat for migratory waterfowl and local wildlife. The area changed drastically when it was drained for agricultural purposes under the auspices of the Farm Drainage Act of 1885. The first levee, Banner Special Drainage and Levee District, was constructed between 1910 and 1917 and subsequently repaired and raised in 1926 and 1943. From 1958 to 1974, the United Electrical Coal Companies, Inc., purchased the majority of the land or mineral rights and actively strip-mined approximately 90 percent of the area. The strip-mined areas have since been reclaimed and purchased by the State of Illinois. The Illinois Department of Natural Resources currently manages the Banner Marsh SFWA.

The opportunity exists in the study area to enhance overall wetland and terrestrial habitat quality and quantity by improving the reliability of the currently deteriorating levee. A reliable levee system would allow the Banner Marsh SFWA to realize the highest benefit to local wildlife and continental migratory species and avoid devastation of interior habitat from a levee failure.

c. Scope of Study. Banner Marsh is a leveed wetland management area located on the Illinois Waterway' right descending bank approximately 18 miles downstream of Peoria Lock and Dam, between River Miles (RM) 138.5 and 143.9. It is located in Fulton and Peoria Counties, approximately 1.5 miles west of Kingston Mines, Illinois, and 1 mile east of Banner, Illinois. Plate 1 provides vicinity and general location maps for the Banner Marsh SFWA. A site-specific plan is shown on plate 2.

The scope of this study focuses on proposed project features that would improve wetland habitat and enhance overall resource values. The project was planned for the benefit of resident and migratory birds, fish, and other wildlife and is consistent with agency management goals.

Field surveys, aerial photography, and habitat quantification procedures were completed to support the planning and assessment of proposed project alternatives. Hydrographic soundings were performed in determining main channel depths and estimating storage capacities. Soil borings were taken to determine sediment types, excavation difficulty, and ground water source potential.

Wildlife observations within the study area have been made by the Illinois DNR. These observations, along with future studies and monitoring, will assist in evaluating project performance.

d. Format of Report. The report is organized to follow a general problem-solving format. The purpose and problems are presented in Section 1. Section 2 provides an overview of how and why Banner Marsh was selected as a project within the Environmental Management Program. Section 3 establishes the baseline for existing resources. Section 4 provides the objectives of the project. Sections 5, 6, 7, and 8 propose and evaluate project features, and Section 9 describes the selected plan in accordance with the National Environmental Policy Act. Section 10 provides general design and construction considerations. Section 11 assesses the environmental effects from the proposed plan. Section 12 summarizes project accomplishments and outputs. Sections 13, 14, and 15 describe estimated operation and maintenance considerations, performance monitoring, and detailed cost estimates for both initial construction and annual operation and maintenance. Sections 16, 17, 18, and 19 provide a summary of implementation requirements and coordination. Sections 20 and 21 present the conclusions and recommendations. A Finding of No Significant Impact follows the main report.

Drawings (plates) have been furnished to provide sufficient detail to allow review of the existing features and the proposed plan. Plate 1 shows the project location and the La Grange Pool environs. Plates 2 and 3 show the potential enhancement features and the recommended plan. Plates 4 and 5 provide 16 years of hydrographic record of the Illinois Waterway at the proposed project site. These hydrographs provide the relationship between river flood events and levee heights. Plates 6 through 11 provide soil boring logs which were used to evaluate foundation effects, excavation/fill methods, and hydrologic conditions. Plate 12 provides water quality sampling locations. Typical sections for proposed features are presented on plates 13 and 14. The pump station site plan, section views, and details are shown on plates 15 through 17. Plates 18 through 20 show pump station electrical plans, diagrams, and details. The project monitoring plan is shown on plate 21.

e. Authority. The authority for this report is provided by the 1985 Supplemental Appropriations Act (Public Law 99-88) and Section 1103 of the Water Resources Development Act of 1986 (Public Law 99-662). The proposed project would

be funded and constructed under this authorization. Section 1103 is summarized as follows:

Section 1103. UPPER MISSISSIPPI RIVER PLAN

(a)(1) This section may be cited as the Upper Mississippi River Management Act of 1986.

(2) To ensure the coordinated development and enhancement of the Upper Mississippi River System (UMR), it is hereby declared to be the intent of Congress to recognize that system as a nationally significant commercial navigation system. Congress further recognizes that this system provides a diversity of opportunities and experiences.

The system shall be administered and regulated in recognition of its several purposes.

(e)(1) The Secretary, in consultation with the Secretary of the Interior and the States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin, is authorized to undertake, as identified in the Master Plan-

(A) a program for the planning, construction, and evaluation of measures for fish and wildlife habitat rehabilitation and enhancement;

(B) implementation of a long-term resource monitoring program;

(C) implementation of a computerized inventory and analysis system;

(f)(1) implementation of a program of recreational projects;

(2) assessment of the economic benefits generated by recreational activities in the system; and

(h)(1) monitoring of traffic movements on the system.

2. GENERAL PROJECT PROCESSING

a. Eligibility Criteria. A design memorandum did not exist at the time of the enactment of Section 1103. Therefore, the North Central Division, U.S. Army Corps of Engineers, completed a "General Plan" for the implementation of the Upper Mississippi River System - Environmental Management Program (UMRS-EMP) in January 1986. The U.S. Fish and Wildlife Service (USFWS), Region 3, and the five affected states (Illinois, Iowa, Minnesota, Missouri, and Wisconsin) participated through the Upper Mississippi River Basin Association. Programmatic updates of the General Plan for budget planning and policy development are accomplished through Annual Addenda.

Coordination with the States and the USFWS during the preparation of the General Plan and Annual Addenda led to an examination of the *Comprehensive Master Plan for the Management of the Upper Mississippi River System*. The Master Plan, completed by the Upper Mississippi River Basin Commission in 1981, was the basis of the recommendations enacted into law in Section 1103. The Master Plan and General Plan identify examples of potential habitat rehabilitation and enhancement techniques. Consideration of the Federal interest and Federal policies has resulted in the following conclusions:

(1) First Annual Addendum. The Master Plan report and the authorizing legislation do not pose explicit constraints on the kinds of projects to be implemented under the UMRS-EMP. For habitat projects, the main eligibility criteria should be that a direct relationship should exist between the project and the central problem as defined by the Master Plan, i.e., the sedimentation of backwaters and side channels of the UMRS. Other criteria include geographic proximity to the river (for erosion control), other agency missions, and whether the condition is the result of deferred maintenance.

(2) Second Annual Addendum. The types of projects that are definitely within the realm of Corps of Engineers implementation authorities include the following:

- backwater dredging
- dike and levee construction
- island construction
- bank stabilization
- side channel opening/closures
- wing and closing dam modifications
- aeration and water control systems
- waterfowl nesting cover (as a complement to one of the other project types)
- acquisition of wildlife lands (for wetland restoration and protection)

(3) Subsequent Annual Addenda. Subsequent annual addenda, of which the Sixth Annual Addendum (dated May 1991) is the most recent, provide a vehicle for reporting program progress, communicating policy guidance, and ensuring thorough coordination among the participating State and Federal agencies.

b. General Selection Process. The following steps provide an overview of the process of project selection. The steps are interactive with communication in both directions and occur through a continual process.

(1) State/USFWS Project Nomination. Projects are nominated for inclusion in the Rock Island District's habitat program by the respective State conservation agencies and the USFWS based on agency management objectives. Rock Island District assists the States and USFWS agencies in proposing habitat projects through an in-house task force that includes staff members from the Engineering, Planning, Operations, and Construction Divisions. As projects are being conceptualized, this group meets on-site with State and USFWS personnel to examine as fully as possible what site-specific enhancements would be both environmentally desirable and engineering feasible.

(2) Fish and Wildlife Interagency Committee (FWIC) Ratings. To assist in the project formulation process, the FWIC, a group composed of State and Federal biologists who are assigned to aquatic and terrestrial projects (refuges, wildlife areas) along the Mississippi River and Illinois Waterway, has convened a series of meetings starting in 1986 to consider critical habitat needs along the Mississippi and Illinois Rivers. At these meetings, the available habitat is evaluated on a pool-by-pool basis. These analyses reveal deficiencies (such as feeding, resting, and loafing areas for migratory waterfowl, absence of deep water off the main channel for diving ducks and fish) as well as types of habitat in abundant supply (e.g., mature bottomland hardwood). (With this information, projects being considered can most accurately reflect broader regional needs in addition to representing the best site-specific choices.)

Projects then are ranked by the FWIC according to the biological benefits that they could provide. Each project is considered and evaluated relative to increasing habitat benefits for fish, waterfowl, and other wildlife. Every project is ranked according to the outputs provided as high, medium, or low.

(3) River Resources Coordinating Team (RRCT) Rankings. The FWIC rankings also are forwarded to the RRCT, an interagency policy group which meets to coordinate Mississippi and Illinois River activities. The RRCT examines the FWIC rankings and includes consideration of the broader policy perspectives of the agencies submitting the projects. The RRCT makes a recommended ranking.

(4) U.S. Army Corps of Engineers District Ranking. The FWIC and RRCT recommended rankings are evaluated by the District. The District then formulates a recommended program consistent with the EMP program guidance and District requirements.

(5) U.S. Army Corps of Engineers, North Central Division Prioritizing. The District then submits a recommended program to the North Central Division. Additional coordination by the Division through the Environmental Management Program Coordinating Committee (EMP-CC) is effected. North Central Division then

submits project fact sheets to the Chief of Engineers and Assistant Secretary of the Army for Civil Works for approval. Fact sheets and schedules are subsequently published, thereby completing the project selection process.

c. Specific Site Selection. Recognition of changes occurring in habitat composition and subsequent declines in waterfowl and fisheries habitat quality and availability along the Illinois Waterway prompted the proposal of several habitat rehabilitation and enhancement projects by the Federal and State agencies responsible for natural resource management in the area. Four of these projects, the Rice Lake Complex; the Banner Marsh State Fish and Wildlife Area; the Lake Chautauqua Refuge, encompassing sites adjacent to the La Grange Pool; and the Peoria Lake project, located within the Peoria Pool of the Illinois Waterway, have been elevated to the active status through the ranking and recommendation process detailed in Section 2.b. of this report. These projects are currently under construction or in various stages of planning.

All of these projects address the specific need for enhanced aquatic and wetland habitat along the central reach of the Illinois Waterway. The conversion of wetlands to farmlands throughout central Illinois over the past several decades has greatly reduced the availability of prime waterfowl habitat in this region. In addition, increased sedimentation resulting from expanded agricultural activities has brought about tremendous changes in the morphology of the Illinois Waterway, with the primary impacts being the loss of aquatic habitat depth and diversity off the main channel and decreased water quality. Flowing side channel and deep water slough habitat is virtually nonexistent along much of the Illinois Waterway, yet it is considered critical to fisheries.

The Banner Marsh SFWA was recommended and supported as providing significant upland, wetland, and fisheries benefits with opportunities for habitat enhancement if the proposed project features are implemented.

Originally leveed and farmed and then strip-mined, active management of the Banner Marsh SFWA began in the mid-1980's following reclamation of the mined lands and eventual purchase by the Illinois DNR. Although restored to some degree, the opportunity exists to increase the reliability, total quantity, and overall quality of preferred habitats at this location. However, past and future habitat restoration efforts are threatened by a deteriorating perimeter levee that could potentially negatively impact efforts to optimize operation of the area and meet management goals and objectives.

Though the Banner Marsh SFWA remains a quality wildlife area, enhanced capability to manage the area for waterfowl and nongame wildlife will only be achieved by providing a reliable perimeter levee. The primary features proposed for this project address these needs.

The following points were major considerations, along with the FWIC rankings, in selecting this project for the Habitat Rehabilitation and Enhancement Project program:

a. The Banner Marsh SFWA is a high priority project of the Illinois DNR.

b. The Banner Marsh SFWA is located in an area of historically high wildlife use, as evidenced by the proximity of the Rice Lake State Wildlife Area and the Lake Chautauqua National Wildlife Refuge downstream of this project.

c. The area experiences a high degree of recreational use.

d. The opportunity exists to capitalize on the project's present habitat interspersion—a mixture of aquatic, marshland, agricultural, and grassland areas.

3. ASSESSMENT OF EXISTING RESOURCES

a. Resource History and Description of Existing Features. Prior to the Wisconsinan glaciation, the Mississippi River flowed down the Illinois Valley. About 21,000 years ago, the most recent ice sheet, the Wisconsinan, moved westward and diverted the Mississippi to its present location. Because the ancient Mississippi Valley had been broadened and deepened by repeated pre-Wisconsinan glacial melts, the Illinois River entered a much deeper valley than was warranted by its volume of water. The valley had also been considerably filled with sediment carried by the glacial meltwater. This origin resulted in a river with an unusually low rate of fall.

The Illinois River's low volume of flow for its channel capacity and its low rate of fall combined to form the unique bottomland lakes associated with the Illinois Valley. Under overflow conditions, the faster-moving waters of the channel meet the slower-moving backwaters with the result that sediment is deposited more rapidly along the shear. Through eons of time, natural levees rose, like barrier islands, to separate most of the channel waters from adjacent backwaters (Bellrose, *et al.*, 1979).

Steffeck and Striegl (1989) wrote the following description of the pristine conditions once found on the Illinois River:

> Early explorers in the study area were impressed by the productivity of the Illinois River area. In 1673, following his ascension of the Illinois River, Marquette wrote that: "We have seen nothing like this river that we enter, as regards to its fertility of soil, its prairies and woods, its cattle, elk, deer, wildcats, bustards, swans, ducks, parroquets, and even beaver." (Mills, *et al.*, 1966; University of Illinois Water Resources Center, 1977). The Illinois River was described as clear in 1798 and infested with wild beasts in 1838 (Mills, *et al.*, 1966). The "Grand Marsh" of the Kankakee River was described by French explorers; marsh prairies and swamp forest held "countless" waterfowl, "were full of game," and the "meandering river teemed with fish" (Meyer, 1936). In the late 1890s, the waters of bottomland lakes associated with the Illinois River were described by Kofoid (1903) as being transparent at that time and having bottom materials composed of decaying vegetation rather than mineral silts. An abundance of submergent and emergent vegetation was documented at the beginning of the 20th century (Bellrose, *et al.*, 1983). The general habitat types and backwaters areas of the Des Plaines River and Illinois River from Chicago downstream were documented on maps prepared for the Corps (Woermann, 1902-1904). Associated aquatic organisms were abundant. Aquatic insects and snails associated with aquatic plants were prevalent; invertebrates associated with aquatic plants were found to have, on average, eight times the biomass of benthic invertebrates in Illinois River bottomland lakes (Bellrose, *et al.*, 1977). In 1900, the dollar value of commercial fishery of the Illinois was ranked third nationally behind the salmon fishery of the Pacific coast and the Great Lakes fishery. The commercial turtle fishing and mussel industries

also were substantial along the Illinois River in the early 1900's (Bellrose, *et al.*, 1977).

Human disturbances in the Illinois River Valley over the last century have greatly reduced the abundant fish and wildlife of the past. Adverse changes include diversion of Lake Michigan water, excessive sewage and industrial waste, a greatly modified hydrology and landscape due to drainage and levee districts, impoundment by navigation dams, and sedimentation. While it is recognized that the river can never be as pristine as it once was, many actions are reversible and could result in restoration of a functional system in a number of areas along the river (USFWS, 1990).

According to maps prepared in 1902-1904, the Banner Marsh SFWA was a mosaic of backwater lakes, sloughs, timber, and cultivated fields (Woermann, 1902-1904). The area was predominated by bottomland timber with four main water bodies. Several low, moist areas also were present. At higher elevations, tree clearing and cultivation had begun.

Between 1910 and 1917, the area was leveed off from the Illinois Waterway to form the Banner Special Drainage and Levee District. Supporting facilities such as pumps and ditches also were installed, followed by subsequent land clearing, draining, and farming. Between 1918 and 1930, substantial amounts of money were spent on maintenance and repair activity. Farming continued despite the $139 per acre spent on flood damage repairs and maintenance for land valued at $70 per acre (Thompson, 1989). In 1958, over half of the District was purchased by the United Electrical Coal Companies, Inc., for the purpose of coal mining by stripping. The mining ended in 1974. Reclamation efforts varied on the site based upon strip-mine reclamation legislation that guided the restoration efforts. The reclamation practices were very basic at first, improving as time went on. Final reclamation efforts ended in the mid-1980's.

The Illinois DNR began purchasing tracts of land in the project area in the 1980's. Management since this time has focused on finalizing reclamation efforts, stabilizing the ongoing erosion on the levee, and installing wildlife enhancement features such as nesting islands, moist soil units, and fish rearing ponds.

b. Land Use and Current Area Management Objectives. The Banner Marsh SWFA encompasses 5,524 acres of reclaimed coal mining and farm land. Reclamation efforts have created the beginnings of long-term wildlife management, but because of past land uses, certain limitations and obstructions remain for high quality wildlife management opportunities.

The acreage shown in Table 3-1 represents the area of Banner Marsh between the Illinois Waterway and U.S. Highway 24. The portion of Banner Marsh north of U.S. Highway 24 will not be affected by this project. For the purpose of habitat analysis, the project area has been classified into the habitat types shown in Table 3-1.

TABLE 3-1

Existing Habitat Classification
Habitat Type (in Acres)

Non-Forested Wetland	Forested Upland	Grassland	Oldfield*	Cropland
253 (Deep Water)	150	1526	1629	206
281 (Shallow Water)				

* Oldfield habitat is defined as agricultural fallowed lands, or have similar characteristics. Characteristics include: a dominant monotypic grass composition, pole-sized or smaller trees (if present).

The Banner Marsh Natural Resource Management Plan (IDOC, 1989) states, "...Strategically located within the Illinois River Valley Flight Corridor of the Mississippi Flyway, this Complex [Banner Marsh and Rice Lake SFWAs] and other sites in the immediate area are famous as traditional resting areas for waterfowl and shorebirds on both their spring and fall migrations to and from Canada and their wintering areas in the Mississippi Delta, along coastal marshes and Central and South America."

Unfortunately, wetland habitat within the Illinois River Valley has been steadily deteriorating during this century. The primary long-range goal at the complex is to moderate this trend within the confines of the project area through implementation of a management, development, and acquisition program that would provide quality habitat, attractive to many species of wildlife, while at the same time providing the public with increased hunting, fishing, and other outdoor recreational opportunities (IDOC, 1989).

To this end, the Illinois DNR currently has several objectives to meet this goal (not necessarily in order of importance):

1. Protect and enhance endangered species habitat.

2. Increase bird nesting opportunities by erecting nest structures such as tree swallow and bluebird boxes, osprey and bald eagle platforms, and double-crested cormorant platforms.

3. Restore vegetation regimes once found in the area such as warm season grass areas, sedge meadow, and marsh.

4. Establish reliable water level manipulation capabilities so that either flood effect water regimes or optimal migratory waterfowl habitat and fish spawning habitat can be created.

5. Increase waterfowl nesting opportunities by constructing waterfowl nesting islands and erecting wood duck nest boxes.

6. Continue and finalize reclamation efforts.

7. Rehabilitate the levee system to reduce the threat of levee failure, which would set back all interior management efforts and eliminate any habitat benefits derived.

8. Maintain a viable fish community within the existing ponds and eventual flooded areas (objective 4). Fish carrying capacity should increase from 100 lbs/acre to 250 lbs/acre.

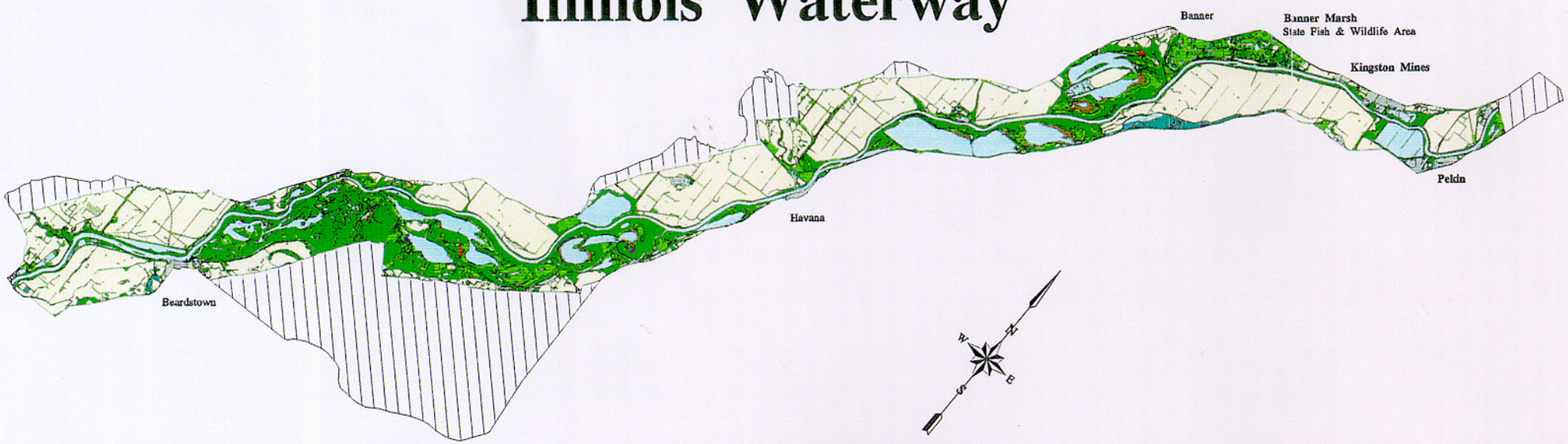
The emphasis on wetland and waterfowl management at the Banner Marsh SFWA reflects not only the immediate goals of local resource managers, but also those of the Fish and Wildlife Interagency Committee (FWIC) for habitat enhancement in Pools 11-22 of the Upper Mississippi River and Illinois Waterway, Partners in Flight, and the North American Waterfowl Management Plan (NAWMP). The NAWMP aims to increase waterfowl populations and their habitats, particularly those which are at critically low levels. It has been estimated that 20 percent of all ducks in North America utilize the Upper Mississippi River System for feeding and resting during migration (Upper Mississippi River Basin Commission, 1981). This statistic points to the need for optimum management of refuge areas such as Banner Marsh. In fact, a recent study indicates that refuge areas may be necessary to prevent disturbance of waterfowl during spring and fall migrations (Havera, *et al.*, 1992), particularly in areas where waterfowl numbers have declined.

c. Wetland and Waterfowl Resources. The Banner Marsh Area is surrounded on three sides by a levee constructed for agricultural production. Continuous pumping has created a situation where water levels in the Illinois River are higher than the ground water levels inside the levee. Contiguous surface water and isolated ponds currently total some 535 acres.

Surface-mine clay soils are not conducive to natural moist soil plant development and production. Within the surface-mined portion of Banner Marsh are approximately 100 acres of scattered bottomland forest composed of the following species: cottonwood (*Populus deltoides),* box elder *(Acer negundo),* black willow *(Salix nigra),* elm *(Ulmus sp.),* and green ash *(Fraxinus pennsylvanica).* Also present in smaller quantities are silver maple (Acer *saccharinum*), sycamore *(Platanus sp.),* and dogwood *(Cornus sp.).* Many of these species invaded the area after mining. Much of the ground cover is in cool season grasses and alfalfa. Figures 3-1 and 3-2 provide 1991 land cover classification data for the La Grange Pool and the Banner Marsh State Fish and Wildlife Area, respectively.

Mallards, blue-winged teal, and Canada geese presently nest on the area. Although suitable nesting sites for wood ducks are limited on the site, excellent brood habitat exists on site. Waterfowl use data from 1988-1993 show the total fall duck use days in Table 3-2.

1991 Land Cover/Land Use
La Grange Pool
Illinois Waterway



KILOMETERS

5 0 5 10 15

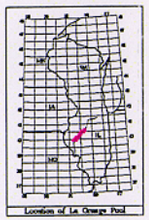
2 0 2 4 6 8

MILES

Universal Transverse Mercator Projection, Zone 15, NAD 27

	Freq	% of Pool	Acres
Open Water	763	16.9	24,490.2
Submergents	605	1.0	1,389.9
Submergents-rooted floating aquatics	60	0.2	240.7
Submergents-rooted floating aquatics-emergents	0	0.0	0.0
Rooted floating aquatics	109	0.2	272.8
Rooted floating aquatics-emergents	2	0.0	9.0
Emergents	192	0.3	417.2
Emergents-annual/perennial grasses/forbs	2	0.0	9.7
Annual/perennial grasses/forbs	3,721	10.6	15,340.9
Woody terrestrial	4,485	21.7	31,454.9
Agriculture	267	45.2	65,303.1
Urban/developed	372	2.4	3,430.7
Sand/mud/rock	825	1.5	2,135.5
Totals	11,403	100.0	144,494.6

- Open water
- Submergents
- Submergents-rooted floating aquatics
- Submergents-rooted floating aquatics-emergents
- Rooted floating aquatics
- Rooted floating aquatics-emergents
- Emergents
- Emergents-annual/perennial grasses/forbs
- Annual/perennial grasses/forbs
- Woody terrestrial
- Agriculture
- Urban/developed
- Sand/mud/rock
- No photo coverage

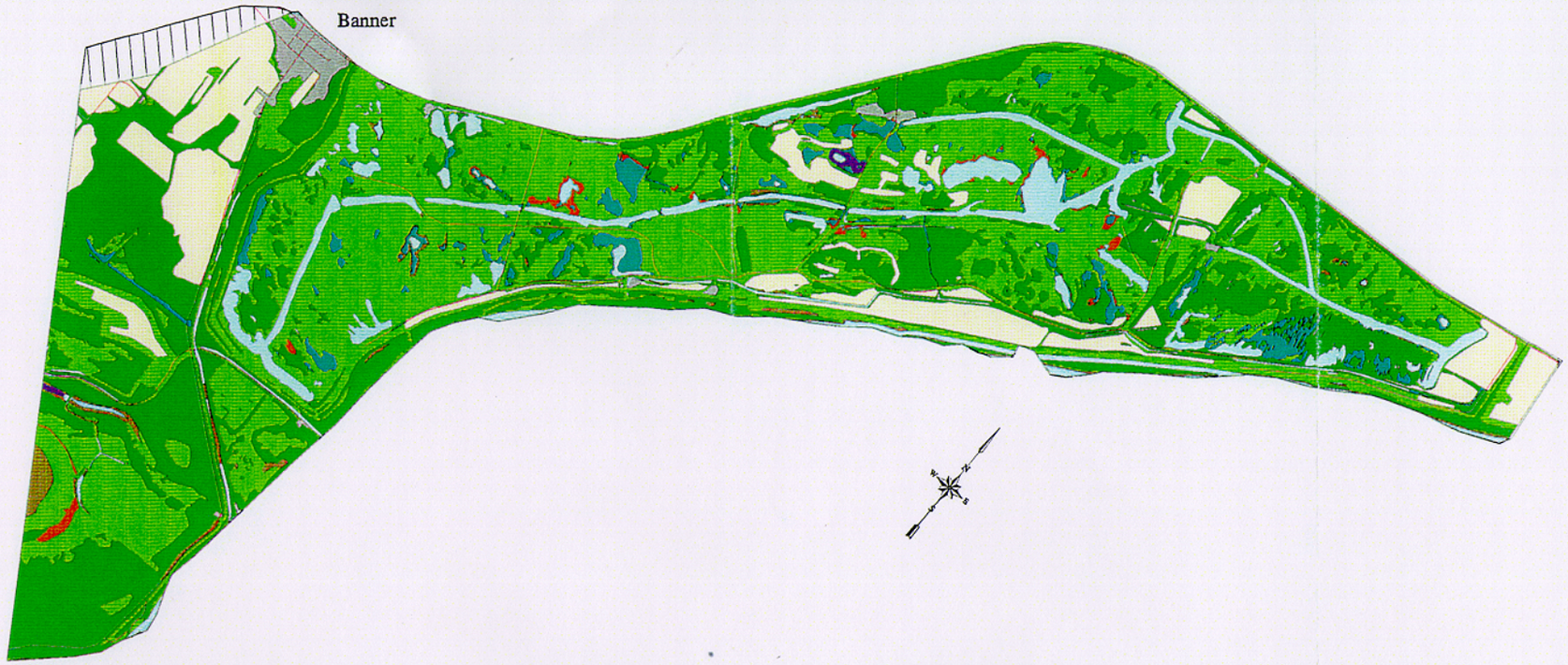


Cartographer: Melvin L. Bower
November, 1994

FIGURE 3-1

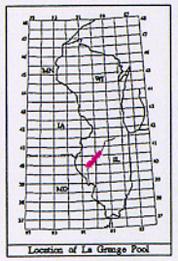
1991 Land Cover/Land Use, La Grange Pool

Banner Marsh State Fish And Wildlife Area



- Open water
- Submergents
- Submergents-rooted floating aquatics
- Submergents-rooted floating aquatics-emergents
- Rooted floating aquatics
- Rooted floating aquatics-emergents
- Emergents
- Emergents-annual/perennial grasses/forbs
- Annual/perennial grasses/forbs
- Woody terrestrial
- Agriculture
- Urban/developed
- Sand/mud/rock
- No coverage

	Freq	Acres
Open water	148	497.7
Submergents	170	194.4
Rooted floating aquatics	3	8.2
Emergents	46	43.3
Annual/perennial grasses/forbs	415	2,564.8
Woody terrestrial	630	1,964.9
Agriculture	38	802.1
Urban/developed	13	77.1
Sand/mud/rock	93	73.9
No coverage	1	102.1
Totals	1,557	6,328.5



Location of La Grange Pool

KILOMETERS

1 0 1 2 3 4

1 0 1 2

MILES

Universal Transverse Mercator Projection, Zone 15, NAD 27

Environmental Management Technical Center

Catrographer: Melvin L. Bower

November, 1994

FIGURE 3-2

TABLE 3-2

The Fall Use Day for Total Ducks at Banner Marsh State Fish and Wildlife Area

Year	Fall Duck Day Use
1988	56,832
1989	96,390
1990	78,465
1991	39,415
1992	49,488
1993	23,985

In 1986, it was estimated that 20 to 30 trappers actively trapped on the site. Currently, about four trappers use the area to trap muskrat, raccoon, and mink. Beaver are present on the site but are protected because of their appetite for willows (*Salix* sp.). Once the beaver population exceeds the number needed for willow control, trapping these creatures would be allowed. The low number of trappers has been attributed to low pelt prices rather than low numbers of animals on the site.

d. Terrestrial Resources. While upland resources have been heavily influenced by mine reclamation, management efforts have sustained sufficient populations of dove, quail, pheasant, and rabbit so that hunting these species is allowed. Wildlife food plots are grown to provide winter cover and food. Sunflower fields are planted to support a dove hunting program. These fields also present food and shelter opportunities for nongame birds and animals. Mowing, burning, and grazing have been used to maintain a cool season grass community and to stimulate conditions conducive to warm season grass conversion. Although grassland management is a high priority and an important habitat to the Banner Marsh ecosystem, this habitat has not fully reached its potential for wildlife benefits. The conversion from mine activity to grassland to prairie has been slow due to soil types, natural time, and costs.

e. Aquatic Resources. Twenty-six fish species have been collected from the waters of Banner Marsh. The many ponds and lakes present at Banner Marsh contain mixed populations, dominated by bluegill (*Lepomis macrochirus)* and largemouth bass *(Micropterus salmoides*). Several lakes have large populations of carp, bullheads (*Ameiurus nebulosus)*, and gizzard shad, as well as other undesirable species. The shear walls that comprise much of the shoreline have limited the fishery potential at Banner Marsh because of the lack of shallow spawning areas on the site.

At present, a sport fishery (channel catfish, walleye, northern pike, largemouth bass, and bluegill) exists because of a rigorous stocking program. Some structure has been added to the lakes, but a self-sustaining community to meet the goals of the site is not present.

f. Water Quality. Baseline monitoring results indicate that water quality within the Banner Marsh complex is adequate to support indigenous aquatic life during most periods. In fact, a 1992 assessment of 25 Illinois lakes performed by the Illinois State Water Survey rated Shovel and Johnson Lakes (two of the larger lakes within the complex) as having the highest water quality based on their trophic state index. Corps of Engineers studies have shown that on occasion, during the summer, the dissolved oxygen concentration can fall below the State standard; however, no fish kills have been observed. In the past, localized pH problems were occasionally encountered, but it appears management actions have remedied these. Water clarity within the complex is generally quite good, as evidenced by Secchi disk and turbidity values. Specific conductance values are relatively high when compared to Illinois River values; however, judging by the abundance of aquatic life present, there appears to be little or no impact. A more detailed analysis of baseline water quality monitoring results can be found in Appendix F.

g. Endangered Species. The following is a list of federally endangered species known to occur in Peoria and Fulton Counties:

Status	Common Name	Scientific Name
E	Bald eagle	*Haliaeetus leucocephalus*
T	Decurrent false aster	*Boltonia decurrens*

The bald eagle occurs in the vicinity of Banner Marsh during the winter. A portion of the adjacent Rice Lake State Fish and Wildlife Area has been designated as a significant winter roost site. From this site, the eagles may disperse foraging for fish in the Illinois Waterway or waterfowl that may be overwintering in the area. Banner Marsh is used by eagles for this purpose.

Decurrent false aster prefers disturbed, open sites of the Illinois River Valley. While these conditions exist at Banner Marsh in high proportions, decurrent false aster depends upon flooding for seed dispersal. Because the area is leveed off, the potential is very low for finding this species.

In a letter dated January 10, 1995, the Illinois DNR provided the following list of State endangered species known to occur in the Banner Marsh SFWA:

Status	Common Name	Scientific Name
E	River otter	*Lutra canadensis*
E	American bittern	*Botaurus lentiginosus*
T	King rail	*Rallus elegans*

The Illinois DNR indicated that the proposed project would not impact these species and may benefit the American bittern and king rail by increasing the available nesting habitat.

h. Historic Properties. Most land within the project boundary of the Banner Marsh Phase I archaeological survey (Figures 3-3 through 3-5) was previously disturbed by surface mining for coal. Of the 5,524 acres within the project boundary, only 402 acres can be classified as unmined. Twenty-one of these unmined acres is identified as the Site Manager's residence (Figure 3-4 and Figure 10-1). The remaining 381 acres of unmined land is scattered over various portions of the project area and was subject to Phase I archaeological survey and geomorphological evaluation.

Several sites have been previously recorded in the vicinity of the present project. The prehistoric Copperas Creek site (11F100) was recorded in 1931. It is located on the grounds of the Site Manager's residence. This is an important multicomponent site dominated by an early Late Woodland Weaver Phase occupation.

Four prehistoric sites (11F2721, 11F2722, 11P355, and 11P356) are recorded just outside the project area on the riverward side of the levee; two additional prehistoric sites (11P357 and 11P358) are recorded on islands along this stretch of the river. These six sites were found along the shoreline during a low-water event (Esarey, 1988, 1990). Artifacts date from Early Woodland through Mississippian times. These sites are outside the present project boundary.

Phase I archaeological survey and geomorphological evaluation of the 381 unmined acres lying outside the site manager's residence was carried out in two parts. Schroeder (1991) surveyed 24 of these acres with negative results. Wiant and Hajic (1994) surveyed the remaining 357 acres. Except for the Copperas Creek site, no cultural resource sites had been recorded within the project area prior to these two surveys.

Survey by Wiant and Hajic (1994) produced four isolated finds and two standing structures. The structures are located at Bell's Landing. One is a grain elevator and the other is an associated office building. The isolated finds and standing structures do not meet the criteria for nomination to the National Register of Historic Places (Wiant and Hajic, 1994:1).

FIGURE 3-3

Phase I Intensive Archaeological Survey Project Boundary: Map 1 of 3

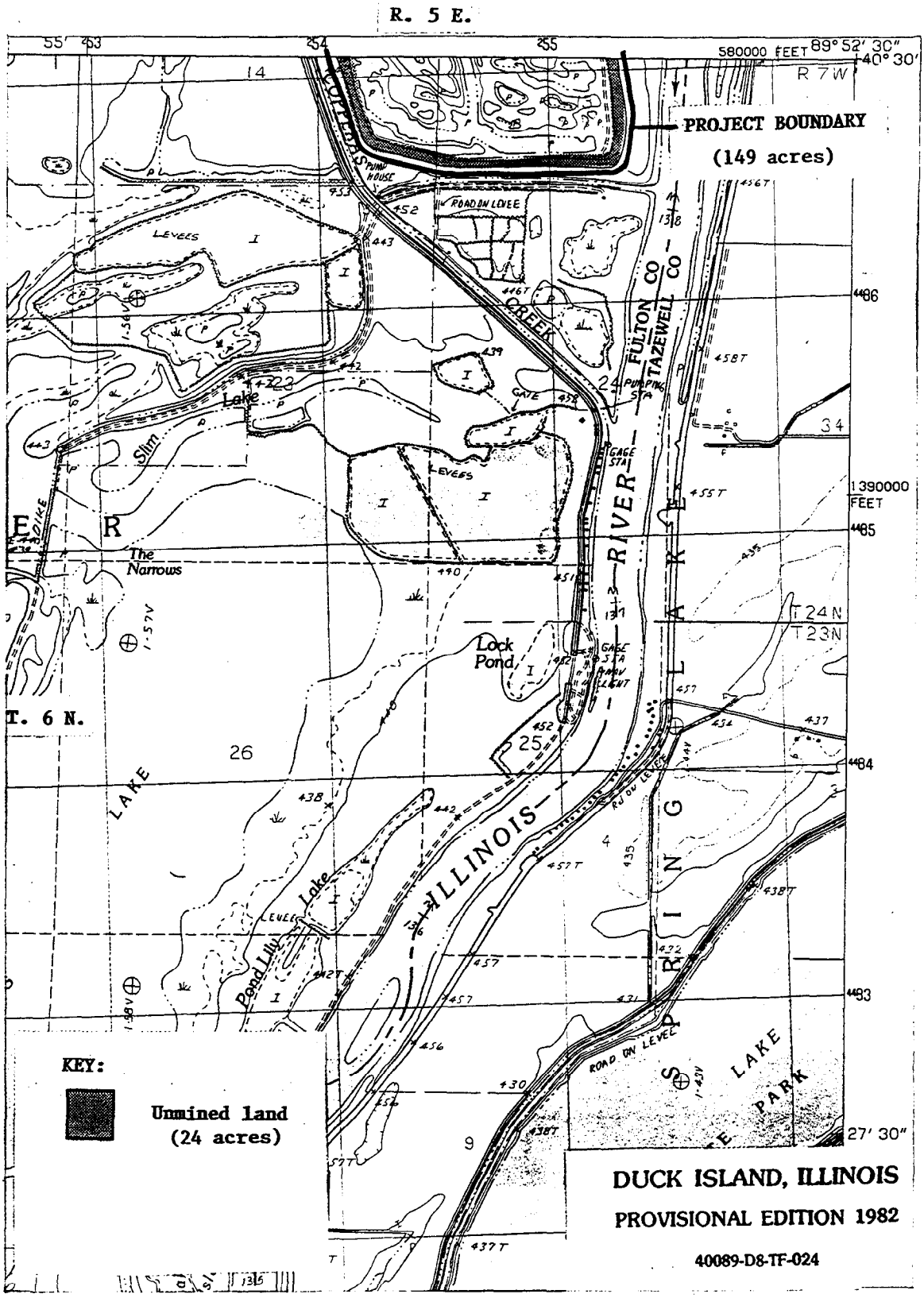
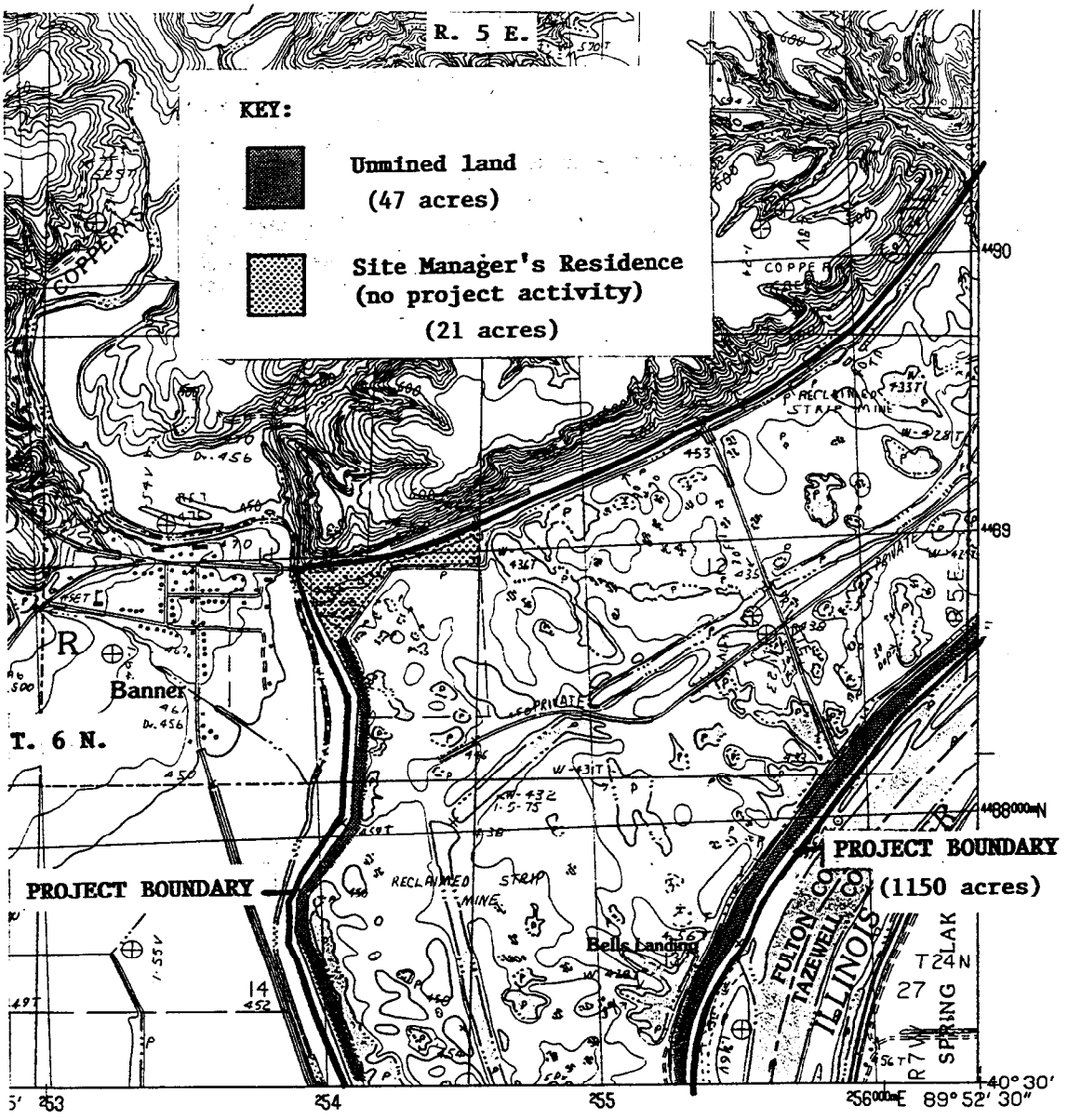


FIGURE 3-4

Phase I Intensive Archaeological Survey Project Boundary: Map 2 of 3



INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1982

QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

1 Farmington West
2 Farmington East
3 Hanna City
4 Canton
5 Glasford
6 St. David
7 Duck Island
8 Manito

ADJOINING 7.5' QUADRANGLE NAMES

ROAD LEGEND

Improved Road .....
Unimproved Road .....
Trail .....

Interstate Route U. S. Route State Route

BANNER, ILLINOIS

PROVISIONAL EDITION 1982

40089-E8-TF-024

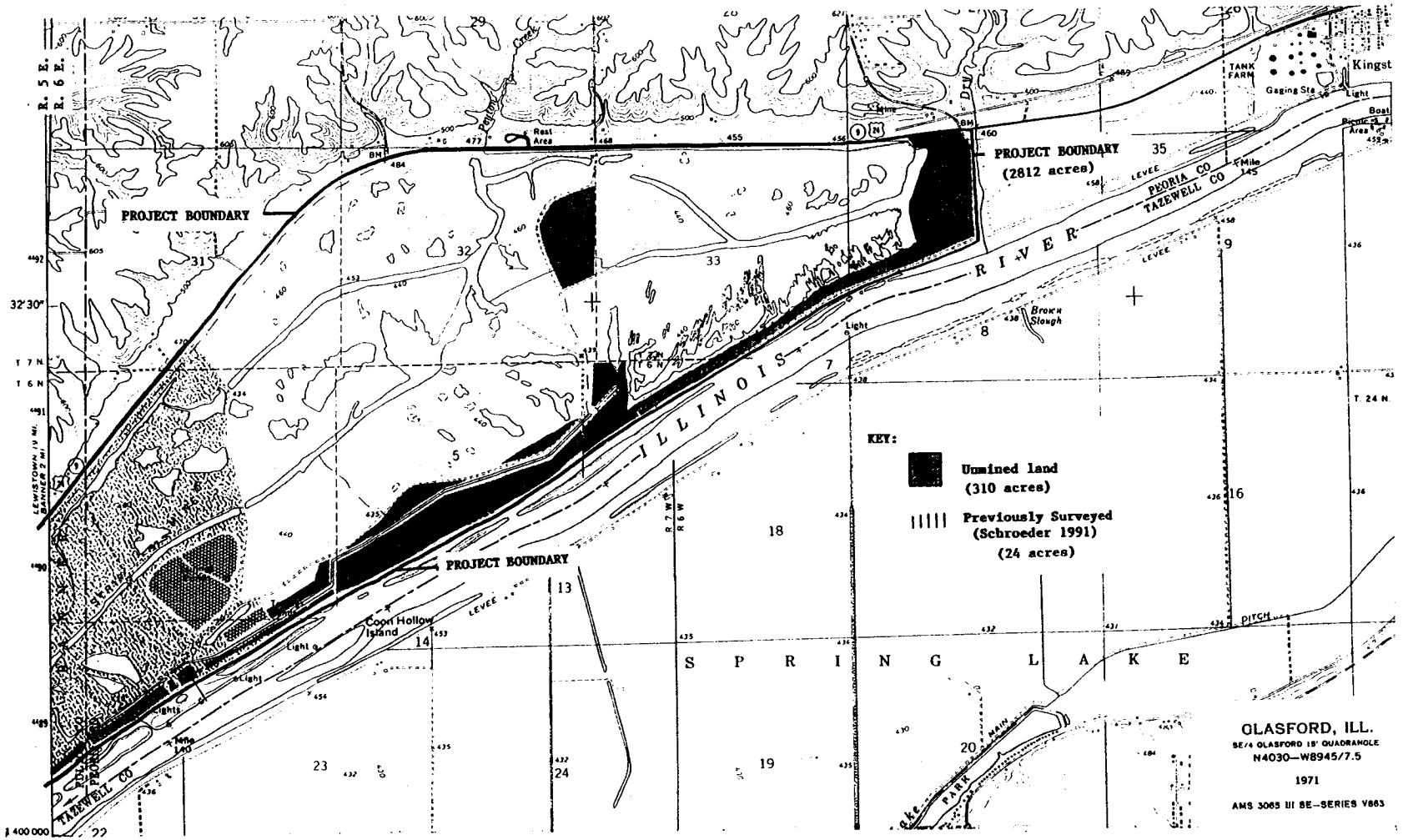


FIGURE 3-5

Phase I Intensive Archaeological Survey Project Boundary: Map 3 of 3

i. Hazardous, Toxic, and Radioactive Waste Assessment. A preliminary hazardous, toxic, and radioactive waste compliance assessment was conducted for the Banner Marsh HREP. The Banner Marsh area was historically agricultural land that was purchased and mined for coal by United Electrical Coal Companies, Inc., in the 1940s through the 1970s. The mining activities left some areas with evidence of potential sources of contamination. The slurry pile and slurry lagoon which have been capped are potential sources of acidic waste. A large lake in the northeast portion of the site has had a history of pH problems but has recently stabilized and is currently productive in vegetation and fish. The coal mine operation buildings and maintenance buildings were adjacent to the slurry pile. These facilities had large storage tanks for fuel and several drums with unknown content. These potential sources of contamination are all concentrated in the south-central portion of the project area. No earth-moving activities are anticipated in the area. The coal piles should be continually monitored by the site personnel to ensure that severe erosion does not wash highly acidic waste into the marsh and lakes. There were several areas during the project studies that indicated some vegetative distress related to acidic soils left by the mining activities. When these areas become problems, they are handled by incorporating lime to neutralize the soils. During the study, there were no other signs of chemical storage, unusual odors, or surface staining.

4. PROJECT OBJECTIVES

a. Objectives and Potential Enhancement Features. The project goals, objectives, and potential enhancement features are summarized in Table 4-1. In the development of the potential enhancement features, consideration was given to satisfying project objectives, while maximizing utilization of resource opportunities. A potential enhancement feature is intended to satisfy at least one objective, either singularly or in combination with other enhancement features.

Enhancement features are to be components of an overall plan which will satisfy the project goals and objectives. The enhancement features are described and assessed in Section 5.

TABLE 4-1

Project Goals, Objectives, and Potential Enhancement Features

Goal	Objective	Potential Enhancement Feature
Enhance Wetland Habitat	Increase Littoral Zone for Ducks and Fish	- Provide Reliable Water Control/ Source for Contiguous Channels
		- Littoral Zone Grading
	Improve Flood Control Reliability	- Clear and Stabilize Levee
Enhance Terrestrial Habitat	Increase Food and Cover for Terrestrial Birds and Mammals	- Seed with Native Warm Season Grasses
Enhance Aquatic Habitat	Increase Diversity in Aquatic Habitat	- Littoral Zone Grading

b. Criteria for Potential Enhancement Features. Table 4-2 presents general and specific criteria developed to assess potential enhancement features.

TABLE 4-2

Potential Enhancement Feature Development Criteria

Item	Purpose of Criteria
A. General Criteria	
Locate and construct features consistent with EMP directives.	Comply with program authorities.
Construct features consistent with Federal, State, and local laws.	Comply with environmental laws.
Develop features that can be monitored.	Provide baseline of project effects (e.g., sedimentation, stability, water quality).
Design features to facilitate operation and maintenance.	Minimize operation and maintenance costs.
Locate and construct features consistent with best planning and engineering practice.	Provide basis for project evaluation and alternative selection.
B. Levee Restoration	
Provide reliable levee system consistent with management goals.	Provide flood protection to meet seasonal/annual reliability goals.
Locate borrow excavation in areas to enhance aquatic and wetland development.	Improve existing habitat suitability for migratory birds and fish.
C. Water Level Control	
Construct small pump station outside the levee.	Allow for maximum site management flexibility to maintain water levels under varying annual conditions.
D. Littoral Zone Grading	
Increase littoral zone area by grading locations near existing water.	Optimize feeding and rearing habitat for waterfowl and spawning habitat for fish.
E. Warm Season Grass Planting	
Locate grass plantings on existing higher elevations.	Provide escape and nesting cover and a variety of food sources for upland birds and animals.

5. POTENTIAL FEATURES OF ALTERNATIVES

The purpose of this section is to describe and assess a preliminary number of potential enhancement features. Once these features are evaluated in Section 6, Section 7 formulates alternatives based on combinations of features.

Potential enhancement features were determined based on their ultimate contribution to the project goals and objectives, engineering considerations, and local restrictions or constraints. These development criteria are summarized in Table 4-2. Enhancement features which were not feasible or did not meet the criteria of Table 4-2 were not subject to further evaluation. Once the initial screening was completed, the remaining potential enhancement features were optimized to fully or partially satisfy the project objective(s). The optimized potential enhancement features were combined to make up alternatives which meet the project goals and objectives.

a. **Levee Restoration.** The levee surrounding Banner Marsh is crucial in preventing interior sedimentation and providing protection against loss of water control due to flooding. The levee was built with adjacent material between 1910 and 1917 to an approximate 50-year flood height. Although the construction material (primarily topsoil) is highly erosive, the levee has never failed. It has however, experienced continual maintenance to resolve ongoing erosion. Restoration of a reliable levee system is paramount to protect against flooding and its deleterious effects on wetland management unit operations at Banner Marsh.

Levee restoration consists of restoring the perimeter levee to the 50-year level of protection. Original construction dimensions would be restored and riprap would be added to prevent wave wash and erosive forces of high water events. This would require approximately 140,000 cubic yards of borrow material and 33,000 tons of riprap.

Several options were considered for borrow material for the levee restoration. Borrow material sources considered were:

(1) Borrow from Interior Highwalls. The utilization of these sites offers additional habitat benefit by converting the shear highwall banklines adjacent to lakes, ponds, and waterways to non-forested wetland and spawning habitat for fish (littoral habitat). These sites would be developed as shallow borrow excavations, which would not only maximize habitat benefits, but also would yield the most suitable impervious borrow material.

(2) Borrow from Interior Areas Other Than Highwalls. This option is similar to option a.(1) above, but the borrow sites are not at highwall areas. Although the quality of created littoral habitat would be equal, the area would be much greater because excavation down to a suitable elevation would be less. Therefore, to obtain the required quantities of material, a more extensive area would be needed. A larger area would offer more habitat benefits.

(3) Riverward Sites. The historic borrow ditch lies adjacent to the levee riverward. Since the construction of the locks and dams on the Illinois Waterway, the ditch has filled with water and has served as side channel habitat. Over time, the lower end of the ditch has silted in and is limited in its value to fish and other aquatic creatures. Because of side channel value to fish, compounded with the lack of side channel habitat on the Illinois Waterway, this may be a very desirable feature.

This action would negatively impact mussels currently found in the upper two-thirds of the side channel/ditch; however, the overall benefit to the Illinois Waterway would outweigh the negative impacts.

(4) Channel Maintenance Activities. Periodic dredging occurs on the Illinois Waterway for maintaining a minimum 9-foot navigation channel. Beneficial uses of dredged material are always preferred over placing the material in either aquatic or wetland habitats. If dredged material could be used for levee restoration, a win/win situation would occur: beneficial use of dredged material and levee restoration.

Unfortunately, this feature was not evaluated for several reasons. Once again, the material in the main channel is primarily sand and would require encroachment into the adjacent borrow ditch. Historically, dredging events have produced 25,000 cubic yards of material per dredging event. This quantity would not satisfy the Banner Marsh levee needs. The regulatory agencies did not want the material placed on the river side of the levee because of the potential of filling in mussel habitat. The Illinois DNR did not want the material placed on the landside because of the potential of introducing undesirable fish species to the site. Finally, maintenance dredging is completed via hydraulic dredging methods with a very high percentage of the slurry being water. Placement of the slurry onto the damaged levee may scour the levee, doing the levee more harm than good.

b. Water Level Control. To optimize water level control management capabilities, four options were considered. Each feature would allow for interior water control to desired management levels, but because of construction and operation costs, these features may be analyzed incrementally to determine the best feature to build.

(1) Construct a new two-way pumping facility at the existing one-way pump station site.

(2) Construct a second small pump station outside the levee with the capability to pump into the marsh.

(3) Construct a new two-way pumping facility near Copperas Creek. This feature has been given little consideration because Copperas Creek is not a reliable water source throughout the year. Therefore, this feature has not been included in the incremental analysis.

(4) Install a well or well system to pump ground water into the marsh. This feature was not evaluated in the incremental analysis because geotechnical analysis did not locate a reliable aquifer present in the area.

c. Littoral Zone Grading. Three features were considered to optimize habitat that could be used for fish spawning, waterfowl and waterbird feeding, and rearing areas for both fish and waterfowl. This type of habitat is very limited at Banner Marsh. Desired is a zone adjacent to various water bodies of approximately 18 inches of standing water. Construction techniques for the features would be similar, whereby shorelines would be graded to change from highbank to flat, shallow habitat.

These features are either stand-alone features or expand the area of habitat creation found in features a.(1) and a.(2) above.

(1) Grading would occur along 7 miles of highbank shoreline. Material would be pushed into deep areas of the water bodies, increasing the littoral zone.

(2) Grading would occur at selected locations that are near existing water bodies, but are not highwall in character. Material would be pushed into deep areas of the water bodies, increasing the littoral zone.

(3) Both features in combination would be constructed.

d. Warm Season Grass Planting. An upland site of 208 acres on the site has little to no habitat value as it exists today. It is comprised of brome grass (*Bromus enermous*) and scattered honey locust (*Gleditsia triacanthos*). The local site managers have termed it their "brome desert." This area was created through mine reclamation efforts. It was graded with a shallow soil and brome was planted as a cover crop to reduce erosion.

Three features to enhance this area for upland bird and animal use have been considered:

(1) A mixture of warm season grasses and forbs (broadleafed plants that are not grasses) would be planted. This feature introduces a seed bank that would quickly create the desired mix of plants to resemble a pre-settlement grass habitat.

(2) A mixture of warm season grasses would be planted. Although forbs would not be planted, habitat benefits closely equivalent to a full mix of prairie plants would be gained. Future management by the State may include forb planting for this site.

(3) A monoculture of switchgrass would be planted. This feature was not evaluated because it would not meet the State's goal of closely creating prairie habitat with similar character of pre-settlement grasslands. A monoculture of switchgrass would produce similar habitat benefits as exist now.

6. EVALUATION OF FEATURES

Environmental Output Evaluation. *A habitat evaluation was completed for* the Banner Marsh Habitat Rehabilitation and Enhancement Project (HREP), with a project goal of enhancing wetland and aquatic habitats (Appendix D). The appraisal guides for wetland habitats were chosen, and the channel catfish, largemouth bass, red head, mallard, green-backed heron, ring-necked pheasant, and dickcissel were used as the target species, emphasizing Banner Marsh's role as both an important refuge for migrating birds and a source of quality habitat for various marsh-dwelling, prairie, and aquatic species. Several other species also were considered in the analysis process. It is accepted that some species, particularly nongame species, would benefit from certain areas of habitat which are not well reflected in the analysis. These species generally have small home ranges and require narrow land use patterns, conditions opposite of those rated by the habitat evaluation models. The evaluation study team consisted of staff from the Illinois DNR, the USFWS, and the Corps of Engineers.

Habitat evaluation procedures were used to optimize the potential of each enhancement feature. Two procedures were chosen for habitat evaluation. One was developed by the Missouri Department of Conservation and the Soil Conservation Service. The system, the Wildlife Habitat Appraisal Guide (WHAG), is a numerical habitat appraisal system based on USFWS Habitat Evaluation Procedures (HEP) (1980). The system is used to evaluate existing habitat conditions and the effects of planned habitat management features. The second, the Aquatic Habitat Appraisal Guide (AHAG) (Mathias, *et al.*, unpublished) is a model that has been developed to evaluate fish habitat in the Upper Mississippi River System. Like the WHAG, it, too, uses the equation habitat suitability index (HSI) x area = habitat units (HUs) to quantify habitat output in the form of HUs.

Table 6-1 shows each feature management measure and its respective output measured in average annual habitat units (AAHUs) if the feature were to be implemented.

Because the project would be a habitat restoration effort and not mitigation for habitat losses occurring elsewhere, there were no numerical goals per se as part of the objective. However, if conditions could be optimized (HSI of 1.0), total outputs of 5,524 AAHUs would be expected (5,524 acres x 1.0). Although optimal conditions would be welcomed at Banner Marsh, these conditions are neither physically attainable nor affordable. The goal of this project is to produce the highest environmental output at a reasonable and acceptable cost to the Corps of Engineers and the Illinois DNR.

TABLE 6-1

Features Analyzed
Measured in Average Annual Habitat Units

Feature	Symbol	Net Gain
Levee Restoration		
no action	A0	0
interior highwalls	A1	123.41
interior low areas	A2	180.14
Water Control		
no action	B0	0
two-way pump	B1	1629.00
new small one-way pump	B2	1629.00
Littoral Zone Grading		
no action	C0	0
highwall sites	C1	126.38
low areas	C2	286.07
highwall sites and low areas	C3	412.45
Upland Grass Planting		
no action	D0	0
mixed grass + forbs	D1	52.4
mixed grass	D2	52.4

a. Levee Restoration. The levee surrounding Banner Marsh is crucial in preventing interior sedimentation and providing protection against loss of water control due to flooding. Restoration of a reliable levee system is paramount to protecting against flooding and its deleterious effects on the operations at Banner Marsh.

To quantify environmental outputs of levee restoration, the source of borrow was evaluated as to its importance in improving habitat quality for local as well as continental species utilizing the marsh area. The potential source of borrow dictated the potential to alleviate or soften the effects of limiting factors found at each site.

(A1) Borrow from Interior Highwalls. The utilization of these sites offers additional habitat benefit by converting the shear highwall banklines adjacent to lakes, ponds, and waterways to spawning habitat for fish (littoral habitat). The lack of spawning habitat has been determined to be the limiting factor in having a self-sustaining fishery. Also, this habitat would be utilized by several wading birds, ducks, and other wetland animals. Seven acres of littoral areas would be created.

(A2) Borrow from Interior Areas Other Than Highwalls. This feature is similar to feature A1 above, but the borrow sites are not at highwall areas. Although quality of created littoral habitat would be equal, the area would be much greater

because excavation down to a suitable elevation would be less. Therefore, to get the required quantities of material, a more spread out area would be needed. In the habitat evaluation, the HSI scores were equal to A1, however, the acreage changed from 7 to 50 acres.

Other Features Considered But Not Evaluated. See paragraphs 5.a.(3) and 5.a.(4).

Riverward Borrow Sites. This feature was found to be engineeringly infeasible and therefore not evaluated for cost or environmental outputs. It was determined that the type of material found in the side channel habitat would be too fine grained and not suitable for levee construction.

Channel Maintenance Activities. Again, this feature was found to be engineeringly infeasible and therefore not evaluated for cost or environmental outputs. The quantity of material and type (sand) eliminated this feature from further consideration.

b. (B1, B2) Water Level Control. Water control is necessary to raise the water level at Banner Marsh for adequate flooding of what are now upland and newly created littoral areas (Features A and/or C). A one-way facility now exists for drainage, but in order to raise the water levels, and thus the habitat value, pumping into the area is required. Four measures were considered. Two of the four measures would allow for interior water control to desired management levels. Because of construction and operation costs, these features may be analyzed incrementally to determine the best feature to build.

The two measures not analyzed were using Copperas Creek as a water supply and drilling a well. Both of these features could not provide a reliable water supply, and therefore were eliminated from further analysis (see paragraphs 5.b.(3) and 5.b.(4)).

Once again, a variety of wildlife species would be impacted by increased water control. For each option, the AAHU value was equal (Table 6-1).

c. Littoral Zone Grading. Two features were considered to optimize habitat that could be used for fish spawning, waterfowl and waterbird feeding, and rearing areas for both fish and waterfowl. This type of habitat is very limited at Banner Marsh. Desired is a zone adjacent to various water bodies of approximately 18 inches of standing water. Construction techniques for both features would be similar, whereby shorelines would be graded to change from highbank to flat, shallow habitat. This feature is the same as described above for interior borrow sites for the levee restoration. The same assumptions and evaluation methods were used.

(C1) Interior Highwall Locations. Grading would occur in a 7-mile stretch of highbank shoreline. Material would be pushed into deep areas of the water bodies, increasing the littoral zone. The area of impact would be approximately 21 acres.

(C2) Locations Other Than Highwalls. Grading would occur at selected locations that are near existing water bodies, but are not highwall in character. Material would be pushed into deep areas of the water bodies, increasing the littoral zone. Material also may be shaped into nesting islands within the littoral zone, adding to the diversity of this measure. The area of impact would be approximately 106 acres.

(C3) Interior Highwall Locations and Locations Other Than Highwalls (C1+C2). This feature combines the above two features. The impacted acreage would total 127 acres.

d. Warm Season Grass Planting. An upland site of 208 acres on the site has little to no habitat value as it exists today. The goal for this site is to restore it to pre-settlement appearance. It is comprised of brome grass (*Bromus enermous*) and scattered honey locust (*Gleditsia triacanthos*). The local site managers have termed it their "brome desert." Although a brome field has more habitat value than a mine spoil pile, it is minimal. Without-project, or baseline conditions, were very low for the evaluation species outlined in a modified WHAG upland grass model (Appendix D). By changing the plant species composition on the site to a warm season mix and actively managing the site, habitat value would increase. Warm season grass produces more escape and nesting cover, as well as more of a variety of food (seeds) for grass-dwelling species.

Three features to enhance this area for upland bird and animal use have been considered. One of these, planting a monoculture of switchgrass, was not evaluated. While switchgrass has been used in wildlife plantings in the past, it has been found to be very aggressive and very thick, not allowing growth of other desirable plant species. This feature was not evaluated because it did not meet the goals and objectives of the Illinois DNR.

(D1) A mixture of warm season grasses and forbs would be planted. This option provides the greatest diversity of plant heights and food sources. Although this option is the desired goal of the site, prairie plants such as forbs are very costly for the amount of biomass they produce.

(D2) A mixture of warm season grasses would be planted. Although not as diverse as D1, a variety of grass species would still offer the desired goal of approaching presettlement conditions and at a cheaper cost. Native grass species are generally found to grow in clumps, allowing for a diverse cover as well as the opportunity for forb species to grow naturally if seeds are introduced into the area either by wind, animals, or future management.

e. Cost Estimates for Habitat Improvement Measures. Table 6-2 shows the cost per feature. A breakdown of costs is outlined in Section 15 - Cost Estimates. Costs were annualized and are based on construction and real estate estimates.

TABLE 6-2

Environmental Output and Costs of Each Feature

Feature	Symbol	Output*	Cost**
Levee Restoration			
no action	A0	0	0
interior highwalls	A1	123.41	166.8
+interior low areas	A2	180.14	166.8
Water Control			
no action	B0	0	0
two-way pump	B1	1629.00	59.92
+new small one-way pump	B2	1629.00	49.4
Littoral Zone Grading			
no action	C0	0	0
highwall sites	C1	126.38	39.86
+low areas	C2	286.07	51.01
highwall & low areas	C3	412.45	90.87
Upland Grass Planting			
no action	D0	0	0
mixed grass + forbs	D1	52.40	35.99
+mixed grass	D2	52.40	31.85

* Outputs are calculated as Average Annual Habitat Units.
** Costs in $1,000s and are annualized.
\+ Preferred Features.

7. FORMULATION OF ALTERNATIVES

a. General Discussion. In restoration and enhancement projects like the Banner Marsh project, incremental analysis is an excellent tool to evaluate and determine what management measures should be built based on habitat benefit outputs that meet the goals and objectives of the project and at the same time are the most cost effective. The Corps of Engineers has incorporated incremental analysis into its planning documents for some time, mostly in mitigation planning.

Incremental analysis is basically a three-step procedure: (1) calculate the environmental outputs of each feature; (2) determine a cost estimate for each feature; and (3) combine the features to evaluate the best overall project alternative based on habitat benefits and cost. While cost and environmental output are necessary factors, other factors such as constructibility and meeting the goals and objectives of the sponsor are very important in deciding on the preferred alternative.

Several steps were taken to incrementally analyze this project. This project was evaluated using guidance prepared by the Corps of Engineers' Institute for Water Resources (Carlson, 1993; Orth, 1993; and Orth, 1994).

b. Levee Restoration Feature. For Banner Marsh, levee restoration is paramount. Without this feature, the management area is at high risk of devastation from a levee breech or failure. The management measures identified for levee restoration borrow were evaluated alone, and the preferred measure was included in the analysis of water control and littoral zone grading. These measures are considered to be independent and combinable.

The following table lists the three features for levee restoration borrow and their incremental cost:

Feature	Output	Cost	Additional Output	Additional Cost	Cost per AAHU
no action	0	0			0
interior highwalls (A1)	113.41	166.8	113.41	166.8	1.47
interior low areas (A2)	160.25	166.8	160.25	166.8	1.04

Output is measured in AAHUs. Costs are in $1,000s and are annualized.

Feature A2 was the selected feature. For the same cost, an additional 47 AAHUs would be gained if feature A2 were used.

c. Potential Alternatives. For those management measures that are dependent upon each other (levee restoration, water control, littoral zone grading, and warm season grass planting), all possible combinations of their features were evaluated to determine the most cost efficient and effective alternative. Table 7-1 lists all the possible combinations.

TABLE 7-1

Outputs and Costs of Combinations

Ranked Combinations	Output*	Cost**
A0+B0+C0+D0	0	0
A2+B0+C0+D0	180.14	166.82
A2+B0+C0+D2	232.54	198.67
A2+B0+C0+D1	232.54	202.81
A2+B0+C1+D0	306.52	206.68
A2+B0+C1+D2	358.92	238.53
A2+B0+C1+D1	358.92	242.67
A2+B0+C2+D0	466.21	217.83
A2+B0+C2+D2	518.61	249.68
A2+B0+C2+D1	518.61	253.82
A2+B0+C3+D0	592.59	257.69
A2+B0+C3+D2	644.99	289.54
A2+B0+C3+D1	644.99	293.68
A2+B2+C0+D0	1809.14	216.22
A2+B1+C0+D0	1809.14	226.74
A2+B2+C0+D2	1861.54	248.07
A2+B2+C0+D1	1861.54	252.21
A2+B1+C0+D2	1861.54	258.59
A2+B1+C0+D1	1861.54	262.73
A2+B2+C1+D0	1935.52	256.08
A2+B1+C1+D0	1935.52	266.6
A2+B2+C1+D2	1987.92	287.93
A2+B2+C1+D1	1987.92	292.07
A2+B1+C1+D2	1987.92	298.45
A2+B1+C1+D1	1987.92	302.59
A2+B2+C2+D0	2095.21	267.23
A2+B1+C2+D0	2095.21	277.75
+A2+B2+C2+D2	2147.61	299.08
A2+B2+C2+D1	2147.61	303.22
A2+B1+C2+D2	2147.61	309.6
A2+B1+C2+D1	2147.61	313.74
A2+B2+C3+D0	2221.59	307.09
A2+B1+C3+D0	2221.59	317.61
A2+B2+C3+D2	2273.99	338.94
A2+B2+C3+D1	2273.99	343.08
A2+B1+C3+D2	2273.99	349.46
A2+B1+C3+D1	2273.99	353.6

* Outputs are Average Annual Habitat Units
** Costs are $1,000 and are annualized
\+ Preferred Alternative

8. EVALUATION OF ALTERNATIVES

Plans within measures (two water control plans, for example) cannot be combined to form an alternative. A total of 37 combinations was formed, including the no action alternative.

levee restoration		water control		littoral zone grading		warm season grass planting	
1	x	3	x	4	x	3	= 36
						no action	= 1
						total number of alternatives	= 37

Table 8-1 displays the combinations in their ascending order based on their respective outputs. Those combinations shaded were deemed to be cost inefficient for the amount of output produced. These alternatives were no longer evaluated. The combinations that were unshaded are presented in Table 8-2. These combinations are the least cost combinations for each level of output.

TABLE 8-1

Outputs and Costs of Combinations for Each Level of Output

Ranked Combinations	Output*	Cost**
A0+B0+C0+D0	0	0
A2+B0+C0+D0	180.14	166.82
A2+B0+C0+D2	232.54	198.67
A2+B0+C0+D1	232.54	202.81
A2+B0+C1+D0	306.52	206.68
A2+B0+C1+D2	358.92	238.53
A2+B0+C1+D1	358.92	242.67
A2+B0+C2+D0	466.21	217.83
A2+B0+C2+D2	518.61	249.68
A2+B0+C2+D1	518.61	253.82
A2+B0+C3+D0	592.59	257.69
A2+B0+C3+D2	644.99	289.54
A2+B0+C3+D1	644.99	293.68
A2+B2+C0+D0	1809.14	216.22
A2+B1+C0+D0	1809.14	226.74
A2+B2+C0+D2	1861.54	248.07
A2+B2+C0+D1	1861.54	252.21
A2+B1+C0+D2	1861.54	258.59
A2+B1+C0+D1	1861.54	262.73
A2+B2+C1+D0	1935.52	256.08
A2+B1+C1+D0	1935.52	266.6
A2+B2+C1+D2	1987.92	287.93
A2+B2+C1+D1	1987.92	292.07
A2+B1+C1+D2	1987.92	298.45
A2+B1+C1+D1	1987.92	302.59
A2+B2+C2+D0	2095.21	267.23
A2+B1+C2+D0	2095.21	277.75
+A2+B2+C2+D2	2147.61	299.08
A2+B2+C2+D1	2147.61	303.22
A2+B1+C2+D2	2147.61	309.6
A2+B1+C2+D1	2147.61	313.74
A2+B2+C3+D0	2221.59	307.09
A2+B1+C3+D0	2221.59	317.61
A2+B2+C3+D2	2273.99	338.94
A2+B2+C3+D1	2273.99	343.08
A2+B1+C3+D2	2273.99	349.46
A2+B1+C3+D1	2273.99	353.6

* Outputs are Average Annual Habitat Units
** Costs are $1,000 and are annualized
+ Preferred Alternative

TABLE 8-2

Outputs and Costs of Least Cost Combinations for Each Level of Output

Ranked Combinations	Output*	Cost**
A0+B0+C0+D0	0.00	0
A2+B0+C0+D0	180.14	166.82
A2+B0+C0+D2	232.54	198.67
A2+B0+C1+D0	306.52	206.68
A2+B0+C1+D2	358.92	238.53
A2+B0+C2+D0	466.21	217.83
A2+B0+C2+D2	518.61	249.68
A2+B0+C3+D0	592.59	257.69
A2+B0+C3+D2	644.99	289.54
A2+B2+C0+D0	1809.14	216.22
A2+B2+C0+D2	1861.54	248.07
A2+B2+C1+D0	1935.52	256.08
A2+B2+C1+D2	1987.92	287.93
A2+B2+C2+D0	2095.21	267.23
+A2+B2+C2+D2	2147.61	299.08
A2+B2+C3+D0	2221.59	307.09
A2+B2+C3+D2	2273.99	338.94

* Outputs are Average Annual Habitat Units
** Costs are $1,000 and are annualized
\+ Preferred Alternative

Table 8-3 identifies those combinations that are ineffective. Unshaded combinations produce more output for less cost (Table 8-4).

TABLE 8-3

Outputs and Costs of Least Cost Combinations for Each Level of Output, With Shading Over Ineffective Combinations

Ranked Combinations	Output*	Cost**
A0+B0+C0+D0	0.00	0
A2+B0+C0+D0	180.14	166.82
A2+B0+C0+D2	232.54	198.67
A2+B0+C1+D0	306.52	206.68
A2+B0+C1+D2	358.92	238.53
A2+B0+C2+D0	466.21	217.83
A2+B0+C2+D2	518.61	249.68
A2+B0+C3+D0	592.59	257.69
A2+B0+C3+D2	644.99	289.54
A2+B2+C0+D0	1809.14	216.22
A2+B2+C0+D2	1861.54	248.07
A2+B2+C1+D0	1935.52	256.08
A2+B2+C1+D2	1987.92	287.93
A2+B2+C2+D0	2095.21	267.23
+A2+B2+C2+D2	2147.61	299.08
A2+B2+C3+D0	2221.59	307.09
A2+B2+C3+D2	2273.99	338.94

* Outputs are Average Annual Habitat Units
** Costs are $1,000 and are annualized
\+ Preferred Alternative

Table 8-4 is the same as Table 8-3, except that shaded (economically ineffective) combinations are no longer listed and only efficient combinations are listed.

TABLE 8-4

Outputs and Costs of Cost-Effective Least Cost Combinations for Each Level of Output

Ranked Combinations	Output*	Cost**
A0+B0+C0+D0	0.00	0
A2+B0+C0+D0	180.14	166.82
A2+B0+C0+D2	232.54	198.67
A2+B0+C1+D0	306.52	206.68
A2+B2+C0+D0	1809.14	216.22
A2+B2+C0+D2	1861.54	248.07
A2+B2+C1+D0	1935.52	256.08
A2+B2+C2+D0	2095.21	267.23
+A2+B2+C2+D2	2147.61	299.08
A2+B2+C3+D0	2221.59	307.09
A2+B2+C3+D2	2273.99	338.94

* Outputs are Average Annual Habitat Units
** Costs are $1,000 and are annualized
\+ Preferred Alternative

At this point, average cost per AAHU is calculated (Table 8-5). The combination A2+B2+C0+D0 is shaded in Table 8-5. This alternative has the lowest average cost and is the first to be included in the incremental cost analysis. Levels of output less than the lowest average cost level (A2+B2+C0+D0) are dropped from further analysis.

TABLE 8-5

Average Cost of Each Level of Output

Ranked Combinations	Output*	Cost**	Average Cost $ per AAHU
A0+B0+C0+D0	0.00	0	0
A2+B0+C0+D0	180.14	166.82	0.9261
A2+B0+C0+D2	232.54	198.67	0.8543
A2+B0+C1+D0	306.52	206.68	0.6743
A2+B2+C0+D0	1809.14	216.22	0.1195
A2+B2+C0+D2	1861.54	248.07	0.1333
A2+B2+C1+D0	1935.52	256.08	0.1323
A2+B2+C2+D0	2095.21	267.23	0.1275
+A2+B2+C2+D2	2147.61	299.08	0.1393
A2+B2+C3+D0	2221.59	307.09	0.1382
A2+B2+C3+D2	2273.99	338.94	0.1491

* Outputs are Average Annual Habitat Units
** Costs are $1,000 and are annualized
\+ Preferred Alternative

Next, the question is asked: Of the remaining levels of output, which level has the lowest average cost for additional output? Using combination A2+B2+C0+D0 as the "zero level," additional costs and additional outputs of the other combinations were calculated in Table 8-6. Again, the lowest average cost combination is highlighted (A2+B2+C3+D0) and is the second combination added to the incremental analysis. Those combinations with lower levels of output are dropped from the analysis.

TABLE 8-6

Average Cost for Additional Output
Round I

Ranked Combinations	Output*	Addl. Output	Cost**	Addl. Cost	Avg. Cost for Addl. Output $ per AAHU
A2+B2+C0+D0	1809.14	0	216.22	0	
A2+B2+C0+D2	1861.54	52.40	248.07	31.85	0.61
A2+B2+C1+D0	1935.52	126.38	256.08	39.86	0.32
A2+B2+C2+D0	2095.21	286.07	267.23	51.01	0.18
+A2+B2+C2+D2	2147.61	338.47	299.08	82.86	0.24
A2+B2+C3+D0	2221.59	360.05	307.09	59.02	0.16
A2+B2+C3+D2	2273.99	338.47	338.94	82.86	0.24

* Outputs are Average Annual Habitat Units
** Costs are $1,000 and are annualized
\+ Preferred Alternative

A final reiteration is completed with the remaining combinations that have a higher level of output than Combination A2+B2+C3+D0. In this analysis, only one combination remains. Table 8-7 shows the average cost of the remaining combination.

TABLE 8-7

Average Cost for Additional Output
Round II

Ranked Combinations	Output*	Addl. Output	Cost**	Addl. Cost	Avg. Cost for Addl. Output $ per AAHU
A2+B2+C3+D0	2221.59	0.00	307.09	0	
A2+B2+C3+D2	2273.99	52.40	338.94	31.85	0.61

* Outputs are Average Annual Habitat Units
** Costs are $1,000 and are annualized

Table 8-8 displays the four combinations that had the lowest average cost (highlighted combinations from Tables 8-5, 8-6, and 8-7, as well as the no action alternative), and the incremental costs of these combinations. Figure 8-1 graphically displays this data.

TABLE 8-8

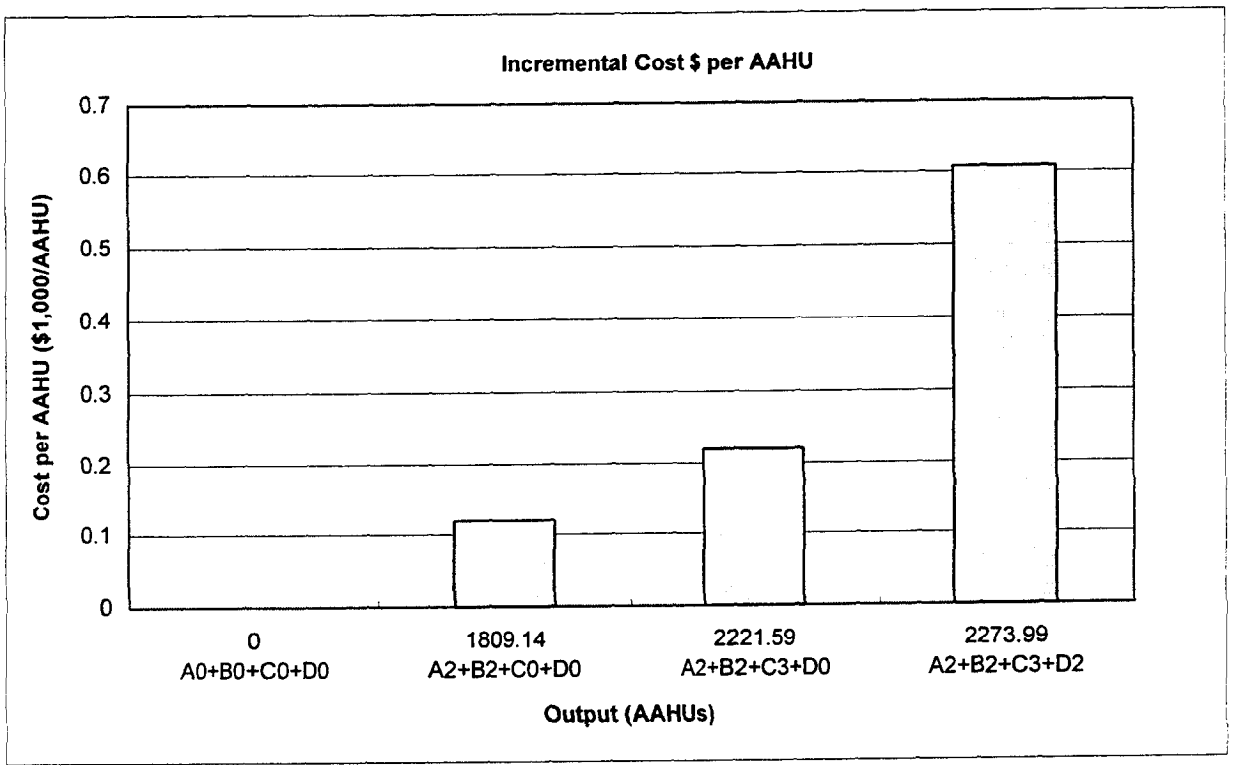
Incremental Costs

Ranked Combinations	Output*	Cost**	Addl. Output	Addl. Cost	Incremental Cost $ per AAHU
A0+B0+C0+D0	0	0			
A2+B2+C0+D0	1809.14	216.22	1809.14	216.22	0.12
A2+B2+C3+D0	2221.59	307.09	412.45	90.87	0.22
A2+B2+C3+D2	2273.99	338.94	52.40	32	0.61

* Outputs are Average Annual Habitat Units
** Costs are $1,000 and are annualized

FIGURE 8-1

Incremental Costs



Incremental Analysis Summary. The incremental analysis methodology used, Nine Easy Steps, provides for a very complete analysis of the project's output and costs even though the litany of combinations and tables can become confusing at times. Other elements adding to the complexity of the analysis are the goals and objectives of the project as well as the landscape of the site. For large, dynamic projects like Banner Marsh, presenting the data in a concise manner is a challenge. However, the Nine Easy Steps methodology hopefully presents the data in a clear and understandable fashion.

Federal planning for water resources development is conducted in accordance with the requirements of *the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* (P&G). The P&G provide a decision rule for selecting a recommended plan where both outputs and costs are measured in dollars. This rule states that "the alternative plan with the greatest net economic benefit consistent with protecting the Nation's environment (National Economic Development Plan, NED Plan) is to be selected..." (paragraph 1.10.2). There is no similar rule for plan selection where outputs are not measured in dollars, as is the case in planning for restoration and mitigation.

Neither cost effectiveness analysis nor incremental cost analysis include a plan selection rule similar to the NED rule. In the absence of such a decision making rule, neither analysis will indicate what choice to make. However, the information developed by both analyses will help in making better informed decisions and, once a decision is made, will help in better understanding its consequences in relation to other choices.

While the incremental cost analysis identified those alternatives that are the most cost effective, and as stated above, provides excellent information to the decision maker, this procedure should not be the sole source on which to base a decision. Other factors considered in this analysis were landscape of the site (including physical dynamics associated with the riverine environs), management objectives of the resource agencies, critical needs of the region, and ecosystem needs of the Upper Mississippi River System.

In cooperation with the Illinois DNR, FWIC, and USFWS, the Corps has planned and designed what we feel as the best alternative that serves the needs of the resources and resource managers, while being cost conscious. Ironically, the preferred alternative was found to be cost inefficient through the incremental cost analysis. That alternative, A2+B2+C2+D2, would fall out midway in Figure 8-1, between Alternatives A2+B2+C0+D0 and A2+B2+C3+D0. This alternative, levee restoration using low areas, water control by installing a small one-way pump, littoral zone creation in low lying areas, and creating a 208-acre warm season grass planting, has an overall output of 2,148 AAHUs for a cost of approximately $4,378,343.

The question posed to the agencies involved in this analysis was, "Is the cost of the increment in output worth the added costs?" The Illinois DNR and the Rock Island District feel that alternative A2+B2+C2+D2 meets the goals and objectives of each agency and the EMP program. While the individual features of other alternatives

would address the goals and objectives of the project, it was felt that collectively the other cost-effective alternatives did not strike the right balance of habitat benefits for the overall project. It was preferred by both agencies and supported by the FWIC that for the added output of increasing the area of littoral zone grading, the investment in warm season grass planting was better at meeting management goals, and, more importantly, at increasing the diversity and potential wildlife benefits of the site.

One concern identified in the incremental cost analysis process was the cost of the warm season grass planting compared to the amount of habitat output (52.4 AAHUs). This high cost may be misleading for two reasons. The HEP team felt that the WHAG analysis is very accurate when change in habitat types occurs such as changing an upland habitat to a wetland or an aquatic habitat. When within-habitat changes occur (cool season grass to warm season grass habitat), the model is not as sensitive.

A change of 52.4 AAHUs may be a very low estimate when converting cool season grasses to a more diverse and natural warm season grass setting. As mentioned in the first paragraph of Section 6, many of the species inhabiting this habitat have small home ranges and narrow land use patterns that are not conducive to HEP model analysis. The HEP team did not alter the model or the output to better reflect their assumptions because it was felt that the model was not sensitive to reflect small, yet important, habitat units for many of the nongame species that may use a prairie type habitat.

Again, the question of worth was asked. The goal of enhancing upland habitat types is equal to that of aquatic and wetland habitats in this report. Both the Corps and Illinois DNR feel the analysis may not reflect an output that is as accurate as they prefer, but their wildlife specialists feel that many benefits that are not reflected in the model will be realized if the warm season grass planting is implemented.

9. DETAILED DESCRIPTION OF PREFERRED ALTERNATIVE

The preferred alternative meets the goals and objectives of the State for wildlife management at Banner Marsh. This alternative also is the most cost-efficient alternative to meet these goals. This alternative includes interior borrow at low areas, two-way water control by constructing a small pump near the existing one-way pumping facilities, littoral zone grading at low areas encompassing 106 acres, and planting warm season grasses on a 208-acre oldfield site.

a. General Description. Features A2, B2, C2 and D2 were selected as the recommended project to be constructed. The recommended project features include levee improvement, pump station construction, littoral zone grading, and native grass planting.

b. Levee Improvement. The existing perimeter levee slopes will be restored to ensure a 50-year level of protection, as shown on plates 13 and 14. The levee slope will be repaired to a 2.5 horizontal feet on 1 vertical foot. The levee top will be offset away from the river side to avoid fill on the riverside slopes. Riprap will be placed on selected reaches of the levee which have been historically vulnerable to scouring.

c. Pump Relocation. The existing pumps are considered to be more than adequate to drain the marsh. To facilitate the pumping requirements for maintaining a 434.0 water surface elevation, one of the existing 14,000 gpm pumps will be relocated, as shown on plate 16. A permanent concrete sheet piling and cinder block structure will be constructed to house the electrical engine, pump, and supplies, as shown on plate 17. The building will provide a weather-tight, vandal-resistant enclosure. The intake structure will be provided with a steel trash rack to protect the pump from debris, etc. Pump discharge piping will be 24-inch steel pipe and will discharge into the sand and gravel filter pit designed to remove small fry and eggs.

The sand and gravel filter is designed to operate for the 2- to 3-month period of makeup water required without needing to be shut down for maintenance. As designed, the filter should remove upwards of 90 percent of bacteria present with particle sizes approximately $2x10^{-7}$ inches. With approximate sizes of 0.02-0.04 inches, fish eggs and small fry should be effectively eliminated from the water being discharged into the interior lakes.

d. Littoral Zone/Contour Grading. Three sites were selected for contour grading for littoral zone development. These sites correspond to the same sites selected for borrow source and will be expanded. Material moved may be pushed into the deep channels if they are adjacent to the site to be graded or it may be pushed onto the nearby lands and graded to slopes no greater than 10 percent and seeded.

e. Native Grass Planting. A site has been selected for planting in the north-central portion of the area (plate 2). The entire 208 acres of the site will be utilized. Species selected include big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), Indian grass (*Sorghastrum nutans*), sideoats gramma (*Bouteloua curtipendula*), and perennial rye grass (*Lolium perenne*) as a cover crop.

Planting will begin in the spring no earlier than March 15th and will be completed no later than May 5th. If planted in the fall, starting and ending dates will be October 1st and November 15th, respectively. Species will be intermixed to avoid solid blocks of individual species. Planting rates per acre are as follows:

Species	**Pounds/Acre**
Big bluestem (*Andropogon gerardii*)	3 pounds
Little bluestem (*Schizachyrium scoparium*)	3 pounds
Indian grass (*Sorghastrum nutans*)	2 pounds
Perennial rye grass (*Lolium perenne*)	20 pounds
Sideoats gramma (*Bouteloua curtipendula*)	2 pounds

10. DESIGN AND CONSTRUCTION CONSIDERATIONS

a. Existing Site Elevations. The entire Banner Marsh project area is located within the floodplain of the Illinois Waterway. Because the entire area has previously been strip-mined, there is no continuity of geologic formations throughout the site. Flat pool elevation is 429 NGVD. The land surface elevation in the designated borrow areas ranges from 433 to 438. During the borrow operations, the water surface elevation will need to be held below the 433 elevation. It is anticipated that shallow borrow and subsequent embankment construction can be accomplished using traditional earth-moving equipment. Dewatering likely will be required for foundation work associated with the pump station structures.

b. Borrow Sites/Construction Materials.

(1) Borrow Sites. Borrow material for the perimeter levee will come from the designated borrow areas indicated as areas for littoral zone development shown on plate 2. Areas of relatively undisturbed lands are available at each location that will provide suitable borrow.

(2) Construction Materials. Only common construction materials are required for this project. Crushed stone and ready mix materials are available locally and can be trucked to the site. Riprap is available from Valley City, Illinois, and can be barged or trucked to the site. Construction areas are easily accessible, and construction materials can be transported on site by conventional equipment.

c. Storm Water Pollution/Erosion Control. The potential for storm water pollution during construction is minimal for this project. Storm water runoff from the disturbed areas on the landside of the perimeter levee as well as the runoff from all construction activity within the confines of the perimeter levee system will be contained within the Banner Marsh State Fish and Wildlife Area. Temporary stabilization measures will be employed on disturbed areas of the riverside perimeter levee slopes until final seeding and stabilization occurs. Stabilization practices may include mulching, temporary seeding, and/or the erection of silt fencing. Overall, the long-term storm water runoff characteristics of the site are not expected to change; all disturbed areas will be reseeded with similar vegetation types as before project conditions.

d. Construction Sequence. The probable construction sequence is summarized in Table 10-1. The contractor will be required to complete the levee repair prior to initiating any of the other project features.

TABLE 10-1

Perimeter Levee, Probable Construction Sequence

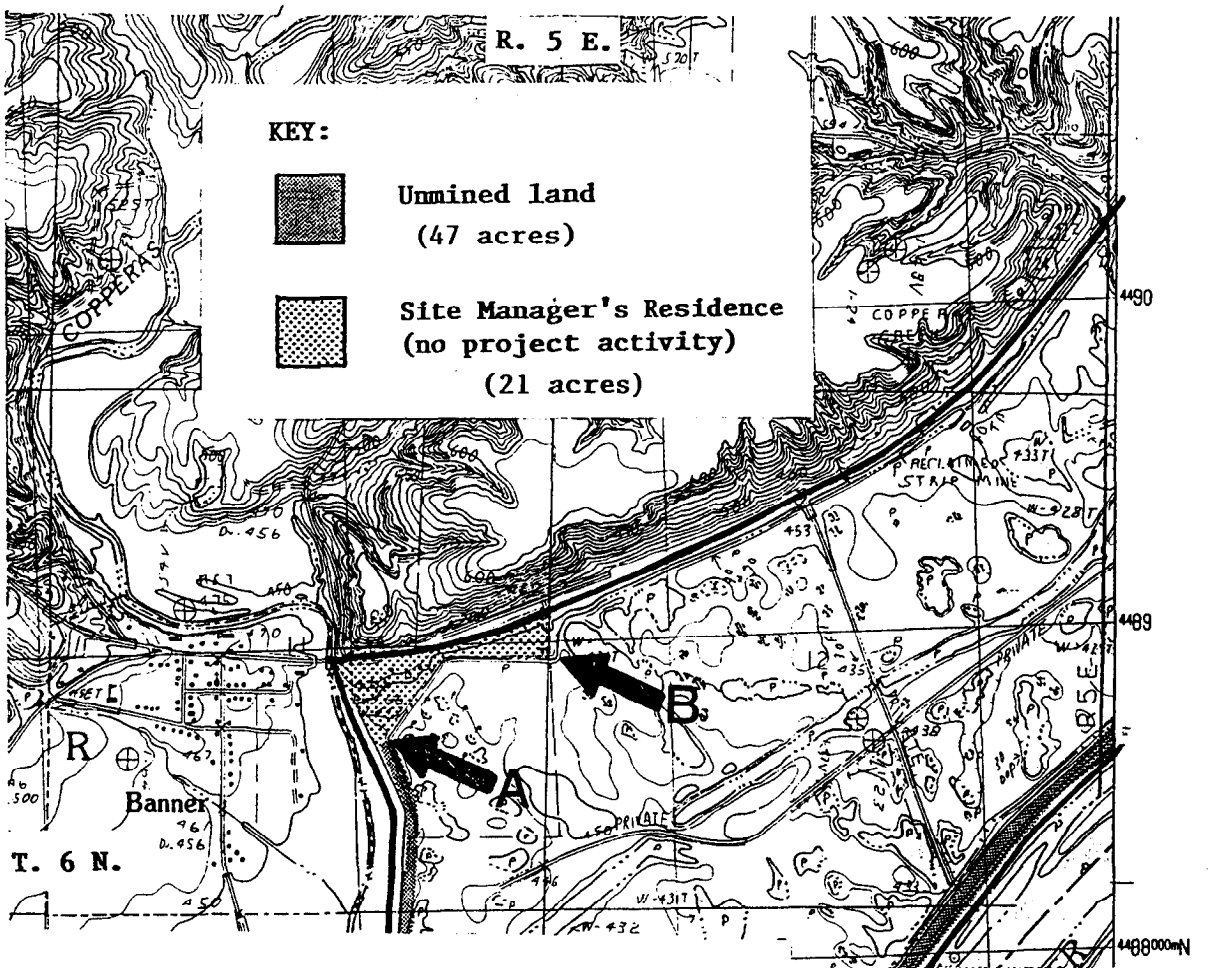
Construction Work Item	Instructions	Purpose
Clear & grub specified vegetation from perimeter levee	Place debris in piles adjacent to landside toe embankment	Provide slope erosion protection
Strip/excavate & place embankment	Any debris may be disposed of within the deep cut lakes to provide structure	--
Place riprap where specified	--	--
Implement temporary soil stabilization practices on riverside slopes of perimeter levee	Only required if time between final levee shaping and initial seeding exceeds 21 days	To minimize storm water pollution potential
Seed levee	--	--
Pump relocation	No sequence required	--

e. Permits. A public notice, as required by Section 404 of the Clean Water Act, will be made prior to submission of this report for final approval. A Section 401 water quality certificate from the State of Illinois and a Section 404(b)(1) Evaluation will be included in the final submission of this report (Appendix B). Because all land disturbances associated with this project are addressed in the 404(b)(1) Evaluation, a National Pollutant Discharge Elimination System (NPDES or Section 402) permit for storm water discharges will not be required.

f. Historic Properties. A construction avoidance zone will be marked out over the entire 21-acre area identified as the Site Manager's residence in order to avoid any potential impact to the Copperas Creek site (11F100). No construction materials, equipment, or activity shall be allowed in this 21-acre area. Because of this restriction, approximately 2,200 feet of littoral zone development (and/or any other activity) has been deleted along the north side of the drainage ditch which abuts the south edge of the site manager's residence between points A and B, as shown on Figure 10-1.

FIGURE 10-1

Site Manager's Residence: a 21-Acre Construction Avoidance Zone



Site Manager's Residence: a 21-acre Construction Avoidance Zone

The construction avoidance zone covers the entire 21-acre area identified as the Site Manager's residence in order to avoid any potential impact to the Copperas Creek archaeological site (11F100). No construction materials, equipment, or activity shall be allowed in this 21-acre area. Because of this restriction, approximately 2200 feet of Littoral Zone development (and/or any other activity) is prohibited along the north side of the drainage ditch which abuts the south edge of the Site Manager's residence between points A and B.

QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

1 Farmington West
2 Farmington East
3 Hanna City
4 Canton
5 Glasford
6 St. David
7 Duck Island
8 Manito

ADJOINING 7.5' QUADRANGLE NAMES

ROAD LEGEND

Improved Road .....
Unimproved Road .....
Trail .....

Interstate Route U. S. Route State Route

BANNER, ILLINOIS

PROVISIONAL EDITION 1982

40089-E8-TF-024

11. ENVIRONMENTAL EFFECTS

a. Summary of Effects. Banner Marsh is a large, complex site with a variety of resources that vary in quantity and quality. The goal for the site is to raise the quality and quantity of some of these resources, but usually at the expense of other habitats (i.e., littoral zone habitat in place of oldfield habitat). In most cases, the trade-off for quality habitat is a loss in lower quality habitat. In other cases, because of the landscape, habitats of similar quality may be altered in order to carry out management objectives to meet the State's goals for the site (i.e., loss of cropfield for aquatic habitat).

The primary objectives of the Banner Marsh HREP are to improve water level control capabilities, create additional marshland habitat, and restore upland grasslands. Improved water level control would be achieved through levee restoration and constructing an additional pumping facility. These features would provide greater flexibility in water level and vegetation management, thus providing a more desirable mix of open water, emergent vegetation, and littoral zone conditions.

Borrow sites for levee improvements and littoral habitat creation would provide reliable spawning habitat for fish, and small marshlands for waterfowl and other marsh-dwelling species which are particularly important as brood habitat.

One particular site, a 208-acre oldfield site, would be converted to a warm season grass mixture.

b. Economic and Social Impacts.

(1) Community and Regional Growth. No short-term or long-term impacts to the growth of the neighboring community or region would be realized as a result of the project. The project would directly improve recreation opportunities at the Banner Marsh State Fish and Wildlife Area, increasing the attractiveness of the area for hunting, trapping, wildlife observation, and photography.

(2) Displacement of People. The project would not result in any residential relocations.

(3) Community Cohesion. The proposed environmental enhancement project would positively impact community cohesion by attracting visitors and recreationists from other communities to the wildlife area. This increase would not adversely impact area residents or property owners.

(4) Property Values and Tax Revenues. The project would have no direct impact on property values or related tax revenues. The land is in State ownership, so an increase in its value would not increase local tax revenues.

(5) Public Facilities and Services. The project site attracted more than 135,000 recreationists to the area in 1993. The proposed environmental enhancement project would protect the existing facilities and allow for further

development. This would positively impact public facilities by enhancing outdoor recreational opportunities oriented toward wildlife, fish and wildlands. The project would provide greater flexibility in water level and vegetation management, thus providing a desirable mix of enjoyable recreation experiences.

(6) Life, Health and Safety. The project poses no threats to the life, health, or safety of recreationists or others in the area. The proposed project would not affect current conditions in regard to these areas of concern.

(7) Business and Industrial Activity. Changes in business and industrial activities during project construction would be insignificant. Long-term impacts to business and industrial development would be related to tourism and recreational activities. The project would require no business relocations.

(8) Employment and Labor Force. Project construction would slightly increase short-term employment opportunities in the project area. The project would not directly affect employment of the labor force in Fulton and Peoria Counties.

(9) Farm Displacement. No farms would be affected as the project site is located entirely on State-owned land.

(10) Noise Levels. Heavy machinery would generate a temporary increase in noise levels during project construction, disturbing wildlife and recreationists in the area. The project is located in an area with limited residential or other development, and no significant, long-term noise impacts would result.

(11) Aesthetics. The project would provide for a variety of intermixed habitats and plant species from what is currently found on the site. This would have a positive impact to Banner Marsh's aesthetic value. The enhancement of nesting and habitat areas would encourage higher wildlife use and, in turn, increase the wildlife viewing opportunities for visitors.

c. Natural Resources Impacts. Effects of the project on natural resources, particularly terrestrial and wetland resources, were evaluated using WHAG (Urich, *et al.*, 1984) and AHAG (Mathias, *et al.*, unpublished) methodologies. These habitat evaluation methods were used during project planning to evaluate various features in terms of increased benefits to wildlife resources. Optimization of habitat units (HUs) in relation to project costs for target species is considered the goal of feature selection. Results of the habitat evaluations are summarized in Table 6-1, with a more detailed analysis in Appendix D. Assessment of project impacts also was based on experience and sound management practices.

(1) Aquatic Resources. Additional discussion of aquatic and water quality impacts is contained in Appendix B - Clean Water Act, Section 404(b)(1) Evaluation.

Short-term construction activities would increase turbidity in the Illinois Waterway along the toe of the levee. As material is placed and graded for levee restoration, some material would be placed in the river's edge. The increased turbidity would

have negligible impact considering the existing turbidity levels of the river. In fact, long-term beneficial impacts should accrue since the proposed project would decrease the amount of levee material entering the river due to erosion. Construction would cover benthic organisms, but the new materials should be recolonized quickly. In fact, new interstices would be created, thereby increasing the habitat diversity in the area.

Deep aquatic resources found at Banner Marsh would be used as placement sites for material removed for littoral zone grading. Some of these lakes are up to 84 feet deep and should suffer no long-term impacts. Construction will increase turbidity, but should not pose any life-threatening impacts to these lakes' ecosystems. This activity would cover up benthic organisms, but this new material should recolonize quickly.

(2) Wetland and Terrestrial Resources. The proposed plan would create 156 acres of littoral zone around existing waterbodies. Littoral aquatic resources would benefit from the increased reliability expected in water level control. Although the primary benefits would be in the form of improved vegetative composition, particularly waterfowl food plants, littoral habitat would offer spawning and rearing habitat for several species of fish.

Migratory water birds, in particular waterfowl, would not only benefit from a more reliable food source, but nesting and rearing habitat will increase.

Beaver and muskrat populations should not be negatively affected, and, in fact, would likely benefit from an increase in aquatic and emergent plant growth in the created littoral zone. Even during periods of summer drawdown, some standing water would remain, and existing deep water during the winter months would provide further insurance against complete ice-up, a more critical concern for muskrat populations.

Obviously, a project of this scope cannot be expected to benefit all evaluation species. The target species such as red head ducks and green-backed heron showed definite benefits from project implementation, and overall, the range of evaluation species seems to reflect the positive changes expected from increased habitat diversity. However, terrestrial species such as dickcissel and ring-necked pheasant may decrease with a loss in available habitat. Improving 208 acres of oldfield habitat into a mixed warm season grass area will offset some impacts felt by these species elsewhere on the site.

(3) Endangered Species. The federally endangered bald eagle (*Haliaeetus leucocephalus*) occurs in the vicinity of Banner Marsh during the winter. The USFWS, in their Coordination Act Report (Appendix A), stated the proposed project would not affect bald eagles or their habitats.

Decurrent false aster should not be impacted by the project. Decurrent false aster prefers disturbed, open sites of the Illinois River Valley. While these conditions exist at Banner Marsh in high proportions, decurrent false aster depends upon flooding for

seed dispersal. Because the area is leveed off, the potential is very low for finding this species.

In a letter dated January 10, 1995, the Illinois Department of Conservation indicated that the following three State threatened or endangered species have recently been identified on the project area: river otter (*Lutra canadensis*), American bittern (*Botaurus lentiginosus*), and king rail (*Rallus elegans*). The agency states that the proposed project would not present a problem to such species and may benefit the American bittern and king rail by increasing available nesting habitat.

d. Historic Properties. Wiant and Hajic (1994) located four isolated finds and two standing structures within the project area; all were determined to be not eligible for listing on the National Register of Historic Places [Appendix A: Illinois Historic Preservation Agency letter dated September 20, 1994 (IHPA Log #930517009W-F)]. Schroeder (1991) located no properties within the project area.

The prehistoric Copperas Creek site (11F100) is considered by the Corps to be potentially eligible for listing on the National Register of Historic Places. The site is located in the 21-acre area identified as the site manager's residence. A construction avoidance zone would be marked out over the entire 21 acres in order to avoid any potential impact to the Copperas Creek site (11F100). No construction materials, equipment, or activity shall be allowed in this 21-acre area. Because of this restriction, approximately 2,200 feet of littoral zone development was deleted along the north side of the drainage ditch which abuts the south edge of the site manager's residence.

Since 11F100 would be avoided and since no other potentially significant historic properties are in the project area, the project would have no effect on significant historic properties. In a letter dated August 18, 1994 (Appendix A), the Corps stated that the proposed project area had no potential to contain significant historic properties. By letter dated September 20, 1994 (Appendix A), the Illinois Historic Preservation Agency concurred with this finding. The proposed project can proceed in full compliance with the National Historic Preservation Act (as amended).

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

f. Farmland Protection. Existing cropland encompasses 206 acres. The primary crops are mixed grain and sunflower. These lands are farmed for food plots targeting upland and duck species. The proposed project would reduce the amount of crops to 137 acres in the following ways: levee restoration borrow, 15 acres; water control, 24 acres; and littoral zone grading, 30 acres. A U.S. Department of Agriculture Form AD-1006 was submitted to the Natural Resources Conservation Service (NRCS) for review. Full compliance under the Illinois Farmland Preservation Act has been completed. This was confirmed by letter from the Illinois Department of Agriculture, dated March 14, 1995.

g. Cumulative Impacts. Although short-term impacts are likely to occur to local and migratory animals during construction, no cumulative impacts are expected. Construction disruptions and habitat alterations should have long-term benefits to the fish and wildlife resources utilizing the site. This project, in concert with other EMP projects on the Illinois River, should counter other impacts to the river ecosystem such as sedimentation, pollution, and general decline in river habitats.

h. Adverse Impacts Which Cannot Be Avoided. The most significant unavoidable adverse impact is the clearing of vegetation for constructing temporary haul roads between the levee restoration borrow sites to the levee. Existing roads would be used as much as practicable. Clearing of existing vegetation would be kept to a minimum.

Levee restoration and construction of littoral areas would temporarily degrade water quality, primarily from increased turbidity.

By adding water control, existing habitats would be flooded. Likewise the creation of 156 acres of littoral habitat and 208 acres of a warm season grassland would alter existing habitat. Species using existing habitats would be impacted. This impact is considered a tradeoff for the benefits realized to the other species. The overlapping and sometimes conflicting needs of a range of species cannot all be met by a single habitat improvement project such as this. The trade-offs were weighed, and it was determined that those species negatively impacted were either found in abundance (i.e., white-tailed deer, cottontail rabbit) or would benefit from existing goals and objectives at Banner Marsh (i.e., Eastern bluebird benefiting from a nest box program).

i. Short-Term Versus Long-Term Productivity. During construction, impacts would disrupt wildlife as well as human use.

Long-term productivity would be enhanced as ratios of open water/littoral areas can be maintained and the establishment of desirable vegetative species can be promoted. Overall habitat diversity would be increased, and both game and nongame wildlife species would benefit. In turn, both consumptive and nonconsumptive users would realize heightened opportunities for recreational use of the Banner Marsh area.

The Banner Marsh site has been manipulated for the last 100 years for the pursuit of a variety of productive endeavors: first agriculture, secondly for coal mining, and now for natural resources. The proposed project supports the current endeavor by restoring and enhancing degraded habitats from the previous two endeavors. Long-term productivity for natural resource management would benefit considerably by the construction of this project.

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

k. Relationship of the Proposed Project to Land-Use Plans. The proposed project is in agreement with the Banner Marsh State Fish and Wildlife Management Area Natural Resource Management Plan (IDOC, 1989). The proposed project is not in conflict with any land-use plans currently being used for the site.

l. Compliance With Environmental Quality Statutes. Compliance with applicable statutes is summarized in Table 11-1.

TABLE 11-1

Compliance of the Preferred Plan with WRC-Designated Environmental Statutes

Federal Policies	Compliance
Archeological and Historic Preservation Act, 16 U.S.C. 469, et seq.	Full compliance
Clean Air Act, as amended, 42 U.S.C. 165h-7, et seq.	Full compliance
Clean Water Act (Federal Water Pollution Control Act), 33 U.S.C. 1251, et seq.	Full compliance
Coastal Zone Management Act, 16 U.S.C. 1451, et seq.	Not applicable
Endangered Species Act, 16 U.S.C. 1531, et seq.	Full compliance
Estuary Protection Act, 16 U.S.C. 1221, et seq.	Not applicable
Federal Water Project Recreation Act, 16 U.S.C. 460-1(12), et seq.	Full compliance
Fish and Wildlife Coordination Act, 16 U.S.C. 661, et seq.	Full compliance
Farmland Protection Act, Agriculture and Food Act of 1981, P.L. 97-98	Full compliance
Land and Water Conservation Fund Act, 16 U.S.C. 4601, et seq.	Full compliance
Marine Protection Research and Sanctuary Act, 33 U.S.C. 1401, et seq.	Not applicable
National Environmental Policy Act, 42 U.S.C. 4321, et seq.	Full compliance
National Historic Preservation Act, 16 U.S.C. 470a, et seq.	Full compliance
Rivers and Harbors Act, 33 U.S.C. 401, et seq.	Full compliance
Watershed Protection and Flood Prevention Act, 16 U.S.C. 1001, et seq.	Full compliance
Wild and Scenic Rivers Act, 16 U.S.C. 1271, et seq.	Not applicable

NOTES:

a. Full compliance. Having met all requirements of the statute for the current stage of planning (either preauthorization or postauthorization).

b. Partial compliance. Not having met some of the requirements that normally are met in the current stage of planning. Partial compliance entries should be explained in appropriate places in the report and referenced in the table.

c. Noncompliance. Violation of a requirement of the statute. Noncompliance entries should be explained in appropriate places in the report and referenced in the table.

d. Not applicable. No requirements for the statute required; compliance for the current stage of planning.

12. SUMMARY OF PROJECT ACCOMPLISHMENTS

The proposed project consists of restoring the existing perimeter levee, constructing a second pump station structure, littoral zone grading at selected locations near existing water bodies, and planting a mixture of warm season grasses.

Restoration of the perimeter levee will provide a reliable levee system that will protect against flooding and its deleterious effects on management operations. A second pump station will provide the required water level control by raising water elevations to the optimum depth that will inundate previously dry land and the newly created littoral zone areas. Littoral zone grading will increase habitat for fish spawning, waterfowl/waterbird feeding, and rearing areas for both fish and waterfowl by creating areas next to existing water bodies that are approximately 18 inches deep. Planting warm season grasses will enhance upland bird and animal use by providing cover and a variety of food sources. Implementation of the proposed enhancement features is projected to result in HU gains of 2,147.

The proposed enhancement features will provide greater water level control flexibility and vegetation management, thereby providing a desirable mix of open water, emergent vegetation, and littoral zone conditions.

13. OPERATIONS, MAINTENANCE, AND REHABILITATION CONSIDERATIONS

a. Project Data Summary. Table 13-1 presents a summary of project data.

TABLE 13-1

Banner Marsh Project Data Summary

Feature	Measurement	*Unit of* Measure
Perimeter Levee		
Length	44,500	Feet
Crown Width	10	Feet
Side Slopes	2.5-3:1	H:V
Level of Protection	50+	Year event
Elevation	555.5-559.4	Feet NGVD
Embankment Volume	140,000	CY
Riprap	33,000	Tons
Pump Station Relocation		
Intake Structure Sill Elevation	425	Feet NGVD
Trash Rack	1	Each
Discharge Pipe		
Diameter	24	Inches
Length	210	Feet
Discharge Flowline El.	442.5	Feet NGVD
Littoral Zone/Contour Grading		
Surface Area	106	Acres
Material Volume Moved	425,000	Cubic yards
Area Seeded	106	Acres
Native Warm Season Grass Seeding		
Surface Area	208	Acres

b. Operation. Estimated annual operation costs are presented in Table 15-2.

c. Maintenance. The proposed features have been designed to ensure low annual maintenance requirements, with the estimated annual maintenance costs presented in Table 15-2. These quantities and costs may change during final design.

14. PROJECT PERFORMANCE ASSESSMENT

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

Table 14-1 presents overall types, purposes, and responsibilities of monitoring and data collection.

Table 14-2 presents actual monitoring and data parameters grouped by project phase, as well as data collection intervals.

Table 14-3 presents the post-construction evaluation plan, which displays the specific parameters and the levels of enhancement which the project hopes to achieve.

TABLE 14-1

Monitoring and Performance Evaluation Matrix

Project Phase	Type of Activity	Purpose	Responsible Agency	Implementing Agency	Funding Source	Implementation Instructions
Pre-Project	Pre-Project Monitoring	Identifies and defines problems at HREP site. Establish need of proposed project features.	IL DNR	IL DNR	IL DNR	--
	Baseline Monitoring	Establishes baselines for performance evaluation	Corps	Corps	LTRM 1/	See Table 6-2
Design	Data Collection for Design	Includes quantification of project objectives, design of project, and development of performance evaluation plan.	Corps	Corps	HREP 2/	See Table 6-2
Construction	Construction Monitoring	Assess construction impacts; assures permit conditions are met.	Corps	Corps	HREP	See State Section 401 Stipulations
Post-Project	Performance Evaluation Monitoring	Determine success of project as related to objectives	Corps (quantitative) sponsor (field observation)	Corps IL DNR	LTRM	See Table 13-3

1/ Long-Term Resource Monitoring of the Environmental Management Program (P.L. 99-662)
2/ Habitat Rehabilitation and Enhancement Project of the Environmental Management Program (P.L. 99-662)

TABLE 14-2

Resource Monitoring and Data Collection Summary

	WATER QUALITY DATA						ENGINEERING DATA			NATURAL RESOURCE DATA				
	Pre-Project Phase		Design Phase		Post-Const. Phase		Pre-Project Phase	Design Phase	Post-Const. Phase	Pre-Project Phase	Design Phase	Post-Const. Phase		
	APR-SEP	OCT-MAR	APR-SEP	OCT-MAR	APR-SEP	OCT-MAR								
Type Measurement													Sampling Agency	Remarks
POINT MEASUREMENTS														
Water Quality Station													COE	
W-M443.6G														
Turbidity	2W		2W											
Secchi Disk Transparency	2W		2W											
Suspended Solids	2W		2W											
Dissolved Oxygen	2W		2W											
Specific Conductance	2W		2W											
Water Temperature	2W		2W											
pH	2W		2W		2W	M								
Total Alkalinity	--		--		2W	M								
Chlorophyll	2W		2W											
Velocity	--		--											
Water Depth	2W		2W											
Water Elevation	2W		2W											
Sediment Test Stations														
Elutriate			1											
Bulk Sediment			1											
Column Settling Stations														
Column Settling Analysis								1						
Boring Stations														
Geotechnical Borings								1						

TABLE 14-2 (Cont'd)

Resource Monitoring and Data Collection Summary

	WATER QUALITY DATA						ENGINEERING DATA			NATURAL RESOURCE DATA				
	Pre-Project Phase		Design Phase		Post-Const. Phase		Pre-Project Phase	Design Phase	Post-Const. Phase	Pre-Project Phase	Design Phase	Post-Const. Phase		
	APR-SEP	OCT-MAR	APR-SEP	OCT-MAR	APR-SEP	OCT-MAR								
Type Measurement													Sampling Agency	Remarks
TRANSECT MEASUREMENTS														
Sedimentation Transects Hydrographic Soundings							1							
Sedimentation Transects Hydrographic Soundings									5Y					
Vegetation Transects Mast Tree Survey												5Y		
AREA MEASUREMENTS														
Mapping Aerial Photography										1		5Y		

LEGEND

W = Weekly
M = Monthly
Y = Yearly
nW = n-Week interval
nY = n-Year interval
1, 2, 3, --- = number of times data is collected within designated project phase

TABLE 14-3

Post-Construction Evaluation Plan

Goal	Objective	Enhancement Feature	Unit	Enhancement Potential: Year 0 Without Alternative	Enhancement Potential: Year X With Alternative[1]	Enhancement Potential: Year 50 Target With Alternative	Feature Measurement Reference Table 14-2	Annual Field Observations by Site Manager
Enhance Wetland Habitat	-Improve flood control reliability	Levee Restoration	Lineal feet of eroded levee	22,900	--	0	Levee system transects/profiles	Describe any erosional/ seepage effects
	-Provide reliable food source for migratory birds	Water control improvements	Acres of aquatic vegetation	0	--	350	Vegetation transects	Estimate effective acreage and wildlife use
		Littoral zone/ contour grading						
Enhance Terrestrial Habitat	-Increase overall vegetation diversity and availability of preferred wildlife foods	Native grasses planting	Acres of native grass	0	--	208	Vegetation transects	Estimate area of established/ regenerated vegetation
Enhance Aquatic Habitat	-Increase diversity in aquatic habitat	Littoral zone/ contour grading	Acres of aquatic habitat less than 18"	0	--	106	Hydrographic soundings	

1 This column is completed for the year the enhancement feature is monitored.

15. COST ESTIMATES

A detailed estimate of project design and construction costs is presented in Table 15-1. A detailed estimate of operation, maintenance, and rehabilitation costs is presented in Table 15-2. Table 15-3 presents the estimated annual monitoring costs as described in Section 14. Quantities may vary during final design.

TABLE 15-1

BANNER MARSH STATE FISH AND WILDLIFE AREA EMP
PROJECT COST SUMMARY
JANUARY 1995 PRICE LEVEL

ACCOUNT	FEATURE	CURRENT WORKING ESTIMATE (CWE)	[2] FULLY FUNDED ESTIMATE (FFE)
01.	LANDS AND DAMAGES	$ 45,000	$ 45,000
06.	FISH AND WILDLIFE FACILITIES	$ 3,227,093	$ 3,579,492
30.	PLANNING, ENGINEERING AND DESIGN	$ 835,000	$ 970,855
31.	CONSTRUCTION MANAGEMENT	$ 271,250	$ 315,382
	PROJECT COSTS SUBJECT TO COST SHARING[1]	$ 4,378,343	$ 4,910,728
	NON-FEDERAL COSTS	$ 1,094,586	$ 1,214,115
	NON-FEDERAL LANDS & DAMAGES	$ (35,000)	$ (35,000)
	REQUIRED NON-FEDERAL CASH CONTRIBUTION	$ 1,059,586	$ 1,179,115
	FEDERAL COSTS	$ 3,283,757	$ 3,642,344
	GENERAL DESIGN, DEFINITE PROJECT REPORT	$ (595,000)	$ (691,807)
	REMAINING FEDERAL COSTS	$ 2,688,757	$ 2,950,537

NOTES:

1. PROJECT FEATURES LOCATED ON STATE LANDS ARE SUBJECT TO 75% FEDERAL AND 25% NON-FEDERAL COST SHARE.

2. CONSTRUCTION SCHEDULED FOR MAY 96 - OCT 97. FULLY FUNDED ESTIMATE (FFE) IS BASED ON MIDPOINT OF CONSTRUCTION OF FEB 97, RESULTING IN INFLATION FACTORS OF 1.1627 FOR SALARIES AND 1.1092 FOR ALL OTHER COSTS PER CECW-B MEMO, 23 FEB 94, SUBJECT: FACTORS FOR UPDATING STUDY/PROJECT COST ESTIMATES FOR THE FY 1996 BUDGET SUBMISSION.

TABLE 15-1 (Cont'd)

BANNER MARSH STATE FISH AND WILDLIFE AREA EMP
PROJECT COST ESTIMATE
JANUARY 1995 PRICE LEVEL

CWBS CODE	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	CON %
01.	**LANDS AND DAMAGES**						
01.A.1.-	Planning	1	JOB	SUM	1,500		
01.C.1.-	PCA	1	JOB	SUM	4,500		
01.D.1.-	Acquisition - Federal Costs	1	JOB	SUM	2,500		
	- Non-Federal Costs	1	JOB	SUM	9,000		
01.F.1.-	Appraisal - Federal Costs	1	JOB	SUM	1,500		
	- Non-Federal	1	JOB	SUM	1,000		
01.-.-.-	Lands (Non-Federal Cost)	1	JOB	SUM	25,000		
	TOTAL				45,000		
06.	**FISH AND WILDLIFE FACILITIES**						
06.-.-.-	Levee Restoration						
06.0.1.B	Stripping	8,000	CY	$1.50	$12,000	$1,200	10%
06.0.1.B	Clearing & Grubbing	64	ACRE	2,700.00	172,800	17,280	10%
06.0.1.B	Embankment Fill	140,000	CY	3.00	420,000	42,000	10%
06.0.1.B	Seeding	52	ACRE	1,500.00	78,000	7,800	10%
06.0.1.B	Bedding Stone	8,330	TON	31.00	258,230	25,823	10%
06.0.1.B	Riprap	25,000	TON	32.00	800,000	80,000	10%
	TOTAL				1,741,030	174,103	
06.-.-.-	Pump Station						
06.0.1.B	Dewatering	1	JOB	SUM	5,000	1,250	25%
06.0.1.B	Sheet Piling	36	TON	980.00	35,280	3,528	10%
06.0.1.B	Structural Excavation	80	CY	8.00	640	160	25%
06.0.1.B	Structural Concrete	15	CY	750.00	11,250	1,125	10%
06.0.1.B	Building & Appurtenances	1	JOB	SUM	9,700	2,425	25%
06.0.1.B	Slide Gate	1	EA	3,000.00	3,000	750	25%
06.0.1.B	Trash Rack Assembly	3,200	LB	2.50	8,000	800	10%
06.0.1.B	Discharge Pipe (24")	210	LF	144.00	30,240	3,024	10%
06.0.1.B	Misc. Electrical Work	1	JOB	SUM	23,900	5,975	25%
06.0.1.B	Pump Modifications	1	JOB	SUM	25,000	6,250	25%
06.0.1.B	Channel Excavation	8,000	CY	3.35	26,800	2,680	10%
06.0.1.B	Clearing & Grubbing	3	ACRE	2,700.00	8,100	810	10%
06.0.1.B	Precast Concrete Manhole	1	EA	2,000.00	2,000	500	25%
06.0.1.B	Perforated Pipe, 8" Dia.	600	LF	5.15	3,090	155	10%
06.0.1.B	Gravel	1,060	TON	28.00	29,680	2,968	10%
06.0.1.B	Embankment	2,600	CY	3.00	7,800	780	10%
	TOTAL				229,480	33,180	

TABLE 15-1 (Cont'd)

BANNER MARSH STATE FISH AND WILDLIFE AREA EMP
PROJECT COST ESTIMATE
JANUARY 1995 PRICE LEVEL

CWBS CODE	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	CON %
06.-.-.-	Littoral Zone Grading						
06.0.1.B	Grading	425,000	CY	1.00	425,000	42,500	10%
06.0.1.B	Seeding	106	ACRE	1,500.00	159,000	15,900	10%
	TOTAL				584,000	58,400	
06.-.-.-	Grassland Seeding						
06.0.1.B	Tree Removal/Grub	1,100	EA	110.00	121,000	12,100	10%
06.0.1.B	Seeding	208	ACRE	1,000.00	208,000	20,800	10%
	TOTAL				$ 329,000	$ 32,900	
	SUBTOTAL, FISH AND WILDLIFE FACILITIES				$ 2,928,510		
	CONTINGENCIES, AVERAGE OF		**10.2%**			$ 298,583	
06.	**TOTAL, FISH AND WILDLIFE FACILITIES**				$ 3,227,093		

30.	Planning, Engineering & Design	
	DPR	$ 595,000
	Plans and Specifications	$ 190,000
	Engineering During Construction	$ 50,000
	TOTAL	$ 835,000
31.	Construction Management	
	Contract Administration	$ 34,500
	Shop Drawing Review	$ 28,100
	Inspection and Quality Assurance	$ 208,650
	TOTAL	$ 271,250

TABLE 15-2

Estimated Annual Operation and Maintenance Costs
(January 1995 Price Level)

	Qty	Unit	Unit Price ($)	Total Cost ($)
Operation				
Pump Station Operation	200	Hr	25	5,000
Filter Operation				
Replacement Sand	400	Ton	22	8,800
Disposal of Dirty Sand	400	Ton	13	5,200
Subtotal Operation:				19,000
Maintenance				
Levee Inspection	40	Hr	25	1,000
Levee Mowing (once/yr)	100	Ac	45	4,500
Pump Replacement (@ yr 25)	1	Sum	4,600	4,600
Pump Maintenance	40	Hr	30	1,200
Riprap	140	Ton	32	4,480
Levee Erosion Control	20	Hr	100	2,000
Planting Maintenance	208	Ac	15	3,120
Maintenance Dredging of Inlet Channel (@ yr 25)	1	Sum	1,360	1,360
Subtotal Maintenance:				22,260
Rehabilitation [1]				
			Subtotal:	41,260
Contingencies (20%)				8,250
			TOTAL:	**49,510**

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

TABLE 15-3

Estimated Post-Construction Annual Monitoring Costs ($) (January 1995 Price Level)

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

[1] Reference tables 14-2 and 14-3.
[2] Includes cost of annual evaluation report.

16. REAL ESTATE REQUIREMENTS

a. General. All project features will be located on lands either presently owned by or to be acquired by the State of Illinois. The State presently owns all but one parcel of land needed for project development. The parcel to be acquired is approximately 50 acres, presently owned by Illinois Power Company. Operation and maintenance of the project after construction will be by the State of Illinois, Department of Natural Resources.

b. Project Cooperation Agreement. A draft project cooperation agreement is included as Appendix C. The agreement principally states that the first cost of the proposed construction will be cost-shared 75 percent Federal/25 percent State. Initial cost-sharing is required because the project lands are not managed as a National Wildlife Refuge as prescribed by Section 906(e) of the Water Resources Development Act of 1986 (Public Law 99-662).

Operation and maintenance will be funded 100 percent by the State in accordance with Section 107(b) of the Water Resources Development Act of 1992, Public Law 102-580, which specifies that the cost of operation and maintenance is the responsibility of the agency that manages the land for fish and wildlife purposes.

The U.S. Army Corps of Engineers would be responsible for the Federal share of any mutually agreed upon rehabilitation of the project that exceeds the annual operation and maintenance requirements identified in the final Definite Project Report and that is needed as a result of specific storm or flood events. Rehabilitation of the project is considered to be reconstructive work that cannot be accurately estimated at this time.

c. Construction Easements. Temporary construction easements are not required for this project at the present time.

d. Cost Estimate. The cost estimate is as follows:

	Federal Cost ($)	**Non-Federal Cost ($)**
Planning	1,500	--
PCA	4,500	--
Acquisition	2,500	9,000
Appraisal	1,500	1,000
Lands	--	25,000
Total	10,000	35,000

Total Federal Costs:	$10,000
Total Non-Federal Costs:	$35,000

17. SCHEDULE FOR DESIGN AND CONSTRUCTION

Table 17-1 presents the schedule of project completion steps.

TABLE 17-1

Project Implementation Schedule

Requirement	Scheduled Date
Submission of Draft DPR to Corps of Engineers, North Central Division, for Review	Jan 95
Distribution of DPR for Public and Agency Review	May 95
Submission of Final and Public Reviewed DPR to North Central Division	Sep 95
Receive Plans and Specifications Funds	Oct 95
Construction Approval by Assistant Secretary of the Army (Civil Works)	Mar 96
Submit Final Plans and Specifications to North Central Division for Review and Approval	May 96
Obtain Approval of Plans and Specifications	May 96
Execute Local Cooperation Agreement	May 96
Advertise Contract	Jun 96
Award Contract	Aug 96
Complete Construction	Nov 98

18. IMPLEMENTATION RESPONSIBILITIES AND VIEWS

a. Corps of Engineers. The Corps of Engineers, Rock Island District, is responsible for project management and coordination with the USFWS, the State of Illinois, and other affected agencies. The Rock Island District will submit the subject definite project report; program funds; finalize plans and specifications; complete all NEPA requirements; advertise and award a construction contract; and perform construction contract supervision and administration.

b. U.S. Fish and Wildlife Service. The USFWS will produce a Coordination Act Report (CAR) for this project. In addition, the USFWS should ensure that all proposed enhancement features are compatible with regional refuge objectives and management strategies.

c. Illinois Department of Natural Resources. Operation and maintenance of the project, as described in Table 15-2, is the responsibility of the Illinois DNR in accordance with Section 107(b) of the Water Resources Development Act of 1992, Public Law 102-580. These functions will be further specified in the Project Operation and Maintenance Manual to be provided by the U.S. Army Corps of Engineers prior to final acceptance of the project by the sponsor. The Illinois DNR is the non-Federal sponsor of the project.

19. COORDINATION, PUBLIC VIEWS, AND COMMENTS

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

Illinois Department of Agriculture
Illinois Department of Natural Resources
(formerly Department of Conservation)
Illinois Historic Preservation Agency
Illinois Department of Transportation
Natural Resources Conservation Agency
U.S. Fish and Wildlife Service
U.S. Environmental Protection Agency

a. Coordination Meetings. Ongoing coordination between the Corps, the U.S. Fish and Wildlife Service, and the Illinois Department of Natural Resources was demonstrated by the following meetings:

(1) July 13, 1989. Corps in-house meeting; general project discussion.

(2) July 25, 1990. Corps in-house meeting; general project discussion.

(3) July 30, 1990. Plan formulation meeting with the Corps, the Illinois DNR, and the USFWS.

(4) November 16, 1992. General project discussion with the Corps, the Illinois DNR, and the USFWS.

(5) February 28, 1994. Corps in-house meeting; general project discussion.

(6) March 9, 1995. Coordination meeting with the Corps, the Illinois DNR, and the USFWS to discuss comments on the draft DPR.

b. Coordination by Letters and Telephone Conversations. To date, the following letters have been received (see Appendix A - Correspondence):

(1) Letter dated October 19, 1988, from the IDOC, stating their high priority assigned to Banner Marsh in their planning efforts. The IDOC encouraged the Corps to elevate its priority in their planning efforts as well.

(2) Letter dated August 31, 1993, from the IDOC, responding to a Corps of Engineers July 29, 1993, letter outlining the direction of the Banner Marsh planning to date. They supported the project planning as described in the Corps letter.

(3) Letter dated January 10, 1995, from the IDOC, providing state endangered species information.

(4) Letter dated August 9, 1993, from the Illinois Department of Transportation (IDOT), responding to a July 29, 1993, letter outlining the direction of the Banner Marsh planning to date. They stated that any activity on the riverside of the levee would require IDOT, Division of Water Resources authorization.

(5) Letter dated August 18, 1994, from the Rock Island District, Corps of Engineers, to the IHPA stating the Corps opinion that the Phase I archeological survey report showed the proposed project area has no potential to contain significant historic properties.

(6) Letter dated September 20, 1994, from the IHPA responding to the Corps of Engineers August 18, 1994, letter stating that the Phase I archeological survey report was adequate and, based on this report, no significant historic, architectural, or archeological resources are located in the project area.

(7) Coordination Act Report, dated January 11, 1995, from the USFWS. The report concluded that the proposed project would have benefits beyond the immediate area, extending to national and international plans to protect and enhance habitat for migratory birds. The report also noted the importance of a sound levee and its role in effective water level management.

(8) By letter dated January 9, 1995, the Natural Resources Conservation Service made initial comments on impacts to agricultural lands affected by the proposed project. Final comments will be included in the final report and prior to the Finding of No Significant Impacts statement being signed.

(9) Letter of intent, dated March 6, 1995, from the IDOC confirming their sponsorship and funding of the project.

(10) Letter dated March 14, 1995, from the Illinois Department of Agriculture finding the project in compliance with the Farmland Protection Act.

(11) Letter dated September 20, 1995, from the Illinois Environmental Protection Agency, issuing certification under Section 401 of the Clean Water Act.

20. CONCLUSIONS

The wetland habitat value of the Banner Marsh State Fish and Wildlife Area is not being fully realized due to the currently deteriorating perimeter levee. A reliable levee system would allow the area to realize the highest benefit to migratory waterfowl and local wildlife and avoid devastation of interior habitat from a levee failure.

The recommended project features (levee restoration, pump station structure, littoral zone grading, and warm season grass plantings) are designed to meet the project's goal of enhancing wetland, terrestrial, and aquatic habitats by increasing littoral zone for ducks and fish, improving flood control reliability, increasing food and cover for terrestrial birds and mammals, and increasing diversity in aquatic habitat.

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

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

21. RECOMMENDATIONS

I have weighed the outputs to be obtained from the full implementation of this habitat rehabilitation and enhancement project against its estimated cost and have considered the various alternatives proposed, impacts identified, and overall scope. In my judgment, this project, as proposed, justifies expenditure of Federal funds. I recommend that the Secretary of the Army for Civil Works approve the proposed project to include: restoring the existing 44,500-foot perimeter levee using borrow material excavated from adjacent interior lands; constructing a pump station structure; grading to increase the littoral zone near existing water bodies; and planting a mixture of warm season grasses on 208 acres.

The current estimated Federal construction cost of this project is $2,420,320. Total Federal estimated project cost, including general design, is $3,283,757.

This project will be constructed on State-owned lands, the project general design cost will be cost shared (75% Federal/25% non-Federal) with the non-Federal project sponsor, the Illinois Department of Natural Resources. The total non-Federal cost share is estimated at $1,094,586.

At this time, I further recommend that funds in the amount of $190,000 be allocated for the preparation of project plans and specifications.

Charles S. Cox
Colonel, U.S. Army
District Engineer

FINDING OF NO SIGNIFICANT IMPACT

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

An array of management features were considered in which alternatives were derived. The features :

a. No Federal Action

b. Levee Restoration

c. Water Level Control

d. Littoral Zone Grading

e. Upland Warm Season Grass Planting

The preferred alternative consists of restoring the levee using interior low areas as a source for borrow, constructing a small one-way pump to actively raise interior water levels using river water, grade 106 acres of low lying areas for littoral zone creation, and plant and manage 208 acres of mixed warm season grass.

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

a. The project is anticipated to improve the value of the Banner Marsh area for resident wildlife and continental bird species.

b. Aside from temporary disturbance, no long-term adverse impacts to natural or cultural resources are anticipated. No endangered species, either State or Federal, would be affected by the project action.

c. Land use after the project should remain unaltered, and no significant economic impacts to the project area are envisioned.

d. The project is in compliance with Sections 401 and 404 of the Clean Water Act.

4 Oct 95
Date

Charles S. Cox
Colonel, U.S. Army
District Engineer

APPENDIX A

CORRESPONDENCE

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT (R-11F)

BANNER MARSH STATE FISH AND WILDLIFE AREA

LA GRANGE POOL, ILLINOIS WATERWAY
RIVER MILES 138.5 THROUGH 143.9
FULTON AND PEORIA COUNTIES, ILLINOIS

APPENDIX A
CORRESPONDENCE

Letter From **Page**

Illinois Department of Conservation, dated October 19, 1988 ..... A-1

Illinois Department of Transportation, dated August 9, 1993 ..... A-2

Illinois Department of Conservation, dated August 31, 1993 ..... A-3

Rock Island District, U.S. Army Corps of Engineers, to Illinois Historic Preservation Agency, dated August 18, 1994 ..... A-4

Illinois Historic Preservation Agency, dated September 20, 1994 ..... A-6

Illinois Department of Conservation, dated January 10, 1995 ..... A-7

U.S. Department of the Interior, Fish and Wildlife Service, Rock Island Field Office, dated January 11, 1995 (draft Fish and Wildlife Coordination Act report) A-8

Illinois Department of Conservation stating their intention to be the non-Federal sponsor, dated March 6, 1995 ..... A-23

Illinois Department of Agriculture, dated March 14, 1995, enclosing Farmland Conversion Impact Rating A-24

U.S. Department of the Interior, Fish and Wildlife Service, Fort Snelling, Minnesota, dated June 29, 1995 ..... A-27

U.S. Department of the Interior, Fish and Wildlife Service, Rock Island Field Office, dated August 24, 1995 ..... A-28

Illinois Department of Conservation emphasizing the importance of the Banner Marsh project, undated A-29

Letter From **Page**

Illinois Environmental Protection Agency, dated September 20, 1995, issuing certification under Section 401 of the Clean Water Act..... A-31

Illinois Department of Conservation
life and land together

LINCOLN TOWER PLAZA • 524 SOUTH SECOND STREET • SPRINGFIELD 62701-1787
CHICAGO OFFICE • ROOM 4-300 • 100 WEST RANDOLPH 60601
MARK FRECH, DIRECTOR

October 19, 1988

Colonel Neil Smart
District Engineer, Rock Island District
U. S. Army Corps of Engineers
Clock Tower Building, P. O. Box 2004
Rock Island, IL 61204

Dear Colonel Smart:

In my letter to you of February 2, 1988, I identified departmental priorities for Illinois habitat projects in the Environmental Management Program (EMP). I would now like to make a revision in that list.

I wish to exchange the Banner Marsh and Rice Lake projects in our priorities. The Banner Marsh project, given the highest ranking of any project in your district by the Fish and Wildlife Interagency Committee, has created much interest and concern —particularly, to get it into the program sooner than its current position (inactive project) permits.

It is our understanding that Banner Marsh is the only project in the EMP that will create new backwater marsh and diving duck habitat, protected from river flooding and siltation. That being the case, we hope that you and your staff will consider moving it up in the program.

We also understand that your office is submitting the Banner Marsh fact sheet to the North Central Division to obtain general design approval. We look forward to and encourage any other effort on your part to promote it.

Sincerely,

Mark Frech

Mark Frech
Director

BD:rt

Illinois Department of Transportation
Division of Water Resources
3215 Executive Park Drive / P.O. Box 19484 / Springfield, Illinois / 62794-9484

August 9, 1993

District Engineer
U. S. Army Engineer District
Rock Island
ATTN: Planning Division
Clock Tower Building, P. O. Box 2004
Rock Island, Illinois 61204-2004

Gentlemen:

Thank you for your July 29, 1993 request for preliminary comments concerning the proposed Banner Marsh Habitat Rehabilitation and Enhancement Project within the Illinois River floodplain in Peoria and Fulton Counties.

The Illinois River floodway at this site is defined by the existing perimeter levee. Therefore, Illinois Department of Transportation, Division of Water Resources authorization would be required for only the work riverward of the levee. Any new structures or regrading riverward of the levee should be designed in a way that they would not impede flows.

Thank you for the opportunity to comment. Feel free to contact Mike Diedrichsen of my staff if you have any questions or comments.

Sincerely,

Dennis L. Kennedy, P.E., Head
Technical Analysis and Permit Unit

DLK:MLD:lmt

Illinois Department of Conservation
LINCOLN TOWER PLAZA • 524 SOUTH SECOND STREET • SPRINGFIELD 62701-1787 CHICAGO OFFICE • ROOM 4-300 • 100 WEST RANDOLPH • CHICAGO 60601
Brent Manning, Director John W. Comerio, Deputy Director Bruce F. Clay, Assistant Director

August 31, 1993

U. S. Army Engineer District, Rock Island
Attn: Planning Division
P. O. Box 2004
Rock Island, IL 61204-2004

Dear Sirs:

In response to your letter of July 29, 1993, regarding the Banner Marsh Habitat Rehabilitation and Enhancement Project, the Department finds the project as described to be satisfactory. My staff looks forward to the opportunity to meet and review the project design to date with you.

Since your last meeting was in November 1992, there should be more details to review before you get too close to the draft Definite Project Report.

Your cooperation is appreciated.

Sincerely,

Brent Manning
Director

BM:BD:mip

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

REPLY TO
ATTENTION OF
Planning Division

August 18, 1994

Ms. Anne Haaker
Deputy State Historic
Preservation Officer
Illinois Historic
Preservation Agency
Old State Capitol
Springfield, Illinois 62704

Dear Ms. Haaker:

The Rock Island District of the U.S. Army Corps of Engineers (Corps) is forwarding a report (enclosure 1) entitled Phase I Intensive Archaeological Survey and Geomorphological Investigations for Historic Properties in the Banner Marsh Habitat Rehabilitation and Enhancement Project, Upper Mississippi River System, Environmental Management Program, La Grange Pool, Illinois Waterway, Fulton and Peoria Counties, Illinois, prepared by Michael D. Wiant and Edwin R. Hajic (Illinois State Museum Quaternary Studies Program Technical Report No. 94-857-12, dated August 3, 1994).

After reviewing this report, the opinion of the Corps is that the proposed project area has no potential to contain significant historic properties. Please provide any comments you may have on the draft report within 30 days so they can be considered in preparing the final report. If no comments are received within 30 days, the Corps will finalize the report and go forward with the project.

If you have any questions regarding this matter, please call Mr. Ron Pulcher of our Environmental Analysis Branch, telephone 309/794-5384, or write to our address above, ATTN: Planning Division.

Sincerely,

ORIGINAL SIGNED BY
TIPPLE

Patrick T. Burke, P.E.
Acting Chief, Planning Division

Enclosure

Copy Furnished:

Dr. Michael Wiant
Principal Investigator
Illinois State Museum Society
1920 South 10 1/2 Street
Springfield, Illinois 62703 (wo/enclosure)

Illinois Historic Preservation Agency

Old State Capitol • Springfield, Illinois 62701 • (217) 782-4836

217/785-4997

FULTON COUNTY
Banner and Ki
Banner Marsh ngston Mines on & Enhancement Project
Habitat Rehabilitati

PLEASE REFER TO:
IHPA LOG #930517009W-F
Acres:357 Sites:0

September 20, 1994

Mr. Dudley M. Hanson, P.E.
Dept of the A E
Chief, Planning Division
Clock Tower Building - P.O.B. 2004
Rock Island, Illinois 61204-2004

Gentlemen:

Thank you for submitting the results of the archaeological reconnaissance. Our comments are required by Section 106 of the National Historic Preservation Act of 1966, as amended, and its implementing regulations, 36 CFR 800: "Protection of Historic Properties".

Our staff has reviewed the archaeological Phase I reconnaissance report performed for the project referenced above.

The Phase I survey and assessment of the archaeological resources appear to be adequate. Accordingly, we have determined, based upon this report, that no significant historic, architectural, and archaeological resources are located in the project area.

Please retain this letter in your files as evidence of compliance with Section 106 of the National Historic Preservation Act of 1966, as amended.

Sincerely,

Anne E. Haaker
Deputy State Historic
Preservation Officer

AEH:

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Illinois Department of Conservation
LINCOLN TOWER PLAZA • 524 SOUTH SECOND STREET • SPRINGFIELD 62701-1787 CHICAGO OFFICE • ROOM 4-300 • 100 WEST RANDOLPH • CHICAGO 60601
Brent Manning, Director John W. Comerio, Deputy Director Bruce F. Clay, Assistant Director

January 10, 1995

Darron Niles
CENCR-PD-W
Corps of Engineers, Rock Island District
P.O. Box 2004
Rock Island, IL 61204

RE: Habitat Rehabilitation & Enhancement Project
Environmental Management Program
Banner Marsh, Peoria & Fulton Counties, Illinois

Dear Mr. Niles:

This is in reply to your request for information about state endangered or threatened species at the referenced project site.

River otter (Lutra canadensis), American bittern (Botaurus lentiginosus) and king rail (Rallus elegans) have been reported from Banner Marsh Wildlife Area. The otter and American bittern are listed as endangered in Illinois, while the king rail is listed as threatened.

After review of the project description and discussion with other staff, it is my opinion that the proposed levee improvement, pump relocation, littoral zone grading and native grass planting is not likely to have adverse effects on these species. It is possible that the planned littoral grading will benefit the bittern and rail by increasing available nesting habitat on the site.

Thank you for the opportunity to review the project plans. If you have other questions, please call me at (217)785-8290.

Sincerely,

Glen Kruse

Glen Kruse
Project Manager
Endangered and Threatened Species

cc: Marvin Hubbell

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IN REPLY REFER TO:

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Rock Island Field Office (ES)
4469 - 48th Avenue Court
Rock Island, Illinois 61201

COM: 309/793-5800
FAX: 309/793-5804

January 11, 1995

Colonel Charles S. Cox
District Engineer
U.S. Army Engineer District
Rock Island
Clock Tower Building, P.O. Box 2004
Rock Island, Illinois 61204-2004

Dear Colonel Cox:

This letter constitutes our draft Fish and Wildlife Coordination Act (FWCA) report for the Banner Marsh State Fish and Wildlife Area Habitat Rehabilitation and Enhancement Project (HREP) in LaGrange Pool, Illinois River, Fulton and Peoria Counties, Illinois. It has been prepared under the authority of and in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat.401, as amended; 16 U.S.C. 661 et seq.); the Endangered Species Act of 1973, as amended; and in accordance with the Fish and Wildlife Service's Mitigation Policy.

The Banner Marsh State Fish and Wildlife Area HREP is a component of the Upper Mississippi River System Environmental Management Program (EMP) authorized in Section 1103 of the Water Resources Development Act of 1986. The goal of the EMP is to implement "...numerous enhancement efforts...to preserve, protect and restore habitat that is deteriorating due to natural and man-induced activities."

DESCRIPTION OF THE PROJECT AREA

The study area is located adjacent to the right descending bank of the Illinois River between river miles 147 and 138 near the town of Banner, Illinois. Prior to construction of a perimeter levee built by the Banner Special Drainage District in the early 1900's the area was a complex of backwater lakes and marshes, with over 1900 acres of the 4,500 acre area cultivated. Construction of the levee and drainage network between 1912 and 1917 isolated the District from the Illinois River. Subsequent sale of the mineral rights in the early 1950's led to the area being mined extensively by the Union Electric Coal Company. Over ninety-percent of the site was strip-mined. Reclamation efforts of varying degrees were completed for most of the area following

the end of the mining operation. Revegetation of the site, primarily with cool season grasses has given way successionally to old field habitats in portions of the area providing a mixture of grass and trees. However, the 6.5 miles of deeper final cuts remain, creating water depths that range from 18 to over 50 feet. Isolated water bodies are interspersed along the linear final cuts for a total water surface acreage of 534 acres (approximately 281 acres of shallow water and 253 acres of deep water). Presently, the area is owned in fee title and managed by the Illinois Department of Conservation.

As an actively managed marsh complex, Banner Marsh provides a unique and diverse wildlife area with importance to resident and migrating waterfowl, upland wildlife species as well as an excellent sportfishery. Ongoing management and site improvements include recent construction of fish hatchery ponds for restocking the ponds and creation of over 100 small nesting islands for resident waterfowl populations.

PROJECT OBJECTIVES

The goal of the Banner Marsh HREP is to rehabilitate, enhance, and protect aquatic, forested and nonforested wetlands, upland and grassland habitats for resident and migratory birds and upland game and nongame species. This will be accomplished by a combination of construction features and management practices that will increase nesting and brood habitat as well as feeding and loafing areas for waterfowl and nongame species alike. Water level manipulations and selective grading of strip mine cuts will provide an improved fishery in addition to on-site management of hatchery ponds. Food, cover, and travel corridors for resident upland species like deer and turkey populations will be enhanced through the combination of features described below. In addition the integrity of the marsh complex will be maintained by upgrading the existing levee system.

METHODOLOGY

Habitat analysis of existing study area conditions, future conditions without the project and impacts of the several proposed alternatives and increments was accomplished using the Wildlife Habitat Appraisal Guide (WHAG) procedures developed by the Missouri Department of Conservation and the USDA Natural Resources Conservation Service. This analysis employed a multi-agency team approach with representatives from the Corps of Engineers, the Illinois Department of Conservation, the Illinois Natural History Survey, as well as the Service.

The WHAG analysis is a numerical system for evaluating the quality and quantity of particular habitats for species selected by the WHAG team members. The qualitative component of the analysis is known as the habitat suitability index (HSI) and is

rated on a 0.1 to 1.0 scale. The suitability of a given habitat type for a set of evaluation species is determined by the qualitative characteristics of the habitat type. The WHAG procedures include the use of limiting factors which is a habitat requirement for an individual species during a critical time of year. Absence of that habitat characteristic makes the habitat unsuitable and results in the lowest HSI value of 0.1. The quantitative component of the WHAG analysis is the measure of acres of habitat that are available for the selected target species. From the qualitative and quantitative determinations, the standard unit of measure, the Habitat Unit (HU), is calculated using the formula (HSI x Acres = HU's).

Existing habitat conditions were evaluated on-site by the team, whereas future conditions with and without the project were estimated using the expertise of team members. The team considered wetland and upland habitats and both game and nongame species aspects of the project. Target species were selected from the total group of species in the model to be able to focus in on, and evaluate, the goals and objectives of the project. Several planning iterations were required as the project evolved and engineering data was refined.

For project planning and impact analysis, project life was established as 50 years. To facilitate comparison, target years were established at 0 (existing conditions) 1, 15 and 50 years. Habitat suitability indices (HSI) and average annual habitat units (AAHU's) for each evaluation species were calculated to reflect expected habitat conditions over the life of the project.

THREATENED AND ENDANGERED SPECIES

To facilitate compliance with Section 7(c) of the Endangered Species Act of 1973, as amended, Federal agencies are required to obtain from the Fish and Wildlife Service information concerning any species, listed or proposed to be listed, which may be present in the area of a proposed action.

Therefore, we are furnishing you the following list of species which may be present in the concerned area:

Classification	Common Name	Scientific Name	Habitat
Endangered	Bald eagle	*Haliaeetus leucocephalus*	Winters along major rivers and reservoirs
Threatened	Decurrent false aster	*Boltonia decurrens*	disturbed alluvial soil

Since the proposed project will not affect these species or their habitats this precludes the need for further action on this project as required under Section 7 of the Endangered Species Act of 1973, as amended. Should this project be modified or new information indicate endangered species may be affected, consultation should be initiated.

EXISTING FISH AND WILDLIFE RESOURCES

For the purpose of evaluation, the study area was categorized according to the following habitat types: wetland, upland and aquatic. These categories were further subdivided into the following habitat types: nonforested wetland, forested wetland, upland hardwoods, old field, cropland, and grassland. Table 1 presents the acreage calculations of existing habitat types. Note that the same acreage numbers for cropland and grassland are used in both habitat types because the model evaluates species that utilize both upland and wetland habitat types as well as those species that use only one or the other habitat types.

Table 1. Banner Marsh HREP existing habitat types and acreage.

Wetland habitat type	Acres
Aquatic	253
Non-forested wetland	281
Forested wetland	0
Cropland	206
Grassland	1526

Upland habitat type	Acres
Bottomland hardwoods	0
Upland hardwoods	150
Old field	1629
Cropland	206
Grassland	1526

The results of the WHAG analysis for existing conditions indicate a broad range of values for the evaluation species, reflective of the variety of habitat requirements for those species (Table 2).

Table 2. Banner Marsh HREP existing habitat suitability and corresponding Habitat Unit values.

SPECIES	HSI	HU
Mallard	0.21	102
Redhead	0.70	374
Canada goose	0.52	1041

SPECIES	HSI	HU
Least bittern	0.30	84
Lesser yellowlegs	0.30	85
Muskrat	0.12	34
King rail	0.43	120
Green-backed heron	0.33	92
American coot	0.31	88
White-tailed deer	0.62	1966
Turkey	0.68	2132
Dickcissel	0.57	872
Bluebird	0.52	1650
Bobwhite quail	0.27	864
Cottontail rabbit	0.21	670
Indigo bunting	0.50	1586
Ring-necked pheasant	0.52	1635
Prairie chicken	0.10	0
Catfish	0.63	336
Crappie	0.45	238
Largemouth bass	0.43	228
Gizzard shad	0.61	324
Common carp	0.67	358
Bluegill	0.44	234
Black bullhead	0.61	328

The habitat values calculated using the WHAG matrix are consistent with past field data collected at the Banner Marsh site. The mixture of habitats within the marsh provide life requisites for many resident and nonresident wildlife species. By selecting the mallard and redhead as target species, both dabbling and diving duck species are represented in the analysis. Green-backed heron and the dickcissel represent the nongame components, while ring-necked pheasant represents the upland game species. Channel catfish and largemouth bass were selected to represent the fisheries component of the project.

FUTURE WITHOUT PROJECT

The No Federal Action alternative is the future without the project condition with the Banner marsh complex continuing to function primarily as floodplain wetland, with minor successional changes occurring over time. The area will be actively managed with the existing pump facility but there would be no new construction under this alternative. The most critical component of the continued success of the marsh complex, the protective levee system, will be subjected to further degradation over time, jeopardizing management of the entire complex. The without project values that have been calculated for this analysis assume that the levee system remains intact over the next 50 years. Erosional forces of the Illinois River at flood stages further degrades the levee each year, increasing the potential for failure at some point in the future. The loss of the protective levee system would permanently alter the habitat types and water regime of the Banner complex subjecting the area to the flooding and sedimentation of the Illinois River. Habitat values projected under this scenario would be much lower, reflecting the overall negative impacts that would result without the afforded protection of the levee.

FUTURE WITH PROJECT

Enhancement options at the project site included increasing the quality of existing habitat types, increasing the acreage of a particular habitat type(s), or a combination of both. Several alternatives were evaluated using the WHAG methodology to determine the best management of the habitat types in Banner marsh area. To meet the overall goal of enhancing habitat for migratory birds, continued active management of the area was evaluated. This included evaluating the existing condition of levee protection, the current water control and pumping facilities as well as improved pumping capacity to flood additional acreage in the fall after desired vegetation has matured. One of the primary objectives is to ensure the future value of the Banner Marsh area by protecting it with a reliable levee system. Secondly, a goal of increasing the quality and acres of habitat for fish and waterfowl, diving ducks in particular was identified. The focus of habitat improvement was determined to be waters 0 to 6 feet deep for both species to promote the growth of submergent vegetation. Third, the invasion of woody shrubs and locust trees into the grasslands was also a concern of the IDOC site managers. The team proposed to bring this encroachment under control by clearing and treating the trees and re-establishing the native grass prairie ecosystem which is all but lost in Illinois.

<u>Proposed Array of Options Considered:</u>

- Levee upgrade using selective borrow areas.

This option involves the necessary upgrade of the levee system with selective excavation of borrow from one or several areas on the interior of the levee system and/or borrowing from the riverward side of the levee in an adjacent side channel of the Illinois River. However, further investigation of the side channel material determined that this location would not be feasible. Subsequently, two interior borrow sites were investigated: a 7-acre borrow site along the highwall cuts (the near vertical banks left by strip mining operations) 50 acres of borrow at selective low contour areas as a source for levee material. The changes in habitat types as a result of removal of borrow material are summarized below (see Table 3). The 7-acre borrow alternative would convert old field habitat to shallow wetland if implemented, whereas the 50-acre alternative would convert both the grassland and old field habitats to shallow water wetlands.

Table 3. Banner Marsh HREP habitat types and acreage with levee upgrade and selective excavation.

Habitat	W/O	1*	2*
Non-forested wetland	281	288	331
Forested wetland	0	0	0
Cropland	206	206	191
Grassland	1526	1526	1516
Old field	1629	1622	1604
Upland hardwoods	150	150	150

1* 7-acre borrow along the highwall
2* 50 acres of selective borrow

- Littoral zone grading.

This feature increases the overall acreage of littoral zone habitat at Banner Marsh by mechanically grading or benching the perimeter of the water's edge in areas where low contours allow increases in shallow water expanses with minor to moderate removal of material. The two acreage values calculated for this option were determined to be 21 and 106 acres of grading; affecting several habitat types to create these increased shallow water habitats (see Table 4).

Table 4. Banner Marsh HREP habitat types and acreage with selective excavation to increase littoral zone.

Habitat	W/O	1*	2*
Non-forested wetland	281	302	387
Forested wetland	0	0	0
Cropland	206	206	176
Grassland	1526	1526	1507
Old field	1629	1608	1572
Upland hardwoods	150	150	150

1* 21 acres of grading
2* 106 acres of grading

- Improved water level control.

Increased water control translates into the capacity to pond water up to six feet deeper over the complex, creating an additional 87 acres of aquatic habitat and 281 acres of additional nonforested wetlands (see Table 5). Currently the marsh is dependent on rainfall and upland watershed runoff for water supply with seepage and evaporation causing wide fluctuations in water levels through the year. The pumping operations would be modified from an existing one-way pump which only allows water to be pumped out of the complex into the Illinois River, to a two-way system that would also have the ability to bring water from the river back into the marsh. The result would be stable, reliable water levels for management of the area. However, a six-foot pool raise would reduce the acreages of several other habitat types. Although the upland hardwood acreage is reduced by 105 acres, the habitat is converted primarily into floodplain forest. The upland hardwoods category is not a true upland and contains a mixture of tree species including some flood tolerant species. Therefore, we assumed that the tradeoff would be an even one from upland to bottomland, realizing that species like honey locust would not withstand the flooding or saturated soils and some tree mortality would occur with the pool raise.

Table 5. Banner Marsh HREP habitat types and acreage with improved water control capabilities.

Habitat	W/O	With
Aquatic	253	534
Non-forested wetland	281	368
Forested wetland	0	0
Cropland	206	182
Grassland	1526	1403
Old field	1629	1408
Upland hardwoods	150	45

- Warm season grass plantings.

This option would convert 208 acres of old field habitats back into native grass prairie (see Table 6). The plantings would include a mixture of warm season grasses like big and little bluestem, indiangrass, and side oats gramma, with the option of introducing prairie forbs into the site depending on seed availability and cost.

Table 6. Banner Marsh HREP habitat types and acreage with warm season grass conversion.

Habitat	W/O	With
Non-forested wetland	281	281
Forested wetland	0	0
Cropland	206	206
Grassland	1526	1734
Old field	1629	1421
Upland hardwoods	150	150

DISCUSSION

Evaluation of Alternatives

The value of this area for fish and wildlife is reflected in the qualitative assessment of the WHAG analysis. The target species selected from the list of evaluation species presented earlier in Table 2. include: mallard and redhead which represent the dabbling and diving duck species, respectively; green-backed heron which represents shallow water wetland species; dickcissel and ring-necked pheasant which represent the upland old field and grassland habitats; and channel catfish and largemouth bass, representing the fishery resource. Evaluation of the project generated low to moderate habitat values for all of the selected target species. This indicates the wide range of habitat types suitable for many different species (remembering that the target species represent a group of species). As an existing refuge area that is being actively managed for fish and wildlife resources, qualitative improvements result in smaller incremental gains in habitat units than larger acreage habitat conversions such as with increased water control.

The Banner Marsh HREP offers a multi-faceted opportunity to benefit the fishery resource, waterfowl (both diving and dabbling ducks), upland species, and nongame species alike. However, any gain in habitat benefits is ultimately dependent on the level of protection afforded by the mainstem levee system which protects the existing project area. Therefore, it was assumed that the

rehabilitation of the levee would be a priority goal of the project. Further evidence for reliable protection was recently shown when rough fish from the Illinois River were unintentionally re-introduced into the Banner Marsh fishery during a flood that allowed river water to backflow through a deteriorated outlet pipe. This was a costly set-back for fishery biologists who were chemically treating the interior ponds to eradicate rough fish.

In conjunction with flood protection, reliable water level control is necessary for the continued management of the complex. The Illinois River flyway is one of the primary travel corridors for migratory birds seasonally. The marsh functions as both a migratory stopover area as well as a nesting grounds for ducks, both diving and dabblers, geese, and shorebirds. Opportunities to restore and enhance habitats for these species were incorporated into the array of alternatives for analysis. Secondary benefits, such as wetland enhancements as a result of borrowing material for the levee repairs were also quantified using the WHAG model. Rehabilitation of the levee system would require borrow material to reshape and reslope the banks. Several options were considered for obtaining the needed borrow. A riverward borrow site would yield the quantities of material, but the sands would not be suitable for levee construction. Due to the engineering infeasibility, the option was dropped and not evaluated further. The remaining options included two potential borrow sites, interior of the levee. The first involved using material from the higwall cuts, which are steep vertical banks left from the mining operations of the 1950's. A smaller reach of borrow is needed due to the vertical height of the cuts. A total of 7 acres of old field habitat would be required if borrow was removed at this location.

The other option involves up to 50 acres of land at several locations within the project area. Sites with suitable material and lower contour elevations adjacent to shallow wetland habitats would be selected so that by removing several feet of material, these areas can be made larger and enhanced even further. The tradeoff is a loss of cropland, old field and grassland acreages. Table 7 summarizes the changes in Average Annual Habitat Units (AAHU's) with each of the options. The 50-acre selective borrow option is the most feasible of the two, especially with the benefits that can be generated for diving ducks (increase in AAHU values for redhead), a priority target species of the Banner HREP. In addition, increases in AAHU's for both channel catfish and largemouth bass with only minimal losses of habitat value for the old field and grassland species is a plus.

Table 7. Banner Marsh HREP Average Annual Habitat Units with Levee Repair Feature.

Wetland Target Species

SPECIES	Without Project	Alt. 1*	Alt. 2**
Mallard	102	102	101
Redhead	374	379	409
Green-backed heron	98	100	115

Upland Target Species

SPECIES	Without Project	Alt. 1*	Alt. 2**
Dickcissel	872	872	866
Ring-necked pheasant	1635	1631	1616

Aquatic Target Species

SPECIES	Without Project	Alt. 1*	Alt. 2**
Channel catfish	344	366	680
Largemouth bass	285	289	387

1*. 7-acre levee borrow
2**. 50-acre levee borrow

The littoral zone grading feature involves selective grading or "benching" of banks of the vertical cutbanks left by strip mining. The water depths adjacent to these cuts is too deep to support aquatic vegetation. Benching will fill in the depths partially, and create optimal water depths along the shoreline, promoting the growth of submergent vegetation. Review of the contour maps determined that two increments of grading would be evaluated for potential benefits to fish and waterfowl. A proposed 21-acre grading option would convert entirely old field habitat into nonforested wetlands. The second option, a 106-acre grading plan, would convert cropfield, grassland, and old field habitats into nonforested wetland. Quantification of the changes in habitat units is presented in Table 8. The fishery resource, as represented by channel catfish and largemouth bass, will benefit by the creation of shallower zones for spawning and increased densities of submergent vegetation for nursery areas. The submergent beds of vegetation are especially preferred by diving duck species such as redhead and canvasback. Habitat

units for the dabbling duck species, represented by the mallard, remain relatively unchanged since these species prefer nursery and more shallow water wetlands for feeding areas. The conversion of old field has only a minimal impact on upland species, as reflected by the AAHU values for dickcissel and pheasant.

Table 8. Banner Marsh HREP Average Annual Habitat Units Littoral Zone Grading Feature.

Wetland Target Species

SPECIES	Without Project	Alt. 1*	Alt. 2**
Mallard	102	104	102
Redhead	374	388	448
Green-backed heron	98	105	134

Upland Target Species

SPECIES	Without Project	Alt. 1*	Alt. 2**
Dickcissel	872	872	861
Ring-necked pheasant	1635	1623	1594

Aquatic Target Species

SPECIES	Without Project	Alt. 1*	Alt. 2**
Channel catfish	344	376	433
Largemouth bass	285	368	424

1*. 21-acre littoral zone grading.
2**. 106-acre littoral zone grading.

The project feature that would result in the largest conversion of habitat would be improvement of the water control capabilities at the site by construction of a new pump station with two-way pumping capacity. The greater the reliability and level of control over the water levels, the more fine-tuned the management of the complex can be year to year. In addition to the capacity to be able to drawdown the marsh to promote seasonal growth of vegetation, the new pump will be able to bring water into the marsh from the river. The water will be filtered through a sand or gravel bed to remove larval fish and other undesirable species before flowing into the complex. Based on survey data, water level management will allow for an increase in water levels up to

an additional six feet over the current pool elevation. This would create an additional 281 acres of aquatic deepwater habitat and 87 acres of nonforested wetland habitat. Corresponding changes to habitat values are presented in Table 9.

Table 9. Banner Marsh HREP Average Annual Habitat Units Water Control Improvement Feature.

Wetland Target Species

SPECIES	Without Project	Alt. 1*
Mallard	102	480
Redhead	374	629
Green-backed heron	98	298

Aquatic Target Species

SPECIES	Without Project	Alt. 1*
Channel catfish	344	608
Largemouth bass	285	596

1*. Improved water control and pumping capacity.

The final habitat improvement considered for the Banner Marsh HREP was conversion of some of the old field habitat back into native grass. Invasion of woody vegetation, especially honey locust, has converted over 1600 acres of the project area into old field. Without active management, successional changes will continue to convert additional grassland to trees. Therefore, the team agreed that restoration/preservation of prairie habitats should be included in the HREP. A goal of 208 acres would be restored back to native grasses (Table 10). This restoration could serve as a seed source for future restoration projects on site. Re-introduction of native forbs was considered, but since the model is not sensitive enough to quantify forbs independently, it was decided that cost and seed availability would be the overriding factors.

Table 10. Banner Marsh HREP Average Annual Habitat Units Warm Season Grass Restoration.

Upland Target Species

SPECIES	Without Project	Alt. 1*
Dickcissel	872	1050
Ring-necked pheasant	1635	1678

1*. Warm season grass conversion of old field habitats.

CONCLUSIONS AND RECOMMENDATIONS

The Banner Marsh HREP offers a multi-faceted opportunity to protect and enhance a floodplain wetland community, a diverse fishery resource, and an upland grassland community under the umbrella of one HREP project. In addition, the proposed HREP will contribute directly to achieving the goals of the North American Waterfowl Management Plan (an international, inter-agency plan to increase waterfowl populations) for both diving and dabbling duck species, and the goals of the Partners for Flight program to protect and increase the habitats for neotropical migrants.

First and foremost, the future value of the project is dependent on the integrity of the levee system to keep floodwaters and sedimentation out of the area. Therefore, the levee upgrade is a necessary part of any proposed alternative. Secondly, water level control offers the best tool for management of this area for fish and wildlife resources. Water level manipulations play a key role in determining which species will benefit the most. Stable, permanent water will benefit the species which are more indicative of a true hemi-marsh habitat.

Not only is the capacity to pump water important, but equally important is the ability to manage optimum water levels which create the most acreage of water during critical times of the migration season for birds or during the spawning/nursery periods for fish.

Additional wetland habitat can be created by mechanically grading and shaping the shoreline contours to increase the littoral zone at Banner Marsh. This increased littoral zone generates benefits for fish, waterfowl, herons, and shorebirds alike.

Habitat improvements in the uplands consist of converting old field back to grasslands, native grasses in particular, by clearing trees and replanting the areas to prairie grasses.

Therefore we recommend:

1. The mainstem levee improvements be made to protect Banner Marsh utilizing the 21-acre interior borrow option.

2. The two-way pumping facilities be constructed to improve water level control and increase the acreage of aquatic and nonforested wetland habitats.

3. The littoral zone grading be implemented to create an additional 106 acres of marsh.

4. The 208 acres of old field be converted into native grass.

We appreciate the opportunity to provide these comments and look forward to continued coordination. If you have any questions, please contact Mr. Joe Slater of my staff at (309) 793-5800.

Sincerely,

FOC Richard C. Nelson
Field Supervisor

cc: USEPA
ILDOC

JS:sjg

Illinois Department of Conservation
LINCOLN TOWER PLAZA • 524 SOUTH SECOND STREET • SPRINGFIELD 62701-1787 CHICAGO OFFICE • ROOM 4-300 • 100 WEST RANDOLPH • CHICAGO 60601
Brent Manning, Director John W. Comerio, Deputy Director Bruce F. Clay, Assistant Director

March 6, 1995

Colonel Charles S. Cox
U.S. Army District Engineer
Clock Tower Building
P.O. Box 2004
Rock Island, IL 61204-2004

Dear Colonel Cox:

With this letter of intent, I wish to confirm that the Illinois Department of Conservation will be the nonfederal sponsor for the Banner Marsh Habitat Rehabilitation and Enhancement Project, located in the LaGrange Pool of the Illinois River, in the Upper Mississippi River Environmental Management Program.

In accordance with Section 906(e) of the Water Resources Development Act of 1986, project funding will be 75% Federal government and 25% nonfederal sponsor. Legislation for our funding will be in place for the proposed construction start in Fiscal Year 1996. The State of Illinois acknowledges that we are responsible for 100 percent of operations, maintenance, and repair of project features located on non-Federal lands.

We wish to compliment your Environmental Management Program task force staff on their efforts. I look forward to the successful completion of this and other projects in the program.

Sincerely,

Brent Manning
Director

BM:MH:rdc

cc: John Tranquilli
Jerry Beverlin
Jim Garner
Marvin Hubbell
Bill Douglas

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State of Illinois
DEPARTMENT OF AGRICULTURE
State Fairgrounds / P.O. Box 19281 / Springfield 62794-9281 TDD: 217/524-6858

Bureau of Environmental Programs 217/ 785-2427
Bureau of Farmland Protection 217/ 782-6297
Bureau of Soil and Water Conservation 217/ 782-6297

March 14, 1995

Mr. Joe Jordan
U.S. Army Engineer District, Rock Island
ATTN: Planning Division
Clock Tower Building- P.O. Box 2004
Rock Island, Illinois 61204-2004

Re: Upper Mississippi River System
Environmental Management Program
Definite Project Report
Banner Marsh State Fish and Wildlife Area

Dear Mr. Jordan:

The Illinois Department of Agriculture has examined the project proposal for its potential impact to agricultural land as well as its compliance with Illinois' Farmland Preservation Act.

The 5,524 acre Banner Marsh State Fish and Wildlife Area (SFWA) lies adjacent to the Illinois Waterway approximately 18 miles downstream of Peoria Lock and Dam between Banner and Kingston Mines, Illinois. The Banner Marsh SFWA has been managed for migratory birds and other wetland dwelling species since the IDOC began purchasing tracts of land in the project area in the 1980's.

Banner Marsh SFWA is experiencing problems with a deteriorating perimeter levee which could eventually impact efforts to optimize the operation of the area and meet management goals and objectives. The recommended plan includes restoring the existing 44,500 foot perimeter levee to a 100-year level of protection using borrow material excavated from adjacent interior lands which would create shallow marsh areas; grading to increase the littoral zone (106 acres) at selected locations near existing bodies (excluding highwall shoreline) by pushing material into deep water areas or spreading over surrounding lands; and planting a mixture of warm season grasses on 208 acres.

Because the plan will be implemented within the existing boundaries of the SFWA and no additional property is to be acquired, we do not object to the project. We have also found the project to be in compliance with the Farmland Preservation Act.

Sincerely,

Teresa J. Savko

Teresa J. Savko
Bureau of Farmland Protection

Enclosure: 2

TJS:mdg

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*	Date Of Land Evaluation Request ~~22 Dec 94~~ 1-6-95
Name Of Project: Banner Marsh Habitat Restoration and Enhancement Project	Federal Agency Involved: U.S. Army Corps of Engineers
Proposed Land Use: Fish & Wildlife Management	County And State: Fulton County, IL
PART II *(To be completed by SCS)*	Date Request Received By SCS: 1-9-95

Does the site contain prime, unique, statewide or local important farmland? Yes ☐ No ☒
(If no, the FPPA does not apply – do not complete additional parts of this form)

Acres Irrigated: —

Average Farm Size: 321

Major Crop(s): Corn, Soybeans, Wheat, Hay	Farmable Land In Govt. Jurisdiction Acres: 29,633,500 % 97	Amount Of Farmland As Defined in FPPA Acres: 27,695,900 % 91
Name Of Land Evaluation System Used: Illinois	Name Of Local Site Assessment System: Statewide	Date Land Evaluation Returned By SCS: 1-13-95

PART III *(To be completed by Federal Agency)*	Alternative Site Rating: Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly	69			
B. Total Acres To Be Converted Indirectly	0			
C. Total Acres In Site	206			
PART IV *(To be completed by SCS)* Land Evaluation Information				
A. Total Acres Prime And Unique Farmland	68			
B. Total Acres Statewide And Local Important Farmland	—			
C. Percentage Of Farmland In County Or Local Govt. Unit To Be Converted	0.00024			
D. Percentage Of Farmland In Govt. Jurisdiction With Same Or Higher Relative Value	~~45.4~~ (45.4)			
PART V *(To be completed by SCS)* Land Evaluation Criterion Relative Value Of Farmland To Be Converted *(Scale of 0 to 100 Points)*	83			

PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(These criteria are explained in 7 CFR 658.5(b)*	Maximum Points	Site A	Site B	Site C	Site D
1. Area In Nonurban Use					
2. Perimeter In Nonurban Use					
3. Percent Of Site Being Farmed					
4. Protection Provided By State And Local Government					
5. Distance From Urban Builtup Area	(See attached Illinois Site Assessment Factors)				
6. Distance To Urban Support Services					
7. Size Of Present Farm Unit Compared To Average					
8. Creation Of Nonfarmable Farmland					
9. Availability Of Farm Support Services					
10. On-Farm Investments					
11. Effects Of Conversion On Farm Support Services					
12. Compatibility With Existing Agricultural Use					
TOTAL SITE ASSESSMENT POINTS *200	~~160~~	74			
PART VII *(To be completed by Federal Agency)*					
Relative Value Of Farmland *(From Part V)*	100	83			
Total Site Assessment *(From Part VI above or a local site assessment)* *200	~~160~~	74			
TOTAL POINTS *(Total of above 2 lines)* *300	~~260~~	157			

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? Yes ☐ No ☒ State Site Assessment System

Reason For Selection:

* When utilizing the state Site Assessment factors, 200 points are assigned to the Site Assessment section of the LESA system for a maximum score of 300 points.

Banner Marsh State Fish and Wildlife Area
Habitat Restoration and Enhancement Project
Fulton and Peoria Counties
US Army Corps of Engineers

PART VI-A **Illinois Site Assessment Criteria**	**Maximum Point**	**Site A**
1. Land Use on the Site	20	0
2. Adjacent Land Use	20	8
3. General Character of Area Within 1½ Miles of Site	20	12
4. Distance to City	20	4
5. Zoned Use of Proposed Site	20	0
6. Zoned Use of Land Adjacent to Proposed Site	20	16
7. Planned Land Use of Proposed Site	20	0
8. Compatibility of Proposed Use with Surrounding Land Uses	20	0
9. Alternative Sites Proposed on Less Productive Land	10	10
10. Availability of Central Water System	10	10
11. Availability of Central Waste Disposal System (Sewer)	10	10
12. Transportation	10	4
TOTAL SITE ASSESSMENT POINTS	**200**	**74**

PART VII		
Relative Value of Farmland	100	83
Total Site Assessment	200	74
TOTAL ILLINOIS LESA POINTS	**300**	**157**

031495
TJS:mdg

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Bishop Henry Whipple Federal Building
1 Federal Drive
Fort Snelling, MN 55111-4056

IN REPLY REFER TO:

FWS/AES-DHC

June 29, 1995

Mr. Darron Niles
Technical Manager
Rock Island District Habitat Projects
U.S. Army Corps of Engineers
Clock Tower Building, P.O. Box 2004
Rock Island, Illinois 61204-2004

Dear Mr. Niles:

The Fish and Wildlife Service has reviewed the Draft Definite Project Report and Environmental Assessment for the Banner Marsh State Fish and Wildlife Area (ER-95/399). We have no comments to offer.

Sincerely,

Mamie A. Parker

Mamie A. Parker
Acting Assistant Regional Director

IN REPLY REFER TO:

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Rock Island Field Office (ES)
4469 - 48th Avenue Court
Rock Island, Illinois 61201

COM: 309/793-5800
FAX: 309/793-5804

August 24, 1995

Colonel Charles S. Cox
District Engineer
U.S. Army Engineer District
Rock Island
Clock Tower Building, P.O. Box 2004
Rock Island, Illinois 61204-2004

Dear Colonel Cox:

The U.S. Fish and Wildlife Service has reviewed the project plan(s) advertised by the public notice(s) on the following list. Based on the information provided, the U.S. Fish and Wildlife Service has no objection to the issuance of the related permit(s).

This letter provides comment under the authority of and in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and the Endangered Species Act of 1973, as amended.

Notice No.	Date	Applicant	Due Date
CENCR-OD-S-302280	08/14/95	U.S. Army Corps of Engineers	09/03/95

Sincerely,

Wayne A. Fischer
for Richard C. Nelson
Field Supervisor

cc: USEPA (Mazur)
ILEPA (Yurdin)
ILDNR (Schanzle)

JS:am

Illinois Department of Conservation
LINCOLN TOWER PLAZA • 524 SOUTH SECOND STREET • SPRINGFIELD 62701-1787 CHICAGO OFFICE • ROOM 4-300 • 100 WEST RANDOLPH • CHICAGO 60601
Brent Manning, Director John W. Comerio, Deputy Director Bruce F. Clay, Assistant Director

Colonel Charles S. Cox
District Engineer
U.S. Army Corps of Engineers
Clock Tower Building
P.O. Box 2004
Rock Island, IL 61204-2004

Re: Draft DPR (R-11PR) - Banner Marsh

Dear Colonel Cox:

The Department of Natural Resources has reviewed the draft Definite Project Report (R-11PR) for the Banner Marsh State Wildlife Area. Overall we are pleased with the draft DPR and feel that it will provide many environmental benefits to a broad range of habitats that benefit migratory fowl, non-game terrestrial wildlife and aquatic resources.

I would like to reemphasize that the Banner Marsh project is very important to the Department and would like to see it move forward as rapidly as possible. The Department is concerned about erosion on the Banner Marsh Levee and the threat that it may fail in a serious flood event. If this occurs it will greatly increase the cost of any repairs to the levee, alter management of the site and will cause the river to inundate up to 214 acres of reclaimed acid mine spoil.

I would like to see repairs made to the levee as soon as possible. One option would be to expedite the engineering design of the levee repair and bid this work separately from the rest of the project. Other options would be to either expedite formal Corps approval of the project or to allow the Department to repair the levee and receive credit for our expenses prior to formal Corps project approval.

I would like to emphasize some additional elements of the draft DPR. These include a strong emphasis on planting warm season native grass and forbs, the importance of establishing the littoral zone in the final mine cut impoundments and expanded use of piping to help facilitate site management. We will continue to work with members of your staff to provide specific guidance on these and other issues.

Please Note: As of July 1, 1995, this agency is a part of the newly formed Department of Natural Resources. To conserve natural resources and reduce waste, agencies affected by the merger are using their remaining inventory of stationery and printed envelopes. All correspondence should now be directed to: Illinois Department of Natural Resources, 524 S. Second St., Springfield, IL 62701-1787.

Draft DPR (R-11PR) - Banner Marsh

I appreciate the willingness of your staff to meet with us and look forward to completion of the project.

Sincerely,

Brent Manning, Director

MEH
cc: Kirby Cottrell
Jerry Beverlin
Jim Garner
Charlie Black
Mike Conlin
Carl Becker
Jeff VerSteeg
Bill Douglas
Marvin Hubbell

State of Illinois
ENVIRONMENTAL PROTECTION AGENCY

Mary A. Gade, Director

2200 Churchill Road, Springfield, IL 62794-9276

217/782-0610

September 20, 1995

Rock Island District
Corps of Engineers
Clock Tower Building
Rock Island, Il 61201

Re: Rock Island District Corps of Engineers (Fulton County)
Banner Marsh EMP
Log # C-1170-95 [CoE appl.# 302280]

Gentlemen:

This Agency received a request on August 11, 1995 from the Rock Island District Corps of Engineers requesting necessary comments for environmental consideration concerning the Environmental Management Plan for the Banner Marsh State Fish and Wildlife Area. This project includes the repair and modification to approximately 44,500 feet of perimeter levee using 140,000 cubic yards of material excavated from adjacent borrow areas, creating shallow marsh areas; the placement of materials into existing deep lakes; the construction of a pump station and water control structures; and the regrading of additional marsh areas. We offer the following comments.

Based on the information included in this submittal, it is our engineering judgment that the proposed project may be completed without causing water pollution as defined in the Illinois Environmental Protection Act, provided the project is carefully planned and supervised.

These comments are directed at the effect on water quality of the construction procedures involved in the above described project and is not an approval of any discharge resulting from the completed facility, nor an approval of the design of the facility. These comments do not supplant any permit responsibilities of the applicant toward the Agency.

This Agency hereby issues certification under Section 401 of the Clean Water Act (PL 95-217), subject to the applicant's compliance with the following conditions:

1. The applicant shall not cause:

   a. violation of applicable water quality standards of the Illinois Pollution Control Board, Title 35, Subtitle C: Water Pollution Rules and Regulation;

   b. water pollution defined and prohibited by the Illinois Environmental Protection Act; and

   c. interference with water use practices near public recreation areas or water supply intakes.

2. The applicant shall provide adequate planning and supervision during the project construction period for implementing construction methods, processes and cleanup procedures necessary to prevent water pollution and control erosion.

3. Any spoil material excavated, dredged or otherwise produced must not be returned to the waterway but must be deposited in a self-contained area in compliance with all state statutes, regulations and permit requirements with

no discharge to waters of the State unless a permit has been issued by this Agency. Any backfilling must be done with clean material and placed in a manner to prevent violation of applicable water quality standards.

4. All areas affected by construction shall be mulched and seeded as soon after construction as possible. The applicant shall undertake necessary measures and procedures to reduce erosion during construction. Interim measures to prevent erosion during construction shall be taken and may include the installation of staked straw bales, sedimentation basins and temporary mulching. All construction within the waterway shall be conducted during zero or low flow conditions. The applicant shall be responsible for obtaining an NPDES Storm Water Permit prior to initiating construction if the construction activity associated with the project will result in the disturbance of 5 (five) or more acres, total land area. An NPDES Storm Water Permit may be obtained by submitting a properly completed Notice of Intent (NOI) form by certified mail to the Agency's Division of Water Pollution Control, Permit Section.

5. The applicant shall implement erosion control measures consistent with the "Standards and Specifications for Soil Erosion and Sediment Control" (IEPA/WPC/87-012).

6. The applicant shall provide plans and specifications to the Agency for approval prior to construction that indicate all construction procedures and measures for the installation of erosion and sediment controls, related to the excavation of the borrow areas, the placement of the borrow material along the levees and the regrading of the areas adjacent to the quarry lakes (littoral zone grading).

This certification becomes effective when the Department of the Army, Corps of Engineers, includes the above condition #1 through 6 as conditions of the requested permit issued pursuant to Section 404 of PL 95-217.

This certification does not grant immunity from any enforcement action found necessary by this Agency to meet its responsibilities in prevention, abatement, and control of water pollution.

Very truly yours,

Thomas G. McSwiggin, P. E.
Manager, Permit Section
Division of Water Pollution Control

TGM/by/9-20

cc: IEPA, Records Unit
IEPA, DWPC, FOS, Peoria
IDNR, OWR, DWRM, Springfield
USEPA, Region 5
IDNR, Office of Natural Resources

CLEAN WATER ACT
SECTION 404(b)(1) EVALUATION

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UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT (R-11F)

BANNER MARSH STATE FISH AND WILDLIFE AREA

LA GRANGE POOL, ILLINOIS WATERWAY
RIVER MILES 138.5 THROUGH 143.9
FULTON AND PEORIA COUNTIES, ILLINOIS

APPENDIX B
CLEAN WATER ACT
SECTION 404(b)(1) EVALUATION

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UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT (R-11F)

BANNER MARSH STATE FISH AND WILDLIFE AREA

LA GRANGE POOL, ILLINOIS WATERWAY
RIVER MILES 138.5 THROUGH 143.9
FULTON AND PEORIA COUNTIES, ILLINOIS

APPENDIX B
CLEAN WATER ACT
SECTION 404(b)(1) EVALUATION

SECTION 1 - PROJECT DESCRIPTION

LOCATION

The proposed project is located on the right descending bank of the Illinois River (River Miles 138.5 - 143.9) in Fulton and Peoria Counties, Illinois. The Banner Marsh State Fish and Wildlife Area was purchased by the Illinois Department of Conservation for the purpose of providing consumptive and nonconsumptive enjoyment of fish, wildlife, and natural habitats. The area comprises 5,524 acres of primarily surface mine reclamation lands. (See plates 1 and 2 of the Definite Project Report (DPR).)

GENERAL DESCRIPTION

By definition and Federal regulatory jurisdiction, much of the site is classified as wetland or as "waters of the United States" and is therefore subject to evaluation and regulation under Section 404 of the Clean Water Act.

The Banner Marsh Habitat Rehabilitation and Enhancement Project is a proposed project to enhance levee integrity, increase water level control capability, and create additional marshland habitat in existing floodplain marsh and upland habitats. In addition, a 208-acre upland brome field would be converted to a warm season grassland. This site is not in a wetland. These improvements would benefit both game and nongame wildlife, as well as enhance overall habitat diversity.

Paramount to the overall protection of the site is the restoration of the perimeter levee. The levee system has experienced erosion along its face, jeopardizing the levee reliability and the destruction of the interior managed wildlife habitat. Restoration

would be achieved by using borrow material from interior low areas. The interior excavations would be configured to create additional shallow marshland habitat, referred to as littoral zones, totaling approximately 50 acres. Approximately 140,000 cubic yards of material and 45,000 tons of riprap and bedding material would be required for perimeter levee improvements.

Water level control would be improved by construction of a pumping system, enabling Illinois River water to be pumped onto the site.

Water control structures and a pump house would be constructed adjacent to the perimeter levee. In operation, the pump would act in concert with the existing dewatering pumping system to flood approximately 2,400 acres of existing crop fields, nonforested and forested wetlands, oldfields, and grasslands.

In addition to water control and levee restoration, additional littoral zone grading would be completed. An additional 106 acres of littoral habitat would be created. Material removed for this feature would be used to create small nesting islands or would be pushed into adjacent, deep, steep-sided quarry lakes.

AUTHORITY AND PURPOSE

The authority for this action is provided by the 1985 Supplemental Appropriations Act (Public Law 99-88) and Section 1103 of the Water Resources Development Act of 1986 (Public Law 99-662). Section 1103 is summarized in the DPR.

The purpose of this project, under Section 1103, is "to ensure the coordinated development and enhancement of the Upper Mississippi River (UMR)." The project is the result of planning efforts by the State of Illinois, the U.S. Fish and Wildlife Service, and the U.S. Army Corps of Engineers.

GENERAL DESCRIPTION OF DREDGED AND FILL MATERIAL

Levee restoration would require approximately 140,000 cubic yards of clay material. Plate 2 of the DPR identifies the interior locations of borrow. These locations are characterized by large particles influenced by mining and reclamation operations. As a result of mining, the deeper overburden materials (rock/shale) were placed on top of the surface. These materials are classified as a calcareous loam and silty shale and are primarily slightly acid to alkaline. The subsoil is high in calcium and rich in phosphorus and potash.

Similar material would be pushed into the deeper water bodies found on the site for the creation of littoral zone habitat. Material would be placed and shaped according to the elevations and profiles shown on plates 16 and 17 of the DPR. One hundred-six acres of littoral zone would be created with the majority of material entering the water bodies.

DESCRIPTION OF PROPOSED DISCHARGE SITES

Enhancement of the perimeter levee would entail placement of material on grass-covered and/or eroded sites. No clearing of trees would be required. Placement sites would be reseeded to grass or riprapped as needed (plate 2 of the DPR). At the eroded sites, material would be placed along the toe of the levee. This area is a bankline comprised of eroded levee material, rock, mud, and areas of sand. Fluctuating Illinois River levels have left this area predominately clear of vegetation. Construction activities would grade and shape this area so that a reliable restoration can be completed.

Littoral zone creation would require moving material adjacent to quarry lakes into these deep lakes. Sediment analysis conducted by the Corps indicated that substrate was comprised of clay and sand. The material being pushed into the lakes is similar material.

The majority of littoral zone grading would be constructed in the dry on what is now upland habitats of oldfield, grassland, and croplands. Once grading is complete, another feature of this project, water control, would be invoked and would flood approximately 281 acres. Existing littoral habitat would be flooded by the water control feature, but would be restored at a higher elevation and increased by the proposed 106 acres of littoral zone grading.

Construction activities are anticipated to last at least one construction season (May through October). If bad weather or other circumstances arise, construction would carry on to the next season.

Transportation of borrow material between the borrow sites and the levee will be primarily on upland sites and existing roadways. Any temporary haul roads built in wetlands will be degraded to original contour once the project is completed.

DESCRIPTION OF PLACEMENT METHOD

Material would be excavated by mechanical means, using belly scrapers and backhoes, and then transported to the appropriate locations. Riprap would be either trucked or barged to the levee where it would be placed by crane. Plate 17 of the DPR shows the detail of the water control structure and pump station to be constructed.

The pump station would require a concrete pad, as well as construction of inlet and discharge pipes. A sand filtering system would be used to prevent the introduction of rough fish into the site. This system would also reduce the risk of the introduction of zebra mussels *(Dreissena polymorpha)*. It is anticipated that zebra mussels would be introduced by other means sometime in the future.

SECTION 2 - FACTUAL DETERMINATIONS

PHYSICAL SUBSTRATE DETERMINATIONS

Prior to mining, soils in the Banner Marsh Area were of the Lawson-Titus-Beaucoup Association. As a result of mining, the deeper overburden materials (rock/shale) were placed on top of the surface. These materials are classified as a calcareous loam and silty shale and are primarily slightly acid to alkaline. The subsoil is high in calcium and rich in phosphorus and potash.

For the most part, aquatic substrates would be affected incidentally to adjacent upland construction activities. Aquatic substrates would be directly affected by pushing material into waterbodies adjacent to littoral zone creation. These substrates would be covered with material of similar character. Recolonization of vegetative and animal biomass should occur quickly.

WATER CIRCULATION, FLUCTUATION, AND SALINITY DETERMINATIONS

WATER

Construction activities would increase turbidity in existing water bodies in the short term. By placing material on the riverward side of the levee and protecting the levee with riprap, material would not erode into the Illinois River as it has done after past repair operations.

When pumping facilities are in use, Illinois River water would be introduced into the area. It is not anticipated that differences in water chemistry would be significant, nor would the introduction of river water degrade the water quality of interior water bodies. Short-term rises in turbidity may occur, but should not have a detrimental effect on water quality or plant and animal life.

CURRENT PATTERNS AND CIRCULATION

Banner Marsh is essentially a closed system, so water movement is virtually nonexistent other than during controlled flood events. Proposed changes in pumping regime may affect currents in the adjacent slough, but not to any significant degree.

NORMAL WATER LEVEL FLUCTUATIONS

As stated above, the closed nature of the Banner Marsh system precludes any significant water level fluctuations other than planned changes for management purposes. Fluctuations in the adjacent Illinois River system, both daily and seasonal, depend on discharge changes, lock and dam operations, and seasonal weather patterns. These changes should not affect the project site, and conversely, project implementation is not expected to affect normal river stages or flood heights.

Proposed water control operations call for an increase of 6 feet in current water elevations. This level would remain constant during the year with a 1- to 2-foot fluctuation for wildlife management purposes, possibly in the fall.

SALINITY GRADIENTS

This consideration is not applicable.

ACTIONS TAKEN TO MINIMIZE IMPACTS

The use of borrow material of upland origin and the stabilization of levee improvement areas by riprap are both intended to minimize impacts to the aquatic system. Construction of littoral zone in the uplands prior to water control operation would avoid any impacts to newly flooded habitat.

SUSPENDED PARTICULATE/TURBIDITY DETERMINATIONS

Due to the normal isolation of the project area from flowing water, suspended particulates and elevated turbidity would likely be limited to the vicinity of levee construction, littoral zone grading, and construction of the pumping facilities. These effects would be limited in both scope and duration.

Approximately 156 acres of littoral zone habitat would be created by removing material adjacent to various water bodies. Some of the material would be removed for levee restoration. Some of the material would be pushed into the deeper lakes that are adjacent to littoral zone creation. These lakes were previously quarry coal mine sites that are deep and have very steep grades. Material pushed into these areas would increase turbidity for a short time during and after construction. No long-term effects are anticipated.

CONTAMINANT DETERMINATIONS

Because the proposed project is situated on previously mined lands, water quality and heavy metal contamination was a concern. Elutriate testing was conducted to evaluate the impacts of construction and the possibility of introducing any metals from the soils to any wetlands. Elutriate test results indicate there would not be significant release of heavy metals to the overlying water column. Grading or excavation activities would not result in an increase in total suspended solids concentrations and a decrease in pH values. It is anticipated that these changes would be temporary in nature and would not be of such magnitude to significantly impact aquatic life.

Any contaminants introduced into the Banner Marsh or adjacent river systems are not expected to differ from those ordinarily found in these systems.

Possible introduction of equipment or construction-related contaminants would be controlled by adherence to runoff monitoring plans during construction activity. No toxic materials would be introduced to the area as a result of construction activities. Appropriate measures, such as hay bales or silt fences, would be implemented to control stormwater discharge. Should any such discharges occur, they would be contained on site.

These measures are designed to constitute compliance with point source discharge (Section 402) requirements of the Clean Water Act. A complete stormwater pollution prevention plan is found in Section 10c. of the main report.

AQUATIC ECOSYSTEM AND ORGANISM DETERMINATIONS

Review and consideration of 40 CFR, Section 230, Subparts D, E, F, and G involved analysis of the following effects:

A. Effects on Plankton.
B. Effects on Benthos.
C. Effects on Nekton.
D. Effects on Aquatic Food Web (refer to Section 230.31).
E. Effects on Special Aquatic Sites Found in the Project Area or Placement Sites.
   (1) Sanctuaries and Refuges (refer to Section 230.40)
   (2) Wetlands (refer to Section 230.41)
   (3) Mud Flats (refer to Section 230.42)
   (4) Vegetated Shallows (refer to Section 230.43)
   (5) Coral Reefs (not found in project area)
   (6) Riffle and Pool Complexes (refer to Section 230.45) were not considered in this project.
F. Threatened and Endangered Species (refer to Section 230.30).
G. Other Wildlife (refer to Section 230.32).

The nature and location of the project does not project any effects on A through F above, as enhancement of wetland habitat values is to be emphasized.

Elements E(1) through (4) and G are found in the project area. Project goals and features have been coordinated to match the management objectives of the Illinois Department of Conservation, and these elements are expected to be enhanced by implementation of the project.

Direct impacts of construction involve the following conversions of habitat:

a. Levee Restoration. Littoral zone habitat would increase from 281 to 331 acres by converting 15 acres of croplands, 10 acres of grasslands, and 25 acres of oldfield.

b. Water Control. Aquatic habitat would increase from 253 to 534 acres:
- 281 acres of existing littoral wetlands would be lost, but regained at a higher elevation;
- 24 acres of cropland converted to littoral habitat;
- 123 acres of grassland converted to littoral habitat;
- 221 acres of oldfield converted to littoral habitat; and
- 150 acres of upland hardwoods converted to bottomland hardwoods.

c. Littoral Zone Grading at Low Areas. Littoral zone habitat would increase from 281 to 387 acres by converting 30 acres of croplands, 19 acres of grassland, and 57 acres of oldfield.

Project planning considered to the full extent the minimization of wetland loss, and it is intended that wetland values and extent would be improved as a result of project implementation.

Correspondence from the U.S. Fish and Wildlife Service and the Illinois Department of Conservation (see Appendix A) indicates that no impacts are envisioned to threatened or endangered species. Other wildlife, both avian and mammalian, is generally expected to benefit from this project due to increased overall habitat diversity.

PROPOSED PLACEMENT SITE DETERMINATIONS

This project does not involve dredging, but rather placement of material on existing levees for means of enhancement or reconstruction. All construction materials would be obtained on site, and direct impacts to wetland substrates would be minimal.

Baseline monitoring indicated that the water quality at Banner Marsh was good. In fact, in a study of 25 lakes, Shovel and Johnson lakes (both at Banner Marsh) were

among the four lakes with the highest water quality based on their trophic state index.

Illinois General Use Water Quality Standards were met for all parameters except dissolved oxygen on four occasions. These occasions occurred during the summer, but no fish kills were observed. Table F-1 in the Water Quality Appendix (Appendix F) compares the state water quality standards and test results.

DETERMINATION OF CUMULATIVE EFFECTS ON THE AQUATIC ECOSYSTEM

The project would have positive benefits to aquatic resources found on the site. Temporary turbidity impacts may occur on and off site, but would be short-term in duration. Protection of the levee should reduce continual introduction of levee material in the Illinois River. No cumulative negative impacts are anticipated to occur. Beneficial impacts are anticipated to occur on site for wetlands, wetland animals, and fish. Long-term productivity would be ensured with the levee restoration and habitat improvements that are proposed.

DETERMINATION OF SECONDARY EFFECTS ON THE AQUATIC ECOSYSTEM

Sedimentation has not been a problem at this site in the past, and sediment deposition is not expected to change significantly as a result of project implementation. Although material would be pushed into some of the water bodies, this would not significantly contribute to degradation of these waters. Creatures utilizing these water bodies should benefit from the added structure that the construction would create.

SECTION 3 - FINDINGS OF COMPLIANCE OR NONCOMPLIANCE WITH THE RESTRICTIONS ON DISCHARGE

1. No significant adaptations of the guidelines were made relating to this evaluation.

2. Alternatives which were considered for the proposed action were as follows:

Alternative A - No Federal Action

Alternative B - Preferred Alternative. Levee restoration using riprap and material landward of the levee found in low areas, construction of a one-way pumping facility, grading 106 acres of littoral zone near existing water bodies, and planting a 208-acre oldfield site with warm season grasses. These features would allow the State of Illinois to achieve its management goals for Banner Marsh.

Alternative C - Management features considered but not selected. Several management features were considered for construction but not evaluated based on engineering feasibility, environmental impacts, and/or cost. These features did not meet the goals of the State of Illinois for Banner Marsh or were found to be cost ineffective and/or inefficient in habitat output. These features include gaining levee borrow material from highwall areas or riverward of the levee, constructing a two-way pumping facility for water control, littoral zone grading at highwall sites, and warm season grass with forb planting at a 208-acre oldfield site.

3. Certification under Section 401 of the Clean Water Act would be obtained from the Illinois Department of Conservation and would be included in the final version of this report. The project would thus be in compliance with the water quality requirements of the State of Illinois.

4. The project would not introduce toxic substances into nearby waters or result in appreciable increases in existing levels of toxic materials.

5. No significant impact to federally listed endangered species would result from this project. This determination is supported by the U.S. Fish and Wildlife Service, Ecological Services Office, Rock Island, Illinois.

6. The project is located along a freshwater inland river system. No marine sanctuaries are involved or would be affected.

7. No municipal or private water supplies would be affected. There would be no adverse impact to recreational fishing, and no unique or special aquatic sites are located in the project location. No long-term adverse changes to the ecology of the river system would result from this action.

8. Project construction materials would be chemically and physically stable. No contamination of the river is anticipated.

9. No other practical alternatives have been identified. The proposed project is in compliance with the guidelines for Section 404(b)(1) of the Clean Water Act, as amended. The proposed project would not significantly impact water quality or the integrity of the aquatic ecosystem.

10. On the basis of the guidelines, the proposed disposal site for the discharge of dredged material is specified as complying with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects to the aquatic ecosystem.

4 Oct 95
Date

Charles S. Cox
Colonel, U.S. Army
District Engineer

DRAFT PROJECT COOPERATION AGREEMENT

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PROJECT COOPERATION AGREEMENT
BETWEEN
THE DEPARTMENT OF THE ARMY
AND
THE STATE OF ILLINOIS
FOR CONSTRUCTION OF THE
BANNER MARSH STATE FISH AND WILDLIFE
REHABILITATION AND ENHANCEMENT PROJECT
AT FULTON AND PEORIA COUNTIES, ILLINOIS

THIS AGREEMENT is entered into this _____ day of _____, 199__, by and between the DEPARTMENT OF THE ARMY (hereinafter the "Government"), represented by U.S. Army Engineer for the Rock Island District (hereinafter the "District Engineer"), and THE STATE OF ILLINOIS DEPARTMENT OF NATURAL RESOURCES (hereinafter the "State"), represented by the Director, Illinois Department of Natural Resources.

WITNESSETH, THAT:

WHEREAS, construction of the Habitat Rehabilitation and Enhancement Project, at Banner Marsh State Fish and Wildlife Area in Fulton and Peoria Counties, Illinois was approved under the terms of the Upper Mississippi River System Environmental Management Program, as authorized by Section 1103(e) of the Water Resources Development Act of 1986, Public Law 99-662, as amended;

WHEREAS, the Government and the State desire to enter into a Project Cooperation Agreement for construction of the Banner Marsh State Fish and Wildlife Area Rehabilitation and Enhancement Project (hereinafter the "Project", as defined in Article I.A. of this Agreement);

WHEREAS, Section 906(e) provides that the first costs for enhancement of fish and wildlife resources shall be a Federal cost when certain specified circumstances are present;

WHEREAS, Section 906(e) further provides that when such specified circumstances are not present, 25 percent of the first cost of enhancement of fish and wildlife resources shall be provided by the Non-Federal Interest;

WHEREAS, the Government and the State agree that the specified circumstances referred to in Subsection 906(e) of Public Law 99-662 are not present;

WHEREAS, Section 1103(e)(7)(a) of the Water Resources Development Act of 1986, Public Law 99-662, as amended by Section 107(b) of the Water Resources Development Act of 1992, Public Law 102-580, specifies the operation and maintenance responsibilities for the Project;

WHEREAS, Section 221 of the Flood Control Act of 1970, Public Law 91-611, as amended, provided that the Secretary of that Army shall not commence construction of any water resources project, or separable element thereof, until each non-federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element;

WHEREAS, Section 1103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended, establishes the maximum amount of costs for the habitat rehabilitation and enhancement component of the Upper Mississippi River System Environmental Management Program;

NOW, THEREFORE, the Government and the State agree as follows:

ARTICLE I - DEFINITIONS AND GENERAL PROVISIONS

For purposes of this Agreement:

A. The term "Project" shall mean the improvement of the existing levee which is approximately 44,500 feet; relocation of an existing 14,000 gpm pump which includes constructing a permanent concrete building to house the diesel engine and supplies; contour grading of three selected sites for littoral zone development which will also be used for borrow; and planting of native grass on approximately 144 acres all as generally described in the Upper Mississippi River System Environmental Management Program Definite Project Report With Integrated Environmental Assessment (R-11F) Banner Marsh State Fish and Wildlife Area LaGrange Pool Illinois River Miles 138.5 through 143.9 Fulton and Peoria County, Illinois, dated September 1995 and approved by the Commander, North Central Division on _____.

B. The term "total project costs" shall mean all costs incurred by the State and the Government in accordance with the terms of this Agreement directly related to construction of the Project. Subject to the provisions of this Agreement, the term shall include, but is not necessarily limited to: continuing planning and engineering costs incurred after October 1, 1985; advanced engineering and design costs; preconstruction engineering and design costs; engineering and design costs during construction; the costs of investigations to identify the existence and extent of hazardous substances in accordance with Article XV.A. of this Agreement; costs of historic preservation activities in accordance with Article XVIII.A. of this Agreement; actual construction costs; supervision and administration costs; costs of participation in the Project Coordination Team in accordance with Article V of this Agreement; costs of contract dispute settlements or awards; the value of lands, easements, right-of-way, relocation, and suitable borrow and dredged or excavated material disposal areas for which the Government affords credit in accordance with Article IV of this Agreement; and costs of audit in accordance with Article X of this Agreement. The term does not include any costs for operation or maintenance; any costs due to betterments; or any costs of dispute resolution under Article VII of this Agreement.

C. The term "financial obligation for construction" shall mean a financial obligation of the Government, other than an obligation pertaining to the provision of lands, easements, rights-of-way, relocations, and borrow and dredged or excavated material disposal areas, that results or would result in a cost that is or would be included in total project costs.

D. The term "non-Federal proportionate share" shall mean the ratio of the State's total cash contribution required in accordance with Articles II.D.1. and II.D.3. of this Agreement to total financial obligations for construction, as projected by the Government.

E. The term "period of construction" shall mean the time from the date the Government first notifies the State in writing, in accordance with Article VI.B. of this Agreement, of the scheduled date for issuance of the solicitation for the first construction contract to the date that the U.S. Army Engineer for the Rock Island District (hereinafter the "District Engineer") notifies the State in writing of the Government's determination that construction of the Project is complete.

F. The term "highway" shall mean any public highway, roadway, street, or way, including any bridge thereof.

G. The term "relocation" shall mean providing a functionally equivalent facility to the owner of an existing utility, cemetery, highway or other public facility, or railroad when such action is authorized in accordance with applicable legal principles of just compensation or as otherwise provided in the authorizing legislation for the Project or any report referenced therein. Providing a functionally equivalent facility may take the form of alteration, lowering, raising, or replacement and attendant removal of the affected facility or part thereof.

H. The term "fiscal year" shall mean one fiscal year of the Government. The Government fiscal year begins on October 1 and ends on September 30.

I. The term "functional portion of the Project" shall mean a portion of the Project that is suitable for tender to the State to operate and maintain in advance of completion of the entire Project. For a portion of the Project to be suitable for tender, the District Engineer must notify the State in writing of the Government's determination that the portion of the Project is complete and can function independently and for a useful purpose, although the balance of the Project is not complete.

J. The term "betterment" shall mean a change in the design and construction of an element of the Project resulting from the application of standards that the Government determines exceed those that the Government would otherwise apply for accomplishing the design and construction of that element.

ARTICLE II - OBLIGATIONS OF THE GOVERNMENT AND THE STATE

A. The Government, subject to receiving funds appropriated by the Congress of the United States (hereinafter, the "Congress") and using those funds and funds provided by the State, shall expeditiously construct the Project, applying those procedures usually applied to Federal projects, pursuant to Federal laws, regulations, and policies.

1. The Government shall afford the State the opportunity to review and comment on the solicitations for all

contracts, including relevant plans and specifications, prior to the government's issuance of such solicitations. The Government shall not issue the solicitation for the first construction contract until the State has confirmed in writing its willingness to proceed with the Project. To the extent possible, the Government shall afford the State the opportunity to review and comment on all contract modifications, including change orders, prior to the issuance to the contractor of a Notice to Proceed. In any instance where providing the State with notification of a contract modification or change order is not possible prior to issuance of the Notice to Proceed, the Government shall provide such notification in writing at the earliest date possible. To the extent possible, the Government also shall afford the State the opportunity to review and comment on all contract claims prior to resolution thereof. The Government shall consider in good faith the comments of the State, but the contents of solicitations, award of contracts, execution of contract modifications, issuance of change orders, resolution or contract claims, and performance of all work on the Project (whether the work is performed under contract or by Government personnel), shall be exclusively within the control of the Government.

2. Throughout the period of construction, the District Engineer shall furnish the State with a copy of the Government's Written Notice of Acceptance of Completed Work for each contract for the Project.

B. The State may request the Government to accomplish betterments. Such requests shall be in writing and shall describe the betterments requested to be accomplished. If the Government in its sole discretion elects to accomplish the requested betterments or any portion thereof, it shall so notify the State in writing that sets forth any applicable terms and conditions, which must be consistent with this Agreement. In the event of conflict between such a writing and this Agreement, this Agreement shall control. The State shall be solely responsible for all costs due to the requested betterments and shall pay all such costs in accordance with Article VI.C. of this Agreement.

C. When the District Engineer determines that the entire Project is complete or that a portion of the Project has become a functional portion of the Project, the District Engineer shall so notify the State in writing and furnish the State with an Operation and Maintenance Manual (hereinafter the "O&M Manual") and with copies of all of the Government's Written Notices of

Acceptance of Completed Work for all contracts for the Project or the functional portion of the Project that have not been provided previously. Upon such notification, the State shall operate and maintain the entire Project or the functional portion of the Project in accordance with Article VIII of this Agreement.

D. The State shall contribute 25 percent of total project costs in accordance with the provisions of this paragraph.

1. In accordance with Article III of this Agreement, the State shall provide all lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas that the Government determines the State must provide for the construction, operation, and maintenance of the Project and shall perform or ensure performance of all relocations that the Government determines to be necessary for the construction, operation, and maintenance of the Project.

2. If the Government projects that the value of the State's contributions under paragraph D.1 of this Article and Articles V, X, and XV.A. of this Agreement will be less than 25 percent of total project costs, the State shall provide an additional cash contribution, in accordance with Article VI.B. of this Agreement, in the amount necessary to make the Non-Federal Sponsor's total contribution equal to 25 percent of total project costs.

3. If the Government determines that the value of the State's contributions provided under paragraphs D.1. and D.2. of this Article and Articles V, X, and XV.A. of this Agreement has exceeded 25 percent of total project costs, the Government, subject to the availability of funds, shall reimburse the State for any such value in excess of 25 percent of total project costs. After such a determination, the Government, in its sole discretion, may provide any remaining Project lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas and perform any remaining project relocations on behalf of the State.

E. The State may request the Government to provide lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas or perform relocations on behalf of the State. Such requests shall be in writing and shall describe the services requested to be performed. If in its sole discretion the Government elects to perform the requested

services or any portion thereof, it shall so notify the State in a writing that sets forth any applicable terms and conditions, which must be consistent with this Agreement. In the event of conflict between such a writing and this Agreement, this Agreement shall control. The State shall be solely responsible for all costs of the requested services and shall pay all such costs in accordance with Article VI.C. of this Agreement. Notwithstanding the provision of lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas or performance of relocations by the Government, the State shall be responsible, as between the Government and the State, for the costs of cleanup and response in accordance with Article XV.C. of this Agreement.

F. The Government shall perform a final accounting in accordance with Article VI.D. of this Agreement to determine the contributions provided by the State in accordance with paragraphs B., D., and E. of this Article and Articles V, X, and XV.A. of this Agreement and to determine whether the State has met its obligations under paragraphs B., D., and E. of this Article.

G. The State shall not use Federal funds to meet the State's share of total project costs under this Agreement unless the Federal granting agency verifies in writing that the expenditure of such funds is expressly authorized by statute.

ARTICLE III - LANDS, RELOCATIONS, DISPOSAL AREAS, AND PUBLIC LAW 91-646 COMPLIANCE

A. The Government, after consultation with the State, shall determine the lands, easements, and rights-of-way required for the construction, operation, and maintenance of the Project, including those required for relocations, borrow materials, and dredged or excavated material disposal. The Government in a timely manner shall provide the State with general written descriptions, including maps as appropriate, of the lands, easements, and rights-of-way that the Government determines the State must provide, in detail sufficient to enable the State to fulfill its obligations under this paragraph, and shall provide the State with a written notice to proceed with acquisition of such lands, easements, and rights-of-way. Prior to the end of the period of construction, the State shall acquire all lands, easements, and rights-of-way set forth in such descriptions. Furthermore, prior to issuance of the solicitation for each construction contract, the State shall provide the Government

with authorization for entry to all lands, easements, and rights-of-way the Government determines the State must provide for that contract. For so long as the Project remains authorized, the State shall ensure that lands, easements, and rights-of-way that the Government determines to be required for the operation and maintenance of the Project and that were provided by the State are retained in public ownership for uses compatible with the authorized purposes of the Project.

B. The Government, after consultation with the State, shall determine the improvements required on lands, easements, and rights-of-way to enable the proper disposal of dredged or excavated material associated with the construction, operation, and maintenance of the Project. Such improvements may include, but are not necessarily limited to, retaining dikes, wasteweirs, bulkheads, embankments, monitoring features, stilling basins, and de-watering pumps and pipes. The Government in a timely manner shall provide the State with general written descriptions of such improvements in detail sufficient to enable the State to fulfill its obligations under this paragraph, and shall provide the State with a written notice to proceed with construction of such improvements. Prior to the end of the period of construction, the State shall provide all improvements set forth in such descriptions. Furthermore, prior to issuance of the solicitation for each Government construction contract, the State shall prepare plans and specifications for all improvements the Government determines to be required for the proper disposal of dredged or excavated material under that contract, submit such plans and specifications to the Government for approval, and provide such improvements in accordance with the approved plans and specifications.

C. The Government, after consultation with the State, shall determine the relocations necessary for the construction, operation, and maintenance of the Project, including those necessary to enable the removal of borrow materials and the proper disposal of dredged or excavated material. The Government in a timely manner shall provide the State with general written descriptions, including maps as appropriate, of such relocations in detail sufficient to enable the State to fulfill its obligations under this paragraph, and shall provide the State with a written notice to proceed with such relocations. Prior to the end of the period of construction, the State shall perform or ensure the performance of all relocations as set forth in such descriptions. Furthermore, prior to issuance of the solicitation

for each Government construction contract, the State shall prepare or ensure the preparation of plans and specifications for, and perform or ensure the performance of, all relocations the Government determines to be necessary for that contract.

D. The State in a timely manner shall provide the Government with such documents as are sufficient to enable the Government to determine the value of any contribution provided pursuant to paragraphs A., B. or C. of this Article. Upon receipt of such documents the Government, in accordance with Article IV of this Agreement and in a timely manner, shall determine the value of such contribution, include such value in total project costs, and afford credit for such value toward the State's share of total project costs.

E. The State shall 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), and the Uniform Regulations contained in 49 C.F.R. Part 24, in acquiring lands, easements, and rights-of-way required for the construction, operation, and maintenance of the Project, including those necessary for

relocations, borrow materials, and dredged or excavated material disposal, and shall inform all affected persons of applicable benefits, policies, and procedures in connection with said Act.

ARTICLE IV - CREDIT FOR VALUE OF LANDS, RELOCATIONS, AND IMPROVEMENTS OF DISPOSAL AREAS

A. The State shall receive credit toward its share of total project costs for the value of the lands, easements. rights-of-way, and suitable borrow and dredged or excavated material disposal areas that the State must pursuant to Article III of this Agreement, and for the value of the relocations, that the State must perform or for which it must ensure performance pursuant to Article III of this Agreement. However, the State shall not receive credit for the value of any lands, easements, rights-of-way, relocations, or borrow and dredged or excavated material disposal areas that have been provided previously as an item of cooperation for another Federal project, or that are owned by the State and used for fish and wildlife management purposes on the effective date of this agreement. The State also shall not receive credit for the value of lands, easements,

rights-of-way, relocations, or borrow and dredged or excavated material disposal areas to the extent that such items are provided using Federal funds unless the Federal granting agency verifies in writing that such credit is expressly authorized by statute.

B. For the sole purpose of affording credit in accordance with this Agreement, the value of lands, easements, and rights-of-way, including those necessary for relocations, borrow materials, and dredged or excavated material disposal, shall be fair market value of the real property interests, plus certain incidental costs of acquiring those interests, as determined in accordance with the provisions of this paragraph.

1. Date of Valuation. The fair market value of lands, easements, or rights-of-way owned by the State on the effective date of this Agreement shall be fair market value of such real property interests as of the date the State provides the Government with authorization for entry thereto. The fair market value of lands, easements, or rights-of-way acquired by the State after the effective date of this Agreement shall be the fair market value of such real property interests at the time the interest are acquired.

2. General Valuation Procedure. Except as provided in paragraph B.3. of this Article, the fair market value of lands, easements, or rights-of-way shall be determined in accordance with paragraph B.2.a. of this Article, unless thereafter a different amount is determined to represent fair market value in accordance with paragraph B.2.b. of this Article.

a. The State shall obtain, for each real property interest, an appraisal that is prepared by a qualified appraiser who is acceptable to the State and the Government. The appraisal must be prepared in accordance with the applicable rules of just compensation, as specified by the Government. The fair market value shall be the amount set forth in the State's appraisal, if such appraisal is approved by the Government. In the event the Government does not approve the State's appraisal, the State may obtain a second appraisal and the fair market value shall be the amount set forth in the State second appraisal, if such appraisal is approved by the Government. In the event the Government does not approve the State's second appraisal, or the State chooses not to obtain a second appraisal, the Government shall obtain an appraisal and the fair market value shall be the amount set forth

in the Government's appraisal, if such appraisal is approved by the State. In the event the State does not approve the Government's appraisal, the Government, after consultation with the State shall consider the Government's and the State's appraisal and determine an amount based thereon, which shall be deemed to be the fair market value.

b. Where the amount paid or proposed to be paid by the State for the real property interest exceeds the amount determined pursuant to paragraph B.2.a. of this Article, the Government, at the request of the State, shall consider all factors relevant to determining fair market value and, in its sole discretion, after consultation with the State, may approve in writing an amount greater than the amount determined pursuant to paragraph B.2.a. Article, but not to exceed the amount actually paid or proposed to be paid. If the Government approves such an amount, the market value shall be the lesser of the approved amount or the amount paid by the State, but not less than the amount determined pursuant to paragraph B.2.a. of this Article.

3. Eminent Domain Valuation Procedure. For lands, easements, or rights-of-way acquired by eminent domain proceeding instituted after the effective date of this Agreement, the State shall, prior to instituting such proceedings, submit to the Government notification in writing of its intent to institute such proceedings and an appraisal of the specific real property interest to be acquired in such proceedings. The Government shall have 60 days after receipt of such notice and appraisal within which to review the appraisal, if not previously approved by the Government in writing.

a. If the Government previously has approved the appraisal in writing, or if the Government provides written approval of, or takes no action on, the appraisal within such 60-day period, the State shall use the amount set forth in such appraisal as the estimate of just compensation for the purpose of instituting the eminent domain proceeding.

b. If the Government provides written disapproval of the appraisal, including the reasons for the disapproval, within such 60-day period, the Government and the State shall consult in good faith to promptly resolve the issues or areas of disagreement that are identified in the Government's written disapproval. If, after such good faith consultation, the

Government and the State agree as to an appropriate amount, then the State shall use that amount as the estimate of just compensation for the purpose of instituting the eminent domain proceeding. If, after such good faith consultation, the Government and the State can not agree as to an appropriate amount, than the State may use the amount set forth in its appraisal as the estimate of just compensation for the purpose of instituting the eminent domain proceeding.

c. For lands, easements, or rights-of-way acquired by eminent domain proceeding instituted in accordance with sub-paragraph B.3. of this Article, fair market value shall be either the amount of the court award for the real property interests taken, to the extent the Government determined such interest are required for the construction , operation, and maintenance of the project, or the amount of any stipulated settlement or portion thereof that the Government approves in writing.

4. Incidental Costs. For lands, easements, or rights-of-way acquired by the State within five-year period proceeding the effective date of this Agreement, or at any time after the effective date of this Agreement, the value of the interest shall include the documented incidental costs of acquiring the interest as determined by the Government, subject to an audit in accordance with Article X.C. of this Agreement to Determine reasonableness, allocability, and allowability of costs. Such incidental costs shall include, but not necessarily be limited to, closing and title costs, appraisal costs, survey the actual amounts expended for payment of any Public Law 91-646 relocation assistance benefits provided in accordance with Article III.E. of this Agreement.

C. After consultation with the State, the Government shall determine the value of relocation in accordance with the provisions of this paragraph.

1. For a relocation other than a highway, the value shall be only that portion of relocation costs that the Government determines is necessary to provide a functionally equivalent facility, reduced by depreciation, as applicable and by the salvage value of any removed items.

2. For a relocation of a highway, the value shall be only that portion of relocation costs that would be necessary to accomplish the relocation in accordance with the design standard

that the State of Illinois would apply under similar conditions of geography and traffic load, reduced by the salvage value of any removed items.

3. Relocation costs shall include, but not necessarily be limited to, actual costs of performing the Relocation; planning, engineering and design costs; supervision and administration costs; and documented incidental costs associated costs due to betterments, as determined by the Government, nor any additional cost of using new material when suitable used material is available. Relocation costs shall be subject to an audit in accordance with Article X.C. of this Agreement to determine reasonableness, allocability, and allowability of costs.

D. The value of the improvements made to lands, easements, and rights-of-way for the proper disposal of dredged or excavated material shall be the costs of the improvements, as determined by the Government, subject to an audit in accordance with Article X.C. of this Agreement to determine reasonableness, allocability, and allowability of costs. Such costs shall include, but not necessarily be limited to, actual costs of providing the improvements; planning, engineering and design costs; supervision and administration costs; and documented incidental costs associated with providing the improvements, but shall not include any costs due to betterments, as determined by the Government.

ARTICLE V - PROJECT COORDINATION TEAM

A. To provide for consistent and effective communication, the State and the Government, not later than 30 days after the effective date of this Agreement, shall appoint named senior representatives to a Project Coordination Team. Thereafter, the Project Coordination Team shall meet regularly until the end of the period of construction. The Government's Project Manager and a counterpart named by the State shall co-chair the Project Coordination Team.

B. The Government's Project Manager and the State's counterpart shall keep the Project Coordination Team informed of the progress of construction and of significant pending issues and actions, and shall seek the views of the Project Coordination Team on matters that the Project Coordination Team generally oversees.

C. Until the end of the period of construction, the Project Coordination Team shall generally oversee the Project, including issues related to design; plans and specifications; scheduling; real property and relocation requirements; real property acquisition; contract awards and modifications; contract costs; the Government's cost projections; final inspection of the entire Project or functional portions of the Project; preparation of the proposed O&M Manual; anticipated requirements and needed capabilities for performance of operation, maintenance, repair, replacement, and rehabilitation of the Project; and other related matters. This oversight shall be consistent with a project management plan developed by the Government after consultation with the State.

D. The Project Coordination Team may make recommendations that it deems warranted to the District Engineer on matters that the Project Coordination Team generally oversees, including suggestions to avoid potential sources of dispute. The Government in good faith shall consider the recommendations of the Project Coordination Team. The Government, having the legal authority and responsibility for construction of the Project, has the discretion to accept, reject, or modify the Project Coordination Team's recommendations.

E. The costs of participation in the Project Coordination Team shall be included in total project costs and cost shared in accordance with the provisions of this Agreement.

ARTICLE VI - METHOD OF PAYMENT

A. The Government shall maintain current records of contributions provided by the parties and current projections of total project costs and costs due to betterments. By April 1 of each year and at least quarterly, the Government shall provide the State with a report setting forth all contributions provided to date and the current projections of total project costs, of total costs due to betterments, of the components of total project costs, of each party's share of total project costs, of the State's total cash contributions required in accordance with Articles II.B., II.D., and II.E. of this Agreement, of the non-Federal proportionate share, and of the funds the Government projects to be required from the State for the upcoming fiscal year. On the effective date of this Agreement, total project costs are projected to be $_____, and the State's cash contribution required under Article II.D. of this Agreement is

projected to be $_____. Such amounts are estimates subject to adjustment by the Government and are not to be construed as the total financial responsibilities of the Government and the State.

B. The State shall provide the cash contribution required under Articles II.D.2. of this Agreement in accordance with the provisions of this paragraph.

1. Not less than 60 calendar days prior to the scheduled date for issuance of the solicitation for the first construction contract, the Government shall notify the State in writing of such scheduled date and the funds the Government determines to be required from the State to meet the non-Federal proportionate share of projected financial obligations for construction through the first fiscal year of construction, including the non-Federal proportionate share of financial obligations for construction incurred prior to the commencement of the period of construction. Not later than such scheduled date, the State shall provide the Government with full amount of the required funds by delivering a check payable to "FOA, USAED, Rock Island" to the District Engineer.

2. For the second and subsequent fiscal years of construction, the Government shall notify the State in writing, no later than 60 calendar days prior to the beginning of that fiscal year, of the funds the Government determines to be required from the State to meet the non-Federal proportionate share of projected financial obligations for construction for that fiscal year. No later than 30 calendar days prior to the beginning of the fiscal year, the State shall make the full amount of the required funds for that fiscal year available to the Government through the funding mechanism specified in Article VI.B.1. of this Agreement.

3. The Government shall draw from the funds provided by the State such sums as the Government deems necessary to cover: (a) the non-Federal proportionate share of financial obligations for construction incurred prior to the commencement of the period of construction; and (b) the non-Federal proportionate share of financial obligations for construction as they are incurred during the period of construction.

4. If at any time during the period of construction the Government determines that additional funds will be needed

from the State to cover the non-Federal proportionate share of projected financial obligations for construction for the current fiscal year, the Government shall notify the State in writing of the additional funds required, and the State, no later than 60 calendar days from receipt of such notice, shall make the additional required funds available through the payment mechanism specified in Article VI.B.1 of this Agreement.

C. In advance of the Government incurring any financial obligation associated with additional work under Article II.B. or II.E. of this Agreement, the Non-Federal Sponsor shall provide the Government with the full amount of the funds required to pay for such additional work by delivering a check payable to "FOA, USAED, Rock Island" to the District Engineer. The Government shall draw from the funds provided by the State such sums as the Government deems necessary to cover the Government's financial obligations for such additional work as they are incurred. In the event the Government determines that the State must provide additional funds to meet its cash contribution, the Government shall notify the State in writing of the additional funds required. Within 30 calendar days thereafter, the State shall provide the Government with a check for the full amount of the additional required funds.

D. Upon completion of the Project or termination of this Agreement, and upon resolution of all relevant claims and appeals, the Government shall conduct a final accounting and furnish the State with the results of the final accounting. The final accounting shall determine total project costs, each party's contribution provided thereto, and each party's required share thereof. The final accounting also shall determine costs due to betterments and the State's cash contribution provided pursuant to Article II.B. of this Agreement.

1. In the event the final accounting shows that the total contribution provided by the State is less than its required share of total project costs plus costs due to any betterments provided in accordance with Article II.B. of this Agreement, the State shall, no later than 90 calendar days after receipt of written notice, make a cash payment to the Government of whatever sum is required to meet the State's required share of total project costs plus costs due to any betterments provided in accordance with Article II.B. of this Agreement.

2. In the event the final accounting shows that the total contribution provided by the State exceeds its required share of total project costs plus costs due to any betterments provided in accordance with Article II.B. of this Agreement, the Government shall, subject to the availability of funds, refund the excess to the State no later than 90 calendar days after the final accounting is complete. In the event existing funds are not available to refund the excess to the State, the Government shall seek such appropriations as are necessary to make the refund.

ARTICLE VII - DISPUTE RESOLUTION

As a condition precedent to a party bringing any suit for breach of this Agreement, the party must first notify the other party in writing of the nature of the purported breach and seek in good faith to resolve the dispute through negotiation. If the parties cannot resolve the dispute through negotiation, they may agree to a mutually acceptable method of non-binding alternative dispute resolution with a qualified third party acceptable to both parties. The parties shall each pay 50 percent of any costs for the services provided by such a third party as such costs are incurred. The existence of a dispute shall not excuse the parties from performance pursuant to this Agreement.

ARTICLE VIII - OPERATION and MAINTENANCE (O&M)

A. Upon notification in accordance with Article II.C. of this Agreement and for so long as the Project remains authorized, the State shall operate and maintain the entire Project or the functional portion of the Project, at no cost to the Government, in a manner compatible with the Project's authorized purposes and in accordance with applicable Federal and State laws as provided in Article XI of this Agreement and specific directions prescribed by the Government in the O&M Manual and any subsequent amendments thereto.

B. The State hereby gives the Government a right to enter, at reasonable times and in a reasonable manner, upon property that the State owns or controls for access to the Project for the purpose of inspection and, if necessary, for the purpose of completing, operating and maintaining the Project. If an inspection shows that the State for any reason is failing to perform its obligations under this Agreement, the Government shall send a written notice describing the non-performance to the

State. If, after 30 calendar days from receipt of notice, the State continues to fail to perform, then the Government shall have the right to enter, at reasonable times and in a reasonable manner, upon property that the State owns or controls for access to the Project for the purpose of completing, operating and maintaining the Project. No completion, operation or maintenance by the Government shall operate to relieve the State of responsibility to meet the State's obligations as set forth in this Agreement, or to preclude the Government from pursuing any other remedy at law or equity to ensure faithful performance pursuant to this Agreement.

ARTICLE IX - INDEMNIFICATION

The State shall hold and save the Government free from all damages arising from 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 its contractors.

ARTICLE X - MAINTENANCE OF RECORDS AND AUDIT

A. Not later than 60 calendar days after the effective date of this Agreement, the Government and the State shall develop procedures for keeping books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to this Agreement. These procedures shall incorporate, and apply as appropriate, the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 C.F.R. Section 33.20. The Government and the State shall maintain such books, records, documents, and other evidence in accordance with these procedures and for a minimum of three years after the period of construction and resolution of all relevant claims arising therefrom. To the extent permitted under applicable Federal laws and regulations, the Government and the State shall each allow the other to inspect such books, documents, records, and other evidence.

B. Pursuant to 32 C.F.R. Section 33.26, the State is responsible for complying with the Single Audit Act of 1984, 31 U.S.C. Sections 7501-7507, as implemented by Office of Management and Budget (OMB) Circular No. A-128 and Department of Defense Directive 7600.10. Upon request of the State and to the extent permitted under applicable Federal laws and regulations, the

Government shall provide to the State and independent auditors any information necessary to enable an audit of the State's activities under this Agreement. The costs of any non-Federal audits performed in accordance with this paragraph shall be allocated in accordance with the provisions of OMB Circulars A-87 and A-128, and such costs as are allocated to the Project shall be included in total project costs and cost shared in accordance with the provisions of this Agreement.

C. In accordance with 31 U.S.C. Section 7503, the Government may conduct audits in addition to any audit that the State is required to conduct under the Single Audit Act. Any such Government audits shall be conducted in accordance with Government Auditing Standards and the cost principles in OMB Circular No. A-87 and other applicable cost principles and regulations. The costs of Government audits performed in accordance with this paragraph shall be included in total project costs and cost shared in accordance with the provisions of this Agreement.

ARTICLE XI - FEDERAL AND STATE LAWS

In the exercise of their respective rights and obligations under this Agreement, the State and the Government agree to 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 Regulations 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army".

ARTICLE XII - RELATIONSHIP OF PARTIES

A. In the exercise of their respective rights and obligations under this Agreement, the Government and the State each act in an independent capacity, and neither is to be considered the officer, agent, or employee of the other.

B. In the exercise of its rights and obligations under this Agreement, neither party shall provide, without the consent of the other party, any contractor with a release that waivers or purports to waive any rights such other party may have to seek relief or redress against such contractor either pursuant to any

cause of action that such other party may have or for violation of any law.

ARTICLE XIII - OFFICIALS NOT TO BENEFIT

No member of or delegate to the Congress, nor any resident commissioner, shall be admitted to any share or part of this Agreement, or to any benefit that may arise therefrom.

ARTICLE XIV - TERMINATION OR SUSPENSION

A. If at any time the State fails to fulfill its obligations under Article II.B., II.D., II.E., VI, or XVIII.C. of this Agreement, the Assistant Secretary of the Army (Civil Works) shall terminate this Agreement or suspend future performance under this Agreement unless he determines that continuation of work on the Project is in the interest of the United States or is necessary in order to satisfy agreements with any other non-Federal interests in connection with the Project.

B. If the Government fails to receive annual appropriations in amounts sufficient to meet Project expenditures for the then-current or upcoming fiscal year, the Government shall so notify the State in writing, and 60 calendar days thereafter either party may elect without penalty to terminate this Agreement or to suspend future performance under this Agreement. In the event that either party elects to suspend future performance under this Agreement pursuant to this paragraph, such suspension shall remain in effect until such time as the Government receives sufficient appropriations or until either the Government or the State elects to terminate this Agreement.

C. In the event that either party elects to terminate this Agreement pursuant to this Article or Article XV of this Agreement, both parties shall conclude their activities relating to the Project and proceed to a final accounting in accordance with Article VI.D. of this Agreement.

D. Any termination of this Agreement or suspension of future performance under this Agreement in accordance with this Article or Article XV of this Agreement shall not relieve the parties of liability for any obligation previously incurred. Any delinquent payment shall be charged interest at a rate, to be determined by the Secretary of the Treasury, equal to 150 per centum of the average bond equivalent rate of the 13-week

Treasury bills auctioned immediately prior to the date on which such payment became delinquent, or auctioned immediately prior to the beginning of each additional 3-month period if the period of delinquency exceeds 3 months.

ARTICLE XV - HAZARDOUS SUBSTANCES

A. After execution of this Agreement and upon direction by the District Engineer, the State shall perform, or cause to be performed, any investigations for hazardous substances that the Government or the State determines to be necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (hereinafter "CERCLA"), 42 U.S.C. Sections 9601-9675, that may exist in, on, or under lands, easements, and rights-of-way that the Government determines, pursuant to Article III of this Agreement, to be required for the construction, operation, and maintenance of the Project. However, for lands that the Government determines to be subject to the navigation servitude, only the Government shall perform such investigations unless the District Engineer provides the State with prior specific written direction, in which case the State shall perform such investigations in accordance with such written direction. All actual costs incurred by the State for such investigations for hazardous substances shall be included in total project costs and cost shared in accordance with the provisions of this Agreement, subject to an audit in accordance with Article X.C. of this Agreement to determine reasonableness, allocability, and allowability of costs.

B. In the event it is discovered through any investigation for hazardous substances or other means that hazardous substances regulated under CERCLA exist in, on, or under any lands, easements, or rights-of-way that the Government determines, pursuant to Article III of this Agreement, to be required for the construction, operation, and maintenance of the Project, the State and the Government shall provide prompt written notice to each other, and the State shall not proceed with the acquisition of the real property interests until both parties agree that the State should proceed.

C. The Government and the State shall determine whether to initiate construction of the Project, or, if already in construction, whether to continue with work on the Project, suspend future performance under this Agreement, or terminate

this Agreement for the convenience of the Government, in any case where hazardous substances regulated under CERCLA are found to exist in, on, or under any lands, easements, or rights-of-way that the Government determines, pursuant to Article III of this Agreement, to be required for the construction, operation, and maintenance of the Project. Should the Government and the State determine to initiate or continue with construction after considering any liability that may arise under CERCLA, the State shall be responsible, as between the Government and the State, for the costs of clean-up and response, to include the costs of any studies and investigations necessary to determine an appropriate response to the contamination. Such costs shall not be considered a part of total project costs. In the event the State fails to provide any funds necessary to pay for clean up and response costs or to otherwise discharge the State's responsibilities under this paragraph upon direction by the Government, the Government may, in its sole discretion, either terminate this Agreement for the convenience of the Government, suspend future performance under this Agreement, or continue work on the Project.

D. The State and the Government shall consult with each other in accordance with Article V of this Agreement in an effort to ensure that responsible parties bear any necessary clean up and response costs as defined in CERCLA. Any decision made pursuant to paragraph C. of this Article shall not relieve any third party from any liability that may arise under CERCLA.

E. As between the Government and the State, the State shall be considered the operator of the Project for purposes of CERCLA liability. To the maximum extent practicable, the State shall operate, maintain, repair, replace, and rehabilitate the project in a manner that will not cause liability to arise under CERCLA.

ARTICLE XVI - NOTICES

a. Any notice, request, demand, or other communication required or permitted to be given under this Agreement shall be deemed to have been duly given if in writing and either delivered personally or by telegram or mailed by first-class, registered, or certified mail, as follows:

If to the State:

Director
Illinois Department of Natural Resources
Lincoln Tower Plaza
524 South 2nd Street
Springfield, Illinois 62701-1787

If to the Government:

District Engineer
U.S. Army Engineer District, Rock Island
Clock Tower Building, P.O. Box 2004
Rock Island, Illinois 61204-2004

B. A party may change the address to which such communications are to be directed by giving written notice to the other party in the manner provided in this Article.

C. Any notice, request, demand, or other communication made pursuant to this Article shall be deemed to have been received by the addressee at the earlier of such time as it is actually received or seven calendar days after it is mailed.

ARTICLE XVII - CONFIDENTIALITY

To the extent permitted by the laws governing each party, the parties agree to maintain the confidentiality of exchanged information when requested to do so by the providing party.

ARTICLE XVIII - HISTORIC PRESERVATION

A. The costs of identification, survey and evaluation of historic properties shall be included in total project costs and cost shared in accordance with the provisions of this Agreement.

B. As specified in Section 7(a) of Public Law 93-291 (16 U.S.C. Section 469c(a)), the costs of mitigation and data recovery activities associated with historic preservation shall be borne entirely by the Government and shall not be included in total project costs, up to the statutory limit of one percent of the total amount authorized to be appropriated for the Project.

C. The Government shall not incur cost for mitigation and data recovery that exceed the statutory one percent limit

specified in paragraph B. of this Article unless and until the Assistant Secretary of the Army (Civil Works) has waived that limit in accordance with Section 208(3) of Public Law 96-515 (16 U.S.C. Section 469c-2(3)). Any costs of mitigation and data recovery that exceed the one percent limit shall be included in total project costs and cost shared in accordance with the provisions of this Agreement.

ARTICLE XIX - SECTION 1103 PROJECT COST LIMITS

The State has reviewed the provisions set forth in Section 1103 of Public Law 99-662, as amended, and understands that Section 1103 establishes the maximum amount of costs for the habitat rehabilitation and enhancement component of the Upper Mississippi River System Environmental Management Program.

Notwithstanding any other provisions of this Agreement, the Government shall not make a new project expenditure, or afford credit toward total project costs for the value of any contribution provided by the State, if such obligation, expenditure, or credit would result in total project costs, plus the value of any obligations already made under the habitat rehabilitation and enhancement component of the Upper Mississippi River System Environmental Management Program, exceeding the maximum amount, unless otherwise authorized by law.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement, which shall become effective upon the date it is signed by the Department of the Army.

THE DEPARTMENT OF THE ARMY	**THE STATE OF ILLINOIS DEPARTMENT OF NATURAL RESOURCES**
BY: **[SIGNATURE]**	BY: **[SIGNATURE]**
_____	_____
[TYPED NAME]	**[TYPED NAME]**
[TITLE IN FULL]	**[TITLE IN FULL]**
DATE: _____	DATE: _____

CERTIFICATE OF AUTHORITY

I, _____, do hereby certify that I am the principal legal officer of the State of Illinois, that the State of Illinois is a legally constituted public body with full authority and legal capability to perform the terms of the Agreement between the Department of the Army and the State of Illinois in connection with the Banner Marsh State Fish and Wildlife Area Rehabilitation and Enhancement Project, and to pay damages in accordance with the terms of this Agreement, if necessary, in the event of the failure to perform, as required by Section 221 of Public Law 91-611 (42 U.S.C. Section 1962d-5b), and that the persons who have executed this Agreement on behalf of the State of Illinois have acted within their statutory authority.

IN WITNESS WHEREOF, I have made and executed this certification this _____ day of _____ 19____.

[SIGNATURE]

_____

[TYPED NAME]
[TITLE IN FULL]

CERTIFICATION REGARDING LOBBYING

The undersigned certifies, to the best of his or her knowledge and belief that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrant, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

[SIGNATURE OF PCA SIGNATORY]
[TYPED NAME]
[TITLE IN FULL]

DATE: _____

CERTIFICATION OF LEGAL REVIEW

The draft Project Cooperation Agreement for Banner Marsh State Fish and Wildlife Enhancement Project has been fully reviewed by the Office of Counsel, USAED, Rock Island, Illinois.

THOMAS F. CRANE
District Counsel

HABITAT EVALUATION AND QUANTIFICATION

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UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT (R-11F)

BANNER MARSH STATE FISH AND WILDLIFE AREA

LA GRANGE POOL, ILLINOIS WATERWAY
RIVER MILES 138.5 THROUGH 143.9
FULTON AND PEORIA COUNTIES, ILLINOIS

APPENDIX D
HABITAT EVALUATION AND QUANTIFICATION

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UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT (R-11F)

BANNER MARSH STATE FISH AND WILDLIFE AREA

LA GRANGE POOL, ILLINOIS WATERWAY
RIVER MILES 138.5 THROUGH 143.9
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APPENDIX D
HABITAT EVALUATION AND QUANTIFICATION

PURPOSE

Habitat Evaluation Procedures (HEP) were used to evaluate the potential benefits of alternative habitat improvement features at the Banner Marsh State Fish and Wildlife Area. Active participants included biologists from the Rock Island District of the Corps of Engineers; the U.S. Fish and Wildlife Service, Rock Island Ecological Service Office; and the Illinois Department of Conservation.

BACKGROUND

The need for quantification of HREP outputs as a project performance evaluation tool, a project ranking tool, and a project planning tool has been discussed by various agencies associated with the UMRS-EMP. This application involves quantification solely for the purpose of project planning.

Habitat Units (HUs) were calculated from the HEP models. Habitat units are a measure of habitat quality (habitat suitability indices (HSI)) and quantity (acres). Annualization of HUs can then be used to determine changes brought about by project features/alternatives over time. This annualization computes average annual habitat units (AAHUs). Once construction begins and as a project matures, habitat changes occur, and therefore habitat benefits may change. Many features, such as tree planting, would not begin to show benefits until well into the project life. The particular dynamics of the ecosystem under study then determine the target years chosen for analysis. With or without a project, habitat conditions change over time; therefore, the overall value of a proposed project depends upon the comparison of with-project benefits and without-project benefits.

METHODOLOGY

Two HEP procedures were used in this evaluation; the Aquatic Habitat Appraisal Guide (AHAG) (Mathias, *et al.*, unpublished), and the Wildlife Habitat Appraisal Guide (WHAG) (Urich, *et al.,* 1984).

The AHAG was developed for the Environmental Management Program because, at the time, a dynamic, flexible model was not available to predict and quantify aquatic variables of big rivers such as the Upper Mississippi and Illinois Rivers. The AHAG has been developed to evaluate habitat conditions for three life stages of eight fish species. It can be used to evaluate up to five life stages of any animal species, given the proper variable inputs. (Red head ducks were evaluated using the AHAG.) However, the AHAG is flexible enough that a variety of habitat variables for species other than fish can be evaluated.

The WHAG was developed by the Missouri Department of Conservation. It is a field evaluation procedure designed to estimate habitat quality and account for changes due to land management practices. Checklist-type appraisal guides are used for both upland and wetland habitats, and computer programs are used to analyze field data in terms of habitat suitability for various evaluation species.

Numeric ranking for terrestrial and wetland habitat values was accomplished using the existing WHAG field data sheets for forested and non-forested wetlands, cropfield, grassland, and oldfield habitat. Similarly, aquatic habitat impacts and improvements were evaluated using the WHAG and AHAG models. Field data was then inputted into the respective computer program for HSI, HU, and ultimately AAHU calculations.

Results are provided for calculated HSI and estimated total HU values for the forested, non-forested wetlands, cropland, grassland, oldfield, and aquatic components of the project (Tables D-1 through D-6). After existing conditions were determined, the study team reviewed the habitat appraisal guides to determine where habitat quality can be improved. HUs were annualized for target years using the USFWS HEP 80 program in order to evaluate changes in project features over time.

Habitat quality ratings can be improved by: (1) increasing acreages for particular habitat types that may be limited or lacking; (2) altering a limiting factor, such as unpredictable water levels; (3) altering a management strategy such as cropping practice or cover crop composition; or (4) a combination of the preceding, depending on management goals, target species requirements, or available funds.

TABLE D-1

Habitat Evaluation for Feature A1:
Levee Restoration, Using Borrow at Highwall Locations - 7 Acres

	Habitat Suitability Index Borrow at highwall locations -7 acres (A1)						
	Present	Future Without			Future With		
Species	YR 0	YR 1	YR 25	YR 50	YR 1	YR 25	YR 50
Channel catfish	0.63	0.63	0.65	0.65	0.7	0.67	0.67
Crappie	0.45	0.45	0.57	0.57	0.65	0.63	0.63
Largemouth bass	0.43	0.43	0.57	0.57	0.65	0.67	0.67
Gizzard shad	0.61	0.61	0.59	0.59	0.66	0.1	0.1
Carp	0.67	0.67	0.69	0.69	0.75	0.71	0.71
Bluegill	0.44	0.44	0.59	0.59	0.59	0.61	0.61
Black bullhead	0.61	0.61	0.66	0.66	0.72	0.74	0.74
Red head	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Mallard	0.21	0.21	0.21	0.21	0.21	0.21	0.21
Canada goose	0.52	0.52	0.52	0.52	0.52	0.52	0.52
Least bittern	0.3	0.3	0.29	0.29	0.3	0.29	0.29
Lesser yellowlegs	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Muskrat	0.12	0.12	0.12	0.12	0.12	0.12	0.12
King rail	0.43	0.43	0.43	0.43	0.43	0.43	0.43
Green-backed heron	0.33	0.33	0.36	0.36	0.33	0.36	0.36
American coot	0.31	0.31	0.31	0.31	0.31	0.31	0.31
White-tailed deer	0.62	0.62	0.62	0.62	0.62	0.62	0.62
Wild Turkey	0.68	0.68	0.68	0.68	0.68	0.68	0.68
Dickcissel	0.57	0.57	0.57	0.57	0.57	0.57	0.57
Eastern bluebird	0.52	0.52	0.52	0.52	0.52	0.52	0.52
Bobwhite quail	0.27	0.27	0.13	0.13	0.27	0.13	0.13
Eastern cottontail	0.21	0.21	0.11	0.11	0.21	0.11	0.11
Indigo bunting	0.5	0.5	0.46	0.46	0.5	0.46	0.46
Ring-necked pheasant	0.52	0.52	0.52	0.52	0.52	0.52	0.52
Prairie Chicken	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Acres of available habitat*			
habitat type	without	with	gain/loss
nonforested wetland	281	288	7
aquatic	253	253	0
total	534	541	7
nonforested wetland	281	288	7
bottomland hrdwds.	0	0	0
cropfield	206	206	0
grass wetland	1526	1526	0
total	2013	2020	7
grassland	1526	1526	0
upland hardwoods	150	150	0
oldfield	1629	1622	-7
croplands	206	206	0
total	3511	3504	-7

*Mallard evaluates nonforested wetland and cropland acreages. Green-backed heron evaluates nonforested wetland acreages. Dickcissel evaluates grassland acreages. Ring-necked pheasant evaluates grassland and oldfield habitats.

	Habitat Units for Target Species (species that are shaded above)									
	Present	Future Without				Future With				
	YR 0	YR 1	YR 25	YR 50	AAHUs	YR 1	YR 25	YR 50	AAHUs	net AAHUs
Channel catfish	336.42	336.42	347.10	347.10	344.32	378.70	362.47	362.47	366.27	21.94
Largemouth bass	229.62	186.90	192.24	192.24	191.28	232.63	308.37	308.37	288.65	97.37
Red head	373.80	373.80	373.80	373.80	373.80	378.70	378.70	378.70	378.60	4.80
Mallard	101.70	101.70	101.70	101.70	101.70	102.40	102.40	102.40	102.40	0.70
Green-backed heron	91.70	91.70	100.00	100.00	97.90	94.00	102.50	102.50	100.30	2.40
Dickcissel	872	872	872	872	872	872	872	872	872	0
Ring-necked pheasant	1634.6	1634.6	1634.6	1634.6	1634.6	1630.8	1630.8	1630.8	1630.8	-3.8
AAHUs for Target Species										123.41

TABLE D-2

Habitat Evaluation for Feature A2:
Levee Restoration, Using Borrow at Non-Highwall Sites - 50 Acres

	Habitat Suitabiltiy Index						
	Borrow at locations other than highwall - 50 acres (A2)						
	Present	Future Without			Future With		
Species	YR 0	YR 1	YR 25	YR 50	YR 1	YR 25	YR 50
Channel catfish	0.63	0.63	0.65	0.65	0.7	0.67	0.67
Crappie	0.45	0.45	0.57	0.57	0.65	0.63	0.63
Largemouth bass	0.43	0.43	0.57	0.57	0.65	0.67	0.67
Gizzard shad	0.61	0.61	0.59	0.59	0.66	0.1	0.1
Carp	0.67	0.67	0.69	0.69	0.75	0.71	0.71
Bluegill	0.44	0.44	0.59	0.59	0.59	0.61	0.61
Black bullhead	0.61	0.61	0.66	0.66	0.72	0.74	0.74
Red head	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Mallard	0.21	0.21	0.21	0.21	0.19	0.19	0.19
Canada goose	0.52	0.52	0.52	0.52	0.51	0.51	0.51
Least bittern	0.3	0.3	0.29	0.29	0.3	0.29	0.29
Lesser yellowlegs	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Muskrat	0.12	0.12	0.12	0.12	0.12	0.12	0.12
King rail	0.43	0.43	0.43	0.43	0.43	0.43	0.43
Green-backed heron	0.33	0.33	0.36	0.36	0.33	0.36	0.36
American coot	0.31	0.31	0.31	0.31	0.31	0.31	0.31
White-tailed deer	0.62	0.62	0.62	0.62	0.62	0.62	0.62
Wild Turkey	0.68	0.68	0.68	0.68	0.68	0.68	0.68
Dickcissel	0.57	0.57	0.57	0.57	0.57	0.57	0.57
Eastern bluebird	0.52	0.52	0.52	0.52	0.52	0.52	0.55
Bobwhite quail	0.27	0.27	0.13	0.13	0.27	0.13	0.13
Eastern cottontail	0.21	0.21	0.11	0.11	0.21	0.11	0.11
Indigo bunting	0.5	0.5	0.46	0.46	0.5	0.46	0.46
Ring-necked pheasant	0.52	0.52	0.52	0.52	0.52	0.52	0.52
Prairie Chicken	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Acres of available habitat*			
habitat type	without	with	gain/loss
nonforested wetl.	281	331	50
aquatic	253	253	0
total	534	584	50
nonforested wetl.	281	331	50
croplands	206	191	-15
bottomland hrdwds.	0	0	0
grass wetland	1526	1516	-10
total	2013	2038	25
upland hardwoods	150	150	0
oldfield	1629	1604	-25
croplands	206	191	-15
grassland	1526	1516	-10
total	3511	3461	-50

*Mallard evaluates nonforested wetland and cropland acreages. Green-backed heron evaluates nonforested wetland acreages. Dickcissel evaluates grassland acreages. Ring-necked pheasant evaluates grassland and oldfield habitats.

	Habitat Units for Target Species (species that are shaded above)									
	Present	Future Without				Future With				
	YR 0	YR 1	YR 25	YR 50	AAHUs	YR 1	YR 25	YR 50	AAHUs	net AAHUs
Channel catfish	336.42	336.42	347.1	347.1	344.32	408.8	391.28	391.28	395.10	50.78
Largemouth bass	229.62	229.62	304.38	304.38	284.94	379.6	391.28	391.28	386.71	101.76
Red head	373.8	373.8	373.8	373.8	373.8	408.8	408.8	408.8	408.8	35
Mallard	101.7	101.7	101.7	101.7	101.7	101.3	101.3	101.3	101.3	-0.4
Green-backed heron	91.7	91.7	100	100	97.9	108.1	117.8	117.8	115.1	17.2
Dickcissel	872	872	872	872	872	866.3	866.3	866.3	866.3	-5.7
Ring-necked pheasant	1634.6	1634.6	1634.6	1634.6	1634.6	1616.1	1616.1	1616.1	1616.1	-18.5
AAHUs for Target Species										180.14

TABLE D-3

Habitat Evaluation for Features B1 & B2: Water Control

	Habitat Suitabiltiy Index						
	Water Control (B1, B2)						
	Present	Future Without			Future With		
Species	YR 0	YR 1	YR 25	YR 50	YR 1	YR 25	YR 50
Channel catfish	0.63	0.63	0.65	0.65	0.7	0.67	0.67
Crappie	0.45	0.45	0.57	0.57	0.65	0.63	0.63
Largemouth bass	0.43	0.43	0.57	0.57	0.65	0.67	0.67
Gizzard shad	0.61	0.61	0.59	0.59	0.66	0.1	0.1
Carp	0.67	0.67	0.69	0.69	0.75	0.71	0.71
Bluegill	0.44	0.44	0.59	0.59	0.59	0.61	0.61
Black bullhead	0.61	0.61	0.66	0.66	0.72	0.74	0.74
Red head	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Mallard	0.21	0.21	0.21	0.21	0.21	0.21	0.21
Canada goose	0.52	0.52	0.52	0.52	0.52	0.52	0.52
Least bittern	0.3	0.3	0.29	0.29	0.3	0.29	0.29
Lesser yellowlegs	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Muskrat	0.12	0.12	0.12	0.12	0.12	0.12	0.12
King rail	0.43	0.43	0.43	0.43	0.43	0.43	0.43
Green-backed heron	0.33	0.33	0.36	0.36	0.33	0.36	0.36
American coot	0.31	0.31	0.31	0.31	0.31	0.31	0.31
White-tailed deer	0.62	0.62	0.62	0.62	0.68	0.75	0.75
Wild Turkey	0.68	0.68	0.68	0.68	0.73	0.7	0.7
Dickcissel	0.57	0.57	0.57	0.57	0.71	0.77	0.74
Eastern bluebird	0.52	0.52	0.52	0.52	0.65	0.1	0.1
Bobwhite quail	0.27	0.27	0.13	0.13	0.35	0.14	0.14
Eastern cottontail	0.21	0.21	0.11	0.11	0.27	0.11	0.11
Indigo bunting	0.5	0.5	0.46	0.46	0.56	0.1	0.1
Ring-necked pheasant	0.52	0.52	0.52	0.52	0.65	0.58	0.57
Prairie Chicken	0.1	0.1	0.1	0.1	0.1	0.73	0.76

Acres of available habitat*			
habitat type	without	with	gain/loss
nonforested wetland	281	368	87
aquatic	253	534	281
total	534	902	368
nonforested wetland	281	368	87
bottomland hrdwds.	0	105	105
cropfield	206	182	-24
grass wetland	1526	1403	-123
total	2013	2058	45
btmlnd hardwds	0	105	105
grassland	1526	1403	-123
upland hardwoods	150	45	-105
oldfield	1629	1408	-221
cropfield	206	182	-24
total	3511	3143	-368

*Mallard evaluates nonforested wetland and cropland acreages. Green-backed heron evaluates nonforested wetland acreages. Dickcissel evaluates grassland acreages. Ring-necked pheasant evaluates grassland and oldfield habitats.

	Habitat Units for Target Species (species that are shaded above)									
	Present	Future Without				Future With				
	YR 0	YR 1	YR 25	YR 50	AAHUs	YR 1	YR 25	YR 50	AAHUs	net AAHUs
Channel catfish	336.42	336.42	347.1	347.1	344.323	631.4	604.34	604.34	608.3399	264.02
Largemouth bass	229.62	229.62	304.38	304.38	284.942	586.3	604.34	604.34	595.8129	310.87
Red head	373.8	373.8	373.8	373.8	373.8	631.4	631.4	631.4	628.824	255.02
Mallard	101.7	101.7	101.7	101.7	101.7	450.9	496.4	492.1	479.8	378.1
Green-backed heron	91.7	91.7	100	100	97.9	316.5	295.1	295.1	298.2	200.3
Dickcissel	872	872	872	872	872	1002.1	1082.3	1042.2	1050.2	178.2
Ring-necked pheasant	1634.6	1634.6	1634.6	1634.6	1634.6	1833.7	1640.2	1593.8	1677.1	42.5
AAHUs for Target Species										1629.01

TABLE D-4

Habitat Evaluation for Feature C1:
Littoral Zone Grading at Highwall Sites - 21 Acres

	Habitat Suitability Index						
	Littoral Zone Grading - 21 Acres (C1)						
	Present	Future Without			Future With		
Species	YR 0	YR 1	YR 25	YR 50	YR 1	YR 25	YR 50
Channel catfish	0.63	0.63	0.65	0.65	0.7	0.67	0.67
Crappie	0.45	0.45	0.57	0.57	0.65	0.63	0.63
Largemouth bass	0.43	0.43	0.57	0.57	0.65	0.67	0.67
Gizzard shad	0.61	0.61	0.59	0.59	0.66	0.1	0.1
Carp	0.67	0.67	0.69	0.69	0.75	0.71	0.71
Bluegill	0.44	0.44	0.59	0.59	0.59	0.61	0.61
Black bullhead	0.61	0.61	0.66	0.66	0.72	0.74	0.74
Red head	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Mallard	0.21	0.21	0.21	0.21	0.2	0.2	0.2
Canada goose	0.52	0.52	0.52	0.52	0.51	0.51	0.51
Least bittern	0.3	0.3	0.29	0.29	0.3	0.29	0.29
Lesser yellowlegs	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Muskrat	0.12	0.12	0.12	0.12	0.12	0.12	0.12
King rail	0.43	0.43	0.43	0.43	0.43	0.43	0.43
Green-backed heron	0.33	0.33	0.36	0.36	0.33	0.36	0.36
American coot	0.31	0.31	0.31	0.31	0.31	0.31	0.31
White-tailed deer	0.62	0.62	0.62	0.62	0.62	0.62	0.62
Wild Turkey	0.68	0.68	0.68	0.68	0.68	0.68	0.68
Dickcissel	0.57	0.57	0.57	0.57	0.57	0.57	0.57
Eastern bluebird	0.52	0.52	0.52	0.52	0.52	0.52	0.52
Bobwhite quail	0.27	0.27	0.13	0.13	0.27	0.13	0.13
Eastern cottontail	0.21	0.21	0.11	0.11	0.21	0.11	0.11
Indigo bunting	0.5	0.5	0.46	0.46	0.5	0.46	0.46
Ring-necked pheasant	0.52	0.52	0.52	0.52	0.52	0.52	0.52
Prairie Chicken	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Acres of available habitat*			
habitat type	without	with	gain/loss
nonforested wetland	281	302	21
aquatic	253	253	0
total	534	555	21
nonforested wetland	281	302	21
bottomland hrdwds.	0	0	0
cropfield	206	206	0
grass wetland	1526	1526	0
total	2013	2034	21
bottomland hrdwds	0	0	0
cropfield	206	206	0
grassland	1526	1526	0
upland hardwoods	150	150	0
oldfield	1629	1608	-21
total	3511	3490	-21

*Mallard evaluates nonforested wetland and cropland acreages. Green-backed heron evaluates nonforested wetland acreages. Dickcissel evaluates grassland acreages. Ring-necked pheasant evaluates grassland and oldfield habitats.

	Habitat Units for Target Species (species that are shaded above)									
	Present	Future Without				Future With				
	YR 0	YR 1	YR 25	YR 50	AAHUs	YR 1	YR 25	YR 50	AAHUs	net AAHUs
Channel catfish	336.42	336.42	347.10	347.10	344.32	388.50	371.85	371.85	375.65	31.33
Largemouth bass	229.62	229.62	304.38	304.38	284.94	360.75	371.85	371.85	367.64	82.69
Red head	373.80	373.80	373.80	373.80	373.80	388.50	388.50	388.50	388.35	14.55
Mallard	101.70	101.70	101.70	101.70	101.70	103.80	103.80	103.80	103.80	2.10
Green-backed heron	91.70	91.70	100.00	100.00	97.90	98.60	107.50	107.50	105.10	7.20
Dickcissel	872.00	872.00	872.00	872.00	872.00	872.00	872.00	872.00	872.00	0.00
Ring-necked pheasant	1634.60	1634.60	1634.60	1634.60	1634.60	1623.10	1623.10	1623.10	1623.10	-11.50
AAHUs for Target Species										126.38

TABLE D-5

Habitat Evaluation for Feature C2: Littoral Zone Grading at Lower Areas - 106 Acres

	Habitat Suitability Index						
	Littoral Zone Grading - 106 Acres (C2)						
	Present	Future Without			Future With		
Species	YR 0	YR 1	YR 25	YR 50	YR 1	YR 25	YR 50
Channel catfish	0.63	0.63	0.65	0.65	0.7	0.67	0.67
Crappie	0.45	0.45	0.57	0.57	0.65	0.63	0.63
Largemouth bass	0.43	0.43	0.57	0.57	0.65	0.67	0.67
Gizzard shad	0.61	0.61	0.59	0.59	0.66	0.1	0.1
Carp	0.67	0.67	0.69	0.69	0.75	0.71	0.71
Bluegill	0.44	0.44	0.59	0.59	0.59	0.61	0.61
Black bullhead	0.61	0.61	0.66	0.66	0.72	0.74	0.74
Red head	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Mallard	0.21	0.21	0.21	0.21	0.18	0.18	0.18
Canada goose	0.52	0.52	0.52	0.52	0.5	0.5	0.5
Least bittern	0.3	0.3	0.29	0.29	0.3	0.29	0.29
Lesser yellowlegs	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Muskrat	0.12	0.12	0.12	0.12	0.12	0.12	0.12
King rail	0.43	0.43	0.43	0.43	0.43	0.43	0.43
Green-backed heron	0.33	0.33	0.36	0.36	0.33	0.36	0.36
American coot	0.31	0.31	0.31	0.31	0.31	0.31	0.31
White-tailed deer	0.62	0.62	0.62	0.62	0.62	0.62	0.62
Wild Turkey	0.68	0.68	0.68	0.68	0.67	0.67	0.67
Dickcissel	0.57	0.57	0.57	0.57	0.57	0.57	0.57
Eastern bluebird	0.52	0.52	0.52	0.52	0.52	0.52	0.55
Bobwhite quail	0.27	0.27	0.13	0.13	0.27	0.13	0.13
Eastern cottontail	0.21	0.21	0.11	0.11	0.21	0.11	0.11
Indigo bunting	0.5	0.5	0.46	0.46	0.5	0.46	0.46
Ring-necked pheasant	0.52	0.52	0.52	0.52	0.52	0.52	0.52
Prairie Chicken	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Acres of available habitat*			
habitat type	without	with	gain/loss
nonforested wetland	281	387	106
aquatic	253	253	0
total	534	640	106
nonforested wetland	281	387	106
bottomland hrdwds.	0	0	0
cropfield	206	176	-30
grass wetland	1526	1507	-19
total	2013	2070	57
bottomland hardwoods	0	0	0
cropfield	206	176	-30
grassland	1526	1507	-19
upland hardwoods	150	150	0
oldfield	1629	1572	-57
total	3511	3405	-106

*Mallard evaluates nonforested wetland and cropland acreages. Green-backed heron evaluates nonforested wetland acreages. Dickcissel evaluates grassland acreages. Ring-necked pheasant evaluates grassland and oldfield habitats.

	Habitat Units for Target Species (species that are shaded above)									
	Present	Future Without				Future With				
	YR 0	YR 1	YR 25	YR 50	AAHUs	YR 1	YR 25	YR 50	AAHUs	net AAHUs
Channel catfish	336.42	336.42	347.10	347.10	344.32	448.00	428.80	428.80	432.65	88.33
Largemouth bass	229.62	229.62	304.38	304.38	284.94	416.00	428.80	428.80	423.53	138.59
Red head	373.80	373.80	373.80	373.80	373.80	448.00	448.00	448.00	447.26	73.46
Mallard	101.70	101.70	101.70	101.70	101.70	101.60	101.60	101.60	101.60	-0.10
Green-backed heron	91.70	91.70	100.00	100.00	97.90	126.30	137.70	137.70	134.40	36.50
Dickcissel	872.00	872.00	872.00	872.00	872.00	861.10	861.10	861.10	861.30	-10.70
Ring-necked pheasant	1634.60	1634.60	1634.60	1634.60	1634.60	1594.20	1594.20	1594.20	1594.60	-40.00
AAHUs for Target Species										286.07

TABLE D-6

Habitat Evaluation for Features D1 & D2: Warm Season Grass Planting

	Habitat Suitabiltiy Index						
	Warm season grass planting (D1, D2)						
	Present	Future Without			Future With		
Species	YR 0	YR 1	YR 25	YR 50	YR 1	YR 25	YR 50
Channel catfish	-	-	-	-	-	-	-
Crappie	-	-	-	-	-	-	-
Largemouth bass	-	-	-	-	-	-	-
Gizzard shad	-	-	-	-	-	-	-
Carp	-	-	-	-	-	-	-
Bluegill	-	-	-	-	-	-	-
Black bullhead	-	-	-	-	-	-	-
Red head	-	-	-	-	-	-	-
Mallard	-	-	-	-	-	-	-
Canada goose	-	-	-	-	-	-	-
Least bittern	-	-	-	-	-	-	-
Lesser yellowlegs	-	-	-	-	-	-	-
Muskrat	-	-	-	-	-	-	-
King rail	-	-	-	-	-	-	-
Green-backed heron	-	-	-	-	-	-	-
American coot	-	-	-	-	-	-	-
White-tailed deer	0.62	0.62	0.62	0.62	0.62	0.62	0.62
Wild Turkey	0.68	0.68	0.68	0.68	0.68	0.68	0.68
Dickcissel	0	0	0	0	0.71	0.77	0.74
Eastern bluebird	0.52	0.52	0.52	0.52	0.52	0.52	0.55
Bobwhite quail	0.27	0.27	0.13	0.13	0.27	0.13	0.13
Eastern cottontail	0.21	0.21	0.11	0.11	0.21	0.11	0.11
Indigo bunting	0.5	0.5	0.46	0.46	0.5	0.46	0.46
Ring-necked pheasant	0.52	0.52	0.52	0.52	0.65	0.58	0.57
Prairie Chicken	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Acres of available habitat*			
habitat type	without	with	gain/loss
btmlnd hardwds	0	0	0
grassland	1526	1734	208
upland hardwoods	150	150	0
oldfield	1629	1421	-208
cropfield	206	206	0
total	3511	3511	0

*Mallard evaluates nonforested wetland and cropland acreages. Green-backed heron evaluates nonforested wetland acreages. Dickcissel evaluates grassland acreages. Ring-necked pheasant evaluates grassland and oldfield habitats.

	Habitat Units for Target Species (species that are shaded above)*									
	Present	Future Without				Future With				
	YR 0	YR 1	YR 25	YR 50	AAHUs	YR 1	YR 25	YR 50	AAHUs	net AAHUs
Channel catfish	-	-	-	-	0	-	-	-	0	0
Largemouth bass	-	-	-	-	0	-	-	-	0	0
Red head	-	-	-	-	0	-	-	-	0	0
Mallard	-	-	-	-	0	-	-	-	0	0
Green-backed heron	-	-	-	-	0	-	-	-	0	0
Dickcissel	118.56	869.82	869.82	869.82	869.82	1565.72	1565.72	1565.72	906.32	36.50
Ring-necked pheasant	1640.6	1640.6	1640.6	1640.6	1640.6	1659.32	1649.24	1566.29	1656.48	15.88
AAHUs for Target Species										52.38

* Habitat Units presented are for the 208 acre site only. Average annual habitat units presented are for total oldfield and grassland habitat acreages.

Primary project goals for habitat enhancement include improving water level control to enhance management capability, create additional littoral habitat, and enhance grassland quality. Benefits would accrue to fish, migratory and upland birds, furbearers, and game as well as nongame species. These goals led the study team to select appraisal guides for wetland, aquatic, and upland habitats, with seven species as target species (species of emphasis).

Prior to site sampling, the study team reviewed aerial photography, topographic maps, and preliminary design drawings to select representative sample sites for WHAG application. During site sampling, assumptions were developed regarding existing conditions and projected post-project conditions relative to limiting factors and management practices.

Evaluation Species Selection

a. **Water Control and Littoral Zone Grading**. For the water control and littoral zone grading, a host of species was used as evaluation species. The WHAG has a set number of aquatic and wetland species that was used as evaluation species in littoral zone grading and water control measures. Likewise, an upland community of birds and mammals was used to evaluate conversion of upland sites to wetland habitat. These species are an established set in the WHAG model. Although a set list of species has been used, each species represents a guild of other similar species that utilize the habitat in similar ways. In essence, each species represents a palate of habitat variables for the site being evaluated. Table D-7 lists the evaluation species used. These species were selected because they represent key management goals and objectives of the Banner Marsh project.

TABLE D-7

Target Species Evaluated for Water Control and Littoral Zone Grading

Species	Scientific Name	Habitat Evaluated
Large-mouth bass	*Micropterus salmoides*	aquatic
Channel catfish	*Ictalurus punctatus*	aquatic
Mallard	*Anas platyrhynchos*	nonforested wetland
Green-backed heron	*Butorides striatus*	nonforested wetland
Red head	*Aythya americana*	aquatic, nonforested wetland
Dickcissel	*Spiza americana*	grassland
Ring-necked pheasant	*Phasianus colchicus*	grassland, oldfield

b. **Warm Season Grass Planting**. On the project site there are approximately 3,155 acres of grassland and oldfield habitat. Most of this habitat has been a result of the coal mining operations and ongoing management of the site. To

track changes on these lands, the dickcissel and ring-necked pheasant were used as target species. For the most part, some of this habitat would be converted to littoral zone habitat. However, a 208-acre site of oldfield habitat is proposed to be converted to warm season grass habitat. The primary goal on the site would be to reestablish a habitat with pre-settlement upland habitat conditions.

ASSUMPTIONS

Several assumptions have been made in regards to model performance, changes in habitat conditions over time, and future management practices.

a. Model Performance. The WHAG has been designed to be applied to many different types of habitat. Banner Marsh is unique in the sense of its habitats and how to classify them into the WHAG's definitions of habitat types. The upland and bottomland hardwood wetland WHAG matrices were used, in part, to evaluate the water control feature. While these matrices best describe the habitat being evaluated, past mining operations have created a nontypic tree component. The WHAG assumes typical tree species and standard age classes. On ground circumstances indicate more scrub tree species. Habitat suitability indices derived on these habitats may not reflect real life circumstances, but are consistent between species. No target species was selected to assess these habitats.

b. Changes in Habitat Conditions Over Time. Habitat conditions are not static. Either through natural processes or human incurred, habitat evolves and may change in either quality and/or quantity. Imbedded in each cover type evaluation, change has been added to the model. To assess the change over the period of analysis, target years have been defined. At each target year, a change in the habitat variables may be noticed. Noticeable changes can be characterized by a change in habitat benefit output.

Target years of 0, 1, 25, and 50 are sufficient to annualize HUs and characterize habitat changes over the estimated project life.

c. Future Management Use. It can be expected that there would be minor capital improvements made at Banner Marsh whereby wildlife and human use would respond.

d. The existing levee's current level of integrity/projection would remain essentially the same over the 50-year project life.

e. Proposed improvements would result in desired changes in landscape contour and vegetative composition and distribution so that habitat benefits would accrue.

f. Habitat Use. This project proposes to flood a portion of the site as well as create littoral zone habitat for the benefit of a variety of species. While most target

species are selected to identify changes to just one habitat type, it was assumed that the target fish species and diving ducks would benefit from both aquatic and nonforested wetland (littoral zone grading) creation. Both habitat type acreages were used in calculating HU values for these species.

RESULTS

This section describes the HSI scores for each feature discussed in the main report. These features are levee restoration completed by one of three borrow source locations, water level control, littoral zone grading, and upland warm season grass planting using one of three planting scenarios. In each feature discussion, the no action, or without-project conditions would also be discussed.

a. Levee Restoration. Actually there were four management measures discussed in the main report, but two of those, gaining material from channel maintenance activities and riverside borrow, were found to be engineeringly infeasible and were not evaluated for this project. The no action alternative would preclude the need for borrow material. Therefore, no additional habitat benefits would accrue above existing, or baseline, conditions.

(1) Interior Borrow from Highwall Sites (A1). Gaining the required amount of material for the levee restoration can be achieved by reducing highwall conditions at Banner Marsh. Because of historic mining operations, shear banklines are present throughout the site. These shear banklines have limited the fishery from becoming self sustaining. Species such as bluegill and largemouth bass, among others, require shallow areas for spawning and rearing habitat. This shallow interface between deep water and the bankline is referred to as the littoral zone of a water body. Not only is it required for a viable fishery, but other wetland species, such as mallards and green-backed herons, utilize this habitat for feeding, rearing, and escape cover.

Oldfield habitat would be converted to littoral (nonforested wetland as described in the WHAG model) habitat.

In general, HSI scores remain essentially equal with or without the project. With-project conditions would convert habitat types rather than raise the existing quality (already relatively high from active management.)

Positive impacts result for all the target species except for the upland species. The overall AAHU calculation is positive.

(2) Interior Borrow from Areas Other Than Highwall Sites (A2). These sites can be described as near the shoreline of existing water bodies, but at an elevation just above the water line. Creation of littoral zones would equal the habitat quality of highwall locations because the habitat variables created would be the same. This measure has one advantage; the area needed for the required borrow is

much greater than in the previous alternative feature. Approximately 50 acres of littoral zone would be created rather than 7 acres in the highwall option. This measure optimizes habitat benefits given the existing landscape of the site. Like the highwall locations, beneficial impacts were positive but were greater in AAHUs at the same cost.

The conversion of 50 acres would involve 25 acres of oldfield, 15 of cropfield, and 10 of grassland to littoral wetland habitat.

b. Water Level Control (B1,B2). This feature would allow greater water control inside the levee at Banner Marsh. Currently, the only water control is holding rain runoff inside the levee system. Existing pumping facilities offer only one-way pumping out of the site. With two-way pumping, the site manager can actively control water levels so that optimal levels can reliably be maintained and not left up to varying rain runoff amounts and evaporation. The management goal for this feature is to raise water levels by 6 feet, increasing the amount of aquatic and littoral wetland habitats.

Several water sources were investigated, but the Illinois River was determined to be the only reliable water source. Regardless of the water source, HSI scores would be equal because only those reliable water sources would be evaluated for design and implementation. Table D-3 displays the HSI, HU, and AAHU values for this management feature. Although upland species were negatively impacted, a positive net AAHU value for the overall project was realized.

With a 6-foot increase in water levels, the following habitat changes would occur:

- Aquatic habitat would increase from 253 to 534 acres,
- 281 acres of existing littoral wetlands would be lost, but regained at a higher elevation,
- 24 acres of cropland converted to littoral habitat,
- 123 acres of grassland, converted to littoral habitat,
- 221 acres of oldfield, converted to littoral habitat,
- 150 acres of upland hardwoods converted to bottomland hardwoods (see Assumption A)

c. Littoral Zone Grading. Similar benefits of interior levee restoration borrow sites would be derived for this management feature. Again, reduction of highwall areas and selected low areas was evaluated.

(1) Littoral Zone Grading at Highwall Areas (C1). Twenty-one acres of oldfield would be converted to littoral zone habitat.

(2) Littoral Zone Grading at Low Areas (C2). 106 acres of cropfield, grassland, and oldfield habitat would be converted to littoral zone habitat.

(3) Littoral Zone Grading at Both Types of Areas (C1+C2).

d. Warm Season Grass Planting (D1, D2). An oldfield site of 208 acres was identified as having potential of conversion to a warm season grass planting. The management goal for this feature is to restore habitat benefits similar to a prairie habitat prevalent in Illinois prior to extensive agricultural development. Although this site was probably bottomland hardwood wetlands prior to development, the levee system and past development has converted this area to an upland site. A state-wide goal of protecting and restoring prairie habitat has been pursued wherever possible on State-owned lands.

Three alternative plantings were evaluated. Planting a single species of warm season grass such as switchgrass was considered, but this does not meet the goal of restoring a mixed species stand. This feature was not evaluated for consideration in this project. Planting a mixture of grass species such as big bluestem, little bluestem, Indiangrass, and sideoats gramma would meet the objective the State has set. Additionally, the planting of forbs with a warm season grass seed mix was considered as the third feature.

The WHAG evaluation was not sensitive enough to detect changes in habitat value between planting mixed grasses only and mixed grasses and forbs. It was assumed there would be some improvement in habitat quality if forbs were planted, but it was also assumed forbs may eventually be planted by the State or naturally invade the site as it matures into a prairie site.

All acres of existing grassland and oldfield were taken into consideration when calculating AAHUs for this site. This was done to reflect habitat value of the entire area, and not just the 208-acre site for the proposed planting. In order to avoid assigning the improved HSI scores from the 208 acres across all acres (and elevate the AAHUs derived for the project), the existing conditions at the site and all other grassland and oldfield acres were calculated separately and then added together. These calculations were then subtracted from the with-project conditions to get a net gain/loss AAHU score.

The HEP team felt that the WHAG analysis is very accurate when change in habitat types occurs such as changing an upland habitat to a wetland or an aquatic habitat. When within habitat changes occur (cool season grass to warm season grass habitat), the model is not as sensitive.

A change of 52.4 AAHUs may be a very low estimate when converting cool season grasses to a more diverse and natural warm season grass setting. As mentioned in Section 6, first paragraph, of the main report, many of the species inhabiting this habitat have small home ranges and narrow land use patterns that are not conducive to HEP model analysis. The HEP team did not alter the model or the output to better reflect their assumptions because it was felt the model was not sensitive to reflect small, yet important habitat units for many of the nongame species that may use a prairie type habitat. It can be assumed that changing the 208-acre oldfield site to a warm season prairie will result in higher benefit than the WHAG model presents.

DISCUSSION

The results of the HEP analysis appear to confirm that Banner Marsh is a well-functioning wetland complex, but can be enhanced with the features proposed for this project. Results of the HEP application were compared as increments to costs where applicable. This incremental analysis is discussed in Section 7 (Formulation of Alternatives) of the main report.

The proposed project for Banner Marsh involves four primary enhancement features: levee restoration, improved water level control, littoral zone grading, and warm season grass planting. As explained in the text of the main report, improvement of the existing levee is considered an essential starting point for implementation of these features. Thus, the incremental cost analysis evaluated levee restoration by itself and in combination with the two water control options, two littoral zone grading options, and warm season grass planting.

In conclusion, the HEP analysis indicates that a water control and littoral zone grading would best capitalize upon the improved levee. This combination would allow the IDOC manager optimal management flexibility conditioned on existing area topography. Warm season grass planting adds to habitat quality and diversity.

UPPER MISSISSIPPI RIVER
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT (R-11F)

BANNER MARSH STATE FISH AND WILDLIFE AREA

LA GRANGE POOL, ILLINOIS WATERWAY
RIVER MILES 138.5 THROUGH 143.9
FULTON AND PEORIA COUNTIES, ILLINOIS

APPENDIX E
GEOTECHNICAL CONSIDERATIONS

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APPENDIX E
GEOTECHNICAL CONSIDERATIONS

GENERAL

The Banner Marsh, Illinois, habitat rehabilitation and enhancement project is part of the Upper Mississippi River System Environmental Management Program (UMRS-EMP). This project, shown on plate 1 of the main report, is located in Fulton and Peoria Counties, Illinois, on the right descending bank of the Illinois River between river miles 138.5 and 143.9. The project area lies between Copperas Creek to the west and Dry Run Creek to the east and is bounded to the north by U.S. Route 24 and to the south by the Illinois River. Control of water levels in ponds, lakes, and ditches of the area are of prime interest for the Banner Marsh project currently managed as a conservation area by Illinois Department of Conservation (IDOC).

The purpose of this appendix is to present an evaluation of the existing conditions of the Banner Marsh levee system and to depict the general geologic setting of the project.

GENERAL GEOLOGY

The Banner Marsh project area extends as much as 1.5 miles inland from the river to the valley wall. The valley in this area was once occupied by the ancient Mississippi River which, through extensive lateral erosion, left a very wide valley floor. Subsequently, the Mississippi was diverted to the west farther upstream, and the ancient valley was filled by successive glacial outwashes to an elevation approximately 50 feet higher than the present floodplain. During a final active erosional cycle, a more voluminous Illinois River incised its present valley into these older glacial sediments. Evidence indicates that the Banner Marsh area is underlain by a strath terrace of bedrock with a relatively thin layer of recent alluvium. This terrace surface is at approximate elevation 415, as is the thalweg of the Illinois River in this reach; thus, the surficial material in the project area, which was initially a more coarse outwash deposit, has probably been reworked and redeposited in the

present alluvial plain. This material varies in thickness from 20 to 40 feet and consists of finer gravels, sands, silts, and clays.

Beneath these alluvial deposits, the bedrock of this area is Pennsylvanian age cyclic deposits of sandstones, shales, limestones, and coals of the Carbondale Formation. While some of the limestone and coal members possess remarkable lateral persistence, the sandstones and gray silty shales show rapid lateral changes in local and regional thickness.

The geologic unit of economic interest in the project area was the Colchester or No. 2 Coal, which is generally 1.5 to 3.5 feet thick. Above the No. 2 Coal in the project area, a generalized geologic section would consist of the Francis Creek Member, a gray silty shale possibly with thin sand lenses equivalent to the Jake Creek Sandstone; the Mecca Quarry Member, a hard black fissile shale; the Oak Grove Limestone Member; and probably the Purington Member, another gray silty shale.

GEOLOGIC EXPLORATION

The earliest available subsurface information in the Banner Marsh area is the result of explorations conducted by the United Electric Coal Companies (later Freeman United Coal Co.) during the period 1951 through 1960. Numerous borings were taken to explore the potential for coal production from the Colchester coal, and the majority of the borings were terminated shortly after locating this unit at elevations generally between 365 and 405. Virtually the entire area covered by these borings has subsequently been strip-mined and is thus in a completely reworked state, which would make the borings useful only for historical stratigraphy of the valley. Unfortunately, the stratigraphic and geologic descriptions reflected by these borings are vague, imprecise, and, in some cases, geologically impossible.

Thus, their value as a tool for even the generalized description of the original deposits is limited, and areal extrapolation of current conditions based upon these borings would be imprudent. However, the logs of 42 of these borings which were in the vicinity of the levees were used to generate a general geologic profile, to which additional logs of later borings were added. While this profile shows the rock units to have relatively good lateral continuity, the surficial material is less consistent and more dissected.

Two holes of specific note are 23 and 23B-1, drilled on April 29, 1960. Both developed an artesian condition during their boring with water flowing out on the ground surface and the holes being abandoned at 43 and 37 foot depths, respectively. Surface elevations were recorded as 438 and 437 feet; however, nearby spot elevations on the 1975 project base maps show hole area elevations to be in the 430 to 434 foot range. Both boring logs show approximately 25 feet of "surface" material and/or "soft gray shale" over a "sand" unit penetrated 17 and 9 feet, respectively, before abandonment. Based upon the simplistic descriptions on all field logs, the soft gray shale may not be a true in-place shale but an alluvial clay, as is probably most of

the "surface" material. The above elevations and depths place the top of the sand unit at elevations 414 and 412, respectively. Records for the river gage at Kingston Mines, just upstream, show the Illinois River at this time to have been at 443.60 feet elevation. The approximate locations for holes 23 and 23B-1 based on present levee stationing are 406+21, 292'L, and 412+37, 197'L, respectively (see plate 6 of the main report). Two other holes drilled the same day, 23C and 23A-1, approximately 625 feet farther from the levee with slightly lower surface elevations, show similar stratigraphies though with only roughly 11 feet of "surface" material before encountering a sand unit roughly 13 feet thick. Neither of these holes experienced problems, and both went deep into the underlying rock units below the sand.

Other borings done at this time show the preponderance of sand occurrences to be generally at either end of the site, roughly from station 10+00 to 195+00 and from station 370+00 to 435+00. These sand units vary in thickness from a few feet to over 20 feet and are covered by 10 to 25 feet of "surface" material. These sand units generally lie between elevation 410 and 420; however, the stratigraphic profile of these holes does not show well defined lateral consistency for these units.

During the summer 1988, a visual inspection of the levee was conducted, and the levee evaluated as to the extent of repairs required (Reference 2). A section from approximate station 408+00 to 346+00 (current stationing) required immediate attention, and holes B-1 through B-7 were bored 11 feet deep approximately 80 feet from the landward toe of the levee in search of suitable borrow. Acceptable repair material was found, but none of these holes went deep enough to encounter sand. During December 1988, an additional 13 holes, B-10 through B-22, were bored along the levee crest; sand was found in holes B-13 through B-16 (approximate current stationing 388+66 to 373+66) at approximate elevations from 412.5 to 416.8 feet.

Only one thickness of 6.9 feet was accurately determined before striking bedrock (coal); the remainder of the holes were discontinued after penetrating the sand from 4 to 7.5 feet. After 24 hours, water levels in these holes were recorded between 431.2 and 432.5 feet elevation; the river gage at Kingston Mines was 433.8 feet.

During the period July 18-24, 1990, Rock Island District personnel bored eight holes (BAN-90-1 through 8) at various locations throughout the area. The locations of borings are shown on plate 6 of the main report. The boring logs are shown on plates 7 through 11 of the main report. Holes 1, 4, 5, 6, and 8 were taken in the interior of the area and reflected the reworked nature of the strip mine tailings; holes 2, 3, and 7 were along the landward toe of the levee. Water levels in these three holes varied from 424.3 and 432.1 feet for holes 2 and 3 on the 19th to 431.2 feet for hole 7 on July 24th. River stage during this period ranged from 440.1 to 442.2 feet elevation. During October 22-25, 1990, an additional nine holes (BAN-90-9 through 17) were drilled at selected sites along the main-stem levee and both flank levees. Several of these borings encountered sand units which correlate well with earlier geologic profiles. A few, however, did not integrate well with earlier profiles; BAN-90-15, for example, showed no sand in an area where earlier borings showed the thickest accumulation. Water levels in these holes ranged from 426.6 to 437.6, with the river remaining relatively constant at 439 plus.

HYDROLOGIC EXPLORATION

During the spring 1974, the Illinois State Water Survey conducted an extensive hydrologic survey of the Banner Marsh area which included much historical research (Reference 1). Six surface water staff gages, four piezometers, and two rain gages were installed at selected sites. Readings were collected from these and analyzed by a variety of methods and in various combinations. The major conclusions from this study are:

1. Water levels in the project area are controlled primarily by:

    a. The stage of the Illinois River.

    b. The intensity of rainfall.

    c. The outflow pumpage rate.

2. Because of the nature of the strip-mine tailings, it is difficult to predict the water level fluctuations of the individual unconnected lakes and ponds.

3. The average permeability between the river and the main drainage ditch (i.e., through the undisturbed soil) is estimated at 200 gallons per day per square foot (gpd/ft^2), and that of the mining spoil in the interior is estimated at 50 gpd/ft^2.

4. For each foot of head differential between the river and the main drainage ditch, about 700,000 gallons per day of underflow beneath the levee will occur.

5. An external source of water will be needed to control water levels at an elevation of 434 feet.

6. The drainage tile system beneath the land to the east of the area will be a problem which must be addressed.

7. There is minimal underseepage beneath the flank levees along Copperas and Dry Creeks.

BANNER MARSH LEVEE

Geotechnical Branch (CENCR-ED-G) personnel conducted field inspections of the Banner Marsh levee system. The first inspection was conducted on May 6-7, 1991, during high river stage by Captain Dean Cerny and Sibte Zaidi. The second inspection was conducted on July 30, 1991, during low river stage by Hans Drehsler and Sibte Zaidi. The third inspection was conducted on June 1, 1994, by Nic Davila and Sibte Zaidi. The Illinois River was at elevation 441.8 feet NGVD (National

Geodetic Vertical Datum) on May 6 and 7, 1991; 430.93 feet NGVD on July 30, 1991; and 431.71 feet NGVD on June 1, 1994.

The purposes of these inspections were to evaluate the existing conditions of the Banner Marsh levee and to identify any needed repair along the length of the Banner Marsh levee which would be incorporated into the proposed EMP project. The typical cross sections of the levee at various locations were taken by Survey Branch prior to the field inspections.

HISTORICAL BACKGROUND

The Banner Marsh levee, approximately 8 miles in length, was constructed with impervious clayey material. It was built between 1910 and 1917 by the U.S. Army Corps of Engineers, Chicago District (Reference 2).

The levee is located on the right bank of the Illinois River northeast of Banner, Illinois, and extends from river mile 138.5 to 143.9. The levee was constructed to protect approximately 7 square miles of farmland from flood damage. The area lies between Copperas Creek to the west and Dry Run Creek to the east and is bounded to the north by U.S. Route 24 and to the south by the Illinois River. The entire area was strip-mined from 1958 until 1974. Numerous ponds and lakes are present in the strip mine area. These ponds and lakes were formed by the strip mining operation and the process of smoothing or land reclaiming processes. Presently, the Illinois Department of Conservation operates the project. The existing levee provides 100-year flood protection to the site.

At the request of the Illinois Department of Conservation, R.A.N. Consultants, Inc., of Peoria, Illinois, conducted a visual inspection of the levee during the summer of 1988. The levee was evaluated as to the extent of repairs required (Reference 2). A section from approximate Station 346+00 to 408+00 (current stationing) was identified as requiring immediate attention. During the spring of 1989, this section of the levee was repaired by the Illinois Department of Conservation.

ROCK ISLAND DISTRICT EXPLORATION PROGRAM

During the period July 18-24, 1990, Rock Island District personnel bored eight holes (BAN-90-1 through BAN-90-8) at various locations throughout the area. Holes BAN-90-1, BAN-90-4, BAN-90-6, and BAN-90-8 were taken at the interior of the area and reflected the reworked nature of the strip mine tailings; holes BAN-90-2, BAN-90-3, and BAN-90-7 were taken along the landward side of the levee. During the period October 22-25, 1990, an additional nine holes (BAN-90-9 through BAN-90-17) were drilled at selected sites along the main-stem levee and both flank levees. Borings were taken to investigate the groundwater conditions in the Banner Marsh Conservation Area. The locations of the borings pertinent to the levee inspection

report are shown on plate 6 of the main report. The boring logs are shown on plates 7 through 11 of the main report.

The subsurface exploration program was conducted in accordance with U.S. Army Corps of Engineers and ASTM standards as follows:

a. EM 1110-1-1804, "Geotechnical Investigation"
b. EM 1110-1-1806, "Presenting Subsurface Information in Contract Plans and Specifications"
c. M 1110-2-1907, "Soil Sampling"
d. ASTM D 1586, "Penetration Test and Split-Barrel Sampling of Soils"

The borings (BAN-90-1 through BAN-90-17) were made with an all-terrain vehicle (ATV) mounted rotary drilling rig Central Mine Equipment (CME) Model 55. The borings were advanced using hollow stem augers (3-1/4-inch inside diameter and 6-3/4-inch outside diameter) to stabilize the sides of the borehole. The borings were drilled to depths varying from 18 to 52 feet below the ground surface.

Soil samples were obtained using a split-spoon sampler (2-inch outside diameter) as part of the standard penetration test (ASTM D 1586). All borings were sampled at 2-foot intervals. Representative samples obtained by the standard penetration (split-spoon) method were placed in 12 ounce jars with additional jars used, as required, for material changes within the split-spoon sampler.

The purpose of the laboratory testing program was to classify and provide engineering properties of the soils encountered. The laboratory testing program consisted of the following tests: (a) visual classification, (b) moisture content, and (c) Atterberg limits. Visual classification was performed on all samples. All soil samples were tested for moisture content. Selected fine-grained representative samples were tested for Atterberg limits. Gradation tests also were performed on selected pervious soil samples.

FOUNDATION OF BANNER LEVEE

According to the borings pertinent to the foundation of the existing levee, the top stratum beneath the levee varied in thickness from 12 to more than 50 feet and consisted of impervious materials classified as lean clay (CL), medium clay (CL-CH), and fat clay (CH). The standard penetration test "N" values recorded during drilling operations for the clay soils ranged from 2 to 16. The moisture content ranged from 24 to 44 percent. The pervious and semi-pervious materials (SP-SC, SW-SC, and SP) were found underlying the clay soils in only seven borings (BAN-90-9, BAN-90-11, BAN-90-13, B-13, B-14, B-15, and B-16). The pervious and semi-pervious substratum varied in thickness from 4 to 12 feet. The gradation tests that were performed on selected pervious soil samples revealed that the effective grain size (D10) ranged from 0.04 mm to 0.19 mm. The semi-pervious material passing U.S. Standard Sieve No. 200 varied from 6.1 percent to 11.2 percent. The pervious and semi-pervious

materials were underlain by impervious materials consisting of clay and shale. A detailed description of the soils encountered is shown on the boring logs presented on plates 7 through 11 of the main report.

The groundwater level located below the top of the levee ranged from 21 to 35 feet from elevation 436 to 423 feet NGVD. The water level was not encountered in borings B-11, B-12, B-20, B-21, and B-22.

DISCUSSION OF FIELD DATA

The amalgamation of all the subsurface exploratory data shows the original unconsolidated material of this area to consist of complex alluvial valley deposits of interfaced channel sands and slack water clays. Because of the simplicity of terminology on the early boring logs and the relatively large spacing between all available borings, it is not possible to construct with any certainty a subsurface profile sufficiently accurate to establish a permeability cross section. The permeability established in Reference 1 was apparently based on the drill logs for the piezometers installed for that study. Logs 1 and 4 show 20 and 23 feet, respectively, of alluvial silty and/or clayey sand. However, this is not necessarily typical of the subsurface beneath the full length of the main-stem levee; in fact, the log for piezometer 1 is markedly dissimilar to BAN-90-2, which was drilled in close proximity to number 1, yet shows no sand but a continuous clay layer down to bedrock. Finally, there is evidence of sand units under both flank levees which could serve as conduits for groundwater movement at higher flow gradients.

INSPECTIONS OF LEVEE EMBANKMENTS

The existing levee was constructed with impervious material (CL, CL-CH, CH) as indicated by borings B-11 through B-22, visual inspections, and shovel samples. Embankment material was apparently obtained from borrow areas adjacent to the levee. Embankment heights varied from 10 to 22 feet with an average height of 18 feet. The crown of the levee generally varied from 10 to 16 feet wide. The landside slope of the levee was 1 vertical (V) on 3 horizontal (H) throughout, with some reaches having flatter embankment slopes. The riverside slope varied from 1V on 1.5H to 1V on 3H, with some reaches having steeper slopes. It appears that this levee has not been mowed for a long time. There were areas of the levee where weeds were more than 8 feet high and very dense. General and specific embankment conditions were noted as follows:

a. Station 0+00 to 22+00±: All levee embankments were in good condition and were firm. Vegetation cover in the form of grass and some weeds was well established. Some small trees were noted on the riverside slope of the levee. The levee on both side slopes was 1V on 3H or flatter.

b. Station 22+00 to 27+00±: This reach of the levee was generally in fair condition. Some small trees and weeds were growing on the riverside slope of the levee. Vegetation cover in the form of grass and weeds was thick on the top and landside slopes of the levee. Both side slopes of the existing levee were 1V on 3H or flatter.

c. Station 27+00 to 146+00±: This reach of the levee appeared to be in stable condition; however, all levee embankment side slopes were heavily covered with tall weeds, grass, and 2- to 12-inch diameter trees. The riverside slope from station 50+00± to 107+00± could not be inspected due to heavy growth of tall weeds and grass. From station 114+00± to 121+00±, a few large trees, some 12 to 36 inches in diameter, were growing on the landside slope of the levee. The landside slope appeared to be in good condition. The side slope of the levee was 1V on 3H or flatter.

d. Station 146+00 to 184+00±: In this reach of the levee, the tall grass and weed growth were heavy on the upper part of the riverside slope of the levee. The riverside slope ranged from 1V on 2.5H to 1V on 1.5H with some sections less than 1V on 1.5H. The riverside toe and a portion of the slope had been washed away. A number of rodent holes also were noted in the riverside slope of the levee. These situations could easily lead to through-seepage and possible failure. This area should be monitored and repaired as necessary to prevent further erosion of the levee embankment in this reach. An old and abandoned concrete silo was located in the lower portion of the landside slope of the levee near station 147+23. The landside slope was 1V on 3H and appeared to be in satisfactory condition.

e. Station 184+00 to 232+00±: In general, this portion of the levee was found to be in good condition, except for tall, 4- to 12-inch diameter trees growing on the riverside slope of the levee. The landside slope was 1V on 3H, with some reaches having flatter slopes. The riverside slopes ranged from 1V on 2H to 1V on 3H. The pump station was located near station 203+63.

f. Station 232+00 to 308+00±: The tall grass, weeds, and a few 2- to 24±-inch-diameter trees were observed on the upper portion of the riverside slope of the levee. The toe and a substantial portion of the levee slope had been eroded, causing slope instability and slope failure along various reaches of the levee. This problem will continue until the slopes are repaired and protected against wave wash, river current, and rainfall. The riverside slope was generally 1V on 1.5H, with some reaches having steeper slopes. The landside slope was 1V on 3H and appeared to be in satisfactory condition. However, numerous 2- to 24-inch-diameter trees were noted at the landside toe of the levee.

g. Station 308+00 to 421+00±: In this reach of the levee, the landside slope appeared to be in good condition, except for some tall grass and weeds on the top and landside slope of the levee. The landside slope was 1V on 3H. The riverside slope was in poor condition. The lower portion (5 to 12 feet) of the riverside slope had been eroded. A few tall trees also were noted growing between station 406+00 and 421+00 on the riverside slope. The riverside slope varied from 1V on 2H to 1V on 3H.

h. Station 421+00 to 444+86 (end of levee): This portion of the levee is located along the Dry Run Creek. Both side slopes appeared to be in stable condition, and both were generally 1V on 2.5H or flatter. Tall grass, weeds, and tall, 4- to 24-inch-diameter trees were found growing along this reach of the levee.

SLOPE STABILITY

The riverside slope from station 232+00± to 421+00± was found to be critical in terms of slope stability. The stability of the most critical slope near station 265+26 was analyzed using the Modified Swedish Method for a Circular Arc Slope Stability Analysis in accordance with EM 1110-2-1902, "Engineering Design Stability of Earth and Rockfill Dams" dated April 1, 1970. Design parameters were selected using available test results, established correlation between shear strengths and moisture contents by Rock Island District for the similar type of soils from other projects, and engineering judgment. These values and the results of the slope stability analysis are shown on plate E-1. The computed minimum factor of safety for the riverside slope near station 265+26 is 1.6. The minimum factor of safety required by EM 1110-2-1913 ("Design and Construction Levees", dated March 31, 1978) is 1.3. Stability analysis also was checked and confirmed using UTEXAS3 program Spencer Method. The safety factor was found to be 1.7. Thus, the slopes are satisfactory with respect to stability. However, because this reach is located adjacent to the Illinois River and is without slope protection against wave wash and current action, the frequent high water flows encroached on the riverside slope and eroded a substantial portion of the slope. The riverside steep slope between this reach also was found to be sloughing, which could easily lead to failure during a high water period. It is recommended that the riverward side slope of this reach of the existing levee should be rehabilitated to minimum slope of 1V on 2.5H and should be protected from wave wash and current action by graded riprap.

SEEPAGE

The field inspection during high river stages revealed no signs of past and present underseepage or through-seepage distress along the landward or on the landside slope of the entire levee. According to the subsurface investigation, the 12- to 50-foot top impervious stratum appears to exist beneath and landside of the entire existing impervious levee. From approximate stations 26+70 to 62+00, 90+00 to 365+00, and 439+00 to 444+86 (end of levee), the pervious and semi-pervious substratum was not encountered. In other reaches, the pervious and semi-pervious substratum 4 to 12 feet in thickness was found 12 to 22 feet deep beneath the impervious top stratum. For such a condition, seepage will not occur through the landside top stratum; therefore, underseepage and berm analyses were not made to provide hold down against uplift.

RECOMMENDATIONS

Based on the results of field inspections and the evaluation of the geotechnical investigation and analyses, the following recommendations are made if the levee is to be incorporated as part of the Banner Marsh Environmental Management Program Project:

a. The burrowing rodents should be controlled, and their burrows should be filled.

b. All the heavy vegetation and trees growing on the levee should be cut. This will allow for better maintenance and will reduce further extensive repair work. All of the stumps should be removed from the levee. The riverside slope from approximate station 53+00 to 107+00 should be inspected following the removal of the heavy vegetation. This portion of the riverside slope could not be inspected due to heavy growth of tall weeds and grass.

c. Areas between approximate stations 146+00± to 184+00± and 232+00± to 421+00 will require extensive repair work. A good portion of the levee riverside slope has been eroded and most of the trees have fallen and have been uprooted, presenting a very dangerous condition that is highly susceptible to complete failure during high floodwaters. This portion of the levee is located adjacent to the Illinois River and has no tree buffer zones, except in a few small reaches, and has no slope protection against wave wash and current action. Therefore, the reaches which are found to be less than 1V on 2.5H slope should be rehabilitated to a slope of 1V on 2.5H for ease of construction and normal maintenance and operation. The rehabilitated slope should be protected against wave wash and current action by an 18-inch-thick graded riprap on the 6-inch-thick graded bedding stone. Riprap computation and size are shown on plates E-2 and E-3.

18-Inch Riprap

Percent Lighter by Weight	Weight of Stone in Pounds
100	400-200
50	180-90
15	50-25

A similar gradation used on various similar installations has served satisfactorily for several years. A bedding layer of 6-inch thickness will be of the following gradation:

U.S. Standard Sieve Size	Percent Passing (by Weight)
1-1/2 inch	85-100
3/4 inch	40-85
3/8 inch	15-45
No. 4	0-20
No. 8	0-5

d. Based on the available information, any attempt to predict with accuracy the existing geohydrologic conditions would be difficult and imprecise. The available subsurface profile for the undisturbed area immediately under the levees is sufficiently diverse so as to make generalized assumptions of overall permeability difficult. Based upon the quantity of shale in the geologic section, the reworked strip-mine spoil would probably reflect a permeability similar to a sandy clay. It appears that the quantity figures presented in Reference 1 are based upon data not sufficiently precise enough to dictate project specifications. Unfortunately, the critical issue of maintaining the interior water level of the project site at a given predetermined elevation depends upon these predictions. Accepting the assumptions that some hydrologic control mechanism and an external source of water are needed, the problem is exacerbated by the desire to prevent transference of certain fish species into the project area with any makeup water which may be required. The apparent solution is to design and establish some form of water point sufficiently close, productive, and flexible so as to be economically feasible. Such method would be to establish a well point or well system which taps into the groundwater provided by local areas of coarser material beneath the river. It would have to be understood, however, that any well point or well system design of given capacity may have to be incrementally increased in the future as hydrologic productivity and requirements dictate.

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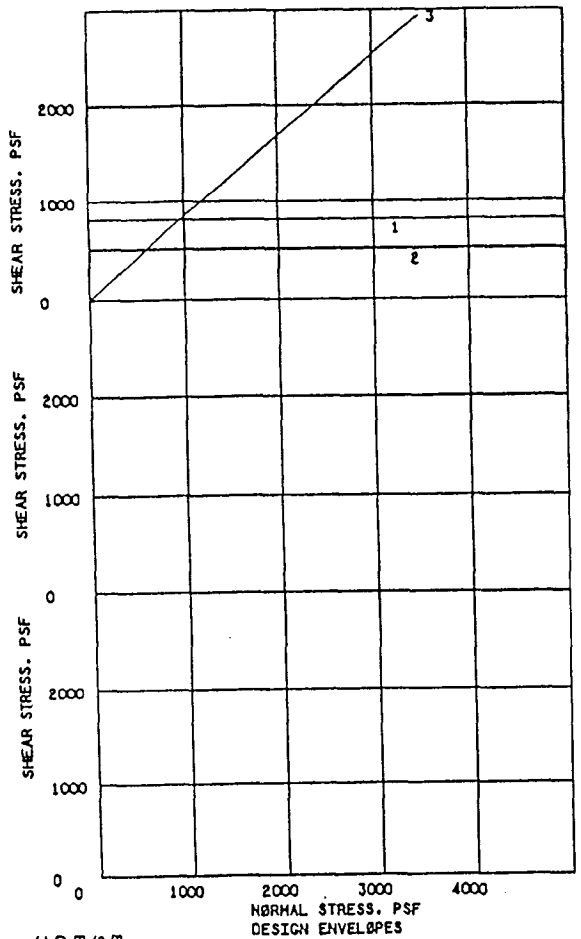
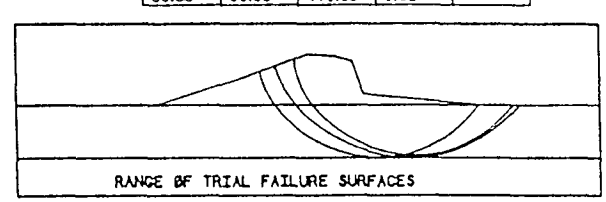


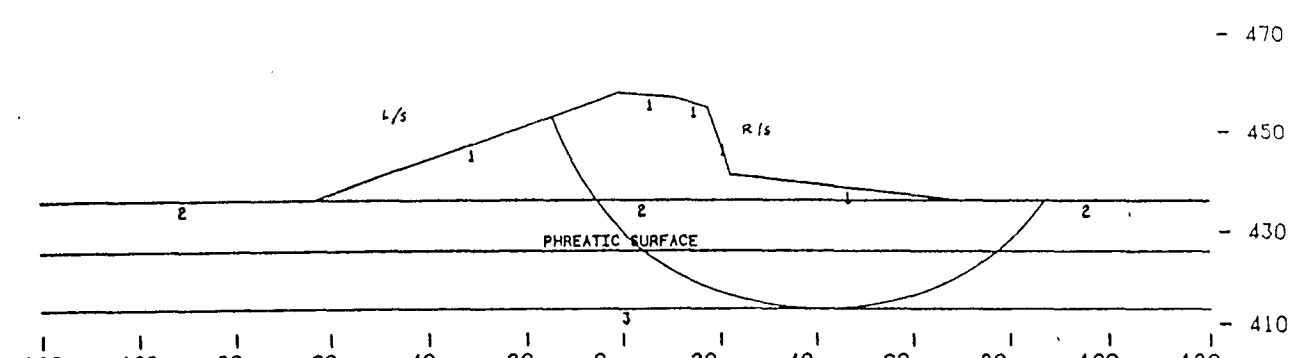
MATERIAL		SOIL WT. LBS./CUFT		SHEAR STRENGTH							
				Q		R		S		(R+S)/2	
		MOIST	SAT.	PHI DEGREES	COHESION PSF	PHI DEGREES	COHESION PSF	PHI DEGREES	COHESION PSF	PHI DEGREES	COHESION PSF
COMPACTED IMPER. FIL ELEV. 438 TO 458	1	115.00	118.00	0.00	800.00	0.00	0.00	0.00	0.00	0.00	0.00
CLAY FOUNDATION ELEV. 413 TO 438	2	110.00	115.00	0.00	500.00	0.00	0.00	0.00	0.00	0.00	0.00
WEATHERED SANDSTONE BELOW ELEV. 413	3	135.00	140.00	40.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

CIRCLE FAILURE SURFACE
RESULTS BY HARRIS-500
COMPUTER PROGRAM 741-H5-F424A
TANGENT TO ELEV 413.10
TRIAL ARCS

RADIUS OF CIRCLE	CENTER OF CIRCLE DISTANCE FROM ℄	CENTER OF CIRCLE ELEV	F.S. ℄= 0.00
58.00	41.00	471.00	1.81
50.00	28.00	483.00	1.79
50.00	43.00	484.00	1.71
45.00	38.00	458.00	1.71
60.00	40.00	473.00	1.81
58.00	38.00	471.00	1.82



NOTES
1- ANALYSES WERE RUN ACCORDING TO EM 1110-2-1902 DATED APRIL 1970
2- THE SIDE EARTH FORCE DIRECTION WAS TAKEN AS THE AVERAGE OF THE EMBANKMENT SLOPES IMMEDIATELY ADJACENT TO THE SLICE INTERFACE
3- PSI-SIESMIC COEFFICIENT USED IN ANALYSES



BANNER MARSH EMP PROJECT
SLOPE STABILITY ANALYSIS
END OF CONSTRUCTION CONDITION
CRITICAL CROSS SECTION 285+20
10 AUG 81

PLATE E-1

Subject	Date
BANNER MARSH EMP PROJECT, ILLINOIS	SEP 94
Computed by SAZ / Checked by	Sheet 1 of 1

RIPRAP COMPUTATION

W_R = 165 pcf = UNIT WEIGHT OF STONE

H = DESIGN WAVE = 3 FT.

G_s = 2.6

Levee R/S Slope = $\cot\alpha$ = 2.5

K_{rr} = Stability Coeff. = 4.37

REFERENCES

1. EM 1110-2-2300
2. ETL 1110-2-305

$$W_{50} = \frac{W_r H^3}{K_{rr}(G_s-1)^3 \cot\alpha}$$

$$W_{50} = \frac{165(3)^3}{4.37(2.6-1)^3\, 2.5} = 99.55 \approx 100 \text{ lbs}$$

$$W_{max} = 4W_{50} = 400 \text{ lbs}$$

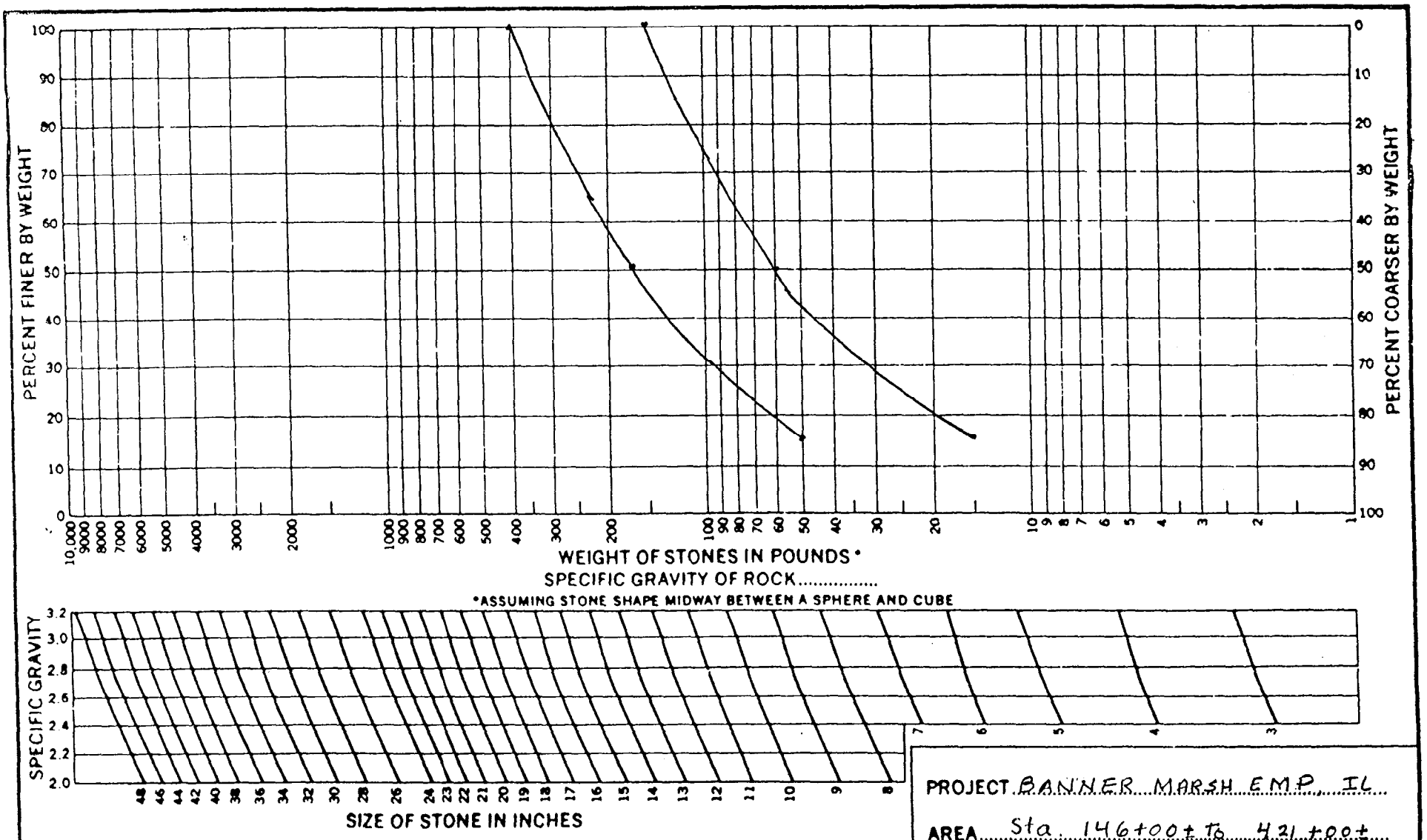
$$W_{min} = \frac{W_{50}}{8} = 12.5 \text{ lbs}$$

$$T \text{ (Layer thickness)} = 20\sqrt[3]{\frac{W_{50}}{W_R}}$$

$$= 20\sqrt[3]{\frac{100}{165}} = 17''$$

USE T = 18"

NCR Form 381b
1 Aug 80



PROJECT BANNER MARSH EMP, IL

AREA Sta. 146+00± To 421+00±

DATE SEP 1994

RIPRAP GRADATION CURVES

ENG FORM 4055
APR 67

WATER QUALITY

A

P

P

E

N

D

I

X

F

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT (R-11F)

BANNER MARSH STATE FISH AND WILDLIFE AREA

LA GRANGE POOL, ILLINOIS WATERWAY
RIVER MILES 138.5 THROUGH 143.9
FULTON AND PEORIA COUNTIES, ILLINOIS

APPENDIX F
WATER QUALITY

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UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT (R-11F)

BANNER MARSH STATE FISH AND WILDLIFE AREA

LA GRANGE POOL, ILLINOIS WATERWAY
RIVER MILES 138.5 THROUGH 143.9
FULTON AND PEORIA COUNTIES, ILLINOIS

APPENDIX F
WATER QUALITY

PURPOSE

The purpose of this appendix is twofold: to discuss the results of elutriate analyses performed on samples representative of the project construction areas and to address the results of baseline water quality monitoring. In order to evaluate the impacts of construction activities and to assess existing water quality conditions, sediment and water samples were collected at sites representative of the proposed design features. The elutriate test was performed in order to determine if newly exposed Banner Marsh sediments would release contaminants to the overlying water column upon inundation. Baseline water quality monitoring was performed in an effort to define present water quality conditions/problems. Upon project completion, a post-project water quality monitoring program will be implemented. Project induced water quality impacts will be determined by comparing pre-project and post-project data.

GENERAL

The surface water resources within the Banner Marsh complex are primarily a consequence of the surface mining activities which commenced during the late 1950's. Approximately 90 percent of the complex has been surface-mined for coal. Most of this mined land has been reclaimed to varying degrees, depending on reclamation laws in effect at the time. The current landscape is predominantly gently rolling pasture/grassland interspersed with numerous lakes/ponds of various sizes and shapes. The predominant surface water body is a final cut lake (6.5 miles long and up to 56 feet deep) which is a result of the last sweep in the mining operation. The steep slopes along several portions of this lake's shoreline allow for a relatively narrow littoral zone. Many of the shallow ponds throughout the complex are the result of reclamation activities. Under high Illinois River flows, the backwater complex is subject to flooding, which results in several of the isolated water bodies being joined.

As a result of mining, rock and shale overburden materials (gob) were placed on the land surface. These materials are primarily slightly acid to alkaline in nature. Portions of some roads within the complex have a gob base. It is thought that runoff from one of these roads has caused the low pH values observed in the past at Blue Lake (personal communication with John Ball). Lime has been added to this lake on occasion to increase the pH. Lime was last added in 1992, and since this time, no pH problems have been observed (personal communication with Bill Douglas).

The elutriate tests and baseline water quality monitoring accomplished to date have been performed primarily with the objective of determining the effect of mine spoils on water quality. Metals contamination and lowering of pH are of particular interest when addressing the water quality impacts of mine spoils.

ELUTRIATE TEST

Several of the enhancement alternatives identified for Banner Marsh involve excavation or grading activities for the purpose of increasing littoral zone area. An increase in the water surface elevation is also an enhancement feature being considered. In order to determine if newly exposed Banner Marsh sediments would release contaminants to the overlying water column upon inundation, an elutriate analysis was performed.

The version of the elutriate test utilized consisted of placing 50 ml of a well-mixed sediment sample and 200 ml of process water collected from a nearby lake into a bottle. The mixture was shaken for 30 minutes, allowed to settle for 30 minutes, and the supernatant was then drawn off and analyzed.

Water and sediment samples for the elutriate test were collected by Corps Water Quality and Sedimentation Section personnel on August 17, 1994. Sediment samples were collected at sites E-I138.6G, E-I138.5J and E-I138.9G (see plate 12 of the Definite Project Report). A duplicate sample was collected at site E-I138.5J as a quality control measure. Sediment samples were collected with a spade to a depth of 1 to 2 feet. The edge of each subsample was scraped away with a stainless steel spoon to prevent contamination. Each subsample was placed in a stainless steel basin and mixed to form a homogeneous composite sample. The mixture was then placed into appropriate sample bottles which were stored in an ice chest.

Water samples were collected at the surface with a plastic bucket just off shore from site E-I138.6G. An ambient water sample (BM-AW) and water for the elutriate test were collected at this location. Each sample was poured into an appropriate container, preserved as necessary, and stored in an ice chest. Water temperature, pH and conductivity measurements were taken at the time of sample collection.

Sediment and water samples were shipped to EIS Environmental Engineers, Inc., South Bend, Indiana, for chemical analysis. Chemical analyses were performed

according to the American Public Health Association, *et al.* (1992) or the U.S. Environmental Protection Agency (1983). Grain size analyses were performed by Corps Geotechnical Branch personnel in accordance with the U.S. Army Corps of Engineers (1970).

Results from ambient water and elutriate analyses are found in Table F-1. None of the reported concentrations exceeded Illinois General Use Water Quality Standards. All PCB, acid herbicide and chlorinated hydrocarbon pesticide concentrations were less than detection limits. All ambient water and most elutriate metals concentrations were also less than detection limits. Metals having detectable concentrations in at least one of the elutriate samples include cadmium, copper and zinc. The detected concentrations did not approach the state standard for these parameters. Of the remaining parameters listed, oil and grease, pH and total suspended exhibited elutriate values which varied noticeably from ambient water values. Elutriate oil and grease concentrations ranged from 6.4 mg/l to 11.6 mg/l, while the ambient water concentration was less than the detection limit of 1 mg/l. Elutriate pH values ranged from 6.91 to 7.34, while the ambient value was 8.26. Elutriate total suspended solids concentrations ranged from 76 mg/l to 300 mg/l, while the ambient concentration was 16 mg/l.

Grain size analysis results are found in Table F-2. Samples E-I138.6G and E-I138.9G were classified as sandy clay, while E-I138.5J was classified as clay. The quantity of material passing a #230 sieve ranged from 77.7 percent at E-I138.6G to 92.7 percent at E-I138.5J.

BASELINE MONITORING

The majority of Banner Marsh baseline water quality monitoring data were collected by Daily and Associates, Engineers, Inc., Peoria, Illinois, under contract to the Corps of Engineers. Data were also collected by the Corps of Engineers, Illinois Department of Conservation, and Illinois State Water Survey.

The sampling methodology used by Daily and Associates and the Corps of Engineers was the same. At each sampling station, a water sample was collected just below the surface. In general, sampling date, time, water depth, water velocity, wave height, air temperature, percent cloud cover, and wind speed and direction were recorded in the field. The following measurements also were taken in the field: pH, water temperature, dissolved oxygen, conductivity, Secchi disk depth and total alkalinity. Samples for laboratory analysis were placed on ice and transported to Daily Analytical Laboratories, Peoria, Illinois, or EIS Environmental Engineers, Inc., South Bend, Indiana. Sample collection/preservation and field/laboratory analytical procedures were performed according to the American Public Health Association, *et al.* (1989 or 1992) or the U.S. Environmental Protection Agency (1983).

In general, quality control procedures for the number of field duplicates, replicate analyses, spiked samples, control samples, and blanks run followed the guidelines of

the U.S. Environmental Protection Agency (1979) or U.S. Environmental Protection Agency (1986).

The results of baseline monitoring data collected by Daily and Associates and the Corps of Engineers are listed in Tables F-3 through F-9. Sampling commenced on June 27, 1990, at four sites: W-I141.0C, W-I140.8D, W-I140.1G and W-I139.1F. As project design features evolved, some sampling stations were dropped and others were added. The following stations were sampled in both 1991 and 1992: W-I142.6F, W-I141.0C, W-I139.7F, W-I139.1F and W-I138.8F. The location of each sampling site is shown on plate 12 of the DPR. From 1990 through 1992, samples were collected approximately biweekly from May or June through October. Samples were collected through the ice in February of 1993 and 1994.

The results from pH and dissolved oxygen measurements found in Tables F-3 through F-9 were compared against Illinois General Use Water Quality Standards. All pH values were within the accepted range of 6.5 to 9.0. The minimum pH value was 7.27 which occurred on July 11, 1990, at sites W-I140.8D and W-I140.1G. The maximum pH value was 8.60 which occurred on August 15, 1991, at site W-I139.1F. The Illinois General Use Water Quality Standard for dissolved oxygen states that the concentration shall not be less than 6.0 mg/l during at least 16 hours of any 24-hour period, nor shall it be less than 5.0 mg/l at any time. A review of the data indicate the dissolved oxygen concentration was below 5.0 mg/l on only four instances: on July 11, 1990, at W-I140.8D (1.40 mg/l) and W-I140.1G (4.00 mg/l); and at W-I139.7F on August 15, 1991 (4.30 mg/l) and August 29, 1991 (3.10 mg/l).

Other parameters of interest include specific conductance, Secchi disk depth, turbidity and total suspended solids. Specific conductance values indicate a relatively high concentration of dissolved solids at all but one of the sites sampled. A maximum value of 620 µmhos/cm at 25°C was measured at site W-I139.9K, while values ranged from 1,015 µmhos/cm at 25°C (W-I138.8F) to 2,660 µmhos/cm at 25°C (W-I141.0C) at the remaining sites. Secchi disk depth and turbidity are related parameters which are indicators of water clarity. High Secchi disk depth readings and low turbidity values are generally indicators of good water clarity. Suspended solids is related to these two parameters in that high suspended solids concentrations usually result in a reduction to water clarity. Site W-I139.1F exhibited the best water clarity. The average suspended solids, turbidity and Secchi disk values at this site were 2.6 mg/l, 3.7 NTU and 5.08 feet, respectively. Water clarity appeared to be most impacted at site W-I140.1G. The average suspended solids, turbidity and Secchi disk values at this site were 27.2 mg/l, 23.5 NTU and 1.23 feet, respectively.

In addition to the data described previously, a limited amount of baseline water quality data were also collected in three other studies. Fourteen lakes located throughout the marsh complex were surveyed once by Corps of Engineers personnel during the summer of 1994 for the purpose of determining pH. No low pH readings were observed. Values ranged from 7.80 to 9.90 (this value appeared to be due to algal photosynthesis). The Illinois Department of Conservation performed a dissolved oxygen profile at Shovel Lake and Johnson Lake (see plate 12) on July 6, 1992 (personal communication with Wayne Herndon). Lake depths at the sampling

sites were 33 feet and 50 feet, respectively. Both lakes exhibited chemical stratification. Dissolved oxygen concentrations near the surface of both lakes exceeded 8 mg/l and did not fall below the 5 mg/l standard until a depth of 16 feet at Shovel Lake and 14 feet at Johnson Lake. The final baseline water quality monitoring study was performed by the Illinois State Water Survey. Three Banner Marsh lakes (Shovel, Johnson and Wheel), as shown on plate 12, were included as part of their 1992 water quality assessment of 25 Illinois Lakes (Lin, 1993). Each lake was sampled once at its deepest location. Of the 25 lakes sampled, Shovel and Johnson were among the four lakes rated with the highest water quality based on their trophic state index.

DISCUSSION AND CONCLUSIONS

Since the surface water resources within the Banner Marsh complex are primarily a product of prior surface mining activities, it was anticipated pH would be the major water quality parameter impacted. Discussions with on-site Department of Conservation personnel revealed there were at least two bodies of water (Blue Lake and a small pond) within the complex which experienced acidity problems. According to Bill Douglas, site manager, lime added to Blue Lake and the small pond in the past (*circa* 1992) was successful in raising the pH. He also stated that during high water level periods, when several of the water bodies are joined, the pH problem was not evident. The pH of Blue Lake (see plate 12) during the Corps of Engineers' 1994 study was 8.04, which is well within the acceptable range. In addition to the two lakes, there was also a problem with acidic leachate originating from a gob pile (see plate 12). Lime was added to the gob pile and it has since been planted to warm season grasses, which are doing well. When considering baseline water quality monitoring results coupled with past observations made by on-site personnel, it appears a water level increase would not result in any pH problems within the complex. In fact, any future increase in water level would probably allow for more dilution, thus improving the pH of any impaired water bodies.

Heavy metals are also of concern when addressing the potential contaminants associated with past mining operations. In order to determine if newly exposed Banner Marsh sediments would release heavy metals to the overlying water column upon inundation, an elutriate analysis was performed. The elutriate test results indicate there would not be a significant release of heavy metals to the overlying water column. Most metals were not detected. Metals which were detected occurred at acceptable concentrations (they did not approach applicable state standards).

In addition to pH and heavy metals, several other parameters were analyzed in the elutriate test. Of these parameters, only oil and grease, pH and total suspended solids exhibited elutriate values which varied noticeably from background levels. These values did not occur at levels which would adversely impact aquatic life. All oil and grease concentrations were below the Illinois Secondary Contact and Indigenous Aquatic Life Standard of 15 mg/l (there is no Illinois General Use Water Quality Standard for oil and grease). All pH values were within the state standard range of

6.5 to 9.0. There is no Illinois General Use Water Quality Standard for total suspended solids; however, the observed elutriate concentrations are comparable to values seen in the Illinois River during periods of high flow.

Baseline monitoring results indicate water quality within the Banner Marsh complex is adequate to support indigenous aquatic life during most periods. On occasion, during the summer, the dissolved oxygen concentration fell below the state standard; however, no fish kills have been observed (personal communication with Bill Douglas). In the past, localized pH problems were occasionally encountered but it appears management actions have remedied these. Water clarity within the complex is generally quite good as evidenced by Secchi disk and turbidity values. Specific conductance values are relatively high when compared to Illinois River values; however, judging by the abundance of aquatic life present, there appears to be little or no impact.

Elutriate analysis results indicate that grading or excavation activities would result in an increase in total suspended solids concentrations and a decrease in pH values. It is anticipated these changes would be temporary in nature and would not be of such magnitude to significantly impact aquatic life.

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TABLE F-1. Elutriate (E-I138.6G, E-I138.5J and E-I138.9G) and ambient water (BM-AW) analysis results from samples collected at Banner Marsh on August 17, 1994

PARAMETER	UNITS	STATE * STANDARD	LOCATION E-I138.6G	E-I138.5J	E-I138.9G	BM-AW
Ammonia Nitrogen	mg/l	**	<0.05	<0.05	<0.05	<0.01
BOD	mg/l	-	<2	<2	<6	<2
Total Organic Carbon	mg/l	-	4.4	4.3	3.8	3.5
Oil and Grease	mg/l	-	10.4	6.4	11.6	<1.0
pH	SU	6.5-9.0	7.22	7.34	6.91	8.26
Temperature	°C	-	-	-	-	26.6
Specific Conductance	****	-	-	-	-	1,134
Total Suspended Solids	mg/l	-	300	76	300	16
Total Volatile Solids	mg/l	-	135	250	340	140
Arsenic	mg/l	0.360	<0.005	<0.005	<0.005	<0.005
Cadmium	mg/l	0.02739***	<0.003	<0.003	0.006	<0.003
Chromium	mg/l	-	<0.01	<0.01	<0.01	-
Hexavalent Chromium	mg/l	0.016	-	-	-	<0.01
Copper	mg/l	0.04203***	<0.01	0.014	0.014	<0.01
Lead	mg/l	0.100	<0.01	<0.01	<0.01	<0.01
Mercury	mg/l	0.0005	<0.0002	<0.0002	<0.0002	<0.0002
Zinc	mg/l	1.0	0.036	0.015	0.037	<0.01
Total PCBs	mg/l	-	<0.0008	<0.0008	<0.0008	<0.0008
2,4-D	mg/l	-	<0.0005	<0.0005	<0.0005	<0.0005
2,4,5-TP	mg/l	-	<0.0005	<0.0005	<0.0005	<0.0005
Aldrin	mg/l	-	<0.00005	<0.00005	<0.00005	<0.00005
Lindane	mg/l	-	<0.00005	<0.00005	<0.00005	<0.00005
Chlordane	mg/l	-	<0.0020	<0.0020	<0.0020	<0.0020
DDD	mg/l	-	<0.0001	<0.0001	<0.0001	<0.0001
DDE	mg/l	-	<0.0001	<0.0001	<0.0001	<0.0001
DDT	mg/l	-	<0.0001	<0.0001	<0.0001	<0.0001
Dieldrin	mg/l	-	<0.00005	<0.00005	<0.00005	<0.00005
Endrin	mg/l	-	<0.00005	<0.00005	<0.00005	<0.00005
Heptachlor	mg/l	-	<0.0001	<0.0001	<0.0001	<0.0001
Heptachlor Epoxide	mg/l	-	<0.0001	<0.0001	<0.0001	<0.0001
Methoxychlor	mg/l	-	<0.0001	<0.0001	<0.0001	<0.0001
Toxaphene	mg/l	-	<0.0026	<0.0026	<0.0026	<0.0026

* Illinois General Use Water Quality Standard

** Ammonia nitrogen shall never exceed 15 mg/l. If ammonia nitrogen is less than 15 mg/l and greater than or equal to 1.5 mg/l, then un-ionized ammonia nitrogen shall not exceed 0.04 mg/l

*** Acute standard calculated by assuming a hardness of 250 mg/l

**** µmhos/cm at 25°C

TABLE F-2. Grain size analysis results from sediment samples collected at Banner Marsh on August 17, 1994.

Percent Finer By Weight

SAMPLE NUMBERS:		E-I138.6G	E-I138.5J	E-I138.9G	E-I138.5J (Dup.)
S	**3/8"**	100.0	100.0	100.0	100.0
I	**#4**	100.0	100.0	99.4	100.0
E	**#8**	100.0	100.0	97.9	100.0
V	**#16**	99.4	99.8	96.8	99.7
E	**#30**	98.5	99.7	95.5	99.5
S	**#40**	97.3	99.4	94.5	99.2
I	**#50**	94.3	98.7	92.8	98.6
Z	**#70**	89.3	97.5	90.1	97.5
E	**#100**	84.5	96.1	87.0	96.1
S	**#230**	77.7	92.7	79.3	91.6
	CLASSIFICATION:	CL, SANDY CLAY	CL, CLAY	CL, SANDY CLAY	CL, CLAY

Notes:

1. Visual classification of soils is in accordance with "The Unified Soils Classification System (USCS)."

2. Laboratory testing was performed in accordance with EM 1110-2-1906, dated 30 Nov 70, revised 1 May 80 and 20 Aug 86. All samples were oven dried at 110°C. Sample designated E-I138.5J (Dup.) is a duplicate sample.

Table F-3. Baseline water quality monitoring results from samples collected at site W-I141.0C

DATE	WATER DEPTH (FT)	VELOCITY (FT/SEC)	WAVE HEIGHT (FT)	AIR TEMP. (°C)	CLOUD COVER (%)	WIND SPEED (MPH)
6/27/90	4.91	0.00	0.00	26	80	-
7/11/90	4.75	-	0.00	21	100	2
7/26/90	5.25	-	0.20	30	30	6
8/9/90	4.50	-	0.00	24	0	-
8/23/90	8.00	-	0.00	28	80	1
9/7/90	4.00	-	0.00	29	100	3
9/17/90	4.00	-	0.30	61	30	10
10/2/90	3.50	-	0.50	29	0	7
10/15/90	8.60	-	-	16	3	-
10/29/90	5.00	-	0.16	16	0	13
5/21/91	7.00	-	-	-	-	-
6/6/91	7.00	-	-	-	-	-
6/21/91	7.00	-	-	-	-	-
7/4/91	9.00	-	-	-	-	-
7/18/91	5.00	-	-	-	-	-
8/1/91	8.00	-	-	-	-	-
8/15/91	8.00	-	-	-	-	-
8/29/91	7.00	-	-	-	-	-
9/12/91	7.00	-	-	-	-	-
9/26/91	8.00	-	-	-	-	-
10/10/91	8.00	-	-	-	-	-
10/24/91	8.00	-	-	-	-	-
5/13/92	10.00	-	-	-	-	-
5/27/92	9.00	-	-	-	-	-
6/11/92	10.00	-	-	-	-	-
6/25/92	10.00	-	-	-	-	-
7/8/92	10.00	-	-	-	-	-
7/23/92	10.00	-	-	-	-	-
8/6/92	11.00	-	-	-	-	-
8/19/92	10.00	-	-	-	-	-
9/2/92	10.00	-	-	-	-	-
9/17/92	10.00	-	-	-	-	-
10/1/92	9.00	-	-	-	-	-
10/14/92	8.00	-	-	-	-	-
2/1/93	6.05	-	-	1	5	6
2/15/94	11.35	0.042	-	2	5	10
MIN.	3.50	0.00	0.00	1	0	1
MAX.	11.35	0.04	0.50	61	100	13
AVG.	7.66	0.02	0.13	23	36	6

Table F-3 (Cont.). Baseline water quality monitoring results from samples collected at W-I141.0C

DATE	WIND DIRECTION	WATER TEMP. (°C)	DISSOLVED OXYGEN (MG/L)	pH (SU)	TOTAL ALKALINITY (MG/L as $CaCO_3$)
6/27/90	-	29.0	9.80	7.89	230
7/11/90	N	28.0	7.20	7.67	200
7/26/90	S	27.0	9.30	8.01	200
8/9/90	-	25.0	6.90	7.78	230
8/23/90	SE	28.0	8.40	8.05	230
9/7/90	S	28.5	7.90	7.87	230
9/17/90	N	22.1	7.50	7.84	250
10/2/90	-	21.0	7.90	7.74	290
10/15/90	SE	14.0	7.40	7.82	300
10/29/90	SE	11.0	9.20	7.87	300
5/21/91	-	-	8.40	7.90	280
6/6/91	-	-	7.20	7.90	250
6/21/91	-	-	8.20	7.90	230
7/4/91	-	-	7.00	8.00	250
7/18/91	-	-	7.60	7.90	220
8/1/91	-	-	6.80	8.10	230
8/15/91	-	-	6.50	7.90	220
8/29/91	-	-	8.10	8.10	210
9/12/91	-	-	7.60	8.00	200
9/26/91	-	-	7.60	7.70	230
10/10/91	-	-	8.50	7.80	230
10/24/91	-	-	9.10	7.80	230
5/13/92	-	-	7.40	7.90	260
5/27/92	-	-	7.00	7.90	250
6/11/92	-	-	7.60	8.00	250
6/25/92	-	-	6.20	7.90	230
7/8/92	-	-	7.40	7.90	200
7/23/92	-	-	6.60	8.10	190
8/6/92	-	-	7.40	8.20	160
8/19/92	-	-	6.50	7.70	190
9/2/92	-	-	7.70	7.80	190
9/17/92	-	-	8.20	7.90	190
10/1/92	-	-	8.20	7.70	210
10/14/92	-	-	9.50	7.30	220
2/1/93	N	5.8	14.29	7.47	-
2/15/94	NW	3.2	14.08	7.72	219

MIN.	-	3.2	6.20	7.30	160
MAX.	-	29.0	14.29	8.20	300
AVG.	-	20.2	8.12	-	229

Table F-3 (Cont.). Baseline water quality monitoring results from samples collected at W-I141.0C

DATE	SPECIFIC CONDUCTANCE (µMHOS/CM @ 25°C)	SECCHI DISK DEPTH (FT)	TURBIDITY (NTU)	SUSPENDED SOLIDS (MG/L)
6/27/90	1930	2.66	5.9	8.0
7/11/90	1650	1.22	11.0	21.0
7/26/90	1850	1.36	9.0	10.0
8/9/90	2070	0.77	16.0	27.0
8/23/90	1990	1.72	5.8	10.0
9/7/90	1990	2.15	13.0	9.0
9/17/90	2070	1.51	30.0	14.0
10/2/90	2130	2.13	15.0	8.0
10/15/90	2220	1.84	35.0	16.0
10/29/90	2660	2.07	20.0	11.0
5/21/91	1690	-	-	-
6/6/91	1690	-	-	-
6/21/91	2030	-	-	-
7/4/91	2150	-	-	-
7/18/91	2040	-	-	-
8/1/91	1730	-	-	-
8/15/91	2180	-	-	-
8/29/91	2180	-	-	-
9/12/91	2230	-	-	-
9/26/91	2320	-	-	-
10/10/91	2160	-	-	-
10/24/91	2130	-	-	-
5/13/92	2220	-	-	-
5/27/92	2170	-	-	-
6/11/92	2260	-	-	-
6/25/92	2210	-	-	-
7/8/92	2180	-	-	-
7/23/92	2120	-	-	-
8/6/92	1870	-	-	-
8/19/92	1790	-	-	-
9/2/92	1820	-	-	-
9/17/92	1750	-	-	-
10/1/92	1380	-	-	-
10/14/92	2070	-	-	-
2/1/93	1624	-	-	-
2/15/94	1584	-	3.0	6.6

MIN.	1380	0.77	3.0	6.6
MAX.	2660	2.66	35.0	27.0
AVG.	2004	1.74	14.9	12.8

Table F-3 (Cont.). Baseline water quality monitoring results from samples collected at W-I141.0C

DATE	CHLOROPHYLL a (MG/M3)	CHLOROPHYLL b (MG/M3)	CHLOROPHYLL c (MG/M3)	PHEOPHYTIN a (MG/M3)
6/27/90	2.0	2.0	2.0	2.0
7/11/90	10.0	5.0	4.0	2.0
7/26/90	5.0	2.0	2.0	2.0
8/9/90	4.0	2.0	2.0	2.0
8/23/90	9.0	2.0	2.0	3.0
9/7/90	4.0	3.0	2.0	2.0
9/17/90	5.0	2.0	2.0	2.0
10/2/90	2.0	2.0	2.0	2.0
10/15/90	4.0	16.0	2.0	2.0
10/29/90	16.0	2.0	2.0	25.0
5/21/91	-	-	-	-
6/6/91	-	-	-	-
6/21/91	-	-	-	-
7/4/91	-	-	-	-
7/18/91	-	-	-	-
8/1/91	-	-	-	-
8/15/91	-	-	-	-
8/29/91	-	-	-	-
9/12/91	-	-	-	-
9/26/91	-	-	-	-
10/10/91	-	-	-	-
10/24/91	-	-	-	-
5/13/92	-	-	-	-
5/27/92	-	-	-	-
6/11/92	-	-	-	-
6/25/92	-	-	-	-
7/8/92	-	-	-	-
7/23/92	-	-	-	-
8/6/92	-	-	-	-
8/19/92	-	-	-	-
9/2/92	-	-	-	-
9/17/92	-	-	-	-
10/1/92	-	-	-	-
10/14/92	-	-	-	-
2/1/93	-	-	-	-
2/15/94	2.3	1.3	1.6	2.7
MIN.	2.0	1.3	1.6	2.0
MAX.	16.0	16.0	4.0	25.0
AVG.	5.8	3.6	2.1	4.2

Table F-4. Baseline water quality monitoring results from samples collected at site W-I140.8D

DATE	WATER DEPTH (FT)	VELOCITY (FT/SEC)	WAVE HEIGHT (FT)	AIR TEMP. (°C)	CLOUD COVER (%)	WIND SPEED (MPH)
6/27/90	2.66	0.02	0.00	28	10	1
7/11/90	9.00	-	0.00	19	100	2
7/26/90	7.00	-	0.00	26	90	9
8/9/90	8.50	-	0.20	25	10	2
8/23/90	9.00	-	0.00	28	80	2
9/7/90	9.70	-	0.00	29	95	3
9/17/90	8.50	-	-	70	50	10
10/4/90	5.50	-	-	17	0	7
10/15/90	6.00	-	-	21	15	-
10/29/90	4.20	-	0.20	18	0	18
MIN.	2.66	0.02	0.00	16.50	0.00	1.00
MAX.	9.70	0.02	0.20	70.00	100.00	18.00
AVG.	7.01	0.02	0.06	28.00	45.00	6.00

Table F-4 (Cont.). Baseline water quality monitoring results from samples collected at W-I140.8D

DATE	WIND DIRECTION	WATER TEMP. (°C)	DISSOLVED OXYGEN (MG/L)	pH (SU)	TOTAL ALKALINITY (MG/L as $CaCO_3$)
6/27/90	N	27.0	7.90	7.82	140
7/11/90	N	27.0	1.40	7.27	140
7/26/90	S	26.0	9.10	7.87	140
8/9/90	N	27.5	6.70	7.88	150
8/23/90	S	28.0	6.50	7.79	160
9/7/90	S	29.0	7.50	8.14	150
9/17/90	N	22.0	6.30	7.83	152
10/4/90	SE	17.0	6.10	7.60	190
10/15/90	-	13.5	8.20	8.06	190
10/29/90	SE	10.0	7.40	7.90	180
MIN.	-	10.0	1.40	7.27	140
MAX.	-	29.0	9.10	8.14	190
AVG.	-	22.7	6.71	-	159

Table F-4 (Cont.). Baseline water quality monitoring results from samples collected at W-I140.8D

DATE	SPECIFIC CONDUCTANCE (µMHOS/CM @ 25°C)	SECCHI DISK DEPTH (FT)	TURBIDITY (NTU)	SUSPENDED SOLIDS (MG/L)
6/27/90	620	0.94	5.9	10.0
7/11/90	510	2.33	5.0	6.0
7/26/90	460	3.00	4.0	6.0
8/9/90	490	2.00	4.0	4.0
8/23/90	460	1.64	3.6	10.0
9/7/90	440	3.21	7.5	4.0
9/17/90	460	1.77	25.0	14.0
10/4/90	470	2.26	18.0	12.0
10/15/90	440	2.19	16.0	10.0
10/29/90	520	3.71	2.8	2.0
MIN.	440	0.9	2.8	2.0
MAX.	620	3.7	25.0	14.0
AVG.	487	2.3	9.2	7.8

Table F-4 (Cont.). Baseline water quality monitoring results from samples collected at W-I140.8D

DATE	CHLOROPHYLL a (MG/M3)	CHLOROPHYLL b (MG/M3)	CHLOROPHYLL c (MG/M3)	PHEOPHYTIN a (MG/M3)
6/27/90	6.0	2.0	2.0	2.0
7/11/90	4.0	4.0	3.0	9.0
7/26/90	7.0	4.0	2.0	12.0
8/9/90	8.0	2.0	2.0	2.0
8/23/90	9.0	2.0	2.0	2.0
9/7/90	4.0	2.0	2.0	2.0
9/17/90	8.0	4.0	2.0	2.0
10/4/90	7.0	7.0	2.0	4.0
10/15/90	2.0	2.0	2.0	6.0
10/29/90	7.0	2.0	2.0	19.0
MIN.	2.0	2.0	2.0	2.0
MAX.	9.0	7.0	3.0	19.0
AVG.	6.2	3.1	2.1	6.0

Table F-5. Baseline water quality monitoring results from samples collected at site W-I139.1F

DATE	WATER DEPTH (FT)	VELOCITY (FT/SEC)	WAVE HEIGHT (FT)	AIR TEMP. (°C)	CLOUD COVER (%)	WIND SPEED (MPH)
6/27/90	4.00	0.00	0.25	32	20	2
7/11/90	5.00	-	0.20	20	100	2
7/26/90	5.00	-	0.30	26	90	7
8/9/90	4.00	-	0.00	25	10	2
8/23/90	5.50	-	0.00	28	80	2
9/7/90	7.30	-	0.00	29	100	3
9/17/90	6.00	-	0.30	62	60	12
10/4/90	4.00	-	0.50	20	10	12
10/15/90	4.00	-	0.30	18	70	8
10/29/90	6.00	-	0.20	20	0	17
5/21/91	4.00	-	-	-	-	-
6/6/91	11.00	-	-	-	-	-
6/21/91	6.00	-	-	-	-	-
7/4/91	8.00	-	-	-	-	-
7/18/91	3.00	-	-	-	-	-
8/1/91	11.00	-	-	-	-	-
8/15/91	16.00	-	-	-	-	-
8/29/91	16.00	-	-	-	-	-
9/12/91	7.00	-	-	-	-	-
9/26/91	10.00	-	-	-	-	-
10/10/91	4.00	-	-	-	-	-
10/24/91	14.00	-	-	-	-	-
5/13/92	17.00	-	-	-	-	-
5/27/92	17.00	-	-	-	-	-
6/11/92	17.00	-	-	-	-	-
6/25/92	8.00	-	-	-	-	-
7/8/92	8.00	-	-	-	-	-
7/23/92	18.00	-	-	-	-	-
8/6/92	13.00	-	-	-	-	-
8/19/92	8.00	-	-	-	-	-
9/2/92	14.00	-	-	-	-	-
9/17/92	13.00	-	-	-	-	-
10/1/92	14.00	-	-	-	-	-
10/14/92	8.00	-	-	-	-	-
2/15/94	6.65	0.037	-	0	2	10
MIN.	3.0	0.0	0.0	0.0	0.0	2.0
MAX.	18.0	0.0	0.5	62.0	100.0	17.0
AVG.	9.2	0.0	0.2	25.4	49.3	7.0

Table F-5 (Cont.). Baseline water quality monitoring results from samples collected at W-I139.1F

DATE	WIND DIRECTION	WATER TEMP. (°C)	DISSOLVED OXYGEN (MG/L)	pH (SU)	TOTAL ALKALINITY (MG/L as $CaCO_3$)
6/27/90	N	29.0	8.10	8.05	110
7/11/90	N	28.0	6.00	7.79	100
7/26/90	S	27.0	8.10	7.99	100
8/9/90	N	27.0	6.70	7.92	100
8/23/90	S	28.0	6.20	7.89	100
9/7/90	S	31.0	7.10	8.08	100
9/17/90	N	22.2	7.20	8.11	100
10/4/90	SE	18.5	6.50	8.01	140
10/15/90	SW	14.0	8.90	8.31	110
10/29/90	SE	11.0	9.50	8.35	110
5/21/91	-	-	9.10	7.80	130
6/6/91	-	-	7.60	8.10	110
6/21/91	-	-	7.70	8.00	79
7/4/91	-	-	7.70	8.20	84
7/18/91	-	-	7.40	8.00	77
8/1/91	-	-	7.30	8.30	100
8/15/91	-	-	7.80	8.60	60
8/29/91	-	-	6.50	8.20	54
9/12/91	-	-	6.60	8.00	60
9/26/91	-	-	8.60	8.20	60
10/10/91	-	-	9.30	8.20	70
10/24/91	-	-	9.40	8.20	70
5/13/92	-	-	8.00	8.20	140
5/27/92	-	-	8.00	8.10	110
6/11/92	-	-	8.10	8.00	100
6/25/92	-	-	8.10	-	80
7/8/92	-	-	7.20	7.60	90
7/23/92	-	-	7.90	8.10	100
8/6/92	-	-	8.10	8.10	95
8/19/92	-	-	7.60	7.90	120
9/2/92	-	-	7.80	8.20	110
9/17/92	-	-	7.90	8.10	110
10/1/92	-	-	7.60	7.90	120
10/14/92	-	-	7.80	8.00	120
2/15/94	NW	4.8	11.04	7.89	170
MIN.	-	4.8	6.00	7.60	54
MAX.	-	31.0	11.04	8.60	170
AVG.	-	21.9	7.84	-	100

Table F-5 (Cont.). Baseline water quality monitoring results from samples collected at W-I139.1F

DATE	SPECIFIC CONDUCTANCE (µMHOS/CM @ 25°C)	SECCHI DISK DEPTH (FT)	TURBIDITY (NTU)	SUSPENDED SOLIDS (MG/L)
6/27/90	1570	4.00	1.0	2.0
7/11/90	1430	4.98	2.3	3.0
7/26/90	1370	5.00	2.0	2.0
8/9/90	1370	4.00	4.0	2.0
8/23/90	1320	5.51	1.0	4.0
9/7/90	1300	7.33	6.4	2.0
9/17/90	1310	6.00	10.0	2.0
10/4/90	1340	4.00	5.3	3.0
10/15/90	1320	4.00	2.8	2.0
10/29/90	1530	6.00	1.9	2.0
5/21/91	1220	-	-	-
6/6/91	1190	-	-	-
6/21/91	1410	-	-	-
7/4/91	1520	-	-	-
7/18/91	1460	-	-	-
8/1/91	1310	-	-	-
8/15/91	1550	-	-	-
8/29/91	1570	-	-	-
9/12/91	1620	-	-	-
9/26/91	1620	-	-	-
10/10/91	1490	-	-	-
10/24/91	1260	-	-	-
5/13/92	1770	-	-	-
5/27/92	1670	-	-	-
6/11/92	1760	-	-	-
6/25/92	1770	-	-	-
7/8/92	1740	-	-	-
7/23/92	1690	-	-	-
8/6/92	1770	-	-	-
8/19/92	1480	-	-	-
9/2/92	1520	-	-	-
9/17/92	1450	-	-	-
10/1/92	1160	-	-	-
10/14/92	1230	-	-	-
2/15/94	1204		4.0	4.7

MIN.	1160	4.00	1.0	2.0
MAX.	1770	7.33	10.0	4.7
AVG.	1466	5.08	3.7	2.6

Table F-5 (Cont.). Baseline water quality monitoring results from samples collected at W-I139.1F

DATE	CHLOROPHYLL a (MG/M3)	CHLOROPHYLL b (MG/M3)	CHLOROPHYLL c (MG/M3)	PHEOPHYTIN a (MG/M3)
6/27/90	2.0	2.0	2.0	2.0
7/11/90	8.0	3.0	2.0	6.0
7/26/90	11.0	14.0	7.0	51.0
8/9/90	9.0	2.0	2.0	2.0
8/23/90	3.0	2.0	2.0	2.0
9/7/90	2.0	2.0	2.0	2.0
9/17/90	2.0	2.0	2.0	7.0
10/4/90	2.0	2.0	2.0	2.0
10/15/90	2.0	2.0	2.0	2.0
10/29/90	2.0	2.0	2.0	2.0
5/21/91	-	-	-	-
6/6/91	-	-	-	-
6/21/91	-	-	-	-
7/4/91	-	-	-	-
7/18/91	-	-	-	-
8/1/91	-	-	-	-
8/15/91	-	-	-	-
8/29/91	-	-	-	-
9/12/91	-	-	-	-
9/26/91	-	-	-	-
10/10/91	-	-	-	-
10/24/91	-	-	-	-
5/13/92	-	-	-	-
5/27/92	-	-	-	-
6/11/92	-	-	-	-
6/25/92	-	-	-	-
7/8/92	-	-	-	-
7/23/92	-	-	-	-
8/6/92	-	-	-	-
8/19/92	-	-	-	-
9/2/92	-	-	-	-
9/17/92	-	-	-	-
10/1/92	-	-	-	-
10/14/92	-	-	-	-
2/15/94	2.3	1.3	1.6	2.7

MIN.	2.0	1.3	1.6	2.0
MAX.	11.0	14.0	7.0	51.0
AVG.	4.1	3.1	2.4	7.3

Table F-6. Baseline water quality monitoring results from samples collected at site W-I140.1G

DATE	WATER DEPTH (FT)	VELOCITY (FT/SEC)	WAVE HEIGHT (FT)	AIR TEMP. (°C)	CLOUD COVER (%)	WIND SPEED (MPH)
6/27/90	2.58	0.05	0.50	32	10	3
7/11/90	3.00	-	0.00	21	100	2
7/26/90	3.00	-	0.00	28	40	7
8/9/90	4.50	-	0.00	24	0	1
8/23/90	4.50	-	0.00	28	80	2
9/7/90	2.80	-	0.00	28	95	-
9/17/90	2.00	-	0.30	68	80	10
10/4/90	4.50	-	-	21	90	12
10/15/90	3.50	-	-	20	15	-
10/29/90	2.00	-	-	21	-	17
MIN.	2.0	-	0.0	20.0	0.0	1.0
MAX.	4.5	-	0.5	68.0	100.0	17.0
AVG.	3.24	-	0.11	29.00	56.67	6.75

Table F-6 (Cont.). Baseline water quality monitoring results from samples collected at W-I140.1G

DATE	WIND DIRECTION	WATER TEMP. (°C)	DISSOLVED OXYGEN (MG/L)	pH (SU)	TOTAL ALKALINITY (MG/L as $CaCO_3$)
6/27/90	N	27.0	5.80	7.48	240
7/11/90	N	25.0	4.00	7.27	210
7/26/90	S	28.0	10.00	7.75	220
8/9/90	N	24.0	6.50	7.73	220
8/23/90	S	28.0	7.40	7.71	240
9/7/90	-	28.0	6.60	7.75	250
9/17/90	N	21.1	7.80	7.90	250
10/4/90	SE	18.0	6.30	8.00	290
10/15/90	-	14.0	8.90	7.91	270
10/29/90	SE	10.5	8.40	7.75	320
MIN.	-	10.5	4.00	7.27	210
MAX.	-	28.0	10.00	8.00	320
AVG.	-	22.36	7.17	-	251

Table F-6 (Cont.). Baseline water quality monitoring results from samples collected at W-I140.1G

DATE	SPECIFIC CONDUCTANCE (µMHOS/CM @ 25°C)	SECCHI DISK DEPTH (FT)	TURBIDITY (NTU)	SUSPENDED SOLIDS (MG/L)
6/27/90	1820	1.64	10.0	17.0
7/11/90	1480	0.67	28.0	53.0
7/26/90	1500	1.38	10.0	17.0
8/9/90	1890	0.85	14.0	17.0
8/23/90	1820	0.75	7.0	22.0
9/7/90	1900	0.62	50.0	50.0
9/17/90	1900	2.58	26.0	31.0
10/4/90	1960	0.82	30.0	22.0
10/15/90	1890	1.61	20.0	19.0
10/29/90	2260	1.35	40.0	24.0
MIN.	1480	0.62	7.0	17.0
MAX.	2260	2.58	50.0	53.0
AVG.	1842	1.23	23.5	27.2

Table F-6 (Cont.). Baseline water quality monitoring results from samples collected at W-I140.1G

DATE	CHLOROPHYLL a (MG/M3)	CHLOROPHYLL b (MG/M3)	CHLOROPHYLL c (MG/M3)	PHEOPHYTIN a (MG/M3)
6/27/90	4.0	2.0	2.0	2.0
7/11/90	14.0	7.0	3.0	2.0
7/26/90	28.0	2.0	5.0	3.0
8/9/90	4.0	2.0	2.0	9.0
8/23/90	35.0	7.0	2.0	2.0
9/7/90	5.0	2.0	2.0	2.0
9/17/90	13.0	2.0	2.0	2.0
10/4/90	12.0	4.0	2.0	16.0
10/15/90	30.0	2.0	2.0	4.0
10/29/90	2.0	2.0	2.0	2.0
MIN.	2.0	2.0	2.0	2.0
MAX.	35.0	7.0	5.0	16.0
AVG.	14.7	3.2	2.4	4.4

Table F-7. Baseline water quality monitoring results from samples collected at site W-I142.6F

DATE	WATER DEPTH (FT)	VELOCITY (FT/SEC)	WAVE HEIGHT (FT)	AIR TEMP. (°C)	CLOUD COVER (%)	WIND SPEED (MPH)
5/21/91	9.00	-	-	-	-	-
6/6/91	9.00	-	-	-	-	-
6/21/91	8.00	-	-	-	-	-
7/4/91	10.00	-	-	-	-	-
7/18/91	9.00	-	-	-	-	-
8/1/91	9.00	-	-	-	-	-
8/15/91	9.00	-	-	-	-	-
8/29/91	7.00	-	-	-	-	-
9/12/91	8.00	-	-	-	-	-
9/26/91	8.00	-	-	-	-	-
10/10/91	9.00	-	-	-	-	-
10/24/91	9.00	-	-	-	-	-
5/13/92	10.00	-	-	-	-	-
5/27/92	9.00	-	-	-	-	-
6/11/92	7.00	-	-	-	-	-
6/25/92	8.00	-	-	-	-	-
7/8/92	8.00	-	-	-	-	-
7/23/92	9.00	-	-	-	-	-
8/6/92	10.00	-	-	-	-	-
8/19/92	9.00	-	-	-	-	-
9/2/92	10.00	-	-	-	-	-
9/17/92	9.00	-	-	-	-	-
10/1/92	8.00	-	-	-	-	-
10/14/92	9.00	-	-	-	-	-
2/1/93	4.90	-	-	1	5	6
2/15/94	9.40	-	0.0	1	5	6
MIN.	4.90	-	-	1	5	6
MAX.	10.00	-	-	1	5	6
AVG.	8.63	-	-	1	5	6

Table F-7 (Cont.). Baseline water quality monitoring results from samples collected at W-I142.6F

DATE	WIND DIRECTION	WATER TEMP. (°C)	DISSOLVED OXYGEN (MG/L)	pH (SU)	TOTAL ALKALINITY (MG/L as $CaCO_3$)
5/21/91	-	-	9.00	7.80	210
6/6/91	-	-	7.20	8.00	200
6/21/91	-	-	7.80	7.90	180
7/4/91	-	-	7.60	8.10	200
7/18/91	-	-	6.60	7.80	190
8/1/91	-	-	6.90	8.10	190
8/15/91	-	-	6.80	8.10	180
8/29/91	-	-	7.60	8.10	170
9/12/91	-	-	7.50	8.00	160
9/26/91	-	-	7.80	7.90	170
10/10/91	-	-	8.90	8.10	180
10/24/91	-	-	9.00	8.00	180
5/13/92	-	-	7.90	7.80	220
5/27/92	-	-	6.70	8.10	210
6/11/92	-	-	6.80	8.00	210
6/25/92	-	-	6.00	8.00	190
7/8/92	-	-	7.50	7.70	180
7/23/92	-	-	7.40	8.20	170
8/6/92	-	-	7.40	8.40	140
8/19/92	-	-	7.10	7.80	150
9/2/92	-	-	7.40	7.90	170
9/17/92	-	-	8.30	8.00	150
10/1/92	-	-	8.40	7.90	170
10/14/92	-	-	9.00	7.40	180
2/1/93	N	6.0	16.48	8.01	-
2/15/94	NW	3.4	15.88	8.04	-
MIN.	-	3.4	6.00	7.40	140
MAX.	-	6.0	16.48	8.40	220
AVG.	-	4.7	8.27	-	181

Table F-7 (Cont.). Baseline water quality monitoring results from samples collected at W-I142.6F

DATE	SPECIFIC CONDUCTANCE (µMHOS/CM @ 25°C)	SECCHI DISK DEPTH (FT)	TURBIDITY (NTU)	SUSPENDED SOLIDS (MG/L)
5/21/91	1460	-	-	-
6/6/91	1390	-	-	-
6/21/91	1680	-	-	-
7/4/91	1700	-	-	-
7/18/91	1740	-	-	-
8/1/91	1490	-	-	-
8/15/91	1820	-	-	-
8/29/91	1750	-	-	-
9/12/91	1780	-	-	-
9/26/91	1810	-	-	-
10/10/91	1680	-	-	-
10/24/91	1700	-	-	-
5/13/92	1750	-	-	-
5/27/92	1820	-	-	-
6/11/92	1850	-	-	-
6/25/92	1650	-	-	-
7/8/92	1790	-	-	-
7/23/92	1730	-	-	-
8/6/92	1640	-	-	-
8/19/92	1500	-	-	-
9/2/92	1570	-	-	-
9/17/92	1400	-	-	-
10/1/92	1210	-	-	-
10/14/92	1780	-	-	-
2/1/93	1327	-	-	-
2/15/94	1255	-	4.0	5.6
MIN.	1210	-	-	-
MAX.	1850	-	-	-
AVG.	1626	-	-	-

Table F-7 (Cont.). Baseline water quality monitoring results from samples collected at W-I142.6F

DATE	CHLOROPHYLL a (MG/M3)	CHLOROPHYLL b (MG/M3)	CHLOROPHYLL c (MG/M3)	PHEOPHYTIN a (MG/M3)
5/21/91	-	-	-	-
6/6/91	-	-	-	-
6/21/91	-	-	-	-
7/4/91	-	-	-	-
7/18/91	-	-	-	-
8/1/91	-	-	-	-
8/15/91	-	-	-	-
8/29/91	-	-	-	-
9/12/91	-	-	-	-
9/26/91	-	-	-	-
10/10/91	-	-	-	-
10/24/91	-	-	-	-
5/13/92	-	-	-	-
5/27/92	-	-	-	-
6/11/92	-	-	-	-
6/25/92	-	-	-	-
7/8/92	-	-	-	-
7/23/92	-	-	-	-
8/6/92	-	-	-	-
8/19/92	-	-	-	-
9/2/92	-	-	-	-
9/17/92	-	-	-	-
10/1/92	-	-	-	-
10/14/92	-	-	-	-
2/1/93	-	-	-	-
2/15/94	2.3	1.3	1.6	2.7
MIN.	-	-	-	-
MAX.	-	-	-	-
AVG.	-	-	-	-

Table F-8. Baseline water quality monitoring results from samples collected at site W-I139.7F

DATE	WATER DEPTH (FT)	VELOCITY (FT/SEC)	WAVE HEIGHT (FT)	AIR TEMP. (°C)	CLOUD COVER (%)	WIND SPEED (MPH)
5/21/91	6.00	0.390	0.2	29	50	3
6/6/91	3.00	0.130	0.0	28	10	7
6/21/91	3.00	0.050	0.0	29	50	0
7/4/91	5.00	0.330	0.5	29	15	13
7/18/91	6.00	0.250	0.0	32	0	7
8/1/91	3.00	0.070	0.5	32	5	3
8/15/91	3.00	0.100	0.0	30	3	7
8/29/91	3.00	0.190	0.0	27	100	0
9/12/91	6.00	0.090	0.0	32	5	7
9/26/91	5.00	0.090	0.3	16	0	13
10/10/91	6.00	0.280	0.0	19	90	3
10/24/91	6.00	0.150	0.0	16	30	3
5/13/92	7.00	0.100	0.5	19	0	13
5/27/92	7.00	0.050	0.5	20	10	3
6/11/92	8.00	0.100	0.5	29	5	7
6/25/92	8.00	0.050	0.0	29	75	0
7/8/92	8.00	0.090	0.5	31	20	13
7/23/92	8.00	0.060	0.0	28	98	3
8/6/92	8.00	0.170	0.0	29	0	3
8/19/92	8.00	0.060	0.1	29	0	3
9/2/92	8.00	0.060	0.5	20	100	13
9/17/92	8.00	0.050	0.0	29	70	3
10/1/92	6.00	0.100	0.0	16	0	7
10/14/92	8.00	0.020	0.5	21	0	7
2/15/94	11.25	0.044	-	1	2	3
MIN.	3.00	0.020	0.0	1	0	0
MAX.	11.25	0.390	0.5	32	100	13
AVG.	6.33	0.123	0.2	25	30	6

Table F-8 (Cont.). Baseline water quality monitoring results from samples collected at W-I139.7F

DATE	WIND DIRECTION	WATER TEMP. (°C)	DISSOLVED OXYGEN (MG/L)	pH (SU)	TOTAL ALKALINITY (MG/L as $CaCO_3$)
5/21/91	S	25.0	8.60	7.80	100
6/6/91	E	24.0	10.70	8.10	280
6/21/91	-	27.0	7.30	7.50	270
7/4/91	SW	29.0	8.90	8.30	280
7/18/91	SE	30.0	10.90	8.00	250
8/1/91	NW	31.0	10.80	8.20	270
8/15/91	W	28.0	4.30	7.80	240
8/29/91	-	27.0	3.10	7.80	230
9/12/91	NW	26.0	5.50	7.90	200
9/26/91	NW	17.0	7.80	8.00	200
10/10/91	NE	15.0	9.30	7.90	170
10/24/91	SW	12.0	8.50	7.90	180
5/13/92	NE	21.0	6.80	7.90	250
5/27/92	N	19.0	6.10	7.90	260
6/11/92	NW	24.0	7.40	8.00	290
6/25/92	-	24.0	7.60	8.20	280
7/8/92	SW	26.0	6.30	7.60	260
7/23/92	NE	26.0	7.70	7.90	260
8/6/92	W	25.0	7.40	7.80	190
8/19/92	NE	24.0	8.50	7.60	210
9/2/92	S	22.0	6.50	7.80	220
9/17/92	NW	26.0	8.70	8.10	220
10/1/92	W	15.0	7.10	7.70	210
10/14/92	SW	16.0	8.00	7.80	210
2/15/94	NW	3.7	12.90	7.92	132
MIN.	-	3.7	3.10	7.50	100
MAX.	-	31.0	12.90	8.30	290
AVG.	-	22.5	7.87	-	226

Table F-8 (Cont.). Baseline water quality monitoring results from samples collected at W-I139.7F

DATE	SPECIFIC CONDUCTANCE (µMHOS/CM @ 25°C)	SECCHI DISK DEPTH (FT)	TURBIDITY (NTU)	SUSPENDED SOLIDS (MG/L)
5/21/91	1070	3.84	-	2.0
6/6/91	1300	0.62	15.0	28.0
6/21/91	1580	0.66	4.5	30.0
7/4/91	1860	1.87	6.2	11.0
7/18/91	1810	1.44	9.0	26.0
8/1/91	1510	1.08	13.0	23.0
8/15/91	1970	1.02	19.0	29.0
8/29/91	2080	0.75	36.0	56.0
9/12/91	2020	0.85	19.0	37.0
9/26/91	1860	0.98	17.0	28.0
10/10/91	1750	1.44	6.9	9.0
10/24/91	1410	0.62	7.6	9.6
5/13/92	1720	1.97	7.8	10.0
5/27/92	1910	0.56	9.4	15.0
6/11/92	1860	1.41	7.8	17.0
6/25/92	2030	1.81	5.9	5.0
7/8/92	2000	1.23	9.8	14.0
7/23/92	1980	2.00	5.4	4.0
8/6/92	1810	1.28	9.3	10.0
8/19/92	1570	1.54	6.3	10.0
9/2/92	1620	1.57	8.1	14.0
9/17/92	1590	1.67	6.5	8.0
10/1/92	1190	1.05	16.0	26.0
10/14/92	1220	1.41	7.9	15.0
2/15/94	1559	-	5.0	9.6

MIN.	1070	0.56	4.5	2.0
MAX.	2080	3.84	36.0	56.0
AVG.	1691	1.36	10.8	17.8

Table F-8 (Cont.). Baseline water quality monitoring results from samples collected at W-I139.7F

DATE	CHLOROPHYLL a (MG/M3)	CHLOROPHYLL b (MG/M3)	CHLOROPHYLL c (MG/M3)	PHEOPHYTIN a (MG/M3)
5/21/91	2.0	2.0	2.0	3.0
6/6/91	8.0	2.0	2.0	16.0
6/21/91	33.0	2.0	2.0	2.0
7/4/91	8.0	4.0	2.0	5.0
7/18/91	22.0	6.0	2.0	5.0
8/1/91	31.0	4.0	2.0	2.0
8/15/91	1200.0	230.0	40.0	180.0
8/29/91	48.0	210.0	24.0	120.0
9/12/91	2.0	2.0	2.0	2.0
9/26/91	2.0	2.0	2.0	2.0
10/10/91	4.0	2.0	3.0	2.0
10/24/91	2.0	2.0	2.0	2.0
5/13/92	6.0	2.0	2.0	2.0
5/27/92	4.0	4.0	2.0	12.0
6/11/92	2.0	5.0	2.0	21.0
6/25/92	13.0	4.0	8.0	3.0
7/8/92	40.0	2.0	12.0	10.0
7/23/92	8.0	3.0	2.0	6.0
8/6/92	13.0	4.0	8.0	2.0
8/19/92	7.0	2.0	2.0	8.0
9/2/92	12.0	2.0	2.0	5.0
9/17/92	3.0	2.0	2.0	2.0
10/1/92	14.0	2.0	2.0	2.0
10/14/92	10.0	3.0	2.0	8.0
2/15/94	5.5	1.3	2.5	2.7

MIN.	2.0	1.3	2.0	2.0
MAX.	1200.0	230.0	40.0	180.0
AVG.	60.0	20.2	5.3	17.0

Table F-9. Baseline water quality monitoring results from samples collected at site W-I138.8F

DATE	WATER DEPTH (FT)	VELOCITY (FT/SEC)	WAVE HEIGHT (FT)	AIR TEMP. (°C)	CLOUD COVER (%)	WIND SPEED (MPH)
5/21/91	16.00	-	-	-	-	-
6/6/91	15.00	-	-	-	-	-
6/21/91	16.00	-	-	-	-	-
7/4/91	17.00	-	-	-	-	-
7/18/91	15.00	-	-	-	-	-
8/1/91	16.00	-	-	-	-	-
8/15/91	16.00	-	-	-	-	-
8/29/91	15.00	-	-	-	-	-
9/12/91	16.00	-	-	-	-	-
9/26/91	17.00	-	-	-	-	-
10/10/91	15.00	-	-	-	-	-
10/24/91	18.00	-	-	-	-	-
5/14/92	17.00	-	-	-	-	-
5/27/92	17.00	-	-	-	-	-
6/11/92	17.00	-	-	-	-	-
6/25/92	17.00	-	-	-	-	-
7/8/92	17.00	-	-	-	-	-
7/23/92	18.00	-	-	-	-	-
8/6/92	14.00	-	-	-	-	-
8/19/92	14.00	-	-	-	-	-
9/2/92	18.00	-	-	-	-	-
9/17/92	18.00	-	-	-	-	-
10/1/92	18.00	-	-	-	-	-
10/14/92	16.00	-	-	-	-	-
2/15/94	22.15	0.620	-	0	2	10
MIN.	14.00	-	-	-	-	-
MAX.	22.15	-	-	-	-	-
AVG.	16.61	-	-	-	-	-

Table F-9 (Cont.). Baseline water quality monitoring results from samples collected at W-I138.8F

DATE	WIND DIRECTION	WATER TEMP. (°C)	DISSOLVED OXYGEN (MG/L)	pH (SU)	TOTAL ALKALINITY (MG/L as $CaCO_3$)
5/21/91	-	-	9.00	8.10	210
6/6/91	-	-	8.50	8.20	200
6/21/91	-	-	8.50	8.00	180
7/4/91	-	-	7.70	8.30	190
7/18/91	-	-	7.60	8.00	180
8/1/91	-	-	7.80	8.20	190
8/15/91	-	-	8.00	8.30	180
8/29/91	-	-	7.40	8.20	180
9/12/91	-	-	7.90	8.10	190
9/26/91	-	-	7.90	7.90	190
10/10/91	-	-	7.30	7.80	200
10/24/91	-	-	9.00	8.10	210
5/14/92	-	-	7.90	8.20	210
5/27/92	-	-	7.80	8.10	200
6/11/92	-	-	7.30	8.00	200
6/25/92	-	-	7.10	-	180
7/8/92	-	-	7.90	7.60	170
7/23/92	-	-	7.50	8.10	180
8/6/92	-	-	8.20	8.10	160
8/19/92	-	-	8.60	7.90	160
9/2/92	-	-	8.00	8.20	170
9/17/92	-	-	8.40	8.10	160
10/1/92	-	-	8.40	7.90	180
10/14/92	-	-	8.70	8.00	180
2/15/94	N	2.4	15.08	8.35	208
MIN.	-	-	7.10	7.60	160
MAX.	-	-	15.08	8.35	210
AVG.	-	-	8.30	-	186

Table F-9 (Cont.). Baseline water quality monitoring results from samples collected at W-I138.8F

DATE	SPECIFIC CONDUCTANCE (µMHOS/CM @ 25°C)	SECCHI DISK DEPTH (FT)	TURBIDITY (NTU)	SUSPENDED SOLIDS (MG/L)
5/21/91	1130	-	-	-
6/6/91	1140	-	-	-
6/21/91	1260	-	-	-
7/4/91	1350	-	-	-
7/18/91	1260	-	-	-
8/1/91	1200	-	-	-
8/15/91	1340	-	-	-
8/29/91	1360	-	-	-
9/12/91	1410	-	-	-
9/26/91	1410	-	-	-
10/10/91	1380	-	-	-
10/24/91	1180	-	-	-
5/14/92	1440	-	-	-
5/27/92	1450	-	-	-
6/11/92	1320	-	-	-
6/25/92	1450	-	-	-
7/8/92	1420	-	-	-
7/23/92	1360	-	-	-
8/6/92	1470	-	-	-
8/19/92	1240	-	-	-
9/2/92	1250	-	-	-
9/17/92	1150	-	-	-
10/1/92	1030	-	-	-
10/14/92	1040	-	-	-
2/15/94	1015	-	2.0	5.4
MIN.	1015	-	-	-
MAX.	1470	-	-	-
AVG.	1282	-	-	-

Table F-9 (Cont.). Baseline water quality monitoring results from samples collected at W-I138.8F

DATE	CHLOROPHYLL a (MG/M3)	CHLOROPHYLL b (MG/M3)	CHLOROPHYLL c (MG/M3)	PHEOPHYTIN a (MG/M3)
5/21/91	-	-	-	-
6/6/91	-	-	-	-
6/21/91	-	-	-	-
7/4/91	-	-	-	-
7/18/91	-	-	-	-
8/1/91	-	-	-	-
8/15/91	-	-	-	-
8/29/91	-	-	-	-
9/12/91	-	-	-	-
9/26/91	-	-	-	-
10/10/91	-	-	-	-
10/24/91	-	-	-	-
5/14/92	-	-	-	-
5/27/92	-	-	-	-
6/11/92	-	-	-	-
6/25/92	-	-	-	-
7/8/92	-	-	-	-
7/23/92	-	-	-	-
8/6/92	-	-	-	-
8/19/92	-	-	-	-
9/2/92	-	-	-	-
9/17/92	-	-	-	-
10/1/92	-	-	-	-
10/14/92	-	-	-	-
2/15/94	7.9	1.3	1.6	2.7
MIN.	-	-	-	-
MAX.	-	-	-	-
AVG.	-	-	-	-

HYDROLOGY AND HYDRAULICS

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UPPER MISSISSIPPI RIVER
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT (R-11F)

BANNER MARSH STATE FISH AND WILDLIFE AREA
RIVER MILES 138.5 THROUGH 143.9
FULTON AND PEORIA COUNTIES, ILLINOIS

APPENDIX G
HYDROLOGY AND HYDRAULICS

PURPOSE AND SCOPE

The purpose of this appendix is to provide hydrologic, hydraulic, and climatological support for the development of the Banner Marsh State Fish and Wildlife Area.

CLIMATOLOGICAL DATA

GENERAL

The climate in the vicinity of the Banner Marsh State Fish and Wildlife Area is generally mid-continental with hot summers and cold winters. Climatological data is summarized in the following paragraphs.

TEMPERATURE

Data is based upon observations recorded at the Peoria Airport by the National Weather Service. The average temperature is 50 degrees Fahrenheit. Record extremes are a maximum of 103 degrees and a minimum of 25 degrees below zero, Fahrenheit. Table G-1 portrays average monthly temperatures:

TABLE G-1

Average Monthly Temperatures (Degrees Fahrenheit)

Month	Average Temperature	Month	Average Temperature
January	21.5	July	75.1
February	26.8	August	73.1
March	37.8	September	65.6
April	51.3	October	53.9
May	61.5	November	39.7
June	71.2	December	27.9

PRECIPITATION

The average annual precipitation is 34.9 inches, with most occurring during the months of April through September. However, heavy precipitation (and flooding) can occur during any month of the year, as exemplified by the December 1982 storm which caused near record flooding on much of the Illinois Waterway. Table G-2 summarizes monthly average precipitation.

TABLE G-2

Average Monthly Precipitation (inches)

Month	Average Precipitation	Month	Average Precipitation
January	1.61	July	3.99
February	1.41	August	3.39
March	2.86	September	3.63
April	3.81	October	2.51
May	3.84	November	1.96
June	3.88	December	2.01

HYDROLOGY

The drainage area of the Illinois Waterway at the Banner Marsh State Fish and Wildlife Area exceeds 14,600 square miles. The Illinois Waterway originates with the confluence of the Kankakee and Des Plaines Rivers (Illinois Waterway River Mile 273.0).

STAGE DATA

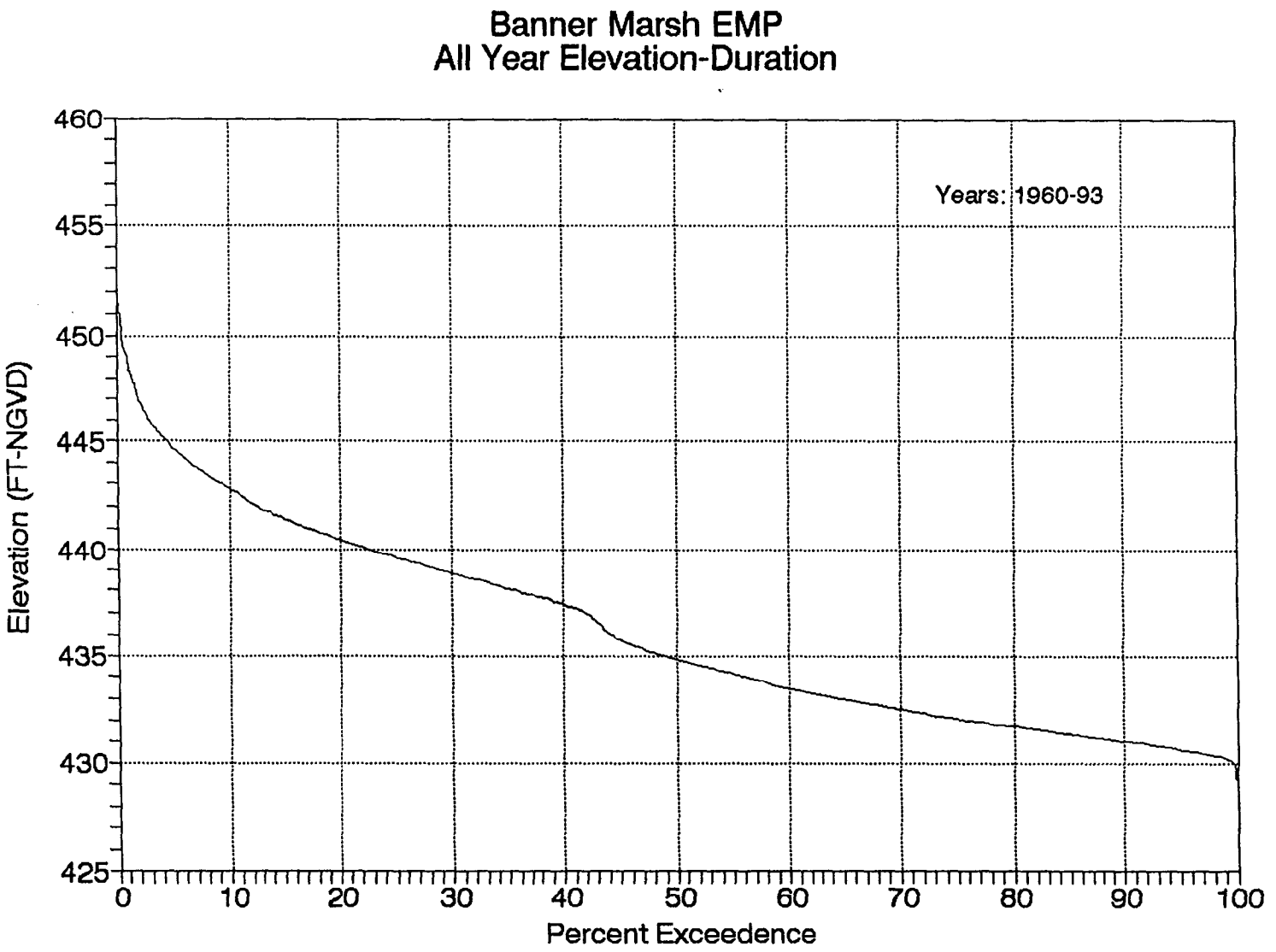
Stage data is available at the Copperas gage.

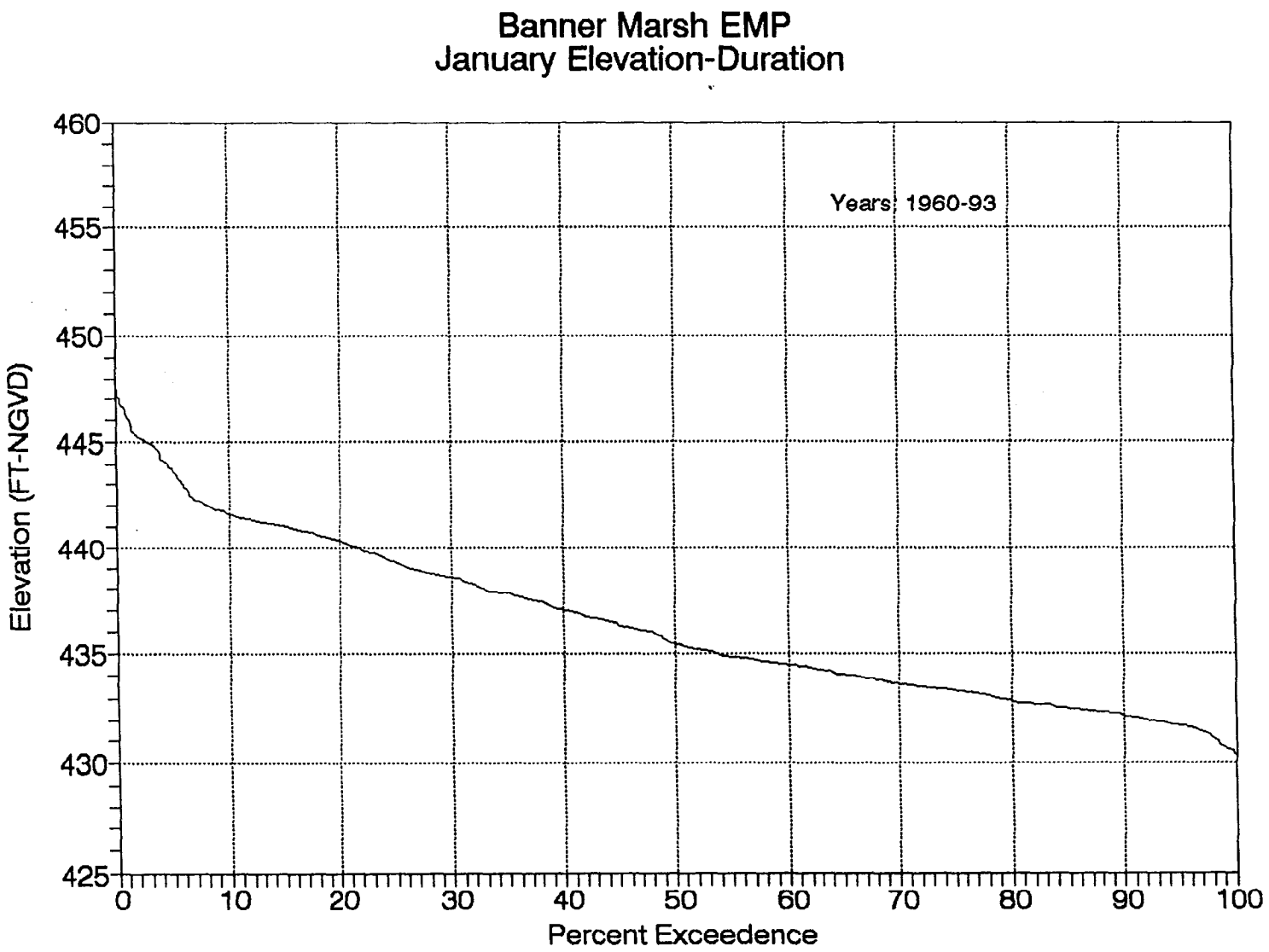
FLOW DATA

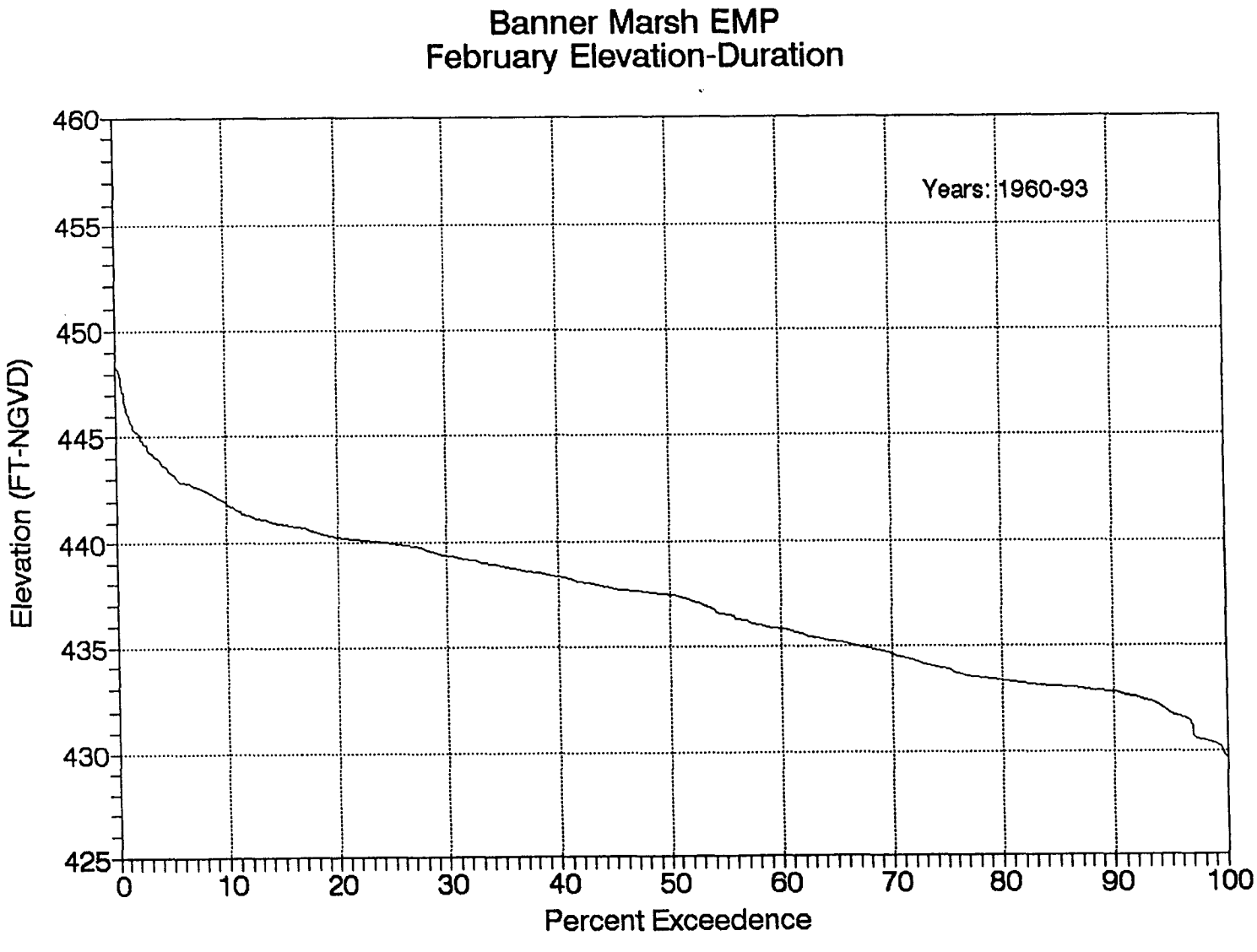
Because of unsteady flow conditions frequently occurring in the Illinois Waterway, flow data is not reliable. The nearest source for direct flow data is at the Peoria Lock and Dam.

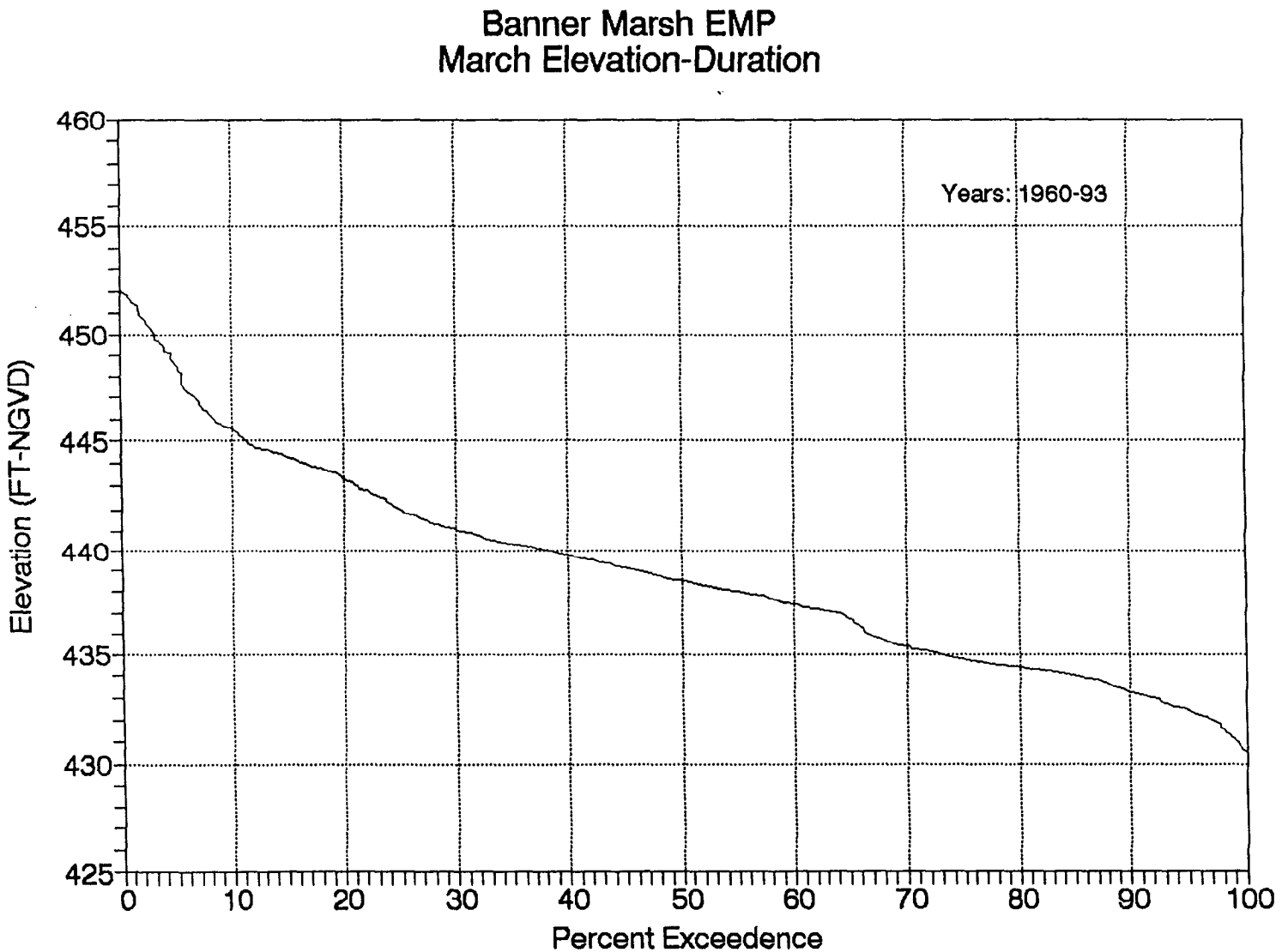
STAGE-DURATION DATA

This data is available at the Copperas gage for the years 1960 through 1987 and is shown on plate G-1. Monthly stage-duration data is shown on plates G-2 through G-13, and plate G-14 shows the all year data.

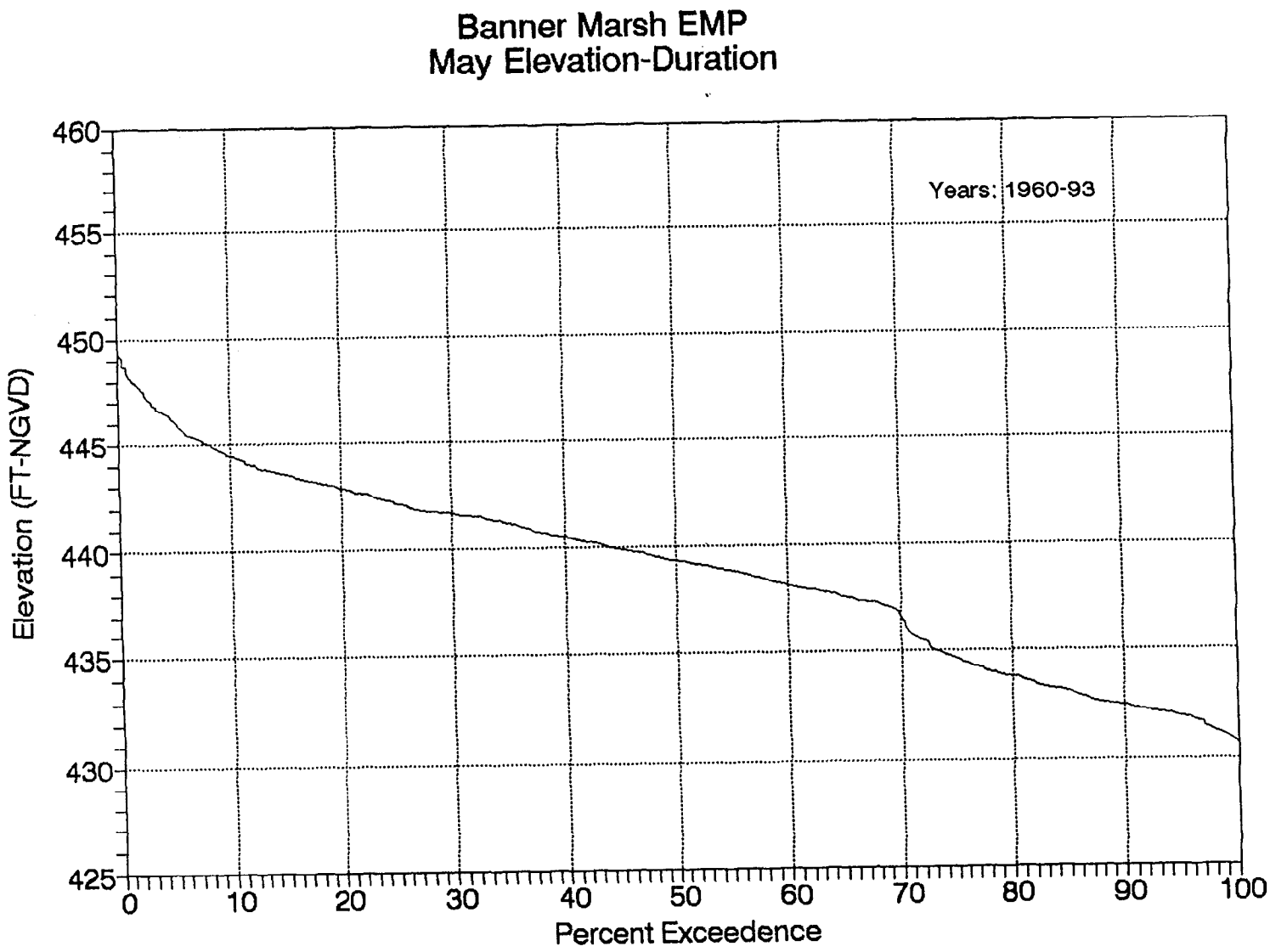

Banner Marsh EMP
All Year Elevation-Duration
Years: 1960-93
Elevation (FT-NGVD)
460
455
450
445
440
435
430
425
0
10
20
30
40
50
60
70
80
90
100
Percent Exceedence

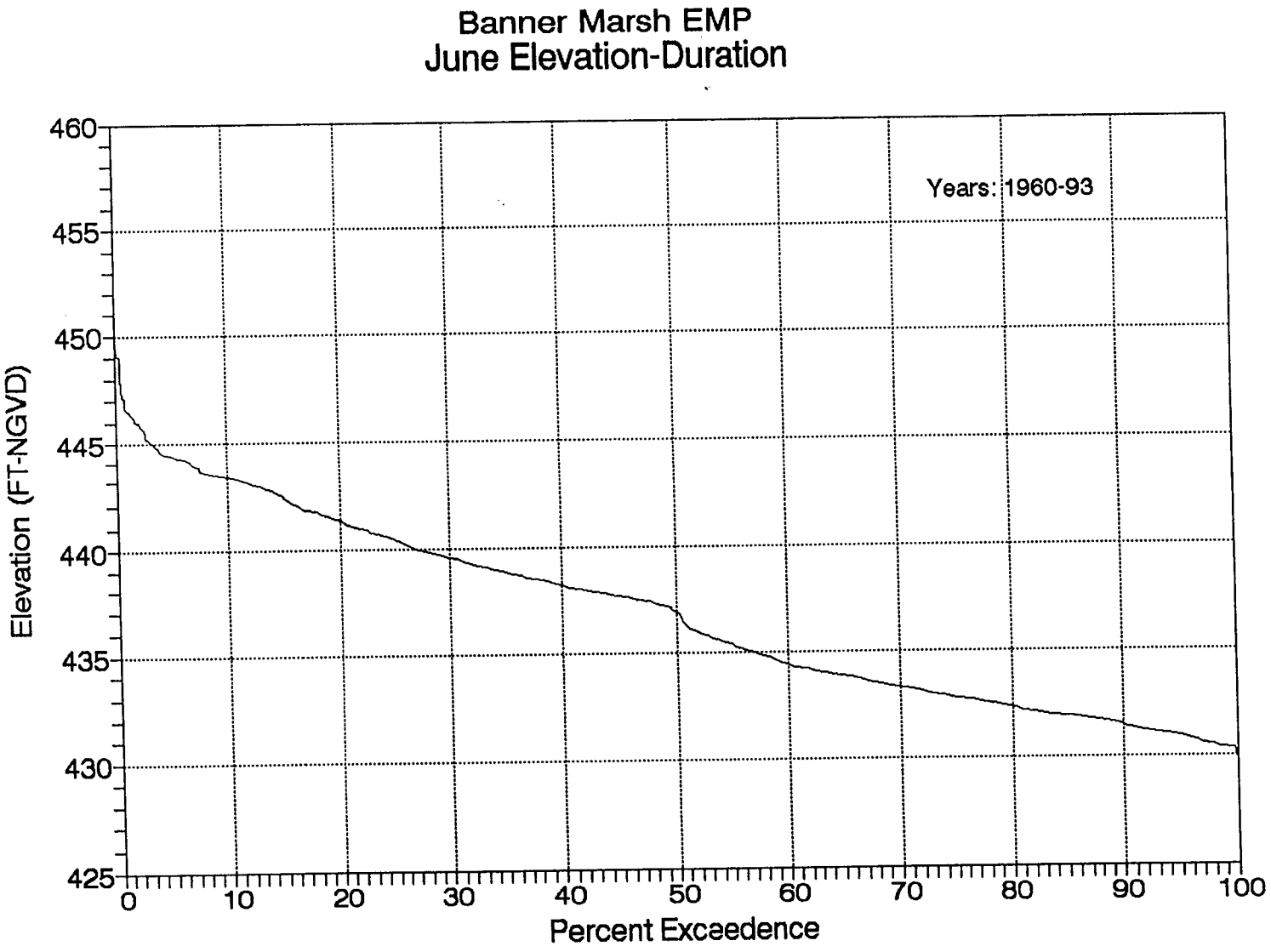

Banner Marsh EMP
January Elevation-Duration
Years: 1960-93
Elevation (FT-NGVD)
460
455
450
445
440
435
430
425
0
10
20
30
40
50
60
70
80
90
100
Percent Exceedence

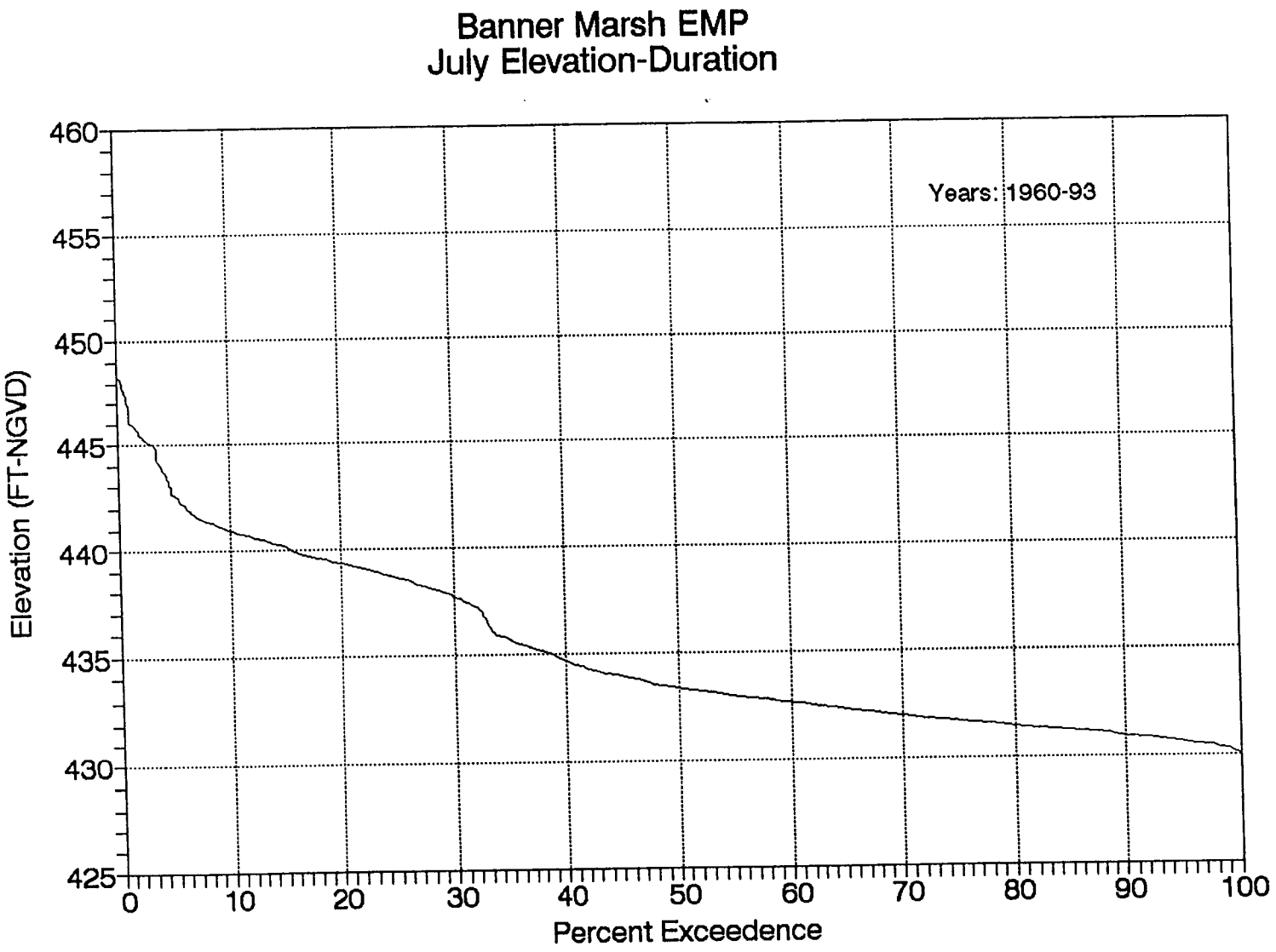

Banner Marsh EMP
February Elevation-Duration
Years: 1960-93
Elevation (FT-NGVD)
460
455
450
445
440
435
430
425
0
10
20
30
40
50
60
70
80
90
100
Percent Exceedence

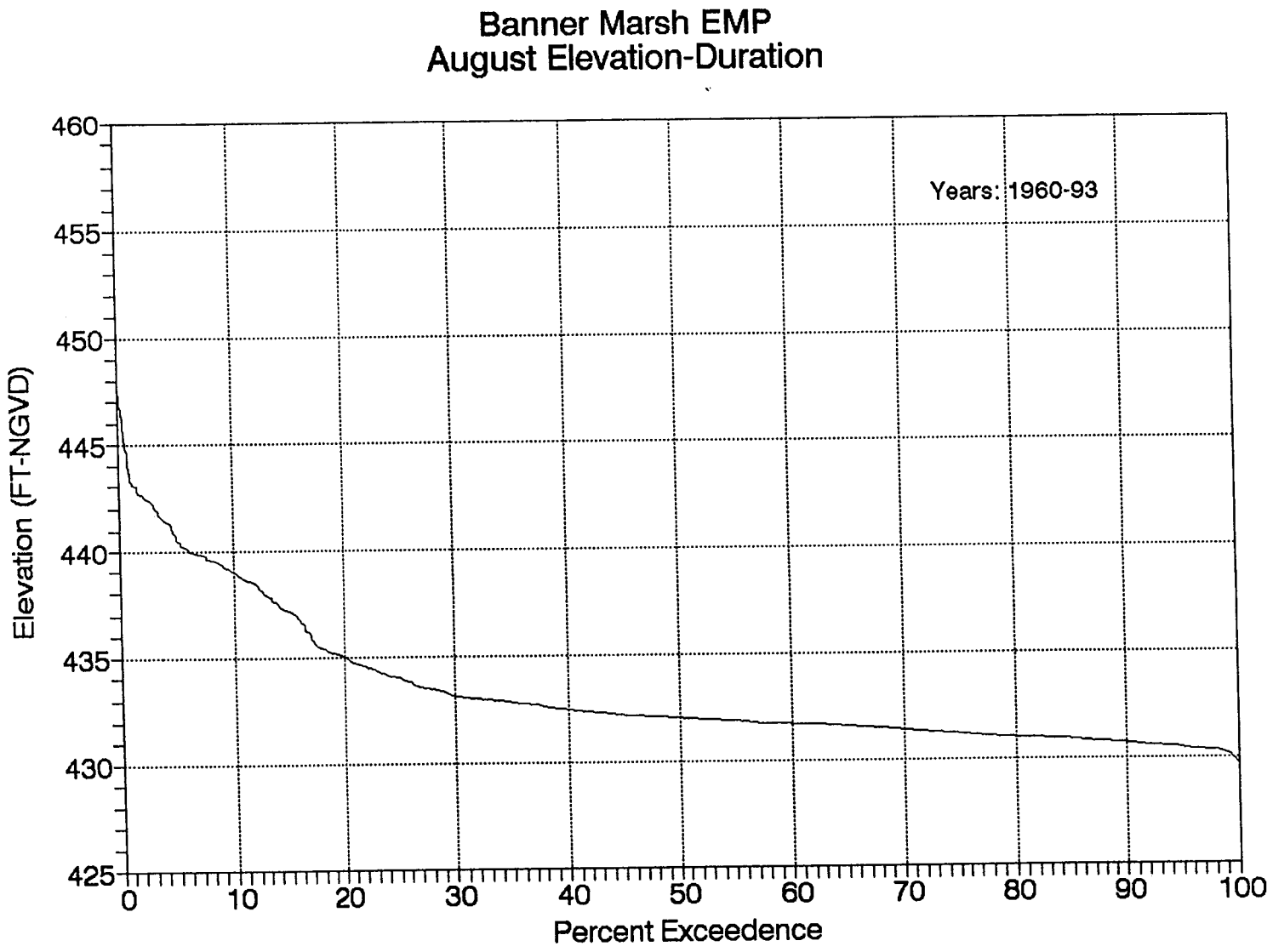

Banner Marsh EMP
March Elevation-Duration
Years: 1960-93
Elevation (FT-NGVD)
460
455
450
445
440
435
430
425
0
10
20
30
40
50
60
70
80
90
100
Percent Exceedence

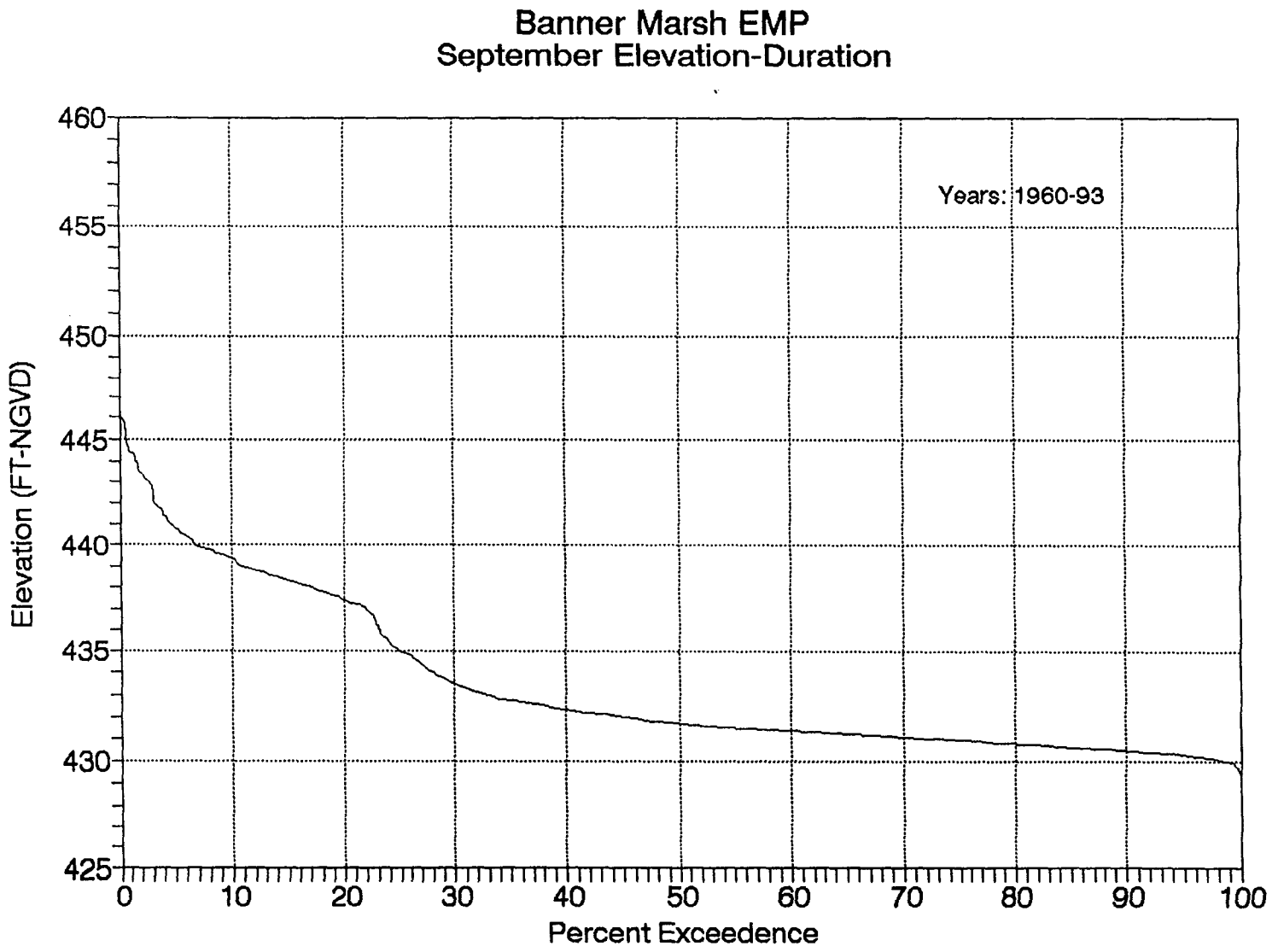
Banner Marsh EMP
April Elevation-Duration
Years: 1960-93
Elevation (FT-NGVD)
460
455
450
445
440
435
430
425
0
10
20
30
40
50
60
70
80
90
100
Percent Exceedence

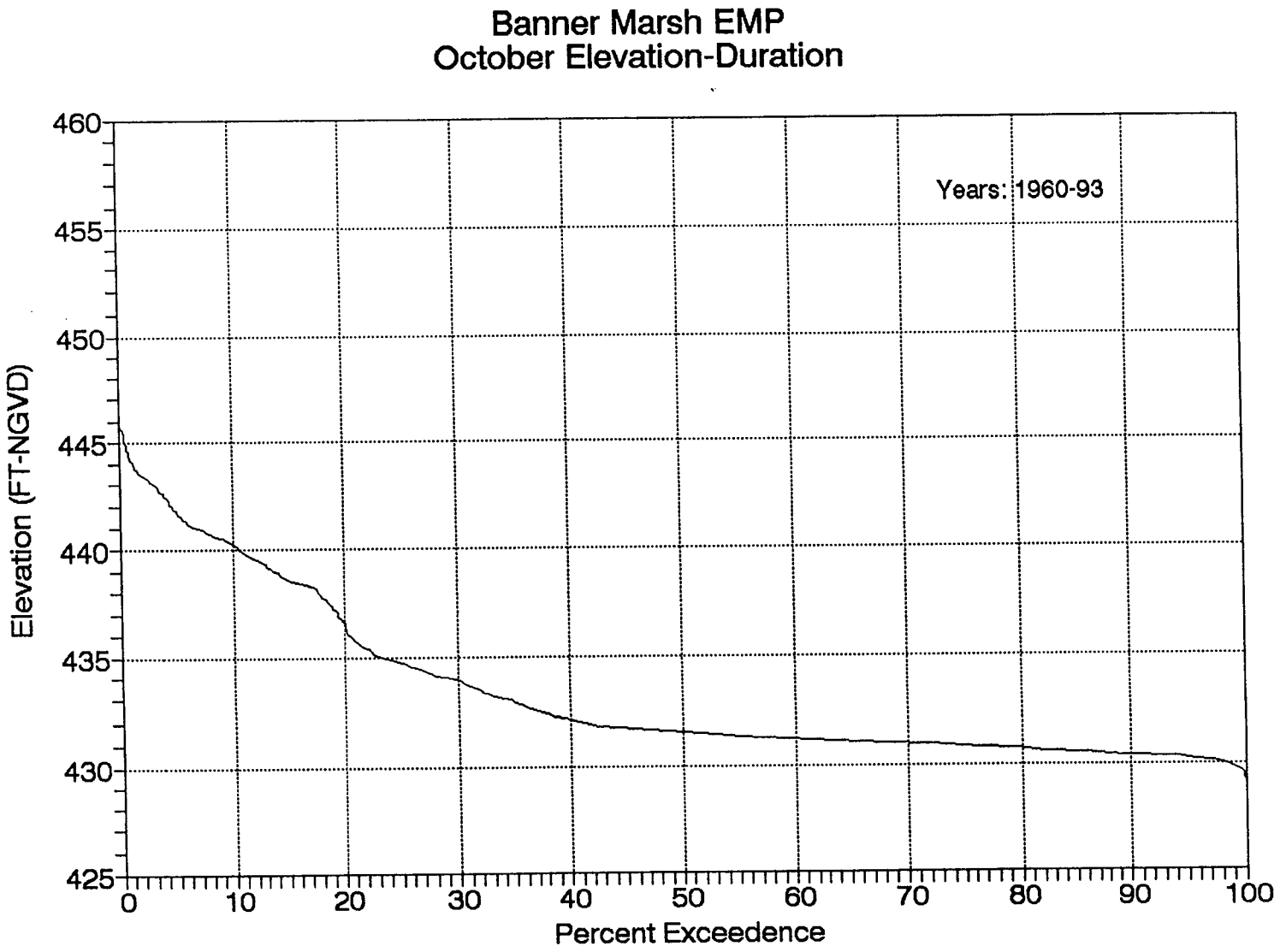

Banner Marsh EMP
May Elevation-Duration
Years: 1960-93
Elevation (FT-NGVD)
460
455
450
445
440
435
430
425
0
10
20
30
40
50
60
70
80
90
100
Percent Exceedence

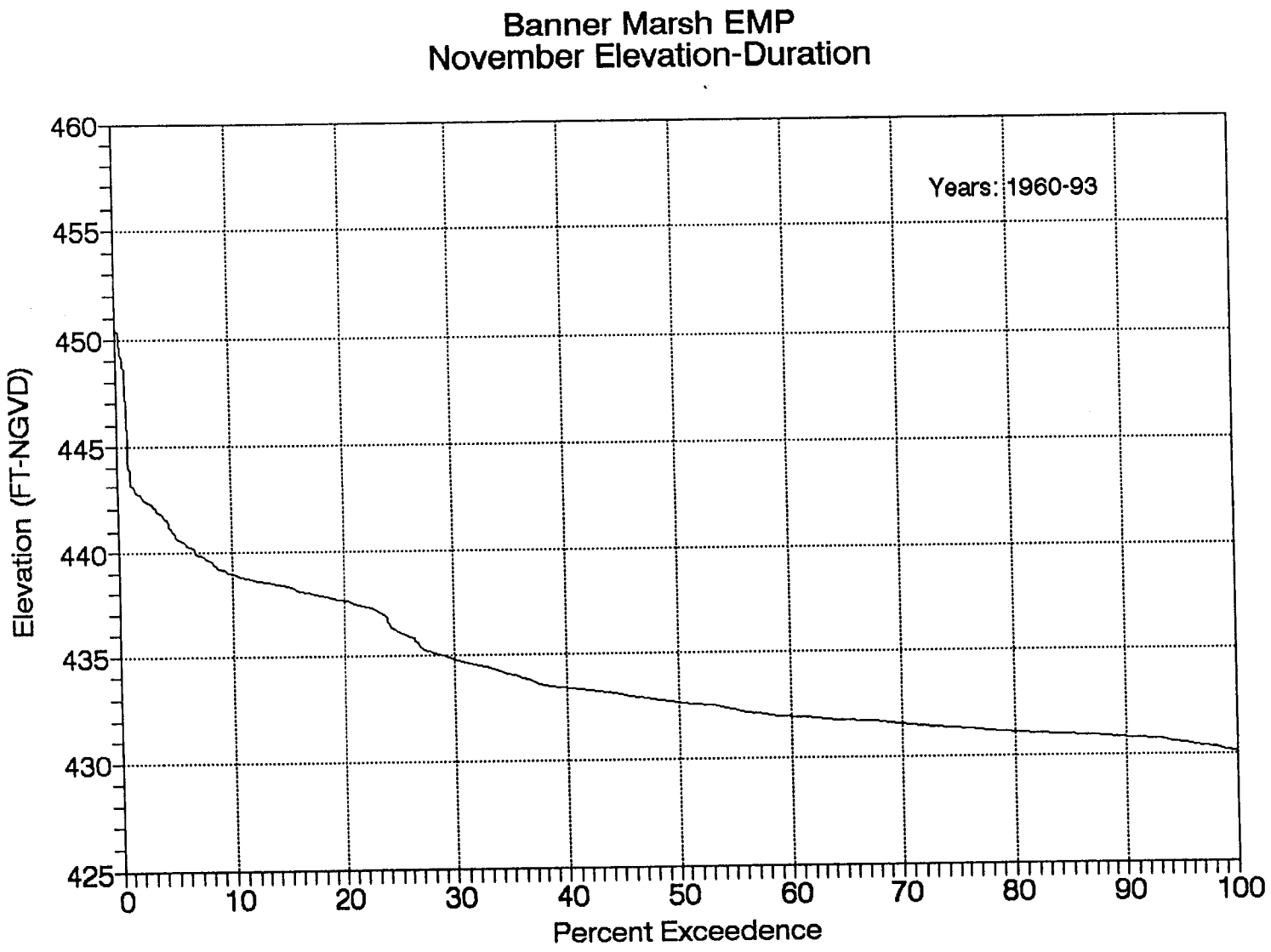

Banner Marsh EMP
June Elevation-Duration
Years: 1960-93
Elevation (FT-NGVD)
460
455
450
445
440
435
430
425
0
10
20
30
40
50
60
70
80
90
100
Percent Exceedence

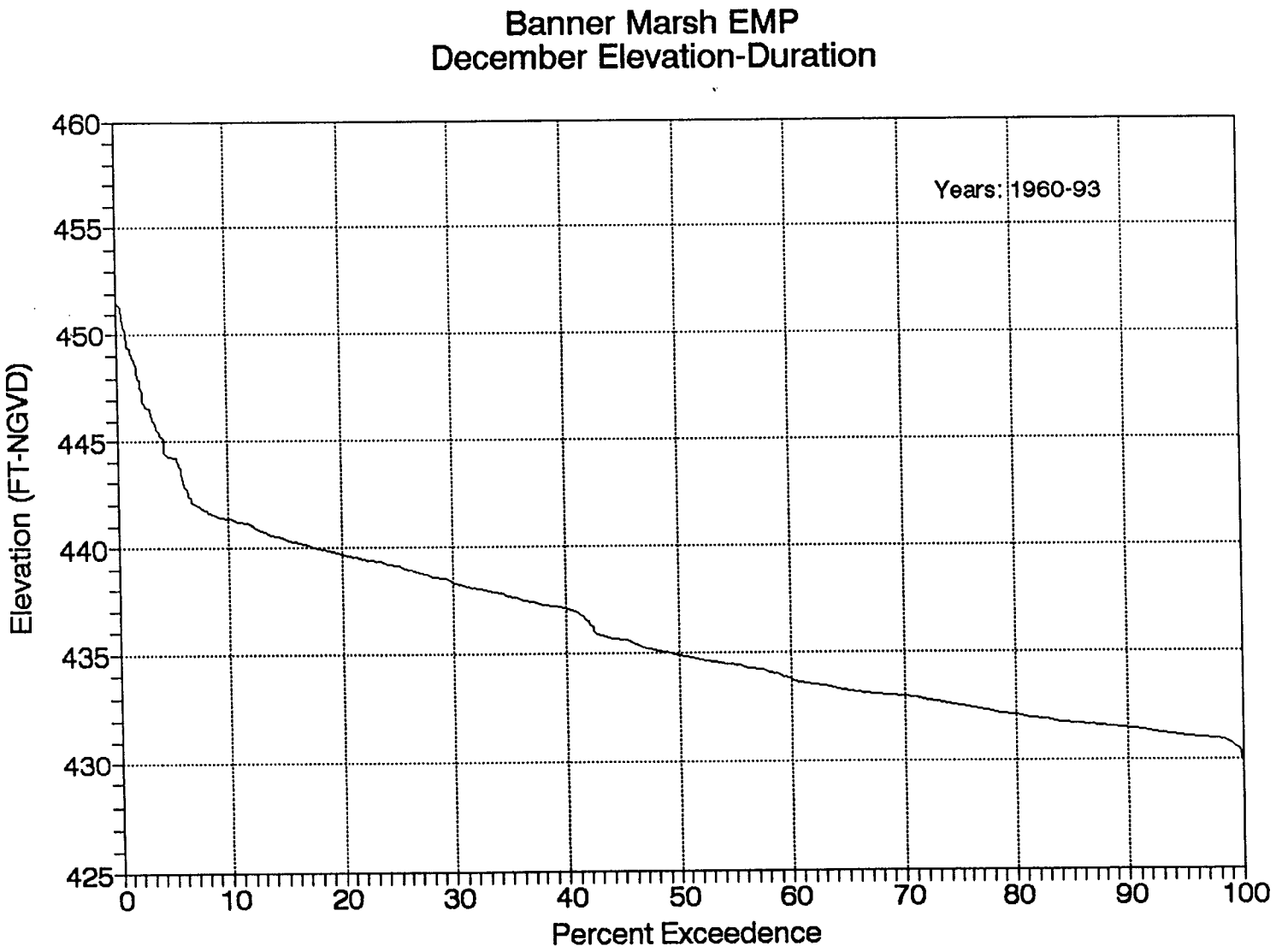

Banner Marsh EMP
July Elevation-Duration
Years: 1960-93
Elevation (FT-NGVD)
460
455
450
445
440
435
430
425
0
10
20
30
40
50
60
70
80
90
100
Percent Exceedence


Banner Marsh EMP
August Elevation-Duration
Years: 1960-93
Elevation (FT-NGVD)
460
455
450
445
440
435
430
425
0
10
20
30
40
50
60
70
80
90
100
Percent Exceedence


Banner Marsh EMP
September Elevation-Duration
Years: 1960-93
Elevation (FT-NGVD)
460
455
450
445
440
435
430
425
0
10
20
30
40
50
60
70
80
90
100
Percent Exceedence


Banner Marsh EMP
October Elevation-Duration
Years: 1960-93
Elevation (FT-NGVD)
460
455
450
445
440
435
430
425
0
10
20
30
40
50
60
70
80
90
100
Percent Exceedence


Banner Marsh EMP
November Elevation-Duration
Years: 1960-93
Elevation (FT-NGVD)
460
455
450
445
440
435
430
425
0
10
20
30
40
50
60
70
80
90
100
Percent Exceedence


Banner Marsh EMP
December Elevation-Duration
Years: 1960-93
Elevation (FT-NGVD)
460
455
450
445
440
435
430
425
0
10
20
30
40
50
60
70
80
90
100
Percent Exceedence

STRUCTURAL CONSIDERATIONS

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UPPER MISSISSIPPI RIVER
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT (R-11F)

BANNER MARSH STATE FISH AND WILDLIFE AREA

LA GRANGE POOL, ILLINOIS WATERWAY
RIVER MILES 138.5 THROUGH 143.9
FULTON AND PEORIA COUNTIES, ILLINOIS

APPENDIX H
STRUCTURAL CONSIDERATIONS

GENERAL CRITERIA

An existing pump station at the site has a surplus pump that, with appropriate modification, will be usable in the proposed new pump station. The pump is an electrically driven centrifugal propeller pump of 24-inch diameter with the discharge pipe above the operating floor level. The pump station configuration is adapted to this size and type of pump.

SUMP INLET

It is desired that the pump provide water at the relatively low inlet river level of about elevation 431.0. The sump floor was established at elevation 425.67 to provide minimum submergence of the intake bell. Some dredging of the inlet channel will be necessary to provide flow from the adjacent river to the pump station. A dredged channel about 8 feet wide and bottom elevation of 425.0 will allow flow toward the pump at less than 1 foot per second for optimum pumping efficiency. Periodic maintenance dredging of the inlet channel and pump sump area will be necessary.

PUMP DISCHARGE

The pump discharge line is held at a high elevation as it exits the station. It will pass over new parking area fill on the riverside of the levee slope and over the existing levee. Penetration of the levee is avoided since that could provide a seepage path through the levee during flood conditions. The high discharge line allows vehicles to pass under it on both the landside and riverside of the crest. The 24-inch-diameter steel discharge pipe will be provided with several supports, as well as being supported by the levee. The exact nature and spacing of supports will be determined

during a later design stage. Flexible couplings are provided to maintain pipeline integrity under temperature changes and vibration of the pump. These also provide a separation point if pipeline repair is necessary. The discharge line terminates in a concrete manhole with an open, grated top. The discharge elevation is selected for optimum pump operation. The manhole bottom is set below the 24-inch discharge pipe to allow using a small portable pump to evacuate the pipeline to prevent water from freezing in the line or for maintenance of the pipeline. To inhibit corrosion, the pipeline will be epoxy coated.

PUMP STATION SUMP AREA

The station sump walls are formed by sheet piling. The sheet piling will allow dewatering the site during construction and then remain in place to form the permanent sump and wing walls. Temporary piling will be installed across the sump intake area to allow dewatering during construction, and then will be removed when the low-level construction work is complete. A trash rack will be provided. A low-level deck is provided to allow occasional hand raking of the trash rack when necessary. A steel-covered access hatchway is provided for entry to the sump area for occasional maintenance. A permanent ladder would be installed.

PUMP STATION STRUCTURE

The concrete operating deck is at an elevation equal to the levee top to ensure the electrical controls and motor remain dry at all flood stages below extreme events. A concrete block building is to be provided for weather protection of controls and for security. A hatch will be provided in the roof to allow removal of the pump by a crane. Ventilation of the station is by a motorized roof fan and louvers in the walls. The concrete decks provide support to the tops of the piling and allow analysis of the piling as an anchored system. The piling at the back of the station supports the parking area fill and are the most critical for structural analysis. Analysis was performed using computer program CWALSHT following guidance of Engineering Manual 1110-2-2504, "Design of Sheet Pile Walls." Wing walls are cantilevered piles and will be analyzed at a later design stage, as will reinforcing for the concrete decks.

Banner Marsh Pump Station Nov 94

DAP WMc

Existing Allis Chalmers pump will be moved into the new Station.

Pumping requirement of 4500 gpm
Exist pump rated at 13000 gpm @ 21 ft TDHead, 100 hp motor
685 rpm

For dimensioning sump use "equivalent" pump say
Patterson pump 24 SAFV @ 700 RPM, Bell diam. = 33"

Use sump width = 2 x 33 = 66" say 6'-0"
Dist. bell to floor = 16" ± = 1.33'

Assume low water elev. = 431.0
Assume 4' min. submergence above bell
for satisfactory pump operation (Note 1)

∴ Sump Floor Elev. = 431.0 − (4.0 + 1.33) = 425.67

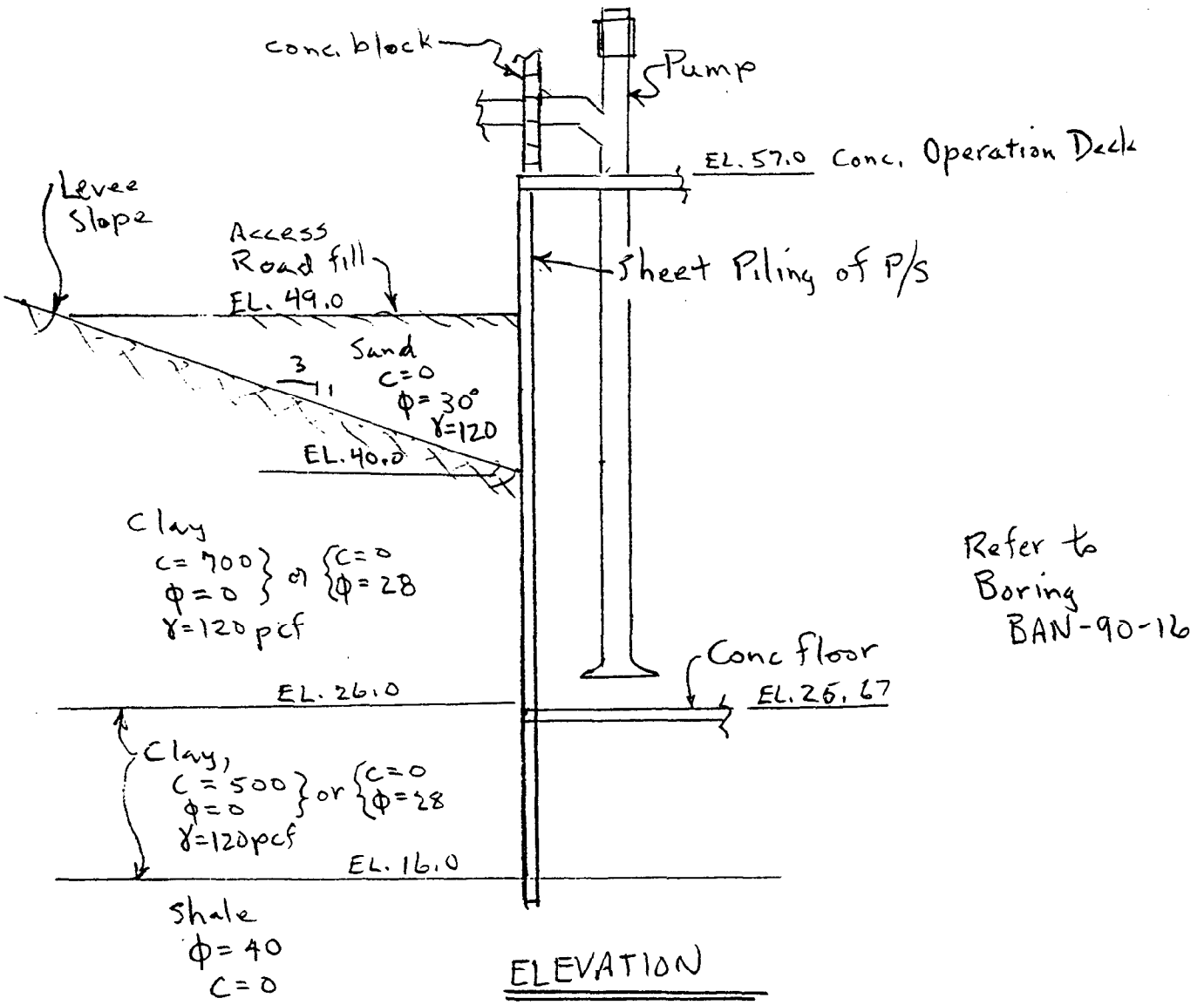
Note 1: Tapering approach walls can be constructed, if necessay, to eliminate vortexing if pump submergence of only 4' is not sufficient.

Banner Marsh Pump Station

DAP

Design pump inlet bay walls to be sheet piling to be used for dewatering and then for permanent pump sta. walls.

The concrete deck of the station will support the top of the piling and permit analysis of the piling as an anchored wall. Analysis by program CWALSHT; printout on following pages



ELEVATION

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 12-DEC-1994 TIME: 9.01.42

INPUT DATA

I.--HEADING:
'BANNER MARSH PUMP STATION

II.--CONTROL
ANCHORED WALL DESIGN

LEVEL 1 FACTOR OF SAFETY FOR ACTIVE PRESSURES = 1.00
LEVEL 1 FACTOR OF SAFETY FOR PASSIVE PRESSURES = 1.00

III.--WALL DATA
ELEVATION AT TOP OF WALL = 57.00 (FT)
ELEVATION AT ANCHOR = 56.50 (FT)

IV.--SURFACE POINT DATA

Analysis for depth of piling using quick failure soil properties

IV.A--RIGHTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	49.00

IV.B-- LEFTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	25.67

V.--SOIL LAYER DATA

V.A.--RIGHTSIDE LAYER DATA
LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURES = 1.00
LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURES = 1.00

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> <-FACTOR-> ACT.	PASS.
120.00	120.00	30.00	.0	15.00	.0	40.00	.33	1.00	1.50
120.00	120.00	.00	700.0	.00	100.0	26.00	.00	1.00	2.00
120.00	120.00	.00	500.0	.00	.0	16.00	.00	1.00	2.00
120.00	120.00	40.00	.0	20.00	.0			1.00	1.50

V.B.-- LEFTSIDE LAYER DATA

LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURES = 1.00
LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURES = 1.00

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> <-FACTOR-> ACT.	PASS.
150.00	150.00	50.00	.0	25.00	.0	24.80	.00	1.00	1.50
120.00	120.00	.00	500.0	.00	.0	16.00	.00	1.00	2.00
120.00	120.00	40.00	.0	20.00	.0			1.00	1.50

VI.--WATER DATA

UNIT WEIGHT = 62.40 (PCF)
RIGHTSIDE ELEVATION = 10.00 (FT)
LEFTSIDE ELEVATION = 10.00 (FT)
NO SEEPAGE

VII.--SURFACE LOADS
NONE

VIII.--HORIZONTAL LOADS
NONE

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 12-DEC-1994 TIME: 9.02.15

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WALL BOTTOM ELEV. (FT) :	14.32	10.04	10.81
PENETRATION (FT) :	11.35	15.63	14.86
MAX. BEND. MOMENT (LB-FT) :	-50988.	66333.	44430.
AT ELEVATION (FT) :	27.01	14.10	14.17
MAX. SCALED DEFL. (LB-IN3) :	1.4710E+10	1.8691E+09	6.2056E+09
AT ELEVATION (FT) :	34.00	40.41	36.00
ANCHOR FORCE (LB) :	2453.	885.	1402.

(NOTE: PENETRATION FOR EQUIVALENT BEAM METHOD DOES NOT INCLUDE INCREASE PRESCRIBED BY DRAFT EM 1110-2-2906.)

(NOTE: DIVIDE SCALED DEFLECTION BY MODULUS OF ELASTICITY IN PSI TIMES PILE MOMENT OF INERTIA IN IN**4 TO OBTAIN DEFLECTION IN INCHES.)

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 12-DEC-1994 TIME: 9.02.15

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48.00	-20847.	-2436.	8.0379E+09	34.94
47.00	-23260.	-2383.	8.8628E+09	69.87
46.00	-25603.	-2296.	9.6474E+09	104.81
45.00	-27840.	-2174.	1.0388E+10	139.75
44.00	-29939.	-2017.	1.1080E+10	174.68
43.00	-31862.	-1824.	1.1721E+10	209.62
42.00	-33576.	-1597.	1.2306E+10	244.56
41.00	-35045.	-1335.	1.2834E+10	279.50
40.41	-35804.	-1253.	1.3118E+10	.00
40.00	-36314.	-1253.	1.3301E+10	.00
39.00	-37566.	-1253.	1.3705E+10	.00
38.00	-38819.	-1253.	1.4045E+10	.00
37.00	-40071.	-1253.	1.4317E+10	.00
36.00	-41324.	-1253.	1.4520E+10	.00
35.00	-42576.	-1253.	1.4652E+10	.00
34.00	-43829.	-1253.	1.4710E+10	.00
33.00	-45081.	-1253.	1.4693E+10	.00
32.00	-46334.	-1253.	1.4597E+10	.00
31.00	-47586.	-1253.	1.4421E+10	.00
30.00	-48821.	-1199.	1.4164E+10	107.74
29.00	-49927.	-976.	1.3822E+10	337.18
28.00	-50706.	-553.	1.3393E+10	509.15
27.00	-50988.	7.	1.2877E+10	610.16
26.00	-50614.	803.	1.2273E+10	981.90
25.67	-50293.	1153.	1.2055E+10	1141.27
25.02	-49378.	1525.	1.1595E+10	.00
25.01	-49365.	1525.	1.1588E+10	-15.13
25.00	-49352.	1525.	1.1582E+10	-30.26
24.80	-49046.	1536.	1.1433E+10	137.62
24.67	-48844.	1589.	1.1335E+10	675.22
24.00	-47629.	2038.	1.0805E+10	666.98
23.00	-45259.	2699.	9.9468E+09	654.77
22.00	-42234.	3348.	9.0100E+09	642.67
21.00	-38566.	3988.	8.0002E+09	637.05
20.00	-34232.	4706.	6.9240E+09	799.92
19.00	-29087.	5622.	5.7887E+09	1032.41
18.00	-22937.	6691.	4.6033E+09	1104.09
17.55	-19844.	7183.	4.0614E+09	1106.15
17.00	-15693.	7797.	3.3784E+09	1108.71
16.00	-7754.	7670.	2.1265E+09	-1362.57
15.00	-1469.	4195.	8.6101E+08	-5588.17
14.32	0.	0.	0.0000E+00	-6774.73

(NOTE: DIVIDE SCALED DEFLECTION BY MODULUS OF ELASTICITY IN PSI TIMES PILE MOMENT OF INERTIA IN IN**4 TO OBTAIN DEFLECTION IN INCHES.)

III.--SOIL PRESSURES

ELEVATION	< LEFTSIDE PRESSURE (PSF) >		<RIGHTSIDE PRESSURE (PSF) >	
(FT)	PASSIVE	ACTIVE	ACTIVE	PASSIVE
57.00	0.	0.	0.	0.
56.50	0.	0.	0.	0.
56.00	0.	0.	0.	0.
55.00	0.	0.	0.	0.
54.00	0.	0.	0.	0.
53.00	0.	0.	0.	0.
52.00	0.	0.	0.	0.
51.00	0.	0.	0.	0.
50.00	0.	0.	0.	0.

49.00	0.	0.	0.	0.
48.00	0.	0.	35.	369.
47.00	0.	0.	70.	738.
46.00	0.	0.	105.	1108.
45.00	0.	0.	140.	1477.
44.00	0.	0.	175.	1846.
43.00	0.	0.	210.	2215.
42.00	0.	0.	245.	2584.
41.00	0.	0.	279.	2954.
40.41+	0.	0.	0.	1098.
40.41-	0.	0.	0.	1854.
40.00	0.	0.	0.	1098.
39.00	0.	0.	0.	1200.
38.00	0.	0.	0.	2212.
37.00	0.	0.	0.	2419.
36.00	0.	0.	0.	2582.
35.00	0.	0.	0.	2744.
34.00	0.	0.	0.	2894.
33.00	0.	0.	0.	3033.
32.00	0.	0.	0.	3175.
31.00	0.	0.	0.	3321.
30.00	0.	0.	108.	3452.
29.00	0.	0.	337.	3596.
28.00	0.	0.	509.	3738.
27.00	0.	0.	610.	3859.
26.00	0.	0.	982.	3840.
25.67	0.	0.	1141.	3805.
25.02	1282.	11.	1282.	3847.
25.01	1299.	11.	1284.	3848.
25.00	1316.	11.	1286.	3848.
24.80+	1709.	15.	1307.	3882.
24.80-	631.	0.	1307.	3882.
24.67	646.	0.	1321.	3893.
24.00	727.	0.	1393.	3564.
23.00	847.	0.	1501.	3435.
22.00	967.	0.	1609.	3855.
21.00	1087.	0.	1724.	3977.
20.00	1207.	0.	2006.	4099.
19.00	1327.	0.	2359.	4220.
18.00	1447.	0.	2551.	4341.
17.55	1500.	0.	2606.	4395.
17.00	1567.	67.	2675.	4462.
16.00+	1687.	187.	2732.	14744.
16.00-	6504.	222.	2732.	14744.
15.00	7161.	245.	1573.	20258.
14.00	7819.	267.	482.	15889.

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 12-DEC-1994 TIME: 10.12.40

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LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURES = 1.00
LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURES = 1.00

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> <-FACTOR-> ACT.	PASS.
150.00	150.00	50.00	.0	25.00	.0	24.80	.00	1.00	1.50
120.00	120.00	28.00	.0	14.00	.0	16.00	.00	1.00	1.50
120.00	120.00	40.00	.0	20.00	.0			1.00	1.50

VI.--WATER DATA

UNIT WEIGHT = 62.40 (PCF)
RIGHTSIDE ELEVATION = 10.00 (FT)
LEFTSIDE ELEVATION = 10.00 (FT)
NO SEEPAGE

VII.--SURFACE LOADS
NONE

VIII.--HORIZONTAL LOADS
NONE

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 12-DEC-1994 TIME: 10.13.06

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WALL BOTTOM ELEV. (FT) :	16.33	11.53	11.80
PENETRATION (FT) :	9.34	14.14	13.87
MAX. BEND. MOMENT (LB-FT) :	-72133.	58277.	51257.
AT ELEVATION (FT) :	34.11	15.88	15.93
MAX. SCALED DEFL. (LB-IN3) :	1.9298E+10	6.8884E+09	1.0682E+10
AT ELEVATION (FT) :	36.00	40.00	37.00
ANCHOR FORCE (LB) :	4107.	2664.	2837.

(NOTE: PENETRATION FOR EQUIVALENT BEAM METHOD DOES NOT INCLUDE INCREASE PRESCRIBED BY DRAFT EM 1110-2-2906.)

(NOTE: DIVIDE SCALED DEFLECTION BY MODULUS OF ELASTICITY IN PSI TIMES PILE MOMENT OF INERTIA IN IN**4 TO OBTAIN DEFLECTION IN INCHES.)

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 12-DEC-1994 TIME: 10.38.36

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¤  INPUT DATA  ¤
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I.--HEADING:
BANNER MARSH PUMP STATION

II.--CONTROL
ANCHORED WALL DESIGN

LEVEL 1 FACTOR OF SAFETY FOR ACTIVE PRESSURES = 1.00
LEVEL 1 FACTOR OF SAFETY FOR PASSIVE PRESSURES = 1.00

III.--WALL DATA
ELEVATION AT TOP OF WALL = 57.00 (FT)
ELEVATION AT ANCHOR = 56.50 (FT)

IV.--SURFACE POINT DATA

Analysis for maximum moment in piling using slow failure soil properties.

IV.A--RIGHTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	49.00

IV.B-- LEFTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	25.67

V.--SOIL LAYER DATA

V.A.--RIGHTSIDE LAYER DATA
LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURES = 1.00
LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURES = 1.00

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> <-FACTOR-> ACT.	PASS.
120.00	120.00	30.00	.0	15.00	.0	40.00	.33	1.00	1.00
120.00	120.00	28.00	.0	14.00	.0	26.00	.00	1.00	1.00
120.00	120.00	28.00	.0	14.00	.0	16.00	.00	1.00	1.00
120.00	120.00	40.00	.0	20.00	.0			1.00	1.00

V.B.-- LEFTSIDE LAYER DATA

LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURES = 1.00
LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURES = 1.00

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> <-FACTOR-> ACT.	PASS.
150.00	150.00	50.00	.0	25.00	.0	24.80	.00	1.00	1.00
120.00	120.00	28.00	.0	14.00	.0	16.00	.00	1.00	1.00
120.00	120.00	40.00	.0	20.00	.0			1.00	1.00

VI.--WATER DATA

UNIT WEIGHT = 62.40 (PCF)
RIGHTSIDE ELEVATION = 10.00 (FT)
LEFTSIDE ELEVATION = 10.00 (FT)
NO SEEPAGE

VII.--SURFACE LOADS
NONE

VIII.--HORIZONTAL LOADS
NONE

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 12-DEC-1994 TIME: 10.39.04

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WALL BOTTOM ELEV. (FT) :	19.20	14.81	14.46
PENETRATION (FT) :	6.47	10.86	11.21
MAX. BEND. MOMENT (LB-FT) :	-57232.	-40165.	39539.
AT ELEVATION (FT) :	35.36	37.06	18.75
MAX. SCALED DEFL. (LB-IN3):	1.3191E+10	6.4832E+09	7.5154E+09
AT ELEVATION (FT) :	37.00	40.00	38.00
ANCHOR FORCE (LB) :	3423.	2582.	2369.

(NOTE: PENETRATION FOR EQUIVALENT BEAM METHOD DOES NOT INCLUDE INCREASE PRESCRIBED BY DRAFT EM 1110-2-2906.)

(NOTE: DIVIDE SCALED DEFLECTION BY MODULUS OF ELASTICITY IN PSI TIMES PILE MOMENT OF INERTIA IN IN**4 TO OBTAIN DEFLECTION IN INCHES.)

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 12-DEC-1994 TIME: 10.39.04

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PZ22	18.10	84.40	19000.	2.90E+07
PLZ25	32.80	223.25	19000.	2.90E+07
PLZ23	30.20	203.75	19000.	2.90E+07

III.--PRELIMINARY DESIGN DATA

SHEET PILE	LOG(H**4/EI)	ROWE'S MOMENT REDUCTION COEF.	RATIO OF ALLOWABLE MOMENT TO FREE EARTH MOMENT
PZ40	-3.84	1.0 (***)	1.68
PZ38	-3.73	1.0 (***)	1.29
PZ35	-3.71	1.0 (***)	1.34
PZ27	-3.42	1.0 (***)	.84
PZ22	-3.08	1.0 (***)	.50
PLZ25	-3.50	1.0 (***)	.91
PLZ23	-3.46	1.0 (***)	.84

*** REDUCTION NOT APPLICABLE DUE TO ALPHA GREATER THAN 0.8.

*** REDUCTION NOT APPLICABLE DUE TO RIGHTSIDE SURFACE BELOW TOP OF WAL

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 12-DEC-1994 TIME: 9.23.20

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LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURES = 1.00
LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURES = 1.00

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> <-FACTOR-> ACT.	PASS.
150.00	150.00	50.00	.0	25.00	.0	24.80	.00	1.00	1.00
120.00	120.00	.00	500.0	.00	.0	16.00	.00	1.00	1.00
120.00	120.00	40.00	.0	20.00	.0			1.00	1.00

VI.--WATER DATA

UNIT WEIGHT = 62.40 (PCF)
RIGHTSIDE ELEVATION = 10.00 (FT)
LEFTSIDE ELEVATION = 10.00 (FT)
NO SEEPAGE

VII.--SURFACE LOADS
NONE

VIII.--HORIZONTAL LOADS
NONE

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 12-DEC-1994 TIME: 9.23.47

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WALL BOTTOM ELEV. (FT)	:	15.81	13.75	13.86
PENETRATION (FT)	:	9.86	11.92	11.81
MAX. BEND. MOMENT (LB-FT)	:	-20664.	22422.	19807.
AT ELEVATION (FT)	:	29.29	15.73	15.74
MAX. SCALED DEFL. (LB-IN3)	:	6.1231E+09	1.6691E+09	2.6369E+09
AT ELEVATION (FT)	:	36.00	41.00	38.00
ANCHOR FORCE (LB)	:	1389.	838.	902.

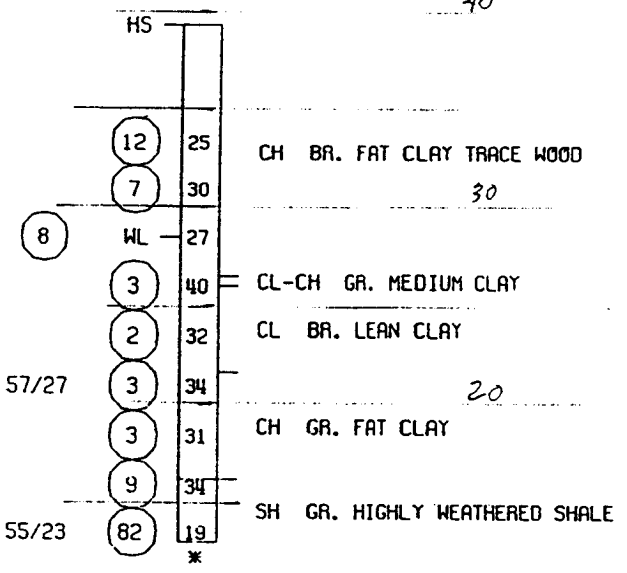
(NOTE: PENETRATION FOR EQUIVALENT BEAM METHOD DOES NOT INCLUDE INCREASE PRESCRIBED BY DRAFT EM 1110-2-2906.)

(NOTE: DIVIDE SCALED DEFLECTION BY MODULUS OF ELASTICITY IN PSI TIMES PILE MOMENT OF INERTIA IN IN**4 TO OBTAIN DEFLECTION IN INCHES.)

less critical than moment in slow failure soil properties

BAN-90-16

TOP ELEVATION 439.3



STA 202+91
172' L
25 OCTOBER 1990

NOTE: WATER LEVEL AT 11.0' AFTER DRILLING
TOP OF ROCK 23.2' (SPLIT SPOON REFUSAL AT 26.5')

BANNER MARSH EMP PROJECT

SCALE: 1IN=10 FT

MECHANICAL/ELECTRICAL

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UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT (R-11F)

BANNER MARSH STATE FISH AND WILDLIFE AREA

LA GRANGE POOL, ILLINOIS WATERWAY
RIVER MILES 138.5 THROUGH 143.9
FULTON AND PEORIA COUNTIES, ILLINOIS

APPENDIX I
MECHANICAL/ELECTRICAL

MECHANICAL

PURPOSE AND SCOPE

The purpose of this appendix is to present a preliminary design for the new pumping station at Banner Marsh Refuge. EM 1110-2-3105, "Mechanical and Electrical Design of Pumping Stations," and pump manufacturers' engineering information were used to develop the design and layout presented in this appendix. The layout was based on efficient operation of the station and ease of normal maintenance.

GENERAL

A new pump station housing the existing 20-inch electric motor-driven propeller pump is proposed for the Banner Marsh project. The pump will be moved from its location in the existing pump station. The function of the new pump station will be to discharge river water into the protected refuge during waterfowl migration seasons for the purpose of creating a maintained flooded marsh.

The pumping station will be located in the middle portion of the river levee approximately 140 feet south of the existing pump station. The pump station will be constructed integral with the levee river toe section.

The pump will provide approximately 14,000 gpm and is sized to maintain a water elevation of 434.0 in the Wildlife Management Area (WMA). The existing axial flow propeller pitch will be modified and an additional stage will be provided to achieve the priming heads necessary for pumping over the levee. The existing power and control equipment will be utilized and will be housed in the new pump station. The existing manual and automatic float controls will be used to maintain the proper water elevations. Pump and motor removal will be accomplished through a secured

opening in the pump station roof. A hand cleanable trash rack will be provided at the intake entrance for protection of the pump propellers from large debris.

STATION FEATURES

The pump station structure will consist of a masonry building above a sheet pile formed sump. Access to the sump will be by an access hatch located outside of the building. The pump discharge will feed a 230-foot-long, 24-inch steel pipe which will enter a 48-inch concrete standpipe. The standpipe will be located in an outlet pond which will be used to remove rough fish. System head computations and pump curves are shown on pages I-4 through I-8.

OPERATION

The pump unit will be manually activated and in the automatic mode and will be shut off by float switches when the WMA reaches elevation 434.0. There also will be a provision for complete manual operation which will allow for manual shutoff when pumping is supervised.

ELECTRICAL

The existing pump station houses a 400 hp pump and a 100 hp pump which are both fed off 800 amp service. The three major parts of electrical work for this project are as follows:

1. Move the 100 hp pump and its controller to the new pump station location.

2. Create a new ground field for each pump station. Ground all equipment in both the existing and new pump stations and tie these grounds to that pump station's ground field in an effort to reduce the likelihood of damage due to lightning strikes.

3. Install lightning protection as per NFPA 780.

The 100 hp pump, motor, controller, switches, floats, and float electronic boxes will be moved from the existing pump station to the new pump station. The main disconnect will be replaced due to its age, hence, its ability to protect the equipment as well as a new model. The new pump station will be approximately 160 feet from the meter pole, so there will be approximately 200 feet of power line and two utility poles to supply service to the new pump station. The transformer and meter poles will remain in place. Since the ownership for the utility ends at the meter, installation of service from the meter to the new pump station and the grounding of the existing pump station will be the Government's responsibility through its contractor. The

contractor must coordinate with the utility to develop a plan on division of work responsibilities.

The existing three-phase transformer configuration is of delta secondary. A wye secondary would offer a much better configuration for reducing the damage caused by lightning. The local utility does not offer the wye configured, pole-mounted transformers as an option at this time. Therefore, part 2 is a second option to limit lightning damage.

The local utility which supplies the Banner Marsh area is Central Illinois Public Service (CIPS), Canton, Illinois, phone (800) 543-2477.

The total load on the utility has not changed; it is only physically moved.

Load and short circuit analysis for the pump station are shown on pages I-9 through I-16. An electrical one-line diagram and details are shown on plates 18, 19, and 20 of the main report.

Subject: BANNER MARSH PUMP STATION		Date 11/94
Computed by JWB	Checked by	Sheet 1 of

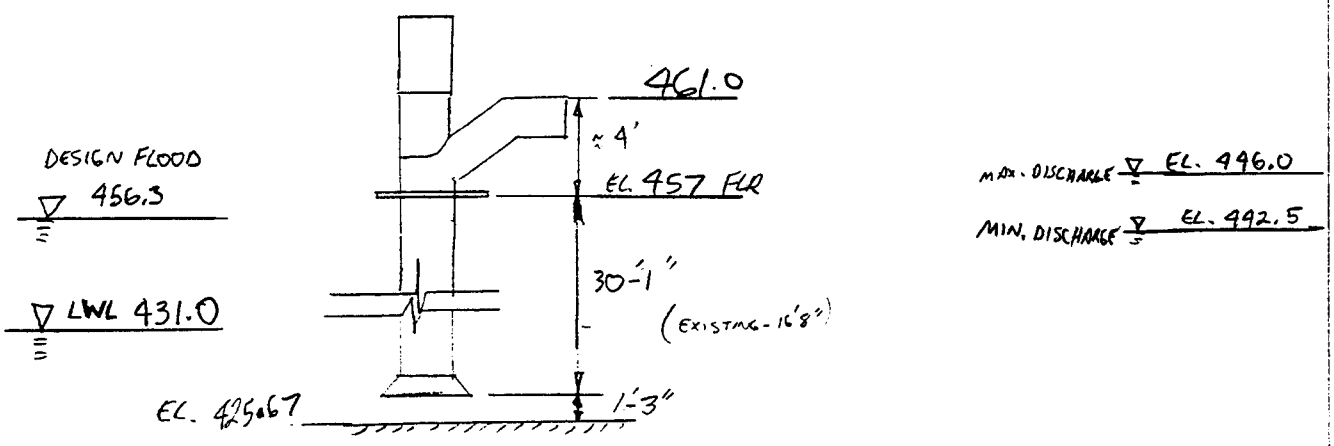
EXISTING PUMP IS A COUCH AXIAL FLOW 20" PROP., 24" DISCHARGE
RATED AT 13,600 GPM @ 21' TDH
30" INTAKE, 885 RPM

SUMP DIMENSIONS BASED ON D = 30"

WIDTH = 2D = 60"
DIST. FROM FLOOR = .5D = 15" = 1.25'
DIST. FROM BACK WALL = .25D = 7.5"

L.W.L = 431.0
TOP OF LEVEE = 457.0
MIN. SUBMERGED DISTANCE ABOVE INTAKE = 3'-9"

SUMP FLOOR EL. = 431.0 − (3.75 + 1.25') ≈ 426.0



PRIMING STATIC HEAD 461 − 431 = 30'
STATIC HEAD @ TOP OF LEVEE 457 − 431 = 26'
EQUIV. LENGTH OF PIPE ≈ 230 LF.

BANNER MARSH PUMP STATION		Date 11/94
Computed by JWB	Checked by	Sheet 2 of

PRIMING REQUIRMENTS:

MINIMUM VELOCITY = 7 FPS

$$A_{pipe} = \frac{(24)^2 \pi}{4} = \frac{452.4 \text{ in}^2}{144} = 3.14 \text{ ft}^2$$

MINIMUM CAPACITY FOR PRIMING

$$Q_p = 7 \text{ FPS} \times 3.14 \text{ ft}^2 = 22 \text{ ft}^3/\text{s}$$

$$Q_p = (22)(448.8) = 9{,}900 \text{ GPM MINIMUM}$$

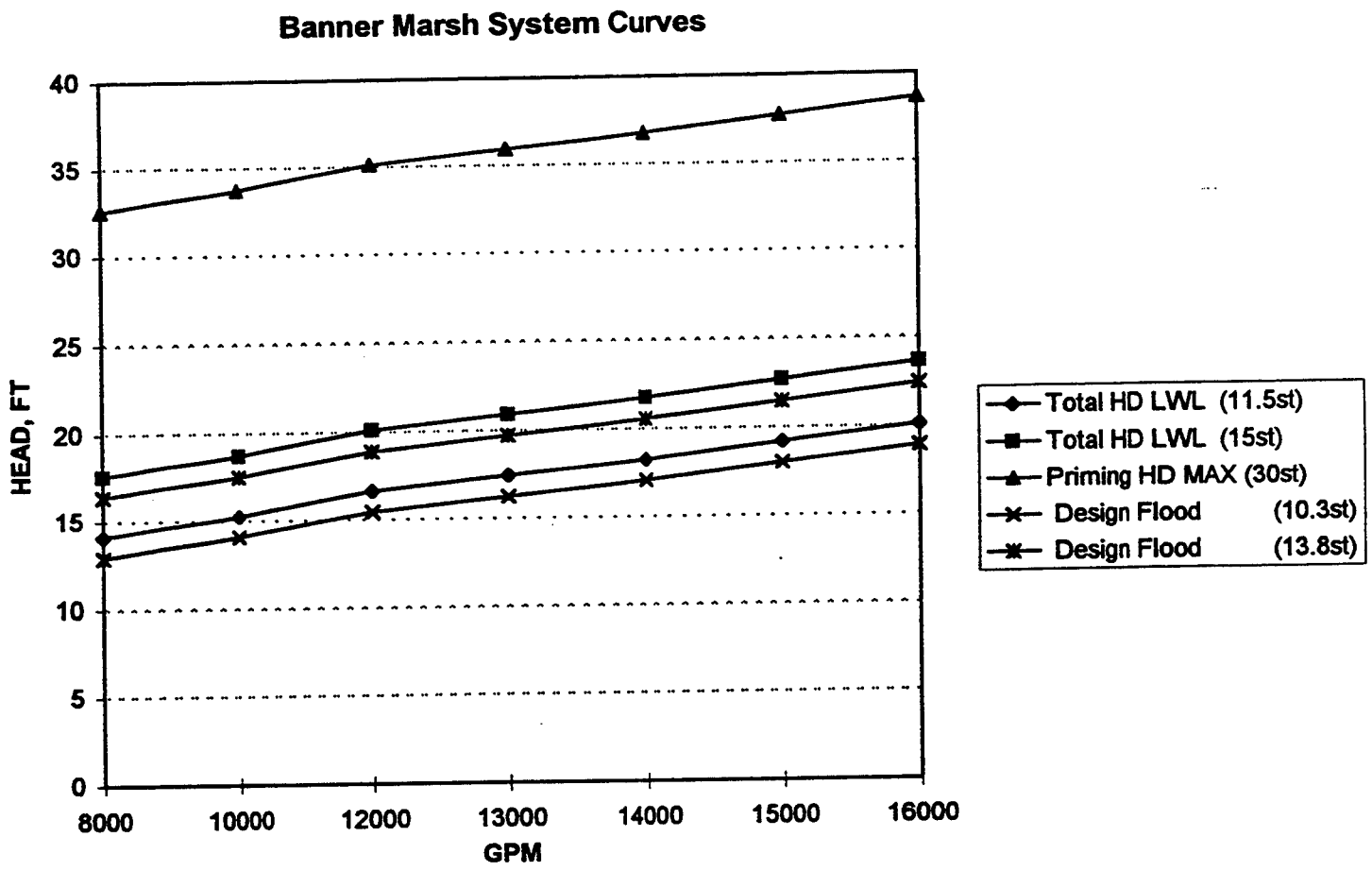
THE MINIMUM REQUIREMENT FOR KEEPING THE MARSH AT 434.0 IS 4500GPM, THERE FORE THE EXISTING PUMPING IS MORE THAN ADEQUATE. SELECT A CAPACITY OF 14,000 GPM SINCE THIS FALLS WITHIN THE EXISTING PUMP CURVE RANGE.

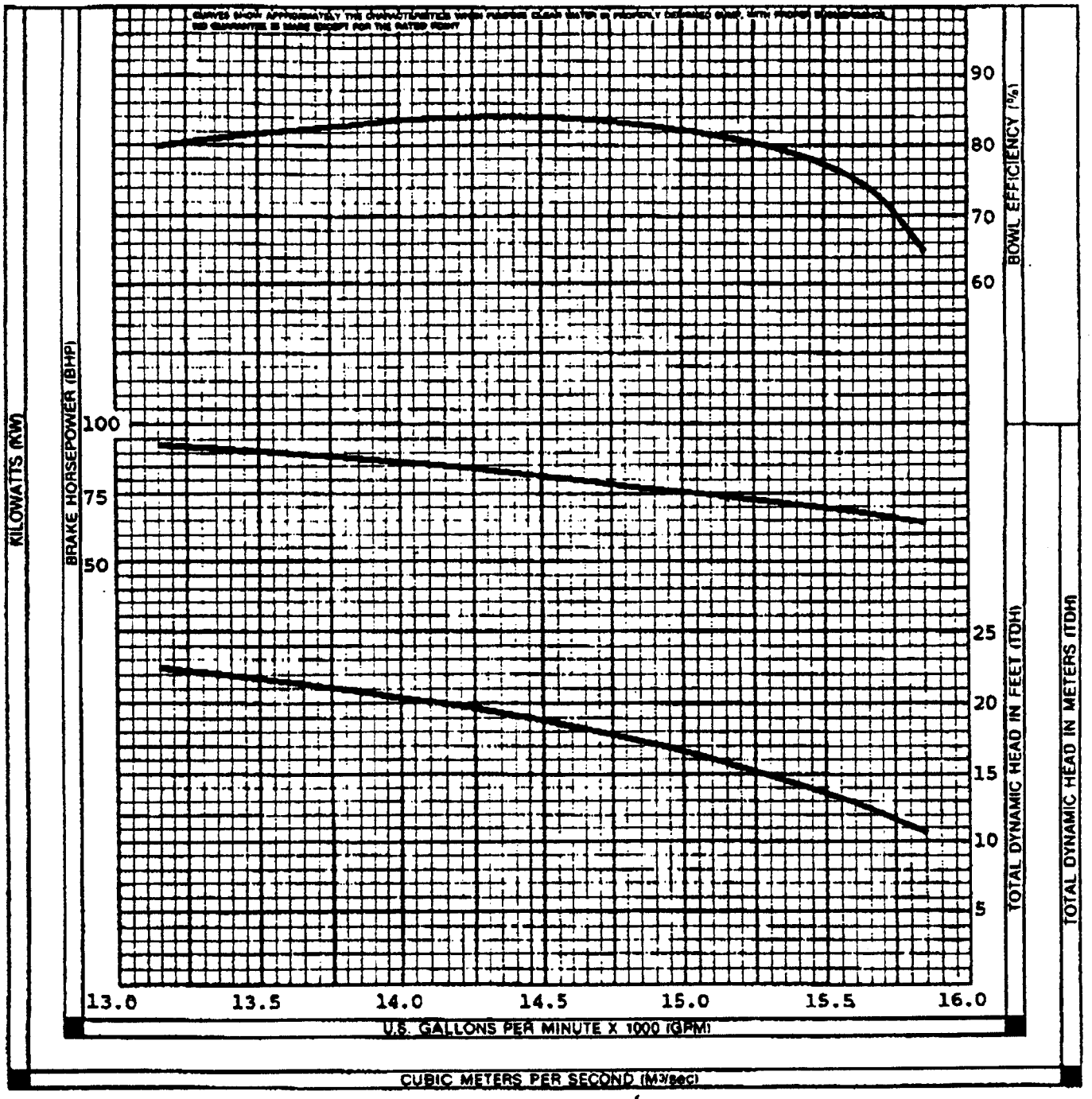
A TWO STAGE PUMP IS REQUIRED DUE TO THE HIGH HEADS ENCOUNTERED IN PUMPING OVER THE LEVEE. THE EXISTING PUMP PUMPS APPROXIMATELY 14,000GPM @ 20 FT OF HEAD. A TWO STAGE PUMP CAN PUMP UP TO 40FT.

THE PUMP COLUMN WILL REQUIRE AN EXTENSION OF 13'-5".

Banner Marsh Pump Requirements

Banner Marsh propeller pump 24 " discharge										
LWL @ 431.0; Design Flood @ EL. 456.3; Discharge EL. 442.5-446.0										
GPM	V*V/2g	Losses Bends K=.7	Loss per 100'	Pipe Losses (230LF)	Trsh rck Add .5'	Total HD LWL (11.5st)	Total HD LWL (15st)	Priming HD MAX (30st)	Design Flood (10.3st)	Design Flood (13.8st)
8000	0.63	0.441	0.441	1.0143	0.5	14.0853	17.5853	32.5853	12.8853	16.3853
10000	0.99	0.693	0.671	1.5433	0.5	15.2263	18.7263	33.7263	14.0263	17.5263
12000	1.42	0.994	0.959	2.2057	0.5	16.6197	20.1197	35.1197	15.4197	18.9197
13000	1.68	1.176	1.12	2.576	0.5	17.432	20.932	35.932	16.232	19.732
14000	1.94	1.358	1.29	2.967	0.5	18.265	21.765	36.765	17.065	20.565
15000	2.24	1.568	1.48	3.404	0.5	19.212	22.712	37.712	18.012	21.512
16000	2.53	1.771	1.67	3.841	0.5	20.142	23.642	38.642	18.942	22.442


Banner Marsh System Curves
HEAD, FT
40
35
30
25
20
15
10
5
0
8000
10000
12000
13000
14000
15000
16000
GPM
Total HD LWL (11.5st)
Total HD LWL (15st)
Priming HD MAX (30st)
Design Flood (10.3st)
Design Flood (13.8st)



13,600 GPM @ 21' TDH

COUCH PUMP COMPANY
GRANT, FLA.

5355 U.S. HWY. 1
P.O. BOX 255
GRANT, FL.
32949 U.S.A.

ESTABLISHED 1917

PUMP PERFORMANCE CURVE

PROJECT: BANNER MARSH PUMP SN: 6574

TYPE: AXIAL FLOW	PROPELLER DIA.: 20"
MODEL NO.: NW320x24-P41	SPEED (RPM): 885
INTAKE DIA.: 30"	DISCHARGE COLUMN DIA.: 24"
CURVE NO.: PG10478	Ns: CODE:

SINGLE STAGE
FOR TWO STAGES MULTIPLY HEAD AND HORSEPOWER BY 2.0 AND EFFICIENCY BY 1.0

PERFORMANCE BASED ON PUMPING CLEAR COLD NON-AERATED WATER, SPECIFIC GRAVITY 1.0, TEMPERATURE 85 DEGREES (FAHRENHEIT) OR LESS, AT SEA LEVEL. PERFORMANCE MAY BE AFFECTED BY HIGHER TEMPERATURES, SPECIFIC GRAVITIES.

IT IS HEREBY CERTIFIED THAT THIS CURVE REPRESENTS THE TRUE PERFORMANCE CHARACTERISTICS OF THE COUCH PUMP MODEL SHOWN AND WAS OBTAINED BY SCALE MODEL TEST AND CALCULATIONS IN ACCORDANCE WITH STANDARDS OF THE HYDRAULIC INSTITUTE

COUCH PUMP COMPANY
CERTIFIED BY

J. DAVID ELLER, P.E 10439
Couch Pump Company
Grant, Florida

Subject	BANNER MARSH PUMP STATION	Date 21 DEC. 94
Computed by RJN	Checked by	Sheet 1 of 5

TRANSFORMER SIZING

SINCE NO CHANGE IN LOAD, THERE WILL NOT BE ANY CHANGE IN TRANSFORMER SIZE.

CONDUCTOR SIZING (METER POLE TO NEW PUMP STN)

$I_{FL\ 100\ HP\ MOTOR} = 124A$ (NEC TABLE 430-150)

$125\% \times I_{FL} = 125\% \times 124A = 155A$

LIGHTING + RECEPTACLES $\approx 5A$ FOR A TOTAL CURRENT OF 155+5=160A

FROM NEC TABLE 310-16 AND SOUTHWIRE QUADRUPLEX SERVICE DROP TABLE.

#2/0 COPPER CONDUCTOR WILL CARRY 175A.

PERCENT VOLTAGE DROP (%VD)

FROM NEC TABLE 9 AND ASSUMING .85 PF

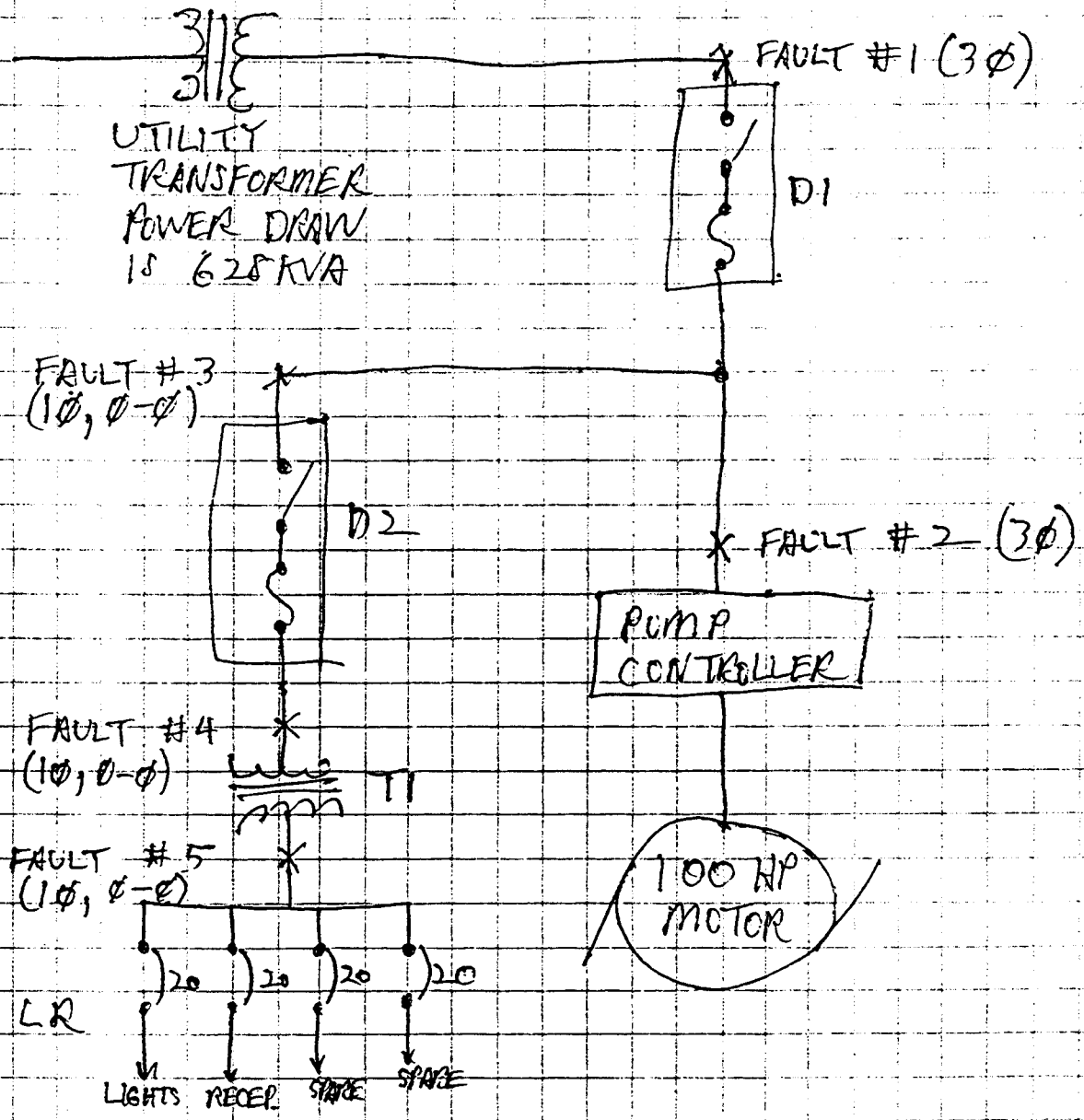
$.11\ \Omega / 1000\ ft \longrightarrow .022\ \Omega / 200\ ft.$

$V_D = IR = (160A)(.022\Omega) = 3.52V.$

$\%V_D = \frac{3.52V\sqrt{3}}{480V} = 1.26\%$ BELOW THE 3% LIMIT.

Subject BANNER MARSH PUMP STATION		Date 21 DEC. 94
Computed by RJW	Checked by	Sheet 2 of 5

SHORT CIRCUIT CURRENT STUDY.



Subject BANNAR MARSH PUMP STATION		Date 21 DEC. 94
Computed by RJW	Checked by	Sheet 3 of 5

ASSUME INFINITE CURRENT TO UTILITY TRANSFORMER.

SINCE THE TRANSFORMER LOAD IS 628 KVA, ASSUME IT IS SIZED BETWEEN 500 AND 750 KVA, WHICHEVER THE WORST CASE MAY BE.

I_{SCA} = 46,230A (TABLE 5-7-4 FOR 500 KVA)

FAULT #1

WORST CASE IS FOR 3Φ FAULT.

$$f_1 = \frac{1.73 \times L \times I_{SCA}}{C \times E_{L-L}} = \frac{1.73 \times 200\,ft \times 46{,}230A}{9350A \times 480V.}$$

(TABLE 5-7-1)

$f_1 = 3.56$

$M_1 = .22$ (TABLE 5-7-3)

$I_1 = 46{,}230A \times .22 = 10{,}171\,A$

FAULT #2

$$f_2 = \frac{1.73 \times L \times I_1}{C \times E_{L-L}} = \frac{1.73 \times 5\,ft \times 10{,}171A}{870CA \times 480V.} = .021$$

$M_2 = .98$

$I_2 = 10{,}171A \times .98 = 9968A.$

Subject BANNER MARSH PUMP STATION		Date 21 DEC. 94
Computed by RJW	Checked by	Sheet 4 of 5

FAULT #3

WORST CASE IS FOR 1Ø FAULT, Ø TO Ø VOLTAGE.

$$f_3 = \frac{2 \times L \times I_2}{C \times E_{L-L}} = \frac{2 \times 54 \times 9968A}{617 \times 480V} = .34$$

$M_3 = .74$

$I_3 = 9968A \times .74 = 7376A$

FAULT #4

$$f_4 = \frac{2 \times L \times I_3}{C \times E_{L-L}} = \frac{2 \times 5 \times 7376}{617 \times 480V} = .25$$

$M_4 = .80$

$I_4 = 7376 \times .80 = 5900A$

FAULT #5

$$f_5 = \frac{I_4 \times E_{L-L} \times \%Z}{100{,}000 \times KVA_{T_1}} = \frac{5900A \times 480V \times 1}{100{,}000 \times 2} = 14.16$$

(ASSUMPTION)

$M_5 = .06$

$$I_5 = \frac{E_{L-L}}{120V} \times M_5 \times I_4 = \frac{480V}{120V} \times .06 \times 5900A = 1416\ A.$$

Subject BANNER MARSH PUMP STATION		Date 21 DEC. 94
Computed by RJW	Checked by	Sheet 5 of 5

THE RESULT OF THESE SHORT CIRCUIT CALCULATIONS GIVES THE MINIMUM FAULT CURRENT RATINGS OF THE COMPONENTS OF THE ELECTRICAL COMPONENTS USED, ie D1, D2, AND LR.

5.7 Calculation Of Short-Circuit Currents—Point-To-Point Method.

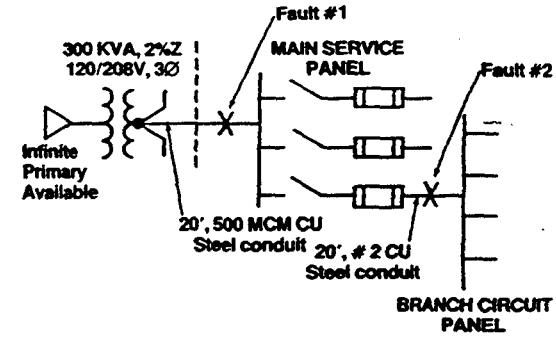
Adequate interrupting capacity and protection of electrical components are two essential aspects required by the 1984 National Electrical Code in Sections 110-9, 110-10, 230-98, and 240-1. The first step to assure that system protective devices have the proper interrupting rating and provide component protection is to determine the available short-circuit currents. The application of the point-to-point method permits the determination of available short-circuit currents with a reasonable degree of accuracy at various points for either 3ϕ or 1ϕ electrical distribution systems. This method assumes unlimited primary short-circuit current (infinite bus).

Basic Short-Circuit Calculation Procedure.

Procedure		Formulae	
Step 1	Determine transf. full-load amperes from either: a) Name plate b) Table 5-7-2 c) Formula	3ϕ trahsf.	$I_{FLA} = \frac{KVA \times 1000}{E_{L-L} \times 1.73}$
		1ϕ transf.	$I_{FLA} = \frac{KVA \times 1000}{E_{L-L}}$
Step 2	Find transf. multiplier.	—	$\text{Multiplier} = \frac{100}{\text{Transf.}\%Z}$
Step 3	Determine transf. let-thru short-circuit current (Table 5-7-4 or formula).	—	$^{\dagger}I_{SCA} = \text{Transf.}_{FLA} \times \text{multiplier}$
Step 4	Calculate "f" factor.	3ϕ faults	$f = \frac{1.73 \times L \times I}{C \times E_{L-L}}$
		1ϕ line-to-line (L-L) faults on 1ϕ, center-tapped transformers	$f = \frac{2 \times L \times I}{C \times E_{L-L}}$
		1ϕ line-to-neutral (L-N) faults on 1ϕ, center-tapped transformers	$f = \frac{2 \times L \times I^{*}}{C \times E_{L-N}}$
		L = length (feet) of circuit to the fault. C = constant from Table 5-7-1. For parallel runs, multiply C values by the number of conductors per phase. I = available short-circuit current in amperes at beginning of circuit.	
Step 5	Calculate "M" (multiplier) or take from Table 5-7-3.	$M = \frac{1}{1+f}$	
Step 6	Compute the available short-circuit current (symmetrical) at the fault.	I_{SCA} at fault $= I_{SCA}$ at beginning of crk. $\times M$	

†**Note 1.** Motor short-circuit contribution, if significant, may be added to the transformer secondary short-circuit current value as determined in Step 3. Proceed with this adjusted figure through Steps 4, 5, and 6. A practical estimate of motor short-circuit contribution is to multiply the total load current in amperes by 4.

Example Of Short-Circuit Calculation.



FAULT #1

Step 1 $I_{FLA} = \frac{KVA \times 1000}{E_{L-L} \times 1.73} = \frac{300 \times 1000}{208 \times 1.73} = 834A$

Step 2 $\text{Multiplier} = \frac{100}{\text{Trans.}\%Z} = \frac{100}{2} = 50$

Step 3 $I_{SCA} = 834 \times 50 = 41{,}700A$
At Transformer Secondary

Step 4 $f = \frac{1.73 \times L \times I}{C \times E_{L-L}} = \frac{1.73 \times 20 \times 41{,}700}{18{,}100 \times 208} = .383$

Step 5 $M = \frac{1}{1+f} = \frac{1}{1+0.383} = .723$ (See Table 5-7-3)

Step 6 I_{SCA} Fault #1 $= 41{,}700 \times .723 = 30{,}150A$

FAULT #2

Step 4 Use I_{SCA} @ Fault #1 to calculate

$f = \frac{1.73 \times 20 \times 30{,}150}{4760 \times 208} = 1.05$

Step 5 $M = \frac{1}{1+f} = \frac{1}{1+1.05} = 0.49$ (See Table 5-7-3)

Step 6 I_{SCA} Fault #2 $= 30{,}150 \times 0.49 = 14{,}770A$

Note: For simplicity, the motor contribution was not included.

***Note 2.** The L-N fault current is higher than the L-L fault current at the secondary terminals of a single-phase center-tapped transformer. The short-circuit current available (I) for this case in Step 4 should be adjusted at the transformer terminals as follows:

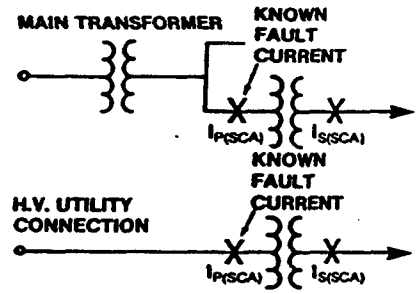
At L-N center tapped transformer terminals
I = 1.5 × L-L Short-Circuit Amperes at Transformer Terminals

At some distance from the terminals, depending upon wire size, the L-N fault current is lower than the L-L fault current. The 1.5 multiplier is an approximation and will theoretically vary from 1.33 to 1.67. These figures are based on change in turns ratio between primary and secondary, infinite source available, zero feet from terminals of transformer, and 1.2 × %X and 1.5 × %R for L-N vs. L-L resistance and reactance values. Begin L-N calculations at transformer secondary terminals, then proceed point-to-point.

BULLETIN 5P084
ELECTRICAL PROTECTION HANDBOOK
McGRAW-EDISON
BUSS

Calculation Of Short-Circuit Currents At Second Transformer In System.

Use the following procedure to calculate the level of fault current at the secondary of a second, downstream transformer in a system when the level of fault current at the transformer primary is known.



Procedure For Second Transformer In System.

Procedure		Formulae	
Step 1	Calculate "f" ($I_{P(SCA)}$, known).	3ϕ transformer ($I_{P(SCA)}$ and $I_{S(SCA)}$ are 3ϕ fault values.)	$f = \frac{I_{P(SCA)} \times V_P \times 1.73\,(\%Z)}{100{,}000 \times KVA_{TRANS.}}$
		1ϕ transformer ($I_{P(SCA)}$ and $I_{S(SCA)}$ are 1ϕ fault values; $I_{S(SCA)}$ is L-L.)	$f = \frac{I_{P(SCA)} \times V_P \times (\%Z)}{100{,}000 \times KVA_{TRANS.}}$
Step 2	Calculate "M" (multiplier) or take from Table 5-7-3.	—	$M = \frac{1}{1+f}$
Step 3	Calculate short-circuit current at secondary of transformer. (See Note 1 under "Basic Procedure")	—	$I_{S(SCA)} = \frac{V_P}{V_S} \times M \times I_{P(SCA)}$

$I_{P(SCA)}$ = Available fault current at transformer primary.
$I_{S(SCA)}$ = Available fault current at transformer secondary.
V_P = Primary voltage L-L.
V_S = Secondary voltage L-L.

KVA_{TRANS} = KVA rating of transformer.
% Z = Percent impedance of transformer.
Note — To calculate fault level at the end of a conductor run, follow Steps 4, 5, and 6 of Basic Procedure.

Table 5-7-1. "C" Values For Conductors and *Busway.

AWG Or MCM	Copper Three Single Conductors				Copper Three-Conductor Cable		Aluminum-Three Single Conductors Or Three-Conductor Cables	
	Magnetic Duct		Nonmagnetic Duct		Magnetic Duct	Nonmagnetic Duct	Magnetic	Nonmagnetic Duct
	600V And 5KV Nonshielded	5KV Shielded And 15KV	600V And 5KV Nonshielded	5KV Shielded And 15KV	600V And 5KV Nonshielded	600V And 5KV Nonshielded	600V And 5KV Nonshielded	600V And 5 KV Nonshielded
12	617	—	—	—	—	—	—	—
10	982	—	—	—	—	—	—	—
8	1230	1230	1230	1230	1230	1230	—	—
6	1940	1940	1950	1940	1950	1950	1180	1180
4	3060	3040	3080	3070	3080	3090	1870	1870
3	3860	3830	3880	3870	3880	3900	2360	2360
2	4760	4670	4830	4780	4830	4850	2960	2970
1	5880	5750	6020	5920	6020	6100	3720	3750
1/0	7190	6990	7460	7250	7410	7580	4670	4690
2/0	8700	8260	9090	8770	9090	9350	5800	5880
3/0	10400	9900	11500	10700	11100	11900	7190	7300
4/0	12300	10800	13400	12600	13400	14000	8850	9170
250	13500	12500	14900	14000	14900	15800	10300	10600
300	14800	13600	16700	15500	16700	17900	11900	12400
350	16200	14700	18700	17000	18600	20300	13500	14200
400	16500	15200	19200	17900	19500	21100	14800	15800
450	17300	15900	20400	18800	20700	22700	—	—
500	18100	16500	21500	19700	21900	24000	17200	18700
600	18900	17200	22700	20900	23300	25700	18900	21000
700	—	—	—	—	—	—	20500	23100
[illegible]	[illegible]0200	18300	24700	22500	25600	28200	21500	24300
[illegible]	—	—	—	—	—	—	23600	27600

*See next page for Busway

Table 5-7-1B. "C" Values For Busway.

Ampacity	Plug-In Busway		Feeder Busway		High Imped. Busway
	Copper	Aluminum	Copper	Aluminum	Copper
225	28700	23000	18700	12000	—
400	38900	34700	23900	21300	—
600	41000	38300	36500	31300	—
800	46100	57500	49300	44100	—
1000	69400	89300	62900	56200	15600
1200	94300	97100	76900	69900	16100
1350	119000	104200	90100	84000	17500
1600	129900	120500	101000	90900	19200
2000	142900	135100	134200	125000	20400
2500	143800	156300	180500	166700	21700
3000	144900	175400	204100	188700	23800
4000	—	—	277800	256400	—

Table 5-7-2A. Three-Phase Transformer—Full-Load Current Rating (In Amperes).

Voltage (Line-To-Line)	Transformer KVA Rating								
	150	167	225	300	500	750	1000	1500	2000
208	417	464	625	834	1388	2080	2776	4164	5552
220	394	439	592	788	1315	1970	2630	3940	5260
240	362	402	542	722	1203	1804	2406	3609	4812
440	197	219	296	394	657	985	1315	1970	2630
460	189	209	284	378	630	945	1260	1890	2520
480	181	201	271	361	601	902	1203	1804	2406
600	144	161	216	289	481	722	962	1444	1924

Table 5-7-2B. Single-Phase Transformer—Full-Load Current Rating (In Amperes).

Voltage	Transformer KVA Rating									
	25	50	75	100	150	167	200	250	333	500
120	109	217	326	435	652	726	870	1087	1448	2174
120/240	104	208	313	416	625	696	833	1042	1388	2083
230/460	54	109	163	217	326	363	435	544	724	1087
240/480	52	104	156	208	313	348	416	521	694	1042

Table 5-7-3. "M" (Multiplier).*

f	M	f	M
0.01	0.99	1.50	0.40
0.02	0.98	1.75	0.36
0.03	0.97	2.00	0.33
0.04	0.96	2.50	0.29
0.05	0.95	3.00	0.25
0.06	0.94	3.50	0.22
0.07	0.93	4.00	0.20
0.08	0.93	5.00	0.17
0.09	0.92	6.00	0.14
0.10	0.91	7.00	0.13
0.15	0.87	8.00	0.11
0.20	0.83	9.00	0.10
0.25	0.80	10.00	0.09
0.30	0.77	15.00	0.06
0.35	0.74	20.00	0.05
0.40	0.71	30.00	0.03
0.50	0.67	40.00	0.02
0.60	0.63	50.00	0.02
0.70	0.59	60.00	0.02
0.80	0.55	70.00	0.01
0.90	0.53	80.00	0.01
1.00	0.50	90.00	0.01
1.20	0.45	100.00	0.01

* $M = \frac{1}{1 + F}$

Table 5-7-4. Short-Circuit Currents Available from Various Size Transformers.

Voltage And Phase	KVA	Full Load Amps	% Impedance	†Short Circuit Amps
120/240 1 ph.	25	104	1.6	10,300
	37½	156	1.6	15,280
	50	209	1.7	19,050
	75	313	1.6	29,540
	100	417	1.6	38,540
	167	695	1.8	54,900
120/208 3 ph.	150	417	2.0	20,850
	225	625	2.0	31,250
	300	834	2.0	41,700
	500	1388	2.0	69,400
	750	2080	5.0	41,600
	1000	2776	5.0	55,520
	1500	4164	5.0	83,280
	2000	5552	5.0	111,040
277/480 3 ph.	112½	135	1.0	13,500
	150	181	1.2	15,083
	225	271	1.2	22,583
	300	361	1.2	30,083
	500	601	1.3	46,230
	750	902	5.0	18,040
	1000	1203	5.0	24,060
	1500	1804	5.0	36,060
	2000	2406	5.0	48,120
	2500	3007	5.0	60,140

*Three-phase short-circuit currents based on "infinite" primary. Single-phase short-circuit currents on 100,000 KVA primary. Single phase values are line to neutral currents at transformer terminals.

APPENDIX J

COST ESTIMATE

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT (R-11F)

BANNER MARSH STATE FISH AND WILDLIFE AREA

LA GRANGE POOL, ILLINOIS WATERWAY
RIVER MILES 138.5 THROUGH 143.9
FULTON AND PEORIA COUNTIES, ILLINOIS

APPENDIX J
COST ESTIMATE

GENERAL

This appendix contains the detailed cost estimate prepared for the Banner Marsh State Fish and Wildlife Area Environmental Management Program project including Federal construction, planning, engineering, and design, and construction management costs. The current working estimate (CWE) prepared for this Definite Project Report (DPR) level study was developed after review of project plans, discussion with the design team members, and review of costs for similar construction projects. The Micro-Computer Aided Cost Estimating System (M-CACES Gold, v. 5.30), incorporating local wage and equipment rates, was utilized to assemble and calculate project element costs. Costs, including appropriate contingencies, are presented in accordance with EC 1110-2-536, Civil Works Project Cost Estimating - Code of Accounts, as Table 15-1 on pages 58 and 59 of the Definite Project Report.

PRICE LEVEL

Project element costs are based on January 1995 prices. These costs are considered fair and reasonable to a well-equipped and capable contractor and include overhead and profit. Calculation of the Fully Funded Estimate (FFE) was done in accordance with guidance from CECW-B Memorandum, dated 23 February 1994, Subject: Factors for Updating Study/Project Cost Estimates for the FY 1996 Budget Submission.

CONTINGENCY DISCUSSION

After review of project documents and discussion with personnel involved in the project, cost contingencies were assigned which reflect the uncertainty associated with each cost item. Per EC 1110-2-263, these contingencies are based on qualified

cost engineering judgment of the available design data, type of work involved, and uncertainties associated with the work and schedule. Costs were not added as contingency amounts to cover items which are identified project requirements. The following discussion of major project features indicates the basis for contingency selection and assumptions. For other elements not addressed below, the assignment of contingencies was deemed appropriate to account for the uncertainty in design and quantity calculation and further discussion is not included.

a. Feature 06, Fish and Wildlife Facilities.

The quantities for this work were developed by the Design and Cost Engineering Branches.

06.-.-.- Levee Improvement. This project feature involves upgrading the existing levee by restoring the riverside slope and the addition of riprap at critical locations. After clearing and grubbing operations are completed, excavation in adjacent borrow locations will occur to provide the material for the slope restoration. No compaction is required other than that obtained by tracked equipment working the area. It is assumed that the riprap needed for this feature will have to be barged in to the site and placed directly by crane from the barge where the levee slope is accessible from the river. An overall contingency of 10 percent is considered adequate for this work since earthwork in this project is a low risk type operation and the riprap delivered material price is taken from a recent quote from a supplier.

06.-.-.- Pump Station. This work will require the construction of a building composed of concrete block masonry that is founded on steel sheet piling. The pump for this new pump station will be one taken from an existing pump station located nearby. This will require electrical and mechanical demolition and electrical and mechanical new work. The pump installation will also require adding a stage and changing the pitch of the propeller to account for the higher lift that will be needed. A supplier's quote was used for the material price of the additional parts needed for this. The discharge pipe from this pump station will run above ground for about 200 feet and terminate in the center of a filter stone pit with a precast concrete manhole. The installed cost for this item is based on historical unit prices with additional cost to account for the fact that the pipe will be elevated. To acquire water from the river the pump station will be connected to the river by an open cut channel. It is assumed that this work will be done by dragline crane. The contingency rates range from 10 to 25 percent. The higher rates have been applied to those items where there is incomplete design where uncertainty of actual construction features to be used is greater.

06.-.-.- Littoral Zone Grading. This work consists of the removal and placement of earth whereby areas surrounding the existing deep water areas would be graded to change from dry land not exceeding 4 feet above the water surface to flat shallow areas of water about 18 inches deep. This work would provide habitat that could be used for fish spawning, waterfowl and waterbird feeding, etc. This type of work would probably be done with scrapers and dozers and some of the material excavated will be used for the levee restoration work described earlier. Once the grading work

is completed the area will be seeded. The overall contingency for this work is about 10 percent. This rate was used because the work is common earthwork and seeding and there is not much uncertainty with this type of sitework except for quantities.

06.-.-.- Grassland Seeding. This work will involve the removal of select trees and mowing of the remaining vegetation to provide an area for grassland seeding Recent quotes were used for the material cost of the prairie grass seed and for typical productivity rates for seeding operations of this type. A contingency of 10 percent was chosen because of the simple procedures involved.

The project's overall construction cost contingency is 10.3 percent.

b. Feature 30, Planning, Engineering & Design.

The engineering and design for this project includes all planning and design work necessary to complete the Definite Project Report and prepare construction plans and specifications. This cost also includes engineering support during construction and preparation of as-built drawings and operation/maintenance manuals. The design effort for the project was analyzed to determine the man-year effort required. This estimate is based upon monies expended to date, discussions between the project engineer and project manager, and historical data and experience gained on other projects of similar nature.

c. Feature 31, Construction Management.

Construction management includes the following items: review of project reports, plans and specifications, and conferences of construction staff to become familiar with design requirements; biddability, contractability, and operability reviews; preaward activities to acquaint prospective bidders with the nature of work; administration of construction contracts; administration of A/E contracts which provide for supervision and inspection; establishment of bench marks and baselines required for layouts of construction, relocations, and clearing; review of shop drawings, manuals, catalog cuts, and other information submitted by the construction contractor; assure specifications compliance by supervision and inspection on construction work, conferences with the contractors to coordinate various features of the project and enforce compliance with schedules; sampling and testing during the construction phase to determine suitability and compliance with plans and specifications; negotiation with the contractor on all contract modifications, including preparation of all contract documents required therefore; estimate quantities, determine periodic payments to contractors, and prepare, review, and approve contract payments; review and approve construction schedules and progress charts; prepare progress and completion reports; project management and administration not otherwise identified; and district overhead. These costs may be incurred at the job site, an area office, or at the District Office. For the construction of the Banner Marsh State Fish and Wildlife Area Environmental Management project, the estimated cost of construction management is $375,000 for a construction contract with a 1.6-year duration and an estimated value of $3.8 million.

LITERATURE CITED

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UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT (R-11F)

BANNER MARSH STATE FISH AND WILDLIFE AREA

LA GRANGE POOL, ILLINOIS WATERWAY
RIVER MILES 138.5 THROUGH 143.9
FULTON AND PEORIA COUNTIES, ILLINOIS

APPENDIX K
LITERATURE CITED

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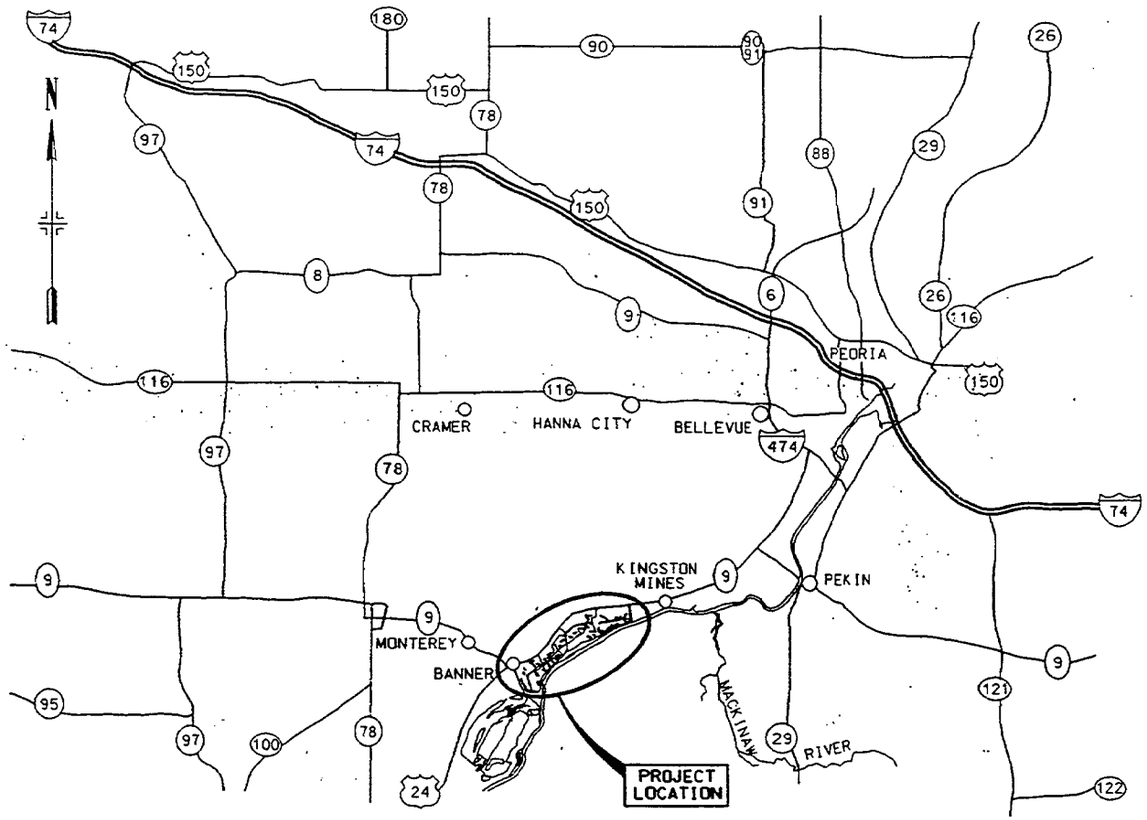
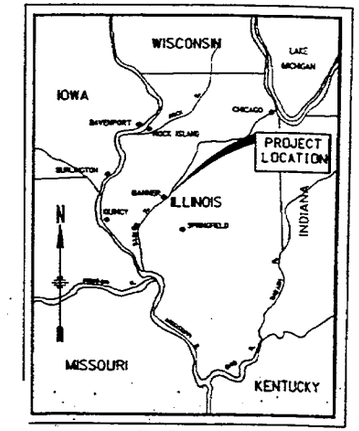
CENCR-ED-DN	3	3	3	1	1	1
CENCR-ED-DS	1	1	1	1	1	1
CENCR-ED-G	1	1	1	1	1	1
CENCR-ED-H	1	1	1	1	1	1
CENCR-ED-HH	1	1	1	1	1	1
CENCR-ED-HQ	1	1	1		1	1
CENCR-ED-T				1		
CENCR-IM-CL			2			
CENCR-LM				1		
CENCR-OC				1		
CENCR-OD	1	1	1	1	1	1
CENCR-OD-SI	1	1	1	1	1	1
CENCR-OD-T (DEVOS)	1	1	1	1	1	1
CENCR-OD-T (PORTECK)	1	1	1	1	1	1
CENCR-OD-MN	1	1	1	1	1	1
CENCR-PA	1	1	1			1
CENCR-PD	2	2	2			2
CENCR-PD-E	1	10	10	1	1	1
CENCR-PD-W (NILES)	1	1	1	1	1	1
CENCR-PP-M (KOWALCZYK)	1	1	1		1	1
CENCR-PP-P				1		1
CENCR-RE	1	1	1			

1/ I - DRAFT COORDINATION DOCUMENTS
II - PUBLIC REVIEW DOCUMENTS
III - ADMINISTRATION APPROVAL DOCUMENTS
IV - CONSTRUCTION PLANS AND SPECIFICATIONS
V - OPERATIONS AND MAINTENANCE INSTRUCTIONS
VI - PROJECT PERFORMANCE EVALUATION DOCUMENTS



LOCATION MAP

SCALE: 1" = 3M



VICINITY MAP

25 0 25 50 75

SCALE IN MILES

Revisions			
Symbol	Description	Date	Approved

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

Designed by: REH

Drawn by: TPD/SDH

Checked by: REH

Reviewed by: DJH

Approved by: CHARLES S. COX, COL., CORPS OF ENGINEERS

US Army Corps of Engineers

ILLINOIS WATERWAY
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL RIVER MILE 138-144
BANNER WILDLIFE MANAGEMENT AREA

LOCATION MAP, VICINITY PLAN, AND INDEX

Scale: AS SHOWN

Date: 13 JAN. 1995

Sheet reference number: X-2

Solicitation number:

Sheet 2 of

Drawing Code:

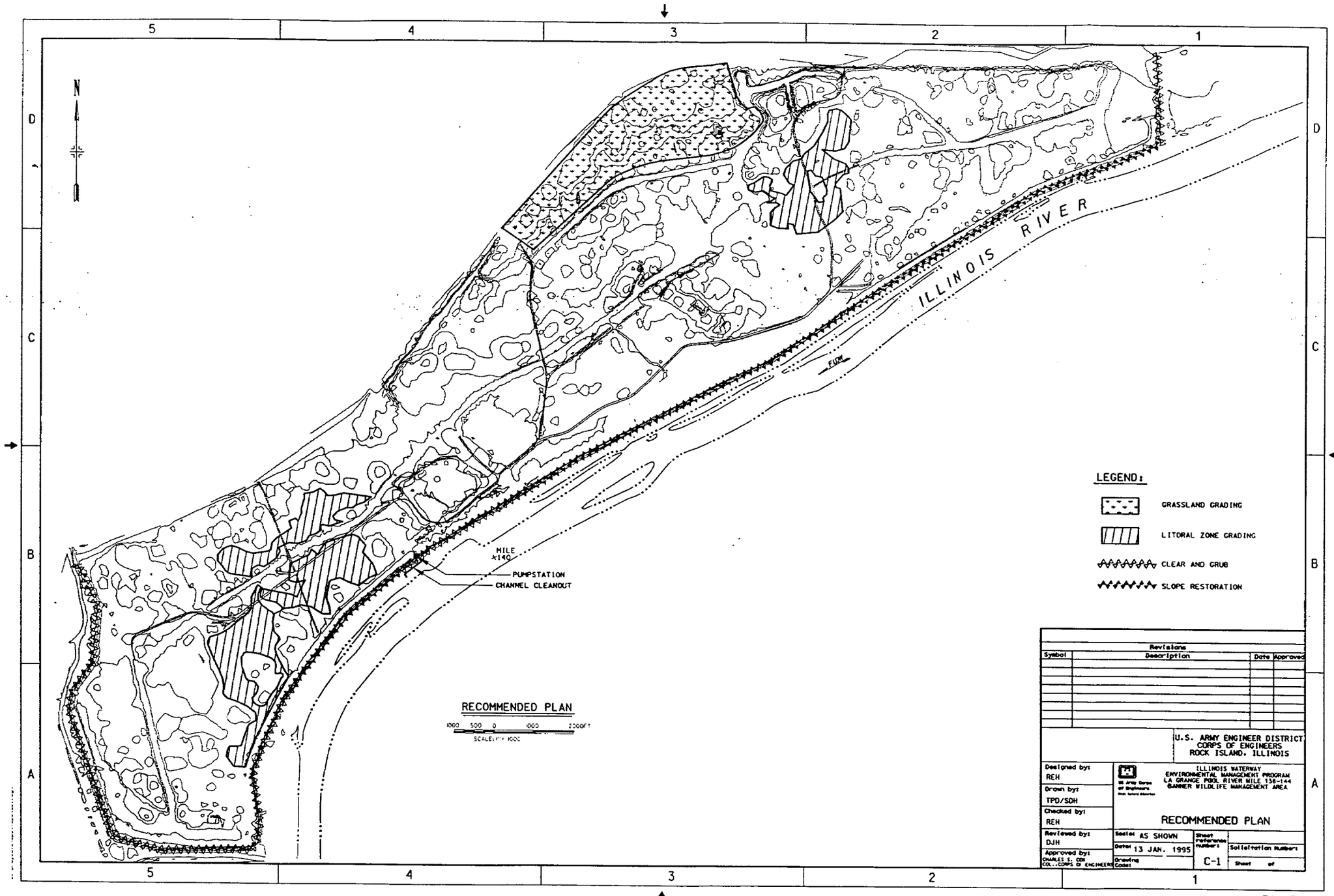
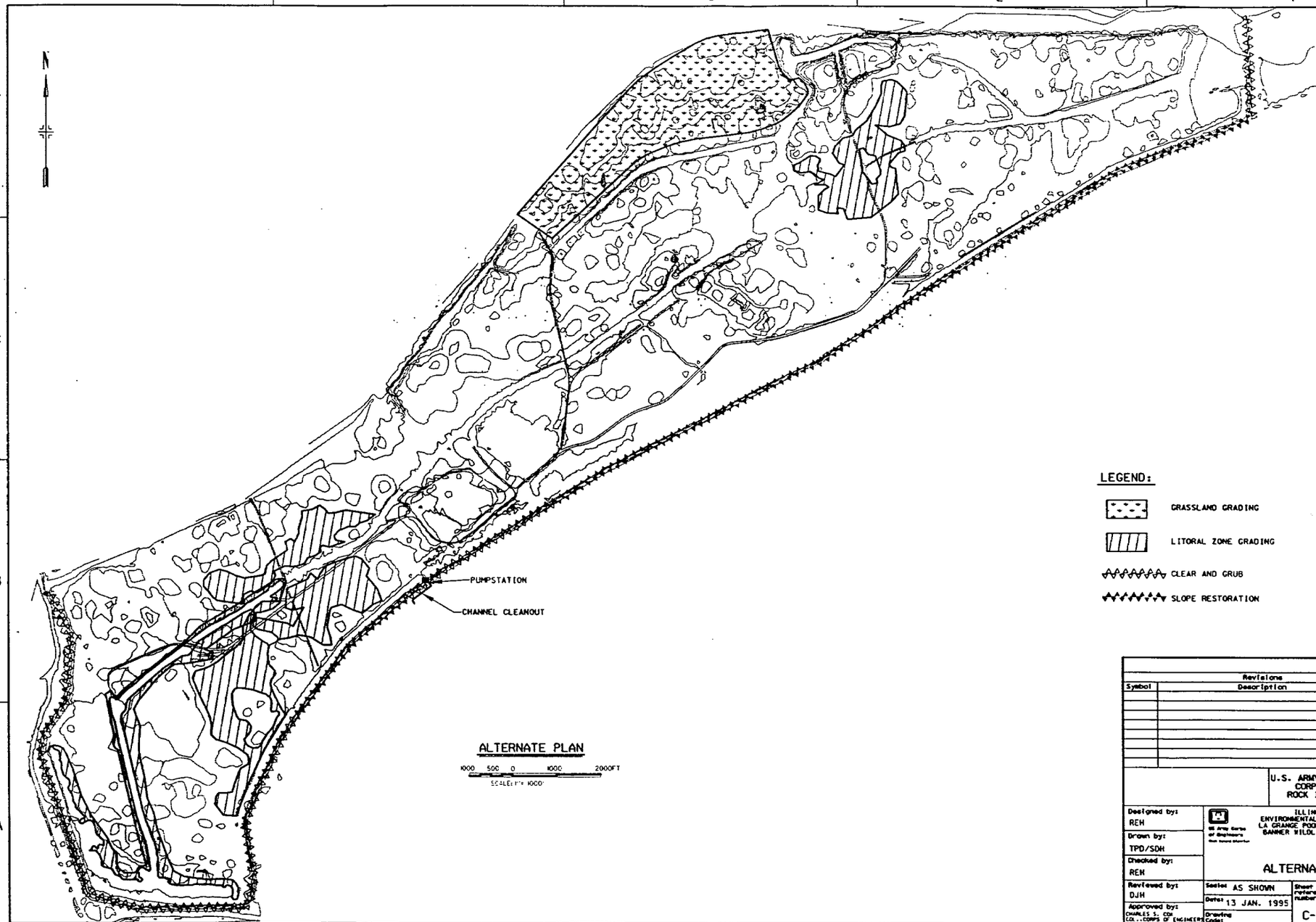

N
ILLINOIS RIVER
FLOW
MILE 140
PUMPSTATION
CHANNEL CLEANOUT
RECOMMENDED PLAN
1000 500 0 1000 2000FT
SCALE: 1"= 1000'
LEGEND:
GRASSLAND GRADING
LITORAL ZONE GRADING
CLEAR AND GRUB
SLOPE RESTORATION
Revisions
Symbol
Description
Date
Approved
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS
Designed by: REH
Drawn by: TPD/SDH
Checked by: REH
Reviewed by: DJH
Approved by: CHARLES S. COX COL., CORPS OF ENGINEERS
US Army Corps of Engineers Rock Island District
ILLINOIS WATERWAY
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL RIVER MILE 138-144
BANNER WILDLIFE MANAGEMENT AREA
RECOMMENDED PLAN
Scale: AS SHOWN
Date: 13 JAN. 1995
Sheet reference number: C-1
Drawing Code:
Solicitation Number:
Sheet of

PLATE 2



Revisions			
Symbol	Description	Date	Approved

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

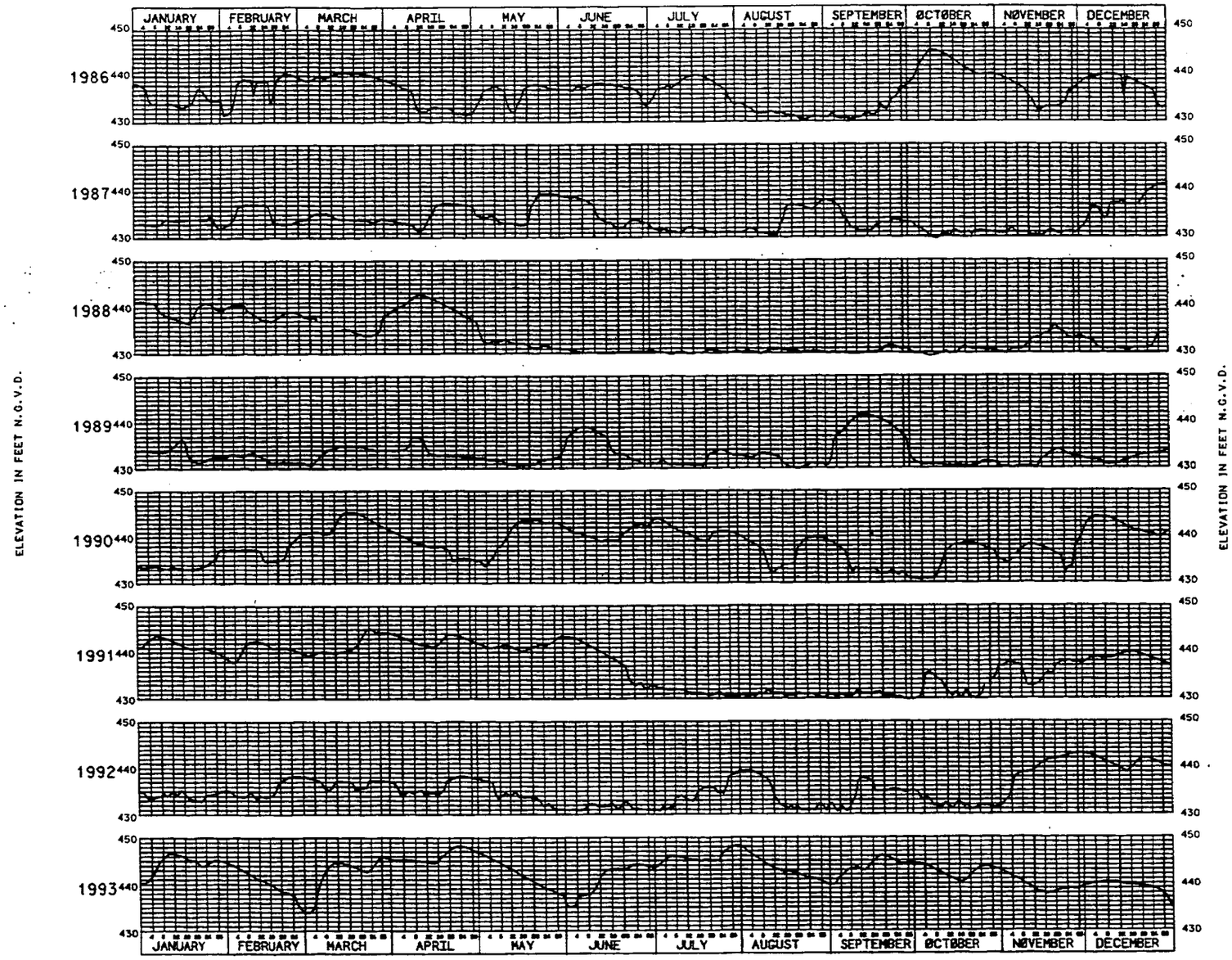
US Army Corps of Engineers Rock Island District

ILLINOIS WATERWAY
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL RIVER MILE 134-144
BANNER WILDLIFE MANAGEMENT AREA

ALTERNATE PLAN

Designed by: REH	Scale: AS SHOWN	Sheet reference number:	
Drawn by: TPD/SDH	Date: 13 JAN. 1995		Solicitation Number:
Checked by: REH	Drawing Code:	C-2	Sheet of
Reviewed by: DJH			
Approved by: CHARLES S. COX COL., CORPS OF ENGINEERS			

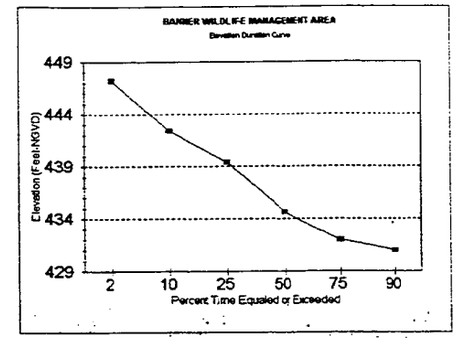
PLATE 3



ILLINOIS RIVER

NOTE- MILE 136.9

HYDROGRAPH
COPPERAS CREEK



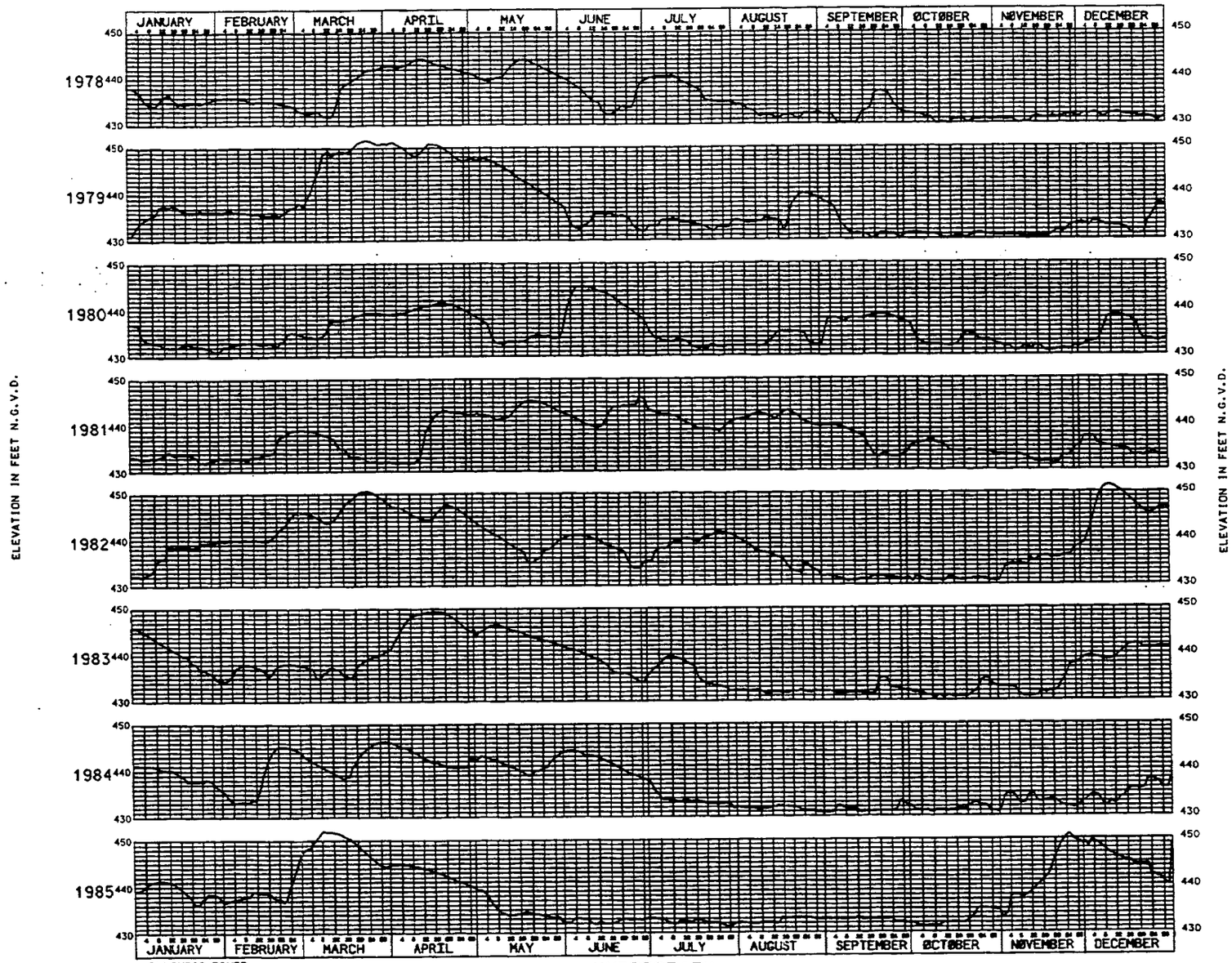
Revisions			
Symbol	Description	Date	Approved

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

ILLINOIS WATERWAY
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL RIVER MILE 138-144
BANNER WILDLIFE MANAGEMENT AREA

HYDRAULIC DATA I

Designed by: REH	Scale: AS SHOWN	Sheet reference number: C-3	
Drawn by: TPD/SDH	Date: 13 JAN. 1995		Solicitation Number:
Checked by: REH	Drawing Code:		Sheet 6 of
Reviewed by: DJH			
Approved by: CHARLES S. COX COL., CORPS OF ENGINEERS			



ILLINOIS RIVER

NOTE- MILE 136.9

HYDROGRAPH
COPPERAS CREEK

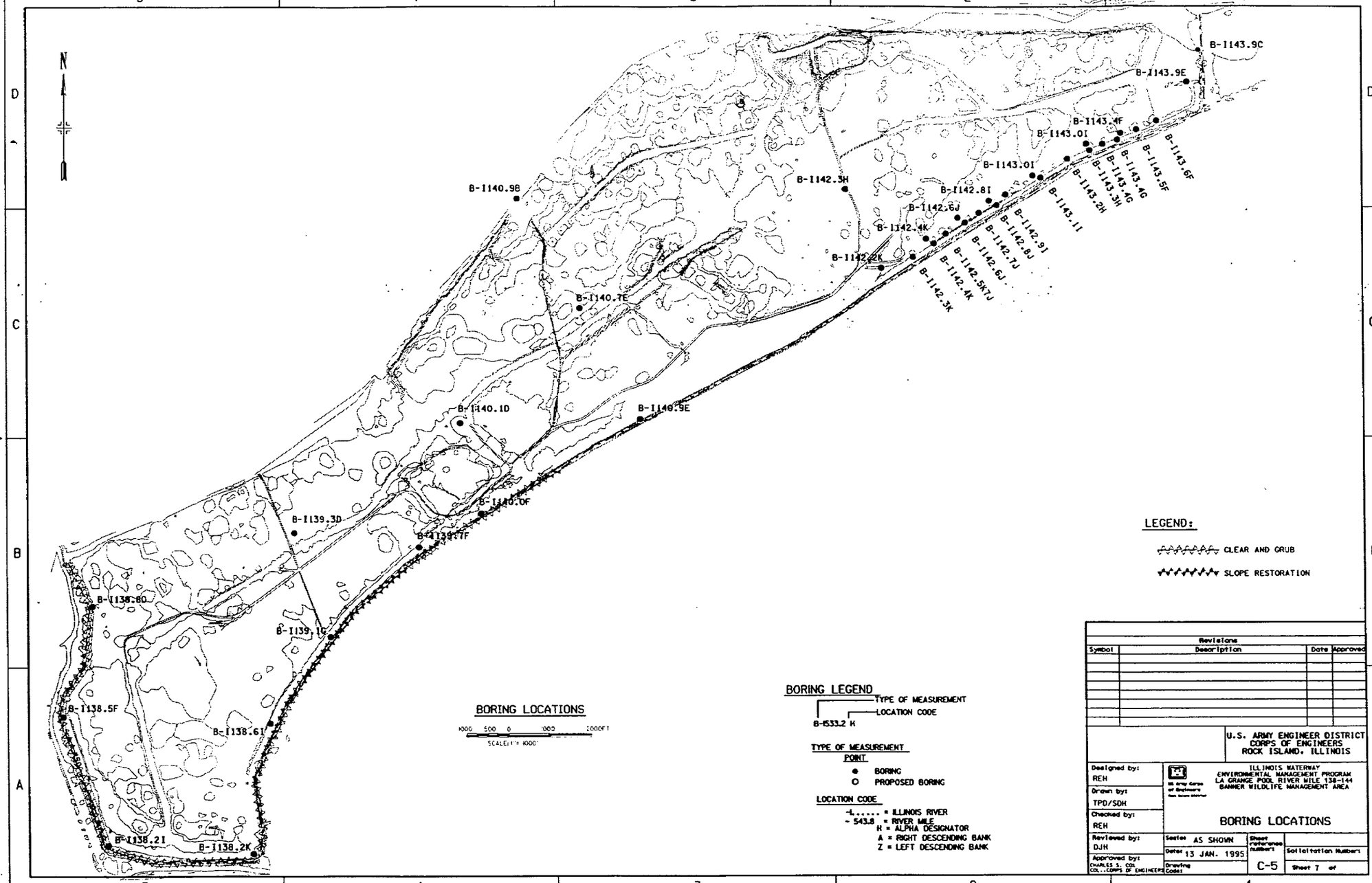
Revisions			
Symbol	Description	Date	Approved

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

ILLINOIS WATERWAY
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL RIVER MILE 136-144
BANNER WILDLIFE MANAGEMENT AREA

HYDRAULIC DATA II

Designed by: REH			
Drawn by: TPD/SDH			
Checked by: REH			
Reviewed by: DJH	Scale: AS SHOWN	Sheet reference number:	
Approved by: CHARLES S. COX COL., CORPS OF ENGINEERS	Date: 13 JAN. 1995	C-4	Solicitation Number:
	Drawing Code:		Sheet 6 of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B-I143.9C
B-I143.9E
B-I143.4F
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B-I143.6F
B-I143.5F
B-I143.4G
B-I143.3H
B-I143.2H
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B-I142.3H
B-I142.8I
B-I142.6J
B-I142.4K
B-I142.2K
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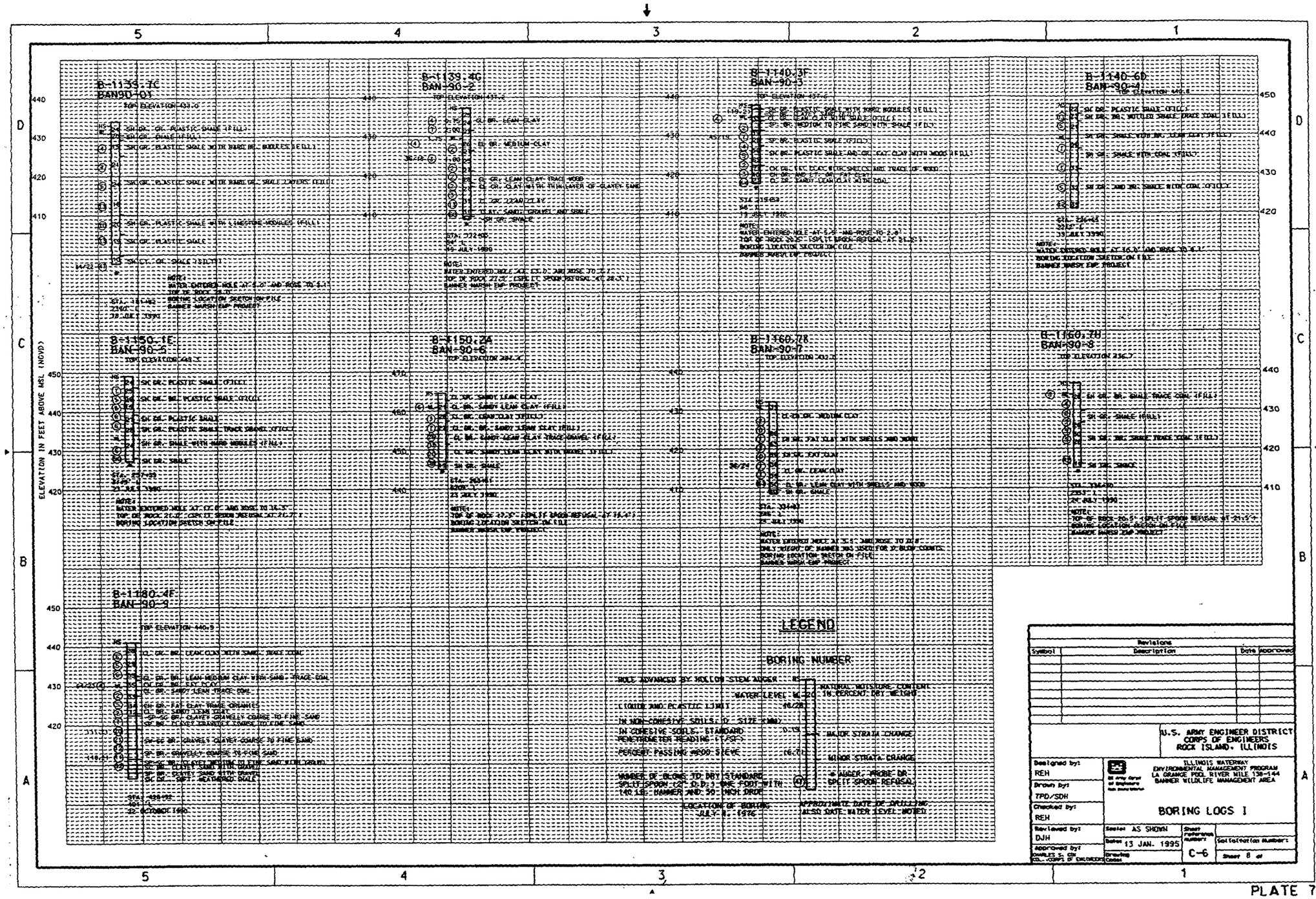
B-I142.5KTJ
B-I142.4K
B-I142.3K
B-I140.9B
B-I140.7E
B-I140.1D
B-I140.9E
B-I140.0F
B-I139.3D
B-I139.7F
B-I138.8O
B-I139.1G
B-I138.5F
B-I138.6I
B-I138.2I
B-I138.2K
LEGEND:
CLEAR AND GRUB
SLOPE RESTORATION
BORING LOCATIONS
1000 500 0 1000 2000FT
SCALE: 1"= 1000'
BORING LEGEND
TYPE OF MEASUREMENT
LOCATION CODE
B-I533.2 K
TYPE OF MEASUREMENT
POINT
BORING
PROPOSED BORING
LOCATION CODE
-L..... = ILLINOIS RIVER
- 543.8 = RIVER MILE
H = ALPHA DESIGNATOR
A = RIGHT DESCENDING BANK
Z = LEFT DESCENDING BANK
Revisions
Symbol
Description
Date
Approved
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS
Designed by: REH
Drawn by: TPD/SDH
Checked by: REH
Reviewed by: DJH
Approved by: CHARLES S. COX COL., CORPS OF ENGINEERS
ILLINOIS WATERWAY
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL RIVER MILE 138-144
BANNER WILDLIFE MANAGEMENT AREA
BORING LOCATIONS
Scale: AS SHOWN
Date: 13 JAN. 1995
Sheet reference number: C-5
Solicitation Number:
Sheet 7 of

PLATE 6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B-1140.6D
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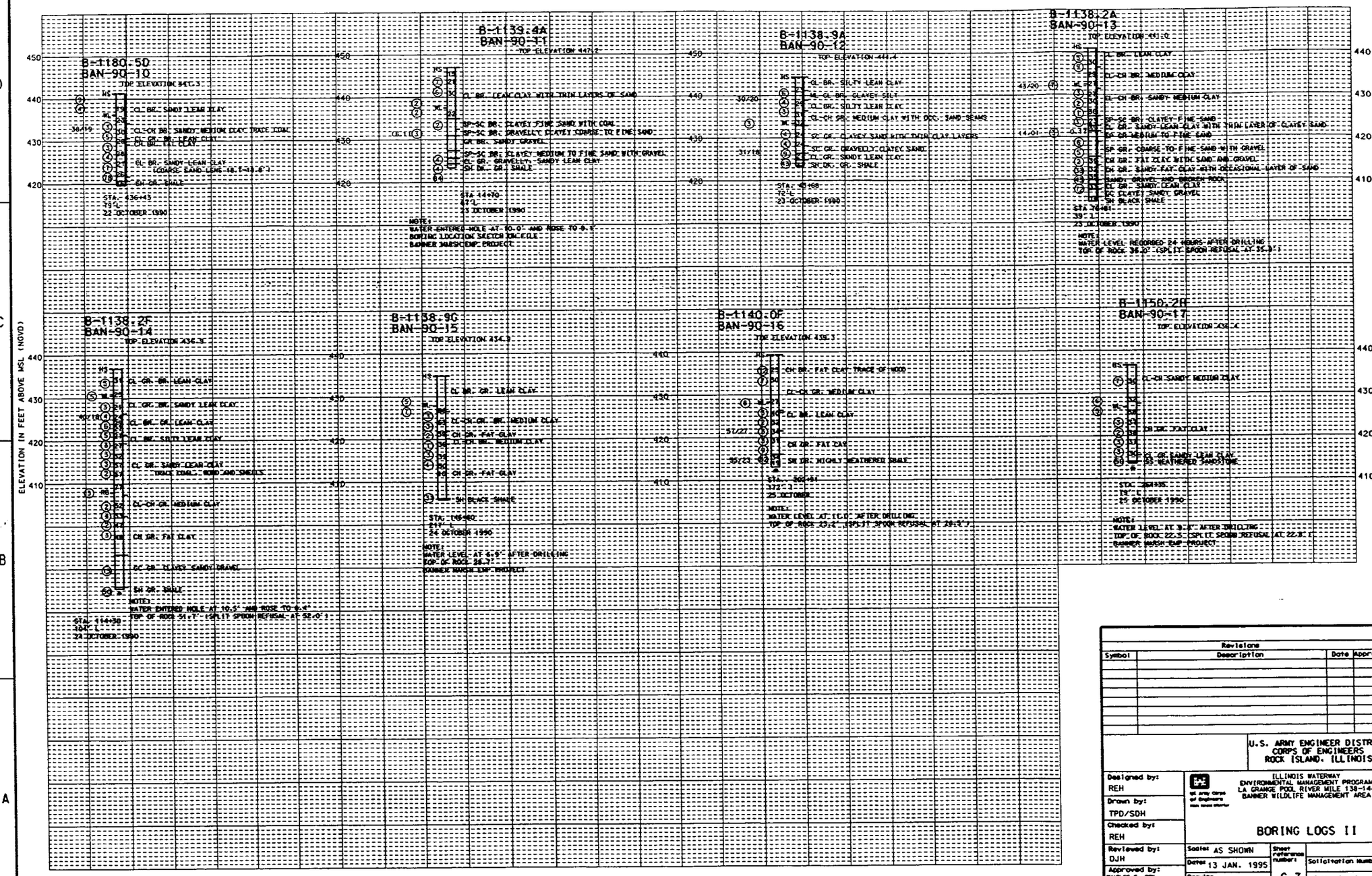
B-1150.1E
BAN-90-5
B-1150.2A
BAN-90-6
B-1160.7B
BAN-90-7
B-1160.7D
BAN-90-8
B-1180.4F
BAN-90-9
ELEVATION IN FEET ABOVE MSL (NGVD)
LEGEND
BORING NUMBER
HOLE ADVANCED BY HOLLOW STEM AUGER
WATER LEVEL
NATURAL MOISTURE CONTENT IN PERCENT DRY WEIGHT
LIQUID AND PLASTIC LIMIT
IN NON-COHESIVE SOILS: D 50 SIZE (MM)
IN COHESIVE SOILS: STANDARD PENETROMETER READING (TSF)
MAJOR STRATA CHANGE
PERCENT PASSING #200 SIEVE
MINOR STRATA CHANGE
NUMBER OF BLOWS TO DRIVE STANDARD SPLIT SPOON (2" O.D.) ONE FOOT WITH (140 LB. HAMMER AND 30" HOIST DROP)
AUGER, PROBE OR SPLIT SPOON REFUSAL
LOCATION OF BORING
JULY 8, 1996
APPROXIMATE DATE OF DRILLING
ALSO DATE WATER LEVEL NOTED
Revisions
Symbol
Description
Date
Approved
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS
ILLINOIS WATERWAY
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL RIVER MILE 158-144
BANNER WILDLIFE MANAGEMENT AREA
Designed by: REH
Drawn by: TPD/SDH
Checked by: REH
Reviewed by: DJH
Approved by: CHARLES S. CAY COL., CORPS OF ENGINEERS
BORING LOGS I
Scale: AS SHOWN
Date: 13 JAN. 1995
Sheet reference number: C-6
Solicitation Number:
Sheet 8 of

PLATE 7



Revisions			
Symbol	Description	Date	Approved

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

ILLINOIS WATERWAY
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL RIVER MILE 138-144
BANNER WILDLIFE MANAGEMENT AREA

US Army Corps of Engineers

Designed by: REH
Drawn by: TPD/SDH
Checked by: REH
Reviewed by: DJH
Approved by: CHARLES S. COX COL., CORPS OF ENGINEERS

BORING LOGS II

Scale: AS SHOWN
Date: 13 JAN. 1995
Sheet reference number: C-7
Solicitation Number:
Drawing Code:
Sheet 9 of

PLATE B

B-1180.3F
B-1

25	12	SILTY CLAY LOAM ORGANIC TOP SOIL
24	7	STIFF TO MEDIUM BR AND DK BR SILTY CLAY
21	6	
13	4	MEDIUM BR AND DK BR CLAY

------ NO WATER LEVEL ENCOUNTERED

SEE PLAN SHEET FOR LOCATION OF BORING
ELEVATION NOT AVAILABLE
15 JUNE 1988

B-1180.1C
B-2

27	7	SILTY CLAY LOAM ORGANIC TOP SOIL
26	8	STIFF BR AND DK BR SILTY CLAY
21	8	STIFF BR AND DK BR CLAY
23	5	MEDIUM BR SILTY CLAY
		MEDIUM BR SILTY CLAY WITH SOME FINE-GRAINED SAND

------ NO WATER LEVEL ENCOUNTERED

SEE PLAN SHEET FOR LOCATION OF BORING
ELEVATION NOT AVAILABLE
15 JUNE 1988

B-1170.8G
B-3

28	10	SILTY CLAY LOAM ORGANIC TOP SOIL
28	4	STIFF TO MEDIUM BR AND DK BR CLAY
24	5	MEDIUM BR AND DK BR CLAY WITH SOME FINE-GRAINED SAND
22	4	MEDIUM BR AND DK BR SILTY CLAY

------ NO WATER LEVEL ENCOUNTERED

SEE PLAN SHEET FOR LOCATION OF BORING
ELEVATION NOT AVAILABLE
15 JUNE 1988

B-1170.7H
B-4

29	9	SILTY CLAY LOAM ORGANIC TOP SOIL
25	6	STIFF BR AND DK BR CLAY
24	5	MEDIUM BR AND DK BR SILTY CLAY LOAM
22	3	SOFT BR SILTY CLAY WITH SOME FINE-GRAINED SAND

------ NO WATER LEVEL ENCOUNTERED

SEE PLAN SHEET FOR LOCATION OF BORING
ELEVATION NOT AVAILABLE
15 JUNE 1988

B-1170.6H
B-5

26	9	SILTY CLAY LOAM ORGANIC TOP SOIL
26	7	STIFF BR AND DK BR CLAY
30	5	MEDIUM BR CLAY
13	6	MEDIUM BR SILTY CLAY

------ NO WATER LEVEL ENCOUNTERED

SEE PLAN SHEET FOR LOCATION OF BORING
ELEVATION NOT AVAILABLE
15 JUNE 1988

B-1170.35J
B-6

22	9	SILTY CLAY LOAM ORGANIC TOP SOIL
21	7	STIFF BR AND DK BR CLAY
21	6	MEDIUM BR SILTY CLAY
22	8	MEDIUM BR SILTY CLAY WITH SOME FINE-GRAINED SAND
23	5	

------ NO WATER LEVEL ENCOUNTERED

SEE PLAN SHEET FOR LOCATION OF BORING
ELEVATION NOT AVAILABLE
15 JUNE 1988

B-1170.25J
B-7

29	10	SILTY CLAY LOAM ORGANIC TOP SOIL
28	6	STIFF BR AND DK BR CLAY
28	4	STIFF BR AND DK BR SILTY CLAY LOAM
28	7	STIFF DK BR TO BR SILTY CLAY
23	8	SOME FINE-GRAINED SAND

------ NO WATER LEVEL ENCOUNTERED

SEE PLAN SHEET FOR LOCATION OF BORING
ELEVATION NOT AVAILABLE
15 JUNE 1988

NOTE: BORING AND LOG BY WHITNEY AND ASSOSCIATES
SOILS CLASSIFIED USING U.S.B.S.C. SYSTEM

LEGEND

BORING NUMBER

HOLE ADVANCED BY HOLLOW STEM AUGER

NUMBER OF BLOWS TO DRIVE STANDARD SPLIT SPOON 12" O.D. ONE FOOT WITH 140 LB. HAMMER AND 30 INCH DROP (47)

20 NATURAL MOISTURE CONTENT IN PERCENT DRY WEIGHT

MAJOR STRATA CHANGE

MINOR STRATA CHANGE

LOCATION OF BORING
JULY 4, 1976 APPROXIMATE DATE OF DRILLING

Revisions			
Symbol	Description	Date	Approved

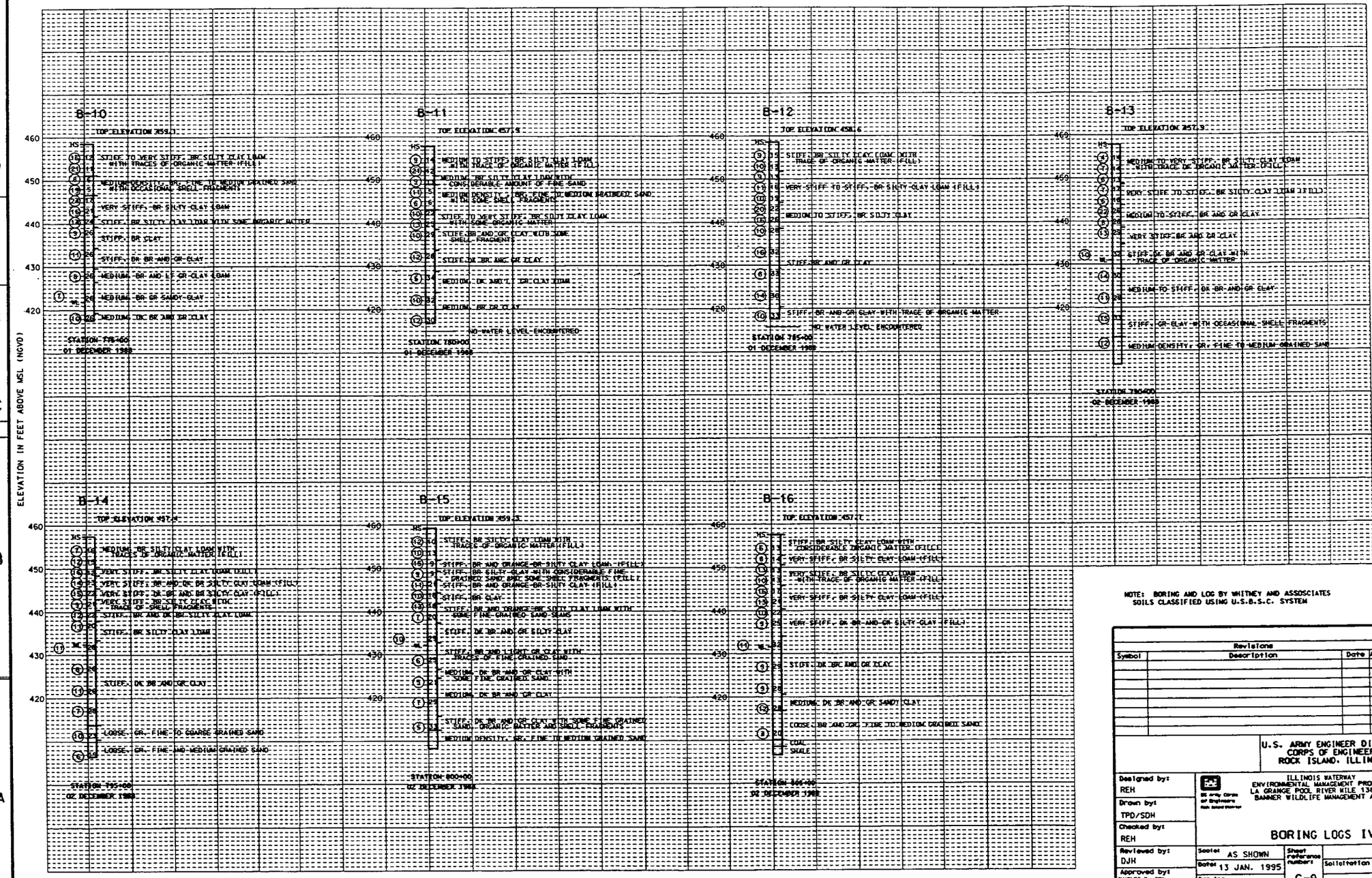
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

ILLINOIS WATERWAY
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL RIVER MILE 138-144
BANNER WILDLIFE MANAGEMENT AREA

BORING LOGS III

Designed by: REH	Scale: AS SHOWN	Sheet reference number:	
Drawn by: TPD/SDH	Date: 13 JAN. 1995		Solicitation Number:
Checked by: REH	Drawing Code:	C-8	Sheet 10 of
Reviewed by: DJH			
Approved by: CHARLES S. COX COL., CORPS OF ENGINEERS			

PLATE 9



NOTE: BORING AND LOG BY WHITNEY AND ASSOSCIATES
SOILS CLASSIFIED USING U.S.B.S.C. SYSTEM

Revisions			
Symbol	Description	Date	Approved

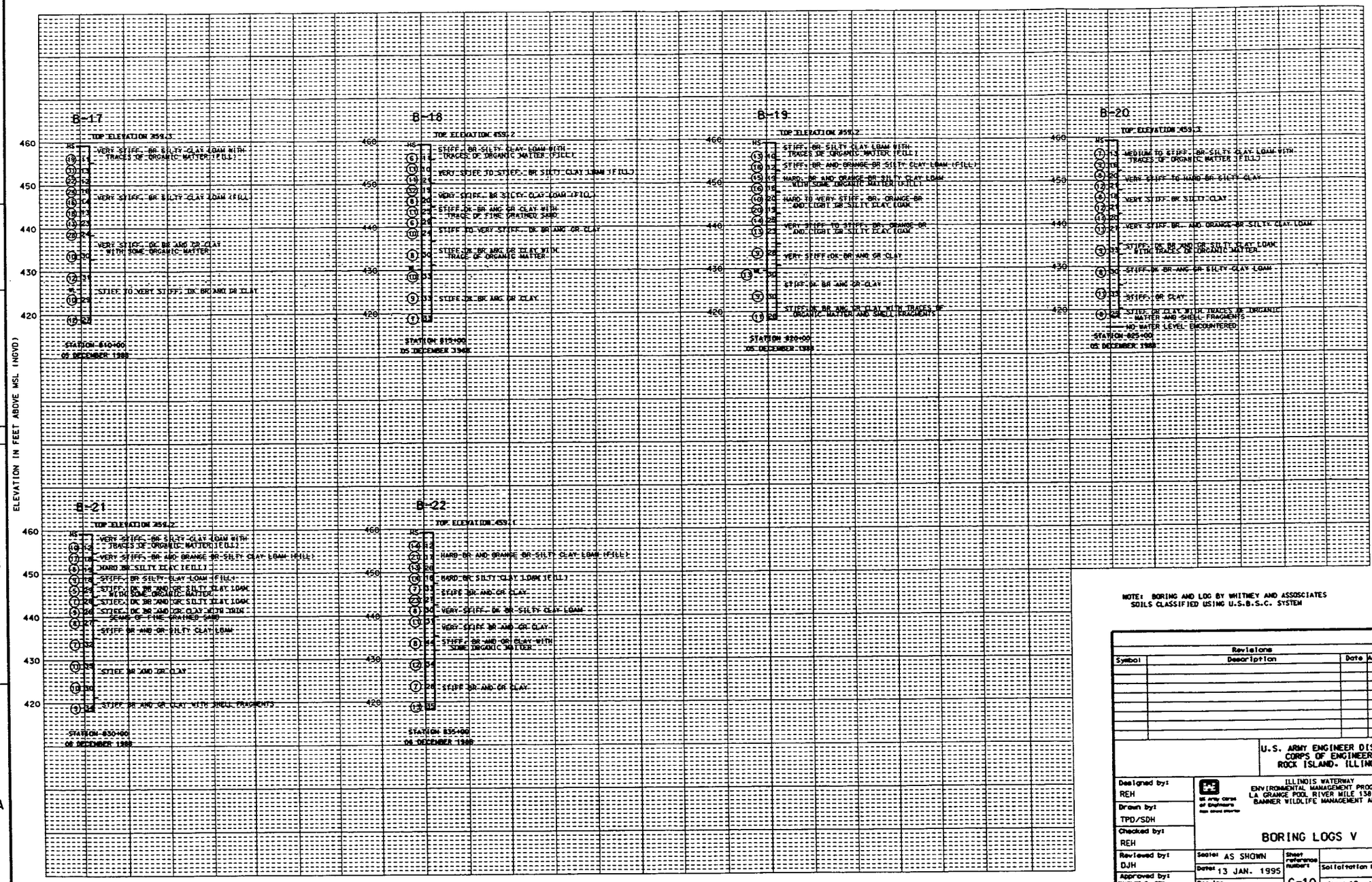
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

ILLINOIS WATERWAY
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL RIVER MILE 136-144
BANNER WILDLIFE MANAGEMENT AREA

BORING LOGS IV

Designed by: REH	Scale: AS SHOWN	Sheet reference number: C-9	
Drawn by: TPD/SDH	Date: 13 JAN. 1995		Solicitation Number:
Checked by: REH	Drawing Code:		Sheet 11 of
Reviewed by: DJH			
Approved by: CHARLES S. COX COL., CORPS OF ENGINEERS			

PLATE 10



NOTE: BORING AND LOG BY WHITNEY AND ASSOSCIATES
SOILS CLASSIFIED USING U.S.B.S.C. SYSTEM

Revisions			
Symbol	Description	Date	Approved

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

ILLINOIS WATERWAY
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL RIVER MILE 138-144
BANNER WILDLIFE MANAGEMENT AREA

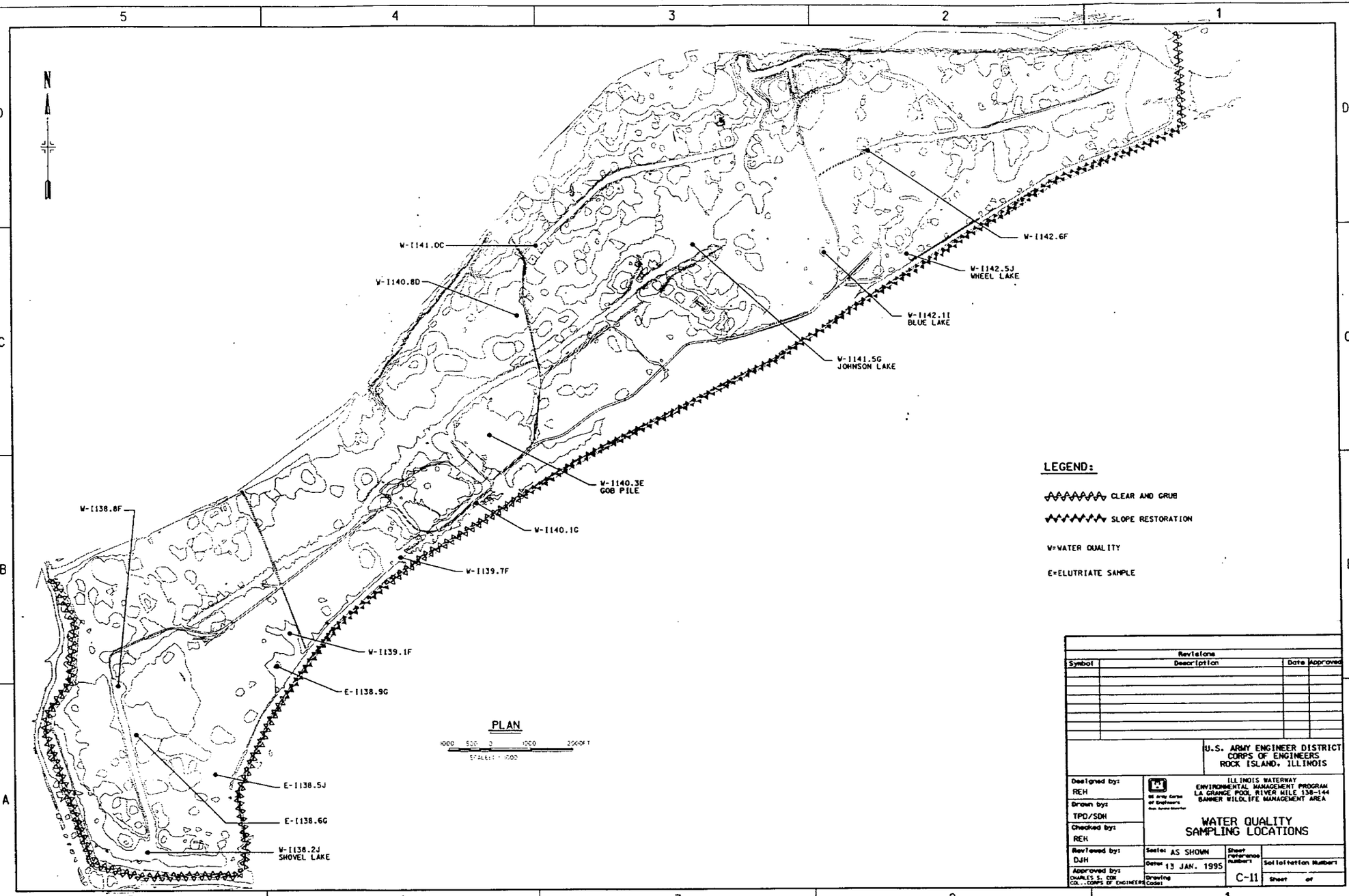
US Army Corps of Engineers
Rock Island District

Designed by: REH
Drawn by: TPD/SDH
Checked by: REH
Reviewed by: DJH
Approved by: CHARLES S. COX COL., CORPS OF ENGINEERS

BORING LOGS V

Scale: AS SHOWN
Date: 13 JAN. 1995
Drawing Code:
Sheet reference number: C-10
Solicitation Number:
Sheet 12 of

PLATE 11



Revisions			
Symbol	Description	Date	Approved

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

US Army Corps of Engineers

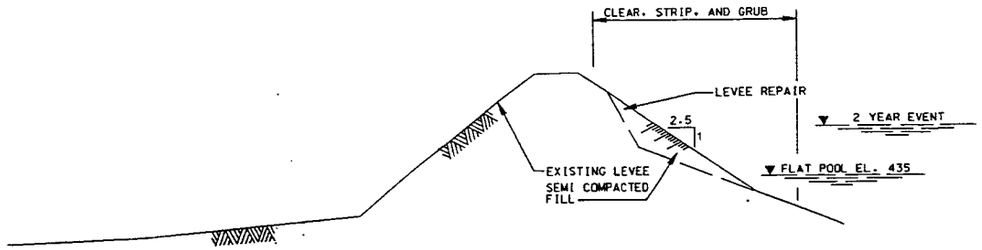
ILLINOIS WATERWAY
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL RIVER MILE 138-144
BANNER WILDLIFE MANAGEMENT AREA

WATER QUALITY
SAMPLING LOCATIONS

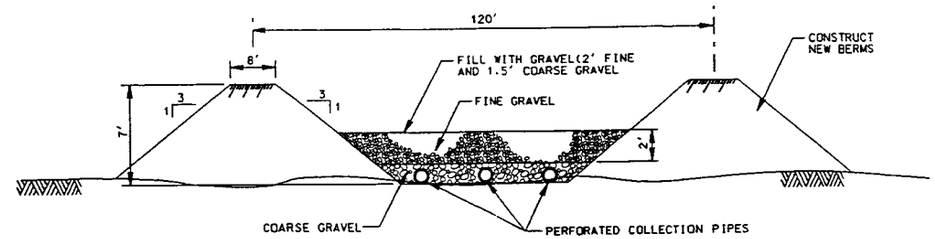
Designed by: REH
Drawn by: TPO/SDH
Checked by: REH
Reviewed by: DJH
Approved by: CHARLES S. COX COL., CORPS OF ENGINEERS

Scale: AS SHOWN
Date: 13 JAN. 1995
Drawing Code:
Sheet reference number: C-11
Solicitation Number:
Sheet of

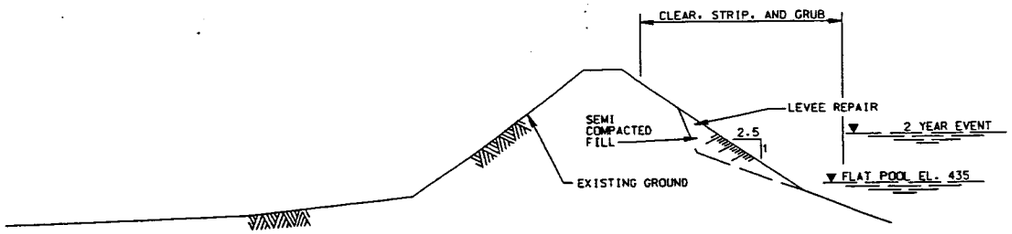
PLATE 12



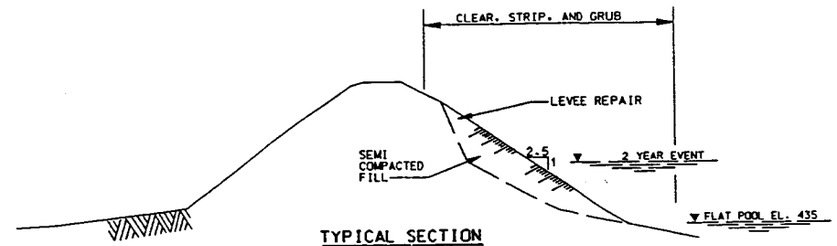
TYPICAL SECTION
STATION 155+00 TO 165+00



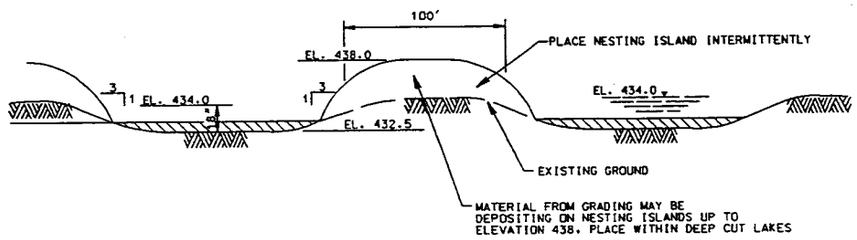
RIVER WATER FILTRATION PIT



TYPICAL SECTION
STATION 146+00 TO 155+00



TYPICAL SECTION
STATIONS 165+00 TO 175+00



TYPICAL SECTION
LITORAL ZONE GRADING

Revisions			
Symbol	Description	Date	Approved

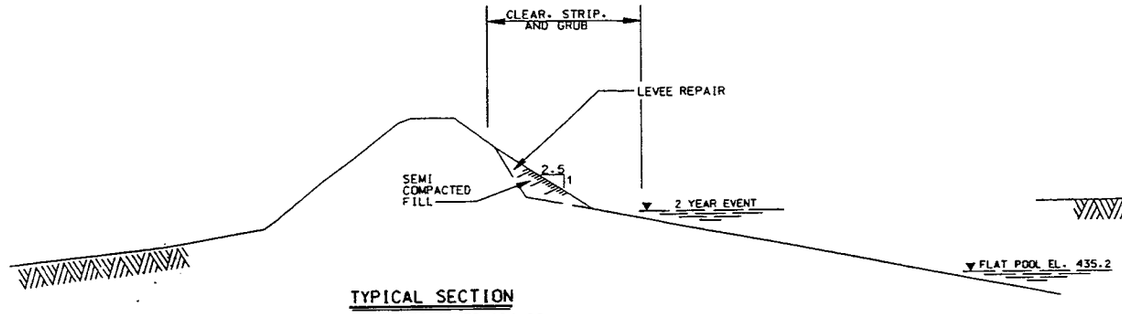
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

ILLINOIS WATERWAY
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL RIVER MILE 138-144
BANNER WILDLIFE MANAGEMENT AREA

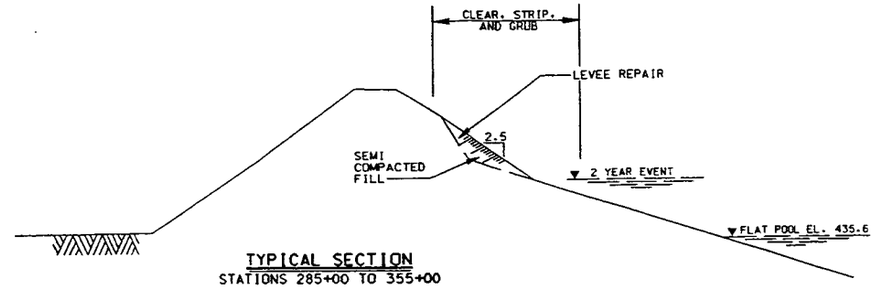
PLAN AND TYPICAL SECTIONS I

Designed by: REH
Drawn by: TPD/SDH
Checked by: REH
Reviewed by: DJH
Approved by: CHARLES S. COX COL., CORPS OF ENGINEERS
Scale: NO SCALE
Date: 13 JAN. 1995
Sheet reference number: C-12
Drawing Code:
Solicitation Number:
Sheet 13 of

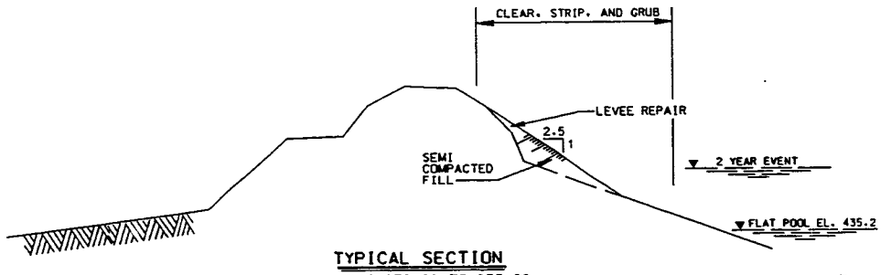
PLATE 13



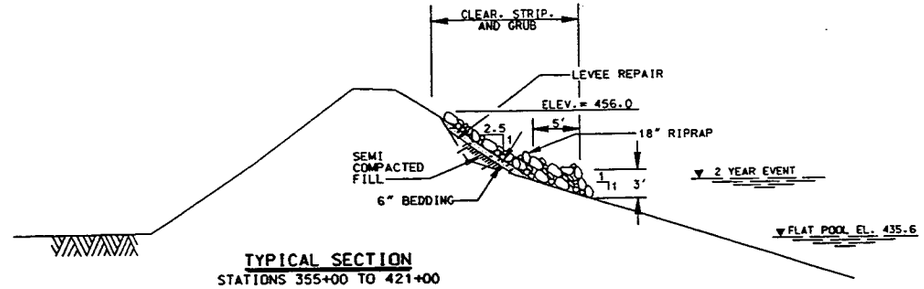
TYPICAL SECTION
STATIONS 175+00 TO 184+00



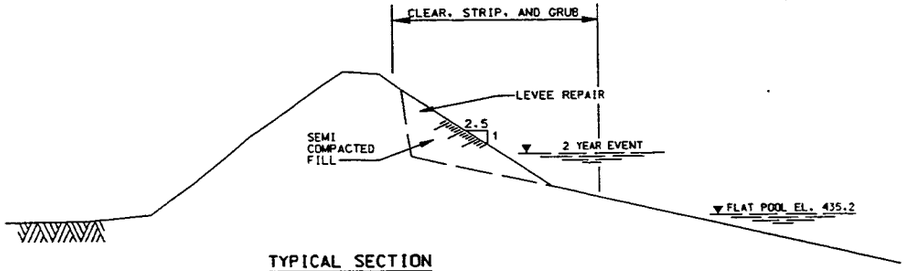
TYPICAL SECTION
STATIONS 285+00 TO 355+00



TYPICAL SECTION
STATIONS 232+00 TO 255+00



TYPICAL SECTION
STATIONS 355+00 TO 421+00



TYPICAL SECTION
STATIONS 255+00 TO 285+00

Revisions			
Symbol	Description	Date	Approved

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

ILLINOIS WATERWAY
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL RIVER MILE 138-144
BANNER WILDLIFE MANAGEMENT AREA

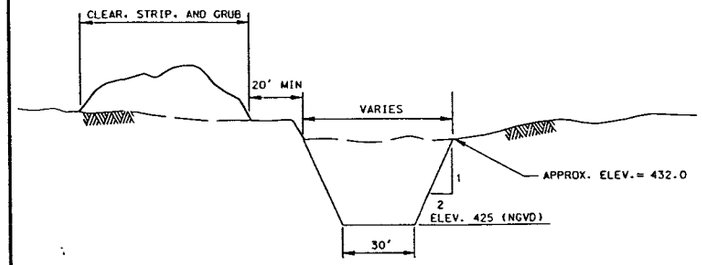
US Army Corps of Engineers

TYPICAL SECTIONS II

Designed by: REW
Drawn by: JRB/SDH
Checked by: REW
Reviewed by: BGM
Approved by: CHARLES S. COX COL., CORPS OF ENGINEERS

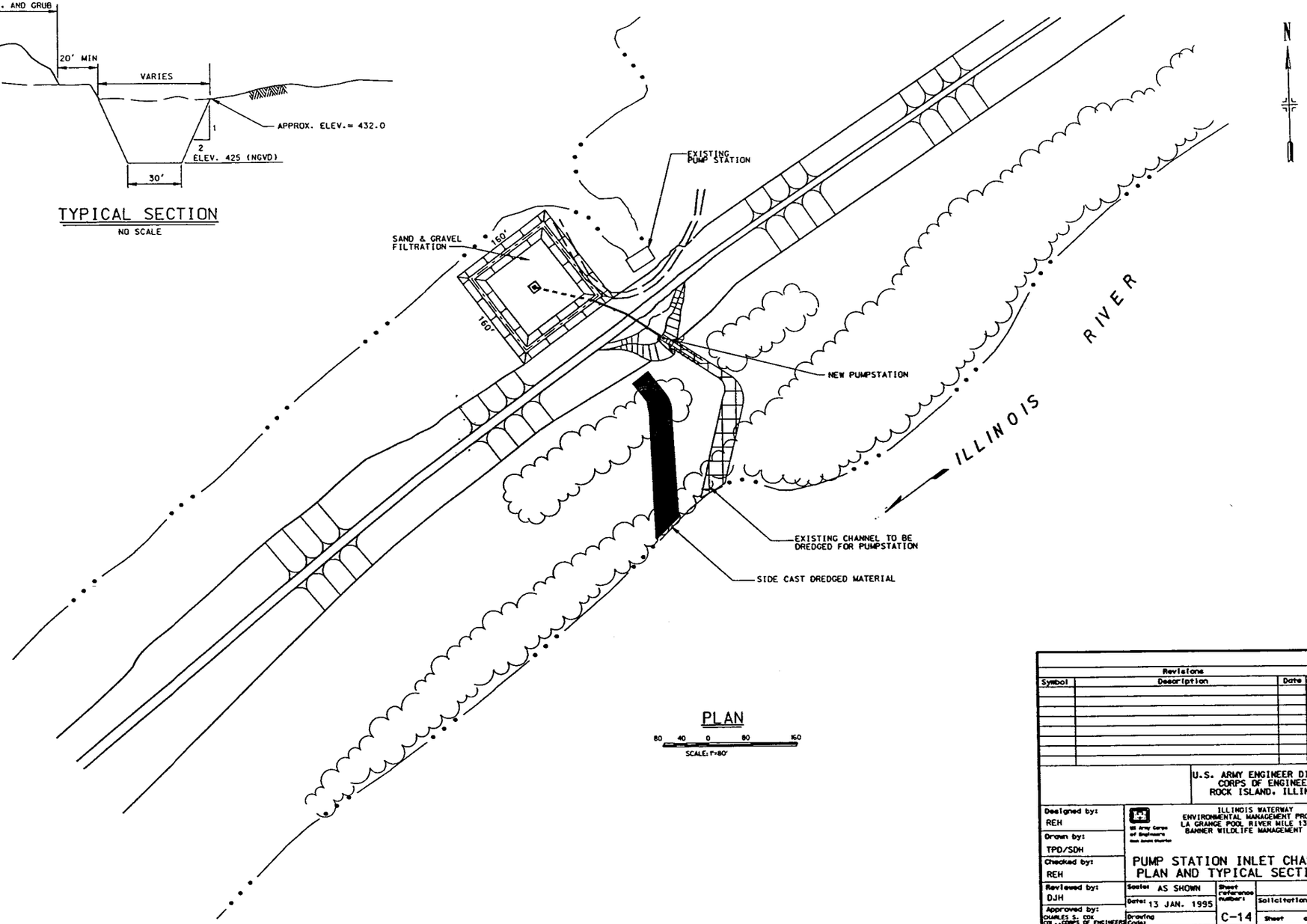
Scale: NO SCALE
Date: 13 JAN. 1995
Drawing Code:
Sheet reference number: C-13
Solicitation Number:
Sheet 14 of

PLATE 14



TYPICAL SECTION

NO SCALE



PLAN

80 40 0 80 160

SCALE: 1"=80'

Revisions			
Symbol	Description	Date	Approved

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

US Army Corps of Engineers Rock Island District

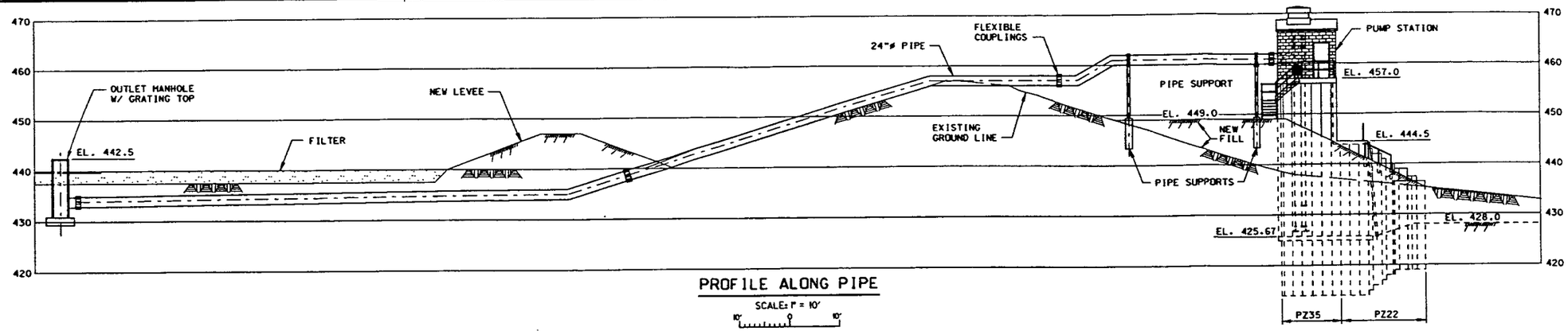
ILLINOIS WATERWAY
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL RIVER MILE 138-144
BANNER WILDLIFE MANAGEMENT AREA

PUMP STATION INLET CHANNEL
PLAN AND TYPICAL SECTIONS

Designed by: REH
Drawn by: TPD/SDH
Checked by: REH
Reviewed by: DJH
Approved by: CHARLES S. COX COL., CORPS OF ENGINEERS

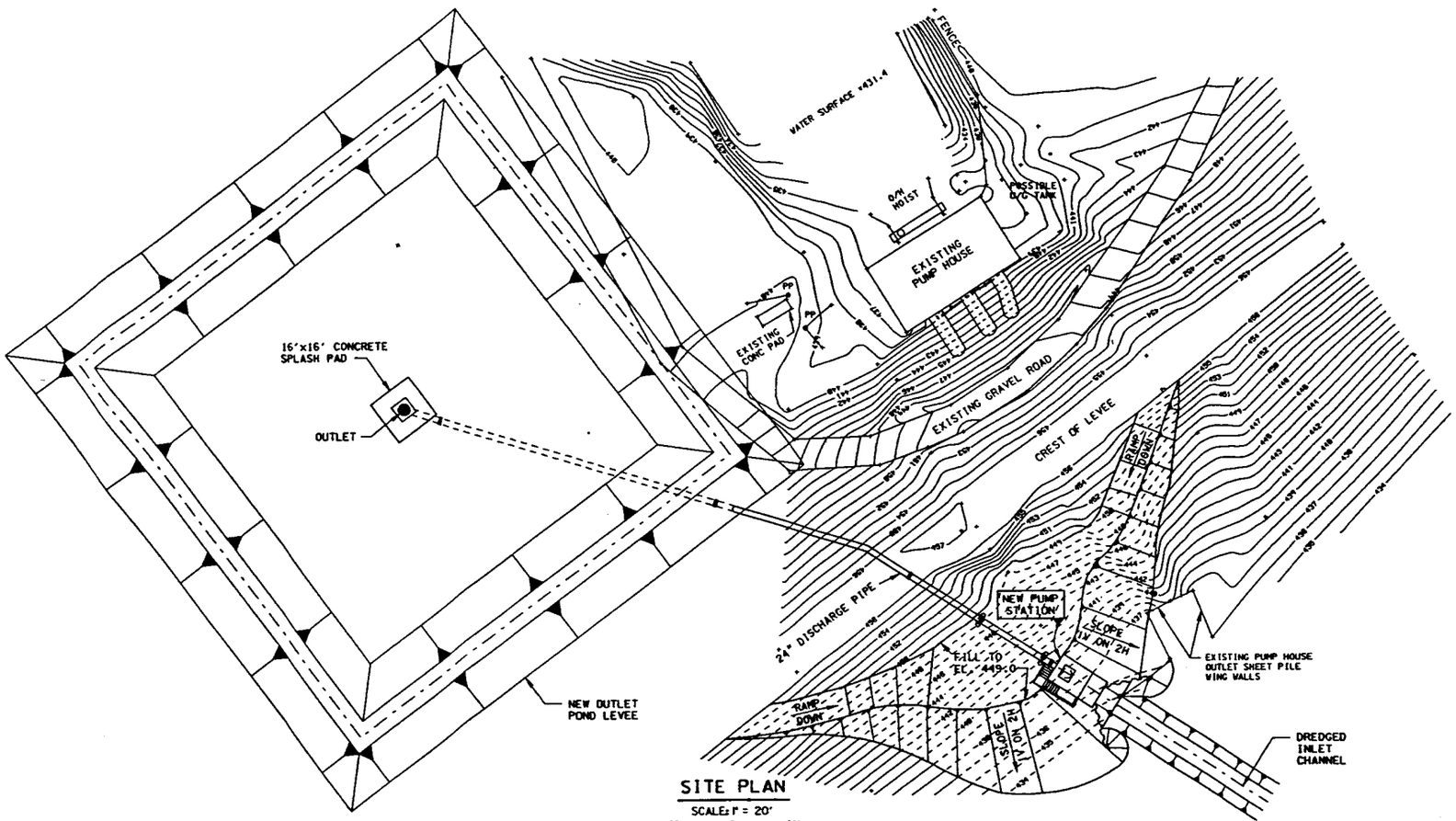
Scale: AS SHOWN
Date: 13 JAN. 1995
Drawing Code:
Sheet reference number: C-14
Solicitation Number:
Sheet of

PLATE 15



PROFILE ALONG PIPE

SCALE: 1" = 10'



SITE PLAN

SCALE: 1" = 20'

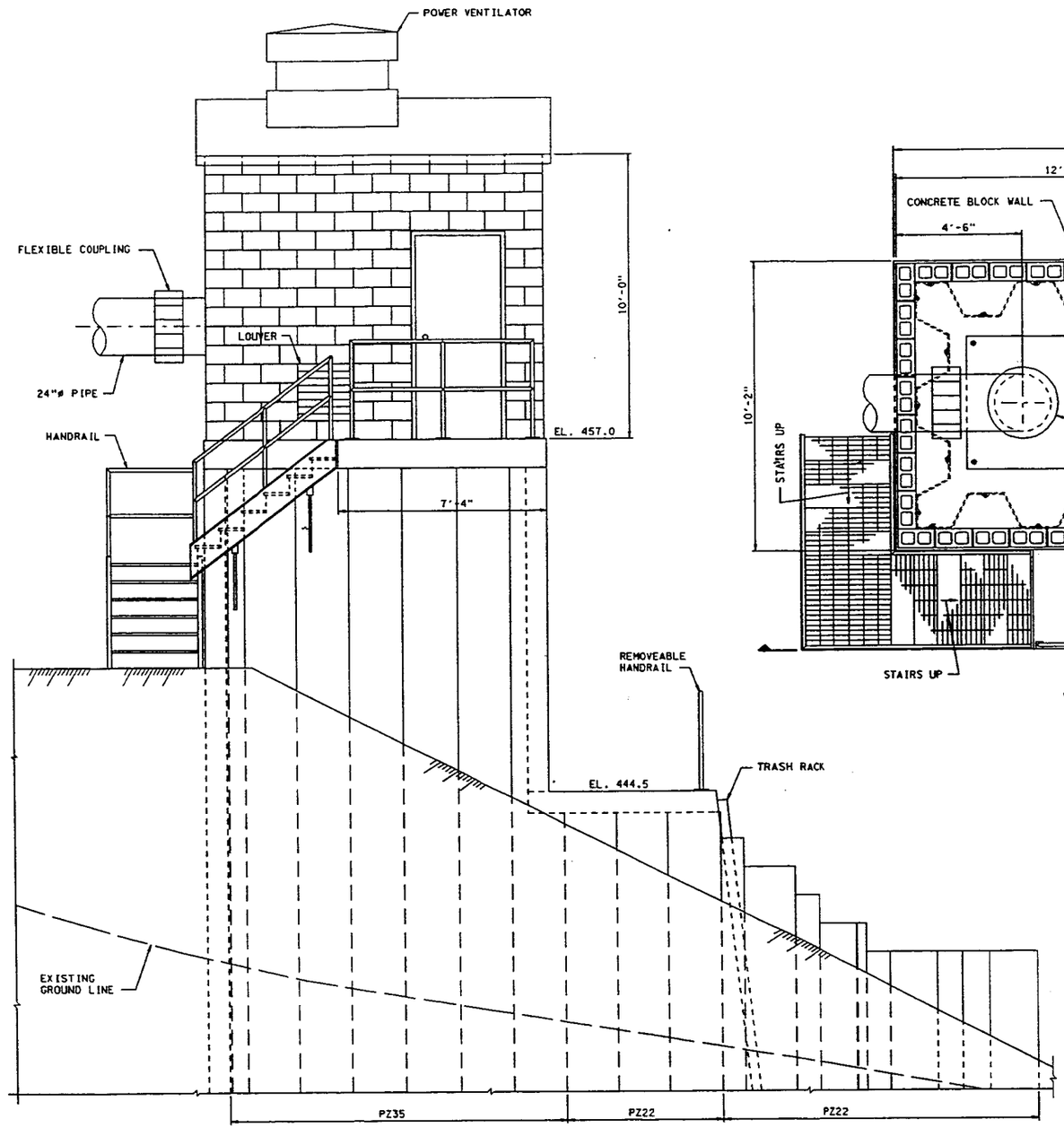
Revisions			
Symbol	Description	Date	Approved

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

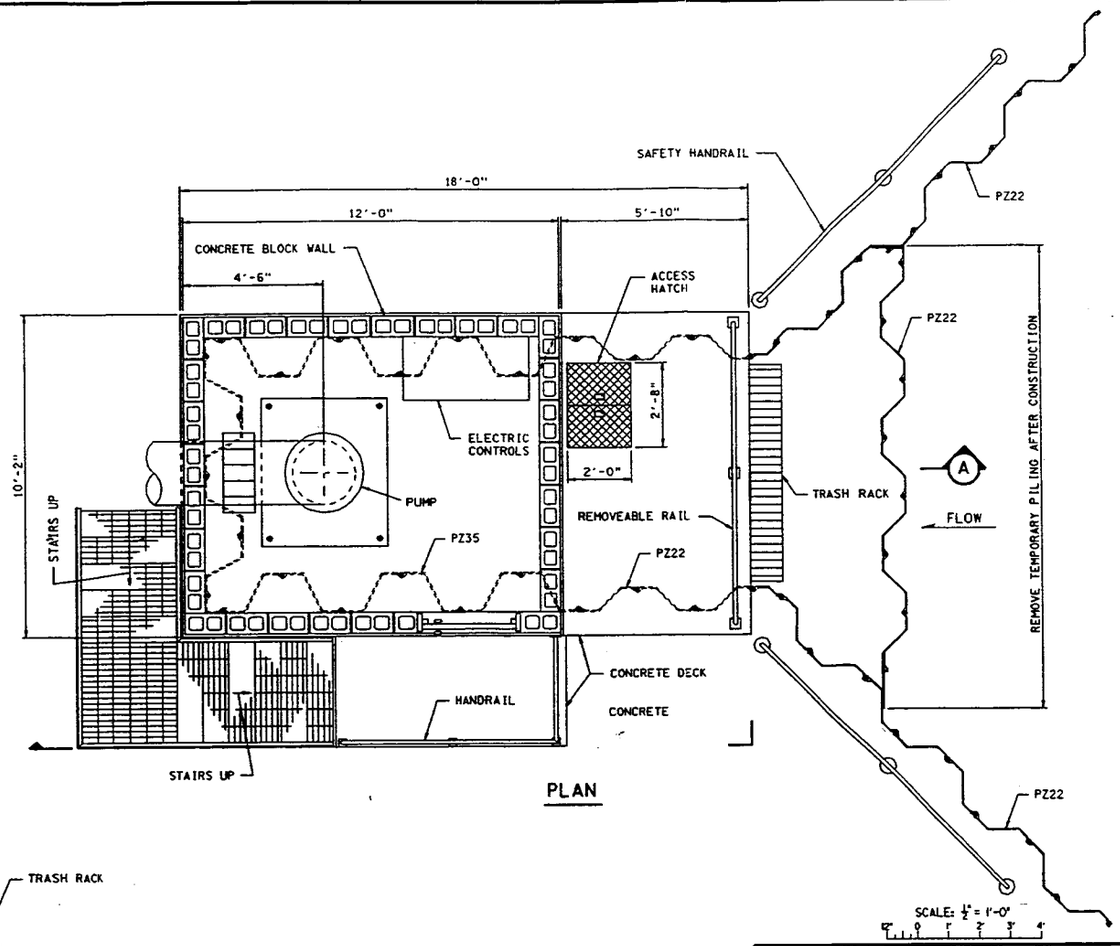
ILLINOIS WATERWAY
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL RIVER MILE 138-144
BANNER WILDLIFE MANAGEMENT AREA

PUMP STATION
SITE PLAN & PROFILE

Designed by: DAP	Scales: AS SHOWN	Sheet reference number: S1	
Drawn by: DGP	Dated: 13 JAN. 1995		Solicitation Number:
Checked by: DAP	Drawing Code:		Sheet of
Reviewed by: RCA			
Approved by: CHARLES S. COX COL., CORPS OF ENGINEERS			



SECTION (A)



PLAN

Revisions			
Symbol	Description	Date	Approved

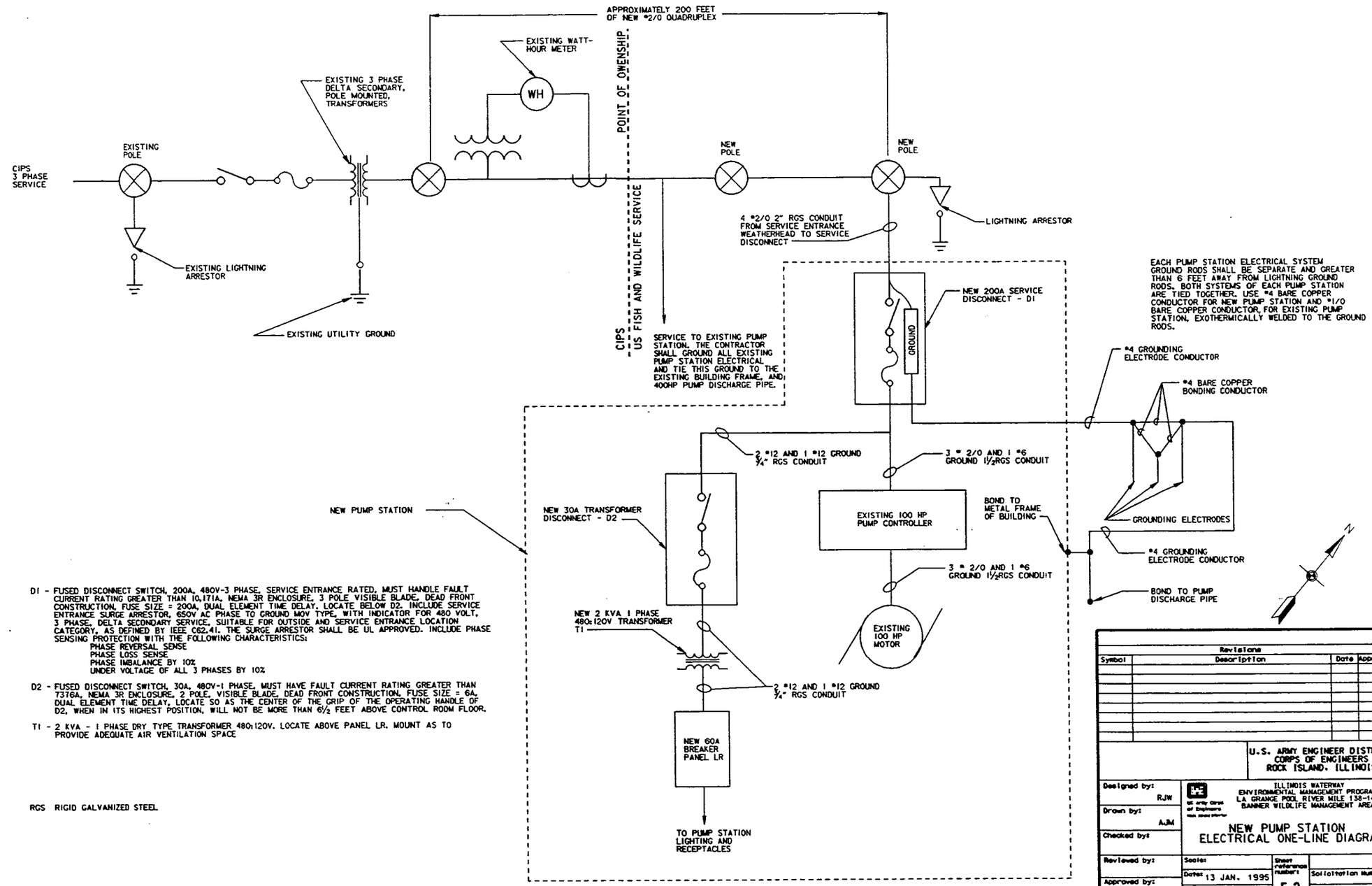
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

Designed by: DAP
Drawn by: DGP
Checked by: DAP
Reviewed by: RCA
Approved by: CHARLES S. COX COL., CORPS OF ENGINEERS

ILLINOIS WATERWAY
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL RIVER MILE 138-144
BANNER WILDLIFE MANAGEMENT AREA

PUMP STATION
PLAN & ELEVATION

Scale: AS SHOWN
Date: 13 JAN. 1995
Drawing Code:
Sheet reference number: S2
Solicitation Number:
Sheet of



D1 - FUSED DISCONNECT SWITCH, 200A, 480V-3 PHASE, SERVICE ENTRANCE RATED, MUST HANDLE FAULT CURRENT RATING GREATER THAN 10,171A, NEMA 3R ENCLOSURE, 3 POLE VISIBLE BLADE, DEAD FRONT CONSTRUCTION, FUSE SIZE = 200A, DUAL ELEMENT TIME DELAY, LOCATE BELOW D2. INCLUDE SERVICE ENTRANCE SURGE ARRESTOR, 650V AC PHASE TO GROUND MOV TYPE, WITH INDICATOR FOR 480 VOLT, 3 PHASE, DELTA SECONDARY SERVICE, SUITABLE FOR OUTSIDE AND SERVICE ENTRANCE LOCATION CATEGORY, AS DEFINED BY IEEE C62.41. THE SURGE ARRESTOR SHALL BE UL APPROVED. INCLUDE PHASE SENSING PROTECTION WITH THE FOLLOWING CHARACTERISTICS:

PHASE REVERSAL SENSE
PHASE LOSS SENSE
PHASE IMBALANCE BY 10%
UNDER VOLTAGE OF ALL 3 PHASES BY 10%

D2 - FUSED DISCONNECT SWITCH, 30A, 480V-1 PHASE, MUST HAVE FAULT CURRENT RATING GREATER THAN 7376A, NEMA 3R ENCLOSURE, 2 POLE, VISIBLE BLADE, DEAD FRONT CONSTRUCTION, FUSE SIZE = 6A, DUAL ELEMENT TIME DELAY, LOCATE SO AS THE CENTER OF THE GRIP OF THE OPERATING HANDLE OF D2, WHEN IN ITS HIGHEST POSITION, WILL NOT BE MORE THAN 6 1/2 FEET ABOVE CONTROL ROOM FLOOR.

T1 - 2 KVA - 1 PHASE DRY TYPE TRANSFORMER 480:120V. LOCATE ABOVE PANEL LR. MOUNT AS TO PROVIDE ADEQUATE AIR VENTILATION SPACE

RGS RIGID GALVANIZED STEEL

Revisions			
Symbol	Description	Date	Approved

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

ILLINOIS WATERWAY
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL RIVER MILE 138-144
BANNER WILDLIFE MANAGEMENT AREA

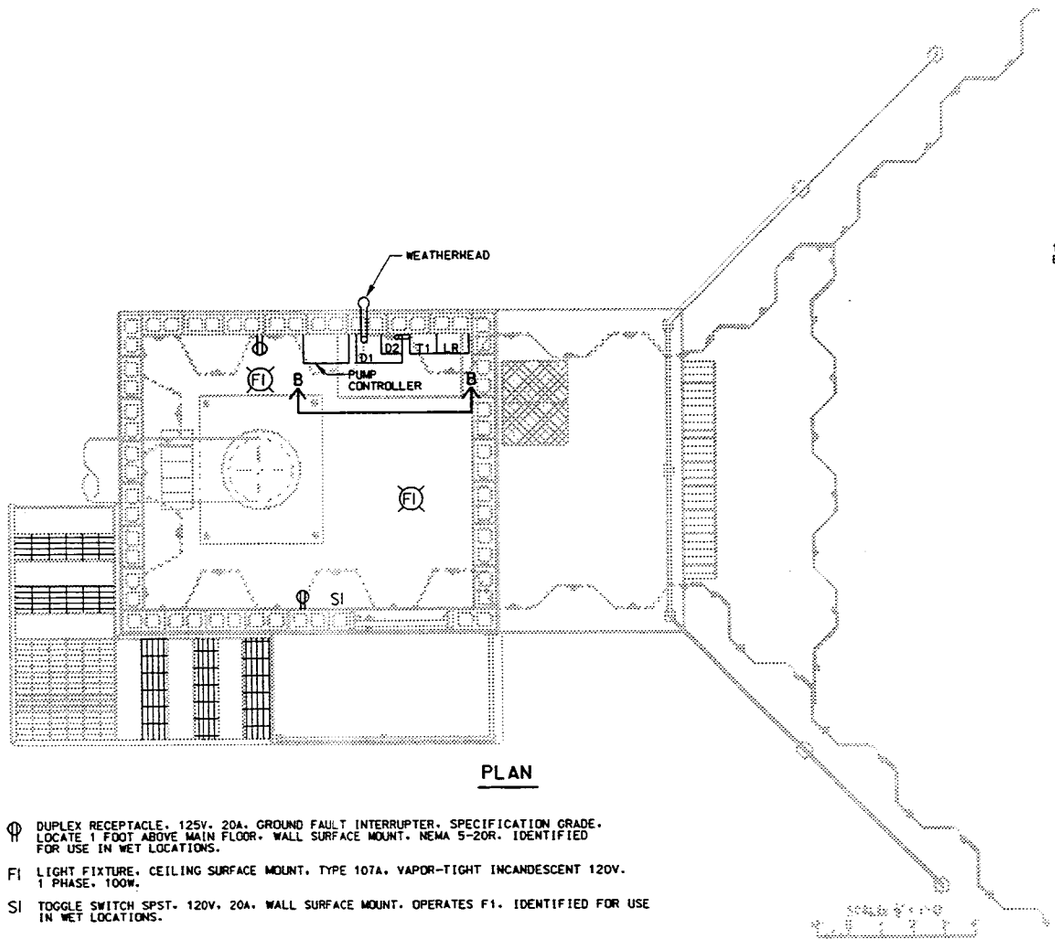
NEW PUMP STATION ELECTRICAL ONE-LINE DIAGRAM

Designed by: RJW
Drawn by: AJM
Checked by:
Reviewed by:
Approved by: CHARLES S. COX COL., CORPS OF ENGINEERS
Scale:
Date: 13 JAN. 1995
Drawing Code:
Sheet reference number: E-2
Solicitation Number:
Sheet of

PLATE 18

NOTES:

1. ALL WIRING IS XHHW COPPER SIZE #12 UNLESS OTHERWISE SPECIFIED.
2. ALL CONDUIT IS 3/4" MINIMUM RIGID GALVANIZED STEEL, SURFACE MOUNTED.
3. DIMENSIONS ON THIS DRAWING ARE APPROXIMATE. CONTRACTOR MUST FIELD VERIFY ACTUAL DIMENSIONS OF EQUIPMENT BEFORE INSTALLATION.
4. THESE DRAWINGS SHOW APPROXIMATE PLACEMENT OF ALL ELECTRICAL HARDWARE. CONTRACTOR SHALL USE DISCRETION DURING INSTALLATION TO GET BEST FIT AND MEET NFPA 70.
5. ALL ELECTRICAL HARDWARE SHALL BE SURFACE MOUNTED UNLESS SPECIFIED.

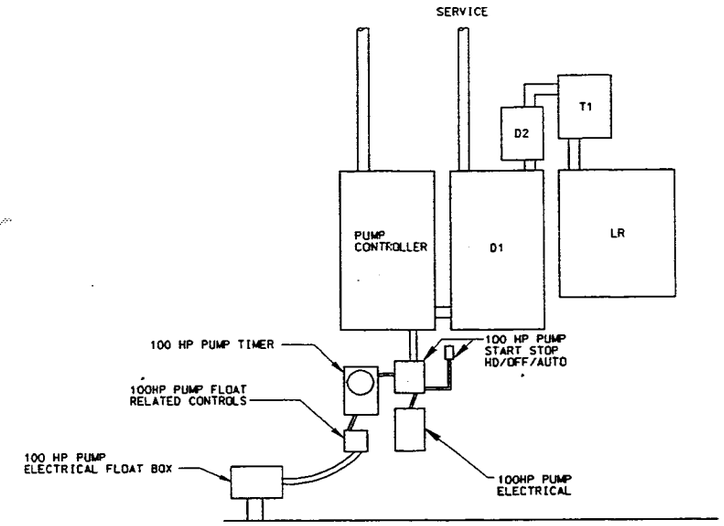


PLAN

DUPLEX RECEPTACLE, 125V, 20A, GROUND FAULT INTERRUPTER, SPECIFICATION GRADE, LOCATE 1 FOOT ABOVE MAIN FLOOR, WALL SURFACE MOUNT, NEMA 5-20R, IDENTIFIED FOR USE IN WET LOCATIONS.

FI LIGHT FIXTURE, CEILING SURFACE MOUNT, TYPE 107A, VAPOR-TIGHT INCANDESCENT 120V, 1 PHASE, 100W.

SI TOGGLE SWITCH SPST, 120V, 20A, WALL SURFACE MOUNT, OPERATES F1, IDENTIFIED FOR USE IN WET LOCATIONS.



SECTION B

Revisions			
Symbol	Description	Date	Approved

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

Designed by: RJW
Drawn by: AJM
Checked by:
Reviewed by:
Approved by: CHARLES S. COX, COL., CORPS OF ENGINEERS

US Army Corps of Engineers

ILLINOIS WATERWAY
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL RIVER MILE 138-144
BANNER WILDLIFE MANAGEMENT AREA

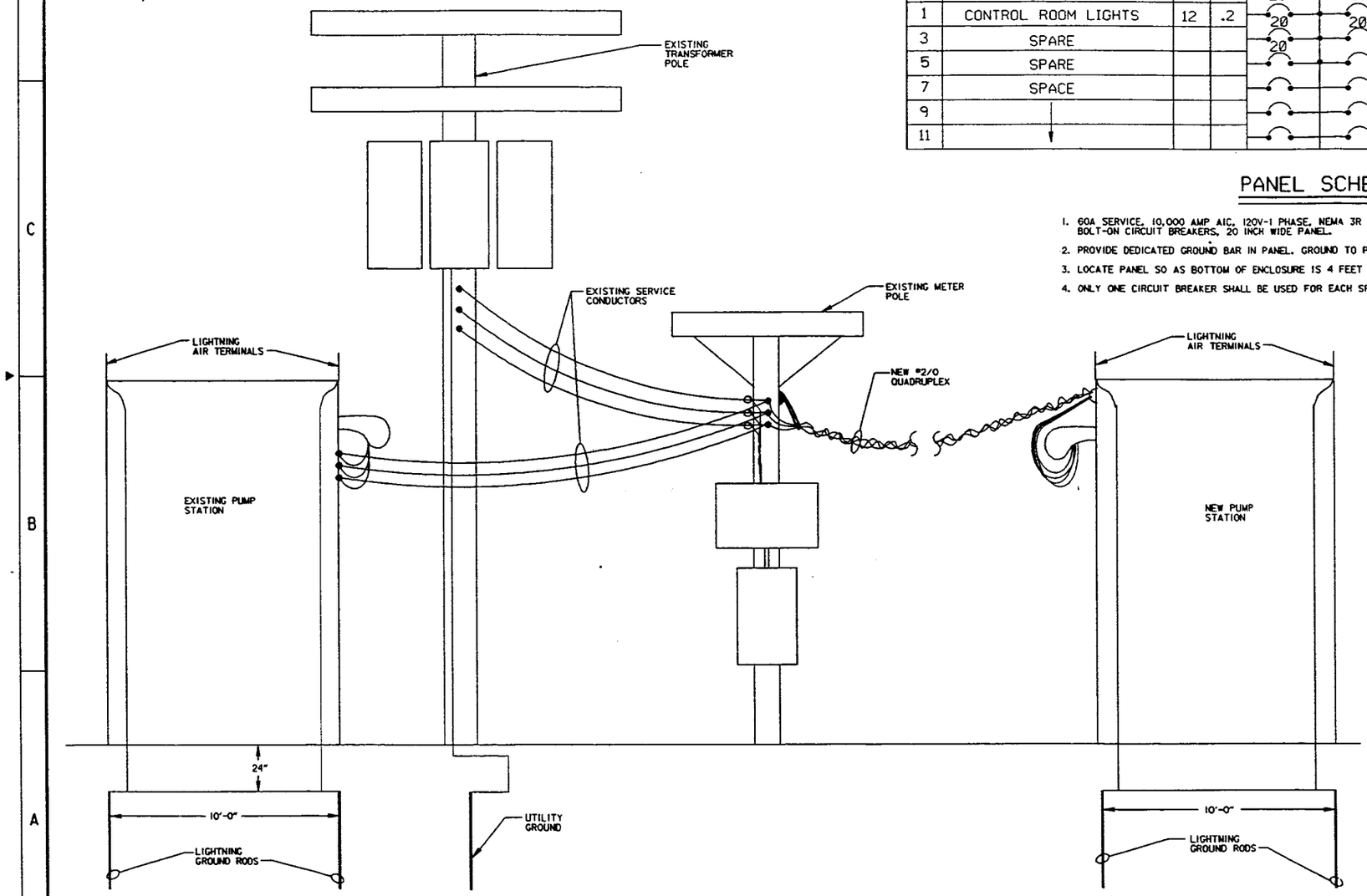
PUMP STATION
PLAN & ELEVATION

Scale: AS SHOWN
Date: 13 JAN. 1995
Drawing Code:
Sheet reference number: E-3
Solicitation Number:
Sheet of

PLATE 19

NOTES:

1. LIGHTING PROTECTION FOR BOTH STRUCTURES SHALL BE A CLASS I INSTALLATION PER NFPA 780.



PANEL SYMBOL LP

TYPE BRKS. BOLT ON BREAKERS

MOUNTING TYPE SURFACE

MAIN BUS 60A

N/A MAIN BRK.

120 VOLTS

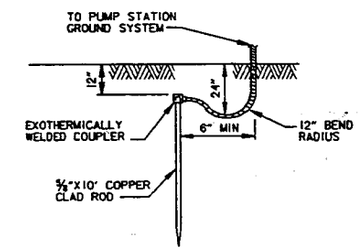
1 PHASE, 3 WIRE,

L1

CKT NO.	DESCRIPTION	WIRE SIZE	KVA			KVA	WIRE SIZE	DESCRIPTION	CKT NO.
1	CONTROL ROOM LIGHTS	12	.2	20	20	.4	12	RECEPTACLES	2
3	SPARE			20	20			SPARE	4
5	SPARE			20				SPACE	6
7	SPACE								8
9									10
11									12

PANEL SCHEDULE

1. 60A SERVICE, 10,000 AMP AIC, 120V-1 PHASE, NEMA 3R ENCLOSURE WITH BOTTOM BREATHER, BOLT-ON CIRCUIT BREAKERS, 20 INCH WIDE PANEL.
2. PROVIDE DEDICATED GROUND BAR IN PANEL. GROUND TO PUMP STATION GROUND.
3. LOCATE PANEL SO AS BOTTOM OF ENCLOSURE IS 4 FEET ABOVE CONTROL ROOM FLOOR.
4. ONLY ONE CIRCUIT BREAKER SHALL BE USED FOR EACH SPACE. TANDEM CIRCUIT BREAKERS SHALL NOT BE USED.



GROUND ROD DETAIL

NOT TO SCALE

Revisions			
Symbol	Description	Date	Approved

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

Designed by: RJW

Drawn by: AJM

Checked by:

Reviewed by:

Approved by: CHARLES S. CIX COL., CORPS OF ENGINEERS

US Army Corps of Engineers

ILLINOIS WATERWAY
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL RIVER MILE 138-144
BANNER WILDLIFE MANAGEMENT AREA

PUMP STATION SERVICE ENTRANCE

Scale:

Date: 13 JAN. 1995

Drawing Code:

Sheet reference number: E-4

Solicitation Number:

Sheet of

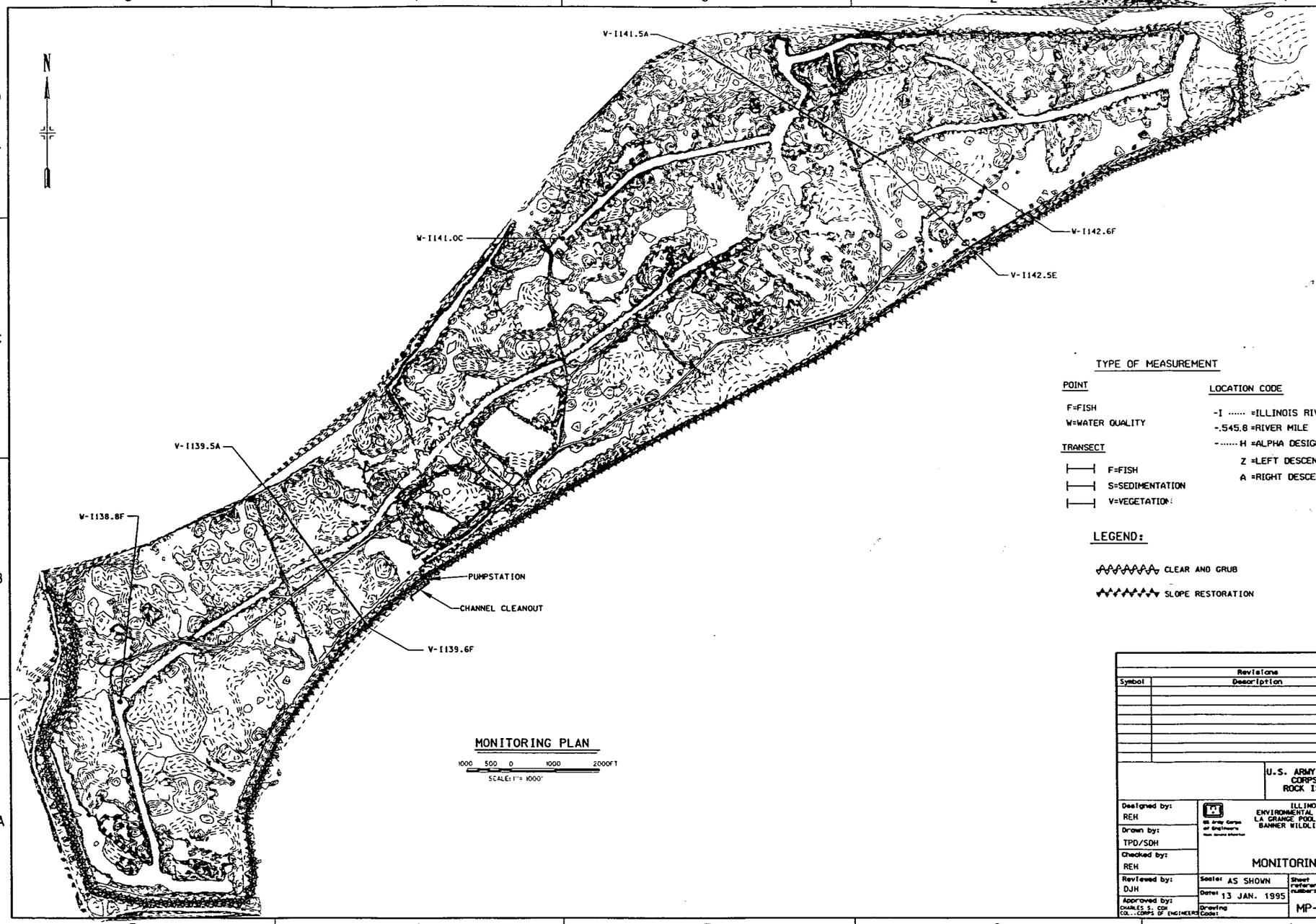

N
V-I141.5A
W-I141.0C
W-I142.6F
V-I142.5E
V-I139.5A
W-I138.8F
PUMPSTATION
CHANNEL CLEANOUT
V-I139.6F
MONITORING PLAN
1000 500 0 1000 2000FT
SCALE: 1"= 1000'
TYPE OF MEASUREMENT
POINT
F=FISH
W=WATER QUALITY
TRANSECT
F=FISH
S=SEDIMENTATION
V=VEGETATION
LOCATION CODE
-I ..... =ILLINOIS RIVER
-.545.8 =RIVER MILE
-.....H =ALPHA DESIGNATOR
Z =LEFT DESCENDING BANK
A =RIGHT DESCENDING BANK
LEGEND:
CLEAR AND GRUB
SLOPE RESTORATION
Revisions
Symbol
Description
Date
Approved
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS
Designed by: REH
Drawn by: TPD/SDH
Checked by: REH
Reviewed by: DJH
Approved by: CHARLES S. COX COL., CORPS OF ENGINEERS
US Army Corps of Engineers Rock Island District
ILLINOIS WATERWAY
ENVIRONMENTAL MANAGEMENT PROGRAM
LA GRANGE POOL RIVER MILE 138-144
BANNER WILDLIFE MANAGEMENT AREA
MONITORING PLAN
Scale: AS SHOWN
Date: 13 JAN. 1995
Drawing Code:
Sheet reference number: MP-1
Solicitation Number:
Sheet of

PLATE 21